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# Science and GIS Update



Sonoran Desert Conservation Plan

November 1999





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# MEMORANDUM

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Date: November 23, 1999

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

From: C.H. Huckelberry  
County Administrator

A handwritten signature in dark ink, appearing to be "CHH", is written over the printed name "C.H. Huckelberry".

Re: *Sonoran Desert Conservation Plan Science and Geographic Information Systems Update*

## I. Background

This memorandum summarizes four documents that reflect some of the work that Pima County and Department of Interior staff, along with the Science and Geographic Information Systems (GIS) Technical Teams, have created to develop the biological component of the Sonoran Desert Conservation Plan. The first document, entitled *Determining Vulnerable Species Within Pima County*, updates the April 30, 1999 discussion paper, and describes over 100 species, 12 habitat types, and 20 plant communities that are currently being considered for protection under the Sonoran Desert Conservation Plan.

The second document is the request for proposals for the biological consultant for the Sonoran Desert Conservation Plan. It contains a detailed work plan and describes the tasks that will be carried out by the consultant. Through the efforts of Congressman Kolbe and Secretary Babbitt, and with the support of Congressman Pastor and Senator Kyl, an appropriation for \$1 million is included in the latest version of the federal budget. The workplan for the biological evaluation requires that seven major deliverables be received by Pima County on or before June 30, 2000. Described in more detail below, these work products will allow the County to issue a major status report about the Sonoran Desert Conservation Plan in the summer of 2000.

The third document is a habitat conservation plan decision support system workplan for which Pima County has applied for funding from the National Fish and Wildlife Foundation. Pima County has entered into a collaborative relationship through the United States Geological Survey with four prominent California conservation biologists and geographic information scientists to create a decision support model that will combine the best available biotic, cultural resource and socio-economic data to produce alternative potential preserves that attain a balance of fiscal and natural resources.

The fourth document is an interim report from Pima Association of Governments on a study being conducted to create geographic information system coverages for perennial and intermittent streams and shallow groundwater. In addition to these efforts, County staff along with staff from the Department of the Interior have gathered data from other jurisdictions and performed analysis of this information to accelerate the time line involved in developing the Sonoran Desert Conservation Plan. Whereas the County GIS system had about 175 coverages before planning began, we now have 1004 data layers, gathered by County staff.

## II. Determining Vulnerable Species within Pima County

In April of 1999 a report entitled *Determining Species of Concern* was issued to launch the work of the Science Technical Advisory Team. The report described the status, location, distribution and habitat needs of species already recognized by the federal government as imperiled, extirpated species, and the surprisingly large number of species that are in decline and potentially on the way toward listing if conservation measures are not put in place. Since the release of this report, the Science Technical Advisory Team has met on a monthly basis and refined the original report.

The second draft, found at attachment 1, is renamed *Determining Vulnerable Species within Pima County, Arizona*. It includes a statement of the goals and objectives of the Science Technical Advisory Team and expands the list from 75 species of concern to over 100 vulnerable species. The report also presents two systems of categorizing species that are preliminarily recommended for protection under the conservation plan.

Under one method of categorization, the report describes 24 federally listed, proposed and candidate species for Pima County; 13 extirpated species are described (most of which were dependant on aquatic habitat that is now lost); and four subcategories of vulnerable species are described: (1) species at risk in Pima County and for whom habitat in Pima County is crucial for their existence; (2) species at risk in Pima County and /or are generally declining throughout their range; (3) species that are rare in Pima County, but the overall status is unknown; and (4) species that are at risk in Pima County, but are not at risk overall.

Under a second method of categorizing vulnerable species, the report describes (1) keystone species, i.e., those who enrich ecosystem function in a unique and significant manner, with effects beyond their numerical abundance; (2) flagship species, i.e., charismatic species that have wide appeal; and (3) umbrella species, who generally serve as mobile links at the landscape scale through predation, seed dispersal or pollination.

In addition to making preliminary recommendations about particular species to protect, the report recommends protection of particular habitats and plant communities. Foremost are aquatic environments, wetlands, and riparian woodlands, which the Science Team considers "to be a high priority for conservation.... A large number of species listed within the 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."

The importance of the Riparian Restoration element of the Sonoran Desert Conservation Plan becomes more apparent as the Science Team continues its work. Accordingly, riparian vegetation mapping is included in the scope of work for the biological consultant, and data layers for shallow ground water and perennial and intermittent streams are now being developed.

### III. Biological Consultant Services for the Sonoran Desert Conservation Plan

On November 12, 1999, the request for proposals found at attachment 2 was publicly noticed and sent to all known interested biological consultants. Proposals are due to Pima County on December 16, 1999. A recommendation by a subcommittee of the Science Technical Advisory Team will be forwarded to the County Administrator and the Board so that work may begin in January, pending funding availability. It was noted earlier that the latest version of the federal budget contains an appropriation of \$1 million for the Sonoran Desert Conservation Plan. County staff is working with the Department of Interior to determine how quickly these funds can be transferred, if adopted in the final budget. The work plan was developed over a six month period by the Science Team and it was the subject of extensive peer review. In general, the biological consultant contract will create a program of work needed to achieve the biological goals of conserving Pima County's indigenous plants and animals. The contract will have several phases, with services including the following:

- ▶ Compile, document and synthesize existing information on vulnerable species, and high priority biotic communities as recommended by the Science Team. Produce or synthesize new GIS-based data layers on selected biotic communities. Identify data gaps and prioritize data needs. Produce a threats assessment.
- ▶ Recommend species/habitat goals. Review remaining focal species and special habitats or plant communities to devise conservation strategies. Investigate pest species important to the planning area and planning goals.
- ▶ Prepare and recommend preserve designs with specific management recommendations that meets the goals of the plan for selected species, habitats and plant communities as approved by the Science Team.

These phases are divided into fifteen categories within the scope of work, each containing a number of specific tasks. A number of draft, interim and final work products are called for under the work plan, with seven major deliverables due to Pima County by June 30 of 2000:

- 1) Threats assessment;
- 2) Recommendations on adjustments to vulnerable species list;
- 3) Draft vulnerable species data summaries, including distribution maps;
- 4) Draft data analysis;
- 5) Pilot riparian vegetation mapping;
- 6) Draft land cover community map; and
- 7) Draft reserve design guidelines.

These work products will allow County staff to draft a major status report about the scientific research and other elements of the Sonoran Desert Conservation Plan, by next summer. A detailed description of each component of the biological evaluation work plan is found on pages 2 through 14 of the sample contract in attachment 2.



#### **IV. Habitat Conservation Plan GIS Decision Support System**

The Pima County Geographic Information System has an extensive library of data layers. Prior to work being conducted to develop the Sonoran Desert Conservation Plan, the County held approximately 175 coverages within its system. Since April of 1999, County staff members have gathered additional data bases, bringing the total number of coverages to over 1000. Currently, county staff is dividing and analyzing all relevant data layers into subarea units. This data will become the basis of the initial subarea draft concept plans which will be issued to land panels in early 2000.

County staff members have also entered into a collaborative effort with conservation biologists who have experience with complex modeling to create a habitat conservation plan GIS decision support model. The principal investigators working with Pima County in this effort are: Dr. Michael Gilpin from the Department of Biology at the University of California at San Diego; Dr. Michael Gilpin from the Department of Biology at the University of California at San Diego; Dr. Richard Peter Stine of the United States Geological Survey at California State University; Dr. Richard Church of the University of California at Santa Barbara; and Dr. Ross Gerrard. A full description of the project is found at attachment 3. In general, the project attempts to address issues that have plagued prior habitat conservation planning efforts, such as whether sufficient desirable alternatives are being considered; whether there has been an objective analyses of a full range of alternative outcomes; and whether the proposed preserve alternatives maximize all desired features and minimize risks and costs.

The research effort to improve decision support in the area of habitat conservation planning focuses on combining the best available biotic, cultural and fiscal data within an optimization models with the intent that this approach will produce potential solutions that appropriately evaluate conservation goals as well as socio-economic goals and identify high-quality alternatives that attain the best balance of both. The approach shows the trade-offs between various levels of conservation, obtained by reserving certain lands, and the economic and social costs of doing so. The components of the proposed decision support tool can be summarized within these four categories:

- 1) Incorporation of expert biological data and opinion;
- 2) Computer-based processing to determine relative habitat suitability and socio-economic suitability in the region of interest;
- 3) Modeling viable territories for basic demographic units of the target species; and
- 4) Optimizing the selection of species territories to balance the conflicting goals of environmental and human needs.

The primary product expected from this effort is a customized software package, combined with linkages to commercially available software that executes this entire model. Several scientific publications will result from the research and development activities of this project. Pima County has applied for an award from the National Fish and Wildlife Foundation to pursue this project. Both the California and Southwest Regions of the United States Fish and Wildlife Service also have committed funding to support this project.

The Honorable Chair and Members of the Pima County Board of Supervisors  
**Sonoran Desert Conservation Plan Science and Geographic Information Systems Update**  
November 23, 1999  
Page 5

**V. GIS Coverage for Perennial Streams, Intermittent Streams, and Shallow Groundwater**

Reports issued since April of 1999 consistently point out the need to protect and restore riparian habitat. To accelerate the development of information in this area, County staff along with the Pima Association of Governments have created three GIS coverages to show perennial streams, intermittent streams, and areas of shallow groundwater within eastern Pima County. An interim report on this project is found at attachment 4. Final maps and the GIS product will be delivered in December, in time for the Science Team to review the results, and the consultant to incorporate this information into the biological evaluation.

**VI. Conclusion**

Since the Board adopted the Sonoran Desert Conservation Plan in concept in March of 1999, technical teams have been meeting to review staff reports and existing data, and create workplans to carry out the components of the Sonoran Desert Conservation Plan. Reports on the progress of other technical teams will be sent to the Board in the coming weeks. This memorandum conveys information about some of the work that Pima County and Department of Interior staff, along with the Science and Geographic Information Systems (GIS) Technical Teams, have carried out so far to develop the biological component of the Sonoran Desert Conservation Plan. Recommendations for award of contract to a biological consultant will also be sent to the Board as soon as possible so that work can begin and deliverables can be produced to create the Sonoran Desert Conservation Plan.

Attachments

**ATTACHMENT 1**



# Determining Vulnerable Species Within Pima County, Arizona

A discussion paper for the Sonoran Desert Conservation Plan

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November 1999



# **Determining Vulnerable Species Within Pima County, Arizona**

Formerly  
"Determining Species of Concern Within Pima County, Arizona"

## **A Discussion Paper For The Sonoran Desert Conservation Plan**

**Drafted April 29, 1999  
Revised November 19, 1999**

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and

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## EXECUTIVE SUMMARY

This document was initially drafted by County staff and 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. The report compiles information on plants and animals that are already recognized by the federal government as imperiled species, species which have been extirpated, and a much larger number of species that are in decline either locally or nationally. Descriptions of status, location, distribution and habitat needs are presented for each species proposed. The report also considers vegetative communities, their history of decline and modification, and recommends priorities for their protection. The information is based on interviews with members of the local science community and reviews performed by members of the Science and Technical Advisory Team (STAT) between March and November 1999.

While reading through this report, one should be aware that the authors do not present a full list of species whose existence is considered vital to the natural ecosystems within Pima County. This report was written to provide the initial frame of reference for the development of a work plan for conservation of Pima County's native plants and animals. Numerous changes have been made to the report to this date, and most likely more changes will occur before recommendations are made to the Steering Committee about what species should be covered for the purposes of any incidental take permits issued as part of the Sonoran Desert Conservation Plan.



**TABLE OF CONTENTS**

<b><u>SECTION</u></b>	<b><u>TITLE</u></b>	<b><u>PAGE</u></b>
1.0	INTRODUCTION	1-1
1.1	Background	1-1
1.2	Setting	1-7
1.3	Environmental History	1-9
1.3.1	End of the Glacial Period	1-9
1.3.2	Arrival of Ancient Peoples to the New World	1-10
1.3.3	Human Population Increase in Historic Era	1-10
1.4	Information Needs	1-13
1.5	Purpose	1-13
2.0	METHODS	2-1
2.1	Previous Studies	2-1
2.2	Interview Process	2-1
2.3	Species Database	2-3
2.4	STAT Review Process	2-3
2.5	Supplemental Information	2-4
3.0	SPECIES EXTIRPATED FROM PIMA COUNTY	3-1
4.0	VULNERABLE SPECIES IN PIMA COUNTY	4-1
5.0	HABITATS OF CONCERN AND TARGET PLANT COMMUNITIES	5-1
6.0	OTHER SPECIES DISCUSSED	6-1
7.0	PEST SPECIES FOUND IN PIMA COUNTY	7-1
8.0	DISCUSSION	8-1
8.1	Keystone Species in Pima County	8-1
8.2	Flagship Species in Pima County	8-1
8.3	Umbrella Species in Pima County	8-1
8.4	ESA Conservation vs. Unlisted Species Conservation	8-1
8.5	Conservation of Species vs. Habitat Conservation	8-1
8.6	Species vs. Subspecies	8-2
8.7	Taxonomic Uncertainties	8-2
8.8	Other Issues	8-2

**TABLE OF CONTENTS (Continued)**

9.0	RECOMMENDATIONS	9-1
9.1	STAT Goals and Objectives	9-1
9.2	STAT Recommendations	9-1
10.0	REFERENCES	10-1

**FIGURES**

<u>NUMBER</u>	<u>TITLE</u>	<u>PAGE</u>
1	Location Map	1-8
2	Comparison of Aquatic and Semiaquatic Habitats before 1890 and Today	1-11

**LIST OF TABLES**

<u>NUMBER</u>	<u>TITLE</u>	<u>PAGE</u>
1	Federally Listed, Proposed and Candidate Species	1-2
2	People Interviewed for Species of Concern	2-2
3	Species Extirpated from Pima County	3-2
4	Vulnerable Species in Pima County, Arizona	4-2
5	Habitats of Concern & Target Plant Communities	5-2

**APPENDICES**

<u>LETTER</u>	<u>TITLE</u>	<u>PAGE</u>
A	Additional Species & Interview Process Forms	A-1
B	Other Species Discussed	B-1
C	Pest Species Found in Pima County	C-1
D	Keystone Species in Pima County, Arizona	D-1
E	Flagship Species in Pima County, Arizona	E-1
F	Umbrella Species in Pima County, Arizona	F-1

## **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 through 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 and other indigenous plants and animals whose existence in Pima County may be at risk; (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 listed within Table 1, along with four additional species which are considered candidates for federal listing, one species proposed for listing, and one species which has been petitioned for listing under the ESA. The intent is that protection of these species will be addressed by the SDCP and the Section 10 Permit/Multi-species Conservation Plan.

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. Significant protection and restoration of our river corridors and floodplains will be part of the SDCP.



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

SCIENTIFIC NAME	COMMON NAME	STATUS	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
<i>Rana chiricahuensis</i>	Chiricahua Leopard Frog	Candidate	Eastern	Also found in mountain regions of central and southeastern Arizona, southwestern New Mexico, and the Sierra Madre Occidental to southern Durango, Mexico	Streams, rivers, backwaters, ponds and stock tanks that are free from introduced fish, bullfrogs and crayfish	Continued presence in Pima County is tenuous without a strong conservation effort on extant populations and restoration of additional populations
<i>Haliaeetus leucocephalus</i>	Bald Eagle	Threatened	Eastern	Widely distributed	Large trees or cliffs near water (reservoirs, rivers and streams) with abundant prey	Winters along rivers and reservoirs, no breeding in Pima County; species has been proposed for delisting from the federal "threatened" species list under the Endangered Species Act
<i>Glaucidium brasilianum cactorum</i>	Cactus Ferruginous Pygmy-Owl	Endangered with designated critical habitat	Eastern/Western	?	Mature cottonwood/willow, mesquite bosque, and Sonoran desert scrub	Few documented sites; surveys are needed
<i>Colinus virginianus ridgwayi</i>	Masked Bobwhite	Endangered	Eastern	Limited distribution	Desert grasslands with diversity of dense native grasses, forbs and brush	Presently, only known from reintroduced population at Buenos Aires National Wildlife Refuge; also found in Mexico in limited distributions
<i>Strix occidentalis lucida</i>	Mexican Spotted Owl	Threatened	Eastern/Western	Sky Islands	Nests in canyons and older forests with multi-layered foliage structure	Found in Saguaro National Park and Coronado National Forest
<i>Empidonax traillii eximius</i>	Southwestern Willow Flycatcher	Endangered with designated critical habitat	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
<i>Charadrius montanus</i>	Mountain Plover	Proposed Threatened	Eastern	?	Open arid plains, short grass prairies and scattered cactus	Winters in Pima County only, no breeding
<i>Coccyzus americanus occidentalis</i>	Western Yellow-billed Cuckoo	Petitioned for listing under the ESA	Eastern	Widespread	Streamside cottonwood, willow groves and large mesquite bosques for migrating and breeding	Declining throughout its range; this species may be rarely observed as transient in desert and urban settings

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

SCIENTIFIC NAME	COMMON NAME	STATUS	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
<i>Falco femoralis septentrionalis</i>	Northern Aplomado Falcon	Endangered	Eastern	Limited distribution in the U. S. (known from introduced populations in Texas)	Grassland	Extirpated from Pima County; listed as "endangered" by the USFWS throughout its entire range; historic range included Arizona, New Mexico, Texas, Mexico and Guatemala
<i>Poecilopsis occidentalis occidentalis</i>	Gila Topminnow	Endangered	Eastern (Upper Cienega Creek; Santa Cruz River near Tubac)	Narrow distribution	Small streams, springs and cienegas with vegetated shallows; backwaters of large rivers	Historically occurred in backwaters of large rivers (Santa Cruz River, Rillito Creek, Sabino Creek)
<i>Cyprinodon macularius*</i>	Desert Pupfish	Endangered with designated critical habitat	Western (Quitobaquito)	Very narrow	Shallow springs, small streams, and marshes; tolerates saline and warm water	Formerly occurred in the Santa Cruz River
<i>Gila intermedia</i>	Gila Chub	Candidate	Eastern	Scattered statewide	Pools, springs, cienegas and streams	Multiple private landowners including The Nature Conservancy, Audubon Society, Bureau of Land Management, U. S. Forest Service and others; also found in Sonora, Mexico
<i>Canis lupus baileyi</i>	Mexican Gray Wolf	Endangered	Eastern (historically)	Formerly widespread in distribution	Chaparral, woodland, and forested areas; may cross desert areas; needs large areas of mountain and grassland terrains	Unconfirmed reports of individuals in southern Arizona; experimental nonessential population was introduced in the Blue Primitive Area; last record in 1952 on the southern side of the Catalina Mountains; may still persist in Mexico
<i>Antilocapra americana sonoriensis</i>	Sonoran Pronghorn Antelope	Endangered	Western	Narrow; historic range was probably larger than today	Broad, Intermountain alluvial valleys with Creosote-Bursage & Palo Verde-Mixed Cacti Associations	Formerly ranged east to near Tucson; also occurs in Mexico in Pinacate Biosphere Reserve

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

SCIENTIFIC NAME	COMMON NAME	STATUS	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
<i>Leptonycteris curasoae yerbabuenae</i>	Lesser Long-nosed Bat	Endangered	Eastern/Western	Widely distributed south of Arizona	Desert scrub habitat with agave and columnar cacti present as food plants; day roosts in caves and abandoned tunnels	Species is migratory
<i>Panthera onca</i>	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 Arizona (confirmed with photographs); transient in Arizona
<i>Felis yagouaroundi tolteca</i>	Jaguarundi	Endangered	Eastern/Western	Widely distributed south of AZ	Variety of habitats: deciduous forests, riparian areas, swampy grasslands, upland dry savannahs, etc.	Unconfirmed sightings in southern Arizona; AGFD does not consider this species as part of the native fauna.
<i>Felis pardalis</i>	Ocelot	Endangered	Eastern	Widely distributed south of AZ	Humid tropical and sub-tropical forests, savannahs and semi-arid thorn scrub (dense cover)	Last record in 1952 on the southern side of the Catalina Mountains; extirpated from Arizona (AGFD)
<i>Amsonia kearneyana</i>	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
<i>Lilaeopsis schaffneriana ssp recurva</i>	Huachuca Water Umbel	Endangered with proposed critical habitat	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
<i>Coryphantha scheeri</i> var. <i>robustispina</i>	Pima Pineapple Cactus	Endangered	Eastern (Santa Rita Exp. Range, flanks of the Santa Rita Mountains)	Narrow distribution	Sonoran desertscrub or semi-desert grassland communities; alluvial valleys or on hillides in rocky, sandy or silty soils	Impacted by grazing and loss of habitat (urban development); Lehmann's lovegrass is a major problem; recovery is in the initial planning stages



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

SCIENTIFIC NAME	COMMON NAME	STATUS	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
<i>Echinomastus erectocentrus acunensis</i>	Acuna Cactus	Candidate	Western	?	Well drained knolls and gravel ridges in Sonoran Desertscrub	
<i>Echinocactus horizontalis</i> <i>us var nicholii</i>	Nichol's Turk's Head Cactus	Endangered"	Western/Eastern ?	Very narrow distribution	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	
<i>Kinosernon sonoriense longifemorale</i>	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

\* Includes subspecies Quitobaquito Pupfish (*C. m. eremus*)

## ***DRAFT***

2. **Ranch Conservation** - Ranch conservation helps provide a boundary buffer 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 state and federal grazing land. This has led to the sale of their private land holdings to developers, thus facilitating urban sprawl. Conservation of large open spaces as ranches will be part of the SDCP.
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. The SDCP process will identify and prioritize these sites for conservation.
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. These biological corridors will be comprised of a combination of conservation lands (i.e., lands in public ownership for the purpose of conservation) plus areas that are zoned for low-intensity uses that are compatible with maintaining biological linkages between large protected areas such as national parks and national forest lands.
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**

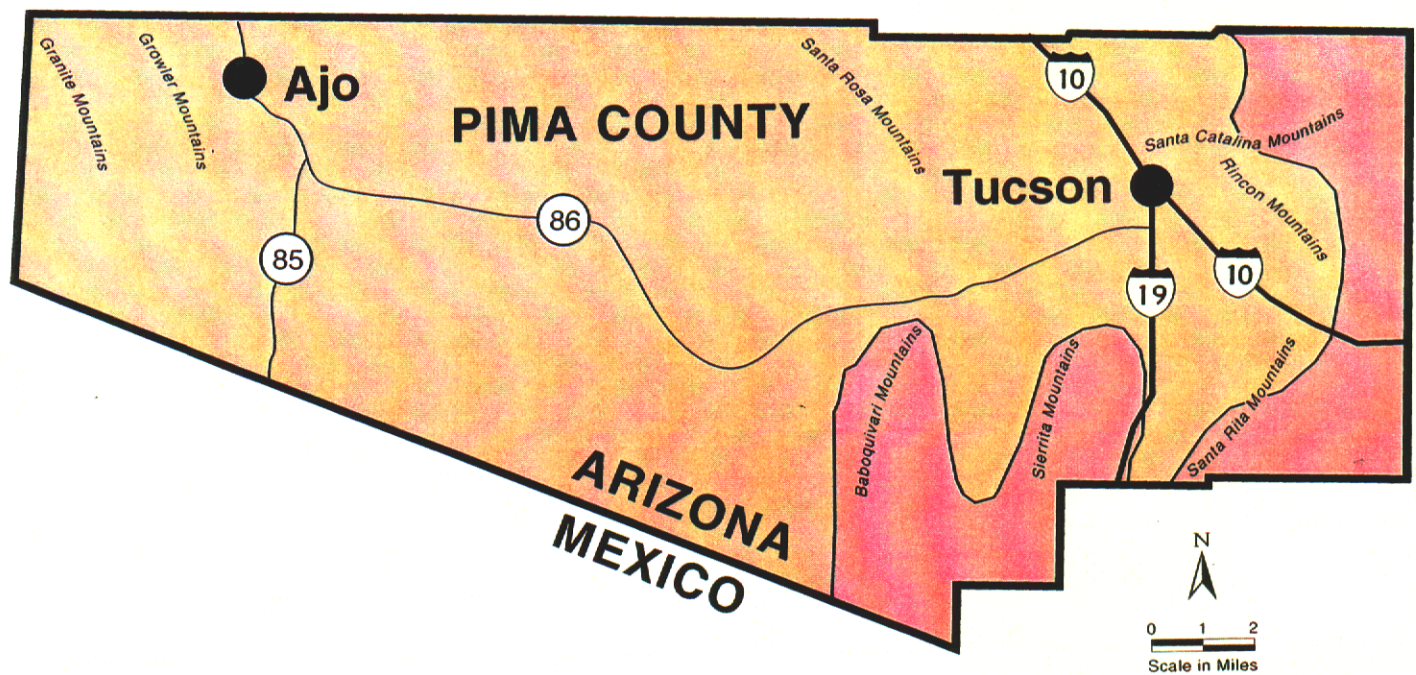
Pima County can be divided into two eco-regions as defined by Omernik (1987) (Figure 1). The central and western portions of Pima County are lower in elevation and are characterized by Sonoran desert vegetation, while the eastern portion of the county possesses a number of high, forested areas surrounded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

To understand the biological 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, interglacial 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.

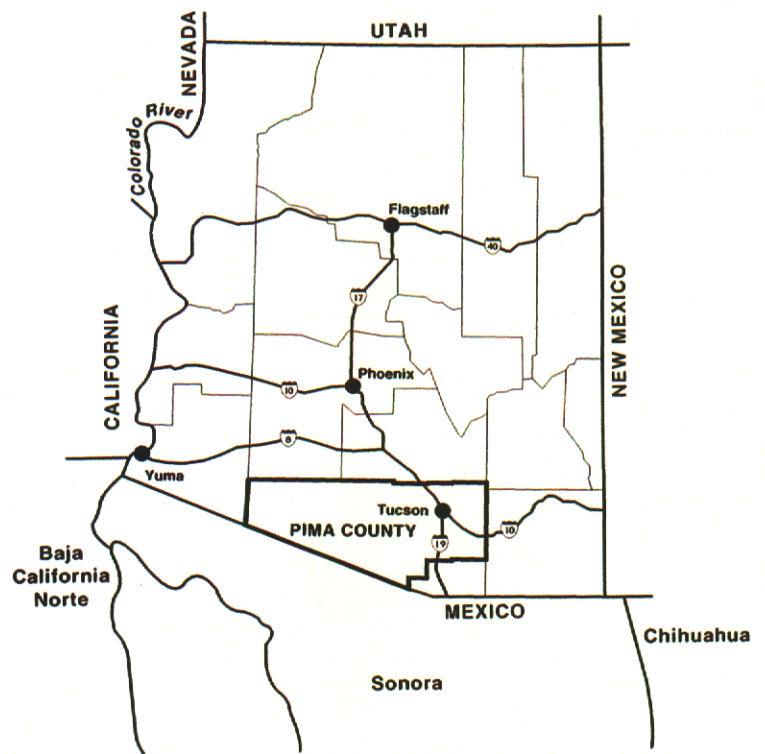
Pima County's biological diversity is attributable in part to its physical proximity to the Sierra Madre Occidental of Mexico, and indeed the sky islands are considered its northern outlier. The Sierra Madre has been identified as one of the three "megadiversity" centers of the planet (Warshall 1995).

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 duration of the arid foreshummer is a key biological constraint. The summer monsoonal rains reduce water stress during the hottest portion of the



Ecoregions as defined by Omernik (1987)

- Southern Basin and Range  
(Sonoran Desert)
- Southern Deserts  
(Sky Islands)



**Figure 1**  
**LOCATION MAP**

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 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. In the rest of the Sonoran Desert, the occurrence of hard freezes is an important influence on vegetation characteristics and the locations between the desert and grassland communities.

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 Environmental History**

Pima County's landscape is ever changing in response to climate and ongoing evolutionary processes. The plant and animal communities we see today have been shaped by several profound events, namely the end of the glacial period, the advent of people to the New World, and the dramatic increase in human population and technology during the last 100 years or so.

#### **1.3.1 End of the Glacial Period**

We live in an interglacial period. Our modern climate is the driest, warmest period during the last 32,000 years (Van Devender et al., 1991). Pinyon pine, juniper, and oak trees grew on the slopes of the Waterman and Ajo Mountains 10,000 to 20,000 years ago; Douglas fir and ponderosa pine grew on Pontatoc Ridge at the base of the Catalina Mountains (Van Devender, 1990). Because interglacial periods are short (10,000 years long) relative to glacial periods (100,000+ years long), the glacial episodes can be considered the "normal theater of evolution" (Martin, 1999). This perspective only heightens the significance of conserving biological diversity during our time.

Saguaro cacti and palo verde trees arrived in Pima County approximately 8,900 years ago, when the climate warmed (Anderson and Van Devender, 1991). The plant communities 8,900 to 4,000 years ago also differed from today. For instance, plants now typical of riparian areas such as catclaw acacia (*Acacia greggii*), blue palo verde (*Cercidium floridum*), and velvet mesquite (*Prosopis velutina*) grew on exposed slopes. As more modern desert scrub communities formed around 4,000 years ago, the species discussed above retreated to the riparian zones and subtropical species moved northward from Sonora, Mexico.

### **1.3.2. Arrival of Ancient Peoples to the New World**

The extent to which native peoples shaped the distribution of plants and animals prior to the arrival of Europeans is perhaps better known in Pima County than anywhere else in the United States. Until approximately 13,000 years ago, southern Arizona hosted a much wider array of large mammals, including bison, mammoth, horse, camel, lion, tapir and dire wolf (Martin, 1999). Martin and Klein (1984) argued that the advent of people to the New World not only coincided with the demise of these species, but that prehistoric hunters were responsible for the abrupt extinction of these and other large mammals. Despite the megafaunal extinctions, there is considerable continuity of occupation by other, smaller animals.

There is evidence of extensive agriculture and stream diversion along the Santa Cruz River three thousand years ago; plantations of agaves were cultivated and small rock check dams were built in the Tortolita piedmont between 1150 and 1250 A.D. (Dr. Paul Fish, personal communication.) The Hohokam utilized small alluvial fans dominated by sheetwash and deposition of fine sediment for floodwater farming (Waters and Field, 1986). Hillside terraces and floodwater fields occur throughout Pima County (Dr. Gary Nabhan, personal communication.) Some researchers believe that native peoples increased fire frequency (Dobyns, 1981), while others do not (Swetnam, et al., in press). Native peoples may have functioned as keystone predators, regulating the population of bighorn sheep and other large ungulates (Martin, 1999).

### **1.3.3 Human Population Increase in Historic Era**

More recently, the landscape has changed due to land uses associated with European settlers and their descendants, and subsequent dramatic population increases as Tucson and other communities have become urbanized. These changes, in combination with the region's variable climate, drastically affected the region's wildlife diversity. The combination of subsistence and market hunting, drought conditions, heavy grazing pressure, and "pest" control practices resulted in drastically reduced populations, if not the complete removal, of beaver, pronghorn, bighorn sheep, grey wolf, jaguar, turkey, and deer. The 1930's ushered in government-sponsored mechanisms such as the Taylor Grazing Act and regulated hunting which sought to curb the undesirable effects of unregulated hunting and grazing. Many areas of former grassland have become dominated by creosote bush and mesquite scrub; non-native species have displaced native species; wildfires have been suppressed in grasslands and forests (Bahre, 1995).

Beginning in 1880, many of the major watercourses began to incise their floodplains, and massive soil erosion ensued. A number of major perennial streams have become ephemeral, and their associated and aquatic riparian habitats lost (Figure 2) or degraded.

Livestock were introduced by the Spanish as a means of supporting the mission system. After subjugation of the Apaches and construction of the Southern Pacific railroad in Pima County in



# SANTA CRUZ VALLEYS AND SAN PEDRO RIVER, ARIZONA

## Comparison of Aquatic and Semiaquatic Habitats before 1890 and Today

(after Hendrickson and Minckley, 1984)

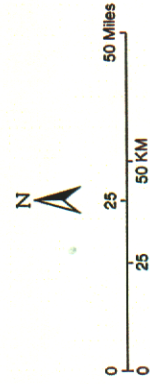
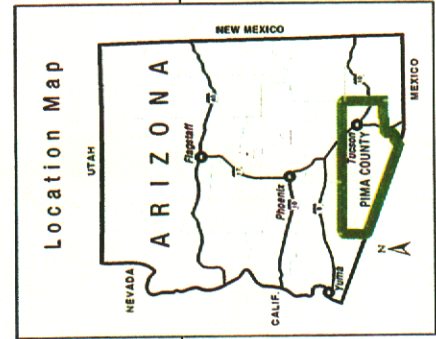
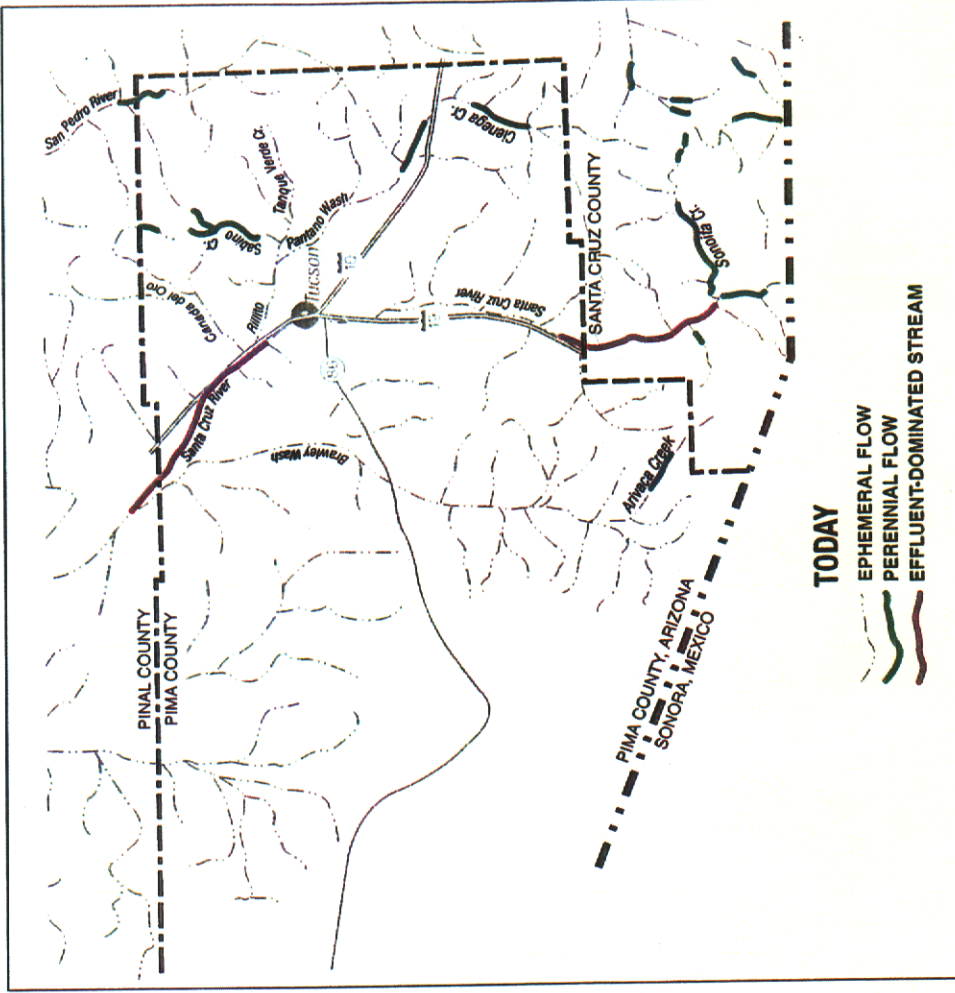
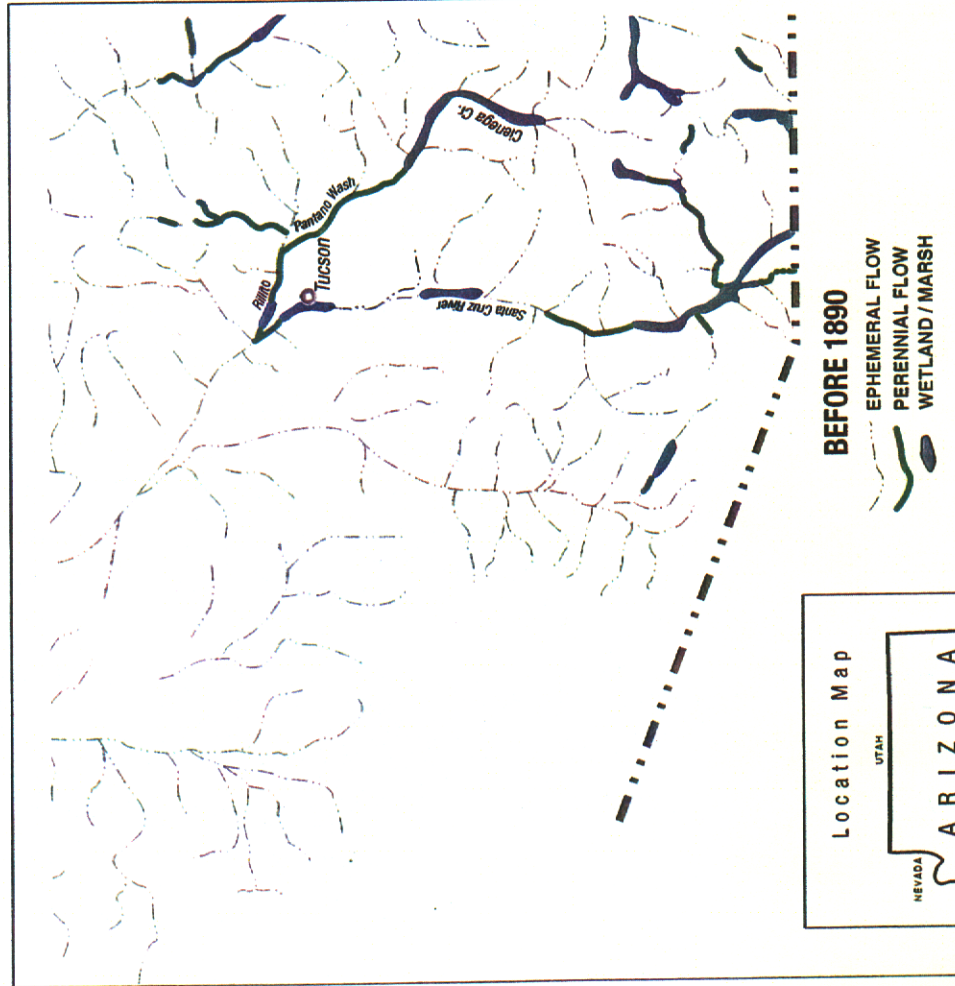


Figure 2  
SANTA CRUZ VALLEY  
Comparison of  
Aquatic and Semiaquatic Habitats  
before 1890 and Today

## DRAFT

1880, livestock grazing intensified, severely reducing the vegetative cover. One observer (Brown, 1904) remarked:

*The causes leading to extermination of the Arizona Masked Bob-white (Colinus ridgwayi) are due to overstocking of the country with cattle, supplemented by several rainless years. This combination practically stripped the country bare of vegetation. Of their range the Colinus occupied only certain restricted portions, and when the food and shelter had been trodden out of existence by thousands of hunger-dying stock, there was nothing left for poor little Bob-white to do but go out with them....*

Continued overgrazing nearly eliminated fire as a disturbance process (McPherson, 1995) Loss of saltbush and galleta grass stands and ensuing soil erosion in Organ Pipe Cactus National Monument is attributed to over-grazing (Rutman, 1998).

After passage of the Taylor Grazing Act in 1934, the federal government began livestock programs aimed at maintaining production of forage for cattle, while reducing soil erosion. Techniques included contour plowing, fencing, burning, fire suppression, herbicides, construction of check dams, predator and rodent control, and bulldozing of woody shrubs, such as mesquite (Bahre, 1995). They also introduced non-native grasses for forage and soil erosion control, such as Lehmann's lovegrass, Bermuda grass, and Johnson grass.

The late 1800's were also a period of indiscriminate, extensive woodcutting, whose effects are still apparent. When Edward Vail drove cattle in Tucson in 1890, he noted that the surrounding countryside had been cut over and nothing remained but creosote bush (Clemensen, 1987). Wood was used not only for building corrals and heating homes, but also to pump water and run mills. The excessive woodcutting continued in forests, deserts, and riparian areas well into the middle of this century. Today, it continues in Sonora (Nabhan and Holdsworth, 1998).

Cultivated agriculture has preferentially replaced native plant communities, particularly saltbush- and mesquite-dominated plant communities, that grew along the broad, fertile floodplains (Turner, 1974). Farmers initially utilized stream diversions and underflow ditches along the Santa Cruz River, San Pedro River and Rillito Creek to supply irrigation to crops. Channel bed down-cutting and widening during the last part of the 19<sup>th</sup> century destroyed the ditches, as well as the productive farm land, and led farmers to rely on groundwater pumping to irrigate areas farther from the channels. Improved pump technology and cheaper fossil fuels allowed pumping from deeper strata, which enabled more land along the Santa Cruz River and in Avra Valley to be cultivated.

Groundwater pumping associated with urbanization diverted the remaining streamflow of the Santa Cruz River, which lost at least six species of native fish, including the federally endangered Gila topminnow and desert pupfish. The endangered Huachuca water umbel, which grew at the base of

Sentinel Peak ("A" Mountain), was eliminated, and the riparian habitats of the Southwestern willow flycatcher and cactus ferruginous pygmy-owl were reduced throughout eastern Pima County as urban development proceeded.

Urbanization also affects plants and animals through habitat conversion and fragmentation. Some species are compatible with urban/ suburban settings, which can offer more water and food in critical drought periods, but many species do not tolerate these settings. Many of the human-designed landscapes in eastern Pima County lack the low-level foliage that is an essential habitat component for many types of animals (Shaw, et al., 1996). On the other hand, structural diversity in landscape is frequently higher than in all but the native riparian communities. This form of vegetation is important to many birds of prey and migratory songbirds (Shaw, et al., 1996).

Tumamoc Hill in Tucson, the oldest scientific desert study area in the world that has remained free of domestic livestock, has added feral dogs, cats and 52 introduced plants to its biota over the last century, but has lost at least 18 native plants and two mammal species (Nabhan, in press). Tumamoc Hill is surrounded by urban growth, though most of the site itself is reserved for scientific study.

Bighorn sheep and scaled quail no longer occur in the Tucson Mountains. The bighorn sheep population in the Catalina Mountains is nearly gone. The spread of the invasive grasses may be altering the composition of desert scrub by promoting a regime of recurrent fires to which palo verde-saguaro plant communities are not adapted (Burgess et al., 1991). A good example of this ongoing conversion of desert scrub to an exotic grassland can be seen at Sentinel Peak, where frequent fires aid the advance of buffel grass, an African savanna species.

## **1.4 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, native species already lost from Pima County and which could 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.

## **1.5 Purpose**

The purpose of this report is to make preliminary recommendations for 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

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with species experts. This report summarizes information obtained regarding species of concern for Pima County. The Science Technical Advisory Team will continue to review the set of focal species, plant communities and habitats for the Sonoran Desert Conservation Plan and make revisions as necessary. 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 ESA.

## **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 her interview.

### **2.2 Interview Process**

Biological experts were interviewed 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 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 because this was the only previous list which focused on this county's biodiversity.

Thirteen people were interviewed 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 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 helped staff organize and prioritize each individual species described during the interviews. Because of the potential for separating the SDCP into phases, staff decided to define the county into two regions, Eastern and Western Pima County<sup>1</sup>. This made it necessary to identify the location or locations where the plants and animals can be found, so that each species will be planned for within the proper phase of the SDCP. The distribution of each species within its general range is useful information for determining the status of each individual species and directing 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 Species Database**

A species database was created to facilitate work performed by Pima County staff regarding information on species defined for the SDCP. Information stored on each species includes the name (both scientific and common), type (mammal, bird, etc.), status (global, federal and state), location in Pima County, distribution, habitat needs, general comments, and categories (vulnerable, keystone, etc.). The database allows staff to quickly respond to information requests for species information. It is continually updated as new information becomes available, and can easily be expanded to incorporate other types of information not listed above.

## **2.4 STAT Review Process**

During formal meetings held from May through October 1999, the Science and Technical Advisory Team (STAT) reviewed the preliminary lists of plants and animals presented within the first draft of this report. After review of these lists, the STAT proposed reorganizing the species into lists based

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<sup>1</sup> 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.

on the following criteria: (1) sensitive species/biodiversity vulnerability (with priority given to the most vulnerable); (2) spatial scale species (e.g. large animals with large home ranges such as mountain lions) and/or animals of special social significance; (3) species which adversely affect vulnerable species (e.g. exotics); and (4) surrogate species. The new criteria are described in more detail in Sections 4.0 and 8.1 through 8.3 of this report. In Section 7.0, the STAT recommended that the title "Exotic Species" be changed to "Pest Species" because they thought it would be a more appropriate representation. A subcommittee was created by STAT to place all of the proposed plants and animals, including those on the threatened and endangered list, in the appropriate new categories. In addition to reorganizing the tables, STAT also recommended additional species to be considered for the conservation plan, which are included in the new tables.

## **2.5 Supplemental Information**

Supplementary information was gathered by staff to help fill in some of the data gaps. Scientific and common names of plants and animals were generally determined using the following references:

1. Amphibians and Reptiles - Stebbins, 1985
2. Birds - Perkins, 1998
3. Mammals - Hoffmeister, 1986
4. Fish - Mayden, 1992
5. Invertebrates - Various sources
6. Plants - McLaughlin, 1992

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 and members of the Science Technical Advisory Team.



### **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.

## **4.0 Vulnerable Species in Pima County**

Vulnerable species are species that are at risk of becoming extirpated in Pima County if current land use practices continue to persist. This category is divided into the following subcategories:

1. Species at risk in Pima County and for whom habitat in Pima County is crucial for their existence
2. Species at risk in Pima County and/or are generally declining throughout their range
3. Species that are rare in Pima County, but the overall status is unknown
4. Species at risk in Pima County but are not at risk overall.

Information for each species is displayed in Table 4 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 4 - Vulnerable Species in Pima County, Arizona

Subcategory (Vulnerable) 1 Species at risk in Pima County and for whom habitat in Pima County is crucial for their existence

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
<i>Abutilon thurberi</i>	Thurber Indian Mallow	AZ Native Plant Law (salvage restricted)	Very narrow: known from only two locations on the Tohono O'Odham Reservation	Partial shade near the mouths of canyons	
<i>Agave schottii</i> var. <i>treleasei</i>	Treleaf Agave	USFWS "Species of Concern"; considered "sensitive" by the Regional Forester; AZ Native Plant Law (highly safeguarded)	Very narrow: only seven records globally, all of which are from Pima County	Sunny, open, gentle rocky slopes or in small drainages in desert grassland or open evergreen woodland vegetation	Found in the Santa Catalinas and Ajo Mountains
<i>Aimophila carpalis</i>	Rufous-winged Sparrow	No federal or state listing	Northern edge of its range; distribution limited in Mexico	Desert grasslands (2400-3200 ft elevation)	Santa Rita Experimental Range has the largest populations
<i>Albionix anophthalmus</i>	Pseudoscorpion (subspecies)	No federal or state listing	Very narrow; only one known record	Caves	Found in Arkenstone Cave within Colossal Cave Mountain Park in Pima County, Arizona.
<i>Amoreuxia gonzalezii</i>	Saiya	USFWS "species of Concern"; considered sensitive by the Regional Forester; AZ Native Plant Law (salvage restricted)	Narrow: 4 records globally, one of which is from Pima County	In Arizona, found on rocky limestone hillsides	Also found in Sonora, Mexico, and probably Baja California
<i>Amsonia kearneyana</i>	Kearney's Blue Star	Federally listed as "endangered" under the Endangered Species Act; considered "sensitive" by the Regional Forester; AZ Native Plant Law (highly safeguarded)	Narrowly distributed	West-facing drainages in the Baboquivari Mountains; grow in stable, partially shaded, coarse alluvium	Protected by Arizona Native Plant Law
* <i>Antilocapra americana sonoriensis</i>	Sonoran Pronghorn Antelope	Federally listed as "endangered" under the Endangered Species Act; "Wildlife of Special Concern" by AGFD	Narrow; historic range was probably larger than today	Broad, Intermountain alluvial valleys with Creosote-Bursage & Palo Verde- Mixed Cacti Associations	Formerly ranged east to near Tucson; also occurs in Mexico in Pinacate Biosphere Reserve
<i>Argia sabino</i>	Sabino Canyon Damselfly	USFWS "Species of Concern"	Narrow distribution	Aquatic	
<i>Chionactis occipitalis klauberi</i>	Tucson Shovel-nosed Snake	No federal or state listing	Subspecies endemic to south-central Arizona; formerly found in Avra Valley	Upland valley floors at low elevation	High priority for this subspecies of the western shovel-nosed snake will almost certainly become federally listed if habitat destruction has been as extensive in Pinal County as in Pima County, where subspecies has already been extirpated
<i>Chionactis palarostris organica</i>	Organ Pipe Shovel-nosed Snake	No federal or state listing	Very local in distribution	Upland valley floors; middle bajada habitat	Subspecies of Sonoran Shovel-nosed Snake

\* Species is listed in more than one category

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# Table 4 - Vulnerable Species in Pima County, Arizona

Subcategory (Vulnerable) 1 Species at risk in Pima County and for whom habitat in Pima County is crucial for their existence

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
<i>Chenidophorus burii xanthonotus</i>	Red-backed Whiptail Lizard	USFWS "Species of Concern"	Ajo, Tabletop and Javelina Mountains	Rocky slopes from 2000 to 4000 feet elevation	
<i>Colinus virginianus ridgwayi</i>	Masked Bobwhite	Federally listed as "endangered" under the Endangered Species Act; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Limited distribution	Desert grasslands with diversity of dense native grasses, forbs and brush	Presently, only known from reintroduced population at Buenos Aires National Wildlife Refuge; also found in Mexico in limited distributions
<i>Coryphantha scheeri</i> var. <i>robustispina</i>	Pima Pineapple Cactus	Federally listed as "endangered" under the Endangered Species Act; considered "sensitive" by the Regional Forester; AZ Native Plant Law (highly safeguarded)	Narrow distribution	Sonoran desertscrub 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 is in the initial planning stages
<i>Cyprinodon macularius eremus</i>	Quitobaquito Pupfish	Federally listed as "endangered" under the Endangered Species Act with designated critical habitat; "Wildlife of Special Concern" by AGFD	Limited distribution	Shallow springs, small streams, and marshes; tolerates saline and warm water	Subspecies of the Desert Pupfish; soon to be elevated to full-species status by A. A. Echelle
<i>Cyprinodon macularius macularius</i>	Desert Pupfish	Federally listed as "endangered" under the Endangered Species Act with designated critical habitat; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Very narrow	Shallow springs, small streams, and marshes; tolerates saline and warm water	Formerly occurred in the Santa Cruz River
<i>Dalea tentaculoides</i>	Gentry Indigobush	USFWS "Species of Concern"; considered "sensitive" by the Regional Forester; AZ Native Plant Law (highly safeguarded)	Narrow distribution	Found along canyon bottoms on cobble terraces subject to occasional flooding; historic collections record possible growth on hillsides	May be extirpated from Pima County; occurs in disturbance prone environments
<i>Echinocactus horizontalis</i> var. <i>nicholii</i>	Nicholl's Turk's Head Cactus	Federally listed as "endangered" under the Endangered Species Act; AZ Native Plant Law (highly safeguarded)	Very narrow distribution	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	
<i>Echinomastus erectocentrus acuminatus</i>	Acuna Cactus	Candidate for listing under the Endangered Species Act; considered "sensitive" by the Regional Forester; AZ Native Plant Law (highly safeguarded)	?	Well drained knolls and gravel ridges in Sonoran Desertscrub	

\* Species is listed in more than one category

DRAFT - 11/19/99

# Table 4 - Vulnerable Species in Pima County, Arizona

Subcategory (Vulnerable) 1 Species at risk in Pima County and for whom habitat in Pima County is crucial for their existence

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
<i>Gila intermedia</i>	Gila Chub	Candidate for listing under the Endangered Species Act; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Scattered statewide	Pools, springs, cienegas and streams	Multiple private landowners including The Nature Conservancy, Audubon Society, Bureau of Land Management, U. S. Forest Service and others; also found in Sonora, Mexico
<i>Glaucidium brasiliense cactorum</i>	Cactus Ferruginous Pygmy-Owl	Federally listed as "endangered" under the Endangered Species Act with designated critical habitat; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	?	Mature cottonwood/willow, mesquite bosque, and Sonoran desert scrub	Few documented sites; surveys are needed
<i>Kinosternon sonoriense longifemorale</i>	Sonoyta Mud Turtle	Candidate for listing under the Endangered Species Act	Also found in Rio Sonoyta, Sonora, Mexico	Ponds and streams; prefers mud or sandy bottoms	Known only from Organ Pipe Cactus National Monument
<i>Lilaeopsis schaffneriana ssp recurva</i>	Huachuca Water Umbel	Federally listed as "endangered" under the Endangered Species Act with proposed critical habitat; considered "sensitive" by the Regional Forester; AZ Native Plant Law (highly safeguarded)	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
<i>Melospiza melodia</i>	Song Sparrow (subspecies)	No federal or state listing	Limited distribution; range is mostly within Pima County	Riparian communities along water	High priority for subspecies; subspecies has lighter shading; also found in Mexico
<i>Muhlenbergia dubioides</i>	Box Canyon Muhly	No federal or state listing	Narrow distribution; 6 global locations, of which 3 are in Pima County	Sky islands (mountains)	Very rare plant; also found in Huachuca Mountains; Arizona endemic
<i>Muhlenbergia xerophila</i>	Sycamore Canyon Muhly	No federal or state listing	Very narrow: 6 locations globally, 5 of which are in Pima County		Arizona endemic
<i>Perilyle ajoensis</i>	Ajo Rock Daisy	AZ Native Plant Law (salvage restricted)	Very narrow: 4 global locations, all of which are in Pima County		Arizona endemic (?)
<i>Pipilo aberti</i>	Abert's Towhee	No federal or state listing	Limited distribution	Riparian habitat along surface water	High priority since its range exists mostly within Pima County; also found in Mexico and along Santa Cruz, Gila & Western Colorado Rivers

\* Species is listed in more than one category

DRAFT - 11/19/99



# Table 4 - Vulnerable Species in Pima County, Arizona

Subcategory (Vulnerable) 1 Species at risk in Pima County and for whom habitat in Pima County is crucial for their existence

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
<i>Poeilopsis occidentalis</i>	Gila Topminnow	Federally listed as "endangered" under the Endangered Species Act; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Narrow distribution	Small streams, springs and cienegas with vegetated shallows; backwaters of large rivers	Historically occurred in backwaters of large rivers (Santa Cruz River, Rillito Creek, Sabino Creek)
<i>Rana chiricahuensis</i>	Chiricahua Leopard Frog	Candidate for listing under the Endangered Species Act; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Also found in mountain regions of central and southeastern Arizona, southwestern New Mexico, and the Sierra Madre Occidental to southern Durango, Mexico	Streams, rivers, backwaters, ponds and stock tanks that are free from introduced fish, bullfrogs and crayfish	Continued presence in Pima County is tenuous without a strong conservation effort on extant populations and restoration of additional populations
<i>Rana tarahumarae</i>	Tarahumara Frog	No federal or state listing	Narrow distribution; found in Mexico	In Arizona, ranges from oak woodland into pine forest, along rocky, gravelly stream courses (canyons); most often found in bedrock plunge pools, or nearby under stones, in niches in cliffs or sitting in riffles.	Extirpated from Pima County; last recorded in 1983
<i>Rhithschildia cincta cincta</i>	Cincta Silkmoth	No federal or state listing	Very local in southeastern Arizona	Diverse habitats ranging from dry desert to riparian areas	Occasional migrant from Mexico; very common in northern Sonora, Mexico
<i>Sonora semiannulata</i>	Ground Snake (valley form)	No federal or state listing	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
<i>Sonorella eremita</i>	San Xavier Talussnail	USFWS "Species of Concern"	Very narrow	Talus slopes	Delisted due to conservation agreement; Only one known population
<i>Sonorella papagorum</i>	Papago Talussnail	No federal or state listing	Narrow distribution	Talus slopes	
<i>Sonorella xanthenes</i>	Kitt Peak Talussnail	No federal or state listing	Narrow distribution	Talus slopes	
<i>Tryonia quitobaquiliae</i>	Quitobaquito Tryonia	USFWS "Species of Concern"	Narrow distribution	Aquatic	
<i>Zaitzevia parvula</i>	Santa Rita Water Beetle	No federal or state listing	Very narrow	Aquatic	

\* Species is listed in more than one category

DRAFT - 11/19/99

# Table 4 - Vulnerable Species in Pima County, Arizona

## Subcategory (Vulnerable) 2 Species at risk in Pima County and/or are generally declining throughout their range

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
* <i>Accipiter gentilis apache</i>	Apache Goshawk	USFWS "Species of Concern"; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD; Navajo Endangered Species List (Status 4)	?	Forest dweller; mature conifers and cottonwoods in mountains	
<i>Agave murpheyi</i>	Hohokam Agave	USFWS "Species of Concern"; considered "sensitive" by the Regional Forester; AZ Native Plant Law (highly safeguarded)	139 global records, of which only one is from Pima County	In southern Arizona, associated with historic or human habitation (i. e. gardens)	Maintained in gardens within the Tohono O'odham Nation; food-plant; cultural importance
<i>Allium gooddingii</i>	Goodding Onion	Considered "sensitive" by the Regional Forester; AZ Native Plant Law (highly safeguarded); Navajo Endangered Species List (Status 3)	Narrow distribution	Moist, shaded canyon bottoms in climax conifer forests. Located most frequently in mature forests, usually along north-trending drainage of perennial, intermittent and ephemeral streams.	Taken off of the ESA "candidate" list; habitat has been degraded due to livestock management, timber harvesting; habitat disturbance associated with silvicultural operations; construction of ski recreation areas and associated facilities.
<i>Anodonta californensis</i>	California Floater (clam)	USFWS "Species of Concern"	Widespread overall (Historically widespread in Arizona)	Aquatic; needs native fish to expand its range (attaches to the gills of native fish)	Possibly extirpated from Pima County
<i>Athene cunicularia</i>	Burrowing Owl	No federal or state listing	Widespread in range; local in distribution	Agricultural areas; levees and dikes	Declining numbers in Pima County
<i>Atta mexicana</i>	Mexican Leaf-cutter Ant	No federal or state listing			
<i>Buteo swainsoni</i>	Swainson's Hawk	Considered "sensitive" by the Regional Forester	Widespread	Grasslands for nesting	Migratory species
* <i>Canis lupus baileyi</i>	Mexican Gray Wolf	Federally listed as "endangered" under the Endangered Species Act	Formerly widespread in distribution	Chaparral, woodland, and forested areas; may cross desert areas; needs large areas of mountain and grassland terrains	Unconfirmed reports of individuals in southern Arizona; experimental nonessential population was introduced in the Blue Primitive Area; last record in 1952 on the southern side of the Catalina Mountains; may still persist in Mexico
<i>Catostomus clarkii</i>	Desert Sucker	No federal or state listing	Historically widespread in Arizona	Aquatic	May occur periodically in Pima County
<i>Catostomus insignis</i>	Sonora Sucker	No federal or state listing	Historically widespread in Arizona	Aquatic	May occur periodically in the Santa Cruz River outside Pima County

\* Species is listed in more than one category

DRAFT - 11/19/99

# Table 4 - Vulnerable Species in Pima County, Arizona

## Subcategory (Vulnerable) 2 Species at risk in Pima County and/or are generally declining throughout their range

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
<i>Charadrius montanus</i>	Mountain Plover	Proposed for listing as "threatened" under the Endangered Species Act	?	Open arid plains, short grass prairies and scattered cactus	Winters in Pima County only, no breeding
<i>Cnemidophorus burti stictogrammus</i>	Giant Spotted Whiptail	USFWS "Species of Concern"	Formerly abundant in Sabino Canyon; extirpated from Santa Cruz	Riparian areas on flanks or flats	
<i>Coccyzus americanus occidentalis</i>	Western Yellow-billed Cuckoo	Petitioned for listing under the Endangered Species Act; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD; Navajo Endangered Species List (Status 4)	Widespread	Streamside cottonwood, willow groves and large mesquite bosques for migrating and breeding	Declining throughout its range; this species may be rarely observed as transient in desert and urban settings
<i>Echinomastus erectocentrus var. erectocentrus</i>	Needle-spined Pineapple Cactus	USFWS "Species of Concern"; considered "sensitive" by the Regional Forester; AZ Native Plant Law (salvage restricted)	?	Limestone rock outcrop or limestone alluvium in upland areas	Rare, but not likely to be listed under the ESA
<i>Empidonax traillii eximius</i>	Southwestern Willow Flycatcher	Federally listed as "endangered" under the Endangered Species Act with designated critical habitat	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
* <i>Falco femoralis septentrionalis</i>	Northern Aplomado Falcon	Federally listed as "endangered" under the Endangered Species Act	Limited distribution in the U. S. (known from introduced populations in Texas)	Grassland	Extirpated from Pima County; listed as "endangered" by the USFWS throughout its entire range; historic range included Arizona, New Mexico, Texas, Mexico and Guatemala
* <i>Felis pardalis</i>	Ocelot	Federally listed as "endangered" under the Endangered Species Act	Widely distributed south of AZ	Humid tropical and sub-tropical forests, savannahs and semi-arid thorn scrub (dense cover)	Last record in 1952 on the southern side of the Catalina Mountains; extirpated from Arizona (AGFD)
* <i>Felis yagouaroundi tolteca</i>	Jaguarundi	Federally listed as "endangered" under the Endangered Species Act; considered "sensitive" by the Regional Forester	Widely distributed south of AZ	Variety of habitats: deciduous forests, riparian areas, swampy grasslands, upland dry savannahs, etc.	Unconfirmed sightings in southern Arizona; AGFD does not consider this species as part of the native fauna.
<i>Lanius excubitor</i>	Northern Shrike	No federal or state listing	Widespread	Grasslands	Migratory species
<i>Lasius borealis</i>	Western Red Bat	Considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Broad range, but not very common	Foothills riparian	Always has been low in numbers

\* Species is listed in more than one category

DRAFT - 11/19/99

# Table 4 - Vulnerable Species in Pima County, Arizona

Subcategory (Vulnerable) 2 Species at risk in Pima County and/or are generally declining throughout their range

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
<i>Lasius Ega</i>	Southern Yellow Bat	No federal or state listing	Narrow distribution	Palm fronds	Little is known; some concern due to low numbers
* <i>Leptomycotis curasoae yerbae</i>	Lesser Long-nosed Bat	Federally listed as "endangered" under the Endangered Species Act; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Widely distributed south of Arizona	Desert scrub habitat with agave and columnar cacti present as food plants; day roosts in caves and abandoned tunnels	Species is migratory
* <i>Panthera onca</i>	Jaguar	Federally listed as "endangered" under the Endangered Species Act; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	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 Arizona (confirmed with photographs); transient in Arizona
<i>Peromyscus merriami</i>	Merriam's Mouse (Mesquite Mouse)	No federal or state listing	Small range in Pima County; widespread elsewhere	Mesquite bosque	Numbers have plummeted in Pima County; more commonly found in Mexico
<i>Plecotus townsendii pallascens</i>	Pale Townsend's Big-eared Bat	USFWS "Species of Concern"	Widespread	Day roosts in caves and mines from desert scrub to woodlands and coniferous forests.	
* <i>Rana yavapaiensis</i>	Lowland Leopard Frog	USFWS "Species of Concern"; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Range has been reduced	Streams, springs and ponds	Threatened by loss of habitat, disease, and exotic species (bullfrogs, fish and crayfish)
<i>Rhinichthys osculus</i>	Speckled Dace	No federal or state listing	Widespread	Aquatic (bottom)	Extirpated from Pima County; taxonomic uncertainties; surveys are needed in Buchanan Canyon, etc.
<i>Sonorella bagnarai</i>	Bagnara's Talussnail	No federal or state listing	?	Talus slopes	
<i>Sonorella pupela</i>	Talussnail	No federal or state listing	?	Talus slopes	More surveys and better taxonomy are required to better understand its status
<i>Sorex arizonae</i>	Arizona Shrew	USFWS "Species of Concern"; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Very localized	Arizona springs in mountain ranges (5000-7000 ft)	Santa Rita population is gone; very small numbers
<i>Speyeria nokomis caerulea</i>	Blue Silverspot Butterfly	No federal or state listing	?	Mountain cienegas; violets are a food source	Extirpated in the United States; Mount Lemmon population extirpated due to water diversion which resulted in a loss of its food source

\* Species is listed in more than one category

DRAFT - 11/19/99

# Table 4 - Vulnerable Species in Pima County, Arizona

## Subcategory (Vulnerable) 2 Species at risk in Pima County and/or are generally declining throughout their range

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
<i>Strix occidentalis lucida</i>	Mexican Spotted Owl	Federally listed as "threatened" under the Endangered Species Act; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD; Navajo Endangered Species List (Status 3)	Sky Islands	Nests in canyons and older forests with multi-layered foliage structure	Found in Saguaro National Park and Coronado National Forest
<i>Terrapene ornata luteola</i>	Desert Box Turtle	No federal or state listing	Western edge of subspecies' range	Desert Grasslands/Chihuahuan Desert Scrub	Still present at Buenos Aires National Wildlife Refuge and Empire-Cienega Ranch as far north as T-10.
<i>Thamnophis eques megalops</i>	Mexican Garter Snake	USFWS "Species of Concern"; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Northern edge of its range	Perennial aquatic habitat with dense vegetation (cienegas and riverine marshes)	U. S. populations (Arizona and New Mexico) are in danger of being extirpated; already extirpated in Arizona from Colorado River and Yuma; threats include loss of habitat and introduction of exotic species
<i>Toxostoma lecontei</i>	Le Conte's Thrasher	No federal or state listing	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
<i>Tryonia protea</i>	Desert Tryonia	No federal or state listing	?	Aquatic	Extirpated from Pima County
<i>Tumamoca macdougallii</i>	Tumamoc Globeberry	Considered "sensitive" by the Regional Forester; salvage restricted under the Native Plant Law	Narrow distribution	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 require by the ESA has lapsed.
<i>Vireo bellii</i>	Bell's Vireo	No federal or state listing	Eastern edge of range	Mostly found in dense woodland or shrubland along streams.	

## Subcategory (Vulnerable) 3 Species that are rare in Pima County, but the overall status is unknown

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
<i>Amsonia grandiflora</i>	Large-flowered Blue Star	USFWS "Species of Concern"; considered sensitive by the Regional Forester	20 global records, 2 of which are from Pima County	Normally found in canyon bottoms in oak woodlands typically dominated by Emory oak and Mexican blue oak	Arizona endemic; adapted to rock fall disturbance
<i>Arabis tricornuta</i>	Chiricahua Rock Cress	No federal or state listing	Narrow: six global records, one of which is from Pima County		Pima County population is disjunct from the Chiricahua populations

\* Species is listed in more than one category

DRAFT - 11/19/99



# Table 4 - Vulnerable Species in Pima County, Arizona

Subcategory (Vulnerable) 3 Species that are rare in Pima County, but the overall status is unknown

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
<i>Asclepias lemmonii</i>	Lemon Milkweed	No federal or state listing	12 global records, one of which is from Pima County		
<i>Berberis harrisoniana</i>	Kofa Barbbery	No federal or state listing	Narrow: 6 global records, 2 of which are from Pima County		
<i>Carex ultra</i>	Arizona Giant Sedge	No federal or state listing	12 global records, 2 of which are from Pima County		
<i>Eryngium sparganophyllum</i>	Ribbonleaf Button Snakeroot	No federal or state listing	Very narrow: one record from Pima County		Possibly extirpated
<i>Eucnide rupestris</i>	Flor de la Piedra	No federal or state listing	Very narrow: two global records, one of which is from Pima County		
* <i>Falco peregrinus anatum</i>	American Peregrine Falcon	Delisted from the "endangered" species list under the Endangered Species Act; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD, Navajo Endangered Species List (Status 3)	Widely distributed in the 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 Arizona; species was recently removed from the federal "endangered" species list under the Endangered Species Act
* <i>Haliaeetus leucocephalus</i>	Bald Eagle	Federally listed as "threatened" under the Endangered Species Act; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD, Navajo Endangered Species List (Status 3)	Widely distributed	Large trees or cliffs near water (reservoirs, rivers and streams) with abundant prey	Winters along rivers and reservoirs, no breeding in Pima County; species has been proposed for delisting from the federal "threatened" species list under the Endangered Species Act
<i>Hermannia pauciflora</i>	Sparselcaf Hermannia	No federal or state listing	Very narrow: 7 global records, all of which are from Pima County		
<i>Hieracium rusbyi</i>	Rusby Hawkweed	No federal or state listing	Narrow: 4 global records, one of which is from Pima County		
<i>Lupinus huachucae</i>	Huachuca Mountain Lupine	No federal or state listing	Narrow: 4 global records, one of which is from Pima County		
<i>Malaxis porphyrea</i>	Malaxis Porphyrea (orchid)	No federal or state listing	7 global records		Extirpated from the Santa Catalina mountains.

\* Species is listed in more than one category

DRAFT - 11/19/99

# Table 4 - Vulnerable Species in Pima County, Arizona

## Subcategory (Vulnerable) 3 Species that are rare in Pima County, but the overall status is unknown

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
<i>Metastelma mexicanum</i>	Wiggins Milkweed Vine	USFWS "Species of Concern"; considered "sensitive" by the Regional Forester	12 global locations; one of which is in Pima County		Arizona endemic
<i>Pectis imberbis</i>	Beardless Clinch Weed	USFWS "Species of Concern"; considered "sensitive" by the Regional Forester	11 global locations, one of which is in Pima County	Open situations in grassland and oak/grassland	Pima County population may be extirpated; adapted to disturbance, grows along road cuts
<i>Penstemon discolor</i>	Catalina Beardtongue	AZ Native Plant Law (salvage restricted)	14 global locations, 3 of which are in Pima County		Arizona endemic
<i>Physalis latiphysa</i>	Broadleaf Ground Cherry	No federal or state listing	Narrow: 4 global locations, one of which is in Pima County		
<i>Salvia amissa</i>	Aravaipa Sage	USFWS "Species of Concern"	10 global locations, one of which is in Pima County	Shady canyon bottoms near streams	Pima County population may be extirpated; Arizona endemic
<i>Samolus vagans</i>	Chiricahua Mountain Brookweed	No federal or state listing	15 global locations, 3 of which are in Pima County		

## Subcategory (Vulnerable) 4 Species at risk in Pima County, but are not at risk overall

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
* <i>Asturina nitida</i>	Gray Hawk	USFWS "Species of Concern"; considered "sensitive" by the Regional Forester; ""Wildlife of Special Concern"" by AGFD	Widespread; northern edge of range	Riparian areas	15 to 20 pairs in Pima County
* <i>Buteo albonotatus</i>	Zone-tailed Hawk	Considered "sensitive" by the Regional Forester; Navajo Endangered Species List (Status 1)	Northern edge of range	Canyon riparian areas	
<i>Caprimulgus ridgwayi</i>	Buff-collared Nightjar	Considered "sensitive" by the Regional Forester	Widespread	Riparian and riparian uplands	Abundant elsewhere
* <i>Caracara plancus</i>	Crested Caracara	Considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Northern edge of range; widespread south of AZ	Sonoran Desert uplands	Breeding sites in Sells and Tohono O'Odham Nation; also common in Texas

\* Species is listed in more than one category

# Table 4 - Vulnerable Species in Pima County, Arizona

Subcategory (Vulnerable) 4 Species at risk in Pima County, but are not at risk overall

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
<i>* Choeronycteris mexicana</i>	Mexican Long-tongued Bat	USFWS "Species of Concern"; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Northern end of its range	Roosts and maternity sites are along perennial and intermittent streams	Not very common, low in numbers
<i>Elaphe triaspis intermedia</i>	Western Green Snake	Considered "sensitive" by the Regional Forester	Widespread; common in Mexico and farther south	Productive riparian areas in mountains	
<i>Empidonax fulvifrons</i>	Northern Buff-breasted Flycatcher	USFWS "Species of Concern"; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Northern edge of its range	Open stands of pine or sycamore with bare, weedy or grassy understory areas; riparian vegetation (above 6000ft); does not tolerate dense vegetation	
<i>Lampropeltis getula nigrita</i>	Black Kingsnake	No federal or state listing	Northern edge of subspecies range	Frequents a variety of habitats including coniferous forest, woodland, swampland, river bottoms, farmland, prairie, chaparral and desert.	
<i>* Parabuteo unicinctus</i>	Harris's Hawk	Considered "sensitive" by the Regional Forester	Scattered, isolated populations in Arizona, New Mexico and Texas	Semiopen desert scrub, savanna, grassland and wetland habitats; in Arizona, affiliated closely with palo-verde/saguaro communities	
<i>Peniocereus striatus</i>	Dahlia Rooted Cereus	AZ Native Plant Law (salvage restricted)	Narrow distribution		Strongly associated with ironwood
<i>Progne subis</i>	Purple Martin	No federal or state listing	Widespread	Saguaro/Pinyon Pine communities	Cavity nests needed; at risk in Pima County
<i>Trilelelopsis palmeri</i>	Blue Sand Lily	AZ Native Plant Law (salvage restricted)	Very narrow distribution; more common in Mexico	Sand dunes	Habitat invaded by exotics (Sahara Mustard); important culturally
<i>* Trogon elegans</i>	Elegant Trogon	No federal or state listing	Northern edge of range	Canyon riparian areas	

\* Species is listed in more than one category

DRAFT - 11/19/99

## **5.0 HABITATS OF CONCERN & TARGET PLANT COMMUNITIES**

Table 6 displays a list of habitats of concern and target plant communities for conservation within Pima County. Target environments were determined during 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 and the STAT.

Aquatic environments, wetlands and riparian woodlands are considered to be a high priority for conservation planning based on discussions during the interviews. These environments are rapidly disappearing throughout the United States, including Pima County. Diversion of water and desiccation of these environments 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 introduced or "invader" species which inhibit growth of native species.

Native grasslands were also mentioned by our experts as being 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. overstocking livestock) have degraded grasslands and reduced species diversity. One specific grassland type mentioned by our experts 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 environments 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 other native species. Saguaro communities indicate areas suitable for cavity nesters such as the Cactus Ferruginous Pygmy-owl and the Gila Woodpecker. Several experts recommended that attention should be focused on these indicator species and communities when determining critical habitat for species listed within the SDCP.

## **6.0 OTHER SPECIES DISCUSSED**

Appendix B contains a list of species which were discussed in the interviews, for which interviewees 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) or any of the other species listed in Table 4 or Appendices D through F.

## **7.0 PEST SPECIES FOUND IN PIMA COUNTY**

A list of pest species which occur in Pima County is located in Appendix C. Many of these species are closely associated with humans and human modified environments. Some of them can take over natural environments, creating monocultures which are very harmful to other species. Other species can affect natural processes. For instance, buffel grass, red brome and Lehmann's lovegrass are capable of changing the frequency of fire in the landscape. Nearly all of the pest species are not native to this region.

Changes in species composition are to be expected over the geologic time scale. As climate changes, and land bridges are formed or sundered, the geographic range over which plants and animals will extend or contract in distribution. These changes are occurring now, but they are hard to detect. A recent example may be provided by animals such as javelina and coatimundi, which appear to have extended their ranges northward over the last 100 years (Brown and Davis, 1994). Over the last several thousand years, indigenous human cultures of North America also moved some plants and animals beyond their natural ranges, principally through domestication and cultivation.

Today new species are being introduced at a rate which is much higher than has been typical over geologic time. Rapid, intercontinental commerce allows many species to move beyond their native ranges, in effect connecting environments that have not been linked for millions of years (Westbrooks and Eplee, 1995). Species from other lands are now a growing threat to native plants and animals in the U.S. (OTA, 1993).



## **8.0 DISCUSSION**

### **8.1 Keystone Species in Pima County**

Keystone species are species who enrich ecosystem function in a unique and significant manner through their activities, and the effect is disproportionate to their numerical abundance. Their removal initiates changes in ecosystem structure and often loss of diversity (Mills et. al, 1993). These keystones may be habitat modifiers (i.e., cottonwoods, prairie dog, beaver), keystone predators (i.e., puma and coyote) or keystone herbivores (i.e., muskrat). Appendix D provides a draft list of the "keystone" species found in Pima County.

### **8.2 Flagship Species in Pima County**

Flagship species are charismatic creatures that have wide appeal across cultural and economic classes, and thus draw attention to a conservation objective. They are the foundation of building popular support for a protected area (Miller, 1999). A list of potential "flagship" species is located in Appendix E.

### **8.3 Umbrella Species in Pima County**

Umbrella species are species who generally cover large areas in their daily or seasonal movements. They serve as "mobile links" at the landscape scale through predation, seed dispersal or pollination. Protecting enough habitat and connectivity to assure viable population of these organisms benefits many other species more restricted in their range (Miller, 1999). Appendix F displays a list of the "umbrella" species for Pima County.

### **8.4 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.

### **8.5 Conservation of Species vs. Habitat Conservation**

The best way of protecting individual plant and animal species is by preserving the environments upon which they depend. Interactions between the various plant and animal species that compose

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 some way, 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.

## **8.6 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.

## **8.7 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 because 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 Talussnail is found to exist on one particular hillslope in Eastern Pima County. Another hillslope close by contains a population of talussnail which could be the same genus or might be a different one. (Bob McCord, personal communication).

## **8.8 Other Issues**

Under Section 9 of the Endangered Species Act (ESA), the "take" of any federally listed animal is prohibited. However, there are no such protections for plant species listed under the 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

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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 through pre-listing agreements or local or federal management activities.

Introduced or "invasive" species are of great concern when developing conservation measures designed to protect listed and unlisted species. Many invasive 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 invasives 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 introduced species.

## **9.0 RECOMMENDATIONS**

### **9.1 STAT Goals and Objectives**

The Science and Technical Advisory Team (STAT) was created to develop and promote the biological element of the Sonoran Desert Conservation Plan (SDCP). The biological goal of the SDCP, adopted by the STAT on July 20, 1999, is to ensure the long-term survival of the full spectrum of plants and animals that are indigenous to Pima County through maintaining or improving the habitat conditions and ecosystem functions necessary for their survival.

Inherent within this broad goal are several objectives:

1. Promote recovery of federally listed and candidate species to the point where their continued existence is no longer at risk.
2. Where feasible and appropriate, re-introduce and recover species that have been extirpated from this region.
3. Maintain or improve the status of unlisted species whose existence in Pima County is vulnerable.
4. Identify biological threats to the region's biodiversity posed by introduced and nonnative species of plants and animals, and develop strategies to reduce these threats and avoid additional invasive species in the future.
5. Identify compromises to ecosystem functions within target plant communities selected for their biological significance and develop strategies to mitigate them.
6. Promote long-term viability for species, environments and biotic communities that have special significance to people in this region because of their aesthetic or cultural values, regional uniqueness, or economic significance.

In the broadest sense, this conservation element of the SDCP will be the framework for integrating biological conservation into Pima County's development process. If the plan effectively addresses the objectives above, it will also lead to Section 10 Permits under the Endangered Species Act, for those species where it is justified by scientific evidence and by the implementation of a defensible habitat conservation plan.

### **9.2 STAT Recommendations**

As seen in the Tables 8 through 12, the list of species proposed for conservation under the Sonoran Desert Conservation Plan is quite large.<sup>1</sup> Research and analysis of a large number of species can be quite costly and time consuming. In an effort to expedite the SDCP process, members of the Science

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<sup>1</sup> The total number of species is 262. A breakdown of the plants and animals in each category is as follows: Vulnerable (108); Keystone (14); Flagship (34); Umbrella (27); Pest (59); Other (58). There are thirty-six multiple listings (species listed in more than one category) which accounts for the difference in the final total.

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Technical Advisory Team (STAT) decided to request species data summaries for the first two categories of the vulnerable species list (Table 6). Prioritizing these species would allow for more time to be spent on researching and gathering data for threatened habitats and plant communities, which is essential to the overall SDCP process. Information obtained on the species chosen by the STAT will provide a basis to determine which species are adequately conserved and protected by the SDCP to warrant inclusion in a Section 10 permit application.

The remainder of the species listed will be set aside until the habitat conservation elements are better developed. These species provide useful insights into the ecological processes needed to maintain a healthy environment. Some species may be added to the SDCP list as more information is obtained about their status within Pima County. Others may be useful tools in planning for wildlife preserves or movement corridors which is a future task within the SDCP process. The STAT has recommended that challenges presented by invasive introduced species to native species, their habitats and ecological processes must be identified through the biological scope of work for the SDCP.

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## 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: \_\_\_\_\_

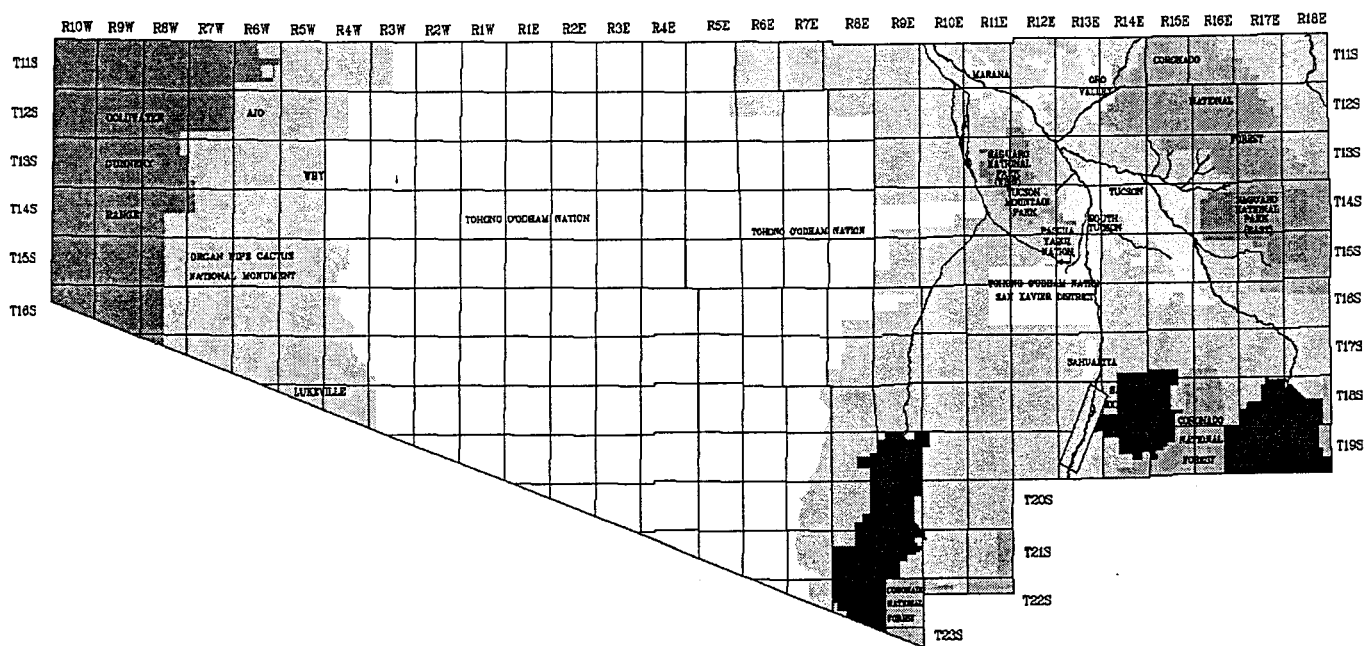
Briefly describe its range outside of Pima County: \_\_\_\_\_

\_\_\_\_\_  
 \_\_\_\_\_

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		

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## APPENDIX B

## APPENDIX B OTHER SPECIES DISCUSSED

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
<i>Kinosternon flavescens</i>	Yellow-bellied Mud Turtle	Western (Altar Valley, Tohono O'Odham)	Narrow distribution	Aquatic	
<i>Bufo alvarius</i>	Sonoran Desert Toad (Colorado River Toad)			Ranges from arid mesquite-cresote bush lowlands and arid grasslands into oak-sycamore mountain canyons; often found near permanent water, but also frequents temporary pools.	
<i>Gastrophryne olivacea</i>	Great Plains Narrow-mouthed Toad	Eastern/Western	Northwestern edge of range	Temporary ponds required for breeding; adult habitat requirements are poorly known	
<i>Bufo retiformis</i>	Sonoran Green Toad	Eastern/Western	Northern edge of range	Temporary ponds required for breeding; adult habitat requirements are poorly known	
<i>Pternohyla fodiens</i>	Northern Casque-headed Frog (Lowland Burrowing Treefrog)	Eastern/Western	Northern edge of range; narrower distribution than Sonoran green and narrow-mouthed Toads	Temporary ponds required for breeding; adult habitat requirements are poorly known	
<i>Amphispiza bilineata</i>	Black-throated Sparrow	Eastern	Widespread		
<i>Tyrannus malancholicus</i>	Tropical Kingbird	Eastern	Northern edge of range	Tall riparian growth (thick cottonwoods)	
<i>Tyrannus crassirostris</i>	Thick-billed Kingbird	Eastern (San Pedro River near Reddington)	Widespread	Tall riparian growth (thick cottonwoods)	
<i>Camptostoma imberbe</i>	Northern Beardless Tyrannulet	Eastern	Northern edge of range; limited distribution in Pima County	Dense riparian growth	
<i>Butorides virescens</i>	Green Heron	Eastern	Widespread	Wetlands	
<i>Vireo vicinior</i>	Gray Vireo	Eastern (near Reddington Pass)	Very local in distribution; southern edge of range	Oak and Pinyon Pine communities	
<i>Porzana carolina</i>	Sora	Eastern/Western	Widespread	Cattail marshes (mostly man-made in Pima County)	



# **APPENDIX B** **OTHER SPECIES DISCUSSED**

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
<i>Dendrocygna autumnalis</i>	Black-bellied Whistling-Duck	Eastern	Limited in Arizona	Wetlands	More common in Mexico
<i>Passerina versicolor</i>	Varied Bunting	Eastern (Tanque Verde, Cienega Creek)	Northern edge of its range	Higher elevation washes	
<i>Melanerpes uropygialis</i>	Gila Woodpecker	Eastern/Western	Endemic	Saguaro communities	
<i>Rallus limicola</i>	Virginia Rail	Eastern/Western	Widespread	Cattail marshes (mostly man-made in Pima County)	
<i>Dendroica petechia</i>	Yellow Warbler	Eastern	Widespread	Tall riparian habitat (Cottonwoods)	
<i>Colaptes chrysoides</i>	Gilded Flicker	Eastern/Western	Endemic	Saguaro communities (needed for breeding)	Must use saguaro cavities created by others
<i>Polioptila melanura</i>	Black-tailed Gnatcatcher	Eastern	?		
<i>Agosia chrysogaster</i>	Longfin Dace	Eastern (Cienega Creek)	Widely distributed	Aquatic	
<i>Apis mellifera</i>	Honey Bee	Eastern/Western	Widespread	Desert; riparian	
<i>Chlorochroa rita</i>	Santa Rita Mountain Chlorochroan Bug	Eastern	May be at the northern edge of its range	Mountain riparian	
<i>Ascia howarthii</i>	Sulfur Butterfly	Western	?		
<i>Heterelmis stephani</i>	Stephan's Heterelmis Riffle Beetle	Eastern (Santa Rita-Bog Spring)	Edge of its range	Aquatic	
<i>Cicindela oregona maricopa</i>	Maricopa Tiger Beetle	Not in Pima County	?		
<i>Perdita versis</i>	Bee	Eastern (Baboquivari)	Widespread		
<i>Stinga morrisoni</i>	Morrison's Skipper	Eastern (Empire Mountains, Baboquivari)	Edge of its range; very local distribution in Arizona	Grassy openings in Ponderosa pine, piñon forest and oak woodlands	Also found in Colorado, New Mexico, west Texas and northern Mexico
<i>Neotoma mexicana</i>	Mexican Wood Rat	Eastern	Widespread	In Arizona, found in montane coniferous forest	
<i>Sigmodon arizonae</i>	Arizona Cotton Rat	Eastern	?	Weedy patches; grassland	

# APPENDIX B OTHER SPECIES DISCUSSED

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
<i>Myotis auricularis</i>	Southwestern Myotis	Eastern/Western	Localized	Roosts in caves, mines, tunnels, under bridges and sometimes in buildings within a few miles of water.	
<i>Eumops underwoodi</i>	Underwood's Mastiff Bat	Western	Very localized; northern edge of its range	Very little is known; has been netted over waterholes in desert mesquite/grassland	
<i>Eumops perotis californicus</i>	Greater Mastiff Bat	Western/Eastern	Widespread in range	Roosts in crevices and shallow caves on the sides of cliffs and rock walls	
<i>Macrotus californicus</i>	California Leaf-nosed Bat	Eastern/Western	Widespread, eastern edge of range	Caves, crevices and mines within desertscrub	
<i>Thomomys spp.</i>	Pocket Gophers	Eastern/Western	Widespread		
<i>Dipodomys spectabilis</i>	Banner-tailed Kangaroo Rat	Eastern/Western	Scattered throughout Pima County	Found in open creosote bush deserts, grassy bajadas, mesquite flats, desert grassland and Chihuahuan desertscrub in southeastern Arizona	
<i>Sorex palustris</i>	Water Shrew	Not in Pima County	?	Mountains near water	
<i>Perognathus longimembris</i>	Little Pocket Mouse	?	Narrow distribution in Arizona	Found on or in sandy or gravelly soils, often in terrain that is rolling or broken by ravines or rocks	
<i>Perognathus amplus</i>	Arizona Pocket Mouse	Eastern	Widespread in Arizona	In southern Arizona, found mostly on creosotebush flats with some mesquite, palo verde and mixed cacti	
<i>Didelphis virginiana californica</i>	Mexican Opossum	Eastern (Arivaca area)	Narrow distribution; species is at the northern edge of range	Various	This species is expanding its range from Mexico
<i>Lutra canadensis</i>	River Otter	Not in Pima County	Widespread	Rivers, streams	
<i>Perognathus flavus</i>	Silky Pocket Mouse	Eastern (Santa Rita Mountains)	Eastern edge of range	Grassland	
<i>Lepus callotis</i>	White-sided Jackrabbit	Eastern	?		
<i>Sophora arizonica</i>	Arizona Necklace	Eastern	?		

# APPENDIX B OTHER SPECIES DISCUSSED

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
<i>Prosopis velutina</i>	Velvet Mesquite	Eastern/Western	Wide distribution in southern Arizona	Occurs in vegetation types such as paloverde-bursage, cacti, desert grasslands, oak woodlands and pinyon-juniper woodlands	Along major water courses and their tributaries, the velvet mesquite can form bosques
<i>Bursera fagaroides</i>	Torch Wood Copal	Eastern/Western	Narrow distribution		
<i>Canotia holocantha</i>	Crucifixion Thorn	Eastern	Widely distributed, but patchy	Floodplains and edge of floodplains	
<i>Phrynosoma cornutum</i>	Texas Horned Lizard	Eastern?	Widely distributed East of Pima County	Inhabits arid and semiarid open country with sparse plant growth - bunch grass, cactus, juniper, acacia and mesquite.	Historically not common in Pima County
<i>Sceloporus scalaris</i>	Bunch Grass Lizard	Eastern (possibly near Empire Ranch)	Widely distributed East of Pima County	Very dependent on bunch grass in mountains or lower grasslands	
<i>Tantilla wilcoxi wilcoxi</i>	Huachuca Black-headed Snake	Eastern (Santa Ritas- Madera and Gardner Canyons)	Narrow distribution	Found under rocks, logs and dead plants (agave, yucca, sotol) in shady, rocky canyons. Also found in open rocky areas in desert grasslands and evergreen woodland	
<i>Tantilla wilcoxi</i>	Chihuahuan Black-headed Snake	Eastern	May be more widely distributed south of Pima County	Found under rocks, logs and dead plants (agave, yucca, sotol) in shady, rocky canyons. Also found in open rocky areas in desert grasslands and evergreen woodland	
<i>Gyalopion quadrangularis</i>	Thornscub (Desert) Hook-nosed Snake	Not in Pima County	May be more widely distributed south of Pima County	Found in loose soil of canyon bottoms and outwash plains in foothills of mesquite grassland.	
<i>Gyalopion canum</i>	Western (Chihuahuan) Hook-nosed Snake	Eastern (Empire Mtns and Santa Ritas)	Widespread; northern edge of range	Grassland (lowland)	
<i>Oxybelis aeneus</i>	Brown Vine Snake	Eastern (Arivaca Lake, Agua Caliente Cave in Santa Ritas)	Widely distributed south of Pima county	Normally found near water (Arboreal); also found in oak woodlands	

# **APPENDIX B OTHER SPECIES DISCUSSED**

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
<i>Lichanura trivirgata</i>	Mexican Rosy Boa	Western (Organ Pipe, Tohono O'Odham)	Narrow distribution	Inhabits rocky shrublands and desert; attracted to permanent and intermittent streams, but does not require permanent water source.	
<i>Crotalus lepidus klauberi</i>	New Mexico Banded Rock Rattlesnake	Eastern (Santa Rita)	Widely distributed East of Pima County	Primarily inhabits rocky ridges, hillsides, streambeds, and gorges in arid and semiarid habitats (5000 ft elevation); may also occur in lowlands	
<i>Lampropeltis getulus splendida</i>	Desert Kingsnake	Does not occur in Pima County	Widespread	Frequents a variety of habitats including coniferous forest, woodland, swampland, river bottoms, farmland, prairie, chaparral and desert.	
<i>Eumeces callicephalus</i>	Mountain Skink	Eastern	More common in Mexico	Madrean canyons	

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## APPENDIX C

# **APPENDIX C** **PEST SPECIES FOUND IN PIMA COUNTY, ARIZONA**

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT FOUND	COMMENTS
<i>Pseudemys concinna</i>	River Cooter	Eastern	Widespread	Aquatic	Known from Maricopa County; not verified in Pima County; expansion from urban ponds; released by humans
<i>Pseudemys scripta</i>	Slider (Turtle)	Eastern	Widespread	Aquatic	Expansion from urban ponds; released by humans
<i>Pseudemys rubriventris</i>	Red-bellied Turtle	Eastern	Widespread	Aquatic	Known from Maricopa County; not verified in Pima County; expansion from urban ponds; released by humans
<i>Macrochelys temminckii</i>	Alligator Snapping Turtle	Eastern	Widespread	Aquatic	Known from Maricopa County; not verified in Pima County; expansion from urban ponds; released by humans
<i>Ambystoma tigrinum</i>	Tiger Salamander	Eastern	Widespread (introduced species)	Aquatic	May cause damage to pupfish, topminnow and other salamander populations
<i>Rana catesbeiana</i>	Bullfrog	Eastern	Widespread	Aquatic	Competes with native frogs; efforts are currently underway to combat the problem
<i>Rana berlandieri</i>	Rio Grande Leopard Frog	Eastern	Narrow distribution	Aquatic	May arrive in Pima County via the Central Arizona Project canal; may outcompete native leopard frogs
<i>Xenopus laevis</i>	African Clawed Frog	Eastern/Western	Narrow distributions in U.S.; populations introduced	Aquatic	Bad for native fish populations
<i>Trionyx spiniferus</i>	Spiny Softshell Turtle	Eastern	Widespread	Aquatic	Bad for native fish populations
<i>Chrysemys picta</i>	Painted Turtle	Eastern	Widespread	Aquatic	Known from Maricopa County; not verified in Pima County; expansion from urban ponds; released by humans
<i>Graptemys spp.</i>	Map Turtles	Eastern	Widespread	Aquatic	Known from Maricopa County; not verified in Pima County; expansion from urban ponds; released by humans
<i>Chelydra serpentina</i>	Snapping Turtle	Eastern	Widespread	Aquatic	Known from Maricopa County; not verified in Pima County; expansion from urban ponds; released by humans

# APPENDIX C PEST SPECIES FOUND IN PIMA COUNTY, ARIZONA

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT FOUND	COMMENTS
<i>Columba livia</i>	Rock Dove (Pigeon)	Eastern	Widespread		
<i>Passer domesticus</i>	House Sparrow	Eastern	Widespread		
<i>Sturnus vulgaris</i>	Starling	Eastern	Widespread	Saguaro cavities (mostly in developed areas)	
<i>Molothrus aeneus</i>	Bronzed Cowbird	Eastern/Western	Widespread		Will sometime parasitize the nests of other bird species
<i>Molothrus ater</i>	Brown-headed Cowbird	Eastern/Western	Widespread		Will sometimes parasitize the nests of other bird species.
<i>Quiscalus mexicanus</i>	Great-tailed Grackle	Eastern	Widespread		
<i>Micropterus salmoides</i>	Largemouth Bass	Eastern/Western	Widespread	Aquatic	
<i>Gambusia affinis</i>	Western Mosquitofish	Eastern	Widespread	?	
<i>Lepomis cyanellus</i>	Green Sunfish	Eastern (Sabino Canyon)	?	Aquatic	
<i>Ameiurus natalis</i>	Yellow Bullhead	Eastern		Aquatic; found in isolated water bodies	
<i>Ameiurus melas</i>	Black Bullhead	Eastern	?	Aquatic	Check with Will Hayes at AGFD for more information
<i>Lamellaxis gracilis</i>	Graceful Awtlsnail	Eastern	Widespread	Gardens	
<i>Oxychilus draparnaudi</i>	Dark-bodied Glass-snail	Eastern	Widespread	Gardens; plant nurseries	
<i>Limax valentianus</i>	Three-band Garden Snail	Eastern	Widespread	Aquatic	
<i>Vallonia pulchella</i>	Lovely Vallonia	Eastern	Widespread		
<i>Radix auricularia</i>	Big-eared Radix	Eastern	Widespread	Aquatic	
<i>Pseudosuccinea columella</i>	Mimic Columella	Eastern	Widespread	Aquatic	
<i>Rumina decollata</i>	Decollate Snail	Eastern	Widespread	Gardens	
<i>Biomphalaria havanensis</i>	Ghost Rams-horn (snail)	Eastern	?	Aquatic	?

DRAFT - 11/19/99



# APPENDIX C PEST SPECIES FOUND IN PIMA COUNTY, ARIZONA

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT FOUND	COMMENTS
<i>Corbicula manilensis</i>	Asian Clam	Eastern	Widespread	?	
<i>Succinea campestris</i>	Crinkled Ambersnail	Western	Very isolated	?	
<i>Otala lactea</i>	Milk Snail	Eastern	Widespread	Gardens	
<i>Helix aspersa</i>	Escargot Snail	Eastern	Widely distributed in residential areas	?	
<i>Viviparus chinensis</i>	Mystery Snail	Southeastern	Widespread	Aquatic (cold water); does not like warm water	Introduced in the aquarium trade.
<i>Orconectes virilis and others</i>	Crayfish	Eastern	Widespread	Aquatic	Jeanette Carpenter (USGS) is studying this species
<i>Bos taurus</i>	Cattle	Eastern/Western	Global		
<i>Ovis aries</i>	Goat	Eastern	Global		
<i>Felis spp.</i>	Cats	Eastern (urban periphery)	Global		
<i>Canis familiaris</i>	Dogs	Eastern (urban periphery)	Global		
<i>Sus scrofa</i>	Pig	Eastern	Global	Riparian	Found along the San Pedro River
<i>Mus musculus</i>	House Mouse	Eastern	Widely distributed in urban settings	Urban - will expand into natural settings during population explosions; agricultural areas	Not too much concern - does not compete with natives in the natural setting
<i>Brassica tournefortii</i>	Asian Mustard	Western (Cabeza Prieta, Pinta Sands)	Widely distributed	?	
<i>Salvinia</i>	Salvinia	Eastern/Western	Widespread	Aquatic	Exotic species which displaces native aquatic ecosystems
<i>Eragrostis lehmanniana</i>	Lehman's Lovegrass	Eastern	Widespread	Grasslands	Abundance of this grass depresses natives and affects fires
<i>Pennisetum ciliare</i>	Buffel Grass	Eastern/Western	African origin; increasing in Mexico; invades from disturbed areas along roadways	Grasslands	Very bad for bird species in grassland communities
<i>Hemidactylus turcicus</i>	Mediterranean Gecko				

# APPENDIX C PEST SPECIES FOUND IN PIMA COUNTY, ARIZONA

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT FOUND	COMMENTS
<i>Ctenosaura pectinata</i>	Black Iguana (Mexican Spiny-tailed Iguana)				
<i>Lepomis macrochirus</i>	Bluegill	Eastern/Western	Widespread	Aquatic	
<i>Oncorhynchus mykiss</i>	Rainbow Trout	Eastern	Widespread	Aquatic	Introduced game fish
<i>Arundo donax</i>	Giant Reed				
<i>Tamarix chinensis</i>	Fivestamen Tamarisk	Eastern/Western	Widespread	Riparian	
<i>Pennisetum setaceum</i>	Fountain Grass	Eastern/Western	Widespread	?	
<i>Arcotis stoechadifolia</i>	African Daisy	Eastern (Tucson Mountains and Santa Cruz River)	Widespread	?	Displaces native annuals; this is a plant to watch out for
<i>Bromus rubens</i>	Red Brome	Eastern	Widespread	?	
<i>Erodium cicutarium</i>	Filaree	Eastern/Western	Widespread	?	
<i>Euryops multifidus</i>	Sweet Resin Bush	Santa Rita Experimental Range	?	?	
<i>Ctenosaura hemilopha</i>	Spiny-tailed Iguana	Eastern (records near Sonoran Desert Museum and Catalina Mountains.)	Sonora	Aquatic	Not likely to spread according to some sources

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## APPENDIX D

# Appendix D - Keystone Species in Pima County, Arizona

## Subcategory (Keystone) Habitat Modifying Species

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
<i>Hilaria rigida</i> or <i>Hilaria berlandieri</i>	Galleta Grass	No federal or state listing	Widespread		
<i>Muhlenbergia rigida</i>	Deer Grass	No federal or state listing	Widespread		
* <i>Olneya tesota</i>	Desert Ironwood	No federal or state status	Widespread; northern edge of range	Found in the Sonoran Desert, in dry locales below 2,500 foot elevation; normally common in dry ephemeral washes	
* <i>Populus fremontii</i>	Fremont Cottonwood	No federal or state listing	Widespread	Found along streams and rivers; needs shallow groundwater table	
<i>Salix spp.</i>	Willows	No federal or state listing	Widespread		
<i>Scirpus americanus</i>	Bulrush Tule	No federal or state listing	Widespread		
<i>Sporobolus airoides</i>	Sacaton Grass	No federal or state listing	Narrow distribution	Found on river banks, sandy washes, floodplains and valley flats	Widely distributed historically

## Subcategory (Keystone) Habitat Modifying Species/Keystone Herbivore

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
* <i>Castor canadensis</i>	Beaver	No federal or state listing	Widespread	Aquatic - Riparian	Extirpated from Pima County; formerly at Ft. Lowell and other places
<i>Cynomys ludovicianus</i>	Black-tailed Prairie Dog	No federal or state listing	Widespread	Plains and desert grasslands	No historic records in Pima County; believed to be extirpated from Arizona in the late 1930's
<i>Ondatra zibethicus</i>	Muskrat	No federal or state listing	Widespread	Aquatic	Extirpated from Pima County

\* Species is listed in more than one category

D-1

DRAFT - 11/19/99

# Appendix D - Keystone Species in Pima County, Arizona

## Subcategory (Keystone) **Keystone Predator**

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
* <i>Bubo virginianus</i>	Great Horned Owl	No federal or state listing	Widely distributed		
* <i>Canis lupus baileyi</i>	Mexican Gray Wolf	Federally listed as "endangered" under the Endangered Species Act	Formerly widespread in distribution	Chaparral, woodland, and forested areas; may cross desert areas; needs large areas of mountain and grassland terrains	Unconfirmed reports of individuals in southern Arizona; experimental nonessential population was introduced in the Blue Primitive Area; last record in 1952 on the southern side of the Catalina Mountains; may still persist in Mexico
* <i>Panthera onca</i>	Jaguar	Federally listed as "endangered" under the Endangered Species Act; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	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 Arizona (confirmed with photographs); transient in Arizona
* <i>Puma concolor</i>	Mountain Lion	No federal or state listing	Widespread	Rugged, mountainous areas	
* <i>Ursus arctos</i>	Grizzly Bear	No federal or state listing	Widespread	Large upland montane areas with riparian habitat	Extirpated from Pima County; last seen in the 1920's in Catalina and Rincon Mountains

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## APPENDIX E

# Appendix E - Flagship Species in Pima County, Arizona

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
<i>Anemopsis californica</i>	Yerba Mansa	No federal or state listing	Narrowly distributed (Quitobaquito)		
<i>Aphonopelma spp.</i>	Tarantulas	No federal or state listing	Widely distributed		
* <i>Bubo virginianus</i>	Great Horned Owl	No federal or state listing	Widely distributed		
<i>Callipepla gambelii</i>	Gambel's Quail	No federal or state listing	Widely distributed		
* <i>Calypte anna</i>	Anna's Hummingbird	No federal or state listing	Widely distributed		
* <i>Canis latrans</i>	Coyote	No federal or state listing	Widespread	Found in a wide variety of habitats	
<i>Capsicum annuum</i> var. <i>glabriusculum</i>	Chiltepín	Considered "sensitive" by the Regional Forester	Widely cultivated	Riparian overstory of mesquite and hackberry	Food plant
<i>Carnegiea giganteus</i>	Saguaro	No federal or state listing	Widely distributed in southern Arizona	Desert slopes and flats; healthiest populations are located on bajadas verde	Uses "nurse" plants (i.e., mesquite and palo verde) at the beginning stages of development
* <i>Castor canadensis</i>	Beaver	No federal or state listing	Widespread	Aquatic - Riparian	Extirpated from Pima County; formerly at Ft. Lowell and other places
<i>Crotalus willardi willardi</i>	Arizona Ridgenose Rattlesnake	No federal or state listing	Very narrow distribution	Chiefly found in pine-oak and pine-fir habitats, but also ranges into foothill canyons.	
* <i>Falco peregrinus anatum</i>	American Peregrine Falcon	Delisted from the "endangered" species list under the Endangered Species Act; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD, Navajo Endangered Species List (Status 3)	Widely distributed in the 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 Arizona; species was recently removed from the federal "endangered" species list under the Endangered Species Act

\* Species is listed in more than one category

E-1

DRAFT - 11/19/99



# Appendix E - Flagship Species in Pima County, Arizona

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
* <i>Felis pardalis</i>	Ocelot	Federally listed as "endangered" under the Endangered Species Act	Widely distributed south of AZ	Humid tropical and sub-tropical forests, savannahs and semi-arid thorn scrub (dense cover)	Last record in 1952 on the southern side of the Catalina Mountains; extirpated from Arizona (AGFD)
* <i>Felis yagouaroundi tolteca</i>	Jaguarundi	Federally listed as "endangered" under the Endangered Species Act; considered "sensitive" by the Regional Forester	Widely distributed south of AZ	Variety of habitats: deciduous forests, riparian areas, swampy grasslands, upland dry savannahs, etc.	Unconfirmed sightings in southern Arizona; AGFD does not consider this species as part of the native fauna.
<i>Geococcyx californianus</i>	Greater Roadrunner	No federal or state listing	Widely distributed		
* <i>Gopherus agassizii</i>	Desert Tortoise	USFWS "Species of Concern"; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Widespread	Thermally buffered Sonoran Desert bajadas	Protected by the State of Arizona; major problem is collection and release by humans; public education is recommended
* <i>Haliaeetus leucocephalus</i>	Bald Eagle	Federally listed as "threatened" under the Endangered Species Act; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD; Navajo Endangered Species List (Status 3)	Widely distributed	Large trees or cliffs near water (reservoirs, rivers and streams) with abundant prey	Winters along rivers and reservoirs, no breeding in Pima County; species has been proposed for delisting from the federal "threatened" species list under the Endangered Species Act
<i>Heloderma suspectum</i>	Gila Monster	Considered "sensitive" by the Regional Forester	Widespread	Upland desert scrub (paloverde/mixed cacti)	Protected by the State of Arizona; major problem is collection and release by humans; public education is recommended
<i>Lophocereus schottii</i>	Senita	AZ Native Plant Law (salvage restricted)	Widely distributed south of Pima County		Less common in the U. S. than the Organ Pipe Cactus; easy to cultivate; provides food for Long-nosed Bats
<i>Nasua nasua</i>	Coati	No federal or state listing	Wide distribution; northern edge of its range	In Arizona, inhabits woodlands of lower canyons consisting of oak, sycamore and walnut trees.	Species is expanding its range from Mexico
* <i>Odocoileus hemionus</i>	Mule Deer	No federal or state listing	Widespread	Variety of habitats ranging from the low deserts to pine forests	

# Appendix E - Flagship Species in Pima County, Arizona

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
* <i>Odocoileus virginianus</i>	White-tailed Deer	No federal or state listing	Widespread	Primarily found in woodland communities consisting of evergreen oaks or in mixtures of oak, junipers and pinyon pines	
* <i>Olneya tesota</i>	Desert Ironwood	No federal or state status	Widespread; northern edge of range	Found in the Sonoran Desert, in dry locales below 2,500 foot elevation; normally common in dry ephemeral washes	
* <i>Ovis canadensis mexicana</i>	Desert Bighorn Sheep	No federal or state listing	Widespread	Precipitous, rocky desert mountain ranges in Arizona	
* <i>Parabuteo unicinctus</i>	Harris's Hawk	Considered "sensitive" by the Regional Forester	Scattered, isolated populations in Arizona, New Mexico and Texas	Semiopen desert scrub, savanna, grassland and wetland habitats; in Arizona, affiliated closely with palo-verde/saguaro communities	
* <i>Populus fremontii</i>	Fremont Cottonwood	No federal or state listing	Widespread	Found along streams and rivers; needs shallow groundwater table	
* <i>Rana yavapaiensis</i>	Lowland Leopard Frog	USFWS "Species of Concern"; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Range has been reduced	Streams, springs and ponds	Threatened by loss of habitat, disease, and exotic species (bullfrogs, fish and crayfish)
* <i>Selasphorus rufus</i>	Rufous Hummingbird	No federal or state listing	Widespread		
<i>Stenocereus thurberi</i>	Organ Pipe Cactus	AZ Native Plant Law (salvage restricted)	Widely distributed south of Pima County	Mostly found on south facing, hot and sunny slopes at elevations from 1,000 to 3,500 feet	
<i>Tayassu tajacu</i>	Collared Peccary (Javelina)	No federal or state listing	Widespread in Arizona	In Arizona, found in desertscrub, especially in thickets along creeks and old stream beds; will use nearby caves, mine shafts and rocky slopes as retreats	

\* Species is listed in more than one category

E-3

DRAFT - 11/19/99

# Appendix E - Flagship Species in Pima County, Arizona

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
* <i>Trogon elegans</i>	Elegant Trogon	No federal or state listing	Northern edge of range	Canyon riparian areas	
<i>Ursus americanus</i>	Black Bear	No federal or state listing	Widely distributed	In Arizona, found mostly in encinal woodland and coniferous forest	
<i>Vulpes macrotis</i>	Kit Fox	No federal or state listing	Widespread	In Arizona, they are found in soft, alluvial soils, sand dunes, or easily diggable clay soils, most often in desert scrub or desert grassland; prefers sandy soils where they can dig their dens	At risk of significant reduction, but not extirpation
<i>Xerophyllum</i>	Beargrass	No federal or state listing	?		Culturally significant to Tohono O'Odham
<i>Yucca arizonica</i>	Spanish Dagger	No federal or state listing	?		Culturally significant to Tohono O'Odham

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## APPENDIX F

# Appendix F - Umbrella Species in Pima County, Arizona

## Subcategory (Umbrella) Mobile Herbivore

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
<i>Antilocapra americana chiluhuiensis</i>	Chihuahuan Pronghorn Antelope	No federal or state listing	Introduced to Empire-Cienega and Buenos Aires National Wildlife Refuge	Grasslands (upland)	May have historically existed in Empire-Cienega
* <i>Antilocapra americana sonoriensis</i>	Sonoran Pronghorn Antelope	Federally listed as "endangered" under the Endangered Species Act; "Wildlife of Special Concern" by AGFD	Narrow; historic range was probably larger than today	Broad, Intermountain alluvial valleys with Creosote-Bursage & Palo Verde-Mixed Cacti Associations	Formerly ranged east to near Tucson; also occurs in Mexico in Pinacate Biosphere Reserve
* <i>Gopherus agassizii</i>	Desert Tortoise	USFWS "Species of Concern"; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Widespread	Thermally buffered Sonoran Desert bajadas	Protected by the State of Arizona; major problem is collection and release by humans; public education is recommended
* <i>Odocoileus hemionus</i>	Mule Deer	No federal or state listing	Widespread	Variety of habitats ranging from the low deserts to pine forests	
* <i>Odocoileus virginianus</i>	White-tailed Deer	No federal or state listing	Widespread	Primarily found in woodland communities consisting of evergreen oaks or in mixtures of oak, junipers and pinyon pines	
* <i>Ovis canadensis mexicana</i>	Desert Bighorn Sheep	No federal or state listing	Widespread	Precipitous, rocky desert mountain ranges in Arizona	

## Subcategory (Umbrella) Mobile Pollinator

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
* <i>Calypte anna</i>	Anna's Hummingbird	No federal or state listing	Widely distributed		
* <i>Choronycteris mexicana</i>	Mexican Long-tongued Bat	USFWS "Species of Concern"; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Northern end of its range	Roots and maternity sites are along perennial and intermittent streams	Not very common, low in numbers
<i>Danaus plexippus</i>	Monarch Butterfly	No federal or state listing	Widespread		

\* Species listed in more than one category

# Appendix F - Umbrella Species in Pima County, Arizona

## Subcategory (Umbrella) Mobile Pollinator

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
* <i>Selasphorus rufus</i>	Rufous Hummingbird	No federal or state listing	Widespread		
<i>Zenaidura macroura</i>	White-winged Dove	No federal or state listing			

## Subcategory (Umbrella) Mobile Pollinator/Mobile Seed Disperser

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
* <i>Leptonycteris curasoae yerbabuena</i>	Lesser Long-nosed Bat	Federally listed as "endangered" under the Endangered Species Act; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Widely distributed south of Arizona	Desert scrub habitat with agave and columnar cacti present as food plants; day roosts in caves and abandoned tunnels	Species is migratory

## Subcategory (Umbrella) Mobile Predator

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
* <i>Accipiter gentilis apache</i>	Apache Goshawk	USFWS "Species of Concern"; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD; Navajo Endangered Species List (Status 4)	?	Forest dweller; mature conifers and cottonwoods in mountains	
* <i>Asurina nitida</i>	Gray Hawk	USFWS "Species of Concern"; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Widespread; northern edge of range	Riparian areas	15 to 20 pairs in Pima County
* <i>Buteo albonotatus</i>	Zone-tailed Hawk	Considered "sensitive" by the Regional Forester; Navajo Endangered Species List (Status 1)	Northern edge of range	Canyon riparian areas	
* <i>Canis lupus baileyi</i>	Mexican Gray Wolf	Federally listed as "endangered" under the Endangered Species Act	Formerly widespread in distribution	Chaparral, woodland, and forested areas; may cross desert areas; needs large areas of mountain and grassland terrains	Unconfirmed reports of individuals in southern Arizona; experimental nonessential population was introduced in the Blue Primitive Area; last record in 1952 on the southern side of the Catalina Mountains; may still persist in Mexico

\* Species listed in more than one category

# Appendix F - Umbrella Species in Pima County, Arizona

## Subcategory (Umbrella) Mobile Predator

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
* <i>Caracara plancus</i>	Crested Caracara	Considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	Northern edge of range; widespread south of AZ	Sonoran Desert uplands	Breeding sites in Sells and Tohono O'Odham Nation; also common in Texas
* <i>Falco femoralis septentrionalis</i>	Northern Aplomado Falcon	Federally listed as "endangered" under the Endangered Species Act	Limited distribution in the U. S. (known from introduced populations in Texas)	Grassland	Extirpated from Pima County; listed as "endangered" by the USFWS throughout its entire range; historic range included Arizona, New Mexico, Texas, Mexico and Guatemala
* <i>Falco peregrinus anatum</i>	American Peregrine Falcon	Delisted from the "endangered" species list under the Endangered Species Act; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD, Navajo Endangered Species List (Status 3)	Widely distributed in the 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 Arizona; species was recently removed from the federal "endangered" species list under the Endangered Species Act
* <i>Felis pardalis</i>	Ocelot	Federally listed as "endangered" under the Endangered Species Act	Widely distributed south of AZ	Humid tropical and sub-tropical forests, savannas and semi-arid thorn scrub (dense cover)	Last record in 1952 on the southern side of the Catalina Mountains; extirpated from Arizona (AGFD)
* <i>Felis yagouaroundi tolteca</i>	Jaguarundi	Federally listed as "endangered" under the Endangered Species Act; considered "sensitive" by the Regional Forester	Widely distributed south of AZ	Variety of habitats: deciduous forests, riparian areas, swampy grasslands, upland dry savannas, etc.	Unconfirmed sightings in southern Arizona; AGFD does not consider this species as part of the native fauna.
* <i>Panthera onca</i>	Jaguar	Federally listed as "endangered" under the Endangered Species Act; considered "sensitive" by the Regional Forester; "Wildlife of Special Concern" by AGFD	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 Arizona (confirmed with photographs); transient in Arizona
* <i>Parabuteo unicinctus</i>	Harris's Hawk	Considered "sensitive" by the Regional Forester	Scattered, isolated populations in Arizona, New Mexico and Texas	Semiopen desert scrub, savanna, grassland and wetland habitats; in Arizona, affiliated closely with palo-verde/saguaro communities	
* <i>Puma concolor</i>	Mountain Lion	No federal or state listing	Widespread	Rugged, mountainous areas	
* <i>Ursus arctos</i>	Grizzly Bear	No federal or state listing	Widespread	Large upland montane areas with riparian habitat	Extirpated from Pima County; last seen in the 1920's in Catalina and Rincon Mountains

\* Species listed in more than one category

F-3

DRAFT - 11/19/99

# Appendix F - Umbrella Species in Pima County, Arizona

Subcategory (Umbrella)    **Mobile Seed Disperser**

Scientific Name	Common Name	Status	Distribution	Habitat Needs	Comments
* <i>Canis latrans</i>	Coyote	No federal or state listing	Widespread	Found in a wide variety of habitats	
<i>Phainopepla nitens</i>	Phainopepla	No federal or state listing			

\* Species listed in more than one category



**ATTACHMENT 2**

## PIMA COUNTY NOTICE OF REQUEST FOR PROPOSALS



NUMBER AND TITLE: RFP #539 - BIOLOGICAL CONSULTANT SERVICES FOR SONORAN DESERT CONSERVATION PLAN.

PRE-PROPOSAL CONFERENCE: DECEMBER 1, 1999 AT 10:00 AM MST  
IN THE 6TH FLOOR CONFERENCE ROOM  
130 WEST CONGRESS, 6TH FLOOR  
TUCSON, ARIZONA

DUE IN: DECEMBER 16, 1999 AT 2:00 PM MST

RETURN TO: PIMA COUNTY PROCUREMENT DEPARTMENT  
130 WEST CONGRESS, 6TH FLOOR, RECEPTIONIST  
TUCSON, ARIZONA 85701

OPENS: DECEMBER 16, 1999 AT 2:00 PM MST  
IN THE 6TH FLOOR CONFERENCE ROOM  
130 WEST CONGRESS, 6TH FLOOR  
TUCSON, ARIZONA 85701

DESCRIPTION: TO PROVIDE PIMA COUNTY WITH BIOLOGICAL CONSULTANT SERVICES FOR THE SONORAN DESERT CONSERVATION PLAN, PER SPECIFICATIONS LISTED HEREIN.

A PRE-PROPOSAL CONFERENCE WILL BE HELD FOR THE PURPOSE OF CLARIFYING ANY POINTS OR ANSWERING ANY QUESTIONS THAT PROSPECTIVE RESPONDENTS MAY HAVE WITH THE INVITATION. IT IS THE RESPONSIBILITY OF THE PROSPECTIVE RESPONDENTS TO REVIEW THIS RFP AND BE PREPARED TO ADDRESS ANY AND ALL ISSUES AT THE CONFERENCE.

PROPOSALS MUST BE SUBMITTED IN A SEALED ENVELOPE CLEARLY MARKED ON THE OUTSIDE WITH THE PROPOSAL NUMBER, TITLE, DUE DATE AND TIME, AND RESPONDENT'S NAME.

PROPOSALS MUST BE RECEIVED AND TIME STAMPED AT THE PIMA COUNTY PROCUREMENT DEPARTMENT, RECEPTIONIST, ON OR BEFORE THE ABOVE SPECIFIED DATE AND TIME. IT IS THE RESPONDENTS' RESPONSIBILITY TO ASSURE PROPOSALS ARE RECEIVED AT THE ABOVE LOCATION BY THE SPECIFIED TIME. LATE PROPOSALS WILL BE RETURNED. PROPOSALS RECEIVED WILL BE OPENED AND RESPONDENTS' NAME WILL BE ANNOUNCED. ALL INTERESTED PARTIES ARE INVITED TO ATTEND.

RESPONDENT MUST COMPLETE AND RETURN THE FOLLOWING PAGES: 9-15

PROPOSALS MAY NOT BE WITHDRAWN FOR 120 DAYS AFTER OPENING TO ALLOW ADEQUATE TIME FOR EVALUATION AND AWARD.

BOND(S) REQUIRED: ☐ YES ☒ NO

THE RECOMMENDATION FOR AWARD SHALL BE MADE TO THE RESPONDENT(S) WHOSE BID/PROPOSAL IS THE MOST ADVANTAGEOUS TO PIMA COUNTY IN THE FOLLOWING MANNER: ☐ SINGLE AWARD ☒ ITEM BY ITEM ☐ BY GROUP

QUESTIONS CONCERNING THIS INVITATION SHOULD BE DIRECTED TO DAN DEERING AT (520)740-8161.

RESPONDENTS ARE STRONGLY ENCOURAGED TO CAREFULLY READ THE ENTIRE INVITATION.

A handwritten signature in dark ink, appearing to read "Dan Deering", is written over a horizontal line.  
DANIEL T. DEERING  
CHIEF CONTRACTS AND PROCUREMENT OFFICER

PUBLISH: THE DAILY TERRITORIAL, NOVEMBER 12, 15, 16 AND 17, 1999.

## INSTRUCTIONS

### PREPARATION OF IFB/RFP RESPONSES:

ALL BIDS/PROPOSALS SHALL BE ON THE FORMS PROVIDED IN THIS PACKAGE. ALL PRICES AND NOTATIONS MUST BE PRINTED IN INK OR TYPEWRITTEN. NO ERASURES ARE PERMITTED. ERRORS MAY BE CROSSED OUT AND CORRECTIONS PRINTED IN INK OR TYPEWRITTEN ADJACENT TO ERROR AND SHALL BE INITIALED IN INK BY PERSON SIGNING BID/RFP. PRICE EACH ITEM SEPARATELY. IN CASE OF ERROR IN EXTENSION OF PRICES, UNIT PRICES SHALL GOVERN. DELIVERY TIME IF STATED AS A NUMBER OF DAYS, SHALL MEAN "CALENDAR" DAYS. PIMA COUNTY RESERVES THE RIGHT TO QUESTION AND CORRECT OBVIOUS ERRORS.

### EQUIPMENT SPECIFICATIONS:

BRAND NAMES AND NUMBERS WHEN GIVEN ARE FOR REFERENCE ONLY. UNLESS OTHERWISE SPECIFIED IN THE BID/RFP, DEVIATIONS FROM SPECIFICATIONS WILL BE ACCEPTED FOR EVALUATION SO LONG AS THOSE DEVIATIONS ARE CROSS-REFERENCED TO THE ITEMS HEREINAFTER SET FORTH AND FULLY EXPLAINED WITH REGARD TO THEIR IMPACT ON THE END PERFORMANCE OF THE ITEM. FAILURE TO EXAMINE ANY DRAWINGS, SPECIFICATIONS, AND INSTRUCTIONS WILL BE AT THE RESPONDENT'S RISK.

### SUBMISSION OF RESPONSES:

BIDS/PROPOSALS MUST BE SIGNED BY AN AUTHORIZED AGENT OF THE RESPONDENT AND SUBMITTED IN A SEALED ENVELOPE. BIDS, PROPOSALS AND MODIFICATIONS RECEIVED AFTER THE CLOSING TIME SPECIFIED WILL NOT BE ACCEPTED. FACSIMILES OF BIDS/PROPOSALS WILL NOT BE ACCEPTED.

ANY SURETY REQUIRED BY THIS BID/RFP MAY BE IN THE FORM OF A BOND, CASHIER'S CHECK OR CERTIFICATE OF DEPOSIT SHALL BE MADE PAYABLE TO PIMA COUNTY. PERSONAL OR COMPANY CHECKS ARE NOT ACCEPTABLE.

### FAILURE TO RESPOND:

FAILURE TO BID OR TO ADVISE PIMA COUNTY THAT FUTURE INVITATIONS FOR BIDS/RFP'S ARE DESIRED, MAY RESULT IN THE REMOVAL OF YOUR NAME FROM OUR VENDOR'S LIST COVERING THIS CATEGORY OF ITEMS.

### INQUIRIES:

RESULTS OF THIS PROCUREMENT WILL NOT BE GIVEN IN RESPONSE TO TELEPHONE INQUIRIES. INTERESTED PARTIES ARE INVITED TO ATTEND THE PUBLIC OPENING AT THE TIME AND DATE STATED IN THIS SOLICITATION. FOLLOWING EVALUATION AND AWARD, ALL VENDORS RESPONDING ARE NOTIFIED OF RESULTS. A TABULATION WILL BE ON FILE IN THE PROCUREMENT SECTION.

NO ORAL INTERPRETATIONS OR CLARIFICATIONS WILL BE MADE TO ANY RESPONDENT AS TO THE MEANING OF ANY OF THE BID/RFP DOCUMENTS. IF A VENDOR BELIEVES ANY PROVISION OF THE BID/RFP DOCUMENTS ARE NEEDLESSLY RESTRICTIVE, UNFAIR, OR UNCLEAR, THE RESPONDENT SHOULD NOTIFY PIMA COUNTY PURCHASING PERSONNEL IN WRITING PRIOR TO THE CLOSING TIME SET FOR RECEIPT OF BIDS/RFP'S. RESPONSES FROM PIMA COUNTY WILL BE MADE BY WRITTEN ADDENDUM AND SENT TO ALL KNOWN POTENTIAL RESPONDENTS.

### MINORITY/WOMEN-OWNED BUSINESS ENTERPRISE (MWBE) NOTIFICATION:

IN ACCORDANCE WITH THE PIMA COUNTY CODE, TITLE 20, A 2.5% BID PREFERENCE WILL BE GIVEN TO LOCAL COUNTY CERTIFIED MBE OR WBE FIRMS WHO BID ON ELIGIBLE CONTRACTS. IN DETERMINING THE LOWEST RESPONSIVE AND RESPONSIBLE BID OR PROPOSAL, ANY BID OR PROPOSAL SUBMITTED BY A LOCAL CERTIFIED MBE OR WBE FIRM SHALL RECEIVE A BID PREFERENCE OF 2.5%. THE MBE/WBE FIRM MUST BE CERTIFIED AT THE TIME OF THE BID OPENING. THE BID PREFERENCE SHALL BE SOLELY FOR THE PURPOSE OF ESTABLISHING THE LOW BID OR PROPOSAL. THE ACTUAL VALUE OF ANY CONTRACT AWARDED SHALL BE FOR THE AMOUNT IN THE BID OR PROPOSAL. TO BE ELIGIBLE FOR THE PRICE PREFERENCE, MBE OR WBE FIRMS MUST INCLUDE IN THE BID OR PROPOSAL A COPY OF THEIR CURRENT CERTIFICATION CERTIFICATE.

NOTICE: THE PROCESS OF BECOMING A CERTIFIED MBE/WBE FIRM MAKE TAKE SEVERAL WEEKS. PLEASE CONTACT OUR MWBE OFFICE AT (520) 740-8161 FOR ASSISTANCE OR FURTHER INFORMATION.

### PIMA COUNTY PROCUREMENT CODE

ON JUNE 3, 1997 THE PIMA COUNTY BOARD OF SUPERVISORS ADOPTED THE PIMA COUNTY PROCUREMENT CODE VIA ORDINANCE NO. 1997-45, PIMA COUNTY CODE TITLE 11. THE PURPOSE OF THE CODE IS TO: 1) SIMPLIFY, CLARIFY AND MODERNIZE THE RULES GOVERNING PROCUREMENT. 2) PERMIT THE CONTINUED DEVELOPMENT OF COUNTY PROCUREMENT POLICIES AND PRACTICES. 3) PROVIDE FOR UNIFORM SYSTEM OF CONTROL TO ENHANCE ACCOUNTABILITY AND INCREASE PUBLIC CONFIDENCE IN THE PROCESS FOLLOWED IN COUNTY PROCUREMENT. 4) ENSURE FULL AND EQUITABLE ECONOMIC OPPORTUNITIES TO PERSONS OR BUSINESSES THAT COMPETE FOR BUSINESS WITH PIMA COUNTY GOVERNMENT, INCLUDING SMALL, MINORITY-OWNED AND WOMAN-OWNED BUSINESS ENTERPRISES. 5) PROVIDE INCREASED ECONOMY IN COUNTY PROCUREMENT ACTIVITIES AND MAXIMIZE TO THE FULLEST EXTENT PRACTICABLE THE PURCHASING VALUE OF PUBLIC MONIES OF THE COUNTY. 6) FOSTER EFFECTIVE BROAD-BASED COMPLETION WITHIN THE FREE ENTERPRISE SYSTEM. 7) PROVIDE SAFEGUARDS FOR THE MAINTENANCE OF A PROCUREMENT SYSTEM OF QUALITY AND INTEGRITY.

### CONFLICTING INSTRUCTIONS:

IN THE EVENT THERE ARE VARIATIONS BETWEEN THESE INSTRUCTIONS TO RESPONDENTS AND THE INSTRUCTIONS IN THE BID/RFP, THE INSTRUCTIONS IN THE BID/RFP SHALL GOVERN.

# PIMA COUNTY STANDARD TERMS AND CONDITIONS

## AWARD OF CONTRACTS:

CONTRACTS AND PURCHASES SHALL BE MADE OR ENTERED INTO WITH THE BEST RESPONSIBLE BIDDER EXCEPT AS OTHERWISE REQUIRED OR AUTHORIZED BY LAW. THE PIMA COUNTY BOARD OF SUPERVISORS RESERVES THE FOLLOWING RIGHTS: 1) TO WAIVE INFORMALITIES IN ANY BID OR THE BIDDING PROCEDURE; 2) TO REJECT THE RESPONSE OF ANY PERSONS OR CORPORATIONS WHO HAVE PREVIOUSLY DEFAULTED ON ANY CONTRACT WITH PIMA COUNTY OR WHO HAVE ENGAGED IN CONDUCT THAT CONSTITUTES A CAUSE FOR DEBARMENT OR SUSPENSION AS SET FORTH IN PIMA COUNTY CODE SECTION 11.32; 3) TO REJECT ANY AND ALL RESPONSES; 4) TO RE-ADVERTISE FOR BIDS PREVIOUSLY REJECTED; 5) TO OTHERWISE PROVIDE FOR THE PURCHASE OF SUCH EQUIPMENT, SUPPLIES, MATERIALS AND SERVICES AS MAY BE REQUIRED HEREIN; 6) TO AWARD THE CONTRACT ON THE BASIS OF THE BEST RESPONSE, INCLUDING, BUT NOT LIMITED TO SUCH FACTORS AS DELIVERY TIME, PRICES, QUALITY, UNIFORMITY OF PRODUCT, SUITABILITY FOR AN INTENDED TASK AND BIDDER'S ABILITY TO SUPPLY; 7) TO INCREASE OR DECREASE THE QUANTITY HEREIN SPECIFIED.

## NOTICE OF RECOMMENDATION FOR AWARD:

IFB AND RFP RECOMMENDATIONS FOR AWARD WILL BE POSTED AND AVAILABLE FOR REVIEW BY ALL INTERESTED PARTIES. RECOMMENDATIONS WILL BE POSTED IN THE PROCUREMENT DEPARTMENT FOLLOWING PLACEMENT ON THE NEXT REGULARLY SCHEDULED MEETING OF THE BOARD OF SUPERVISORS.

## WAIVER:

EACH BIDDER, BY SUBMISSION OF HIS BID, PROCLAIMS AND AGREES AND DOES WAIVE ANY AND ALL CLAIMS FOR DAMAGES AGAINST PIMA COUNTY OR ITS OFFICERS OR EMPLOYEES WHEN ANY OF THE RIGHTS RESERVED BY PIMA COUNTY IN THE BID NOTICE OR HEREIN MAY BE EXERCISED.

## ACKNOWLEDGMENTS AND ACCEPTANCE:

A WRITTEN PURCHASE ORDER/CONTRACT MAILED, OR OTHERWISE FURNISHED, TO THE SUCCESSFUL BIDDER WITHIN THE TIME FOR ACCEPTANCE SPECIFIED IN THE BID, RESULTS IN A BINDING CONTRACT WITHOUT FURTHER ACTION BY EITHER PARTY. THE CONTRACT SHALL BE INTERPRETED, CONSTRUED AND GIVEN EFFECT IN ALL RESPECTS ACCORDING TO THE LAWS OF THE STATE OF ARIZONA. THE CONTRACT SHALL NOT BE ASSIGNABLE BY THE VENDOR EITHER IN WHOLE OR IN PART WITHOUT WRITTEN CONSENT OF PIMA COUNTY. IF ANY OF SELLER'S TERMS OR CONDITIONS ARE NOT IN AGREEMENT WITH PIMA COUNTY'S TERMS AND CONDITIONS AS SET FORTH HEREIN, PIMA COUNTY'S SHALL GOVERN. NO ORAL AGREEMENT OR OTHER UNDERSTANDING SHALL IN ANY WAY MODIFY THESE TERMS AND CONDITIONS.

## PRICE WARRANTY:

SELLER SHALL GIVE PIMA COUNTY BENEFIT OF ANY PRICE REDUCTION BEFORE ACTUAL TIME OF SHIPMENT EXCEPT THAT SHOULD PIMA COUNTY PERMIT SHIPMENT TO BE MADE PRIOR TO SPECIFIED SHIPPING DATE. PIMA COUNTY SHALL HAVE ADVANTAGE OF ANY PRICE REDUCTION BEFORE SHIPPING DATE.

## WARRANTY:

PIMA COUNTY MAY WAIVE PERFORMANCE OF ANY CONDITION AND TREAT IT AS A WARRANTY, BUT WAIVER OF ANY CONDITION IN ANY SHIPMENT SHALL NOT BE CONSIDERED A WAIVER OF THAT CONDITION FOR SUBSEQUENT SHIPMENTS.

## QUANTITY:

THE QUANTITY OF GOODS ORDERED SHALL NOT BE EXCEEDED OR REDUCED WITHOUT WRITTEN PERMISSION FROM PIMA COUNTY EXCEPT IN CONFORMITY WITH ACKNOWLEDGED INDUSTRY TOLERANCES.

## DELIVERIES:

TIME IS OF THE ESSENCE. PIMA COUNTY RESERVES THE RIGHT TO CANCEL AND REJECT THE GOODS UPON DEFAULT BY SELLER IN TIME, RATE OR MANNER OF DELIVERY. IF STATED DELIVERY TIMES CANNOT BE COMPLIED WITH SELLER SHALL IMMEDIATELY NOTIFY PIMA COUNTY IN WRITING. UPON NOTIFICATION PIMA COUNTY AT ITS SOLE OPTION MAY CANCEL OR EXTEND DELIVERY TIMES.

## INSPECTION:

ALL GOODS ARE SUBJECT TO INSPECTION AND TESTING AT PLACE OF MANUFACTURE, THE DESTINATION OR BOTH BY PIMA COUNTY. GOODS FAILING TO MEET SPECIFICATIONS OF THE ORDER SHALL BE HELD AT SELLER'S RISK AND MAY BE RETURNED TO SELLER WITH COSTS FOR TRANSPORTATION, UNPACKING, INSPECTION, REPACKING, RESHIPING OR OTHER LIKE EXPENSES TO BE THE RESPONSIBILITY OF SELLER.

## TAXES, FEES, EXPENSES:

ARTICLES SOLD TO PIMA COUNTY ARE EXEMPT FROM FEDERAL EXCISE TAXES. PIMA COUNTY WILL FURNISH AN EXEMPTION CERTIFICATE UPON REQUEST. NO CHARGES FOR DELIVERY, SALES TAX, DRAYAGE, EXPRESS, PARCEL POST, PACKING, INSURANCE, LICENSE FEES, PERMITS, COSTS OF BONDS, OR BID/RFP PREPARATION, WILL BE PAID BY PIMA COUNTY, UNLESS EXPRESSLY INCLUDED AND ITEMIZED IN THE BID/RFP. PRICING EVALUATIONS WILL BE BASED ON PRE-TAX PRICING OFFERED BY VENDOR.

## PAYMENT TERMS:

PAYMENT TERMS ARE NET 30, UNLESS OTHERWISE SPECIFIED IN THE IFB/RFP.

## ACCEPTANCE OF PAYMENT:

PIMA COUNTY WILL NOT EXECUTE AN ACCEPTANCE OR AUTHORIZE PAYMENT OF ANY EQUIPMENT OR COMPONENT PRIOR TO DELIVERY AND VERIFICATION THAT ALL THE SPECIFICATIONS HAVE BEEN MET.

## RIGHTS AND REMEDIES OF PIMA COUNTY FOR DEFAULT:

IN THE EVENT ANY ITEM FURNISHED BY THE VENDOR IN THE PERFORMANCE OF THE CONTRACT OR PURCHASE ORDER SHOULD FAIL TO CONFORM TO THE SPECIFICATIONS THEREOF, OR TO THE SAMPLE SUBMITTED BY THE VENDOR WITH HIS BID, THE PIMA COUNTY BOARD OF SUPERVISORS MAY REJECT THE SAME, AND IT SHALL THEREUPON BECOME THE DUTY OF THE VENDOR TO RECLAIM AND REMOVE THE SAME, WITHOUT EXPENSE TO PIMA COUNTY, AND IMMEDIATELY REPLACE ALL SUCH REJECTED ITEMS WITH OTHERS CONFORMING TO THE SPECIFICATIONS OR SAMPLES: PROVIDED THAT SHOULD THE VENDOR FAIL, NEGLECT, OR REFUSE TO DO SO, PIMA COUNTY, SHALL HAVE THE RIGHT TO PURCHASE IN THE OPEN MARKET, IN LIEU THEREOF, A CORRESPONDING QUANTITY OF ANY SUCH ITEMS AND TO DEDUCT FROM ANY MONIES DUE OR THAT MAY BECOME DUE TO THE VENDOR THE DIFFERENCE BETWEEN THE PRICE NAMED IN THE CONTRACT OR PURCHASE ORDER AND ACTUAL COST TO PIMA COUNTY. IN THE EVENT THE VENDOR SHALL FAIL TO MAKE PROMPT DELIVERY AS SPECIFIED OF ANY ITEM.

## PIMA COUNTY STANDARD TERMS AND CONDITIONS (CONT.)

THE SAME CONDITIONS AS TO THE RIGHTS OF PIMA COUNTY TO PURCHASE IN THE OPEN MARKET AND INVOKE THE REIMBURSEMENT CONDITION ABOVE SHALL APPLY, EXCEPT WHEN DELIVERY IS DELAYED BY FIRE, STRIKE, FREIGHT EMBARGO, OR ACTS OF GOD OR OF THE GOVERNMENT. IN THE EVENT OF CANCELLATION OF THE CONTRACT OR PURCHASE ORDER, EITHER IN WHOLE OR IN PART, BY REASON OF THE DEFAULT OR BREACH BY THE VENDOR, ANY LOSS OR DAMAGE SUSTAINED BY PIMA COUNTY IN PROCURING ANY ITEMS WHICH THE VENDOR AGREED TO SUPPLY SHALL BE BORNE AND PAID FOR BY THE VENDOR. THE RIGHTS AND REMEDIES OF PIMA COUNTY PROVIDED ABOVE SHALL NOT BE EXCLUSIVE AND ARE IN ADDITION TO ANY OTHER RIGHTS AND REMEDIES PROVIDED BY LAW OR UNDER THE CONTRACT.

### FRAUD AND COLLUSION:

EACH BIDDER, BY SUBMISSION OF A BID, PROCLAIMS AND AGREES THAT NO OFFICER OR EMPLOYEE OF PIMA COUNTY OR OF ANY SUBDIVISION THEREOF HAS: 1) AIDED OR ASSISTED THE BIDDER IN SECURING OR ATTEMPTING TO SECURE A CONTRACT TO FURNISH LABOR, MATERIALS OR SUPPLIES AT A HIGHER PRICE THAN THAT PROPOSED BY ANY OTHER BIDDER; 2) FAVORED ONE BIDDER OVER ANOTHER BY GIVING OR WITHHOLDING INFORMATION OR BY WILLFULLY MISLEADING THE BIDDER IN REGARD TO THE CHARACTER OF THE MATERIAL OR SUPPLIES CALLED FOR OR THE CONDITIONS UNDER WHICH THE PROPOSED WORK IS TO BE DONE; 3) WILL KNOWINGLY ACCEPT MATERIALS OR SUPPLIES OF A QUALITY INFERIOR TO THOSE CALLED FOR BY ANY CONTRACT; 4) WILL KNOWINGLY CERTIFY TO A GREATER AMOUNT OF LABOR PERFORMED THAN HAS BEEN ACTUALLY PERFORMED, OR TO THE RECEIPT OF A GREATER AMOUNT OR DIFFERENT KIND OF MATERIAL OR SUPPLIES THAT HAS BEEN ACTUALLY RECEIVED; 5) ANY DIRECT OR INDIRECT FINANCIAL INTEREST IN THE BID. IF AT ANY TIME IT SHALL BE FOUND THAT THE PERSON OR ENTITY TO WHOM A CONTRACT HAS BEEN AWARDED HAS, IN PRESENTING ANY BID, OR BIDS, COLLUDED WITH ANY OTHER PARTY OR PARTIES FOR THE PURPOSE OF PREVENTING ANY OTHER BID BEING MADE, THEN THE CONTRACT SO AWARDED SHALL BE TERMINATED AND THAT PERSON OR ENTITY SHALL BE LIABLE FOR ALL DAMAGES SUSTAINED BY PIMA COUNTY.

### OTHER PARTICIPATING GOVERNMENTAL ENTITIES:

PIMA COUNTY HAS ENTERED INTO COOPERATIVE PURCHASING AGREEMENTS WITH OTHER POLITICAL SUBDIVISIONS, CITIES AND TOWNS OF THE STATE OF ARIZONA IN ORDER TO CONSERVE RESOURCES, REDUCE PROCUREMENT COSTS AND IMPROVE THE TIMELY ACQUISITION AND COST OF SUPPLIES, EQUIPMENT AND SERVICES. THE VENDOR TO WHOM THIS CONTRACT IS AWARDED, MAY BE REQUESTED BY OTHER PARTIES TO EXTEND TO THEM THE RIGHT TO PURCHASE SUPPLIES, EQUIPMENT AND SERVICES PROVIDED BY THE VENDOR UNDER THIS CONTRACT, PURSUANT TO THE TERMS AND CONDITIONS STATED HEREIN.

### PATENT INDEMNITY:

BIDDER SHALL HOLD PIMA COUNTY, ITS OFFICERS, AGENTS AND EMPLOYEES, HARMLESS FROM LIABILITY OF ANY NATURE OR KIND, INCLUDING COSTS AND EXPENSES, FOR INFRINGEMENT OR USE OF ANY COPYRIGHTED COMPOSITION, SECRET PROCESS, PATENTED OR UNPATENTED INVENTION, ARTICLE OR APPLIANCE FURNISHED OR USED IN CONNECTION WITH THE CONTRACT OR PURCHASE ORDER. BIDDERS MAY BE REQUIRED TO FURNISH A BOND OR OTHER INDEMNIFICATION TO PIMA COUNTY AGAINST ANY AND ALL LOSS, DAMAGE, COSTS, EXPENSES, CLAIMS AND LIABILITY FOR PATENT OR COPYRIGHT INFRINGEMENT.

### UNFAIR COMPETITION AND OTHER LAWS:

RESPONSES SHALL BE IN ACCORDANCE WITH ARIZONA TRADE AND COMMERCE LAWS (TITLE 44 A.R.S.) AND ALL OTHER APPLICABLE COUNTY, STATE, AND FEDERAL LAWS AND REGULATIONS.

### CONFLICT OF INTEREST:

ALL AGREEMENTS ARE SUBJECT TO THE PROVISIONS OF A.R.S. §38-511 WHICH PROVIDES IN PERTINENT PART: "THE STATE, ITS POLITICAL SUBDIVISIONS OR ANY DEPARTMENT OF EITHER MAY, WITHIN THREE YEARS AFTER ITS EXECUTION, CANCEL ANY CONTRACT, WITHOUT PENALTY OR FURTHER OBLIGATION, MADE BY THE STATE, ITS POLITICAL SUBDIVISIONS, OR ANY OF THE DEPARTMENTS OR AGENCIES OF EITHER IF ANY PERSON SIGNIFICANTLY INVOLVED IN INITIATING, NEGOTIATING, SECURING, DRAFTING OR CREATING THE CONTRACT ON BEHALF OF THE STATE, ITS POLITICAL SUBDIVISIONS OR ANY OF THE DEPARTMENTS OR AGENCIES OF EITHER IS, AT ANY TIME, WHILE THE CONTRACT OR ANY EXTENSION OF THE CONTRACT IS IN EFFECT, AN EMPLOYEE OR AGENT OF ANY OTHER PARTY TO THE CONTRACT IN ANY CAPACITY OR A CONSULTANT TO ANY OTHER PARTY TO THE CONTRACT WITH RESPECT TO THE SUBJECT MATTER OF THE CONTRACT."

### NON-DISCRIMINATION:

DURING THE PERFORMANCE OF ANY CONTRACT WITH PIMA COUNTY, CONTRACTOR AGREES TO OBSERVE THE NON-DISCRIMINATION CLAUSE AS SPECIFIED UNDER THE REGULATIONS OF THE SECRETARY OF LABOR CONTAINED IN 29 CFR 3 (1974) MADE PURSUANT TO 40 USC SECTION 276 © (1964) AND ARIZONA EXECUTIVE ORDER NUMBER 75-5, AND SHALL BE BINDING AS IF SAME WERE WRITTEN HEREIN.

### NON-APPROPRIATION OF FUNDS:

PURSUANT TO THE PROVISIONS OF A.R.S. §11-251, SUB-SECTION 42, ANY AGREEMENT MAY BE CANCELED AT THE END OF EACH FISCAL YEAR (JUNE 30) IF FOR ANY REASON THE PIMA COUNTY BOARD OF SUPERVISORS DOES NOT APPROPRIATE FUNDS FOR THE STATED PURPOSE OF MAINTAINING ANY AGREEMENT. IN THE EVENT OF SUCH CANCELLATION, PIMA COUNTY SHALL HAVE NO FURTHER OBLIGATION, OTHER THAN FOR SERVICES OR GOODS THAT HAVE ALREADY BEEN PROVIDED.

### PUBLIC INFORMATION:

PURSUANT TO A.R.S. §39-121.01 ET SEQ., ALL INFORMATION SUBMITTED WITH BID RESPONSES, INCLUDING, BUT NOT LIMITED TO, PRICING, PRODUCT SPECIFICATIONS, WORK PLANS, AND ANY SUPPORTING DATA BECOMES PUBLIC INFORMATION AND UPON REQUEST, IS SUBJECT TO RELEASE AND/OR REVIEW BY THE GENERAL PUBLIC INCLUDING COMPETITORS.

### AMERICANS WITH DISABILITIES ACT:

BIDDERS SHALL COMPLY WITH ALL APPLICABLE PROVISIONS OF THE AMERICANS WITH DISABILITIES ACT (PUBLIC LAW 101-336, 42 USC 12101-12213) AND ALL APPLICABLE FEDERAL REGULATIONS UNDER THE ACT, INCLUDING 28 CFR PARTS 35 AND 36.

### PROTESTS:

AN INTERESTED PARTY MAY FILE A PROTEST REGARDING ANY ASPECT OF A SOLICITATION, EVALUATION, OR RECOMMENDATION FOR AWARD. PROTESTS MUST BE FILED IN ACCORDANCE WITH THE PIMA COUNTY PROCUREMENT CODE, SECTION 11.20.010.

### CONFLICTS IN TERMS AND CONDITIONS:

IN THE EVENT THERE ARE INCONSISTENCIES BETWEEN THESE TERMS AND CONDITIONS AND THE ONES IN THE BID/RFP, THE TERMS AND CONDITIONS IN THE BID/RFP SHALL GOVERN.

## SPECIFIC TERMS AND CONDITIONS

### INTRODUCTION:

Pima County intends to establish a contract to provide biological consultant services for the Sonoran Desert Conservation Plan (SDCP), per specifications listed herein.

### Location and Purpose of Project

The Sonoran Desert Conservation Plan (SDCP) is a county-wide planning tool. The purpose of this contract is to provide a sound biological basis for the plan. The biological goals of the SDCP are stated on Table 1. The area for which the plan is being developed is Eastern Pima County, exclusive of the San Xavier District, and Western Pima County, excluding the Goldwater Gunnery Range (Figure 1). Pima County reserves the right to reduce the extent of the plan area during the term of the contract. Areas outside of the planning area may be locally and regionally important to the biological elements of the planning area and will be considered according to the biological significance of the lands involved and agency participation.

### SAMPLE CONTRACT:

A sample copy of the Contract the successful respondent will enter into with Pima County is included for your review. Each respondent, by submitting a proposal, will be certifying that the Contract is acceptable as written, unless exceptions are taken and specific alternate language is proposed. Exceptions which include language unacceptable to Pima County may be cause for disqualification. (It is not necessary to return the sample contract.) **THE SCOPE OF SERVICES, FIGURES AND TABLES ARE DESCRIBED IN THE SAMPLE CONTRACT AND ATTACHMENT "A" TO SAMPLE CONTRACT, NOT IN THE RFP.** County reserves the right to negotiate certain terms and conditions of the Contract as necessary to reach a mutually satisfactory agreement.

### BACKGROUND:

On October 27, 1998, the Board of Supervisors launched a major conservation planning effort – the Sonoran Desert Conservation Plan – that will: (1) define urban form and prevent urban sprawl through the protection of natural and cultural resources; (2) provide the basis for natural resource protection and an environmental element of the Comprehensive Plan; (3) lead to the recovery of the endangered cactus ferruginous pygmy-owl and other listed species; (4) stabilize the ecosystem and plant communities which support indigenous plants and animals and thereby prevent the need for future listings under the Endangered Species Act (ESA); and (5) lead to issuance of a Section 10 (a)(1)(B) permit under the ESA for a regional multi-species conservation plan.

Following a three-month public comment period on the draft concept plan, in March 2, 1999, the Board adopted the Sonoran Desert Conservation Concept Plan, accepting the 189 comments from the public and inviting over 80 individuals to participate in the development of the Plan.

Figure 2 shows the entire process at a glance, with the Steering Committee, public and intergovernmental process running parallel to the technical, information gathering and assessment process. The timing of completion of the Sonoran Desert Conservation Plan depends on Congressional funding availability. This biological services contract will be funded by pending federal grants awarded to Pima County. Award of this Contract is dependent on Pima County's receipt of these grant monies, and the Pima County Board of Supervisor's approval of the budget for this project.

The SDCP will include an application for an ESA Section 10(a)(1)(B) permit, which will be submitted by Pima County to USFWS on behalf of the County and its partners. Pima County and its partners may also choose to enter into pre-listing agreements for unlisted species and modifications of federal management plans. Potential partners include federal land managing agencies, local jurisdictions, the State of Arizona, and the Tohono O'Odham Nation. Activities that may result in incidental take of listed species may include grazing, flood control, transportation, parks and recreation, residential and commercial development, solid waste facilities, sewage treatment facilities, water treatment facilities, and recharge projects. Pima County is the lead local agency and will be responsible to USFWS for plan implementation and monitoring.

The issuance of a Section 10 (a.) permit is a federal agency action subject to the National Environmental Policy Act (NEPA) process. Pima County is responsible for preparing NEPA documents.

**QUESTIONS:**

Respondents having questions regarding the RFP shall contact Dan Deering, Chief Contracts and Procurement Officer, Procurement Department, Telephone (520) 740-8161.

**MINIMUM REQUIREMENTS:**

Team-specific expertise will be highly ranked in evaluating proposals. Minimum team qualifications:

1. Lead biologist botanist or ecologist: extensive experience in the southwest United States, and experience with Arizona Endangered Species. A Master of Science or Ph.D. in biology, botany, ecology or related field, and experience in the field of biological science. Demonstrated experience with conservation planning, population biology, and habitat conservation plans. Project management experience and communication abilities in a variety of media is a must.
2. GIS Analyst: Extensive experience with county-wide or larger planning area. Ability to analyze and evaluate data accuracy and gaps. Familiarity with county, state, and federal GIS capabilities and programs.
3. Support Biologists/Ecologists: Extensive experience and expertise with the habitats and species included in the SDGP; familiar with Arizona biotic communities and management issues. Higher education preferred. Experience and education complementary to lead biologists.
4. Regulatory Specialist: The team should include individual(s) with extensive experience with Endangered Species Act and related federal regulations. Prefer familiarity with local and regional office of the USFWS.
5. Availability: the project team is expected to work very closely with Pima County in Tucson, Arizona. The project team must maintain an office in Tucson for the duration of the service.

**PRICING:**

Respondents shall submit pricing in the manner requested on the Pricing Pages.

**PROPOSAL REQUIREMENTS:**

*Proposals shall contain the following information:*

1. Pages 9 - 15 (pricing and certification) fully completed as requested.
2. No more than 2 pages describing firm(s) including experience of firm, location of Tucson office, size and services provided, including computer hardware and software available for this project.
3. Describe five examples of recent (last 10 years) experience with similar large scale planning efforts. List experience in order of recency. Provide eight copies of one deliverable from any of the five projects. Describe the team members' roles in working with the client including: responsiveness to a diverse management team, a single project manager or an advisory committee, and the public. Describe team members experience with information compilation and analysis including data gap analysis, population viability analysis, population modeling, plant and animal community description and classification, remote sensing applications for natural resources, community classification accuracy assessments (error estimation), statistical sampling and analysis, development of land management plans, communication of technical information, and similar or related experience. Provide references for project clients (include name and phone number, start and completion date estimated if not yet completed), address, and cost of contract. For completed projects, reference any contract extensions and why they were needed.
4. Technical qualifications, availability expressed as a percentage of time, and experience of project team members. This must include those whose primary duties will include fieldwork, data analysis, classification and imagery interpretation. Describe the staff experience in these disciplines necessary for project execution:
  - a. Conservation biology, species conservation and planning. Extensive knowledge of population biology, population viability assessments, species-habitat relationships, Sonoran Desert ecosystems, southwestern riparian communities, and the relationship of human activities to plant and animal community conservation.
  - b. Endangered Species Act and related regulation. Extensive practice in preparing biological assessments and familiarity with Endangered Species Act consultations. Working relationships with the Arizona Ecological Services office and staff, in addition to Region II USFWS staff.

- c. Geographic Information System (GIS) use and limitations. Experience with computerized GIS, diverse data management, and accuracy assessment. Skill in using GIS as one of several planning tools.
  - d. Educational and information transfer. Skills in presenting technical information to a broad public. Clear, concise, and understandable communication is essential.
5. Organization chart for project team (including sub-consultants, if applicable).
  6. Proposed approach to the project tasks, proposed deliverables and description of personnel involved in tasks.
  7. Proposed project schedule showing anticipated completion data for each task and deliverable.
  8. Percentage of project cost to be performed by employees who live in Pima County.
  9. Electronic mail address or fax number where messages may be sent to facilitate communications related to the interview or award.
  10. 254 form if applicable (including sub-consultants if applicable).

Proposals not containing the above information may be considered "non - responsive" and may not be considered or evaluated.

#### **PROPOSAL SUBMITTAL:**

One original proposal, and eight (8) complete copies shall be submitted. Original shall be clearly marked "Original".

#### **CERTIFICATION:**

The certification must be completed and signed by the respondent. Failure to complete and sign this may cause the proposal to be rejected. In the event "No" is checked for meeting specifications, terms and/or conditions, failure to fully explain exceptions taken may cause the proposal to be rejected.

#### **EVALUATION CRITERIA:**

Pima County shall evaluate proposals after Pima County determines that the proposals are responsive. Proposals must contain all required information to be considered "responsive". Price, minimum requirements, project team, organization, availability, approach, schedule and all other requirements in this RFP will be considered in the evaluation. Pima County reserves the right to request additional information and/or clarification.

The following will be used by the County in the evaluation of responsive proposals and selection of Contractor.

#### ***Project Team***

- |  |                    |
|--|--------------------|
| Qualifications and experience of project manager in conservation biology, regulatory issues, GIS-based investigations, knowledge of the region, project management and communication skills. | 15 points possible |
| Qualifications and experience of team members in conservation biology, regulatory issues, GIS-based investigations, knowledge of the region and communication skills.                        | 15 points possible |
| Demonstrated capability on similar/related projects.   | 15 points possible |

#### ***Organization***

- |  |                   |
|--|-------------------|
| Team organization chart – efficiency; clear lines of authority/responsibility; how well the team is organized; appropriateness; quality control responsibility | 5 points possible |
|--|-------------------|



**Availability**

Time commitment of *key* project team members and availability of team members to the project site and community resources.

10 points possible

**Approach**

Proposed approach of the firm towards completion of the project, including reasonableness of hours estimate.

20 points possible

**Schedule**

Schedule; includes measures to progress in an efficient manner.

10 points possible

**Cost**

Lowest cost.

10 points possible

**Total**

**100 points possible**

**EVALUATION CRITERIA (CONT.):**

The proposals will be evaluated by Pima County Procurement, the Project Manager (PM), U. S. Fish and Wildlife Service, and the members of the STAT. Interviews of the top candidates may be held at a time and place to be determined.

Recommendation for award will be item by item. The respondent who has submitted the proposal most advantageous to the County considering price, conformity to the RFP requirements and the evaluation scores shall be recommended for award.

**PRICING PAGE****COMPANY NAME:** \_\_\_\_\_

Respondent shall complete the following pricing in the precise manner requested. All prices must be completely explained on the pricing pages. Pima County will not pay any costs not disclosed on the Pricing Page.

Total cost to perform ALL consultant services described herein:

Total project cost\*: \$ \_\_\_\_\_

Pima County may request additional services, including but not limited to those specified in the Sample Contract. Please list an all inclusive hourly rate for additional services: \$ \_\_\_\_\_ /Hr.

PRICES LISTED ABOVE MUST INCLUDE ALL COSTS, INCLUDING BUT NOT LIMITED TO OVERHEAD, LABOR, SUPPLIES, TRAVEL, EQUIPMENT, REPORTS, ETC.

**\*Pricing Detail:**

Respondent shall breakdown and itemize total project cost estimate by task as set forth below. Personnel (including job title and hourly rate), benefits, supplies, equipment, travel, subcontractors, other (describe), and indirect costs (if applicable). Cost breakdowns for subcontractors shall be included in similar detail.

**I. Project Management**

Labor costs: (each employee, include ERE)	Job Title:	Hourly Rate:	Total Hours:
--	------------	--------------	--------------

Supplies:

Equipment:

Travel:

Subcontractors:	Job Title:	Hourly Rate:	Total Hours:
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Indirect Costs:

Other Costs:

Total Cost for Item I: \_\_\_\_\_

**II. Threats Assessment Based on Existing Plans**

Labor costs: Job Title: Hourly Rate: Total Hours:  
(each employee, include ERE)

Supplies:

Equipment:

Travel:

Subcontractors: Job Title: Hourly Rate: Total Hours:

Indirect Costs:

Other Costs:

Total Cost for Item II: \_\_\_\_\_

**III. Review of Vulnerable Species List**

Labor costs: Job Title: Hourly Rate: Total Hours:  
(each employee, include ERE)

Supplies:

Equipment:

Travel:

Subcontractors: Job Title: Hourly Rate: Total Hours:

Indirect Costs:

Other Costs:

Total Cost for Item III: \_\_\_\_\_

**IV. Data Compilation and Synthesis for Vulnerable Species**

Labor costs: Job Title: Hourly Rate: Total Hours:  
(each employee, include ERE)

Supplies:

Equipment:

Travel:

Subcontractors: Job Title: Hourly Rate: Total Hours:

Indirect Costs:

Other Costs:

Total Cost for Item IV: \_\_\_\_\_

**V. Vulnerable Species Goals**

Labor costs:  
(each employee, include ERE)

Job Title:

Hourly Rate:

Total Hours:

Supplies:

Equipment:

Travel:

Subcontractors:

Job Title:

Hourly Rate:

Total Hours:

Indirect Costs:

Other Costs:

Total Cost for Item V: \_\_\_\_\_

**VI. Vulnerable Species Habitat Data Analysis**

Labor costs:  
(each employee, include ERE)

Job Title:

Hourly Rate:

Total Hours:

Supplies:

Equipment:

Travel:

Subcontractors:

Job Title:

Hourly Rate:

Total Hours:

Indirect Costs:

Other Costs:

Total Cost for Item VI: \_\_\_\_\_

**VII. Riparian Vegetation Mapping**

Labor costs:  
(each employee, include ERE)

Job Title:

Hourly Rate:

Total Hours:

Supplies:

Equipment:

Travel:

Subcontractors:

Job Title:

Hourly Rate:

Total Hours:

Indirect Costs:

Other Costs:

Total Cost for Item VII: \_\_\_\_\_

**VIII. Land Cover Community Inventory**

Labor costs:  
(each employee, include ERE)

Job Title:

Hourly Rate:

Total Hours:

Supplies:

Equipment:

Travel:

Subcontractors:

Job Title:

Hourly Rate:

Total Hours:

Indirect Costs:

Other Costs:

Total Cost for Item VIII: \_\_\_\_\_

**IX. Preserve Design and Management Recommendations**

Labor costs:  
(each employee, include ERE)

Job Title:

Hourly Rate:

Total Hours:

Supplies:

Equipment:

Travel:

Subcontractors:

Job Title:

Hourly Rate:

Total Hours:

Indirect Costs:

Other Costs:

Total Cost for Item IX: \_\_\_\_\_

**X. Habitat Suitability Modeling**

Labor costs:  
(each employee, include ERE) -

Job Title:

Hourly Rate:

Total Hours:

Supplies:

Equipment:

Travel:

Subcontractors:

Job Title:

Hourly Rate:

Total Hours:

Indirect Costs:

Other Costs:

Total Cost for Item X: \_\_\_\_\_

**XI. Pest Species Data Summary**

Labor costs:  
(each employee, include ERE)

Job Title:

Hourly Rate:

Total Hours:

Supplies:

Equipment:

Travel:

Subcontractors:

Job Title:

Hourly Rate:

Total Hours:

Indirect Costs:

Other Costs:

Total Cost for Item XI: \_\_\_\_\_

**XII. Adaptive Management Plan Recommendations and Manual**

Labor costs:  
(each employee, include ERE)

Job Title:

Hourly Rate:

Total Hours:

Supplies:

Equipment:

Travel:

Subcontractors:

Job Title:

Hourly Rate:

Total Hours:

Indirect Costs:

Other Costs:

Total Cost for Item XII: \_\_\_\_\_

**XIII. Evaluate Plan Impact on Federally Listed and Candidate Species**

Labor costs:  
(each employee, include ERE)

Job Title:

Hourly Rate:

Total Hours:

Supplies:

Equipment:

Travel:

Subcontractors:

Job Title:

Hourly Rate:

Total Hours:

Indirect Costs:

Other Costs:

Total Cost for Item XIII: \_\_\_\_\_

**XIV. Assistance with Preparation of NEPA Documents**

Labor costs:  
(each employee, include ERE)

Job Title:

Hourly Rate:

Total Hours:

Supplies:

Equipment:

Travel:

Subcontractors:

Job Title:

Hourly Rate:

Total Hours:

Indirect Costs:

Other Costs:

Total Cost for Item XIV: \_\_\_\_\_

**CERTIFICATION PAGE**

RESPONDENTS TO FILL IN THE FOLLOWING INFORMATION AND SUBMIT AS A PART OF THEIR PROPOSAL:

This firm certifies that it meets all specifications, terms and conditions contained in this RFP  
Yes \_\_\_\_ No \_\_\_\_ If no, respondent must explain all deviations in writing and attach to this proposal.

PROPOSAL MUST BE SIGNED BY AN AUTHORIZED VENDOR REPRESENTATIVE

COMPANY NAME: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_

NAME & TITLE: \_\_\_\_\_  
(PLEASE PRINT/TYPE)

ADDRESS: \_\_\_\_\_

CITY, STATE, ZIP: \_\_\_\_\_

TELEPHONE: \_\_\_\_\_

FAX NUMBER: \_\_\_\_\_

CONTACT PERSON: \_\_\_\_\_

CONTACT PERSON TELEPHONE: \_\_\_\_\_

FEDERAL TAX IDENTIFICATION NUMBER: \_\_\_\_\_

CORPORATE HEADQUARTERS LOCATION:

ADDRESS: \_\_\_\_\_

CITY, STATE, ZIP: \_\_\_\_\_

OPTIONAL INFORMATION

Pima County has a Minority Women Business Enterprise (MWBE) Program. Please provide information as appropriate.

Are you a?                      Women-Owned Business                      ☐

Minority-Owned Business                      ☐

Are you currently certified by any Agency?                      Yes ☐ No ☐

Agency Name: \_\_\_\_\_



## SAMPLE CONTRACT

### BIOLOGICAL CONSULTANT SERVICES FOR SONORAN DESERT CONSERVATION PLAN

THIS CONTRACT entered into between Pima County, a body politic and corporate of the State of Arizona, hereinafter called COUNTY; and \_\_\_\_\_ hereinafter called CONSULTANT.

#### WITNESSETH

WHEREAS, COUNTY requires the services of a CONSULTANT qualified to provide biological consultant services for the Sonoran Desert Conservation Plan; and

WHEREAS, CONSULTANT is qualified and willing to provide such services; and

WHEREAS, pursuant to RFP #539 CONSULTANT submitted the proposal most advantageous to COUNTY.

NOW, THEREFORE, the parties hereto agree as follows:

#### ARTICLE I - TERM

This Contract shall commence on the \_\_\_\_\_ day of \_\_\_\_\_, 1999, and shall terminate on the \_\_\_\_\_ day of \_\_\_\_\_, 2000, unless sooner terminated or further extended pursuant to this Contract.

#### ARTICLE II - SCOPE

CONSULTANT shall provide biological consultant services pursuant to RFP #539 and as described below.

##### Organization and Definitions

The organization of the SDCP is shown on Figure 2. The Technical Reports listed have been or are being prepared by staff. The technical report entitled "Determining Species of Concern in Pima County, Arizona" is incorporated into this document by reference. This contract is represented by the box labeled "biological evaluation" in Figure 2.

Definitions of terms used in the scope of work are as follows:

Scientific and Technical Advisory Team (STAT): a team of scientific and technical staff appointed by the County Administrator who advise the County on technical issues. The team reviews and approves the work of the Biological Consultant through the Project Manager.

Project Manager (PM): A Pima County staff member who implements decisions of the STAT, and oversees the contract.

Steering Committee: Advisory body to the Pima County Board of Supervisors.

Pima County GIS: Pima County will perform GIS-based evaluations as requested by the PM. Biological consultant will produce GIS-compatible information layers for these evaluations. Biological consultant works with STAT to develop the biological assumptions, constraints and weights for use in GIS-based reserve design.

GIS Decision Support Model: The biological consultant shall collaborate with a team of conservation biologists and geographic information scientists to create a decision support model for conservation planning. The principal investigators in this effort are: Dr. Michael Gilpin, Dr. Ross Gerrard, Dr. Peter Stine, and Dr. Richard Church. The components of proposed decision support model can be condensed into four main categories:

- (a) incorporation of expert biological data and opinion derived in part from the biology contract deliverables;
- (b) computer-based processing to determine relative habitat suitability and socio-economic suitability in the region of interest;
- (c) modeling viable territories for basic demographic units of the vulnerable species; and
- (d) optimizing the selection of species territories to balance the conflicting goals of environmental and human needs

**Independent Peer Reviewers:** Pima County will contract with scientists outside the STAT to provide independent peer review of selected deliverables produced by the biological consultant. Two independent peer reviewers have been selected by the Science Advisory Team, and both Dr. Reed Noss and Ms. Laura Hood have accepted invitations to serve in this role. Other peer reviewers will be selected as the planning process continues.

**Focal Species:** plant or animal species (taxa) that are considered for conservation within the plan, as described in the Determining Species of Concern report.

**Vulnerable species:** species in categories 1 and 2, whose existence is considered to be at risk in Pima County within the planning period. Described within the Determining Species of Concern Report.

**Pest Species:** primarily non-native species of plants or animals that pose a threat to focal species or native animal or plant communities in the planning area. Further description is contained within the Determining Species of Concern report.

#### Professional Services Provided.

The biological consultant contract will create a program of work needed to achieve the biological goals of conserving Pima County's indigenous plants and animals. The work will incorporate three approaches (Figure 3). The contract will have several parts, with services including the following:

- a. Compile, document and synthesize existing information on vulnerable species, and high priority biotic communities as recommended by the STAT. Produce or synthesize new GIS-based data layers on selected biotic communities. Identify data gaps and prioritize data needs. Produce a threats assessment.
- b. Recommend species/habitat goals. Review remaining focal species and special habitats or plant communities to devise conservation strategies. Investigate pest species important to the planning area and SDCP goals.
- c. Prepare and recommend reserve designs with specific management recommendations that meet the goals of the plan for selected species, habitats and plant communities as approved by the STAT.

Work done under this contract must be consistent with the Endangered Species Act, the implementing regulations under Title 50 of the Code of Federal Regulations, and the Habitat Conservation Planning Handbook.

During the term of this contract, a number of draft, interim and final products will be developed for review and approval of the STAT. The following deliverables must be received by Pima County on or before June 30, 2000:

- 1) Threats assessment (Task II.A)
- 2) Recommendations on adjustments to vulnerable species list (Task III)
- 3) Draft vulnerable species data summaries, including distribution maps (Task IV)
- 4) Draft data analysis (Task VI.B)

- 5) Pilot vegetation mapping exercise (Task VII. B1 and B2)
- 6) Draft land cover community map (Task VIII.A)
- 7) Draft reserve design guidelines (Task IX.A)

The consultant is expected to act in an advisory capacity to the PM on scientific matters relating to the plan and its development. Frequent and open communication with the PM is essential, as is a collaborative, problem-solving approach.

The consultant will be responsible for developing recommendations for review by the STAT who act in an advisory capacity to Pima County. The consultant will lend their expertise to the STAT where needed, as directed by the PM. The consultant may be asked to present information to the STAT, and occasionally the Steering Committees or Sub-area Committees, regarding work products and progress. The Project Manager will coordinate the format of information presentations.

#### **I. Project Management**

This shall include all meetings with the STAT, coordination with the project manager, Pima County Technical Services, and the decision support model team, preparation of biweekly status reports, internal coordination among the consultant team members, quality control measures, and monthly invoicing.

#### **II. Threats Assessment based on Existing Plans**

- A. Identify key biological threats based on review of existing and proposed land or water uses described by the technical reports prepared by Pima County (Figure 2), existing land use plans prepared by federal, local, state and tribal jurisdictions, incidental take permits and approved development plans and subdivision plats. Emphasis shall be placed on identifying the specific components of existing and proposed land or water uses, by sub-area, which pose the greatest biological threats over the next 30 years to focal species and special habitats, plant associations, and communities identified by the STAT.
- B. Attend subarea panel meetings. Provide biological information to subarea panels via oral presentations.

#### **III. Review of Vulnerable Species List**

The consultant shall review categories 1 and 2 of the vulnerable species list and identify, to the STAT, those species which are not recommended for further evaluation because:

- a. Species conservation can be accomplished as a result of other species, habitat or plant community protection afforded by the SDCP.
- b. Insignificant or non-viable numbers of the species occur in the planning area and conservation is best accomplished elsewhere (accidentals, range peripherals, etc.).
- c. The species does not occur in the study area, nor is it likely to occur in the study area within the planning horizon, or
- d. The species is too broadly distributed to help differentiate among a range of plan alternatives.

The consultant may recommend to the STAT that other species be added to the categories 1 and 2 of the Vulnerable Species list, with supporting documentation.

#### **IV. Data Compilation and Synthesis for Vulnerable Species**

- A. For vulnerable species (categories 1 and 2) affirmed in Task III, the consultant shall compile existing biological and management information. All sources of data must be documented. Consultant will review, at a minimum: AGFD HDMS records, State and Federal government reports and data compilations, AGFD species Abstracts and BISON-M compilations, as well as the relevant scientific literature. Consultant will secure review of each compilation by qualified species experts. For each vulnerable species the consultant shall provide a written summary of information in manual format including

1. Federal status.
2. State and federal recovery goals.
3. Other status (global rankings, state lists, other lists).
4. Taxonomy, especially of Pima County populations.
5. Past and present distribution
6. Habitat requirements, including home range requirements and ability to utilize major human land use categories.
7. Life history.
8. All available demographic (population density, status, trend, survival rates, reproductive rates, sex and age ratios etc.) and distributional information within Pima County and range-wide. Define population or (sub-population) basis in the planning area, and identify any areas of special significance to the Pima County populations.
9. Habitat trends within the planning area, if known.
10. Current and potential threats to species or populations in Pima County, considering the location, amount, and quality of habitat already protected, as well as existing and potential pest species. Identify the mechanism of threats.
11. Management needs, including sensitivity to human activity and densities, corridor needs, key relationships, migratory requirements, etc.
12. Results of past mitigation activities.
13. Existing monitoring and research programs.

- B. Maps will be prepared depicting distribution of species within Pima County and, where appropriate, range-wide.

#### **V. Vulnerable Species Goals**

- A. For all vulnerable species (categories 1 and 2), the consultant shall recommend County-level conservation goals and objectives to the STAT. County-level goals must be consistent with SDCP goals (Table 1) and recovery plan (USFWS) goals. Conservation goals and objectives may be expressed in terms of demographic or population units (numbers of populations, density, age-class, etc.) or in terms of habitat units, depending on information available. The scientific basis for choosing a demographic or habitat-based objective should be described.
- B. The STAT will review and comment on the consultant recommendations for a prioritized list of vulnerable species with conservation goals and objectives, including new candidate vulnerable species. The consultant will revise the list as directed by the PM.

#### **VI. Vulnerable Species Habitat Data Analysis**

- A. Once data compilation, synthesis and evaluation (including expert review) is completed for each vulnerable species (categories 1 and 2), the consultant shall identify data gaps relative to essential information for conservation planning. The consultant shall make recommendations on data gathering priority to the STAT.

Data gathering priorities shall be identified in the context of preserve design and species management. The consultant shall recommend studies, research, or suitable surrogates (ecological equivalents) to fill data gaps. Sources of error or uncertainty which can be expected to affect subsequent analyses which would be generated based on the data will be described. The biological basis for using other species as surrogates for vulnerable species shall be described in detail. An estimate of the time and resources needed to fill data gaps shall be provided. A description of the specific consequences to the process of not obtaining those data shall be included.

- B. Evaluate the feasibility of using existing and developed GIS covers to model species habitat, distributions, or habitat potential for focal species and pest species. Evaluation of GIS modeling capabilities in this context will be conducted in close cooperation with the Project Manager and County GIS staff. The consultant will clearly indicate the GIS covers, or combinations of covers, may serve to represent particular habitats or communities used by a species.

As part of this evaluation, the consultant will construct a matrix showing presence or absence of vulnerable species (rows) as they relate to environmental characteristics depicted in various GIS layers (columns). These characteristics would primarily be related to land cover. The consultant will base the matrix on the species data summaries as well as expert opinion. The consultant will quantify the representation of each species' habitat within the existing reserve network, and summarize species richness by land-cover type.

## VII. Riparian Vegetation Mapping

- A. The consultant shall produce the following deliverables:

1. Vegetation maps and a map showing field verification locations shall be delivered as Arc/Info vector coverages or in a format pre-approved by Pima County DOT Technical Services GIS Section.
2. A complete reproducible set of mylars registered to 7.5 minute USGS quadrangle maps shall be prepared. Each mylar shall contain a legend, scale, index map and title block.

Each map shall portray the locations of boundaries and the geographic extent of vegetative communities. Each polygon shall be labeled numerically with the vegetation classification. In addition, one mylar index map shall be provided.

3. A report shall be prepared describing the methods, the scale and source of base information used, assumptions made, the nature of any interim products, and a non-statistical assessment of reliability in the mapping in terms of 1) positional accuracy and 2) classification accuracy as it varies by geographic area and by classification category.

To the extent thought reliable, existing sources of information shall be used. Information to be reviewed which will be provided by Pima County include but are not limited to the following:

- a. PAG maps of perennial, intermittent, and ephemeral streams and shallow groundwater zones (digital)
- b. Digital USGS orthophotoquadrangles for portions of Pima County
- c. Unincorporated Pima County riparian habitat maps (digital)
- d. Gap Analysis Program vegetation maps (digital)
- e. NDVI map for portions of Pima County (digital)
- f. PAG 208 maps for non-urban Pima County (paper)
- g. Wildlife Habitat Inventory maps for metropolitan Tucson (digital)
- h. Organ Pipe Cactus National Monument vegetation map (digital)
- i. PAG 208 vegetation and soils data cards (paper)
- j. Cienega Creek Natural Preserve vegetation map (paper)
- k. USGS and Pima County stream centerlines (digital)
- l. USFWS wetland inventory maps (mostly paper)

Emphasis shall be placed on classifying the existing riparian areas as delineated on Pima County's riparian habitat maps, delineating additional riparian areas where no data currently exists, and addressing specific mapping requirements below. Work shall emphasize areas outside existing public reserves. Applicants may further assume that ground-truthing will not be conducted on tribal lands or on private lands aside from visual inspection from public thoroughfares. Fieldwork to provide statistical measures of accuracy is not requested. The consulting team is encouraged to describe additional existing data which it proposes to bring to bear on the project for the purpose of

increasing efficiency and accuracy. The cost of any additional data acquisition should be included in the budget for this task.

#### VEGETATION MAPPING REQUIREMENTS

1. Discriminate the location of riparian vegetation versus upland vegetation with a minimum map area of 5 acres.
2. Identify physiognomy and dominance, discriminating among leguminous tree forests, broadleaf deciduous forest, tamarisk forest, other riparian forest, emergent marsh, tobosa or sacaton grassland, and riparian scrub. Units should be mappable on 7 ½ minute scale — i.e. 5 acres minimum unit.
3. Map unit classifications should be compatible with the National Vegetation Classification System. The hierarchical classification system used by Brown, Lowe and Pase is acceptable.

#### B. Procedure

1. In consultation with the project manager, refine and develop a mapping protocol to meet the STAT vegetation mapping requirements, budget, and schedule.
2. Design and conduct a pilot vegetation mapping exercise covering several nonadjacent USGS 7.5 minute quadrangles, including field verification. The pilot study areas need to represent the range of vegetation types present in the study area, as well as the variation in available data sources. Design of the pilot study shall be developed in consultation with project manager. Evaluate and refine the mapping protocol and classification scheme to meet the schedule and budget.
3. Complete draft deliverables for the rest of the study area.
4. Revise and finalize deliverables according to review comments.

#### VIII. Land Cover Community Inventory

- A. Produce a consolidated land cover map which represents the best available information for the study area. Document data sources, accuracy of data sources and the decision-making process for producing the land cover map.
- B. Considering the needs of focal species, and the range of ecological processes needed to sustain these biotic communities, identify and prioritize additional survey, mapping, and protection, and management needs. Priority ranking shall consider the plan goals, objectives, community integrity, historic loss, and relative degree of threat or vulnerability of each of the special habitats or plant associations within these biotic communities. Conservation opportunities within each community shall be identified.

#### IX. Preserve Design and Management Recommendations:

- A. The biological consultant shall work with the STAT to develop detailed reserve design guidelines comparable to, but more specific than, the *Southern California Coastal Sage Scrub Natural Community Conservation Planning Conservation Guidelines* (Table 2) for use in the GIS-based reserve design. Design guidelines will address corridors for selected focal species.
- B. Following the data synthesis phase, the consultant shall make reserve design recommendations based on the best available scientific information for all remaining focal species, special habitats, species associations and plant communities. The reserve (plan) shall be designed to obtain the goals and objectives of the plan (Table 1), integrating conservation of focal species, special habitats, plant associations and plant communities according to a priority ranking developed above. The reserve design shall clearly indicate priority areas that identify the most vulnerable components of the preserve design for quick action. The reserve design and management

recommendations from the biological consultant shall be based upon conservation biology principles, including long-term population viability (for species which might be listed or considered for listing), focal species ecology and behavior, community ecology, and relevant biological considerations.

1. **Focal Species:** The consultant shall make reserve design and management recommendations that accomplish the goals of the plan for focal species, considering:
  - a. Desired effective population size and long-term population viability.
  - b. Habitat area and configuration requirements to sustain an effective population
  - c. Buffer habitat or space requirements.
  - d. Imminent and foreseeable threats.
  - e. Ecosystem function: ecosystem functions that support habitat or communities shall be considered and made part of the reserve design.
  - f. Management recommendations shall apply to focal species, habitats or communities and will state the desired conditions.
2. **Special Habitats, Plant Associations, and Communities:** The reserve design and management recommendations shall address stated conservation goals for these features. Recommendations shall consider and address:
  - a. Relative community condition regarding compromising invasion or colonization by pest species. Representative community or association examples free from pest species shall be given higher priority ranking.
  - b. Target area or function goals for the habitats, communities or associations.
  - c. Ecosystem functions and processes sufficient to support the desired community or habitat.
  - d. Community inter-relationships in the landscape, as it may affect community integrity.
  - e. Potential and foreseeable threats to community function.
  - f. Biotic and abiotic components of communities and habitats and the necessary conditions to support communities (e.g. hydrology for riparian).
  - g. Desired habitat or community condition, including species composition and range of variation, cover values, functions, recruitment conditions, configuration, degree of buffer, absence of pest species, and others.

#### **X. Habitat Suitability Modeling**

The consultant shall work collaboratively with County GIS and the decision support model team to refine the habitat suitability models by identifying and consulting appropriate experts, identifying literature sources, identifying limitations of data sources, and providing technical opinions related these products. The habitat suitability models produced by the decision support model team will be iterative products.

#### **XI. Pest Species Data Summary**

- A. The consultant shall, in close consultation with PM and STAT, evaluate pest species (plant and animal) which have the potential to expand into the planning area. The evaluation shall consider the vulnerable species literature review, consultation with experts, and an evaluation of the potential variable in climatic and ecological conditions likely to occur in the planning area within the next 30 to 50 years. The list of potential pest species shall be ranked according to likelihood of occurrence within the planning window and by potential threat to elements of the conservation plan.
- B. For up to ten *pest species* recommended by consultant and approved by STAT, the consultant shall summarize existing data and identify data gaps for :
  - a. Taxonomy.

- b. Habitat, affected native species, communities or habitats.
  - c. Effects on host or vulnerable species, including specific mechanisms, if known.
  - d. Rate of invasion, spread, or date of introduction.
  - e. Population trend.
  - f. Factors affecting spread and distribution: hosts, etc.
  - g. Legal status.
  - h. Management methods, efficacy and sensitivity.
  - i. Research ongoing and planned.
  - j. Potential future status in the planning area.
- C. The consultant shall map the range of up to ten selected pest species within the planning area, to produce GIS maps to aid with the reserve design. The selection of pest species to be mapped shall be made in consultation with the PM and STAT. The consultant shall verify pest species mapping by ground-truthing using a sampling method and analysis approved by the PM and STAT.

## **XII. Adaptive Management Plan Recommendations and Manual**

The consultant shall prepare a management plan that includes:

1. Species and community-specific management recommendations and practices.
2. Clear statements of desired future conditions for each management subject.
3. A plan for assessing progress toward desired project goals including assessment and adjustment of management actions. The process should detect surprises, and generate improved decision-making over time.
4. Management recommendations and long-term monitoring plans for assessing continuing and developing threats, including pest species. Monitoring must be able to detect population trends and habitat quality changes.
5. Establishing a process for reviewing, analyzing, and disseminating data gathered.
6. Recommend acceptable levels of deviation of species populations and communities that accounts for natural environmental variability, including disease and catastrophic events; determine action levels for increased monitoring or intervention.
7. Consideration for incidental take that is phased with achievement of specified population levels as determined through monitoring.
8. Procedures for changed circumstances, defined as listing of new species, modifications in activities described by the original HCP, or modifications in the monitoring program.
9. Procedures for dealing with unforeseen circumstances (which shall not include natural variation, such as catastrophic flooding, disease).
10. Review by species and community experts and the STAT, with incorporation of changes as recommended by the Project Manager.
11. Prioritized research recommendations consistent with the plan goals, and classed as short-term, mid-term, and long-term.
12. Mitigation requirements that consider species' habitat requirements and conservation of core habitats and linkages, as well as the efficacy of the mitigation method used. Avoiding and minimizing impacts should be the first option considered to limit impacts to vulnerable species.
13. Provisions for independent scientific review of research and monitoring results.

## **XIII. EVALUATE PLAN IMPACT ON FEDERALLY LISTED AND CANDIDATE SPECIES**

- A. Issuance of a Section 10 (a)(1)(B) Endangered Species Act Permit is a federal action and must be evaluated under the Endangered Species Act for effects on listed species and species proposed for listing. The consultant will prepare an assessment of the impacts on federally listed threatened and endangered species, species proposed for listing, and designated and proposed critical habitat within the planning area for four plan alternatives. Three alternatives must meet the SDCP biological and species goals. The fourth alternative shall be the no-action alternative. The consultant shall estimate the amount of take for each listed species for each alternative, the effects on the species population, and the impacts on the recovery of each species.



- B. Biological assessments shall include all threatened, endangered, and candidate species, species proposed for listing, and proposed and designated critical habitat in the planning area, regardless of inclusion in the SDCP. Each Alternative Assessment shall estimate local population effects and effects of the action (plan) on the entire species, as required under the Endangered Species Act. The assessment shall follow USFWS guidelines regarding Section 10 (a)(1)(B) permits and Biological Assessments. Each assessment will include:
1. A description of the planned action.
  2. Description of the project area biological resources and condition.
  3. A list of federally listed species and critical habitat in the project area.
  4. Descriptions of the kinds of effects expected from the plan alternatives.
  5. A summary of population levels and trends for each listed, or proposed, species in the project area and range-wide.
  6. Assessment of direct, indirect, and cumulative impacts based on the proposed action (the SDCP).

#### **XIV. ASSISTANCE WITH PREPARATION OF NEPA DOCUMENTS**

- A. The consultant shall assist Pima County and their National Environmental Policy Act (NEPA) consultant, if any, with preparation of technical studies and analysis in support of the plans NEPA process and documents. This will be limited to include descriptions of the project areas' biological resources, impacts of the plan on these resources (see V. A. above) including Threatened and Endangered Species, and evaluation of impacts on common biological components and plant communities.
- B. The consultant shall provide technical information and assistance to the NEPA consultant in a cooperative working relationship emphasizing meeting PM goals, objectives and quality standards. The biological consultant may be asked to provide review and editorial suggestions on the NEPA document, through the PM. NEPA documentation assistance is secondary to the primary goal of developing the Reserve Design and Management Plan.

#### **XV. ADDITIONAL SERVICES**

Additional services may include but are not limited to the following:

Additional data summaries for selected species;  
Mapping of vegetative communities or other resource conditions  
Field verification of resource conditions;  
Preparation of GIS covers to represent species habitat;  
Biological inventory or surveys for species occurrence and diversity;  
Population viability analysis;  
Biological guidelines for management of individual preserves;  
Identification or evaluation of interim conservation measures intended to address the needs of endangered species;  
Additional alternative evaluations for ESA and NEPA compliance;  
Technical review or evaluation of SDCP products prepared by others;  
Presentations to Steering Committee, or other technical committees.

#### **ARTICLE III - COMPENSATION**

For the performance of its services CONSULTANT shall be paid by COUNTY, in the manner and at the rates hereinafter specified below

(To be modified as necessary)

CONSULTANT shall provide detailed documentation in support of requested payment. These expenses will be protested or paid within thirty days of receipt. A payment under this Article shall not prevent the COUNTY from objecting to charges after payment therefor in appropriate cases, or from seeking reimbursement for any such charges.

Total contract amount is \$\_\_\_\_\_.

#### ARTICLE IV - CONTRACT EXTENSION

COUNTY shall have the option to extend this Contract for additional periods up to a maximum of five additional one-year periods. Any modification, or extension shall be by formal written amendment and executed by the parties hereto. In the event economic conditions are such that price increases become necessary, the CONSULTANT must submit to COUNTY supporting documents justifying such increases. COUNTY will review the proposed pricing and determine if it is in the best interest of COUNTY to extend or initiate a new contract.

#### ARTICLE V - TERMINATION

COUNTY reserves the right to terminate this Contract at any time and without cause by serving upon CONSULTANT 30 days advance written notice of such intent to terminate. In the event of such termination, the COUNTY'S only obligation to CONSULTANT shall be payment for services rendered prior to the date of termination.

This Contract may be terminated at any time without advance notice and without further obligation to the COUNTY when the CONSULTANT is found by County to be in default of any provision of this Contract.

#### ARTICLE VI - CONFLICT OF INTEREST

This contract is subject to the provisions of A.R.S. 38-511 which provides in pertinent part: "The state, its political subdivisions or any department of either may, within three years after its execution, cancel any contract, without penalty or further obligation, made by the state, its political subdivisions, or any of the departments or agencies of either if any person significantly involved in initiating, negotiating, securing, drafting or creating the contract on behalf of the state, its political subdivisions or any of the departments or agencies of either is, at any time, while the contract or any extension of the contract is in effect, an employee or agent of any other party to the contract in any capacity or a consultant to any other party to the contract with respect to the subject matter of the contract."

#### ARTICLE VII - STATUS OF CONSULTANT

The status of the CONSULTANT shall be that of an independent CONSULTANT and CONSULTANT shall not be considered an employee of Pima County and shall not be entitled to receive any of the fringe benefits associated with employment, and will not be subject to the provisions of the merit system. CONSULTANT will be responsible for payment of all Federal, State and Local taxes associated with the compensation received by CONSULTANT from COUNTY. CONSULTANT shall be responsible for program development and operation without supervision by COUNTY.

#### ARTICLE VIII - SUCCESSORS AND ASSIGNS

CONSULTANT shall not assign its rights to this Contract in whole or in part, without prior written approval of the COUNTY. Assignment may be withheld at the sole discretion of the COUNTY, provided that such approval shall not be unreasonably withheld. This Contract shall be binding upon and inure to the benefit of the parties to this Contract and their respective successors and assigns.

#### ARTICLE IX - OWNERSHIP OF DOCUMENTS

All original drawings, boring logs, field data, estimates, field notes, plans, specifications, documents, reports, calculations, maps and models, and other information provided by COUNTY or developed by CONSULTANT under this Contract shall vest in and become the property of the COUNTY and shall be delivered to COUNTY upon completion or termination of the services. CONSULTANT may neither use for other purposes nor retain record copies, except as specifically approved by COUNTY.

#### **ARTICLE X - NON-DISCRIMINATION**

CONSULTANT will not discriminate against any COUNTY employee, client or any other individual in any way involved with the COUNTY, because of race, age, creed, color, religion, sex, disability or national origin in the course of carrying out CONSULTANT'S duties pursuant to this Contract. CONSULTANT agrees to comply with the provisions of Arizona Executive Order 99-4, which are incorporated into this Contract by reference as if set forth in full. All sub-contractors associated with this Contract shall adhere to the same standards as set forth in this Article.

#### **ARTICLE XI - CONSULTANT'S PERFORMANCE**

CONSULTANT shall perform the work in accordance with the terms of the contract and to the best of CONSULTANT'S ability. CONSULTANT shall employ suitably trained and skilled professional personnel to perform all consultant services under this Contract. Prior to changing any key personnel, especially those key personnel COUNTY relied upon in making this contract, CONSULTANT shall obtain the approval of COUNTY. The key personnel are: \_\_\_\_\_

#### **ARTICLE XII - AMERICANS WITH DISABILITIES ACT**

CONSULTANT shall comply with all applicable provisions of the Americans with Disabilities Act (Public Law 101-336, 42 U.S.C. 12101-12213) and all applicable federal regulations under the Act, including 28 CFR Parts 35 and 36.

#### **ARTICLE XIII - NON-WAIVER**

The failure of COUNTY to insist in any one or more instances upon the full complete performance of any of the terms and conditions of this Contract to be performed on the part of the other, or to take any action permitted as a result thereof, shall not be construed as a waiver or relinquishment of the right to insist upon full and complete performance of the same, or any other covenant or condition, either in the past or in the future. The acceptance by either party of sums less than may be due and owing it at any time shall not be construed as an accord and satisfaction.

#### **ARTICLE XIV - COMPLIANCE WITH LAWS**

CONSULTANT shall comply with all federal, state, and local laws, rules, regulations, standards and Executive Orders, without limitation to those designated within this contract. The laws and regulations of the State of Arizona shall govern the rights of the parties, the performance of this contract, and any disputes hereunder. Any action relating to this contract shall be brought in a court of the State of Arizona in Pima County. Any changes in the governing laws, rules, and regulations during the terms of this contract shall apply, but do not require an amendment.

#### **ARTICLE XV - INSURANCE**

CONSULTANT shall obtain and maintain at its own expense, during the entire term of this Contract the following type(s) and minimum amounts of insurance:

General Liability - \$1,000,000.00

Commercial/Business Automobile Liability (for vehicles used  
in the performance of actual work, not for commuting) - \$1,000,000.00

Workers' Compensation - Statutory (if required by law)

Insurance must be from carriers acceptable to COUNTY. CONSULTANT shall provide COUNTY with certificates of insurance. Commercial General Liability shall name Pima County as an "Additional Insured". All certificates must provide for a 30 day advance notice of any modification, material change, non-renewal or cancellation.

#### ARTICLE XVI - NON-APPROPRIATIONS OF FUNDS

Notwithstanding any other provision in this Contract, this Contract may be terminated for any reason the Pima County Board of Supervisors does not appropriate funds for the purpose of maintaining this Contract. In the event of such termination, COUNTY shall have no further obligation to CONSULTANT, other than for services rendered prior to termination.

#### ARTICLE XVII - INDEMNIFICATION

CONSULTANT shall perform the services hereunder in accordance with generally accepted methods and standards. CONSULTANT shall indemnify, defend, and hold harmless COUNTY, its officers, departments, employees and agents from and against any and all suits, actions, legal administrative proceedings, claims or demands or damages of any kind or nature arising out of this Contract which are attributed to any act or omission of CONSULTANT, its agents, employees, or anyone acting under its direction, control or on its behalf unless such actions are due solely to the negligence of COUNTY.

#### ARTICLE XVIII - SEVERABILITY

Each provision of this Contract stands alone, and any provision of this Contract found to be prohibited by law shall be ineffective to the extent of such prohibition without invalidating the remainder of this Contract.

#### ARTICLE XIX - OTHER DOCUMENTS

CONSULTANT and COUNTY in entering into this Contract have relied upon information provided in RFP #539 and on information provided in the CONSULTANT'S response to said RFP. These documents are hereby incorporated into and made a part of this Contract as if set forth in full herein, to the extent not inconsistent with the provisions of this Contract.

#### ARTICLE XX - NON-WARRANTY

The parties do not warrant their respective right or power to enter into this Contract and if the same is declared null and void by court action initiated by third persons, there shall be no liability to the other party by reason of such action, or by reason of this Contract.

#### ARTICLE XXI - NON-EXCLUSIVE

CONSULTANT understands that this Contract is Non-Exclusive and is for the sole convenience of the COUNTY. The COUNTY reserves the right to obtain like services from other sources for any reason.

#### ARTICLE XXII - REMEDIES

Either party may pursue any remedies provided by law for the breach of this Contract. No right or remedy is intended to be exclusive of any other right or remedy and each shall be cumulative and in addition to any other right or remedy existing at law or at equity or by virtue of this Contract.

#### ARTICLE XXIII - YEAR 2000 COMPLIANCE (Y2K)

CONSULTANT warrants that all hardware and software products offered to COUNTY or delivered per any resultant Contract shall be able to accurately process date/time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999 and 2000 and leap year calculations. In addition, all contractors who are awarded any type of open or annual contract for goods or services shall have in house systems Y2K compliant. It is COUNTY'S intention to have NO INTERRUPTIONS in the delivery/performance of goods or services because of non-compliance.

**ARTICLE XXIV - NOTICES**

Any notice required or permitted to be given under this Contract shall be in writing and shall be served by delivery or by certified mail upon the other party as follows:

COUNTY:

Pima County Administrator

CONSULTANT:

**ARTICLE XXV - ENTIRE CONTRACT**

This document constitutes the entire Contract between the parties and shall not be modified, amended, altered or changed except through a written amendment and signed by the parties.

IN WITNESS THEREOF, the parties have affixed their signatures to this Contract the date first written above.

PIMA COUNTY

CONSULTANT

\_\_\_\_\_  
Chair, Board of Supervisors

\_\_\_\_\_  
Name Here

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name and Title (please Print)

ATTEST:

\_\_\_\_\_  
Clerk of the Board

APPROVED AS TO FORM:

\_\_\_\_\_  
Deputy County Attorney

APPROVED AS TO CONTENT:

\_\_\_\_\_  
Department Head

**Attachment "A"**  
**FIGURES AND TABLES**

**BIOLOGICAL CONSULTANT SERVICES FOR SONORAN DESERT CONSERVATION PLAN**

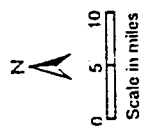
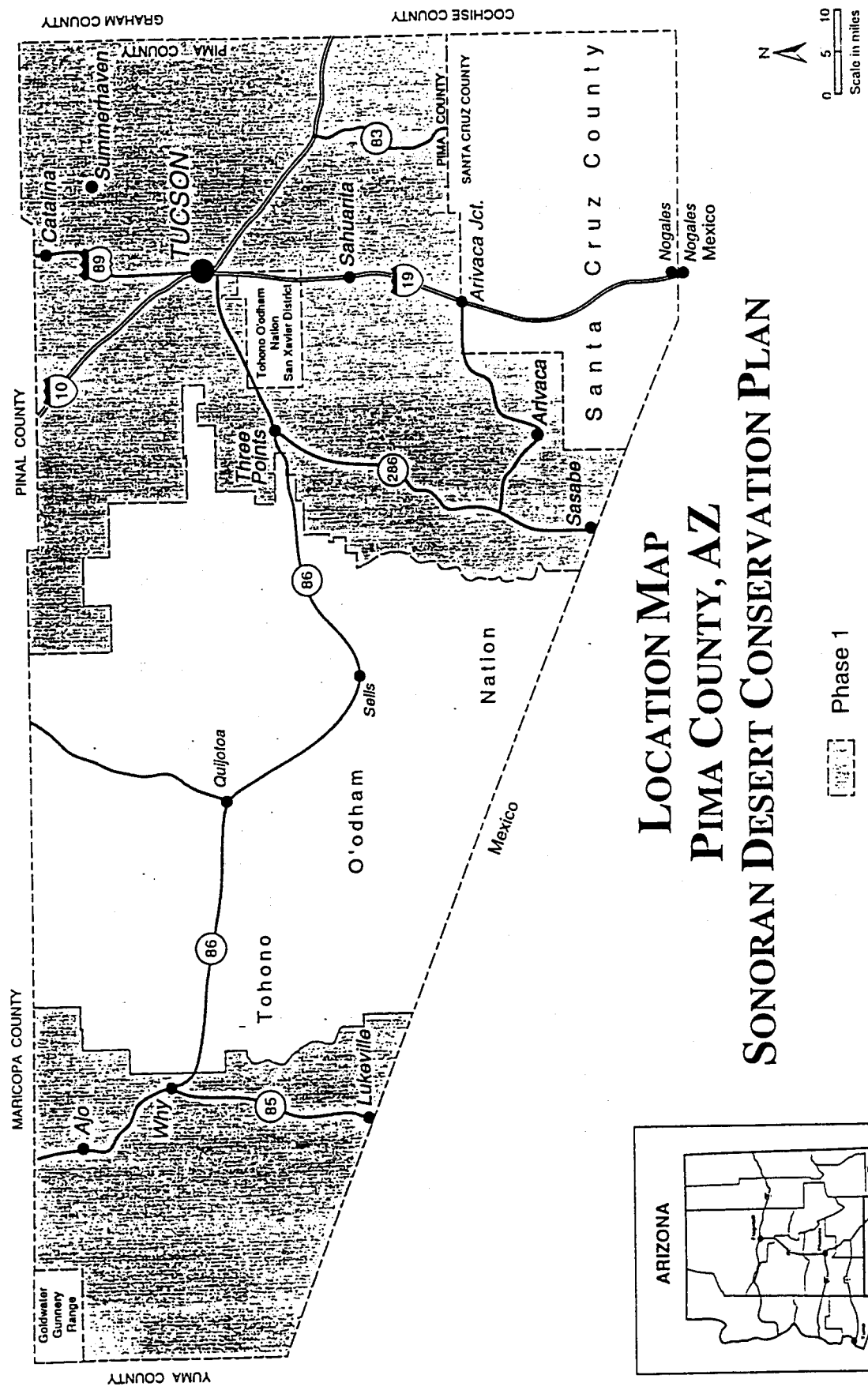
Figure 1 - Location Map

Figure 2 - Sonoran Desert Conservation Concept Plan

Figure 3 - Three Tracks of Conservation Planning

Table 1 - Goals and Objectives for the Biological Element of the Sonoran Desert Conservation Plan

Table 2 -Southern California Coastal Sage Scrub Natural Community Conservation Planning Conservation Guidelines



# LOCATION MAP PIMA COUNTY, AZ SONORAN DESERT CONSERVATION PLAN

- Phase 1
- Future Phases

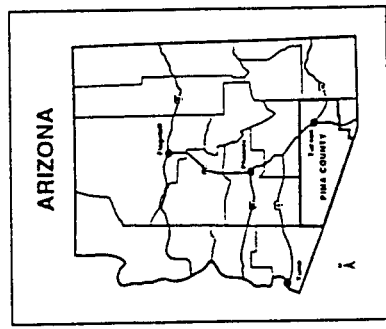
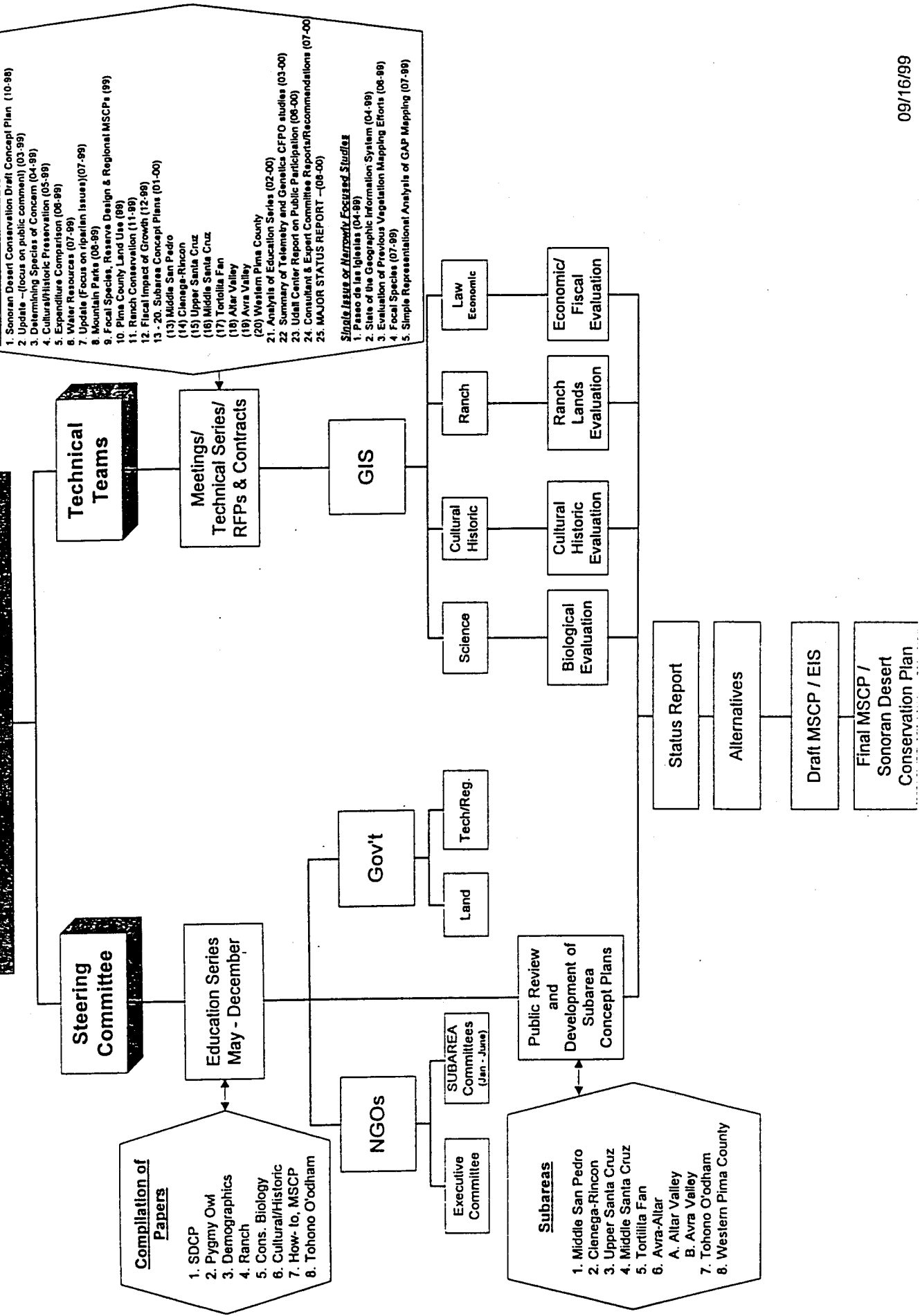


Figure 1

# SONORAN DESERT CONSERVATION CONCEPT PLAN





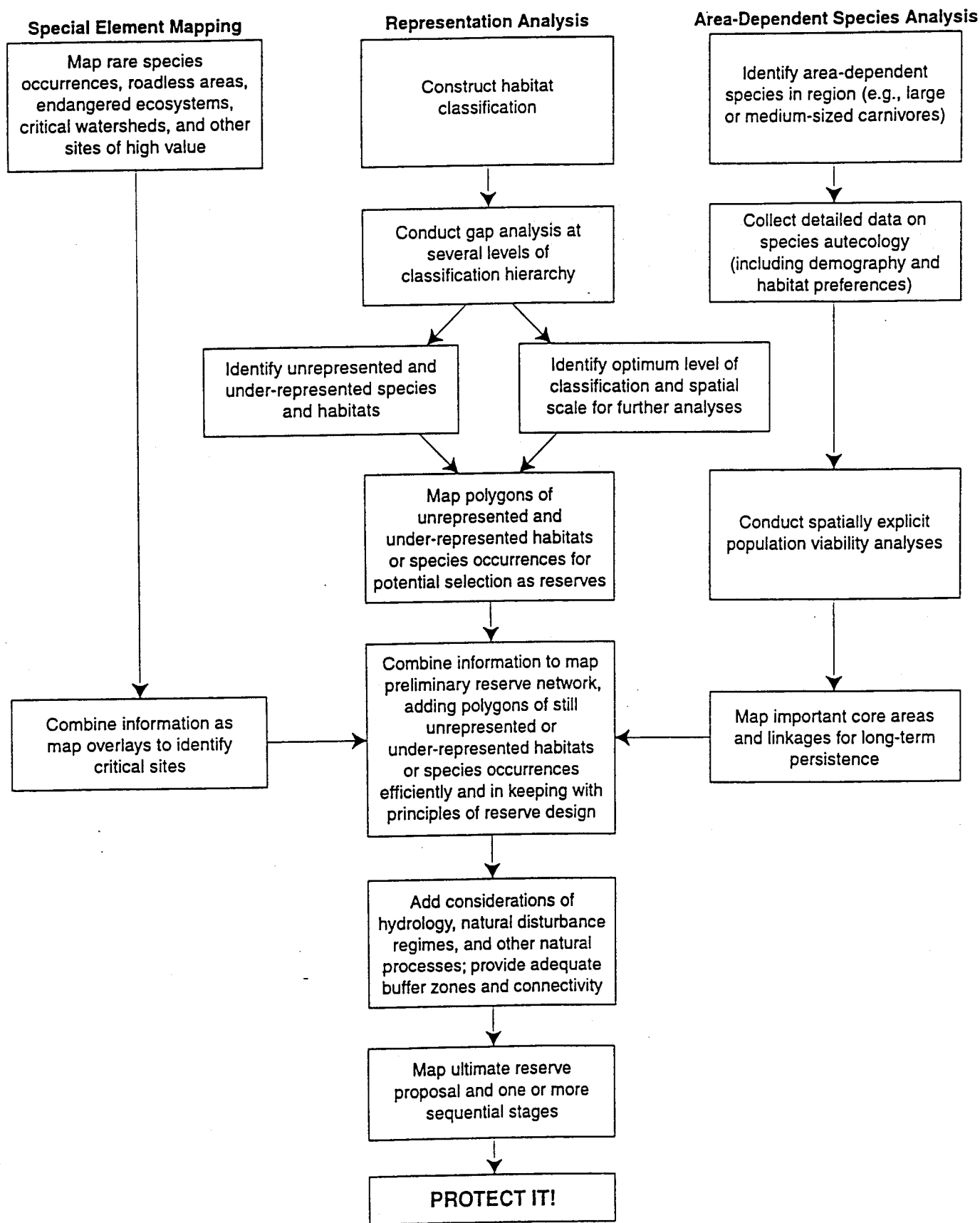


FIGURE 3. Three tracks of reserve selection and design, which converge in a defensible reserve system. These three tracks have rarely been combined in practice, as researchers usually pursue their specialized interests independently. Adapted from Noss (1996b).

TABLE 1

GOAL AND OBJECTIVES FOR THE BIOLOGICAL ELEMENT OF THE  
SONORAN DESERT CONSERVATION PLAN

The biological goal of the Sonoran Desert Conservation Plan is to ensure the long-term survival of the full spectrum of plants and animals that are indigenous to Pima County through maintaining or improving the habitat conditions and ecosystem functions necessary for their survival.

Inherent within this broad goal are several objectives:

1. Promote recovery of federally listed and candidate species to the point where their continued existence is no longer at risk.
2. Where feasible and appropriate, re-introduce and recover species that have been extirpated from this region.
3. Maintain or improve the status of unlisted species whose existence in Pima County is vulnerable.
4. Identify biological threats to the region's biodiversity posed by exotic and native species of plants and animals, and develop strategies to reduce these threats and avoid additional invasive exotics in the future.
5. Identify compromises to ecosystem functions within target plant communities selected for their biological significance and develop strategies to mitigate them.
6. Promote long-term viability for species, environments and biotic communities that have special significance to people in this region because of their aesthetic or cultural values, regional uniqueness, or economic significance.

In the broadest sense, this conservation element of the SDCP will be the framework for integrating biological conservation into Pima County's development process. If the plan effectively addresses the objectives above, it will also lead to Section 10 Permits under the Endangered Species Act, for those species where it is justified by scientific evidence and by the implementation of a defensible habitat conservation plan.

**Table 1**  
**FOCAL SPECIES FOR PIMA COUNTY, ARIZONA**

<u>Scientific Name</u>	<u>Common Name</u>	<u>Scientific Name</u>	<u>Common Name</u>
<i>Atta mexicana</i>	Mexican Leaf-cutter Ant	<i>Empidonax traillii extimus</i>	Southwestern Willow Flycatcher
<i>Allium gooddingii</i>	Goodding Onion	<i>Charadrius montanus</i>	Mountain Plover
<i>Rana chiricahuensis</i>	Chiricahua Leopard Frog	<i>Coccyzus americanus occidentalis</i>	Western Yellow-billed Cuckoo
<i>Kinostemon sonoriense longifemorale</i>	Sonoyta Mud Turtle	<i>Vireo bellii</i>	Bell's Vireo
<i>Rana tarahumarae</i>	Tarahumara Frog	<i>Parabuteo unicinctus</i>	Harris's Hawk
<i>Rana yavapaiensis</i>	Lowland Leopard Frog	<i>Empidonax fulvifrons</i>	Northern Buff-breasted Flycatcher
<i>Pipilo aberti</i>	Abert's Towhee	<i>Falco femoralis septentrionalis</i>	Northern Aplomado Falcon
<i>Melospiza melodia</i>	Song Sparrow (subspecies)	<i>Gila intermedia</i>	Gila Chub
<i>Aimophila carpalis</i>	Rufous-winged Sparrow	<i>Cyprinodon macularius eremus</i>	Quitobaquito Pupfish
<i>Athene cunicularia</i>	Burrowing Owl	<i>Rhinichthys osculus</i>	Speckled Dace
<i>Accipiter gentilis apache</i>	Apache Goshawk	<i>Catostomus clarkii</i>	Desert Sucker
<i>Lanius excubitor</i>	Northern Shrike	<i>Catostomus insignis</i>	Sonora Sucker
<i>Buteo swainsoni</i>	Swainson's Hawk	<i>Cyprinodon macularius macularius</i>	Desert Pupfish
<i>Asturina nitida</i>	Gray Hawk	<i>Poeciliopsis occidentalis occidentalis</i>	Gila Topminnow
<i>Caracara plancus</i>	Crested Caracara	<i>Argia sabino</i>	Sabino Canyon Damselfly
<i>Buteo albonotatus</i>	Zone-tailed Hawk	<i>Tryonia protea</i>	Desert Tryonia
<i>Caprimulgus ridgwayi</i>	Buff-collared Nightjar	<i>Anodonta californensis</i>	California Floater (clam)
<i>Progne subis</i>	Purple Martin	<i>Speyeria nokomis caerulescens</i>	Blue Silverspot Butterfly
<i>Trogon elegans</i>	Elegant Trogon	<i>Rothschildia cincta</i>	Cincta Rothschildia (Moth)
<i>Toxostoma lecontei</i>	Le Conte's Thrasher	<i>Sonorella eremita</i>	San Xavier Talussnail
<i>Falco peregrinus anatum</i>	American Peregrine Falcon	<i>Tryonia quitobaquitae</i>	Quitobaquito Tryonia
<i>Haliaeetus leucocephalus</i>	Bald Eagle	<i>Sonorella xanthenes</i>	Kitt Peak Talussnail
<i>Glaucidium brasilianum cactorum</i>	Cactus Ferruginous Pygmy-Owl	<i>Sonorella papagorum</i>	Papago Talussnail
<i>Colinus virginianus ridgwayi</i>	Masked Bobwhite	<i>Sonorella bagnarai</i>	Bagnara's Talussnail
<i>Strix occidentalis lucida</i>	Mexican Spotted Owl	<i>Sonorella pupela</i>	Talussnail
<i>Canis lupus baileyi</i>	Mexican Gray Wolf	<i>Salix spp.</i>	Willows
<i>Antilocapra americana sonoriensis</i>	Sonoran Pronghorn Antelope	<i>Populus fremontii</i>	Cottonwood
<i>Leptonycteris curasoae yerbabuenae</i>	Lesser Long-nosed Bat	<i>Hilaria rigida</i>	Galleta Grass
<i>Panthera onca</i>	Jaguar	<i>Echinomastus erectocentrus var. erectocentrus</i>	Needle-spined Pineapple Cactus
<i>Ondatra zibethicus</i>	Muskrat	<i>Stenocereus thurberi</i>	Organ Pipe Cactus
<i>Castor canadensis</i>	Beaver	<i>Dalea tentaculoides</i>	Gentry Indigobush
<i>Felis yagouaroundi tolteca</i>	Jaguarundi	<i>Danaus plexippus</i>	Monarch Butterfly
<i>Choeronycteris mexicana</i>	Mexican Long-tongued Bat	<i>Selasphorus rufus</i>	Rufous Hummingbird

**Table 1**  
**FOCAL SPECIES FOR PIMA COUNTY, ARIZONA**

<u>Scientific Name</u>	<u>Common Name</u>	<u>Scientific Name</u>	<u>Common Name</u>
<i>Sorex arizonae</i>	Arizona Shrew	<i>Zenaida asiatica</i>	White-winged Dove
<i>Dasypterus egaxanthinus</i>	Southern Yellow Bat	<i>Canis latrans</i>	Coyote
<i>Puma concolor</i>	Mountain Lion	<i>Phainopepla nitens</i>	Phainopepla
<i>Odocoileus virginianus</i>	White-tailed Deer	<i>Bubo virginianus</i>	Great Horned Owl
<i>Odocoileus hemionus</i>	Mule Deer	<i>Ursus americanus</i>	Black Bear
<i>Ovis canadensis mexicana</i>	Desert Bighorn Sheep	<i>Calypte anna</i>	Anna's Hummingbird
<i>Peromyscus merriami</i>	Merriam's Mouse (Mesquite Mouse)	<i>Callipepla gambelii</i>	Gambel's Quail
<i>Ursus arctos</i>	Grizzly Bear	<i>Geococcyx californianus</i>	Greater Roadrunner
<i>Plecotus townsendii pallescens</i>	Pale Townsend's Big-eared Bat	<i>Carnegiea giganteus</i>	Saguaro
<i>Lasiurus borealis</i>	Western Red Bat	<i>Aphonopelma spp.</i>	Tarantulas
<i>Felis pardalis</i>	Ocelot	<i>Anemopsis californica</i>	Yerba Mansa
<i>Antilocapra americana</i>	Chihuahuan Pronghorn	<i>Nasua nasua</i>	Coati
<i>Chihuahuensis</i>	Antelope		
<i>Vulpes macrotis</i>	Kit Fox	<i>Pecari tajacu</i>	Collared Peccary (Javelina)
<i>Cynomys ludovicianus</i>	Black-tailed Prairie Dog	<i>Scirpus americanus</i>	Bulrush Tule
<i>Lilaeopsis schaffneriana ssp recurva</i>	Huachuca Water Umbel	<i>Triteleiopsis palmeri</i>	Blue Sand Lily
<i>Sporobolus airoides</i>	Sacaton Grass	<i>Tumamoca macdougallii</i>	Tumamoc Globeberry
<i>Lophocereus schottii</i>	Senita	<i>Abutilon thurberi</i>	Thurber Indian Mallow
<i>Muhlenbergia dubioides</i>	Box Canyon Muhly	<i>Agave schottii var. treleasei</i>	Trelease Agave
<i>Yucca arizonica</i>	Spanish Dagger	<i>Acacia Smallii</i>	Sweet Acacia
<i>Peniocereus striatus</i>	Dahlia Rooted Cereus	<i>Amoreuxia gonzalezii</i>	Saiya
<i>Coryphantha scheeri var. robustispina</i>	Pima Pineapple Cactus	<i>Amsonia grandiflora</i>	Large-flowered Bluestar
<i>Echinomastus erectocentrus acunensis</i>	Acuna Cactus	<i>Arabis tricornuta</i>	Chiricahua Rock Cress
<i>Xerophyllum</i>	Beargrass	<i>Asclepias lemmonii</i>	Lemon Milkweed
<i>Echinocactus horzonthalonius var nicholii</i>	Nichol's Turk's Head Cactus	<i>Berberis harrisoniana</i>	Kofa Barberry
<i>Agave murpheyi</i>	Hohokam Agave	<i>Carex ultra</i>	Arizona Giant Sedge
<i>Capsicum annuum var. glabriusculum</i>	Chiltepin	<i>Eryngium sparganophyllum</i>	Ribbonleaf Button Snakeroot
<i>Olneya tesota</i>	Desert Ironwood	<i>Eucnide rupestris</i>	Flor de la Piedra
<i>Amsonia kearneyana</i>	Kearney's Blue Star	<i>Hermannia pauciflora</i>	Sparseleaf Hermannia
<i>Chionactis occipitalis klauberi</i>	Tucson Shovel-nosed Snake	<i>Hieracium rusbyi</i>	Rusby Hawkweed
<i>Sonora semiannulata</i>	Ground Snake (valley form)	<i>Lupinus huachucanus</i>	Huachuca Mountain Lupine
<i>Thamnophis eques</i>	Mexican Garter Snake	<i>Malaxis porphyrea</i>	Malaxis Porphyrea (orchid)
<i>Chionactis palarostris organica</i>	Organ Pipe Shovel-nosed Snake	<i>Metastelma mexicanum</i>	Wiggins Milkweed Vine
<i>Crotalus willardi willardi</i>	Arizona Ridgenose Rattlesnake	<i>Muhlenbergia xerophila</i>	Sycamore Canyon Muhly
<i>Terrapene ornata luteola</i>	Desert Box Turtle	<i>Penstemon discolor</i>	Catalina Beardtongue
<i>Cnemidophorus burti xanthonotus</i>	Red-backed Whiptail Lizard	<i>Pectis imberbis</i>	Beardless Cinch Weed

**Table 1**  
**FOCAL SPECIES FOR PIMA COUNTY, ARIZONA**

<u>Scientific Name</u>	<u>Common Name</u>	<u>Scientific Name</u>	<u>Common Name</u>
<i>Elaphe triaspis</i>	Green Rat Snake	<i>Perityle ajoensis</i>	Ajo Rock Daisy
<i>Lampropeltis getulus nigrilus</i>	Black Kingsnake	<i>Physalis latiphysa</i>	Broadleaf Ground Cherry
<i>Heloderma suspectum</i>	Gila Monster	<i>Salvia amissa</i>	Aravaipa Sage
<i>Gopherus agassizii</i>	Desert Tortoise	<i>Samolus vagans</i>	Chiricahua Mountain Brookweed
<i>Cnemidophorus burti</i> <i>stictogrammus</i>	Giant Spotted Whiptail	<i>Albionix anophthalmus</i>	Pseudoscorpion (subspecies)
<i>Zaitzevia parvula</i>	Santa Rita Water Beetle		

**TABLE 2**

**Southern California Coastal Sage Scrub Natural Community Conservation Planning Conservation Guidelines**

Conserve target species throughout the planning area: Species that are well-distributed across their native ranges are less susceptible to extinction than are species confined to small portions of their ranges (species distributions relative to plan area and heterogeneity).

Larger reserves are better: Large blocks of habitat containing large populations of the target species are superior to small blocks of habitat containing small populations.

Keep reserve areas close: Blocks of habitat that are close to one another are better than blocks of habitat far apart.

Keep habitat contiguous: Habitat that occurs in less fragmented, contiguous blocks is preferable to habitat that is fragmented or isolated by urban lands.

Link reserves with corridors: Interconnected blocks of habitat serve conservation purposes better than do isolated blocks of habitat. Corridors or linkage function better when the habitat within then resembles habitat that is preferred by target species.

Reserves should be diverse: Blocks of habitat should contain a diverse representation of physical and environmental conditions.

Protect reserves from encroachment: Blocks of habitat that are roadless or otherwise inaccessible to human disturbance serve to better conserve target species than do accessible habitat blocks.

**Table 2**  
**VULNERABLE SPECIES IN PIMA COUNTY, ARIZONA**  
**Categories 1 & 2**

<u>Scientific Name</u>	<u>Common Name</u>	<u>Scientific Name</u>	<u>Common Name</u>
<i>Atta mexicana</i>	Mexican Leaf-cutter Ant	<i>Rhinichthys osculus</i>	Speckled Dace
<i>Allium gooddingii</i>	Goodding Onion	<i>Catostomus clarkii</i>	Desert Sucker
<i>Rana chiricahuensis</i>	Chiricahua Leopard Frog	<i>Catostomus insignis</i>	Sonora Sucker
<i>Kinosternon sonoriense longifemorale</i>	Sonoyta Mud Turtle	<i>Cyprinodon macularius macularius</i>	Desert Pupfish
<i>Rana tarahumarae</i>	Tarahumara Frog	<i>Poeciliopsis occidentalis occidentalis</i>	Gila Topminnow
<i>Rana yavapaiensis</i>	Lowland Leopard Frog	<i>Argia sabino</i>	Sabino Canyon Damselfly
<i>Pipilo aberti</i>	Abert's Towhee	<i>Tryonia protea</i>	Desert Tryonia
<i>Melospiza melodia</i>	Song Sparrow (subspecies)	<i>Anodonta californensis</i>	California Floater (clam)
<i>Aimophila carpalis</i>	Rufous-winged Sparrow	<i>Speyeria nokomis caerulescens</i>	Blue Silverspot Butterfly
<i>Athene cunicularia</i>	Burrowing Owl	<i>Rothschildia cincta</i>	Cincta Rothschildia (Moth)
<i>Accipiter gentilis apache</i>	Apache Goshawk	<i>Sonorella eremita</i>	San Xavier Talussnail
<i>Lanius excubitor</i>	Northern Shrike	<i>Tryonia quitobaquitae</i>	Quitobaquito Tryonia
<i>Buteo swainsoni</i>	Swainson's Hawk	<i>Sonorella xanthenes</i>	Kitt Peak Talussnail
<i>Toxostoma lecontei</i>	Le Conte's Thrasher	<i>Sonorella papagorum</i>	Papago Talussnail
<i>Glaucidium brasilianum cactorum</i>	Cactus Ferruginous Pygmy-Owl	<i>Sonorella bagnarai</i>	Bagnara's Talussnail
<i>Colinus virginianus ridgwayi</i>	Masked Bobwhite	<i>Sonorella pupela</i>	Talussnail
<i>Strix occidentalis lucida</i>	Mexican Spotted Owl	<i>Albiorix anophthalmus</i>	Pseudoscorpion (subspecies)
<i>Empidonax traillii extimus</i>	Southwestern Willow Flycatcher	<i>Zaitzevia parvula</i>	Santa Rita Water Beetle
<i>Charadrius montanus</i>	Mountain Plover	<i>Canis lupus baileyi</i>	Mexican Gray Wolf
<i>Coccyzus americanus occidentalis</i>	Western Yellow-billed Cuckoo	<i>Antilocapra americana sonoriensis</i>	Sonoran Pronghorn Antelope
<i>Vireo bellii</i>	Bell's Vireo	<i>Leptonycteris curasoae yerbabuenae</i>	Lesser Long-nosed Bat
<i>Falco femoralis septentrionalis</i>	Northern Aplomado Falcon	<i>Panthera onca</i>	Jaguar
<i>Gila intermedia</i>	Gila Chub	<i>Felis yagouaroundi tolteca</i>	Jaguarundi
<i>Cyprinodon macularius eremus</i>	Quitobaquito Pupfish	<i>Sorex arizonae</i>	Arizona Shrew
<i>Dasypterus egaxanthinus</i>	Southern Yellow Bat	<i>Echinocactus horizonthalonius var nicholii</i>	Nichol's Turk's Head Cactus
<i>Peromyscus merriami</i>	Merriam's Mouse (Mesquite Mouse)	<i>Agave murpheyi</i>	Hohokam Agave
<i>Plecotus townsendii pallescens</i>	Pale Townsend's Big-eared Bat	<i>Amsonia keameyana</i>	Kearney's Blue Star
<i>Lasiurus borealis</i>	Western Red Bat	<i>Abutilon thurberi</i>	Thurber Indian Mallow
<i>Felis pardalis</i>	Ocelot	<i>Agave schottii var. treleasei</i>	Trelease Agave
<i>Lilaeopsis schaffneriana ssp recurva</i>	Huachuca Water Umbel	<i>Perityle ajoensis</i>	Ajo Rock Daisy
<i>Echinomastus erectocentrus var. erectocentrus</i>	Needle-spined Pineapple Cactus	<i>Amoreuxia gonzalezii</i>	Saiya
<i>Dalea tentaculoides</i>	Gentry Indigobush	<i>Muhlenbergia xerophila</i>	Sycamore Canyon Muhly
<i>Tumamoca macdougallii</i>	Tumamoc Globeberry	<i>Chionactis occipitalis klauberi</i>	Tucson Shovel-nosed Snake

**Table 2**  
**VULNERABLE SPECIES IN PIMA COUNTY, ARIZONA**  
**Categories 1 & 2**

<u>Scientific Name</u>	<u>Common Name</u>	<u>Scientific Name</u>	<u>Common Name</u>
<i>Muhlenbergia dubioides</i>	Box Canyon Muhly	<i>Sonora semiannulata</i>	Ground Snake (valley form)
<i>Coryphantha scheeri</i> var. <i>robustispina</i>	Pima Pineapple Cactus	<i>Thamnophis eques</i>	Mexican Garter Snake
<i>Echinomastus erectocentrus</i> <i>acunensis</i>	Acuna Cactus	<i>Chionactis palarostris organica</i>	Organ Pipe Shovel-nosed Snake
<i>Terrapene ornata luteola</i>	Desert Box Turtle		
<i>Cnemidophorus burti</i> <i>xanthonotus</i>	Red-backed Whiptail Lizard		
<i>Cnemidophorus burti</i> <i>stictogrammus</i>	Giant Spotted Whiptail Lizard		



**ATTACHMENT 3**

## PROPOSAL NARRATIVE -- HABITAT CONSERVATION PLAN DECISION SUPPORT SYSTEM

### I. Project Summary

We propose a two-year research effort to improve decision support in the area of habitat conservation planning, focused on combining the best available biotic data and socio-economic data, GIS and database software, and optimization models. We believe that this approach can produce alternative potential solutions that appropriately evaluate conservation goals as well as socio-economic goals and identify high-quality land allocation alternatives that attain the best balance of both.

### II. Project Abstract

#### A. Project Description

Our research team has explored the possibilities of a decision support tool that would address the salient ecological and reserve selection components of a conservation planning program. We describe here the concepts that we have developed which we plan to use as launching point for this proposed work. The components of our proposed decision support tool can be condensed into four main categories:

- 1) incorporation of expert biological data and opinion,
- 2) GIS processing to create GIS datasets that reflect the relative habitat suitability of the entire landscape for each individual species, and the socio-economic suitability in the region of interest,
- 3) identifying an array of alternative viable territories for the basic demographic unit of each of the target species, and
- 4) optimizing the selection of species territories to balance the conflicting goals of environmental (endangered species) and human, local community needs.

The overall goal of our effort is the development of a computer-based framework for incorporating biological data, socio-economic data, and optimization modeling to support the development of good conservation plans. Our approach is to show the explicit trade-offs between various levels of conservation, obtained by reserving certain lands, and the economic and social costs of doing so. Our methods would seek to operate within an open decision process, utilizing the best science possible and attempting to address interests of all stakeholders. Furthermore, our intention is to provide a tool that gives the user (planners, local biologists, decision-makers) control over setting the salient ecological and economic parameters and in defining the appropriate values of each parameter.

#### B. Why NFWF Should Fund the Project

Upon completion of this project we will be able to provide a valuable planning tool to wildlife resource management agencies and a wide variety of local communities. This tool has

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***Proposal Narrative -- Habitat Conservation Plan Decision Support System***

Pima County, Arizona / August 1999 / Page 2

potential application throughout the country and addresses the critical need of allocation of limited land resources to best achieve a balanced and effective strategy for conservation of endangered species. The National Fish and Wildlife Foundation could make an important contribution to conservation and sustainable use of our most limited natural resources, endangered species, through development of a tool that can assist in public policy development.

**C. Partners**

We are attempting to distribute the costs of developing this tool among an array of logical, interested partners. Pima County is pursuing one of the largest multi-species conservation plans in the United States -- the Sonoran Desert Conservation Plan. The Packard Foundation has been instrumental in funding environmental projects in California. State Wildlife agencies along with the U. S. Fish and Wildlife Service and other federal agencies participating in the Sonoran Desert Conservation Plan (BLM, USGS, Bureau of Reclamation, Army Corp, Forest, Air Force, and National Parks) clearly have a strong interest in accessing such tools and will benefit from the end product in both the initial and implementation stages of conservation planning in other jurisdictions.

**D. Final Products**

The primary product expected from this effort is a customized software package, combined with linkages to commercially available software that executes this entire model. This software will be accompanied by an instruction manual and technical assistance from the team. Several scientific publications will result from the research and development activities of this project. We also plan to hold workshops on this project, culminated in a final workshop where we will provide potential users of this tool with a full review of the potential applications of the tool. The Advisory Team will be intimately linked with the development of the tool and will therefore be provided with significant transfer of information on the technology development and the science underlying the potential applications.

**III. PROPOSAL**

**A. Project Need**

Conservation planning, which has often centered on the protection of individual species, has more recently begun to focus more on the protection of suites of species, their habitats, and even the ecological processes that characterize and help form and sustain the system. This trend reflects both an ecological and an economic rationale. The species-by-species approach produces biological inefficiencies by giving priority to the needs of the species that are earliest identified in the planning process. The serial nature of protecting one species after another fosters great economic uncertainty. Continuing pressures for land development and the realization that case by case conservation actions are ineffective has provided the incentives to be more proactive in both land use planning and conserving animals and plants before they are pushed to the brink of extinction.

The growth of conservation planning on the regional level has been enhanced by the rapid expansion in the gathering and dissemination of large amounts of computer-based data. These data include fieldwork results, time series from monitoring programs, and geographic data such as remotely sensed images and vegetation maps. Along with data proliferation has been huge growth in the power of desktop computer hardware and windows-based on-screen graphics. In particular, the growth in the power and use of desktop geographic information systems (GIS) has been tied to these trends. As a result, substantial progress has been made in the ability to apply data and software to regional scale conservation planning.

Computer technologies are enabling more and better habitat-based analyses and regulatory and policy mechanisms are moving in the same direction. The federal Endangered Species Act (ESA) as renewed in 1982 allowed for Habitat Conservation Plans or HCPs. The intent was to put more flexibility into the ESA by providing for allowed "incidental take" of a listed species as long as habitat conservation or similar mitigation was undertaken. HCPs have mushroomed in the 1990's, from about 10 in 1993 to 250 in 1999 (covering over 6 million acres in 16 states). While an HCP may cover a small area and focus on only a single species, there is an increase in plans involving large areas, multiple species, and long time periods. For example, the Plum Creek HCP in Washington state covers 1.6 million acres of timber land in the Cascade Range that is habitat for several sensitive and threatened species. The Balcones Canyonlands Conservation Plan (30,000 acres) in Travis County, Texas allows for substantial development while directing mitigation funds toward the protection of areas deemed important for listed Texas songbirds.

The Sonoran Desert Conservation Plan, which is the largest plan ever considered covering over 9,000 square miles, is now moving forward. This will be the testbed for the proposed research and development. Large-area regional HCPs inherently involve diverse interest groups - developers, agriculture, recreationists, and environmentalists. For any consensus to be achieved, an open process with explicit goals, targets, assumptions, and data is essential.

While regional planning for conservation has gathered great momentum and many plans have been implemented, serious questions linger. Are all desirable alternatives being considered in HCPs or other conservation plans? Are there general approaches that could be applied that would aid the planning process? Can we provide for objective analyses of a full range of alternative outcomes? What can research do to improve the process of developing conservation plans and the quality of the final product? The resources being devoted to data gathering, consensus building, and implementation have grown greatly. For all of these funds and resources, little effort has been made to specifically establish or define what is a "good" plan, one that will maximize all desired features and minimize risks and costs, and what kind of process can lead to this desired result.

#### **B-C. Objectives and Methodology**

Through the initial phases of the project we attempted to define exactly what our methods would be and refine the approach that we believed would successfully combine biological criteria, defined within a GIS framework, with an optimal or ultimately a heuristic method of selecting among a large set of alternatives. Our earliest progress was slow, due to some

challenging problems in three phases; habitat suitability estimation, patch construction, and discrete linear optimization - now all solved problems. We had limited funds for the exploratory nature of the initial work, but we have now established the basic concept that we think can be developed into a useful tool. Our primary objectives for this proposed development phase of the project include the following main issues:

- 1) Develop the model as a multi-species/habitat based problem.

As we have mentioned above, it seems clear that multi-species and multi-habitat conservation strategies will become the primary strategy for regional conservation efforts. There will likely be significant incentive for this approach in new legislation at all levels of government, encouraging this kind of comprehensive solution. It presents certain challenges to our model that we have anticipated. Optimum or heuristic solutions, where suitable habitat is being selected for more than one taxon, will require new and more complicated formulations in model. However, it also presents an opportunity for creating a component of this tool that has never been done before.

- 2) Address the requirement for adjacency of patches to preserve contiguity of protected areas.

In the course of our initial efforts of selecting patches for an optimal solution we have discovered solutions that result in units of habitat that are disjunct from one another. Contiguity is one of the fundamental principles of reserve design that is crucial to the success of a planning effort. An additional constraint needs to be built into this model that will encourage or even require that a given selected patch have some acceptable level of adjacency with at least one other selected patch.

- 3) Formulate a heuristic solution to replace a optimal solution, once an optimal solution is demonstrated as a benchmark.

The intention is to create a formulation that can be executed without specialized software and for large problems that require unusually (and generally unavailable) powerful hardware. Ultimately a user of this tool should be capable of executing this work using commonly available GIS systems. We are not yet sure whether or not this could be executed using simple platforms that would require little training or whether it is more realistic to expect this to be executed by highly trained personnel with a fairly sophisticated software/hardware platform. However, the process is expected to be performed in a manner that will allow repeated runs of the model to examine alternative outcomes. Thus a relatively quick path to a solution is desirable, thus the desire to develop a heuristic alternative to an optimal solution.

- 4) Account for overlap of multiple patches (both intraspecific and interspecific) when identifying/formulating cost-efficient heuristic solutions.

This issue is a technical problem, probably transparent to a user. However, it is important that the solution formulation be able to account for the "savings" that results

from the overlap of protected patches, both intraspecific and interspecific overlap. This is particularly important in the latter situation, when a multi-species solution is generated. We are not sure yet how this accounting process will be executed. Given the analysis will depend fundamentally on a raster GIS data source, cell by cell analysis will likely be required. This presents some significant challenges from a programming and problem formulation standpoint. However, addressing this problem successfully will be a significant advancement.

- 5) Develop the front-end software to run the model in a user-friendly manner. Explore use of Arc/Info or Arc/view as the platform for executing this model.

This entire process is ultimately intended to run on an Arcview or Arcinfo GIS platform, with data ported back and forth with any custom software. The user will be in control of setting all the biological and socio-economic parameters, a feature we believe is crucial for the acceptance of this approach and the ultimate success of the method. If the user is in control, he/she can run sensitivity analyses, varying only certain parameters deemed most crucial to decision-makers. Our progress to date has taken us through steps (1)-(3) above, and we have formulated the models that are the basis of steps (4) and (5). By the conclusion of the proposed project we will have developed a multi-species prototype of the entire process running within the Arc/Info GIS, including the software customization that will enable an average user to execute this method.

#### **D. Research/Management Implications**

We anticipate that this tool can be used by a large variety of those engaged in Habitat Conservation Planning. The emphasis on this mechanism of the Endangered Species Act is growing rapidly in importance and we believe this tool will enable users to objectively evaluate a wide range of possible alternative outcomes. Having the ability to objectively evaluate a range of alternatives should be a significant advantage to HCP planners. HCP alternatives often represent a compilation of expert opinion that is hard to track and contains much subjectivity that can lead to controversy. The results of any alternative option generated by this model has the advantage of 1) being based on assumptions and values provided by the planning team, 2) explicitly documented, and 3) can be adjusted and re-evaluated to consider how minor or even major changes in any assumption or input value effects the outcome. Perhaps the most important aspect of this approach is the flexibility and control that the users, the people most familiar with the local landscape, will have in implementing the tool.

#### **E. Evaluation**

We plan to establish an advisory team for this project consisting of local biological and land planning expertise, resource management agency staff, and scientists. The function of this advisory team is help us set/modify our specific objectives using the Sonoran Desert Conservation Plan as the testbed, to assess our work as we proceed, and to ensure that the tool we build will be both of practical value and scientifically rigorous. They will advise us on the presentation of the tool and how it can be used most effectively by the intended audience.

We also intend to prepare manuscripts to submit to peer-reviewed journals so that our work receives maximum scientific scrutiny and acceptance.

The work schedule assumes that the PIs will attend all meetings of the Advisory Team and the graduate students will attend all meetings, as needed. Assignments are discussed in the text elsewhere.

- |   |               |   |
|---|---------------|---|
| ▶ | January 2000  | Assemble Advisory Team                                  |
| ▶ | Feb 2000      | Workshop to Refine Objectives                           |
| ▶ | Feb 2000      | PIs define work assignments                             |
| ▶ | March 2000    | Graduate students begin individual assignments          |
| ▶ | July 2000     | PIs meet to review progress of individual work          |
| ▶ | October 2000  | Advisory Team meets with PIs to review progress         |
| ▶ | March 2001    | PIs meet to review first prototype                      |
| ▶ | June 2001     | Advisory team meets with PIs to review prototype        |
| ▶ | July 2001     | PIs meet to re-evaluate progress, re-assess assignments |
| ▶ | October 2001  | PIs meet to evaluate progress                           |
| ▶ | December 2001 | Advisory Team meets to evaluate progress                |
| ▶ | December 2001 | PIs meet to make final adjustments                      |

F. Overall Context

This is a discrete research and development effort, however, we intend to integrate this set of modeling tools with other modeling efforts that have been developed or are under development now, to the maximum extent possible. The issue of model interoperability is at the forefront of Decision Support System development. We are cognizant of this issue and hope to collaborate with others where it appears prudent to do so.

G. Dissemination

We plan on providing a package of software, linked with appropriate commercially available software, that will enable a proficient GIS/database management lab to execute the model. In conjunction with that software we will provide a basic user manual and make recommendations on how training can be provided to users. In conjunction with these products we will prepare manuscripts for submittal to peer-reviewed journals.



**ATTACHMENT 4**

# SONORAN DESERT CONSERVATION PLAN

## GIS COVERAGE OF PERENNIAL AND INTERMITTENT STREAMS, AND SHALLOW GROUNDWATER

INTERIM REPORT – November 1999

### Purpose and Scope

The purpose of this project is to create, in ArcView shapefile format, three GIS coverages :

- Perennial Streams;
- Intermittent Streams;
- Areas of Shallow Groundwater.

The study area encompasses all of Pima County, excluding the Tohono O'odham Reservation, with emphasis on eastern Pima County. Pima County's Land Information System is serving as the base map for this project.

This effort is relying heavily on existing reports, maps and studies, as well as input from a technical advisory committee and the general public. The opportunity for field verification of sites by project staff is very limited.

### Project Schedule

The project began in September 1999 and is expected to be completed in December 1999. An initial draft of the coverages should be ready by November 1999.

### Funding

Pima County is funding the creation of these GIS coverages through its annual contribution to PAG's Water Quality Planning work program.

### Background and Problem Statement

Pima County, in its work on the Sonoran Desert Conservation Plan (SDCP), has determined that preserving and restoring riparian and aquatic habitats will be very important to the SDCP. These habitats are found in and along perennial streams, intermittent streams, and areas of shallow

groundwater. In addition, different types of riparian vegetation could be restored to many of these areas, even if the vegetation is not presently found there.

In its effort to identify aquatic and riparian habitats, Pima County reviewed existing GIS coverages and found the following limitations:

- The present wash coverage from Pima County's Land Information System (PCLIS) did not differentiate between types of watercourses (i.e., perennial vs. ephemeral or intermittent)
- The perennial streams GIS coverage from the Arizona Fish and Game Department and the general streams coverage from the State Land Department (Arizona Land Resource Information System - ALRIS) contained errors, and were incomplete
- No comprehensive coverage showing intermittent streams or areas of shallow groundwater was available from any local, state, or federal agency.

## Project Approach

### *Definitions*

Definitions of perennial, intermittent and ephemeral streams were obtained from United States Geological Survey Water-Supply Paper #1541:

- Perennial: one which flows continuously
- Intermittent: one which flows only at certain times of the year when it receives water from springs or from some surface sources such as melting snow in mountainous areas
- Ephemeral: one that flows only in direct response to precipitation, and whose channel is at all times above the water table

In addition, "shallow" groundwater was defined as groundwater within 50 feet of the land surface. This depth was based on the needs of various types of riparian vegetation.

### *Data Sources*

A preliminary list of locations was compiled from a review of the following:

- Existing literature (agency reports, theses/dissertations, local publications)
- Existing maps
- Electronic databases and GIS coverages

### *Technical Advisory Committee*

A Technical Advisory Committee (TAC) was convened, consisting of local experts in hydrology, biology, and ecology from the University of Arizona, ADEQ, Arizona Fish and Game, US Fish and Wildlife, The Nature Conservancy, and private consultants.

The role of the TAC is to:

- Determine site criteria and review methodology
- Answer questions that arise during the project, which thus far have included:
  - Which definitions should be used
  - How to define the length of a reach, considering seasonal and annual variations in flow
  - How to resolve conflicting information
  - What criteria should be used to determine "shallow" groundwater
  - What information should be included in the coverage and associated database
  - Criteria and documentation necessary to classify a stream as perennial
  - How to classify, and whether to include, high-elevation watercourses and bedrock pools
- Review data source lists and provide additional data
- Provide support on reach/site identification
- Review draft and final deliverables (GIS coverages and associated maps and reports)

The following people are currently serving on the TAC:

Doug Duncan, US Fish and Wildlife  
Mima Falk, Coronado National Forest.  
Julia Fonseca, Pima County Flood Control  
Dave Gori, The Nature Conservancy  
Steve Hopp, UA Ecology and Evolutionary Biology  
Lin Lawson, ADEQ  
Tom Maddock, University of Arizona  
Scott Richardson, AZ Game and Fish  
Danielle Stearns, Dames and Moore

### *Web Page*

PAG and Pima County jointly developed a web page and associated web form to provide the general public an opportunity to inform project staff about any stream locations that might

otherwise be missed through the literature review. The web form can be reached from the following sites:

[WWW.CO.PIMA.AZ.US/CMO/SDCP](http://WWW.CO.PIMA.AZ.US/CMO/SDCP)

and

[WWW.PAGNET.ORG](http://WWW.PAGNET.ORG)

A hardcopy of the questionnaire posted on the web is attached. To date, 4 electronic forms and 11 direct emails have been received. Information on 7 areas, 3 of which were not previously identified, has been obtained.

### *Database and GIS Coverage*

Microsoft Access was selected as the database software. "Input Forms" were designed for each GIS coverage. An example of an input form for a perennial stream reach is attached. The forms contain all the fields that will be included in the attribute table of each GIS coverage.

The forms are completed as research for each site or reach progresses. In addition, the length of each stream reach is delineated on USGS 7 ½ minute Quadrangles. When all of the available information is compiled, the USGS Quadrangles and input forms are submitted for inclusion into the GIS coverage.

The GIS coverages are created through the use of on-screen digitizing and arc manipulation.

### Results and Progress to Date

Preliminary lists of stream reaches that appear to meet the criteria for perennial or intermittent flows is attached. As of mid-November 1999, project staff have identified:

- 39 Perennial Reaches\*
- 55 Intermittent Reaches\*
- 34 Areas of Shallow Groundwater

(\*Totals include multiple reaches on a single stream)

Progress on the GIS coverage includes:

- Completion of over 50% of the perennial streams coverage; and
- Completion of approximately 40% of intermittent coverage

Work on the shallow groundwater coverage will begin after the perennial streams and intermittent streams coverages are completed.

## Attachments

- Web Questionnaire
- Example of Database Input Form
- List of Perennial Streams Identified
- List of Intermittent Streams Identified

**SDCP STREAM FLOW LOCATION INFORMATION FORM**Name of site: General description of site location and directions to site: 

If you know the Township/Range/Section of the site, please enter it here:

T.  S. R.  E. Section:  Section 1/4: 

If you are unsure of the stream location, you can use Pima County's MapGuide website to access online coverages showing roads, county boundaries, National Forest and Park boundaries, Township/Range/Section information, and other useful locational information. If you are unable to access this information, please call PAG at (520) 792-1093, and we would be happy to help you determine the location of your stream.

[Click here for the Pima County MapGuide site](#)

What is the approximate distance, in feet, that the stream usually flows during wet seasons?

What is the approximate distance, in feet, that the stream usually flows during dry seasons?

Describe the stream characteristics:

depth of flow: width of channel: How would you describe the flow? 

Are there bedrock outcrops in the area around or near the flowing reach?

- ☐ Yes  
☐ No

Can you identify, based on area landmarks, the location of beginning and end of flow?  
(i.e. upstream/downstream, of a confluence, near sharp bend in channel, trail markers, GPS coordinates, etc.)

What time of year did you make this observation?

Do you have a map, such as a topographic or National Forest map, that you could locate the beginning and end of flow on?

- ☐ Yes, If so, please fax or snail mail us a copy!  
☐ No

Are any of the following types of animal life located in or near the stream?

Fish

☐ Yes ☐ No ☐ Don't know

Other water dependent animals

☐ Yes ☐ No ☐ Don't know

Waterfowl

☐ Yes ☐ No ☐ Don't know



Does any of the following vegetation grow along the stream?

Cottonwood  
Willow  
Mesquite  
Sycamore  
Ash  
Walnut  
Maple  
Cattails

<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> Don't know
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> Don't know
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> Don't know
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> Don't know
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> Don't know
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> Don't know
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> Don't know
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> Don't know

Do you know of any books, articles, or studies that describe this site?  
If so, please list the author, title and year published.

	▲
	▼
◀	▶

Do you know the depth to groundwater for this area? (perhaps from a private well)  
If so, please indicate below the general location or address of the property that the well is located  
the depth to water, and the date of measurement, if available.

	▲
	▼
◀	▶

(Information below is optional)

Additional comments or information :

	▲
	▼
◀	▶

Please include your contact information so we may call/email you if we have any questions.

--

THANK YOU FOR TAKING THE TIME TO PARTICIPATE IN THIS EFFORT!!!

Submit Form



Pima Association of Governments  
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last updated 10/29/99

Water Quality

PAG staff

Date

Perennial Reach Name		WILD BURRO CANYON 2	
General Location Using Place Names			
Tortolita Mtns, NE of Marana			
Legal Land Description (TRS)	USGS Watershed Code and Name	USGS Topo Name	
11-12 Secs 1, 12	15050303 Lower Santa Cruz	Ruelas Canyon, AZ	
Flow (Q)	Flow Measurement Date		
Designated Use			
List of Tree Species			
Cottonwood - willows series			
List of Other Environmental Features			
References Used (Author, Date)	Certainty Level		
PC Parks + Res, 1996	2 0		
Notes			
2 springs supporting pools + riparian veg.			

Reach Name	General Location
1 Apache Spring	Whetstone Mtns W
2 Arivaca Creek	Arivaca
3 Buehman Canyon 2	San Pedro River Valley; W of Redington
4 Buehman Canyon 4	San Pedro River Valley; W of Redington
5 Bullock Canyon 3	San Pedro River Valley; NE of Bellota Ranch; trib. To Buehman Canyon
6 Cienega Creek (lower)2	Rincon Mtns S; E of Vail; below Jungle Rd
7 Cienega Creek (lower)4	Rincon Mtns S; E of Vail
8 Cienega Creek (lower)5	Rincon Mtns S; E of Vail
9 Cienega Creek (lower)6	Rincon Mtns S; upstream Del Lago dam
10 Cienega Creek (upper) 1	Sonoita Valley; north of Sonoita; headwaters to Oak Tree Canyon confluence
11 Cienega Creek (upper) 3	Sonoita Valley; near Cienega Ranch; Mattie Canyon to the Narrows
12 Edgar Canyon	San Pedro River Valley; NW of Redington
13 Empire Gulch 1	Sonoita Valley; near Empire Ranch house
14 Empire Gulch 2	Sonoita Valley; near Cienega Creek confluence
15 Espiritu Canyon 2	San Pedro River Valley; W of Cascabel
16 Lemmon Creek	Santa Catalina Mtns; tributary to Sabino Creek; begin upstream of Wilderness of Rocks Trail crossing
17 Little Nogales Spring	Whetstone Mtns NW; tributary to Wakefield Canyon
18 Mattie Canyon 2	Sonoita Valley; near Cienega Creek confluence
19 Nogales Spring	Whetstone Mtns NW; tributary to Wakefield Canyon
20 Quitobaquito Springs	Organ Pipe Cactus National Monument
21 Romero Canyon	Santa Catalina Mtns W; Romero Pools; near Catalina State Park
22 Ruelas Canyon	Tortolita Mtns; NE of Marana
23 Sabino Creek (lower)	Santa Catalina Mtns; adjacent to shuttle road
24 Sabino Creek (mid)	Santa Catalina Mtns; below Marshall Gulch area
25 Sabino Creek (upper)	Santa Catalina Mtns; near Summerhaven
26 San Pedro 4	San Pedro River Valley; N of Redington; near Peck Canyon confluence
27 San Pedro River 2	San Pedro River Valley; N of Redington; near Bingham Cienega
28 Santa Cruz River 2	Tucson W; E of Tucson Mtns
29 Scholefield Spring	Santa Catalina Mtns NE; N of Scholefield Canyon; NW of Hidden Valley Ranch
30 Tanque Verde (upper)3	Redington Pass; Tanque Verde Falls
31 Wakefield Canyon 1	Whetstone Mtns NW; tributary to Cienega Creek; Silver Spring
32 Wakefield Canyon 3	Whetstone Mtns NW; tributary to Cienega Creek
33 Wakefield Canyon 5	Whetstone Mtns NW; tributary to Cienega Creek; near Wakefield Cabin
34 Wakefield Canyon 6	Whetstone Mtns NW; tributary to Cienega Creek; Wakefield Spring
35 Wild Burro Canyon 1	Tortolita Mtns; NE of Marana
36 Wild Burro Canyon 2	Tortolita Mtns; NE of Marana
37 Wild Cow Spring	Whetstone Mtns W
38 Youtcy Canyon 1	San Pedro River Valley; S of Redington; adjacent to Youtcy Ranch
39 Youtcy Canyon 3	San Pedro River Valley; S of Redington

# Draft Intermittent Stream Coverage

Reach Name	General Location
1 Alder Canyon	Santa Catalina Mtns E; NE of Butterfly Peak
2 Ash Creek	Rincon Mtns E; Happy Valley S
3 Atchley Canyon	Santa Catalina Mtns E; tributary to Alder Canyon
4 Bear Canyon (lower)	Santa Catalina Mtns; Sycamore Reservoir to National Forest boundary
5 Bear Canyon (upper)	Santa Catalina Mtns; below Bear Canyon picnic area to Sycamore Reservoir
6 Bear Creek	Rincon Mtns E; Happy Valley N
7 Bootlegger Spring	Sonoita Valley; small tributary to Cienega Creek; N of Narrows
8 Box Canyon	Santa Rita Mtns; Box Canyon Rd
9 Buehman Canyon 1	San Pedro River Valley; W of Redington
10 Buehman Canyon 3	San Pedro River Valley; W of Redington
11 Bullock Canyon 1	San Pedro River Valley; NE of Bellota Ranch; trib. to Buehman Canyon
12 Bullock Canyon 2	San Pedro River Valley; NE of Bellota Ranch; trib. to Buehman Canyon
13 Bullock Canyon 4	San Pedro River Valley; near Buehman Canyon confluence
14 Canada del Oro 1	Santa Catalina Mtns; headwaters to county line
15 Cargodera Canyon	Santa Catalina Mtns W; N. of Romero Canyon
16 Chimney Canyon	Rincon Mtns S; tributary to Agua Verde Creek
17 Cienega Creek (lower)1	Rincon Mtns S; near Jungle Rd
18 Cienega Creek (upper)2	Sonoita Valley; near Cienega Ranch; Oak Tree Canyon to before Mattie Canyon confluence
19 Cienega Creek (upper)4	Sonoita Valley; the Narrows
20 Deer Creek	Rincon Mtns E; Happy Valley N
21 Distillery Canyon	Rincon Mtns S; tributary to Agua Verde Creek
22 East Fork Sabino Canyon	Santa Catalina Mtns; drains Palisade, Pine, Box Camp Canyons
23 Espiritu Canyon 1	San Pedro River Valley; W of Cascabel
24 Fraguita Wash	Arivaca S; W of Arivaca Lake
25 Gardner Canyon	Sonoita Valley; near Cienega Creek confluence
26 Geesaman Wash	Santa Catalina Mtns; N of Alder Canyon
27 Madera Canyon	Santa Rita Mtns W; near Madera Canyon picnic area and Bogg Springs area
28 Mattie Canyon 1	Sonoita Valley; near Cienega Creek confluence
29 Milagrosa Canyon	Santa Catalina Mtns; below Molino Basin; tributary to Agua Caliente Creek
30 Miller Creek	Rincon Mtns E; Happy Valley; trib. to Paige Creek
31 Molino Canyon	Santa Catalina Mtns; above Molino Basin campgrounds to Agua Caliente Creek confluence
32 Mud Spring Canyon	Sonoita Valley; south end of Empire-Cienega Resources Area
33 Paige Creek 1	Rincon Mtns E; Happy Valley; near Miller Creek confluence
34 Paige Creek 2	Rincon Mtns E; Happy Valley; Turkey Creek confluence
35 Palisade Canyon Creek	Santa Catalina Mtns; below Palisade Ranger Station; tributary to Sabino Creek
36 Pima Canyon	Santa Catalina Mtns; S side of Pusch Ridge

# Draft Intermittent Stream Coverage

37 Rincon Creek	Rincon Mtns SW; Rincon Valley
38 Rose Canyon Creek	Santa Catalina Mtns; tributary to Rose Lake
39 San Pedro River 1	San Pedro River Valley; near Redington
40 San Pedro River 3	San Pedro River Valley; N of Bingham Cienega
41 San Pedro River 5	San Pedro River Valley; Peck Canyon confluence to county line
42 Smitty Spring	Whetstone Mtns NW; small tributary to Cienega Creek; S of Wakefield Canyon
43 Soldier Canyon	Santa Catalina Mtns; crosses first bend in Catalina Hwy
44 Sycamore Canyon	Santa Catalina Mtns; next to upper Bear Canyon
45 Tanque Verde Creek (mid)	Redington Pass, NE Tucson; below Tanque Verde Falls to Wentworth Rd
46 Tanque Verde Creek (upper)1	Redington Pass
47 Tanque Verde Creek (upper)2	Redington Pass; above Tanque Verde Falls
48 Tanque Verde Creek (upper)4	Redington Pass; below Tanque Verde Falls to National Forest boundary
49 Turkey Creek	Rincon Mtns E; Happy Valley; Paige Creek confluence
50 Unnamed Spring	Sonoita Valley; small tributary to Cienega Creek from east; S of Smitty Spring
51 Unnamed tributary to Ash Creek	Rincon Mtns E; Happy Valley S
52 Wakefield Canyon 2	Whetstone Mtns NW; tributary to Cienega Creek
53 West Fork Sabino Creek	Santa Catalina Mtns.; tributary to Sabino Creek
54 Youtcy Canyon 4	San Pedro River Valley; S of Redington
55 Youtcy Canyon2	San Pedro River Valley; S of Redington