Draft
Pima County

MULTI-SPECIES CONSERVATION PLAN

PIMA COUNTY BOARD OF SUPERVISORS
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COUNTY ADMINISTRATOR
C.H. Huckelberry

MEMORANDUM

Date: January 15, 2004

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

From: C.H. Huckelberry
County Administrator

Re: **Draft Pima County Multiple Species Conservation Plan**

Background

Concern over the continuing adverse effects of urban growth caused the Board to initiate a process to improve growth management planning beginning in February of 1998. This process resulted in a number of positive actions taken by the Board to manage urban growth and expansion. A broad-based conservation vision was first articulated and approved by the Board in October of 1998 as the framework for the present Sonoran Desert Conservation Plan.

In March of 1999 the Board directed staff to pursue a Multiple Species Conservation Plan (MSCP) as part of the larger Sonoran Desert Conservation Plan. I have attached the draft Pima County Multiple Species Conservation Plan for your information and to begin a process of inviting public comment.

The Multiple Species Habitat Conservation Plan is only one component of a larger Board conservation vision expressed through the Sonoran Desert Conservation Plan. The Habitat Conservation Plan acts to demonstrate our continuing compliance with the Federal Endangered Species Act. This compliance is essential to eliminate the uncertainty faced by the community related to Endangered Species Act enforcement and to prevent the economic chaos that results from this uncertainty.

Overview of the Multiple Species Conservation Plan

The draft Pima County Multiple Species Conservation Plan has nine chapters in the first volume, and a six-part volume of Appendices. The chapters are as follows:

1. Introduction
2. Pima County Multiple Species Conservation Plan
3. Mitigation Program and Standards
4. Monitoring and Adaptive Management
5. Changed Circumstances and Other Federal Commitments
6. Implementation
7. References Cited and Bibliography
8. Preparers and Contributors
9. Glossary and Acronyms

The appendices include intergovernmental cooperative agreements, the scope of work for the Science Team, the Priority Vulnerable Species Analysis, proposed permitted activities of the Pima County Flood Control District, the Special Elements study, and the Habitat Protection Priorities of Eastern Pima County. This memorandum provides some highlights from the chapters of the draft Pima County Multiple Species Conservation Plan and describes actions that will follow.

Introduction

As is customary in federal habitat conservation plan documents, the purpose and need for the document is described, as are the mandatory elements of the Multiple Species Conservation Plan under Section 10(a)(1)(B) of the Endangered Species Act. The relationship of the Section 10 permit to the larger Sonoran Desert Conservation Plan and to the Pima County Comprehensive Land Use Plan is described. The text also describes the alternatives that will be considered as part of the Environmental Impact Statement as recommended by the Steering Committee. The Environmental Impact Statement will be developed during 2004 through a public participation process. The first chapter of the draft Pima County Multiple Species Conservation Plan essentially places previously known information into the framework of a federal Section 10 document.

Pima County Multiple Species Conservation Plan

Similarly, the second chapter of the draft Pima County Multiple Species Conservation Plan organizes already developed information into a format that we will be able to submit to the United States Fish and Wildlife Service. The study area and plan area are described and participants in the process thus far are detailed. An extensive review of the scientific process and methods used during the last years is provided, along with a description of the physical setting and relevant demographic information. The activities proposed for coverage under the permit are those recommended by the Steering Committee. Anticipated levels of take of habitat are based on information developed as part of the economic study. The proposed authorized level of incidental take under the permit relates directly and logically to the species conservation goals established by the science process.

Mitigation Program and Standards

The third chapter of the program and standards to achieve mitigation places the draft Pima County Multiple Species Conservation Plan within the context of the Conservation Lands System, which has been a part of the Comprehensive Land Use Plan since 2001. The work of the science team from prior studies and science team recommendations are reiterated in terms that address federal issues, such as the relation of our local permit to recovery goals and the benefit to covered species. Again, the information presented is not new but is organized in a format intended for future submission to the United States Fish and Wildlife Service.

Adoption of the Conservation Lands System in 2001 has been the cornerstone of conserving the biological integrity of the County land base over which the Board has land use decision-making authority.

Monitoring and Adaptive Management

Chapter four presents already established aspects of the process, such as the role of the Science Commission, and a proposal for the role and responsibilities of a future Government Work Group. Currently Pima County has cooperative agreements for the Sonoran Desert Conservation Plan with a variety of entities.

These agreements can be renewed and revised following discussions with the jurisdictions in light of their review and contributions to the draft Multiple Species Conservation Plan. The proposed role of the future government working group is to "function as a collaborative interagency partnership with Pima County to support and benefit from a successful implementation of the Multiple Species Conservation Plan and Adaptive Management and Monitoring Plan."

Substantial cost savings to the participating entities might be achieved, in addition to streamlined permitting processes for project proponents and consistent or complementary management plans at the landscape level. The benefits of shared data and improved geographic information systems (GIS) analysis in land planning can be expected to continue with the related benefits to the community through access to sophisticated and updated information for multiple purposes.

Changed Circumstances and Other Federal Commitments

Chapter five provides text which outlines Pima County obligations and the limits thereof given changes in circumstances. Unforeseen circumstances are defined and the draft Pima County Multiple Species Conservation Plan and the application of the "no surprises" policy are anticipated. The no surprises clause is the provision which limits Pima County's financial obligation in the event of an unforeseen circumstance. This commitment on the part of the United States Fish and Wildlife Service is a common feature of habitat conservation plans.

A recent decision by the United States District Court for the District of Columbia has remanded the No Surprises Rule after finding that procedural requirements relating to the notice and comment period under the federal Administrative Procedure Act were not followed in establishing the rule. We understand from discussions with the United States Fish and Wildlife Service that the agency will seek to correct the procedural defects and restore the rule in a time frame that will allow Pima County to negotiate for such a provision as part of our Habitat Conservation Plan. Therefore, draft language in included.

Comments from the business community and the environmental community relating to this provision will be useful to the Board as it makes its final decisions about the contract document between Pima County and the United States Fish and Wildlife Service in the future.

Implementation

In the sixth chapter of the draft Pima County Multiple Species Conservation Plan implementation issues such as future partnerships, funding, and the phasing of the Plan are discussed, along with provisions for amending the Plan in the event of future listings.

The annual reporting requirement is outlined, and perhaps most importantly, provisions for partnering with the private sector and accommodating Safe Harbor or Candidate Conservation Agreements involving private land owners are described. These provisions allow for flexibility in conservation commitments that are carefully tailored to the landowner's needs and thus create an incentive to conserve.

Process for Continued Development of the Multiple Species Conservation Plan

Copies of the draft Pima County Multiple Species Conservation Plan are being sent to Steering Committee members, governmental partners, and members of the technical teams with a request for comments that will assist us in improving the draft document. Copies will be available to all interested individuals and we are posting the draft Pima County Multiple Species Conservation Plan on the website. In addition, we are scheduling public meetings and will be available to answer questions and accept comments from individuals, all of which will be available as public record. We anticipate that the comments we receive from all sectors of the community will assist in shaping the next drafts of the Pima County Multiple Species Conservation Plan and we look forward to this productive time.

Participatory Process for the Environmental Impact Statement Development

As we work with the United States Fish and Wildlife Service to schedule the next scoping meetings and provide information for the Environmental Impact Statement, I would like to invite the Native American Nations and individuals of Pima County to work with the Cultural Resources Team and County staff to enhance the Environmental Impact Statement through a participatory process that involves more members of the Native American community in plan and program development. Similarly, we will invite the Ranch Team to fashion a process that accommodates the concerns and priorities of the ranch community.

Multi-Species Conservation Plan Conclusion

The draft Pima County Multiple Species Conservation Plan organizes the science research and recommendations of the last five years into a format that Pima County will be able to work from as we improve the current draft and submit the plan in the future to the United States Fish and Wildlife Service in order to obtain a Section 10 permit. The attached document should clarify

issues and facilitate public discussion of the Conservation Plan during 2004. The document demonstrates that the Sonoran Desert Conservation Plan itself is something that we have been implementing since 1999.

Towards a Comprehensive Understanding of Conservation

While today I am transmitting the draft of the Multi-Species Habitat Conservation Plan in support of the Biological Element of the Sonoran Desert Conservation Plan, I will also be transmitting a number of other interrelated reports to the Board in the next 45 days. Within the next two to three weeks I will be providing the Board with vision documents associated with each element of the Sonoran Desert Conservation Plan. These vision documents are the syntheses of the last five years of studies, public meetings and public discussion on the Sonoran Desert Conservation Plan. These vision documents will provide the conceptual framework for continuing conservation efforts in Pima County that should become part of our lexicon in managing future urban growth and development in Pima County.

By mid February I will be providing a report to the Board regarding "Tax Revenue, Tax Base and Land Availability Issues Related to the Sonoran Desert Conservation Plan." This report will specifically address the tax revenue and tax base implications associated with reserve establishment as deemed appropriate in the Multi-Species Habitat Conservation Plan, whether the reserve be developed through open space acquisition or the acquisition of conservation easements on lands that are in compliance with guiding principles of the Conservation Lands System. Further, the issue of land availability for future urban growth and development will also be addressed in this report, addressing the specific issue of sufficient lands within Pima County for development purposes.

By mid to late March, I will also provide the Board with a report that identifies the interrelationships between the proposed May 2004 bond issue for open space conserving both community open space and habitats, as well as the Biological Element of the Sonoran Desert Conservation Plan, which is the Habitat Conservation Plan transmitted in draft with this memorandum. In addition, this report will also discuss the proposed State Land Trust reform proposal and how the proposal benefits our conservation efforts. This last report should provide a clear basis for understanding the interrelationship between the open space bond issue, the Habitat Conservation Plan, and State Land Trust reform, all from the perspective of balanced, coordinated and comprehensive conservation. As has been stated before, great communities are no accident – they take hard work, sacrifice and compromise. Following through with the Sonoran Desert Conservation Plan will reaffirm that this community is a great place to live.

CHH/jj

Attachment

ADVANCE DRAFT PIMA COUNTY MULTIPLE SPECIES CONSERVATION PLAN PIMA COUNTY, ARIZONA

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1 INTRODUCTION

This document represents the culmination of many years of planning and studies in the development of the biological element of the Sonoran Desert Conservation Plan (SDCP). That work effort has been lead by Pima County staff and guided by the Science Technical Advisory Team (STAT). The overriding biological goal of the SDCP as established by the STAT is:

> To insure 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.

Towards that end, an ecosystem-based Conservation Lands System (CLS) has been developed to serve as the basis for the regional-scale conservation of biological resources in Pima County as summarized by this Pima County Multiple Species Conservation Plan (PCMSCP).

While it represents a culmination of past efforts, it is also a reflection of current knowledge and commitment of intent and resources to a desired future condition in the coming decades. Therefore, it is in the spirit of a dynamic strategy, rather than a static reporting, that this information is presented.

In addition to the STAT members and Pima County staff, numerous persons have contributed their scientific knowledge and expertise. Contributors to the science of the PCMSCP are listed in Chapter 9.

1.1 Purpose and Need for Document

This PCMSCP serves as the basis for the U.S. Fish and Wildlife Service (USFWS) decision regarding issuance of an "Incidental Take" Permit under Section 10(a)(1)(B) of the Endangered Species Act (ESA). While Section 9 of the ESA prohibits "take," Section 10(a)(1)(B) authorizes exceptions for take that may occur incidental to otherwise lawful activities, with the provision of a Habitat Conservation Plan (HCP). The HCP must thoroughly describe the anticipated effects of anticipated take on affected species and the measures proposed to avoid, minimize, and mitigate resulting impacts.

The general purposes of the ESA Section 10(a)(1)(B) and the HCP requirement can be summarized as follows:

- To permit non-federal projects to "take" federally listed species while ensuring their long-term survival and enhancement,
- To promote the long-term conservation of federally listed species,
- To reduce conflicts between endangered species and economic activities,
- To develop "creative partnerships" between the public and private sectors.

For Pima County, the HCP addresses the needs of more than one single species, hence the multi-species designation. The PCMSCP:

- Provides a summary of biological technical studies conducted in developing a regional landscape conservation plan for Pima County. Throughout this document there are

references to scientific and planning reports that have been prepared as the information base for the SDCP. These reports total over 200 and are listed in Chapter 8. The intent of this document is to concisely summarize the relevant background information rather than to repeat it.

- Serves as the document of record for conservation, mitigation, management, and monitoring commitments. Once the Section 10(a)(1)(B) Permit has been approved and the plan implementation is underway, the permit is the document that becomes a legal record of the permit requirement details, including funding and implementation agreements.

- Provides a programmatic framework for developing other incidental take permits for non-Pima County jurisdictions and facilitating Section 7 consultations for federal land management partners. The PCMSCP identifies the criteria for determining impacts to species covered by the Section 10(a)(1)(B) Permit. In this way, it functions to give direction and guidance for other incorporated jurisdictions within the county in their pursuit of their individual permits. Similarly, it can be utilized by federal agencies proposing actions that require consultations with the USFWS. In both cases, the information base herein gives direction in reaching consistent evaluations of biological impacts and appropriate mitigation.

1.2 Background

The PCMSCP has been developed in a broad context, as part of the SDCP and in concert with the Pima County Comprehensive Land Use Plan. In addition to providing Pima County with incidental take protection under the ESA for covered species and permitted activities identified in the plan, the PCMSCP also provides the framework for ESA compliance for other Federal and nonfederal participants throughout the County.

1.2.1 Sonoran Desert Conservation Plan (SDCP)

The 1997 listing of the Cactus ferruginous pygmy owl (CFPO) as a federally endangered species, followed by the 1999 designation of this species' Critical Habitat galvanized the community dialogue regarding growth in Pima County. The Pima County Board of Supervisors (BOS) initiated the SDCP planning process in 1998 with a broader purpose than simply allowing continued community growth and expansion without significant adverse regulatory consequences from enforcement of the ESA relative to the CFPO. This broader purpose was to develop a regional plan to address the long-term conservation needs of the full range of natural and cultural resources—a plan that can serve as the cornerstone of conservation as well as economic expansion (Pima County 2000). The development of the SDCP has been an iterative planning process whereby concepts are developed using science-based principles, shaped by public review and discussion, and further developed into a plan that reflects community values. Over 200 separate studies documents have been prepared as part of this planning and public outreach effort.

1.2.2 Pima County Comprehensive Land Use Plan

In 2000 the BOS initiated an update of the 1992 Comprehensive Plan, reflecting the land use concepts, policies, and principles of conservation identified in the draft Preliminary SDCP. This major plan amendment, the Pima County Comprehensive Land Use Plan (CLUP) Update (Pima County 2001 and 2002), was completed and its adoption established the initial implementation of the biological goals expressed by this PCMSCP and the CLS. (See further discussion in Section 3.1, Conservation Lands System).

1.3 Pima County Multiple Species Conservation Plan

The PCMSCP is the document that institutionalizes the biological resources aspects of the SDCP and the CLUP. By so doing, it provides the legal and logistical framework for implementing those actions that will allow for "smart growth" and economic health while maintaining appropriate levels of ecological conservation.

1.3.1 Mandatory Elements of an HCP

In accordance with the USFWS HCP Handbook (Dept. of Interior, 1996) the required elements of the HCP are as follows:

- Identification of impacts likely to result from the proposed taking of the species for which permit coverage is requested
- Measures the applicant will undertake to monitor, minimize, and mitigate such impacts; the funding that will be made available to undertake such measures; and the procedures to deal with unforeseen circumstances
- Alternative actions that the applicant considered that would not result in take and the reasons why such alternatives are not being utilized
- Additional measures USFWS or National Marine Fisheries Service may require as necessary or appropriate for purposes of the plan

In the update addendum to the HCP Handbook (Dept. of Interior, 2000) the "5-point policy" focuses on the integration of five components of the Habitat Conservation Planning program, namely:

- Biological goals
- Adaptive management
- Monitoring
- Permit duration
- Public participation

Each of these Handbook and Addendum components are discussed in detail in sections that follow.

1.4 Alternatives Considered

As required in Section 10(a)(1)(B), Pima County has considered a full range of alternative actions to the incidental take proposed in this HCP. These alternative approaches have been the focus of discussions among the STAT, Steering Committee, other advisory committees, and numerous public forums. These will be described in detail in the Environmental Impact Statement (EIS) and summarized here.

A number of alternatives were discussed but not considered in further detail because they either were not within the control of the participants, were otherwise considered infeasible, or on their face, did not meet the County's or the USFWS purpose and need for an incidental take permit. These alternatives included:

- A Sonoran desert ecosystem permit including adjacent counties and, potentially, northern Mexico
- A single species permit for the cactus ferruginous pygmy owl
- A permit for all species identified as vulnerable by the STAT

Two sets of alternative approaches for an HCP for Pima County emerged from the public processes to develop the SDCP and HCP. These provide the basis for the PCMSCP as well as the alternatives analysis in the EIS.

1.4.1 Steering Committee Recommendations

In their final report, approved by the BOS in June 2003, the SDCP Steering Committee considered a number of issues associated with the scope and coverage of the Section 10(a)(1)(B) permit applications (Pima County 2003). These issues related to the duration of the permit, entities and projects to be covered by the HCP, and species to be covered by the permit.

The Steering Committee specifically recommended that:

- Pima County should apply for a permit with a term of 20 to 50 years. The decision on the specific duration of the permit should be made after other details of the application are completed.
- The Section 10(a)(1)(B) permit application should cover all relevant County projects and permits, and willing entities within the county.
- The adoption of the ecosystem approach that resulted in a CLS map that protects the habitat of 55 priority vulnerable species.
- The EIS for the MSCP will clearly describe and analyze five alternatives:
    - The 55 priority vulnerable species and the conservation measures enacted for their protections
    - The nine listed species plus those that would be adequately addressed by the conservation measures enacted for the species
    - A combination between the 8 and 55 species
    - The species within the 55 that are currently listed as threatened and endangered or are candidates for listing
    - The no action alternative as required by law

- This analysis should include an economic analysis of all five alternatives and other important topics that would include, but not be limited to, reserve requirements and regulatory requirements.

1.4.2 Alternatives Evaluated in Economic Analysis

Pima County undertook an economic analysis of potential costs and benefits of obtaining a Section 10(a)(1)(B) permit (ESI and SWCA 2003). The scope of this study specified the range of alternatives in three scenarios, which measured the impact of:

- Not acquiring the permit while not allowing zoning to change over time
- Acquiring the permit while not allowing zoning to change over time
- Acquiring the permit while allowing zoning to change over time

Each of these future scenarios was analyzed in the context of population and economic growth projections that quantified future land demand and the suitability of land for different development types. In this way future development "footprints" were predicted for 10 years, 20 years and maximum future development. The predicted urban growth patterns were used as a basis for estimating the amount and cost of developable land, and the amount and cost of lands that may be needed to offset or mitigate impacts resulting from development.

Furthermore, the economic analysis compared the reserve system incorporated in the CLS (an ecosystem approach based on 55 vulnerable species) with a reserve system designed to protect eight currently listed species (Pima County 2002b). The analysis also evaluated a range of mitigation ratios for land acquisition that might be used to accomplish assembly of these two reserve systems with the assumption of the three scenarios during the three time horizons.

2 PIMA COUNTY MULTIPLE SPECIES CONSERVATION PLAN IMPACTS

2.1 Delineation of PCMSCP Boundary

2.1.1 Study Area

The Study Area for the PCMSCP includes the 9,184 square miles (5,877,760 acres) of Pima County. Elevations range from 1,200 feet in the Lower Colorado Desert of western Pima County to over 9,000 feet at the peak of Mount Lemmon in the Catalina Mountains (Figure 2.1). Geographically, it is representative of the Basin and Range Province, with mountainous "sky islands" separated by the desert floors of broad valleys.

The San Xavier, Pascua Yaqui, and Tohono O'odham reservations together account for ownership of 42.1 percent of county land. The state of Arizona owns 14.9 percent; the U.S. Forest Service and Bureau of Land Management, 12.1 percent; National Parks and other public lands, 17.1 percent; and individual or corporate ownership, 13.8 percent (Pima County, 2003).

In addition to the reservations, jurisdictions within Pima County include the cities of Tucson and South Tucson, the towns of Oro Valley, Marana, and Sahuarita.

All of these areas were included in the study area of the PCMSCP, regardless of jurisdiction. The best available biological information for the study area was sought, compiled, and analyzed with the intent of providing a fuller context for analysis of the plan area.

2.1.2 Plan Area

The plan area, for which a Section 10(a)(1)(B) permit is being sought, is a smaller subset of the County and includes only the lands under the Pima County BOS legal authority—a total of approximately 630,000 acres (Figure 2.2). Excluded from the permit area are those incorporated areas under separate jurisdictions and State of Arizona lands. Federal lands are not specifically included under the permit, however Federal land management agencies (i.e., Bureau of Land Management (BLM), U.S. Forest Service (USFS), National Park Service (NPS), USFWS) are active partners in the conservation plan efforts, as identified by the Working Agreements entered into with Pima County (Appendix A).

2.1.3 Participants

Pima County has made broad participation by many agencies, organizations, and interested citizens a top priority for its conservation planning effort. Public participation has included public scoping meetings and comment periods, a citizens' Steering Committee of over 80 members meeting since March of 1999, over 400 public meetings, a series of educational sessions and workshops (also known as "SDCP Bootcamp"), meetings of 12 advisory and technical teams, and numerous informal meetings held with a variety of interest groups and concerned citizens. More than 150 scientists have contributed their expertise. Nationally recognized peer reviewers have provided insights and suggestions that have been incorporated.

Local jurisdictions and state and federal agencies have participated in meetings, on committees and as members of the STAT and Government Working Group (See Sections 4.2 and 4.3), and their concerns have been made part of the reserve design and conservation planning process. Entities with whom Pima County has formal Working Agreements and/or Cooperative Agreements are discussed in Section 6.2.

Figure 2.1 Study Area

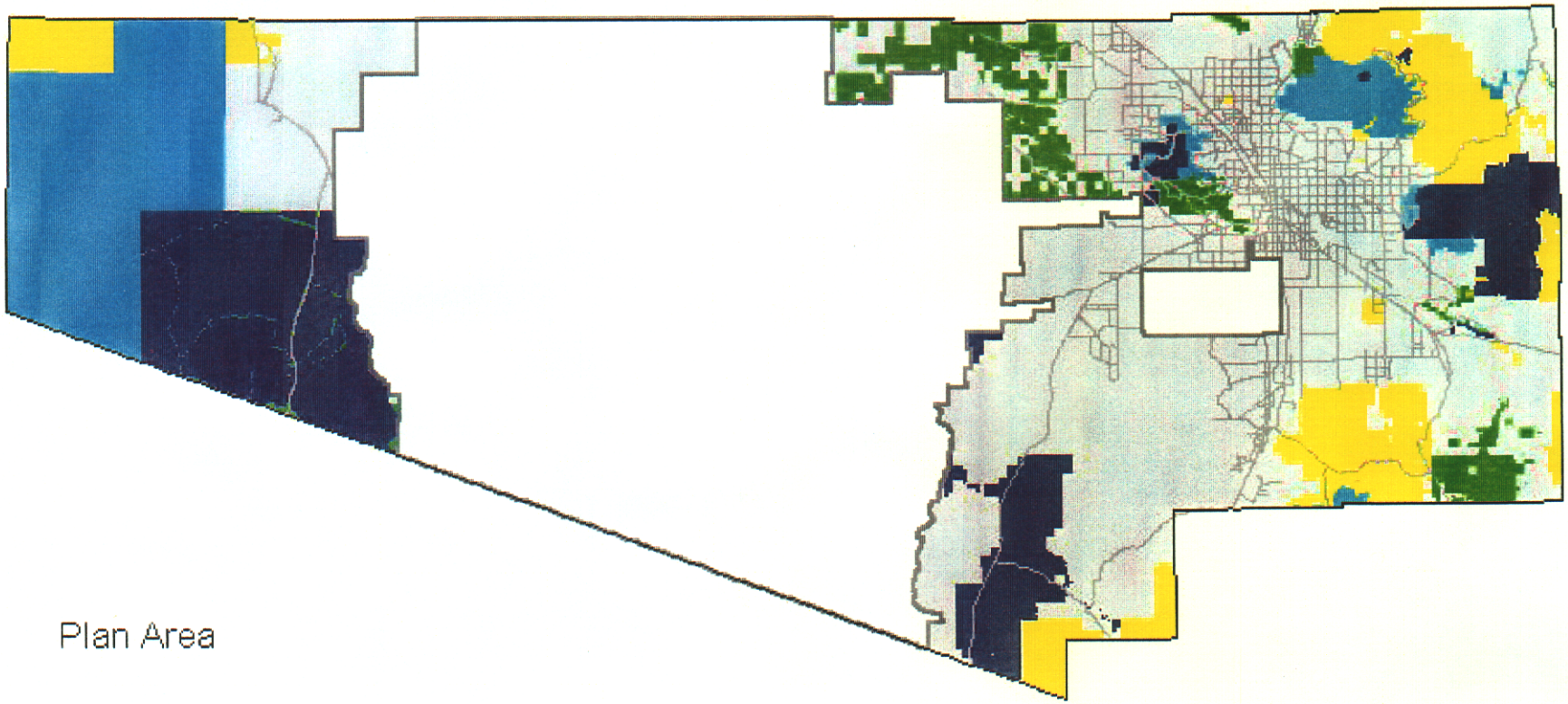

Figure 2.2 Plan Area

2.2 Collection and Synthesis of Biological Data

The Pima County BOS appointed a team of scientists to oversee the development of the biological resources component of the SDCP (see list of STAT members in Section 9). In May 1999, this multi-agency, multi-disciplinary team met for the first time to begin discussions about the biological underpinnings for a regional conservation plan. Since that time they and County staff, along with consultants and other biologists and natural resource managers, have identified the plant and wildlife species of greatest concern, identified mapping and data gathering needs, participated in geographic information system (GIS) decision-making workshops, produced the CLS map and identified monitoring and management needs for long-term viability of the proposed conserved lands. The result of this process, detailed in an extensive series of technical documents (see References Cited), forms the basis for the proposed PCMSCP. This process is described briefly below.

2.2.1 Methodology

The collection and synthesis of biological data has been ongoing in Pima County for many years, with formal records dating back to the 1800s and extending into present time to reflect agency, academic, and private sector efforts. This information provides a broad historical context for examining existing conditions.

The focused efforts of scientists working on the SDCP began with the formation of the STAT. The STAT developed the initial goals and objective statement for the process (Pima County 1999a), developed a scope of work for the plan (Appendix B), and has continued to provide guidance and direction to the multidisciplinary team developing the plan. The STAT has performed the critical role of formal and informal peer review, fully incorporated into the plan development process.

The overall concept for development of the plan, established early in the process, was to make extensive use of GIS technology. This was recognized as the only feasible approach to assemble all of the extensive existing data (both digital and non-digital), identify critical gaps in the existing data (and potential remedies to the gaps), and to provide a means for analyzing the information on biological and physical resources over the 6 million acres study area. The GIS data and analytical results were used by the STAT and multidisciplinary team to develop a sophisticated approach to achieving the goal of conservation of the full range of diversity of biological resources in Pima County, as well, as providing the basis for this application of a Permit under Section 10(a)(1)(B) of the ESA.

2.2.2 Environmental Setting

2.2.2.1 Land Use

A major plan amendment to Pima County's CLUP was completed in 2002 (Pima County 2001 and 2002). This updated plan incorporated the land conservation concepts, policies and principles reflected by the CLS and identified by preliminary drafts of the SDCP (Figure 2.3). The seven elements of the CLUP (i.e., Growth Area, Land Use, Circulation, Water Resources, Open Space, Cost of Development and Environmental Planning) demonstrate a compatibility of natural and built environment planning that recognizes the physical interdependence of the conservation land system and the urban land system. By incorporating the CLS goals and guidelines, the CLUP established the initial implementation of the biological goals expressed by the PCMSCP. The primary mechanisms to achieve this are expressed by 1) Growth Areas

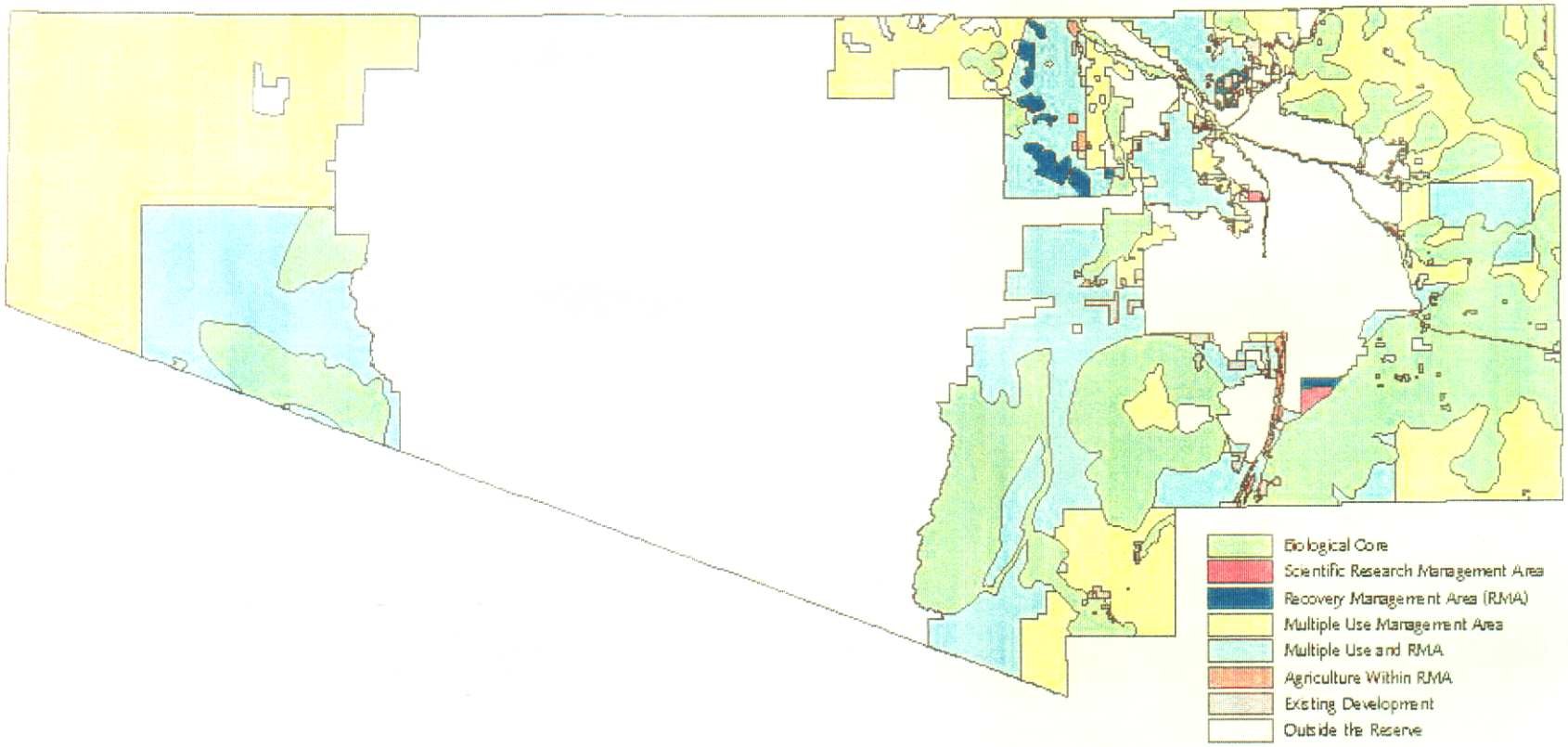

Figure 2.3 Conservation Land System

focused on lands outside of the CLS, 2) down-planning in environmentally sensitive areas, 3) policies related to Water Resources, conservation and ecological restoration, 4) policies related to Natural Resource Protection and specifically, in support of the Conservation, and 5) the extent of Resource Conservation Areas.

2.2.2.2 Population

Pima County's population has grown from less than 25,000 in 1910 (City of Tucson 2003) to the current estimate of approximately 889,000, and is expected to exceed 1.2 million in 20 years Using water availability estimates as a constraint to growth, Pima County's population at buildout (i.e., the point at which water availability will cease to support additional population) has been projected at approximately 1.9 million people (ESI Corp and SWCA 2003). The amount of land needed to accommodate the population increase expected to take place outside the current built environment in eastern Pima County is projected to be just over 195,000 acres. The footprint of this projected population and land absorption is discussed further under the analysis described in Section 2.4.

2.2.2.3 Land Cover Data Assessment and Compilation

Vegetation and land cover data are essential for assessing conservation needs and developing potential reserve designs, since it is these data that describe habitat needs and are significant determinants of species distributions. Recognizing the importance of vegetation and land cover mapping to the development of a regional multi-species habitat conservation plan, the STAT identified the need to assess and improve existing data for Pima County. A June 1999 report, "An Evaluation of Previous Vegetation Mapping Efforts for the Sonoran Desert Conservation Plan" was submitted to STAT (Pima County 1999b), which examined the suitability of previous mapping efforts for use in the SDCP. This paper examined four data sources: Arizona Gap Analysis Program, Pima County Wildlife Habitat Inventory Phase 2 (WHIP2), Pima Association of Governments 208 studies, and Pima County Riparian Habitat Mapping. This paper recommended that the accuracy of vegetation delineation and classification could be improved for upland communities by combining multiple sources of vegetation data, but that special effort, including extensive fieldwork were necessary for improving riparian mapping. The December 1999 report, "An Evaluation of Previous Riparian Vegetation Mapping Efforts for the Sonoran Desert Conservation Plan" assessed the same data sources (Pima County 1999c), plus Arizona Game and Fish Department (AGFD) Vegetation and National Wetland Inventory Maps, focusing specifically on riparian vegetation communities. Deficiencies in existing data and recommendations for additional work were described.

From these studies, STAT developed a scope of work that outlined two separate tasks to be conducted:

- Produce new mapping for riparian areas based on existing data plus field work, and
- Compile an overall land cover map based on existing data, including an assessment and recommendations for improvement.

The primary goals for this work were to produce the best possible land cover data layer from available resources, adopt and apply a standard classification system, develop a system for compiling this data layer that facilitates the incorporation of new data and assumptions, evaluate the results, and prioritize map improvements necessary for achieving the goals of the SDCP

(RECON 2000a). Vegetation mapping was standardized to the classification system developed by Brown, Lowe and Pase (Brown et al. 1979, 1980, 1982), using their codes.

Both mapping tasks have been completed, supporting metadata documented, and the revised riparian mapping has been incorporated into the Composite Land Cover Mapping (Figure 2.4).

2.2.3 Biological Resources

2.2.3.1 Priority Vulnerable Species

Under the direction of the STAT, a list of the most vulnerable plant and wildlife species was developed (RECON 2000b). This began with an initial list of over one hundred species recognized by the federal government as imperiled, species extirpated from Pima County and additional species that are in decline or jeopardy. That list was then analyzed and certain species were screened out based on one or more of the following criteria:

- Species for which conservation can be accomplished as a result of protection afforded other species, habitat types, or plant communities by the Sonoran Desert Conservation Plan;
- Species of which insignificant or non-viable numbers occur in the planning area and for which conservation is best accomplished elsewhere (accidentals, range peripherals, etc.),
- Species that are not known to occur in the study area, nor are likely to occur in the study area within the planning horizon, or species that are too broadly distributed to help differentiate among a range of plan alternatives,
- Species known only from or predominantly within Pima County on lands managed by the U.S. Forest Service, the U.S. Fish and Wildlife Service, and/or the National Park Service, and species known only from or predominantly within Pima County on the Tohono O'odham Reservation. (Species in this category are already being managed by Federal agencies with commitments to protect them or they occur on Tohono O'odham Nation lands.)

This review resulted in a short list of fifty-five species that were identified by the STAT as "Priority Vulnerable Species" (PVS) of Pima County warranting further analysis and consideration for conservation and possible coverage by a Section 10(a)(1)(B) Permit (Table 2.1).

Detailed species accounts were compiled for each of these species (RECON 2000c). Sources of information used in assembling these accounts included AGFD Species Abstracts, Heritage Data Management System records, species accounts in various formats, local and regional field guides, primary literature, notes from conversations with species experts, and cumulative experience of the STAT and their consultants. Organized by taxonomic group, the list of PVS includes:

Mammals

Of the nine mammals in the study area, seven are bats. A number of the bat species depend on, or occur along, riparian corridors. Riparian losses have had a negative impact on the Merriam's mouse, listed above, and water is thought to be important to the Arizona shrew.

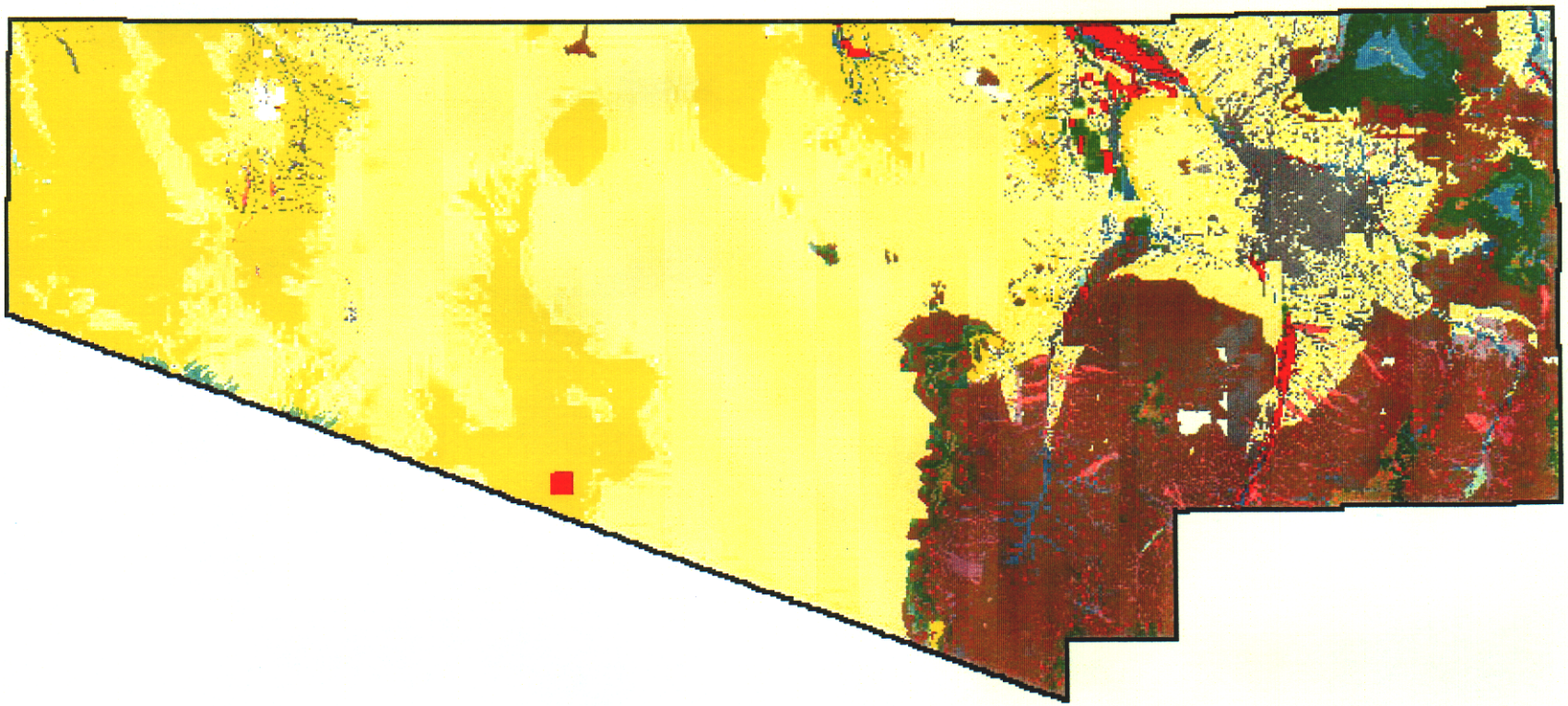

Figure 2.4 Composite Cover

Table 2.1
Priority Vulnerable Species of Pima County

Scientific Name	**Common Name**
Mammals	**9 species**
Choeronycteris mexicana	Mexican long-tongued bat
Idionycteris phyllotis	Allen's big-eared bat
Lasiuris blossevillii	Western red bat
Lasiurus xanthinus	Southern yellow bat
Leptonycteris curasoae yerbabuena	Lesser long-nosed bat
Macrotus californicus	California leaf-nosed bat
Peromyscus merriami	Merriam's mouse
Plecotus townsendii pallescens	Pale Townsend's big-eared bat
Sorex arizonae	Arizona Shrew
Birds:	**8 Species**
Aimophila carpalis	Rufous-winged sparrow
Athene cunicularia hypugaea	Burrowing owl
Buteo swainsoni	Swainson's hawk
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo
Empidonax traillii extimus	Southwestern willow flycatcher
Glaucidium brasilianum cactorum	Cactus ferruginous pygmy-owl
Pipilo aberti	Abert's Towhee
Vireo bellii	Bell's Vireo
Reptiles:	**7 Species**
Chionactis occipitalis klauberi	Tucson shovel-nosed snake
Chionactis palarostris organica	Organ Pipe shovel-nosed snake
Cnemidophorus burti stictogrammus	Giant Spotted whiptail
Cnemidophorus burti xanthonotus	Red-backed whiptail
Sonora semiannulata	Ground snake
Terrapene ornata luteola	Desert box turtle
Thamnophis eques megalops	Mexican Garter Snake
Amphibians:	**2 Species**
Rana chiricahuensis	Chiricahua Leopard Frog
Rana yavapaiensis	Lowland Leopard Frog
Fish:	**6 Species**
Agosia chrysogaster	Longfin dace
Catostomus clarki	Desert sucker
Catostomus insignis	Sonora sucker
Cyprinodon macularius macularius	Desert pupfish
Gila intermedia	Gila Chub
Poeciliopsis occidentalis occidentalis	Gila Topminnow

Priority Vulnerable Species of Pima County (continued)

Scientific Name	Common Name
Invertebrates:	**17 Species**
Albiorix anophthalmus	Arkenstone Cave pseudoscorpion
Sonorella species	Talus snail species
Plants:	**7 Species**
Coryphantha scheeri var. robustispina	Pima pineapple cactus
Dalea tentaculoides	Gentry indigo bush
Echinocactus horizonthalonius var.	Nichol's Turk's head cactus
Echinomastus erectocentrus var.	Acuna cactus
Echinomastus erectocentrus var.	Needle-spined pineapple cactus
Lilaeopsis schaffneriana recurva	Huachuca water umbel
Tumamoca macdougalii	Tumamoc globeberry

Birds

Six of the eight birds described in the text have an association with riparian areas. These areas have been seriously altered from baseline conditions and continue to decline.

Reptiles

Desert box turtles and Mexican garter snakes are found in riparian areas, as are Giant spotted whiptail lizards. Mixed riparian scrub (xeroriparian) and Mesquite Bosque are identified as important to the Tucson shovel-nosed snake.

Fish & Amphibians

Both frogs and all six fish species are dependent on aquatic environments.

Invertebrates

Sixteen species of talus snails are included on the list of PVS. Although the state of taxonomic understanding is evolving, the actual number of species or subspecies is somewhat uncertain.

Plants

Riparian or aquatic ecosystems are important for the Gentry indigo bush and the Huachuca water umbel.

The majority of these PVS are associated with aquatic and riparian-based ecosystems. This list of species also points out the importance of other landscape elements or features that are also threatened in Pima County. Grasslands, desert scrub, caves, adits, and talus slopes serve as unique habitat niches that support vulnerable species. These and other landscape elements also have an important function in providing landscape-scale connectivity between otherwise isolated conservation areas.

2.2.4 Special Plant Communities and Other Special Elements

Protecting indigenous species requires more than individual species' habitat conservation. Maintaining the full spectrum of native biodiversity requires the inclusion of vegetation communities as well as particular species of concern when assembling a viable reserve system. Planning with a focus on species is referred to as a "fine filter" approach, while planning with a focus on plant communities and larger landscape ecological processes has been called the "coarse filter" approach (Noss and Cooperrider, 1994). Because these different strategies serve as an effective check and balance on one another, STAT directed that aspects of both be incorporated into the design of the CLS. In this way the number of species represented is maximized and the variability of ecological conditions and functions is captured (Marshall et al. 2000).

Special Elements are the landscape features that have been used in the PCMSCP reserve design. A number of categories of special element conservation targets were considered and used to constrain or influence the extent and boundaries of the CLS (Table 2.2).

Table 2.2
Special Elements

Special Elements	Acres in Plan Area
Cattail	511
Cottonwood-willow (Son)	2,946
Interior southwest riparian deciduous forest	6,155
Intermittent Streams (20-foot buffers)	1,076
Mixed conifer	1,737
Perennial Streams (20-foot buffers)	325
Sacaton	7,160
Saltbush	11,564
Springs (50-foot buffers)	43
Talus slopes	579
Unincised floodplains	2,429
Grassland	365,606
Ironwood	193,321
Limestone	39,118
Mesquite	23,404
Oak-grass ecotone	105,492
Sonoran riparian scrub	151,658
Watershed	80,643

Many of the Special Element conservation targets are plant community types. Others represent specific habitat types important for individual species, such as talus slopes for talus snails, or caves, adits and bridges for bats. All but the low elevation valley floors were used to guide or constrain the reserve design (Pima County 2002a). These areas are adequately represented by the combination of grasslands, riparian corridors and desert scrub.

2.2.4.1 Biological Threats and Stressors

At the same time the existing information regarding species, habitat distribution, and land cover data were being compiled, a Countywide biological resources stress assessment was undertaken. The purpose of this evaluation was to establish the baseline knowledge of existing and potential threats and stressors to plants, wildlife species, and overall ecological health. Emphasis was placed on identifying the specific components of past, existing, and proposed land and water uses posing the greatest threats over the next 30 years to the PVS, special habitats, and plant communities that were identified by the STAT. The Biological Stress Assessment was developed in concert with the development of detailed Species Accounts in order to incorporate information on specific stressors to species to the extent possible. Each of the County's nine watershed Sub-areas were evaluated separately (Figure 2.5). The work effort was summarized in the report, "Biological Stress Assessment: An Overview Discussion of Issues and Concerns" (RECON 2000d).

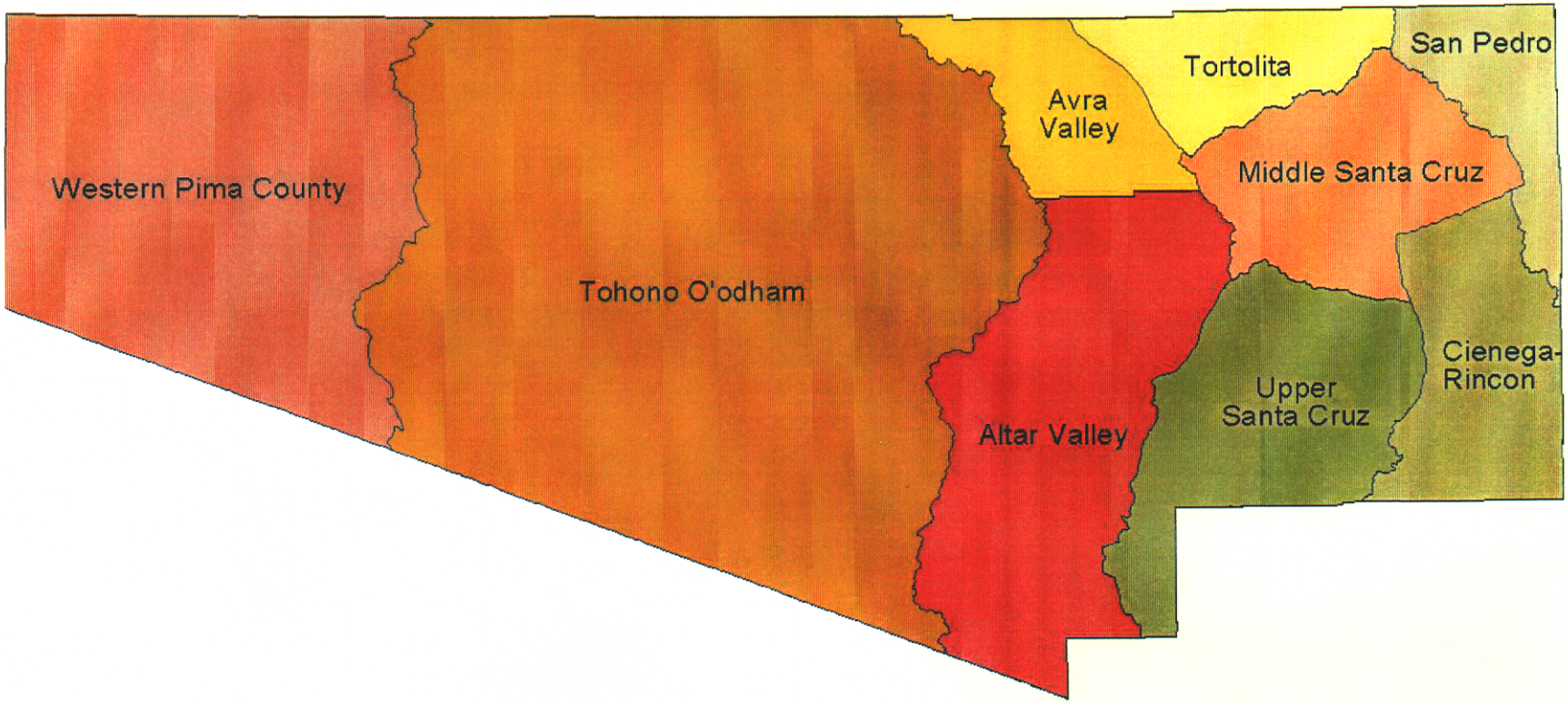

Figure 2.5 Pima County Watershed Subunits

The role and value of the Biological Stress Assessment is several fold in that it:

- Identifies species and landscape elements of greatest concern
- Provides a science-based first step in identifying issues to evaluate under National Environmental Policy Act (NEPA) process
- Provides a mechanism to rank land areas by intensity of threat- least to most critical-and compare that to current conservation status
- Highlights data gaps (GIS and otherwise)
- Points to avenues for future analysis

The stress assessment made a first cut in identifying issues to be evaluated under NEPA review. In the context of an HCP, some land uses will be considered as "otherwise lawful activities" that would be allowed and permitted under the terms and conditions of a federal Section 10(a)(1)(B) "Incidental Take" permit. Stressors to biological resources stem from events, activities, changes over time, and other factors that affect individual plant and wildlife species-as well as the biological and hydrological systems that support them.

Stressors to wildlife include those factors that either directly or indirectly affect their ability to find or provide for their basic needs of food, water, and cover.

Stressors to plants include reduction in water availability, removal and damage to plants, competition with invasive species, and loss of pollinator species.

Each of these sources of stress has the potential to effect biological resources in numerous ways—some positive, some negative. Furthermore, many of these sources of stress are directly linked to specific land and water use activities. While these stressors are not unique to Pima County, the way they are manifested and managed vary between the watershed Sub-Areas.

2.2.4.2 Primary Threats and Stressors

The biologically rich landscape elements or areas most threatened in Pima County, and throughout the arid west, are riparian forests, wetlands, perennial streams, and areas of shallow groundwater. This has been documented and discussed for decades. The spread of introduced, non-native aquatic species is on the forefront of biodiversity discussions. The negative impact of non-natives on native populations has been greatly exacerbated by habitat modifications such as the damming of streams and the creation of ponds and lakes.

Other examples of threatened or stressed habitats in Pima County include cave habitats and limestone dependent plant communities, mine adits used by bats, grasslands and other undeveloped, low elevation valley lands, saguaro and Ironwood plant communities, remaining xeroriparian areas that provide key connections to and extensions from existing preserves.

2.2.4.3 Significance of Historic Depletion of Water within Eastern Pima County

One of the most profound stressors to biological resources in Pima County has been the depletion of surface water flows and the drop in groundwater levels. This has resulted from a combination of factors.

The In the late 1800s the Tucson basin was relatively undeveloped. Watercourses that are now dry most of the year had perennial flows. Numerous springs flowed as well. The small community of Tucson depended almost entirely on surface flows from the Santa Cruz River or from springs that bubbled to the surface at the base of Sentinel Peak (now called "A" Mountain), Black Mountain near San Xavier Mission and several other spots (J. Gelt et al. ND). There was enough water to support the few thousand residents, including irrigation of crops. Windmills, frequently inactive, powered well pumps in areas of shallow groundwater. The technological development of pumps powered by wood-burning steam engines in the 1890s enabled wells to be drilled to much greater depths and produce far greater flows. From then on, groundwater pumping increased steadily and exponentially, proportionate to population growth and water demands. The depth to groundwater increased dramatically. By the 1940s the water table had dropped so low that the Santa Cruz River flowed only during flood events.

Extended droughts in California and Texas in the 1880s, coupled with the arrival of the railroad, brought huge numbers of livestock to the area. Severe weather patterns, overgrazing, and drought resulted in a landscape vulnerable to the heavy rains that fell in 1890. Erosion, down cutting of watercourses, and long-term range damage result (Tellman et al. 1997). These climatic and human developments worked together to eliminate many former wetlands and perennial watercourses.

The resulting loss of aquatic, semi-aquatic, and riparian ecosystems, and the corresponding loss of species that depend on these habitat types, presents a significant threat to biodiversity in Pima County for this reason: a high percent of Endangered, Threatened or otherwise sensitive species in Pima County are associated with aquatic and riparian habitat types. This presents a significant dilemma given the resource protection and mitigation mandates of the ESA. As a practical matter, the permitting requirements and time delays associated with impacts to watercourse areas are by themselves a significant constraint to public works and private development (Pima County 1999d).

2.2.4.4 Landscape Conservation Management Status

Land ownership/management categories were assessed for level of threat to biodiversity by determining the conservation management status of each category. Conservation Status is adapted from the system devised for the Natural Heritage Database System and utilized in the National Gap Analysis Program. This classification system uses a scale of 1 through 4 to represent the degree of management commitment to biodiversity maintenance (Table 2.3). The purpose of identifying land conservation status as part of an HCP reserve design process is to reveal the real potential for landscape modification and management that may or may not be consistent with conservation goals for a given area.

- Conservation Status 1 lands have the greatest level of protection (represented by the national parks and wildlife refuges)

- Conservation Status 4 lands have the lowest level of protection (represented by urbanized and mined areas)

- Forest service lands are managed for multiple uses and are mostly Status 3

Additional categories to further define level 4 Conservation Status were developed. For example private or public lands, including Unreserved State Trust lands, with no management agreements to maintain native species were assigned a status of 4b.

TABLE 2.3
Conservation Status Classifications

GAP Status	Status Description	Examples
1a	Primarily public lands with permanent protection from conversion of natural cover and a mandated management plan to maintain a natural state within which disturbance events are allowed or mimicked through management.	Some USFWS Wildlife Refuges; some Pima County Natural Preserves; some USFS Research Natural Areas (RNAs); most USFS, BLM, and NPS Wilderness Areas.
1b	Primarily public lands with permanent protection from conversion of natural land cover and a mandated management plan to maintain a natural state within which disturbance events are allowed or mimicked through management, but may contain uses that detract from quality of land such as visitor centers, high levels of traffic through land, heavily used trails and campgrounds. A maximum of five percent of the land is allowed to be managed in an unnatural state.	Some USFWS Wildlife Refuges; some USFS RNAs; some USFW Wilderness Areas; The Nature Conservancy (TNC) deeded lands; some NPS National Parks
2	Primarily public lands with permanent protection from conversion of natural land cover and mandated management plan in operation, but receives uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance. Over five percent of the land is managed in an unnatural state.	Some BOR lands; State Parks; some Pima County Mountain Park lands; NPS National Monument; some BLM American Council of Engineering Companies (ACECs).
3a	Primarily pubic lands managed to maintain biodiversity, but not subject to permanent protection.	Some TNC Nature Preserves; some Pima County Natural Preserves.
3b	Primarily public lands with permanent protection from conversion of natural land cover for the majority of the area, and subject to extractive uses of either broad, low-intensity type (logging), or localized intensive type (mining, bombing, residential). It also confers protection to federally endangered and threatened species throughout the area.	Most Pima County Parks; most USFS unreserved land; most BLM undesignated land; U of A Experimental Range land.
4a	Private or public lands without existing easements or irrevocable management agreements to maintain native species and natural communities; but without existing development or land uses which limit the lands value for conservation purposes, and without entitlements or existing plans for changes in land use intensity.	Grazing lands.

TABLE 2
GAP STATUS CATEGORIZATION
(continued)

GAP Status	Status Description	Examples
4b	Private or public lands without existing easements or irrevocable management agreements to maintain native species and natural communities, with no existing development but with existing uses which limit the lands value for conservation purposes.	Grazing lands.
4c	Private or public lands without existing easements or irrevocable management agreements to maintain native species and natural communities, with no existing development, but with existing land use designations for increased intensity of land uses.	Vacant private lands, with anticipated future land uses.
4d	Private or public lands with entitlements to increased intensity of land uses.	Vacant private lands with approved or planned development projects, recreation-oriented parks, agriculture.
4e	Native American lands	Undetermined
4f	Private or pubic lands with existing development or other uses that minimize value for conservation purposes.	Existing residential, commercial, industrial, transportation, etc.

All lands within Pima County were assigned a Conservation Status of 1–4. Additional subcategories, which further define level 4, were added to reflect the existing potential for modification for uses that are not consistent with conservation goals.

The Land Conservation Status, as it was assigned to different management categories and land use areas, summarizes the patterns of existing biodiversity protection, and shows opportunities for establishing future protection within the CLS (Figure 2.6). For a given land area, the Land Conservation Status provides a snapshot of the real potential for landscape modification and management that may not be consistent with conservation goals. Based on the distribution of general levels of potential threats and stressors, certain general conclusions emerge:

Eastern Pima County has a well-defined set of core conservation areas, primarily centered on higher elevations areas.

Because of the existing level of threats and stressors, coupled with the limited opportunities for increasing the amount of conservation lands within the Tucson metropolitan area, conservation planning should focus on the protection of key resources (e.g., riparian and aquatic habitats, endangered species habitats) and the provision of corridors and connections between more appropriate and feasible conservation areas.

Pima County's conservation planning should focus on augmenting the existing reserve core areas to provide for coverage of additional conservation targets, increasing the coverage of underrepresented conservation targets, and protecting landscape connections between important conservation areas.

Landscape fragmentation and habitat degradation resulting from urbanization, roads and highways, and other linear infrastructure elements represents a significant threat to biodiversity throughout Pima County.

The opportunities for developing a biologically meaningful CLS are substantial. Almost half of Pima County (exclusive of the Tohono O'odham lands) is represented by a Land Conservation Status of 4a and 3b, which although not currently managed for conservation, is *not* committed to more intensive uses.

2.2.4.5 Potentially Problematic Species

The number of species and the relative sizes of populations of species in Pima County have changed during historical times. Some native species have increased, some have decreased, and several species native to other areas have become established. Some of the non-native species have had adverse impacts on other native species. Because these non-native species have the potential to adversely affect native species in Pima County, their role was an important consideration in the development of the SDCP (RECON & SWCA, 2000).

Non-native species (also referred to as exotic species), invasive native species, pets, and livestock are considered here as "Potentially" problematic because they do not always or necessarily pose direct threats to PVS. In many cases, management strategies can offset potential impacts. Invasive plants often compete with desirable native plant species, resulting in an altered ecosystem less capable of supporting native wildlife and more easily degraded by natural events (e.g., tamarisk can out-compete native riparian species for water and nutrients; the spread of invasive grasses can render a palo-verde/saguaro plant community susceptible to long-term damage from wildfires). Non-native wildlife species prey aggressively upon native

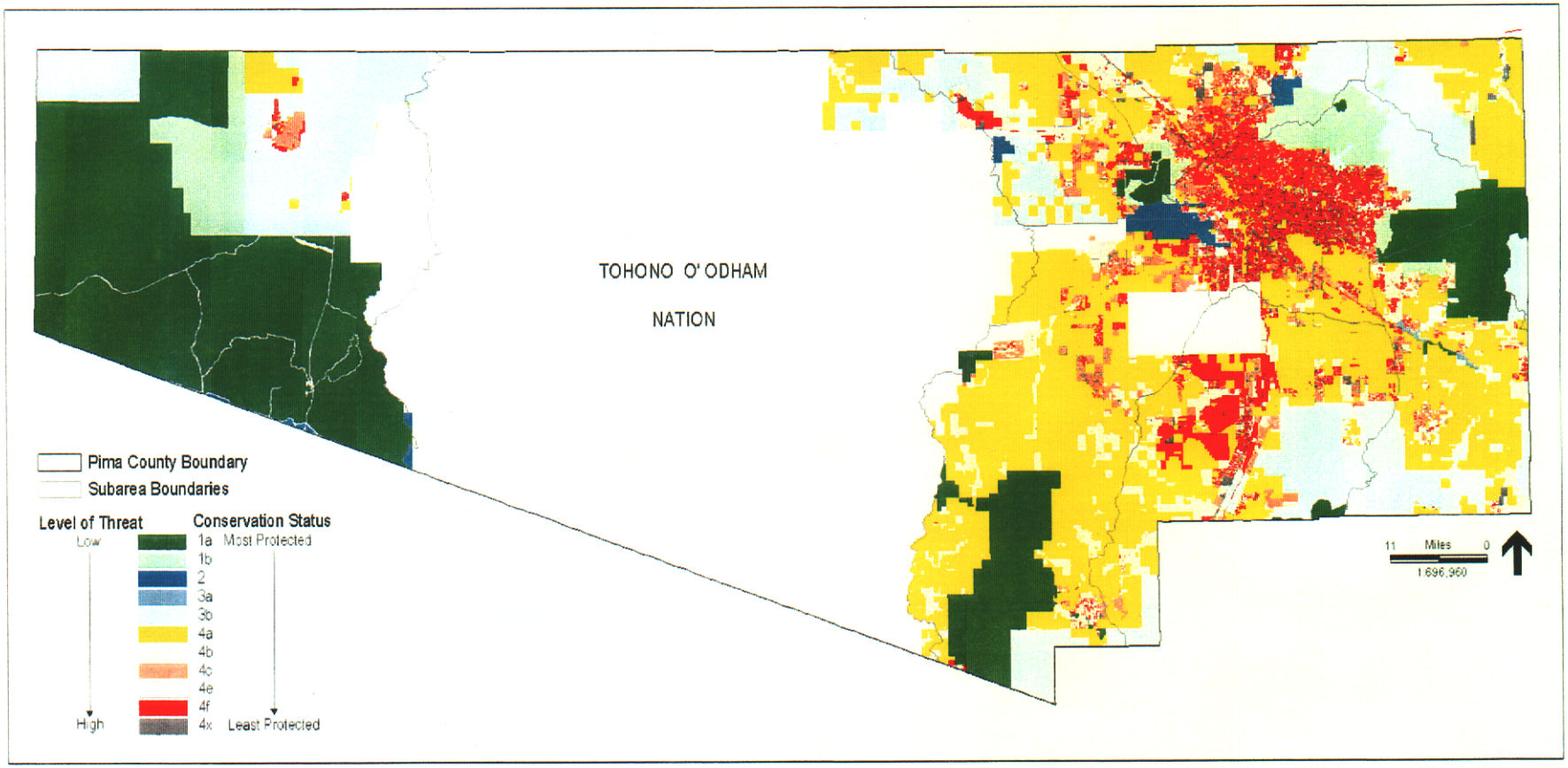

Figure 2.6 Land Conservation Status

wildlife (e.g., bullfrogs are predators of Mexican garter snakes and leopard frogs, cowbirds are nest parasites of some riparian nesting birds.)

Criteria for identifying Potentially Problematic Species

Potentially Problematic Species of Pima County were generally identified using these criteria:

- A non-native species, or an invasive native species that presents a high level of threat to the survival and recovery of PVS or biotic communities of concern (i.e., Special Elements)
- Established in Pima County or likely to become established
- At least moderate management feasibility, at least in certain circumstances

Representative Potentially Problematic Species

Based on those criteria, some of the most significant Potentially Problematic Species are described as follows:

Bullfrog: Significant predator of aquatic and riparian small animal species, known to be established at numerous locations in Pima County, some of which may afford an opportunity for effective control.

Green Sunfish: Important predator of aquatic species, known to be established at several locations in Pima County, potentially controllable with intensive program of repeated poisoning and other methods.

Western Mosquitofish: Potentially important predator/competitor with Gila Topminnow at some locations. May also disrupt aquatic ecosystems and harm other fish species. Potentially controllable, but also important in public health for mosquito control.

Red Shiner: An important predator of aquatic species, known to be established at several locations in Pima County, potentially controllable with intensive program of repeated poisoning and other methods.

Crayfish: Significant predator of native fish, frogs, and Mexican garter snakes. Damages Huachuca Water Umbel. Established in many bodies of water.

Fivestamen Tamarisk: Potentially capable of crowding out other riparian plants and sucking up water. Not as problematic in healthy river and stream corridors, but it takes over in systems that have been damaged by human activities such as damming. Potentially controllable at springs and other very limited water locations, not likely to be controllable along rivers and streams with hydrologic alteration. Important nest substrate for Southwestern willow flycatcher (which is not known to nest in Pima County)—95 percent of nests located last year by AGFD were in Tamarix.

Imported Fire Ant: Not yet established in Pima County, but likely to become established in riparian and urban areas. Potentially disruptive in riparian areas, may out-compete native ants, prey on native insects and disrupt food chain, and may prey on birds and small mammals. Also may impact cave-dwelling species. Hazardous to people; potentially controllable.

Africanized Bee: Well-established in Pima County, effects unknown but may have very significant competition effect on native pollinators and consequential effect on native plants as well as health and life hazard for some wildlife, domestic animals, and people. Potentially controllable, but with difficulty in some situations.

Non-native grasses (Red Brome, Lehman's Lovegrass, Buffle Grass, Bermuda Grass, Cheat Grass): Well-established in Pima County, serious fire hazard for many species of native plants and animals, also may compete with native plants and result in change of food and cover availability for native animals. Potentially controllable in some situations, but control is likely to be very difficult.

Asian mustard: Important competitor of sand dune plants and other plants that require sandy, open soil Known to be established in natural habitats in western Pima County as well as roadsides. Potentially controllable with intensive hand labor at limited sites.

Giant Reed: Potentially capable of crowding out other riparian plants. Due to high water use, may be especially problematic at springs, but may also be especially controllable at springs.

Cattle and other Livestock: potentially damaging by excessive herbivory and soil impacts when not properly managed. Historically have caused or contributed to great damage, but better management appears to be reducing ecosystem stresses. Carefully managed grazing may be neutral or beneficial with some native species management goals.

Rio Grande Leopard Frog: Not yet documented in Pima County but potentially serious predator/competitor with native leopard frogs.

Feral pig: Occurring in the San Pedro Valley in Pima County, feral pigs dig, root and consume plants and ground-nesting birds' eggs. Potentially controllable by trapping and shooting.

People: Last but not least, the impacts of people can be problematic to the conservation of species and ecosystems. Land use and activities can be managed and directed to eliminate, reduce, and mitigate many of the impacts we impose.

Table 2.4 lists potentially problematic species and the PVS they may affect by aquatic, riparian and terrestrial ecosystem types.

Table 2.4
Potentially Problematic Species by Representative Ecosystems

Ecosystems & Landscape Elements	Potentially Problematic Species	Affected Priority Vulnerable Species
Springs	tamarisk, giant reed, Bermuda grass, fountain grass, bullfrog, green sunfish, western mosquitofish, tiger salamander, crayfish, Africanized bees, cattle, horses, burros, tiger salamander, nonnative snails, and introduced fire ants	desert pupfish, Gila topminnow, bat species, Arizona shrew, Chiricahua leopard frog, lowland leopard frog, Merriam's mouse, and Huachuca water umbel
Riparian Systems	bullfrog, green sunfish, bluegill, western mosquito fish, red shiner, bluegill, black bullhead, yellow bullhead, rainbow trout, several species of snails and clams, spiny softshell turtle, tamarisk, giant reed, Bermuda grass, cattle (horses and burros appear to be less of a problem than at springs), feral pigs, bullfrogs, cowbirds, fire ants, and Africanized bees	Chiricahua leopard frog, lowland leopard frog, Mexican garter snake, longfin dace, desert sucker, Sonora sucker, desert pupfish, Gila chub, Gila topminnow, Huachuca Water Umbel, bat species, Merriam's mouse, Arizona shrew, Abert's towhee, Bell's vireo, western yellow-billed cuckoo, southwestern willow flycatcher, and cactus ferruginous pygmy-owl (historically)
Caves and other Carbonate Terrains	People, introduced fire ants, and Africanized bees. People may affect these delicate ecosystems by limestone mining, groundwater depletion, direct development, recreational caving and mine exploring, plant collecting (especially commercial collecting of rare plants), and collecting and observing snails. Fire ants are considered a potential problem as predators on and competitors with native cave-dwelling species. They consume insects that may be food for bats, and may have other ecosystem effects that are currently	Arkenstone Cave pseudoscorpion, Talus snails, Nichol's Turk's head cactus, and Needle-spined pineapple cactus, Mexican long-tongued bat, Allen's big-eared bat, Lesser long-nosed bat, California leaf-nosed bat, and Pale Townsend's big-eared bat. (Although not exclusively dependent on carbonate terrains, many bats are dependent on caves and mines for roosts.)

Table 2.4
Potentially Problematic Species by Representative Ecosystems (continued)

Ecosystems & Landscape Elements	Potentially Problematic Species	Affected Priority Vulnerable Species
	unknown. Africanized bees that develop nests in caves and rock crevices may keep out or drive away bats, affect pollination ecology of plants and compete with native bee species.	
Grasslands	domestic and feral ungulates (cattle, horses, burros), buffel grass, Lehmann's lovegrass, red brome, cheat grass, African daisy, filaree, sweet resin bush, and Africanized bees	Lesser-long-nosed bat, Rufous-winged sparrow, Burrowing owl, Swainson's hawk, Tucson shovel-nosed snake, Organ Pipe shovel-nosed snake, Ground snake, Desert box turtle, Talus snails, Pima pineapple cactus, Acuña cactus, Needle-spined pineapple cactus, Nichol's Turk's-head cactus, Tumamoc globeberry
Desert scrubshrub	cattle, horses, burros, buffel grass, Lehmann's lovegrass, red brome, cheat grass, African daisy, filaree, sweet resin bush, Africanized bees	lesser-long-nosed bat, California leaf-nosed bat, rufous-winged sparrow, burrowing owl, Tucson shovel-nosed snake, Organ Pipe shovel-nosed snake, ground snake, giant spotted whiptail, talus snails, Pima pineapple cactus, Acuña cactus, needle-spined pineapple cactus, and Tumamoc globeberry
Sky Islands	Lesser long-nosed bat, Mexican long-tongued bat, Allen's big-eared bat, Pale Townsend's big-eared bat, Arizona shrew, and several species of talus snails	people, cattle, horses, burros, buffel grass, Lehmann's lovegrass, red brome, cheat grass, African daisy, filaree, sweet resin bush, and Africanized bees

2.2.5 Ecosystem Basis of the PCMSCP

2.2.5.1 Habitat Analysis and Species Distributions

As part of the scientific basis for determining a reserve design for the PCMSHCP, the STAT, consultant team, and species experts compiled information on species' requirements and conducted habitat analysis and mapping for the PVS. This effort is summarized in the report, "Priority Vulnerable Species: Analysis and Review of Species Proposed for Coverage by the Multiple Species Conservation Plan" in May 2001. Details for each species, including status, recovery goals, HCP goals, taxonomy, life history traits, distribution, demographics, habitat requirements, current and potential threats, management needs, and habitat model results, can be found in Appendix C of this document. The discussion below presents a summary overview of the habitat analysis, modeling process, and species distribution results.

Habitat Modeling and Mapping

Initial data collection efforts include the compilation and analysis of species information regarding descriptions, habitats, known locations, generalized habitat maps, and early species potential distribution maps based on GIS models. This process is documented and described in detail in the reports, "Priority Vulnerable Species Data Compilation" (RECON 2000e), and "Priority Vulnerable Species: Habitat Data Analysis" (RECON 2000f). These initial efforts provided a foundation for further analyses and determined the focus for additional work on species habitat, distribution, and modeling.

The next goal was to improve the spatial representation and quality of species data, habitat models and potential distribution maps. A rigorous, iterative process was implemented to refine and improve the species distribution information through a habitat modeling procedure (see Appendix C).

A general overview of the species habitat modeling and mapping effort is as follows. The first step was to compile species information regarding habitat requirements. This information was then incorporated into a species environmental matrix. The species environmental matrix is a Microsoft Excel database that contains habitat variables and the attributes for each variable. For example, vegetation is a habitat variable, the type of vegetation (sacaton scrub, sonoran desert scrub, etc.) is an attribute for that variable. Table 2.5 lists the 14 of the primary variables contained in the species environmental matrix.

Table 2.5
Environmental Variables in Species Environmental Matrix

Category	Environmental Variable	Number of Attributes
Landcover	Vegetation and Landcover	29
	Urban	9
	Mesoriparian	9
	Xeroriparian	13
Hydrology	Perennial and Intermittent Streams	8
	Shallow Groundwater	1
	Springs	2
Topography	Elevation	13
	Slope	9
	Aspect	8
	Landform	15
Geology	Carbonates—Cave and Mine Potential	3
	Geology	1
	Soils	10

The second step in the habitat modeling process was to assess that habitat value for the variables and attributes. For each species, each attribute was given a score that indicates the suitability of a species utilizing that particular environmental variable as it relates to habitat requirement. Scores, ranging from zero to three were assigned to represent the following categories:

- 0–unsuitable
- 1–low value potential habitat
- 2–medium value potential habitat
- 3–high value potential habitat
- mask–unsuitable barrier

The "mask" category indicates that an unsuitable barrier or environmental condition exists that would effectively deter that species from utilizing the area where the mask is present. For example, Merriam's mouse is not found in high elevation, therefore, the elevation attributes ranging from 1,601 to 2,600 meters were assessed as a mask, meaning that it is extremely unlikely for Merriam's mouse to occur in these high elevation areas. For habitat suitability scores, the hydrology variable for the Western Red Bat provides a good example. The Western Red Bat is riparian dependent, so areas such as intermittent and perennial streams were assessed as 3–high value potential habitat. Areas around shallow groundwater were assessed as 2–medium potential habitat, and areas around springs, an area where this bat is not typically found, is scored as 1–low value potential habitat. The team of experts assessed the variables and attributes for each species in the environmental matrix.

The third step in the habitat modeling process was to incorporate the species environmental matrix into GIS. In GIS, each variable is represented by a data layer with attributes, or a grid.

ESRI ArcView Spatial Analyst software was used. Grids were established for each species for variables, so each species had a unique grid for each variable. Environmental data with suitability scores was reclassified into each grid. Some variables were more relevant to species than others. For example, while the Western Red Bat is associated with riparian habitat, it is not necessarily associated with caves, so the carbonate data layer was not considered in the GIS model for this species. On the other hand, the Mexican long-tongued bat is associated with caves, so the carbonate data layer was considered in the GIS model for this species. In all, there were approximately 500 grid layers used in the species habitat modeling process.

The fourth step in the habitat modeling process was to combine the data layers. The Grid data layers were combined in an overlay process so the GIS model considered all relevant data variables and attributes for each species. The result of this modeling process was a map that showed levels of potential suitable habitat for each species.

The fifth step in the habitat modeling process was a quality review check. Known location data for each species (based on Arizona Department of Agriculture June 1999, SWCA 2000, and AGFD HDMS 2000) was incorporated into the potential habitat map to serve as a preliminary model accuracy check. For approximately one third of species, more than 10 data locations were available, however, for most species only a few locations were known. Approximately one third of the species have no known location data. While initial model results gave some indication of potential habitat, most maps were not very definitive. Due to this, a rigorous, iterative process of model review and refinement was begun.

GIS is an important tool for identifying species potential habitat distribution for conservation planning, especially when data may be limited. The habitat modeling procedure is able to predict areas where species are very likely to occur, despite limitations in data and field surveys. While GIS is a powerful tool, it is limited by the data used for the models. The key to making the habitat modeling process successful, with the most accurate potential habitat maps, was the interactive and iterative process between GIS analysts and species experts that improved model accuracy and results.

The interactive and iterative process utilized by STAT, GIS analysts, and expert reviewers was a dynamic procedure. After completion of the modeling, the expert team scrutinized the species potential distribution maps. The team of experts then identified and filled data gaps, continually updated the species environmental matrix, refined model parameters, and made final map adjustments to improve model accuracy. This dynamic process was completed seven times to maximize model efficiency and potential distribution map accuracy. The team of experts was able to provide first hand field knowledge of species likelihood of occurrence throughout Pima County.

The result of the habitat analysis and modeling procedure was a potential distribution map for each PVS that identified areas of high, medium, low and unsuitable potential habitat. Maps for each individual species can be found in Appendix C. The potential species distribution models produced a range of potential habitat classes that were combined by GIS analysts in a logical manner, to reflect the high, medium, low and unsuitable habitat categories. Figure 2.7 is a synoptic presentation of the distribution of the potential habitat for all of the species combined.

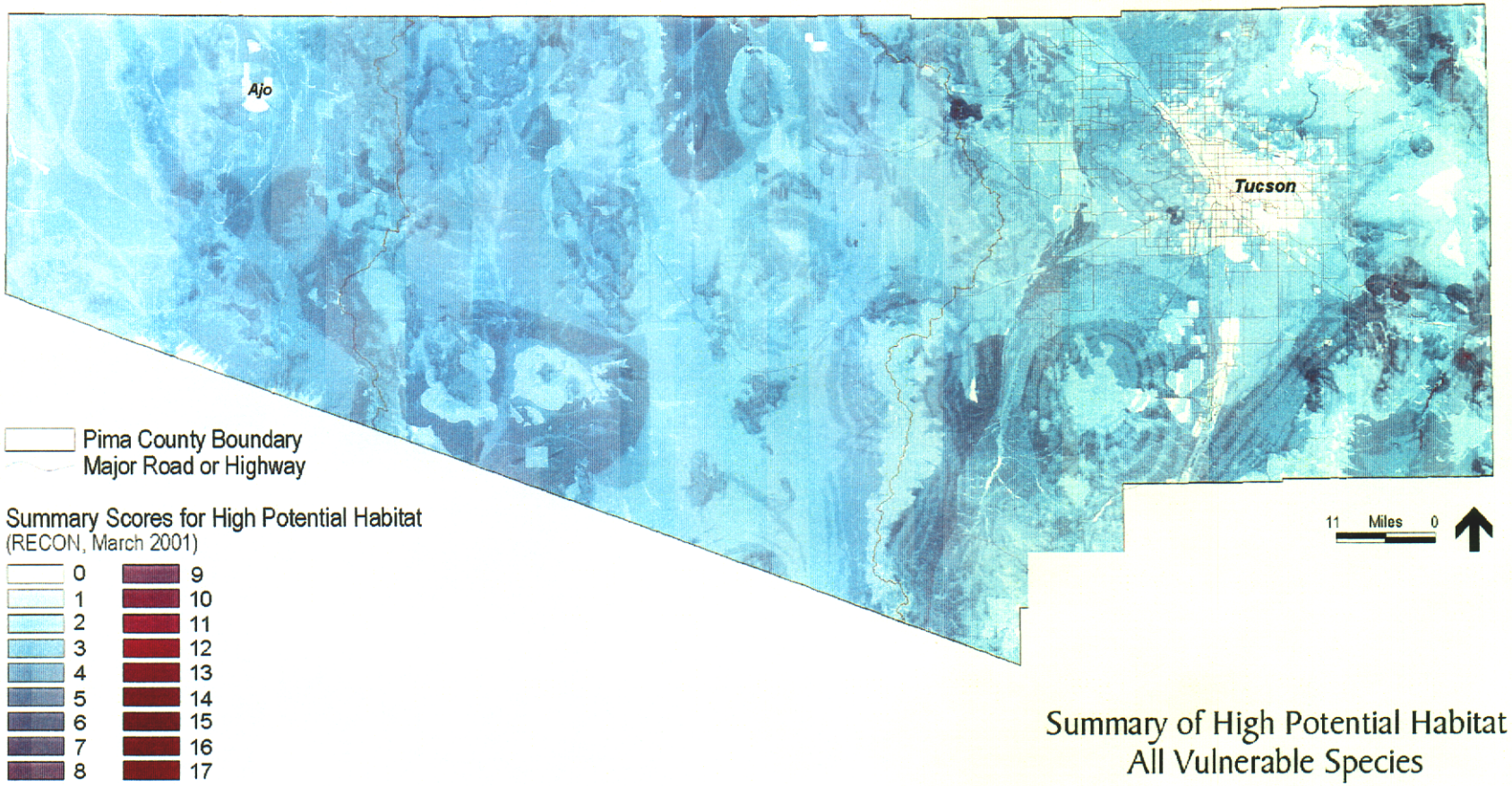

Figure 2.7 Priority Vulnerable Species Richness

Priority Conservation Areas

In addition, the reviewers were asked to identify priority conservation areas (PCAs), based upon their knowledge or experience, that are of significance for conservation of each of the PVS (RECON 2001). This was a means to present important specific knowledge that did not emerge from the species distribution modeling process.

For each species, PCAs were identified according to six tiers:

1. Areas that contained populations that must be included in the reserve system
2. Areas that would be of value to the reserve system
3. Areas that represent critical landscape linkages
4. Areas that have the cotangential for restoration or enhancement
5. Areas that need not be in the reserve system
6. Areas that should not be in the reserve based on fragmentation isolation, or degradation

2.2.5.2 Reserve Design Process

The foundation for the reserve design process was the multitude of layers of information relating to both natural and built environments in Pima County. The process of designing the reserve system for Pima County evolved with the incorporation of input from the iterative review process. The reserve design approach developed by STAT and RECON was founded on the principles of conservation biology applied to the particular species and the habitats of concern in Pima County (RECON 2000c, RECON 2002). GIS has been an important tool in building reserve designs, primarily because of its ability to manage large amounts of spatial data. Overlays were developed to present and understand complex spatial patterns on the landscape, whether the issues are biology, land use, or an intersection of the two. Overlay analysis provided the basis for building the component layers and ultimately the reserve design.

The biologically preferred alternative reserve system was developed based on biological value as assessed by the STAT in cooperation with many experts in the community. The major components of the biological value were vulnerable species habitat, other special habitats identified by STAT, expert-defined priority conservation areas, and USFWS critical habitat for endangered species. Also considered in subsequent analyses was existing urban density, which facilitated identification and removal of areas of lower biological value from the initial reserve system.

The biological value mapping was founded upon data layers representing species richness, a representation of the biological diversity of Pima County. The initial assessment was based on the distribution of high potential habitat for the 41 vulnerable species with mapped information (Figure 2.8). The distribution of high potential habitat was assembled from the GIS modeling of environmental variables for each species, as discussed in the previous section. Areas of higher species richness—places where three or more species have overlapping high potential habitat—are shown in graduated shades of blue.

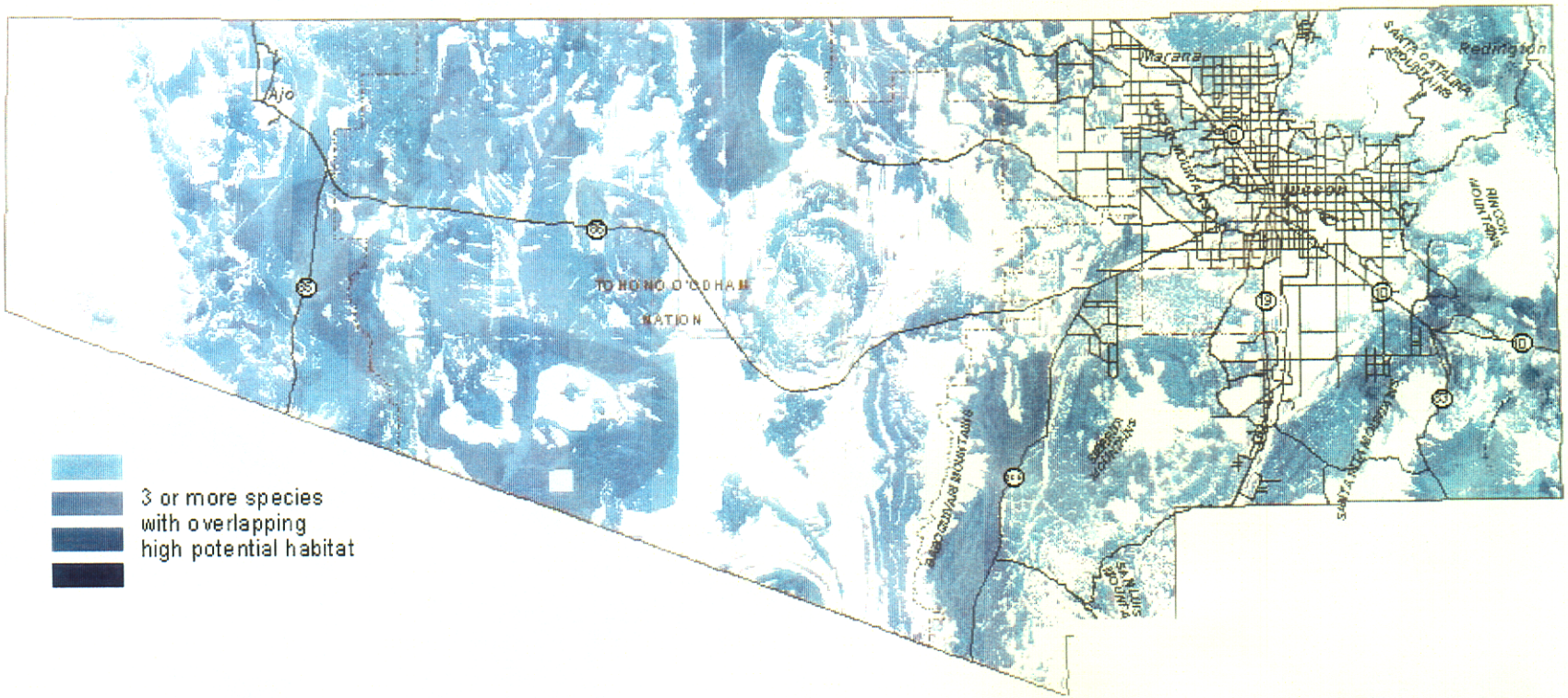

Figure 2.8 Initial Assessment of Areas of High Biological value

These areas of higher species richness provided the starting point for drawing the initial reserve system boundaries (Figure 2.9). The initial reserve system boundaries were delineated on the basis of a complex set of rules developed by STAT, guided by principles of reserve design (Appendix B)

Using the reserve design rules and the principles of reserve design in an iterative process (Figure 2.10), STAT and the consultant team, with assistance from Pima County staff, developed a "biologically preferred alternative" reserve configuration (Figure 2.11). This configuration represents a reserve system with the potential to meet the goals of conservation of the full range of biological resources in Pima County as well as meeting the requirements of Section 10(a)(1)(B) of the ESA for most, if not all, of the PVS. This reserve system configuration was adopted by the Pima County BOS in the Comprehensive Plan Update (2000) as the Conservation Land System (CLS) described in Section 3.1 below.

2.2.6 Proposed Covered Species

Table 2.6 lists the PVS provisionally proposed for coverage in the PCMSCP. The species are listed in order of their Federal status: threatened or endangered (nine species); proposed (one species); candidate (two species); and other PVS. This list is provisional based on the analyses in sections 2.4, Anticipated Incidental Take, and 2.5, Effects of the PCMSCP, in this document and Chapter 4, Environmental Consequences, in the EIS. Modifications of the list of covered species may be made after technical review of these analyses.

2.3 Activities Proposed for Coverage by the PCMSCP

Activities proposed for coverage under the incidental take permit include otherwise lawful activities on non-Federal lands within the Plan Area, such as maintenance of county operations, implementation of capital improvement projects, and issuance of land use related discretionary permits, including those for development.

2.3.1 Criteria for Inclusion

Activities to be covered by the incidental take provisions of the PCMSCP are those within the Plan Area that:

- Are likely to result in incidental take
- Are reasonably certain to occur over the life of the permit
- For which the applicant has some form of control

2.3.2 Covered Activities

The specific categories of activity anticipated in the permit are described below. These include land disturbance activities on approximately 58,000 acres in the first 10 years of the permit, 59,000 acres in the second 10 years of the permit, and 142,000 acres in years 21 through buildout of lands in eastern Pima County, for a total of approximately 260,000 acres of development on non-Federal lands in the Plan Area (ESI and SWCA 2002). Most importantly, from the perspective of the PCMSCP, these activities are anticipated to occur on approximately

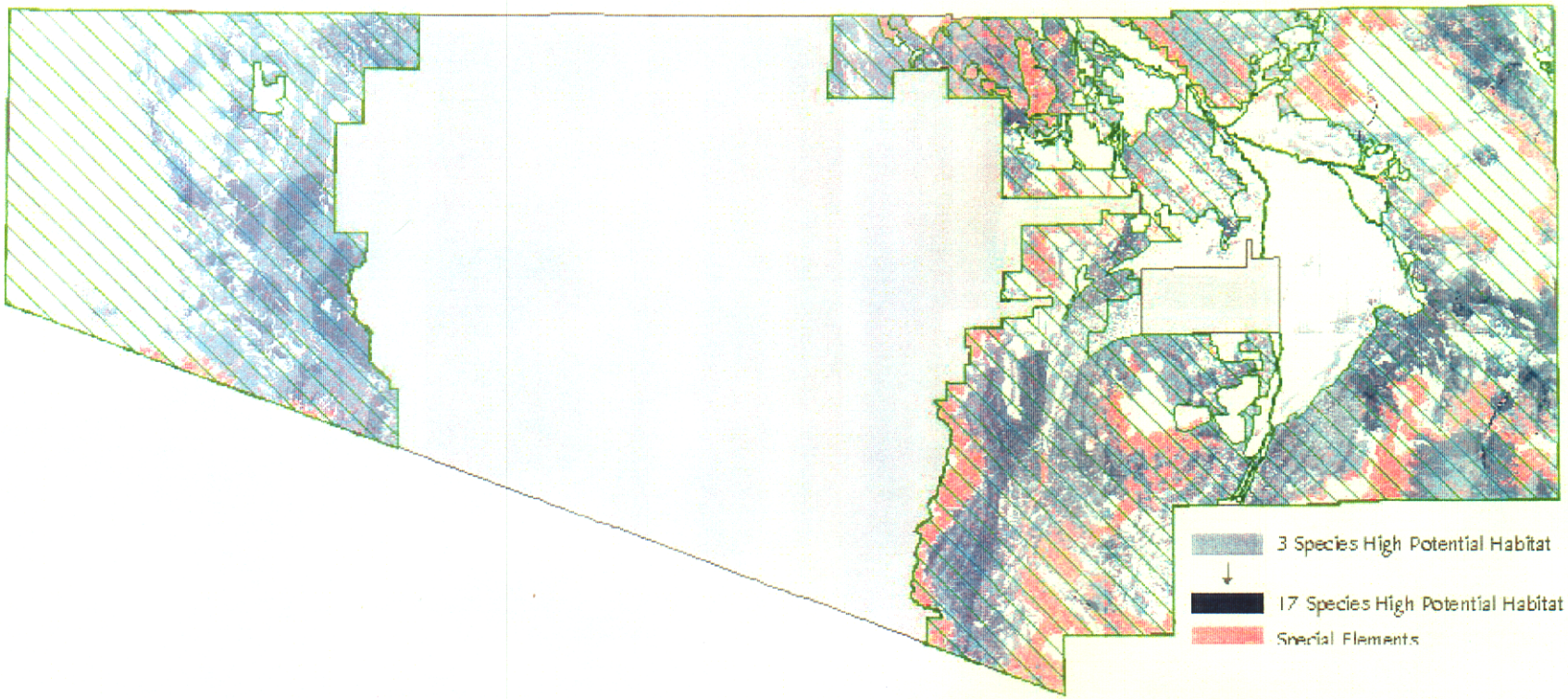

Figure 2.9 Initial Reserve System Boundaries

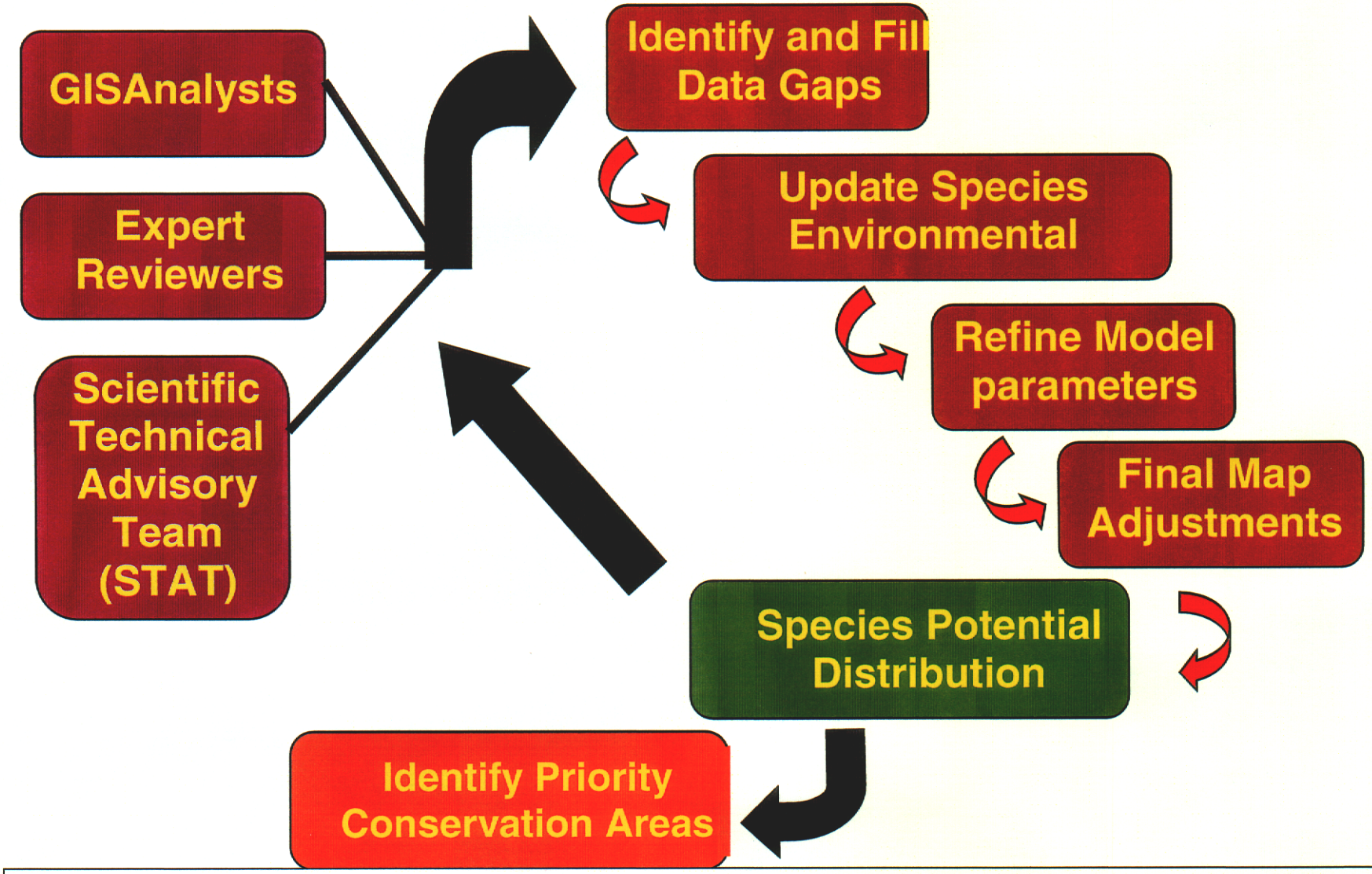

Figure 2.10 Iterative Reserve Design Process

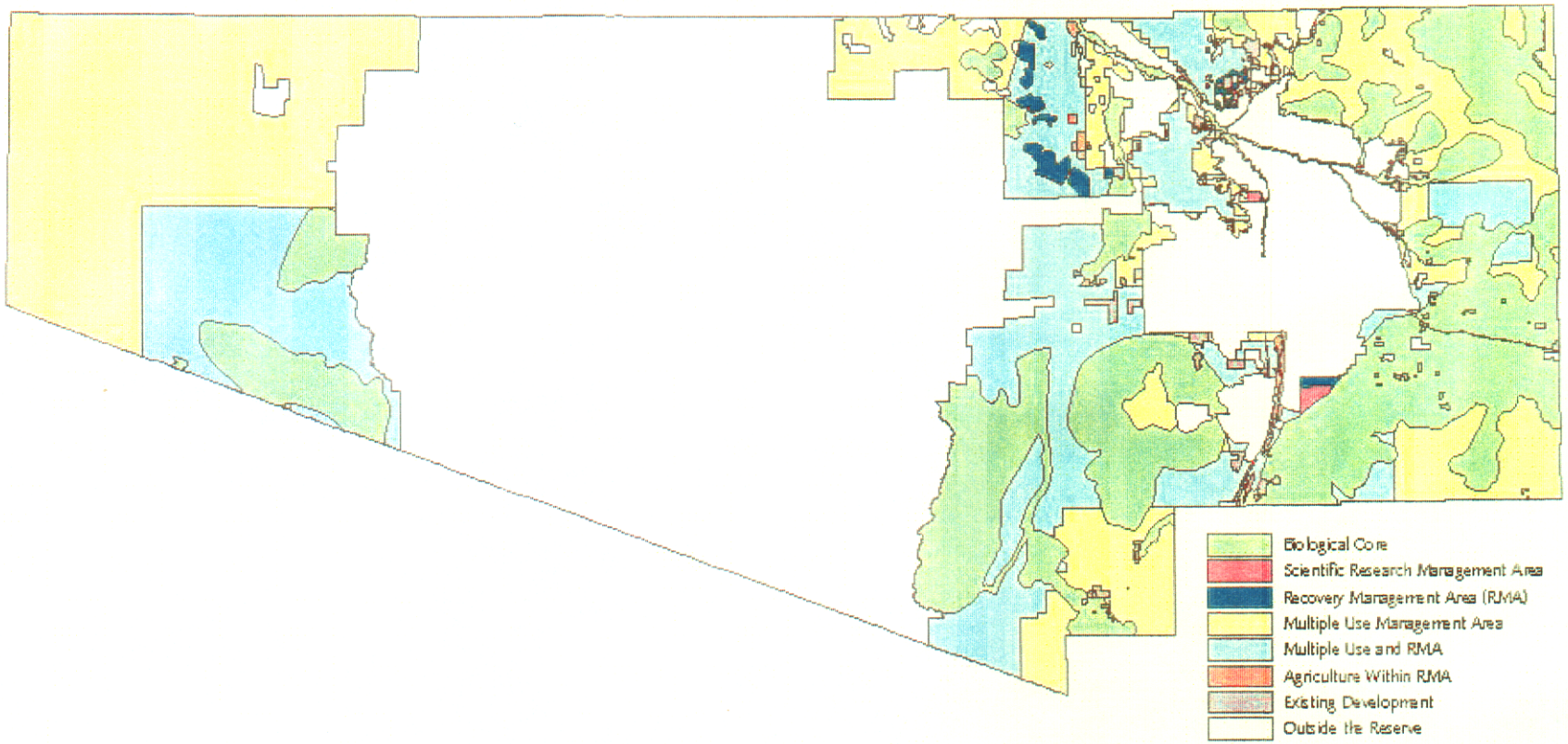

Figure 2.11 Biologically Preferred Reserve Design

Table 2.6
Species Proposed for Coverage Under the PCMSCP

	Common Name	*Scientific name*	Status
Threatened and Endangered Species			
Birds (2)	Cactus ferruginous pygmy-owl	*Glaucidium brasilianum cactorum*	E
	Southwestern willow flycatcher	*Empidonax traillii extimus*	E
Mammal	Lesser long-nosed bat	*Leptonycteris curasoae yerbabuena*	E
Fish (2)	Desert pupfish	*Cyprinodon macularius macularius*	E
	Gila Topminnow	*Poeciliopsis occidentalis occidentalis*	E
Frog	Chiricahua Leopard Frog	*Rana chiricahuensis*	T
Plants (3)	Huachuca water umbel	*Lilaeopsis schaffneriana recurva*	E
	Nichol's Turk's head cactus	*Echinocactus horizonthalonius var. nicholii*	E
	Pima pineapple cactus	*Coryphantha scheeri var. robustispina*	E
Proposed Species			
Fish	Gila chub	*Gila intermedia*	PE
Candidate Species			
Bird	Yellow-billed Cuckoo	*Coccyzus americanus*	C
Plant	Acuna cactus	*Echinomastus erectocentrus var. acunensis*	C
Other Priority Vulnerable Species			
Mammals	Arizona Shrew	*Sorex arizonae*	
	Merriam's mouse	*Peromyscus merriami*	
	Mexican long-tongued bat	*Choeronycteris mexicana*	
	Allen's big-eared bat	*Idionycteris phyllotis*	
	Western red bat	*Lasiuris blossevillii*	
	Southern yellow bat	*Lasiurus xanthinus*	
	California leaf-nosed bat	*Macrotus californicus*	
	Pale Townsend's big-eared bat	*Plecotus townsendii pallescens*	
	Rufous-winged sparrow	*Aimophila carpalis*	
Birds	Abert's Towhee	*Pipilo aberti*	
	Burrowing owl	*Athene cunicularia hypugaea*	
	Swainson's hawk	*Buteo swainsoni*	
Reptiles	Desert box turtle	*Terrapene ornata luteola*	
	Giant Spotted whiptail	*Cnemidophorus burti stictogrammus*	
	Red-backed whiptail	*Cnemidophorus burti xanthonotus*	
	Ground snake	*Sonora semiannulata*	
	Mexican Garter Snake	*Thamnophis eques megalops*	
	Organ Pipe shovel-nosed snake	*Chionactis palarostris organica*	

Table 2.6
Species Proposed for Coverage Under the PCMSCP (continued)

	Common Name	*Scientific name*	Status
	Tucson shovel-nosed snake	*Chionactis occipitalis klauberi*	
Frog	Lowland Leopard Frog	*Rana yavapaiensis*	
Fish	Longfin dace	*Agosia chrysogaster*	
	Desert sucker	*Catostomus clarki*	
	Sonora sucker	*Tumamoca macdougalii*	
Plants	Gentry indigo bush	*Dalea tentaculoides*	
	Needle-spined pineapple cactus	*Echinomastus erectocentrus var. erectocentrus*	
	Tumamoc globeberry	*Catostomus insignis*	

7,000 acres of the CLS in the first 10 years of the permit, 27,000 acres in the second 10 years of the permit, and 71,000 acres in years 21 through buildout of lands in eastern Pima County, for a total of approximately 105,000 acres of development on non-Federal lands in the Plan Area.

2.3.2.1 Development

All non-Federal land development permitted by Pima County in accordance with the Pima County Comprehensive Plan (2001) and applicable regulations will be covered.

2.3.2.2 Pima County Public Works

Public works activities, Including on-going projects, maintenance of County rights-of-way, easements, and properties; and projects identified by the 2004 Capitol Improvement Plan are covered activities.

2.3.2.3 Pima County Flood Control District

The Pima County Flood Control District (PCFCD), as a separate legal entity from Pima County, collects tax revenue for the purpose of funding the construction, inspection, maintenance and repair of public structures along watercourses. Structures receiving maintenance include constructed channels, grade-control structures, retention/detention basins and their inlets and outlets, dry wells, energy dissipaters, and bank protection. Maintenance activities include repairing existing constructed features, removing sediment build-up, clearing vegetation and debris, mowing grass, installing culverts and fences, regrading channels, and maintaining drainageway access roads. The new structures are also built as part of maintenance activities. These structures are funded and installed separately from those installed under the Pima County or PCFCDs Capital Improvements Program (CIP). New construction funded outside the CIP is typically smaller in scale and requires no right-of-way acquisition. (See Appendix D. for description of PCFCD permitted activities.)

2.3.2.4 Agriculture

Although general agricultural activities are not subject to jurisdiction of Pima County, this permit is intended to cover incidental take associated with ongoing agricultural activities on lands under agriculture at the time of approval of the permit.

2.3.2.5 Recreation

Recreational activities, maintenance, and support services for Pima County Natural Resources, Parks and Recreation Department properties and reserves are covered.

2.3.2.6 Other activities

Activities permitted under existing and future land use designations that are consistent with the terms and conditions of the PCMSCP are covered.

2.3.2.7 Monitoring and Adaptive Management Actions

Activities proposed for the purposes of insuring the compliance with the permit, such as surveys, scientific studies and activities associated with monitoring and management described in Chapter 6 are covered.

2.3.3 Federal Actions

Activities on Federal Lands or Federal actions reviewed under Section 7 in Plan Area of this HCP are not covered directly by the PCMSCP. However, Federal land managers and applicants for Federal actions will benefit from: 1) the reduced likelihood of the need to list additional species within the plan area (and the resultant need for additional Section 7 consultations for the newly listed species) because of the comprehensive nature of conservation measures included in the PCMSCP; 2) the streamlining of existing Section 7 requirements for Federal land managers and Federal actions that are consistent with the provisions of the PCMSCP; and 3) the opportunity to make use of the conservation benefits incorporated in terms and conditions of the PCMSCP, including participation in the Adaptive Management Program.

2.4 Anticipated Incidental Take Levels of the PCMSCP

Under the ESA Section 10(a)(1)(B), a conservation plan must detail the impacts likely to result from the proposed taking of the species covered by the proposed incidental take permit. These are to be determined based on the a) identification of the plan area boundary, b) the biological relationships of the species to be covered, c) activities likely to result in incidental take, and a quantification of the anticipated incidental take.

2.4.1 Methods of Calculation of Incidental Take

The goals and objectives of the PCMSCP go beyond the requirements of Section 10(a)(1)(B) in their breadth, primarily based on a landscape level approach to conservation of biological resources in the County. This approach focused on the use of biological data developed at the County scale: including models of high and medium potential habitat for each covered species, Priority Conservation areas for each covered species.

2.4.1.1 Acres of Medium and High Potential Habitat

The foundation layers of information developed for the PCMSCP were maps (models) of the areas of the County with a high or medium potential for occurrence for each of the proposed covered species, based on their known or estimated biological and physical habitat associations. Incidental Take of covered species is estimated by calculating the number of acres of medium and high potential habitat that are both lost (i.e., cleared and developed) and gained (provided by mitigation or otherwise conserved) for each of the covered species.

2.4.1.2 Acres of Priority Conservation Areas

Estimated losses to the various components of the PCAs for each species with defined habitats were also calculated. These losses provide a complimentary assessment of the potential effects of implementation of the PCMSCP on the proposed Covered Species.

2.4.1.3 Expected Level of Incidental Take and Related Impacts

The level of Incidental Take is expected to stay within the thresholds expressed by the STAT as conservation goals for each of the species. These conservation thresholds are expressed as percentages of the medium and high potential habitat that should be conserved and are shown in Table 4.2 in Section 4.

2.4.1.4 Authorized level of Incidental Take

The level of Incidental Take authorized by this permit, as expressed in loss of acres of high and medium potential habitat or PCAs, shall not exceed that identified in the species conservation goals identified by Table 4.2.

2.5 Effects of the PCMSCP

2.5.1 Direct Effects of the PCMSCP on the CLS

In order to evaluate the potential effects of the implementation of the PCMSCP, it is necessary to:

- Delineate the lands within the PCMSCP Plan Area that will be managed under the terms of the plan (the CLS)
- Evaluate the relationship of conserved lands in the CLS to surrounding lands identified as important for their conservation value (the biologically preferred reserve design for Pima County)
- Estimate the potential for loss of lands within the CLS
- Assess the relationship between potential losses in the plan area to potential losses of surrounding lands identified as important for their conservation value
- Assess the effects of effects of potential losses on the PVS proposed for coverage in the PCMSCP

The CLS that is the core of the implementation strategy for the PCMSCP represents the portion of the biologically preferred reserve design developed by the STAT for Pima County that occurs within the Plan Area (and not including Tribal lands within Pima County). The biologically preferred reserve design and the CLS categorize the proposed conserved lands into Biological Core Management Areas, Scientific Research Areas, Multiple Use Management Areas, Special Species Management Areas, and Agriculture In-Holdings within the CLS (see Chapter 3.1 for definitions).

More than 82 percent of the biologically preferred reserve design lands are on lands managed by Federal and State of Arizona agencies (Table 2.7). The Federal agencies, including the BLM, Department of Defense (DOD), USFS, NPS, and National Wildlife Refuges (USFWS), are the largest land managers, with over 58 percent of the biologically preferred reserve design lands. State managed lands, including State Trust Lands, State Parks, and the University of Arizona, cover almost 24 percent of the biologically preferred reserve design.

Table 2.7

Acreages of Biologically Preferred Reserve within Federal and State Jurisdictions in Pima County (excluding Tribal Lands)

	BLM	Dept. of Defense	U.S. Forest Service	National Park Service	National Wildlife Refuge	State Lands	State Park	U of A
Inside the reserve	408,538	57,455	336,483	422,646	517,453	655,581	5,493	53,159
Biological Core	37,686	–	134,945	132,646	24,475	349,387	4,400	–
Scientific Core	–	–	–	–	–	–	–	53,159
Multiple Use/Special	356,027	57,455	189,686	288,569	472,950	267,352	232	–
Agriculture	743	–	–	–	–	2,668	–	–
Important Riparian	14,082	–	11,852	1,431	20,028	36,174	861	–
Outside the reserve	13,810	–	682	34	1	31,02	2	–
TOTAL	422,348	57,455	337,165	422,680	517,454	686,623	5,495	53,159
Percent within reserve	96.7%	100.0%	99.8%	100.0%	100.0%	95.5%	100.0%	100.0%
Percent of reserve	13.7%	1.9%	11.3%	14.2%	17.3%	22.0%	0.2%	1.8%

Approximately 18 percent of the lands in the biologically preferred reserve design, including the CLS within the PSMSCP Plan area, are on incorporated and unincorporated lands (Table 2.8). Pima County's CLS, including unincorporated lands and Pima County Parks and Preserves, covers approximately 430,000 acres or, 14.5 percent, of the biologically preferred reserve design, with the rest within the cities of Marana, Tucson, Oro Valley and Sahuarita.

The direct effects of the PCMSCP include the clearing and development of lands, and would potentially affect components of the CLS and areas predicted as medium and high potential habitat for covered species. Initial projections for new development (Table 2.9), as predicted by the County's economic analysis (ESI and SWCA 2003) were made for the first and second 10-year periods after plan implementation, and for years 21 through buildout (defined as the point when water availability ceases to support additional population). These projections are for eastern Pima County as a whole and include incorporated and unincorporated lands, as well as Arizona State Trust Lands.

Within the PCMSCP Plan Area, these numbers can be compared with the constraints that are implicit in the CLS (Table 2.10). Although the CLS covers 460,000 of the 630,000 acres of unincorporated land in eastern Pima County, some land disturbance is anticipated to occur (see Table 2.9). The projected amount of new development within the PCMSCP Plan Area (195,000 acres), even at buildout, is less than the land available after conservation guidelines are applied to the CLS lands (285,000 acres).

Table 2.11 reflects how the projected acres of new development in eastern Pima County intersect with the PSMSCP CLS. If development proceeds as projected above, this represents the amount of land that would be subject to new development and, therefore, would be potential direct effects of the permit. These losses are one estimate of potential take that could result from the PCMSCP, and do not reflect mitigation requirements as described in Chapter 3.

The projected losses in Table 2.11 were calculated on the basis that the CLS within the PCMSCP Plan Area represents approximately 34 percent of the biologically preferred reserve design within eastern Pima County. The acreages for each CLS Management Area Category were generated from the assumption that they might develop in proportional to their area. This is likely to be a somewhat conservative set of assumptions, because it does not reflect a key spatial aspect of the economic analysis: new development tends to occur immediately adjacent to the built environment, and extend out from the urban core. The CLS, for the most part, encompasses lands away from the urban core that are less likely than the undeveloped land nearer the built environment to be subject to new development.

These estimated losses of lands within the PCMSCP would constitute an overall loss of approximately 38,000 acres, which represents just under nine percent of the CLS on County Lands, or just over one percent of the biologically preferred reserve system countywide. The actual amount of land affected by direct effects will be substantially lessened as a result of conservation and mitigation measures outlined in this PCMSCP. Therefore, the net impact of the PCMSCP is significantly less than what would be incurred without the permit and its requirements. The mitigation for the direct effects of permitting the above projections for land development is discussed in Sections 3 and 4. Although it is assumed that the mitigation required for the projected development during the first decade will be provided at the onset of the permit, the USFWS will require Pima County to revisit the growth projections for subsequent decades and adjust the up-front mitigation required at years 11 and 21.

Table 2.8

Acreages of Biologically Preferred Reserve and CLS within Local Jurisdictions in Pima County (excluding Tribal Lands)

	Pima County	Pima Parks and Preserves	Marana	Oro Valley	Sahuarita	South Tucson	Tucson	TOTALS
Inside the reserve/CLS	401,516	28,981	50,755	11,355	0	13,7575	13,757	2,972,391
Biological Core	157,892	6,489	2,278	282	–	–	1,178	851,685
Scientific Core	–	–	–	–	–	–	871	54,030
Multiple Use/Special	185,889	19,886	39,774	9,460	4,552	–	6,272	1,898,104
Agriculture	6,814	–	310	–	3,683	–	–	14,218
Important Riparian	50,921	2,606	8,393	1,613	984	–	5,436	154,381
Outside the reserve/CLS	197,843	114	24,409	9,729	9,614	652	130,968	418,900
TOTAL	599,359	29,095	75,164	21,084	18,833	652	44,725	3,391,291
Percent within reserve/CLS	67.0%	99.6%	67.5%	53.9%	49.0%	0.0%	9.5%	87.6%
Percent of reserve/CLS	13.5%	1.0%	1.7%	0.4%	0.3%	0.0%	0.5%	99.6%

Table 2.9
Lands Potentially Subject to Direct and Indirect Effects: Projected Future Development

Maximum projected acres of new development Eastern Pima County	1–10 Years	11–20 Years	20–buildout Years	TOTAL
Total	58,195	59,300	142,197	259,692
Outside built environment	13,564	41,769	139,980	195,340
In CLS and biologically preferred reserve	7,193	26,988	75,603	109,784

Table 2.10
Potential New Development Allowable Under CLS Guidelines (acres)

CLS Management Areas	CLS Open Space Guidelines (%)	Potential Minimum Conservation	Potential New Development
Total for PCMCP CLS	–	343,596	87,411
Biological Core	80	132,802	31,578
Multiple Use/Special Species	75/80	159,303	46,472
Agriculture in holdings within the CLS	–		6,814
Important Riparian Areas	95	50,980	2,546
Outside CLS	–	110	197,843
TOTAL	–	343,196	285,254

Table 2.11
Projected Potential Loss of CLS Lands (acres)

CLS Management Areas	1–10 Years	11–20 Years	21–buildout Years	TOTAL
Total for PCMCP CLS	2,466	9,252	25,919	37,638
Biological Core	970	3,638	10,193	14,801
Multiple Use/Special Species	1,142	4,284	12,000	17,425
Agriculture In-holdings within the CLS	42	157	440	639
Important Riparian Areas	313	1,173	3,287	4,773
Total Projected development within Bio Preferred Alternative/CLS in Eastern Pima County	7,193	26,988	75,603	109,784

2.5.2 Direct Effects of the PCMSCP on Covered Species

Over all, the biologically preferred alternative (from which the CLS is derived) provides substantial coverage for the majority of the PVS used in the development of the alternative (Table 2.12). However, inasmuch as the Biologically Preferred Alternative includes Federal, State, and incorporated lands, this represents the potential coverage if all of these entities implement these management actions consistent with the intent of the PCMSCP in their own management efforts.

The relative proportion of the countywide total of high and medium potential habitat for each of the proposed covered species (as predicted by the modeled distributions) that is within the PCMSCP Plan Area varies from 1 to 59 percent (Table 2.13). The PCMSCP Plan Area represents approximately 11 percent of the 5,880,000 acres in the County.

To assess the potential effects of implementation of the PCMSCP, the projected levels of habitat loss identified above can be used to estimate the individual species effects. The amount of high and medium potential habitat for each of the PVS development was overlain with the CLS using GIS analysis. The projected losses of each land management category were cross-tabulated with the distribution of modeled high and medium potential habitat for each species to estimate the amount and proportion of the distribution that might be lost as result of land development within the plan area, which was found to be from 6 to 46 percent (Table 2.14).

Another important consideration is the relationship between the potential losses within the PCMSCP and the remainder of the County. With the assumption that Federal land managers, State Parks, University of Arizona Scientific Research Areas, and Pima County Parks and Reserves will be managed in a manner consistent with goals of the PCMSCP, the potential loss of high and medium potential habitat for each PVS within the CLS can be estimated as a proportion of areas that may be conserved (Table 2.15).

A third measure of the level of take of PVS resulting from implementation of the PCMSCP is provided by assessing the proportion of PCAs that are potentially lost to land development (Table 2.16).

The species specific analyses summarized in Tables 2.14 through 2.16 provide the means to assess the levels of coverage provided by the CLS for each of the PVS with respect to the STAT conservation goals in Table 2.11 (and Table 2.14).

2.5.3 Indirect Effects of the PCMSCP

Indirect effects caused by or resulting from the PCMSCP are more likely to manifest themselves by certain levels of habitat fragmentation, particularly within the urbanizing areas. This is because the development of County and private lands will continue to be lawful activities under the permit. However, the potential for habitat fragmentation on a landscape-scale will be far less than it would almost certainly be without the permit, due to the scale and connectivity of conservation areas identified and protected by the PCMSCP CLS. Other indirect effects such as the increase of invasive species will also be minimized by the PCMSCP.

2.5.4 Cumulative Effects of Other Activities on Covered Species

Cumulative effects, those caused by other projects and activities not covered by the permit, will be minimized by the efforts being undertaken by the town of Marana and the city of Tucson in

Table 2.12
Biologically Preferred Alternative Coverage Relative to STAT Goals for Covered Species (percentages)

Common Name*	High–Medium Potential Habitat in CLS	High Potential Habitat in CLS	Goal for CLS
Abert's towhee	82	80	75
Acuna cactus	**91**	**91**	**95**
Allen's big-eared bat	93	99	75
Arizona shrew	**88**	**94**	**95**
Bell's vireo	79	76	75
Burrowing owl	77	**69**	**75**
Cactus ferruginous pygmy-owl	82	88	75
California leaf-nosed bat	88	95	75
Chiricahua leopard frog	100	100	95
Desert box turtle	90	98	75
Desert pupfish	**98**	**99**	**100**
Desert sucker	98	99	95
Gentry indigobush	**97**	100	100
Giant spotted whiptail	97	99	75
Gila chub	**99**	**99**	**100**
Gila topminnow	98	99	95
Ground snake	95	95	75
Huachuca water umbel	89	99	75
Lesser long-nosed bat	**89**	**94**	**95**
Longfin dace	99	100	75
Lowland leopard frog	76	**73**	**75**
Merriam's mouse	83	93	75
Mexican garter snake	**57**	95	**75**
Mexican long-tongued bat	**94**	**98**	**100**
Needle-spined pineapple cactus	98	99	95
Nichol's Turk's head cactus	92	100	90
Organ Pipe shovel-nosed snake	99	100	95
Pale Townsend's big-eared bat	96	99	75
Pima pineapple cactus	**85**	90	90
Red-backed whiptail	100	100	90
Rufous-winged sparrow	85	99	75
Sonoran sucker	98	99	95
Southwestern willow flycatcher	85	**74**	**75**
Swainson's hawk	81	99	75
Tucson shovel-nosed snake	75	84	75
Tumamoc globeberry	86	89	75
Western red bat	96	96	75
Western yellow bat	**74**	**62**	**75**
Western yellow-billed cuckoo	**68**	**63**	**75**

*Bolded species are below goals

Table 2.13
Proportion of High and Medium Habitat for
Each Species within the Biologically Preferred Alternative

Species	Total Potential Habitat (acres)	Percentages of Habitat w/in Jurisdiction				
		Pima Co.	Federal	State	Cities	Nations
Abert's towhee	192,549	35	25	28	10	2
Acuna cactus	4,564,878	8	28	8	3	53
Allen's big-eared bat	1,580,539	16	35	27	2	20
Arizona shrew	1,792,139	19	33	27	6	14
Bell's vireo	282,823	31	34	22	11	1
Burrowing owl	3,333,523	10	23	8	7	52
Cactus ferruginous pygmy-owl	3,895,362	11	18	12	5	54
California leaf-nosed bat	5,035,583	9	30	11	3	48
Chiricahua leopard frog	223,274	14	58	25	1	3
Desert box turtle	822,145	24	21	46	5	4
Desert pupfish	1,003	22	60	8	9	0
Desert sucker	977	22	60	8	9	0
Gentry indigobush	150,144	20	26	38	0	16
Giant spotted whiptail	91,942	21	31	26	3	20
Gila chub	905	24	57	9	10	0
Gila topminnow	1,003	22	60	8	9	0
Ground snake	3,167,686	10	19	18	2	50
Huachuca water umbel	28,606	59	30	7	4	0
Lesser long-nosed bat	4,730,719	12	23	15	5	45
Longfin dace	583	37	35	12	16	0
Lowland leopard frog	617,500	31	23	26	21	0
Merriam's mouse	1,398,057	25	17	38	9	10
Mexican garter snake	114,741	39	10	8	37	6
Mexican long-tongued bat	1,477,016	17	32	30	2	20
Needle-spined pineapple cactus	385,304	22	27	51	0	0
Nichol's Turk's head cactus	92,513	8	29	0	0	63
Organ Pipe shovel-nosed snake	456,390	2	79	0	0	19
Pale Townsend's big-eared bat	996,508	12	34	17	3	33
Pima pineapple cactus	831,232	24	16	45	6	9
Red-backed whiptail	706,980	1	37	3	0	59
Rufous-winged sparrow	2,934,744	11	14	19	3	51
Sonoran sucker	1,007	22	60	8	9	0
Southwestern willow flycatcher	48,862	56	20	8	13	2
Swainson's hawk	4,293,331	11	26	15	5	44
Tucson shovel-nosed snake	1,132,442	17	8	8	16	50
Tumamoc globeberry	3,784,918	7	27	6	3	58
Western red bat	1,495,466	19	36	37	3	6
Western yellow bat	2,358,745	16	14	15	8	47
Western yellow-billed cuckoo	140,139	51	12	8	24	4
TOTALS	**5,879,508**	**11**	**30**	**13**	**4**	**42**

Table 2.14
Potential Loss of High and Medium Potential Habitat within the PCMSCP Plan Area

Species	Medium and High Potential Habitat in the CLS: Total (acres)	Loss (acres)	Loss (%)	Pima Co. Total High–Medium Potential Habitat (acres)
Abert's towhee	64,520	11,950	19	192,549
Acuna cactus	356,307	153,155	43	4,564,878
Allen's big-eared bat	230,314	60,872	26	1,580,539
Arizona shrew	320,628	107,735	34	1,792,139
Bell's vireo	85,280	21,336	25	282,823
Burrowing owl	327,503	149,936	46	3,333,523
Cactus ferruginous pygmy-owl	387,453	150,314	39	3,895,362
California leaf-nosed bat	407,661	143,664	35	5,035,583
Chiricahua leopard frog	25,624	2,362	9	223,274
Desert box turtle	193,508	57,190	30	822,145
Desert pupfish	168	11	7	1,003
Desert sucker	162	9	6	977
Gentry indigobush	29,811	6,107	20	150,144
Giant spotted whiptail	16,721	1,734	10	91,942
Gila chub	162	9	6	905
Gila topminnow	168	11	7	1,003
Ground snake	324,443	67,856	21	3,167,686
Huachuca water umbel	15,713	3,462	22	28,606
Lesser long-nosed bat	537,534	215,342	40	4,730,719
Longfin dace	161	9	6	583
Lowland leopard frog	177,828	75,256	42	617,500
Merriam's mouse	330,718	120,841	37	1,398,057
Mexican garter snake	41,007	18,283	45	114,741
Mexican long-tongued bat	222,563	52,503	24	1,477,016
Needle-spined pineapple cactus	80,760	12,247	15	385,304
Nichol's Turk's head cactus	7,471	1,374	18	92,513
Organ Pipe shovel-nosed snake	7,008	2,636	38	456,390
Pale Townsend's big-eared bat	323,988	104,234	32	2,996,508
Pima pineapple cactus	187,330	64,187	34	831,232
Red-backed whiptail	9,888	2,384	24	706,980
Rufous-winged sparrow	328,625	81,958	25	2,934,744
Sonoran sucker	168	11	7	1,007
Southwestern willow flycatcher	26,157	4,919	19	48,862
Swainson's hawk	471,117	168,186	36	4,293,331
Tucson shovel-nosed snake	196,087	84,534	43	1,132,442
Tumamoc globeberry	234,385	85,823	37	3,784,918
Western red bat	277,719	50,342	18	1,495,466
Western yellow bat	377,103	170,572	45	2,358,745
Western yellow-billed cuckoo	69,947	20,239	29	140,139

Table 2.15
Potential Loss of High and Medium Habitat in CLS Relative to County Totals

Species	Pima Co. excluding Nations Total (acres)	Federal, State Parks, U of A, Pima Co. Total (acres)	CLS Loss as % Federal, State Parks, U of A, Pima Co.	Goal for CLS expressed as % loss
Abert's towhee	188,366	120,771	10	10
Acuna cactus	2,161,997	1,664,281	9	5
Allen's big-eared bat	1,265,901	832,940	7	25
Arizona shrew	1,542,252	989,373	11	25
Bell's vireo	278,638	188,855	11	25
Burrowing owl	1,598,897	1,125,506	13	25
Cactus ferruginous pygmy-owl	1,775,724	1,169,493	13	25
California leaf-nosed bat	2,611,409	1,961,969	7	5
Chiricahua leopard frog	216,824	162,568	1	5
Desert box turtle	787,769	419,029	14	25
Desert pupfish	1,001	826	1	25
Desert sucker	977	805	1	25
Gentry indigobush	126,837	69,150	9	0
Giant spotted whiptail	73,789	48,351	4	25
Gila chub	905	733	1	25
Gila topminnow	1,001	826	1	25
Ground snake	1,580,512	986,924	7	25
Huachuca water umbel	28,592	25,435	14	10
Lesser long-nosed bat	2,613,337	1,732,680	12	5
Longfin dace	583	423	2	25
Lowland leopard frog	617,500	337,175	22	25
Merriam's mouse	1,255,373	640,688	19	25
Mexican garter snake	107,660	55,670	33	25
Mexican long-tongued bat	1,175,544	744,893	7	25
Needle-spined pineapple cactus	385,304	194,480	6	25
Nichol's Turk's head cactus	34,204	34,201	4	25
Organ Pipe shovel-nosed snake	368,891	367,515	1	5
Pale Townsend's big-eared bat	1,993,186	1,420,063	7	10
Pima pineapple cactus	752,505	377,540	17	0
Red-backed whiptail	288,534	270,742	1	0
Rufous-winged sparrow	1,425,181	814,946	10	5
Sonoran sucker	1,005	831	1	25
Southwestern willow flycatcher	47,658	37,325	13	5
Swainson's hawk	2,425,415	1,634,378	10	5
Tucson shovel-nosed snake	571,463	295,024	29	25
Tumamoc globeberry	1,599,487	1,270,266	7	25
Western red bat	1,412,886	879,581	6	25
Western yellow bat	1,248,194	759,071	22	0
Western yellow-billed cuckoo	133,918	89,744	23	5

Table 2.16
Potential Loss of Priority Conservation Areas within the PCMSCP Plan Area

Species	Acres of PCA in CLS		
	Total	Loss	% Loss
Abert's towhee	23,360	4,453	19
Acuna cactus	13	1	8
Allen's big-eared bat	–	–	0
Arizona shrew	2,117	186	9
Bell's vireo	25,000	4,817	19
Burrowing owl	100,159	37,110	37
Cactus ferruginous pygmy-owl	146,151	57,870	40
California leaf-nosed bat	6,358	1,514	24
Chiricahua leopard frog	3,815	328	9
Desert box turtle	6,671	555	8
Desert pupfish	–	–	0
Desert sucker	–	–	0
Gentry indigobush	16,069	1,388	9
Giant spotted whiptail	14,106	3,786	27
Gila chub	–	–	0
Gila topminnow	–	–	0
Ground snake	13,477	4,521	34
Huachuca water umbel	1,226	104	8
Lesser long-nosed bat	36,619	6,340	17
Longfin dace	2,280	200	9
Lowland leopard frog	18,330	1,638	9
Merriam's mouse	29,657	9,455	32
Mexican garter snake	3,894	457	12
Mexican long-tongued bat	32,654	5,520	17
Needle-spined pineapple cactus	3,763	709	19
Nichol's Turk's head cactus	309	26	9
Organ Pipe shovel-nosed snake	–	–	0
Pale Townsend's big-eared bat	32,965	3,906	12
Pima pineapple cactus	7,623	1,730	23
Red-backed whiptail	1,492	126	8
Rufous-winged sparrow	205,734	48,053	23
Sonoran sucker	–	–	0
Southwestern willow flycatcher	2,173	129	6
Swainson's hawk	173,246	26,229	15
Tucson shovel-nosed snake	14,483	6,192	43
Tumamoc globeberry	–	–	0
Western red bat	660	58	9
Western yellow bat	–	–	0
Western yellow-billed cuckoo	11,285	1,643	15

pursuit of their individual HCPs and Section 10(a)(1)(B) Permits. The total land area covered by the combination of permit areas under these two jurisdictions will constitute the major portion of land area in Pima County, with the exclusion of the Tohono O'odham Nation, Arizona State Trust Lands and Federal lands.

Also minimizing cumulative effects will be the Federal signatories to the PCMSCP who will be assisting in the implementation of conservation actions. The Coordination Agreements between Pima County and the cooperating agencies will establish the PCMSCP goals and management framework as a guiding context for federal land management activities.

2.5.4.1 ESA Section 7(a)(2) Standards, Jeopardy Analysis Framework

Section 7(a)(2) of the ESA requires Federal agencies to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat. The Coordination Agreements will commit any future Section 7(a)(2) consultations to be made in support of the PCMSCP.

2.5.5 Effects on Critical Habitat

2.5.5.1 Cactus Ferruginous Pygmy Owl

Previously designated Critical Habitat for CFPO is currently under reconsideration. The CLS incorporated the best available scientific information on the habitat and recovery needs of this species. Therefore the PCMSCP supports previously designated CFPO Critical Habitat.

2.5.5.2 Southwestern Willow Flycatcher

Designated Critical Habitat for this species occurs along the San Pedro River in northeastern Pima County. Conservation efforts here will continue to include land acquisition, pursuit of conservation easements, partnering with The Nature Conservancy at Bingham Cienega and other conservation strategies to protect Critical Habitat. The Critical Habitat lands have been incorporated into the PCMSCP CLS, as have other areas of medium and high potential habitat for this species.

2.5.5.3 Mexican Spotted Owl

Designated Critical Habitat for this species occurs within the Saguaro National Monument, at higher elevations within the East Unit. Conservation of this area is achieved by the National Park Service and is incorporated into the CLS.

3 MITIGATION PROGRAMS AND STANDARDS

The cornerstone of the PCMSCP mitigation program is the CLS as adopted by the Pima County BOS as part of the Comprehensive Plan Update (see Figure 2.3). The CLS provides a template for implementing the conservation actions within the County that will achieve the goals and objectives of the PCSMCP.

3.1 Conservation Land System

3.1.1 CLS Land-use Designations

The purpose of the CLS is to ensure the long-term survival of the full spectrum of plants, animals, and biological communities that are indigenous to Pima County. The CLS identifies those areas in Pima County that are essential for accomplishing this goal and places them into eight land categories. Listed below are general land-use guidelines associated with each of these land categories. In some cases, more than one category is indicated for a given land unit (for example, Threatened and Endangered Species Management Areas may overlap Biological Core or Multiple Use Management Areas). In these situations, the guidelines for the most protective CLS category for that area should take precedence.

3.1.1.1 Important Riparian Areas

These are areas of very high biological importance distinguished by high potential habitat for five or more PVS and special elements (e.g., caves, perennial streams, cottonwood-willow forests). Land use and management within these areas will focus on conservation, restoration, and enhancement of natural communities, with provision for other land uses that are consistent with improvement of conditions for native species, soils, and native vegetation.

3.1.1.2 Biological Core Management Areas

These are areas of very high biological importance distinguished by high potential habitat for five or more PVS and special elements (e.g., caves, perennial streams, cottonwood-willow forests). Land use and management within these areas will focus on conservation, restoration, and enhancement of natural communities, with provision for other land uses that are consistent with improvement of conditions for native species, soils, and native vegetation.

3.1.1.3 Scientific Research Areas

These areas are currently managed for scientific research: the Santa Rita Experimental Range and the University of Arizona Desert Laboratory (at Tumamoc Hill). Land use and management within these areas focus on balancing conservation, restoration, and enhancement of natural communities in support of scientific research on the environment and natural resources (e.g., monitoring ecological change, measuring effects of experimental grazing methods).

3.1.1.4 Multiple Use Management Areas

These areas are generally defined by the occurrence of high potential habitat for three or more PVS and special elements (e.g., caves, perennial streams, cottonwood-willow forests). Land use and management goals within these areas will focus on balancing conservation, restoration, and enhancement of natural communities with other uses compatible with the maintenance of

biological values. Land uses appropriate for these areas must be consistent with maintaining open space, natural vegetation, and wildlife habitat values.

3.1.1.5 Special Species Management Areas

These are areas defined as crucial for the conservation of plant or wildlife species of special concern to Pima County. Land use and management within these areas will focus on conservation, restoration, and enhancement of habitat for these species.

3.1.1.6 Agriculture In-Holdings Within Conservation Lands System

These are areas identified as having existing or abandoned agricultural uses. Agriculture provides greater permeability than higher intensity land uses for many wildlife species. Changes in land uses in these areas may impact the conservation effectiveness of adjacent or nearby CLS lands.

3.1.1.7 Critical Landscape Connections

These are broadly defined areas that contain potential or existing barriers that tend to isolate major conservation areas. Specifically, these regional-scale areas are located: 1) across the I-10/Santa Cruz River corridors in the northwest; 2) between the Catalina and Tortolita Mountains; 3) across the I-10 corridor along Cienega Creek in the east; 4) across the I-19 and Santa Cruz River corridors in southern Pima County; 5) across the Garcia strip extension of the Tohono O'odham Reservation; and 6) across the CAP canal in Avra Valley. Habitat loss and fragmentation by roads, other infrastructure, and housing and commercial development pose major challenges to wildlife movement in these areas, and high priority should be given to the identification, preservation, and reconnection of habitat linkages.

3.1.1.8 Existing Development Within Conservation Lands System

These are areas within the CLS identified as having existing development that could be intensified under existing zoning. Changes in land uses in these areas may impact the conservation effectiveness of adjacent CLS lands

3.1.2 Urban Development Guidelines for Lands within the Conservation Lands System

The Environmental Element of the CLUP was adopted by the BOS on December 18, 2001. Under state law, the Environmental Element requires analysis, planning, and strategies to address anticipated effects of land-use changes associated with proposed development on natural and cultural resources. The SDCP provides a strategy for natural and cultural resource protection by identifying conservation goals and defining the CLS. The following guidelines and procedures ensure that the SDCP conservation goals are given proper consideration in evaluating development proposals. Nothing in these guidelines shall alter, modify, decrease, or limit existing and legal land uses, zoning, permitted activities, or management of lands within the CLS.

3.1.2.1 Guidelines

The CLS is designed to protect biodiversity and provide land-use guidelines consistent with the conservation goals of the SDCP.

New applications for land-use changes within the CLS will be evaluated to ensure that the following guidelines are met. In the case of land parcels that include more than one of these CLS categories, the guidelines should be met for each CLS subsection of that parcel (i.e., if a parcel consists of some land that is Multiple Use and some that is Important Riparian, each subsection should comply with the guidelines for the respective CLS category).

Important Riparian Areas

Land-use changes should retain at least 95 percent of the riparian area's land cover in a natural or undisturbed condition. This protective level also applies to all washes with a 100-year discharge of 250 cubic feet per second or larger, regardless of whether such wash is located within or outside the CLS boundaries.

Biological Core Management Areas

Land-use changes within Biological Core Management Areas should retain at least 80 percent of the land in natural vegetation and in a configuration that achieves actual conservation of the native species that may occupy that landscape.

Scientific Research Areas

Scientific Research Areas should continue to be managed for the purpose of scientific research on the environment and natural resources. Scientific research activities should minimize any long-lasting impacts that may affect adjacent or nearby CLS lands. Any land-use changes subject to Pima County jurisdiction should achieve the conservation goals of the underlying CLS category.

Multiple Use Management Areas

Land-use changes within Multiple Use Management Areas should retain at least 75 percent of the land in natural vegetation and in a configuration that achieves actual conservation of the native species that may occupy that landscape.

Special Species Management Areas

Land-use changes within Special Species Management Areas should retain at least 80 percent of the land in natural vegetation and in a configuration that achieves actual conservation of these species that may occupy that landscape.

Agriculture In-Holdings Within the Conservation Lands System

Land-use changes within these areas should emphasize the restoration of natural vegetation communities. Development within these areas should be configured in a manner that does not compromise the conservation values of adjacent and nearby CLS lands.

Critical Landscape Connections

Land-use changes in these general areas should protect existing biological linkages and attempt to remove barriers and restore fragmented corridors of natural habitat (Figure 3.1).

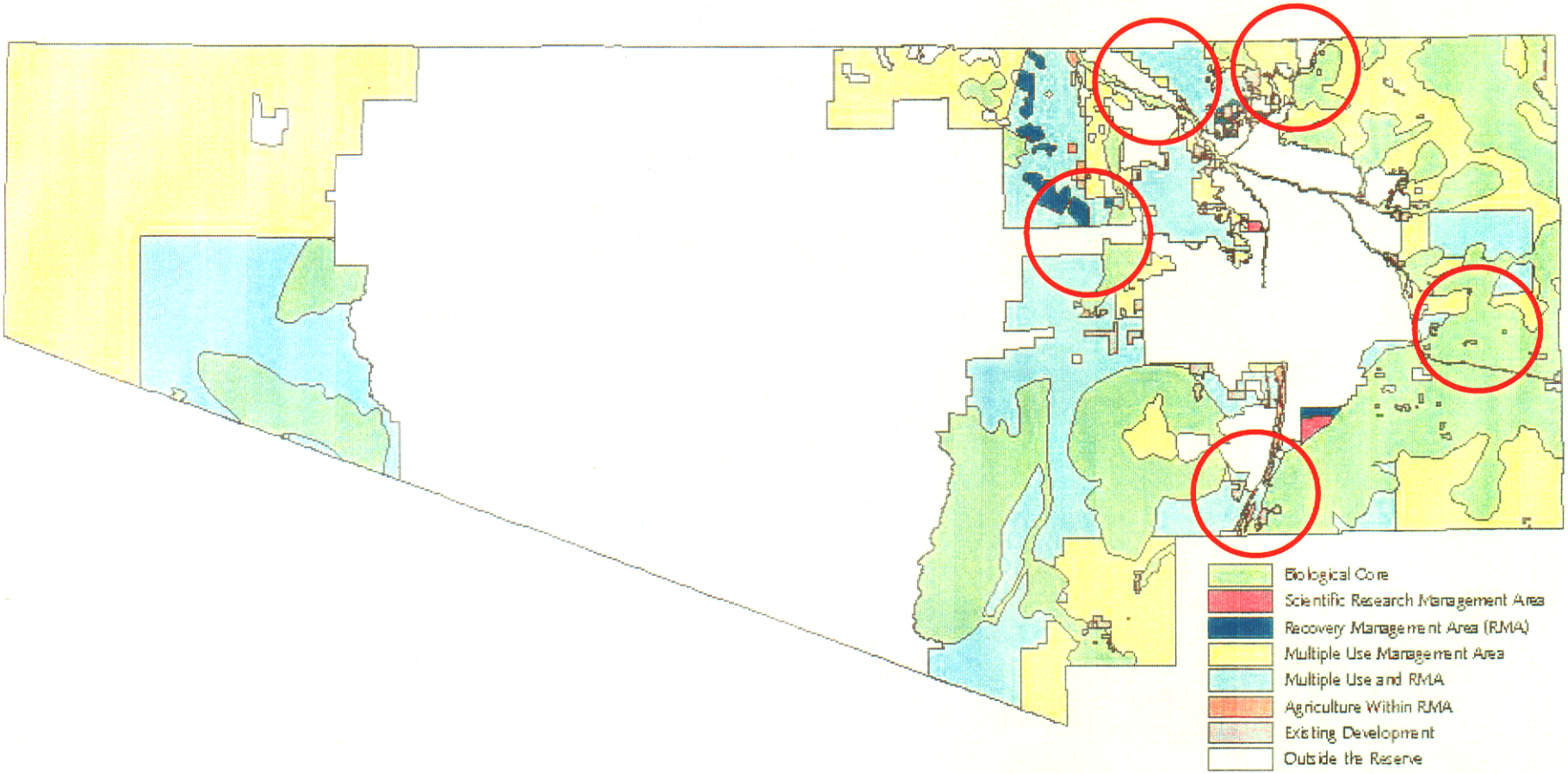

Figure 3.1 Critical Landscape Linkages

Existing Development within Conservation Lands System

Land-use changes within these areas should emphasize the restoration of natural vegetation communities. New development within these areas should be configured in a manner that does not compromise the conservation values of adjacent and nearby CLS lands.

3.1.2.2 Site Design Criteria

Pima County will ensure that direct and indirect impacts of new development on the CLS will be minimized using good land planning and design principles and preserve management provisions. The determination of the specific measures necessary to contain impacts from a new development project, and thereby avoid, reduce, or mitigate edge effects on the preserve to less than significant levels, will be determined through the applicable project and environmental review process.

Site design objectives: avoidance, and/or minimization of impacts to biological resources and ecosystem functions within the CLS from new development, and retention of core areas and functional linkages. Potential impacts from new development on biological resources and ecosystem functions within the CLS that should be considered in the design of any project include:

- Access
- Non-native predators
- Non-native species
- Illumination
- Alterations to surface water
- Depletion of shallow groundwater
- Noise

Development activities usually have profound and permanent impacts on native vegetation and wildlife, both during and after construction. Therefore, there should be only limited, compatible development within the CLS, particularly within linkages, and development, where practicable, should be directed outside the CLS or within disturbed or lower value habitats.

New, higher intensity uses, commercial and industrial uses, and landfills generally are not compatible within the CLS. Lower intensity uses, such as low-density residential (one dwelling unit per one or more acres), utility corridors, and limited water facilities, may be compatible with certain restrictions. Residential development can promote habitat loss and fragmentation; degrade soil, air, water, and visual quality; introduce nonnative species; alter the composition of wildlife communities; and increase predation by domestic animals. Commercial development may have fewer indirect impacts, although lighting impacts can be greater.

Low-density residential development represents a particular challenge. Pima County should provide incentives to cluster development away from core biological areas and sensitive

resources. Careful planning of access, building pads, utilities, fencing, brush management, and landscaping can further minimize impacts.

Existing and planned regional public facilities identified in existing general plans, such as roads, landfills, and other infrastructure, are expected to be incorporated into the PCMSCP in a manner that will allow planned preserve areas to function. Heavily used roads, rail lines, and aqueducts can isolate populations, increase mortality, restrict wildlife movement, interrupt breeding cycles, and affect runoff, among other impacts. Roadway widths have a critical effect on wildlife movement and should be minimized. When roads cannot be relocated, bridges or structures providing wildlife under crossings should be used instead of culverts for all riparian crossings and regional wildlife corridors, and fences should be placed to direct wildlife toward these crossings. If culverts must be used, they should be at least 30 feet wide by 15 feet high with a maximum 2:1 length-to-width ratio. Future and currently unplanned regional facilities will avoid preserve areas, except as needed for public health and safety. Any projects thus constructed cannot compromise overall levels of conservation in the CLS or adversely affect preservation and species goals, and must mitigate accordingly.

3.1.2.3 Reserve Design Criteria

The following criteria will be employed to evaluate the potential effects of proposed activities within the CLS:

- Include measures to maximize the habitat structural diversity of conserved habitat areas, including conservation of unique habitats and habitat features (e.g., soil types, rock outcrops, drainages, host plants)
- Create significant blocks of habitat to reduce edge effects and maximize the ratio of surface area to the perimeter of conserved habitats using the criteria set out above
- Provide incentives for development in the least sensitive habitat areas
- Minimize impacts to narrow endemic species and avoid impacts to PCAs for these species
- Preserve the biological integrity of linkages between Core areas
- Achieve the conservation goals for covered species and special elements

3.1.2.4 Design Criteria for Linkages and Corridors

The following criteria will be employed in the process of designing and evaluating linkages and corridors within the CLS:

- Habitat linkages will be maintained
- Existing movement corridors within linkages will be identified and maintained
- Corridors with good vegetative and/or topographic cover will be protected
- Regional linkages that accommodate travel for a wide range of wildlife species, especially those linkages that support resident populations of wildlife, will be selected

- The width of a linkage will be based on the biological information for the target species, the quality of the habitat within and adjacent to the corridor, topography, and adjacent land uses. Where there is limited topographic relief, the corridor must be well vegetated and adequately buffered from adjacent development.

- If a corridor is relatively long, it must be wide enough for animals to hide in during the day. Generally, wide linkages are better than narrow ones. If narrow corridors are unavoidable, they should be relatively short. If the minimum width of a corridor is 400 feet, the length should be no longer than 500 feet. A width of greater than 1,000 feet is recommended for large mammals and birds. Corridors for bobcats, deer, and other large animals should reach rim-rim along drainages, especially if the topography is steep.

- Visual continuity (i.e., long lines-of-sight) will be provided within movement corridors. This makes it more likely that the animals will keep moving through the corridor. Developments along the rim of a canyon used as a corridor should be set back from the canyon rim and screened to minimize their visual impact.

- Corridors with low levels of human disturbance, especially at night, will be selected. This includes maintaining low- noise levels and limiting artificial lighting.

- Barriers, such as roads, will be minimized. Roads that cross corridors should have 10-foot high fencing that channels wildlife to underpasses.

3.1.2.5 Procedure To Demonstrate Compliance

Applications for land-use changes requiring approval by the BOS shall include information that provides: 1) mapped and descriptive documentation of the natural resources of the area applicable to the site; and 2) mapped and descriptive explanations as to what extent natural resource disturbance will occur, if at all, and how actual conservation will occur as part of the development.

"Actual conservation" means a demonstration of in-place conservation or mitigation where natural biological resources are protected from loss, or where disturbed areas are restored to the level of biological resources surrounding the disturbed area. Actual conservation also means siting development in the least sensitive portions of the property and in a configuration that achieves actual conservation of the native species that may occupy the landscape.

Conservation actions are to be encouraged, and protection of biological resources is considered an essential component of land-use planning.

3.2 Regulatory Standards and Relationship to Recovery

Section 10(a)(2)(B) of the ESA identifies Permit Issuance Criteria that must be met before the USFWS may issue an incidental take permit. Included are criterion that:

- The taking will be incidental

- The applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking

- The applicant will ensure that adequate funding for the HCP and procedures to deal with unforeseen circumstances will be provided

- The applicant will ensure that other measures that the Services may require as being necessary or appropriate will be provided

- The Services have received such other assurances as may be required that the HCP will be implemented

- The taking will not appreciably reduce the likelihood of survival and recovery of the species in the wild

According to the ESA this last statutory criterion is important because it establishes a standard for any covered species and any listed species affected by the PCMSCP. The wording of this criterion is also used in the definition of "jeopardy" under the ESA Section 7 regulations (50 CFR Part 402.02), which defines the phrase "jeopardize the continued existence of" as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species."

3.2.1 Recovery: Mandate vs. Enhancement

While Section 10 does not mandate recovery, the USFWS will not permit activities that preclude recovery of covered and/or listed species. The ESA does not explicitly require the PCMSCP to recover species or contribute to the objectives identified by adopted Recovery Plans, but the USFWS must consider the extent to which the PCMSCP is likely to enhance the habitat of the covered species or increase the long-term survivability of the species or their ecosystem. Therefore, the PCMSCP has been developed to produce a net positive effect on all covered species, whether listed or not.

3.2.2 Recovery Plans & Goals

Several of the PCMSCP covered species have a Recovery Plan (draft or Final) promulgated by the USFWS:

- Lesser long-nosed bat

- Cactus ferruginous pygmy-owl (2003 draft)

- Southwestern willow flycatcher

- Desert pupfish

- Gila topminnow

- Nichol's Turk's head cactus

The Recovery Plans for these species will be used as the basis for identifying minimization and mitigation measures, for information on appropriate management strategies, and for identifying monitoring needs and protocols. In the absence of other information approved by the USFWS, the Recovery Plans will be assumed to constitute the "best available science" for a species.

3.2.3 Recovery by Cooperation with Private Landowners: Safe Harbor Agreements

This program provides assurances to non-federal partners who participate in conservation and recovery efforts on their private property. Safe Harbor Agreements will be authorized under the PCMSCP to allow landowners to restore habitat and allow the return of covered and/or listed species to their property without the ESA land use restrictions that would otherwise pose concern.

3.2.4 Recovery by Reintroduction of Covered Species

Section 10(j) is the provision for experimental populations of plants or wildlife species being reintroduced back into their historic range without certain land use restrictions that would otherwise come into play. This flexibility in rules is provided to reduce potential economic threats while benefiting the recovery of species. Reintroduction will be permitted under the PCMSCP, particularly as it applies to covered aquatic species of fish, frogs, snakes, turtles and plants, in order to augment populations or individuals of the species to increase the likelihood of their metapopulation health and recovery.

3.3 Benefit of the HCP to Covered Species

The CLS has been designed and the PCMSCP has been developed to produce a net positive effect on all covered species, in spite of the authorized Incidental Take that may occur over the life of the Permit. Pima County's intent has been to seek flexibility by including planning for listed as well as unlisted species, to take an ecosystem and landscape-level approach to biological conservation and thereby reduce future conflicts and possibly preclude future listing of species.

Specifically,

- The taking will be incidental to otherwise lawful permitted activities. Pima County does not consider "Take" of covered species a legitimate purpose of any permitted activities

- Pima County will, to the maximum extent practicable, minimize and mitigate the impacts of any incidental take. Minimization of take will be achieved on a landscape-scale by implementing the ecosystem-based CLS, which provides conservation of, and connectivity between biologically rich areas. The CLS further minimizes take by establishing maximum allowable land disturbance (percentages described under Section 3.1). The mitigation levels described under Sections 3.4 and 4.4 will mitigate the impacts of incidental take to the maximum extent practicable.

- Pima County, by putting into effect the funding measures described in Section 3.5 and 6.4, ensures that adequate funding for the PCMSCP is provided and that procedures to deal with unforeseen circumstances will be provided, per Section 5.

- Pima County ensures that other measures the USFWS may require as being necessary or appropriate, such as Coordination Agreements with cooperating agencies, are or will be provided.

Other benefits to covered species are expressed in the high percentages of conservation achieved in the long-term by the CLS, and by the provision of a priori mitigation for the projected growth as described in Section 4.4.

4 MONITORING AND ADAPTIVE MANAGEMENT

The overall conservation strategy of the PCMSCP is primarily goal oriented as opposed to mitigation oriented, although mitigation will play an important part in achieving the goal. Simply stated, the goal of the PCMSCP is the assembly and management of a portion of the landscape of Pima County sufficient to ensure the continued existence of the full diversity of species and ecological systems. This goal can be expressed as the desired future condition (DFC), which in the case of the PCMSCP, must be viewed from several perspectives as discussed below.

Assembly of a system of conserved lands, the CLS, is the first step in achieving the DFCs for the PCMSCP. Critical to the ultimate success of the PCMSCP in achieving the conservation goals embodied in the several DFCs will be the implementation of a program to monitor and manage the conserved lands. The PCMSCP will develop and implement an Adaptive Management Plan (AMP) as the framework for a countywide comprehensive approach to managing conserved lands. The AMP will be guided by the DFCs, overseen by the Science Conservation Commission, and implemented by the entities represented in the Government Working Group. The AMP will have three components: the management plan, the monitoring program, and database management and sharing. The roles of each of these components of the AMP are discussed in detail below.

4.1 Vision of the Desired Future Condition

The DFCs of the PCMSCP permit area is one in which Pima County's biological resource conservation goals are met over the course of the permit period and in the context of the commitments and requirements of the ESA, the SDCP, and the CLUP. DFCs can be defined for the key participants for habitat characteristics of species proposed for coverage in the PCMSCP, and for ecological restoration actions, and management. The DFCs provide an overall set of goals upon which the implementation and management elements of the PCMSCP can be developed, and ultimately, be measured.

4.1.1 ESA

The USFWS DFC for permitted actions is that they not "appreciably reduce the likelihood of the survival and recovery of the species in the wild." Further, impacts to biological resources that may occur because of the permit-covered activities will be minimized, mitigated, and monitored. The HCP Handbook Addendum has established Monitoring and Adaptive Management as the primary tools used to demonstrate that these fundamental requirements are met, by measuring the extent to which conservation commitments are fulfilled and biological uncertainties about the covered species is reduced.

4.1.2 SDCP

The overarching DFC established by STAT is the long-term survival of the full spectrum of indigenous plants and animals through maintaining or improving the habitat conditions and ecosystem functions necessary for their survival. The CLS is the foundation for achieving that DFC. The initial vision for prioritizing lands conservation within the CLS is expressed by the Habitat Protection Priorities in Eastern Pima County (Appendix F) as adopted by the Pima County Board of Supervisors.

4.1.3 CLUP

The DFC expressed by the 2001–2002 CLUP Update establishes parameters for the physically interdependent and compatible urban and conservation lands systems, with the CLS defining the form for current and future urban landscapes. The Natural Resource Protection of the CLUP sets the policies for protecting natural resources according to their value, as defined by the CLS (see conservation standards under Section 3.1).

4.1.4 SDCP and CLUP Subgoals

The SDCP and the CLUP each have specific subgoals, or directives, that Pima County has committed to in order to achieve the DFC by avoiding, minimizing, mitigating, and monitoring impacts to biological resources that may occur as a result of the permit-covered activities. These have been formulated, and in some cases implemented, in direct response to the evaluation of biological threats and stressors and establish the context for future management actions and monitoring criteria. SDCP and CLUP subgoals that more specifically express the MSCP DFCs are summarized as follows.

Habitat Protection Desired Future Conditions

- Future growth and associated infrastructure expansion is focused in areas in closest proximity to existing urbanizing areas, not in areas of highest biological richness

- Intensity of future land uses allowed in certain biologically sensitive areas is significantly lowered (the CLUP 'downplans' over 45,000 acres near major washes, within CFPO habitat, adjacent to Saguaro National Park, in Rincon Valley, and in other sensitive areas)

- Future losses and fragmentation are avoided or minimized by a publicly supported land acquisition and conservation program. Open Space Acquisition funds and other private/public partnerships enable the acquisition of lands adjacent to the existing reserve system and ranches purchased from willing sellers, thereby implementing the Ranch Conservation and Mountain Park Expansion Elements of the SDCP.

- Twenty-six percent of the CLS is prioritized for conservation by the adoption of *Habitat Protection Priorities in Eastern Pima County*. This includes approximately 525,000 acres of Biological Core, Important Riparian Areas, Special Species Management Areas, and Special Landscape Elements (Appendix F).

- Pima County continues to nominate and pursue acquisition of biologically sensitive lands for reclassification by the Arizona State Land Department under the Arizona Preserves Initiative.

- The expansion goals of the SDCP Mountain Parks Element are implemented for Tortolita and other County Mountain Parks by the above and other strategies.

Ecological Restoration Desired Future Conditions

- The Riparian Restoration Element of the SDCP is implemented in partnership with the U.S. Army Corps of Engineers (USACE), USFWS, AGFD, and other state and federal agencies and local jurisdictions. This program and its policies addresses ecological restoration from a comprehensive integrated regional perspective and are initiated by restoration studies of segments of the Santa Cruz and Rillito Rivers and the Ajo Regional Detention Basin.

- Recovery of natural functions within riverine systems is achieved over time. This contributes to the prevention of future T&E species listings and leads to recovery or improved conditions for riparian and aquatic-dependent species, which constitute approximately two thirds of the species covered by the MSCP.

- Restoration and impact mitigation requirements for private lands are strengthened by amendments to ordinances such as the Floodplain Protection Ordinance.

- Opportunities for restoring conservation lands are pursued for upland ecosystems as well and are initiated as part of the management strategy for existing reserve areas and newly acquired lands such as the Empire-Cienega Ranch and Canoa Ranch.

Management Desired Future Conditions

Pima County prepares and implements Management Plans for each of their conservation reserve areas, including existing and future parks and open space lands. Elements in support of the MSCP include:

- Invasive species
- Recreation Use
- Resource protection and restoration
- Enforcement and staffing
- Fire
- Grazing
- Mining & Extraction
- Monitoring high priority species
- Monitoring for ecological health

4.2 Role of Science Commission

4.2.1 Purpose

The purpose of the Science Conservation Commission (SCC) is to provide an overarching view of conservation in Pima County- one that integrates and balances the various elements using

science as a basis for decisions and recommendations. This Commission will oversee the implementation of the MSCP and will monitor the progress of the SDCP.

4.2.2 Composition

The SCC is comprised of representatives of each the Technical Advisory Teams (i.e., Science, Ranching, Cultural Resources and Recreation Technical Advisory Teams) that have been working on parallel tracks to develop elements of the SDCP. (See Section 9 for appointed members.) The SCC will be permanently staffed and funded by Pima County.

4.2.3 Responsibilities

The SCC will inform and advise the Board of Supervisors on matters pertaining to the MSCP, and will have a directing and oversight role in efforts including but not limited to the following:

- Review MSCP Permit Application and annual status reports.
- Track the progress towards meeting goals and reaching DFCs. Recommend changes to management strategies as needed.
- Oversee the implementation of Adaptive Management and Monitoring components of the MSCP. Identify and prioritize research and monitoring needs.
- Identify long-term program and structure elements needed in order to incrementally achieve the MSCP commitments. These may be in addition to those included in the MSCP and/or developed at a more detailed level.
- Prepare "State of the Conservation Lands System" Report. The SCC will oversee the preparation of an annual report that describes and monitors the health of the environment in terms of key indicators (2002. Pima County. State of the Environment Reporting. November). This will be the primary document in support of USFWS-required status reports for the MSCP permit continuance. It will address topics such as baseline conditions, land acquisitions, ecosystem function, change in land cover, invasive species, riparian conditions, ground and surface water conditions, ranch resources, fire management and abiotic resources (air, soil, visual, precipitation, weather, climate trends). (See further discussion under Section 4.4 and 4.5.)

4.3 Role of Government Working Group

4.3.1 Purpose

The purpose of the Government Working Group (GWG) is to function as a collaborative interagency partnership with Pima County to support and benefit from a successful implementation of the MSCP and Adaptive Management and Monitoring Plan.

4.3.2 Composition

The GWG is a consortium of land managers, resource managers and regulatory representatives of state and federal government agencies and local jurisdictions. (See list of participants in Section 8.) Representatives of many of these entities have been meeting together under the

auspices of the Tucson Basin Managers for many years. The GWG will provide additional focus, structure and funding to implement management actions.

4.3.3 Responsibilities pertaining to the MSCP

The GWG will work cooperatively with Pima County and other GWG members with common purposes for natural resource conservation and a focus on management and monitoring efforts pertaining to the MSCP. This working relationship will include formal Working Agreements (see Section 6.2) and a continuing dialogue addressing, but not limited to the following:

- Consistency of management plans (existing and proposed) with regional conservation goals;
- Developing consistent protocols for gathering, sharing and updating information on T&E and other species of concern within various reserve areas;
- Developing mutually beneficial, workable solutions to existing or potential regulatory conflicts;
- Actions needed to raise Conservation Status of lands,
- Actions needed to achieve management compatibility between/along reserve boundaries;
- Increasing knowledge of management issues and effective prescriptions;
- Increasing knowledge of ecosystem health and biological resources, particularly relating to covered species and their habitat types;
- Increasing knowledge of primary threats and stressors to biological resources and effective techniques for their management;
- Ways to contribute and share monitoring knowledge, expertise, protocols, data, on-going efforts, particularly for covered species;
- Adaptations to management and monitoring strategies that are deemed necessary for improved conservation of biological resources;
- Opportunities for intergovernmental training;
- Opportunities for cross-training of staff to expand their management and monitoring capabilities;
- Existing intergovernmental efforts, local or otherwise that can be supported and/or emulated;
- Opportunities for cooperative and coordinated efforts; staffing needs and opportunities for shared responsibilities;
- Cost-sharing and cost-saving strategies;
- Funding needs and mechanisms; opportunities to leverage funding from federal or other sources with local support; and

- Opportunities to increase the effectiveness of the reserve system either by land acquisitions, easements, exchanges or other means.

The GWG will generate information and recommendations, both as a whole and by the parties represented, regarding research, surveys, incremental achievement of goals, State of the Conservation Lands System, and circumstances requiring adaptations to the overall implementation plan. These will be submitted to the SCC for their consideration and use.

4.4 Management Plan: Collaborative Multi-Agency Effort

One of the key lessons learned from regional scale conservation planning elsewhere in the U.S. is the importance of cooperation and coordination among federal, state, and local governmental agencies as well as other land managing participants (Fromer 2002). Ultimately, the success of the program will hinge upon the development of a adaptive management framework that focuses on the application of the best scientific and management principles in a neutral political context (RECON 2001).

The general principles of the adaptive management program to be implemented for the PCMSCP are summarized below and in the initial scope of work (Appendix B). The AMP will begin with this framework as a starting point and evolve and develop under the direction of the Science Conservation Committee and with the cooperation of the Government working Group.

4.4.1 Working Model of Organizational Framework for PCMSCP

Figure 4.1 presents the conceptual framework for organizing the regional effort to manage lands consistent with the PCMSCP conservation goals and commitments.

4.4.2 Interagency Collaborative Management Strategies

Numerous vehicles will be used to facilitate collaborative land management. First are the Cooperative Agreements that the Board of Supervisors has entered into since 1998 with federal land and resource management agencies and other entities to formally establish a common purpose with regard to natural resource conservation. (See List, Appendix A.) Through these Cooperative Agreements many of the PCMSCP conservation objectives have been initiated and/or completed. A number of actions involving federal lands have resulted from close cooperation with federal agencies. Examples of these actions include: establishment of Ironwood Forest National Monument, establishment of Las Cienegas National Conservation Area, wetland and riparian restoration of 120 acres at the Ajo Detention Basin, and initiation of riparian restoration plans for thirty miles of regionally significant watercourses, the Santa Cruz and Rillito Rivers.

Second are the Coordination Agreements that are an integral part of Pima County's MSCP Implementing Agreement with the USFWS. These Coordination Agreements provide additional specificity to the above Cooperative Agreements and serve as the basis for clarifying intent and responsibilities relative to land management, species protection, monitoring efforts, public education and other actions to be taken in support of the MSCP. (See additional detail in Section 6.2, Coordination Agreements.)

Third are the policy changes and ordinances associated with the built environment that cooperating jurisdictions can adopt to assist in meeting conservation goals. Since the inception of the SDCP planning process Pima County has initiated and/or passed a series of Zoning Code

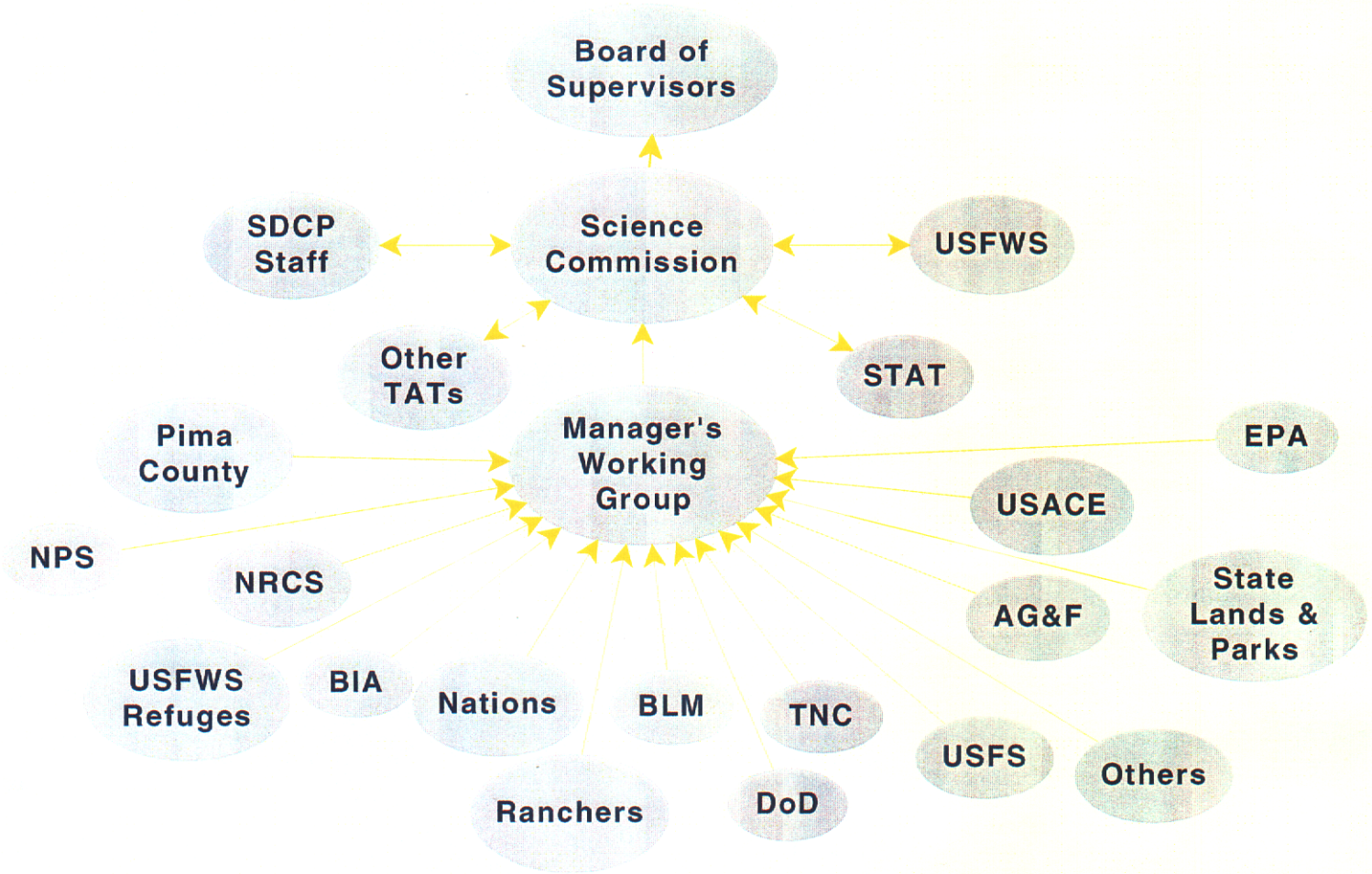

Figure 4.1 Potential Organization of Regional Management Activities

changes to increase protection of biological resources (e.g., Conservation Subdivision Option, Hillside Development Zone & Buffer Overlay, Riparian Habitat Mitigation Standards, Environmentally Sensitive Resource Ordinance). Cooperating local entities will work together to adopt and enforce similar and consistent resource protective ordinances and policies for other jurisdictions.

Other Interagency Collaborative Management Strategies will be conceived and implemented during the course of ongoing dialogue with the GWG, the SCC.

4.4.3 Management Goals and Specific Objectives

4.4.3.1 Land Area Goals and Objectives

The land area based goals and objectives for the PCSMCP are summarized under the discussion of the CLS Management Areas, Sections 2.2.7, and 3.1. They establish specific percentage standards for conserved land within Important Riparian Areas (95 percent), Biological Core and Special Species Management Areas: (80 percent), Multiple Use Management Areas (75 percent), and clarify conservation intent for the other CLS components. The CLS goals and objectives incorporate considerations given to Special Landscape Elements discussed under Section 2.2.3.2.

4.4.3.2 Ecosystem Function Goals for Riparian Areas

STAT adopted specific ecosystem function goals for the management and conservation of Riparian Areas:

- To the extent possible, maintain or restore the connection between interdependent components of river systems: channel, overbank floodplain, distributary flow zones, riparian vegetation and connected shallow groundwater.
    - Maintain or restore natural flooding and sediment balance;
    - Preserve or re-establish connection between channels and their floodplains, and channels and their distributary flow zones;
    - Maintain or re-establish hydrologic connections between riparian and aquatic ecosystems and shallow groundwater zones
- Manage uplands as appropriate to protect the functioning of riparian and aquatic ecosystems within the watershed;
- Manage point-source and non-point source pollution to maintain water quality at a level needed to support SDCP biological goals;

STAT also established guidelines for protecting existing self-sustaining riparian and aquatic ecosystems over the creation of new or enhanced areas of riparian and aquatic life that depend on continuing inputs of water, energy and materials.

- Protect systems that are self-sustaining over those that need continual inputs. STAT prioritizes substitution of renewable water supplies for groundwater and surface water

diversions in areas where high-quality aquatic and riparian ecosystems still exist and where diversion of water is a primary stressor of those systems.

- Restore or enhance native riparian and aquatic ecosystems by releasing water to restore local aquifer conditions. Where ground water pumping is limited and favorable hydrogeologic conditions exist, reclaimed water and secondary effluent can be released into an area in a manner that restores local aquifer conditions. Where hydrogeologic conditions are suitable, restoring localized shallow groundwater systems and floodplain dynamics will have a greater likelihood of success in creating a sustainable system than construction of artificial wetlands and container plantings or seedings of riparian vegetation.

- If plantings are to be used: a) revegetation is favored in areas where perpetual irrigation will not be needed; Ideally, these projects will be designed to avoid disturbance of existing vegetation and minimize the need for perpetual irrigation and maintenance. Placement in areas where hydrologic conditions are suitable can provide the necessary water. b) conflicts with other social objectives should be minimized; Revegetation sites should be chosen to minimize future conflicts with aesthetic, recreation, or public safety considerations. c) native species appropriate to the site must be used; Using native species that are adapted to the specific soil, aspect and elevation of the site will assist in establishment and d) sites which augment existing high-quality riparian habitats are favored.

- Insure sufficient instream flows to achieve and protect natural functions of riparian and aquatic ecosystems.

4.4.3.3 Covered Species Goals and Objectives

Goals and objectives for covered species have been established by the STAT with primary consideration given to the attributes of rarity and endemism. For each of the PVS, the STAT established conservation goal ranging between 75 percent and 100 percent of the modeled high and medium potential habitat within the Study Area (Table 4.1). Other goals for the management and monitoring of covered species are described in species accounts in the PVS report.

The proportions of various elements within the CLS (e.g., species habitat, species known locations, PCAs, special elements, and various land cover types) are detailed in Appendix E.

4.4.4 Hierarchy of Space and Time Priorities

4.4.4.1 Spatial Priorities

Spatial priorities for conservation have been identified generally by the CLS and incorporated into the CLUP. Approximately 26 percent of the CLS has been more narrowly prioritized for conservation by the adoption of *Habitat Protection Priorities in Eastern Pima County.* This includes approximately 525,000 acres of Biological Core, Important Riparian Areas, Special Species Management Areas and Special Landscape Elements (see Appendix F) Pima County's Open Space Acquisition Master Plan identified specific properties for conservation, some of which have been acquired using funds approved by voters in the 1997 bond election. Open space conservation priorities are now being reevaluated in the context of the SDCP *Habitat Protection Priorities* by the Conservation Bond Advisory Committee, whose recommendations will be considered by the Board of Supervisors for inclusion in a bond election scheduled for May 2004.

Table 4.1
STAT Habitat Conservation Goals for Covered Species

Common Name	% Goal for CLS
Abert's towhee	75
Acuna cactus	95
Allen's big-eared bat	75
Arizona shrew	95
Bell's vireo	75
Burrowing owl	75
Cactus ferruginous pygmy-owl	75
California leaf-nosed bat	75
Chiricahua leopard frog	95
Desert box turtle	75
Desert pupfish	100
Desert sucker	95
Gentry indigobush	100
Giant spotted whiptail	75
Gila chub	100
Gila topminnow	95
Ground snake	75
Huachuca water umbel	75
Lesser long-nosed bat	95
Longfin dace	75
Lowland leopard frog	75
Merriam's mouse	75
Mexican garter snake	75
Mexican long-tongued bat	100
Needle-spined pineapple cactus	95
Nichol's Turk's head cactus	90
Organ Pipe shovel-nosed snake	95
Pale Townsend's big-eared bat	75
Pima pineapple cactus	90
Red-backed whiptail	90
Rufous-winged sparrow	75
Sonoran sucker	95
Southwestern willow flycatcher	75
Swainson's hawk	75
Tucson shovel-nosed snake	75
Tumamoc Globeberry	75
Western red bat	75
Western yellow bat (12/01 model)	75
Western yellow-billed cuckoo	75

A high priority will be placed on protecting and managing the biologically rich lands that are most threatened by on-going or near-future development. However, this will be balanced by a long-term strategy for protecting less immediately threatened lands, further from the urban core, particularly when warranted by opportunistic and cost-saving considerations.

4.4.4.2 Temporal Priorities

Temporal priorities will be phased, relative to growth and land absorption. Initial projections for new development, as predicted by the County's growth model (ESI and SWCA 2003) are made for the first and second 10-year periods and for years 21 through buildout (defined as the point when water availability ceases to support additional population). This information projects a maximum additional area of 196,341 acres being developed outside the existing built environment of Eastern Pima County. The area projected for development within the first ten years is between 11,159 and 13,564 acres.

Using these initial 10-year increments as a basis for setting phased priorities, the initial management, monitoring and land acquisition strategies will focus on minimizing and mitigating impacts resulting from the projected development of land. Assuming a worst case scenario of mitigating for lands that become developed within the CLS at a ratio of 4:1, and assuming mitigation would be required "up-front" (i.e., before impacts are accrued) mitigation for years 1, 11, and 21 would be as shown in Table 4.2.

Table 4.2
Temporal Mitigation Priorities for the PCMSCP

Acres of mitigation land required at	Year 1: Onset of permit	Year 11	Year 21
1:1	7,193	34,931	109,784
2:1	14,385	69,863	219,569
3:1	21,578	104,794	329,353
4:1	28,770	139,725	439,137

Although it is assumed that the mitigation required for the projected development during the first decade will be provided at the onset of the permit, additional development of CLS lands beyond the projected 28,770 acres would not be covered by the permit without the provision of additional mitigation. Correspondingly, the USFWS will require Pima County to revisit the growth projections for subsequent decades and adjust the up-front mitigation required at years 11 and 21.

4.5 Monitoring Program

Monitoring is an essential component of the PCMSCP (and AMP) that provides the basis for both assessing and assuring the ultimate success of the plan. Specifically the monitoring program must provide information to (1) evaluate compliance with the terms and conditions of the PCMSCP (Compliance Monitoring); (2) assess the achievement of the biological goals and objectives of the PCMSCP (Effectiveness Monitoring); and (3) provide direction for the adaptive management program (an adjunct to Effectiveness Monitoring). In addition, the monitoring program will provide measures to identify the occurrence of changed circumstances or

unforeseen circumstances, which will require responses as delineated in Chapter 6 of this PCMSCP.

The general guidance in Section 10 requires Pima County to incorporate measures in the PCMSCP to "monitor" the impacts of the taking resulting from activities covered in the plan [50 CFR 17.22(b)(1)(iii)(B) and 50 CFR 222.22(b)(5)(iii)]. These monitoring measures should provide detail and specificity commensurate with the scope and scale of the permit and sufficient to detect anticipated effects.

The general elements of the monitoring program should include:

- Periodic accountings of take,
    - Surveys to determine species status in affected and mitigation areas,
    - Progress reports on fulfillment of mitigation requirements,
    - Established target milestones,
    - Requirements through the life of the permit, and
    - Adaptive management actions.
- The steps in developing an HCP monitoring program:
    - Develop objectives for the monitoring program,
    - Describe the subject of the monitoring program
    - Describe the variables to measured and how the data will be collected
    - Detail the frequency, timing, and duration of the sampling of the variables, and
    - Describe how the data are to be analyzed and who will conduct the analyses,

The biological monitoring program should be sufficient to determine trends in species populations or other biologically important variables in the plan area but should be as economical as possible. The monitoring programs can be conducted by entities other than the permittee as long as (1) this is specified in the HCP, (2) funding is provided, and (3) the entities are qualified.

The monitoring program PCMSCP will build upon the countywide GIS data base developed for the PCMSCP and CLUP processes. This database will be updated and improved through the implementation of the PCMSCP and provide comprehensive information that will be used in both compliance monitoring and effectiveness monitoring.

4.5.1 Compliance Monitoring

The annual compliance monitoring report (as part of the State of the Environment Report) will provide information verifying that the Permittees are carrying out the terms and conditions of the PCMSCP, the Implementation Agreement (IA), and associated agreements. The SCC will be the primary entity responsible for monitoring compliance with the PCMSCP. Other signatories to

the PCMSCP will provide compliance monitoring information to the SCC with respect to their obligations under the PCMSCP to be included in the annual report. The report will outline the status of implementation of the terms and conditions of the PCMSCP, including: financial responsibilities and obligations; management responsibilities; and other requirements of the PCMSCP, IA and agreements. The results of the monitoring report will be presented in an annual public meeting of the Science Conservation Commission.

4.5.1.1 Compliance Monitoring Report

The Compliance Monitoring Report will provide clear and distinct evaluation criteria, defined thresholds, and pre-established review questions. The report will function as a formal annual or periodic review with the USFWS. The report will be prepared and reviewed under the direction of the Science Conservation Commission. The report will be prepared by a trained review team, and incorporate field visits to various sites, as necessary and appropriate. This team will be available for briefing to the STAT, SCC, BOS, and USFWS. To the extent possible, the annual report should provide links to the decision making process with:

- Clear and detailed contingency action steps or plans if terms are not being met.
- Prescribe changes to improve monitoring program to provide needed information
- Prescribe changes to improve management strategies
- Update and/or revise evaluation criteria and review questions for the following year(s).

4.5.1.2 Quantification of Compliance Monitoring

The annual report will quantify for the Administrative Record:

- Annual acquisitions
- Take of covered species
- Impacts to habitat and vegetation communities
- Annual financial status of the plan
- Status of CLS lands
- Status of landscape linkages

4.5.1.3 Compliance Database

The results of the annual compliance report will be incorporated into on-going database management and provide a means for agencies and public to access monitoring data.

4.5.2 Effectiveness Monitoring

The purpose of effectiveness monitoring is to evaluate the effects of activities authorized by the incidental take provisions of the PCMSCP, particularly with respect to covered species. The monitoring effort for the PCMSCP will also monitor the effects of permitted activities on a

broader range of biological resources, in keeping with the broader goals and objectives of the SDCP. The effectiveness monitoring program will provide (1) measures of the progress toward meeting the defined biological goals and objectives of the PCMSCP and (2) information critical to the implementation of adaptive management activities.

The monitoring program will be structured initially in two tiers: countywide monitoring and site specific monitoring. The countywide monitoring program will focus on integrating and coordinating monitoring activities on a countywide scale, building on existing monitoring activities. Site specific monitoring incorporated in the PCMSCP will overlap with site specific monitoring goals and objectives of participating land managers

4.5.2.1 Effectiveness Monitoring Report

The Effectiveness Monitoring Report will provide an evaluation, in both quantitative and qualitative terms, of the effects of activities covered by the permit in the context of conservation activities implemented during each year and on a cumulative basis for the term of the permit. Initially this evaluation will focus on three general aspects of the implementation of the PCMSCP:

- status and trends of populations of covered species (as measured directly or inferred from other appropriate indicators)
- progress and status of assembly of the CLS, and
- response to expected changes in biological circumstances and causative agents.

4.5.2.2 Countywide Biological Monitoring Program

Within two years of issuance of the PCMSCP, the SCC will prepare a countywide AMP, including a comprehensive monitoring plan. The AMP will be developed in consultation with the STAT, USFWS, and AGFD. The AMP will coordinate with management and monitoring efforts of Pima County, the cities of Tucson, Marana, Oro Valley, Sahuarita, South Tucson, USFS, BLM, NPS, DOD, the Nations, and other land managers. The plan will be developed in consultation with the best available scientific expertise. The plan will build upon the GIS data sets developed as part of the PCMSCP and focus on developing cost effective methods for evaluating the assembly of the CLS and monitoring of the effectiveness of management activities in achieving the DFCs.

The AMP will include monitoring of the status and or trends of selected Covered Species, indicator species, habitats, vegetation communities, or other indicator parameters that enable evaluation of the status of the Covered Species and their habitats. The focus will be on the development of the most cost effective means of assessing the general status of the complete suite of biological resources within the plan area, while providing an adequate assessment of the status and trend of the Covered Species.

The AMP will provide guidelines for coordination and integration of monitoring activities throughout Pima County. The monitoring plan will include:

- Methodologies and protocols
- Timing, including frequency, duration, and scheduling

- Locations
- Personnel and equipment needs
- Documentation methods
- Methods of analysis
- Information expected
- Criteria and thresholds for modification of methods
- Criteria and thresholds for modification of management

4.5.2.3 Site Specific Monitoring Programs

In addition to countywide monitoring focused on the assembly and management of the CLS, more site specific monitoring will be undertaken for key ecological systems and for discrete management units. For example, riparian and aquatic systems play an important role for a large proportion of the covered species of the PCMSCP. These systems are localized and fine-grained on the landscape and are not as easily monitored on a large scale as many other of the vegetation communities that provide habitat for other species. Therefore, the development of a cost effective monitoring program focusing on key areas of riparian and aquatic habitats will be of highest priority. Other priorities for site specific monitoring will come from the list of expected changed conditions identified and discussed in Chapter 5.

The monitoring for discrete management units (e.g., Saguaro NP, Ironwood NM, Colossal Cave Park, Tucson Mountain Park, etc.) will be added with input from the land managers.

4.6 Database Management & Information Sharing

The availability and dissemination of high quality information is essential for effective implementation of the PCMSCP. Decisions affecting covered species, as well as, other aspects of the implementation of the PCMSCP, IA, and particularly the AMP are critically dependent upon the quality of information.

Pima County will serve as the central data repository of all scientific data for the PCMSCP for the term of the permit. The County will cooperate with the SCC to facilitate collection, maintenance, management, analysis, and distribution of the data collected for the purposes of compliance, effectiveness monitoring, and management actions under the AMP. The SCC will conduct periodic review of the data reliability and validity, with assistance from the STAT and other qualified reviewers. The database will be updated at least annually with data pertinent to the compliance and monitoring activities. Pima County will ensure data security, compliance with Federal and State standards, and provision of guidance with respect to standards for data submitted by participants.

5 CHANGED CIRCUMSTANCES, UNFORESEEN CIRCUMSTANCES, NO SURPRISES, AND OTHER FEDERAL COMMITMENTS

Section 10 regulations [50 CFR 17.22(b)(2)(iii)] require that an HCP specify the procedures to be used for dealing with changed and unforeseen circumstances that may arise during the implementation of the HCP. In addition, the Habitat Conservation Plan Assurances ("No Surprises") Rule [50 CFR 17.2, 17.22(b)(5) and (6); 63 FR 8859] defines "changed circumstances," "unforeseen circumstances," and describes the obligation of the permittees and the USFWS.

5.1 In General

Pima County has made every effort to anticipate the minimization, monitoring, and mitigation measures (conservation measures) necessary to conserve the Covered Species and the habitats that support those species and, to that end, have relied upon the best scientific and commercial information available. In addition, the AMP and the flexible provisions regarding the expenditure of mitigation funds provided by the County are intended to meet and address future exigencies and emergency situations. Thus, the PCMSCP is intended to reduce the potential for adverse changed or unforeseen circumstances on the Covered Species and their habitats to a level of insignificance. Notwithstanding the provisions of the PCMSCP, if adverse changes or unforeseen circumstances result in, or threaten, a substantial change in the population of any Covered Species or the overall quality of any habitat of that species, as determined pursuant to the procedure outlined hereinafter, the County and USFWS shall cooperate to resolve the adverse impacts in accordance with this section.

The terms "changed circumstances" and "unforeseen circumstances" as defined in this PCMSCP are intended to have the same meaning as defined in the Habitat Conservation Plan Assurances ("No Surprises") Rule:

Changed Circumstances: Changed circumstances means changes in circumstances affecting a species or geographic area covered by a conservation plan that can reasonably be anticipated by plan developers and the Services, and that can be planned for (e.g., the listing of new species, or a fire or other natural catastrophic event in areas prone to such events). If additional conservation and mitigation measures are deemed necessary to respond to changes in circumstances that were provided for in the HCP, the permittee(s) will be expected to implement the measures specified in the HCP, but only those measures and no others.

Unforeseen Circumstances: Unforeseen circumstances means changes in circumstances affecting a species or geographic area covered by a conservation plan that could not reasonably have been anticipated by plan developers or the Services at the time of the conservation plan's negotiation and development, and that result in a substantial and adverse change in the status of a covered species (e.g., the eruption of Mount St. Helens was not reasonably foreseeable). The USFWS will not require the commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources, even upon a finding of unforeseen circumstances, unless the permittee(s) consent. Upon a finding of unforeseen circumstances, the USFWS will be limited to modifications within conserved habitat areas and the HCPs operating conservation program. Additional conservation and mitigation measures will not involve the commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources.

5.2 Methodology for Developing Criteria for Changed Versus Unforeseen Circumstances

The USFWS will determine changed versus unforeseen circumstances based on the likelihood of the change or event occurring during the 50-year PCMSCP permit period. These criteria may be refined during the first year of the permit based upon the collection and analysis of available data on the frequency, geographic scope, and magnitude of events identified below. Data will be from the ecosystems covered by the PCMSCP or appropriate, scientifically comparable surrogate areas.

The data on natural catastrophic events will be analyzed to describe and predict, within appropriate confidence limits, the probability of occurrence of those events during the term of the permit. To the extent that appropriate data are available, the likelihood of occurrence of invasion by exotic species or species-specific disease or any other circumstance that significantly threaten Covered Species or their habitats will also be analyzed.

5.3 Procedure for Determining Occurrence of Unforeseen Circumstances

Prior to making a determination regarding the occurrence of any unforeseen circumstance, the USFWS shall comply with the following procedure:

5.3.1 Notice to Applicants and Participants

The USFWS shall provide written notice to the County together with a detailed statement of the facts regarding the unforeseen circumstance involved, the anticipated impact thereof on the Covered Species and its habitat, and all information and data that supports the allegation. In addition, the notice shall include any proposed conservation measure(s) that is/are likely to effectively address the unforeseen circumstance, an estimate of the cost of implementing such conservation measure(s), and the likely effects upon a) the County and its permittees and b) the existing plans and policies of any involved Federal or State agencies.

5.3.2 Response through the Adaptive Management Plan

The County, in consultation with the USFWS, may choose to perform an expedited AMP analysis of the Covered Species or its habitat affected by the alleged unforeseen circumstance and to modify or redirect existing conservation measures to mitigate the effects of the unforeseen circumstance, within the scope of existing funded conservation actions. To the extent that these modified or redirected conservation measures do not affect conservation of other species, habitats, or key areas, this may be deemed an adequate response to the unforeseen circumstance. If the proposed modifications or redirected conservation actions could affect the conservation of other Covered Species or its habitat, the procedure outlined below will be followed.

5.3.3 Submission of Information by Others

The County and/or other entities shall have a meaningful opportunity to submit information to the USFWS and shall submit such information to the USFWS within 60 days of the written notice as provided above. Upon the written request of any Applicant or Participant, the time for submission of said information may be extended by the USFWS, which will not be unreasonably denied.

5.3.4 County Review

Within 30 days after the close of the period for submission of additional information, the County shall assess: a) the alleged unforeseen circumstances; b) the proposed additional conservation measure(s); c) its effects upon the species and its habitat and the economy and lifestyles of the County and permittees; and d) possible alternatives to the proposed additional conservation measures which would result in the least adverse impacts upon the economy and lifestyles of the County and permittees, while at the same time leading to the survival and recovery of the affected species.

5.3.5 Findings

The USFWS shall have the burden of demonstrating that an unforeseen circumstance has occurred, that such unforeseen circumstance is having or is likely to have a significant adverse impact on the Covered Species or its habitat, and that the proposed conservation measure(s) are appropriate. The findings of the USFWS must be clearly documented and be based upon the best scientific and commercial data available regarding the status and habitat requirements of the species. In addition, based on the results of an expedited AMP analysis of the changed or unforeseen circumstance and the information provided by the Applicants and Participants, the USFWS shall provide the justification and approval for any reallocation of funds or resources necessary to respond to the unforeseen circumstance within the existing commitments of the County under the PCMSCP.

5.4 Changed Circumstances

For the purposes of this PCMSCP, "changed circumstances" include:

- Listing of a new species not covered by this PCMSCP
- Vandalism or other intentional, destructive illegal human activities
- Natural catastrophic events such as fire, drought, severe wind or water erosion, floods, and landslides of a magnitude and geographic scope expected to occur during the term of the permit. The magnitude of natural catastrophic events should be evaluated on the basis of historical records of the frequency and severity of such events, as well as the increased frequency that could be attributed to urbanization. For floods along a given watercourse, this would include a flood in excess of a 100-year event.
- Invasion by new, native and/or exotic species or species-specific disease or any other circumstance that significantly threatens populations of Covered Species or their habitats throughout a substantial portion of their distribution in the Plan Area

5.4.1 Response to Occurrence of Changed Circumstances—Adaptive Management

While the County believes that the initial measures to be funded by the PCMSCP will be effective to conserve both habitats and the Covered Species, it is anticipated that conditions within the Permit Area, the status of habitats, and the overall conditions of individual species over time will change (changed circumstances). In addition, it is quite likely that additional and different conservation measures, not contained within the PCMSCP, will be suggested and be proven effective during the term of the PCMSCP. Finally, measures currently funded by the PCMSCP may prove to be ineffective in the conservation of either species or the habitats in

which they dwell. Therefore, the County, with the cooperation of USFWS and AGFD, are proposing an AMP to gauge the effectiveness of existing conservation measures, and to propose additional or alternative conservation measures as the need arises and to deal with changed circumstances.

In order to mitigate the impact of changed circumstances that may occur at any time during the plan term (including the first year during which thresholds are being developed) and require immediate response, the County and the appropriate State and Federal agencies will conduct an expedited analysis for the purposes of the development of appropriate management responses for the species, habitats, or key areas impacted by any changed circumstance. This expedited analysis will be a function of the AMP.

The analysis will begin as soon as the requisite personnel from the County and the Federal and State agencies can be made available. If specific AMP management analysis has been performed previously for such species, habitat, key areas, or circumstances, then that analysis will be reviewed in light of the changed circumstances. If management protocols for the species, habitats, key areas, or circumstances have not been previously developed as part of the AMP, then their development will be made a priority.

If multiple changed circumstances occur sufficiently close to each other in time such that the response will be significantly delayed due to lack of immediately available personnel or other resources, the County will meet and confer with the applicable agencies in order to prioritize the analyses that need to be done. The purpose of the prioritizing will be to first consider those species, habitats, key areas, or circumstances that are most at risk of further impacts.

The outcome of the analysis will be the development of appropriate measures to minimize to the extent practicable the occurrence of adverse effects resulting from the changed circumstances. The measures will then be implemented. Ongoing management activities may continue until new measures resulting from the analyses are developed. However, as the agencies deem necessary, in consultation with the County, measures will be promptly implemented to minimize adverse effects prior to completion of the analysis to the extent feasible.

5.4.2 New or Proposed Listings of Uncovered Species

The new listing of a species not covered by this PCMSCP may constitute a changed circumstance. The USFWS shall immediately notify the County upon becoming aware that a species which is associated with the habitats found in the Plan Area and which is not a Covered Species (an "Uncovered Species") may be or has been proposed for listing.

Upon receipt of notice of the potential listing of an Uncovered Species, the County may, but is not required to, enter into negotiations with the USFWS regarding necessary modifications, if any, to the PCMSCP. An amendment to the Federal permit is then required to to cover the Uncovered Species. If the County elects to pursue amendment of the applicable permit, the USFWS will provide technical assistance to the County in identifying any modifications to the PCMSCP that may be necessary to amend the applicable Federal permit.

In determining whether any further conservation or mitigation measures are required in order to amend the affected permit to authorize incidental take of such Uncovered Species, the USFWS shall take into account the conservation and mitigation measures already provided in the PCMSCP and cooperate with the County to minimize the adverse effects of the listing of such

Uncovered Species on the covered activities consistent with Section 10(a)(1)(B) of the ESA, as required by the IA.

Once a species is proposed or petitioned and is found to be warranted, the USFWS shall use its best efforts to identify any necessary measures to avoid the likelihood of jeopardy to or take of the Uncovered Species ("no take/no jeopardy" measures).

5.4.3 Significant Population Increases of Listed but Uncovered Species

Increases of populations or geographic distribution of listed species not covered by the PCMSCP, for example jaguars or wolves, also may constitute a changed circumstance, to the extent that the likelihood of take from otherwise lawful activities covered by the plan is no longer negligible. The USFWS shall immediately notify the County upon becoming aware that activities covered by this plan are affected by the prohibition of take of a species which is associated with the habitats found in the Plan Area and which is not a Covered Species (an "Uncovered Species").

Upon receipt of notice of the potential taking of a listed but Uncovered Species, the County may, but is not required to, enter into negotiations with the USFWS regarding necessary modifications, if any, to the PCMSCP required to amend the applicable Federal permit to cover the Uncovered Species. If the County elects to pursue amendment of the applicable permit, the USFWS will provide technical assistance to the County in identifying any modifications to the PCMSCP that may be necessary to amend the applicable Federal permit.

In determining whether any further conservation or mitigation measures are required in order to amend the affected permit to authorize incidental take of such listed but Uncovered Species, the USFWS shall take into account the conservation and mitigation measures already provided in the PCMSCP and cooperate with the County to minimize the adverse effects of the additional conservation measures of such listed but Uncovered Species on the covered activities consistent with Section 10 of ESA, as required by the IA.

5.4.4 Examples of Changed Circumstances

The STAT developed a preliminary list of examples of conditions or occurrences that could be defined as changed circumstances as defined above and as illustrated in Table 5.1. This list is not meant to be exhaustive, or inclusive, but to provide general guidance in future evaluations and determinations of changed circumstances during the term of the PCMSCP.

5.5 Unforeseen Circumstances

For the purposes of this PCMSCP, "unforeseen circumstances" are any events not identified as a changed circumstance and specifically includes:

- Natural catastrophic events such as fire, drought, severe wind or water erosion, floods, and landslides (also landslides associated with earthquakes) of a magnitude exceeding that expected to occur during the term of the permit

- Invasion by exotic species or habitat or species-specific disease that threaten Covered Species or their habitats which cannot be effectively controlled by currently available methods or technologies or which cannot be effectively controlled without resulting in greater harm to other Covered Species than to the affected Covered Species

Table 5.1

Examples of Changed Circumstances

Priority	Circumstance/Scenario	Potential Impact on Covered Species and/or Effectiveness of PCMSCP	Minimization and Monitoring Strategies (on-going or proposed)
High	Utilization of CAP water introduces new non-native aquatic species	Harm could be great to native aquatic vertebrates, as well as infrastructure. New species could include zebra mussel, New Zealand mudsnail, salvinia.	Federally funded monitoring at Cienega Creek; fish barriers installed along Santa Cruz River; Bureau of Reclamation (BOR) grant program; local land-use restrictions on use of raw CAP in floodplains
High	Non-native aquatic species (NNAS) enter Cienega Creek or other aquatic sites from non-CAP sources	Bullfrogs: negative effect on PVS aquatics vertebrates. Crayfish: negative effect on PVS aquatic vertebrates and Huachuca water umbel. Mosquitofish would have adverse effects upon Gila topminnow and would be difficult to remove. Sunfish could affect topminnow and chub. Effects greater if the fish get into Upper Cienega watershed as opposed to lower Cienega.	Eradicate selected pond habitats (e.g., SLD claypit); eradicate non-natives; SHA for natives; support crayfish restrictions on commerce; public education
High	West Nile Virus will take hold in southern Arizona.	Likely to cause increased PVS bird mortality and place restrictive constraints on riparian restoration element.	Proactive vector management with multi-jurisdiction/multi-agency involvement; intensive public education program
High	Urbanization causes further desiccation of other groundwater-dependent riparian systems.	Less aquatic habitat, more strand vegetation. Mesquite bosques and broadleaved deciduous trees will be more stressed, and fewer recruitment events will occur. Habitat quality and quantity for PVS aquatic species will decline. Habitat quality and quantity for PVS species associated with riparian forest will decline.	Buy water rights; prevent rezonings that increase water use; multi-jurisdiction efforts to increase water conservation and public education; substitution of reclaimed water for groundwater for landscape irrigation; reduced groundwater pumping in central well-field and other areas, particularly those areas with remnant riparian and aquatic vegetation.

Table 5.1

Examples of Changed Circumstances (continued)

Priority	Circumstance/Scenario	Potential Impact on Covered Species and/or Effectiveness of PCMSCP	Minimization and Monitoring Strategies (on-going or proposed)
High	Cactus poaching of Nichol's Turk's head	Significant numbers of individual cacti may be removed from reserves or mitigation banks established for them.	Minimize public access especially vehicular public access to the area
High	Regional, decadal-scale drought continues to affect all reserve components. Reduced aquatic habitat, and more strand vegetation. Mesquite bosques and broadleaved deciduous trees will be more stressed, and fewer recruitment events will occur. Periodic desiccation of Bingham Cienega and Agua Caliente ponds. More shrubs, less grass in rangeland areas. Secondary diseases in woodlands and forests.	Declines in habitat quality and extent for species that are dependent on riparian forest structure and aquatic habitat. Periodic elimination of non-native or native fish, potentially other PVS aquatic vertebrates. Decline in the percent of vegetative cover systematically affects regional biodiversity levels Increased erosion and flashier stormflow episodes—may positively or negatively impact PVS fish depending on how they occur.	More emphasis on conserving vegetation in floodplains and sustainability of restoration efforts; restocking native fish; preventing woodcutting and agricultural clearing; conservation of upland soil resources and better livestock management on contributing uplands through cooperative efforts.
High	New genetic information about Talus-snails; Tucson shovel-nosed snake; desert box turtle; ground snake subpopulations; red-backed whiptail subpopulations; and other PVS shows that they are a separate species.	No physical effect on PVS. Legal status may change, however.	Plan to add species information to coverage as needed; support research efforts that inform the Adaptive Management Program.

Table 5.1

Examples of Changed Circumstances (continued)

Priority	Circumstance/Scenario	Potential Impact on Covered Species and/or Effectiveness of PCMSCP	Minimization and Monitoring Strategies (on-going or proposed)
High	Elimination of natural, restored or created wetlands, cienega and cienega-like environments due to social conflict or public perception (airport restrictions; mosquito, other vector and aesthetic preference issues)	Failure to meet biological objectives of habitat restoration and species re-establishment. Destruction of existing wetlands may affect for one or more PVS species related to these habitats.	Don't rely on open-water or created wetlands restoration for satisfying permit conditions
Medium	African sumac, Arundo, and other existing non-native expand further into riparian areas.	Effects upon PVS are impossible to forecast. Arundo already invading Santa Cruz River.	Restrict commercial distribution; restrict use in new development; implement monitoring and control efforts in reserves.
Medium	Expansion in range of non-native grasses continues.	Potential direct negative effect on Pima pineapple cactus. Increased spread of non-native grasses in uplands will encourage wildfires that will severely damage or eliminate local stands of palo verde and saguaro. General effects to watershed and hydrology, insect faunal composition. Direct negative impact to nesting, breeding and roosting habitat of several PVS birds and bats, including CFPO.	Expand monitoring control efforts in reserves; expand educational outreach programs; involve all land managers in control efforts; support community volunteer efforts such as those of the "Weedwhackers"
Medium	Chytrid fungus may appear in Las Cienegas, where it has not been found.	The small population of Chiricahua leopard frog in las Cienegas could be eliminated	Researchers in the aquatic environment should follow protocols for minimizing disease transmission. Plan and implement monitoring for presence/absence of Chytrid fungus

Table 5.1

Examples of Changed Circumstances (continued)

Priority	Circumstance/Scenario	Potential Impact on Covered Species and/or Effectiveness of PCMSCP	Minimization and Monitoring Strategies (on-going or proposed)
Medium	Residential and commercial development in the Vail, Empirita, and Mescal areas continues to increase, along with reliance on groundwater pumping. Lower Cienega Creek will be gradually desiccated by pumping.	Shift to less aquatic habitat, more strand vegetation over time. Mesquite bosques and broadleaved deciduous trees will be more stressed, and fewer recruitment events will occur. Habitat quality and quantity for PVS aquatic species will decline. Habitat quality and quantity for PVS species associated with riparian forest will decline. Greater chance for NNAS invasion, as impacts to habitat facilitate invasion.	Coordinated and concerted effort to work with landowners and developers in minimizing high-water using elements; long-term potential for treating and reusing wastewater for landscape irrigation and support of natural systems.
Medium	Fires occurring inside and outside the reserve system. Not all reserves are affected at the same time, but several are.	Enhanced erosion and siltation potential. Lowland leopard frogs disappear from Santa Catalina Mountains and/or Rincons due to ash inflows to Montrose-Romero and Buehmann Canyons. Fire may open up the forested environments on mountains possibly harming some species, e.g. localized decline of PVS birds, as well as giant spotted whiptail. Loss of potential pygmy-owl habitat. Temporary loss of potential Yellow-billed Cuckoo habitat. Fires may benefit other species, like reptiles that need warmth at ground level, and parkland or grassland birds. May be instrumental in improving watershed condition over the long term.	Coordinate fire management across jurisdictions. Continue to build upon a reserve network that spans different mountain ranges and watersheds.

Table 5.1

Examples of Changed Circumstances (continued)

Priority	Circumstance/Scenario	Potential Impact on Covered Species and/or Effectiveness of PCMSCP	Minimization and Monitoring Strategies (on-going or proposed)
Medium	Populations of Leopard frog and other aquatic PVS decline in other areas of southeast Arizona (not Pima County).	Viability of species' continued existence declines.	USFWS and AGFD complete Safe Harbor Agreements and allow land owners with suitable ponds and/or stream segments to "host" re-establishment of leopard frogs and other aquatic PVS, resulting in establishment of many new, small populations. Contribution to recovery could lead to downlisting
Medium	Loss of a known population of covered species.	Rufous-winged sparrow populations on the southeast and south sides of Tucson are in peril today; Tucson shovel-nosed snake may be already gone from Pima County.	
Medium	Conversion of desert, riparian areas, or grasslands to agriculture in permit area or on adjacent tribal lands	Fragmentation of landscape, reducing viability of some PVS populations	Conservation easement program
Medium	Increased off-road vehicle (ORV) use in existing and proposed reserves.	General habitat degradation with potential direct impact to several PVS	More enforcement needed; road restoration efforts; consideration for designated ORV areas to be established
Medium-Low	New species of landscaping plants are discovered to be invasive into wildland settings.	Effects upon PVS are impossible to forecast.	Develop protocols to restrict commercial distribution of landscaping species found to be invasive.
Medium-Low	Wasting disease affects deer population; predators (e.g., mountain lions) are also affected	Loss of top predator could effect the entire ecosystem	Support on-going monitoring efforts by AGFD and federal land managers

Table 5.1

Examples of Changed Circumstances (continued)

Priority	Circumstance/Scenario	Potential Impact on Covered Species and/or Effectiveness of PCMSCP	Minimization and Monitoring Strategies (on-going or proposed)
Low	Arrival of fire ants into riparian areas.	Unknown	Coordinate with Arizona Department of Agriculture. Fire ants should be monitored for presence. Immediate response may prevent establishment.
Low	More cats and feral dogs in urbanizing areas and riparian areas.	Feral dogs in the city (i.e., West Branch) control cats, and appear to benefit the lizards, and maybe the birds	Monitor presence and increases
Low	Due to TNC efforts and discontinued mining, Lower San Pedro River becomes better watered, with bigger pools and more beaver	Native dace and lowland leopard frog decline due to improved habitat conditions for NNAS. Riparian forest-dependent PVS species benefit.	Coordinate with TNC and other land managers to develop a balanced system for wider variety of species
Low	Gradual increase followed by gradual decrease of the extent and discharge rate of effluent-dominated reaches of the Santa Cruz River.	Increase in marsh and riparian scrub and forest, followed by reduced extent of cottonwood-willow and increase extent of burrobrush. Riparian forest-dependent PVS species benefit at first, then decline with habitat desiccation.	Insure commitments for minimal water requirements of on-going riparian restoration design are met over long-term. Decrease in volume may be compensated by increase in alternative water sources (e.g., CAP water)
Low	CAP recharge, farming, and restoration along Santa Cruz River near Martinez Hill increases riparian vegetation	Increased riparian and aquatic habitat for some non-aquatic PVS species outside plan area; potential for NNAS habitat	Insure adequate management and monitoring efforts are incorporated into all restoration and recharge implementation plans.
Low	Windthrow or disease affects saguaros in Tortolita piedmont.	Potential to lose a few pygmy-owl nest sites and foraging habitat for Lesser long-nosed bats	Determine appropriate level of revegetation strategy, if any

Table 5.1

Examples of Changed Circumstances (continued)

Priority	Circumstance/Scenario	Potential Impact on Covered Species and/or Effectiveness of PCMSCP	Minimization and Monitoring Strategies (on-going or proposed)
Low	A few severe freezes. Mesquite die back, incidence of bacterial necrosis in saguaros increases.	Minor effects to pygmy-owl nesting sites. Minor loss of foraging habitat for Lesser long-nosed bat.	Landscape-scale reserve design covers broad areas, not all of which would be effected equally at any given time. Built in resilience.
Low	Periodic rainy winters will result in dense growth of red brome, black mustard, fiddleneck, and other winter annuals	Spring and early summer fires will eliminate local populations of Pima Pineapple Cactus.	Support on-going coordinated regional efforts to raise awareness, actively monitor and remove to fullest extent possible.
Low	Increased warming increases the length of the growing season. More annual growth in plants when sufficient water exists.	Shifts in plant community composition and distribution that could indirectly affect PVS.	None.
Low	100-year floods will occur in several reserves. Riparian vegetation will be removed. Channel vegetation will quickly recover, but mature mesquite forest on terraces will be lost due to erosion over the term of the permit.	Localized decline of PVS birds, as well as giant spotted whiptail. Loss of potential pygmy-owl habitat. Temporary loss of potential Yellow-billed cuckoo habitat	Proposed reserve design should include riparian reserves in many different watersheds.
Low	Movement of mobile PVS species from reserves into areas outside of reserves.		Acceptable

Table 5.1

Examples of Changed Circumstances (continued)

Priority	Circumstance/Scenario	Potential Impact on Covered Species and/or Effectiveness of PCMSCP	Minimization and Monitoring Strategies (on-going or proposed)
Low	Limestone quarries established in various areas outside reserves.	Could affect needle-spined cactus, Nichol's Turk's head cactus, and potential certain bat roosts	Include limestone areas in reserve system as much as possible.
Low	New federal listings or delistings	No physical effect on PVS; legal status may change.	Plan to add species to coverage needed.
Low	New planned and unplanned foot trails extended from new developments	More disturbances of roosting, nesting, resting, and other activities in urbanizing areas. Spread of nonindigenous species.	Monitoring and discouragement of wildcat trails; designated access points.
Low	Runoff from paved surfaces increases, causing localized increase in xeroriparian vegetation in smaller, urbanizing watersheds	Countervailing force that may somewhat mitigate the adverse effects of urbanization upon habitat of species such as Abert's towhee, Bell's vireo.	For new development, include bonding for invasive species monitoring watercourses on private lands; all plan signators participate and support invasive species monitoring and management.
Low	New roads established through talus slopes.	Low potential for talus snails to be affected.	Conservation easements on private lands; careful control and monitoring on public lands.
Low	Clearing of pecan groves for urban development	Loss of habitat for Yellow-billed cuckoo resulting in decrease in numbers of this species in the County.	PCWWM will acquire and revegetate lands near Green Valley WWTF; developers will minimize destruction of pecans during development.
Low	Paving Oracle Control Road		Section 7 Consultation with USFS and FHWA; measures to minimize and mitigate vegetative losses will be incorporated and implemented.

In making the determination that such an event constitutes an unforeseen circumstance, the USFWS will consider, but not be limited to, the level of knowledge about the affected species and the degree of specificity of the species' conservation program under the PCMSCP. Whether or not failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the affected species in the wild will also be considered by the USFWS.

5.5.1 Response to Occurrence of Unforeseen Circumstances—No Surprises

After the conclusion of the process outlined above, if the USFWS determines that an unforeseen circumstance has occurred and that additional conservation measures are required to address such circumstances which are not contemplated or were not capable of implementation by the AMP and procedures of the PCMSCP, and provided that the County has fully complied with the terms of the PCMSCP, any proposed additional conservation measures shall fit, to the maximum extent possible, within the terms of the PCMSCP and its AMP. To the extant allowed by law, additional conservation measures shall not require the payment of additional compensation by the County or permittees. If additional expenditures are required, the USFWS or any other Federal agency shall take additional actions that might lead to the conservation or enhancement of a species that is being adversely affected by an unforeseen circumstance. The costs of these additional actions shall be borne by the USFWS or any other Federal agency. However, the USFWS agrees that, prior to undertaking or attempting to impose any action or conservation measure, it shall consider all practical alternatives to the proposed conservation measures, and adopt only those actions or conservation measures which would have the least effect upon the economy and lifestyle of the County and permittees, while at the same time addressing the unforeseen circumstance and the survival and recovery of the affected species and its habitat. The purpose of this provision is to recognize that Congress intended, even in the event of unforeseen, extraordinary, or changed circumstances, that additional mitigation requirements not be imposed upon a Section 10 permittee which has fully implemented the requirements undertaken by it pursuant to an approved habitat conservation plan.

5.5.2 Response to Occurrence of Unforeseen Circumstances—Adaptive Management

The County believes that the initial measures to be funded by the PCMSCP will be effective to conserve both habitats and the Covered Species for that period. However, over time, unforeseen circumstances may affect the status of habitats and the condition of individual species within the ecosystems in the Plan Area. Therefore, the County, with the cooperation of USFWS and AGFD, are proposing an AMP to gauge the effectiveness of existing conservation measures, and to propose alternative conservation measures as the need arises, to deal with unforeseen circumstances, within the budget and scope of the AMP. If existing or additional conservation measures within the budget and scope of the approved PCMSCP AMP do not adequately respond to unforeseen circumstances, the County will assist and coordinate with any additional conservation efforts undertaken by the USFWS.

5.5.3 Examples of Unforeseen Circumstances

The STAT also developed a preliminary list of examples of conditions or occurrences that could be defined as unforeseen circumstances as defined above and as illustrated in Table 5.2. This list is not meant to be exhaustive or inclusive, but to provide general guidance in future evaluations and determinations of unforeseen circumstances during the term of the PCMSCP.

Table 5.2

Examples of Unforeseen Circumstances

Circumstance/Scenario	Potential Impact on Covered Species and/or Effectiveness of PCMSCP	Comments on Potential Responses by Pima County that may warrant Contingency Funds
Weapons of mass destruction affect the urbanized area, causing social breakdown; warfare along International Border extends into biologically sensitive areas	Potential for large-scale destruction of PVS habitat types.	Support federal efforts, with priority given to public health, safety, and welfare.
Massive internal or external population shifts overwhelm public services, causing the appearance of shantytowns in the urban or rural areas.	Increase in landscape fragmentation, decrease in connectivity, possible isolation of PVS populations, influx and spread of nonindigenous species.	Continue to conduct advance planning for future growth and development; maintain strong and adequate clup.
Construction of expanded International port-of-entry and highway improvements in Altar Valley.	Increase in roadkill, particularly along State Routes 286 and 86, increased risk of influx of non-native species; potential adverse effect upon CFPO.	Support State and Federal agencies in efforts to minimize impacts and monitor conditions, especially for PVS.
Toxic or hazardous waste spill into Cienega Creek or the Santa Cruz River either from the railroad or from the Interstate Highway.	Potential adverse effect on PVS native fish and frogs, including kill-off; loss of vegetation within Important Riparian Area.	Develop County-level contingency plan that parallels and supports State and Federal response plans.
Copper or other mining begins in Davidson Canyon, Buehman Canyon or other watersheds;	Potential contamination of streams with heavy metals, and watershed diversions or habitat losses. Potential effects upon PVS located in the direct impact areas, or upon downstream aquatic PVS.	Support the USFS or other land management agency in their efforts to develop permit requirements to avoid or minimize potential adverse impacts.
Greatly reduced pumping along Santa Cruz River allows formation of new intermittent and perennial stream segments at Canoa, Tucson, and Marana.	Increase in riparian and aquatic vegetative communities likely to have a positive effect, particularly for native fish, frogs and other PVS; potential for contamination of upstream conditions.	Maintain strong vector and disease control monitoring and response measures at County level; coordinate efforts with State and Federal agencies.
Massive poaching for subsistence.	Unlikely to directly impact PVS; Indirect effects more likely.	Coordinate biological monitoring with AGFD and other State and Federal Agencies.

Table 5.2

Examples of Unforeseen Circumstances (continued)

Circumstance/Scenario	Potential Impact on Covered Species and/or Effectiveness of PCMSCP	Comments on Potential Responses by Pima County that may warrant Contingency Funds
Greatly increased reliance on mesquite as fuelwood.	Reduced canopy cover in mesquite savanna and mesquite forest would affect different PVS differently.	Controlled by local ordinances as well as State and Federal Agencies.
Ranchers decide to shift to planting and irrigating exotic grasses rather than using and managing semi-natural ecosystem.	Potential for exotic species to out-compete native species and provide less suitable habitat for PVS; potential for increased wildfire risk.	NRCS and the State and Federal agencies that grant grazing leases have a critical role in supporting the biological goals of the PCMSCP.
Paved road over Redington Pass.	Likely significant increase in vehicular traffic, ORV use, habitat destruction and fragmentation, roadkill, and spread of non-native species.	CLUP directs growth in areas other than the San Pedro Valley; long-range transportation plans exclude this action.
Arkenstone Cave dries up.	Pseudoscorpion and its food network possibly affected.	Pima County includes this in long-term monitoring of the cave conditions and evaluates possible contingency actions.
Establishment of new, non-native game animals (e.g., oryx, red or Sitka deer).	Unlikely to affect PVS.	Participating State and Federal Agencies consider all land use and management actions in the context of supporting the biological goals of the PCMSCP.
Establishment of feral pigs or sheep in additional riparian areas.	Potentially catastrophic to riparian and aquatic PVS and native bighorn sheep.	Contingency planning by land management agencies calls for prevention of establishment and elimination of such feral species.
Desert tortoise populations in Sonoran Desert develop consistent pattern of decline, seen now in only about 2 or 3 major population sites.	Unlikely to affect PVS.	PCMSCP (and ESA) include amendment provisions to add species to permit.

Table 5.2

Examples of Unforeseen Circumstances (continued)

Circumstance/Scenario	Potential Impact on Covered Species and/or Effectiveness of PCMSCP	Comments on Potential Responses by Pima County that may warrant Contingency Funds
Natural establishment of Yuma clapper rail, mountain plover, or other currently listed species not currently considered PVS.	Unlikely to affect PVS.	PCMSCP (and ESA) include amendment provisions to add species to permit.
Natural colonization of Gila topminnow into the effluent-dominated Santa Cruz River.	New population of Gila topminnow established, possibly increasing long-term viability of metapopulation.	PCMSCP (and ESA) include amendment provisions to add species to permit.
Increased acid rain.	pH changes in ponds, lakes and mountain streams which lack limy substrates, potential loss of species and populations of aquatic and other PVS.	Water quality monitoring is incorporated into management of aquatic ecosystems.
Sustained cooling trend shortens the growing season over the permit period.	Gradual long-term shifts in vegetative composition; possible decrease or die-off in species sensitive to cold (e.g., Saguaro, Ironwood) and increase in extent of montane species (juniper, oaks, pine).	Regional climate monitoring information is brought into PCMSCP monitoring and management decision-making.

5.6 Additional Federal Commitments

5.6.1 Augmentation, not Replacement or Substitution, of Federal Budgets

Each Federal agency that is a Participant in the PCMSCP process and signatory to the required IA will agree that it shall annually include in its agency budget requests dedicated and earmarked funding adequate to allow the agency to fully operate, manage, maintain, and monitor its lands pursuant to the terms of this PCMSCP. Furthermore, each Federal agency shall fulfill its obligations to protect the species and ecosystems consistent with statutory obligations imposed by Congress and to actively cooperate with and provide technical assistance to the County. Each Federal agency will agree that it shall not use funds allocated by the PCMSCP to be substituted for funds which it would otherwise receive from the Federal budget process, and instead will use PCMSCP funds to augment, and not replace, its appropriated funds. Nor will any Federal agency receiving funds from the PCMSCP move or redirect its own funds from categories currently established to implement conservation measures, plans, or policies to other budget categories. Finally, no state or regional office of any Federal agency will take into account any PCMSCP funds paid or expected to be paid in allocating available funds among its various offices and departments.

5.6.2 Section 7 Consultations and Conferences

Except as may be specifically provided elsewhere in this PCMSCP, nothing in the PCMSCP is intended to apply to any activity on Federal lands or Federally funded projects that are governed by Section 7 of the ESA. All minimization measures that result from the authorization of incidental take pursuant to Section 7 and contained within any biological opinion or conference report shall be generally consistent with the minimization measures required by the PCMSCP. However, nothing in this PCMSCP is intended to limit the USFWS from requiring minimization in excess of that provided for in the PCMSCP, if the circumstances so warrant.

5.6.3 Consideration of the PCMSCP in Section 4 Findings

The USFWS will specifically inform the County of any listing proposal under Section 4 of the ESA for species in the Plan Area in writing. To the extent permitted by law, the USFWS will consider actions undertaken by the County in making their determination.

6 IMPLEMENTATION

6.1 Implementation Strategy

The overarching strategy to implement the PCMSCP is for Pima County to work collaboratively with local, state, and federal entities, and local citizens to establish the CLS and manage it for the long-term conservation of biological diversity.

6.2 Participants and Coordination Agreements

6.2.1 Pima County

Pima County's role is that of the permittee, with central responsibility of ensuring that all requirements of the PCMSCP are met (i.e., that any taking will be incidental, all impacts will be minimized and mitigated to the maximum extent practicable; adequate funding will be provided; the taking will not appreciably reduce the likelihood of the survival, and recovery of the species and that other permit requirements are met).

6.2.2 U.S. Fish and Wildlife Service

The USFWS is responsible for ensuring NEPA compliance for the PCMSCP, and makes the final determination of permit requirements and issuance. Local and regional USFWS staff will track and monitor permit compliance on an annual basis and may enforce permit restrictions when permit requirements are not met. USFWS may provide federal funding for the implementation of various aspects of the PSMSCP such as land acquisitions, field surveys, ecosystem restoration and management actions.

6.2.3 Other Participants

Other participants are signatories to the plan and in some cases are third-party beneficiaries to the permit. Formal Coordination Agreements (attached as Appendix A.) commit plan signatories to a long-term course of action and management towards fulfilling the biological goals set forth during the reserve planning process, as reflected by the CLS map and as summarized in Section 3 of this document.

6.2.4 Other Federal Agencies

6.2.4.1 Bureau of Land Management

- Ironwood Forest National Monument
- Las Cienegas National Conservation Area
- Various other BLM lands throughout Pima County

6.2.4.2 Bureau of Reclamation

6.2.4.3 National Park Service

- Saguaro National Park

- East and West Units

6.2.4.4 National Resource Conservation Service

6.2.4.5 National Wildlife Refuges

- Buenos Aires National Wildlife Refuges
- Cabeza Prieta National Wildlife Refuges

6.2.4.6 U.S. Army Corps of Engineers

6.2.4.7 U.S. Department of Defense

- Barry M. Goldwater Air Force Range
- Davis-Monthan Air Force Base

6.2.4.8 U.S. Environmental Protection Agency

6.2.4.9 U.S. Forest Service: Coronado National Forest

6.2.4.10 U.S. Geologic Survey

6.2.5 Native American Tribes

6.2.5.1 Pasqua-Yaqui Nation

6.2.5.2 Tohono O'Odham Nation

6.2.6 State Agencies

6.2.6.1 Arizona Department of Transportation

6.2.6.2 Arizona Game and Fish Department

6.2.6.3 Arizona State Lands Department

6.2.7 Local Jurisdictions

6.2.7.1 City of South Tucson

6.2.7.2 City of Tucson

6.2.7.3 Town of Marana

6.2.7.4 Town of Oro Valley

6.2.7.5 Town of Sahuarita

6.2.8 Other Participants

6.2.8.1 Arizona Open Lands Trust

6.3 Additional Implementation Elements

6.3.1 Safe Harbor Policy

Safe Harbor Agreements are voluntary arrangements between the Service and non-federal landowners, which are designed to benefit endangered species while providing landowners assurances from additional restrictions on their property. The Safe Harbor Policy (64 FR 32717) was developed to encourage private and non-Federal property owners to voluntarily undertake management activities on their property to enhance, restore, or maintain habitat to benefit Federally-listed species.

Under this policy, property owners who undertake management activities that attract listed species onto their properties, or into areas affected by actions on their property, or that increase the numbers or distribution of listed species already present on their properties, will not incur future property-use restrictions.

Safe harbor agreements provide assurances to the property owners that allow alterations or modifications to enrolled property even if such action results in the incidental take of a listed species, or in the future, returns the species back to an originally agreed-upon baseline condition. Baseline conditions could be tied to species population estimates and distribution or characteristics and area of the enrolled property that sustain seasonal or permanent use of the covered species at the Agreement is executed. The Agreements would be between the USFWS, AGFD, and the property owner, as well as, Pima County.

6.3.2 Candidate Conservation Agreements

The Policy for Candidate Conservation Agreements (64 FR 32726) is intended to facilitate the conservation of proposed and candidate species, and species likely to become candidates in the near future by giving citizens, States, local governments, Tribes, businesses, organizations, and other non-Federal property owners incentives to implement conservation measures for declining species by providing certainty with regard to land, water, or resource use restrictions that might be imposed should the species later become listed as threatened or endangered under the Act. Under the policy, non-Federal property owners, who enter into a Candidate Conservation Agreement with assurances that commit them to implement voluntary conservation measures for proposed or candidate species, or species likely to become candidates or proposed in the near future, will receive assurances from the Services that additional conservation measures will not be required and additional land, water, or resource use restrictions will not be imposed should the species become listed in the future.

6.3.3 Migratory Birds and Eagles

This permit also constitutes a Special Purpose Permit under 50 CFR 21.27 for the take of ESA listed birds in the amount and/or number and subject to the terms and conditions specified herein. Any such take will not be in violation of the Migratory Bird Treaty Act of 1918 (MBTA), as amended (16 U.S.C 703-712). Unlisted birds that are covered by the HCP are not covered by the Special Purpose Permit and may be taken only if such take is not in violation of the MBTA. This special purpose permit will be valid for a period of three years from the effective date of the

10(a)(1)(B) Permit, provided that the Permit also remains in effect for that period. The Special Purpose Permit will be renewed automatically, provided that Pima County continues to fulfill its obligations under the Permit and its IA. Each automatic renewal will be valid for the maximum time period allowed by 50 CFR 21.27 or its successor at the time of renewal.

6.3.4 Unlisted Species

Assurances will be given for those species that are adequately covered by the HCP, pursuant to the 'No surprises Policy' (63 FR 8859 February 23, 1998, revised 50 CFR 17). Implicit in this is that 1) the HCP must address the conservation of the species and its habitat (either individually or by habitat association), and 2) all Section 10 issuance criteria specified in the Act and its implementation regulations must be met. To conserve unlisted species, an HCP must not significantly contribute to the subsequent need to elevate that species to candidate or emergency listing status.

6.3.5 Plants in the HCP and Permit

The Federal take prohibitions under the ESA for listed plants on non-Federal lands is limited, unless taking of those plants is in violation of State law or regulations. However, before the USFWS issues a permit, the effects of the permit on listed plants must be analyzed. This is because Section 7 of the ESA requires that any federal action, in this case issuance of a Section 10 permit, must not jeopardize any listed species, including plants.

The USFWS encourages applicants to consider listed plants in HCPs. As part of the overall ecosystem basis of the PCMSCP, and consistent with the goals established by the STAT, seven PVS plants are proposed for coverage under this Section 10 Permit (Table 6.1). Three of these species are listed as endangered under the ESA and one is a candidate for listing. All of these plant species are protected under the Arizona Native Plant Law as highly safeguarded or salvage restricted.

Table 6.1
Federal and State Status Plants in the PCMSCP

Species	*Scientific name*	Federal Status[1]	Arizona Status[2]
Huachuca water umbel	*Lilaeopsis schaffneriana recurva*	E	HS
Nichol's Turk's head cactus	*Echinocactus horizonthalonius var. nicholii*	E	HS
Pima pineapple cactus	*Coryphantha scheeri var. robustispina*	E	HS
Acuna cactus	*Echinomastus erectocentrus var. acunensis*	C	HS
Gentry indigo bush	*Dalea tentaculoides*	sc	HS
Needle-spined pineapple cactus	*Echinomastus erectocentrus var. erectocentrus*	sc	SR
Tumamoc globeberry	*Catostomus insignis*		SR

[1]E = endangered; C = candidate; sc = species of special concern.
[2]HS = highly safeguarded; SR = salvage restricted.

6.4 Funding Mechanisms and Commitments

Pima County commits to funding the implementation of the PCMSCP by securing and/or pursuing a variety of funding sources as described below. Funding for land acquisition will be shared between public and private sectors, with no more than 50 percent of the funding coming from affected private landowners and not less than 50 percent coming from publicly-funded sources. The intent is that the assured funding be a segregated fund to be used solely for the acquisition and management of habitat and the purchase of development rights within the CLS, to carry out the following components and functions of the PCMSCP:

- New land acquisitions and other similar protections to build the CLS
- Creation of mitigation banks
- Protective management and monitoring of the Conservation Lands System
- Riparian restoration
- Contingency funding for private property compensation for takings pursuant to U.S. or Arizona constitutions
- Contingency funding for changed and unforeseen circumstances
- Periodic independent review
- Administration

6.4.1 General Fund Line-Item

Pima County will increase the amount of the designated open space line-item budget as the County budget permits.

6.4.2 Open Space Bonds

The Pima County Board of Supervisors has committed to pursue a bond election in May of 2004 for the purpose of continuing the County's acquisition of lands and other rights within the CLS. If successful, this bond will establish a voter-approved fund of approximately $250 million. The highest priority for the use of this fund is for the acquisition and protection of lands with high biological value necessary to achieve the goals of the PCMSCP.

6.4.3 District Tax Levy and General Obligation Bonds

The PCFCD will continue to use its tax levy to acquire flood prone lands and related water rights, manage, and restore riparian areas, administer the riparian mitigation provisions of the ordinance, and monitor and protect water resources related to the goals of PCMSCP. Pima County administration will accelerate the flood control budget line-item as economic conditions allow, and will pursue the authorization of a general obligation bond for flood prone land acquisition.

6.4.4 Pima County Effluent

Pima County will commit all of its existing and future shares of effluent derived from the Metropolitan and outlying wastewater facilities to riparian restoration, so long as the amounts needed for existing and future park and roadway irrigation, and commitments institutionalized in existing agreements (e.g. Quail Creek) are met.

6.4.5 Sales Tax

Pima County will explore the feasibility of presenting to the voters a sales tax proposal as non-regressive as possible consistent with law. The intent is that this increase would be placed in the segregated fund and be used to obtain lands for the PCMSCP.

6.4.6 Mitigation Fees

Pima County will implement an equitable mitigation fee program with an option whereby property owners may achieve impact mitigation independent of the County fee program.

6.4.7 Impact Fees

Pima County will pursue and support State legislation granting Counties the statutory authority to impose open space impact fees.

6.4.8 Arizona Game & Fish Department's Heritage Fund

Pima County will pursue Heritage Fund Grant requests and will request that the Arizona legislature abide by the will of the voters when establishing the Heritage Fund in 1990 (A.R.S. §5-22), and maintain the Heritage Fund as dedicated funding for the purposes for which it was established.

6.4.9 Arizona Preserve Initiative

Pima County will encourage legislators to assist Pima County in working with the State Land Department so that the Arizona Preserve Initiative can fund conservation efforts in this region. Use of the Arizona Preserve Initiative program allows State funds from Growing Smarter to pay one-half of the acquisition costs.

6.4.10 Public Lotteries

Pima County will pursue and support State legislation to establish county-by-county lotteries, the proceeds for which would be spent in the County in which the tickets are sold. Fifty percent of the proceeds would fund Arizona Preserve Initiative projects in the respective County. Other revenues generated by these games would go for the purchase of development rights.

6.4.11 Federal Line-item Appropriations

Pima County will continue to encourage Congressional Representatives to pursuing line-item appropriations to implement the PCMSCP.

6.4.12 Other Federal Funding and Grants

Pima County will pursue federal funding from sources such as:

- Department of Interior
- Department of Agriculture
- Department of Defense
- The Land and Water Conservation Fund
- National Fish and Wildlife Foundation Challenge Grants
- Applicable Farm Bill funding
- National Oceanic and Atmospheric Administration
- Other Federal programs

6.4.13 Partnering with Private Sector and Non-Profit Organizations

Pima County will pursue partnering opportunities in association with private landowners and non-profit organizations (such as The Nature Conservancy, Arizona-Sonora Desert Museum, Tucson Audubon Society, Tucson Herpetological Society, Tucson Botanical Garden, the Sierra Club, Arizona Open Lands Trust, the Sonoran Institute, Ducks Unlimited, Trout Unlimited, American Rivers, the National Wildlife Federation) with common goals for biological conservation. Such partnering efforts may include but are not limited to:

- Shared staffing and use of equipment
- Matching or other shared funding of land acquisitions and/or conservation easements
- Joint efforts in surveying, monitoring, and management responsibilities
- Coordinated efforts in biological data management
- Public information, outreach and environmental education efforts and materials
- Coordination and use of local contributions, including land, trusts, volunteer support, and other in-kind services

6.4.14 Partnering with Other Jurisdictions and Agencies

Pima County will also foster partnerships with other local jurisdictions within and adjacent to Pima County, and will support their habitat conservation efforts, particularly those that are a subset of implementing the PCMSCP. Pima County will foster partnerships with the University of Arizona, Pima Community College and public and private schools in order to maximize effectiveness of research and education efforts pertaining to the PCMSCP goals. Pima County and its Flood Control District will work with Arizona Department of Water Resources (ADWR) to foster improved water management for the benefit of PCMSCP goals.

6.5 Phasing

Phasing of the PCMSCP is established to respond to the long-term conservation needs identified by the CLS and the projected population growth and development of land as reflected by the Economic Analysis, with corresponding check points to monitor the plan's implementation and effectiveness.

6.5.1 Annual Reporting

Pima County will prepare and submit an annual report for USFWS review of permit compliance. This will be in the form of the "State of the Conservation Lands System" Report prepared by the SCC. This annual report will address topics such as baseline conditions, land acquisitions and acreages, ecosystem function, change in land cover, invasive species, riparian conditions, ground and surface water conditions, ranch resources, fire management and abiotic resources (air, soil, visual, precipitation, weather, climate trends; see further discussion under Sections 4.4 and 4.5). Annual reports will also include brief summaries of joint or concurrent efforts by partnering entities. This Annual Report will be the primary document in support of FWS-required status reports for the PCMSCP permit continuance.

6.5.2 Phase I: Permit Years 1–10

During this phase the initial "down payment" on the CLS will be made by securing funding for, and acquiring or otherwise conserving lands at a level adequate to meet mitigation requirements for the projected growth of the first decade (see Section 4.4.4, Hierarchy of Space and Time Priorities). Pima County will place special emphasis on achievements within the first five years of the permit by pursuit of a bond election and other funding strategies discussed above. Lands and conservation easements acquired by Pima County during the course of their habitat conservation planning efforts (i.e., since 1998) will be credited towards meeting goals of the initial 10-year Phase.

6.5.3 Phase II: Permit Years 11–20

During this phase, Pima County will continue to secure funding for, and acquire or otherwise conserve lands at a level adequate to meet mitigation requirements for the projected growth of the second decade. Lands and conservation easements acquired by Pima County during Phase I will be credited towards meeting goals of this second Phase.

6.5.4 Phase III: Permit Years 21–Buildout

During this phase Pima County will continue to secure funding for, and acquire or otherwise conserve lands at a level adequate to meet mitigation requirements for the projected growth of the third decade or until build-out (i.e., population of 1.94 million). Lands and conservation easements acquired by Pima County during Phase II will be credited towards meeting goals of this third Phase.

6.6 Amendments

Amendments to this permit may be sought if there is unanimous agreement by all permit signatories. Procedurally, a permit amendment application is treated in the same way as the original permit application. However, documentation required by USFWS in support of a proposed amendment will vary depending on the nature of the amendment and the content of

the original PCMSCP documents. If the circumstances necessitating the amendment have been addressed in the original documents (e.g., a previously unlisted species adequately addressed in the HCP is subsequently listed), then only amendment of the permit itself will be needed. If the amendment involves an action that was not addressed in the original documents, IA, or NEPA analysis, these documents may need to be revised or new versions prepared addressing the proposed amendment(s).

7 REFERENCES CITED AND BIBLIOGRAPHY

7.1 References Cited

Brown et al. 1979, 1980, 1982

City of Tucson 2003

Dept. of Interior, 1996

Dept. of Interior, 2000

ESI and SWCA 2003

ESI and SWCA 2002

Fromer 2002

J. Gelt et al. ND

Marshall et al. 2000

Noss and Cooperrider, 1994

Pima County 1999a

Pima County 1999b

Pima County 1999c

Pima County 1999d

Pima County 2000

Pima County 2001 and 2002

Pima County 2002a

Pima County 2002b

Pima County 2003

RECON 2001

RECON 2000a

RECON 2000b

RECON 2000c

RECON 2000d

RECON 2000e

RECON 2000f

RECON & SWCA, 2000

RECON 2000c, RECON 2002

Tellman et al. 1997

Arizona Department of Agriculture June 1999, SWCA 2000, and AGFD HDMS 2000

Pima County Comprehensive Plan (2001)

Pima County BOS in the Comprehensive Plan Update (2000)

2002. Pima County. State of the Environment Reporting. November

7.2 Pima County Documents

- Adaptive Management Workshop; February 2003
- Additional Correspondence on the Draft Preliminary SDCP and Scope of the EIS; January 2003
- Air Quality in Pima County (Primer); February 2003
- Air Quality Strategies for the Comprehensive Plan; September 2003
- Analysis of Racial and Economic Disparities in Home Purchase Mortgage Lending Nationally and in 60 Metropolitan Areas; October 2003
- Applications for the SDCP and Comprehensive Plan Land Use Panels; May 2003
- Aquatic Species Threat in Pima County (workshop); May 2003
- Aquatic Vertebrate Conservation in Pima County; July 2000
- Arivaca Resources; March 2000
- Arizona Game & Fish: Memorandum of Understanding; March 2003
- Arizona Shared Transaction Privilege and Affiliated Excise Taxes; July 2003
- Bingham Cienega Restoration ****; October 2003
- Bingham Cienega Source Water Study; February 2003
- Biological Stress Assessment; March 2000
- Biological Values of the West Branch ****; October 2003

- Cactus Ferruginous Pygmy-Owl Investigations in Pima and Pinal Counties, Arizona; July 2000
- Canoa Ranch; September 2000
- Cienega Creek Storm Flow Frequency Analysis; February 2003
- City of Tucson 2000: Resolution No. 2000-64; March 2000
- City of Tucson 2002: Resolution No. 19435; November 2003
- Classic Period Landscape, Ancient Cultural Landscapes and Southern Arizona; August 2000
- Climate Variability in Pima County, Arizona, and it's Significance to the SDCP; September 2003
- Cocio Wash and the Gila Topminnow; April 2000
- Committed Lands in East Pima County; April 2000
- Comparison of Multi-Species Conservation Plans and Implementing Agreements; March 2003
- Comparison of Pima County Expenditures per Capita to Other Counties and City Governments; June 1999
- Comparison of Ferruginous Pygmy-Owl mtDNA at Local and International Scales; January 2003
- Comprehensive Plan Staff Report; January 2003
- Comprehensive Plan Staff Report: Board of Supervisors Public Hearing 04/23/02; April 2003
- Concept Sonoran Desert Conservation Plan; October 1998
- Concurrency and Urban Development Study; October 2003
- Conservation Biology Modeling and Application; September 1999
- Conservation Biology: The Science of Conservation Planning; September 1999
- Conservation Easement Workshop; December 2003
- Cooperative Agreement Water, Reclamation, BLM, NPS, USFW; December 2000
- Cooperative Efforts with the City of Tucson; August 2003
- Correspondence Received in Response to the Draft of the SDCP; January 1999

- Cost Model for Section 10 Endangered Species Act Compliance for All Impacts in the Unincorporated Area of Pima County; May 2003
- Cultural and Historic Preservation (five presentations); October 1999
- Cultural Landscapes of History in Southern Arizona; May 2000
- Cultural Landscapes of Prehistory in Southern Arizona; May 2000
- Cultural Resource Element (PowerPoint presentation); March 2003
- Cultural Resource Sites Depicted on Early Maps of Pima County, Arizona; April 2000
- Cultural Resource E.I.S. Issue Paper; July 2003
- Cultural Resources Element Report to the SDCP Steering Committee; March 2003
- Desert Ironwood Primer: Biodiversity and Uses Associated with Ancient Legume and Cactus Forests in the Sonoran Desert; February 2000
- Determining Species of Concern within Pima County, Arizona; April 1999
- Determining Vulnerable Species within Pima County, Arizona; November 1999
- Direction of Regional Habitat Conservation Planning; May 1999
- Distribution of Fiscal Resources; October 2003
- Draft Master Plan for Pima County, Arizona Segment Juan Bautista DeAnza National Historic Trail: Part A; December 2003
- Draft Master Plan for Pima County, Arizona Segment Juan Bautista DeAnza National Historic Trail: Part B; December 2003
- Draft Preliminary Sonoran Desert Conservation Plan; September 2000
- Draft Reserve Design Guidelines, Goals, Opportunities and Constraints; October 2000
- Economics of Large Scale Conservation; April 2003
- Effects of Roads on Natural Resources; February 2003
- Endangered Species Act and the Constitution; May 1999
- Environmental Justice E.I.S. Issue Paper; Year 2002
- Environmental Justice in Pima County; July 2003
- Environmental Restoration in Pima County; December 1999
- EPA Memorandum of Understanding; April 2003

- Evaluation of Hydrologic and Riparian Resources in Saguaro National Park, Tucson, Arizona; June 2003
- Fire Management E.I.S. Issue Paper; August 2003
- Floodplain Primer; February 2003
- Geological and Ecological Diversity in the Proposed Ironwood Preserve; May 2000
- GIS Coverage of Perennial and Intermittent Streams and Areas of Shallow Groundwater; January 2000
- GIS Primer; August 2000
- Groundwater Level Changes in the Tanque Verde Valley; January 2003
- Habitat Selection by Cactus Ferruginous Pygmy-Owls in Southern Arizona Preliminary Results; July 2000
- Historic Summary of Pima County; September 2003
- Historical Occurrence of Native Fish in Pima County; November 2000
- History of Archaeological, Historical, and Ethnographic Research; April 2000
- History of Land Use in Pima County: A Discussion Paper on Historical Population Growth and Land Use Planning in Eastern Pima County; January 2000
- Housing in Pima County; October 2003
- Housing in Pima County, Issue Paper No. 1; May 2003
- Huachuca Water Umbel Surveys Report; September 2003
- Impact Fee and Affordable Housing Study; October 2003
- Impact of Unregulated Development at the Community and Watershed Level; March 2000
- Importance of Conserving Resources in the Altar Valley; August 2000
- Importance of Conserving Resources in the Cienega Creek Watershed; July 2000
- Inclusionary Housing Study; October 2003
- Invasive Species E.I.S. Issue Paper; Year 2002
- Invasive Species Management Program for Pima County; Year 2002
- Investigation of Wetland Deposits at Agua Caliente Park, Tucson AZ; July 2003
- Ironwood Preserve: Resolution No. 2000–63 (Interior); March 2003

- Issues of Non-Native Species in Public Reserves; June 2000
- Land Cover Data Assessment in Pima County; April 2000
- Land Stewardship in Pima County; February 2000
- Level of Service Study; December 2003
- Links to Our Past: Ghost Towns & Mining Towns of Pima County; September 2003
- Listed Species Reserve Analysis; April 2003
- Lord's Ranch Recovery Land Acquisition; September 2003
- Lower Cienega Basin Source Water Study; May 2003
- Map Revisions for the Riparian Habitat Mitigation Ordinance; November 2003
- Mapping & Modeling: The Making of the Cultural & Historical Resources Element Report; August 2000
- Mapping Pima County, Arizona; August 2003
- Mitigation Land Banking (workshop); April 2003
- Mixed Use Development; February 2003
- Mountain Parks & the Sonoran Desert Conservation Concept Plan; August 1999
- Multi-Species Plan Comparison; Year 2002
- Native Plant Program Report; January 2003
- Natural & Cultural Resources of the Bukelew Farm Lands; September 2003
- Natural History of the Ferruginous Pygmy-Owl in Texas; June 1999
- Neighborhood Conservation Plan; Year 2002
- Open Space Funding Options (white paper); January 2003
- Origins of Habitat Conservation Plans; May 1999
- Origins of the Sonoran Desert Conservation Plan; May 1999
- Oro Valley: Memorandum of Understanding; January 2003
- Overview of the Biological Reserve Design Process; November 2003
- Overview of the Draft Preliminary Sonoran Desert Conservation Plan; October 2000

- Overview of Traditional Cultural Places and Traditional Cultural Uses Pima Co. & Coronado National Forest: Parts I & II; May 2000
- Paseo de las Iglesias; April 1999
- People & Places: Cultural Landscapes and Pima County; November 2003
- People of Southern Arizona, Past & Present; May 2000
- Pima County Comprehensive Plan Update; December 2003
- Pima County Economy; July 1999
- Pima County Land; July 1999
- Pima County Planning and Zoning Primer; March 2003
- Pima County Reserves, A Summary of Existing Management and Master Plans; May 2003
- Pima County Riparian Habitat Mitigation Ordinance: Effectiveness Review; October 2000
- Pima County Social Demographics; July 1990
- Pima County Water July 1999
- Pima County Watersheds & Watercourses; April 2000
- Pima County Comprehensive Plan Update; October 2003
- Pima County Economic Analysis Section 10 Permit; May 2003
- Pima County Tax Base History (and property valuation); June 2003
- Potentially Problematic Species in Pima County: Ecological Effects and Management Strategies; October 2000
- Preliminary Cultural Resources Element: Saving the Past for the Future; August 2000
- Preliminary Mountain Parks Element; August 2000
- Preliminary Ranch Conservation Element: Our Common Ground; October 2000
- Preliminary Ranch Conservation Element: Our Common Ground—Ranch Lands in Pima County, a Conservation Objective of the SDCP; October 2000
- Preliminary Riparian Protection, Management & Restoration Element; September 2000
- Preserving Cultural & Historic Resources; May 1999
- Preserving Ranch Lands in Pima County; October 2000

- Prioritization of Streams for Conservation in Pima County; April 2000
- Priority Conservation Areas; May 2003
- Priority Cultural Resources in Pima County, Arizona; January 2003
- Priority Vulnerable Species Fact Sheets; September 2003
- Priority Vulnerable Species Habitat Data Analysis; July 2000
- Priority Vulnerable Species: Analysis and Review of Species Proposed for Coverage by the Multiple-Species Conservation Plan; May 2003
- Priority Vulnerable Species: Data Compilation and Synthesis; June 2000
- Proposal in Support of the Ironwood Preserve; March 2000
- Proposal to Create the Arivaca Resource Management Zone; September 2003
- Protecting Our Past: Cultural Resource Management in Pima County; May 2003
- Pumas and Pollinators: Restoring Connectivity in the Sky Islands; September 2003
- Purchase of Development Rights Program Discussion Paper; May 2003
- Pygmy Owl Update; November 1999
- Pygmy-Owl Conservation & Recovery Bank; March 2003
- Pygmy-Owl in Arizona; June 1999
- Ranch Tradition and Conservation in the Altar Valley Area; August 1999
- Ranch Tradition and Conservation in the Empire-Cienega Valley; August 1999
- Ranch Tradition and Conservation on the Santa Rita Experimental Range; August 1999
- Ranching and Agriculture E.I.S. Issue Paper; July 2003
- Ranching in Pima County; November 1999
- Ranching within Pima County: An Overview of Ranch Conservation; August 1999
- Reclassification of Vegetation Mapping Units from the Pima Association of Governments Land Cover Maps; May 2003
- Recreation E.I.S. Issue Paper; August 2003
- Recreation Impacts in Eastern Pima County; March 2003

- Regional Plan Policies and the Development Policy in the Conservation Lands System; November 2003
- Relationships between Land and People: The Cultural Landscapes Approach in Archaeology and History; May 2000
- Report of Independent Peer Reviewers: Sonoran Desert Conservation Plan; October 2003
- Report on Public Comment, Update and Recommendations on the Draft Sonoran Desert Conservation Concept Plan; March 1999
- Report to Pima County Board of Supervisors on Urban Growth and Development in Eastern Pima County; February 1998
- Report, Comment and Analysis of the Canoa Ranch Conservation Proposal; June 2000
- Representation of Vegetation Communities and Special Elements in Reserve Design; March 2003
- Reserve Design Process Update; May 2003
- Resources of the Ajo/Why Subregion: Sonoran Desert Conservation and Comprehensive Land Use Plan; October 2003
- Resources of the Altar Valley. Includes information on: Historic Conditions, Survey and Assessment, Watershed Protection; March 2000
- Resources of the Avra Valley Subarea. Includes Information on Fiscal Resources (mining) and Proposals for the Ironwood Monument; April 2000
- Resources of the Catalina Foothills Subregion; March 2003
- Resources of the Cienega Rincon Subarea; May 2000
- Resources of the Middle San Pedro Subarea. Includes: Middle San Pedro River Subarea Concept Plan (TNC) and other resources; March 2000
- Resources of the Middle Santa Cruz Subarea; May 2000
- Resources of the Northwest Subregion; July 2003
- Resources of the Rincon/Southeast Subregion; March 2003
- Resources of the Southwest Subregion; March 2003
- Resources of the Tortolita Subarea; May 2000
- Resources of the Tucson Mountains/Avra Valley Subregion; March 2003
- Resources of the Upper Santa Cruz Subarea; May 2000

- Resources of the Upper Santa Cruz Subregion; July 2003
- Resources of the West Pima County Subarea; May 2000
- Response to Tucson Water—Tanque Verde; June 2003
- Review of Vulnerable Species List; April 2000
- Rezoning from SR, RH, and GR 1; May 2003
- Riparian Habitat and Riparian Vegetation Mapping Efforts for the SDCP; May 2000
- Riparian Priorities; August 2003
- Riparian Vegetation Mapping and Classification; January 2003
- Role of Adaptive Management in the SDCP; January 2003
- Science and GIS Update; November 1999
- SDCP Alternative Development; May 2003
- SDCP Progress Report and Update; October 2003
- SDCP Project Summary (slide show); March 2003
- Sonoran Desert Conservation Plan Steering Committee Report to the Pima County Board of Supervisors; June 2003
- SDCP Update: Focus on Riparian Areas; July 1999
- Smart Growth Audit; November 2003
- Sonoran Desert Conservation Plan Update; July 2000
- Species Re-establishment within Pima County; September 2003
- Springs in Pima County; May 2000
- Stakeholder Perspectives on Economic Impact of the SDCP; April 2003
- State of the Environment Reporting; November 2003
- Status of Specific Plans; June 2003
- Suitability Analysis and Representation Goals for Cottonwood-Willow Forest Habitat; October 2003
- Tanque Verde II ****; February 2003

- Tax and Estate Tax Planning Workshop; January 2003
- Threatened and Endangered Species Fact Sheets; September 2003
- Tohono O'Odham Nation: Declaration of Intent to Cooperatively Participate in the SDCP; December 1999
- Town of Marana: Memorandum of Understanding; September 2003
- Trails, Rails and Roadways in Pima County; January 2003
- Transportation Primer; September 2003
- Trends in Circulation; October 2003
- Trends in Housing Affordabilty (1975–2001); October 2003
- Trends in Housing Costs and the Affordable Housing Development Policy; December 2003
- Universal Design Adaptations for Housing; September 2003
- Uphold the Endangered Species Act: Resolution No. 1998-250 (Interior); December 1998
- U.S. Forest Service: Cooperative Agreement; December 2000
- Utility and Right of Way E.I.S. Issue Paper August 2003
- Water Conservation in Pima County; March 2003
- Water Quality in Pima Co. (primer); September 2003
- Water Quality in Pima County, Priority Streams, Requirements of Native Aquatic Species; August 2003
- Water Quality Issues (element summary and recommended policies); November 2003
- Water Quality of Priority Streams in Pima County; October 2003
- Water Quality Requirements of Native Aquatic Species in Pima County; October 2003
- Water Resources and the SDCP; July 1999
- Water Resources E.I.S. Issue Paper; August 2003
- Water Resources in Pima County Memorandum; October 2003
- Water Resources in Pima County: A Report for the SDCP and for Update of the Pima County Comprehensive Plan; June 2003
- Water Usage along Selected Streams in Pima County; July 2000

- Wetland Plant Evaluations ****; January 2003
- Wildcat Subdivision Study; April 1998

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9 GLOSSARY AND ACRONYMS

ADWR	Arizona Department of Water Resources
AGFD	Arizona Game and Fish Department
AMP	Adaptive Management Plan
BLM	Bureau of Land Management
BOS	Board of Supervisors
CFPO	Cactus ferruginous pygmy owl
CIP	Capital Improvements Program
CLS	Conservation Lands System
CLUP	Comprehensive Land Use Plan
DFC	Desired Future Condition
DOD	Department of Defense
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FLAP	Flood Prone Land Acquisition Program
GIS	Geographic Information System
GWG	Government Working Group
HCP	Habitat Conservation Plan
IA	Implementation Agreement
MBTA	Migratory Bird Treaty Act of 1918
NEPA	National Environmental Policy Act
NPS	National Park Service
PCAs	Priority Conservation Areas
PCFCD	Pima County Flood Control District
PCMSCP	Pima County Multiple Species Conservation Plan
PVS	Priority Vulnerable Species
SCC	Science Conservation Commission
SDCP	Sonoran Desert Conservation Plan
STAT	Science Technical Advisory Team
T&E	Threatened and Endangered
USACE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service