



Board of Supervisors Memorandum

September 26, 2000

Draft Preliminary Sonoran Desert Conservation Plan

I. Introduction

The Board, in February of 1998, first directed that a comprehensive assessment of urban growth and the environment occur. From this assessment, the Board concluded that initiating action to preserve and protect County natural and cultural resources was of paramount importance. Based on this Board policy direction, staff proposed, in October of 1998, the first concept of the Sonoran Desert Conservation Plan. The Board accepted this concept, but directed that public review and comment take place. Such occurred for an almost four month period and resulted in the Board adopting the Sonoran Desert Conservation Plan concept in March of 1999.

The Board further directed that the planning process be accelerated to develop a regional conservation plan. County resources were appropriated for this purpose, staff dedicated, and a deliberate course of action was taken that resulted in positive actions to conserve the natural, environmental, and cultural resources of Pima County. Thanks to the leadership of the Arizona Congressional Delegation and Department of the Interior, federal appropriations for conservation planning were sought and obtained. County staff has continued to develop scientific reports, and research and community experts have been employed to refine the Sonoran Desert conservation concept plan into a plan formulated on the best science and facts available. The concept plan has evolved between March of 1999 to September of 2000 into what is now recommended to the Board as a draft preliminary Sonoran Desert Conservation Plan.

The draft preliminary Sonoran Desert Conservation Plan serves as a summary of technical and scientific information gathered to date and is intended to frame a broad range of options so that future public participation provides the Board with relevant information that can form the basis of the final plan. The preliminary Sonoran Desert Conservation Plan is simply another iteration of the planning process that will ultimately lead to development and adoption of the final Sonoran Desert Conservation Plan, anticipated in the year 2002. This iterative planning process is the only way in which science and best management practices can be integrated with the views and values of the community to achieve a final community consensus conservation plan.

II. Future Actions

With Board acceptance of the preliminary Sonoran Desert Conservation Plan, the steering committee is now poised to provide meaningful deliberation, input and discussion on reserve design options that are supported by science and fact. The 13 educational steering committee meetings have educated and informed those dedicated members of the steering committee. They are in the best possible position to provide meaningful, educated, and informed input on shaping the fact and science based preliminary Sonoran Desert Conservation Plan into a final plan based on their expression of community views and values.

The process that moves forward from preliminary plan acceptance again requests formal community input and comment to be considered not only by County staff and governmental entities (federal, state and local), but also the steering committee itself. On Thursday, September 7, 2000, notice was published in the Federal Register regarding the intent to prepare an environmental impact statement and notice of public scoping meetings related to the Sonoran Desert Conservation Plan. This signals the beginning of the federal process to prepare the required federal environmental impact statement for the plan. A scoping meeting will be held by the United States Fish and Wildlife Service on October 4 at the Arizona-Sonoran Desert Museum.

I will be asking the Board to approve an additional minimum 15 public meetings to discuss the plan throughout the community and invite public comment on the draft preliminary Sonoran Desert Conservation Plan. From this review and the scoping will evolve the next two-year study process to finalize the plan, during which a regional multi-species conservation plan, environmental impact statement, implementing agreement, and the plan itself, including all six natural and cultural resource elements, will be completed. It is now anticipated that an adopted, legally, federally implementable Sonoran Desert Conservation Plan, which includes a multi-species conservation plan element, will be adoptable by the Board in the fall of 2002.

III. Public Review and Jurisdictional Participation

By Board direction, development of the Sonoran Desert Conservation Plan has been the most public and open process entered into by the County. All meetings of the Steering Committee, Science Technical Advisory Committee, Cultural Resource, Ranch and Implementation teams have been and will continue to be public. Anyone is welcome to attend and observe the proceedings and deliberations. To date, over 72 formal meetings open and noticed to the public have been held. In addition, over 200 community meetings have been held. The process to date has not been behind closed doors or filtered by bureaucratic committees appointed by the County or local jurisdictions.

The Sonoran Desert Conservation Plan is designed as a regional plan. The table below gives the acres of jurisdiction and percent of land base in Pima County.

Regulatory Responsibility of Local Jurisdictions in Eastern Pima County

<u>Eastern Pima County</u>	<u>Land Area in Square Miles (PAG - 1998)</u>	<u>Percent (%)</u>
Unincorporated Pima County	2,244	88
City of Tucson	194	8
Marana	73	3
Oro Valley	31	1
Sahuarita	10	0
South Tucson	1	0
Total	2,553	100

Implementing the Sonoran Desert Conservation Plan in areas outside of the jurisdiction of Pima County, such as the Tohono O'odham Nation, Pascua Yaqui Nation, Coronado National Forest, Saguaro National Park, Ironwood National Monument, and Las Cienegas Resource Conservation Area requires the cooperation of each management entity exercising jurisdiction. We have and will continue to solicit their cooperation.

The decision to accept, reject, or participate in the conservation efforts of the Plan is the sole decision of the particular jurisdiction. Jurisdictional participation has been welcomed and assignment of full-time jurisdictional staff to review and comment on the Plan being prepared is welcome. We will pursue cooperative agreements with those federal and state agencies that wish to participate in the Plan. The Conservation Plan will be a consensus, cooperative process. Only true cooperation and goodwill will result in meaningful conservation.

IV. Regional Growth and Conservation Planning to Sustain Economic Development

The original purpose of the Conservation Plan is to logically plan for continued community growth and expansion without significant adverse regulatory consequences from enforcement of the Federal Endangered Species Act. Through seven terms of Boards of Supervisors growth has been debated. Debate ranged from whether there should be no growth, or whether it should be controlled, managed, encouraged or now "smarter"; the only constant during this period has been the absolute, continued population expansion of Pima County by on average 15,000 persons per year. The debate is not about whether or not we will grow. It is about how we grow. Good, thoughtful advance planning is essential to sustaining economic expansion. Uncontrolled growth and urban sprawl, no matter how good for the economy in the short run, is not sustainable in the long term.

The Sonoran Desert Conservation Plan is a form of growth management plan that will guide future urban growth and expansion by eco-system based planning principles. A successful Sonoran Desert Conservation Plan can, in fact, be both the cornerstone of conservation as well as economic expansion.

V. Important Preliminary Finding for Six Elements of the Sonoran Desert Conservation Plan

As has been stated previously in this memorandum, the development of the Sonoran Desert Conservation Plan has been and will continue to be an iterative planning process where the plan undergoes a series of technical formulations, followed by public review and comment and then necessary and appropriate modification. This process began with the Board's acceptance of the concept plan in October of 1998, and resulted in public review and comment on the draft concept plan. Since March of 1999 the plan has undergone technical and scientific validation. The preliminary plan now recommended for Board acceptance and public review has either discovered or confirmed a number of important assumptions or beliefs regarding each of the elements of the plan. Our plan is unique given the variety of resources it seeks to protect and given the expanse of the landscape available for conservation purposes. The biological goals of the plan are expressed directly through elements such as the habitat corridors and riparian elements. The

ranch, cultural resources and mountain parks elements serve to complement and enhance the overall effectiveness of the plan and go far beyond traditional federal habitat conservation plans. Below are summarized some important findings to date:

Ranch Conservation - Ranching is a significant land use in its own right, comprising some 1.4 million acres of eastern Pima County. Most ranches in Pima County are family-owned enterprises and operate as unique small business enterprises within the County. Eastern Pima County supports approximately 125 ranches that manage both private and leased federal and state land in the County. Pima County ranks third of all counties in the acreage committed to grazing. Ranching itself has probably been the greatest determinant of a definable urban boundary in eastern Pima County. To prevent unwanted urban sprawl and unregulated development, it is most important that Pima County encourage and retain viable ranches. Ranching is a significant land use that has served to protect our natural open space, and it continues to be an important traditional industry that has shaped the rural landscape. Unfortunately, many of these ranches and the natural and cultural landscapes they protect are now threatened with urban encroachment.

Cultural and Historic Resources - The foundation for the future is how well we preserve the past. Pima County is rich in history, culture, regional character, and diversity, all of which contribute greatly to our collective cultural heritage and community identity. Based on the efforts of the Conservation Plan, it is now possible to quantify the richness of Pima County's archaeological and historic resources in a way that has not been possible in the past. Only 12 percent of the land area of eastern Pima County has been formally investigated for archaeological and cultural resources. Within the areas examined, almost 4,000 archaeological sites have been recorded. It is possible to translate these recorded archaeological sites into a probability of discovery during future urban expansion. On average, it is probable that there are almost eight archaeological sites per square mile, or one for every 84 acres. This clearly indicates that urban expansion threatens our cultural and historic resources. Based on historic occupational patterns, it is likely that the greatest threats to our archaeological and historic resources have occurred along the principle riparian and/or drainage basins of Pima County. This research concludes that future conservation can be most effective in the San Pedro River Valley, Cienega Creek area, and in the Avra and Altar Valleys. The research and investigation to date in the cultural and historic resources element of the Sonoran Desert Conservation Plan has emphasized our need to preserve the past in order to learn the future.

Mountain Parks - Of all counties in the State, Pima County has been a leader in natural resource protection. Since 1929 we have exhibited an unparalleled conservation ethic. County efforts to preserve Tucson Mountain Park in 1929 would have been viewed as foolhardy by some, but visionary by most. Since the Sonoran Desert Conservation Plan was proposed in 1998, we have successfully conserved 135,000 acres of Bureau of Land Management land in the Ironwood Forest National Monument. The Secretary of the Interior, Bruce Babbitt, relayed the community's request to President Clinton, who designated the

Monument on June 9, 2000. Congressman Jim Kolbe has taken the lead in attempting to secure National Conservation status for the Cienega Creek Watershed. This effort appears to be succeeding and will contribute greatly to the overall Sonoran Desert Conservation Plan. This type of action will need to continue. As good as our intentions have been in mountain parks, they have fallen short. Regardless of the amount of open space that exists across Pima County, we have not assembled an open space system that effectively preserves and conserves natural, biological species. While our mountain parks have been an extraordinarily successful attempt at preserving the views and vistas associated with the west, they have provided harbor for the over 50 priority environmental species covered by the Sonoran Desert Conservation Plan. We must expand and redouble our efforts at mountain park development and conservation and do so in a manner that directs our resources and energies at sustaining and maintaining biological diversity in the Sonoran Desert.

Riparian - Two years of review and research have led us to the inescapable conclusion that our riparian resources are the most threatened and vulnerable. They are today the least protected by federal or state land reservations. They are the most vulnerable element of Sonoran Desert environments today. We also now know that there are more perennial and intermittent stream and spring environments than we realized two years ago and there are more urban threats to riparian systems than the obvious ones. An urban housing development that destroys a creek or stream environment is obvious. However, the groundwater decline from groundwater pumping that destroys as much or more riparian habitat is less obvious. While it is far too late to restore our riparian communities to their natural condition, it is appropriate that some natural riparian systems be recreated to compensate for the decades of largely unintended destruction of these systems. Today we have the opportunity to create natural riparian systems that also provide urban revitalization, recreation, and park development. It is important that the urban community also experience the natural Sonoran Desert environment. This experience can best be delivered to the urban area by repairing degraded riparian environments of our major drainage system - the Santa Cruz, Rillito and Pantano rivers and washes.

Critical and Sensitive Habitat and Biological Corridors - Two of the elements that express the biological basis of the plan most directly are the Critical and Sensitive Habitats Element and Biological Corridors Element. In 1998, the Science Community did not have a list of priority vulnerable species of concern, a set of biological standards, or even a vegetation map that could serve as the starting point for determining the locations in need of protection for the species that are in decline. After an intensive research effort involving dozens of members of the science community from both the local and national level, a working list of potentially covered species has been identified, the best available vegetation maps are being assembled, and the science community is working to identify the patches of habitat and connecting corridors that will establish an effective and lasting biological reserve.

For the 9 mammals, 8 birds, 7 reptiles, 7 plants, 6 fish, 2 amphibians, and invertebrates that have been identified thus far as being in need of protection, the biological goals of the plan will finally be of some assistance in promoting recovery and improving the status of the species. This is true not only because a statement of biological goals and objectives has been articulated, but because we are now able to gather information in a comprehensive fashion, take actions to improve the status of the species in the short term, and craft an adaptive management plan that continues to improve the information base and the conservation program over the long term. Substantial contributions from the expert community have also built the Habitat and Corridors Elements. The Nature Conservancy's prestigious ecoregional plan for the Sonoran Desert has been published in recent months and adopted by the Science Team. Dr. Gary Nabhan's influential work on the ironwood tree led to the creation of the Ironwood National Monument and will guide Pima County's efforts to continue to conserve this species. The work performed by pygmy-owl biologists in collaboration with Pima County has been invaluable and will become even more important as we go forward.

The work on these elements in the last two years confirms the importance of interconnectivity in our preservation and protection of a range of habitats, not only to protect rare species, but to protect communities, and even landscapes when biological goals gain strength from the other elements of the Plan.

VI. Recommendations to Facilitate Final Development of the Sonoran Desert Conservation Plan

To further advance the draft preliminary Sonoran Desert Conservation Plan, and conservation planning efforts throughout Pima County, it is recommended that the Board of Supervisors:

1. Accept the draft preliminary Sonoran Desert Conservation Plan and request written comment on the draft preliminary plan through January 1, 2001. Copies of the draft preliminary plan will be transmitted to each federal, state, and local jurisdiction or agency having land use management, regulatory authority, or ownership in Pima County. Further, to facilitate and solicit public review and comment, a copy of the draft preliminary Sonoran Desert Conservation Plan will be distributed to each public library in the Tucson-Pima County Library System and advertisements soliciting public comment on the preliminary Plan will be placed in newspapers of general circulation in the County. All written comments will be received until January 1, 2001, and will be made available for public review and inspection. Comments are to be directed to the:

Pima County Board of Supervisors
Attn: Chuck Huckelberry, County Administrator
130 West Congress, 10th Floor
Tucson, Arizona 85701

2. Increase Public Review and Informational Meetings - In order to ensure maximum public awareness of the draft preliminary Sonoran Desert Conservation Plan, and pursuant to adopted Board policy, permission is requested to hold public informational meetings and open houses on the Plan throughout Pima County during the public comment period. Public meetings will be held throughout Pima County within municipal and tribal jurisdictions, as well as at the community centers in Arivaca, Picture Rocks, Robles Junction, Catalina, Ajo, Green Valley Governmental Center, James Lee Kirk Bear Canyon Library, Nanini Library, Katie Dusenberry Craycroft and River Library, Woods Library, Mission Library, El Pueblo Community Center, Kino Recreation Center, ALETA, and the Halberg Center. In total, at least 15 public information meetings will be held on the preliminary Plan before the close of the comment period. Neighborhood associations within five miles of each meeting location will be invited by direct mail to the informational meeting or open houses. The date, location and time of each meeting will be advertised in local newspapers.

3. Authorize Cooperative Planning Agreements - The Chair of the Board would be authorized to sign and execute cooperative agreements regarding the planning process necessary to transform the draft preliminary Sonoran Desert Conservation Plan into a final Sonoran Desert Conservation Plan, including full participation in developing the: A) regional multi-species conservation plan, B) environmental impact statement, C) adaptive management plan, and, finally, D) implementing agreement.
The following federal jurisdictions have agreed to execute cooperative agreements, and these will be forwarded to the Board during the comment period: Bureau of Land Management, Bureau of Reclamation, Environmental Protection Agency, National Parks Service, United States Air Force, United States Army Corps of Engineers, United States Fish and Wildlife Service, and United States Forest Service. Discussions with local jurisdictions are ongoing and it is anticipated that agreements for cooperative planning will be reached with the Cities of South Tucson and Tucson, and the Towns of Marana, Sahuarita and Oro Valley, as well as Tucson Water and the Metropolitan Domestic Water Improvement District.

4. Direct Changes in County Organizational Design to Implement Plan - Authorize and direct that the County Administrator examine and revise the organizational design and institutional roles of County departments and agencies with regard to implementing conservation practices and policies consistent with the draft preliminary Sonoran Desert Conservation Plan. This will involve adding or realigning missions of various departments including but not limited to the following actions:
 - A. Reorganize the Parks and Recreation Department to the Pima County Natural Resources, Parks and Recreation Department to emphasize the emerging role of natural resource protection, including biological research and open space preservation. In addition, a Ranch Division will be added to the Department to better respond to ranch acquisition, management and protection.

- B. The Flood Control District is to be reorganized by adding a division of Riparian Preservation and Restoration. This division will be responsible for implementing the Riparian Element of the Plan.
 - C. The Wastewater Management Department will be charged with developing a high-volume Sonoran Desert plant nursery within buffer areas of outlying treatment facilities or the regional treatment plants. Plant stocks will be used to re-establish riparian and other Sonoran Desert habitats on degraded public lands.
 - D. The Office of Youth, Families and Neighborhood Reinvestment will be charged with instituting a Youth Conservation Corps in conjunction with our Summer Youth Employment Program to integrate the goals of that program to provide opportunities, employment and training for at-risk youth within the County's efforts to conserve and restore our community's natural resources.
 - E. The Department of Environmental Quality will be charged with long-term coordination and oversight among the various County departments and agencies in implementing the adopted Plan and providing comprehensive informational and outreach services within the community regarding the Plan's progress.
 - F. Long-range, comprehensive land use planning will be strengthened by increasing professional planning staff in the Development Services Department to not only react by commenting on private land use proposals, but to proactively provide alternative design concepts that promote natural and cultural resource protection and quality urban design, as well as minimize resource consumption.
5. Initiate Major Comprehensive Plan Amendment to Reflect the Draft Preliminary Sonoran Desert Conservation Plan - Direct that the County Administrator initiate a major amendment process for the Comprehensive Plan, reflecting the land use concepts, policies and principles of conservation identified in the draft preliminary Sonoran Desert Conservation Plan. The Comprehensive Plan of Eastern Pima County, adopted in 1992, will be revised to conform with the Conservation Plan, and, secondarily, to comply with the requirements of new State law, Growing Smarter Plus, and/or the Citizens Growth Management Initiative, if passed by the voters at the November general election.
6. Authorize Public/Private/Non-Profit Research and Planning Partnerships - The draft preliminary Sonoran Desert Conservation Plan has been a collaboration between County staff and private as well as non-profit research and scientific institutions. This collaboration needs a long-term commitment to guide the Conservation Plan during implementation. Long-term collaborative planning agreements should be established with the: A) Nature Conservancy, B) Arizona-Sonoran Desert Museum, C) Rincon Institute, D) Udall Center, E) Arizona Open Lands Trust, and F) various departments and colleges of the University of Arizona.

7. Modify Land Use Planning and Zoning Codes in the Unincorporated Area of Pima County

- A. Defer upzoning or granting of conditional use permits in areas of federally designated Critical Habitat, Ranch Conservation, or where riparian resources will be lost - Requests to upzone such property to more intensive uses or to grant conditional use permits for intensive uses should be deferred until adoption of the final plan unless the land use proposal protects, to a substantial degree, natural and cultural resources contained within the property (at least 65 percent of these resources) and a substantial portion of the property is set aside to preserve habitat and create open space.
- B. Consolidate environmental performance elements of the land use code into a singular Environmentally Sensitive Land Ordinance (ESLO).
- C. Amend the Native Plant Preservation Ordinance to enhance protection for ironwood trees and ironwood communities by increasing preservation in place from 80 percent to 90 percent, with all 8 inch diameter or greater trees to be preserved in place. For each displaced tree below this size, replacement requirements will be increased from 3 to 4, and fines for violation or destruction will be increased from \$2,500 to \$5,000 per tree.
- D. Expand Native Plant Preservation Ordinance to include Sonoran Desert riparian plant species such as cottonwood, Arizona sycamore, desert hackberry, Arizona walnut, Arizona ash, cooding willow, seep willow, and require 80 percent of these riparian species to be preserved in place.
- E. Amend the Buffer Overlay Zone to improve protection of natural resources in buffer areas by eliminating functional open space (golf courses) as a method of achieving the 50 percent open space requirement and other measures as necessary.
- F. Amend Golf Course Overlay Zone to require that all new golf courses be irrigated with renewable water supplies when they open - Recharge and recovery schemes that are not directly hydrologically connected would no longer be allowed.
- G. Expand water conservation requirements in new development landscaping by requiring all new non-residential development to limit water-intensive landscaping to 20 percent of the landscaped area, and requiring all new multi-family developments to limit water-intensive landscaping to 30 percent of the landscaped area. Develop and enhance incentive programs for retrofitting of all residential and non-residential development with water conserving plumbing fixtures at any change in property ownership.
- H. Expand protection for historical and archaeological resources by requiring cultural resource assurance bonds for subdivision development to ensure that requirements for survey, testing and mitigation are actually carried out through appropriate field work, analysis, reporting, and curation and including protections for cultural resources in the grading ordinance so that unregulated development is also held accountable for protecting those resources.

8. Pursue New or Amended State Legislation - In order to assist in implementing the Sonoran Desert Conservation Plan, a number of State laws need to be either created or amended to allow the County to properly manage community growth and development and avoid long-term adverse impacts of unregulated development and sprawl. The Conservation Plan legislative agenda recommended for Board adoption is as follows:
- A. Grant counties the ability to regulate lot splitting by creating a small subdivision ordinance authority for the County that would require the provision of basic infrastructure for public safety and health.
 - B. Create a State-funded grant program to finance the improvement of private and public dirt roads and easements in existing areas of intensive unregulated development to reduce particulate emissions and improve regional air quality. No grant could be made to an area of lot split development to provide road enhancements unless a lot split improvement district was formed by the affected property owners to pay for a significant portion of the cost of the improvements.
 - C. Create a State lot split public improvement infrastructure bank for the purpose of financing lot split improvement districts for existing unregulated or wildcat development areas to pay for essential public infrastructure for safety and health. The infrastructure bank would offer long-term loans at discounted interest rates for financing essential public safety and health infrastructure that otherwise would have been required to have been constructed by the original developer if State law had allowed regulation of these wildcat developments as subdivisions.
 - D. Allow counties to downzone any property when the approved zoning is inconsistent with the adopted Comprehensive Plan of the County and the zoning for the specific property has been unused for a period exceeding 15 years.
 - E. Expand County impact fee authority to include all public facilities and services provided to growth areas such as schools, parks, solid waste, public transit and police facilities.
 - F. Create incentives for private property owners to voluntarily establish permanent conservation easements on their land by allowing such property to be reclassified for property tax purposes from vacant land with a 16 percent assessment ratio to the existing historical classification with a 5 percent assessment ratio.
 - G. Create a statewide mitigation bank to provide loans at discount interest rates to counties or other jurisdictions to finance acquisition of lands deemed essential to mitigate the adverse impacts of growth on federally-declared critical habitat. No county or local jurisdiction could borrow money from the State mitigation bank until an open space element of the County or local jurisdiction has been adopted which contains a method of apportioning fees and charges to eligible property owners or developers who remove and

destroy critical, natural resources designated by the County or local jurisdiction as necessary to meet federal mitigation requirements established by the Federal Endangered Species Act.

- H. Authorize the levy of a countywide real estate transaction surcharge to fund open space acquisition and conservation activities.
9. Financing Local Implementation - To carry out the Sonoran Desert Conservation Plan will require local funding to purchase land, restore habitats, scientifically monitor progress toward recovery of endangered species, and fund cultural and historic preservation programs. The following revenue enhancement programs should be considered for implementation:
- A. Increased Transportation Impact Fees for Development in the Unincorporated Area of Pima County to the Amount Allowed by Present Statute - These transportation impact fees would be dedicated to critical transportation capacity improvements where air quality improvements or reduced traffic congestion would be greatest.
 - B. Regional Transportation Impact Fees - The Board should consider asking other jurisdictions to adopt a uniform regional transportation impact fee with the proceeds of all fees being deposited in a single regional account and funding distributed to resolve the most severe congestion problems in the region without regard to jurisdictional boundary.
 - C. Regional Water Conservation Fees - In order to conserve water resources, the Board should consider adopting a water conservation sewer impact fee with the proceeds of the fee dedicated to water conservation programs such as mandatory plumbing retrofit requirements upon the sale of residential and non-residential property.
 - D. Ask the electorate, every five years, to authorize general obligation bonds to purchase open space - The Board has historically limited the secondary property tax levy for debt service at \$1 per \$100 of assessed value. The total assessed value of the County has steadily increased, however, substantially due to new construction and development. As a result, the \$1 levy increasingly raises additional dollars. The amount of bonds that would be periodically requested for authorization would be determined by an analysis of the growth in assessed value of the County over the prior five-year period. For example, if bonds are to be sold in 2001, the amount of bonds to be authorized would reflect the increase between the assessed value in 1995 and that in 2000 and the resulting increase in the levy at a \$1 rate. Given that historically approximately 75 percent of the growth in assessed value has been due to new construction, future open space acquisitions would be largely financed by new development.
 - E. Mitigation Payments for Rezoned Critical Habitat - For any rezoning of property in areas identified for conservation by the Sonoran Desert Conservation Plan, an appropriate mitigation payment will be required as a special condition of rezoning. The payments would be designated to purchase alternative property containing high resource and habitat to offset the loss of habitat caused by rezoning of the property in question.

- F. Major Development Endowment Funds - For any major development larger than 320 acres, the development economic activity is to be assessed a surcharge as a specific percentage of the economic activity or sales, with these funds being used to set aside larger portions of the developed property or surrounding property than would normally have been set aside in the development process, or used to enhance the natural resources associated with the developing property.

Respectfully submitted,



C.H. Huckelberry
County Administrator

CHH/jj (September 21, 2000)

Preliminary Sonoran Desert Conservation Plan

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Preliminary Sonoran Desert Conservation Plan

I. Introduction

Status report -- In 1998 the Pima County Board of Supervisors launched the Sonoran Desert Conservation Plan with the goal of combining short-term actions to protect and enhance the natural environment and long-range planning to ensure that our natural and urban environments not only coexist but develop an interdependent relationship, where one enhances the other. This document, the draft Preliminary Sonoran Desert Conservation Plan, provides a summary of the last two years of conservation actions and planning, and sketches the outline for actions and planning efforts that will take Pima County through the next two years. In the Fall of 2002, we will be able to apply for a Section 10 permit from the United States Department of the Interior and have a conservation plan that upholds and gives the broadest application to the ecosystem protection goals of the Endangered Species Act.

Enhancing the public and technical processes -- One of the strongest themes to emerge during the last two years is that community members do not simply want a conservation plan that achieves minimum compliance requirements of federal law. The Sonoran Desert Conservation Plan is a process and a mechanism that allows the community to express its aspirations for improving the quality of life in Pima County. Similarly, the research and technical endeavors of the conservation plan have resulted in more than isolated data sets or impracticable proposals. The expert community in the areas of science, cultural resources, and ranching have contributed with enthusiasm, and provided innovative approaches to resolving substantial resource dilemmas. The draft Preliminary Sonoran Desert Conservation Plan describes options for enhancing both the public process and research enterprises during the next two years.

The six elements of the conservation plan and matters of scale -- This document discusses each of the elements of the Sonoran Desert Conservation Plan on an individual basis and in relation to one another. Pima County's plan is unique given the variety of resources it seeks to protect, and given the expanse of the landscape available for conservation purposes. The biological goals of the plan are expressed directly through elements such as the Habitat, Corridors, and Riparian Elements. The Ranch, Cultural Resources, and Mountain Parks Elements serve to complement and enhance the overall effectiveness of the plan and go far beyond traditional federal habitat conservation plans.

Implementation -- The draft Preliminary Sonoran Desert Conservation Plan also discusses options for implementing the Section 10 permit process of the Federal Endangered Species Act, and anticipates the steps that should be taken in the near term to ensure that Pima County is prepared to meet the conditions of the permit in the year 2002, and effectively establish a natural and cultural resource protection plan over the course of the next decades.

Initiating the comprehensive plan update -- The focus of the last two years has been on developing the factual basis for a natural and cultural resource protection plan. Urban issues can be as fully researched and quantified so that the Board is able to address the full spectrum of land use, fiscal and social equity issues as it considers adoption of the multi-species conservation plan in 2002. This can be accomplished by both initiating the Pima County comprehensive plan update and now beginning a similar planning process to protect our urban resources of people and the built environment.

1. **Sonoran Desert Conservation Plan -- October 1998 through October 2000** -

A. **Education and Outreach** -- In March of 1999 the Board of Supervisors adopted the Sonoran Desert Conservation Concept Plan after a three month comment period, and accepted the requests from over eighty members of the community to become members of a Steering Committee that would provide advice to the Board about which reserve design alternative the County should prefer in making application for a multi-species conservation plan to the United States Fish and Wildlife Service. Since May of 1999, thirteen education sessions have been held to bring technical data and information to the Steering Committee and interested members of the community as they prepare to make recommendations on reserve design based on the options available. A number of meetings were also held with groups that formed to discuss information specific to the different watersheds in Pima County. The level of information sharing through the education sessions that Pima County held for the Steering Committee has not been matched in endangered species conservation planning processes in other jurisdictions. Meetings conducted in the future will focus on receiving public input and working toward achieving consensus among the stakeholders on issues related to reserve design. A summary of meeting dates and attendance is found in Appendix 1.

B. **Research** -- There are six elements to the Sonoran Desert Conservation Plan:

- (1) Ranch Conservation Element;
- (2) Cultural Resources Element;
- (3) Mountain Parks Element;
- (4) Riparian Protection, Management, and Restoration Element;
- (5-6) Habitat and Corridors Protection Elements.

The more than one hundred studies that have served to develop the information base are listed by Element in Appendix 2.

2. **Sonoran Desert Conservation Plan -- October 2000 through October 2002** -- Five major conservation plan supporting documents will be drafted and completed during the next two years, along with a number of studies that serve to fill data and information gaps. The five foundational documents of the conservation plan are: (1) the Regional Multi-Species Conservation Plan (MSCP); (2) the Environmental Impact Statement (EIS); (3) the Adaptive Management Plan; (4) the Implementing Agreement (IA); and (5) the Final Sonoran Desert Conservation Plan. Each of these documents will go through multiple drafts that are presented for public comment and review.

- In the year 2000, an outline of Environmental Impact Statement (EIS) alternatives will be presented to the Board, Steering Committee, other governmental entities, and interested members of the community so that the EIS can be developed based on public input. Meetings with governmental land managers to define management programs, gaps and alternatives to cover the gaps will take place as part of developing the adaptive management plan.
- In the year 2001, work will take place to develop vulnerable species goals, reserve design options and alternatives, a draft of the adaptive management plan and manual, three drafts of the Regional Multi-Species Conservation Plan and Environmental Impact Statement, and two drafts of the Implementation Agreement.

- In the year 2002, work will take place to finalize the adaptive management plan and manual based on the vulnerable species goals, additional drafts of the Regional Multi-Species Conservation Plan, Environmental Impact Statement, and Implementation Agreement will be produced, and a final version of each of the major documents will be issued, including the final Sonoran Desert Conservation Plan.

Figure 1 shows the course of plan development for citizen participation and for science and information development. The draft Preliminary Sonoran Desert Conservation Plan serves as a summary of technical information gathered to date, and it is intended to frame the broad range of options available so that public participation is effective in providing the Board with relevant information that can become the basis of the plan itself.

II. Urban Population Growth, Ground Disturbance and Limits to Conservation Opportunity in Urbanized Areas

During the past century the area covered by the incorporated urban footprint of Tucson has expanded from 2 square miles in 1900, to almost 10 square miles in 1950, to 100 square miles in 1980, to around 200 square miles today. Population levels experienced a steady climb, but the density of residents within a square mile has actually declined from nearly 5,200 in 1953 to around 2,400 persons per square mile today. This translates to a minimum land consumption rate of over 7 square miles each year. In the next two decades, population expansion will consume a land base that is as big as the current City of Tucson limits. Most of this growth is expected to take place in unincorporated Pima County, where residential densities tend to be lower.

The amount of ground disturbance that typically accompanies urban densities eliminates the potential to achieve a number of the conservation goals of the Sonoran Desert Conservation Plan within most incorporated areas, including the City of Tucson. Figure 2 of the Tortolita Fan shows that the same is true given densities in the built areas of incorporated Oro Valley and Marana.

In contrast, most of the area within unincorporated Pima County that has not yet experienced urbanization is open space currently in ranch use. The majority of this land -- over 1.4 million acres in unincorporated Eastern Pima County -- is zoned Rural Homestead (RH) which leaves open more possibilities for achieving the conservation goals of the region (Figure 3).

III. Regulatory Responsibility for Land In Eastern Pima County

Among the local government jurisdictions that have regulatory responsibility for land in Eastern Pima County that is now private, or could be sold by the State in the future to private individuals, Pima County has by far the greatest responsibility, and therefore liability for regulatory practices, of the local jurisdictions. Approximately 88 percent of the land in Eastern Pima County, that is not in federal reserves or governed by the Tohono O'odham Nation, is the regulatory responsibility of Pima County Government. All incorporated areas combined have regulatory responsibility for 12 percent of local land in Eastern Pima County. Most land in incorporated areas is already converted or committed to development; therefore, the realistic opportunities for landscape scale conservation achievements are in unincorporated Pima County.

IV. Factors in Reserve Design and Urban Form

1. Legal Landscape re Regional Conservation and the Importance of Federal Partnerships --

The Endangered Species Act establishes a goal of ecosystem protection but in the absence of regional habitat conservation planning provides little means or funding to do more than regulate at the project level. As jurisdictions create landscape level conservation plans the standards applied upon judicial review are scaling up to assess the effectiveness of larger plans.

A recent court decision out of California provides direction for regional planning efforts such as Pima County's. On August 15, 2000, the United States District Court for the Eastern District of California granted several motions for summary judgment in favor of the National Wildlife Federation, which brought suit against the United States Fish and Wildlife Service for issuing a Section 10 permit to the City of Sacramento for a multi-species conservation plan that depended on the participation of third party local governments.

The funding, regulatory and biological protection strategies of the City of Sacramento plan depended on a partnership with other local jurisdictions in the Natomas Basin to form a regional plan, however the other jurisdictions did not follow through with obtaining a permit. Therefore the resulting plan by the City of Sacramento left an unresolved tension between regional aspirations and the permitted local plan, which led the court to reject the Section 10 permit itself.

Future permits issued by the Service will be analyzed in light of the regional picture, and to ensure that each jurisdiction passes the issuance criteria on its own merit. In order to pass this multi-tier test, Pima County's plan will have to provide information about the resource base across jurisdictional boundaries. Likewise, alternative scenarios covering the range of potential impacts will have to be described across the region.

Pima County is on course to meet this standard since the regional resource assessment conducted to date has been by watershed planning unit, and not by political boundaries. Pima County is also well positioned as the lead local agency in the regional planning process since the County's regulatory responsibility includes such a large percent of the Eastern Pima County land base.

The regional interest nearly coincides with Pima County's interest, given that around 88 percent of Eastern Pima County's local jurisdictional land is in the unincorporated area. Not only does this constitute most of the land base under the regulatory control of local governments, it constitutes most of the land base that will be subject to growth pressures in future decades, and it holds the most promise for resource protection.

The chart below shows the major federal land owners who are important to the conservation plan from a landscape perspective. The conservation potential of the majority of the non-Tohono land base rests with potential reserves that might be assembled by Pima County, the Fish and Wildlife Service, the National Parks, the Bureau of Land Management and the Forest Service.

Native American or Federal Ownership and Local Regulatory Responsibility

Land Base	Approximate Acres In All of Pima County	Percent, All Pima County	Agreement in Principle on Cooperative Planning
Tohono O'odham Nation	~ 2.4 million acres	42%	yes
Unincorporated Pima County	~ 1.45 million acres	25%	yes
Refuges, USF&W	~ .5 million acres	9%	yes
National Parks	~ .4 million acres	7%	yes
BLM	~ .33 million acres	6%	yes
Forest Service	~ .33 million acres	6%	yes
City of Tucson	~ 125,000 acres	2%	pending
Air Force	~ 69,585 acres	1%	yes
Marana	~ 47,000 acres	0.8%	pending
County Parks	~ 27,600 acres	0.5 %	yes
Oro Valley	~ 18,000 acres	0.3%	pending
Sahaurita	~ 9,250 acres	0.1%	pending
South Tucson	~ 647 acres	less 1%	yes
Total	5.8+ million acres	100%	(3% pending)

2. **Actual Landscape Conditions for Reserve Design and Urban Form** -- Every landscape offers different possibilities and constraints to conservation planning. Efforts to conserve resources in Pima County have been made more difficult given that:

- The most sensitive riparian areas are often in private ownership, and have been subject to the longest periods of human occupation and consumptive uses;
- Some major land use commitments made by prior Boards confound planning efforts today; and
- State law allows unregulated development that can be destructive to the landscape, the natural resource base and the tax base and has significantly undermined the local planning ability of the County.

As we have proceeded through the study process of the last months, prospects for defining and implementing an effective conservation plan have improved given that:

- The largest unfragmented landscapes in Eastern Pima County -- the Altar Valley, the Cienega Rincon, and the Middle San Pedro areas -- hold the richest riparian and aquatic resource base and are the home to the greatest number of priority vulnerable species of concern, including listed species;
- Combined, these three areas cover more than 1.2 million acres. Altar Valley alone covers 713,807 acres. This makes it the largest watershed planning unit in Eastern Pima County, comprising almost 30 percent of the total 2.4 million acres. Viewed another way, the entire regional multi-species conservation planning area for San Diego would fit into Altar Valley, and the watershed still exceeds the size of the San Diego multi-jurisdictional regional effort by over 130,000 acres.
- The Middle San Pedro and the Altar Valley are largely unfragmented. Approximately 30 ranches make up the majority of the Altar Valley land base. Altar Valley, the Cienega Rincon area, and the Middle San Pedro watershed planning units do not have zoning in place that has generated large investment backed expectations in commercial or residential enterprise. The full cash value of land in Altar Valley and the Middle San Pedro is also significantly lower than many other areas of Eastern Pima County, which could lead to less expensive conservation programs, or, it could lead to large scale land purchases by developers speculating on its future use.
- The Ironwood National Monument was established on June 9, 2000 following scientific study, public comment and the unanimous support of the Pima County Board of Supervisors, the Pinal County Board, and support from the Tohono O'odham Nation. Encompassing approximately 135,000 acres of land owned by the Bureau of Land Management, the Monument will assist in the formation of the reserve for the Sonoran Desert Conservation Plan.
- The proposed Las Cienegas National Conservation Area also has the potential to contribute to the overall effectiveness of the Sonoran Desert Conservation Plan by protecting the Cienega Creek watershed, the aquatic systems and imperiled fish and amphibians, and riparian dependent species in the region.

Figures 4 through 7 show (1) the general distribution of ranches along the urbanizing edge of Tucson; (2) the existing boundary at the urban and rural interface of eastern Pima County; (3) State and federal land plans for disposing of holdings at the urban edge, which will alter the boundaries; and (4) the projected boundary at the urban interface in 2005.

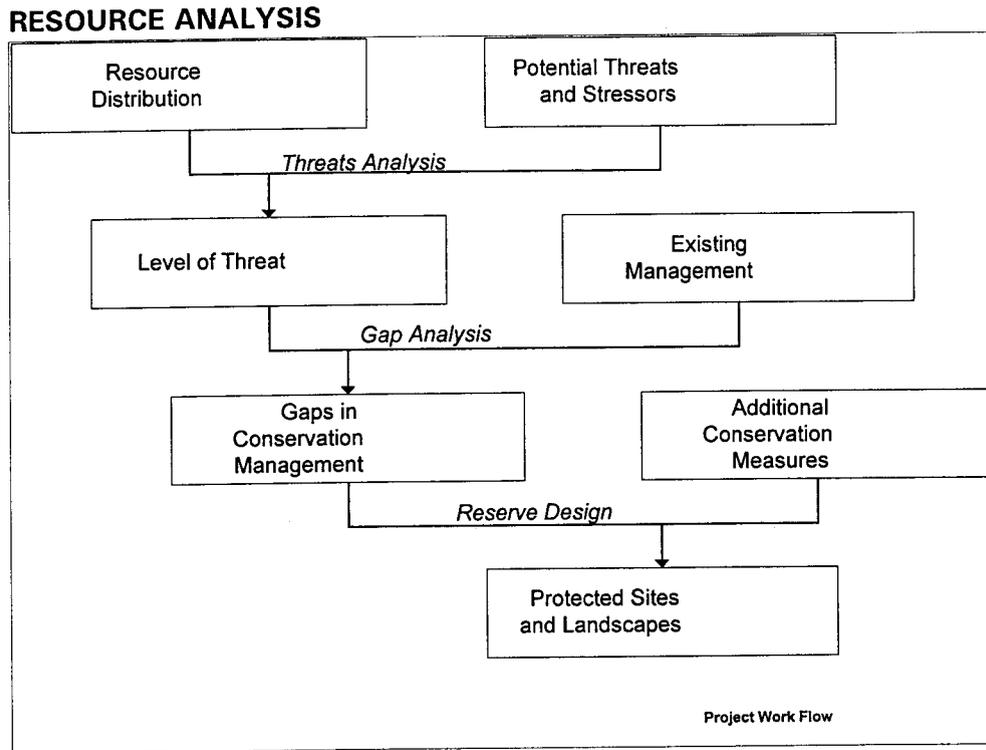
3. The Role of the Six Elements of the Conservation Plan -- Pima County's conservation plan is unique given the variety of resources it seeks to protect, and given the expanse of the landscape available for conservation purposes. While the biological goals of the plan are expressed directly through elements such as the Habitat, Corridors, and Riparian Elements, the Ranch, Cultural Resources, and Mountain Parks Elements serve to complement and enhance the overall effectiveness of the plan.

V. The Draft Preliminary Sonoran Desert Conservation Plan

In 1998 the following paragraph introduced the draft concept document, and it remains true two years later:

“The Sonoran Desert Conservation Plan combines short-term actions to protect and enhance the natural environment with long-range planning to ensure that our natural and urban environments not only coexist but develop an interdependent relationship, where one enhances the other. The action plan will also guide already approved public bond investment and conservation and preservation actions, establish Federal program and funding priorities, and establish our region’s preference for the expenditure of State funds to preserve and protect State Trust lands threatened by urbanization. The Sonoran Desert Conservation Plan will contain the following six elements: 1) ranch conservation, 2) historic and cultural preservation, 3) riparian restoration, 4) mountain parks, 5) habitat, biological and ecological corridor conservation, and 6) critical and sensitive habitat preservation.”

The 1998 draft concept plan listed past, present and future projects by Element. These efforts are revisited and reviewed here. In addition, each Element is discussed in light of the studies that have been carried out during the last twelve to fifteen months by consultants, local experts and county staff. Information for each Element is organized according the resource and threats analysis depicted in the chart below.



Analysis includes a description of: (1) the status of the resource base; (2) threats to the resource base; and (3) current management and existing gaps in protecting resources. Specific conservation measures and projects are recommended as a result of this information.

1. **Ranch Conservation** - Pima County has participated in Ranch Conservation efforts since the 1980s, contributing to the preservation of the Empire, Cienega, Empirita and Posta Quemada ranches. Through the conservation of rangeland in Eastern Pima County, the metropolitan urban boundary is better defined, vast landscapes of open space retain their integrity, and the heritage and culture of the West preserved. Today we might take for granted that over half of our 2.4 million acre region in Eastern Pima County is open land, but the threats to existing ranches are real, and the conversion of a few single large ranches could tear irreparable holes in the integrity of the ranching landscape which would accelerate the conversion of other ranch lands. Since the draft Sonoran Desert Conservation Concept Plan was proposed in 1998, Pima County has purchased Carpenter Ranch in the vicinity of the Tortolita Mountains and discussions are ongoing with regard to the preservation of Canoa Ranch.

A. Description of the Resource Base

Pima County is divided into eight watershed planning units for purposes of the Sonoran Desert Conservation Plan. In assessing the extent of ranch lands within each planning unit, these factors were compared: the total acreage of the watershed; the percent of that land base in ranch use; the number of ranches in the area; grazing capacity; and the percent of federal and state land (Figure 8). By these measures, the Altar Valley, Empire-Cienega Valley, Upper Santa Cruz Valley, and Middle San Pedro area present the best opportunities for ranching in Pima County.

Highest Extent of Ranch Lands

1. Altar Valley
2. Empire-Cienega Valley
3. Upper Santa Cruz Valley
4. San Pedro Valley
5. Avra Valley
6. Tortolita Fan
7. Western Pima County
8. Middle Santa Cruz Valley

Highest Productivity or Grazing Capacity

1. Empire-Cienega Valley
2. Altar Valley
3. Upper Santa Cruz Valley
4. San Pedro Valley
5. Middle Santa Cruz Valley
6. Tortolita Fan
7. Avra Valley
8. Western Pima County

B. Threats to the Resource Base

In assessing threats to the viability of continued ranching, these factors were compared by watershed planning unit: the average cost of an acre of land; the percent of private land that is not ranched; the existing zoning; the number of parcels; and the amount of land slated for sale in the near future by the State Land Department (Figure 9). By these measures, the planning units that are least likely to retain ranch uses in the future are the urbanizing areas of the Middle Santa Cruz, the Tortolita Fan and the Upper Santa Cruz Valley.

Highest Threats to Ranch Lands

1. Middle Santa Cruz Valley
2. Tortolita Fan
3. Upper Santa Cruz Valley
4. Avra Valley
5. Empire-Cienega Valley
6. Altar Valley
7. Western Pima County
8. San Pedro Valley

C. Current Management and Existing Gaps

The following recommendations are offered to fill the gaps in existing land management practices in order to support the Ranch Conservation Element of the Sonoran Desert Conservation Plan.

1. Establish a program that provides certainty for long-term State, BLM, and Forest Service leases.
2. Establish a fairly constructed Purchase of Development Rights program for Pima County.
3. Establish a means to compensate ranchers for decrease in their investment/purchase value of grazing leases at a certain stocking rate should the animal unit numbers be decreased by an agency.
4. Effect changes in the property tax laws that allow a "conservation classification" for private lands for their open space values and that do not meet the agricultural requirements of 40 head of livestock.
5. Build flexibility into the State Statute that mandates 40 head of livestock as a minimum requirement for Agricultural lands tax status, especially in drought years or after fire events.
6. Establish a "grass banks" program which would allow ranchers to "rest" pastures more frequently or perhaps after prescribed burns which require about three years of resting for the grasses to come back.

D. Conservation Opportunities

Altar Valley, Empire-Cienega Valley, Upper Santa Cruz Valley, San Pedro Valley, and now the Ironwood National Monument area of the Avra Valley are the subareas where ranching comprises a significant land use, and where grazing capacity and stability suggest the best potential for future sustainable ranch use (Figure 10). Ranch lands in these valleys have the best potential to define the urban boundary, where developing lands at the urban edge give way to natural open space.

Highest Ranch Conservation Potential

1. Altar Valley
2. Empire-Cienega
3. Upper Santa Cruz Valley
3. San Pedro Valley
4. Western Pima County
5. Avra Valley
6. Tortolita Fan
7. Middle Santa Cruz

Sonoran Desert Conservation Plan

Ranching in Pima County

-  Representative Ranch Locations
-  Ranch Lands
-  Urban/Private Property
-  Existing Reserves
-  Indian Nation



2. **Historic and Cultural Preservation** - The Cultural Resources Element of the Plan provides a detailed review of the known and predicted cultural resources in Pima County -- dating back 12,000 years -- and it analyzes the conservation potential of various landscapes. The 1998 draft Sonoran Desert Conservation Concept Plan identified five past projects, eleven on-going projects, and three future projects. Less than two years later, the review and analysis by the expert community and County staff members has led to a much more comprehensive description of the resource base, identification of existing threats, analysis of gaps in protection, and recommendations and alternatives for conserving historic and cultural resources. Only 12 percent of the land base in Pima County has been formally investigated, yet the diversity of past experience has created a fascinating inventory of known resources.

A. **Description of the Resource Base**

1. **Resources defined by type:** There are three major categories of cultural resources: archaeological resources, historical resources, and traditional cultural places.

2. **Resources defined by time:** Additional divisions based on time periods provide a context for discussions about cultural resources. Mentioned below, these periods include:

- **The Paleolndian Period** covers that time from approximately 12,000 B.C. to 8000 B.C. The Paleolndian Period is believed to have been a time when small bands of highly mobile people hunted and gathered their food following a seasonal round that covered large territories.
- **The Archaic Period** represents a vast stretch of time between 8000 B.C. and A.D. 200. Beginning around 3500 years ago, people began to grow their own food, dig irrigation canals, experiment with making pottery, and settle in large seasonally occupied villages along the banks of well watered rivers, such as the Santa Cruz River. A total of 256 Archaic sites have been found in eastern Pima County, most of which (142) were recorded along Cienega Creek and in the adjoining highlands to the east.
- **The Ceramic Period** covers the time from approximately A.D. 200 to the end of the Prehistoric era defined by the first appearance of Europeans into the Southwest in A.D. 1540. During this time, Archaic populations made the full transition from a mobile society dependant upon hunting and gathering wild food, to a sedentary society dependant upon agriculture. From approximately A.D. 700 to A.D. 1450, the Hohokam Indians dominated central and southeastern Arizona: 1890 archaeological sites have been recorded from the Ceramic Period presenting the single largest number of sites from any time period.
- **The Historic Period ranges in time from A.D. 1540 to 1950.** Of the 338 historic sites recorded in Pima County, most are of ranching, mining, and farming.

3. **Resources described by place:** Data related to the Sonoran Desert Conservation Plan is organized at several scales, including at the landscape scale by watershed subarea planning units. When the number of known archaeological sites, historic resources (including ranches and mines), and traditional cultural places are summarized, a numerical assessment can be obtained, as the following charts reflect. When site data is coupled with landscape level information about past settlement patterns we begin to see zones of high sensitivity for cultural and historical resources, which suggest a reserve design for protecting this resource.

WATERSHED SUBAREA	Archaeological Resources	Historic Resources	Traditional Cultural Places	Total
Middle San Pedro	153	15	27	195
Cienega-Rincon	554	58	20	632
Upper Santa Cruz	472	46	17	535
Middle Santa Cruz	737	130	74	941
Tortolita Fan	970	33	147	1150
Altar Valley	514	79	59	652
Avra Valley	141	25	29	195
Western Pima County	443	13	39	495
TOTAL	3984	399	412	4795

B. Threats to the Resource Base

Cultural resources are valued by the expert community when the contextual relationship between artifacts and the landscape features is not disrupted. The information potential of a site is lost in proportion to the degree of disruption to the surrounding landscape. The attached report quantifies the resource integrity of each subarea by measuring total ground disturbance from four sources that historically have been damaging to cultural and historical resources: urbanization, agriculture, mining and road construction. This provides a means of assessing which subareas have the highest and lowest potential for having intact resources still in existence. The chart below presents this data in order from highest to lowest threat by watershed subarea planning unit.

WATERSHED SUBAREA	Urban Area	Agriculture	Mining	Roads	Total Acres	Percent Subarea
M Santa Cruz	170,453	108		39,806	210,367	58.1%
Tortolita Fan	30,848	22,341	700	10,694	64,583	31.7%
Avra Valley	4,892	29,666	1,648	5,378	41,584	18.7%
U Santa Cruz	15,860	13,182	28,872	12,019	69,933	15.5%
Altar Valley	9,572	6,683		15,275	24,853	3.4%
CienegaRincon	693	1,042		5,273	7,008	2.2%
Mid San Pedro	0	2,131		1,483	3,614	2.0%
W Pima Co.	5,539	127	2,390	10,369	18,425	1.7%
TOTAL	237,857	68,603	33,610	100,297	440,367	

C. Current Management and Existing Gaps

Legal protection for cultural and historical resources is largely a function of landownership.

- Highest Protection Available: Cultural resources on federal lands have the highest legal protection of any lands. State Parks (Catalina State Park) and County Parks lands (Tortolita Mountain, Tucson Mountain Park, Colossal Cave, and the Cienega County Natural Preserve) have been included with this category because both the county and the state have legal control over these areas and both protect cultural resources for the benefit of the public.
- Lowest Protection Available: The second group in the analysis is the state trust land. State trust lands are a commodity and the mission of the Land Department is to dispose of this commodity, not to protect and manage its cultural and natural resources.
- Little or No Protection Available: The last land ownership category is private lands. Cultural resources on private lands are not protected by law, with some exceptions.
- Protection Levels by Local Jurisdictions:

Pima County has a set of cultural resources requirements in the County Code that regulates certain kinds of development through its approval of land rezonings and when grading permits are issued prior to construction. While in place preservation of cultural resources is always preferred, the county has no way to mandate this course of action. As such, the legal requirements work to control the destruction of cultural resources through a mitigation process whereby information is recovered from the cultural resources prior to their destruction through development. There are limitations to this, however. The state's subdivision law allows splitting and development of five or fewer lots without having to meet subdivision planning requirements. Pima County's cultural resources requirements do not apply in these situations and therefore cultural resources within areas under going "wildcat" development are not protected in any way. In a practical sense, this means that cultural resources may be destroyed before they are even recorded. Pima County is the only county government in Arizona that has such a set of preservation requirements in place. They apply only in the unincorporated portions of Pima County. Several other local governments within the county are addressing the preservation issue on their own.

Oro Valley has a cultural resources preservation ordinance on the books that is tied to its development review process, although these provisions are minimal.

The Town of Marana has begun to impose preservation requirements on development projects in its jurisdiction, but does so on a case by case basis without the benefit of a preservation ordinance.

The City of Tucson has a preservation ordinance, however, it is geared towards preserving buildings more than archaeological sites and the city lacks the same legal means as the county to require surveys in advance of development.

Sahuarita has no preservation law at all, nor does it consider cultural resources preservation in its development review process.

- **Resource Protection by Land Status:** The chart below presents this data in order from highest to lowest level of protection by watershed subarea planning unit.

WATERSHED SUBAREA	HIGH: Percent Federal Land, County or State Park	MEDIUM: Percent State Trust Land	LOW: Percent Private Land
W Pima County	98.4%	0.2%	1.2%
Middle San Pedro	47%	38.4%	14.5%
Altar Valley	34.8%	44.9%	20.2%
Cienega Rincon	39.8%	39.4%	20.6%
Avra Valley	45%	22%	31%
Upper Santa Cruz	19.8%	47.3%	34.8%
Tortolita Fan	27.1%	22%	50.4%
Middle Santa Cruz	38.8%	5.4%	53.8%

D. Conservation Opportunities

An analysis of the conservation potential of each watershed for cultural resources was conducted based on these variables: resource distribution (sensitivity); threats assessment (degree of landscape integrity of level of development pressure); and existing legal or management protection. The charts below rank the watershed subareas by conservation potential in qualitative and quantitative formats, with the watersheds that possess the highest potential for conservation listed at the top of the chart (See Figure 11).

WATERSHED SUBAREA	Resource Value	Threat to Site (Development)	Threat to Landscape (Integrity)	Level of Protection
Western Pima County	medium	low	high	high
Middle San Pedro	medium	low	high	high
Cienega-Rincon	high	medium	medium	medium
Avra Valley	medium	medium	medium	medium
Altar Valley	medium	medium	medium	medium
Upper Santa Cruz	medium	medium	medium	low
Tortolita Fan	high	high	low	low
Middle Santa Cruz	medium	high	low	medium

WATERSHED SUBAREA OVERALL COMPARATIVE RANKING	Resource Value Comparative Ranking (1 = high)	Threat to Site Comparative Ranking (1 = low)	Level of Protection Comparative Ranking (1 = high)
1. Western Pima County	4	1	1
2. Middle San Pedro	4	2	2
3. Cienega-Rincon	1	4	5
4. Avra Valley	3	3	3
5. Altar Valley	6	6	6
6. Upper Santa Cruz	5	5	8
6. Tortolita Fan	2	7	7
7. Middle Santa Cruz	4	8	4

General Recommendations -- Cultural and historical resources conservation can be achieved through the Sonoran Desert Conservation Plan in the following general manner:

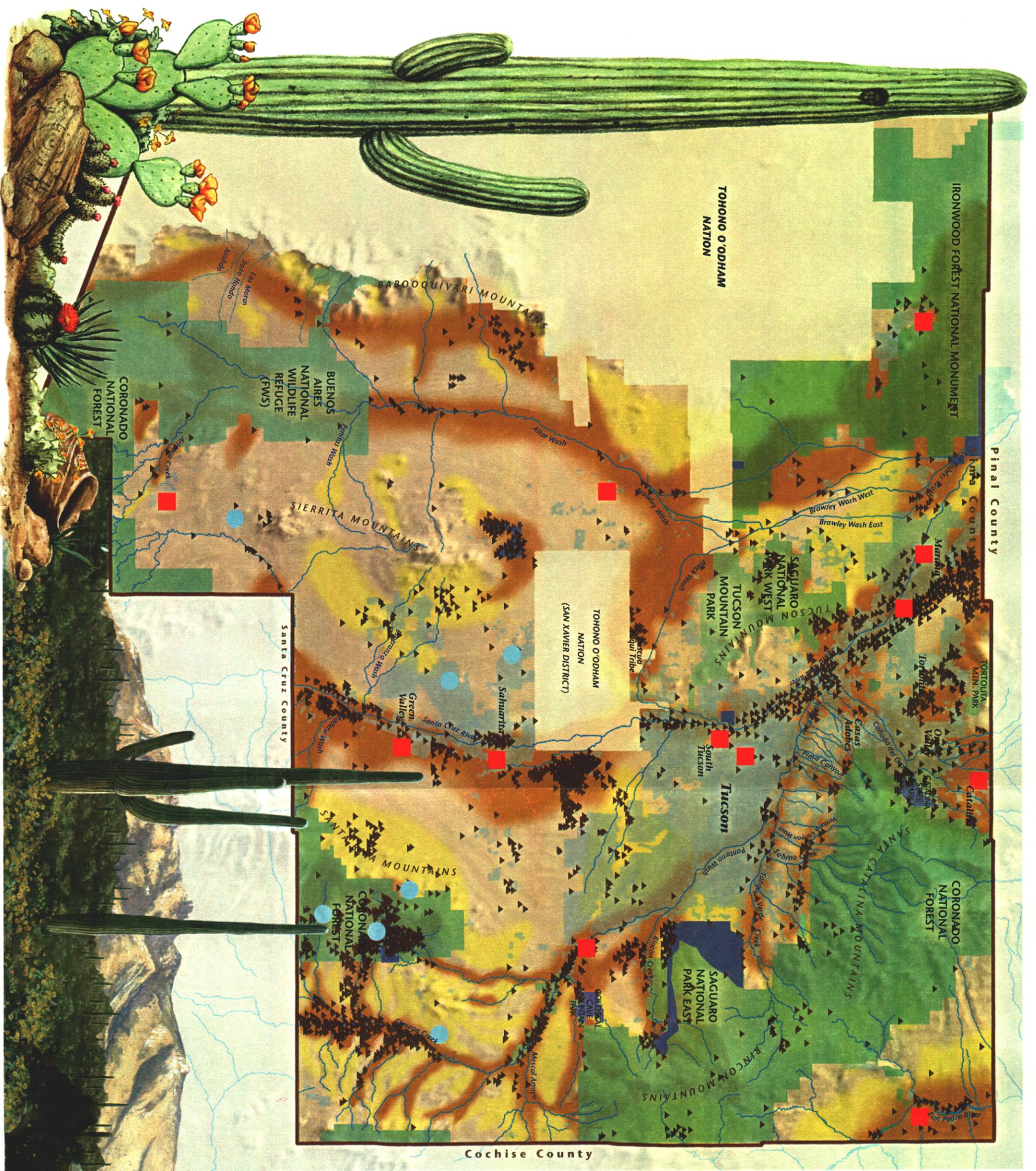
1. Conservation efforts should be directed at the level of the landscape within each subarea. This is needed to ensure that cultural and historical resources are protected along with the contextual evidence of past human interactions with the environment.
2. There are known places that have high cultural and historical value, including but not limited to those listed on the National and State Registers of Historic Places, that should be included as conservation priorities under all reserve design scenarios.
3. Cultural and historical resources will tend to co-occur with other valued resources considered under the Sonoran Desert Conservation Plan (ranch lands, recreational areas, riparian zones, biological corridors, and critical and sensitive habitat). Maximum conservation benefit will be achieved by including cultural and historical resources in designing conservation scenarios for these resources.
4. Priorities for conserving lands containing cultural and historical resources should be multi scalar based on the integrity of the subarea, the cultural resources sensitivity of specific areas within the subarea, and the of threat of future land disturbance from development.
5. Protection of cultural and historical resources should be achieved through both pro-active land acquisition strategies and preservation laws. Where needed, legal tools should be developed and utilized to correct existing inadequacies in law and to enhance consistency in resource protection.

Reserve Alternatives Based on Site Protection and Medium and High Sensitivity Zones -- Based on the information compiled to date in the area of cultural and historic resources, protection opportunities exist at the site and system level. The map on the following page reflects specific important cultural sites, zones of high sensitivity, and zones of medium sensitivity for cultural resource protection.

Sonoran Desert Conservation Plan

Cultural Resources

-  High Sensitivity Archaeological Zone
-  Medium Sensitivity Archaeological Zone
-  Archaeological Sites
-  Historic Communities
-  National Register
-  Ghost Towns
-  Urban/Private Property
-  Existing Reserves
-  Indian Nation



3. **Mountain Parks** - Since the establishment of Tucson Mountain Park in 1929, Pima County's mountain parks and natural preserves have played an important and diverse role in the life of the community. This role will be expanded with the development of the Sonoran Desert Conservation Plan through the design and implementation of a comprehensive open space parks and reserve system that meets endangered species compliance standards for the region. Potential parks and preserves are described below by watershed planning unit, in order to facilitate discussion of the regional reserve network.

A. **Description of the Resource Base**

Pima County's Mountain Park holdings consist of Tucson Mountain Park, the crown jewel of the system; Tortolita Mountain Park, which was first acquired and established after the voters authorized bonds in 1986, and will continue to be expanded; and Colossal Cave Mountain Park, which was established in 1992 with the initial acquisition of the Posta Quemada Ranch, later expanded to its present 1,800 acres, and will be further expanded as part of the Sonoran Desert Conservation Plan. During the past year, community-based initiatives have inspired action at the local and federal level. This has accelerated the planning process and implemented aspects of the Mountain Parks Element. Examples of progressive conservation commitments include the Board of Supervisors significant expansion of Pima County's Tucson Mountain Park by over 1,500 acres, the establishment of the Ironwood Forest National Monument by the President of the United States, and the introduction of legislation by Congressman Jim Kolbe to create the Las Cienegas National Conservation Area. Conservation activity at this scale has not occurred in Pima County since the early part of the century, when most of the existing major reserves were created between 1902 and 1933. Pima County has, since the creation of Tucson Mountain Park in 1929, established two relatively small parks and a natural preserve. But we now realize, as we find that approximately 50 imperiled species create federal compliance issues and signal a general decline in our natural systems, that our incremental approach to conservation over the last 70 years has not been sufficient, and the activity of the of past year will have to continue in order for Pima County to begin to stabilize our resource systems and strike a balance that ensures our quality of life for many future generations. A map of existing reserves is found at Figure 12.

B. **Threats to the Resource Base**

The primary threat to the open space resource base is urbanization and development. Figure 13 reflects how existing reserves are among the most influential of urban form makers, with current development pushing to the edges of the reserve system and spilling over into unplanned and uncommitted land when those limits are reached.

C. **Current Management and Existing Gaps**

Regardless of the amount of open space that exists across Pima County, we have not assembled an open space system that effectively preserves and conserves native species. Our riparian environments have experienced great losses, and these losses relate to wildlife declines. The Science Technical Advisory Team for the Sonoran Desert Conservation Plan has identified over 50 priority vulnerable species for potential coverage under the Sonoran Desert Conservation Plan. There are reasons for the mismatch between past preservation efforts and the reality of our declining natural systems.

- First, parks in Pima County and across the country have often been created to set aside areas of great beauty, but plant and animal communities do not make location decisions based on aesthetics.
- Second, areas that have been set aside for wildlife protection purposes often are too small to support a viable population of the species. It was not until 1985 that scientists in the relatively new field of conservation biology could calculate how badly we have misjudged the area needs of wide ranging carnivores. Large animals are becoming extinct within the boundaries of the very parks that were created to protect them.
- And third, existing protected areas are disconnected. This fragmentation between even large public areas relegates the existing open space patches to the role of a zoo, when the natural functions of the system are replaced by human management and maintenance of the plant and animal communities.

In the past, federal and local public parks were established without a full understanding of the relationship between open space and species conservation, and, as currently configured, they do not sufficiently support suites of species. This applies to parks on a national scale, and it is true in Pima County too. Unlike many communities, however, Pima County still has the opportunity to assemble an effective reserve. We are fortunate to have a number of open space areas, often connected by riparian linkages. The County's parks and preserve system is flexible so that a future open space and preserve system involving federal, state, and private land can include County-owned land managed at the level of conservation that is necessary. This gives the community an opportunity to meet conservation compliance requirements at a regional level, in part through the County's parks and preserve system, while at the same time creating and implementing an adaptive management strategy that can adjust over time to actually improve implementation of the Sonoran Desert Conservation Plan as better scientific information becomes available.

D. Conservation Opportunities --The *Preliminary Mountain Parks Element* suggests where connections exist and it provides a look at the resources within existing and proposed parks and preserves, based on current management and planning documents. The comprehensive biological assessment conducted as part of the Sonoran Desert Conservation Plan is expected to result in changes to proposed preserve boundaries and preserve management. The *Preliminary Mountain Parks Element* frames open space possibilities by outlining the known potential of one ranch conservation area, parks, and preserve areas in Eastern Pima County.

1. Middle San Pedro Subarea -- The Middle San Pedro watershed subarea covers 174,315 acres. Within that area, the United States Forest Service and United States National Parks Service manage substantial land areas. A small reserve exists in the Bingham Cienega Natural Preserve, and the draft *Preliminary Sonoran Desert Conservation Plan* proposes the following addition.

Buehman-Bingham Natural Preserve -- The proposed 7,489-acre Buehman-Bingham Natural Preserve would assure a permanent link between the Catalina Mountains and the San Pedro River corridor and the protection of the sensitive plant and wildlife resources that presently exist in this area.

Animal species -- Riparian species are particularly abundant, and include such high-value inhabitants as leopard frogs (a species of special concern) and the longfin dace. Over 300 species of birds can be found in the area, two-thirds of which are neotropical migrants. Seldom-seen bird species identified in the area include the western yellow-billed cuckoo, the northern gray hawk, the zone-tailed hawk, and others, including the endangered Southwestern willow flycatcher. Other wildlife known to frequent the area include coatimundi, black bear, whitetail and mule deer, javelina, bobcat, and ring-tailed cats. Part of the San Pedro corridor is within the critical habitat designation for the pygmy-owl.

2. Cienega Rincon Subarea -- The Cienega Creek watershed represents one of the most important, if not the most important area in Pima County for aquatic and riparian dependent species. Pima County and the Bureau of Land Management hold sensitive lands, but expansion of current holdings, whether through the proposed Las Cienegas National Conservation Area or achieving additional conservation commitments in the area, are necessary to the success of the Sonoran Desert Conservation Plan. The draft *Preliminary Sonoran Desert Conservation Plan* proposals include additional conservation actions in the Cienega Creek Preserve area, Colossal Cave Mountain Park area, Davidson Canyon, Santa Rita Mountains, and the most sweeping and significant proposal, the Las Cienegas National Conservation Area.

Cienega Creek Natural Preserve --The 3,979-acre Cienega Creek Natural Preserve was Pima County's first Natural Preserve. The Preserve encompasses approximately 12 miles of the Cienega Creek, and roughly half of the protected stretch of the creek experiences perennial stream flow. Important purposes served by keeping this reach of the Cienega Creek in its existing undiminished state are the facilitation of natural aquifer recharge, and the assistance it offers in lessening the severity of flood events capable of impacting the developed area of the Tucson Basin. The utility of the Preserve's flood control capability alone makes it of exceptional value to the Tucson metro area. The lands within the preserve are in excellent natural condition, and few man-made improvements exist within its boundaries. The most significant of the existing improvements is the Vail Water Company diversion, where the perennial base flows of the river are diverted and carried off the preserve via a pipeline. For purposes of planning, the Sonoran Desert Conservation Concept Plan suggests the expansion of the preserve by 7,293 acres, and the protection of Mescal Arroyo which links to Cienega Creek, adding another 1,856 acres to the preserve.

Animal species -- Two principal types of wildlife habitat exist within the existing boundary of the preserve and on its surrounding expansion lands -- those associated with the preserve's riparian areas, and those associated with its upland areas. The more significant of the two are the habitats associated with the preserve's riparian areas, because of the high level of biological productivity and species diversity they foster. As a result of its quality, the preserve's wildlife habitat sustains a diverse and large population of mammals, birds, fish, reptiles, amphibians, and invertebrates. Three special status species are known to exist in the preserve: the Lowland leopard frog, the Mexican long-tongued bat, and the Mexican garter snake. Other special status or species of concern may also be present in the preserve: the Gila chub, the Gila topminnow, the Lesser long-nosed bat, and the Sonoran desert tortoise.

Recreation potential -- The Cienega Creek Natural Preserve's lush vegetation and scenic values, clean running water, outstanding mountain vistas, and sense of solitude and natural quiet make it a very attractive place to visit. However, because resource protection is the principal imperative in the preserve, recreational activities are limited to those that do not adversely impact its sensitive resources:

1. Hiking, walking, backpacking, picnicking and related activities;
2. Railroad train watching, photography and painting;
3. Non-intrusive bird and wildlife observation, photography and painting;
4. Wading in the creek's pools and stream;
5. Scientific research and environmental education;
6. Other low impact recreational or educational activities.

Access is limited to 50 people per day, and a permit is required to enter the preserve. Presently about 10 people per weekday visit the Cienega Preserve.

Colossal Cave Mountain Park -- At approximately 2,000 acres, Colossal Cave is Pima County's smallest existing mountain park, but it too has the potential to grow considerably to meet the region's conservation goals in the Rincon Valley area. While best known for the tourist attraction from which it draws its name, the park has outstanding scenic resources, and includes the 1870s Posta Quemada Ranch. As might be expected from a park that features a natural cave, the geology of Colossal Cave Mountain Park is extraordinary, and is undoubtedly its most significant characteristic. According to experts who have conducted studies on the site, the park's geology is uncommonly diverse, and represents a "mosaic" array of 20 different geologic units. Honoring a request received during the public comment period, the Sonoran Desert Conservation Concept Plan suggests, for planning purposes, that the park be expanded by 14,160 acres in addition to the 4,814 acres recommended by County staff.

Animal species -- Special status wildlife species that are known to occur in the park include the desert tortoise, the American peregrine falcon, the Lesser long-nosed bat, the Mexican long-tongued bat, the California leaf-nosed bat, the western red bat, and Townsend's big-eared bat. The species that inhabit the park range from predatory mammals such as ringtail cats and mountain lions to at least 11 species of bats. The park is especially diverse in bird and reptile species, at least partly owing to the lush riparian habitat in the Posta Quemada Wash and along the nearby Agua Verde Creek.

Cultural resources -- Colossal Cave and the area surrounding it, including the suggested expansion lands, have considerable archeological and historical significance. The lands, with natural springs and riparian corridors, have long attracted the interest of humans and were inhabited for an extended period. To date, 13 prehistoric sites have been identified in vicinity of the park and the adjacent Pistol Hill area.

Recreation potential -- Colossal Cave Mountain Park presently offers a wide range of passive recreation opportunities, including picnicking, birdwatching, hiking, horseback riding and camping.

Davidson Canyon Natural Preserve -- Davidson Canyon is a broad, deep and impressive natural wash corridor approximately 12 miles long that contains high-quality riparian habitat and is extraordinarily picturesque. The canyon, situated a short distance east of the Sonoita Highway and south of Cienega Creek, connects the Cienega Creek Natural Preserve with the Nogales Ranger District of the Coronado National Forest. The proposed Davidson Canyon Natural Preserve, a 6,191-acre unit, and would encompass the roughly 11 miles or so of the canyon not presently protected by Pima County or any other land management agency. The preserve's significance as a corridor between protected natural areas is difficult to overstate; no other linkage proposed in the Sonoran Desert Conservation Concept Plan would connect as many existing or proposed units. The canyon's hydrologic characteristics are also important. Davidson Canyon collects drainage from the northeastern slopes of the Santa Rita Mountains and the northern and western faces of the Empire Mountains, and this runoff ultimately flows into Cienega Creek and through the Tucson Basin. Protecting the canyon in its natural form will maintain its important flood control capacity, as well as its natural recharge capabilities.

Animal species -- Wildlife species likely to be found within Davidson Canyon include endangered leopard frogs, fish such as the long-finned dace, waterbirds, Mexican garter snakes, coyote, gray fox, skunk, collared peccary, bobcat, mule deer, and several varieties of bats, including the Mexican long-tongued bat. The Canyon's scenic values are another of its outstanding natural resources.

Santa Rita Mountain Park -- The proposed 10,703-acre Santa Rita mountain park is situated in the picturesque foothills of the Santa Rita Mountains south of Sahuarita Road and west of Davidson Canyon. The extensive natural resources encompassed by the Santa Rita Mountain Park include Fagan Lake, a man-made pond just outside the Coronado National Forest.

Animal species -- One of the most notable features of the Santa Rita Mountains is the tremendous diversity of wildlife that inhabits the range. In addition to the usual desert species that can be found in the area, such as mule deer, white-tailed deer, javelina, quail, cottontails and the like, the area is also home to the Mexican opossum, the coatimundi and mountain lions. A large variety of birds can also be found in the area, including hummingbirds, several kinds of hawks, Golden eagles, and the tropical kingbird. Reptiles are also plentiful, and include several kinds of rattlesnakes, frogs such as the lowland leopard frog, (a species of special concern) and the western barking frog, gila monsters, and the Sonoran desert tortoise. The area is noteworthy for its large population of bats, which features the Mexican long-tongued bat, the Pale Townsend's big-eared bat, the California leaf-nosed bat, the Ghost-faced bat, and the Western red bat. The Santa Ritas may also support a broad range of threatened and endangered species. Listed-endangered species known or believed to exist in the range and on surrounding lands include the American peregrine falcon, the cactus ferruginous pygmy owl, the jaguarundi, the Lesser long-nosed bat, the pima pineapple cactus, and the Gila topminnow. Listed-threatened species include the Mexican spotted owl.

Recreation potential -- The area is presently lightly used for recreational purposes, partially because of its distance from urban Tucson and partially because it is not well-known. The park does have several existing primitive roads and trails, some of which are listed on the Eastern Pima County Trail System Master Plan.

3. Upper Santa Cruz Subarea -- The Upper Santa Cruz Subarea encompasses the Santa Rita Experimental Range and substantial holdings by the United States Forest Service. Ongoing discussion related to the Canoa Ranch conservation initiative could lead to additional protected acreage within this subarea.

4. Middle Santa Cruz Subarea -- Despite being the most highly urbanized subarea of Eastern Pima County, the Middle Santa Cruz area includes the large reserve of the Coronado National Forest, part of Saguaro National Park, and part of Tucson Mountain Park. Pima County's Agua Caliente Park is also within this watershed subarea. A number of proposals to preserve acreage of less than one section each are included in the draft *Preliminary Mountain Parks Element*. Many of these relate to Tucson Mountain Park, which is described briefly below.

Tucson Mountain Park -- Tucson Mountain Park, formed from volcanic and fault block activity that began an estimated 70 million years ago, is presently Pima County's largest Natural Resource Park and is one of Tucson's most-visited natural areas. Pima County manages 2,514 acres owned by the Bureau of Reclamation adjacent to the western boundary of the park. Saguaro National Park adjoins the County park to the north, adding 24,034 acres to this area.

Animal species found in the park include coyotes, javelina, cottontail and jackrabbits, and mule deer. Other noteworthy wildlife found in the park include bobcats, gray foxes, mountain lions, desert tortoises, gila monsters and a variety of bats and bird species. More than 230 vertebrate species are common to the area, as well as literally thousands of invertebrates. Sensitive species that may be found in the park include the Lesser long-nosed bat and the California leaf-nosed bat. The possibility that the cactus ferruginous pygmy-owl may use the park, and the suitability of its habitat for this listed endangered species, led to the inclusion of Tucson Mountain Park in Unit 2 of the U.S. Fish and Wildlife Service's recent critical habitat designation for the owl.

Cultural resources -- Tucson Mountain Park contains a variety of valuable cultural resources, including prehistoric archaeological sites, rock art sites, historic structures, old mines and trails, traditional O'odham saguaro fruit gathering sites and other traditional cultural places, and natural features of the land that together form a significant cultural and historic landscape.

Recreation potential -- The park includes 26 miles of trails open to hikers, equestrians and mountain bicyclists, an archery range, a rifle range, a campground and picnic areas, and is home to the Arizona-Sonora Desert Museum, the Sonoran Arthropod Research Institute, and Old Tucson Studios.

5. Tortolita Fan Subarea -- The Tortolita Fan subarea includes Forest Service and National Park land, in addition to the Catalina State Park and the County's Tortolita Mountain Park. The major proposal to protect open space and endangered species habitat in the subarea is Pima County's application to the State Land Department to expand the Tortolita Mountain Park area.

Tortolita Mountain Park -- Tortolita Mountain Park was established in 1986, when the Pima County Board of Supervisors approved the expenditure of 1986 bond funds to acquire 3,055.75 acres of private property in the rugged backcountry of the Tortolita Mountains for park purposes. The first 2,426.75 acres was purchased in 1986, and another 629 acres was added in 1988. Several recent acquisitions have brought Pima County's current holdings in the Tortolitas to 3,445.75 acres.

The Tortolita Mountains are one of the oldest geological features in the Tucson area, and include 4,651 foot tall Tortolitas Peak, the highest point in the range. On November 10, 1998, the Board approved County applications to the Arizona Preserve Initiative to expand Tortolita Mountain Park by 25,744 acres. The application includes the Tortolita alluvial fan and Ironwood Forest area, which would serve as a key area for the recovery of the pygmy-owl.

Animal species -- The Tortolita Mountains area supports a wide range of wildlife, and is capable of supporting certain special status wildlife species. The park's proposed expansion lands contain habitat considered suitable for the pygmy-owl. The Sonoran desert tortoise, a species of special concern, is commonly found within the kind of Paloverde-Cacti Mixed Scrub Series habitat found in and around the park, and may be present there. Other special status wildlife found on and around the subject lands include the American peregrine falcon, the Lesser long-nosed bat, the Mexican long-tongued bat, and the California leaf-tongued bat. A wildlife survey conducted as a part of the master planning process for the park in 1996 identified a wide range of animal and bird species, including mountain lion, peccary, mule deer, and large numbers of birds and lizards. The Tortolita Mountains are also home to a small herd of wild horses--one of the few such herds remaining in southern Arizona.

Cultural resources -- The Tortolita Mountains area is rich in cultural resources. Evidence of occupation by Hohokam Indians can be found throughout the area. On the eastern side of the park, the most significant resource is the large and well-known "Indian Town" site, which is the park's first priority acquisition area. However, this area has not yet been systematically surveyed, and additional sites are expected to exist -- particularly along Honeybee Canyon and Sausalito Creek within the adopted park expansion boundary, and along Big Wash in the proposed Tortolita East Biological Corridor.

Catalina State Park Expansion -- The 5,511-acre Catalina State Park is situated in the western foothills of the Catalina Mountains adjacent to the Town of Oro Valley between the Coronado National Forest and the Oracle Highway. Catalina State Park's position and significance in the regional open space network led to its inclusion in both the 1997 Open Space Bond Program and the Sonoran Desert Conservation Concept Plan. The Bond Program identified about 1000 acres, and the Sonoran Desert Conservation Concept Plan identified approximately 2,500 acres of property north of the park for possible protection. The central purpose of the proposed expansion is to facilitate the establishment of a biological corridor that would link the Coronado National Forest, the Sutherland Basin, and Catalina State Park to the Tortolita East Biological Corridor and the Tortolita Mountains.

Animal species -- Species typically found throughout Catalina State Park and on the park's proposed northern expansion lands include javelina, coyote, jackrabbit, cottontail, bobcat, skunk, squirrels, mule deer, and bats, as well as a multiplicity of snakes, lizards and birds. The park provides habitat for migratory neotropical birds and also wintering peregrine falcon. Desert bighorn sheep have been sighted in the park and on surrounding lands in the past, although their numbers have declined to a bare few in recent years. The park's northern expansion lands contain habitat considered suitable for the endangered cactus ferruginous pygmy-owl. The Sonoran desert tortoise, a species of special concern, can be found within the habitat that exists in the area, and could conceivably be present on the expansion lands. Other special status wildlife that may exist on and around the subject expansion lands include the American peregrine falcon, the Lesser long-nosed bat, the Mexican long-tongued bat, and the California leaf-tongued bat.

Cultural resources -- The lands presently within the boundaries of Catalina State Park are home to a wide range of valuable cultural resources. Investigations conducted by the Arizona State Museum and others have found tools, flakes and projectile points that are believed to date back to 5000 B.C. These investigations also suggest that the area was occupied by Hohokam Indians from about 300 B.C. to around 1500 A.D. Some 38 archeological sites have been located and recorded in the park, the most significant of which is the Romero Ruin or "Pueblo Viejo." The Romero Ruin is a classic Hohokam habitation site and historic ranch compound that covers approximately 30 acres, and features a stone compound wall, several rooms of stone masonry construction, rock and trash mounds, rock alignments that are believed to have been irrigation troughs, and two depressions that may have been used as ball courts.

Recreation potential -- Catalina State Park offers approximately 12 miles of recreational trail opportunities for hikers, equestrians and mountain bicyclists.

6A. Altar Valley Subarea -- The major federal land holder in the Altar Valley the United States Fish and Wildlife Service. The National Forest Service and the Bureau of Land Management also manage land in Altar Valley, with other stewardship occurring primarily by ranchers in the vast land base. Conservation initiatives in the area have been discussed primarily in the context of the Ranch Conservation Element of the plan. Similarly, the Cerro Colorado Ranch Conservation Area is a proposal that is cast in the framework of ranchland use.

Cerro Colorado Ranch Conservation Area -- Compared to the sprawling mountain ranges that house county conservation areas, the Cerro Colorado Mountains, which cover an area of about 13 square miles, are relatively small. Despite its less-than-imposing stature, this compact range, named for its rocky red volcanic form, is among the most scenic and biologically diverse in southern Arizona. The craggy peaks of the Cerro Colorados, located less than 6 miles due south of the Sierrita Mountains and immediately north of the Arivaca Road, rise above the surrounding countryside to a height of 5,319 feet.

Animal Species -- The Cerro Colorados boast an impressive roster of wildlife species, including, as previously noted, mule deer, white-trail deer, javelinas, and coatimundis, as well as cliff-dwelling raptors such as the rarely-seen golden eagle. Special status wildlife species in the area include the jaguar and the masked bob-white quail--both of which are listed endangered species--and the Northern gray hawk, Pale Townsend's big-eared bat and Sonoran desert tortoise, all species of special concern. The proposed Ranch Conservation Area will also protect a key portion of the area's watershed. The Cerro Colorado's watershed features are of critical importance because they help sustain several nearby riparian areas, including riparian habitat in the nearby Buenos Aires Preserve. Wildlife authorities have noted that this habitat is especially important for migrating neotropical birds.

6B. Avra Valley Subarea -- Earlier proposals included discussion of conserving the Silverbell Mountains and Waterman Roskrige mountain area. This has been achieved through the establishment of the Ironwood Forest National Monument on June 9, 2000.

Managed by the Bureau of Land Management as part of the Department of Interior's new National Landscape Conservation System, this Monument signals that the conservation ethic can and should be a part of multiple land uses promoted by a wide variety of interested members of the community.

We are looking forward to continuing our partnership with the Bureau of Land Management as they conduct the planning process for the Ironwood Forest National Monument. A goal of future planning will be to connect the land between the Tucson Mountain Park and Saguaro National Park (West) area to the Ironwood Forest National Monument.

Summary of Conservation Opportunities -- The draft *Preliminary Mountain Parks Element* is summarized on the map that follows. It includes:

- The proposed Las Cienegas National Conservation Area
- The proposed new Santa Rita Mountain Park
- Two proposed Natural Reserves: Davidson Canyon and the Buehman Bingham Reserve
- Expansions of existing Mountain Parks, including the Tortolita Mountain Park, Colossal Cave Mountain Park, and Catalina State Park.
- A Ranch Conservation Area proposed for the Cerro Colorado Mountains.

Total acreage for these Mountain Park proposals, including the Las Cienegas National Conservation proposal, is approximately 250,000 acres. Greater conservation commitments will be achieved through the Ranch Element, as we find ways to prevent the fragmentation of ranch land.

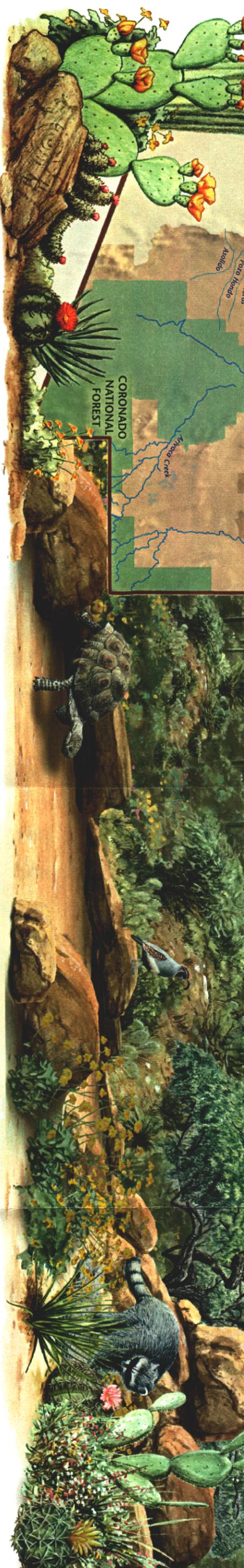
The Riparian Element, and the habitat and corridors conserved to meet the biological goals of the Sonoran Desert Conservation Plan will add dimension to the ultimate reserve and address practical compliance issues at the same time.

A new era for Pima County Mountain Parks has arrived. Not only do parks protect viewsheds, they serve as corridors, connecting biologically significant areas. Mountain Parks will preserve in perpetuity both the beauty and long term sustainability of our resource base. The parks and open space aspects of the Sonoran Desert Conservation Plan will take many years to implement.

Sonoran Desert Conservation Plan

Mountain Parks and Natural Reserves

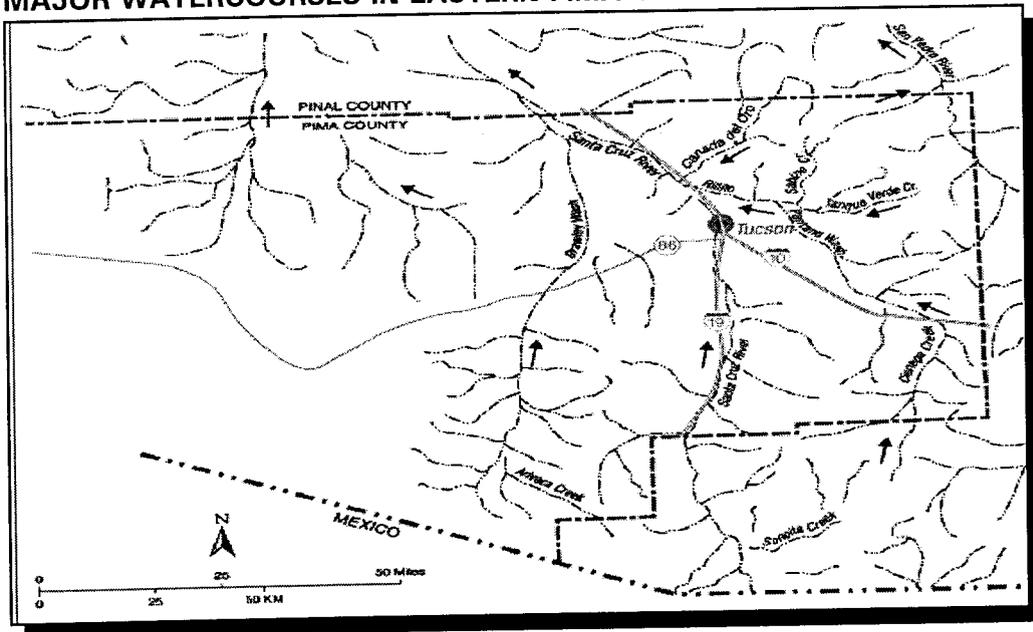
-  Proposed Mountain Park Expansion
-  Proposed Natural Reserve
-  Proposed New Mountain Park
-  Proposed NCA
-  Proposed Ranch Conservation Areas
-  Urban/Private Property
-  Existing Reserves
-  Indian Nation



4. **Riparian Protection, Management and Restoration** - The loss of aquatic, semi-aquatic, and riparian areas is a significant dilemma given the resource protection mandates of the Endangered Species Act: while riparian areas are said to occupy less than one percent of the state's total land base, sixty to seventy-five percent of Arizona's resident wildlife species depend on riparian habitats to sustain their populations. Not surprisingly then, a high percent of extirpated and imperiled species are associated with this habitat type. To begin to address this problem, the Science Technical Advisory Team for the Sonoran Desert Conservation Plan has established biological goals in addition to riparian ecosystem function goals, guidelines for restoration, and guidelines for use of effluent use in riparian projects. This section briefly defines and describes the status of the riparian resource base in terms of its current state, and in terms of its processes.

A. **Description of the Resource Base** -- The native aquatic species in Pima County derive from the Gila River system. In Eastern Pima County, the major watersheds tend to slope northwest in the direction of this system, as reflected on the map below. In general, the components of a riparian area include: (1) water availability; (2) vegetation of the area; and (3) wildlife. Each component is discussed below in relation to the Sonoran Desert Conservation Plan.

MAJOR WATERCOURSES IN EASTERN PIMA COUNTY



1. **Riparian resources defined in part through water availability.** The four major water sources in Pima County are generally held to be surface water, groundwater, Central Arizona Project (CAP) water, and effluent. Surface water includes streams, which have been defined in prior reports to include springs, ponds, pools, wetlands, rivers and washes. A perennial stream has continuous flow; an intermittent stream has flow at certain times; and an ephemeral stream is not connected to the water table so flows only when it rains.

Counting Streams, Shallow Groundwater Sites, and Springs: Fifty-five previously unmapped perennial stream reaches and eighty-two intermittent stream reaches were described in a report by Pima Association of Governments, carried out as part of the Sonoran Desert Conservation Plan. Almost one hundred shallow groundwater sites were also identified in the same report. A separate report identified over 250 springs in Pima County and identified known springs with these characteristics for conservation purposes: springs thought to have perennial flow; springs known to have native fish; or suitable habitat for native fish; and thermal springs.

■ Springs thought to have perennial flow

Agua Caliente Spring	Nogales Spring
Aguajita Spring	Papago Spring
Bingham Cienega Spring	Pidgeon Spring
Box Spring	Quitobaquito Springs
Busch Spring	Scholefield Spring
Cold Spring	Silver Spring
Flicker Spring	Simpson Spring
Green Spring	Unnamed spring
Huntsman Spring	Unnamed spring
Kingler Spring	Unnamed spring
La Cebadilla Spring	Wakefield Spring
Little Nogales Spring	Wild Cow Spring (Whetstones)
Lower Wakefield Spring	Wild Cow Spring (Santa Catalinas)
Mountain Spring	

■ Springs known to have native fish, or suitable habitat for native fish

Agua Caliente Spring
Little Nogales Spring
Mountain Spring
Nogales Spring
Quitobaquito Springs
Unnamed Spring in Davidson Canyon
Wakefield Spring

Prioritizing Streams: One hundred and fifty streams were compared. Streams that ranked in the top 20 by the following parameters are recommended for priority consideration for protection and restoration as part of the Sonoran Desert Conservation Plan: perennial stream length and intermittent stream length; area of hydro-mesoriparian vegetation and of xeroriparian Class A vegetation; area of shallow groundwater; and presence of native fish. Almost 50 percent of the priority streams within the County are found within the Altar Valley and the Cienega Rincon area.

PRIORITY STREAMS

SDCP Planning Unit	Number of Priority Streams	Percentage of Total
1. Middle San Pedro	8	14
2. Cienega Rincon	17	29
3. Upper Santa Cruz	3	5
4. Middle Santa Cruz	9.5	16
5. Tortolita Fan	5.5	9
6A. Altar Valley	12	20
6B. Avra Valley	2	3
7. Tohono Nation	1	2
8. Western Pima Co.	1	2
Total	59	100

2. Riparian resources defined in part through vegetation: Water availability is one of the most significant factors in determining the distribution of riparian plant communities. Xeroriparian vegetation, such as mesquite and acacia, is found in areas with ephemeral stream channels. Mesoriparian vegetation, such as sycamore-ash trees, is found where there is intermittent surface flow, or shallow groundwater. Hydroriparian vegetation, such as cottonwood willow, is found in wetlands or along perennial watercourses. Hydromesoriparian vegetation can be found in the Tanque Verde, Sabino and Agua Caliente areas.

■ Riparian Communities within watershed planning units

WATERSHED SUBAREA	Semi-desert grassland	Sonoran Desertscrub	Mixed Broadleaf	Cottonwood Willow	Mesquite Bosque	Cattail
Middle San Pedro			yes	yes	yes	yes
Cienega-Rincon	yes	yes	yes	yes	yes	yes
Upper Santa Cruz	yes	yes	yes	yes	yes	
Middle Santa Cruz		yes	yes	yes	yes	yes
Tortolita Fan		yes	yes	yes	yes	yes
Altar Valley	yes	yes	yes	yes	yes	yes
Avra Valley		yes			yes	
Western Pima County		yes		yes		yes

3. Riparian resources defined in part though species: A disproportionate number of Pima County's extirpated and imperiled species are associated with riparian habitat.

- Species that depended on riparian or aquatic habitats that no longer exist in Pima County

Muskrat	Desert Sucker	Desert Tryonia
Beaver*	Sonora Sucker	Blue Silverspot Butterfly
Tarahumara Frog	Gentry Indigobush	California Floater (clam)
Speckled Dace	Aravaipa Sage	Ribbonleaf Button Snakeroot
Desert Pupfish **	Malaxis Porphyrea (orchid)	

- Riparian associated species potentially covered by the Sonoran Desert Conservation Plan

Common Name	
Chiricahua Leopard Frog	Mexican Long-tongued Bat
Lowland Leopard Frog	Merriam's Mouse (Mesquite Mouse)
Mexican Garter Snake	Southern Yellow Bat
Red-backed Whiptail Lizard	Allen's Big-eared Bat
Giant Spotted Whiptail	Western Red Bat
Sonora Sucker	Arizona Shrew
Gila Chub	Southwestern Willow Flycatcher
Desert Pupfish	Western Yellow-billed Cuckoo
Longfin Dace	Cactus Ferruginous Pygmy-Owl
Gila Topminnow	Abert's Towhee
Desert Sucker	Bell's Vireo
Huachuca Water Umbel	Gentry Indigobush

- Watercourses associated with existing or very recently extirpated native fish and frogs

WATERSHED SUBAREA	NATIVE FISH -- NUMBER OF STREAMS	NATIVE FROGS -- NUMBER OF STREAMS
Middle San Pedro	4	8
Cienega-Rincon	9	20
Upper Santa Cruz	0	1
Middle Santa Cruz	3	9
Tortolita Fan	1	6
Altar Valley	0	8
Avra Valley	0	2
Western Pima County	1	1

Watercourse Functions and Processes

In addition to possessing a state made up of water, vegetation and wildlife, riparian areas have processes. They function to:

- transport water and dissipate energy during flood events through the floodplain;
- make shallow groundwater available to vegetation;
- flush accumulated salts down below root zones;
- store sediment between floods;
- store and recharge groundwater;
- serve as wildlife corridors;
- provide recreational value;
- improve water quality.

B. Threats to the Resource Base

The major threats to the aquatic and riparian resource base include: groundwater pumping; surface water diversions; encroachment resulting in habitat modification and destruction; non-indigenous species; the potential introduction of non-native species through Central Arizona Project (CAP) water; and the loss of floodplain functions. More specifically:

Groundwater pumping -- On the issue of groundwater pumping, the streams and shallow groundwater with the highest annual reported pumping within one mile of the watercourse include:

- Santa Cruz River
- Tanque Verde Creek
- Sabino Canyon
- Ventana Canyon
- Agua Caliente Wash
- Rillito Creek

Surface water diversion -- Streams with surface water diversions include:

- Cienega Creek (entire base flow diverted)
- San Pedro River (entire base flow diverted)
- Arivaca Creek
- Santa Cruz River

Loss of floodplain function -- In the urban periphery, continued loss of floodplain function is an additional future threat. Examples of areas where future man-made structures may cause large losses of floodplain functions:

- Middle San Pedro Subarea (Subarea 1): Roadway improvements to the San Pedro River Road may require channelization of tributaries, construction of concrete fords, and localized bank protection on the San Pedro River.
- Cienega-Rincon Subarea (Subarea 2): Proposed levees along Rincon Creek will reduce overbank flood storage. Bank protection and channelization are proposed for portions of Pantano Wash adjacent to Vail Valley. Pantano Wash is the likely future source of aggregate for development in the area.

- Upper Santa Cruz Subarea (Subarea 3): Development along the Santa Cruz River could remove overbank storage. Consequent increases in peak discharge downstream to the urban area may be costly. If growth is directed to the distributary flow areas in the southeastern part of the Tucson Basin, flood peaks and erosion potential may increase. Advance planning and infrastructure commitments will be necessary to develop these areas without threatening Old Nogales Highway and increasing erosion of Lee Moore Wash.
- Middle Santa Cruz Subarea (Subarea 4): Encroachment and channelization of tributaries to the Santa Cruz River in the southeastern part of the Tucson Basin will decrease overbank storage and increase erosion potential. Extension of sewer interceptors along erodible stream banks will increase the need for bank protection. Continued channelization of Agua Caliente Wash and Tanque Verde Creek will increase peak flows downstream, and impair the natural development of cottonwood-willow and mesquite forest.
- Tortolita Fan (Subarea 5): The Marana levee construction will remove overbank flood potential and increase the energy directed by flooding upon the Santa Cruz River channel. To develop behind the levee will require advance planning and infrastructure commitments for tributary drainage structures. Development of distributary flow zones on the Tortolita piedmont will increase the need for structures to convey water and sediment to the Santa Cruz River. Encroachment of Big Wash may remove overbank storage.
- Altar Valley Subarea (Subarea 6A): Increasing storage volume at the Arivaca Lake would further reduce flooding as a natural disturbance and would increase the proportion of runoff that evaporates without production of biomass. Development of distributary flow zones on the Sierrita piedmont will increase the need for structures to convey water and sediment to the Black Wash, which has one of the few large remaining mesquite woodlands in the area.
- Avra Valley Subarea (Subarea 6B): Further floodplain development could cause the loss of overbank storage on Brawley Wash and increased peak discharge from the development of distributary flow zones.

C. Current Management and Existing Gaps

Local, State and Federal Management of Riparian Resources -- In general, the gaps in regulatory protection are a lack of a nexus between wildlife programs and local compliance matters, and the lack of protection at the system level.

- Most local regulatory responses focus on retaining natural vegetation, not the other structures or functions of riparian and aquatic ecosystems. For example, in the late 1980's and early 1990's, City of Tucson and Pima County both adopted ordinances protecting or requiring mitigation of damage to certain streamside environments.
- In 1986 and 1997, voters approved bonds to purchase certain high-value riparian areas in Pima County. These measures will reduce but not halt or reverse the rate of loss of riparian vegetation.
- Not all communities have adopted ordinances identifying or protecting their riparian areas, nor do these ordinances address the attrition ongoing in rural areas.

- Measures to reduce the impacts of overbank flooding and sediment balance are primarily found in floodplain management ordinances of the various jurisdictions. For instance, Pima County requires some flood control projects to maintain some overbank storage for the 100-year flood event. In some areas, new in-channel aggregate mining is discouraged in favor of off-channel mining to reduce channel bed degradation.
- Local measures do not exist to protect groundwater-dependent aquatic and riparian ecosystems from drying up as groundwater pumping increases.
- The Safe Yield Task Force for the Tucson Active Management Area is considering recommending that Arizona Department of Water Resources be given authority to work with local communities to designate subareas where groundwater might be regulated to achieve additional goals other than safe-yield, such as subsidence mitigation and protection of groundwater-dependent streams.
- State and federal wildlife agencies neither manage nor conduct research consistently targeted to make a contribution to the protection of imperiled wildlife that is sufficient to resolve compliance issues under federal natural resource laws.
- Non-native species management is another area where new regulatory measures might be needed. Arizona Game and Fish Commission, for example, recently adopted more stringent regulations for crayfish, to reduce the likelihood that this organism will be transferred to aquatic sites where it does not yet occur.
- RECON (2000) has urged Pima County to begin discussions with the Arizona Department of Agriculture (ADA) regarding problems associated with non-native and pest species.
- Rosen (2000) recommended legislation to prohibit purchase and release of bullfrogs.

Most imperiled river systems -- Comparing the watersheds to each other, the most imperiled river systems are:

- Tanque Verde, where habitat losses are high and where continued or increased groundwater pumping impairs streamflow and shallow groundwater conditions;
- Sabino Canyon, where groundwater pumping impairs streamflow, habitat losses are high, and exotic species are a problem;
- Rincon Creek, where groundwater pumping for development may deplete a local aquifer which supports streamflow, and gravel mining may increase channel downcutting;
- Arivaca Creek, where groundwater pumping, surface water diversion, water quality, and exotic species are impairing natural riparian functions;
- Cienega Creek, where future groundwater pumping may deplete streamflow, where derailments along the railroad could contaminate the aquifer, and where non-native species could imperil the largest remaining Gila topminnow population.
- Davidson Canyon, threatened principally by groundwater pumping and habitat loss. Future upstream mining could impair water quality.

D. Conservation Standards and Recommendations

1. Biological and Riparian Ecosystem Function Goals of the Science Technical Advisory Team

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

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

The Science Team adopted specific riparian ecosystem function goals:

1. 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. (A) maintain or restore natural flooding and sediment balance; (B) preserve or re-establish connections between channels and their floodplains, and channels and their distributary flow zones; and [C] maintain or re-establish hydrologic connections between riparian and aquatic ecosystems and shallow groundwater zones.
2. Manage uplands as appropriate to protect the functioning of riparian and aquatic ecosystems within the watershed;
3. Manage point-source and non-point source pollution to maintain water quality at a level needed to support SDCP biological goals;
4. Insure sufficient instream flows to achieve and protect natural functions of riparian and aquatic ecosystems.

2. Recommendations -- Protection: Restoration: Revegetation: Improved Riparian Conditions

Protection

Streams: The most important riparian areas to preserve are defined below in the context of preserving and augmenting the stability of native fish and frog populations. The priority streams have a high, natural availability of water and possess relatively unimpaired water quality. In order to focus on opportunities to improve land stewardship of the most threatened stream segments, only those streams which have part of their length outside core reserves are mentioned below as high priority for protection.

- Subarea 1-- The San Pedro River, Buehman, Edgar, Espiritu, Youtcy and Paige Canyons.
- Subarea 2 -- Agua Verde Creek, upper Rincon Creek, Davidson Canyon, Cienega Creek, Wakefield, Posta Quemada, Gardner, Chimney, and Distillery Canyons.
- Subarea 3 -- None.
- Subarea 4 -- Sabino Canyon, Bear Canyon, Ventana Wash, Tanque Verde and Agua Caliente Creeks.
- Subarea 5 -- Sutherland Wash.
- Subarea 6A -- Arivaca Creek, Las Moras, Pozo Hondo, Asolido, Thomas, Fraguita, Penitas.
- Subarea 6B -- None.
- Subarea 8 -- None.

Systems: Total riparian area is another fundamental biological parameter which is more relevant to terrestrial wildlife than to native fish and frogs. Larger areas are generally capable of sustaining more species and individuals. The streams listed above which possess the largest areas of unprotected riparian habitat include the:

- San Pedro River;
- Agua Verde Creek;
- Sabino Canyon;
- Agua Caliente Wash;
- Tanque Verde Wash; and
- Arivaca Creek.

Infrastructure planning in the metropolitan area could reduce water stress to:

- Tanque Verde Creek;
- Rincon Creek;
- Sabino Creek; and
- Cienega Creek.

Extension of reclaimed and potable water lines and substitution of renewable water for groundwater derived from these areas is needed.

Strategic purchases of land under Pima County's floodprone land acquisition and open space bond programs could reduce water demands and reduce fragmentation due to future development along high priority streams. Open space bonds have been approved for use along:

- Agua Caliente;
- Agua Verde;
- Tanque Verde
- Buehman;
- San Pedro;
- Sabino;
- Bear;
- Honey Bee; and
- Cienega watercourses.

There are a number of properties that are prone to flooding or bank erosion along:

- Sabino;
- Agua Caliente;
- Tanque Verde Creek; and
- Sutherland Wash.

Restoration

Need for restoration: "Restoration" is the effort to restore ecosystem structures and functions as they used to be at some point in the past. The need for riparian restoration was illustrated by the report entitled *Cocio Wash and the Gila Topminnow*, which chronicled how the intention to conserve a relic population of Gila Topminnow under current resource conditions was insufficient.

As is true in most local riparian areas, and even in some upland areas, we have let the resource base degrade too far to expect project and site specific responses to stem losses, much less lead to recovery. The Gila Topminnow was considered to be among the most common of fishes in the Santa Cruz River system in the early 1940s. Three decades later it was considered endangered; and in another three decades time, its recovery is not foreseeable by the science community, given the piecemeal approach to protection efforts. Recovery efforts have been concentrated on federal land, but most perennial waters in the Southwest are controlled by private parties. Therefore, meaningful recovery will have to involve private parties, and will have to provide rewards for conservation efforts.

This theme was extended by the report entitled *Aquatic Vertebrate Conservation in Pima County* (Rosen, 2000). This report documents the tenuous position of native fish and frogs, which are primarily restricted to mountain headwater locations, due to the destruction of valley floor populations and incursion of non-native, predatory aquatic organisms. Without restoration of valley-floor source populations, the small, isolated populations in mountainous regions will be vulnerable to extinction.

Guidelines for restoration: To allow for full ecological restoration, biologists working toward recovery of riparian bird species have recommended these general guidelines:

1. Restore the diversity of fluvial processes, such as movement of channels, deposition of alluvial sediments, and erosion of aggraded flood plains, that allow a diverse assemblage of native plants to co-exist.
2. Restore necessary hydrogeomorphic elements, notably shallow water tables and flows of water, sediments, and nutrients, consistent with the natural flow regime.
3. Restore biotic interactions, such as livestock herbivory, within evolved tolerance ranges of the native riparian plant species.
4. Re-introduce extirpated, keystone animal species, especially keystone species such as beaver, to appropriate sites within their historic range.

Revegetation

Guidelines for Use of Effluent for Riparian Benefits: Effluent derived from wastewater treatment plants will be an important source of water for restoration efforts. Water supplies that can be turned on or off, or at least re-routed to allow drying up of habitat, are ideal for elimination of various exotic fish species that may invade (or be illegally introduced into) re-establishment sites. Thus, effluent, reclaimed water, and highly managed waters in general, offer a key opportunity for multi-species recovery of our native wetland fauna. This opportunity is not readily available in natural water systems, because they are too difficult to regulate, divert, or turn on and off. The Science Team developed some guidelines intended to assist evaluation of the biological benefits of the use of effluent and reclaimed water for the Sonoran Desert Conservation Plan.

1. Protect systems that are self-sustaining over those that need continual inputs.
2. Restore or enhance native riparian and aquatic ecosystems by releasing water to restore local aquifer conditions.
3. If plantings are to be used: revegetation is favored in areas where perpetual irrigation will not be needed.
4. Enhance the ability of secondary effluent or reclaimed water to support aquatic life.
5. Manage riparian and aquatic ecosystems for native species.

Opportunities for Improved Riparian Conditions

Irrigated projects: The major opportunities for irrigated revegetation projects are where infrastructure exists to bring irrigation water and where undeveloped land is available. These areas are primarily along the:

- Santa Cruz River;
- lower Rillito Creek; and
- vicinity of the CAP aqueduct.

Discharge projects: The major opportunities for discharge or aquifer restoration projects are where renewable water infrastructure exists and where hydrogeologic conditions are favorable. Watercourses with favorable hydrogeologic conditions to restore localized aquifers are those reaches which possess an extensive low-permeability layer at a shallow depth:

- Pantano Wash;
- Ventana Wash;
- Sabino Canyon;
- Tanque Verde Creek;
- Agua Caliente Wash; and
- portions of the Santa Cruz River.

Removal of existing surface water diversions could restore flows to parts of: Cienega Creek; Soporí Wash; San Pedro River; Tanque Verde Creek; and Lemmon Creek and Arivaca Creek.

Reintroduction of species: In *Aquatic Vertebrate Conservation in Pima County* (Rosen 2000), development of various Tucson Basin core re-establishment sites is proposed so that (1) leopard frogs and other amphibians and reptiles may disperse from one site to another during especially good and wet years and thus maintain a metapopulation structure, (2) the metapopulation structure also permits occasional immigration-emigration exchange between the valley floor and surrounding mountain canyons, (3) fish are positioned in habitats in the landscape at which they can be expected to weather flooding and drying events. The Lower Santa Cruz River receives discharge of treated sewage from Tucson. Continued groundwater pumping and existing hydrogeologic conditions minimize the potential for the aquifer to rise to levels where the roots of riparian trees could reach. Allowing recharged effluent to mound to the surface would be a concern where landfills occur. For these reasons, the Lower Santa Cruz River is not deemed an opportunity for aquifer restoration. Nonetheless, the existing in-stream flows create valuable riparian habitat for many wildlife species, particularly migratory birds. Aquatic invertebrate communities in the effluent-dominated Santa Cruz River contain only organisms tolerant of poor water quality conditions (USGS, 1998). At present, native fish and frogs are not known to use the effluent-dependent reach of the Santa Cruz River. Water-quality and other habitat improvements could improve the usefulness of the flows to wildlife.

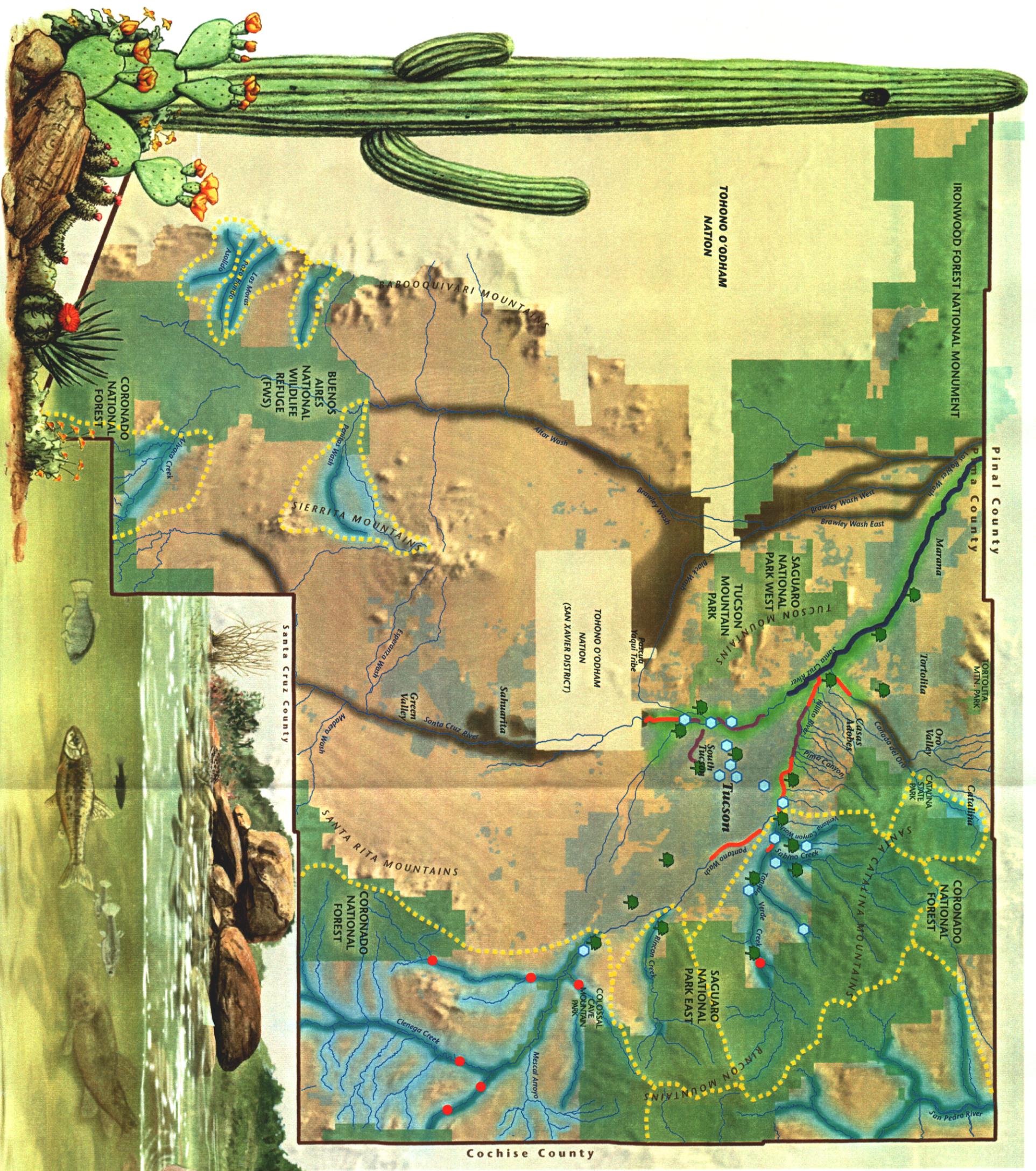
Removing non-natives: To restore natural biotic interactions, Rosen (2000) also recommends removing certain non-native vertebrates in: Canada del Oro; Youtcy; Espiritu; Paige; Romero; Sabino; Bear; Cienega; Agua Caliente; and Tanque Verde watersheds.

Reconstructing flow patterns: The large spring at Agua Caliente Park presents a unique restoration opportunity. The spring flow is impounded to create three or more large ponds in a setting reminiscent of Quitobaquito Springs at Organ Pipe Cactus National Monument, where about 15,000 desert pupfish thrive in about 1/10th the water volume. The substantial spring flow could be used to create more stream-like conditions suitable for the support all of the most critically-declining or endangered wetland vertebrates of the Tucson Basin--pupfish, topminnow, chub, leopard frog, and garter snake--and all in potentially substantial numbers. The spring should be capable of providing a very great linear extent of the habitat type need by the most endangered species--pupfish and topminnows. Bullfrogs are not known to thrive in flow-dominated, small-channel habitat types (as opposed to deep pools, ponds, and lakes, where they do thrive), and thus native lowland leopard frogs, Sonoran mud turtles, and Mexican garter snakes could also exist.

Sonoran Desert Conservation Plan

Riparian Conservation

-  Effluent based Riparian Projects
-  Stream based Potential Native Fish & Frog Projects
-  Spring based Potential Native Fish & Frog Projects
-  High Priority Riparian Protection Areas
-  High Priority Watershed Boundaries
-  Opportunities for Future Revegetation Projects
-  Retain/Restore Natural Flood Plain
-  Existing River Parks
-  Future River Parks
-  Effluent Dominated Reach
-  Urban/Private Property
-  Existing Reserves
-  Indian Nation



5-6. **Critical and Sensitive Habitat; Biological Corridor Conservation** - The first statement of purpose of the Endangered Species Act is to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved" The conservation of biologically connected patches of land, landscapes or systems is essential to protection of species, but the administration of the Act typically occurs at the project level and in relation to a single listed species. Section 9 of the Endangered Species Act prohibits "take" of an endangered animal. This means it is unlawful to hurt, harm, harass or significantly alter the habitat of an endangered animal. Potential liability exists in criminal or civil form. Litigation can be pursued by the federal government or through citizen suits. The high level of conflict and expense, and the relatively low level of lasting conservation that can result from a strictly regulatory approach to the Endangered Species Act has led to the creation of habitat conservation plans. Defined under Section 10 of the Endangered Species Act, these plans, when carried out at the regional and multi-species scale, hold the promise of (1) balancing competing interests in land and natural resource use, and (2) resulting in an overall net benefit to the species. Ideally, habitat conservation plans will contribute to the recovery of listed species. Adding a biological component to land use and fiscal planning also has the effect of enhancing the quality of life within a community.

Pima County's multi-species conservation plan is among the largest in the United States. The biological assessment for the Sonoran Desert Conservation Plan is ongoing. This section summarizes the preliminary findings of studies related to the Sonoran Desert Eco-region; the specific plants and animals that are potentially covered species under the Section 10 permit of the plan; the pygmy-owl and its habitat needs; and the special focus accorded to date on Ironwood habitat in Pima County. A draft preliminary map of important habitat and corridors is also included, based on findings from the Riparian Element, the Ecoregional study by The Nature Conservancy, and designated critical habitat for the pygmy-owl. Preliminary analysis by Recon Consulting is currently being peer reviewed by over two dozen species experts in the community and that data layer will be added to the Habitat and Corridors Elements map in the near future.

A. Description of the Resource Base -- On-going Multi-Species Assessment

1. **Ecological Analysis of Conservation Priorities in the Sonoran Desert Ecoregion** -- In a study effort independent of the Sonoran Desert Conservation Plan, The Nature Conservancy led a bi-national undertaking to compile and analyze ecological data from the entire Sonoran Desert Ecoregion. This study, which encompasses Western Pima County and much of Eastern Pima County, is incorporated into the Sonoran Desert Conservation Plan by the Science Technical Advisory Team. In addition to Special Element Sites, The Nature Conservancy's prestigious study identifies 100 conservation sites, which could, if managed appropriately to reduce the major stressors, ensure long term persistence of most of the biodiversity of the ecoregion. In Eastern Pima County, conservation sites include:

Altar Valley/ Baboquivari Mnts	Sabino Canyon	Silverbell Mountains
Cienega Creek	San Pedro River	Tortolita Mountains
East Tucson Riparian Complex	Santa Rita	Tucson Mountains

2. Priority Vulnerable Species of Concern -- A 300 page draft document entitled *Priority Vulnerable Species, Data Compilation and Synthesis* submitted by the Recon Consulting team as part of the biological evaluation of the Sonoran Desert Conservation Plan provided a detailed description of plants and animals that are being considered by the Science Technical Advisory Team as potentially covered under the multi-species program. Organized by taxonomic group, the priority vulnerable species accounts include:

- 9 mammals
- 8 birds
- 7 reptiles
- 7 plants
- 6 fish
- 2 amphibians
- Invertebrates

Two strong themes emerge when this compilation of species accounts is read together: one is the importance of aquatic and riparian-based habitats to the majority of priority vulnerable species, and the other is the bleak biological status of the riparian system. The *Priority Vulnerable Species* report is currently being peer reviewed by over two dozen species experts and will be updated in the next months. Preliminary analysis is provided below.

Mammals

Detailed accounts of nine mammals considered to be priority vulnerable species are included in the study.

Priority Vulnerable Mammal Species

SCIENTIFIC NAME	COMMON NAME
<i>Choeronycteris mexicana</i>	Mexican long-tongued bat
<i>Idionycteris phyllotis</i>	Allen's big-eared bat
<i>Lasiurus blossevillii</i>	Western red bat
<i>Lasiurus xanthinus</i>	Southern yellow bat
<i>Leptonycteris curasoae yerbabuena</i>	Lesser long-nosed bat
<i>Macrotus californicus</i>	California leaf-nosed bat
<i>Peromyscus merriami</i>	Merriam's mouse
<i>Plecotus townsendii pallescens</i>	Pale Townsend's big-eared bat
<i>Sorex arizonae</i>	Arizona Shrew

Number of Priority Vulnerable Mammal Species by Subarea

WATERSHED SUBAREA	NUMBER OF PRIORITY VULNERABLE SPECIES
Middle San Pedro	4
Cienega-Rincon	7
Upper Santa Cruz	7
Middle Santa Cruz	6
Tortolita Fan	6
Altar Valley	7
Avra Valley	6
Western Pima County	7

Birds -- Eight birds are considered to be priority vulnerable species.

Priority Vulnerable Bird Species

SCIENTIFIC NAME	COMMON NAME
<i>Aimophila carpalis</i>	Rufous-winged sparrow
<i>Athene cunicularia hypugaea</i>	Burrowing owl
<i>Buteo swainsoni</i>	Swainson's hawk
<i>Coccyzus americanus occidentalis</i>	Western Yellow-billed Cuckoo
<i>Empidonax traillii extimus</i>	Southwestern willow flycatcher
<i>Glaucidium brasilianum cactorum</i>	Cactus ferruginous pygmy-owl
<i>Pipilo aberti</i>	Abert's Towhee
<i>Vireo bellii</i>	Bell's Vireo

Number of Priority Vulnerable Bird Species by Subarea

WATERSHED SUBAREA	NUMBER OF PRIORITY VULNERABLE SPECIES
Middle San Pedro	5
Cienega-Rincon	7
Upper Santa Cruz	7
Middle Santa Cruz	7
Tortolita Fan	6
Altar Valley	7
Avra Valley	6
Western Pima County	5

Reptiles

Priority Vulnerable Reptile Species

SCIENTIFIC NAME	COMMON NAME
<i>Chionactis occipitalis klauberi</i>	Tucson shovel-nosed snake
<i>Chionactis palarostris organica</i>	Organ Pipe shovel-nosed snake
<i>Cnemidophorus burti stictogrammus</i>	Giant Spotted whiptail
<i>Cnemidophorus burti xanthonotus</i>	Red-backed whiptail
<i>Sonora semiannulata</i>	Ground snake
<i>Terrapene ornata luteola</i>	Desert box turtle
<i>Thamnophis eques megalops</i>	Mexican Garter Snake

Number of Priority Vulnerable Reptile Species by Subarea

WATERSHED SUBAREA	NUMBER OF PRIORITY VULNERABLE SPECIES
Middle San Pedro	1
Cienega-Rincon	2
Upper Santa Cruz	2
Middle Santa Cruz	4
Tortolita Fan	2
Altar Valley	4
Avra Valley	2
Western Pima County	2

Amphibians

Priority Vulnerable Amphibian Species

SCIENTIFIC NAME	COMMON NAME
<i>Rana chiricahuensis</i>	Chiricahua Leopard Frog
<i>Rana yavapaiensis</i>	Lowland Leopard Frog

Number of Priority Vulnerable Amphibian Species by Subarea

WATERSHED SUBAREA	NUMBER OF PRIORITY VULNERABLE SPECIES
Middle San Pedro	1
Cienega-Rincon	2
Upper Santa Cruz	2
Middle Santa Cruz	1
Tortolita Fan	0
Altar Valley	2
Avra Valley	0
Western Pima County	0

Fish

Priority Vulnerable Fish Species

SCIENTIFIC NAME	COMMON NAME
<i>Agosia chrysogaster</i>	Longfin dace
<i>Catostomus clarki</i>	Desert sucker
<i>Catostomus insignis</i>	Sonora sucker
<i>Cyprinodon macularius macularius</i>	Desert pupfish
<i>Gila intermedia</i>	Gila Chub
<i>Poeciliopsis occidentalis occidentalis</i>	Gila Topminnow

Number of Priority Vulnerable Fish Species by Subarea

WATERSHED SUBAREA	NUMBER OF PRIORITY VULNERABLE SPECIES
Middle San Pedro	4
Cienega-Rincon	3
Upper Santa Cruz	0
Middle Santa Cruz	1
Tortolita Fan	0
Altar Valley	2
Avra Valley	0
Western Pima County	0

Plants

Priority Vulnerable Plant Species

SCIENTIFIC NAME	COMMON NAME
<i>Coryphantha scheeri</i> var. <i>robustispina</i>	Pima pineapple cactus
<i>Dalea tentaculoides</i>	Gentry indigo bush
<i>Echinocactus horizonthalonius</i> var. <i>nicholii</i>	Nichol's Turk's head cactus
<i>Echinomastus erectocentrus</i> var. <i>acunensis</i>	Acuna cactus
<i>Echinomastus erectocentrus</i> var. <i>erectocentrus</i>	Needle-spined pineapple cactus
<i>Lilaeopsis schaffneriana recurva</i>	Huachuca water umbel
<i>Tumamoca macdougalii</i>	Tumamoc globeberry

Number of Priority Vulnerable Plant Species by Subarea

WATERSHED SUBAREA	NUMBER OF PRIORITY VULNERABLE SPECIES
Middle San Pedro	0
Cienega-Rincon	3
Upper Santa Cruz	3
Middle Santa Cruz	2
Tortolita Fan	1
Altar Valley	2
Avra Valley	2
Western Pima County	2

Summary of Priority Vulnerable Species by Subarea -- The chart below combines the total number of priority vulnerable species from the categories mammals, birds, reptiles, amphibians, fish, invertebrates, and plants.

WATERSHED SUBAREA	NUMBER OF PRIORITY VULNERABLE SPECIES
Middle San Pedro	16
Cienega-Rincon	29
Upper Santa Cruz	23
Middle Santa Cruz	22
Tortolita Fan	17
Altar Valley	31
Avra Valley	16
Western Pima County	17

3. Description of the Resource Base -- Focus on the Cactus Ferruginous Pygmy-Owl -- Pima County contracted with the Arizona Game and Fish Department to conduct telemetry analysis and gather information that would lead to effective conservation and recovery initiatives for the cactus ferruginous pygmy-owl. Questions posed as part of the study include:

- *Is there exchange between pygmy-owl populations?*
- *Are pygmy-owls residents of specific areas, rather than migratory?*
- *Where do pygmy-owls go upon dispersal and how far do they travel?*
- *How tolerant are pygmy-owls of various urban occurrences? How adaptable?*

Studies entitled *Cactus Ferruginous Pygmy-Owl Investigations* provided observations related to these and other questions about the behavior of pygmy-owls. During 1997, banded birds were monitored. Beginning in 1998 and during 1999, pygmy-owls were radio-marked with backpack transmitters and followed on foot, by vehicle, and on two occasions aerial location of dispersing pygmy-owls took place using the Arizona Game and Fish aircraft.

Study Area -- The study area covered by scientists from the Arizona Game and Fish Department include:

- Cienega Creek Preserve (1997-1998)
- Pichacho Peak / Suizo Mountains (1999)
- Marana / Redrock (1997-1998, and 1999)
- Northwest Tucson (1997-1998, and 1999)
- Organ Pipe Cactus National Monument (1999)
- Saguaro National Park (1997-1998, and 1999)
- Tucson Mountain Foothills (1997-1998, and 1999)
- Santa Catalina Mountain Foothills (1997-1998, and 1999)
- Altar Valley (1999), Buenos Aires (1999), and Sopori Wash (1997-1998)

Results and Discussion -- A few highlights results of field efforts during the past three years are reproduced below:

- "Arizona Game and Fish Department (AGFD) survey and monitoring efforts in 1999 resulted in confirmation of 25 occupied territories prior to dispersal of young." [Page 13, 1999 study]
- "In cooperation with U.S. Fish and Wildlife Service contract biologists and National Park Service biologists at Organ Pipe National Monument, we located 11 active pygmy-owl nests. Five other territories were believed occupied by unpaired males due to sustained and vigorous territorial calling throughout the nesting season." [Page 13, 1999 study]
- "After dispersal of young, we identified three newly occupied territories defended by pygmy-owls that were tracked using radio telemetry. We recognized 28 total territories when pre and post-dispersal sites are combined." [Page 13, 1999 study]
- During 1999, eleven pygmy-owl nests were located and monitored in Pima and Pinal counties. From these nests, 32 young fledged (average of 2.9 per nest), and 16 were known to survive dispersal. [Page 17, 1999 study]

Nest Productivity in Pima and Pinal Counties, 1999

AREA	# NESTS	# FLEDGED	AVERAGE/NEST
Marana / Redrock	2	5	2.5
Altar Valley	4	11	2.75
Northwest Tucson	4	16	4.0
Organ Pipe National Monument	1	?	?
Totals	11	32	2.9

- During 1998, three nests fledged a total of 11 young (average of 3.66 per nest).
- During 1997, one nest produced 4 young; all 4 fledged and survived dispersal.
- Between 1996 and 1998, 19 of 22 fledglings survived dispersal, whereas in 1999, only 16 of 32 fledglings were known to survive dispersal.
- The 1997-1998 report describes fledgling interactions: "Fledglings maintained a relatively close association from the time of fledging until near dispersal. ... We were not able to characterize any juvenile interactions as overtly aggressive, but did observe position swapping, pushing, and following each other from perch to perch. During prey deliveries and feeding, fledglings would tend to congregate closer to each other, but frequently on separate perches. While intently watching the adult feeding prey to one or two siblings, the remaining young appeared to simply wait their turn and allow the adult to bring prey to them. In contrast, observations of young being fed by adults in Texas suggest greater aggression or squabbling between siblings over prey." [Pages 24-25]
- The 1997-1998 report also describes aggressive defense of young: "When observers searched for recently fledged young during 1997 and 1998, one or both adults would frequently fly to a nearby perch to investigate ... and often use the alarm call. When searching for fledglings at two different nest sites in 1998, three observers were struck on the back of the head during three separate incidents. During searches we would sometimes get very close to fledglings and would not be aware of their presence until hearing adult alarm calls. Adults swooped on observers shortly after the calls were heard. This very aggressive behavior by adults seemed to decrease as young matured." [P. 25]
- Mobbing episodes are described in the 1997-1998 report: "The noise and movement of mobbing birds often attracted our attention and resulted in detections of pygmy-owl adults and young that may otherwise have gone unseen. Sixteen different species were observed engaging mobbing behaviors. These birds ranged in size from hummingbird species to as large as greater roadrunners." [Page 26]

- "The reaction of pygmy-owls to mobbing birds was variable. Sometimes pygmy-owls appeared to ignore the harassment and remained on their perch until the offenders stopped and moved away. In 1998, a recent fledgling appeared stunned or indifferent while being attacked and struck on the head repeatedly by a black-tailed gnatcatcher. On other occasions, owls simply flew off to escape their tormentors, though often were followed from perch to perch." [Page 26, 1997-1998 report]
- Nesting chronology, from the 1997-1998 report

ACTIVITY	APRIL	MAY	JUNE	JULY	AUGUST
Incubation	mid April	to mid May			
Hatching		early - mid			
Nestling/Fledging		early May to	first of June		
Dispersal				start late July	early August

- The report from 1997-1998 provides observations of nestlings, fledging, and first flights:

Nestlings: "Our first direct observations of nestlings were approximately one week prior to fledging, after down was lost and feathers were nearly grown in. ... One nestling would work its way up to the cavity entrance and we could observe its head, neck and breast. Remaining near the entrance appeared difficult at first and may have been the result of several nestlings jostling for position or poor strength and balance. ... One characteristic behavior of both nestlings and fledglings is circular or bobbing head movements which assist the observer in distinguishing perched adults from young."

Fledging: "As nestlings become stronger and balance is increased, they begin to spend more time in the cavity entrance, standing on the bottom ledge of the entrance opening. Older nestlings have been observed leaning their entire bodies outside the cavity opening and almost falling. ... Just prior to fledging, both male and female adults with prey in their possession, appear to increase their time calling from perches, instead of going directly to the cavity. ... We suspect this adult behavior is an attempt to entice the nestlings to leave the cavity in order to obtain the prey."

First flights: "The first flights for all directly observed fledglings during 1997 and 1998 were free of injury and entanglement. Most fledglings traveled successfully to the nearest tree or large shrub and began moving to different perch positions. Subsequent flights were more problematic with some birds landing near or on the ground, others became briefly entangled in branches and one was found a few feet from a road. One fledgling in 1997 was rescued from a cholla where it was unable to extract itself. Observations of distances traveled during initial flights at one nest site in 1998 were surprising as all three fledglings reached a patch of paloverde trees approximately 25 meters away from the nest cavity. Flights were high, floating or bobbing similar to the flight of butterflies, rather than the direct level flights of adult birds. Once a fledgling arrived at its first perch, it was immediately joined by the adults on nearby perches. One nestling fledged directly toward the perched and calling adult female." [Pages 51-52, 1997-1998 study]

- Providing observations about flight patterns and dispersal during 1997 and 1998, the report states at page 54:

Road crossing: "Radio-marked pygmy-owls crossed several two-lane roads with vehicle traffic that ranged from light to moderately heavy in areas with trees and large shrubs on both sides of the road."

Flight style: "The pygmy-owl flight style is typically two or four feet off the ground or just over the tops of shrubs and ground cover plants. It may fly in short hops of several meters in distance and up to 50 meters, as it moves from one tree or shrub to another within desert scrub communities. This flight pattern was also observed during dispersal." Collisions with cars and structures (such as a fence) have been observed.

- In 1999, 11 juveniles were captured and equipped with backpack style radio transmitters. Eight juvenile owls were tracked through dispersal, and the dispersal routes are found on pages 24 and 25 of the report.

A few notes from the report include:

Juvenile 1 dispersed on July 28, 1999, 61 days after fledging, and traveled 24.4 miles during 41 days of monitoring. A new territory was established when the dispersing owl paired with a resident male, 13 direct linear miles from the dispersal site.

Juvenile 2 dispersed between July 27 and July 30, 1999, and traveled 10.95 miles during a 39 day monitoring period. The last radio location site of the owl on September 27, 1999 was 3.14 direct linear miles from the dispersal site.

Juvenile 3 dispersed on July 31, 1999, only 49 days after fledging, and traveled 18.68 miles during 17 days of monitoring. A total of 6.15 direct linear miles separated the new territory from the juvenile's nest site.

Juvenile 4 dispersed on July 30, 1999, and traveled 1.93 miles in 17 days of monitoring. Direct linear distance to the last know detection area was about 1.5 miles from the nest site.

Juvenile 5 dispersed on July 30, 1999, from the same nest site as Juvenile 4. Monitoring during 33 days reflects that the owl traveled 11.26 miles, leaving it 5.3 direct linear miles from the fledge location, when the last detection was recorded.

Juvenile 6 dispersed between July 22 and July 26. After six days of monitoring the signal was lost but a distance of 9.85 miles, or 9.45 direct linear miles, was covered in that time.

Juvenile 7 dispersed late in the season (September 9), but early in its life (48 days after fledging). Monitoring efforts were complicated and after three days of tracking, observers lost the signal for the juvenile. An aerial survey took place on the 13th of September and then the owl was lost again after the fifth day of tracking. Total distance covered was 6.27 miles, or 4.35 miles direct linear distance from the nest site.

Juvenile 8, the even-more-daring sibling of Juvenile 7, took off between September 4th and 7th, only 43 to 46 days after fledging. It took three days to lose the observers, and aerial surveys relocated this owl for another two days of data gathering before the signal was lost again. During six days of observation, Juvenile 8 covered 7.89 miles, or 6.37 direct linear miles.

Conclusions Following the 1999 Survey Season -- In the 1999 report, the authors offer some insights and conclusions based on field investigations of the past years, including:

- Altar Valley: "Fourteen new territories that included at least 4 nest sites were documented in the Altar Valley in 1999. Most territories were located in mesquite-grassland and Sonoran desertscrub transition areas near mountain foothills. These detections reveal an important new component of the known population of pygmy-owls in southern Arizona and may represent the largest known concentration of pygmy-owl activity in Pima and Pinal counties." [Page 27]
 - Telemetry: "As dispersal information is recorded over consecutive years, annual use patterns of certain dispersal routes are beginning to emerge. One explanation for these common dispersal routes, at least in the developed parts of northwest Tucson, is that areas of open, undeveloped desertscrub are limited. Pygmy-owls do not disperse with long distance flights, but rather make short flights from tree to tree, foraging and using the habitat as they go. Connected, undisturbed vegetation facilitates such dispersal. Monitoring has indicated that dispersing juveniles often choose to move through undisturbed desert areas and go around, rather than over high density residential developments. Such developments appear to present barriers to dispersal while open desert with natural washes and mature native vegetation, provide unobstructed and less hazardous dispersal routes. Radio telemetry during 1998 and 1999 has shown these limited habitat connections are being used annually by dispersing juveniles in northwest Tucson." [Page 28-29]
 - Population Segments: "Currently, there are four distinct pygmy-owl population segments in Arizona. These are Pinal County, NW Tucson, Altar Valley and Organ Pipe Cactus National Monument. No exchange between these segments has been documented with [one] exception. An additional population segment is known to occur on the Tohono O'odham [Nation], but no species specific surveys, banding or radio-marking has been done in that area. ... Overall CFPO population viability in Arizona will be very dependent on exchange of pygmy-owls between these population segments. Barriers and habitat fragmentation which may prevent this should be considered hurdles to recovery of pygmy-owls in Arizona." [Page 30]
4. Desert Ironwood -- Pima County had the privilege to forward the report entitled *Desert Ironwood Primer* from the Arizona-Sonora Desert Museum in coordination with the Sonoran Desert Conservation Plan effort. Written by Dr. Gary Nabhan and other scientists, the *Desert Ironwood Primer* is the first study that takes a comprehensive view of ironwood habitats in both the United States and Mexico, evaluating the ecological and cultural resources supported by the ancient ironwood tree. The report inspired and led to the creation of the Ironwood Forest National Monument.

Ecological Significance -- The *Desert Ironwood Primer* establishes the importance of ironwood as a habitat modifying keystone species and nurse plant that has a role in supporting the biodiversity of over 500 Sonoran Desert species, including the endangered cactus ferruginous pygmy-owl. At the site specific level, biodiversity associated with ironwood can be even higher. The ironwood-bursage habitat in the Silverbell Mountains of Pima County is associated with 674 species, including 64 mammals and 57 bird species. Some of the highlights from the report include these points:

- Ironwood “ranks among the most ecologically and economically important plant species in the region. ... It’s influence stands out in two biotic communities: 1) ancient cactus and legume forests of desertscrub on rocky bajadas and alluvium in adjacent valleys; and 2) xeroriparian habitats, which occur as narrow curving corridors along ephemeral and intermittent watercourses in the driest portions of the Sonoran Desert.” (P. 4)
- “Ironwood generates a chain of influences on associated understory plants, affecting their dispersal, germination, establishment, and rates of growth. ... Ironwood is the dominant nurse plant in some subregions of the Sonoran Desert.” (P. ii)
- “The mere presence of ironwood and other legume trees can increase the number of bird species in desertscrub habitat by 63%.” (P. ii)
- “Recent studies show that without the protective cover of the desert legumes, the distributional ranges of saguaro, organ pipe, and senita cactus would retreat many miles, to more southern, frost-free areas.” (P. iii)
- “Protecting ironwood habitat in Pima County, Arizona, will benefit a different mix of native species than would be conserved in ironwood habitats currently being protected on the islands or coasts of the Gulf of California.” (P. v)
- “The Ragged Top site ... contributed the highest levels of species richness [of the study], with six of the ten plots having the highest levels within the entire region.” (P. 56-57)

Ironwood Densities in Pima County	
Location	Ironwood/Hectare
Organ Pipe National Monument (Northern Areas)	37-90 ironwoods / hectare
Ragged Top (Silverbells)	35 ironwoods / hectare
Cocoraque (Brawley Wash)	21.25 ironwoods / hectare
Saguaro National Park West	21.25 ironwoods / hectare
Tortolitas	11.25 ironwoods / hectare
Mason Audubon Center, NW Tucson	11.25 ironwoods / hectare
Cabaza Prieta National Wildlife Refuge	11.25 ironwoods / hectare
Organ Pipe National Monument (cut areas)	2.5 ironwoods / hectare

B. Threats to Resource Base -- Effects Land / Water Use Activities on Biological Resources

1. Ecological Analysis of Conservation Priorities in the Sonoran Desert Ecoregion -- The Nature Conservancy report identified the major stressors for the 100 conservation sites in the Sonoran Desert Ecoregional analysis and major stressors in 18 riverine conservation sites.

SUMMARY OF MAJOR STRESSORS, 100 CONSERVATION SITES	
STRESSOR	NUMBER OF SITES
Introduction of exotic plants and animals	73
Recreation	72
Urban development	56
Mining	55
Improper livestock management	53
Groundwater pumping, surface water diversion	40
Presence of fire in non adapted vegetation community	38
Conversion to agriculture	35

SUMMARY OF MAJOR STRESSORS, 18 RIVERINE CONSERVATION SITES	
STRESSOR	NUMBER OF SITES
Introduction of exotic plants and animals	16
Urban development	15
Improper livestock management	15
Groundwater pumping, surface water diversion	14
Recreation	14
Mining	12
Presence of fire in non adapted vegetation community	10
Conversion to agriculture	10
Channelization	10

2. Biological Stress Assessment -- The draft *Biological Stress Assessment* by Recon Consulting (1) defined biological stressors, (2) assigned a conservation status to land as it relates to land ownership and management categories within the Pima County watershed planning units, and (3) described the effects of land and water use activities on biological resources. The *Assessment* contains an analysis of each of the eight watershed subarea planning units within Pima County, covering the topics of potential threats and stressors, biological resources, and existing and proposed reserves. Under the category of potential threats and stressors, the report covers issues related to land use and landscape character, transportation, water uses, stream characteristics, and recreation uses. Under the category of biological resources, the report covers issues related to vegetation, critical habitat designations, vulnerable species, the potential threats to vulnerable species within the watershed subareas, and the level of threat based on the conservation status.

Middle San Pedro Subarea (Subarea 1):

Areas and Habitats of Concern	Sources of Stress
Perennial stream flows, San Pedro	Population growth
Designated CFPO critical habitat	Conversion of ranches
Proposed spikedeace critical habitat	Groundwater pumping
Proposed Loach minnow c. habitat	Developable land by river
Potential YB cuckoo crit. habitat	High mineral resource areas
Bingham Cienega marsh habitat	Mining in Buehman Canyon
Sacaton grass areas	Recreational uses
Tributary canyon connections	Invasive species

Cienega-Rincon Subarea (Subarea 2):

Areas and Habitats of Concern	Sources of Stress
Perennial stream flows	Population growth
Shallow ground water areas	Conversion of ranches
Associated aquatic habitats	Groundwater pumping
Cottonwood-willow riparian areas	Increased lot splitting
Cienega marshlands	Existing zoning near preserve
Sacaton grassland areas	Excavation of Pantano Wash
Cave habitats	Recreational uses
Tributary connections	Invasive species
	Developable land near preserve
	High mineral resource areas

Upper Santa Cruz Subarea (Subarea 3):

Areas and Habitats of Concern		Sources of Stress
Shallow groundwater Sopori Wash		Population growth
Mixed riparian/xeroriparian areas		Concentrations of lot splitting
Palo verde mixed scrub, uplands		Groundwater pumping
Valley lands along Santa Cruz		Conversion, ag land & ranches
Semi-desert grasslands		Existing and future mining
Groves providing cuckoo habitat		Invasive species
Pineapple cactus habitat		

Middle Santa Cruz Subarea (Subarea 4):

Areas and Habitats of Concern		Sources of Stress
Shallow ground water areas		Population growth
Effluent-dominated stream flow		Existing overdraft
Remaining xeroriparian		Groundwater pumping
Pygmy-owl critical habitat		Increased lot splitting
		Invasive species
		Recreational uses
		Developable land near preserve

Tortolita Fan Subarea (Subarea 5):

Areas and Habitats of Concern		Sources of Stress
Pygmy-owl critical habitat		Population growth
Areas of perennial flow		Lot splitting
Effluent-dominated stream flow		Storage basin, CAP line
Remaining xeroriparian		Conversion of ag land
		Erosion of bajadas
		Developable land near preserve

Altar Valley Subarea (Subarea 6A):

Areas and Habitats of Concern		Sources of Stress
Pygmy-owl critical habitat		Lot splitting
Areas of perennial flow		Historic range degradation
Areas with shallow groundwater		Groundwater pumping
Cottonwood-willow woodlands		Water quality
Semi-desert grasslands		Invasive species
		Developable land near preserve

Avra Valley Subarea (Subarea 6B):

Areas and Habitats of Concern		Sources of Stress
Groundwater east of SB mine		Lot splitting
Ironwood community		Conversion of ranches
Low elevation land along washes		Groundwater pumping
		Mining
		Invasive species
		Developable land near reserve

Western Pima County Subarea (Subarea 8):

Areas and Habitats of Concern		Sources of Stress
Areas of shallow groundwater		Overflights
Riparian and xeroriparian habitat		Livestock grazing, recreation
Aquatic and riparian habitat		Groundwater pumping
Mine adit		Mining
Ironwood plant communities		Invasive species
Palo verde mixed scrub		Resource damage at boarder

3. Pygmy-Owl Studies -- The pygmy-owl was listed as endangered in 1997, but notice of the potential listing dates back to 1989, when the United States Fish and Wildlife Service included the pygmy-owl as a candidate for listing throughout its range. The basis for listing the pygmy-owl as endangered included but was not limited to these factors: a) habitat loss; b) potential vulnerability to extinction due to environmental, demographic and genetic threats; and c) the absence of effective conservation measures. In discussing the degree of habitat loss the Service described the growth pressures on the northwest side and stated that it was "aware of five specific housing and development projects operating or in the planning stages that would affect habitat where the majority of the birds in Arizona currently exist." Aerial photos show the urbanization pattern of pygmy-owl habitat around Arthur Pack Park from 1983 to 1999, and maps show the committed and vacant land within the same area. Growth pressures on the northwest side exceed levels cited by the Service at the time of listing. In addition to the impacts of urbanization in the area of a known owl population, the Final Rule describing the reasons for the listing identifies riparian losses as a major factor leading to the listing of the pygmy-owl and states that "the Federal Clean Water Act contains provisions for regulating impacts to river systems and their tributaries. These mechanisms have been insufficient to prevent major losses of riparian habitat, including habitats occupied by the pygmy-owl." After the listing, subsequent litigation led to an injunction on aspects of the Army Corps Nationwide Permit program until a regionally based programmatic impact analysis is performed, and the Army Corps consults with the Service regarding the effect of the Nationwide Permit program. As these steps are taken, individual permits that require the Corps to take a closer look at the impact of proposed projects will be the course available.

4. Desert Ironwood -- The *Desert Ironwood Primer* points out that the United States offers limited protection for ironwood, compared to Mexico, despite the importance of the ironwood stands to the species itself, and to the larger Sonoran Desert system. The Ragged Top and Cocoraque Rock areas are identified in the report as priorities for new protection and for strengthened conservation management, since "within the region as a whole, the [Ragged Top, Ironwood Picnic Area, and Cocoraque sites] contribute the highest values of significance to biodiversity conservation."

C. Conservation Opportunities: Conservation opportunities will be identified through the biological assessment for the priority vulnerable species of concern for Pima County and published as soon as they are available. Known sites of importance include: high resource riparian areas, sites identified by The Nature Conservancy, designated critical habitat for the pygmy-owl, and those opportunities identified in the *Desert Ironwood Primer*.

1. Ecological Analysis of Conservation Priorities in the Sonoran Desert Ecoregion -- Recommendations from the analysis by The Nature Conservancy include:

- Improve conservation management status at conservation sites
- Establish nexus with regional conservation efforts
- Evaluate conservation sites and conservation management programs
- Implement pilot conservation projects
- Integrate and synthesize existing data at the landscape scale
- Implement ecosystem monitoring projects

These recommendations can be incorporated into the Sonoran Desert Conservation Plan.

2. Priority Vulnerable Species of Concern -- The biological data and information is currently being peer reviewed and it will be included in future habitat mapping and adaptive management recommendations.

3. Pygmy-Owl -- Regulatory guidance exists for pygmy-owl protection in the form of designated critical habitat (see Figure 14). In the near future, the Recovery Plan for the pygmy-owl will be published by the United States Fish and Wildlife Service, providing additional guidance. The resolution of the injunction on Army Corps permitting will also help define the parameters of allowable permitting practices in light of cumulative impact as well as direct impacts. The District Court's scrutiny of federal permitting practices should result in a more effective and coordinated permit program at the federal and local level when impacts are better understood, and advance planning allows permit seekers to know where biologically sensitive areas are so they can be avoided.

4. Desert Ironwood -- Recommendations from the authors of the *Desert Ironwood Primer* are based on a decade of study by the science community. These include:

- Requiring assessments to determine the extent of ironwood destruction during the permitting process;
- Salvaging and relocating ironwood;
- Protecting the areas of highest density ironwood;
- Protecting and devising a corridor of stepping stone reserves within ironwood habitats for the benefit of species, including the pygmy-owl; and
- Planning and implementing protection strategies for ironwood as needed in wash, rocky slope and valley/plains ironwood habitats

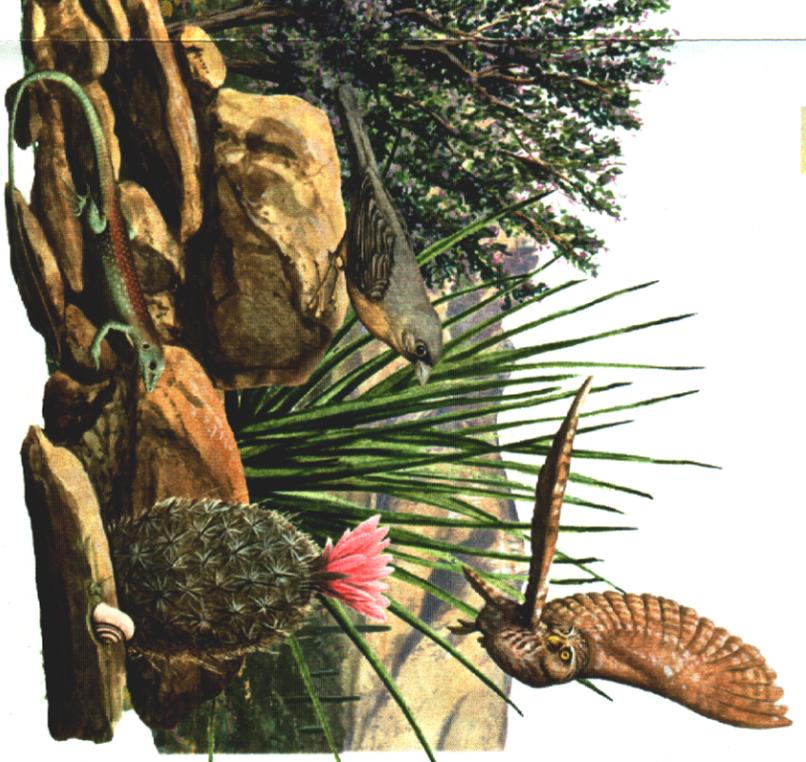
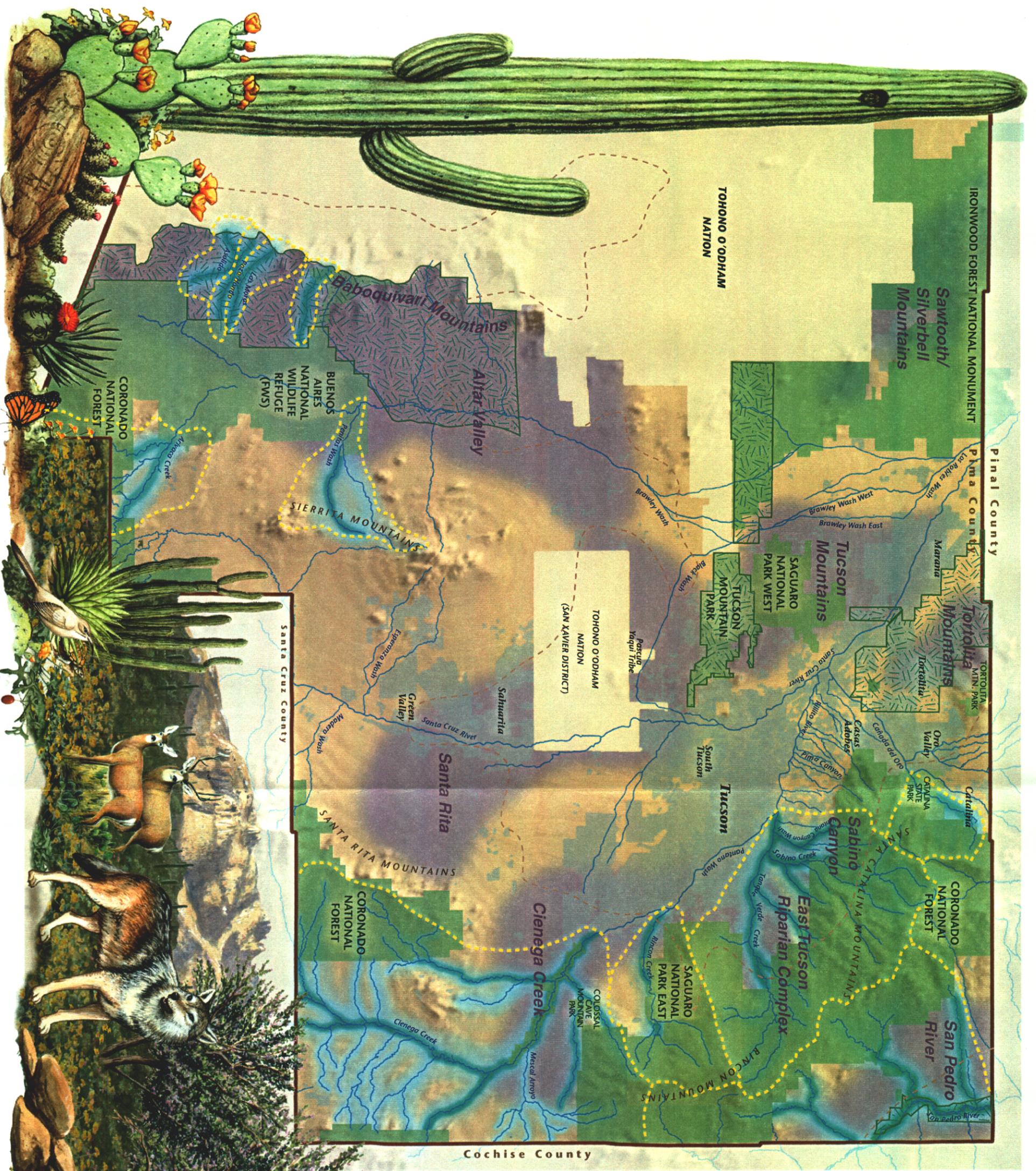
A map that depicts important riparian areas, pygmy-owl critical habitat, and the areas identified by The Nature Conservancy ecoregional analysis are found on the map on the following page.

- This map will be revised when the biological consultant for the Sonoran Desert Conservation Plan and the Science Technical Advisory Team determine the reserve alternatives for priority species and communities of concern.
- The publication of the Pygmy-Owl Recovery Plan may change the areas recommended for protection.
- Finally, the study by The Nature Conservancy is of Sonoran Desert ecoregion, and it does not encompass all of Eastern Pima County. A future ecoregional analysis of the Apache Highlands area, or studies conducted by others about that land base, will likely reveal additional sites and systems in need of protection.

Sonoran Desert Conservation Plan

Habitat and Corridor Elements

-  Proposed Conservation Sites (The Nature Conservancy)
-  High Priority Riparian Protection Areas
-  High Priority Watershed Boundaries
-  Designated Critical Habitat for Pycmy Owl
-  Sonoran Desert Ecoregion Boundary
-  Urban/Private Property
-  Existing Reserves
-  Indian Nation



VI. **Summary** -- A number of potential conservation opportunities are presented by the six Elements of the draft Preliminary Sonoran Desert Conservation Plan and opportunities will continue to be identified as more information becomes available. The most effective plan would combine the resource sites and systems of each Element to the extent possible, particularly where they overlap. No Element alone is sufficient to achieve resource protection goals. In combination, however, the most effective and potentially least costly reserve alternative might be assembled.

No Action -- To take no action to conserve resources would leave Eastern Pima County with a fragmented set of public land patches that would continue to fail as a biological reserve for imperiled species. (See Figures 12 and 13, Existing Reserves, and Existing Reserves with Current Development in Eastern Pima County.)

Mountain Parks -- The preliminary Mountain Parks Element has at least these conservation opportunities to offer to the overall reserve design (see page 27):

- The proposed Las Cienegas National Conservation Area
- The proposed new Santa Rita Mountain Park
- Two proposed Natural Reserves: Davidson Canyon and the Buehman Bingham Reserve
- Expansions of existing Mountain Parks: Tortolita Mountain Park, Colossal Cave Mountain Park, and Catalina State Park.

Total acreage for these Mountain Park proposals, including the Las Cienegas National Conservation proposal, is approximately 250,000 acres. This Element on its own falls short of covering the habitat needs of the pygmy-owl and perhaps many other species of concern, it misses the full potential of the Riparian and Cultural Resources Element, and by itself, it forgoes the opportunity to include an additional 1.2 million acres of ranch land in undeveloped open space status as part of the reserve.

Habitat and Corridors -- The preliminary Habitat and Corridors Element will be developed more by the Science Team and biological consultants, but in its current status offers at least these conservation opportunities to the overall reserve design (see pages 27 and 59):

- Conservation sites from The Nature Conservancy Study:
 - 1) Altar Valley
 - 2) Baboquivari Mountains
 - 3) Cienega Creek
 - 4) East Tucson Riparian Complex
 - 5) Organ Pipe/Goldwater Complex
 - 6) Sabino Canyon
 - 7) San Pedro River
 - 8) Santa Rita
 - 9) Silverbell Mountains
 - 10) Tortolita Mountain
 - 11) Tucson Mountains
- The habitat areas needed for priority vulnerable species of concern, which would likely overlap to some degree with the Riparian Element;
- Pygmy-owl reserves; and
- Ironwood reserves.

In many instances, the existing public land reserve system does not overlap with identified conservation sites, or meet the habitat requirements of listed species.

Cultural Resources: The preliminary Cultural Resources Element (see page 17) overlaps with riparian areas, and these are prioritized according to the cultural resource base, as described below. The charts rank watershed subareas by conservation potential in qualitative and quantitative formats, with the watersheds that possess the highest potential for conservation listed at the top of the chart (See Figure 11).

WATERSHED SUBAREA	Resource Value	Threat to Site (Development)	Threat to Landscape (Integrity)	Level of Protection
Western Pima County	medium	low	high	high
Middle San Pedro	medium	low	high	high
Cienega-Rincon	high	medium	medium	medium
Avra Valley	medium	medium	medium	medium
Altar Valley	medium	medium	medium	medium
Upper Santa Cruz	medium	medium	medium	low
Tortolita Fan	high	high	low	low
Middle Santa Cruz	medium	high	low	medium

WATERSHED SUBAREA OVERALL COMPARATIVE RANKING	Resource Value Comparative Ranking (1 = high)	Threat to Site Comparative Ranking (1 = low)	Level of Protection Comparative Ranking (1 = high)
1. Western Pima County	4	1	1
2. Middle San Pedro	4	2	2
3. Cienega-Rincon	1	4	5
4. Avra Valley	3	3	3
5. Altar Valley	6	6	6
6. Upper Santa Cruz	5	5	8
6. Tortolita Fan	2	7	7
7. Middle Santa Cruz	4	8	4

Based on the information compiled to date in the area of cultural and historic resources, protection opportunities exist at the site and system level. The map on page 17 reflects specific important cultural sites, zones of high sensitivity, and zones of medium sensitivity for cultural resource protection.

Riparian Element -- The preliminary Riparian Element has at least these conservation opportunities to offer to the overall reserve design:

A. Protection

1. Streams: The most important riparian areas to preserve are defined below in the context of preserving and augmenting the stability of native fish and frog populations. The priority streams have a high, natural availability of water and possess relatively unimpaired water quality. In order to focus on opportunities to improve land stewardship of the most threatened stream segments, only those streams which have part of their length outside core reserves are mentioned below as high priority for protection.

- Subarea 1-- The San Pedro River, Buehman, Edgar, Espiritu, Youtcy and Paige Canyons.
- Subarea 2 -- Agua Verde Creek, upper Rincon Creek, Davidson Canyon, Cienega Creek, Wakefield, Posta Quemada, Gardner, Chimney, and Distillery Canyons.
- Subarea 3 -- None.
- Subarea 4 -- Sabino Canyon, Bear Canyon, Ventana Wash, Tanque Verde and Agua Caliente Creeks.
- Subarea 5 -- Sutherland Wash.
- Subarea 6A -- Arivaca Creek, Las Moras, Pozo Hondo, Asolido, Thomas, Fragueta, Penitas.
- Subarea 6B -- None.
- Subarea 8 -- None.

2. Systems: Total riparian area is another fundamental biological parameter which is more relevant to terrestrial wildlife than to native fish and frogs. Larger areas are generally capable of sustaining more species and individuals. The streams listed above which possess the largest areas of unprotected riparian habitat include the:

- San Pedro River;
- Agua Verde Creek;
- Sabino Canyon;
- Agua Caliente Wash;
- Tanque Verde Wash; and
- Arivaca Creek.

3. Infrastructure planning in the metropolitan area could reduce water stress to:

- Tanque Verde Creek;
- Rincon Creek;
- Sabino Creek; and
- Cienega Creek.

4. Strategic purchases of land under Pima County's floodprone land acquisition and open space bond programs could reduce water demands and reduce fragmentation due to future development along high priority streams. Open space bonds have been approved for use along:

- Agua Caliente;
- Agua Verde;
- Tanque Verde
- Buehman;
- San Pedro;
- Sabino;
- Bear;
- Honey Bee; and
- Cienega watercourses.

There are a number of properties that are prone to flooding or bank erosion along:

- Sabino;
- Agua Caliente;
- Tanque Verde Creek; and
- Sutherland Wash.

B. Restoration and Reintroduction

1. Reintroduction of species: In *Aquatic Vertebrate Conservation in Pima County* (Rosen 2000), development of various Tucson Basin core re-establishment sites is proposed so that (1) leopard frogs and other amphibians and reptiles may disperse from one site to another during especially good and wet years and thus maintain a metapopulation structure, (2) the metapopulation structure also permits occasional immigration-emigration exchange between the valley floor and surrounding mountain canyons, (3) fish are positioned in habitats in the landscape at which they can be expected to weather flooding and drying events.

2. Removing non-natives: To restore natural biotic interactions, Rosen (2000) also recommends removing certain non-native vertebrates in: Canada del Oro; Youtcy; Espiritu; Paige; Romero; Sabino; Bear; Cienega; Agua Caliente; and Tanque Verde watersheds.

3. Reconstructing flow patterns: The large spring at Agua Caliente Park presents a unique restoration opportunity. The substantial spring flow could be used to create more stream-like conditions suitable for the support all of the most critically-declining or endangered wetland vertebrates of the Tucson Basin--pupfish, topminnow, chub, leopard frog, and garter snake--and all in potentially substantial numbers. The spring should be capable of providing a very great linear extent of the habitat type need by the most endangered species--pupfish and topminnows.

C. Revegetation / Opportunities for Improved Riparian Conditions

1. Irrigated projects: The major opportunities for irrigated revegetation projects are where infrastructure exists to bring irrigation water and where undeveloped land is available. These areas are primarily along the Santa Cruz; lower Rillito Creek; and vicinity of the CAP aqueduct.

2. Discharge projects: The major opportunities for discharge or aquifer restoration projects are where renewable water infrastructure exists and where hydrogeologic conditions are favorable. Watercourses with favorable hydrogeologic conditions to restore localized aquifers are those reaches which possess an extensive low-permeability layer at a shallow depth: Pantano Wash; Ventana Wash; Sabino Canyon; Tanque Verde Creek; Agua Caliente Wash; and portions of the Santa Cruz River.

3. Removal of existing surface water diversions could restore flows to parts of Cienega Creek; Sopori Wash; San Pedro River; Tanque Verde Creek; and Lemmon Creek and Arivaca Creek.

Ranch Conservation Element -- The preliminary Ranch Conservation Element offers at least these benefits to the overall reserve design of the Sonoran Desert Conservation Plan: it provides the maximum land base reserve and connectivity with riparian areas, and the ranch lands constitute a natural urban form maker for the urban area. Altar Valley, Empire-Cienega Valley, Upper Santa Cruz Valley, San Pedro Valley, and now the Ironwood National Monument area of the Avra Valley are the subareas where ranching comprises a significant land use, and where grazing capacity and stability suggest the best potential for future sustainable ranch use (Figure 10). Ranch lands in these valleys have the best potential to define the urban boundary, where developing lands at the urban edge give way to natural open space. The highest Ranch Conservation potential is as follows: (1) Altar Valley; (2) Empire-Cienega; (3) Upper Santa Cruz Valley; (3) San Pedro Valley; (4) Western Pima County; (5) Avra Valley; (6) Tortolita Fan; (7) Middle Santa Cruz.

VII. **Next Steps** -- Pima County has hosted over 70 meetings in the last seventeen months that have been publicly noticed and well attended. The majority of these meetings have been for the purpose of developing technical and scientific information. Reports summarizing this information have been provided to the Steering Committee and interested members of the community at monthly meetings. In addition, over 270 presentations about the Sonoran Desert Conservation Plan have been given by members County staff at the request of various groups within the community. During the next two years, the information exchange and public participation will be greater. For example, the following types of meetings will be conducted and all will be noticed in advance and open to any interested members of the community:

- **INITIATING THE PROCESS WITH SCOPING:** A scoping meeting sponsored by the United States Fish and Wildlife Service on October 4, 2000 will kick off the public participation process. This meeting is an invitation to the community to begin to tell the Service what issues it would like to see addressed as part of the Environmental Impact Statement.
- **PUBLIC DISCUSSION AND INFORMATION:** Pima County will then sponsor a minimum of fifteen open house meetings and discussion group sessions throughout the public comment period on the draft Preliminary Sonoran Desert Conservation Plan.
- **FORMULATING RECOMMENDATIONS AND BUILDING CONSENSUS:** The Steering Committee will meet regularly to formulate their perspectives and recommendations, and work toward community consensus on issues related to reserve design alternatives. Particular issues in need of attention by working groups can be dealt with by Subarea working groups and Subtopic working groups. Members of the Steering Committee and members of the community have signed up to participate in such working groups. Membership and interest is likely to grow as working meetings begin.
- **INTERGOVERNMENTAL WORK:** A government working group will meet regularly to discuss implementation issues. All federal, state and local government stakeholders are invited to this forum, and all interested members of the community are welcome to attend and participate. All meetings of the government working group will be open and advertised.
- **TECHNICAL:** The technical process will continue too, with monthly public meetings of the Science Team, Cultural Resources Team, and Ranch Technical Advisory Teams. These teams have already expanded to include formal and informal peer review processes. The Science Team has engaged an additional 25 members of the expert community to provide a rigorous review of the work of the staff, consultants, agency experts and team members. The Cultural Resource and Ranch teams have similarly requested and received the advice of the expert community in producing their work products. Pima County is fortunate to have this level of interest and talent in the individuals who are providing oversight and ensuring the quality of the technical work that ultimately is incorporated into the Sonoran Desert Conservation Plan.

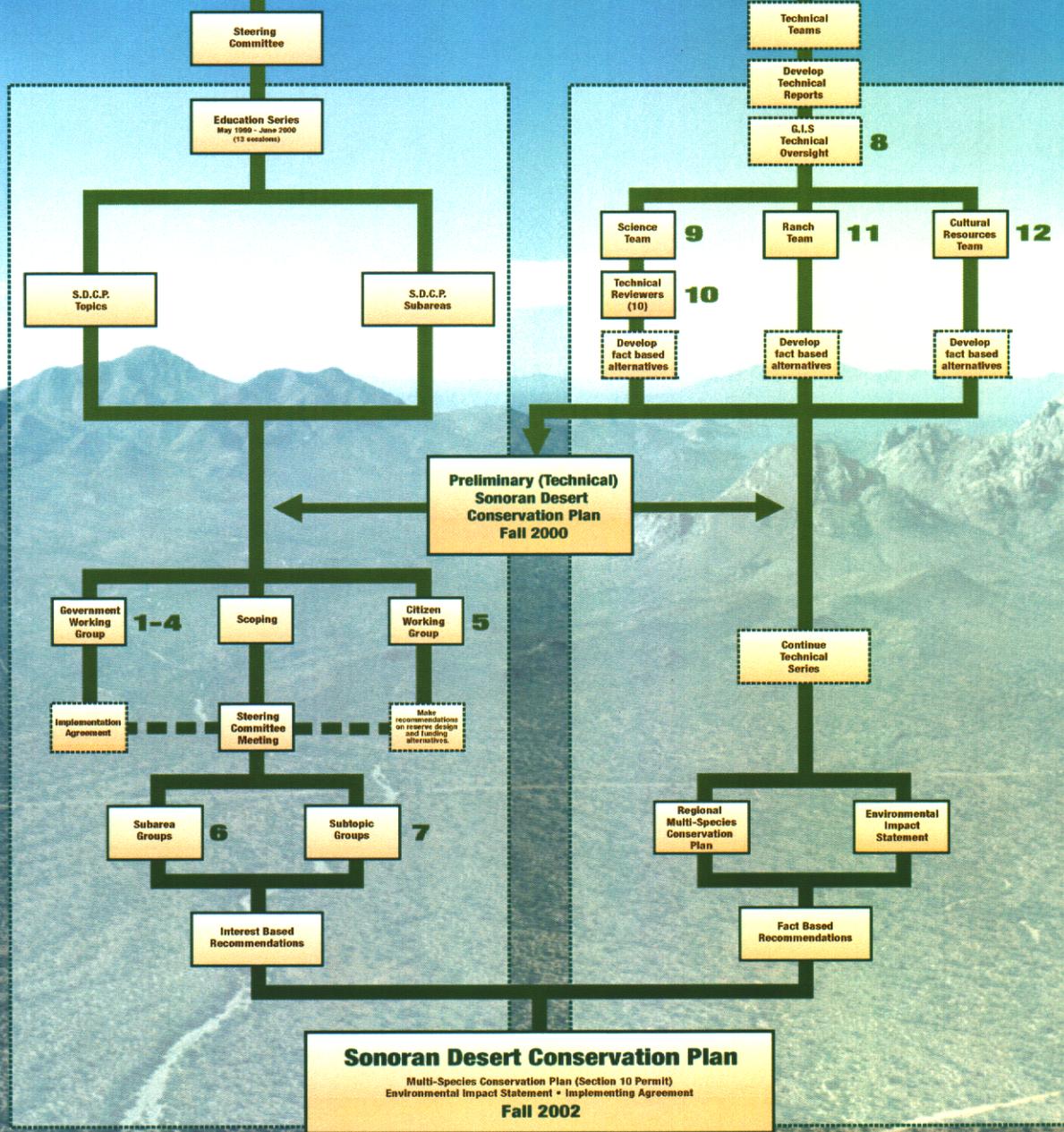
County staff will continue to accept invitations to present information about the draft Preliminary Sonoran Desert Conservation Plan, and a newsletter of broad circulation will be sent to all those who express interest in the Plan. Currently the Sonoran Desert Conservation Plan mailing list includes over 325 people. The major documents that will result from the next two years of process are (1) the regional multi-species conservation plan; (2) the Environmental Impact Statement; (3) the Implementing Agreement; and (4) the Sonoran Desert Conservation Plan itself, inclusive of all six natural and cultural resource protection Elements.

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Sonoran Desert Conservation Concept Plan

October 1998 - Draft • March 1999 - Adopted



Sonoran Desert Conservation Plan

Multi-Species Conservation Plan (Section 10 Permit)
Environmental Impact Statement • Implementing Agreement
Fall 2002

1. Tohono O'odham Nation

- Edward Manuel, Chair
- Austin Nunez, Chair- San Xavier Dist.
- Earl Francisco, Chair- Baboquivari Dist.
- Margo Cowan
- Jefford Francisco
- Joe Joaquin
- Rita Martinez
- Rene Reddy
- Marco Rivera
- Peter Ruiz
- Peter Steeve
- Kenneth Williams

2. Federal Entities

- U.S. Forest Service
- U.S. Air Force, Ranges and Airspace
- U.S. Army Corps of Engineers
- U.S. Bureau of Land Management
- U.S. Bureau of Reclamation
- U.S. National Park Service
- U.S. Secretary of the Interior
- U.S. Fish and Wildlife Service
- U.S. Geological Survey
- U.S. Environmental Protection Agency

3. State Entities

- Arizona Dept. of Environmental Quality
- Arizona Dept. of Water Resources
- Arizona Game and Fish

4. Local Entities

- Arizona State Land Dept.
- City of South Tucson
- City of Tucson
- Town of Marana
- Town of Oro Valley
- Town of Sahuarita
- Tortolita Community
- Casas Adobes Community

5. Citizen Working Group

- Ken Abrahams
- Stan Abrams
- Neale Allen
- Bill Arnold
- Peter Aronoff
- Charles Award
- Ellen Barnes
- Dan Beckel
- George Bender
- Robyn (Louis) Benson
- Laurence Marc Berlin
- Tim Blowers
- John Bordenave
- Carolyn Campbell
- Joe Cesare
- Sue Chilton
- Ernest Cohen

6. Subarea Groups

- Hector Conde
- Vicki Cox Golder
- William Crosby
- Richard Daley
- Mary Darling
- Carl Davis
- Carol Duffner
- Jonathan Duhamel
- Andra Ewton
- Richard Genser
- Gay Lynn Goetzke
- David Goldstein
- Mike Grassinger
- Bruce Gungle
- William Hallihan
- Richard Harris
- Lynn Harris
- Heather Fox
- Gayle Hartmann
- Duff Heaton
- Deborah Hecht
- David Hogan
- Donald (Carolyn) Honnas
- Barbara Huffstetter
- Jan Johnston
- Gerard Juliani
- Pat & Macaela King
- Guy Kirkpatrick

7. Subtopic Groups

- Rob Kulakofsky
- Teresa Leal
- Alan Lurie
- Lance MacVittie
- Teresita Majewski
- John Martin
- Mitch McClaran
- Andrew McGibbon
- Christina McVie
- Doug McVie
- John Menke
- Mary Miller
- Mike Milroy
- Chris Monson
- Joe Murray
- David Naugle
- Joe Parson
- Luther Propst
- Jud Richardson
- Patricia Richardson
- Barbara Rose
- Chris Sheafe
- Jim Shiner
- Victoria Sikora
- Quinn Simpson
- Lisa Stage
- Tim Terrill
- Dale S. Turner

8. GIS Technical Oversight

- Lucy Vitale
- Dick Walbert
- Sally Wegner
- Frances Werner
- Michael Winn
- Carl Winters
- Nancy Young Wright
- Michael Zimet
- Nancy Zurenberg
- Middle San Pedro
- Cienega Rincon
- Upper Santa Cruz
- Middle Santa Cruz
- Tortolita Fan
- Altar Valley
- Avra Valley
- Western Pima
- Conservation
- Cultural Resources
- Law/Economic
- Ranch
- Dr. Rick Church
- Dr. Ross Gerrard

9. Science Team

- Dr. William Shaw, Chair
- Mr. Doug Duncan
- Ms. Mima Falk
- Ms. Natasha Kline
- Mr. Steve Prchal
- Ms. Sherry Ruther
- Dr. Cecil Schwalbe
- Dr. Robert Steidl

10. Technical Reviewers

- Mr. Rob Betasso
- Dr. Russell Davis
- Mr. Mike Demillo
- Mr. James Driscoll
- Mr. Aaron Flesch
- Dr. Phil Jenkins
- Dr. Steve McLaughlin
- Dr. W.M. Minkley
- Mr. Bob Pape
- Mr. Bill Peachey
- Mr. Yar Petryszyn
- Mr. Joseph Platt
- Mr. Scott Richardson
- Dr. Phil Church
- Ms. Sue Schuetz
- Ms. Sabra Schwartz

11. Ranch Team

- Dr. Thomas Sheridan, Chair
- Mr. Tim Snow
- Dr. E. Linwood Smith
- Mr. Mike Sredell
- Dr. Thomas Strong
- Mr. Marty Tuegel
- Mr. Bill VanPelt
- Mr. Carl Jones
- Ms. Kitty Knepper
- Mr. Bart McGuire
- Mr. Dan Robinett
- Mr. Jon Rowley
- Dr. George Royle
- Dr. Nathan Sayre

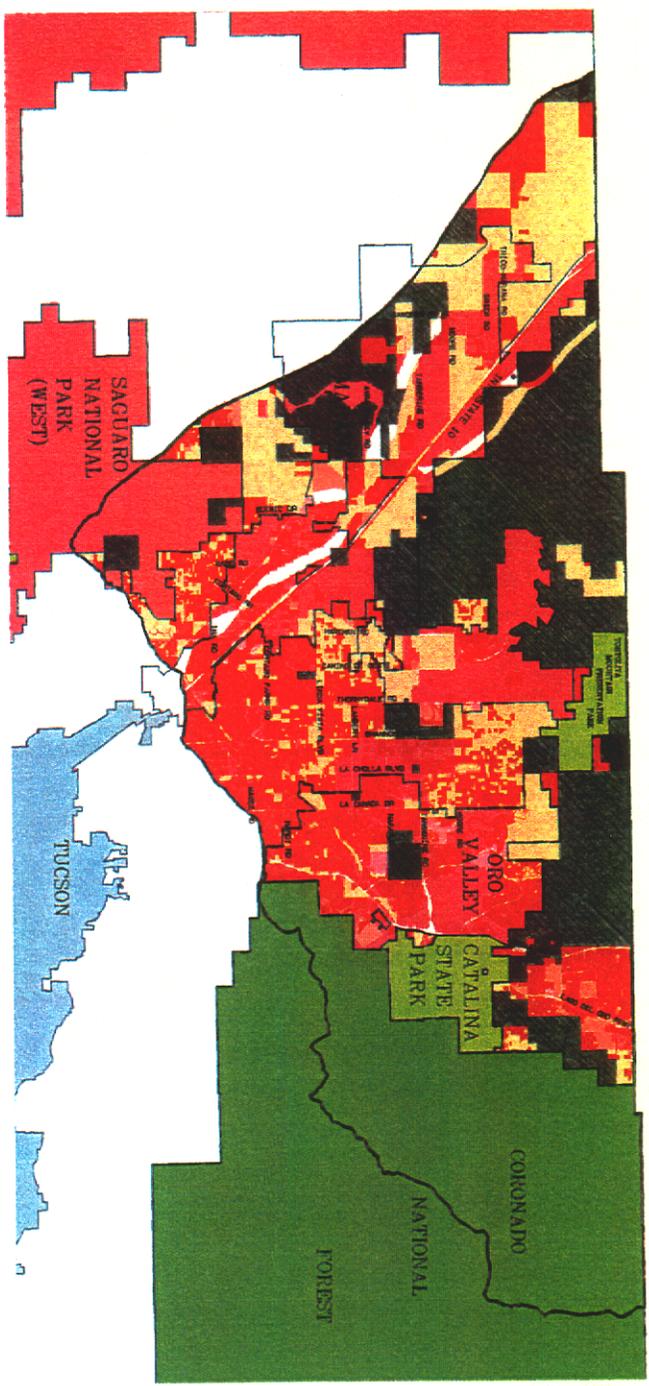
12. Cultural Resource Team

- Dr. Paul Fish, Chair
- Ms. Mary Farrell
- Mr. Beth Grindell
- Mr. Joe Joaquin • Dr. Jerry Kyle
- Ms. Marty McCune
- Mr. Peter Steere
- Ms. Sue Wells
- Mr. Max Witkind

Built-out and Committed Lands in the SDCP Tortolita Fan Subarea

- Administrative Boundaries
- Tortolita Fan Subarea Boundary
- Built
- Greater than 3 RAC
- 1 to 3 RAC
- 0.3 to 1 RAC
- Less than 0.3 RAC
- State Trust Land

Note:
City, county and federal land not in a
public preserve is considered committed.



State Map Code 11300000

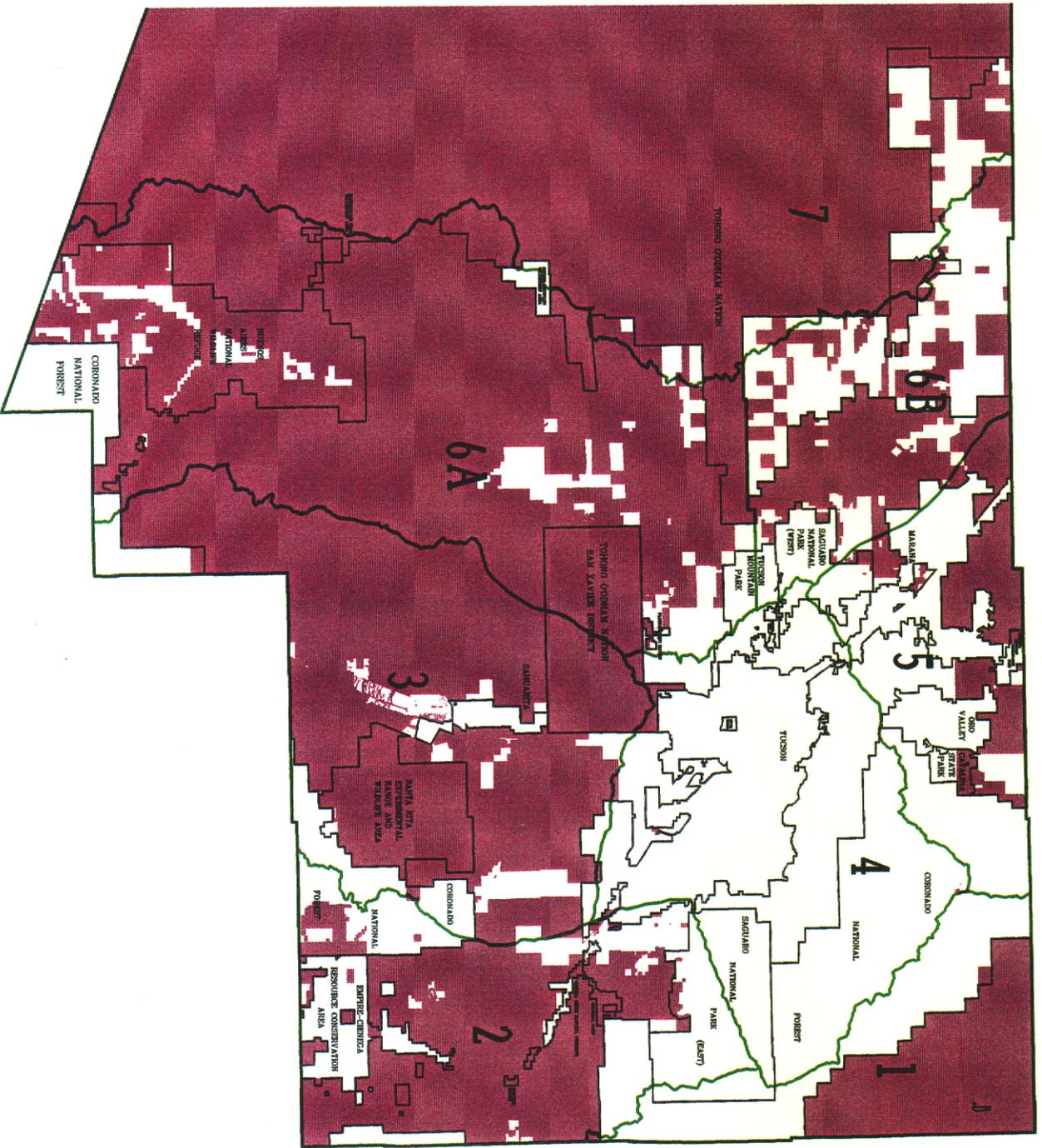
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Scale: 1" = 75,000'

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Tucson, AZ 85702
Phone: (520) 795-3420
Fax: (520) 795-3420



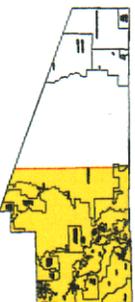
RH Zoning Within Eastern Pima County



- RH Zoning
- Planning Unit Boundaries
- Jurisdictional Boundaries

ACRES OF RH ZONING BY PLANNING UNIT

UNIT ZONE	ACRES
1 RH	91,043
2 RH	183,017
3 RH	368,821
4 RH	5,245
5 RH	59,843
6A RH	614,626
6B RH	102,410
TOTAL	1,422,005



Scale: Map Scale is 1:100,000

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Scale 1:150,000



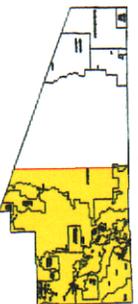
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201 North Stone Avenue, Suite 1100
Tucson, AZ 85701
Phone: (520) 795-3429
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Web: www.pima.gov



Pima County Ranches

- Planning Unit Boundary
- Ranch Boundaries
- Major Washes
- BLM
- County Park
- Indian Lands
- Military Reservations
- National Forest Lands
- National Parks and Monuments
- National Wildlife Refuge
- Private Lands
- State Lands
- State Park
- Ranch Use

Pima County Index Map



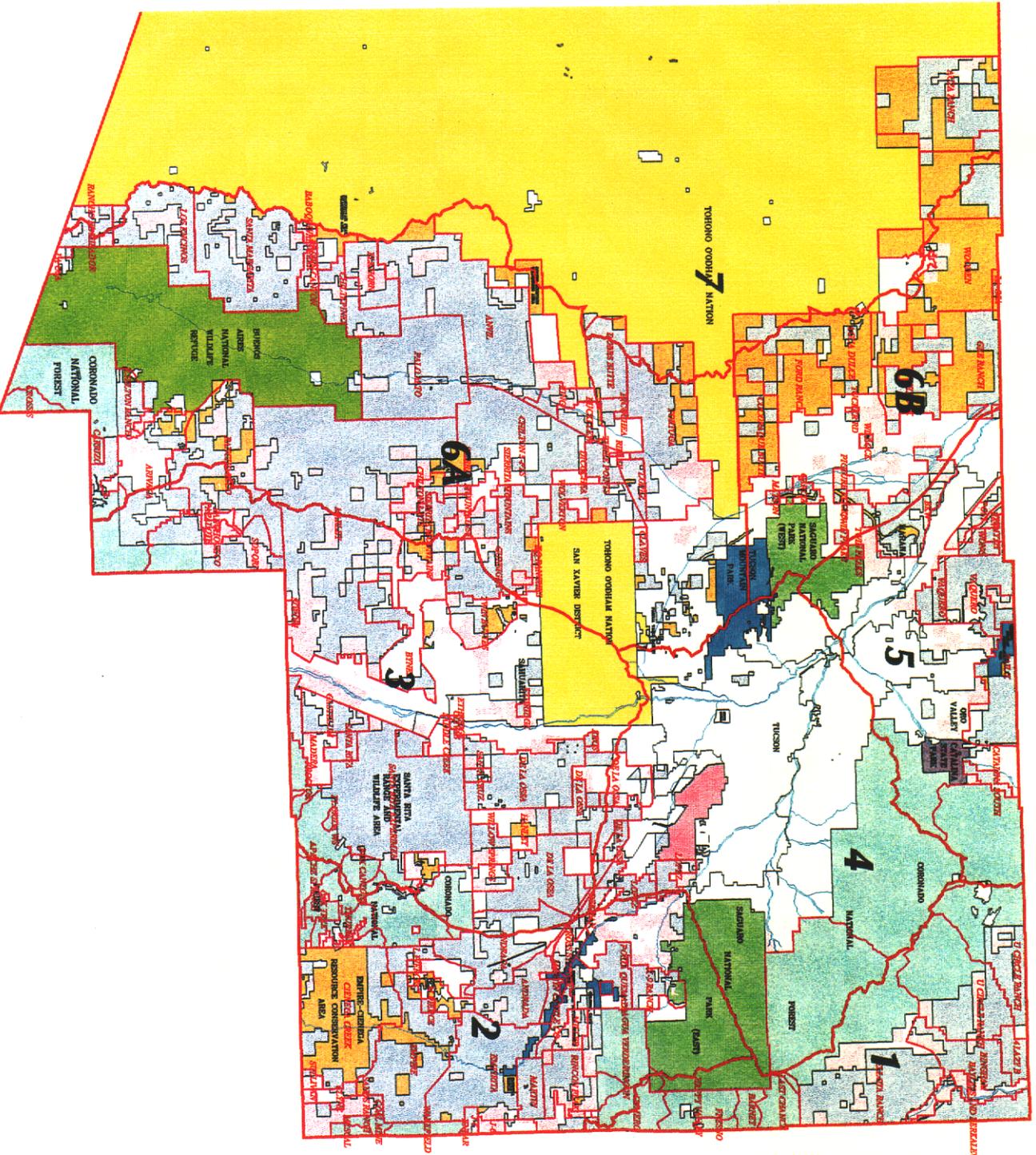
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Scale: 1:125,000

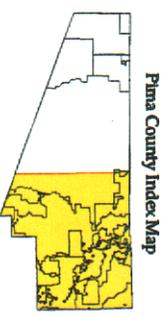


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 Pima County Office of Planning and Economic Development
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 Tucson, Arizona 85702
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 Fax: (520) 796-3459



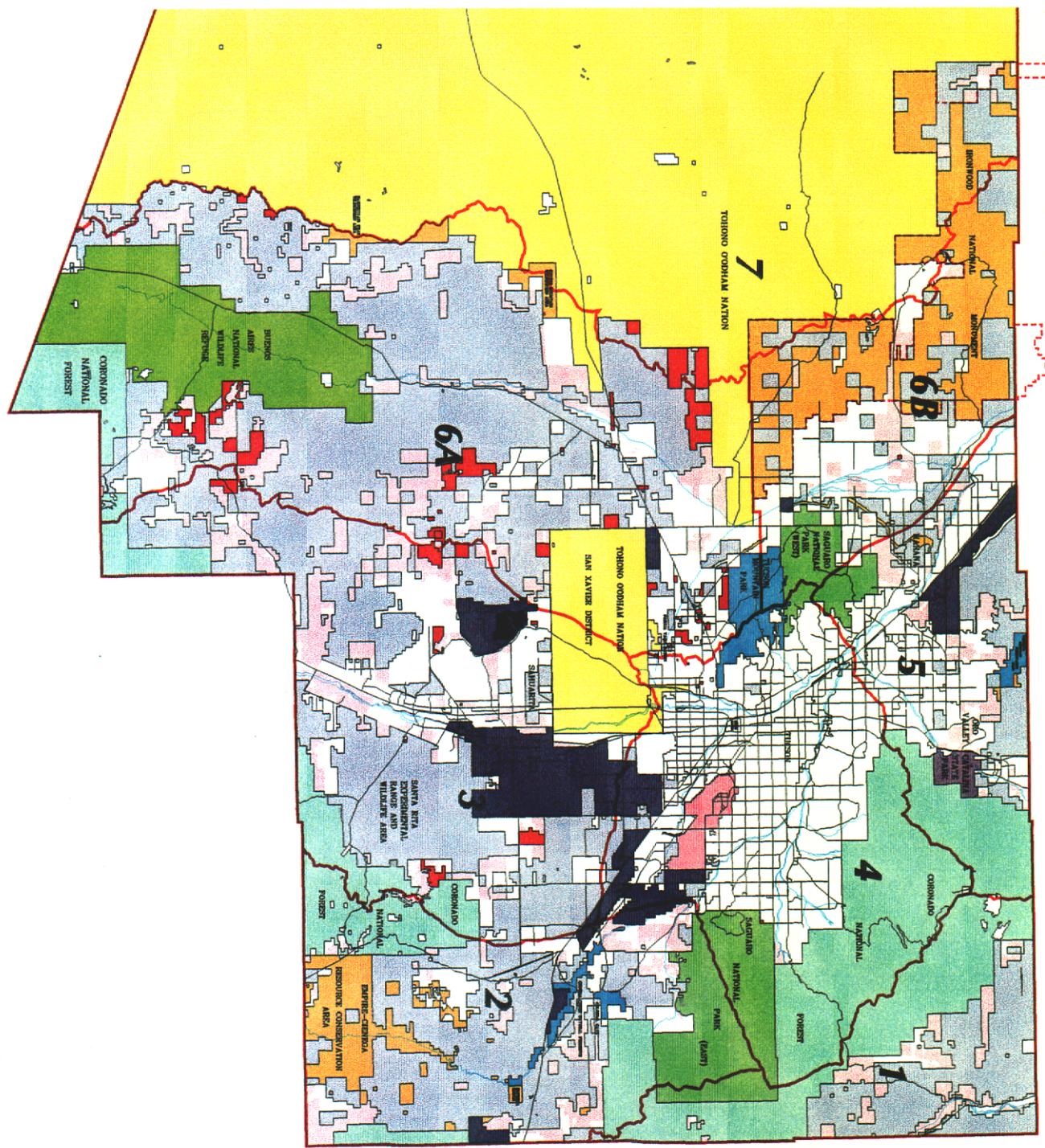
Disposable Lands for BLM and State of Arizona

- Ironwood National Monument
- Planning Unit Boundary
- Major Washes
- Disposable BLM Land
- Disposable State Land
- BLM
- County Park
- Indian Lands
- Military Reservations
- National Forest Lands
- National Parks and Monuments
- National Wildlife Refuge
- Private Lands
- State Lands
- State Park
- Ranch Use



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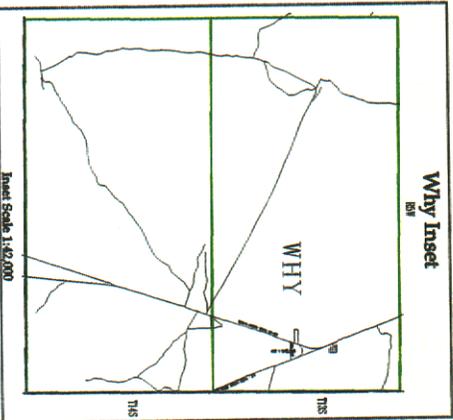
Plan, County Technical Services
 10550 N. AZIZONA BLVD. SUITE 100
 TUCSON, ARIZONA 85747-4429
 TEL: 520-797-1100 FAX: 520-797-1101

BLM

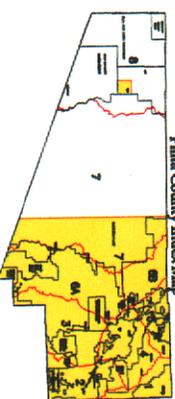
The Projected Urban Boundary Defined by Grazing Allotments and Ranch Lands in Pima County, 2005.

- Urban Boundary
- Major Roads and Routes
- Major Water
- Existing Allotments
- Proposed Future Conservation
- Existing Urban Boundaries
- Ranch Land
- State Land Management (BLM)
- State Trust Lands / State Bldg. Smpg
- Wildlife Refuge / Conservation Area
- Colorado National Forest
- Tucson Watershed Park / State Park
- Golfcourse / Country Smpg
- Tribal Lands
- National Monument
- Change Canal / Colonial Crm
- AEDT / BLDG
- AEDT / BLDG

Why Inset



Pima County Index Map

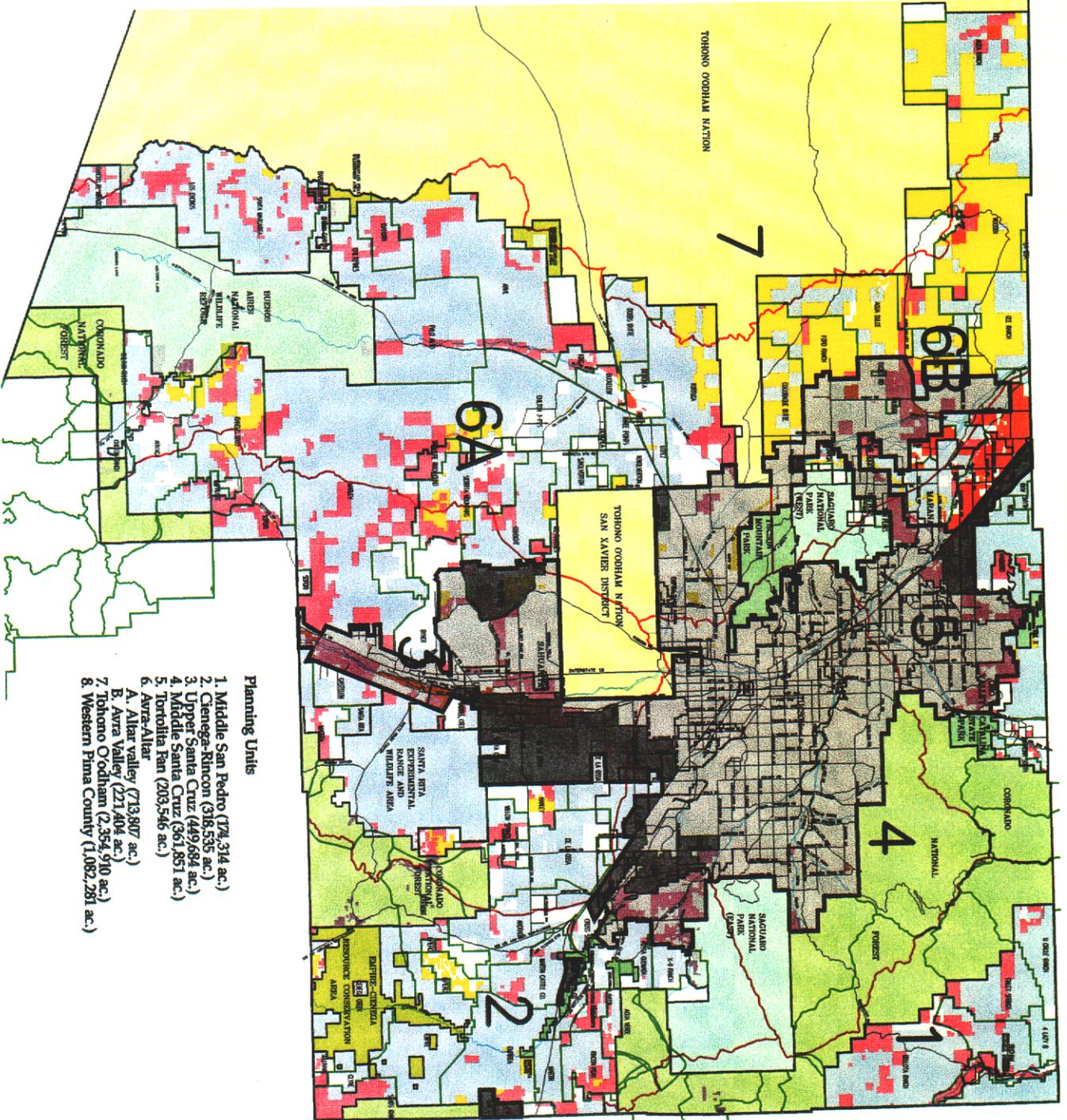


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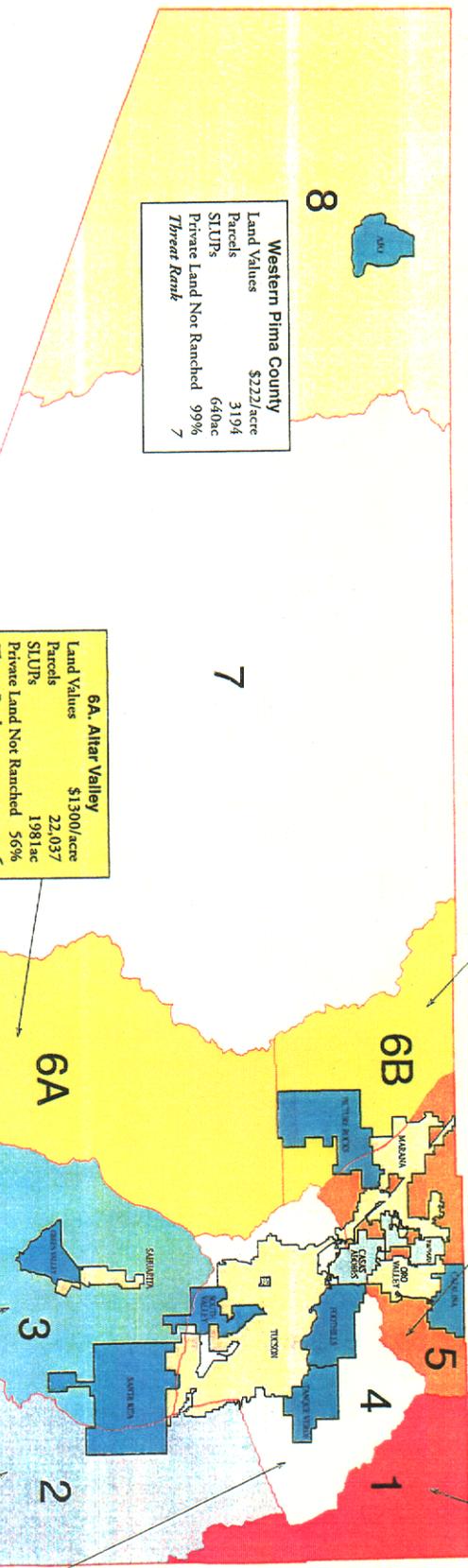
Planning Units

1. Middle San Pedro (774,314 ac.)
2. Cienega-Rincon (318,535 ac.)
3. Upper Santa Cruz (449,684 ac.)
4. Middle Santa Cruz (361,851 ac.)
5. Tortolita Fan (208,546 ac.)
6. Avra-Altar
 - A. Altar valley (713,807 ac.)
 - B. Avra Valley (221,404 ac.)
7. Tohono O'odham (2,354,910 ac.)
8. Western Pima County (1,082,281 ac.)

Most Threatened Ranchlands

Sub Area	Land Values/Acre	ASLD SLUIs	% Private Land
Middle Santa Cruz	\$68,000	18,000 acres	56
Tortolita Fan	\$25,000	11,000 acres	52
Upper Santa Cruz	\$4,000	49,000 acres	35

HIGHEST THREATS TO RANCH LANDS AT THE WATERSHED LEVEL



6B. Avra Valley
 Land Values \$2000/acre
 Parcels 7900
 SLUIs 645ac
 Private Land Not Ratched 76%
 Threat Rank 4

5. Tortolita Fan
 Land Values \$25,000/acre
 Parcels 48,863
 SLUIs 11,101ac
 Private Land Not Ratched 82%
 Threat Rank 2

1. Middle San Pedro
 Land Values \$782/acre
 Parcels 598
 SLUIs 0ac
 Private Land Not Ratched 28%
 Threat Rank 8

6A. Altar Valley
 Land Values \$1300/acre
 Parcels 22,037
 SLUIs 1981ac
 Private Land Not Ratched 56%
 Threat Rank 6

3. Upper Santa Cruz
 Land Values \$4000/acre
 Parcels 28,127
 SLUIs 49,075ac
 Private Land Not Ratched 64%
 Threat Rank 3

2. Clenega - Rincon
 Land Values \$1500/acre
 Parcels 5704
 SLUIs 7817ac
 Private Land Not Ratched 52%
 Threat Rank 5

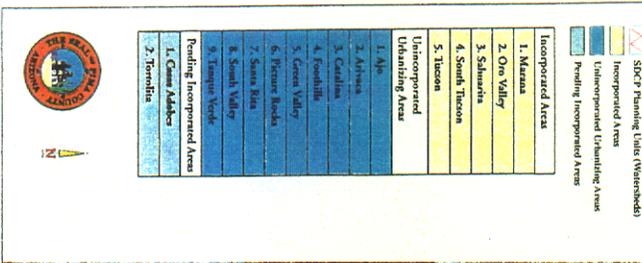
4. Middle Santa Cruz
 Land Values \$68,000/acre
 Parcels 217,093
 SLUIs 17,919ac
 Private Land Not Ratched 98%
 Threat Rank 1

Sonoran Desert Conservation Plan Watershed Based Planning Units

Area	Total # of Acres	% Private	% State	% Federal	% Private Land Not Ratched	Land Values per Acre	% RH Zoning	ASLD (acres) SLUIs	*Proximity to Urban Boundary	Subdivided Parcels	Overall Rank
Middle San Pedro	174,314	14.5	38.7	47	28	\$782	100	0	3.0	598	8
Clenega - Rincon	318,535	22.6	39.3	38	52	1,500	88	7,817	2.5	5,704	5
Upper Santa Cruz	449,685	34.8	47.3	18	64	4,000	92	49,075	2.0	28,127	3
Middle Santa Cruz	361,852	55.6	5.5	38	98	68,000	0	17,919	1.0	217,093	1
Tortolita Fan	203,546	52.3	22.7	25	82	25,000	83	11,101	1.5	48,863	2
Avra Valley	713,807	20.0	45	35	56	1,300	94	1,981	2.5	22,037	6
Alta Valley	221,404	31.5	22	46	76	2,000	84	645	2.0	7,900	4
Tohono Nation	2,354,911	0.7	1.3	-	-	-	-	-	-	-	-
Western Pima	1,082,282	1.2	.25	99	99	222	65	640	4.0	3,194	7
Pima County Totals	5,880,337										
Eastern Pima County Totals	2,443,144										
16 Urbanizing Areas	468,099										

*Urban Boundary Proximity: 1=urban areas; 2=accessible; 3=not easily accessible; 4=distiant from urban area.

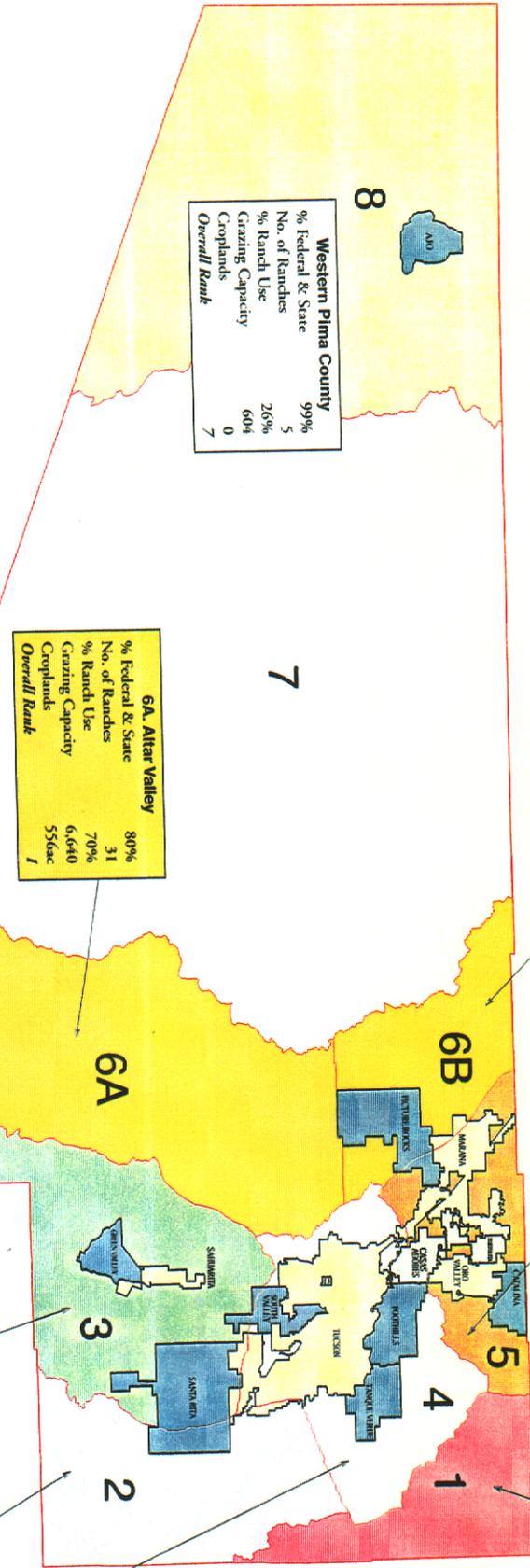
Pima County Highest Threats to Ranch Lands Watershed Comparison



Greatest Extent of Ranchlands

Sub Area	No. of Ranches	% Ranch Use of Valley	% Federal & State Land
Altar Valley	31	70%	80%
Empire Cienega	28	77%	79%
Upper Santa Cruz	25	74%	65%

EXTENT OF RANCLANDS AT THE WATERSHED LEVEL



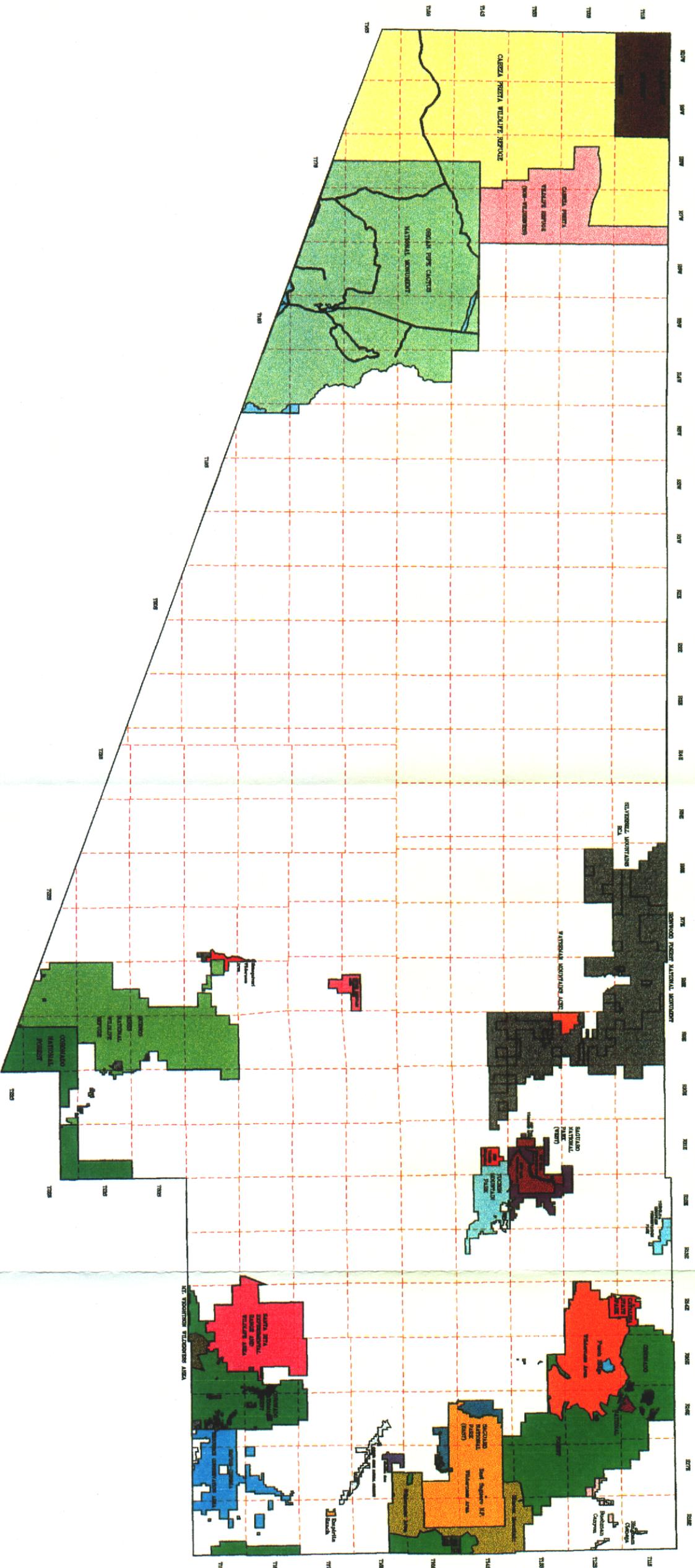
**Pima County
Extent of Ranchlands
Watershed Comparison**

Watershed	% Federal & State	No. of Ranches	% Ranch Use	Grazing Capacity	Croplands	Overall Rank
1. Middle San Pedro	85%	11	91%	1917	2,131ac	4
2. Cienega - Rincon	79%	28	77%	4,250	600ac	2
3. Upper Santa Cruz	46%	25	74%	4,315	7,359ac	3
4. Middle Santa Cruz	46%	5	15%	666	222ac	8
5. Tortolita Fan	50%	9	42%	679	13,821ac	6
6A. Altar Valley	80%	31	70%	6,640	556ac	1
6B. Avra Valley	69%	13	68%	834	3,579ac	5
7. Western Pima County	99%	5	26%	604	0	7
8. Ajo	99%	5	26%	604	0	7

Sonoran Desert Conservation Plan Watershed Based Planning Units

Area	Total # of Acres	% Private	% State	% Federal	No. of Ranches with Leases	% Ranch Use of Entire Valley	% Grasslands	Grazing Capacity Alls Allowed	Croplands(acres)	Overall Rank
Middle San Pedro	174,314	14.5	38.7	47	11	91	46	1,917	2,131	4
Cienega - Rincon	318,535	22.6	39.3	38	28	77	70	4,250	60	2
Upper Santa Cruz	449,685	34.8	47.3	18	25	74	63	4,315	7,359	3
Middle Santa Cruz	361,852	55.6	5.5	38	5	15	18	666	222	8
Tortolita Fan	203,546	52.3	22.7	25	9	42	11	679	13,821	6
Altar Valley	713,807	20.0	45	35	31	70	65	6,640	556	1
Avra Valley	221,404	31.5	22	46	13	68	3	834	3,579	5
Tohono Nation	2,354,911	0.7	1.3	-	-	-	-	-	0	-
Western Pima County	1,082,282	1.2	.25	99	5	26	0	604	19,905	7
Pima County Totals	5,880,337							19,905	27,728	
Eastern Pima County Totals	2,443,144							19,301		

Existing Reserves

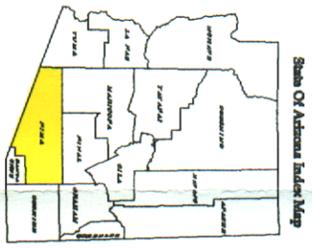


PIMA COUNTY DEPARTMENT OF TRANSPORTATION
TECHNICAL SERVICES

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 Tucson, Arizona 85701-1207
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 http://www.dot.co.pima.az.us

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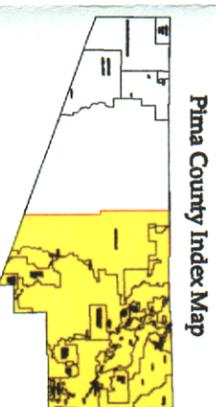
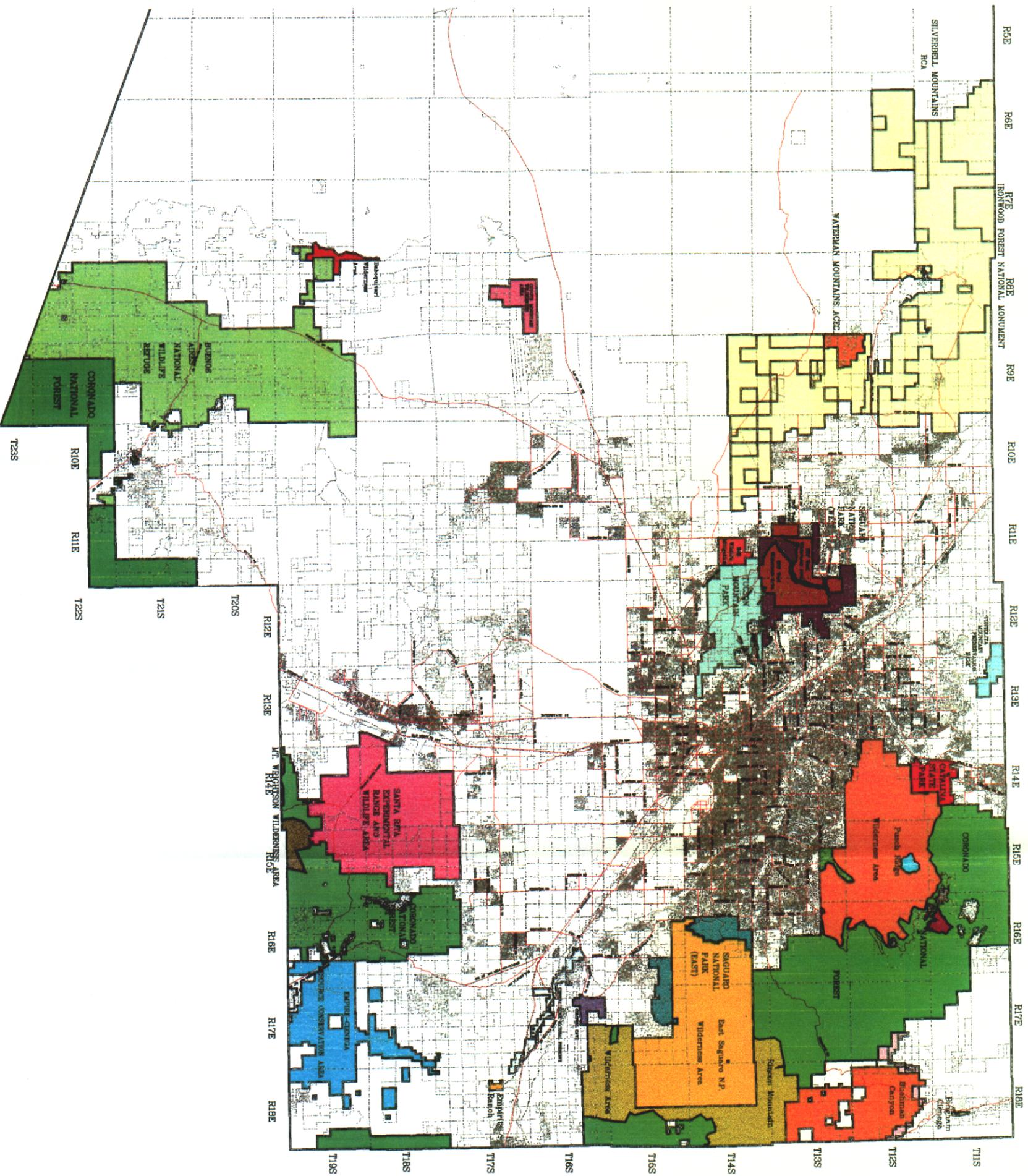
- ARIZONA STATE BARKS BOARD
- BABOQUINAI WILDERNESS AREA
- BINGHAM NATURAL PRESERVE
- BUENO'S ALBES NWR
- BUREAU OF RECLAMATION WILDLIFE MIGRATION CORRIDOR
- BUTTERFLY RNA
- CABEZA PRIETA WILDLIFE REFUGE NWR
- CABEZA PRIETA WILDLIFE REFUGE WA
- CADALINA STATE PARK
- CENEBGA CREEK COAR
- CENEBGA CREEK NATURAL PRESERVE
- COLUMBIAN CAVE
- CORONADO NATIONAL FOREST
- COYOTE MOUNTAIN WA
- DAPFER-CENEBGA RCA
- DAPFERIA RANCH
- GOLDWATER GUNNERY RANGE
- IRONWOOD FOREST NATIONAL MONUMENT
- M.T. WRIGHTSON WA
- ORGAN PIPE NATIONAL MONUMENT
- ORGAN PIPE NATIONAL MONUMENT WA
- PRIVACY/PIVA COUNTY/EXCLUDED
- PUSCH RIDGE WA
- RINCON MOUNTAIN WA
- SAGUARO NATIONAL PARK EAST WA
- SAGUARO NATIONAL PARK WEST
- SAGUARO NATIONAL PARK WEST WA
- SANTA CATALINA MOUNTAINS RNA
- SANTA RITA EXPERIMENTAL RANGE
- THE NATURAL CONSERVANCY - FEE SIMPLE
- THE NATURAL CONSERVANCY EASEMENTS
- TOHOKITA MOUNTAIN PARK
- TUCSON MOUNTAIN PARK
- WATERMAN MOUNTAINS ACSC



Scale 1: 240,000

Existing Preserves And Current Development

-  Parcel Base
-  Major Roads



Index Map Scale: 1:100,000

The information depicted on this display is the result of a data analysis performed on a variety of databases. The accuracy of the information presented is limited to the accuracy of the data sources. The Pinna County Department of Transportation is not responsible for the accuracy of the information presented herein.

Scale 1:150,000

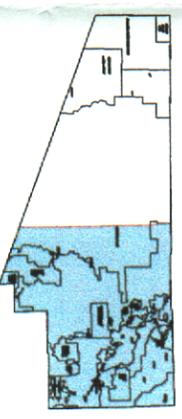
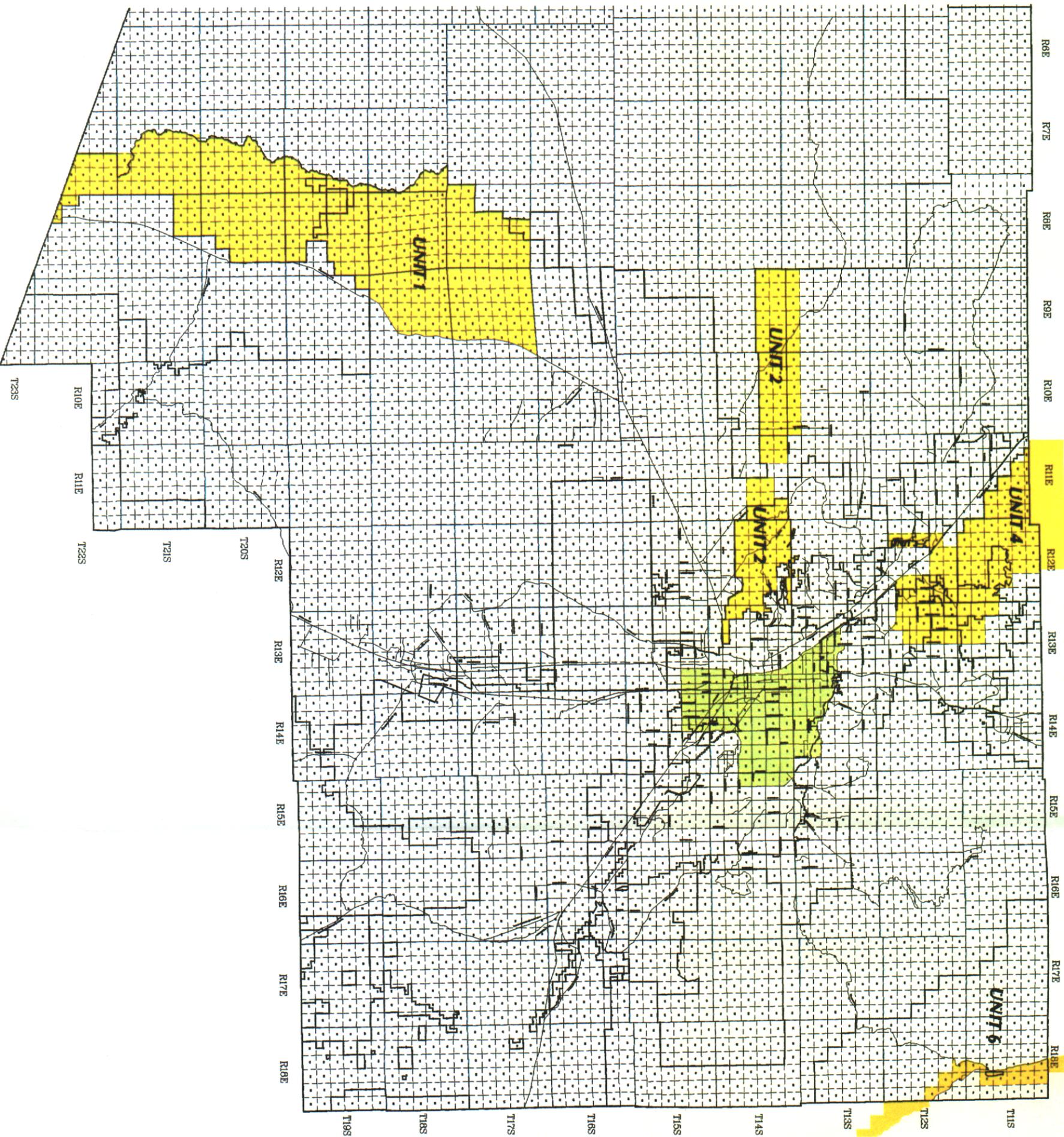


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TECHNICAL SERVICES
Pinna County Technical Services
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Designated Pygmy-owl Critical Habitat

-  Major Streets
-  Township and Range
-  Section Lines
-  Administrative Boundaries
-  Fish and Wildlife Designated Pygmy Owl Critical Habitat
-  Urban Exclusion Area



Scale Map scale: 1:1,000,000

The information depicted on this display is the result of a data compilation by the Pima County Department of Transportation and is not intended to be used for any purpose other than the collection of data for the Department of Transportation. The Pima County Department of Transportation does not warrant the accuracy of the information depicted. This project is subject to the Department of Transportation Technical Services Division's Use Restriction Agreement.



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APPENDIX 1-- STEERING COMMITTEE MEETINGS

- The average attendance for each Steering Committee meeting of the thirteen sessions was 115 people.
- The top five meetings for highest attendance were:
 - 1) May 22, 1999 -- Sonoran Desert Conservation Plan & Endangered Species Act (165)
 - 2) September 18, 1999 -- Conservation Biology (159)
 - 3) August 14, 1999 -- Ranch Conservation (130)
 - 4) June 26, 1999 -- Pygmy-Owl (128)
 - 5) April 29, 2000 -- Avra Valley / Ironwood Preserve (127)
- Other sessions were held on these topics:
 - 6) December 11, 1999 -- Tohono O'odham Nation (113)
 - 7) July 24, 1999 -- Land Use, Water, Social and Economic Considerations (112)
 - 8) October 16, 1999 -- Cultural Resources (108)
 - 9) November 6, 1999 -- How to Draft an MSCP (106)
 - 10) March 25, 2000 -- Resources of the Altar Valley and Middle San Pedro (95)
 - 11) June 3, 2000 -- Resources of the Tortolita Fan and Middle San Pedro (89)
 - 12) June 24, 2000 -- Regional Review of Elements (85)
 - 13) May 20, 2000 -- Resources of Cienega, Upper Santa Cruz, Western Pima County (80)

APPENDIX 2 -- PHASE 1 STUDY SERIES

(1-2) Habitat and Corridors Elements -- Biological Evaluation -- Studies issued as part of this initial information gathering phase of the process to assist in developing the Habitat and Corridors Elements include:

- Determining Species of Concern (April 1999, Science Team and County staff)
- Pygmy-Owl Update (November 1999, Consulting biologists and County staff)
- Science and GIS Update (November 1999, Science Team, Drs. Stine, Gilpin, staff)
- Heritage Data Management System (December 1999, Science Team and County staff)
- Biological Evaluation Workplan (January 2000, Science Team and County staff)
- Land Stewardship in Pima County (February 2000, County staff)
- Desert Ironwood Primer (February 2000, Dr. Gary Paul Nabhan)
- Middle San Pedro Concept Plan (March 2000, The Nature Conservancy)
- Land Cover Data Assessment (April 2000, Recon Consulting)
- Biological Stress Assessment (April 2000, Recon Consulting)
- Review of Vulnerable Species List (April 2000, Recon Consulting)
- Geological and Ecological Diversity (April 2000, Dr. Gary Nabhan, Dr. Mark Dimmitt)
- Priority Vulnerable Species (June 2000, Recon Consulting)
- Pygmy-Owl Investigations 1997-1999 (July 2000, Consulting biologists)
- Habitat Selection by Pygmy-Owls (July 2000, Consulting biologists)
- Issue of Non-Indigenous Species in Public Reserves (July 2000, County staff)
- Priority Vulnerable Species Habitat Data Analysis (Recon Consulting)
- Non-native Species Analysis (September 2000, Recon Consulting)
- Draft Reserve Design Guidelines, Goals, Opportunities and Constraints (Recon Consulting) / Preliminary Habitat and Corridors Elements (September 2000)

Regional Biological Evaluation -- The study series for the biological evaluation includes and goes beyond the workplan created by the Science Technical Advisory Team by incorporating short term investigations to fill data gaps as they become known. Background on the process includes this history:

- In March of 1999, the Board of Supervisors adopted the concept Sonoran Desert Conservation Plan and directed staff to pursue the scientific studies that establish the basis of a habitat conservation plan under the Endangered Species Act.
- A Science Technical Advisory Team was formed and since April of 1999, reports have been issued and geographic information system data layers have been gathered at a steady rate, increasing the data coverages in the Pima County system from 175 to over 1000 data layers that are now available for analysis as part of the Sonoran Desert Conservation Plan. The Science Team, over the course of a six month period, drafted a workplan for a biological consultant who would undertake studies that provide a sound basis for the conservation plan, evaluate and improve existing resource data and mapping, and provide advice about vulnerable species, reserve design and species management programs. In mid-November, 1999, Pima County requested proposals for consulting services when it was clear that funds in the amount of \$996,000 would be appropriated for Pima County in the federal budget, and transferred to Pima County as a grant from the United States Fish and Wildlife Service in order to conduct the underlying scientific studies for the County's multi-species conservation plan this fiscal year.
- Despite the scale and complexity of the Sonoran Desert Conservation Plan, five consulting firms teamed to submit two proposals. On January 18, 2000, the Board awarded contracts to conduct the biological evaluation for the Sonoran Desert Conservation Plan to RECON (Regional Environmental Consulting) to draft documents up to and including the multi-species conservation plan and the environmental impact statement. The Harris Environmental Group was awarded the job of creating the riparian vegetation map.
- The RECON team is led by Paul Fromer, who has directed the habitat conservation planning efforts in Clark County, Nevada; San Antonio, Texas; and Riverside County and numerous other county and city efforts throughout California, dating back to 1989. Mr. Fromer is considered to be one of the most experienced biologists leading the field of regional habitat conservation planning. RECON teamed with local biologists and will manage the project from its local office, thereby gaining economies and local expertise that allowed them to streamline their proposal.
- The Harris Group has superior experience in mapping, with Dr. Lisa Harris having served as the project manager in the multi-phase Wildlife Habitat Inventory Project (WHIPS).
- In addition to having relevant work products reviewed by the Science Technical Advisory Team, more than twenty additional scientists considered to be an expert on a particular species are involved in a peer review process to bring the best information available to the science based documents. This extensive peer review process is coordinated by Dr. Linwood Smith.

(3) Riparian Protection Element -- Studies issued as part of this initial information gathering phase of the process to assist in developing the Riparian Element include:

- Paseo de las Iglesias (April 1999, County staff)
- Water Resources and the Sonoran Desert Conservation Plan (July 1999, staff)
- Focus on Riparian Areas, SDCP Update (July 1999, County staff)
- Environmental Restoration (December 1999, County staff)
- Evaluation of Riparian Mapping (December 1999, County staff)
- Perennial Streams, Intermittent Streams, Shallow Groundwater (January 2000, PAG)
- Resources of Arivaca (March 2000, AWET)
- Prioritization of Streams for Conservation (April 2000, Science Team, County staff)
- Pima County's Watersheds and Watercourses (April 2000, Barbara Tellman et al)
- Cocio Wash and the Gila Topminnow (April 2000, Biologists, County staff)
- Riparian Vegetation Mapping Pilot Study (May 2000, Harris Environmental)
- Riparian Habitat and Riparian Vegetation Mapping (May 2000, County staff)
- Springs in Pima County (May 2000, County staff, Science Team)
- Water Usage Along Selected Streams in Pima County (July 2000, PAG)
- Aquatic Vertebrate Conservation in Pima County (July 2000, Dr. Philip Rosen)
- Preliminary Riparian Element -- Riparian Protection, Restoration and Management

(4) Mountain Parks Element -- Since August of 1999, one major report and eight subarea studies have been drafted to assist in the development of the Mountain Parks Element of the Sonoran Desert Conservation Plan, which was issued in August of 2000.

(5) Ranch Conservation Element -- Studies formulated as part of the initial information gathering phase of the process to develop the Ranch Conservation Element include:

- Ranching in Pima County (November 1999, County staff)
- Ranching in the Middle San Pedro (March 2000, County staff)
- Ranching in the Altar Valley (March 2000, County staff)
- Ranching in the Avra Valley (April 2000, County staff)
- Ranching in the Cienega-Rincon (May 2000, County staff)
- Ranching in the Upper Santa Cruz (May 2000, County staff)
- Ranching in Western Pima County (May 2000, County staff)
- Ranching in the Tortolita Fan (June 2000, County staff)
- Ranching in the Middle Santa Cruz (June 2000, County staff)
- Conservation Tools for Ranching (September 2000, Ranch Team)
- Altar Valley: History, Resource Assessment, Environmental Assessment (Sayer et al)
- Preliminary Ranch Conservation Element (September 2000)

(6) Cultural Resources Element -- Studies formulated as part of the initial information gathering phase of the process to develop the Cultural Resources Element include:

- Preserving Cultural and Historic Resources (May 1999, County staff)
- Cultural Resources in the Middle San Pedro (March 2000, County staff)
- Cultural Resources in the Altar Valley (March 2000, County staff)
- History of Archaeological, Historical and Ethnographic Research (April 2000, SRI)
- Cultural Resources in the Avra Valley (April 2000, County staff)
- People of Southern Arizona, Past and Present (May 2000, SRI)
- Cultural Resource Sites Depicted on Early Maps (May 2000, SRI)

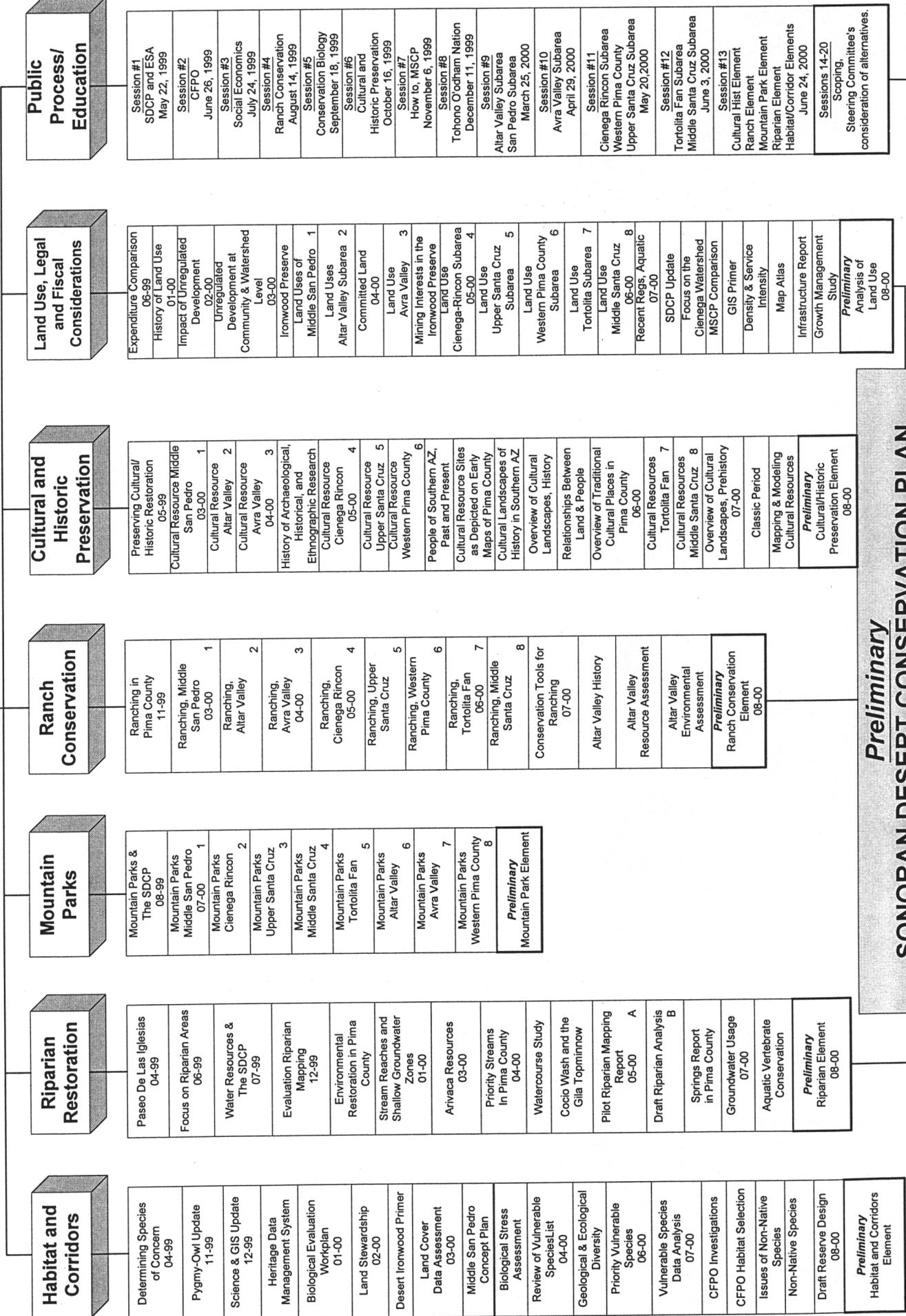
- Cultural Resources in the Cienega-Rincon (May 2000, County staff)
- Cultural Resources in the Upper Santa Cruz (May 2000, County staff)
- Cultural Resources in Western Pima County (May 2000, County staff)
- Cultural Landscapes, Relationships Between Land and People (May 2000, SRI)
- Overview of Traditional Cultural Places (May 2000, SRI)
- Cultural Landscapes of History in Southern Arizona (May 2000, SRI)
- Cultural Resources in the Tortolita Fan (June 2000, County staff)
- Cultural Resources in the Middle Santa Cruz (June 2000, County staff)
- Cultural Landscapes of Prehistory (July 2000, SRI)
- Cultural Resources -- The Classic Period (August 2000, SRI Consulting)
- Mapping and Modeling Cultural Resources (Arizona State Museum, County staff)
- Preliminary Cultural Resources Element -- Saving the Past for the Future (August 2000)

(7) Land Use Considerations -- Since October of 1998, these reports about land use, legal and fiscal issues have been formulated to assist in the development of the Sonoran Desert Conservation Plan.

- Sonoran Desert Conservation Concept Plan (October 1998)
- Correspondence in Response to the Draft SDCP (January 1999)
- Report, Comment, Recommendations -- Draft SDCP Concept (March 1999)
- Comparison of County Expenditures Per Capita, Other Govts (June 1999)
- History of Land Use in Pima County (January 2000, County staff)
- Impact of Unregulated Development, Service Demand (February 2000, County staff)
- Impact of Unregulated Development, Community Level (March 2000, County staff)
- Proposal in Support of the Ironwood Preserve (March 2000, County staff)
- Land Use in the Middle San Pedro (March 2000, County staff)
- Land Use in the Altar Valley (March 2000, County staff)
- Committed Land (April 2000, County staff)
- Land Use in the Avra Valley (April 2000, County staff)
- Mining Interests in the Ironwood Preserve Area (April 2000, County staff)
- Land Use in the Cienega-Rincon (May 2000, County staff)
- Land Use in the Upper Santa Cruz (May 2000, County staff)
- Land Use in Western Pima County (May 2000, County staff)
- Land Use in the Tortolita Fan (May 2000, County staff)
- Land Use in the Middle Santa Cruz (June 2000, County staff)
- Importance of the Cienega Watershed Area (July 2000, County staff)
- Importance of the Altar Valley Watershed Area (August 2000, County staff)
- GIS Primer (August 2000, County staff)
- Map Atlas (County staff)
- Growth Management Study (September 2000, County Staff)
- Draft Regional Analysis of Land Use (September 2000, County Staff)

Concept SONORAN DESERT CONSERVATION PLAN (March 1999)

DRAFT



Habitat and Corridors

Determining Species of Concern	04-99
Pygmy-Owl Update	11-99
Science & GIS Update	12-99
Heritage Data Management System	
Biological Evaluation Workplan	01-00
Land Stewardship	02-00
Desert Ironwood Primer	
Land Cover Data Assessment	03-00
Middle San Pedro Concept Plan	
Biological Stress Assessment	
Review of Vulnerable Species List	04-00
Geological & Ecological Diversity	
Priority Vulnerable Species	06-00
Vulnerable Species Data Analysis	07-00
CFPO Investigations	
CFPO Habitat Selection	
Issues of Non-Native Species	
Non-Native Species	
Draft Reserve Design	08-00
Preliminary Habitat and Corridors Element	

Riparian Restoration

Paseo De Las Iglesias	04-99
Focus on Riparian Areas	06-99
Water Resources & The SDCP	07-99
Evaluation Riparian Mapping	12-99
Environmental Restoration in Pima County	
Stream Reaches and Shallow Groundwater Zones	01-00
Arivaca Resources	03-00
Priority Streams in Pima County	04-00
Watercourse Study	
Cocio Wash and the Gila Topminnow	
Pilot Riparian Mapping Report	05-00
Draft Riparian Analysis	A B
Springs Report in Pima County	
Groundwater Usage	07-00
Aquatic Vertebrate Conservation	
Preliminary Riparian Element	08-00

Mountain Parks

Mountain Parks & The SDCP	08-99
Mountain Parks Middle San Pedro	07-00
Mountain Parks Cienega Rincon	2
Mountain Parks Upper Santa Cruz	3
Mountain Parks Middle Santa Cruz	4
Mountain Parks Tortolita Fan	5
Mountain Parks Allar Valley	6
Mountain Parks Avra Valley	7
Mountain Parks Western Pima County	8
Preliminary Mountain Park Element	

Ranch Conservation

Ranching in Pima County	11-99
Ranching, Middle San Pedro	03-00
Ranching, Allar Valley	2
Ranching, Avra Valley	3
Ranching, Cienega Rincon	4
Ranching, Upper Santa Cruz	5
Ranching, Western Pima County	6
Ranching, Tortolita Fan	7
Ranching, Middle Santa Cruz	8
Conservation Tools for Ranching	07-00
Allar Valley History	
Allar Valley Resource Assessment	
Allar Valley Environmental Assessment	
Preliminary Ranch Conservation Element	08-00

Cultural and Historic Preservation

Preserving Cultural/ Historic Restoration	05-99
Cultural Resource Middle San Pedro	03-00
Cultural Resource Allar Valley	2
Cultural Resource Avra Valley	3
History of Archaeological, Historical, and Ethnographic Research	04-00
Cienega Rincon Cultural Resource	05-00
Cultural Resource Upper Santa Cruz	5
Cultural Resource Western Pima County	6
People of Southern AZ, Past and Present	
Cultural Resource Sites as Depicted on Early Maps of Pima County	
Cultural Landscapes of History in Southern AZ	
Overview of Cultural Landscapes, History Relationships Between Land & People	
Overview of Traditional Cultural Places in Pima County	06-00
Cultural Resources Tortolita Fan	7
Cultural Resources Middle Santa Cruz	8
Overview of Cultural Landscapes, Prehistory	07-00
Classic Period Mapping & Modeling Cultural Resources	
Preliminary Cultural/Historic Preservation Element	08-00

Land Use, Legal and Fiscal Considerations

Expenditure Comparison	06-99
History of Land Use	01-00
Impact of Unregulated Development	02-00
Unregulated Development at Community & Watershed Level	03-00
Ironwood Preserve	
Land Uses of Middle San Pedro	1
Land Uses	2
Alta Valley Subarea	2
Committed Land	04-00
Land Use Avra Valley	3
Mining Interests in the Ironwood Preserve	
Land Use Cienega-Rincon Subarea	4
Land Use Upper Santa Cruz Subarea	5
Land Use Western Pima County Subarea	6
Land Use Tortolita Subarea	7
Land Use Middle Santa Cruz	8
Recent Regs. Aquatic	07-00
SDCP Update	
Focus on the Cienega Watershed	
MSCP Comparison	
GIS Primer	
Density & Service Intensity	
Map Atlas	
Infrastructure Report	
Growth Management Study	
Preliminary Analysis of Land Use	08-00

Public Process/ Education

Session #1 SDCP and ESA	May 22, 1999				
Session #2 CFPO	June 26, 1999				
Session #3 Social Economics	July 24, 1999				
Session #4 Ranch Conservation	August 14, 1999				
Session #5 Conservation Biology	September 18, 1999				
Session #6 Cultural and Historic Preservation	October 16, 1999				
Session #7 How to, MSCP	November 6, 1999				
Session #8 Tohono O'odham Nation	December 11, 1999				
Session #9 Alta Valley Subarea	San Pedro Subarea	March 25, 2000			
Session #10 Avra Valley Subarea	Avra Valley Subarea	April 29, 2000			
Session #11 Cienega Rincon Subarea	Western Pima County	Upper Santa Cruz Subarea	May 20, 2000		
Session #12 Tortolita Fan Subarea	Middle Santa Cruz Subarea	June 3, 2000			
Session #13 Cultural Hist Element	Ranch Element	Mountain Park Element	Riparian Element	Habitat/Corridor Elements	June 24, 2000
Scoping, Steering Committee's consideration of alternatives.					

Preliminary SONORAN DESERT CONSERVATION PLAN (September 2000)