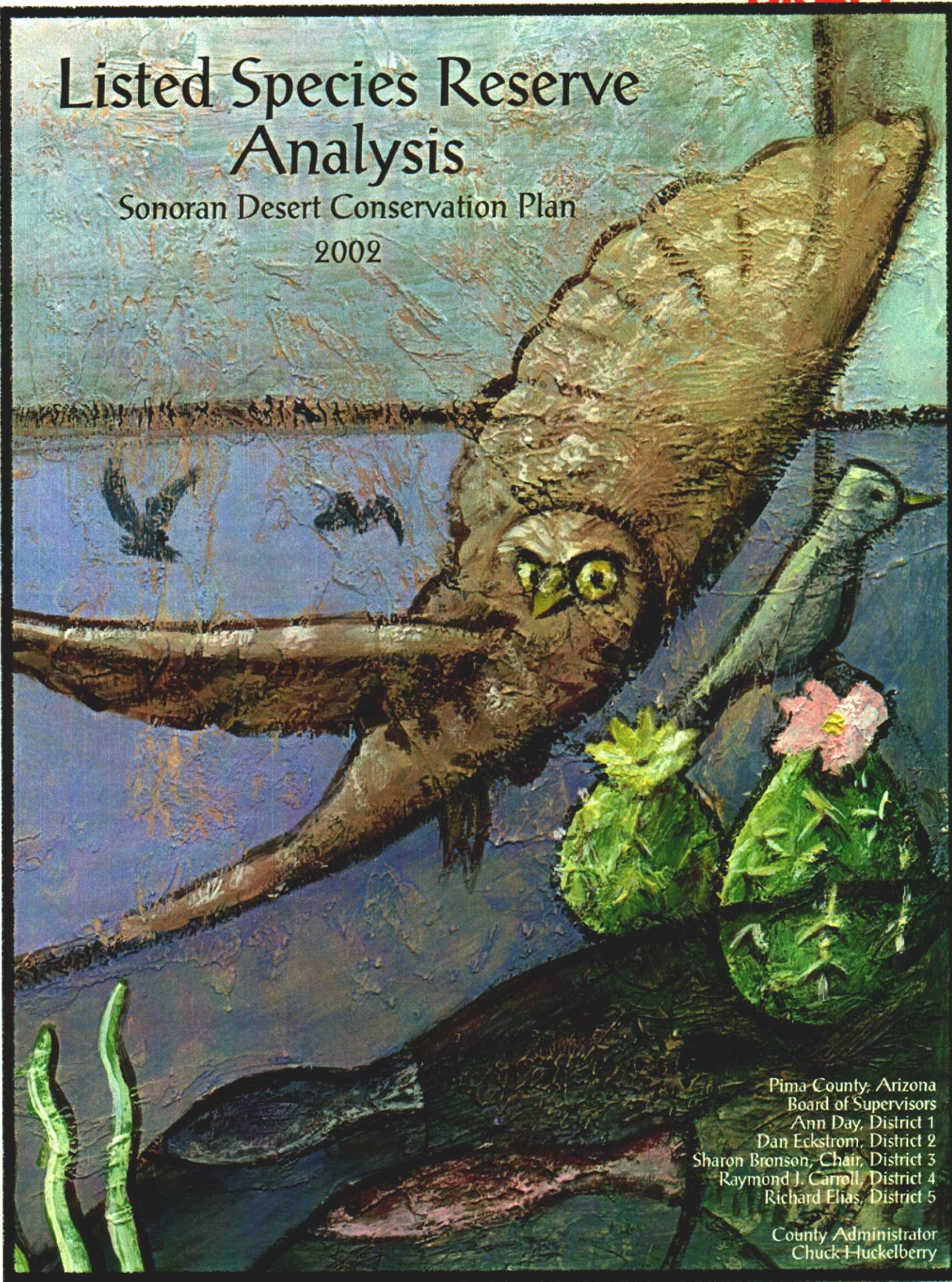


DRAFT

# Listed Species Reserve Analysis

Sonoran Desert Conservation Plan  
2002



Pima County, Arizona  
Board of Supervisors  
Ann Day, District 1  
Dan Eckstrom, District 2  
Sharon Bronson, Chair, District 3  
Raymond J. Carroll, District 4  
Richard Elias, District 5  
County Administrator  
Chuck Huckelberry






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# MEMORANDUM

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Date: April 1, 2002

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

From: C.H. Huckelberry  
County Administrator 

Re: Listed Species Reserve Analysis

## I. Background

In November of 2001 I forwarded to the Board a document entitled *Overview of the Biological Reserve Design Process* which described some of the highlights of the approach taken by the Science Technical Advisory Team during the study process of the last three years. That approach was reviewed as part of a national peer review process in late October. The *Report of Independent Peer Reviewers for the Sonoran Desert Conservation Plan* concluded that "the Sonoran Desert Conservation Plan is a credible, science-based process designed to achieve clear and laudable goals for the long term conservation of biodiversity in Pima County."

In December of 2001, the Science Team issued a map that represents the preferred biological alternative for the Sonoran Desert Conservation Plan. This alternative seeks to protect 55 priority vulnerable species, including species that are listed under the Endangered Species Act. Because the 55 priority vulnerable species also reflect overall biodiversity, protecting these species and special elements within the preferred biological alternative has the effect of conserving the natural system itself. There has been a suggestion that the reserve should only include listed species. The science community has analyzed the listed-species only alternative. The preliminary results are described in this memorandum and reflected in the attached maps.

## II. Findings of the Listed Species Reserve Analysis

The preliminary *Listed Species Reserve Analysis* demonstrates that an effort to protect only listed species would lead to a reserve that was closer to the urbanizing areas of Tucson, and therefore more expensive. The Listed Species Reserve is also one that makes a call on more non-federal land. This is a surprising result for those who believe that less coverage will cost less. To understand this result, the underlying process and principles of reserve design must be understood. One of the simple guiding principles used to create the biological reserve for the Sonoran Desert Conservation Plan is that the reserve achieves the most diversity of species in the least amount of space. In designing the biologically preferred alternative for the Sonoran Desert Conservation Plan, the Science Team has already excluded hundreds of thousands of acres of potential habitat from the proposed reserve because such habitat was not of sufficiently high value, or did not meet a "3 or more species" criteria for inclusion within the reserve.



The Science Team defined, adopted and adhered to a principled biological approach in determining the priority vulnerable species of concern and in recommending a reserve design that would meet the biological goal of the Sonoran Desert Conservation Plan. The principle of species richness served as a biological-based guide to trading off areas with potential habitat. A single species, or limited species reserve proposal offers less ability to make such tradeoffs. By limiting the focus of the reserve to listed species, the broader and long term benefits are lost, and trade-offs of high potential habitat are not based on such comprehensive biological principles.

### **III. Comparison of Listed Species Reserve to Priority Vulnerable Species Reserve**

The biological consultant for the Science Team, RECON, developed a reserve focused on protecting only the species listed as endangered in Pima County. The reserve constructed for listed species was based on these same biological rules as the biologically-preferred reserve for priority vulnerable species:

- species habitat is modeled based on environmental parameters defined by species experts;
- reserve boundaries are delineated based on high potential habitat and species recovery areas;
- reserve boundary shapes follow reserve design rules of patch size and contiguity; and
- urban/developed areas with low biological value are excluded from the reserve.

### **IV. Identifying the Species**

Eight of sixteen federally listed species in Pima County are included in the priority vulnerable species list that was developed to identify the most important conservation targets for the Sonoran Desert Conservation Plan. Modeled potential habitat was developed for each of these species:

- |                                 |                                   |
|---------------------------------|-----------------------------------|
| 1. Cactus Ferruginous Pygmy-Owl | 5. Lesser Long-nosed Bat          |
| 2. Desert Pupfish               | 6. Nichol's Turk's Head Cactus    |
| 3. Gila Topminnow               | 7. Pima Pineapple Cactus          |
| 4. Huachuca Water Umbel         | 8. Southwestern Willow Flycatcher |

The Mexican Spotted Owl, which is not a priority vulnerable species, is also included in the listed species analysis since it occurs in eastern Pima County and its recovery area has been developed. For other species listed as endangered in Pima County, populations are isolated (i.e., Masked bobwhite) or occur outside the plan areas (i.e., Kearney's Blue Star). Therefore these species are not included in the analysis.



## **V. Building the Reserve**

### **1. Developing Habitat Models**

First, habitat models developed as part of the biologically preferred reserve design were used as the basis for delineating listed species reserve boundaries. These habitat models were constructed based on scoring characteristics for environmental variables such as vegetation, topography and hydrology as potential habitat for each species. Scores were reviewed and modified as many as seven times by species experts and members of the Science Technical Advisory Team. These environmental scores were then used to generate habitat models in an Arc/Info Geographic Information System where large amounts of data could be processed: that is, 120 environmental characteristics for 30 by 30 meter landscape cells covering the 5.9 million acre county for the listed species. The flexibility of Arc/Info Geographic Information Systems also allowed for continual updates to environmental data and re-scoring of species habitat characteristics. Species experts further modified models so that final maps reflected habitat boundaries that were not captured by GIS-based modeling. Habitat models used in the listed species reserve are the same as those used in the biologically preferred reserve and are shown in Figures 1a through 1h.

### **2. Delineating Reserve Boundaries**

Next, reserve boundaries were delineated based on high potential habitat for listed species. High potential habitat for the listed species models were overlayed to create a richness map for listed species. (Figure 2). This map shows where there is high potential habitat for one or more listed species. There is overlapping high potential habitat among several of the broadly distributed listed species such as Cactus Ferruginous Pygmy-Owl, Pima Pineapple Cactus, and Lesser Long-nosed Bat. In some of the riparian areas, as many as six listed species share high potential habitat. Areas to be included in the listed species reserve were drawn from this surface. (Figure 3) Since the purpose of the listed species reserve is to provide protection for these species without substantial loss of habitat or species loss, the reserve delineation is based on the occurrence of high potential habitat for one or more listed species. Areas had to be large, that is more than 1000 acres, and contiguous in order to be included in the listed species reserve. Recovery areas for all listed species were included in the reserve (Figures 4 and 5).

### **3. Excluding Medium and High Density Urban / Developed Areas**

Finally, medium and high-density urban/developed areas, as defined for the biologically preferred reserve, were removed from the listed species reserve. These developed areas were identified based on a series of assessments which analyzed parcel size, existing development and existing zoning in order to identify areas where urban and industrial development had already significantly reduced biological value. The results of the urban exclusions on the listed species reserve are shown in Figures 6a and 6b. Figure 7 shows a summary of the listed species reserve.



# **VI. Listed Species and Biologically Preferred Reserves Compared by Land Ownership**

Within Eastern Pima County, when lands owned by Native American Nations are not included, the total acreage of the Biologically Preferred Reserve is on the order of 1,993,051 acres, while the total acreage of the Listed Species Only Reserve is almost equal: at 1,895,693 acres it covers 95 percent of the amount of acreage. The Listed Species Reserve, however, covers more non-federal land and includes an additional 14,184 acres of State Land.

## **Land Ownership in Eastern Pima County for Biologically Preferred and Listed Only Reserves**

LAND OWNER	BIO-PREFERRED RESERVE ACRES	LISTED SPECIES RESERVE ACRES
BLM	184,271	169,517
MILITARY	49	2,281
NATIONAL FOREST	337,368	243,190
NATIONAL PARKS	87,143	87,055
USF&W REFUGE	112,330	112,301
NON-FEDERAL PARK	10,567	10,379
OTHER	78	78
PRIVATE	477,515	472,978
STATE LAND	783,730	797,914
TOTAL	1,993,051	1,895,693

Figures 8 through 15 compare the Listed Species Reserve to the Biologically Preferred Reserve.

A significant difference is that the Listed Species Reserve includes land in the Southeastern portion of Pima County that is generally thought to be the growth area of Tucson.

Figures 8 through 11 demonstrate the differences in the location of land within each reserve, with Figure 11 reflecting the large blocks of land near urbanizing Tucson that are in the Listed Species Only reserve, but not the Reserve that would protect 55 species:

- 79,500 acres in Southeastern Pima County, and
- 20,600 acres above the San Xavier District.



## **VII. Scope of Coverage of the Biologically Preferred Alternative**

The Biologically Preferred Alternative is designed to cover the most biological diversity in the least amount of space, and therefore provides an economy of land use planning that is not obtained in the Listed Species Reserve. The question that arises from the biological perspective is how much high potential habitat for listed species is included in the Biologically Preferred Reserve Design in Eastern Pima County. The chart below provides this data by listed species according to the different categories of land within the Conservation Lands System. In general, the Biologically Preferred Alternative in Eastern Pima County includes the following percentages of high potential habitat for listed species:

- 99 percent of Gila Topminnow high potential habitat
- 99 percent of Desert Pupfish high potential habitat
- 99 percent of Huachuca Water Umbel high potential habitat
- 97 percent of Lesser Long-nosed Bat high potential habitat
- 93 percent of Nichol's Turk's Head Cactus high potential habitat
- 90 percent of Pima Pineapple Cactus high potential habitat
- 76 percent of Cactus Ferruginous Pygmy-owl high potential habitat
- 74 percent of Southwestern Willow Flycatcher high potential habitat

When Western Pima County lands are included, the percent coverage for the Pygmy-owl goes up to 82 percent.

### **Eastern Pima: High Potential Habitat, Listed Species in Biologically Preferred Alternative**

LISTED SPECIES	BIO CORE AREAS OF PREFERRED ALT.	NON-CORE AREAS OF PREFERRED ALT.	TOTAL ACRES AND PERCENT IN RESERVE
Gila Topminnow	823 acres	3 acres	826 acres / 99 %
Desert Pupfish	823 acres	3 acres	826 acres / 99 %
Huachuca Water Umbel	7,456 acres	1,230 acres	8,686 acres / 99 %
Lesser Long-nosed Bat	583,259 acres	472,169 acres	1,055,428 / 97 %
Turk's Head Cactus	7,351 acres	1,583 acres	8,934 acres / 93 %
Pima Pineapple Cactus	102,237 acres	99,463 acres	201,700 acres / 90 %
Pygmy-owl	102,079 acres	298,504 acres	400,583 acres / 76 %
SW Willow Flycatcher	8,992 acres	138 acres	9,130 acres / 74 %



### VIII. Conclusion

The total acreage covered by the two reserves within Eastern Pima County is similar. Differences in the distribution of lands in the two alternatives relative to the urban core, existing reserves, and land ownership have implications for future land development and conservation since the Biologically Preferred Alternative can accommodate biological conservation better and with less cost than the more narrowly-defined reserve based on only the listed species.

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, including that of promoting recovery of federally listed and candidate species to the point where their continued existence is no longer at risk. The biological goal was adopted by the Science Team at the outset of the process and it is reflected in the cooperative agreements that Pima County has with participating agencies, which were submitted for public comment. The Biologically Preferred Reserve is intended to meet the goals and objectives of the Sonoran Desert Conservation Plan. In doing so, it becomes a defensible template for preserving the biota of Pima County and will qualify for a Section 10 permit under the Endangered Species Act.

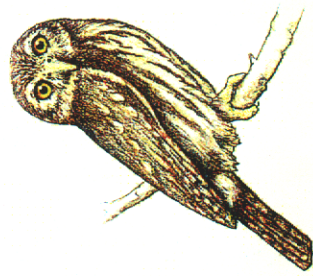
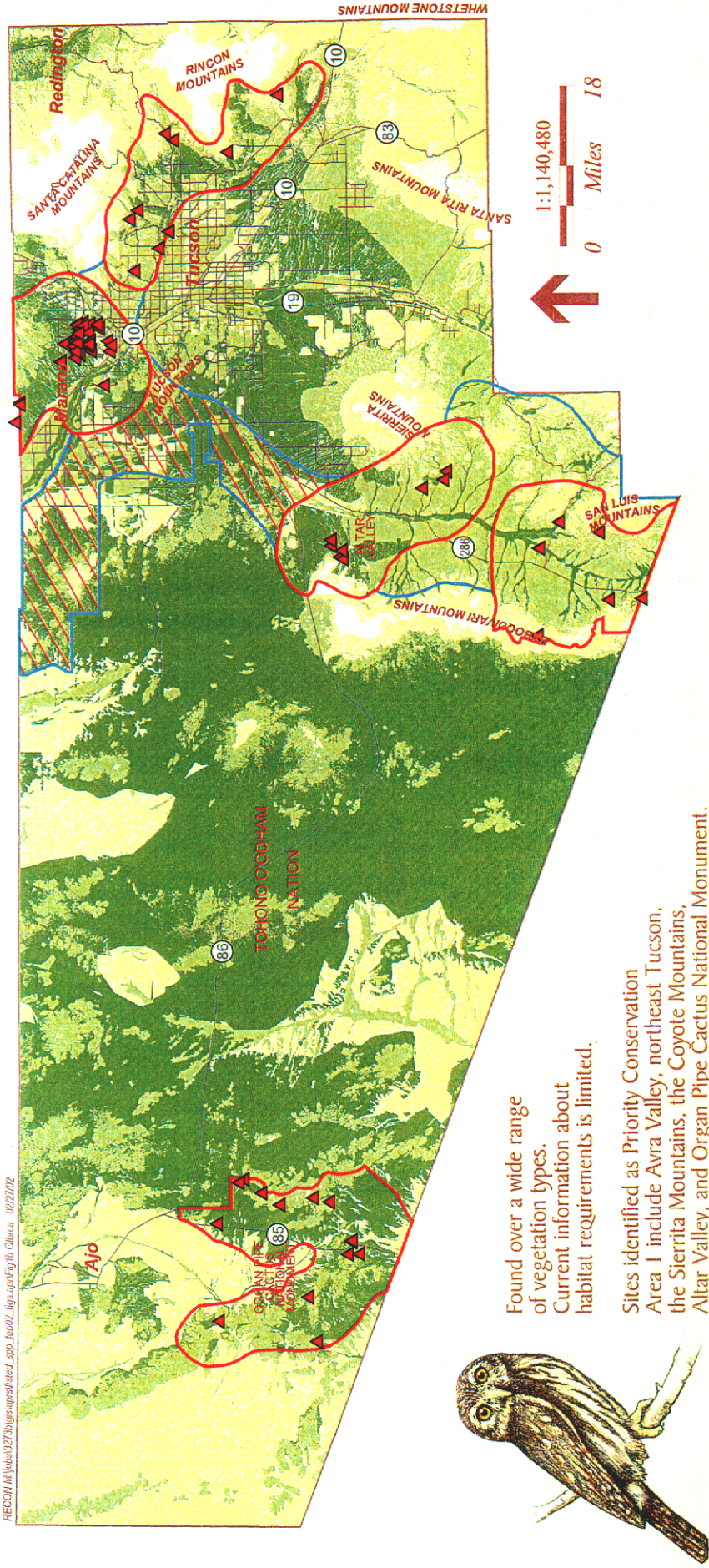
### Attachments:

1a	<u>Lesser Long-nosed Bat</u> .....	7
1b	<u>Cactus Ferruginous Pygmy-owl</u> .....	8
1c	<u>Southwestern Willow Flycatcher</u> .....	9
1d	<u>Desert Pupfish</u> .....	10
1e	<u>Gila Topminnow</u> .....	11
1f	<u>Pima Pineapple Cactus</u> .....	12
1g	<u>Nichol's Turk's Head Cactus</u> .....	13
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11	<u>Listed Species Reserve in Comparison with Biologically Preferred Reserve, EPCo</u> .....	26
12	<u>Biologically Preferred Reserve in Comparison with Existing Preserves, EPCo</u> .....	27
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# Cactus Ferruginous Pygmy-owl (*Glaucidium brasilianum cactorum*) Modeled Potential Habitat and Priority Conservation Areas

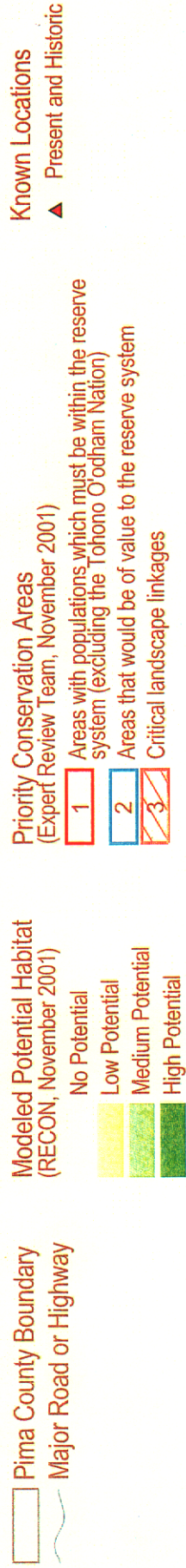
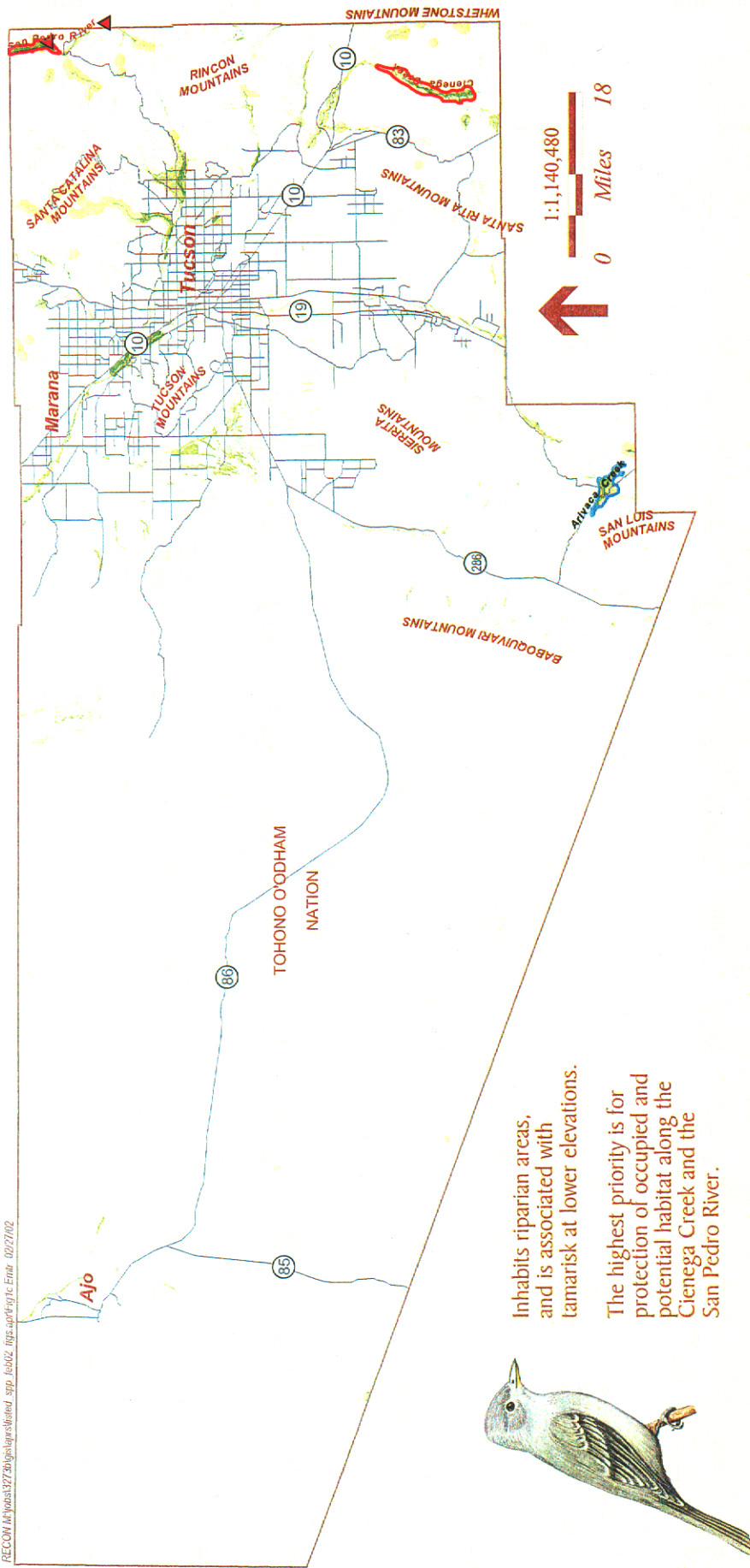


Figure 1b





## Southwestern Willow Flycatcher (*Empidonax traillii extimus*) Modeled Potential Habitat and Priority Conservation Areas

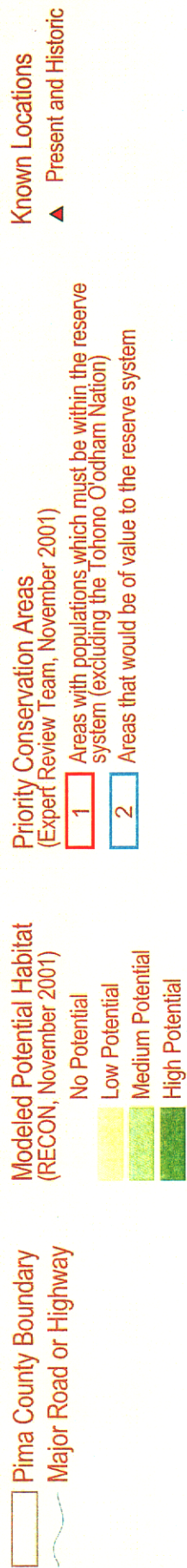


Figure 1c



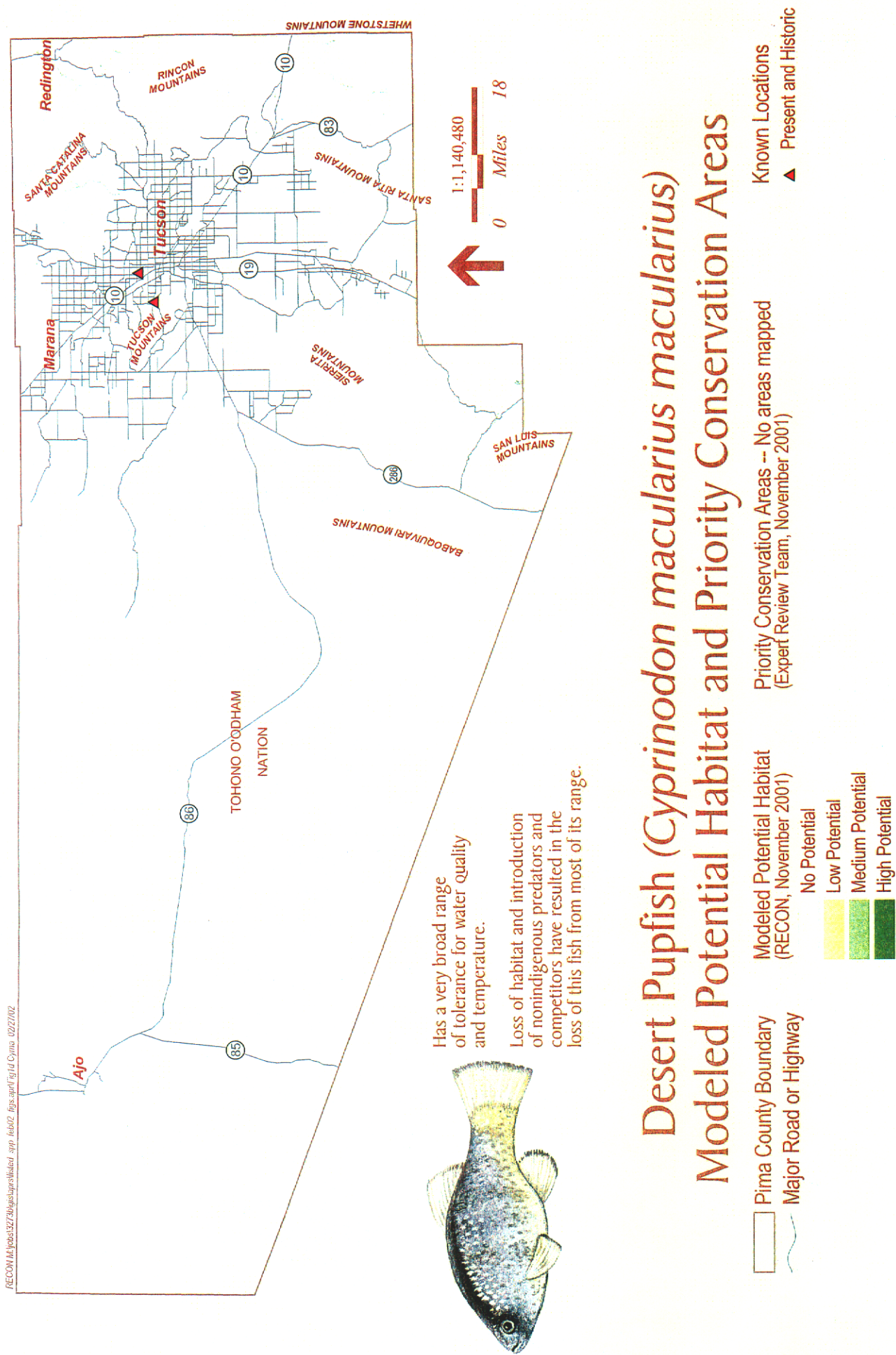
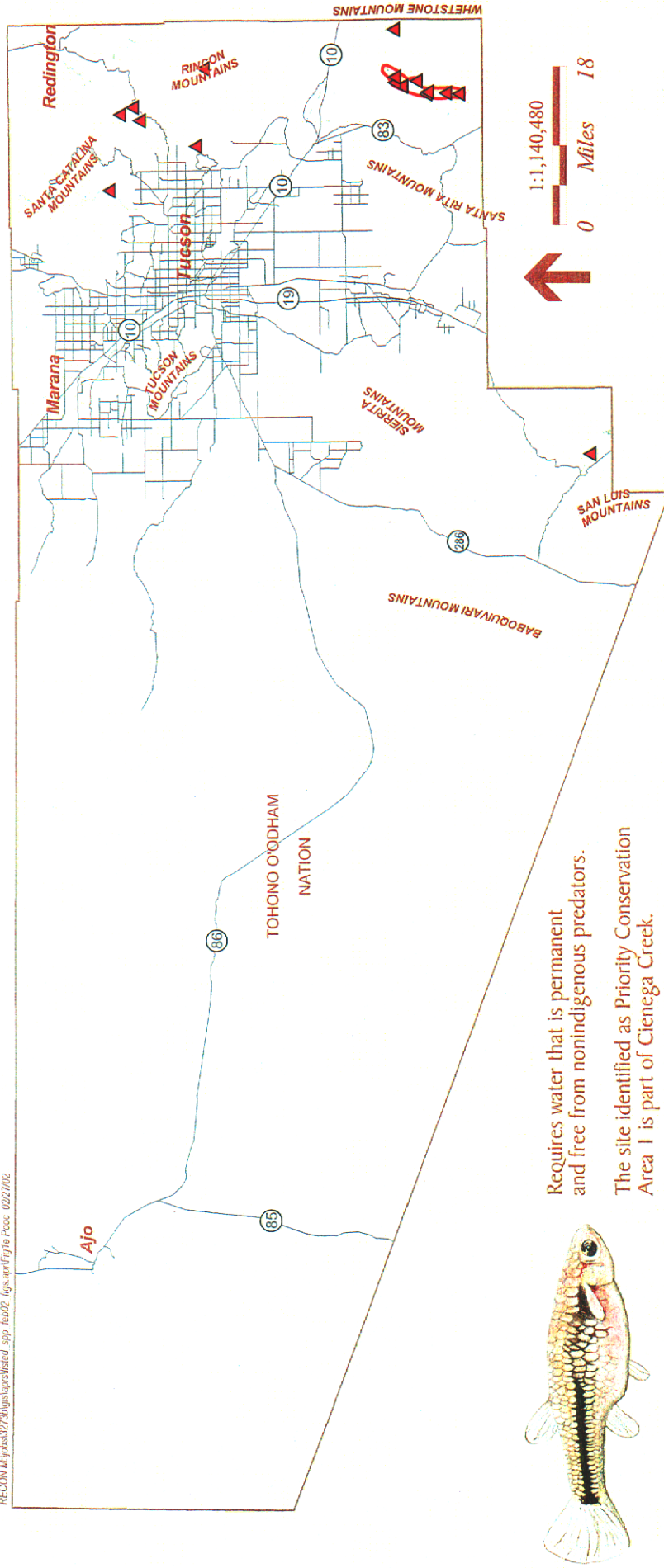


Figure 1d





## Gila Topminnow (*Poeciliopsis occidentalis*) Modeled Potential Habitat and Priority Conservation Areas

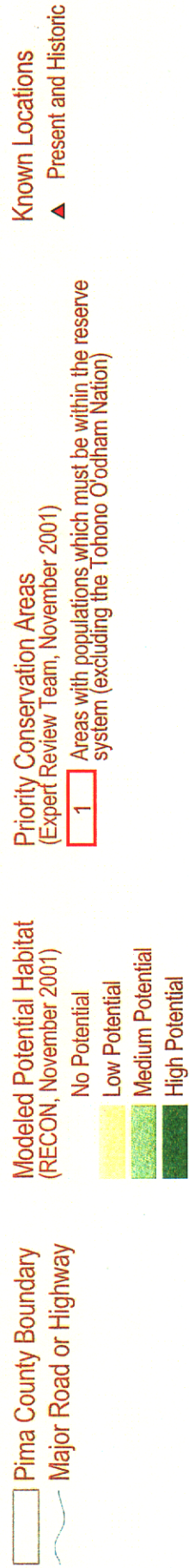


Figure 1e



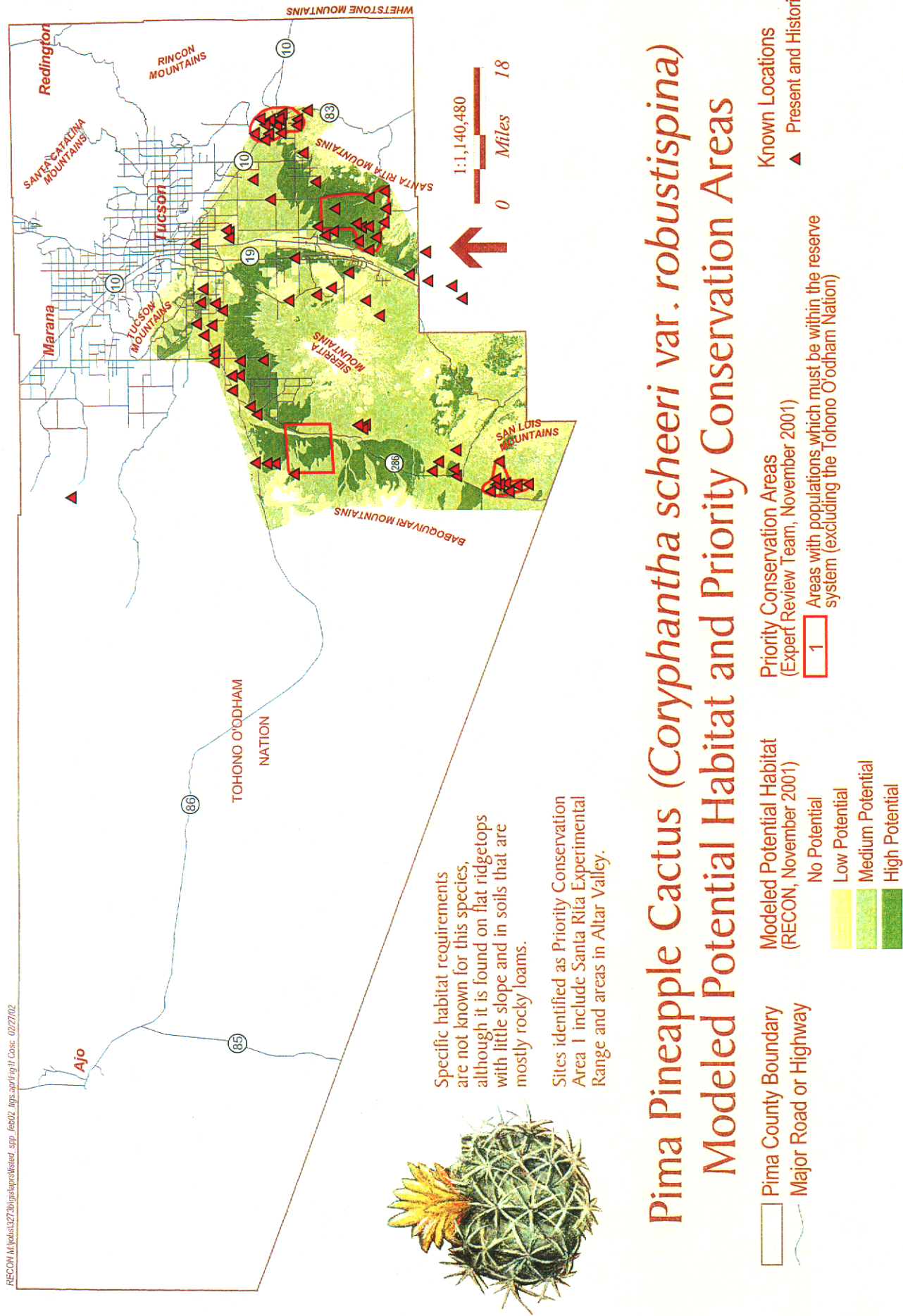
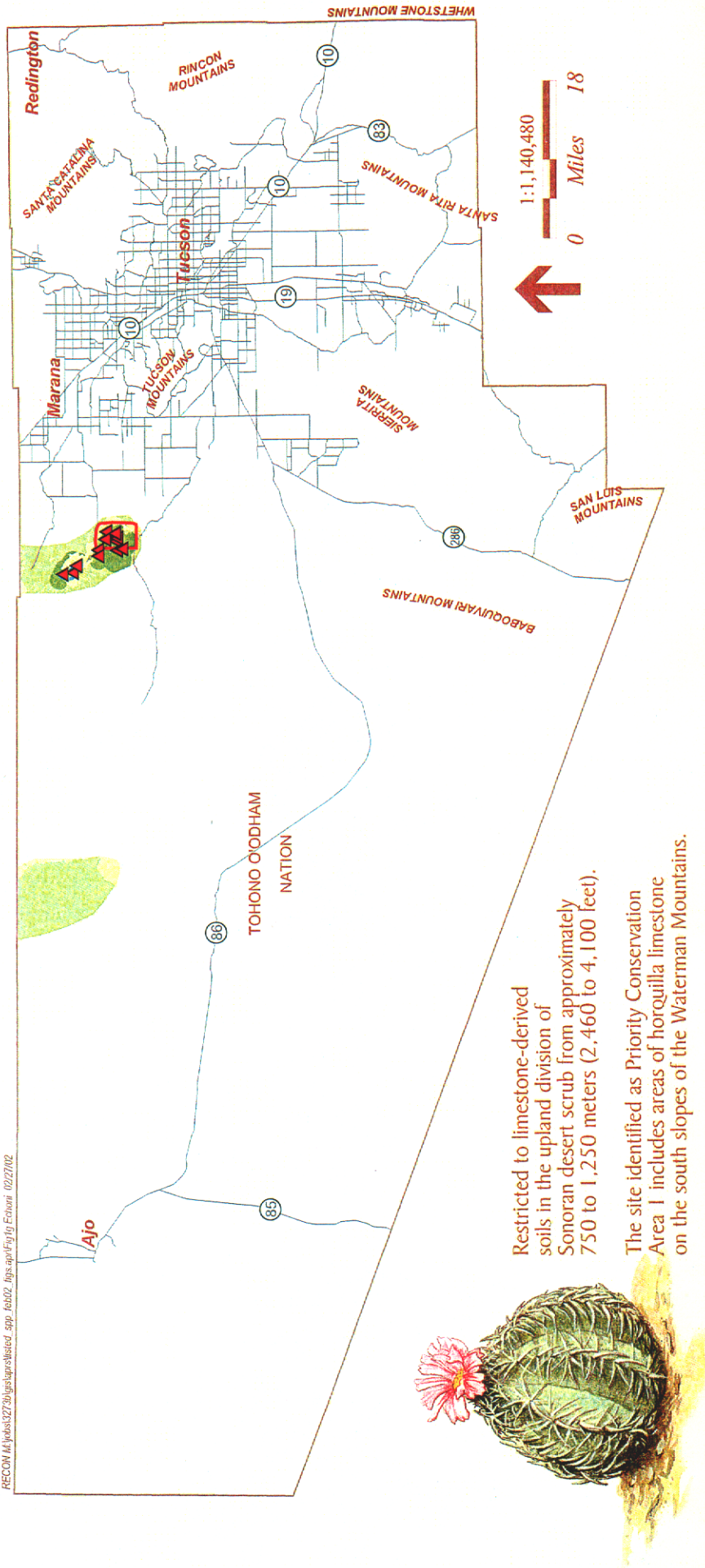


Figure 1f



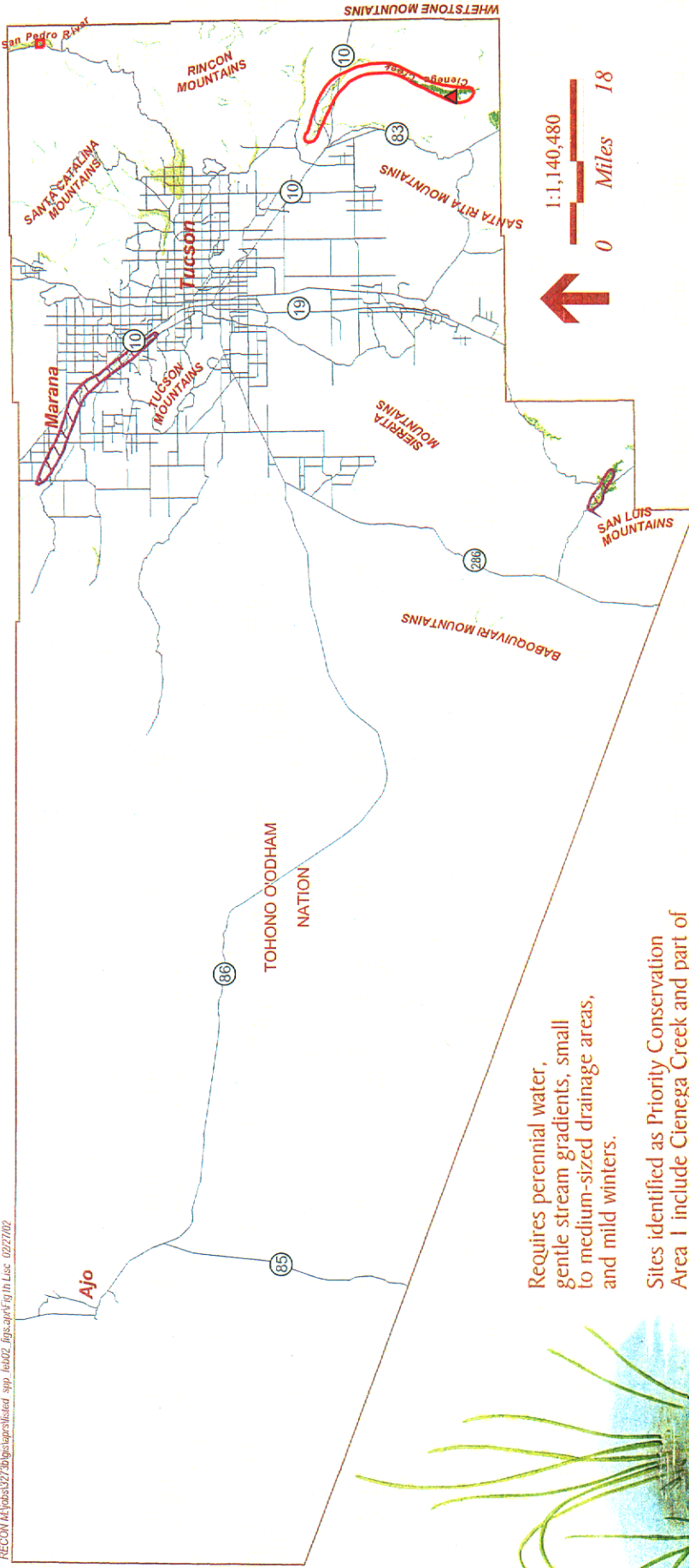


# Nichol's Turk's Head Cactus (*Echinocactus horizontalonius* var. *nicholii*) Modeled Potential Habitat and Priority Conservation Areas

- |  |  |  |  |
|--|--|--|--|
| <p>□ Pima County Boundary</p> <p>— Major Road or Highway</p> | <p>Modeled Potential Habitat (RECON, November 2001)</p> <p>No Potential</p> <p>Low Potential</p> <p>Medium Potential</p> <p>High Potential</p> | <p>Priority Conservation Areas (Expert Review Team, November 2001)</p> <p>1 Areas with populations which must be within the reserve system (excluding the Tohono O'odham Nation)</p> <p>2 Areas that would be of value to the reserve system</p> | <p>Known Locations</p> <p>▲ Present and Historic</p> |
|--|--|--|--|

Figure 1g





# Huachuca Water Umbel (*Lilaeopsis schaffneriana* var. *recurva*) Modeled Potential Habitat and Priority Conservation Areas

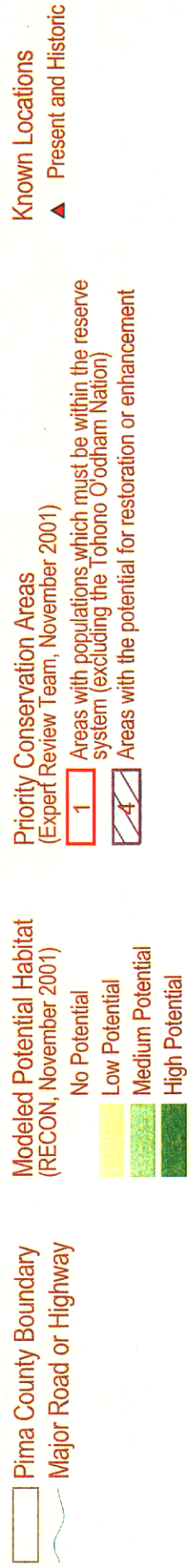
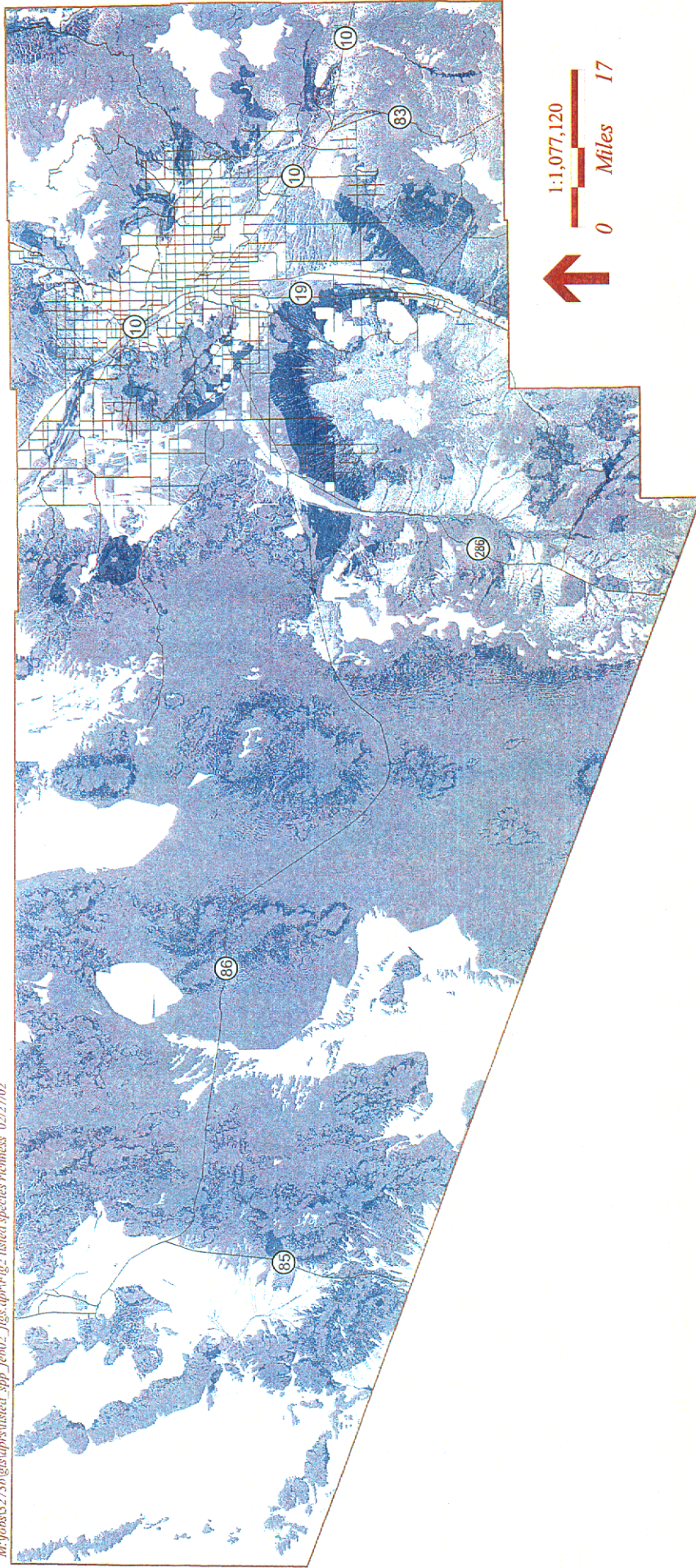


Figure 1h



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## Listed Species Richness - High Potential Habitat

Species Richness  
(RECON, December 2001)

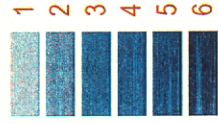


Figure 2



M:\jobs\3273\hgis\sum-listed\_spp\_fig402\_fig402\_fig402\_fig3 listed spp rich + biarea 02/27/02

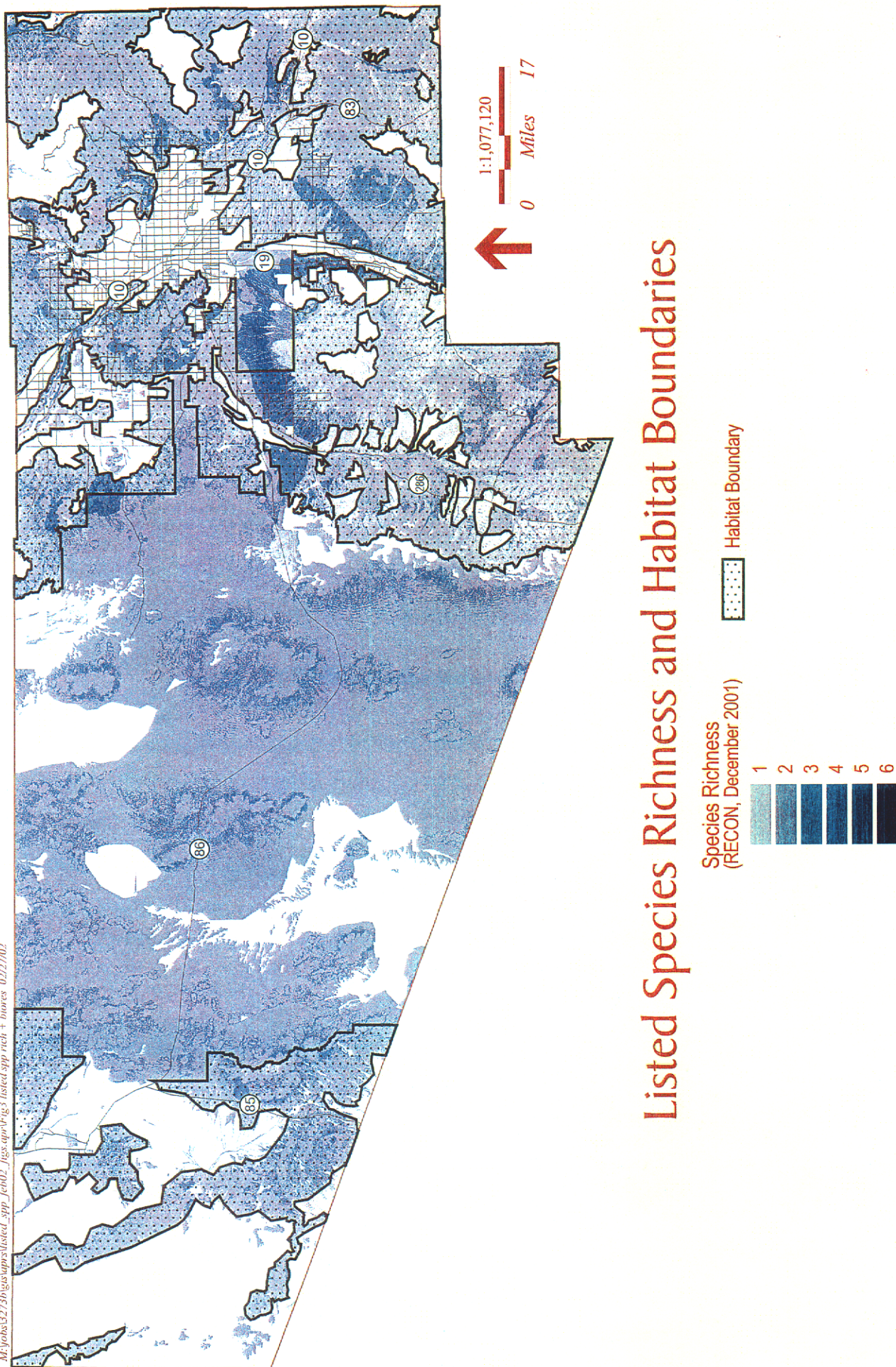
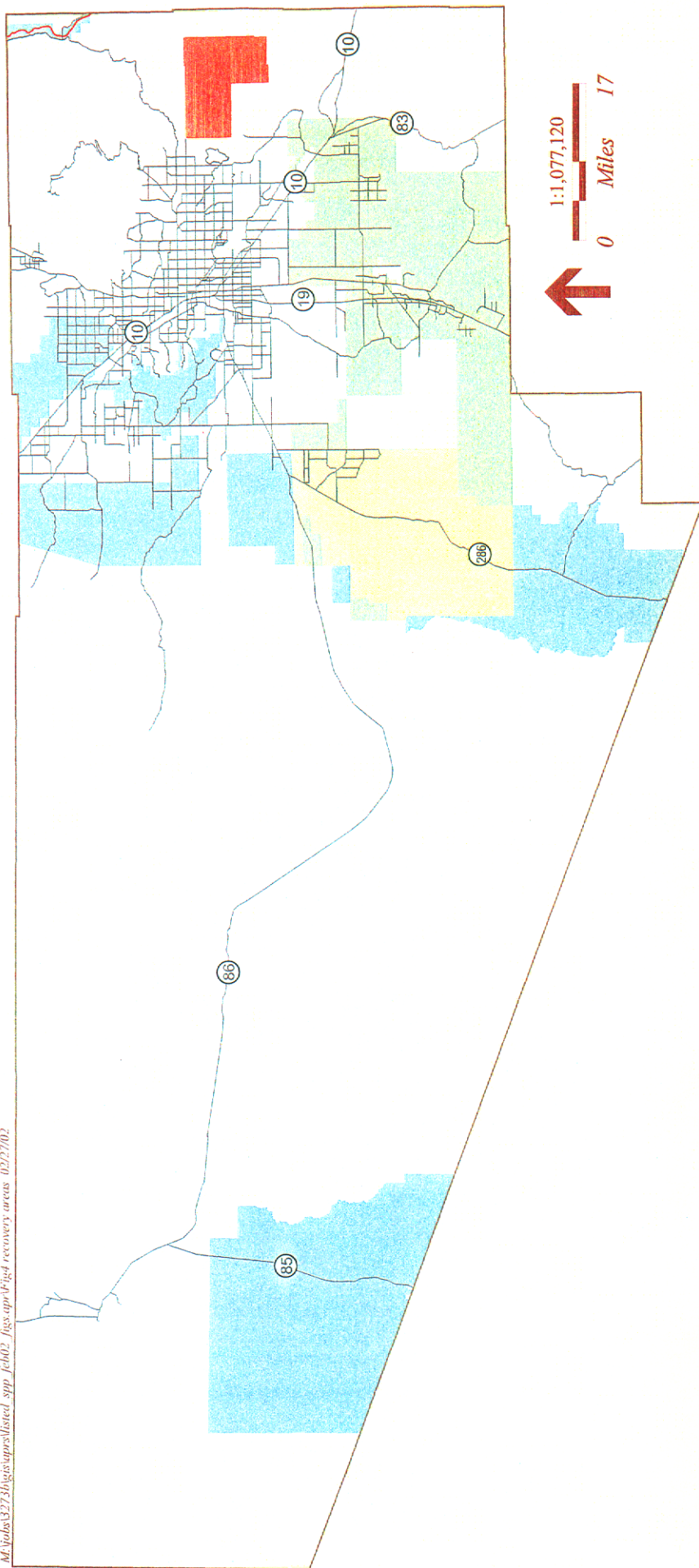


Figure 3





## Recovery Areas

### Proposed Recovery Areas

- Cactus Ferruginous Pygmy-owl
- Pima Pineapple Cactus
- Overlap between Cactus Ferruginous Pygmy-owl and Pima Pineapple Cactus
- Mexican Spotted Owl
- Southwestern Willow Flycatcher

Figure 4



M:\johs\327\bigcats\supplisted\_spp\_fig02\_fig02.apr\fig5 listed spp rich + recon 02/27/02

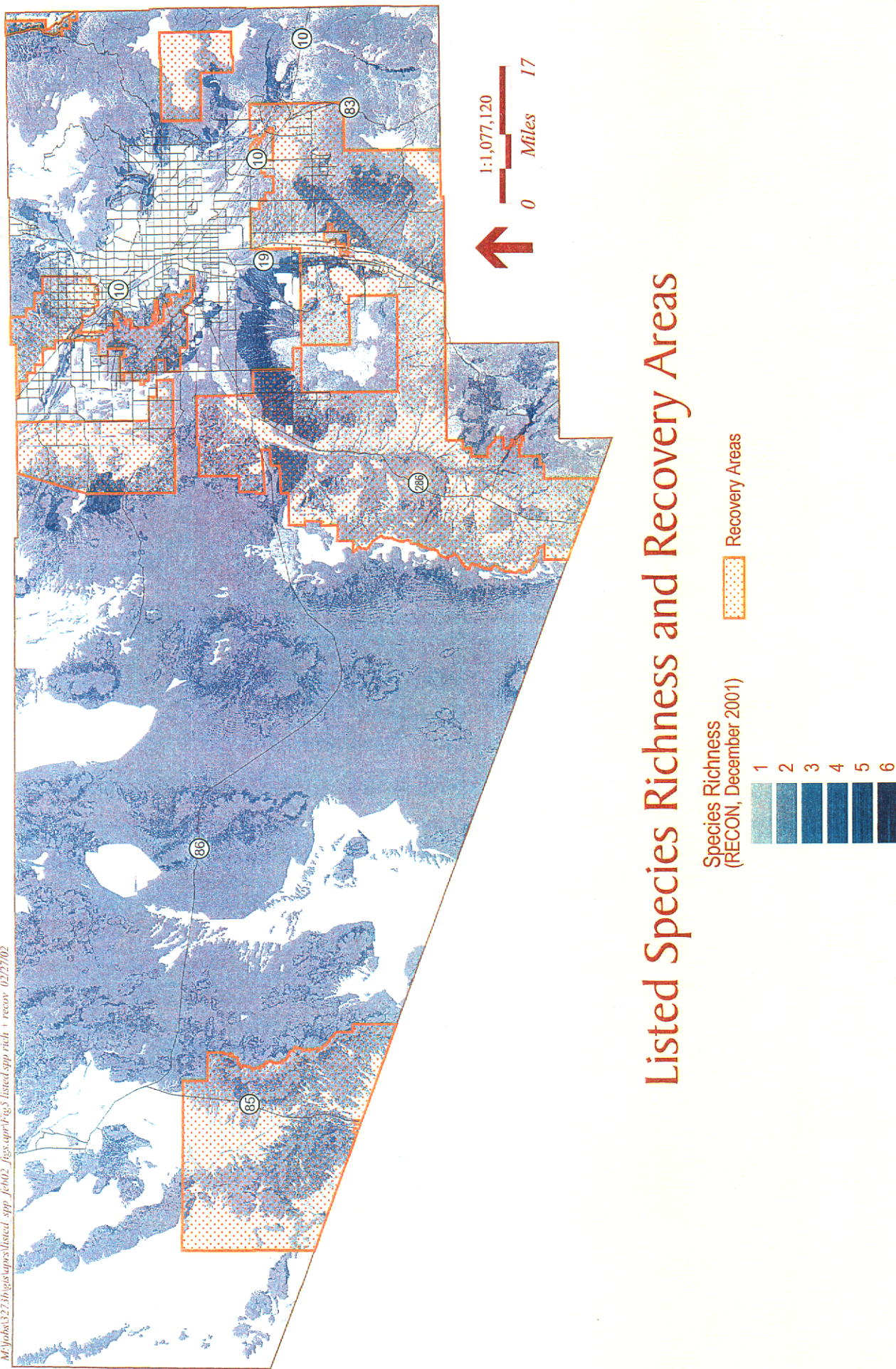
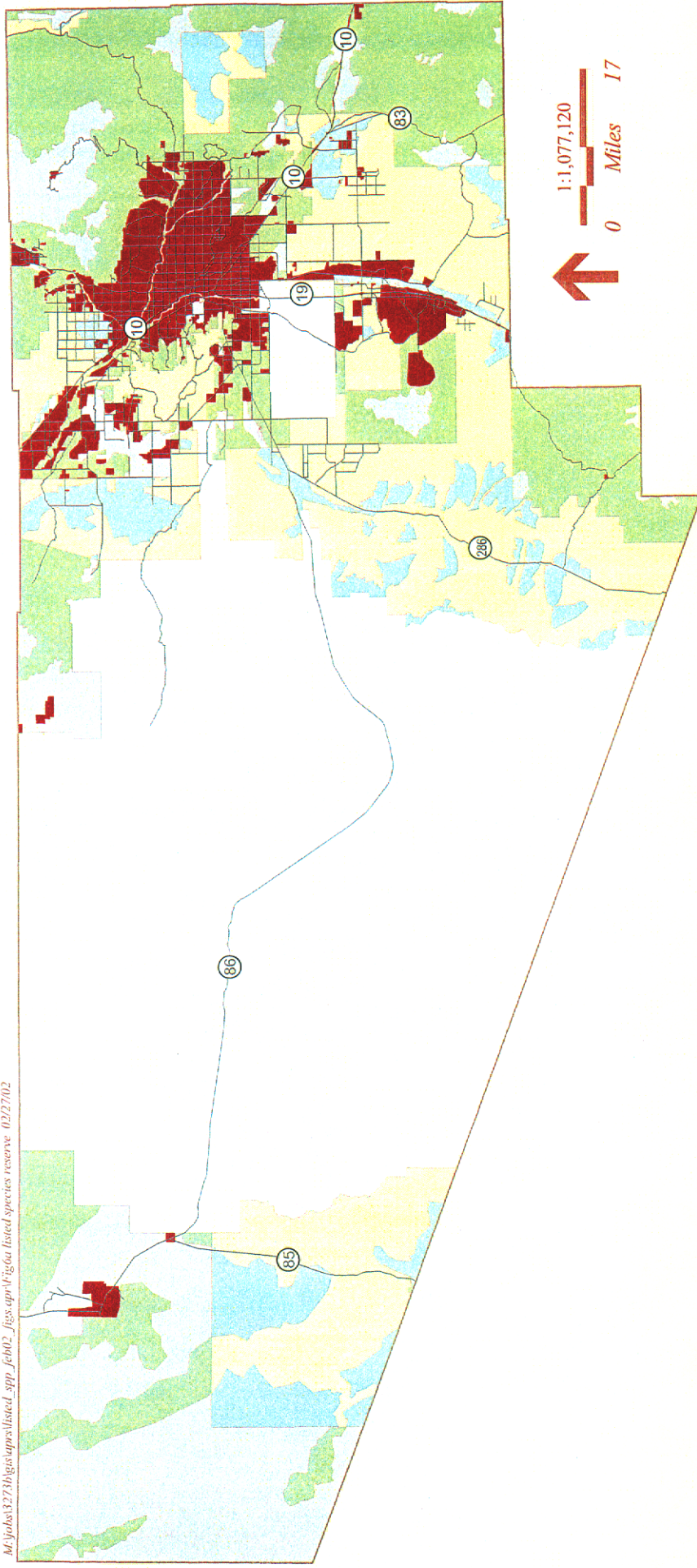


Figure 5



M:\yohs\1273\gis\supr\listed\_spp\_fig02\_fig0a\fig0a listed species reserve 02/27/02



## Listed Species Reserve

- High potential habitat for 1 or more listed species
- High potential habitat and recovery area
- Recovery area
- Exclude from reserve because of high urban density
- Exclude from reserve because of low potential habitat

Figure 6a



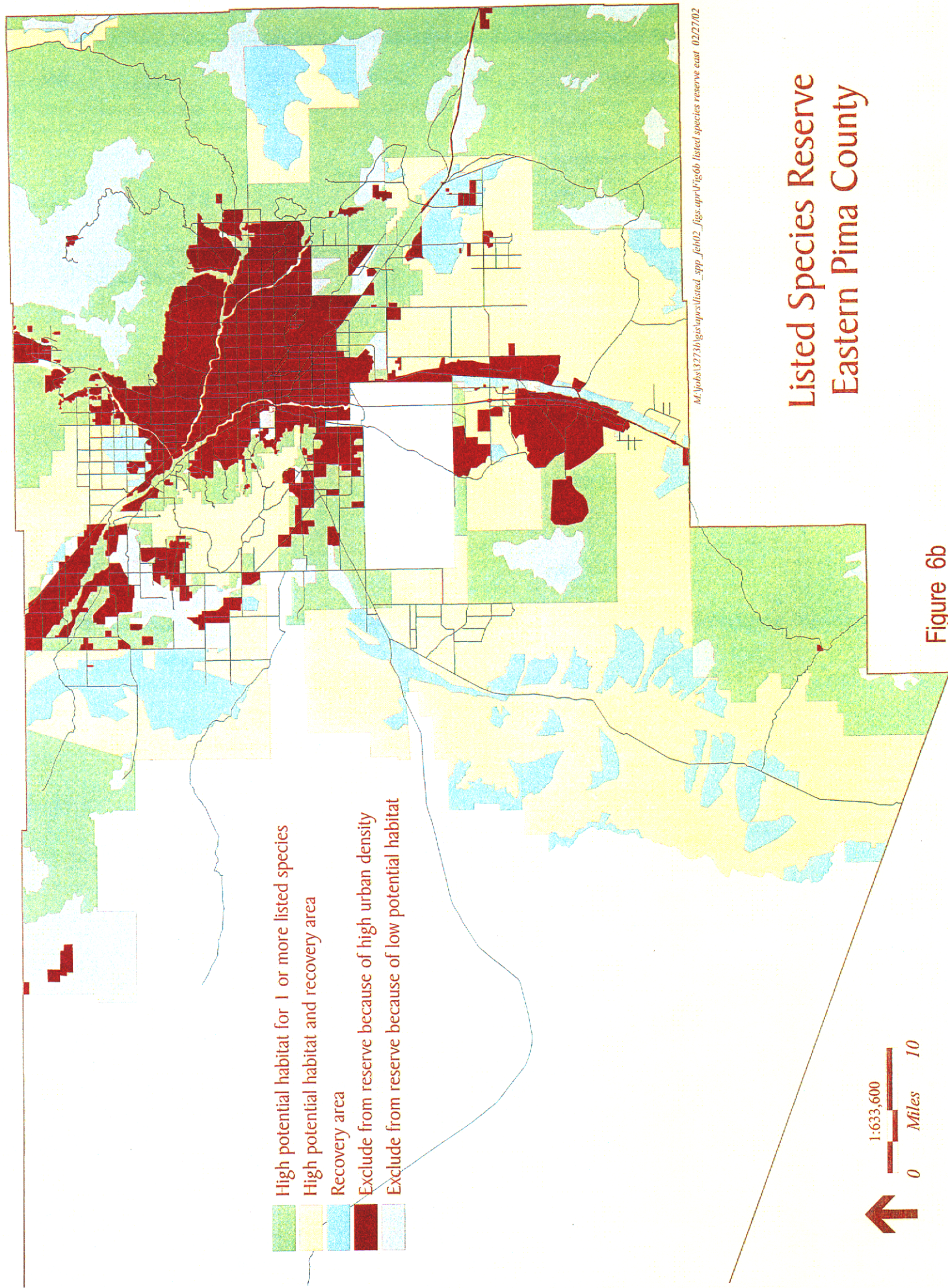


Figure 6b



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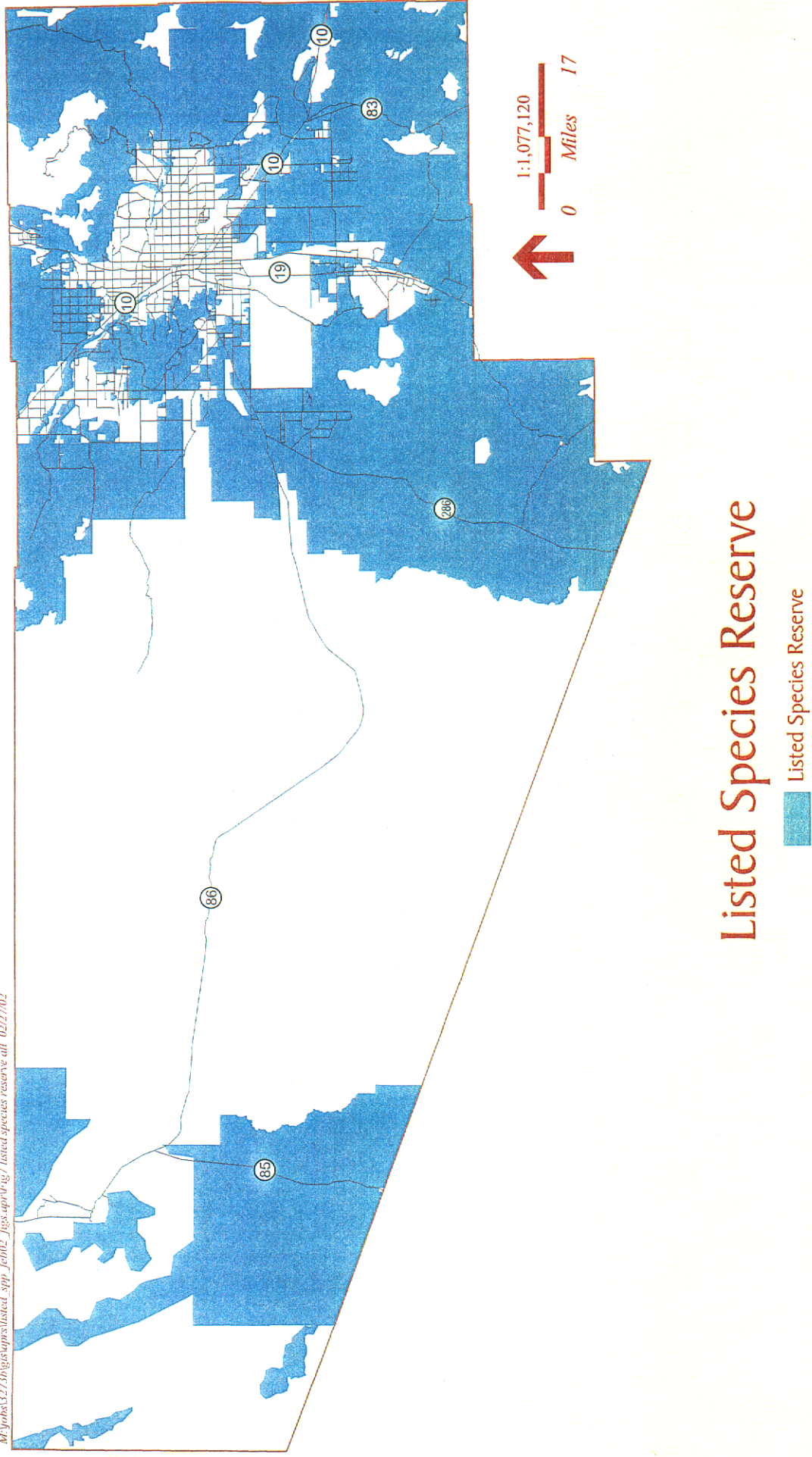
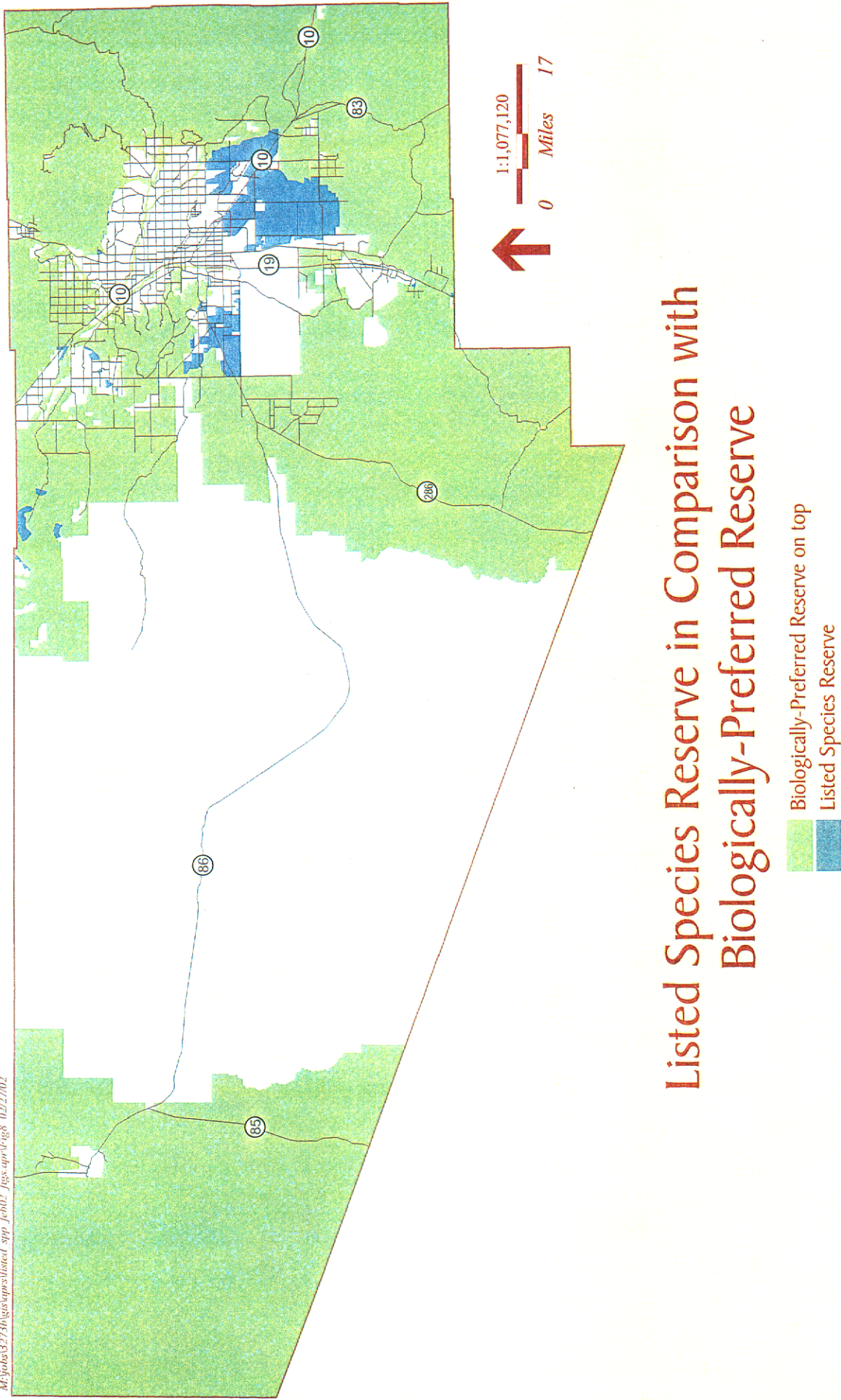


Figure 7





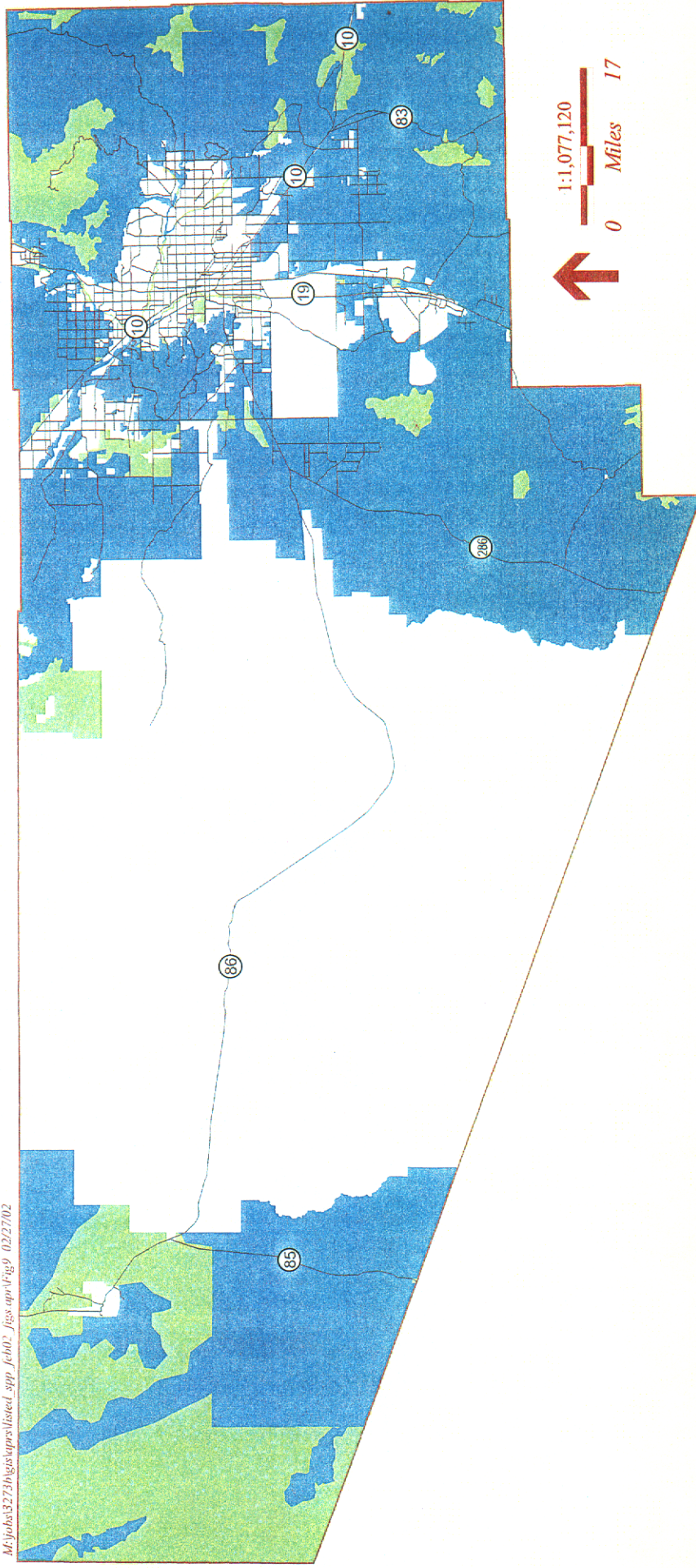
## Listed Species Reserve in Comparison with Biologically-Preferred Reserve

Biologically-Preferred Reserve on top  
Listed Species Reserve

Figure 8



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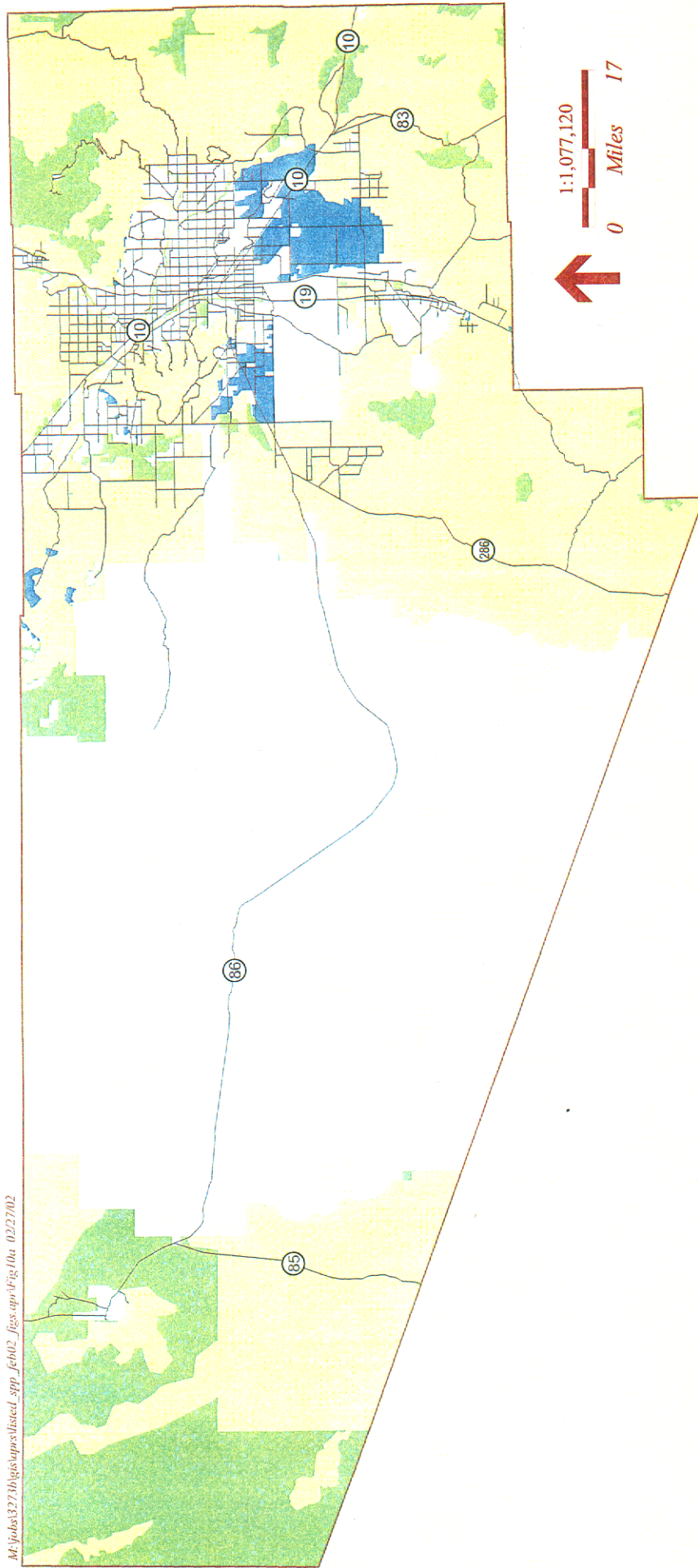


## Listed Species Reserve in Comparison with Biologically-Preferred Reserve

■ Listed Species Reserve on top  
■ Biologically-Preferred Reserve

Figure 9



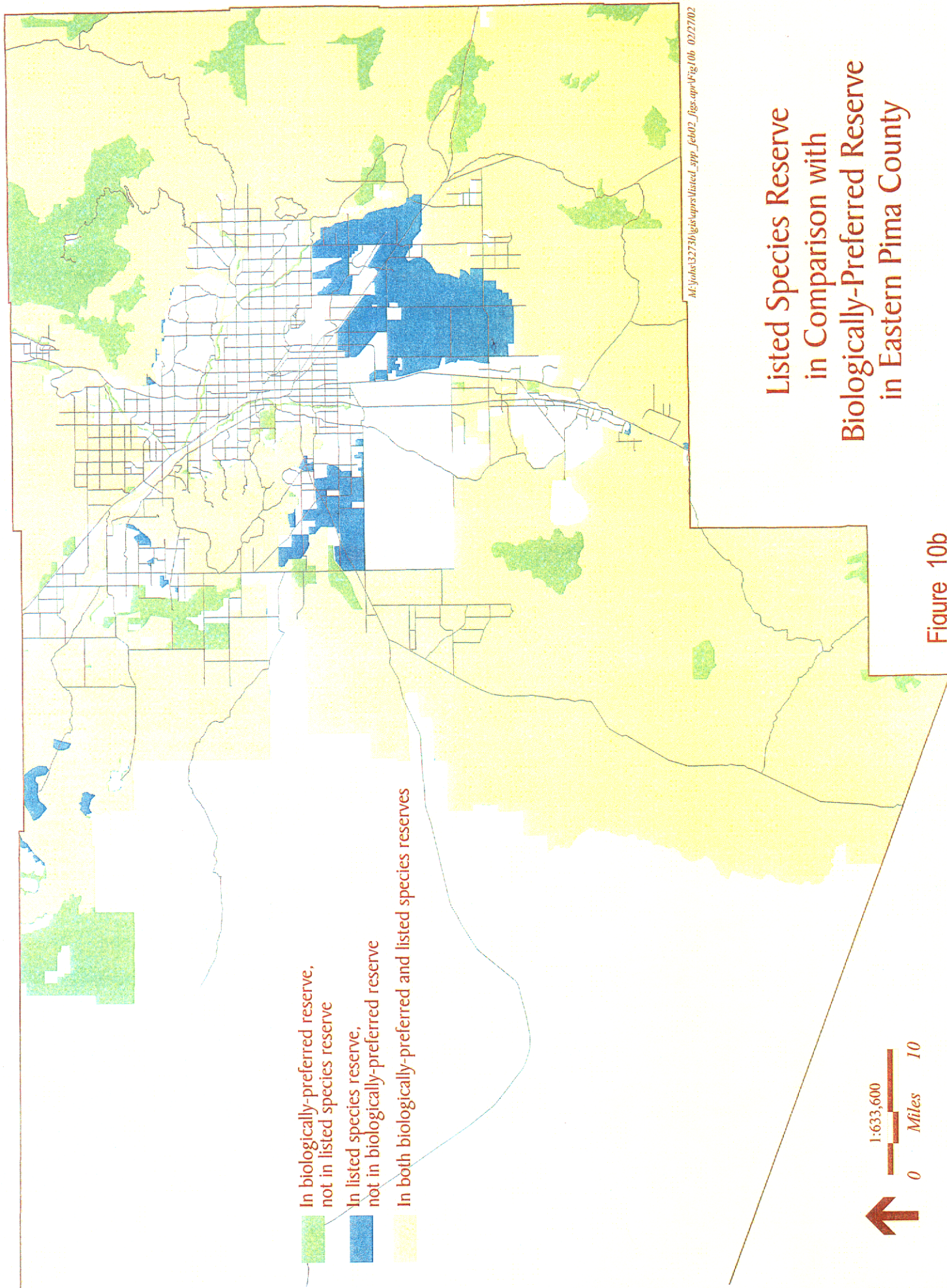


## Listed Species Reserve in Comparison with Biologically-Preferred Reserve

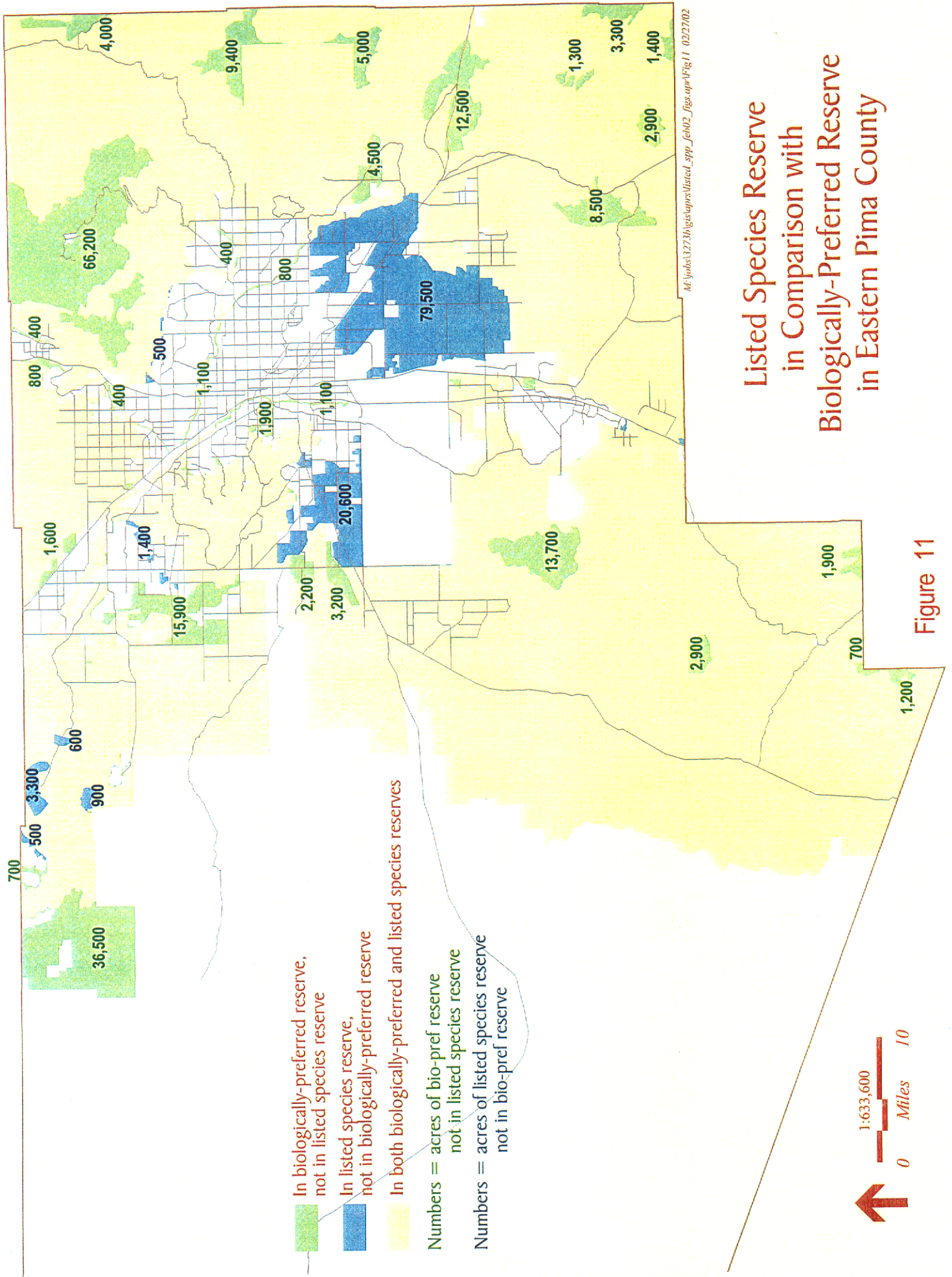
- In biologically-preferred reserve,  
not in listed species reserve
- In listed species reserve,  
not in biologically-preferred reserve
- In both biologically-preferred and listed species reserves

Figure 10a



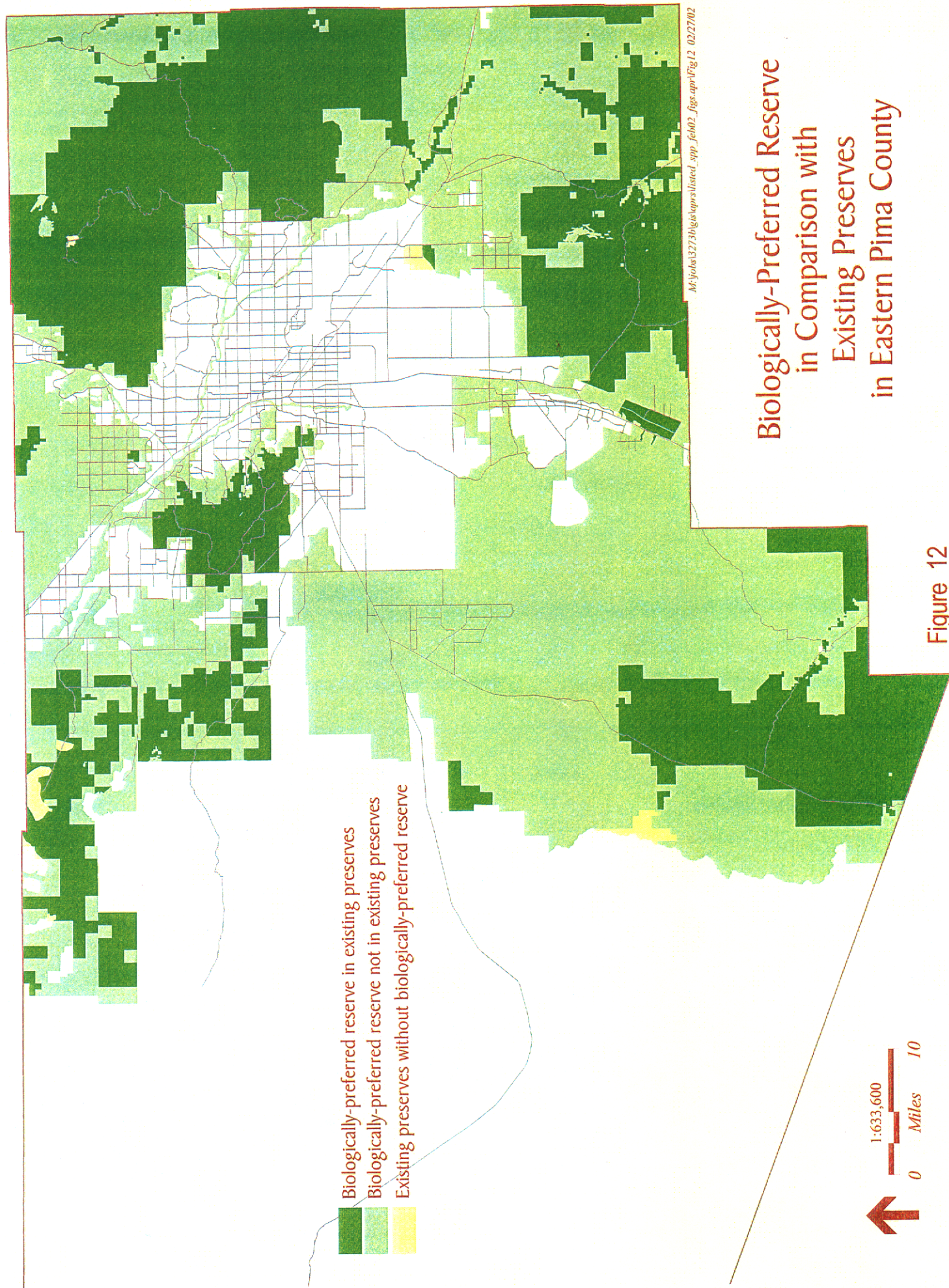




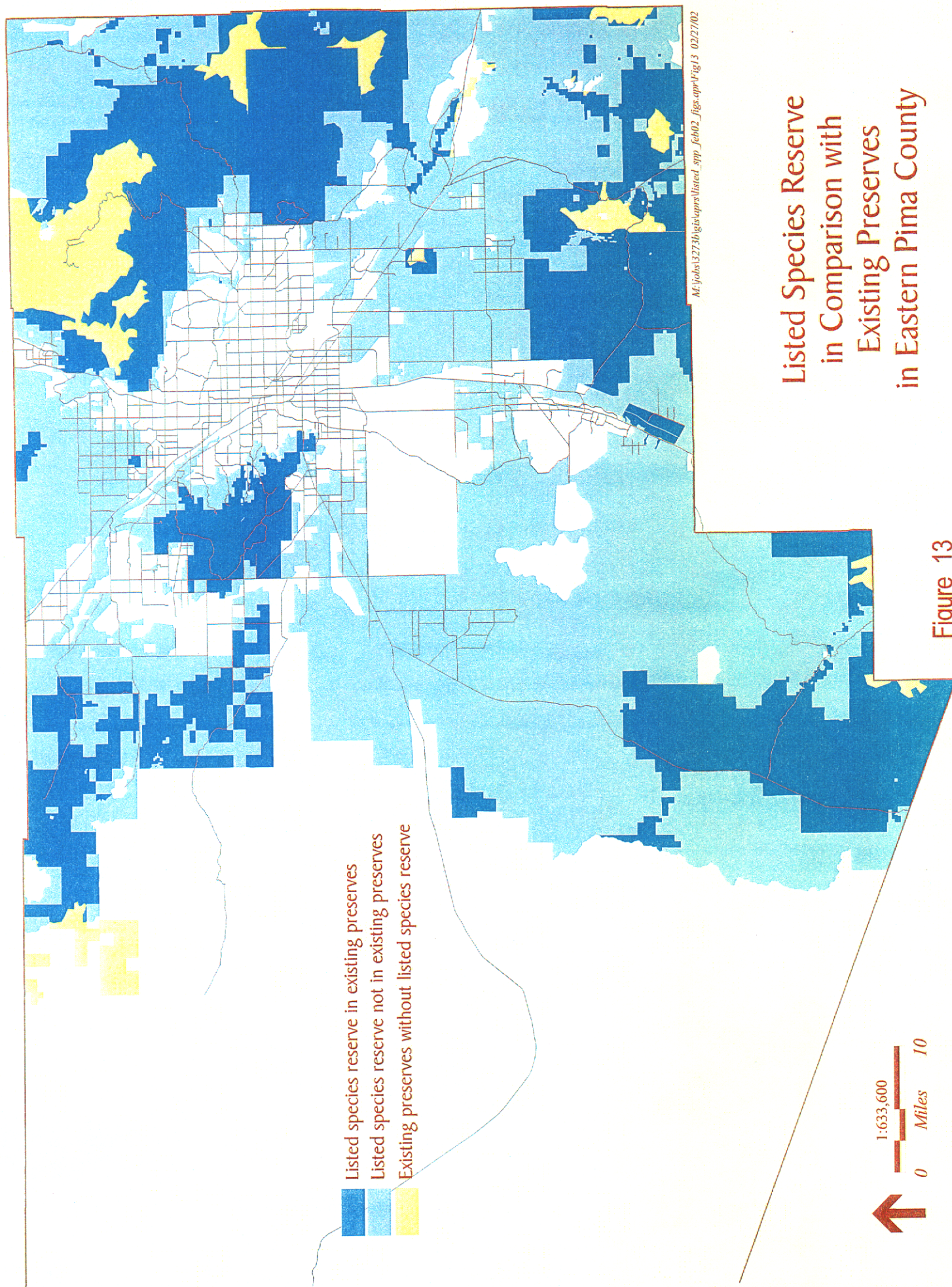


# Listed Species Reserve in Comparison with Biologically-Preferred Reserve in Eastern Pima County









Listed Species Reserve  
in Comparison with  
Existing Preserves  
in Eastern Pima County



