



MEMORANDUM

Date: November 21, 2002

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

From: C.H. Huckelberry
County Administrator

A handwritten signature in black ink, appearing to read "C.H. Huckelberry", is written over the typed name and title.

Re: **Map Revisions for the Riparian Habitat Mitigation Ordinance**

Attached is a report that provides background information on improved mapping techniques that have led to a proposal to update the Watercourse and Riparian Habitat Protection and Mitigation Requirements Ordinance adopted by the Board in 1994. New riparian classification maps will be forwarded to the Board to consider for adoption during 2003. This study is provided now for your information.

Attachment

Map Revisions for the Riparian Habitat Mitigation Ordinance

By Julia Fonseca, Pima County Flood Control District, and John Regan, Technical Services

Background and Purpose

“Riparian” (literally “streamside”) refers to those areas of higher moisture along watercourses and springs of any type, whether flow is ephemeral, intermittent or perennial.

On July 19, 1994 the Pima County Board of Supervisors (Board) adopted the Watercourse and Riparian Habitat Protection and Mitigation Requirements Ordinance 1994-FC2 (Ordinance). The intent of the Ordinance is to “enhance wildlife and recreation values where appropriate by preserving riparian vegetation along watercourses and floodplains”.

The Ordinance was structured to encourage avoidance of damage to riparian areas but does not prohibit development within those areas. If a developer or property owner demonstrates that retaining the riparian vegetation is not possible, then mitigation of disturbed or destroyed vegetation is required. The amount of mitigation is tied to a vegetation classification system.

The Ordinance has been effective in encouraging avoidance of damage to riparian plant communities (Danforth and Fonseca, 2000). One reason it is effective is that it covers a much broader zone than does the U. S. Army Corps of Engineers’ jurisdiction. The Corps’ jurisdiction is generally limited to the channel, or a subset of the channel. The channel is often the least well-vegetated portion of the riparian zone, and the one where natural disturbances are most frequent. By contrast, the Riparian Habitat Mitigation Ordinance covers the area occupied by riparian vegetation, however wide that may be (Figure 1).

Procedure for Developing the Existing “Riparian Habitat” Maps

The existing maps used for regulatory purposes are known as the “riparian habitat” maps. To develop them, a riparian committee comprised of scientists was called upon for help in the early 1990’s. First, they refined the definition and classification system for riparian habitat specific to Pima County, and developed mitigation requirements. Later, a broad-based committee representing all factions of the community was formed to help develop final Ordinance language.

Following adoption of the riparian regulations, work on detailed riparian habitat maps commenced. The resulting riparian habitat maps were adopted into the Ordinance in 1994, and are still used for regulating development in riparian areas.

The Ordinance provides for three types of information to be used in defining and differentiating riparian habitats: species composition, vegetation density and the availability of water. This information is used to classify riparian vegetation as hydromesoriparian, or xeroriparian class A, B, C or D. The original (1994) hydromesoriparian classifications were developed based on aerial reconnaissance flights to observe where riparian forests were located, and information about the availability of surface or groundwater. Xeroriparian classes were related to specific ranges of total vegetation volume inferred from multi-spectral LANDSAT images from the early 1990’s.

When the Science Technical Advisory Team (STAT) commenced its work on the Sonoran Desert Conservation Plan, the riparian habitat maps were reviewed, along with maps available from other agencies. On the basis of review of existing information (Fonseca, 1999a, 1999b), the STAT determined that a special effort would be needed to improve riparian area classification and delineation. One of the problems identified with the existing riparian habitat maps was the boundaries between plant communities with different species and structures were not mapped. Plant species and structure are important variables affecting the distribution of many wildlife species. Another was that many riparian areas were not already mapped, and the basis for distinguishing hydromesoriparian areas from xeroriparian areas was not well documented.

New studies performed for the Sonoran Desert Conservation Plan (SDCP) include mapping based on plant community structure and composition, vegetation density and the availability of water. The next section documents the process used to revise the riparian habitat maps using new data from the Sonoran Desert Conservation Plan.

Procedure for Revising Hydromesoriparian Classifications

Hydromesoriparian habitats are defined in Pima County ordinance by the presence of obligate or preferential riparian plants. Plant communities may be dominated by “species that are also found in drier habitats (e.g. mesquite), but contain some preferential riparian plant species such as ash or netleaf hackberry.” The ordinance further states that such areas are generally associated with perennial or intermittent watercourses or shallow groundwater.

These definitions are the basis for revisions to the distribution of hydromesoriparian habitats. The riparian classification used for the SDCP differentiates plant communities based on the presence of preferential riparian plants and their structure (e.g. grassland versus forest). Using the Brown, Lowe and Pase system, all plant communities which are known to have obligate or preferential riparian plants, or have structures (canopy height or density) not attained outside riparian areas were considered hydromesoriparian. Plant communities were mapped by Harris (2000).

In addition, the water resource mapping conducted by Pima Association of Governments (2000), which identifies perennial and intermittent flow reaches, and shallow groundwater, was used as a basis for identifying hydromesoriparian areas. If shallow groundwater, perennial or intermittent flow is available, the polygon representing the riparian plant community is considered hydromesoriparian. This includes polygons which were not mapped as having preferential riparian plants. By including all vegetation associated with these water resources, this approach is conservative of riparian habitats.

In addition to Harris (2000) and PAG (2000), other investigations were used to decide whether a riparian area (called a polygon, in terms of geographic information systems) should be considered hydromesoriparian. For instance, in the Black Wash area southwest of Tucson, some areas originally mapped as having mesoriparian structure or species by Harris (2000) were revised to reflect an absence of such features based on field investigation.

In several locations, the boundaries delineating riparian areas by Harris (2000) were changed. This occurred principally in the Tanque Verde corridor upstream of Houghton Road, where the boundaries of the hydromesoriparian were enlarged based on field verification conducted by Westland Resources. This is an area where there are many requests for removal of riparian vegetation due to urban development.

Another area where riparian polygons were modified was along the effluent-dominated Santa Cruz River. Some inadvertent inclusions of upland vegetation and roadways were removed from the riparian polygons. Staff also reviewed overlays of polygon boundaries to determine the influence of effluent on the riparian communities. In a few other areas, polygons which included golf courses and small areas of upland were removed.

Finally, spring symbols were added to represent the locations of known springs. Plant communities in association with springs and cienegas are included in the ordinance, but previously no data on their distribution had been included in the regulatory maps. An inventory of springs prepared for the Sonoran Desert Conservation Plan was the basis of the spring mapping. Vegetation associated with springs should be considered hydromesoriparian vegetation.

Procedure for Revising Xeroriparian Delineations

Riparian polygons not designated hydromesoriparian are considered xeroriparian. Lateral boundaries were delineated using digital orthophotography at a scale of 1:24,000. Vegetation and geomorphological evidence of hydrological patterns were used to identify the boundaries (Harris, 2000). The ordinance defines xeroriparian habitat as generally possessing ephemeral water supply and a species composition which is similar to adjacent upland areas. Structurally, the vegetation may be larger or denser. The ordinance distinguishes among four classes of xeroriparian habitats, based on total vegetation volume.

Differences among "xeroriparian" areas can be differentiated using Normalized Difference Vegetation Index (NDVI) values, which provide some consistent, relative data about vegetative conditions along streams. NDVI values are related to the reflectance of land and vegetation features on the landscape, as sensed by satellites. In Pima County, NDVI values have been found to relate to the vegetation leaf volume along riparian areas (SWCA, 1993). Vegetation volume is an indicator of plant productivity and also has been correlated to breeding bird densities (SWCA, 1993). Information about vegetation structure is not provided by the NDVI values.

To differentiate xeroriparian habitats into the four classes, the riparian plant community polygons from the SDCP were superimposed on June 2000 LANDSAT satellite imagery. Precipitation can cause a rapid change in the spectral characteristics in arid ecosystems (David Schaub, personal communication, 2001).

District staff verified that the imagery was taken before the onset of the summer monsoonal rains, meaning that variation due differences in rainfall, plant growth and soil moisture is minimized.

An analysis of the new satellite mosaic was prepared by Terrasystems Incorporated. The imagery was processed using the normalized difference vegetation index (NDVI) for riparian vegetation. This index is a mathematical equation that relates to the reflectance in infrared and near-infrared spectral bands of LANDSAT– these portions of the electromagnetic spectrum are useful for vegetation characteristics.

The NDVI of the pixels which fell within riparian polygons were averaged within each riparian polygons. Because the LANDSAT sensors have changed over the years, resolution has increased from 30 to 15 meters and because different weather-related conditions exist in the new imagery compared to the old imagery, it is not appropriate to use the 1994 NDVI values to distinguish the four classes. Instead, an initial classification based on ten equal increments was created. Four classes A through D were then differentiated on the basis of a “natural breaks” algorithm. The first five equal increments were combined into class A on the basis of the distribution review, which showed that many of these increments would already be classified as hydromesoriparian based on species composition, structure, or water availability. The lowest natural break was selected as class D.

Map Revisions Relating to Applicability

The riparian mapping for the Sonoran Desert Conservation Plan was conducted for areas having the potential for significant future land degradation, including certain areas managed by U. S. Forest Service and Bureau of Land Management. Mapping did not extend into Wilderness areas, National Parks, tribal lands and Wildlife Refuges.

The Riparian Habitat Mitigation Ordinance applies only to unincorporated Pima County. Therefore the revised regulatory maps will depict administrative boundaries of tribal, federal, and municipal jurisdictions. Where available, we will depict the classifications, but the degree of protection offered to riparian areas outside unincorporated Pima County will remain at the discretion of the jurisdiction. Other jurisdictions may use different methods to classify and protect these areas.

Results

Figure 2 displays all hydromesoriparian and xeroriparian areas in eastern Pima County. Hydromesoriparian areas are not evenly distributed. They are almost exclusively located in eastern Pima County (Figure 2). Arivaca Creek, Tanque Verde Creek, San Pedro River, and Cienega Creek are examples of some of the larger hydromesoriparian corridors.

Class A xeroriparian areas are very limited in extent, in part because most of the areas with high NDVI values (and hence high vegetation volume) are already classified as hydromesoriparian. Most of the Class A xeroriparian areas are located in the headwaters of streams in the Coronado National Forest. Class A xeroriparian areas in unincorporated Pima County exist at lower elevations along some of the west-side tributaries of Altar Wash, along tributaries of Sabino Canyon, and several other locations.

Class B riparian areas are much more extensive. Most of the large areas exist in the Altar Valley. Also extensive, but more broadly distributed than B are the Class C areas.

Xeroriparian areas with the lowest NDVI values (class D) are not protected under the current County ordinance. These areas occur primarily in western Pima County, in the broad sandy bed of the Santa Cruz River outside the effluent-dominated reach, outside the main channels of the lower Brawley Wash, and in distributary flow zones in the Santa Rita piedmont south of Tucson. There are 11,681 acres of class D xeroriparian in unincorporated Pima County.

The elimination of riparian areas is evident in Figure 2 in areas where urbanization, mining and agriculture has eliminated them. Central Tucson, the mines west of Green Valley and portions of Avra Valley exemplify areas where riparian areas have been highly fragmented or eliminated due to current land uses.

Riparian classifications are absent in National Wildlife Refuges and Wilderness Areas, tribal lands, and National Parks. Vegetation mapping did not occur in these areas. All springs are shown in Figure 2 regardless of jurisdictions.

Figure 3 shows riparian areas within the jurisdiction of the Pima County Flood Control District.

Significance

The primary significance of the revised maps is that there are many more riparian areas than were previously encompassed by the regulatory maps. The newly mapped riparian areas are found throughout the County, and derive from the natural resource inventory and analyses done for the Sonoran Desert Conservation Plan.

Second, several hydromesoriparian areas have been re-classified as a result of improved information about water resources and vegetation. Two examples of watercourses that should be considered xeroriparian but which are currently regulated as hydromesoriparian include portions of the Cañada del Oro Wash north of Catalina State Park and south of Pinal County, and Woodland Hills Wash, which is a tributary of Sabino Creek. Examples of current xeroriparian areas that should be considered hydromesoriparian include Agua Verde Creek, Black Wash, Davidson Canyon, and Sopori Wash.

Third, the boundaries of some previously regulated riparian areas have changed based on new riparian studies. Examples of changes include areas along watercourses in the Tortolita piedmont, Tanque Verde Creek, and Davidson Canyon.

Fourth, some of the xeroriparian classifications have changed. Changes go both ways, from higher to lower (e.g. B to C) and from lower to higher (e.g. from C to B).

Conclusions

1. Updated "riparian classification maps" will be brought to the Board in the future to consider for adoption.
2. Staff will continue to gather data on vegetation and water availability that may affect the classifications, and evaluate new data periodically to determine if additional map revisions are warranted.

References

Brown, D. E., C. H. Lowe, and C. P. Pase, 1979. A digitized classification system for the biotic communities of North America, with community (series) and association examples for the Southwest. *J. Ariz. Nev. Acad. Sci.* 14 (Suppl. 1): 1-16.

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Pima Association of Governments (PAG), 2000. GIS coverage of Perennial Streams, Intermittent Streams, and Areas of Shallow Groundwater. Final Project Report, prepared for the Sonoran Desert Conservation Plan.

SWCA, 1993. Riparian Habitat Definition and Classification System Technical Report. Prepared for Pima County Department of Transportation and Flood Control District.

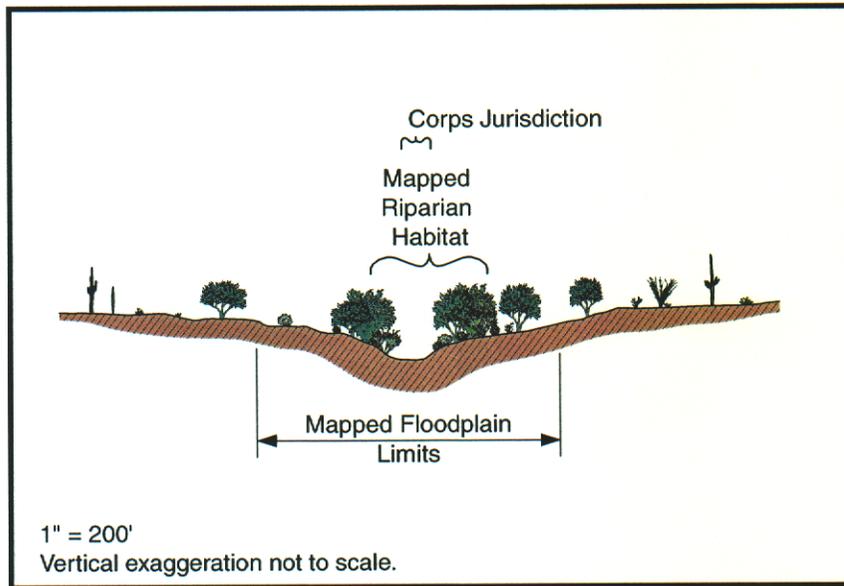
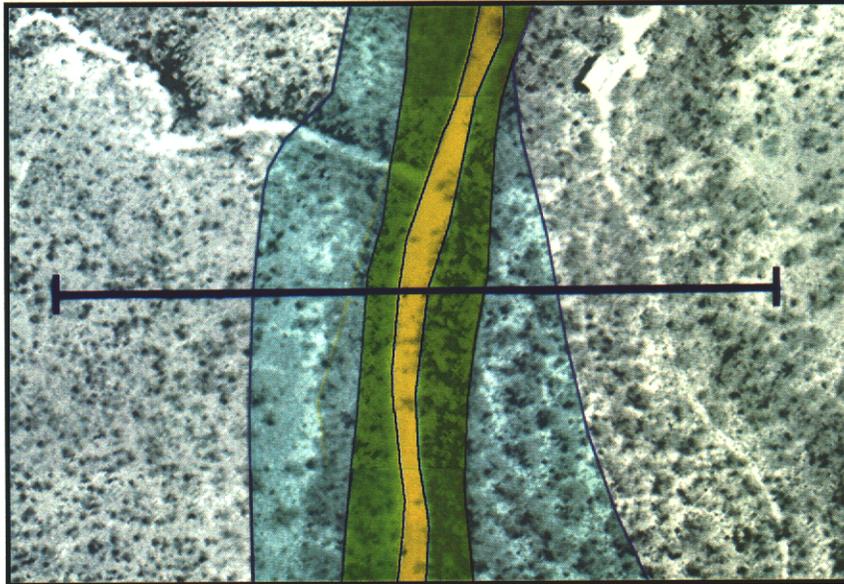
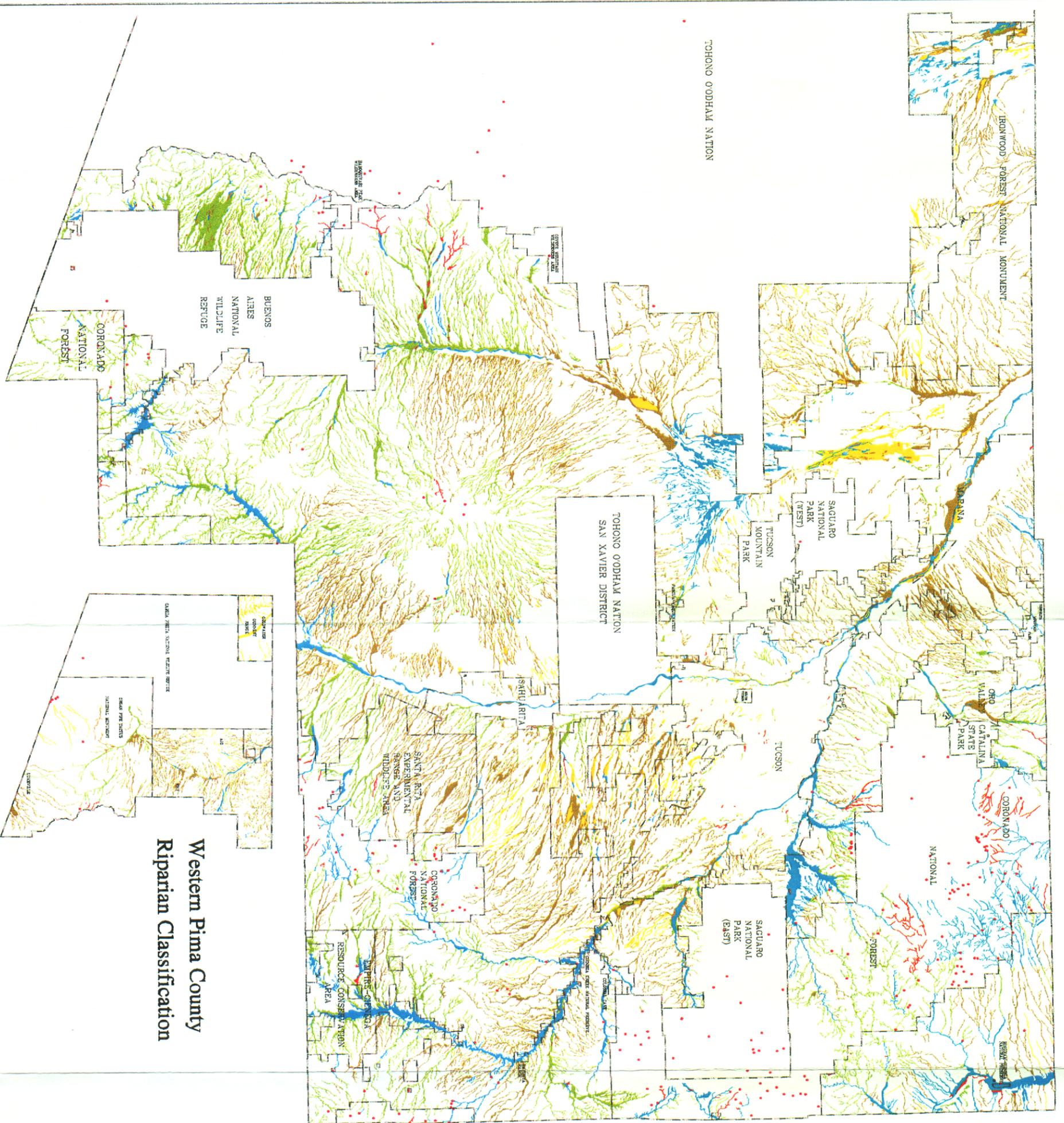


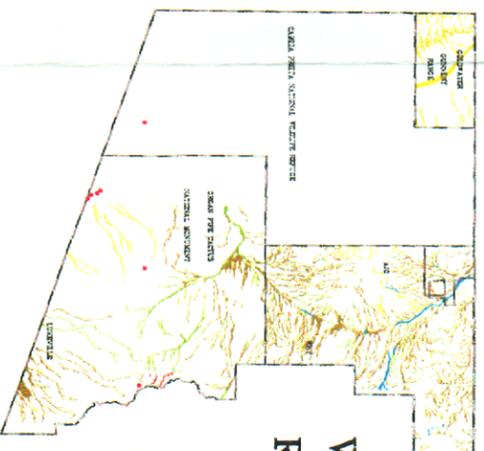
Figure 1. Corps jurisdictional limits (yellow) are typically much narrower than the riparian area (green) or the regulated 100-year floodplain limits (blue).

Figure 2
Riparian Classification
for
Eastern Pima County

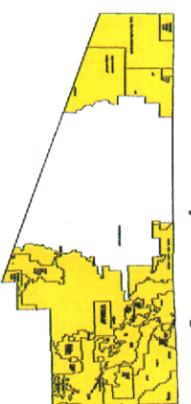


-  Administrative Boundaries
-  Hydromeso Riparian Habitat
-  Class A Xeroriparian Habitat
-  Class B Xeroriparian Habitat
-  Class C Xeroriparian Habitat
-  Class D Xeroriparian Habitat
-  Springs (Hydromeso Riparian Habitat)

Western Pima County
Riparian Classification



Pima County Index Map



Scale Map scale 1:1,500,000

The information contained on this map is the result of a project funded by the Pima County Board of Supervisors. The project was completed in 2002. The project was completed by the Pima County Board of Supervisors. The project was completed by the Pima County Board of Supervisors. The project was completed by the Pima County Board of Supervisors.



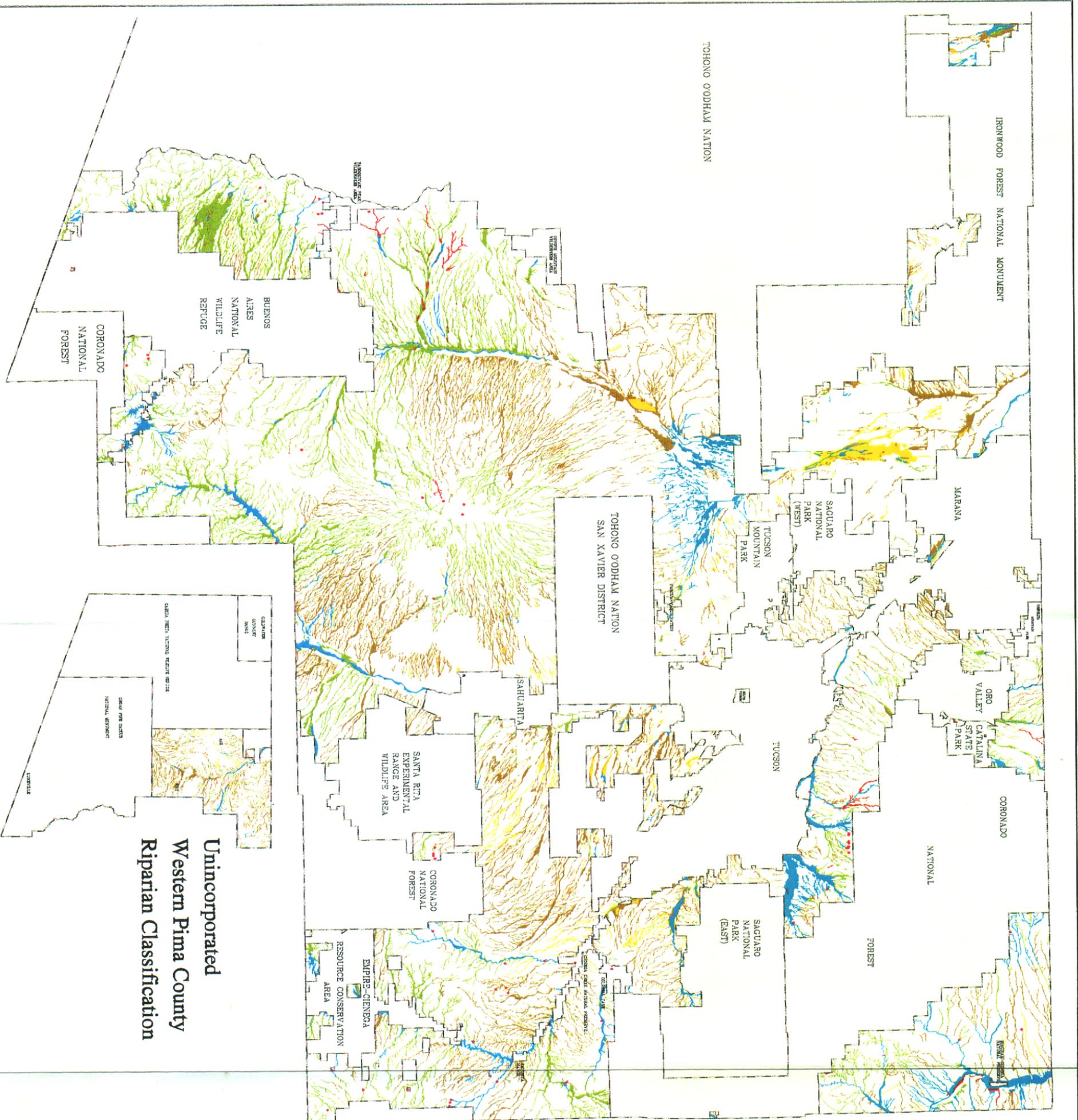
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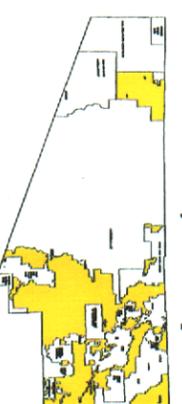
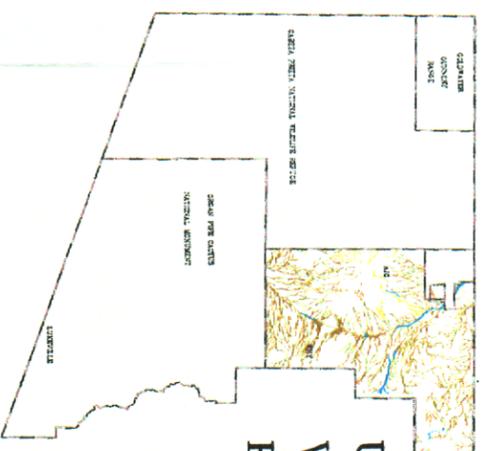
Figure 3

Riparian Classification for Unincorporated Eastern Pima County

-  Administrative Boundaries
-  Hydromeso Riparian Habitat
-  Class A Xeroriparian Habitat
-  Class B Xeroriparian Habitat
-  Class C Xeroriparian Habitat
-  Class D Xeroriparian Habitat
-  Springs (Hydromeso Riparian Habitat)



Unincorporated Western Pima County Riparian Classification



Index Map Scale: 1:1,000,000



Scale: 1" = 144,000'

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