DRAFT

MEMORANDUM

Date: April 3, 2000

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

From: C.H. Huckelberry
County Administrator

Re: *Land Cover Data Assessment in Pima County*

I. Background

This memorandum summarizes the attached report by Recon entitled *Land Cover Data Assessment in Pima County*. In the workplan established by the Science Technical Advisory Team for the Sonoran Desert Conservation Plan, one of the fifteen tasks identified for the biological evaluation requires the consultant to:

1) Produce a consolidated land cover map that represents the best available information for the study area;

2) Document data sources, accuracy of data sources, and the decision-making process for producing the land cover map; and

3) Identify and prioritize additional mapping needs.

The attached report successfully completes the task as it produces and describes the methods involved in creating the best possible land cover data layer from available sources.

It also adopts and applies a standard classification system, and perhaps most importantly, develops a system for improving the land cover map as new data becomes available.

II. Summary of the *Land Cover Data Assessment in Pima County*

A. Review of Past Mapping Efforts

In the data review and selection process, Recon analyzed fourteen mapping efforts that have taken place in the past decades, or that are ongoing. About half of these initiatives created data that is useful for the basemap of the Sonoran Desert Conservation Plan. In addition to producing a useful basemap for regional bio-planning purposes, the analysis by Recon provides advice about how future research and mapping initiatives within Pima County can gather data in a more effective manner so that the community can continue to build and improve the base map that has now been made available through this exercise.

The mapping efforts that were incorporated into the consolidated land cover for the Sonoran Desert Conservation Plan include:

1) the 1993 GAP Analysis Program map of Pima County that was created as part of the National GAP Program;

2) the 1993 and 1996 Wildlife Habitat Inventory Project (WHIP) map, which covers urban and suburban environments in the Tucson metropolitan area;

3) the 1977 and 1981 Organ Pipe Cactus National Monument map from the study conducted by Dr. Peter Warren (now at The Nature Conservancy), which is considered the most detailed vegetation study in the county;

4) the 1993 land cover inventory and mapping effort of the Cienega Creek Natural Preserve developed as part of the Pima County Preserve Management Plan; and

5) the improvements to GAP mapping in the Pima County Bingham-Cienega Natural Preserve area recently provided by The Nature Conservancy.

The mapping efforts that are currently underway and should be incorporated into the consolidated land cover for the Sonoran Desert Conservation Plan include:

1) the riparian study by the Harris Group that is being carried out as a separate task in the Sonoran Desert Conservation Plan biological evaluation workplan; and

2) the Bureau of Reclamation study of effluent dominated reaches of the Santa Cruz river that covers the 28 mile river floodplain from the Roger Road outfall to the Pima County line.

The mapping efforts that were reviewed but not incorporated into the consolidated land cover for the Sonoran Desert Conservation Plan include:

1) the 1993 USGS/EROS coverage based on high resolution satellite imagery;

2) the 1993 riparian habitat maps created for the Riparian Habitat Protection Ordinance (which are potentially useful in the current riparian study by the Harris Group);

3) the 1970s study by the Pima Association of Governments (PAG 208);

4) the 1975 study of riparian vegetation along four drainages;

5) the National Wetland Inventory mapping effort by the U.S. Fish and Wildlife Service;

6) the 1976 Arizona Game and Fish Department vegetation mapping; and

7) the 1980 Natural Vegetation data maps digitized from the Browne and Lowe publication.

B. Creation of a Composite Land Cover Data Layer

The unifying classification system among the maps that Recon combined to create the best available land cover data layer is a format known as the Brown, Lowe and Pase (BPL) system. Within this system there are eight levels of organization, from the broadest description to the most narrow and detailed, and they are: (1) biogeographic realm; (2) upland/wetland; (3) formation type; (4) climatic zone; (5) biome; (6) series; (7) association; and (8) sub-association. The maps that Recon included to create the land cover data layer have varying levels of detail.

- The GAP vegetation coverage has the advantage of covering all of Pima County and thus provides a uniform level of classification. However, its accuracy is higher at the course scale of biome level (82% accurate) but drops off at the series level (68% accurate).

- The Wildlife Habitat Inventory Project (WHIP) map covers almost one million acres at the association level. Given that the WHIP map has higher resolution than the GAP map, delineates riparian areas, and is assumed to be quite accurate at the series level, in areas where WHIP data is available, it takes precedence over GAP mapping in the consolidated land cover created by Recon.

- Similarly, the Cienega Creek Natural Preserve mapping has a more detailed delineation than the WHIP data, and so it takes precedence over the GAP and WHIP coverage, in the areas where this Cienega Creek data is available.

- The Organ Pipe and San Pedro vegetation mapping take precedence over GAP data. The Organ Pipe data covers 330,700 acres at the sub-association level.

In producing the consolidated land coverage, Recon retained all attributes from the multiple coverages, so that the user can always compare data at a uniform level of classification.

III. Recommendations and Follow Up Action

Recon makes seven recommendations to improve the usefulness of the land cover data, and these recommendations have been or are being followed by staff in the ways described below.

1) First, it is recommended that a recent mapping project of perennial and intermittent streams conducted by Pima County and the Pima Association of Governments be expanded to include springs, cienegas, ponds and lakes.

   These suggestions are being followed as staff works with PAG to separate springs from streams in data already collected, prepares point locations and seeks expert review, and derives urban pond and stock pond data from other existing covers.

2) Second, it is recommended that the ongoing riparian mapping effort by the Harris group focus on the distribution of cottonwood, willow and mesquite. This suggestion will be followed as part of the Harris study.

3) Third, the report recommends that grassland mapping is evaluated to ensure that delineations exist among native grasslands and non-native grasslands. This issue will be forwarded to the Science Technical Advisory Team for expert review of currently defined Sacaton / native grassland areas.

4) The fourth recommendation is to map the distribution of Saguaro, Palo Verde and Ironwood. Members of staff are working with federal entities to undertake such a study in the event expert review and analysis by wildlife managers is not sufficient.

5) The fifth recommendation is to map the distribution of limestone outcrops, soils, caves, mines potentially used by bats, and talus slopes. The limestone and soils data is available and being obtained by staff. Expert interviews will be conducted to supplement data on caves and mines.

6) The sixth recommendation is to obtain expert review in order to achieve series level mapping for the study area. This undertaking will be formally pursued by staff and the Science Technical Advisory Team.

7) Finally, the last recommendation is to prepare to map key habitat features as individual species requirements are further defined through the larger study process. County staff has and will continue to meet data gaps through short term studies as the need develops.

IV. Conclusion

The *Land Cover Data Assessment in Pima County* is the first in the series of deliverables that will be received from Recon as the biological evaluation is carried out over the next months. On one level, the study and composite map represent a technical achievement that organizes and provides a context for mapping initiatives of recent decades. On another level, the existence of a comprehensive land cover map will allow the scientific community to become more effective in building the community's store of conservation knowledge, as future bio-planning initiatives can avoid duplication of effort, adopt useful classification methods, and target data gaps with greater precision.

On still another level, the *Land Cover Data Assessment in Pima County* report has a significant place in the long history of local conservation scholarship. It has been said that from 1800 to 1900, explorers, trappers, and naturalists conducting surveys as part of military duty were responsible for accumulating and recording much of the resource information that is understood from that era. Collectors, conservationists and scientists took over and better organized attempts to inventory the resource base during the 20th century. Now we are turning isolated inventories into comprehensive regional maps, which will allow us to synthesize multiple layers of resource information at increasing refined levels of detail as part of the Sonoran Desert Conservation Plan. In this way, the *Land Cover Data Assessment in Pima County* report is a great deal more than a technical achievement. It sets the stage for meaningful conservation planning, and the implementation of broad preservation and restoration measures within Pima County.

LAND COVER DATA ASSESSMENT IN PIMA COUNTY

A Discussion Paper about the Current Status of Vegetation
and Land Cover Mapping and Recommendations

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I. Background

Vegetation and land cover data are essential for assessing conservation gaps (needs) and developing preserve designs since it is these data that describe habitat and determine in part, species distributions. Recognizing the importance of vegetation and land cover mapping to the development of a regional multi-species habitat conservation plan, the Science Technical Advisory Team (STAT) to the Sonoran Desert Conservation Plan (SDCP) identified the need to assess and improve existing data for Pima County.

The STAT evaluated the suitability of previous mapping efforts for use in the SDCP (STAT 1999a). Four data sources were examined: Arizona Gap Analysis Program (GAP), Pima County Wildlife Habitat Inventory Phase 2 (WHIP2), Pima Association of Governments (PAG) 208 studies, and Pima County Riparian Habitat Mapping. The primary recommendation of this review was that the accuracy of vegetation delineation and classification could be improved for upland communities by combining multiple sources of vegetation data, but that special effort, including extensive fieldwork, were necessary for improving riparian mapping. A subsequent report (STAT 1999b) assessed the same data sources, plus Arizona Game and Fish Department (AGFD) Vegetation and National Wetland Inventory Maps, focusing specifically on riparian vegetation communities. Deficiencies in existing data and recommendations for additional work were described.

From these studies, the STAT developed a scope of work that outlined two separate tasks to be conducted by a biological consultant—first to produce new mapping for riparian areas based on existing data and fieldwork and second to compile an overall land cover map based on existing data, including an assessment and recommendations for improvement. This land cover data assessment report details the work product for the second task, conducted by RECON. (This report discusses the incorporation of revised riparian mapping, being conducted by Harris and Associates, when it becomes available.)

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

II. Vegetation and Land Cover Classification and Mapping

Vegetation (assemblages of plants) and land cover (all features that cover the earth's surface), must be described in a way that we can understand their suitability as habitat for species, since the conservation of species and habitats is a primary goal of the SDCP. Patterns of vegetation and land cover can best be described through classification, the organization of similar things into groups for the purpose of communication. The most useful vegetation and land cover classifications are those systems already developed and used in the southwest and Pima County.

A. Vegetation Classification

Vegetation classification may be based on plant physiognomy (or structure), species composition, or a combination of the two, with climatic, geographical, and edaphic terms added (Bennett et al. 1999). Most recent vegetation mapping in Arizona has relied on the Brown, Lowe, and Pase (BLP) classification system (Brown et al. 1979, 1980; Brown 1982). This system is a format for organizing and storing vegetation data—providing a method illustrated with examples but not including all classifications of vegetation that could exist within the system (Bennett et al. 1999).

BLP is founded on the biome concept—natural communities characterized by distinctive vegetation and a common evolutionary history persisting together though time and space (Bennett et al. 1999). All vegetation classifications are, on some level, artificial abstractions, but since biomes are a naturally defined vegetation unit, classifications based on the biome have a greater degree of reality (naturalness) than those based on other biological or geographical elements such as species or climate zones (Bennett et al. 1999).

BLP distinguishes eight levels of organization (in order from broad to narrowly restricted): biogeographic realm, upland/wetland, formation type, climatic zone, biome, series, association, sub-association (Brown et al. 1979). The hierarchical structure of the BLP system makes it applicable to both broad and narrow-scaled studies, and it also facilitates the incorporation of data from studies at different scales into a single data set since at some level, all data are comparable. BLP numerical codes include one number for each level of the hierarchy, with biome coded as the first digit to the right of the decimal point. (Note that Pima County codes do not include the biogeographic realm since this is the same—new world temperate—for the entire region.). A mixed oak association in the BLP system is 123.311, a concise name for the vegetation community that is [1] upland, [2] forests and woodlands, [3] warm temperate, [4] Madrean Evergreen Forest and Woodland, [5] Encinal (Oak) Series, and [6] Mixed Quercus (=*Quercus* spp.) Association. All BLP codes and names used in the land cover data layer compiled for this study are in Attachment 1.

One difficulty arises with using the BLP code for classification of field data—on every level there can exist no more than 10 vegetation types. This is very limiting for detailed studies over broad areas, so Johnson, Bennett and Kunzmann (Bennett et al. 1999) have employed an alphanumeric code within the BLP system, which allows 260 codes at each level. They named their classification system JBK to distinguish it from BLP. For the existing vegetation database in Pima County, BLP should be sufficient at the series level; however, JBK codes do exist in the GAP vegetation data layer and could be

assigned to polygons in the composite land cover data layer if the need arises in the future.

B. Land Cover Classification

Land cover, in its broadest sense refers to all features on the ground, including vegetation. Vegetation classification systems cannot be applied to all land cover types since these include non-native vegetation, man-made structures, nonvegetated areas and water, but differentiation among these land cover types is important since they provide different kinds of habitat for species. For example, a fallow agricultural field provides habitat and connectivity to habitat that the urban built environment does not. Therefore, a classification system is needed to provide enough differentiation of the man-made environment to enable us to identify biological quality and conservation opportunities.

Classification schemes used to organize land cover information in the built or human-influenced environment vary among studies and associated geographic information systems (GIS) data layers for Pima County. Some land cover types are specific to the mapped area (i.e., "Lukeville" denotes the urban area in Organ Pipe Cactus National Monument). Other land cover types are more generic (i.e., "urban" in the GAP vegetation data). Most types are not documented in a way that makes them applicable to new studies or to the composite land cover data layer, with the exception of the Wildlife Habitat Inventory Project (WHIP).

The 1993 WHIP pilot study developed a typology of urban and suburban land cover categories and a methodology that associated land cover categories to aerial photos (Shaw et al. 1993). In phase II of this study a complete land cover classification system was developed and used to map the metropolitan Tucson area (Shaw et al. 1996). Additionally, quantitative data were collected that measured vegetative variables associated with each land cover category. This enabled wildlife habitat values to be interpreted from land cover information in an urban setting (Shaw et al. 1996). The WHIP land cover classification system is also hierarchical, so that if differentiation among residential types for example is not necessary, then the next higher level of classification can be used (Attachment 2).

Currently, GIS data for urban and suburban classes for the WHIP study are unavailable, so the WHIP land cover classification system was not applied in this study. Future land cover updates should investigate the application of a modified WHIP classification. For the purposes of the SDCP, more general classes may be appropriate, differentiated based on wildlife habitat value. For example the class "recreation" could be divided into two subclasses: "small urban," which would include golf courses, zoos, and neighborhood parks, and "large regional," which would include regional parks. Agriculture could be divided into "active" and "inactive" since these subclasses are important for differentiating wildlife habitat value. Central Arizona Project (CAP) canals could be grouped together with major transportation routes since all are barriers to wildlife. Outside the WHIP study area, such land cover data could be obtained from Earth Resources Observation Systems (EROS), agricultural coverages, parcel data, and orthophotos.

For this study, land cover classes from existing coverages were modified to be consistent. Only general categories are mapped (Table 1). In order to make the

classification for urban/suburban areas consistent with BLP classification for vegetation, codes were developed that mimic those of BLP. All non-BLP land cover classes were assigned a front number of 999, then major categories are assigned at the biome level (subcategories could be assigned at the series level).

TABLE 1
NON-VEGETATION LAND COVER CLASSES

Land Cover Code	Land Cover Type
999.0	Unclassified
999.1	Agriculture
999.2	Urban
999.3	Water
999.4	Bare Ground

III. Data Review and Selection

RECON reviewed all digital and hard copy vegetation and land cover data made available through Pima County Department of Transportation (DOT) and Flood Control District. Data sources and map history were researched and data layers were evaluated to assess whether they should be incorporated into the composite land cover data layer. Some data which were unavailable for review are also included in the descriptions below since they may be important for incorporation into a revised data base in the future. Ancillary data that may be used for updating vegetation and land cover data such as orthophotos, and Landsat imagery are not reviewed.

A. GAP

The GAP Analysis Program (GAP) is a national effort to map habitats in every state for use in assessing the status of long-term maintenance of biodiversity (Scott et al. 1993). The Arizona GAP program began in 1991 and was housed within the Advanced Resources Technology Program (ART) in the School of Renewable Natural Resources at the University of Arizona. The initial program, including land cover mapping for Arizona, was directed by Dr. Lee Graham from 1991 to 1995 (Kunzmann et al. 1998).

The Arizona GAP vegetation coverage, 1993, was mapped using remote sensing techniques. Landsat Thematic Mapper (TM) satellite imagery (30 meter resolution scenes from 1991) was digitally classified to differentiate potential vegetation communities. One hundred five classes were aggregated from the imagery based on similarities in their spectral signatures. Vegetation types associated with these classes were assessed and assigned by reviewing airborne video imagery of the same areas. Video transects, flown in fall 1991 and summer 1992 and covering one-third to one-half mile swaths, were reviewed together with field data and historic vegetation data to help interpret vegetation classes (U.S. Fish and Wildlife Service 2000). The original Arizona GAP vegetation classification system developed by Graham was roughly modeled on Brown, Lowe, and Pase (1979) but classification units are not hierarchical. Graham's descriptive vegetation community names correspond to both series and association level BLP classes and reflect the ecotonal nature of vegetation mapped at this scale for Pima County (Kunzmann, pers. com. 2000)

In 1996, the U.S. Geological Survey (USGS) Cooperative Park Studies Unit (CPSU) received funding from the National GAP Program to assess the GAP mapping effort and convert the Graham land-cover types to a standardized classification system (Kunzmann et al. 1998). More than eight percent of the 58,000 originally mapped land cover polygons were sampled and classified. Original polygon boundaries were not modified but the original descriptive names were cross-walked into a BLP series level classification, reducing the number of vegetation types from 105 to 53 for Arizona (from 45 to 22 for Pima County). Scoring agreement between the Graham map polygons and the CPSU field classifications, it was found that the Graham map was 82 percent accurate at the biome level and 68 percent accurate at the series level for all vegetation classes. Agricultural and urban lands scored highest for estimated thematic accuracy (88 percent and 85 percent, respectively), followed by forest/woodland (75 percent), desertscrub (74 percent) and grassland (72 percent). Scrubland types were found to be fairly accurately classified (64 percent) and riparian forests the least well-classified (57 percent) (Kunzmann et al. 1998).

Metadata for this GIS data is available at the University of Arizona GAP website (http://www.srnr.arizona.edu/nbs/gap/gapvegdoc.html), although there is little detail about mapping methods or coverage attributes. From our investigation of this data we learned that the attribute "hab-type" in the GIS coverage holds the Lee Graham descriptive type name. The "biome_series" attribute contains the CPSU BLP series name. And the jbk# attribute contains the corresponding JBK code for the BLP name.

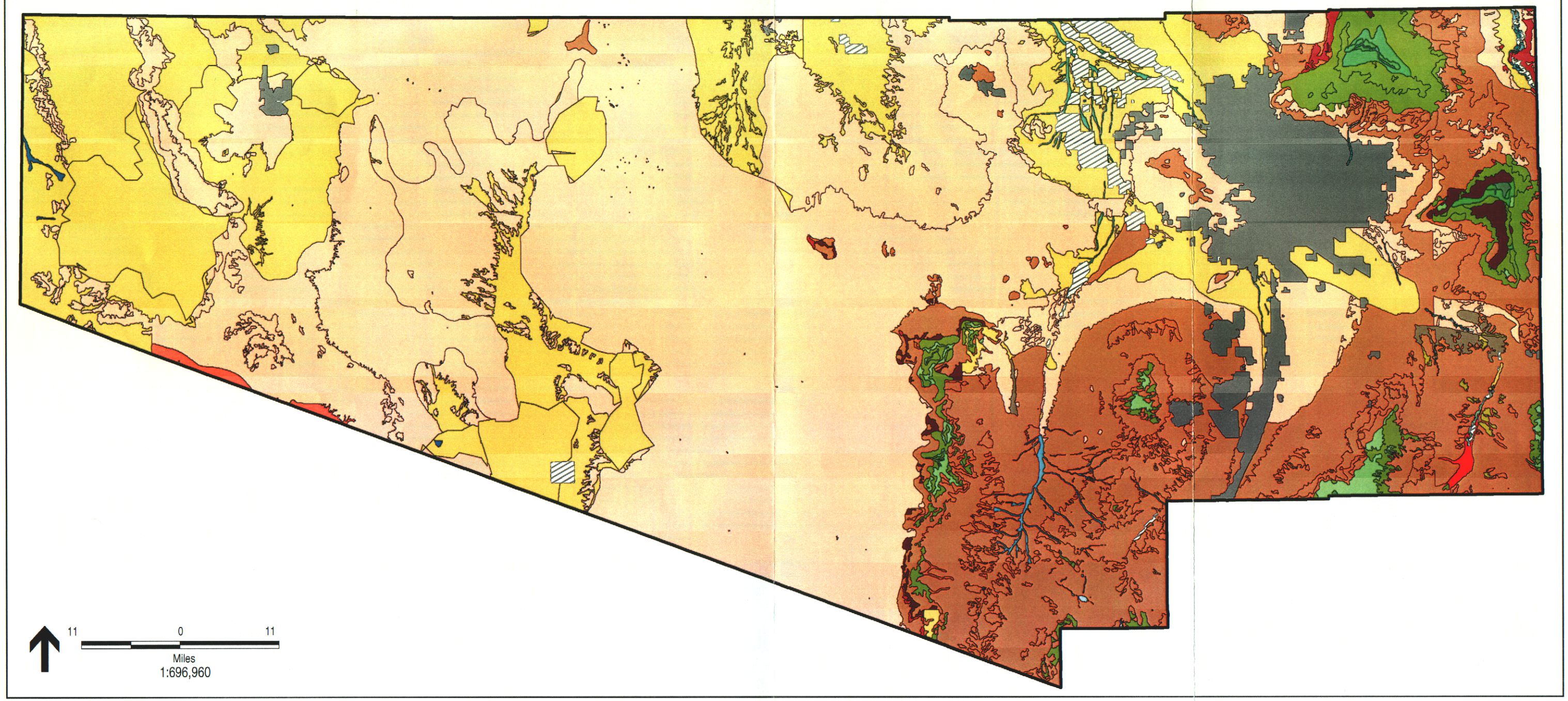
The main advantage of this dataset is that it covers all of Pima County and it has a uniform level of classification (BLP series) throughout GAP mapping does not adequately delineate the long, slender polygons that comprise riparian vegetation, but it does include larger areas of sacaton grassland and marsh, which are important habitat types. Based on the CPSU assessment, GAP vegetation mapping provides a good course-scale classification of land cover, especially given the inherently complex and ecotonal nature of Arizona vegetation (Kunzmann et al. 1998). And for the purposes of the SDCP, GAP provides an essential data layer on which to build an improved composite land cover map. GAP mapping used in the composite land cover map is shown in Figure 1. Colors differentiate series level CPSU data. Additional polygon boundaries based on Graham's vegetation description are also retained in this coverage. CPSU researchers recommend that these additional boundaries should be used only to show heterogeneity in series level polygons, but should not be used to delineate additional types (Kunzmann, pers com. 2000).

B. Wildlife Habitat Inventory Project (WHIP)

The Pima County habitat inventory was conducted to collect habitat information about the urban and suburban environment of the Greater Tucson metropolitan area. The goal of this study was to develop a GIS data base that includes delineations of systematically classified land cover types which are keyed to quantitative vegetation characteristics (Shaw et al. 1996).

Phase I consisted of a pilot study conducted to develop a typology of urban and suburban land cover categories (Shaw et al. 1993). Phase II mapped the study area using this typology and determined vegetative attributes for each land cover type (Shaw et al. 1996). Land cover was mapped by merging land use databases from Pima County and Tucson based on 1990 orthophotos, then updating these using 1:12000 1995 aerial photographs and ground truthing. Land cover categories were characterized by collecting quantitative and qualitative data for randomly selected samples within each land cover category. Methods and variable descriptions are detailed in the Phase II final report (see Shaw et al. 1996).

The WHIP GIS coverage, made available through DOT, provides higher resolution mapping than GAP for this nearly one-million-acre study area. Natural vegetation is classified according to BLP, although it is unclear to what extent mapped polygons may represent disturbed vegetation. Riparian areas in particular are delineated in the WHIP study where none appear in GAP, and mesquite scrub vs. cottonwood-willow are differentiated, although it is believed that the cottonwood-willow delineation and classification is modest (Fonseca 1999a). An accuracy assessment of this data has not been conducted, however, in comparing these data with other sources, and given that they are based on recent aerial photographs, polygon boundary delineations and series level land cover classifications are probably quite accurate.



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Vegetation Communities (BLP Classification)

- 122.61 Douglas-Fir-Mixed Conifer
- 122.62 Pine
- 123.31 Encinal (Oak)
- 123.32 Oak-Pine
- 133.32 Manzanita
- 133.36 Mixed Evergreen Sclerophyll
- 143.14 Sacatan-Scrub
- 143.15 Mixed Grass-Scrub
- 153.21 Creosotebush-Tarbush
- 153.26 Mixed Scrub
- 154.11 Creosote-Bursage
- 154.12 Paloverde-Mixed Cacti
- 154.17 Saltbush
- 223.21 Cottonwood-Willow
- 223.22 Mixed Broadleaf
- 224.53 Cottonwood-Willow
- 234.71 Mixed Scrub
- 244.71 Cattail

Other Land Cover Types

- 999.0 Unclassified
- 999.1 Agriculture
- 999.2 Urban
- 999.3 Water

Pima County Boundary

Gap Analysis Program (GAP) Land Cover Mapping

Figure 1

The urban and suburban land cover types, that are the focus of discussion and analysis in the report, are missing from the current GIS coverage (Figure 2). These appear as "no data" on Figure 2. Coverage polygons with no attribute data appear as "unclassified." Except for a BLP code, there is no attribute data for natural vegetation types, so it is assumed that attributes detailing vegetation characteristics discussed in the WHIP report, are stored in a separate database. These were certainly developed since they provided the basis of GIS analyses discussed in the report.

This coverage replaces GAP mapping in the composite land cover data layer. Further research should be conducted to classify unclassified polygons, and recover the missing urban/suburban land cover data as well as the land cover attribute database upon which past and potential future habitat modeling analyses could be conducted. WHIP land cover classification could also provide the basis for a modified land cover classification system.

C. Organ Pipe Cactus National Monument

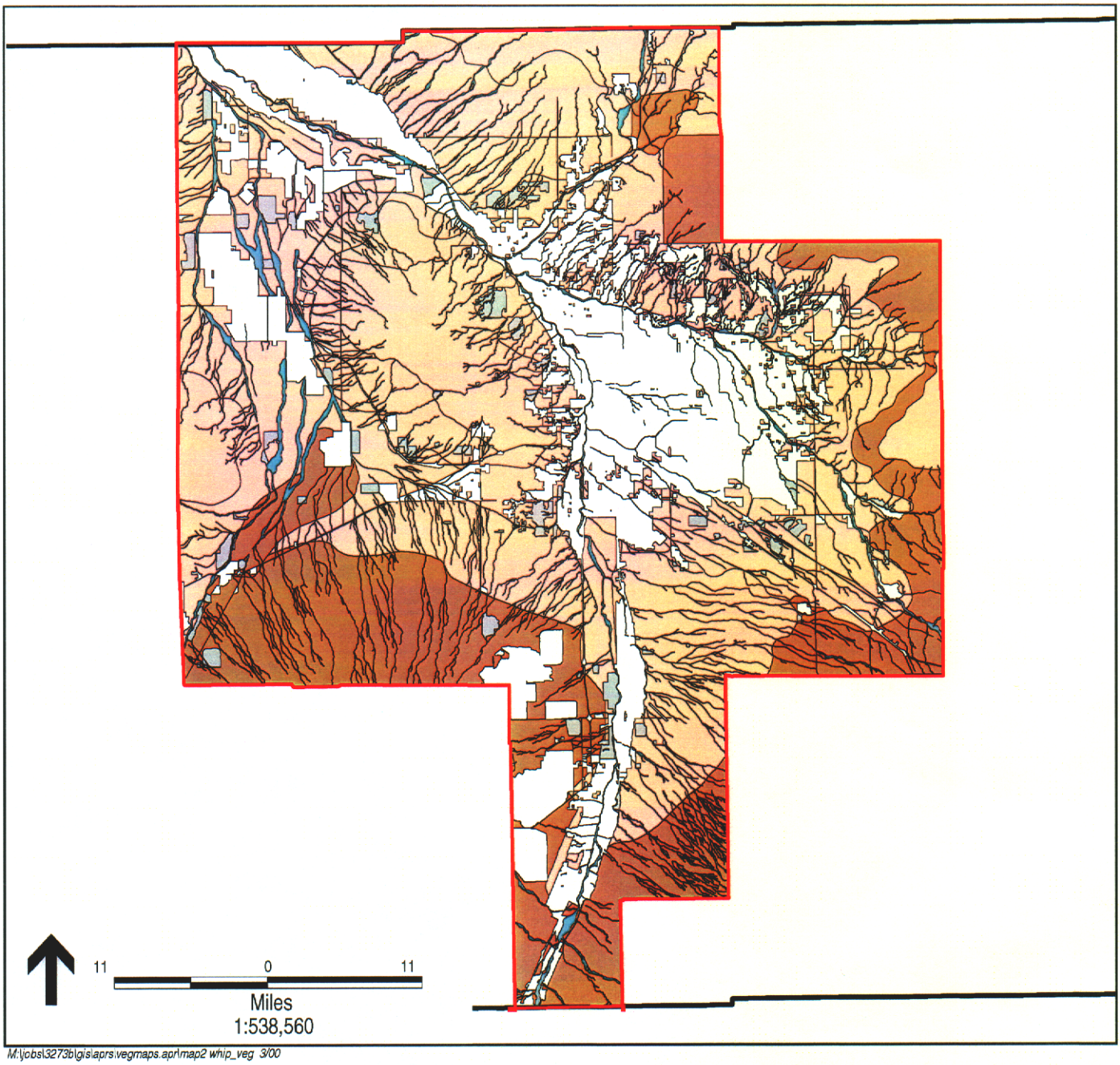
The National Park Service conducted a parkwide survey of existing vegetation between 1977 and 1981, as part of a proposal for managing the monument's natural resources. The survey encompassed the entire 517-square-mile monument and was conducted using both remote sensing and field techniques. Vegetation boundaries were interpreted from and delineated on 1:24,000 color aerial photographs, then checked and attributed with vegetation type information in the field. Representative examples of each vegetation association were sampled in order to classify types. Vegetation classification was based on Brown, Lowe, and Pase (1979) with new associations named below the existing BLP legend. This detailed study recognized 29 vegetation associations and subassociations named and described in CPSU Technical Report No. 8 (Warren et al. 1981).

Organ Pipe Cactus National Monument vegetation mapping represents the most detailed study in the county. A GIS coverage exists for this mapping and includes attributes containing BLP code and association name for all polygons. BLP codes include an "R" where the polygon contains riparian vegetation. The Organ Pipe coverage used in the composite map is shown in Figure 3. Series-level colors are differentiated on the map; additional polygon boundaries show classification detail at the association and subassociation levels. There were some questionable attributes in this database which were corrected based on a discussion with Peter Warren. These corrections are briefly discussed in Section IV.A. of this report.

D. Cienega Creek Natural Preserve

Cienega Creek Natural Preserve, established in 1986, consists of nearly 4,000 acres of land along the Cienega Creek in eastern Pima County. Perennial streamflow along reaches at this site have created lush riparian vegetation, which has a particularly high value for wildlife habitat and exists in a limited number of locations in the county. Land cover inventory, mapping, and description were conducted in 1993, as part of the development of a Preserve Management Plan (McGann & Associates, Inc. 1994).

Vegetation mapping was conducted based on aerial photo interpretation in conjunction with fieldwork. Type delineations in this study are more detailed than in the WHIP or GAP coverages for this area, with polygons as narrow as 30 feet and as small as one-tenth of an acre. Vegetation classification consists of descriptive names which have



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Wildlife Habitat Inventory Project (WHIP)
Land Cover Mapping

Pima County Boundary

WHIP Study Area Boundary

Vegetation Communities (BLP Classification)
and Other Land Cover Types

143.15 Mixed Grass-Scrub
143.152
143.155

154.12 Paloverde-Mixed Cacti
154.121
154.125

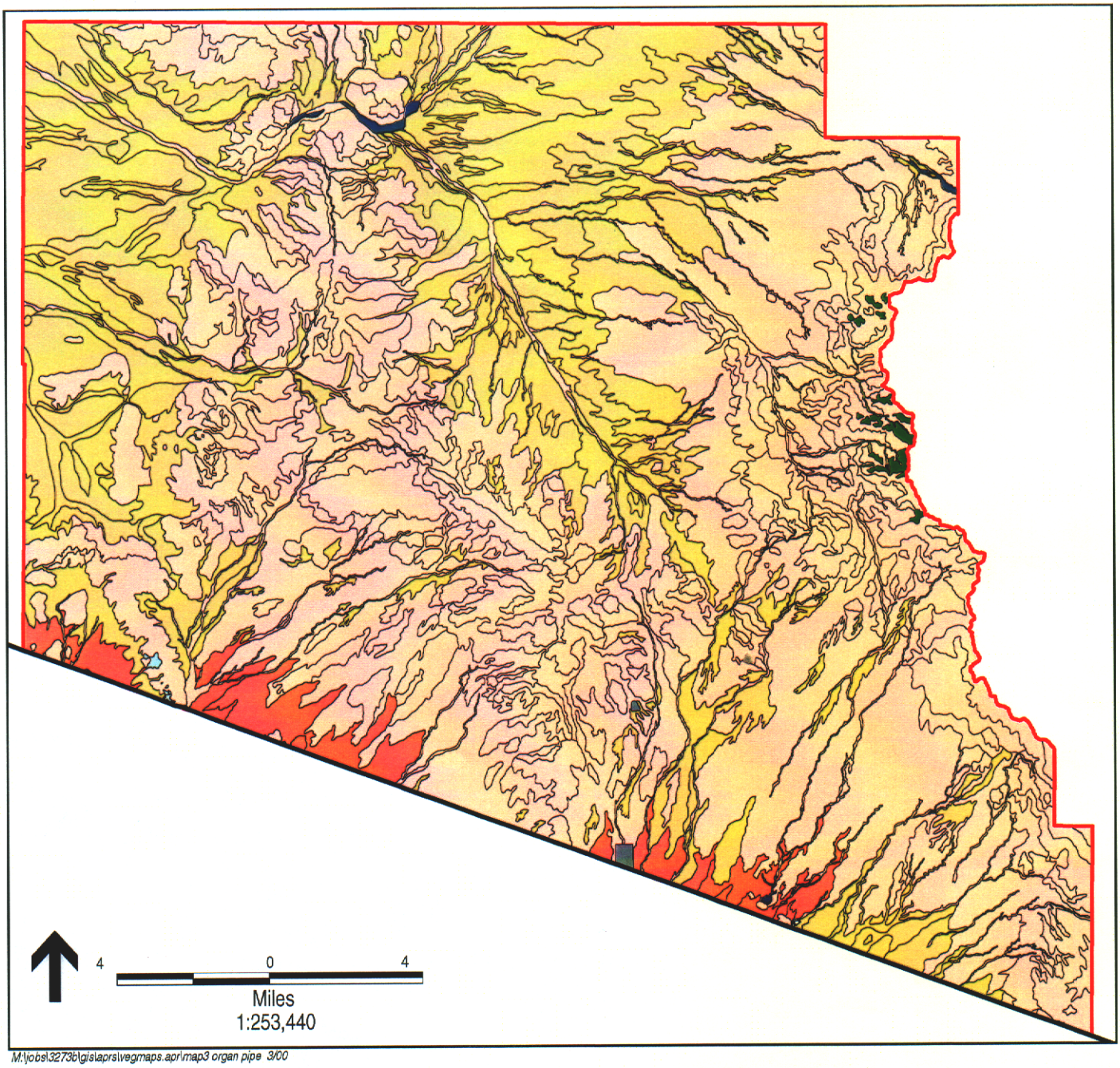
234.71 Mixed Scrub

243.53 Cordgrass

999.0 Unclassified

blank No Data

Figure 2



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Organ Pipe Cactus National Monument
Land Cover Mapping

Vegetation Communities (BLP Classification)

- 122.41 Pinyon-Juniper
  - 122.4151
- 123.31 Encinal (Oak)
  - 123.319
- 124.71 Mesquite
  - 124.711
- 133.36 Mixed Evergreen Sclerophyll
  - 133.361
- 154.11 Creosote-Bursage
  - 154.1111
  - 154.1111/154.1115
  - 154.1112
  - 154.1112/154.1115
  - 154.1113
  - 154.1114
  - 154.1115
  - 154.1115/154.1111
  - 154.1115/154.1214
- 154.12 Paloverde-Mixed Cacti
  - 154.1211
  - 154.1212
  - 154.1213
  - 154.1214
  - 154.1215
  - 154.1216
  - 154.1231
  - 154.1232
  - 154.1234
  - 154.1261
  - 154.1262
  - 154.1263
  - 154.1271
  - 154.1272
- 154.17 Saltbush
  - 154.1761
  - 154.1762
  - 154.1763
- 244.71 Cattail
  - 244.7111
- 244.75 Saltgrass
  - 244.751
  - 244.751/124.711

Other Land Cover Types

- 999.2 Urban
- 999.4 Bare Ground

Pima County Boundary

Organ Pipe Study Area

Figure 3

been cross-walked to BLP associations. The density of mesquite is also noted in the database. The GIS coverage that resides with DOT, contains only descriptive type names, but BLP codes which appear in Cienega Creek map legends have been added to the coverage attribute table. Existing mapping for Cienega Creek is shown in Figure 4. Polygons for which there is no attribute data are shown as "unclassified."

E. San Pedro GAP Update and Bingham Cienega Natural Preserve

The San Pedro watershed is a remote area of eastern Pima County that The Nature Conservancy (TNC) manages for Pima County Flood Control District. Bingham-Cienega Natural Preserve is included in this area. Based on their collective field experience, TNC managers Chris Fichtel, Dave Harris, and Dave Gori revised the GAP vegetation mapping in this area. They made changes only where they believed GAP data was inaccurate based on their working knowledge of land cover in that area (Fonseca, pers. com. 2000). These changes were incorporated by DOT and further updated to include agricultural lands delineated by the EROS coverage.

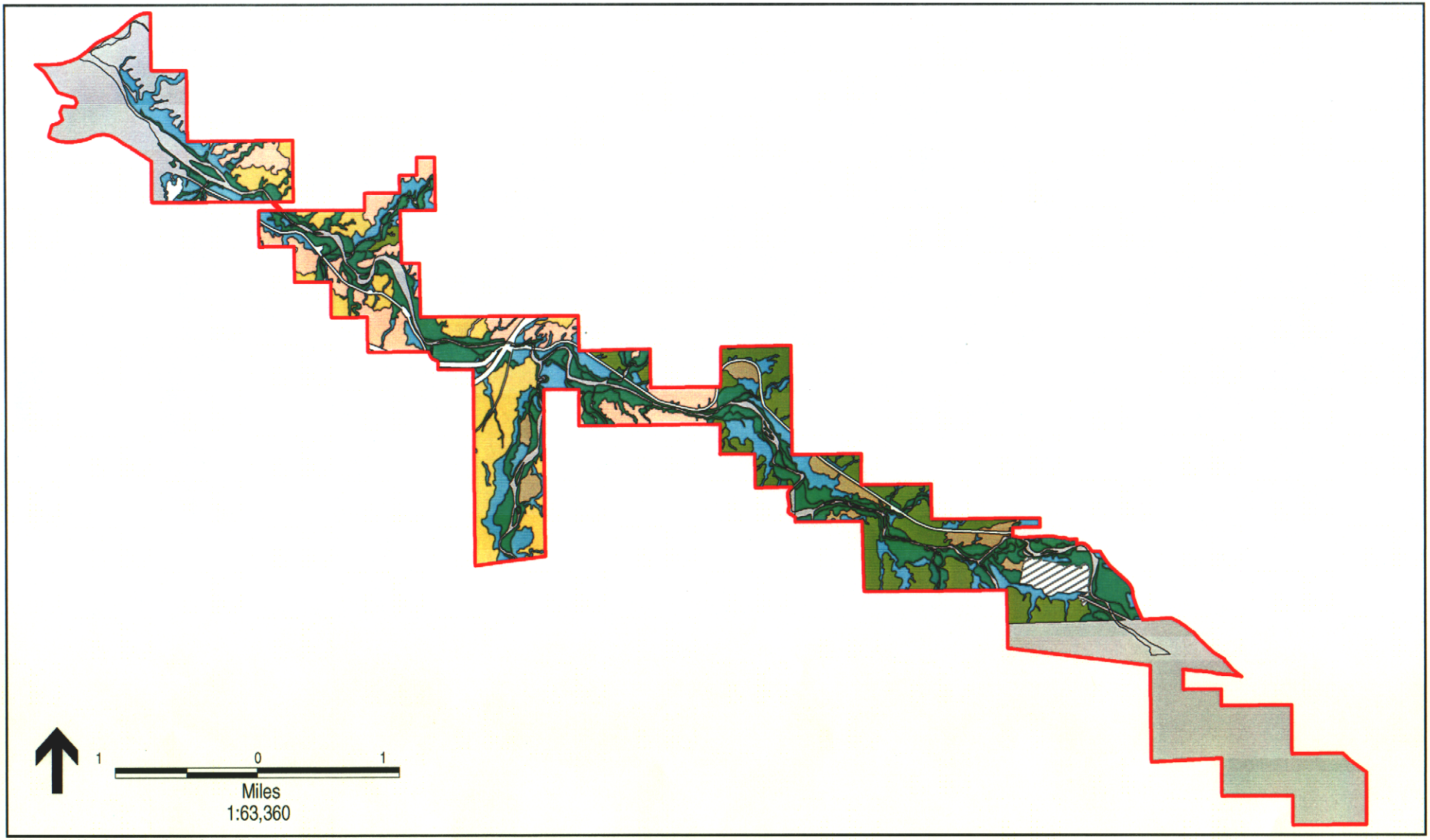
At the series-level, San Pedro vegetation mapping revisions are an improvement over GAP mapping, and represent the kind of vegetation mapping updates that are needed for this phase of the SDCP. Compared to WHIP and Cienega Creek mapping, San Pedro revisions are fairly course-scale. Vegetation units that showed a mosaic of agriculture, mixed riparian scrub, and riparian forest in the GAP mapping are generalized in the San Pedro coverage. The level of effort required to improve the detail of this mapping would involve aerial photo interpretation plus field reconnaissance, which would only be recommended if target species mapping is needed for this area.

The San Pedro vegetation coverage used in the composite map is shown in Figure 5. The GIS coverage included GAP and EROS attribute data for some polygons, and one unique attribute that contained information about vegetation updates. Using this attribute and a legend file, BLP codes were linked to each polygon, and were added as a new attribute in the revised data layer. Some polygons contain no BLP attribute data; these appear as "unclassified" in Figure 5.

F. EROS

In 1993, multiple federal agencies, including USGS, Environmental Protection Agency (EPA), National Oceanic and Atmospheric Administration (NOAA), and U.S. Forest Service (USFS) combined resources to purchase Landsat Thematic Mapper satellite imagery covering the entire United States. USGS/EROS Data Center took the lead to process the data and develop a national land cover database. The Pima County EROS coverage is part of that database.

The EROS land cover map is based on classification of 30-meter resolution imagery from 1992. For the national database, scientists used a variety of supporting information in addition to the satellite data, including topography, census, agricultural statistics, soil characteristics, other land cover maps, and wetlands data to determine and label the land cover type for each 30-meter pixel (USGS 2000; EPA 2000). Twenty-one classes of land cover are mapped, using consistent procedures for the entire U.S. Because land cover classes are generic enough to be applicable nationwide, vegetation is broadly differentiated based on structure (i.e., grassland, shrubland, forest). Non-natural



M:\jobs\3273b\gis\aprs\vegmaps.apr\map4 cienega 3/00

Cienega Creek Land Cover Mapping

Cienega Creek Study Area

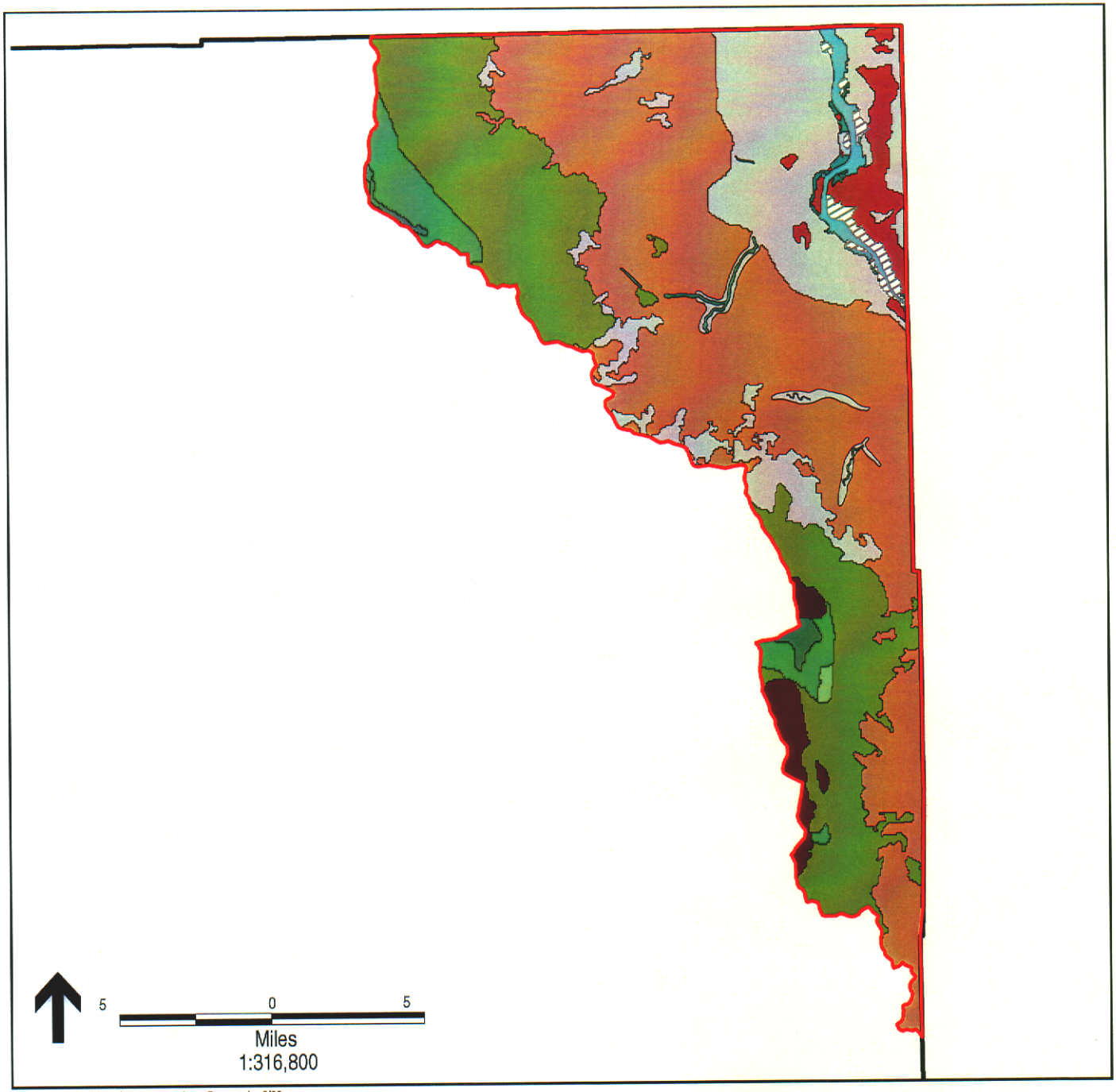
Vegetation Communities (BLP Classification)

- 143.16 Shrub-Scrub Disclimax 143.163
- 154.1111 Creosote-Bursage 154.111
- 154.12 Paloverde-Mixed Cacti 154.125
- 154.21 Creosote-Tarbush 154.212
- 224.52 Mesquite 224.521 224.523
- 234.71Mixed Scrub 234.712

Other Land Cover Types

- 999.0 Unclassified
- 999.1 Urban

Figure 4



M:\jobs\3273b\gis\aprs\vegmaps.apr\map5 sanpedro 3/00

San Pedro Land Cover Mapping

Pima County Boundary
San Pedro Study Area

Other Land Cover Types
999.0 Unclassified
999.1 Agriculture

Vegetation Communities (BLP Classification)
122.61 Douglas-Fir-Mixed Conifer
122.62 Pine
123.32 Oak-Pine
123.31 Encinal (Oak)
133.32 Manzanita
133.36 Mixed Evergreen Sclerophyll
143.15 Mixed Grass-Scrub
223.22 Mixed Broadleaf
224.53 Cottonwood-Willow
234.71 Mixed Scrub
244.71 Cattail

Figure 5

vegetation and non-vegetation classes are more finely differentiated with multiple classes for urban and agricultural land cover types.

High resolution mapping of urban and agricultural land cover make this data set potentially useful for Pima County. Pima County DOT used the EROS data to update GAP's generic "urban" polygon for Green Valley. This gives a better picture of land cover for this area, which is a mosaic of commercial and industrial development, various types of agriculture, and natural vegetation. This data was not incorporated into the composite land cover map at this time since its accuracy is uncertain, its land cover classification does not fit the needs of the SDCP, and its high resolution is not appropriate for county-wide analyses.

Procedures to evaluate the accuracy of the national land cover database have been developed, and private contractors are completing accuracy assessments for each state. Metadata and accuracy assessments are currently unavailable for Arizona. A comparison of the EROS data and the WHIP urban/suburban land cover classes would be informative if the WHIP data become available. Prior to using the EROS data, land cover types should be cross-walked into a modified land cover classification for the SDCP. Also, 30-meter pixels should be aggregated to better describe urban, suburban, and agricultural patterns on the landscape at the scale of SDCP analysis.

G. Santa Cruz River

Bureau of Reclamation has recently completed a study of the effluent-dominated reaches of the Santa Cruz River, downstream of Roger Road. (The report and GIS database were not available for this study but should be available soon.) This study, conducted by Mark Baker, covers the river floodplain from the effluent outfall, 28 miles north to the county line (Laush, pers. com. 2000). Riparian vegetation was delineated and classified for this study, based on aerial photograph interpretation and field sampling. The report describes vegetation associations, and it is assumed these can be cross-walked to BLP. Vegetation data includes information about species dominance but does not describe vegetation density. In riparian areas especially, vegetation density is a critical component for valuing wildlife habitat. It is noted for example that 1,500 acres of velvet mesquite are reported in the Santa Cruz study, but these open stands are very low density, and are not comparable to mesquite bosque. This recent riparian study based on fieldwork should provide important information for the SDCP. When the GIS coverage becomes available, it should be reviewed and incorporated into the composite land cover data layer.

H. Pima County Riparian Habitat

In 1993, as part of the Riparian Habitat Protection Ordinance, Pima County pursued protection of certain riparian habitats through zoning regulations specified by a Riparian Habitat Overlay Zone (ROZ) (SWCA 1995). The County commissioned the preparation of preliminary maps of riparian habitat by the University of Arizona's ART Lab, following the development of a riparian definition and classification system (SWCA 1993). Riparian polygons were delineated using early 1990s 30-meter resolution NDVI Landsat imagery, 1:12000 orthophotos, 1:4800 unrectified aerial photos, and 1998 1:100000 USGS DLG hydrography. The study included only unincorporated areas of the county not otherwise protected. Classification differentiates three major types of riparian vegetation (hydroriparian, mesoriparian, xeroriparian) based on plant species response

to available moisture (Johnson et al. 1984). Xeroriparian habitats are further classified based on total vegetation volume (four classes) (SWCA 1993).

The GIS coverage includes over 3,000 riparian polygons and an attribute that contains classification information. Because vegetation classification is not floristically based, vegetation types for this riparian study do not fit those of the composite land cover database. Riparian boundary delineations could be used in the current riparian mapping effort, especially in conjunction with the WHIP study, since Pima County Riparian Habitat maps xeroriparian habitats not covered by WHIP, and WHIP delineates intermittent streams more extensively.

I. SDCP Riparian Study

Pima County has commissioned a detailed study of the distribution and classification of riparian habitat for the SDCP study area. Harris & Associates have recently completed the pilot study which covered three separate areas around Tucson, overlapping the WHIP study. The pilot study consisted of detailed delineation of all riparian boundaries on orthophotos plus intensive field work used to classify polygons to the BLP association level.

Harris & Associates determined that it would be impossible, given time and budget constraints, to address the study area in the level of detail represented in the pilot. STAT and Harris discussed a modified methodology where riparian boundaries will be delineated on smaller scale (1:24000) orthophotos and classified to the biome level. This revised method significantly reduces the level of effort required in the field. Riparian mapping will build on existing GIS coverages, such as WHIP, and will include only areas outside existing preserves.

Differentiation of riparian vs. upland is essential and should be accomplished adequately at 1:24000 scale mapping. County-wide analyses for the SDCP will also require a uniform data set in order to evaluate, map, and model species distributions. Because the new riparian study will exclude protected areas, there will remain large "holes" in the riparian data layer for the county. Based on their comparison of the WHIP study with the new riparian mapping, Harris & Associates should assess the applicability of WHIP and other riparian data and methods for use in mapping the remaining SDCP study area, and/or recommend a procedure for extrapolating riparian mapping to areas they are not covering from areas that they are covering.

Differentiation of riparian types is also important. After the initial delineation and biome classification is complete, STAT will recommend selected stream corridors for additional survey, with a focus on unprotected stands of cottonwood-willow and mesquite bosques.

J. PAG208

In the 1970s, Pima Association of Governments commissioned a set of maps for the county (excluding metropolitan Tucson) delineating vegetation, landform, slope, geology, and soils. Maps were compiled by the Applied Remote Sensing Program at the Office of Arid Lands Studies (OALS), University of Arizona, and completed in 1977. Resource boundaries were delineated using 1972 and 1973 aerial stereophotographs and registered to USGS 15-minute quadrangles. Vegetation and soils were classified based on 1,000 field records plus ancillary data (STAT 1999). Field records were logged on

data cards which are associated with point data in a GIS coverage. All polygon mapping remains in hard copy format. Vegetation classification is based on dominant/sub-dominant species and gross physiognomy, which together with data cards could be cross-walked to BLP biome or series for many types.

PAG land cover mapping was compared with GAP and the Cienega Creek Natural Preserve study to determine whether PAG maps could be useful in improving GAP mapping (June 1999). This comparison showed that PAG mapping is not reliable in riparian areas since these have changed significantly since the 1970s. And upland areas are not comparable since PAG vegetation classification is unique. PAG data cards could be useful in improving vegetation classification, but it would be unclear where to draw the boundary for these classes, and PAG's relatively course scale (20-acre minimum mapping unit) does not help resolve mapping issues for small areas. Given the level of effort required to digitize these hard copy maps, PAG data should be used only for very specific investigations (i.e., searching for a particular feature).

K. Cienega Creek/Pantano Wash/San Pedro (Lacey et al. 1975)

In the early 1970s, Lacey et al. (1975) mapped riparian vegetation along four drainages. Two of these are in Pima County—San Pedro River and Pantano Wash-Cienega Creek. Riparian boundaries were delineated based on 1972 and 1973 1:125000 color infrared data and refined based on observations from the ground and low-level aircraft flights.

These hard copy maps distinguish among riparian associations, based on an early BLP classification system (Brown and Lowe 1974). The Lacey maps are an important reference for conducting additional riparian mapping; however, due to their age and hard copy format, they are not appropriate for directly incorporating into a revised land cover map.

L. National Wetland Inventory

In order to meet U.S. Fish and Wildlife Service's mandate to map the wetland and deepwater habitats of the United States, the National Wetlands Inventory (NWI) database was developed. Wetlands location and classification data were compiled between 1971 and 1992. The purpose of this survey was not to map all wetlands and deepwater habitats of the United States, but rather to use aerial photointerpretation techniques to produce thematic maps that show the larger ones and types that can be identified by such techniques. The objective was to provide better geospatial information on wetlands than found on the U.S. Geological Survey topographic maps. It was not the intent of the NWI to produce maps that show exact wetland boundaries comparable to boundaries derived from ground surveys. Boundaries are therefore generalized in most cases.

Pima County DOT has two sets of hard copy NWI maps available: The earlier version excludes Goldwater/Cabeza Prieta National Wildlife Refuge (NWR) and is based on 1972-73 1:120,000 aerial photography. The more recent NWI maps include Goldwater/Cabeza Prieta NWR and are based on 1980-81 1:58,000 color infrared aerial photography. These maps delineate and classify some riparian and adjacent uplands.

These maps are not being used in the current riparian mapping effort since delineation extent and detail is inadequate and boundaries that do exist in the database may have

changed since 1980-81. This database could be useful in western Pima County where other riparian studies do not exist, and could potentially fill the gaps in riparian mapping within protected areas. Digital data was developed for this national inventory and should be available.

The online copy of the DLG dataset may be retrieved via ftp at no charge. Quad-specific metadata are forthcoming and should be investigated for Pima County (U.S. Fish and Wildlife Service 2000).

M. AGFD Vegetation

Hard copy maps of Arizona's natural vegetation were drawn by Arizona Game and Fish wildlife managers in 1976. The scale of the manuscript maps was one inch to two miles (1:126,720); base maps were the 'County General' series provided by Arizona DOT. Map attributes represent Arizona's natural vegetation as delineated in 1974 by Brown and Lowe. (Note this classification is different from the Brown et al 1980 system used in the Natural Vegetation of the Southwest coverage. The University of Arizona digitized hard copy maps during 1992-93. Metadata for this coverage is available through DOT.

In Pima County, riparian areas along Cienega Creek, Santa Cruz River, San Pedro River, Altar Wash and tributaries, Los Robles Wash, Canada del Oro, Lower Rillito Creek, and portions of the Brawley Wash were mapped. Vegetation classification for these areas included three riparian types comparable to BLP codes 322.2 333.1, 333.11. After maps were digitized in 1993, polygons for Altar wash and tributaries, Los Robles Wash, and Brawley Wash were imported into the GAP vegetation coverage. Los Robles and Brawley Washes are classified as mixed broadleaf, which is probably incorrect (Fonseca 1999b). This data is older, based on course-scale mapping, and has some known potential errors, so it is not appropriate to include in the composite land cover. Like, NWI and natural vegetation data layers, the Arizona Game and Fish natural vegetation could be useful as a reference, especially in delineating riparian boundaries not covered by other studies.

N. Natural Vegetation

This data set maps the distribution and classification of Arizona's natural vegetation communities based on Brown and Lowe mapping. This coverage was digitized from the 1980 Browne and Lowe 1:1,000,000 scale Biotic Communities of the Southwest. Metadata for this coverage is available through DOT. GIS coverage attributes include BLP code and name from Brown and Lowe 1979. Until GAP mapping became available, this was the vegetation resource for statewide and regional analysis. The scale of this map is more course than GAP resulting in more generalized polygons compared to GAP. A recent assessment of GAP reported that despite known GAP errors, it was an improvement over Brown and Lowe's natural vegetation map (Kunzmann et al. 1998). This coverage, like the ADFG vegetation map, has its place in historic and general studies, but is not appropriate for SDCP analysis.

IV. Creating Composite Land Cover Data Layer

The process of creating and updating the composite land cover data layer was automated using ArcInfo AMLs. Automation has two main advantages. Because the entire process is captured in programs, updates are efficient since they simply require that the programs be modified and rerun. Also, since the programs make explicit which data are used and how data attribute values are assigned, new decision rules can be made by non-GIS reviewers and incorporated into modified programs by technicians. Decisions used to create the existing composite land cover data layer are discussed below. AMLs used to build the composite data layer may be reviewed in Attachment 3. Complete metadata for the composite coverage is in Attachment 4.

A. Compiling Appropriate Data Layers

After reviewing all land cover data, five were evaluated to be most appropriate for incorporation into the composite coverage at this time. GAP vegetation and land cover was the most extensive, so this provided the base. Other coverages including San Pedro, Organ Pipe Cactus National Monument, WHIP, and Cienega Creek were then overlaid onto GAP vegetation so that additional information could be used in these areas to derive modified vegetation boundaries and classification. Attributes containing vegetation classification information in the original coverages were retained in the composite coverage. In order to assign a BLP classification to the composite coverage, each individual coverage had to have a BLP attribute derived from existing vegetation codes or names. All component coverages were based on the BLP system so crosswalks between types were not needed, but BLP attribute calculations from existing codes and names were necessary. Crosswalks between non-vegetation land cover classes were also necessary. All attribute data, including original and derived land cover classifications, are shown in tables for each of the coverages incorporated into the composite.

In the GAP coverage, BLP series names already existed in the attribute "Biome_series." BLP codes were added to the attribute "Gap_blp" (Table 2). Also, land cover classes were cross-walked into the modified land cover classification system. Note that Graham's "hab-type" attribute is retained in the revised coverage but is not used in the BLP code assignments

The WHIP coverage already contained BLP codes in the attribute "Blp" for natural land cover types (Table 3). A new attribute, "Whipblp" was added, which includes the Blp code plus a code for the unclassified WHIP polygons.

The Organ Pipe coverage contained BLP codes and association names for vegetation in the attributes "Map_code" and "Vegetation" (Table 4). BLP codes were copied to the new attribute "Orgblp;" the riparian designation was removed to make these codes consistent with other studies but is still retained in the original "Map_code." Land cover classes for Organ Pipe had to be cross-walked into the modified classification system. Also, there were some classification errors which were corrected in the "Orgblp" attribute only, based on an interview with Peter Warren. These included vegetation names "Ambiguous great basin scrub?", "Unknown association?", "Ambiguous map label?" and blanks (see Table 4).

TABLE 2
GAP COVERAGE ATTRIBUTES

Biome_Series	Hab_Type	Gapblp
Madrean Montane Conifer Forest (Douglas-Fir--Mixed Conifer)	Douglas Fir-Mixed Conifer (Madrean)	122.61
Madrean Montane Conifer Forest (Pine)	Ponderosa Pine (Madrean)	122.622
Madrean Evergreen Forest (Encinal)	Encinal Mixed Oak	123.311
	Encinal Mixed Oak/Mixed Chapparal/Semidesert Grass	123.311
	Encinal Mixed Oak-Mesquite	123.311
	Encinal Mixed Oak-Pinyon-Juniper	123.316
Madrean Evergreen Forest (Oak--Pine)	Encinal Mixed Oak-Mexican Mixed Pine	123.324
Mogollon Chaparral Scrubland (Manzanita)	Int. Chapparal-Shrub Live Oak-Pointleaf Manzanita	133.32
Mogollon Chaparral Scrubland (Mixed Evergreen Sclerophyll)	Int. Chaparral (Mixed)/Son. Paloverde-Mixed Cacti	133.36
	Int. Chaparral-Mixed Evergreen Sclerophyll	133.36
Scrub Grassland (Sacaton--Scrub)	Son. Riparian/Sacaton Grass Scrub	143.14
	Semidesert Mixed Grass-Yucca-Agave	143.151
Scrub Grassland (Mixed Grass--Scrub)	Semidesert Mixed Grass-Mesquite	143.152
	Semidesert Mixed Grass-Mixed Scrub	143.155
Chihuahuan Desertscrub (Creosotebush--Tarbush)	Chihuahuan Creosotebush-Tarbush Scrub	153.21
Chihuahuan Desertscrub (Mixed Scrub)	Chihuahuan Mixed Scrub	153.26
Sonoran Desertscrub (Creosotebush--Bursage)	Son. Riparian/Leguminous Short-Tree Forest/Scrub	154.11
	Sonoran Creosotebush Scrub	154.11
	Sonoran Creosotebush-Bursage Scrub	154.11
	Sonoran Creosotebush-Bursage-Paloverde-Mixed Cacti	154.11
	Sonoran Creosotebush-Mesquite Scrub	154.11
Sonoran Desertscrub (Paloverde--Mixed Cacti)	Sonoran Paloverde Mixed Cacti/Sonoran Creosote-Bur	154.12
	Sonoran Paloverde-Mixed Cacti/Semidesert Grassland	154.12
	Sonoran Paloverde-Mixed Cacti-Mixed Scrub	154.12
Sonoran Desertscrub (Saltbush)	Sonoran Saltbush-Creosote Bursage Scrub	154.17
Mogollon Deciduous Swampforest (Cottonwood--Willow)	Int. Riparian/Cottonwood-Willow Forest	223.21
	Int. Riparian/Mixed Riparian Scrub	223.21
Mogollon Deciduous Swampforest (Mixed Broadleaf)	GB Riparian Forest/Mixed Riparian Scrub	223.22

TABLE 2
GAP COVERAGE ATTRIBUTES
(continued)

Biome_Series	Hab_Type	Gapblp
	Int. Riparian/Mesquite Forest	223.22
	Int. Riparian/Mixed Broadleaf Forest	223.22
	Son. Riparian/Mixed Broadleaf Forest	223.22
Sonoran Riparian and Oasis Forest (Cottonwood--Willow)	Son. Riparian/Cottonwood-Mesquite Forest	224.53
	Son. Riparian/Cottonwood-Willow Forest	224.53
	Son. Riparian/Mesquite Forest	224.53
Sonoran Deciduous Swamp and Riparian Scrub (Mixed Scrub)	Son. Riparian/Low-lying Riparian Scrub	234.71
	Son. Riparian/Mixed Riparian Scrub	234.71
Sonoran Interior Marshland (Cattail)	Son./Chih. Riparian/Reed-Cattail Marsh	244.71
Unclassified	State Boundary	999.0
Agriculture	Agriculture	999.1
Urban	Industrial	999.2
	Mixed	999.2
	Urban	999.2
Water	Water	999.3

NOTE: In the GAP coverage, Gapblp was derived from existing attributes Biome_Series and Hab_Type.

TABLE 3
SAN PEDRO COVERAGE ATTRIBUTES

Psym	Shadeset Name	Sanblp
5	Agriculture	999.1
316	Madrean Evergreen Forest (Encinal)	123.31
9	Madrean Evergreen Forest (Oak--Pine)	123.32
999	Madrean Montane Conifer Forest (Douglas-Fir--Mixed Conifer)	122.61
963	Madrean Montane Conifer Forest (Pine)	122.62
787	Mogollon Chaparral Scrubland	133.32
75	Mogollon Chaparral Scrubland (Mixed Evergreen Sclerophyll)	133.36
739	Semidesert Grassland (Mixed Grass--Scrub)	143.15
315	Riparian Scrub (Mixed Scrub)	234.71
1	Sonoran Desert Scrub (Paloverde--Mixed Cacti)	154.12
439	Mesquite Bosque	224.53
387	Sonoran Deciduous Swamp and Marsh	244.71
2	Mixed Broadleaf Riparian	223.22
0		999.0
100		999.0
724		999.0

NOTE: In the San Pedro coverage, Sanblp was derived from existing attribute Psym and names in the San Pedro shadeset.

TABLE 4
ORGAN PIPE COVERAGE ATTRIBUTES

Vegetation	Map_Code	Orgblp
J. monosperma-Vauquelinia californica mixed scrub association	122.4151	122.4151
Quercus ajoensis-mixed scrub association	123.319R	123.319
Prosopis glandulosa riparian woodland	124.711R	124.711
Ribes quercetorum-Ptelea trifoliata association	133.361	133.361
Larrea tridentata-Ambrosia dumosa association	154.1111	154.1111
Larrea tridentata-Ambrosia dumosa assoc. / L. tridentata-Prosopis glandulosa floodplain assoc.	154.1111/154.1115R	154.1111/154.1115
Larrea tridentata-Ambrosia mixed scrub association	154.1112	154.1112
Larrea tridentata-Ambrosia mixed scrub assoc. / L. tridentat-Prosopis glandulosa floodplain assoc.	154.1112/154.1115R	154.1112/154.1115
Larrea tridentata-ambrosia deltoidea-Fouquieria splendens association	154.1113	154.1113
Larrea tridentata-Annuals association	154.1114	154.1114
Ambiguous great basin scrub ?	152.1115R	154.1115
L. tridentata-Prosopis glandulosa floodplain association	154.1115R	154.1115
Unknown association ?	154.1116R	154.1115
L. tridentata-Prosopis glandulosa floodplain assoc. / Larrea tridentata-Ambrosia dumosa assoc.	154.1115R/154.1111	154.1115/154.1111
L. tridentata-Prosopis glandulosa floodplain assoc. / Acacia-Ambrosia ambrosioides assoc.	154.1115R/154.1214R	154.1115/154.1214
Ambiguous map label ?	154.1115R+154.1214R	154.1115/154.1214
Ambrosia deltoidea-Cercidium microphyllum middle bajada	154.1211	154.1211
Ambrosia deltoidea-Cercidium microphyllum middle bajada association		154.1211
Ambrosia deltoidea-Cercidium microphyllum pediment mixed shrub association	154.1212	154.1212
Cercidium microphyllum-Ambrosia deltoidea-Simmondsia chinensis-pediment association	154.1213	154.1213
Acacia-Ambrosia ambrosioides association	154.1214R	154.1214
Prosopis glandulosa-Cercidium floridum association	154.1215R	154.1215
Cercidium microphyllum-Ambrosia deltoidea-Olneya tesota association	154.1216	154.1216
Simmondsia-Encelia-Fouquieria association	154.1231	154.1231
Simmondsia-Viguiera-Eriogonum association	154.1232	154.1232
Simmondsia-Atriplex polycarpa association	154.1234	154.1234
Cercidium microphyllum-Encelia-Lemaireocereus-Jatropha association	154.1261	154.1261
C. microphyllum-Encelia-Ambrosia deltoidea association	154.1262	154.1262
C. microphyllum-Encelia-Ambrosia dumosa association	154.1263	154.1263

TABLE 4
ORGAN PIPE COVERAGE ATTRIBUTES
(continued)

Vegetation	Map_Code	Orgblp
Cercidium microphyllum-Encelia-Lemaireocereus-Bursera association	154.1271	154.1271
Cercidium microphyllum-Ambrosia deltoidea-Lemaireocereus-Jatropha association	154.1272	154.1272
Atriplex polycarpa-A. linearis-Larrea tridentata association	154.1761	154.1761
A. polycarpa-A. linearis-Suaeda torreyana association	154.1762	154.1762
A. polycarpa-A. linearis-Prosopis glandulosa association	154.1763	154.1763
Typha domingensis-Scirpus olneyi association	244.7111	244.7111
Distichlis spicata-Juncus-mixed herb association	244.751	244.751
Distichlis spicata-Juncus-mixed herb assoc. / Prosopis glandulosa riparian woodland	244.751/124.711R	244.751/124.711
Campground	Campground	999.2
Lukeville	Lukeville	999.2
Bare ground	Bare ground	999.4

NOTE: In the Organ Pipe coverage, Orgblp was derived from existing attributes vegetation and Map_Code.

The Cienega Creek coverage did not have BLP codes in the original GIS coverage but contained an attribute "Veg_type," which contained descriptive names that could be linked to BLP codes (Table 5). The attribute "Cienblp" was assigned based on a map legend in the June 1999 STAT report that contained both "Veg_type" names and BLP codes. Blank and agricultural types were cross-walked to the modified land cover classification.

TABLE 5
WHIP COVERAGE ATTRIBUTES

Blp	Whipblp
143.152	143.152
143.155	143.155
154.121	154.121
154.125	154.125
234.712	234.712
243.531	243.531
	999.0

NOTE: In the WHIP coverage, Whipblp was derived from existing attribute Blp.

The original San Pedro coverage had many attributes from GAP and EROS coverages. Only the unique attribute "psym" was retained and used to derive "Sanpblp" in the modified coverage (Table 6). A shadeset (legend) file from DOT contained "psym" codes and their associated BLP codes for natural vegetation types. Other land cover classes were cross-walked from "Psym" to "Sanblp" based on the modified land cover classification.

B. Discussion of Composite Database

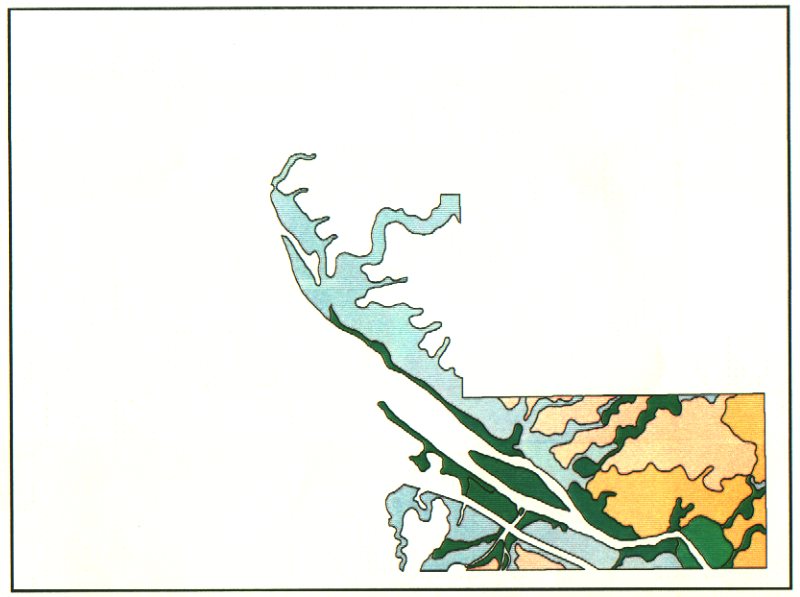
The composite coverage was created by overlaying the five component coverages and calculating new values for land cover classification based on component coverage attributes. New composite land cover attributes include land cover code and names for each level of the BLP typology. Composite land cover attributes were then assigned in the following order: first, the composite coverage classification was set to be the same as the GAP classification, then that classification was replaced by San Pedro, WHIP, Cienega, and Organ Pipe classifications in that order where these coverages overlapped GAP.

For example, in the Cienega Creek area, GAP, WHIP, and Cienega Creek coverages overlap. Land cover classification at the series level varies among the coverages, which can be seen on the left side of Figure 6. GAP's generalized polygon boundaries classify this area into only two types. WHIP's more detailed polygon delineation classifies three types. Cienega Creek mapping delineates the most detailed polygon boundaries and five types. In building the composite coverage, WHIP classification replaces GAP, and Cienega classification replaces GAP and WHIP. The result is shown on the right side of

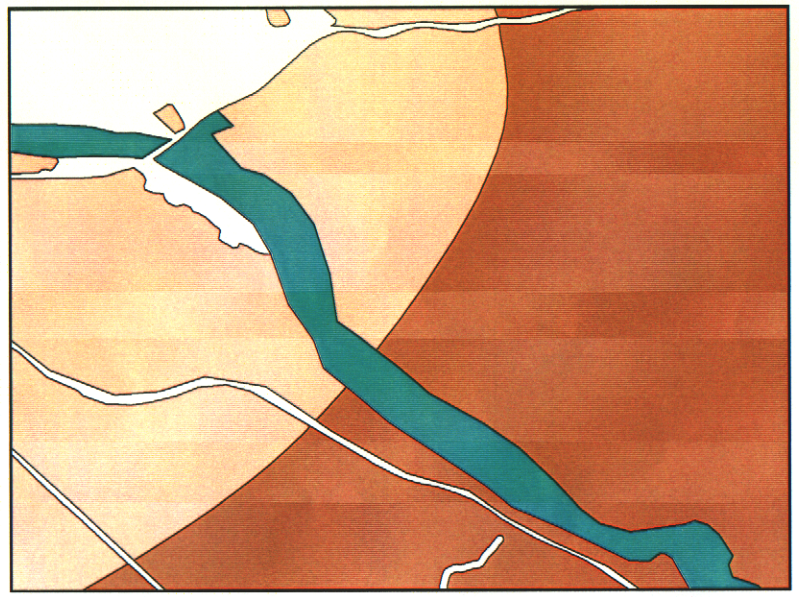
TABLE 6
CIENEGA CREEK COVERAGE ATTRIBUTES

Veg_Type	Cienblp
Burroweed-mesquite-association	143.163
Creosote-mariola-association-1	153.212
Creosote-association	154.111
Creosote-mixed-scrub-assoc-1	154.125
Velvet-mesq-assoc-low-density	224.521
Velvet-mesquite-association	224.521
Velv-mesq-mix-decidu-tree-assoc	224.523
Velvet-mesq-mixed-scrub-assoc	234.712
	999.0
Pasture-graz-agricultur-field	999.1

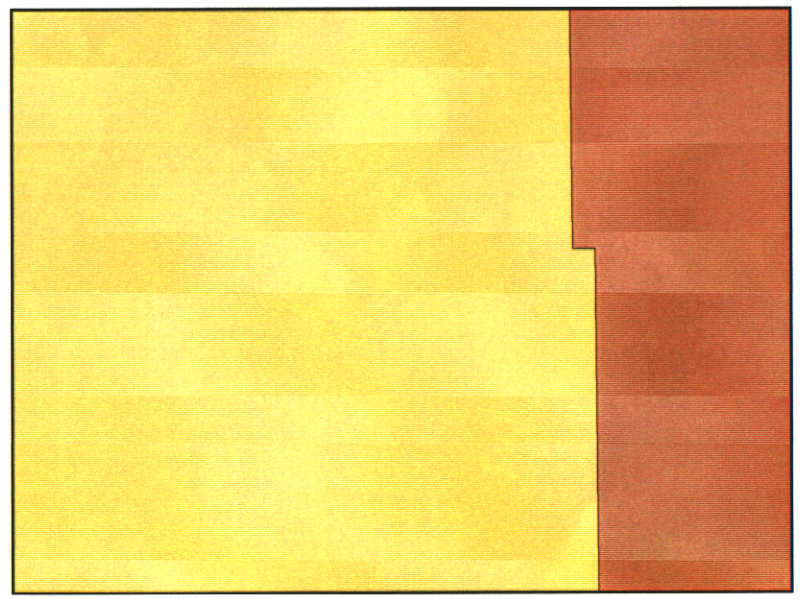
NOTE: In the Cienega Creek coverage, Cienblp was derived from existing attribute Veg_Type and names in a map legend.



1
Cienega Creek
Land Cover
Mapping



2
WHIP
Land Cover
Mapping



3
GAP
Land Cover
Mapping

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Feet
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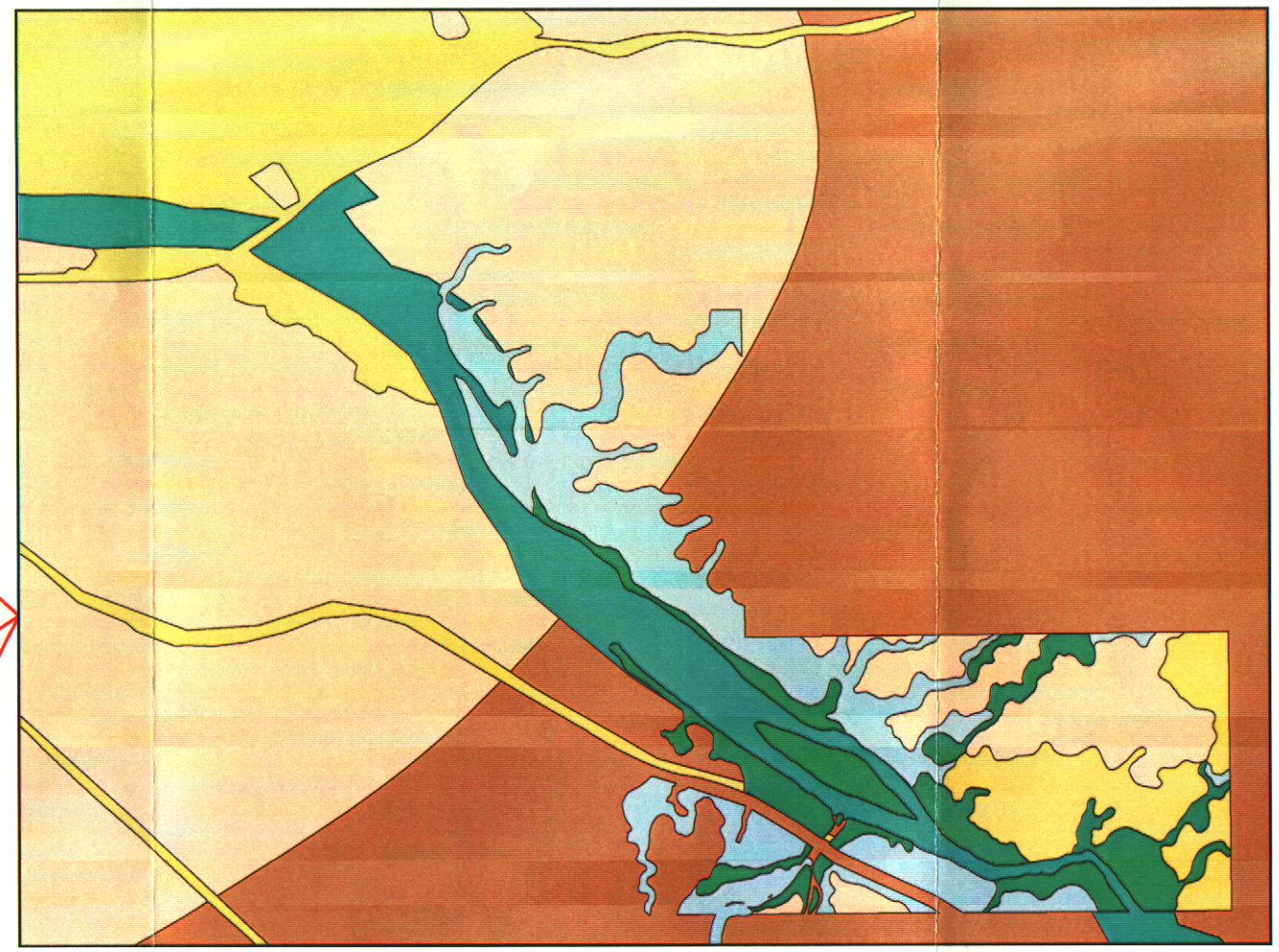


1,500 0 1,500
Feet
1:18,000

Vegetation Communities (BLP Classification)

- 154.11 Creosote Bursage
- 154.12 Paloverde-Mixed Cacti
- 143.15 Mixed Grass-Scrub
- 224.52 Mesquite
- 234.71 Cattail
- 243.53 Cordgrass

Composite
Land Cover
Map
for the
Cienega Creek
Study Area

(Cienega Creek mapping takes precedence over WHIP mapping, and WHIP mapping takes precedence over GAP mapping during the overlay process)

Overlay Process for Creating Composite Land Cover Data Layer

Cienega Creek Study Area

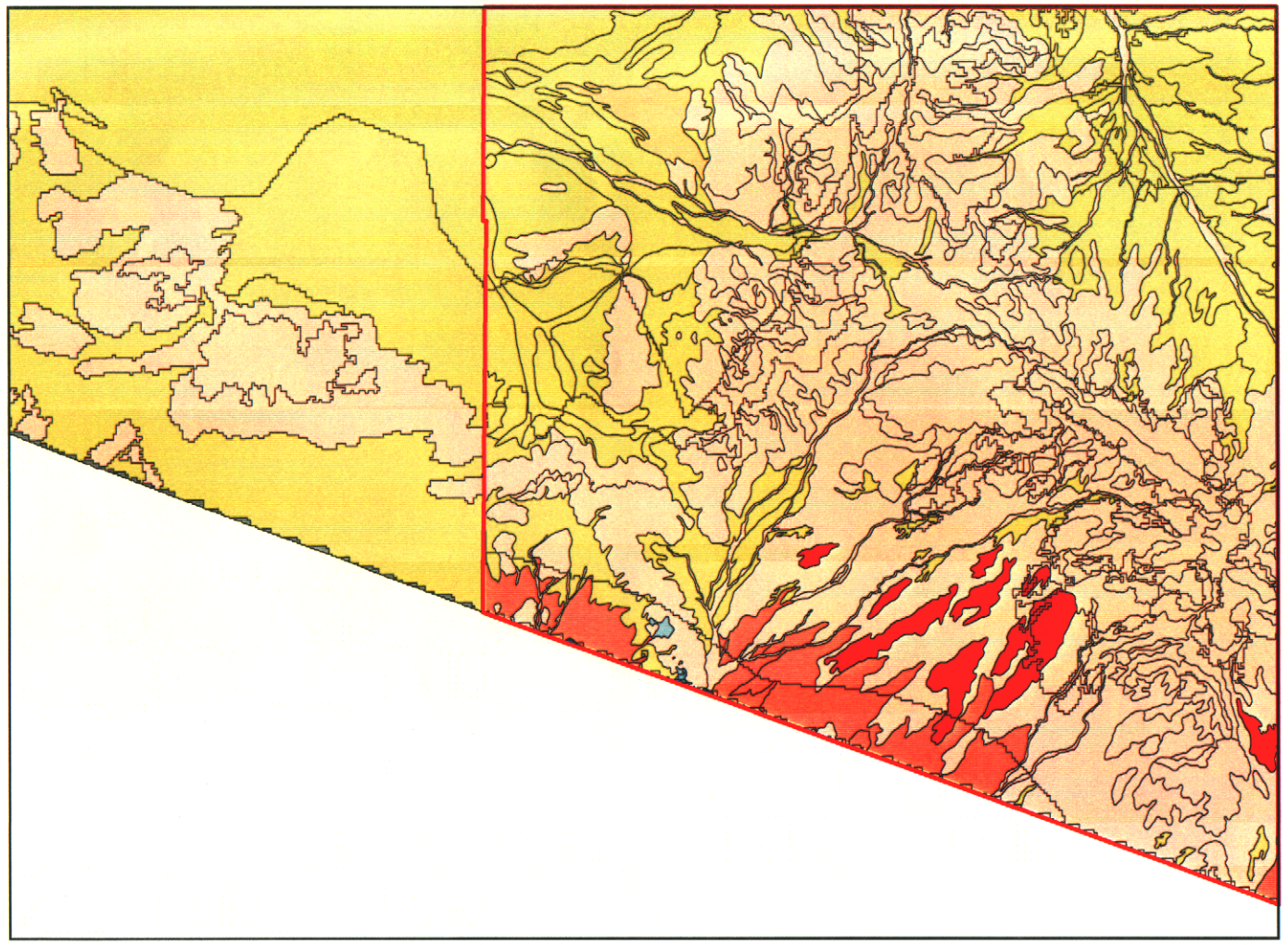
Figure 6

Figure 6. All Cienega Creek mapping appears in the composite map. WHIP mapping appears only in areas not covered by Cienega Creek, and GAP mapping appears only where there is no mapping for Cienega Creek or WHIP.

This is how the composite map appears using the current AML. If we decide that WHIP classification should take precedence over Cienega, the composite map would look different. This illustrates the dynamic nature of the composite land cover database. By retaining original attributes and using assumptions about original data sets to assign values to composite attributes, we may quickly change the composite map.

Retaining all attributes and associated polygon boundaries from multiple coverages also results in a database that can be analyzed using a uniform level of classification (within a single attribute) or using the most detailed information available (across multiple attributes). This is illustrated in Figure 7. At Organ Pipe Cactus National Monument (ORPI), land cover was delineated at a fine scale and classified to the BLP subassociation level. To the west of ORPI, only GAP series level mapping exists. When analyzing the distribution of land cover types for the entire SDCP study area it is essential to use a uniform level of classification. This insures that the same things are being compared, and that the absence or presence of a land cover type reflects the condition on the ground, not the state of mapping for that type. For example, we should not attempt to assess the distribution of a particular subassociation of Paloverde-Mixed Cacti when it is only mapped at ORPI. Instead we should assess the distribution of Paloverde-Mixed Cacti at the series level where mapping exists for all of Pima County. At the same time it is important that more detailed level mapping is retained in the composite land cover data layer since this can be used to show the distribution of important types for areas where they are mapped. For example using subassociation level data at ORPI shows us where ironwood occurs in this area (see Figure 7). We cannot conclude that this represents all ironwood in the county, but we can show its known location together with potential locations mapped based on series level land cover and other data.

The composite land cover database can be used to produce many different maps of vegetation and land cover by "dissolving" polygon boundaries on any number of attributes to create new GIS coverages. This process eliminates polygon boundaries between like types such as series level classification shown in Figure 8.

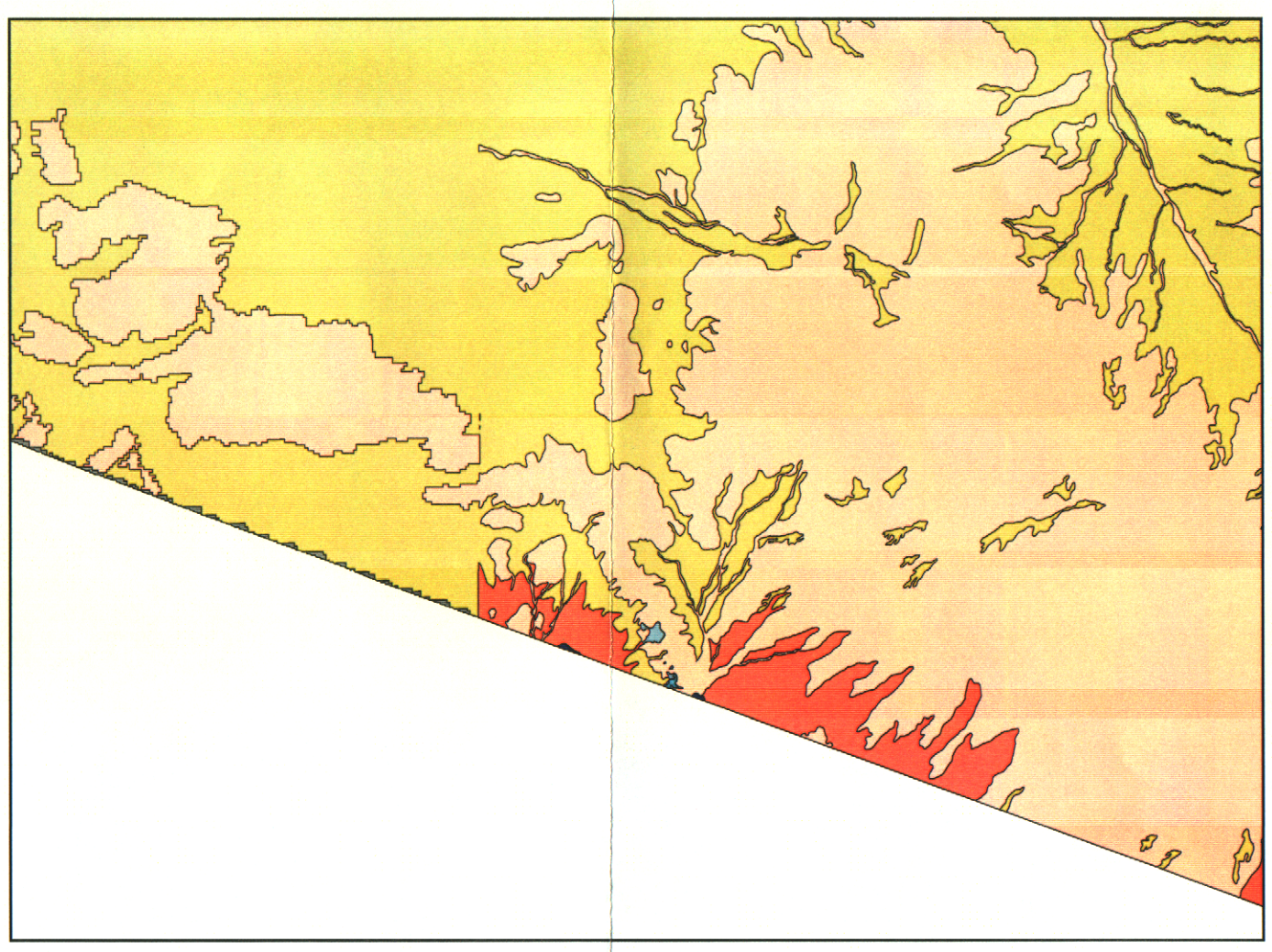


Composite Map - Best Level Classification Available

Vegetation Communities (BLP Classification)

- 124.71 Mesquite
  124.711
- 154.11 Creosote-Bursage
  154.1111
  154.1111/154.1115
  154.1112
  154.1112/154.1115
  154.1113
  154.1114
  154.1115
  154.1115/154.1111
- 154.17 Saltbush
  154.1761
  154.1762
  154.1763
- 154.12 Paloverde-Mixed Cacti
  154.1211
  154.1212
  154.1214
  154.1215
  154.1232
  154.1261
  154.1262
  154.1263
  154.1271
  154.1272
- 154.1216 Cercidium microphyllum-Ambrosia deltoidea-Olneya tesota (Ironwood) sub-association
- 244.71Cattail
  244.7111
- 244.75 Saltgrass
  244.751
  244.751/124.711
- 999.0 Unclassified

M:\jobs\3273b\gis\aprs\vegmaps.apr\map7 uniform vs best 3/00



Composite Map - Series Level Classification

Vegetation Communities (BLP Classification)

- 124.71 Mesquite
- 154.11 Creosote-Bursage
- 154.12 Paloverde-Mixed Cacti
- 154.17 Saltbush
- 244.71 Cattail
- 244.75 Saltgrass
- 999.0 Unclassified

18,000 0 18,000
Feet
1:216,000

Uniform versus Most Detailed Land Cover Classification

Figure 7

11 0 11

Miles

1:696,960

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Vegetation Communities (BLP Classification)

- 122.41 Pinyon-Juniper
- 122.61 Douglas-Fir-Mixed Conifer
- 122.62 Pine
- 123.31 Encinal (Oak)
- 123.32 Oak-Pine
- 124.71 Mesquite
- 133.32 Manzanita
- 133.36 Mixed Evergreen Sclerophyll
- 143.14 Sacatan-Scrub
- 143.15 Mixed Grass-Scrub
- 143.16 Shrub-Scrub Disclimax
- 153.21 Creosotebush-Tarbush
- 153.26 Mixed Scrub
- 154.11 Creosote-Bursage
- 154.12 Paloverde-Mixed Cacti
- 154.17 Saltbush
- 223.21 Cottonwood-Willow
- 223.22 Mixed Broadleaf
- 224.52 Mesquite
- 224.53 Cottonwood-Willow
- 234.71 Mixed Scrub
- 243.53 Cordgrass
- 244.71 Cattail
- 244.75 Saltgrass

Other Land Cover Types

- 999.0 Unclassified
- 999.1 Agriculture
- 999.2 Urban
- 999.3 Water
- Streams
- 999.4 Bare Ground

Pima County Boundary

Composite Land Cover Map for Pima County

Figure 8

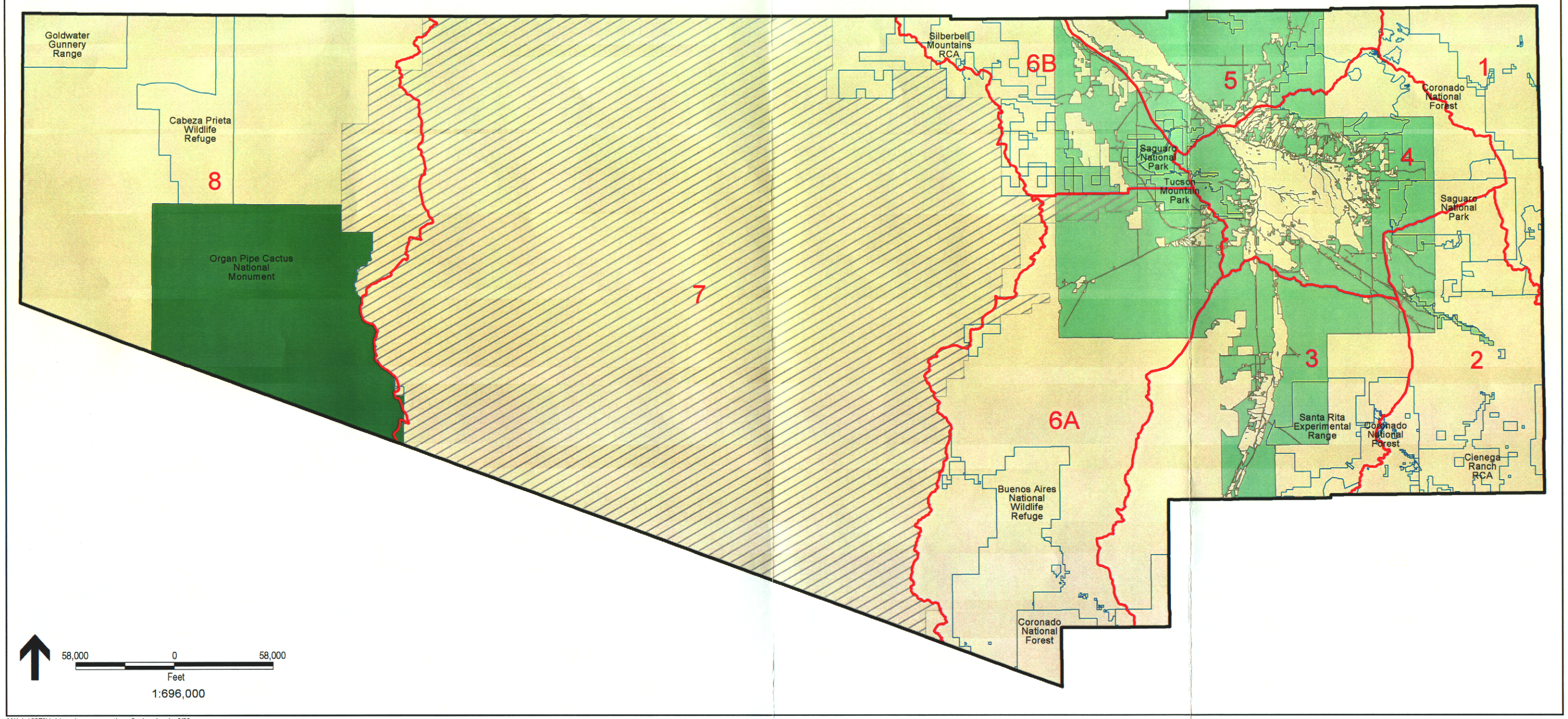
V. Map Assessment

An evaluation of the composite land cover data layer was conducted by researching and evaluating component data layers and analyzing the level of detail in the composite coverage.

GAP mapping, covering the entire study area, was replaced where more detailed or revised mapping was available. These coverages are superior to GAP but can still be improved by replacing missing data discussed in Section III of this report. The composite coverage contains only GAP land cover mapping for 1,988,000 acres or 58 percent of the study area. There remain errors in the GAP mapping, some of which have been pointed out by the STAT, such as misclassification of water and riparian polygons. Boundary delineations of GAP vegetation series are also suspect in certain areas. The boundary between Shrub-Scrub Disclimax and Paloverde-Mixed Cacti in the vicinity of Tucson are mapped differently in the WHIP and GAP studies. This appears as a discontinuous, unnatural boundary in the current composite map (see Figure 8). Known errors in series-level land cover delineation and classification should be resolved in this phase of the SDCP, since vegetation series will provide the basis for reserve design analysis.

As part of the land cover data assessment, large format (E sheet) 1:120,000 scale maps of land cover with Game and Fish Wildlife Management Unit boundaries were produced. These maps will be given to wildlife managers who will be asked to revise land cover classification and boundary delineation in their areas of expertise. Using wildlife managers' collective field knowledge important revisions to the existing database can be made. A more detailed revision, using large scale hard copy maps of vegetation boundaries on orthophotos could be conducted during the next phase of the SDCP, if necessary.

In the composite data layer, an attribute named "class_level" was detail of the mapping. A map of level of classification was produced by dissolving on the attribute "class_level" to show where general and more detailed mapping exist within the study area (Figure 9). The majority of land (almost two million acres) in the study area has series level mapping only, since most areas are covered only by GAP or revised GAP mapping. There are almost one million acres of association level mapped, corresponding to WHIP, Cienega, and some GAP areas. Subassociation level mapping currently exists only for Organ Pipe National Monument (330,700 acres). Large blocks of unprotected land are currently represented by series level GAP mapping only in the Altar Valley and Santa Cruz watersheds in the east and San Cristobal and Childs Valley watersheds in the west. Revising series level mapping in these areas is a priority. Association level mapping requires fieldwork and is not recommended for this phase of the study.



M:\jobs\3273b\gis\aprs\vegmaps.apr\map9 class levels 3/00

Pima County Boundary
5 Planning Units
Tohono O'Odham Nation
Existing Preserve Boundaries

Levels of Vegetation Classification
Series Level (Gap Analysis Program and San Pedro Area Revised)
Association Level (Wildlife Habitat Inventory Project and Cienega Creek)
Association and Sub-association Level (Organ Pipe Cactus National Monument)

Classification Levels of Current Vegetation Mapping or Pima County

Figure 9

VI. Conclusions and Recommendations

The current land cover data base for Pima County relies heavily on series level GAP data which was found to be 68 percent accurate for the statewide coverage. Replacing riparian mapping in this coverage with new Santa Cruz and SDCP riparian mapping should significantly improve the overall accuracy of the current land cover data layer, but inadequacies will remain. Given limited resources, priorities for improving this mapping should be based on the goal for this phase of the SDCP, which is to assess the protection of existing resources in order to recommend preserve design alternatives. To this end, targets for conservation in the final preserve design should be the focus of establishing mapping priorities.

The distribution of vulnerable species (Categories 1 and 2), keystone, flagship, and umbrella species proposed by the STAT was roughly sorted by habitat or habitat feature (Table 7). While many of these species are relatively broad in their distributions among the habitats in Pima County ("broad/other" category in Table 7), a number are primarily associated with or dependent upon specific habitats or habitat features.

TABLE 7
DISTRIBUTION OF SPECIES OF CONSERVATION CONCERN BY HABITAT/FEATURE

	Conservation Category			
Habitat/Feature[1]	Vulnerable	Keystone	Flagship	Umbrella
Aquatic	21	3	2	2
Riparian	8	4	4	2
Grasslands	8	3	-	2
Talus Slopes	5	-	-	-
Sky Islands	4	1	2	2
Mesquite	3	-	1	-
Caves/Mines	3	-	-	-
Limestone Outcrops/Soils	3	-	-	-
Saguaro/Palo Verde	1	-	3	2
Ironwood	-	1	-	-
Broad/Other	18	3	22	8
Total in Category	74	15	34	28

[1]Aquatic habitat includes streams, springs, cienegas, marshes, and ponds; often associated with riparian habitat. Riparian habitat includes cottonwoods and willows. Grasslands include Sacaton and other native grasses. Sky islands include high elevation shrub and woodland habitats.

Few of these special habitats are appropriately mapped in the composite land cover data layer and most are not mapped at all. Therefore, in order to describe the distribution of vulnerable species and assess their conservation status, special habitats and features should be mapped. In addition, series level land cover mapping throughout the study

area should be improved for the purpose of assessing conservation status of those broadly distributed species.

Based on this preliminary analysis and the evaluation of existing land cover data the following recommendations emerge for improving the usefulness of the land cover data to meet subsequent conservation planning and decisions in the development of the SDCP.

1. Building on the PAG mapping of perennial and intermittent streams, add mapping of springs, cienegas, marshlands, ponds, and lakes.

2. Complete the ongoing mapping of riparian habitat focusing on the distribution of cottonwood, willow, and mesquite.

3. Further evaluate the existing mapping of grasslands, focusing on discrimination among Sacaton and other native grasslands and non-native grasslands. Map the distribution of key native grassland areas.

4. Map of the distribution of Saguaro/Palo Verde and Ironwood, features of both intrinsic importance as well as value to vulnerable species.

5. Develop mapping of the distribution of limestone outcrops and soils, caves, mines (potentially used by bats), and talus slopes.

6. Improve series level mapping for the entire study area based on expert review and revision of the current composite land cover data layer.

7. As individual species habitat requirements are further defined, evaluate the need and feasibility to map key features that are not currently mapped.

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ATTACHMENTS

ATTACHMENT 1

ATTACHMENT 1
BROWN, LOWE, AND PASE VEGETATION COMMUNITIES MAPPED IN COMPOSITE LAND COVER GIS COVERAGE

122.4 Great Basin Conifer Woodland
- 122.41 Pinyon-Juniper Series
  - 122.415 *Juniperus monosperma* Association
    - 122.4151 *J. Monosperma-Vauquelinia californica* mixed scrub Subassociation

122.6 Madrean Montane Conifer Forest
- 122.61 Douglas-fir-Mixed Conifer Series
- 122.62 Pine Series
  - 122.622 *Pinus Ponderosa* Association

123.3 Madrean Evergreen Forest and Woodland
- 123.31 Encinal (Oak) Series
  - 123.311 Mixed Quercus (=*Quercus* spp.) Association
  - 123.316 *Quercus* spp.-*Pinus cembroides-Juniperus* spp. Association
  - 123.319 *Quercus ajoensis*-mixed scrub Association
- 123.32 Oak-Pine Series
  - 123.324 *Quercus* spp.-*Pinus* spp. Association

124.7 Sonoran riparian woodland
- 124.71 Mesquite Series
  - 124.711 *Prosopis glandulosa* riparian woodland Association

133.3 Interior Chaparral
- 133.32 Manzanita Series
- 133.36 Mixed Evergreen Sclerophyll Series
  - 133.361 Mixed *Sclerophyll* Association

143.1 Scrub-Grassland (Semidesert Grassland)
- 143.14 Sacaton-Scrub Series
- 143.15 Mixed Grass-Scrub Series
  - 143.151 Mixed grass-*Yucca elata* Association
  - 143.152 Mixed grass-*Prosopis juliflora* Association
  - 143.155 Mixed grass-mixed scrub Association
- 143.16 Shrub-Scrub Disclimax Series
  - 143.163 *Aplopappus tenuisectus-Prosopis juliflora* Association

153.2 Chihuahuan Desert Scrub
- 153.21 Creosotebush-Tarbush Series
  - 153.212 *Larrea divaricata-Parthenium incanium*-mixed scrub Association
- 153.26 Mixed Scrub Series

154.1 Sonoran Desert Scrub
- 154.11 Creosotebush-Bursage ("Lower Colorado Valley") et al Series
  - 154.111 *Larrea divaricata* Association
    - 154.1111 *Larrea tridentata-Ambrosia dumosa* Subassociation
      - 154.1111/154.1115 *Larrea tridentata-Ambrosia dumosa/L. tridentata-Prosopis glandulosa* floodplain Subassociation
    - 154.1112 *Larrea tridentata-Ambrosia* mixed scrub Subassociation
      - 154.1112/154.1115 *Larrea tridentata-Ambrosia* mixed scrub/ *L. trident-Prosopis glandulosa* floodplain Subassociation
      - 154.1113 *Larrea tridentata-Ambrosia deltoidea-Fouquieria splendens* Subassociation

ATTACHMENT 1
BROWN, LOWE, AND PASE VEGETATION COMMUNITIES MAPPED IN COMPOSITE LAND COVER GIS COVERAGE
(continued)

154.1114 *Larrea tridentata*-Annuals Association/*Larrea tridentata-Ambrosia dumosa* Subassociation
154.1115/154.1214 *L. tridentata-Prosopis glandulosa* floodplain Association/*Acacia-Ambrosia* ambrosioides Subassociation
154.12 Paloverde-Mixed Cacti ("Arizona Upland") Series
154.121 *Ambrosia deltoidea-Cercidum microphyllum*-mixed scrub Association
154.1211 *Ambrosia deltoidea-Cercidium microphyllum* middle bajada Subassociation
154.1212 *Ambrosia deltoidea-Cercidium microphyllum* pediment mixed shrub Subassociation
154.1213 *Cercidium microphyllum-Ambrosia deltoidea-Simmondsia chinensis*-pediment Subassociation
154.1214 *Acacia-Ambrosia ambrosioides* Subassociation
154.1215 *Prosopis glandulosa-Cercidium floridum* Subassociation
154.1216 *Cercidium microphyllum-Ambrosia deltoidea-Olneya tesota* Subassociation
154.123 *Simmondsia chinensis*-mixed scrub Association
154.1231 *Simmondsia-Encelia-Fouquieria* Subassociation
154.1232 *Simmondsia-Viguiera-Eriogonum* Subassociation
154.1234 *Simmondsia-Atriplex polycarpa* Subassociation
154.125 *Larrea divaricata*-mixed scrub Association
154.126 *Encelia farinosa*-mixed scrub Association
154.1261 *Cercidium microphyllum-Encelia-Lemaireocereus-Jatropha* Subassociation
154.1262 *C. microphyllum-Encelia-Ambrosia deltoidea* Subassociation
154.1263 *C. microphyllum-Encelia-Ambrosia dumosa* Subassociation
154.127 Mixed shrub-*Cercidum microphyllum-Olneya tesota*-mixed scrub Association
154.1271 *Cercidium microphyllum-Encelia-Lemaireocereus-Bursera* Subassociation
154.1272 *Cercidium microphyllum-Ambrosia deltoidea-Lemaireocereus-Jatropha* Subassociation
154.17 Saltbush Series
154.176 *Atriplex polycarpa* Association
154.1761 *Atriplex polycarpa-A. linearis-Larrea tridentata* Subassociation
154.1762 *A. polycarpa-A. linearis-Suaeda torreyana* Subassociation
154.1763 *A. polycarpa-A. linearis-Prosopis glandulosa* Subassociation
223.2 Interior Southwestern Riparian Deciduous Forest and Woodland
223.21 Cottonwood-Willow Series
223.22 Mixed Broadleaf Series
224.5 Sonoran Riparian and Oasis Forests
224.52 Mesquite Series
224.521 *Prosopis juliflora velutina* Association
224.523 *Prosopis velutina*-mixed diciduous Association
224.53 Cottonwood-Willow Series
234.7 Sonoran Deciduous Swamp and Riparian Scrub Association
234.71 Mixed Scrub Association
234.712 Prosopis pubescens-Mixed Scrub Association
243.5 Madrean Marshland
243.53 Cordgrass Series
243.531 Cordgrass Association

ATTACHMENT 1
BROWN, LOWE, AND PASE VEGETATION COMMUNITIES MAPPED IN COMPOSITE LAND COVER GIS COVERAGE
(continued)

244.7 Sonoran Interior Marshland
- 244.71 Cattail Series
  - 244.711 *Typha Domingensis* Association
    - 244.7111 *Typha domingensis-Scirpus olneyi* Subassociation
- 244.75 Saltgrass series
  - 244.751 *Distichlis spicata-Juncus*-mixed herb Association
  - 244.751/124.711 *Distichlis spicata*-Juncus-mixed herb/*Prosopis glandulosa* riparian woodland Association

ATTACHMENT 2

ATTACHMENT 2
WHIP URBAN/SUBURBAN LAND COVER CLASSES

1.0 Residential
- 1.1 <=1 RAC (residences/acre)
- 1.2 >1-3 RAC (residences/acre)
- 1.3 >3-6 RAC (residences/acre)
- 1.4 > 6 RAC (residences/acre)

2.0 Commercial and Public Facilities
- 2.1 Commercial
- 2.2 Industrial
- 2.3 Regional Mall
- 2.4 Mines
- 2.5 Institutional
  - 2.51 Schools
  - 2.52 Public Buildings
- 2.6 Destination Resorts
- 2.7 Offices
- 2.8 Cemeteries
- 2.9 Landfills

3.0 Recreation
- 3.1 Zoological Park
- 3.2 Golf Courses and Associated Recreation Areas
- 3.3 Park and Playground
  - 3.31 Neighborhood Park (<=10 acres)
  - 3.32 District Park (11-49 acres)
  - 3.33 Regional park (>=50 acres)
  - 3.34 State/Federal Parks and Forests, and County Preserves

4.0 Watercourse and Ponds
- 4.1 Major Rivers
- 4.2 Wash/Riparian Area
- 4.3 Pond
- 4.4 Central Arizona Project (CAP)

5.0 Natural Open Space

6.0 Graded Vacant Land

7.0 Agricultural Land
- 7.1 Animals
- 7.2 Crops
- 7.3 Abandoned Agricultural Lands

8.0 Major Transportation Routes
- 8.1 Roadways (>=4 lanes or equivalent)
- 8.2 Railway Yards
- 8.3 Airports

ATTACHMENT 3

ATTACHMENT 3
GIS ARCINFO PROGRAMS FOR CREATING COMPOSITE LAND COVER

CIEN_VEG.AML

```
/* 3/1/00 Leslie Smith (RECON) for Pima County SDCP
/* revised 3/15/00 Leslie Smith
/* This AML assigns BLP codes to the attribute cienblp
/* in the coverage cien_veg based on original attribute
/* veg_type which has an associated BLP code
/* shown on map produced for the June 1999
/* Vegetation Mapping Evaluation Report

&echo &on
arcedit
ec cien_veg
ef lab
sel all
calc cienblp = ''
sel cienveg = ''
calc cienblp = '999.0'
sel cienveg = 'BURROWEED-MESQUITE-ASSOCIATION'
calc cienblp = '143.163'
sel cienveg = 'CREOSOTE-ASSOCIATION'
calc cienblp = '154.111'
sel cienveg = 'CREOSOTE-MARIOLA-ASSOCIATION-1'
calc cienblp = '153.212'
sel cienveg = 'CREOSOTE-MIXED-SCRUB-ASSOC-1'
calc cienblp =  '154.125'
sel cienveg = 'PASTURE-GRAZ-AGRICULTUR-FIELD'
calc cienblp = '999.1'
sel cienveg = 'VELVET-MESQ-ASSOC-LOW-DENSITY'
calc cienblp = '224.521'
sel cienveg = 'VELVET-MESQ-MIXED-SCRUB-ASSOC'
calc cienblp =  '234.712'
sel cienveg = 'VELVET-MESQUITE-ASSOCIATION'
calc cienblp =  '224.521'
sel cienveg = 'VELV-MESQ-MIX-DECIDU-TREE-ASSOC'
calc cienblp = '224.523'
save
quit
```

ATTACHMENT 3
GIS ARCINFO PROGRAMS FOR CREATING COMPOSITE LAND COVER
(continued)

CLASS_VEG.AML

```
/* 3/1/00 Leslie Smith (RECON) for Pima County SDCP
/* modified 3/15 Leslie Smith
/* This AML assigns values to class_level in composite land cover

&echo &on
arcedit
ec comp_veg
ef lab
sel all
calc class_level = ''
resel subassoc <> ''
calc class_level = 'subassoc'
sel class_level = ''
resel assoc <> ''
calc class_level = 'assoc'
sel class_level = ''
resel series <> ''
calc class_level = 'series'
sel class_level = ''
save
quit
```

ATTACHMENT 3
GIS ARCINFO PROGRAMS FOR CREATING COMPOSITE LAND COVER
(continued)

CODE_VEG.AML

```
/* 3/1/00 Leslie Smith (RECON) for Pima County SDCP
/* modified 3/15 Leslie Smith
/* This AML assigns BLP code to compblp in composite land cover
/* and calculates codes for biomeblp and seriesblp

arcedit
ec comp_veg
ef lab
sel all
calc compblp = gapblp
resel sanpblp <> ''
resel sanpblp <> '999.0'
calc compblp = sanpblp
sel whipblp <> ''
resel whipblp <> '999.0'
calc compblp = whipblp
sel cienblp <> ''
resel cienblp <> '999.0'
calc compblp = cienblp
sel orgblp <> ''
resel orgblp <> '999.0'
calc compblp = orgblp
sel all
calc biomeblp = compblp
calc seriesblp = compblp
save
quit
```

ATTACHMENT 3
GIS ARCINFO PROGRAMS FOR CREATING COMPOSITE LAND COVER
(continued)

GAP_VEG.AML

```
/* 3/1/00 Leslie Smith (RECON) for Pima County SDCP
/* modified 3/15/00 Leslie Smith
/* This AML assigns BLP codes to the attribute gapblp
/* in the coverage gap_veg
/* based on original attributes biome_series and hab-type

&echo &on
arcedit
ec gap_veg
ef lab
sel all
calc gapblp = ''
sel biome_series = 'Chihuahuan Desertscrub (Creosotebush--Tarbush)'
calc gapblp = '153.21'
sel biome_series = 'Chihuahuan Desertscrub (Mixed Scrub)'
calc gapblp = '153.26'
sel biome_series = 'Madrean Evergreen Forest (Encinal)'
calc gapblp = '123.31'
sel biome_series = 'Madrean Evergreen Forest (Oak--Pine)'
calc gapblp =  '123.32'
sel biome_series = 'Madrean Montane Conifer Forest (Douglas-Fir--Mixed Conifer)'
calc gapblp = '122.61'
sel biome_series = 'Madrean Montane Conifer Forest (Pine)'
calc gapblp = '122.62'
sel biome_series = 'Mogollon Chaparral Scrubland (Manzanita)'
calc gapblp = '133.32'
sel biome_series = 'Mogollon Chaparral Scrubland (Mixed Evergreen Sclerophyll)'
calc gapblp = '133.36'
sel biome_series = 'Mogollon Deciduous Swampforest (Cottonwood--Willow)'
calc gapblp = '223.21'
sel biome_series = 'Mogollon Deciduous Swampforest (Mixed Broadleaf)'
calc gapblp = '223.22'
sel biome_series = 'Scrub Grassland (Mixed Grass--Scrub)'
calc gapblp = '143.15'
sel biome_series = 'Scrub Grassland (Sacaton--Scrub)'
calc gapblp = '143.14'
sel biome_series = 'Sonoran Deciduous Swamp and Riparian Scrub (Mixed Scrub)'
calc gapblp = '234.71'
sel biome_series = 'Sonoran Desertscrub (Creosotebush--Bursage)'
calc gapblp = '154.11'
sel biome_series = 'Sonoran Desertscrub (Paloverde--Mixed Cacti)'
calc gapblp = '154.12'
sel biome_series = 'Sonoran Desertscrub (Saltbush)'
calc gapblp = '154.17'
sel biome_series = 'Sonoran Interior Marshland (Cattail)'
calc gapblp = '244.71'
sel biome_series = 'Sonoran Riparian and Oasis Forest (Cottonwood--Willow)'
```

ATTACHMENT 3
GIS ARCINFO PROGRAMS FOR CREATING COMPOSITE LAND COVER
(continued)

GAP_VEG.AML (cont.)

```
calc gapblp = '224.53'
sel biome_series = 'Unclassified'
calc gapblp = '999.0'
sel biome_series = 'Agriculture'
calc gapblp = '999.1'
sel biome_series = 'Urban'
calc gapblp = '999.2'
sel biome_series = 'Water'
calc gapblp = '999.3'
save
quit
```

ATTACHMENT 3
GIS ARCINFO PROGRAMS FOR CREATING COMPOSITE LAND COVER
(continued)

NAME_VEG.AML

```
/* 3/1/00 Leslie Smith (RECON) for Pima County SDCP
/* modified 3/15 Leslie Smith
/* This AML assigns names to character fields biome, series
/* assoc and subassoc in composite land cover
/* based on compblp attribute values

&echo &on
arcedit
ec comp_veg
ef lab
sel all
/*calc biome = ''
/*calc series = ''
/*calc assoc = ''
/*calc subassoc = ''

sel compblp CN '122.4'
calc biome = 'Great Basin Conifer Woodland'
resel compblp CN '122.41'
calc series = 'Pinyon-Juniper Series'
resel compblp CN '122.415'
calc assoc = 'Juniperus monosperma Association'
resel compblp CN '122.4151'
calc subassoc = 'Juniperus monosperma-Vauquelinia californica mixed scrub Subassociation'

sel compblp CN '122.6'
calc biome = 'Madrean Montane Conifer Forest'
resel compblp CN '122.61'
calc series = 'Douglas-fir-Mixed Conifer Series'
sel compblp CN '122.62'
calc series = 'Pine Series'

sel compblp CN '123.3'
calc biome = 'Madrean Evergreen Forest and Woodland'
resel compblp CN '123.31'
calc series = 'Encinal(Oak) Series'
sel compblp CN '123.319'
calc assoc = 'Quercus ajoensis-mixed scrub Association'
sel compblp CN '123.32'
calc series = 'Oak-Pine Series'

sel compblp CN '124.7'
calc biome = 'Sonoran Riparian Woodland'
resel compblp CN '124.71'
calc series = 'Mesquite Series'
resel compblp CN '124.711'
```

ATTACHMENT 3
GIS ARCINFO PROGRAMS FOR CREATING COMPOSITE LAND COVER
(continued)

NAME_VEG.AML (cont.)

```
calc assoc = 'Prosopis glandulosa riparian woodland Association'
sel compblp CN '133.3'
calc biome = 'Interior Chaparral'
resel compblp CN '133.32'
calc series = 'Manzanita Series'
sel compblp CN '133.36'
calc series = 'Mixed Evergreen Sclerophyll Series'
resel compblp CN '133.361'
calc assoc = 'Mixed sclerophyll Association'

sel compblp CN '143.1'
calc biome = 'Scrub-Grassland(Semidesert Grassland)'
resel compblp CN '143.14'
calc series = 'Sacaton-Scrub Series'
sel compblp CN '143.15'
calc series = 'Mixed Grass-Scrub Series'
sel compblp CN '143.152'
calc assoc = 'Mixed grass-Prosopis juliflora Association'
sel compblp CN '143.155'
calc assoc = 'Mixed grass-mixed scrub Association'
sel compblp CN '143.16'
calc series = 'Shrub-Scrub Disclimax Series'
resel compblp CN '143.163'
calc assoc = 'Applopappus tenuisectus-Prosopis juliflora Association'

sel compblp CN '153.2'
calc biome = 'Chihuahuan Desertscrub'
resel compblp CN '153.21'
calc series = 'Creosotebush-Tarbush Series'
sel compblp CN '153.26'
calc series = 'Mixed scrub Series'

sel compblp CN '154.1'
calc biome = 'Sonoran Desertscrub'
resel compblp CN '154.11'
calc series = 'Creosote-Bursage Series'
resel compblp CN '154.111'
calc assoc = 'Larrea divaricata Association'
resel compblp CN '154.1111'
calc subassoc = 'Larrea tridentata-Ambrosia dumosa Subassociation'
sel compblp CN '154.1111/154.1115'
calc subassoc = 'Larrea tridentata-Ambrosia dumosa/L. tridentata-Prosopis glandulosa
floodplain Subassociation'
sel compblp CN '154.1112'
calc subassoc = 'Larrea tridentata-Ambrosia mixed scrub Subassociation'
sel compblp CN '154.1112/154.1115'
```

ATTACHMENT 3
GIS ARCINFO PROGRAMS FOR CREATING COMPOSITE LAND COVER
(continued)

NAME_VEG.AML (cont.)

```
calc subassoc = 'Larrea tridentata-Ambrosia dumosa/Larrea tridentata-Prosopis glandulosa floodplain Subassociation'
sel compblp CN '154.1113'
calc subassoc = 'Larrea tridentata-Ambrosia deltoidea-Fouquieria spendens Subassociation'
sel compblp CN '154.1114'
calc subassoc = 'Larrea tridentata-Annuals Subassociation'
sel compblp CN '154.1115'
calc subassoc = 'Larrea tridentata-Prosopis glandulosa floodplain Subassociation'
sel compblp CN '154.1115/154.1111'
calc subassoc = 'Larrea tridentata-Prosopis glandulosa floodplain/Larrea tridentata-Ambrosia dumosa Subassociation'
sel compblp CN '154.1115/154.1214'
calc subassoc = 'Larrea tridentata-Prosopis glandulosa floodplain/Acacia-Ambrosia ambrosioides Subassociation'
sel compblp CN '154.12'
calc series = 'Paloverde-Mixed Cacti Series'
resel compblp CN '154.121'
calc assoc = 'Ambrosia deltoidea-Cercidium microphyllum-mixed scrub Association'
resel compblp CN '154.1211'
calc subassoc = 'Ambrosia deltoidea-Cercidium microphyllum middle bajada Subassociation'
sel compblp CN '154.1212'
calc subassoc = 'Ambrosia deltoidea-Cercidium microphyllum pediment mixed shrub Subassociation'
sel compblp CN '154.1213'
calc subassoc = 'Cercidium microphyllum-Ambrosia deltoidea-simmondsia chinensis-pediment Subassociation'
sel compblp CN '154.1214'
calc subassoc = 'Acacia-ambrosia ambrosioides Subassociation'
sel compblp CN '154.1215'
calc subassoc = 'Prosopic glandulosa-Cercidium floridum Subassociation'
sel compblp CN '154.1216'
calc subassoc = 'Cercidium microphyllum-Ambrosia deltoidea-Olneya tesota Subassociation'
sel compblp CN '154.123'
calc assoc = 'Simmondsia chinensis-mixed scrub Association'
resel compblp CN '154.1231'
calc subassoc = 'Simmondsia-Encelia-Fouquieria Subassociation'
sel compblp CN '154.1232'
calc subassoc = 'Simmondsia-Viguiera-Eriogonum Subassociation'
sel compblp CN '154.1234'
calc subassoc = 'Simmondsia-Atriplex polycarpa Subassociation'
sel compblp CN '154.125'
calc assoc = 'Larrea divaricata-mixed scrub Association'
sel compblp CN '154.126'
calc assoc = 'Encelia farinosa-mixed scrub Association'
```

ATTACHMENT 3
GIS ARCINFO PROGRAMS FOR CREATING COMPOSITE LAND COVER
(continued)

NAME_VEG.AML (cont.)

```
resel compblp CN '154.1261'
calc subassoc = 'Cercidium microphyllum-Encelia-Lemaireocereus-Jatropha
Subassociation'
sel compblp CN '154.1262'
calc subassoc = 'Cercidium microphyllum-Encelia-Ambrosia deltoidea Subassociation'
sel compblp CN '154.1263'
calc subassoc = 'Cercidium microphyllum-Encelia-Ambrosia dumosa Subassociation'
sel compblp CN '154.127'
calc assoc = 'Mixed shrub-Cercidium microphyllum-Olneya tesota-mixed scrub
Association'
resel compblp CN '154.1271'
calc subassoc = 'Cercidium microphyllum-Encelia-Lemaireocereus-Bursera
Subassociation'
sel compblp CN '154.1272'
calc subassoc = 'Cercidium microphyllum-Ambrosia deltoidea-Lemaireocereus-Jatropha
Subassociation'
sel compblp CN '154.17'
calc series = 'Saltbush Series'
resel compblp CN '154.176'
calc assoc = 'Atriplex polycarpa Association'
resel compblp CN '154.1761'
calc subassoc = 'Atriplex polycarpa-A. linearis-Larrea tridentata Subassociation'
sel compblp CN '154.1762'
calc subassoc = 'A. polycarpa-A. linearis-Suaeda torreyana Subassociation'
sel compblp CN '154.1763'
calc subassoc = 'Atriplex polycarpa-A. linearis-Prosopis glandulosa Subassociation'

sel compblp CN '223.2'
calc biome = 'Interior Southwestern Riparian Deciduous Forest and Woodland'
resel compblp CN '223.21'
calc series = 'Cottonwood-Willow Series'
sel compblp CN '223.22'
calc series = 'Mixed Broadleaf Series'

sel compblp CN '224.5'
calc biome = 'Sonoran Riparian and Oasis Forests'
resel compblp CN '224.52'
calc series = 'Mesquite Series'
resel compblp CN '224.521'
calc assoc = 'Prosopsis Juliflora velutina Association'
sel compblp CN '224.523'
calc assoc = 'Prosopis velutina-mixed deciduous Association'
sel compblp CN '224.53'
calc series = 'Cottonwood-Willow Series'
```

ATTACHMENT 3
GIS ARCINFO PROGRAMS FOR CREATING COMPOSITE LAND COVER
(continued)

NAME_VEG.AML (cont.)

```
sel compblp CN '234.7'
calc biome =  'Sonoran Deciduous Swamp and Riparian Scrub'
resel compblp CN '234.71'
calc series = 'Mixed Scrub Series'
resel compblp CN '234.712'
calc assoc = 'Prosopis pubescens-mixed scrub Association'

sel compblp CN '243.5'
calc biome = 'Madrean Marshland'
resel compblp CN '243.53'
calc series = 'Cordgrass Series'
resel compblp CN '243.531'
calc assoc = 'Cordgrass Association'

sel compblp CN '244.7'
calc biome = 'Sonoran Interior Marshland'
resel compblp CN '244.71'
calc series = 'Cattail Series'
resel compblp CN '244.711'
calc assoc = 'Typha domingensis Association'
resel compblp CN '244.7111'
calc subassoc = 'Typha domingensis-Scirpus olneyi Subassociation'
sel compblp CN '244.75'
calc series = 'Saltgrass Series'
resel compblp CN '244.751'
calc assoc = 'Distichlis spicata-Juncus-mixed herb Association'
sel compblp CN '244.751/124.711'
calc assoc = 'Distichlis spicata-Juncus-mixed herb/Prosopis glandulosa riparian
woodland Association'

sel compblp CN '999.0'
calc biome = 'unclassified'
calc series = 'unclassified'
sel compblp CN '999.1'
calc biome = 'agriculture'
calc series = 'agriculture'
sel compblp CN '999.2'
calc biome = 'urban'
calc series = 'urban'
sel compblp CN '999.3'
calc biome = 'water'
calc series = 'water'
sel compblp CN '999.4'
calc biome = 'bare ground'
calc series = 'bare ground'
save
```

ATTACHMENT 3
GIS ARCINFO PROGRAMS FOR CREATING COMPOSITE LAND COVER
(continued)

OLAY_VEG.AML

```
/* 3/1/00 Leslie Smith (RECON) for Pima County SDCP
/* modified 3/15 Leslie Smith
/* This AML overlays all veg/land cover coverages using UNION
/* adds new items to composite coverage comp_veg
/* drops unneeded items in comp_veg

&echo &on
union gap_veg sanp_veg temp1
union temp1 whip_veg temp2
union temp2 cien_veg temp3
union temp3 org_veg comp_veg
clip comp_veg pimabnd temp4
kill comp_veg all
copy temp4 comp_veg
kill temp1 all
kill temp2 all
kill temp3 all
kill temp4 all
additem comp_veg.pat comp_veg.pat compblp 20 20 c 0
additem comp_veg.pat comp_veg.pat biomeblp 5 5 c 0
additem comp_veg.pat comp_veg.pat seriesblp 6 6 c 0
additem comp_veg.pat comp_veg.pat biome 80 80 c 0
additem comp_veg.pat comp_veg.pat series 80 80 c 0
additem comp_veg.pat comp_veg.pat assoc 80 80 c 0
additem comp_veg.pat comp_veg.pat subassoc 100 100 c 0
additem comp_veg.pat comp_veg.pat class_level 3 3 c 0
/*additem comp_veg.pat comp_veg.pat conf_level 3 3 c 0
dropitem comp_veg.pat comp_veg.pat temp3#
dropitem comp_veg.pat comp_veg.pat temp3-id
dropitem comp_veg.pat comp_veg.pat temp2#
dropitem comp_veg.pat comp_veg.pat temp2-id
dropitem comp_veg.pat comp_veg.pat temp1#
dropitem comp_veg.pat comp_veg.pat temp1-id
```

ATTACHMENT 3
GIS ARCINFO PROGRAMS FOR CREATING COMPOSITE LAND COVER
(continued)

ORG_VEG.AML

```
/* 3/1/00 Leslie Smith (RECON) for Pima County SDCP
/* modified 3/15 Leslie Smith
/* this AML assigns BLP codes to the attribute orgblp
/* in the coverage org_veg based on original attributes
/* vegetation and map_code
/* some BLP codes assigned based on information from
/* Peter Warren (TNC), pers comm 3/10/00 which corrects
/* errors in the original Organ Pipe coverage
&echo &on
arcedit
ec org_veg
ef lab
sel all
calc orgblp = map_code
sel map_code = '123.319R'
calc orgblp = '123.319'
sel map_code = '124.711R'
calc orgblp = '124.711'
sel map_code = '152.1115R'
calc orgblp = '154.1115'
sel map_code =  '154.1111/154.1115R'
calc orgblp = '154.1111/154.1115'
sel map_code = '154.1112/154.1115R'
calc orgblp = '154.1112/154.1115'
sel map_code = '154.1115R'
calc orgblp = '154.1115'
sel map_code = '154.1115R/154.1111'
calc orgblp = '154.1115/154.1111'
sel map_code = '154.1115R/154.1214R'
calc orgblp = '154.1115/154.1214'
sel map_code = '154.1115R+154.1214R'
calc orgblp = '154.1115/154.1214'
sel map_code = '154.1116R'
calc orgblp = '154.1115'
sel map_code = '154.1214R'
calc orgblp = '154.1214'
sel map_code = '154.1215R'
calc orgblp = '154.1215'
sel map_code = '244.751/124.711R'
calc orgblp = '244.751/124.711'
sel vegetation = 'Ambrosia deltoidea-Cercidium microphyllum middle bajada association'
calc orgblp = '154.1211'
sel map_code = 'Bare ground'
calc orgblp = '999.4'
asel all
sel map_code = 'Campground'
calc orgblp = '999.2'
```

ATTACHMENT 3
GIS ARCINFO PROGRAMS FOR CREATING COMPOSITE LAND COVER
(continued)

ORG_VEG.AML (cont.)

```
asel all
sel map_code = 'Lukeville'
calc orgblp = '999.2'
asel all
save
quit
```

ATTACHMENT 3
GIS PROGRAMS FOR CREATING COMPOSITE LAND COVER
(continued)

SANP_VEG.AML

```
/* 3/1/00 Leslie Smith (RECON) for Pima County SDCP
/* revised 3/15/00 Leslie Smith
/* This AML assigns BLP codes to the attribute sanpblp
/* in the coverage sanp_veg based on the original attribute
/* psym which has associated names and BLP codes
/* in the shadeset sanpedro.shd
&echo &on
arcedit
ec sanp_veg
ef lab
sel all
calc sanpblp = ''
sel psym = 0
calc sanpblp = '999.0'
sel psym = 100
calc sanpblp = '999.0'
sel psym = 724
calc sanpblp = '999.0'
sel psym = 5
calc sanpblp = '999.1'
sel psym = 316
calc sanpblp = '123.31'
sel psym = 9
calc sanpblp = '123.32'
sel psym = 999
calc sanpblp = '122.61'
sel psym = 963
calc sanpblp = '122.62'
sel psym = 787
calc sanpblp = '133.32'
sel psym = 75
calc sanpblp = '133.36'
sel psym = 739
calc sanpblp = '143.15'
sel psym = 315
calc sanpblp = '234.71'
sel psym = 439
calc sanpblp = '224.53'
sel psym = 387
calc sanpblp = '244.71'
sel psym = 2
calc sanpblp = '223.22'
save
quit
```

ATTACHMENT 3
GIS ARCINFO PROGRAMS FOR CREATING COMPOSITE LAND COVER
(continued)

WHIP_VEG.AML

```
/* 3/1/00 Leslie Smith (RECON) for Pima County SDCP
/* modified 3/15/00 Leslie Smith
/* This AML assigns BLP codes to the attribute whipblp
/* in the coverage whip_veg based on original attribute blp

&echo &on
arcedit
ec whip_veg
ef lab
sel all
calc whipblp = blp
resel blp = ''
calc whipblp = '999.0'
save
quit
```

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ATTACHMENT 4

ATTACHMENT 4
METADATA FOR GIS COVERAGES

Composite Vegetation/Land Cover Coverage

Descriptive name	Composite Vegetation/Land Cover Coverage
File name	comp_veg
Spatial domain	Pima County
Abstract	This composite coverage was created by overlaying GAP, WHIP, San Pedro, Cienega Creek, and Organ Pipe coverages. These coverages were modified prior to union to include only those attributes containing land cover data. New attributes were created for each coverage to hold Brown, Lowe, and Pase (BLP) vegetation classification. Attributes of component coverages were retained in composite and used to assign a BLP classification to composite polygons. "Comp_blp" attribute was calculated first from GAP attribute "gap_blp" then replaced where San Pedro, WHIP, Cienega, and Organ Pipe blp attributes overlapped GAP, in this order.
Feature type	Polygon
Feature count	15020
Known errors/ qualifications	This coverage is being reviewed and revised by the STAT for the SDCP
Source organization	RECON Environmental Inc. 1927 Fifth Avenue, Suite 200 San Diego, CA 92101-2358 (619) 308-9333 Phone; (619) 308-9334 Fax
Source contact	Leslie Smith (lsmith@recon-us.com)
Source document or file name	M:\jobs\3273b\gis\coverages\comp_veg
Source date	March 2000
Source scale	Multiple scales
Source format	Multiple coverages
Date of last update on maintenance?	March 17, 2000
Maintenance frequency	Ongoing
Maintenance format	Coverage
Maintenance description	As component coverages are revised and made available these will be incorporated into the composite vegetation coverage
Projection	Stateplane feet, Zone 3176, datum NAD27

ATTACHMENT 4
METADATA FOR GIS COVERAGES
(continued)

Composite Vegetation/Land Cover Coverage- BLP Series Level Classification Only

Descriptive name	Composite Series Level Vegetation/Land Cover Coverage
File name	series_veg
Spatial domain	Pima County
Abstract	This coverage was created by dissolving composite land cover coverage comp_veg on series_level attributes "blpseries" and "series". See comp_veg metadata.
Feature type	Polygon
Feature count	4798
Known errors/ qualifications SDCP	This coverage is being reviewed and revised by the STAT for the
Source organization	RECON Environmental, Inc. 1927 Fifth Avenue, Suite 200 San Diego, CA 92101-2358 (619) 308-9333 Phone (619) 308-9334 Fax
Source contact	Leslie Smith (lsmith@recon-us.com)
Source document or file name	M:\jobs\3273b\gis\coverages\comp_veg
Source date	March 2000
Source scale	Multiple scales
Source format	Multiple coverages
Date of last update on maintenance?	March 17, 2000
Maintenance frequency	Ongoing
Maintenance format	Coverage
Maintenance description	Will be revised after each composite land cover coverage revision
Projection	Stateplane feet, Zone 3176, datum NAD27