STATEWIDE RIPARIAN INVENTORY AND MAPPING PROJECT:
METHODOLOGY AND UPDATED ACCURACY ASSESSMENTS FOR PERENNIAL WATERS

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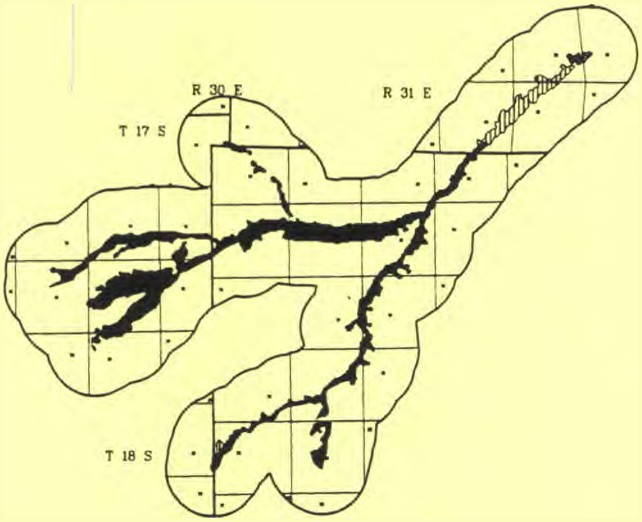

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PROJECT FUNDING

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EXECUTIVE SUMMARY

In 1992 the Arizona Game and Fish Department was directed by the Waters - Riparian Protection Program (Arizona Revised Statute 45-101) to conduct investigations of Arizona's riparian areas. A report was produced that described riparian and land use mapping, riparian ecosystems function and its value to wildlife, development of a classification system, and existing options for riparian protection (Valencia et al. 1993). A more detailed accounting of methods used on perennial waterways by the Statewide Riparian Inventory and Mapping (SRIM) project and an updated analysis of vegetation map successes and failures is provided by the current report.

Vegetation information was collected from October 1992 to October 1994 using a releveé technique and recorded on standardized data forms. These data were used to confirm identities of plants that appeared in aerial videography and to assess accuracy of maps generated by satellite imagery. They also provide a snapshot of conditions existing at specific times and places along Arizona's waterways. More than 270 plant species were reported by Arizona Game and Fish Department biologists as occurring along perennial waters.

Data were coded and stored in database files that are linked by unique identifiers for each sample. The potential exists to link these data sets with Geographic Information System maps using map coordinates. One file contains general site information, including land use and hydrological information. Another contains data relating to vegetation composition and structure. A third file contains photograph information. A final database was used to track status of field activities, summarize vegetation data collected, classify polygons according to data, and record problems encountered by field biologists.

Of 1866 polygons randomly selected from statewide maps of vegetation along perennial waterways, 1671 were sampled. Some polygons were not available for sampling because they had been scoured by floodwater and were without vegetation or were underwater due to high reservoir levels. Other polygons were inaccessible due to topography and, sometimes, landowners chose to deny access. A few polygons were overlooked or missed by biologists. Additional polygons were excluded from sampling because measurements on aerial photography showed them to be less than 60 m wide, the minimum mapping unit.

Of polygons sampled, 1461 (87%) were correctly identified as riparian vegetation. For this study, "A riparian association of any kind is one which occurs in or adjacent to drainages and/or their floodplains and which is further characterized by species and/or life-forms different from that of the immediately surrounding non-riparian climax" (Lowe 1985:62). This definition is also the nucleus of Arizona Game and Fish Commission (1996) policy that addresses riparian habitat issues.

Only 515 (35%) of these riparian polygons were correctly identified to vegetation series. Classification errors were due to incorrect delineation of riparian boundary, important understory

videography. Most boundary errors involved mesquite communities at low elevations and meadow or conifer communities at high elevations. Boundary adjustments to exclude non-riparian portions were required for 271 (18%) of sampled riparian polygons.

Understory riparian obligate plants such as Arizona madrone, broadleaf deciduous trees, and mountain willows were not visible to aerial videography or satellite imagery in conifer and oak dominated landscapes. Many polygons affected by this problem remain unmapped, but for another reason. Based on field measurements, most (86%) montane riparian areas were too small to be even considered for this mapping effort. This resulted in approximately 930 acres being removed from perennial riparian area maps.

Species misidentification by video interpreters commonly involved confusing one broadleaf deciduous species with another or confusing mesquite with tamarisk. Adding to these difficulties was the fact that often these plants occurred close together or in mixes.

Combining similar plant associations increased classification accuracy to 45 percent. Grouped vegetation classes follow an elevational gradient similar to that reported elsewhere. Tamarisk, cottonwood-willow, and mesquite communities occupied low elevation sites and were replaced by mixed broadleaf communities at middle elevations. High elevation sites were occupied by conifer-oak, mountain shrub, and wet meadow communities.

Final SRIM vegetation maps show approximately 165,260 acres of riparian area along perennial waterways in 10 vegetation classes, which is about 101,500 acres (38%) less than reported by Valencia et al. (1993) in 17 classes. That report was published when very little field data had been collected (<15% of selected polygons had been sampled), so maps of vegetation associated with perennial waters were mostly not validated. Most of the total acreage change is due to adjustments in riparian area boundaries. Among sampled polygons, a similar decrease (42%) in acreage was explained by shifts in classification for polygons wholly or partially non-riparian.

Comparing vegetation classes used in Valencia et al. (1993) with classes used on final SRIM perennial area maps is difficult because classes were combined and new ones created during 1994. However, both data sets show similar statewide prevalence patterns for plant communities. Tamarisk, mesquite, flood scoured, marsh, and Russian olive are essentially unchanged from 1993 to now. Combining the 1993 classes of conifer, oak, cottonwood-willow, and sycamore is nearly equivalent to combining the new classes of mixed broadleaf, cottonwood-willow, and conifer-oak.

The final accuracy of perennial riparian vegetation maps is not known exactly because all SRIM maps were not compared with known ground locations. Maps of perennial water riparian areas best delineate the boundary between riparian zones and adjacent upland zones. The classification protocol used on satellite imagery did not provide acceptable accuracy for differentiating riparian plant communities. Further analysis of field data would likely yield different plant community classes that could increase the reliability of existing vegetation maps.

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INTRODUCTION

In 1992 the Arizona Game and Fish Department (AGFD) was directed by the Waters - Riparian Protection Program (Arizona Revised Statute [ARS] 45-101) to conduct investigations of Arizona's riparian areas and to report on its findings to the Governor, legislators, and the Riparian Area Advisory Committee by December 1, 1993. A report was submitted that described riparian and land use mapping, riparian ecosystems function and its value to wildlife, development of a classification system, and existing options for riparian protection (Valencia et al. 1993). Because little field data had been collected and analyzed by the publication date, full discussion of those data and their use was delayed for inclusion in a future technical document.

This report fulfills that obligation by describing methods used on perennial waterways by the Statewide Riparian Inventory and Mapping (SRIM) project before December 1994 (all areas of the state had been inventoried and mapped except those in Grand Canyon National Park, Colorado River Tribes Reservation, White Mountain Apache Reservation, Navajo Reservation, and a small portion of the Tonto National Forest). Topics include field data collection, data forms, the purpose and disposition of data, and use of those data to create or modify vegetation maps. Results are briefly discussed along with possible future modifications to improve map accuracy.

METHODS

PURPOSE OF SITE-SPECIFIC FIELD DATA

Field data provided three important types of information about riparian areas. First, they identified what plant species occurred within a specific area. Species composition ultimately defines the plant association in a geographic area. In addition, identification of individual plants allowed training of videography interpreters, because they could learn what species were expected to be seen in an area and how they appeared in video.

Second, field data provided information on the structural aspects of riparian plant communities. Since wildlife select for particular habitat features, information about vegetation structure suggests to biologists what animal species are likely to occur in an area. Structural data also suggest relative health of a plant community. Is structure diverse, showing multiple sizes of plants, or is some age class obviously missing? In other words, the likelihood that the community will persist and provide value to wildlife into the future can be inferred from current conditions.

Last, detrimental and beneficial impacts to a specific riparian area were documented. Knowledge of activities such as livestock grazing, mining, and fuelwood cutting within the riparian zone allows conjecture about how the area reached its current condition and what its future status is likely to be. Adjacent land uses also suggest potential influence to the riparian area from either spill over of human activity from nearby upland areas or from changes in watershed condition.

These types of information relate directly to the tasks assigned AGFD by ARS 45-101. The first type allows classification and mapping of riparian ecosystems. The second provides one measure of riparian functions and values. And the last addresses current land uses.

DATA COLLECTION

Satellite imagery and aerial videography data were collected by University of Arizona (UA) staff according to methods identified in Graham and Wissler (1992). Beginning in late October 1992, three two-person field crews were trained in the identification of woody riparian plant species. Supplemental training in high elevation willows was given in July 1993. Instructions were given that any questionable plant should be collected and preserved for later identification. Crews were also trained in the use of clinometers, range finders, diameter tapes, and Global Positioning System (GPS) devices. On occasion, vegetation measurements taken by different individuals were compared and pairs of teams were asked to survey the same vegetation polygons as tests of consistency. Staff was temporarily increased from three to six two-person field-crews during fall 1994 to meet project completion dates.

Vegetation was identified by field crews for two purposes related to mapping. The first purpose was to assist assignment of vegetation classes to maps (called plant confirmation). The second purpose was to determine accuracy of maps (called map verification).

Plant confirmation was requested when videotapes of waterways showed vegetation that had not been previously observed on other tapes or was otherwise unknown to the interpreter. This process was used sporadically as mapping efforts moved around the state and plant communities changed or as vegetation appearance changed with seasons of the year.

Biologists assigned to confirm the identity of questionable plants were given prints of video frames showing sites where these plants were found. Videotapes containing zoom footage were used because individual plants could be seen distinctly at higher magnifications. Approximate Universal Transverse Mercator (UTM) coordinates, derived from recorded flight lines, showed general locations of these sites on topographic maps. Obvious landmarks that show in selected video frames allowed the site to be found more precisely on maps. The ability to find sample points on the ground was improved by supplementary wide angle prints that showed not only the sample point, but also the surrounding area.

Once the site was found, individual plants shown on the print were found and identified. Each identified plant was then circled and labeled directly on the print using a permanent ink marker. Occasionally the interpreter requested that a clump of vegetation be classified according to species composition (species homogeneity versus heterogeneity). Labeled prints and additional site information were returned to the interpreters and placed into a reference manual used to aid identification of vegetation along other stream corridors during the same time of year. This manual is archived in AGFD's Research Branch.

SAMPLING EFFORT

During winter 1992-93, sample points for map verification were selected nonrandomly by UA staff after they reviewed ARC VIEW flight files to place beginning and end points for perennial streams. Videotapes containing zoom footage were then viewed to select frames showing vegetation of interest and places having identifiable landmarks. This procedure was also used to find representative stretches of riparian vegetation.

Prominent plants shown on the zoom video frame served as the center point for a 0.5 acre (0.2 ha) sample plot, typically the entire area shown in a single zoom video frame. Plot boundaries were determined by vegetation homogeneity; sampling stopped where plant species and/or structure appeared to change. If a selected area was large or if biologists could not find the exact location shown in a zoom, data were collected from one or more sites that typified the area. These could be related back to videography by UTM coordinates.

From March 1993 to October 1994, data were collected from randomly selected classified polygons and used to assess the effectiveness of the remote sensing technique in mapping riparian areas. Sets of polygons were stratified using UA vegetation classification type and polygon size (acres), downloaded in ASCII format, and then imported into a QuattroPro spreadsheet where each polygon was assigned two random numbers. After each vegetation type was separated into five subsets based on size class (each vegetation class size range divided equally by 5), the subsets were sorted twice using the random numbers. Lastly, the required number of polygons was taken from the top of each sorted subset.

During the early development of sampling protocol, accuracy and data standards were established. Maps that correctly classified vegetation at least 80% of the time were deemed acceptable. This level of accuracy was chosen because the classification and boundary accuracy of remote sensing derived data (satellite imagery) is generally considered no greater than 85% (Jensen 1986). It was also determined that a sample of 20% of all classified polygons would be taken. A conservative estimate of classification accuracy is provided by sampling 15.8% of the total polygons ($p = 0.5$, $a = 0.05$). However, the higher sampling rate was chosen because it provided a buffer should some polygons be unavailable or otherwise unsuitable for sampling.

Field biologists were given lists showing only an identification number, acreage, and the required number of plots. In this way, their verification data could not be biased by prior knowledge of vegetation classification. After transferring some information from the Geographical Information System (GIS) to field maps, biologists were also aware of polygon shape and location. Biologists were then sent afield and asked to evaluate vegetation they found on plots accurately and consistently. Data were recorded on standardized report forms (Appendix A) using standardized codes for plant species (Appendix B). Biologists also recorded on maps any boundary discrepancies they encountered while assessing polygons.

To ensure consistency in verification effort, selected polygons were sampled using 0.5 acre plots (some measured, others estimated). One plot was used for every 2.5 acres of polygon size, with an upper limit of ten plots for any single polygon. This maximum was established because of time limitations and because 71% of mapped polygons were 25 acres or less in size (Valencia et al. 1993). Therefore, most polygons were sampled at a rate proportional to their size and some at a rate lower than wanted.

Since biologists examined the entire polygon before choosing where to place representative plots, they could detect visually any inconsistencies in species composition of large polygons. Plot placement by field crews was stratified. It was accomplished by dividing each polygon into essentially equal sized sections into which single plots were placed. These subdivisions typically were drawn on topographic maps and later assisted in making boundary changes on vegetation maps if some portions of polygons were either non-riparian or contained plant communities different from those classified by the video interpreter.

For each selected polygon, data were collected using field procedures recommended by the Colorado Plateau Vegetation Advisory Committee (1992). This method uses a releveé technique based on "species prominence values," a rating that combines estimated dominance, biomass, and frequency of occurrence. A prominence value is assigned to each species observed at the site on a scale of one through five.

DISPOSITION OF DATA

Immediately upon returning from the field, crews reviewed their data sheets for completeness and accuracy. Unknown plant species were identified and data sheets were corrected accordingly. Completed data sheets and associated maps were reviewed before being stored within AGFD files. Complete copies of data sheets were sent to UA. Video frame prints, appended by field notes written directly on them, were returned simultaneously. Data were recorded in dBASE relational database files (Fig.1).

One file (VEGSITE.DBF) contains general site information, including land use and hydrological information. Another file (VEGDATA.DBF) contains data relating to vegetation composition and

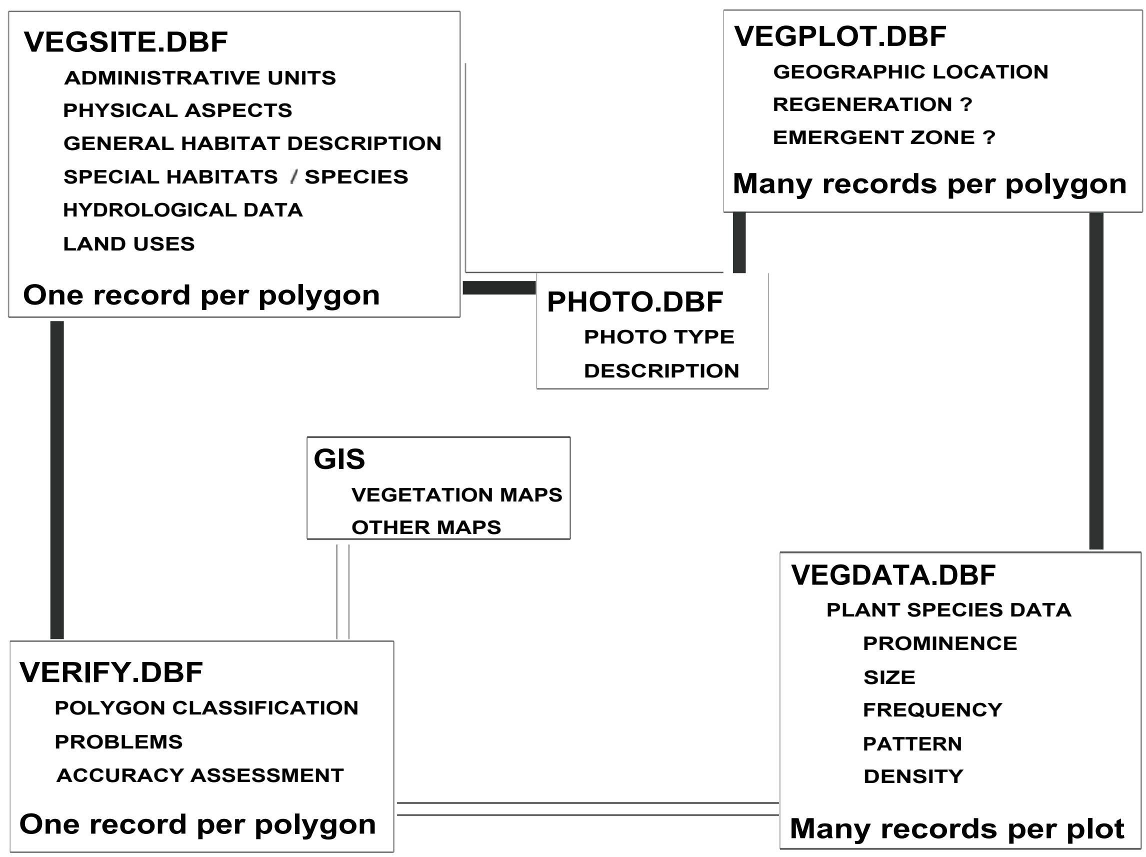

Figure 1. Relationships of information components for classifying and mapping riparian vegetation associated with perennial waters. Text within boxes describe information type. Solid lines show links among relational databases. Hollow lines show major information flow.

structure. A third file (PHOTOLOG.DBF) contains photograph information. All three are linked by topographic map name and plot number, a unique identifier of each sample. The potential exists to link these data sets with GIS maps using UTM coordinates for plots where GPS was used to record plot centers (found in VEGPLOT.DBF). Otherwise, data can be linked to GIS using uniquely numbered polygons. Complete descriptions of database files can be found in Appendix C.

A final database (VERIFY.DBF) was created to track status of field activities, summarize vegetation data collected, classify polygons according to data, and record problems encountered by field biologists. When sample polygons were selected, polygon identification number, acreage, UA vegetation class, and number of required plots were imported into database fields from the spreadsheet used to select polygons. As results of field work were completed, the remaining fields in the database were manually coded with appropriate values.

The greatest value of this database was its use in assessing classification accuracy and potential reasons for errors. After the arithmetic mean of prominence value was calculated for each species recorded in the polygon, results were entered in the database starting with the highest value. These overall prominence values lead to determination of vegetation class. The dominant species (highest value) placed a polygon within a series and the remaining species refined the class to an association. In this way, existing vegetation, as reported by field crews, drove the classification scheme.

The original UA plant class list was modified as field data produced different combinations of species found in riparian areas (Appendix D). Changes also reflected groupings that followed Brown et al. (1979) closer than those of the original list.

RESULTS AND DISCUSSION

Table 1 summarizes results of the sampling effort before December 1994. All proportions reported below include 90% confidence intervals. Taxonomic equivalents of common plant names used in this section can be found in Appendix B.

Field crews sampled 1671 polygons (a minimum of 1490 was needed). Some polygons were not available for sampling because they had been scoured by floodwater and were without vegetation. Others were underwater due to high reservoir levels. Some polygons were inaccessible due to topography and, sometimes, landowners chose to deny access. These are grouped as "Unavailable" in Table 1. Biologists also overlooked or missed some polygons in the field ("Missed" in Table 1). Additional polygons were excluded from sampling because measurement on 1:5000 scale color aerial photographs of the Apache-Sitgreaves National Forest showed these polygons to be less than 60 m wide (12 mm wide on the photos), the minimum mapping unit.

Of polygons sampled, 1461 (87.4 ± 1.3%) were correctly identified as riparian vegetation. For this study, "A riparian association of any kind is one which occurs in or adjacent to drainages and/or their floodplains and which is further characterized by species and/or life-forms different from that of the immediately surrounding non-riparian climax" (Lowe 1985:62). This definition is also the nucleus of Arizona Game and Fish Commission (1996) policy that addresses riparian habitat issues.

A polygon was considered to be correctly classified when field data showed that it was within the same vegetation series as its map classification. Accordingly, 515 (35.2 ± 1.2%) riparian polygons were correctly classified.

Table 1. Summary of sample results from map verification before December 1994.

	Number of Polygons	Percent of		Acres[1]	Percent of		Number of Plots[2]	Percent of	
		Total	Sample		Total	Sample		Total	Sample
TOTAL SELECTED	**1,886**			**72,517**			**8,416**		
Unavailable	109	5.8		4,819	6.6		731	8.7	
Missed	92	4.9		3,543	4.9		378	4.5	
Photo Excluded[3]	14	0.7		83	0.1		31	0.4	
TOTAL SAMPLED	**1,671**	88.6		**64,073**	88.4		**6,470**	76.9	
Non-riparian[4]	210		12.6	10,403		16.2	787		12.2
Riparian - Incorrect classification	946		56.6	27,868		43.5	3,377		52.2
Riparian - Correct classification	515		30.8	25,803		40.3	2,306		35.6

[1] Values reflect shifts of acreage among categories for polygons that were partially non-riparian or unsampled. Shifted acreage equals polygon acreage times the proportion of shifted plots to total plots for each affected polygon (n=387).
[2] Values reflect shifts of plots among categories for polygons that were partially non-riparian or unsampled. Excludes 806 plots that were not sampled because they were associated with obvious upland vegetation.
[3] Shown in aerial photographs to be narrower than 60 m.
[4] Includes upland polygons (n=194) and developed, disturbed, or agricultural polygons (n=16).

One of the most important aspects of the map verification process was to give feedback to the aerial video interpreter to help in finding and correcting classification errors during the mapping process. Not only were specific polygons changed, but maps were reevaluated and corrections were applied throughout. This methodology yielded a 20% increase in classification accuracy for maps of the San Pedro River (Valencia et al. 1993).

Several types of errors were recognized in this process. A summary of the errors and proposed solutions were presented in Valencia et al. (1993). Some of those and others are reviewed here to describe what actions were taken to correct them.

Some classification errors were due to incorrect identification of the extent of the riparian area. The majority of this error involved mesquite communities at low elevations (26.3 ± 5.2% of misclassified upland polygons) and meadow and conifer communities at high elevations (13.4 ± 4.0% and 34 ± 5.6%, respectively). Among sampled riparian polygons, 271 (18.5 ± 1.7%) required boundary adjustments to exclude non-riparian portions.

High elevation errors were greater for at least three reasons. First, montane riparian corridors are narrow and often occur in shadowy canyons. Therefore, they are not accurately detected by satellite imagery. Second, a less dramatic difference between upland and riparian vegetation occurs in montane areas than in desert areas due to greater uniformity in moisture. This effect was escalated by UA's use of late spring satellite imagery that reflected high moisture levels in non-riparian areas due to recent snowmelt. Last, it appeared that many polygons were hand-digitized by UA and showed very rough approximations of actual vegetation boundaries.

Boundaries were corrected using data collected by field crews. Boundary problems were always identified and drawn on topographic maps while crews were afield. In 1994, crews began recording GPS coordinates of upland/riparian edges of sampled polygons. These new boundaries were compared to contour lines on topographic maps. The same relationship was assumed to exist between vegetation and topography for unmeasured polygons when boundary changes were made to that set.

Based on field crew measurements (n=319), most (86.2 + 3.2%) montane riparian areas were too small to be used in this mapping effort. The majority (66.5 + 4.3%) of sampled polygons were one pixel wide (30 m) or less. Polygons reported by field crews as less than the minimum mapping unit of 60 m were deleted from maps, although field data were retained for database use. Other polygons in the White Mountains were removed from maps if aerial photography showed them to be less than 60 m wide or if they were upland polygons (typically aspens). However, no polygons undetected by satellite imagery were added if they were seen on aerial photographs. This resulted in approximately 930 acres being removed from maps.

Table 2. Grouped vegetation classes used on maps of perennial waters.

GIS code	Map key name	Included vegetation class codes'
A	Cottonwood-Willow	A < 3200 ft elevation; E2
B	Mesquite	B; El, E3; H; K; L
C	Tamarisk	C; R
D	Strand	D
M	Wet Meadow	M
N	Russian Olive	N
O	Conifer-Oak	O and P 5000 ft elevation
U	Marsh	G; J; Q; T
W	Mountain Shrub	W; X8
X	Mixed Broadleaf	A ≥ 3200 ft elevation; 0 and P < 5000 ft elevation; S; X except X8

From class codes in Appendix D. Unless an individual association is identified, all associations within a series were included. Excludes flood scoured (F), agriculture (Y), and areas not visited (Z).

Some polygons likely will always be misclassified when compared with field measurements because many understory species are not visible from above and canopy species have enough prominence to influence classification by field biologists. As examples, several evergreen oaks often form a mid-level canopy underneath an upper canopy of pine, and several high elevation willows form an understory beneath a variety of conifers. The video interpreter sees the conifer, but not the riparian plants.

Misclassifications also occurred because some species were indistinguishable from others when viewed on video. Two common errors were to confuse broadleaf deciduous species with one another and to confuse mesquite with tamarisk. Adding to these difficulties was the fact that often these plants occurred close together or in mixes. The result was polygons assigned to the wrong series.

These last two problems were addressed by creating vegetation classes that grouped similar plant associations together for mapping purposes (Table 2). Some were grouped together because

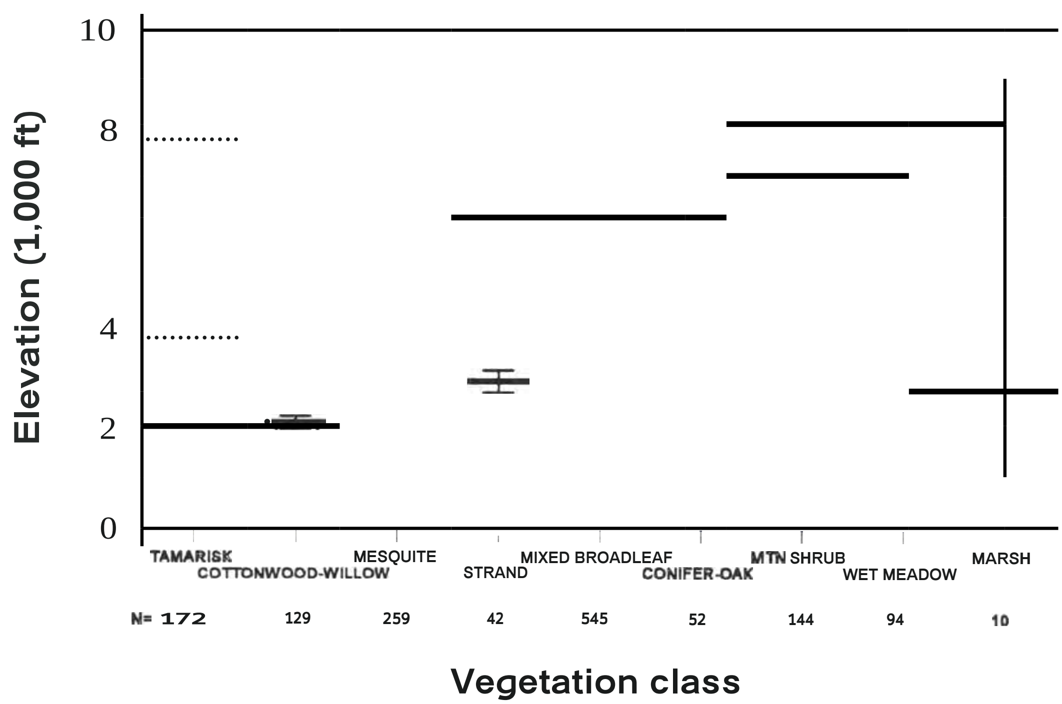

Figure 2. Elevations of grouped vegetation classes used on maps of perennial waters. Class means are shown with 90% confidence intervals.

preliminary data showed they usually occurred together and were indistinguishable on videography (e.g. tamarisk and arrow weed communities). Others were grouped because they occupied similar ecological zones and had similar appearance (e.g. marsh communities consisting of reed, cattail, bulrush, or cane species). Preliminary data also suggested that an elevation cutoff might reduce classification errors involving mixed broadleaf, cottonwood-willow, and conifer riparian communities.

The order of grouped vegetation classes along an elevational gradient (Fig. 2) is similar to that reported by Pase and Layser (1977) and Szaro (1989). Tamarisk, cottonwood-willow, and mesquite communities occupied low elevation sites and were replaced by mixed broadleaf communities at middle elevations. High elevation sites were occupied by conifer-oak, mountain shrub, and wet meadow communities. Using these classes increased classification accuracy to 45.4 + 2.2% (655 correct polygons out of 1444 grouped polygons with known elevations).

Although not carried out due to lack of time, the intent was to refine vegetation classes by reevaluating field data further and then reclassifying polygons on maps of perennial waters. Two identified needs were clarification of some grouped vegetation classes and improvement of agreement with Brown et al. (1979) classification.

The conifer-oak group needs further definition. Currently, it includes areas in which understory riparian obligate plants such as Arizona madrone, broadleaf deciduous trees, and mountain willows were present but not visible to aerial videography or satellite imagery. These plants are diagnostic of riparian forests when present (USFS 1987c). Some conifer associations are recognized as riparian habitat types by the U.S. Forest Service (Alexander and Ronco 1987; USFS 1987a, 1987b, 1987c). Others have been identified by Pase and Layser (1977) and Szaro (1989). Also conifer-oak habitat types (e.g. Arizona cypress/silverleaf oak) expected to occur on upper terraces, but that occupy wetter sites, are considered riparian (USFS 1987a). All these possibilities are indistinguishable within the current map classification.

Some groups should be subdivided to follow better the classification regime suggested by Brown et al. (1979). For instance, a cottonwood-willow series can be found within each of four distinct biomes and a mesquite series within two biomes. Perennial maps currently treat these six series as two groups. To account for these distinctions fully, data analysis using bioregions and/or life zones as factors are needed. Since this incorporates climatic and evolutionary differences within biotic communities, closer relationships possibly can be established among plant assemblages, geographical location, and wildlife distributions.

Plants found by AGFD biologists along perennial waters have been assigned to Brown and Lowe (1980) biotic communities (Appendix E). Classification was done by intersecting riparian sample points with previously mapped upland biotic communities. This provides an approach to classifying the riparian communities, because it can be assumed that riparian areas have climatic and evolutionary histories similar to that of the surrounding upland. Between 37 and 129 of the 270 listed plants were reported by other authors as occurring within riparian areas in the Southwest.

Resultant classifications for final SRIM perennial area maps are summarized in Table 3. Total riparian vegetation reported here is about 101,500 acres (38.0 ± 0.1%) less than reported by Valencia et al. (1993:xii). That report was published when very little field data had been collected (<15% of selected polygons had been sampled), so maps of vegetation associated with perennial waters were mostly not validated. Therefore, vegetation classification and acreages given in 1993 were uncorrected and, as shown now, inaccurate.

Table 3. Areal extent of categories found on final maps of vegetation associated with perennial waters.

	Acres	Percent
Classified **vegetation**	**154264**	**93.3**
Tamarisk	58686	35.5
Mesquite	29978	18.1
Mixed broadleaf	18035	10.9
Strand	14623	8.8
Cottonwood-willow	12600	7.6
Conifer-oak	10440	6.3
Marsh	4923	3.0
Wet meadow	3240	2.0
Russian olive	1108	0.7
Mountain shrub	630	0.4
Flood scoured[1]	**10367**	**6.3**
Unlabeled[2]	**631**	**0.4**
Total	**165263**	**100.0**

[1] Vegetated according to satellite data, but scoured by winter flooding before classification could occur.
[2] Not visited and classified.

Most of the total acreage change is likely due to adjustments to the riparian area boundary. Among sampled polygons, a similar decrease (42.1 ± 0.3%) in acreage is explained by shifts in classification for polygons wholly or partially non-riparian (10,402 non-riparian acres were reclassified from 24,714 satellite riparian acres).

Comparing vegetation classes used in Valencia et al. (1993) with classes used on final SRIM maps is difficult because classes were combined and new ones created during 1994. However, both data sets show similar prevalence patterns for plant communities statewide. Tamarisk (35.1 vs. 35.5%), mesquite (17.5+ vs. 18.1%), flood scoured (7.4 vs. 6.3%), marsh (2.1+ vs. 3.0%), and Russian olive (<1.0 vs. 0.7%) are essentially unchanged from 1993 to now. Combining the 1993 classes of conifer, oak, cottonwood-willow, and sycamore (21.0%) is nearly equivalent to combining the new classes of mixed broadleaf, cottonwood-willow, and conifer-oak (24.8 %).As stated earlier, many classification problems were associated with these plant communities. Map verification merely resorted them into similar categories.

At this stage, the accuracy of riparian vegetation maps is quantitatively unknown. All "final" maps were not compared with known ground locations. However, a field check of the San Pedro and Santa Cruz rivers showed close agreement between maps and existing plant communities. The field check included observations of areas that had not been measured by field crews. In an attempt to evaluate overall mapping accuracy, we distributed many maps to various natural resource professionals. Although the response rate was low, no major problems were reported to project personnel.

In conclusion, maps of riparian vegetation along perennial waters exceed project accuracy standards for delineating the boundary between riparian zones and adjacent upland zones. The classification protocol used on satellite imagery did not provide acceptable accuracy for differentiating riparian plant communities. Interpretation of field data was used to direct modifications to GIS maps. Further analysis of these data would likely yield different plant community classes that could increase the reliability of existing vegetation maps.

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Appendix A. Standardized data forms, including definitions, used during the perennial waters phase of the Statewide Riparian Inventory and Mapping Project.

Riparian Field Form
VEGETATION

Date:
Observer Initials:
Stream:
County
Segment:
Landowner:
UTM(N):
Admin Unit
UTM(E):
Vidframe #:
Flight Date:
Elevation:
7.5 min Quad:
Point:
Aspect: F N NE E SE S SW W NW
Photo ID Roll#:
Frame(s)
Slope: 0 1 2 3 4
Plot#: of

SPECIES	PROM (1-5)	SIZE T(1-5)S(1-4)		FREQ (1-5)	HGT T(1-6)(1-4)		DIST (E,L,C)	NOTES

Over/Understory and Ground Cover Description: ______________________

Adjacent Upland Vegetation (predominant veg type): ______________________

Adjacent Land Use (circle appropriate): dirt/paved road trail agric industrial mining urban grazing logging firewood wilderness cabin RR campground ranch other(s): ________

Special Habitat Features (circle appropriate): springs cliffs caves talus cienega/marsh snags dead/down cavities eroded banks dead limbs other(s): ________

TE&S/Special Interest Spp Observed: ______________________

On sample plot, evaluate the following:

Grazing Intensity:	None	Lo	Med	Hi	Unknown
Recreation Intensity:	None	Lo	Med	Hi	Unknown
Evidence of Mining Activity?			Y	N	Unknown
Evidence of Firewood Collection?			Y	N	Unknown
Regeneration zone present?			Y	N	Species: ________
Emergent zone present?			Y	N	Species: ________

Additional Notes/Calculations: ______________________

Instructions for Vegetation Field Form and Definitions of Terms

Additional Notes: Use this space for any comments on the area as a whole or for expansion to answers.

Adjacent Land Use: Circle applicable land uses occurring in areas next to the riparian zone; note additional ones as necessary.

Adjacent Upland Vegetation: Describe predominant vegetation type found on the adjacent benches/uplands, e.g. oak woodland, pinyon-juniper woodland, Sonoran desert scrub.

Admin Unit: If on FOR land, an example is Kaibab NF (National Forest); if on BLM land, examples are San Pedro Riparian National Conservation Area, Phoenix Resource Area; if on NPS, the admin unit might be Saguaro National Monument; if on NAT, the unit might be Navajo; if on STA, it might be Dead Horse Ranch State Park, etc.

Aspect: Cardinal direction of the slope. Aspect and slope are recorded at the same location. Use a compass to find aspect. If slope is 0%, aspect is flat. Use F (flat), N, NE, E, SE, S, SW, W, NW.

County: Use a complete name.

Date: Use standard format, i.e. 11/22/92.

Distribution: Describes the general pattern of occurrence of species in the polygon. Coded as "L" if plants of species occur in a linear pattern, such as along nursery bar, "C" if clumped together, "E" if evenly distributed (i.e., approximately equal distances between each plant), or "R" if regularly distributed (found in a normal, random distribution). "**R**" is default value, and may be left blank.

Elevation: Record off USGS topographic maps or with a calibrated altimeter, in feet.

Evidence of Mining Activity: Evaluate sample plot (not adjacent area). You may notice old mine shafts, tailings, etc.

Frequency: See Size Class Frequency.

Grazing Intensity: Evaluate on sample plot. Rank as consistently as possible. If unknown, do not guess.

Height: Value between 1-6. 1= 0-0.3m (0-1ft); 2= 0.3-1m (1-3ft); 3= 1-3m (3-9ft); 4= 3-9m (10-29ft); 5= 9-21m (30-69ft); 6= >21m (70+ft). Use a clinometer to measure tree height.

Landowner: BLM (Bureau of Land Management), FOR (Forest Service), NAT (Indian Reservation), NPS (National Park Service), PVT (private; include a name if known), STA (State), **MIL** (Military).

Notes: Any comments that may help in species/association identification.

Observer Initials: 3 initials for each observer, e.g. SRM.

Over/Understory Description: Description of understory and overstory components summarizing dominant, codominant, associate, uncommon and rare species, plus number of woody layers and herbaceous layer. Used to aid identification of vegetative association.

Photo ID/Roll #/Frame #: If photos are taken at plot, record roll and frame numbers for later reference. An alternative to this method is to place a clipboard, referencing videoframe and plot numbers, in the photo.

Plot No.: For each videoframe you may collect data at one or several points. Each point will constitute a plot. A separate data sheet will be used for each plot. If you collect data at 3 points on one videoframe, you will have 3 data sheets with the same videoframe no. but one will be plot no. 1 of 3, the second plot 2 of 3 and the third plot 3 of 3.

Prominence: Value between 1-5.

5= Dominant= uniformly distributed throughout the stand. Clearly the one dominant species.

4= Co-dominant= uniformly distributed throughout the stand. Shares dominance with other species.

3= Associate= common throughout the stand, but not dominant. Easily observed everywhere in the stand.

2= Uncommon= sparse, represented by few individuals (ca. ≤ 12). Coverage < 1%. Erratic distribution.

1 = Rare= represented by few individuals. (ca. 1 or 2). Searching required.

(NOTE: Only record size classes 2 for prominence values ≥ 3.)

Recreation Intensity: Evaluate on sample plot. Rank as consistently as possible. If unknown, do not guess.

Segment: Description of the stream segment where data was collected, e.g., below Hoover Dam, or between Cascabel and Redington. Use major land features like dams, towns, major tributaries.

Size: Value between 1-4 for shrubs, between 1-5 for trees. Tree species are those that normally reach a height of 20 ft (6.1 m) or more. Size is recorded as DBH (diameter at breast height or at 1.4 m/4.5 ft). If a tree is on a slope, be sure to measure DBH on the uphill side. Shrub size is based on the diameter of the largest live stem at 2.54 cm/1 inch above ground level. Enter size classes 2 only for prominence values 3.

Code		Shrub DBH	Tree DBH
1	Seedling	0-0.6 cm (0-1/4")	0-2.5 cm (0-1")
2	Sapling	0.7-1.3 cm (1/4-1/2")	2.6-12.7 cm (1-5")
3	Submature	1.4-2.5 cm (½-1")	12.8-22.9 cm (5-9")
4	Mature	>2.5 cm (>1")	23-45.7 cm (>9")
5	Old		>45.7 cm (>18")

Size Class Frequency: Ranking of prominence of size classes within each species, using values ranging from 1=least common to 5=most common. Follows ranking decisions found under Prominence.

Slope: Expressed as a percent. Estimate or use a clinometer to obtain percent slope of area where data are collected. 0 = Flat; 1 = 1-5% slope; 2 = 6-20% slope; 3 = 21-40% slope; 4 = 40% + slope.

Special Habitat Features: Circle applicable features and note any additional ones of interest.

Species: Use 6 letter acronym, e.g., Populus fremontii would be POPFRE. See a standardized list in Appendix B.

Stream: Name of river/stream/creek if known.

TE&S/Special Interest Species Observed: Note incidental observations of TE&S (Threatened, Endangered, & Sensitive) species or other species of special interest, such as beavers, bat roosts, etc. See AGFD list of Sensitive species.

UTM Coordinates: Obtain Universal Transverse Mercator coordinates off USGS 7.5 min quadrangles for your location. Remember, the UTM coordinates on the back of the video photos may not be correct, since these may be from uncorrected GPS data.

Videoframe No.: Number printed on video photo containing area where data is collected.

POLYGON ID:

Riparian Field Form
ASSOCIATION VERIFICATION

Date:
Stream:
Segment:
Elevation:

Observer Initials:
County:
Landowner:
Admin Unit:
7.5 min Quad: Point

No. Plots in Polygon

PLOT #	SPECIES	PROM	PHOTO	UTM/SOURCE*	NOTES

*SOURCE: G FOR GPS, M FOR MAP

Conversions:	1 m = 3.3 ft 0.5 ac =21,841 sq ft (148 ft or 45 m/side)
Other ½ ac plot dimensions:	100 ft x 218 ft (30m x 66m) 50 ft x 437 ft (15m x 132m) 20 ft x 1092 ft (6m x 331m)

Additional Notes/Calculations:______________________________

« Lines continue to bottom of a full page »

Data on the Association Verification Riparian Field Form use the same definitions as on the previous form. Data here are a less detailed subset of the previous data for all plots within a polygon. Usually only one representative plot was surveyed in detail and recorded on Vegetation Riparian Field Form. The purpose of this form was to provide prominence information linked to geographical coordinates and photographs.

Polygon ID:______________________

Riparian Field Form
VERIFICATION SUMMARY

Date:________________________________ Observer Initials:
Stream:______________________________ County: ________________________________
Segment:_____________________________ Landowner:
UTM:_________________________________ Admin Unit ________________________________
_____________________________________ VF #: ________________________________
Elevation:___________________________ 7.5 min Quad
Slope: 0 1 2 3 4 Aspect: F N NE E SE S SW W NW

SPECIES	PROMINENCE VALUE BY PLOT #										MEAN: SUM OF PROM/# PLOTS SAMPLED	FREQ: #PLOTS WITH SP/ #PLOTS SAMPLED	MxF
	1												

Instructions for Vegetation Summary Form

1) Fill out a separate summary form for each polygon verified.

2) **Mean Prominence Value** (third column from the right) is calculated by dividing the sum of the prominence values by the total number of plots done in the polygon. Remember, if the species is absent on one of your plots, the value is zero and figures into the calculation of the mean.

3) **Frequency** (second column from the right) is calculated by dividing the number of plots the species occurred in by the total number of plots done in the polygon.

4) In order for a species to define an association it must have a mean prominence value 2 **AND** a frequency 50%.

5) Multiply the **Mean Prominence Value** by the **Frequency** for each species, and record the value in the Mean x Frequency column (far right). This value must be 1 for the species to define an association.

Riparian Field Form
HYDROLOGY

Stream:________ Reach No.:________
Segment:________ Date:________
Observer(s):________ Video frame #:________ Flight ________
Water in Channel? Yes No 7.5 min Quad:________ Point:________
Channel: Single Multiple Photo ID Roll #:________ Frame(s):________
Flow: Perennial Interrupted perennial Intermittent Ephemeral
Gradient:________

Channel Geometry Cross-Section Measurements (extended on back if necessary):
(facing downstream) R

Variable	FPW												FPW
Horizontal													
Vertical	0												0
Depth from BFW													

Flood prone Width (FPW)	Bankfull Width (BFW)	Avg BFW Depth	BFW/ Avg BFW Depth	Entrenchment (FPW/BFW)
________	________	________	________	________

Channel Components (3 BFW transects, 3 meters apart; 1 reading/meter):

________ ________ Organic
________ ________ Clay and Silt <.05mm
________ ________ Sand 0.5mm - 2.0mm
________ ________ Gravel 2.0mm - 7.59cm
Cobble 7.6-25.4cm
Boulder > 25.4cm
Bedrock

Other Features (record distance in meters from middle transect):

________ Organic debris in active channel
________ Beaver dams evident
________ Backwater areas/marshes
________ Man-made structures (diversion dams, low dams, controlled by-pass channels, gabions, bridges)
________ Water Pollution (Non-point Source/Point Source)

Habitat Parameter	Excellent	Good	Fair	Poor
Pool/Riffle	Variety of habitat. Deep riffles and pools.	Adequate depth in pools and riffles. Bends provide habitat	Occasional rifle or bend. Bottom contours provide some habitat.	Essentially a straight stream. Generally all flat water or shallow riffle.
Bank Stability	Stable. No evidence of erosion or bank failure. Side slopes generally <30%. Little potential for future problem.	Moderately stable. Infrequent, small areas of erosion mostly healed over. Side slopes >40% on one bank. Slight potential in extreme floods.	Moderately unstable. Moderate frequency and sin of erosional areas. Side slopes <60% on some banks. High erosion potential during extreme high flow.	Unstable. Many eroded areas. Side slopes > 60% common. "Raw" areas frequent along straight sections and bends.
Bank Vegetative Stability	>80% of the stream bank surfaces covered by vegetation or boulders and cobble.	50-79% of the stream bank surfaces covered by vegetation, gravel, or larger material.	25-49% of the stream bank surfaces covered by vegetation, gravel, or larger material.	<25% of the stream bank surfaces covered by vegetation, gravel, or larger material.
Streams ide Cover	Dominant vegetation shrubs.	Dominant vegetation trees.	Dominant vegetation grass/forbs.	>50% of stream bank has no vegetation and dominant material is soil, rock, bridge materials, culverts, or min tailings.

HABITAT VARIABLE	Excellent	Good	Fair	Poor
Pool/Riffle				
Bank Stability				
Bank Vegetation Stability				
Streamside Cover				

Definitions for Hydrology Field Form

Alluvial - predominantly sandy in composition, deposited by river/stream over time.

Aspect - the predominant direction of the stream flow in degrees of compass orientation.

Bankfull Width (BFW)- horizontal distance between points on the banks of a channel showing indications of the most frequent flood flow (1-2 yrs.) which defines the characteristics of the stream channel. Points of definition are usually delineated by undercuts in stream banks, lichen lines on rocks, or debris lines in vegetation within the channel.

Bedrock - contiguous, unbroken rock that contains a stream bed. Possibly directly exposed at locations along a stream segment or be buried under substrates of finer classification.

Boulder - largest (>25.4 cm) category of rocky substrate found in stream channels. Very stable, will not be moved by hydrological forces under most situations.

Channel - deepest, lowest portion of a riparian corridor, which contains water for the longest duration. Either forms one integral channel or multiple channels that contain water at various times of the year, under different hydrological conditions.

Channel Components - the organic and inorganic materials that form the surface on the bottom of the channel (substrate). Measured by classifying overall type of substrate found within each meter of three transects placed within BFW of each site analyzed. Transects are 3 meters apart, one upstream and one downstream from central transect. Component types are recorded as tick marks in appropriate categories. Percentages are determined from these scores and recorded in space beside tally spaces.

Clay and Silt - very fine, often colloidal, particulate materials formed by extensive erosion processes. Easily unsettled by water movement and physical disturbance.

Cobble - large (7.6-25.4 cm) rocks, generally stable except under extreme hydrological forces (e.g. heavy, prolonged flooding).

Controlled by-pass channel - an artificially created channel that has a manual control mechanism (floodgate) associated with it to open or close water passage to the main channel.

Dam - any structure placed in a stream channel perpendicular to the direction of the stream to impound water and/or to raise the water level upstream from it.

Depth (D) – any vertical measurement taken from the defined Flood Prone Width (FPW) horizontal plane to the surface of the stream channel. Take a minimum of one depth measurement per two meters of horizontal distance.

Depth from BFW - vertical measurement below the BFW horizontal plane. Subtract the average BFW value $[(BFW_l+BFW_r)/2]$ from the measured vertical value taken from the FPW. Do calculation before leaving the site to reduce errors made in measuring and recording channel geometry cross-sections.

Edge of Water (EOW) - the actual point at which water and dry substrate meet in a stream channel when the measurements are taken.

Entrenchment - diagnostic classification feature. Calculated as FPW/BFW.

Floodprone Width (FPW) - horizontal distance between two points on a channel (a horizontal plane at about twice the average BFW.) Contains the floodprone area and is usually defined by a recognizable land feature, such as a valley wall or terrace.

Flow - description of the hydrological pattern found in a stream during a year. Possibly difficult to detect from observation of a small segment of stream; best to figure out by remote sensing data (i.e. GIS).

Gabion - man-made retaining wall in a stream channel, usually parallel to streamflow. Construction is usually of rocks constrained by metal hardware cloth or cyclone fencing.

Gravel - moderately course (2.0 mm-7.6 cm) rocky substrates, moderately stable under low hydrological force.

Horizontal Measurement - the reading on a transect tape directly over a point of interest, where the tape is stretched between FPW points, facing downstream, with zero on the left.

Landform Feature-Soils/Stability - general physical description of channel banks and slope, describing composition of banks (bedrock, course soil, alluvial), erosional features (stable, moderately stable, slumped, etc.), and steepness of slope (severe [45-901, moderate [22.5-451, gentle [1-22.51). Refer to Rosgen (1985).

Organic - component of stream substrate that can be finely divided substances occurring in stream bed with fine inorganics (clay/silt, sand, gravel) and/or large woody debris (leaves, branches, snags) submerged wholly or partially in water.

Reach - a length of homogeneous stream that does not change significantly in hydrologic or vegetative characteristic.

Reach No. - a specific identification number for a particular reach of a stream, as shown on National Wetland Inventory (NWI) maps. Needs to be obtained before conducting field inventory.

Sand - fine (0.5-2.0 mm) rocky particulate matter, easily disturbed by moderate hydrological pressure and physical disturbance.

Slumped - stream bank that was undercut and subsequently collapsed, depositing a large amount of fresh material on a lower stream bank.

Substrate - see Channel Components.

Variable - a specific aspect of a stream characteristic that is being measured. Include FPW and BFW points, EOW locations and depth intervals between BFW points.

Vertical Measurement - distance from a horizontal measurement point of interest to the point on the channel bottom directly below it. Each vertical measurement is directly associated with a horizontal measurement of a specific variable (e.g. BFW, FPW) or with a depth measurement (D_n) between these variables. A minimum of one vertical measurement should be made for every two meters of horizontal measurement (see Depth).

ECOSYSTEMS PHOTOLOG FIELD NOTES

VIDEOFRAME:________________ TOPOGRAPHIC QUAD:____________________________

FLIGHTDATE:___/___/______ COUNTY:______________________________________

SURVEYDATE:___/___/______ UTM N:__________________ UTM E:______________

STREAM:_______________________ OBSERVER:________________________________

SEGMENT:______________________ FILMTYPE: P / S

____

PHOTO:______________

PHOTOTYPE: Veg / Hydro / Both / Wildl / Plant / Action

SUBJECT:____

PHOTO:______________

PHOTOTYPE: Veg / Hydro / Both / Wildl / Plant / Action

SUBJECT:____

PHOTO:______________

PHOTOTYPE: Veg / Hydro / Both / Wildl / Plant / Action

SUBJECT:____

PHOTO:______________

PHOTOTYPE: Veg / Hydro / Both / Wildl / Plant / Action

SUBJECT:____

Used to describe photographs taken during field work. Most variables use the same definitions as previous form.

FILMTYPE	P(rint) or S(lide) film.
PHOTOTYPE	Veg(etation), Hydro(logic feature), Both (vegetation and hydro), Wildl(ife), Plant (specimen), and Action (crew members working).

Appendix B. Codes for plant species used in field data forms and databases during the perennial waters phase of the Statewide Riparian Inventory and Mapping Project. Names from Kearney and Peebles (1960), Vines (1960), Hitchcock and Cronquist (1973), Lehr (1978), and Brown (1992).

Code	Family	Taxonomic name	Common name
ABIARI	Pinaceae	*Abies lasiocarpa arizonica*	Corkbark fir
ABICON	Pinaceae	*Abies concolor*	White fir
ACACMB*	Leguminosae	*Acacia* combined	Acacias combined
ACACON	Leguminosae	*Acacia constricta*	Whitethorn
ACAGRE	Leguminosae	*Acacia greggii*	Catclaw
ACASPP	Leguminosae	*Acacia* spp.	Acacia
ACEGLA	Aceraceae	*Acer glabrum*	Rocky Mountain maple
ACEGRA	Aceraceae	*Acer grandidentatum*	Bigtooth maple
ACENEG	Aceraceae	*Acer negundo*	Box elder
AGAPAL	Agavaceae	*Agave palmeri*	Palmer agave
AGASPP	Agavaceae	*Agave* spp.	Century plant
AILALT	Simaroubaceae	*Ailanthus altissima*	Tree of heaven
ALLOCC	Chenopodiaceae	*Allenrolfea occidentalis*	Iodine bush
ALLSPP*	Liliaceae	*Allium* spp.	Onion
ALNCMB*	Betulaceae	*Alnus* combined	Alders combined
ALNOBL	Betulaceae	*Alnus oblongifolia*	Arizona alder
ALNSPP	Betulaceae	*Alnus* spp.	Alder
ALNTEN	Betulaceae	*Alnus tenuifolia*	Thin-leaf alder
ALOWRI	Verbenaceae	*Aloysia wrightii*	Wright lippa
AMBAMB	Compositae	*Ambrosia ambrosoides*	Canyon ragweed
AMBAPT	Compositae	*Ambrosia aptera*	Blood weed
AMBCMB*	Compositae	*Ambrosia* combined	Bursages combined
AMBDEL	Compositae	*Ambrosia deltoidea*	Burrobush
AMBSPP	Compositae	*Ambrosia* spp.	Bursage/ragweed
AMEUTA	Rosaceae	*Amelanchier utahensis*	Utah serviceberry
AMOFRU	Leguminosae	*Amorpha fruticosa*	Bastard indigo
AMOSPP	Leguminosae	*Amorpha* spp.	False indigo
AMSHIR*	Apocynaceae	*Amsonia hirtella*	Blue star
ANITHU	Acanthaceae	*Anisacanthus thurberi*	Desert honeysuckle
ARBARI	Er icaceae	*Arbutus arizonica*	Arizona madrone
ARCPAT	Er icaceae	*Arctostaphylos patula*	Green-leaf manzanita
ARCPUN	Ericaceae	*Arctostaphylos pun gens*	Mexican manzanita
ARTBIG	Compositae	*Artemisia bigelovii*	Bigelow sagebrush
ARTSPP	Compositae	*Artemisia* spp.	Sage
ARTTRI	Compositae	*Artemisia tridentata*	Big sagebrush
ATRCAN	Chenopodiaceae	*Atriplex canescens*	Four-wing saltbush
ATRCMB*	Chenopodiaceae	*Atriplex* combined	Saltbushes combined
ATRCON	Chenopodiaceae	*Atriplex confertifolia*	Shadscale
ATRSPP	Chenopodiaceae	*Atriplex* spp.	Saltbush
BACCMB*	Compositae	*Baccharis* combined	Baccharis combined

Code	**Family**	**Taxonomic name**	**Common name**
BACEMO	Compositae	*Baccharis emoryi*	Emory baccharis
BACSAL	Compositae	*Baccharis salicifolia*	Seep willow
BACSAR	Compositae	*Baccharis sarathroides*	Desert broom
BACSER	Compositae	*Baccharis sergiloides*	Waterweed
BACSPP	Compositae	*Baccharis* spp.	Groundsel tree
BERFRE	Berberidaceae	*Berberis fremontii*	Desert barberry
BERREP	Berberidaceae	*Berberis repens*	Creeping barberry
BERSPP	Berberidaceae	*Berberis* spp.	Barberry
BERTRI	Berberidaceae	*Berberis trifoliata*	Algeritas
BERWIL	Berberidaceae	*Berberis wilcoxii*	Wilcox barberry
BETOCC	Betulaceae	*Betula occidentalis*	Water birch
BOUGLA*	Graminae	*Bouteloua glandulosa*	Grama grass
BRICAL	Compositae	*Brickellia californica*	Pachaba
BRISPP	Compositae	*Brickellia* spp.	Bricklebush
BURSPP	Burseraceae	*Bursera* spp.	Bursera
CALSPP	Leguminosae	*Calliandra* spp.	False mesquite
CANHOL	Celastraceae	*Canotia holacantha*	Canotia
CARCMB*	Cyperaceae	*Carex* combined	Sedges combined
CARSPP	Cyperaceae	*Carex* spp.	Sedge
CEAFEN	Rhamnaceae	*Ceanothus fendleri*	Buck brush
C EAGRE	Rhamnaceae	*Ceanothus greggii*	Desert ceanothus
CEAINT	Rhamnaceae	*Ceanothus integerrimus*	Deer brush
CEASPP	Rhamnaceae	*Ceanothus* spp.	
CELPAL	Ulmaceae	*Celtis pallida*	Desert hackberry
C ELRET	Ulmaceae	*Celtis reticulata*	Net-leaf hackberry
CELSPP	Ulmaceae	*Celtis* spp.	Hackberry
CEPOCC	Rubiaceae	*Cephalanthus occidentalis*	Common button bush
CERBET	Rosaceae	*Cercocarpus betuloides*	Birch-leaf mountain mahogany
CERFLO	Leguminosae	*Cercidium floridum*	Blue paloverde
CERGIG	Cactaceae	*Cereus giganteus*	Saguaro
CERINT	Rosaceae	*Cercocarpus intricatus*	Little-leaf mountain mahogany
CERMIC	Leguminosae	*Cercidium microphyllum*	Foothill paloverde
CERMON	Rosaceae	*Cercocarpus montanus*	Alder-leaf mountain mahogany
CERSPP	Rosaceae	*Cercocarpus* spp.	Mountain mahogany
CHAMIL	Rosaceae	*Chamaebatiaria millefolium*	Fernbush
CHILIN	Bignoniaceae	*Chilopsis linearis*	Desert willow
CHRNAU	Compositae	*Chrysothamnus nauseosus*	Rubber rabbitbrush
CHRSPP	Compositae	*Chrysothamnus* spp.	Rabbitbrush
CHRVIS	Compositae	*Chrysothamnus viscidiflorus*	Sticky-leaved rabbit brush
CICDOU	Umbelliferae	*Cicuta douglasii*	Water hemlock

Code	Family	**Taxonomic name**	**Common name**
CLESPP	Ranunculaceae	*Clematis* spp.	Virgin's bower
CONCMB*			Conifers combined
CONSPP	Rhamnaceae	*Condalia* spp.	
CORSTO	Cornaceae	*Cornus stolonifera*	Red osier dogwood
COWMEX	Rosaceae	*Cowania mexicana*	Quinine bush
COWSPP	Rosaceae	*Cowania* spp.	Cliffrose
CRAERY	Rosaceae	*Crategus erythropoda*	Cerro hawthorn
CRASPP	Rosaceae	*Crategus* spp.	Hawthorn
CROBIG	Crossosomataceae	*Crossosoma bigelovii*	Bigelow ragged rock flower
CUPARI	Cupressaceae	*Cupressus arizonica*	Arizona cypress
CUPGLA	Cupressaceae	*Cupressus glabra*	Smooth-barked Arizona cypress
CYPSPP	Cyperaceae	*Cyperus* spp.	Flat sedge
DACGLO*	Graminae	*Dactylis glomerata*	Orchard grass
DASWHE	Agavaceae	*Dasylirion wheeleri*	Sotol
DATMET	Solanaceae	*Datura meteloides*	Sacred datura
DATSPP	Solanaceae	*Datura* spp.	Thorn apple
DOD VIS	Sapindaceae	*Dodonaea viscosa*	Hopbush
ELAANG	Elaeagnaceae	*Elaeagnus angustifolia*	Russian olive
ELESPP	Cyperaceae	*Eleocharis* spp.	Spike rush
EMECMB*			Emergents combined
EMESPP*		Emergent spp.	Unknown emergent
ENCFAR	Compositae	*Encelia farinosa*	Brittle bush
ENCSPP	Compositae	*Encelia* spp.	
EPHSPP	Ephedraceae	*Ephedra* spp.	Joint-fir
EQUSPP	Equisetaceae	*Equisetum* spp.	Horsetail
ERYFLA	Leguminosae	*Erythrina flabelliformis*	Southwestern coralbean
EUCSPP	Myrtaceae	*Eucalyptus* spp.	Eucalypt
EURLAN	Chenopodiaceae	*Eurotia lanata*	Winter fat
EXOTIC*			Unidentified exotic
FALPAR	Rosaceae	*Fallugia paradoxa*	Apache plume
FENRUP	Saxifragaceae	*Fendlera rupicola*	Fendlerbush
FERWIZ	Cactaceae	*Ferocactus wizlizenii*	Barrel cactus
FESARI*	Gramineae	*Festuca arizonica*	Arizona fescue
FICSPP	Moraceae	*Ficus* spp.	Fig
FORNEO	Oleaceae	*Forestiera neomexicana*	Desert olive
FOUSPL	Fouquieriaceae	*Fouquieria splendens*	Ocotillo
FRAANO	Oleaceae	*Fraxinus anomala*	Single-leaf ash
FRABRA*	Rosaceae	*Fragaria bracteata*	Strawberry
FRALOW	Oleaceae	*Fraxinus lowellii*	Lowell ash

Code	**Family**	**Taxonomic name**	**Common name**
FRASPP	Oleaceae	*Fraxinus* spp.	Ash
FRAVEL	Oleaceae	*Fraxinus velutina*	Velvet ash
FRBCMB*			Forbs combined
FRBSPP*		Forb spp.	Unidentified forb
GARFLA	Garryaceae	*Ganya flavescens*	Silktassel bush
GARWRI	Garryaceae	*Ganya wrightii*	Wright silktassel
GLETRI	Leguminosae	*Gleditsia triacanthos*	Common honey-locust
GRSCMB*			Grasses combined
GRSSPP*		Grass spp.	Unidentified grass
GUTSAR	Compos itae	*Gutierrezia sarothrae*	Broom snakeweed
HAPSPP	Compos itae	*Haplopappus* spp.	
HAPTEN	Compos itae	*Haplopappus tenuisectus*	Burroweed
HETGRA*	Compos itae	*Heterotheca grandiflora*	Telegraph plant
HIBSPP	Malvaceae	*Hibiscus* spp.	Rose mallow
HOLDUM	Rosaceae	*Holidiscus dumosus*	Mountain spray
HRBCMB*			Herbaceous plants combined
HYMMON	Compositae	*Hymenoclea mono gyra*	Burro brush
HYMODO	Compositae	*Hymenoxys odorata*	Bitterweed
HYMSAL	Compositae	*Hymenoclea salsola*	Cheesebush
IRIMIS	Iridaceae	*Iris missouriensis*	Rocky Mountain iris
JUGMAJ	Juglandaceae	*Juglans major*	Arizona walnut
JUNCMB*	Cupressaceae	*Juniperus* combined	Junipers combined
JUNCOM	Cupressaceae	*Juniperus communis*	Common juniper
JUNDEP	Cupressaceae	*Juniperus deppeana*	Alligator juniper
JUNMON	Cupressaceae	*Juniperus monosperma*	One-seed juniper
JUNOST	Cupressaceae	*Juniperus osteosperma*	Utah juniper
JUNSCO	Cupressaceae	*Juniperus scopulorum*	Rocky Mountain juniper
JUNSPP	Cupressaceae	*Juniperus* spp.	Juniper
KOESPI	Koeberliniaceae	*Koeberlinia spinosa*	Allthorn
LARTRI	Zygophyllaceae	*Larrea tridentata*	Creosote bush
LONARI	Caprifoliaceae	*Lonicera arizonica*	Arizona honeysuckle
LONINV	Caprifoliaceae	*Lonicera involucrata*	Bearberry honeysuckle
LONSPP	Caprifoliaceae	*Lonicera* spp.	Honeysuckle
LYCBER	Solanaceae	*Lycium berlandieri*	Berlandier wolfberry
LYCPAL	Solanaceae	*Lycium pallidum*	Rabbit thorn
LYCSPP	Solanaceae	*Lycium* spp.	Wolfberry
MACPOM	Moraceae	*Maclura pomifera*	Osage-orange
MALSPP	Rosaceae	*Malus* spp.	Apple
MARGIL*	Cucurbitaceae	*Marah gilensis*	Wild cucumber
MARVUL*	Lab iatae	*Marrubium vulgare*	Common horehound

Code	**Family**	**Taxonomic name**	**Common name**
MELAZE	Mel iaceae	*Melia azedarach*	Umbrella tree
MENSPP*	Lab iatae	*Mentha* spp.	Mint
MIMBIU	Leguminosae	*Mimosa biuncifera*	Wait-a-minute
MIMSPP	Leguminosae	*Mimosa* spp.	
MORMIC	Moraceae	*Morus microphylla*	Texas mulberry
MORSPP	Celastraceae	*Mortonia* spp.	
NEROLE	Apocynaceae	*Nerium oleander*	Common oleander
NICGLA	Solanaceae	*Nicotiana glauca*	Tree tobacco
NICSPP*	Solanaceae	*Nicotiana* spp.	Tobacco
NICTRI*	Solanaceae	*Nicotiana trigonophylla*	Desert tobacco
NOLBIG	Agavaceae	*Nolina bigelovii*	Bigelow nolina
NOLMIC	Agavaceae	*Nolina microcarpa*	Beargrass
OLNTES	Leguminosae	*Olneya tesota*	Ironwood
OPUCMB*	Cactaceae	*Opuntia* combined	Cactus combined
OPULEP	Cactaceae	*Opuntia leptocaulis*	Desert Christmas cactus
OPUPHA	Cactaceae	*Opuntia phaeacantha*	Engelmann prickly pear
OPUSPP	Cactaceae	*Opuntia* spp.	
OPUWHI	Cactaceae	*Opuntia whipplei*	Whipple cholla
OROCOO*	Orobanchaceae	*Orobanche cooperi*	Burroweed strangler
PARACU	Leguminosae	*Parkinsonia aculeata*	Mexican paloverde
PARINS	V itaceae	*Parthenocissus inserta*	Thicket creeper
PHIMIC	Saxifragaceae	*Philadelphus microphyllus*	Mock orange
PHRAUS	Gramineae	*Phragmites australis*	Common reed
PICENG	Pinaceae	*Picea engelmannii*	Engelmann spruce
PICPUN	Pinaceae	*Picea pun gens*	Blue spruce
PICSPP	Pinaceae	*Picea* spp.	Spruce
PINCEM	Pinaceae	*Pinus cembroides*	Mexican pinyon
PINEDU	Pinaceae	*Pinus edulis*	Colorado pinyon
PINENG	Pinaceae	*Pinus engelmannii*	Apache pine
PINFLE	Pinaceae	*Pinus flexilis*	Limber pine
PINLAT	Pinaceae	*Pinus latifolia*	Apache pine
PINLEI	Pinaceae	*Pinus leiophylla*	Chihuahua pine
PINPON	Pinaceae	*Pinus ponderosa*	Ponderosa pine
PINREF	Pinaceae	*Pinus reflexa*	Southwestern white pine
PINSPP	Pinaceae	*Pinus* spp.	Pine
PLAWRI	Platanaceae	*Platanus wrightii*	Arizona sycamore
POASPP*	Gramineae	*Poa* spp.	Bluegrass
POPACU	Sal icaceae	*Populus acuminata*	Lance-leaved cottonwood
POPANG	Salicaceae	*Populus angustifolia*	Narrow-leaf cottonwood
POPCMB*	Sal icaceae	*Populus* combined	Cottonwoods combined

Code	**Family**	**Taxonomic name**	**Common name**
POPFRE	Salicaceae	*Populus fremontii*	Fremont cottonwood
POPSPP	Salicaceae	*Populus* spp.	Cottonwood
POPTRE	Salicaceae	*Populus tremuloides*	Quaking aspen
POTFRU	Rosaceae	*Potentilla fruticosa*	Shrubby cinquefoil
POTSPP	Rosaceae	*Potentilla* spp.	Cinquefoil
PROCMB*	Leguminosae	*Prosopis* combined	Mesquites combined
PROGLA	Leguminosae	*Prosopis glandulosa*	Honey mesquite
PROPUB	Leguminosae	*Prosopis pubescens*	Screwbean mesquite
PROSPP	Leguminosae	*Prosopis* spp.	Mesquite
PROVEL	Leguminosae	*Prosopis velutina*	Velvet mesquite
PRUEMA	Rosaceae	*Prunus emarginata*	Bitter cherry
PRUSPP	Rosaceae	*Prunus* spp.	
PRUVI1	Rosaceae	*Prunus virens*	Southwestern black cherry
PRUVI2	Rosaceae	*Prunus virginiana*	Common chokecherry
PSEMEN	Pinaceae	*Pseudotsuga menziesii*	Douglas-fir
PTEANG	Rutaceae	*Ptelea angustifolia*	Narrow-leaf hoptree
PTEAQU*	Polypodiaceae	*Pteridium aquilininum*	Western bracken
PTETRI	Rutaceae	*Ptelea trifoliata*	Hoptree
QUEARI	Fagaceae	*Quercus arizonica*	Arizona white oak
QUECHR	Fagaceae	*Quercus chrysolepis*	Canyon live oak
QUECMB*	Fagaceae	*Quercus* combined	Oaks combined
QUEDUN	Fagaceae	*Quercus dunnii*	Palmer oak
QUEEMO	Fagaceae	*Quercus emoryi*	Emory oak
QUEGAM	Fagaceae	*Quercus gambelii*	Gambel oak
QUEGRI	Fagaceae	*Quercus grisea*	Gray oak
QUEHYP	Fagaceae	*Quercus hypoleucoides*	Silver-leaf oak
QUEOBL	Fagaceae	*Quercus oblongifolia*	Mexican blue oak
QUERUG	Fagaceae	*Quercus rugosa*	Net-leaf oak
QUESPP	Fagaceae	*Quercus* spp.	Oak
QUETUR	Fagaceae	*Quercus turbinella*	Shrub live oak
QUEUND	Fagaceae	*Quercus undulata*	Wavyleaf oak
RHABET	Rhamnaceae	*Rhamnus betulaefolia*	Birch leaf buckthorn
RHACAL	Rhamnaceae	*Rhamnus californica*	California buckthorn
RHACRO	Rhamnaceae	*Rhamnus crocea*	Red berry buckthorn
RHASPP	Rhamnaceae	*Rhamnus* spp.	Buckthorn
RHUGLA	Anacardiaceae	*Rhus glabra*	Smooth sumac
RHUMIC	Anacardiaceae	*Rhus microphylla*	Desert sumac
RHUOVA	Anacardiaceae	*Rhus ovata*	Sugar sumac
RHURAD	Anacardiaceae	*Rhus radicans*	Poison ivy
RHUSPP	Anacardiaceae	*Rhus* spp.	Sumac

Code	**Family**	**Taxonomic name**	**Common name**
RHUTRI	Anacardiaceae	*Rhus trilobata*	Squaw bush
RIBAUR	Saxifragaceae	*Ribes aureum*	Golden current
RIBINE	Saxifragaceae	*Ribes inerme*	Whitestem gooseberry
RIBLEP	Saxifragaceae	*Ribes leptanthum*	Trumpet gooseberry
RIBPIN	Saxifragaceae	*Ribes pinetorum*	Orange gooseberry
RIBSPP	Saxifragaceae	*Ribes* spp.	Currant
RIB WOL	Saxifragaceae	*Ribes wolfii*	Wolf currant
ROBNEO	Leguminosae	*Robinia neomexicana*	New Mexico locust
ROSARI	Rosaceae	*Rosa arizonica*	Arizona rose
ROSFEN	Rosaceae	*Rosa fendleri*	Fendler rose
ROSSPP	Rosaceae	*Rosa* spp.	Rose
RUBARI	Rosaceae	*Rubus arizonensis*	Arizona dewberry
RUBNEO	Rosaceae	*Rubus neomexicanus*	New Mexico raspberry
RUBPAR	Rosaceae	*Rubus parvifloris*	Western thimbleberry
RUBSPP	Rosaceae	*Rubus* spp.	Blackberry
RUBSTR	Rosaceae	*Rubus strigosus*	American red raspberry
RUMSPP*	Polygonaceae	*Rumex* spp.	Dock
SALALB	Salicaceae	*Salix alba*	White willow
SALAMY	Salicaceae	*Salix amygdaloides*	Peach-leaf willow
SALARI	Salicaceae	*Salix arizonica*	Arizona willow
SALBEB	Sal icaceae	*Salix bebbiana*	Bebb willow
SALBON	Salicaceae	*Salix bonplandiana*	Bonpland willow
SALCMB*	Salicaceae	*Salix* combined	Willows combined
SALEXI	Salicaceae	*Salix exigua*	Coyote willow
SALGEY	Salicaceae	*Salix geyeriana*	Geyer willow
SALGOO	Sal icaceae	*Salix gooddingii*	Goodding willow
SALIBE*	Chenopodiaceae	*Salsola iberica*	Russian thistle
SALIRR	Salicaceae	*Salix irrorata*	Bluestem willow
SALLA1	Salicaceae	*Salix lasiandra*	Pacific willow
SALLA2	Salicaceae	*Salix lasiolepis*	Arroyo willow
SALLAE	Salicaceae	*Salix laevigata*	Red willow
SALLIG	Salicaceae	*Salix ligulifolia*	Strapleaf willow
SALMON	Salicaceae	*Salix monticola*	Serviceberry willow
SALSPP	Salicaceae	*Salix* spp.	Willow
SALTAX	Salicaceae	*Salix taxifolia*	Yew-leaf willow
SAMMEX	Caprifoliaceae	*Sambucus mexicana*	Mexican elder
SAMSPP	Caprifoliaceae	*Sambucus* spp.	Elder
SAPSAP	Sap indaceae	*Sapindus saponaria*	Western soapberry
SARCYN*	Asclepiadaceae	*Sarcostemma cynanchoides*	Climbing milkweed
SARVER	Chenopodiaceae	*Sarcobatus vermiculatus*	Greasewood

Code	Family	Taxonomic name	Common name
SCICAL	Cyperaceae	Scirpus californicus	Giant bulrush
SCISPP	Cyperaceae	Scirpus spp.	Bulrush
SENSAL	Compositae	Senecio salignus	
SENSPP	Compositae	Senecio spp.	Groundsel
SIMCHI	Buxaceae	Simmondsia chinensis	Jojoba
SLVSPP	Labiatae	Salvia spp.	Sage
SOLELA*	Solanaceae	Solanum elaeagnifolium	Silverleaf nightshade
SORDUM	Rosaceae	Sorbus dumosa	Mountain ash
SUASPP	Chenopodiaceae	Suaeda spp.	Seep weed
SYMORE	Caprifoliaceae	Symphoricarpos oreophilus	Mountain snowberry
SYMROT	Caprifoliaceae	Symphoricarpos rotundifolius	Round-leaf snowberry
SYMSPP	Caprifoliaceae	Symphoricarpos spp.	Snowberry
TAMAPH	Tamaricaceae	Tamarix aphylla	Athel
TAMPEN	Tamaricaceae	Tamarix pentandra	Salt cedar
TESSER	Compositae	Tessaria sericea	Arrow weed
THAMON	Rutaceae	Thamnosma montana	Turpentine broom
TYPDOM	Gramineae	Typha domingensis	Southern cattail
TYPLAT	Gramineae	Typha latifolia	Broad-leaved cattail
TYPSPP	Typhaceae	Typha spp.	Cattail
ULMPUM	Ulmaceae	Ulmus pumila	Siberian elm
ULMSPP	Ulmaceae	Ulmus spp.	Elm
UNKSPP*		Unknown spp.	Unidentified species
VAUCAL	Rosaceae	Vauquelinia californica	Arizona rosewood
VERCAL	Lill iaceae	Veratrum californicum	False hellebore
VITARI	V itaceae	Vitus arizonica	Canyon grape
YUCANG	Agavaceae	Yucca angustissima	Narrow-leaf yucca
YUCELA	Agavaceae	Yucca elata	Soap tree yucca
YUCSCH	Agavaceae	Yucca schottii	Hairy yucca
YUCSPP	Agavaceae	Yucca spp.	Yucca
ZINACE	Compos itae	Zinnia acerosa	Zinnia
ZIZOBT	Rhamnaceae	Zizyphus obtusifolia	Graythorn

*excluded from Appendix E. Data for most herbaceous species were collected less rigorously than data for woody or marsh species. Data for combinations were used only for remote sensing interpretation.

Appendix C. Databases used during the perennial waters phase of the Statewide Riparian Inventory and Mapping Project.

VEGSITE.DBF FILE STRUCTURE

Field	Field Name	Type	Length	Decimals
1	POLYID	Character	8	
2	CHECKDATE	Date	8	
3	NAME	Character	30	
4	SEGMENT	Character	30	
5	REACH	Character	25	
6	ELEVATION	Numeric	5	0
7	ASPECT	Character	2	
8	SLOPE	Character	1	
9	CREW	Character	15	
10	COUNTY	Character	10	
11	LANDOWNER	Character	3	
12	ADMIN_UNIT	Character	30	
13	VIDEOFRAME	Character	11	
14	VIDEODATE	Date	8	
15	TOPO_QUAD	Character	4	
16	OS_US_GC1	Character	254	
17	OS_US_GC2	Character	254	
18	ADJ_VEG	Character	30	
19	ADJ_USE1	Character	1	
20	ADJ_USE2	Character	1	
21	ADJ_USE3	Character	1	
22	ADJ_USE4	Character	1	
23	ADJ_USE5	Character	1	
24	ADJ_USE6	Character	1	
25	ADJ_USE7	Character	1	
26	ADJ_USE8	Character	1	
27	ADJ_USE9	Character	1	
28	ADJ_USE10	Character	1	
29	ADJ_USE11	Character	1	
30	ADJ_USE12	Character	1	
31	ADJ_USE13	Character	1	
32	ADJ_USE14	Character	1	
33	ADJ_USE15	Character	1	
34	ADJ_USE16	Character	1	
35	SPEC_HAB1	Character	1	
36	SPEC_HAB2	Character	1	
37	SPEC_HAB3	Character	1	
38	SPEC_HAB4	Character	1	
39	SPEC_HAB5	Character	1	
40	SPEC_HAB6	Character	1	
41	SPEC_HAB7	Character	1	
42	SPEC_HAB8	Character	1	
43	SPEC_HAB9	Character	1	
44	SPEC_HAB10	Character	1	
45	SPEC_HAB11	Character	1	
46	TES SPP	Character	254	
47	GRA⌧I G	Character	1	
48	RECREATION	Character	1	
49	MINING	Character	1	
50	FIREWOOD	Character	1	
51	REGEN	Character	1	

VEGSITE.DBF FILE STRUCTURE - continued

Field	Field Name	Type	Length	Decimals
61	SAND	Character	3	
62	GRAVEL	Character	2	
63	COBBLE	Character	2	
64	BOULDER	Character	2	
65	BEDROCK	Character	2	
66	ORG_DEBRIS	Character	1	
67	BVR_DAM	Character	1	
68	BACKWATER	Character	1	
69	STRUCTURE	Character	1	
70	POLLUTION	Character	1	
71	FEATURES	Character	254	
72	POOL_RIFF	Character	2	
73	BANK_STAB	Character	2	
74	VEG_STAB	Character	2	
75	STRM_COVER	Character	2	
Total			1603	

VEGSITE FIELD DESCRIPTIONS

Data comes from Vegetation and Hydrology Riparian Field Forms. Each polygon becomes a single record in VEGSITE.

POLYID Common indicator linking database files.

CHECKDATE Date polygon was surveyed. Entered as MM/DD/YY.

NAME Stream name using appropriate abbreviations. See last section of this Appendix.

SEGMENT Physical locator to polygon taken from topo map (ex: .75 mi NE of Chalk Mtn).

REACH Currently blank. Created for use of stream reach numbers.

ELEVATION Recorded in feet and taken from a topographic map.

ASPECT Cardinal direction of slope measured with a compass.

SLOPE Estimated percentage within one of the following groups:
0 = flat; 1 = 1-5%; 2 = 6-20%; 3 = 21-40%; 4 =40%+

CREW Initials of every individual who surveyed the polygon.

COUNTY Complete name giving polygon's location.

LANDOWNER Three letter code assigned as follows:
BLM = Bureau of Land Management
CNT = county
CTY = city, town
FOR = U.S. Forest Service
FWS = U.S. Fish and Wildlife Service
MIL = military
NAT = Native American Tribal Lands
NPS = National Park Service
PVT = private
STA = state

ADMIN UNIT Regional unit, name of pvt property owner, city, tribe, etc.

VIDEOFRAME Number printed on aerial videography freeze frame if supplied for field use. Entered as XX_XX_XX_XX.

VIDEODATE Flight date of videography. Entered as MM/DD/YY.

TOPO QUAD Four digit code from the ALRIS Quad Numbering System for the appropriate 7.5' topographic map. List is available from Research GIS Staff.

OS US GC1 Description of overstory, understory, and ground cover written on the back of the Vegetation Riparian Field Form. This information is recorded for the 0.5 acre detailed vegplot.

OS US GC2 Continuation of the above field, if needed. Also contains riparian width when given.

ADJ VEG Adjacent upland vegetation community type and/or species.

ADJ USE1 Adjacent dirt road? Y(es) or N(o).

ADJ USE2 Adjacent paved road? Y(es) or N(o).

ADJ USE3 Adjacent trail? Y(es) or N(o).

ADJ USE4	Adjacent agricultural land? Y(es) or N(o).
ADJ USE5	Adjacent industrial use? Y(es) or N(o).
ADJ USE6	Adjacent mining area? Y(es) or N(o).
ADJ USE7	Adjacent urban area? Y(es) or N(o).
ADJ USE8	Adjacent grazing? Y(es) or N(o).
ADJ USE9	Adjacent logging? Y(es) or N(o).
ADJ USE10	Adjacent firewood collection? Y(es) or N(o).
ADJ USE11	Adjacent wilderness area? Y(es) or N(o).
ADJ USE12	Adjacent cabin site? Y(es) or N(o).
ADJ USE13	Adjacent railroad? Y(es) or N(o).
ADJ USE14	Adjacent campground? Y(es) or N(o).
ADJ USE15	Adjacent ranch? Y(es) or N(o).
ADJ USE16	Any other land uses? Y(es) or N(o). Specifics should be described in ADD NOTES.
SPEC HAB1	Springs? Y(es) or N(o).
SPEC HAB2	Cliffs? Y(es) or N(o).
SPEC HAB3	Caves? Y(es) or N(o).
SPEC HAB4	Talus slopes? Y(es) or N(o).
SPEC HAB5	Cienega/marsh? Y(es) or N(o).
SPEC HAB6	Snags? Y(es) or N(o).
SPEC HAB7	Dead/down? Y(es) or N(o).

SPEC HAB8	Cavities? Y(es) or N(o).
SPEC HAB9	Eroded banks? Y(es) or N(o).
SPEC HAB10	Dead limbs? Y(es) or N(o).
SPEC HAB11	Other special habitat features? Y(es) or N(o). Specifics should be described in ADD NOTES.
TES SPP	Threatened, endangered or special concern species observed while in the field.
GRAZING	Grazing intensity on the sampled .5 acre vegplot. N(one), L(ow), M(edium), or H(igh).
RECREATION	Recreation use intensity on the sample plot. N(one), L(ow), M(edium), or H(igh).
MINING	Evidence of mining on the sample plot? Y(es), N(o), or U(nknown).
FIREWOOD	Evidence of firewood collection on the sample plot? Y(es), N(o), or U(nknown).
REGEN	Regeneration present on sample plot? Y(es) or N(o).
REGEN SPP	Species within a regeneration zone on the sample plot. See Appendix B.
EMERG	Emergents present on sample plot? Y(es) or N(o).
EMERG SPP	Species within an emergent zone on the sample plot. See Appendix B.
ADD NOTES	Any additional recorded notes applicable to the polygon.
WATER	Water in channel? Y(es) or N(o).
CHANNEL	S(ingle) or M(ultiple) channel?
FLOW	P(erennial),I(nterrupted)P(erennial), I(ntermittent), or E(phemeral)?
ORGANIC	Percentage (no decimals) of organic matter within the channel, including vegetation, algal material, and organic debris.

CLAY SILT Percentage (no decimals) of clay and/or silt in the substrate.

SAND Percentage (no decimals) of sand in the substrate.

GRAVEL Percentage (no decimals) of gravel in the substrate.

COBBLE Percentage (no decimlas) of cobble in the substrate.

BOULDER Percentage (no decimals) of boulder in the substrate.

BEDROCK Percentage (no decimlas) of bedrock in the substrate.

ORG DEBRIS Organic debris in active channel? Y(es) or N(o).

BVR DAM Beaver dams present? Y(es) or N(o).

BACKWATER Backwater areas present? Y(es) or N(o).

STRUCTURE Man-made structures such as dams, gabions, bridges present? Y(es) or N(o).

POLLUTION Water pollution (point or non-point source) observed? Y(es) or N(o).

FEATURES Any additional information about features recorded on the Hydrology Riparian Field Form, including measured distances.

POOL RIFF Rating code for pool/riffle habitat variable.

EE = excellent	EG = excellent/good
GG = good	GF = good/fair
FF = fair	FP = fair/poor
PP = poor	

BANK STAB Rating code for bank stability habitat variable. Coded as in POOL_RIFF.

VEG STAB Rating code for bank vegetation stability habitat variable. Coded as in POOL RIFF.

STRM COVER Rating code for streamside cover habitat variable. Coded as in POOL RIFF.

VEGPLOT.DBF FILE STRUCTURE

Field	Field Name	Type	Length	Decimals
1	POLYID	Character	8	
2	PLOT	Numeric	2	0
3	TOPO_QUAD	Character	4	
4	UTM NORTH	Numeric	7	0
5	UTM EAST	Numeric	6	0
6	UTM SOURCE	Character	1	
7	NOTES1	Character	254	
Total			283	

VEGPLOT FIELD DESCRIPTIONS

Data comes from Association Verification Riparian Field Form. Each plot within a polygon becomes a single record in VEGPLOT.

POLYID Common indicator linking databases.

PLOT Number associated to data at a specific point within the polygon; may be 1-10 plots.

TOPO QUAD Four digit code from the ALRIS Quad Numbering System for the appropriate 7.5' topographic map. List is available from Research GIS Staff.

UTM NORTH North/south Universal Transverse Mercator coordinate taken from GPS or a topographic map.

UTM EAST East/west Universal Transverse Mercator coordinate taken from GPS or a topographic map.

UTM SOURCE Source of above UTM coordinates. G(PS) or M(ap).

NOTES1 Any extraneous information recorded for the plot location.

VEGDATA.DBF FILE STRUCTURE

Field	Field Name	Type	Length	Decimals
1	POLYID	Character	8	
2	PLOT	Numeric	2	0
3	TOPO_QUAD	Character	4	
4	SPECIES	Character	6	
5	PROMINENCE	Numeric	1	0
6	TREE SIZE	Numeric	1	0
7	SHRUB SIZE	Numeric	1	0
8	FREQUENCY	Numeric	1	0
9	TREE_HGT	Numeric	1	0
10	SHRUB_HGT	Numeric	1	0
11	DISTRIB	Character	1	
12	DENSITY	Numeric	5	0
13	NOTES1	Character	254	
Total			287	

VEGDATA FIELD DESCRIPTIONS

Data comes from Vegetation and Association Verification Riparian Field Forms. Each line on those forms becomes a single record in VEGDATA. Therefore, each plot can have multiple records (based on species found in each plot).

POLYID Common indicator linking databases.

PLOT Number associated to data at a specific point within the polygon; may be 1-10 plots.

TOPO QUAD Four digit code from the ALRIS Quad Numbering System for the appropriate 7.5' topographic map. List is available from Research GIS Staff.

SPECIES Species code (Appendix **B).**

PROMINENCE Value (1-5) recorded on Vegetation Riparian Field Form.

TREE SIZE Value (1-5) recorded on Vegetation Riparian Field Form.

SHRUB SIZE Value (1-4) recorded on Vegetation Riparian Field Form.

FREQUENCY Value (1-5) recorded on Vegetation Riparian Field Form.

TREE HGT Value (1-6) recorded on Vegetation Riparian Field Form.

SHRUB HGT Value (1-4) recorded on Vegetation Riparian Field Form.

DISTRIB Pattern of species occurrence within the polygon. C(lumped), E(ven), L(inear), or R(andom).

DENSITY Number of individual plants within each size class found within a 0.5 acre sample plot. Counted, but sometimes extrapolated from a 4.5m square, a 10ft x 10ft plot, or a 0.25 acre sample plot.

NOTES1 Any extraneous information related to a species or plot.

VERIFY.DBF FILE STRUCTURE

Field	Field Name	Type	Length	Decimals
1	NAME	Character	20	
2	POLYID	Character	8	
3	MAPVERSION	Numeric	2	0
4	ASSOC	Character	3	
5	ACRES	Numeric	7	2
6	PLOTS	Numeric	2	0
7	PLOTSDONE	Numeric	2	0
8	SPPCOUNT	Numeric	2	0
9	SPECIES1	Character	6	
10	RANK1	Numeric	4	2
11	SPECIES2	Character	6	
12	RANK2	Numeric	4	2
13	SPECIES3	Character	6	
14	RANK3	Numeric	4	2
15	SPECIES4	Character	6	
16	RANK4	Numeric	4	2
17	CREWASSOC	Character	3	
18	ELEVATION	Numeric	5	0
19	GFBLP	Numeric	9	4
20	MATCH	Character	1	
21	PROBLEM	Numeric	2	0
22	PROBLEM2	Numeric	2	0
23	PROBLEM3	Numeric	2	0
24	CHECKDATE	Date	8	
25	CREW	Character	15	
26	REMARKS1	Character	254	
Total			388	

VERIFY FIELD DESCRIPTIONS

Data comes from GIS and Verification Summary Riparian Field Forms. Each polygon becomes a single record in VERIFY.

NAME Stream name using appropriate abbreviations. See last section of this Appendix.

POLYID Common indicator linking database files (imported from spreadsheet used to select polygons for sampling).

MAPVERSION Most polyids do not have this numeric field created to differentiate between GIS versions of field maps.

ASSOC Vegetative community code assigned by GIS to each polygon (imported from selection spreadsheet).

ACRES	Total acreage of the polygon as assigned by GIS (imported from selection spreadsheet).
PLOTS	Number of plots assigned originally to the polygon. Roughly one plot for every 2.5 acres (imported from selection spreadsheet).
PLOTSDONE	Number of plots actually surveyed.
SPPCOUNT	Number of individual species found on the polygon. Counted from summary sheet.
SPECIES (1-4) /RANK(1-4)	Calculation from summary sheet and assigned a rank from 1-4. Enter highest ranked species into SPECIES1; second highest into SPECIES2; third highest into SPECIES3; and fourth highest into SPECIES4. If more than 4 species meet qualifications (mean of 2.0 or higher and frequency of 0.5 or higher), continued in REMARKS1 (e.g., SALTAX =3). See species codes in Appendix B.
CREWASSOC	Vegetative community codes as assigned after field data was reviewed. See Appendix D.
ELEVATION	Recorded in feet and taken from a topographic map.
GFBLP	Currently blank. Created for use of Brown, Lowe and Pase (1979) hierarchical numbers.
MATCH	Did crewassoc match assoc? Y(es) if both are within the same plant series; N(o) otherwise.
PROBLEM(1-3)	Code for any problem(s) that apply to the polygon. If more than 3 problems, continued in REMARKS1 using the appropriate character string (e.g., UPLAND). 1 = upland polygon 2 = scoured polygon 3 = boundary changes 4 = understory/incorrect association 5 = misidentification of species (wrong series) 6 = agricultural, disturbed, or developed area 7 = access denied/inaccessible 8 = missed 9 = submerged 10 = too narrow in aerial photographs

CHECKDATE Date polygon was surveyed. Entered as MM/DD/YY.

CREW Initials of all individuals surveying the area. Each monograph to be separated by a single space.

REMARKS1 Memo field containing any notes relating to the verification / classification process. Also species /ranks and problems continued from above fields.

PHOTOLOG.DBF FILE STRUCTURE

Field	Field Name	Type	Length	Decimals
1	PHOTO ID	Numeric	6	2
2	ROLL	Numeric	3	0
3	FRAME	Numeric	2	0
4	TOPO_QUAD	Character	20	
5	POLYGON	Character	7	
6	PHOTOTYPE	Character	1	
7	SUBJECT	Character	100	
8	P_GRAPHER	Character	3	
9	FILMTYPE	Character	1	
Total			144	

PHOTOLOG FIELD DESCRIPTIONS

Data comes from Association Verification Riparian Field Forms and Photolog Field Notes. Each photograph becomes a single record in PHOTOLOG.

PHOTO ID Unique identifier for each photograph based on ROLL and FRAME. Entered as RRR.FF.

ROLL Unique number for each roll of film.

FRAME Frame number within a roll of film.

TOPO_QUAD Official name of a topographic map. (Update needs to replace with codes from the ALRIS Quad Numbering System.)

POLYGON Common indicator linking databases. (Update needs to rename and increase size to match other databases.)

PHOTOTYPE Class of subject matter. V(egetation), H(ydrology), B(oth vegetation and hydrology), W(ildlife), P(lant specimen), or A(ction by crew).

SUBJECT Description of photograph.

P GRAPHER Initials of the photographer.

FILMTYPE P(rint) or S(lide) film.

STANDARDIZED ABBREVIATIONS FOR DATABASES

BLM	Bureau of Land Management
CA	Conservation Area
CG	Campground
CNT	County
CP	County Park
CRK	Creek
CTY	City or town
CYN	Canyon
DWNSTRM	Downstream
E	East
FOR	U.S. Forest Service
FT	Fort
FWS	U.S. Fish and Wildlife Service
NAT	Native American Tribal Lands
JCT	Junction
MI	Mile(s)
MIL	Military
MT	Mount
MTN	Mountain
N	North
NE	Northeast
NM	National Monument
NP	National Park
NPS	National Park Service
NW	Northwest
NWR	National Wildlife Refuge
PK	Peak
PVT	Private
R	River
RA	Resource Area
RD	Ranger District
S	South
SE	Southeast
SP	State Park
SPR	Spring(s)
STA	State of Arizona
SW	Southwest
UNK	Unknown
UPSTRM	Upstream
W	West
WA	Wilderness Area
WMA	Wildlife Management Area

Appendix D. Plant classification scheme used during the perennial waters phase of the Statewide Riparian Inventory and Mapping Project.

STATEWIDE RIPARIAN VEGETATION CLASS CODES

A0 Cottonwood-Willow Communities

A1 *Populus-Salix* Associations
A2 *Populus-Salix*-Mixed Broadleaf Association *(Fraxinus, Juglans,* etc.)
A3 *Populus-Sporobolus* Associations
A4 *Populus-Salix-Tamarix* Associations (Often found as Cottonwood-Willow with Tamarisk near the waters edge or in clumps too small to map alone.)
A5 *Populus-Salix-Prosopis* Associations
A6 *Populus-Salix-Platanus* Associations
A7 *Populus-Sambucus* Associations
A8 *Salix* Associations
A9 *Populus* Associations
A10 *Populus-Prosopis* Associations
A11 *Populus angustifolia* Associations

B0 Mesquite Communities

B1 *Prosopis juliflora* Associations
B2 *Prosopis-mixed* narrowleaf (e.g. *Tamarix*, *Chilopsis linearis, Celtis reticulata)*
B3 *Prosopis-Sporobolus* Associations
B4 *Prosopis-Atriplex* Associations
B5 *Prosopis-Baccharis* Associations
B7 *Prosopis-Populus-Salix* Associations
B8 *Prosopis-Populus-SalixAssociations* (Mesquite with a line of willow and cottonwood along the banks)
B9 *Prosopis-Salix* Associations
B10 *Prosopis-Sambucus* Associations
B11 *Prosopis-Quercus* Associations
B12 *Prosopis-Tessaria* Associations
B13 *Prosopis-Mixed* Broadleaf Associations

C0 Tamarisk Disclimax Communities

C1 *Tamarix pentandra* Associations
C2 *Tamarix-Prosopis* Associations
C3 *Tamarix-Salsola-Sorghum* Associations
C4 *Tamarix-Salix-Prosopis* Associations
C5 *Tamarix-Salix-Populus* Associations
C6 *Tamarix/ Salix-Prosopis-Populus* Associations
C7 *Tamarix-Salix* Association
C8 *Tamarix-Tessaria* Association
C9 *Tamarix-Tessaria-Prosopis* Association

C10 *Tamarix-Typha* Association
C11 *Tamarix-Elaeagnus angustifolia* Association
C12 *Tamarix-Acacia* Association
C13 *Tamarix-Mixed* Broadleaf Association

D0 Scattered Mixed Scrub communities
D2 Mixed Scrub (e.g., *Baccharis, Hymenoclea, Tamarix)*
D4 Mixed Scrub-willow (Mixed scrub with a line of willow along the banks)
D6 Mixed *Scrub-Prosopis*

E0 Sacaton Grass Communities
E1 *Sporobolus-Prosopis* Associations
E2 *Sporobolus-Populus* Associations
E3 *Sporobolus-Scrub* Associations

G0 Scirpus Communities

H0 Mexican Elder Communities
H1 *Sambucus* Associations

J0 Rush Communities
J1 *Juncus* Associations
J2 *Juncus-Typha* Associations
J3 *Juncus-Tamarix* Associations

K0 Desert Willow Communities
K1 *Chilopsis linearis* Associations
K2 *Chilopsis-Mixed* Deciduous Associations

L0 Acacia Communities
L1 *Acacia* Associations
L2 *Acacia-Tamarix* Associations

M0 Mountain Meadow Communities
M1 Dry Grassland
M2 Dry Grassland with Shrubs
M3 Wet Meadow
M4 Wet Meadow with Shrubs
M5 Grass with Pines

N0 Russian Olive Communities

N1 *Elaeagnus angustifolia-Tamarix* Associations
N2 *Elaeagnus angustifolia* Associations

00 Oak Communities
01 *Quercus/Platanus* Associations
02 *Quercus-Platanus-Populus* Associations
03 *Quercus-Pinus* Associations
04 *Quercus-Platanus* Associations
05 *Quercus* Associations
06 *Quercus-Juniperus* Associations
07 *Quercus-Platanus-Juniperus* Associations
08 *Quercus-Juniperus-Coniferous* Associations
09 *Quercus-Prosopis-Platanus* Associations

PO Coniferous Forest Communities
P1 *Conifer-Quercus* Associations
P2 *Conifer-Quercus-Juniperus* Associations
P3 *Conifer-Platanus-Quercus* Associations
P4 *Conifer-Platanus* Associations
P5 Conifer Associations
P6 Conifer-*Juniperus* Associations
P7 *Conifer-Populus tremuloides* Associations
P8 Conifer-Mixed Broadleaf Associations

QO Phragmites Communities

RO Arrow weed Communities
R1 *Tessaria sericea* Associations
R2 *Tessaria-Tamarix* Associations
R3 *Tessaria-Tamarix-Salix* Associations
R4 *Tessaria-Prosopis* Associations
R5 *Tessaria-Tamarix-Prosopis* Associations

SO Sycamore Communities
S1 *Platanus-Quercus* Associations
S2 *Platanus-Juniperus* Associations
S3 *Platanus-Populus* Associations
S4 *Platanus wrightii* Associations
S5 *Platanus-Prosopis* Associations
S6 *Platanus-Quercus-Juniperus* Associations
S7 *Platanus-Fraxinus* Associations

S8 *Platanus-Alnus* Associations
S9 *Platanus-Salix* Associations
S10 *Platanus-Juglans* Associations

TO Cattail Communities
T1 *Typha* Associations
T2 *Typha-Salix* Associations
T3 *Typha-Juncus* Associations
T4 *Typha-Tessaria-Tamarix* Associations
T5 *Typha-Tamarix* Associations

WO Mountain Shrub
W1 Mixed Mountain Shrub Associations
W2 Mixed Mountain *Shrub-Quercus*
W3 *Amorphus fructosa* Associations
W4 *Comus* Associations
W5 *Potentilla* Associations
W6 *Rosa* Associations
W7 Robina Associations
W8 High elevation *Salix* Associations
W9 *Crataegus* Associations

XO Mixed Broadleaf Communities
X1 *Fraxinus* Associations
X2 *Juglans* Associations
X3 *Acer negundo* Associations
X4 *Acer grandidentatum* Associations
X5 *Morus* Associations
X6 *Celtis* Associations
X7 *Alnus oblongifolia* Associations
X8 *Alnus tenuifolia* Associations

YY Agriculture

ZZ Areas Not Visited

FO Flood **Impact**

Appendix E. Classification of plants by Brown and Lowe (1980) biotic communities (including wetland ratings).

Taxonomic name	Common name	Wetland ratings[1] I	2	3	4	5	Vegetation class[2] 121.3	122.3	122.4	123.3	133.3	141.4	142.1	143.1	152.1	153.1	153.2	154.11	154.12
Ibies concolor	White fir		X			X	X	X	X	X	X								
Abies lasiocarpa arizonica	Corkbark fir				FACU+			X											
4cacia constricta	Whitethorn										X			X			X		X
4cacia greggii	Catclaw	X	X			X		X	X	X	X		X	X			X		X
4cacia spp.	Acacia							X			X			X			X		X
Acer glabrum	Rocky Mountain maple		X		FAC	X		X	X										
Acer grandidentatum	Bigtooth maple	X	X			X		X	X	X	X								
Acer negundo	Box elder	X	X	2	FACW-	X		X	X	X	X		X	X					X
Agave palmeri	Palmer agave							X						X					
Agave spp.	Century plant							X	X	X	X		X		X		X		X
Ailanthus altissima	Tree of heaven		X		FACU								X	X					
Allenrolfea occidentalis	Iodine bush	X	X		FACW												X		
Alnus oblongifolia	Arizona alder	X	X	2	FACW+	X		X	X	X	X		X	X					X
Alnus spp.	Alder							X	X	X									
Alnus tenuifolia	Thin-leaf alder	X	X			X	X	X	X	X			X						X
Aloysia wrightii	Wright lippa			4													X		X
Ambrosia ambrosoides	Canyon ragweed		X			X			X		X			X					X
Ambrosia aptera	Blood weed													X					
Ambrosia deltoidea	Burrobush																		X
4mbrosia spp.						X													X
4melanchier utahensis	Utah serviceberry					X		X	X		X			X					
Amorpha fruticosa	Bastard indigo	X		2	FACW+	X		X	X	X	X		X	X			X		X
Amorpha spp.	False indigo									X									X
Anisacanthus thurheri	Desert honeysuckle					X			X					X					X
Arbutus arizonica	*Arizona* madrone					X		X		X				X					

Taxonomic name	Common name	Wetland ratings[1] 1	2	3	4	5	Vegetation class[2] 121.3	122.3	122.4	123.3	133.3	141.4	142.1	143.1	152.1	153.1	153.2	154.11	154.12
Arctostaphylos patula	Green-leaf manzanita									X	X								
4rctostaphylos pun gens	Mexican manzanita					X		X			X			X					
4rtemisia bigelovii	Bigelow sagebrush														X				
Artemisia spp.	Sage			5		X		X											
Artemisia tridentata	Big sagebrush					X		X	X						X				
4triplex canescens	Four-wing saltbush								X				X	X	X	X	X	X	X
4triplex confertifolia	Shadscale															X		X	
4triplex spp.	Saltbush		X						X					X		X	X	X	X
Baccharis emoryi	Emory baccharis	X			FACW									X			X		
Baccharis salicifolia	Seep willow		X			X			X	X	X		X	X	X	X	X	X	X
Baccharis sarathroides	Desert broom	X	X		FAC-	X			X	X	X		X	X		X	X	X	X
Baccharis sergiloides	Waterweed				FAC-	X					X			X					X
Baccharis spp.	Groundsel tree								X		X		X	X	X	X	X	X	X
Berberis fremontii	Desert barberry					X			X	X	X		X	X					X
Berberis repens	Creeping barberry					X		X	X					X					
Berheris spp.	Barberry					X			X	X	X			X					X
Berberis trifoliata	Algeritas										X			X					
Berheris wilcoxii	Wiicox barberry					X				X									
Betula occidentalis	Water birch	X	X		FACW			X	X										
Brickellia californica	Pachaba	X		4	FACU +	X			X	X							X		
Brickellia spp.	Bricklebush			4		X		X	X	X	X		X	X					X
Bursera spp.	Bursera													X					X
Calliandra spp.	False mesquite																		X
Canotia holacantha	Canotia										X			X					X
Carex spp.	Sedge	X	X			X	X	X	X	X		X	X						
Ceanothus fendleri	Buck brush					X		X	X	X	X			X					

Taxonomic name	Common name	1Vetland ratings[1] 1	2	3	4	5	Vegetation class[2] 121.3	122.3	122.4	123.3	133.3	141.4	142.1	143.1	152.1	153.1	153.2	154.11	154.1
Ceanothus greggii	Desert ceanothus					X		X		X	X			X					
Ceanothus integerrimus	Deer brush									X									
Ceanothus spp.								X	X	X				X					
Celtis pallida	Desert hackberry		X			X			X		X			X			X		X
Celtis reticulata	Net-leaf hackberry	X	X	3	FACU	X			X	X	X		X	X	X		X		X
Celtis spp.	Hackberry								X										X
Cephalanthus occidentalis	Common buttonbush		X		OBL									X			X		X
Cercidium floridum	Blue paloverde		X											X				X	X
Cercidium microphyllum	Foothill paloverde					X			X		X			X				X	X
Cercocarpus betuloides	Birch-leaf mountain mahogany					X		X	X	X	X								
Cercocarpus intricatus	Little-leaf mountain mahogany								X										
Cercocarpus montanus	Alder-leaf mountain mahogany					X			X	X	X								X
Cercocarpus spp.	Mountain mahogany							X						X				X	X
Cereus giganteus	Saguaro										X			X					X
Chamaebatiaria nillefolium	Fernbush								X										
Chilopsis linearis	Desert willow	X	X			X			X	X	X		X	X	X	X	X		X
Chrysothamnus nauseosus	Rubber rabbitbrush	X						X	X	X			X	X	X		X		X
Chrysothamnus spp.	Rabbitbrush							X	X				X	X	X				X
Chrysothamnus viscidiflorus	Sticky-leaved rabbit brush								X										
Cicuta douglasii	Water hemlock			I	OBL	X								X					
Clematis spp.	Virgin's bower							X	X					X			X		X
Condalia spp.								X						X			X		

Taxonomic name	Common name	Wetland ratings[1] 1	2	3	4	5	Vegetation class[2] 121.3	122.3	122.4	123.3	133.3	141.4	142.1	143.1	152.1	153.1	153.2	154.11	154.12
Cornus stolonifera	**Red osier dogwood**	X	X		FACW	X	X	X	X		X								
Cowania mexicana	Quinine **bush**					X			X					X					
Cowania spp.	Cliffrose								X										
Crategus erythropoda	**Cerro hawthorn**		X		**NI**			X	X										
Crategus spp.	**Hawthorn**	X	X					X											X
Crossosoma bigelovii	**Bigelow ragged rock flower**																		X
Cupressus arizonica	**Arizona cypress**		X			X		X		X	X			X					X
Cupressus glahra	**Smooth-harked Arizona cypress**													X					
Cyperus spp.	**Flat sedge**	X	X												X				
Dasylirion wheeleri	*Sotol*					X				X	X			X	X				X
Datura meteloides	**Sacred** datura			5		X													X
Datum spp.	**Thorn apple**		X										X						
Dodonaea viscosa	Hophush					X			X					X					X
Elaeagnus angustifolia	**Russian olive**	X	X		FACW-			X	X				X	X	X	X			X
Eleocharis spp.	**Spike rush**	X	X					X											
Encelia farinosa	**Brittle hush**								X							X		X	X
Encelia spp.																			X
Ephedra spp.	Joint-fir														X		X		X
Equisetwn spp.	**Horsetail**	X	X			X		X	X	X				X			X		
Etythrina flabelliformis	**Southwestern** coralbean													X					
Eucalyptus spp.	**Eucalypt**																		X
Eurotia lanata	**Winter fat**										X			X					
Fallugia paradoxa	**Apache plume**	X				X				X							X		
Fendlera rupicola	Fendlerbush								X		X								

Taxonomic name	Common name	Wetland ratings[1] 1	2	3	4	5	Vegetation class[2] 121.3	122.3	122.4	123.3	133.3	141.4	142.1	143.1	152.1	153.1	153.2	154.11	154.12
Ferocactus wizlizenii	Barrel cactus													X			X		X
Ficus spp.	Fig													X					X
Forestiera neomexicana	Desert olive	X		4	FACU	X		X	X		X		X	X	X				X
Fouquieria splendms	Ocotillo					X					X			X					X
Fraxinus anomala	Single-leaf ash										X				X				X
Fraxinus *lowellii*	Lowell ash													X					
Fraxinus spp.	Ash	X						X	X	X	X			X					X
Fraxinus velutina	Velvet ash	X	X	3	FAC +	X		X	X	X	X		X	X		X	X		X
Garrya flavescens	Silktassel bush					X		X		X	X								
Garrya *wrightii*	Wright silktassel			4		X		X	X	X	X			X			X		X
Gleditsia triacanthos	Common honey-locust			3	FAC								X	X					
Gutierrezia sarothrae	Broom snakeweed					X		X	X	X	X		X	X	X	X	X		X
Haplopappus spp.														X	X				X
Haplopappus tenuisectus	Burroweed									X							X		X
Hibiscus spp.	Rose mallow									X									
Holidiscus dumosus	Mountain spray								X										
Hymenoclea monogyra	Burro brush	X	X			X			X	X	X			X			X		X
Hymen oclea salsola	Cheesebush													X					X
Hymen oxys odorata	Bitterweed																		X
iris missouriensis	Rocky Mountain iris				FACW-	X		X											
Juglans major	Arizona walnut	X	X	2	FACW-	X		X	X	X	X		X	X			X		X
Juniperus *communis*	Common juniper					X		X											
Juniperus deppeana	Alligator juniper		X	5		X		X	X	X	X		X	X			X		X
Juniperus monosperma	One-seed juniper			5		X		X	X	X	X		X	X					X
Juniperus *osteosperma*	Utah juniper			5		X		X	X	X	X		X	X	X		X		X

Taxonomic name	Common name	Wetland ratings[1] 1	2	3	4	5	Vegetation class[2] 121.3	122.3	122.4	123.3	133.3	141.4	142.1	143.1	152.1	153.1	153.2	154.11	154.12
Juniperus scopulorum	Rocky Mountain juniper			5		X		X	X	X	X		X						
Juniperus spp.	Juniper							X	X	X	X	X	X	X	X		X		X
Koeberlinia spinosa	*Allthorn*																X		X
Larrea tridentata	Creosote bush															X	X	X	X
Lonicera arizonica	Arizona honeysuckle							X	X		X								
Lonicera involucrata	Bearberry honeysuckle	X			FAC U	X		X		X									
Lonicera spp.	Honeysuckle													X					
Lycium berlandieri	Berlandier wolfberry		X																X
Lycium pallidum	Rabbit thorn													X			X	X	X
Lycium spp.	Wolfberry								X	X	X			X			X	X	X
Madura pomifera	Osage-orange		X											X					
Malus spp.	Apple							X						X					X
Welia azedarach	Umbrella tree													X					
Mimosa biuncifera	Wait-a-minute					X			X	X	X			X			X		X
Mimosa spp.																	X		X
Mortonia spp.									X	X	X			X			X		X
Alorus microphylla	Texas mulberry	X	X	3	FACU	X			X	X	X			X			X		X
Nerium oleander	Common oleander																		X
Nicotiana glauca	Tree tobacco		X		FAC	X				X	X			X			X	X	X
Nolina bigelovii	Bigelow nolina										X		X				X		X
Nolina microcarpa	Beargrass					X		X		X				X					X
Olneya tesota	Ironwood		X			X													X

Taxonomic name	Common name	Wetland ratings[1] 1	2	3	4	5	Vegetation class[2] 121.3	122.3	122.4	123.3	133.3	141.4	142.1	143.1	152.1	153.1	153.2	154.11	154.12
Opuntia leptocaulis	Desert Christmas cactus																		X
Opuntia phaeacantha	Engelmann prickly pear					X		X	X	X	X		X	X	X		X		X
Opuntia spp.								X	X	X	X		X	X	X		X		X
Opuntia whipplei	Whipple cholla								X										
Parkinsonia aculeata	Mexican paloverde				FAC-									X					
Parthenocissus inserta	Thicket creeper		X		FACW-	X	X	X	X	X	X		X						
Philadelphus microphyllus	Mock orange	X							X										
Phragmites australis	Common reed	X	X		FACW +				X				X	X	X			X	X
Picea engelmannii	Engelmann spruce		X		FAC-	X		X				X							
Picea pungens	Blue spruce	X	X		FAC	X		X											
Picea spp.	Spruce						X	X				X							
Pinus cembroides	Mexican pinyon							X	X	X				X			X		
Pinus edulis	Colorado pinyon			5		X		X	X	X	X		X						
Pinus engelmannii	Apache pine					X		X		X				X					
Pinus flexilis	Limber pine					X		X											
Pinus latifolia	Apache pine							X		X									
Pinus leiophylla	Chihuahua pine					X		X		X				X					
Pinus ponderosa	Ponderosa pine		X		FACU	X		X	X	X	X		X						
Pinus reflexa	Southwestern white pine						X	X	X										
Pinus spp.	Pine								X	X									
Platanus wrightii	Arizona sycamore	X	X	2	FACW-	X		X	X	X	X		X	X			X		X
Populus acuminata	Lance-leaved cottonwood	X		2	FACW			X	X	X			X						

Taxonomic name	Common name	Wetland ratings[1] 1	2	3	4	5	Vegetation class[2] 121.3	122.3	122.4	123.3	133.3	141.4	142.1	143.1	152.1	153.1	153.2	154.11	154.12
Populus angustifolia	Narrow-leaf cottonwood	X	X	2	FACW	X		X	X	X	X		X						
Populus fremontii	Fremont cottonwood	X	X	2	FACW	X		X	X	X	X		X	X	X	X	X	X	X
Populus spp.	Cottonwood							X		X			X		X				
Populus tremuloides	Quaking aspen	X	X		FACU	X	X	X	X										
Potentilla fruticosa	Shrubby cinquefoil		X		FACW-	X	X	X				X	X						
Potentilla spp.	Cinquefoil					X		X											
Prosopis glandulosa	Honey mesquite	X	X	4	FACU						X			X		X		X	X
Prosopis puhescens	Screwbean mesquite		X		FACW-											X		X	X
Prosopis spp.	Mesquite										X			X		X	X	X	X
Prosopis velutina	Velvet mesquite		X		FACU	X			X	X	X		X	X			X	X	X
Prunus emarginata	Bitter cherry		X					X	X	X									
Prunus spp.			X					X	X	X	X			X	X		X		X
Prunus virens	Southwestern black cherry			3	FACU	X		X	X	X	X								
Prunus virginiana	Common chokecherry	X			FAC	X			X					X					
Pseudotsuga menziesii	Douglas-fir					X	X	X	X	X	X								
Ptelea angustifolla	Narrow-leaf hoptree	X		4	FACU*	X		X	X	X	X			X					
Ptelea trifoliata	Hoptree				FACU*				X	X				X					
Quercus arizonica	Arizona white oak		X	5		X		X	X	X	X		X	X			X		X
Quercus chrysolepis	Canyon live oak		X			X			X										
Quercus dunnii	Palmer oak										X								
Quercus emoryi	Emory oak		X	5		X		X	X	X	X		X	X			X		X
Quercus gambelli	Gambel oak		X	5		X		X	X	X	X								
Quercus grisea	Gray oak					X				X				X					
Quercus hypoleucoides	Silver-leaf oak					X		X		X				X					

Taxonomic name	Common name	Wetland ratings[1] 1	2	3	4	5	Vegetation class[2] 121.3	122.3	122.4	123.3	133.3	141.4	142.1	143.1	152.1	153.1	153.2	154.11	154.12
Quercus oblongifolia	Mexican blue oak					X								X					
Quercus rugosa	Net-leaf oak							X		X				X					
Quercus spp.	Oak							X	X	X	X			X					X
Quercus turbinella	Shrub live oak					X			X		X			X					X
Quercus undulata	Wavyleaf oak									X									
Rhamnus betulaefolia	Birch leaf buckthorn	X			FACW-	X		X	X	X	X								X
Rhamnus californica	California buckthorn					X		X	X	X	X		X	X					X
Rhamnus crocea	Red berry buckthorn					X		X	X	X	X			X					X
Rhamnus spp.	Buckthorn							X	X	X				X					
Rhus glabm	Smooth sumac		X			X		X	X	X	X								
Rhus microphylla	Desert sumac	X				X								X			X		X
Rhus ovata	Sugar sumac					X					X			X					X
Rhus radicans	Poison ivy		X		FACW	X		X	X	X	X		X	X	X		X		X
Rhus spp.	Sumac						X	X	X								X		X
Rhus trilohata	Squaw bush			4	NI[3]	X		X	X	X	X		X	X					X
Ribes aureum	Golden current				FACW			X											
Ribes inerme	Whitestem gooseberry				FACW-			X	X										
Ribes *leptanthum*	TnAmpet gooseberry							X											
Ribes *pinetorum*	Orange gooseberry					X		X	X										
Ribes spp.	Currant		X			X		X	X				X	X					
Ribes wolfii	Wolf currant				FAC			X											
Robinia neomexicana	New Mexico locust		X			X	X	X	X	X	X		X	X					
Rosa arizonica	Arizona rose				FACU			X	X		X		X						
Rosa fendleri	Fendler rose				FACU			X	X				X						

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Rosa spp.	Rose					X		X	X		X			X	X				
Rubus arizonensis	Arizona dewberry				FACU	X		X			X			X					
Rubus neomexicanus	New Mexico raspberry					X		X											
Rubus parviflora	Western thimbleberry				NI[4]	X		X											
Rubus spp.	Blackberry		X					X	X										
Rubus strigosus	American red raspberry				FAC	X		X	X										
Salix alba	White willow							X											
Salix amygdaloides	Peach-leaf willow		X		FACW	X			X										
Salix arizonica	Arizona willow						X					X							
Salix bebbiana	Bebb willow		X		FACW	X		X	X			X							
Salix bonplandiana	Bonpland willow		X		FACW+	X		X	X	X	X		X	X		X			X
Salix exigua	Coyote willow		X	I	OBL	X		X	X	X	X		X	X	X	X	X		X
Salix geyeriana	Geyer willow				OBL		X	X				X							
Salix gooddingii	Goodding willow	X	X	I	OBL	X			X	X	X	X	X	X	X	X	X	X	X
Salix irrorata	Bluestem willow		X	2	FACW +	X	X	X	X	X			X						
Salix laevigata	Red willow				FACW+			X	X	X	X								X
Salix lasiandra	Pacific willow				FACW+	X		X	X	X				X					X
Salix lasiolepis	Arroyo willow		X		FACW	X	X	X	X	X	X		X	X					X
Salix ligulifolia	Strapleaf willow				OBL	X		X	X	X			X		X				
Salix monticola	Serviceberry willow		X		OBL		X	X				X							
Salix spp.	Willow	X	X					X	X	X	X		X	X	X		X	X	X
Salix taxifolia	Yew-leaf willow				FACW-					X				X			X		
Salvia spp.	Sage																X		
Sambucus mexicana	Mexican elder		X		FAC			X		X	X		X	X			X		X

Taxonomic name	Common name	Wetland ratings[1]					Vegetation class[2]												
		1	2	3	4	5	121.3	122.3	122.4	123.3	133.3	141.4	142.1	143.1	152.1	153.1	153.2	154.11	154.12
Sambucus spp.	Elder					X		X	X		X			X					X
Sapindus saponaria	Western soapberry	X	X			X			X	X				X			X		X
Sarcobatus venniculatus	Greasewood	X			FACU +													X	
Scirpus californicus	Giant bulrush		X		OBL									X				X	
Scirpus spp.	Bulrush	X	X			X							X	X			X	X	
Senecio salignus					FAC	X								X			X		
,*Senecio* spp.	Groundsel					X			X	X				X	X		X		
Simmondsia chinensis	Jojoba										X								X
Sorbus dumosa	Mountain ash							X	X										
Suaeda spp.	Seep weed		X												X	X			
Symphoricarpos 9reophilus	Mountain snowberry							X											
Symphoricarpos rotundifolius	Round-leaf snowberry								X	X	X								
Symphoricarpos spp.	Snowberry					X		X	X		X								
Tamarix aphylla	Athel		X		FAC													X	
Tamarix pentandra	Salt cedar		X		NI	X		X	X	X	X		X	X	X	X	X	X	X
Tessaria sericea	Arrow weed	X	X		FACW-										X	X		X	X
Thamnosma montana	Turpentine broom																		X
Typha domingensis	Southern cattail		X	1	OBL										X				
Typha latifolia	Broad-leaved cattail	X	X		OBL									X					
Typha spp.	Cattail					X					X	X	X	X	X	X	X	X	X
Ulmus pumila	Siberian elm														X				
Ulmus spp.	Elm							X	X	X	X		X	X	X		X		
Vauquelinia californica	Arizona rosewood					X													X
Veratrum californicum	False hellebore				OBL	X		X											
Vitus arizonica	Canyon grape		X	3	FAC	X		X	X	X	X		X	X	X		X		X

Taxonomic name	Common name	Wetland ratings[1] 1	2	3	4	5	Vegetation class[2] 121.3	122.3	122.4	123.3	133.3	141.4	142.1	143.1	152.1	153.1	153.2	154.11	154.12
Yucca angustissima	Narrow-leaf yucca								X						X				
Yucca elata	Soap tree yucca																X		X
Yucca schottii	Hairy yucca					X		X		X				X					
Yucca spp.	Yucca							X	X	X	X		X	X	X		X		X
Zinnia acerosa	Zinnia																X		
Zizyphus obtusifolia	Graythorn		X			X		X	X	X	X		X	X			X		X
N 270		49	83	37	80	1129	17	136	139	112	107	11	68	139	43	23	75	29	127

[1] Group 1 contains "major obligate riparian plants found in New Mexico" Dick-Peddie and Hubbard 1977 . Group 2 contains plant species listed as occurring in wetland biotic communities (Brown 1982 . Group 3 plants are found along the Gila and San Francisco rivers, New Mexico Dick-Peddie et al. 1987 . Frequency of occurrence index numbers range from 1 (obligate) to 5 (upland). Group 4 plants are wetland indicator ratings for the Southwest (Reed 1988 . Categories are OBL (obligate wetland), FACW (facultative wetland), FAC (facultative), and FACU (facultative upland). Positive and negative - signs indicate higher and lower frequency in wetlands, respectively. NI (no indicator) denotes species with insufficient information to determine indicator status. An asterisk * identifies tentative assignment based on limited knowledge. Group 5 plants were found within riparian forest and scrubland communities in Arizona and New Mexico Szaro 1989 .

[2] Vegetation classes (Brown and Lowe 1980 where species were observed by AGFD biologists are marked. No data were collected from class 111.5.

* Rated NI for the Southwest, but has a tentative national rating of FAC (Reed 1988 .

* Rated NI for the Southwest, but has a national rating of FACU,FAC (Reed 1988 .

Rated NI for the Southwest, but has a national rating of FACW (Reed 1988 .