RESOURCE PROTECTION IN TEXAS

Contract Study: Number 3, Part I

A Vegetation Inventory for the Proposed Cibolo and Goliad Reservoir Sites

A VEGETATION INVENTORY AND HABITAT QUALITY ASSESSMENT FOR

THE PROPOSED CIBOLO AND GOLIAD RESERVOIR SITES

Prepared By

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Texas Water Development Board
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INTRODUCTION

The purpose of this study was to classify, delineate, and map major vegetational communities for the proposed Cibolo Reservoir in Wilson County and Goliad Reservoir in Karnes and Goliad Counties. The study was conducted through an interagency contract (TWDB Contract No. 92-483-307) between the Texas Water Development Board (TWDB) and Texas Parks and Wildlife Department (TPWD). The vegetation mapping and inventory was accomplished through a subcontract (TPWD Contract No. 332-0123) with the Department of Geography and Planning, Southwest Texas State University. The work was conducted under the supervision of Dr. Ryan Rudnicki. Vegetation inventory data submitted to the TWDB will be used by the Board to evaluate and compare environmental factors associated with proposed reservoir sites within the upper south Texas plains and middle gulf coastal prairie regions. The sites have been identified as potential reservoir locations for satisfying future water supply needs for this region of Texas.

STUDY AREA

The Cibolo Reservoir site lies principally within the floodplain of Cibolo Creek in Wilson County approximately 35 miles southeast of San Antonio (Figure 1). The northern portion of the site lies within the Post Oak Savannah ecological region, while the southern portion of the site lies within the South Texas Plains (Gould et.al. 1960). The Goliad site lies southeast of the Cibolo site within the floodplain of the San Antonio River approximately 5 miles west of the city of Goliad (Figure 2). This site is within portions of Karnes and Goliad Counties and is entirely contained within the South Texas Plains. Climate for both sites is subtropical, humid, with warm summers and mild winters. The average annual precipitation ranges between 28 and 32 inches; average annual high temperature ranges between 81 and 83 degrees F. while average annual low temperature ranges between 59 and 61 degrees F. The average annual gross lake surface evaporation rate for this region is 62 inches (Texas Department of Water Resources 1983).

Major vegetation cover types typical of this region have been previously mapped (McMahan et. al. 1984). These include a mosaic of post oak woods, forests and grasslands, mesquite-blackbrush brush, and pecan-elm riparian forests, all interspersed with croplands. Huisache, elm, and hackberry also commonly occur as variations of the former categories. Floodplains and creek drainages are characterized by pecan-elm forests and parklands that contain a wide diversity of woody vegetation that create sight specific variations from the primary type. Principal crops include agricultural row crops and hay pastures.

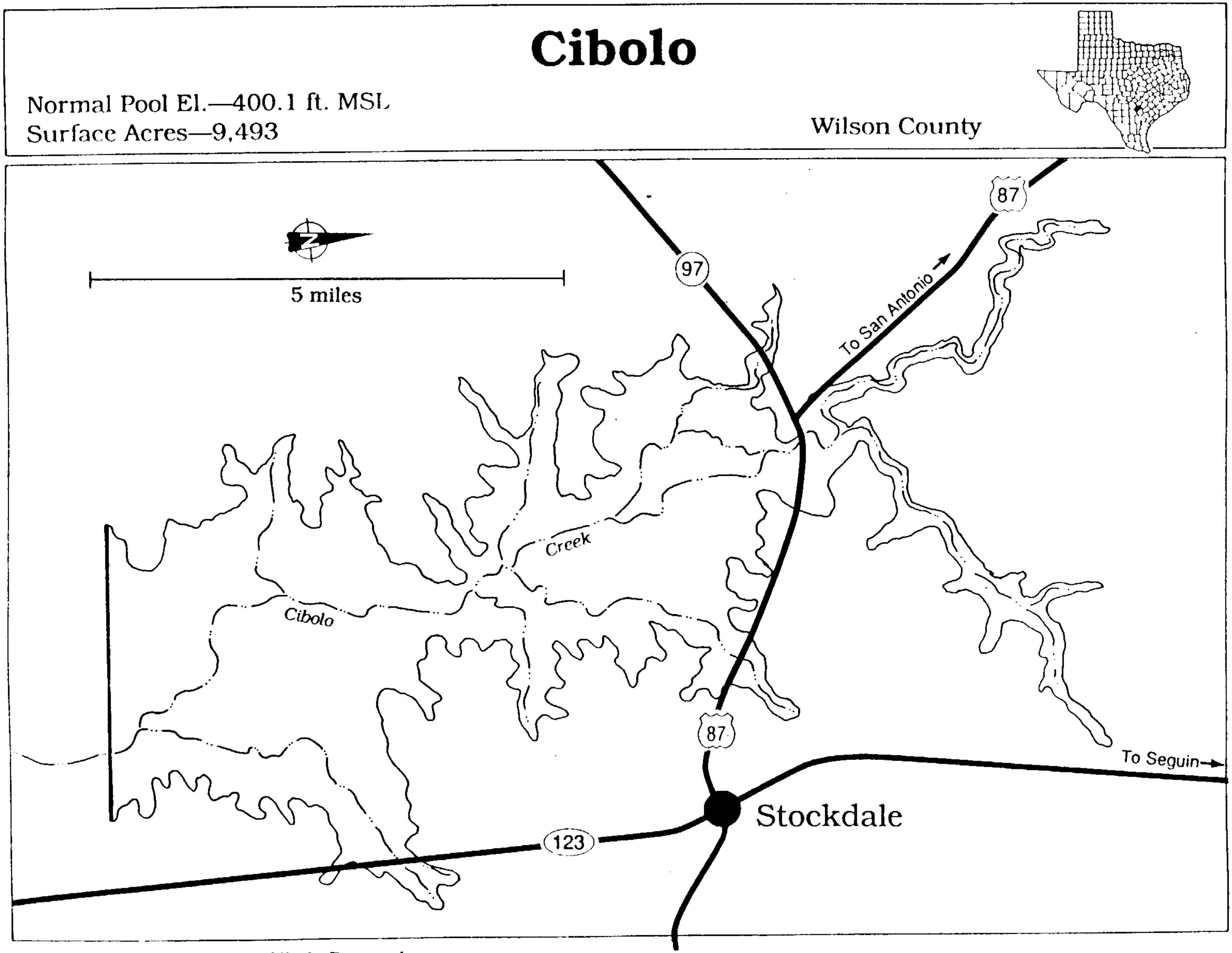
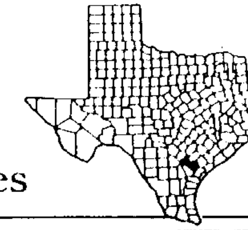


Figure 1. Site Location for Cibolo Reservoir

Goliad

Normal Pool El.—207 ft. MSL
Surface Acres—32,002

Goliad and Karnes Counties



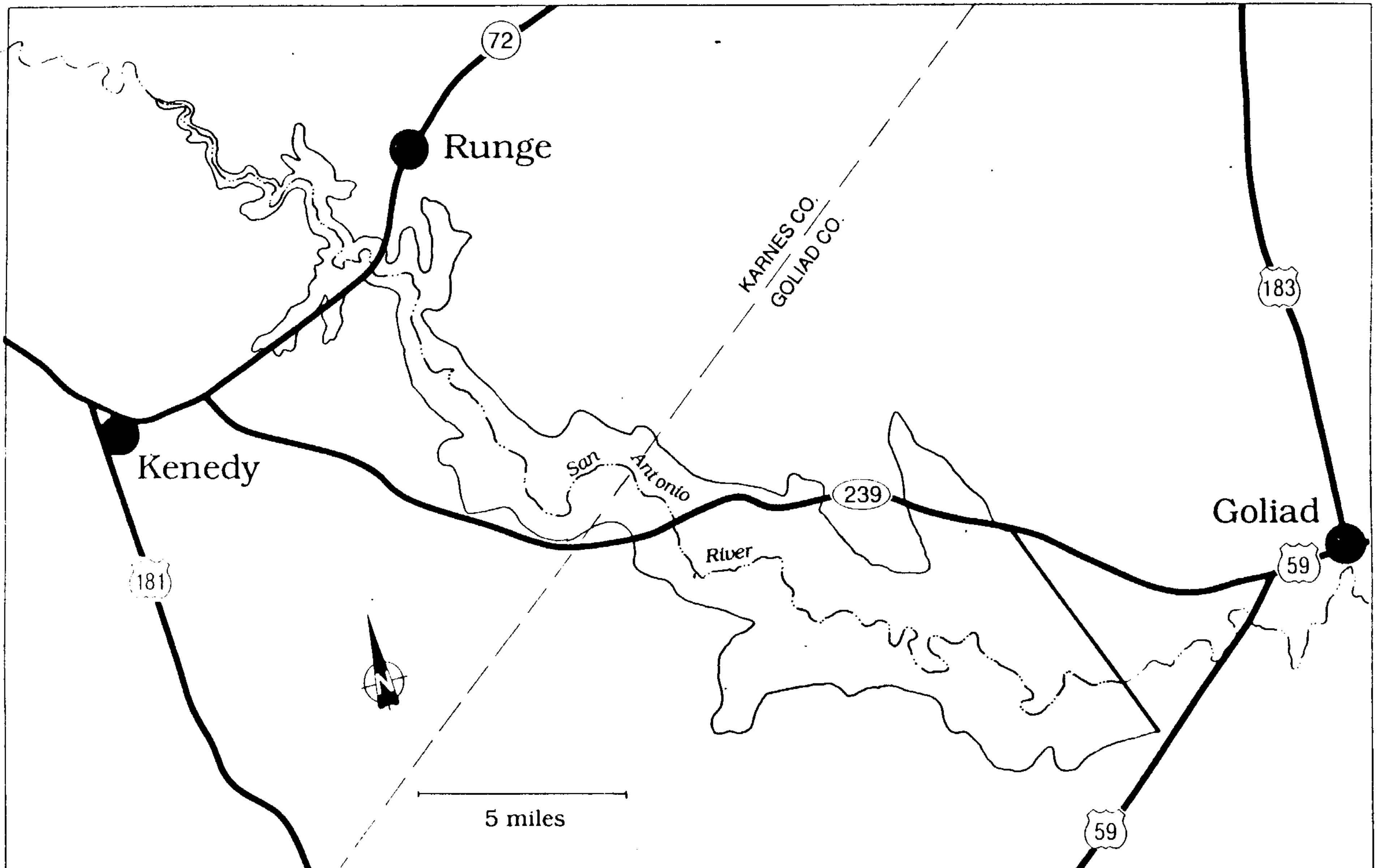


Figure 2. Site Location for Goliad Reservoir

METHODS

Vegetation Mapping and Inventory

Vegetation Mapping and Inventory

Classification and mapping of the occurring vegetation types were conducted through the use of aerial photography and conventional photointerpretation methods.

Color infrared NAPP photography at a scale of 1:24,000 was procured from the Agricultural Stabilization and Conservation Service, U.S. Department of Agriculture, for use in preparation of vegetation maps. A total of 18 individual prints were required to ensure total coverage. Dates of acquisition were February 1989 and January 1990. The scale of the photography was selected to match U.S. Geological Survey (USGS) 7.5 minute maps which provided a registration base and also served to provide ancillary information to assist the vegetation classification process. Boundaries of the proposed normal pool elevations of both Cibolo and Goliad Reservoirs were provided by the TWDB.

The classification and inventory of occurring vegetation cover types employed the services of three graduate students and facilities of the Department of Geography and Planning, Southwest Texas State University. This process entailed a three step process: identification and delineation of a priori physiognomic classes to be mapped; delineation of homogenous vegetation cover types through photointerpretation and field verification; and computer processing that included digitization of reservoir boundaries, delineation of vegetation boundaries, generation of proof plots, processing of digital line graph (DLG) files for orientation, adding attributes to the digitized lines and polygons and generation of acreage summaries and final map plots. Individual reports by each of the three graduate students concerning the above listed tasks are provided as Appendix 1.
Field trips were conducted during the period March through May 1992. Patterns on the photos were correlated with existing ground cover through both on-site field checks, and extrapolation of photo colors, shapes, textures, and patterns. Ground cover was classified according to guidance provided by TPWD staff. Criteria for physiognomic classification are presented in Table 1.

Table 1. Physiognomic Classes of Cover Types Occurring Within the Reservoir Sites.

Grasses/Forbs	Herbs (grasses, forbs and grasslike plants) dominant; woody vegetation lacking or nearly so (generally 10% or less woody canopy coverage).
Brush	Woody plants mostly equal to or greater than 9 feet tall dominant and growing as random or evenly spaced individuals, small clusters or closed canopied stands (greater than 10% canopy cover).
Parks	Woody plants mostly equal to or greater than 9 feet tall generally dominant and growing as small clusters, or as randomly scattered individuals within continuous grass or forbs (11 to 70% woody canopy over overall).
Woods	Woody plants mostly 9 to 30 feet tall with closed crowns or nearly so (71 to 100% canopy cover); midstory usually lacking.
Forest	Deciduous or evergreen trees dominant; mostly greater than 30 feet tall with closed crowns or nearly so (71 to 100% canopy cover); midstory generally apparent except in managed monoculture.
Crops	Includes cultivated crops or row crops used for the purpose of producing food and fiber for man or domestic animals; also includes hay meadows where herbaceous cover is cropped and baled.
Water	Streams, lakes, ponds, flooded oxbows, and water treatment facilities.

Electronic Digitizing and Export of Data to a Geographic Information System

Cover types accounting for proportionately small acreage were lumped into other categories to facilitate the classification process. Ancillary ground truth from previous vegetation maps provided by TPWD was also utilized. The preliminary maps were subsequently revised and modified as necessary to provide final manually drafted map products with well defined ground cover boundaries suitable for digitizing. Digitization was conducted using conventional digitizing pads and pen plotter driven by microcomputers. Attribute data for each of the delineated cover types was extracted and summarized using pcARC/INFO.

RESULTS

Vegetation Mapping

Seven cover types were delineated for both the Cibolo and Goliad Reservoir Sites. These cover types and associated inventory data are listed in Table 2.

Where multiple species occur as indicated by the classification names, such species would generally be considered dominant. However, minor variations to this classification could occur depending on specific site location. A more detailed description of each of the cover types including observed plant species is provided in Appendix 1 , Report of Activities of Mark Kainer.

Composite vegetation maps for the Cibolo and Goliad sites are provided respectively in Figures 4 and 5.

Table 2. Cibolo Reservoir Site Vegetation Cover Types

Cover Type	Cover Type Name	Acres	% Cover	Number of Polygons
1	Mixed Riparian Forest	1615	16.3	3
2	Mixed Oak Forest/Woods	631	6.4	20
3	Mesquite-Hackberry Woods/Brush	1512	15.3	39
4	Oak-Cedar Elm Park	353	3.6	20
5	Grasses	1719	17.4	56
6	Crops	4028	40.7	33
7	Water	38	0.4	28
8	Islands (not included in totals)	116		8
TOTALS:		9,896	100.1	199

Goliad Reservoir Site Vegetation Cover Types

Cover Type	Cover Type Name	Acres	% Cover	Number of Polygons
1	Mixed Riparian Forest	5098	17.8	3
3	Mesquite-Hackberry Woods/Brush	4872	17.0	54
4	Oak-Cedar Elm Park	1377	4.8	34
5	Grasses	6934	24.2	48
6	Crops	10251	35.8	31
7	Water	90	0.3	25
8	Islands (not included in totals)	714		27
TOTALS:		28,622	99.9	195

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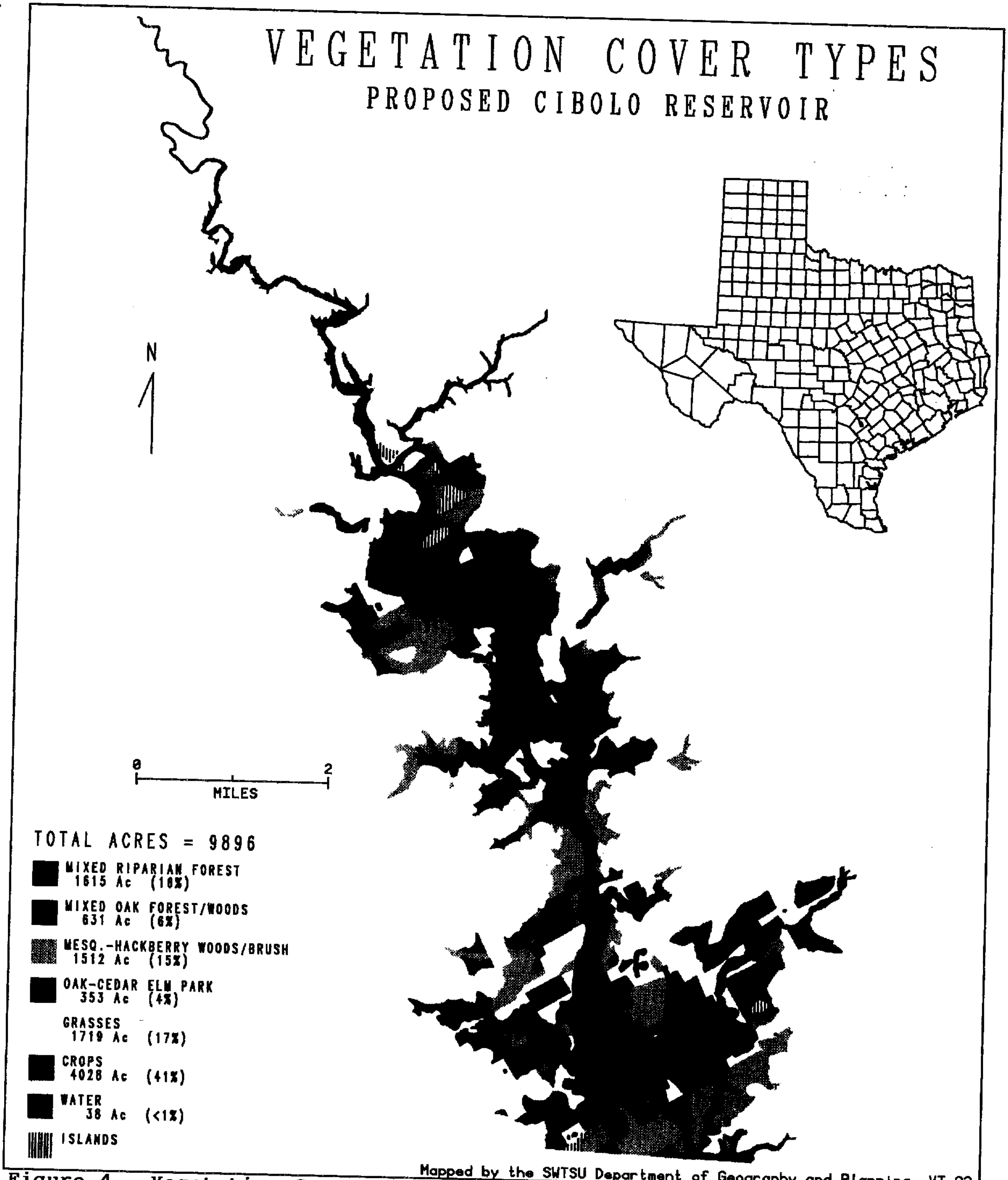

Figure 4. Vegetation Cover Types for Cibolo Reservoir

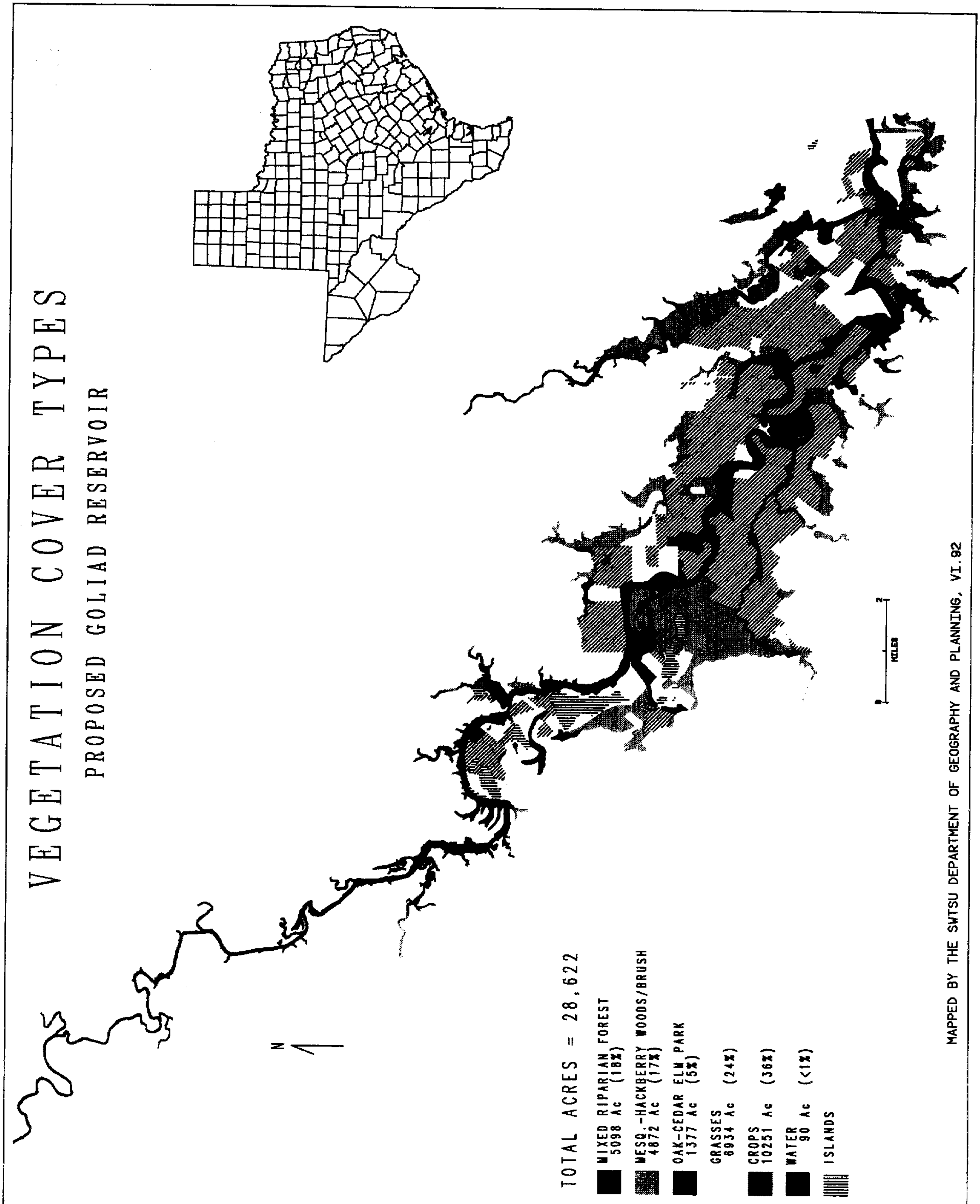

Figure 5. Vegetation Cover Types for Goliad Reservoir

CONCLUSIONS

The total area inundated by Cibolo Reservoir at the proposed normal pool elevation and subsequently digitized was 9,896 acres. Total acreage within the proposed Goliad Reservoir normal pool elevation was calculated at 28,622 acres. Of the four reservoirs (Cibolo, Goliad, Cuero, and Lindenau) included in the Texas Water Plan for the South Texas-San Antonio regional area, Cibolo contains the least amount of riparian forest at 1,615 acres. This acreage accounts for 16 percent of the total area while the Goliad site accounted for 5,098 acres and 18 percent of the total area.

LITERATURE CITED

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Larkin, T.J., and G.W. Bomar. 1983. Climatic atlas of Texas. Tex. Dep. Water Res. LP-192, 149p.

McMahan, C.A., R.G. Frye and K.L. Brown. 1984. The vegetation types of Texas including cropland. Tex. Parks and Wildl. Dep. Bull. 7000-120, 40p.

Texas Water Development Board. 1990. Water for Texas-today and tomorrow. Tex. Water Dev Board Doc. No. GP-5-1.

APPENDIX 1
Individual Graduate Student Reports

Report of Activities: Reservoir Mapping Project

Mark Kainer

June 1, 1992

My primary responsibility was to assist in the delineation of physiognomic classes within the reservoir boundaries using aerial photo interpretation techniques and field verifications. Careful consideration was given to the general distribution and pattern of wildlife habitats in the region to assist in the evaluation of cover types. The vegetation types were delineated with this consideration to provide the most generalized inventory, without sacrificing the integrity of the habitat units.

To accomplish this objective, preliminary surveys of the two sites were conducted to identify the common flora and major vegetational communities present. Unknown species were identified by comparing specimens from the site with herbarium specimens from the SWTSU collection. Under the supervision of Roy Frye, TPWD supervisor, a field trip to reconnoiter the two sites was undertaken on March 18, 1992 to discuss proposed methodologies and techniques. Mr. Frye also alerted us to pitfalls that we should avoid. TPWD guidelines for delineating vegetation cover types were outlined during this trip. Specifically, Mr. Frye explained pertinent information such as the minimum aerial limits of each vegetation type (10%), the approximate minimum size of each polygon (>8 acres), and how to deal with areas not conforming to general vegetation types within the area of the reservoir.

The next step was to study the aerial photos and identify distinguishing characteristics of the various potential cover types, based on the preliminary trips. Several representative sites were then located on the aerial photographs, and compared to existing ground cover during subsequent field trips (March 29, April 12, and May 18). These field observations were then compared to the patterns, textures, and colors of the individual sites on the photos, to assist in the interpretation of the vegetation types. The boundaries of the habitat types (polygons) were then drawn on acetate overlaid directly on the photographs for the Cibolo Creek site; but drawn directly on the laminated vertical aerials for the Goliad site. The procedures differed between the two sites because we found that the acetate overlays were unnecessary. The criteria used to classify the different vegetation types within the reservoir boundaries were based on the method outlined in McMahan, Frye, and Brown (1984). The cover types were delineated considering the parcel size required to provide adequate wildlife habitat. Smaller units of vegetation were assigned to the major categories to assist in the classification process. After all cover types were delineated for each site, field trips to specific locations were conducted to verify the designated classes. Each site contained eight major land cover categories.

There were a few challenges associated with delineating the cover types based on photo-interpretation. The first dilemma we encountered was that many of the individual parcels were not accurately represented by the photographs, due to changes in land-use since they were taken. Most of the photos were taken in early 1989. Our goal was to produce the most current and accurate description of the habitats; therefore we visited as many sites as possible, given time and accessibility constraints, to visually assess the current vegetation. We feel this procedure has helped us depict the vegetation most accurately. There were several areas within the reservoir boundaries, however, which were questionable with respect to vegetation type that were unaccessible. The crew subsequently decided that the best way to obtain the necessary visual contact was to rent a plane (Cessna 172) and fly over the sites. This procedure proved to be a valuable tool in assessing the nature of the questionable areas, as well as an efficient method for reviewing the entire reservoir sites.

Another challenge associated with the delineation of cover types was the heterogeneous pattern of the vegetation due to land-use diversity in the area. Much of the vegetation within the reservoir is currently or has historically been intensely managed. According to the criteria used to delineate the aforementioned cover types, many of the different polygons had components of both woods and brush randomly interspersed. The height requirement for brush, (< 9ft), was also difficult to meet in pure stands at either reservoir site. The species composition was virtually identical in the two categories, so they were lumped together as woods/brush, with woods dominating slightly over brush at both sites. At the Cibolo Creek site, we encountered significant amounts of upland forest, especially on the reservoir perimeters, which we felt needed to be represented. This cover type was detected on the aerial photos as densely vegetated areas on higher slopes. The Landsat images, provided to us by TPWD, also assisted in confirming this cover type. Large areas of this habitat are present just north of the site, and are depicted on the Landsat images as similar to our sites.

After all the polygons were drawn on the photos, they were checked by other members of the crew. The next step was to transfer the finalized cover type boundaries from the aerial photos to the digitized reservoir boundaries. This was accomplished by superimposing a computer generated plot of the reservoir boundary on the acetate overlay (Cibolo site) or the laminated aerial photo directly (Goliad site) on a light table. The aerial photos had some significant shape distortion; therefore, some roads, fence lines, pipelines, and railroad tracks were traced from U.S. Geological Survey (USGS) 7.5 minute quadrangles for reference lines to distribute the distortion evenly across the photos. Cover types were then traced in approximately two inch blocks with one or more pencil drawn reference lines on each side. The overlay was then readjusted for the next block with two or more new reference lines. This procedure was repeated until all the polygons of each photo were transferred. Because the shape and scale distortion was greatest toward the edges of the photos, no cover type delineations were made within two inches of the photo edges.

My final duty was to compare all digitized polygons to the aerial photos to review the accuracy of the final product. This was accomplished by superimposing the digitized maps over the aerials, making additional corrections for distortion, and reviewing the boundaries.

RESULTS

The following is a list of the cover types delineated for each reservoir, followed by a short description of the associated vegetation. Species names included in the cover types indicate dominance:

CIBOLO CREEK SITE

COVER TYPE: ASSOCIATED VEGETATION (in appx. order of occurrence)

Mixed Riparian Forest: pecan, box elder, hackberry, cedar elm, American elm, black willow, sycamore, mulberry, elderberry, anacua, live oak, chinaberry, greenbriar, mustang grape, poison ivy, yaupon, western ragweed, rescuegrass, Texas wintergrass, rattlebush, Virginia creeper.

Mixed Oak Forest: post oak, blackjack oak, live oak, cedar elm, hackberry, black hickory, American beautyberry, yaupon, prickly ash, dewberry.

Live Oak/Cedar Elm Park: post oak, pecan, blackjack oak, hackberry, sycamore, ornamentals (around homesteads), buffalograss, goldenrod, silver bluestem, croton, bull nettle.

Mesquite-Hackberry Woods/Brush: huisatche, prickly pear, granjeno, brasil, dryland willow, whitebrush, lotebush, prickly ash, forestiera, anacua, desert yaupon, kidneywood, mustang grape, tasajillo, palo verde, guayacan, catclaw.

Grasses: little bluestem, coastal bermudagrass, buffalograss, purple three-awn, silver bluestem, southern dewberry, croton, Indian paintbrush, winecups, mesquite, prickly pear, tasajillo, bull nettle, silverleaf nightshade.

Crops: corn, cotton, sorghum, wheat, watermelon.

Water

GOLIAD SITE

COVER TYPE: ASSOCIATED VEGETATION (in appx. order of occurrence)

Mixed Riparian Forest: pecan, box elder, elms, black willow, sycamore, hackberry, cottonwood, mulberry, elderberry, live oak, chinaberry, anacua, mustang grape, greenbriar, Texas persimmon, poison ivy, yaupon, wafer ash, western ragweed, Johnson grass, rescuegrass, Texas wintergrass.

Live Oak/Cedar Elm Park: hackberry, pecan, sycamore, cedar elm, ornamentals (around homesteads), coastal bermuda, silver bluestem, buffalograss, bull nettle, croton, goldenrod.

Mesquite/Hackberry Woods/Brush: huisatche, prickly pear, dryland willow, cedar elm, granjeno, tasajillo, anacua, prickly ash, mustang grape, palo verde, desert yaupon, kidneywood, brasil, whitebrush.

Grasses: Same as Cibolo site.

Crops: Same as Cibolo site.

Water

REFERENCES

McMahan, C.A., R.G.Frye, and K.L.Brown. 1984. ***The vegetation types of Texas -- including cropland***. Texas Parks and Wildlife Department Bulletin 7000-120. Austin, TX (included map).

Report of Activities: Reservoir Mapping Project
Scott Paschall
June 1, 1992

I was the lead computer data processor for the project. My job was to digitize the pool outlines, provide proof plots to the vegetation mappers, process DLG files for use on our project, add attributes to the digitized lines and polygons, and generate the final plots of the vegetation cover areas.

My first task was to make a digital outline of the normal pool levels of the projected Cibolo Creek and Goliad reservoirs. To do this required digitizing pool outlines from three USGS 1:24 000-scale quadrangle maps for Cibolo Creek and nine quads for Goliad. The quadrangles, with pool outlines, were provided by the Texas Water Development Board.

I then gave the pool outline plots by quad to David Deibel, the lead vegetation polygon mapper. He superimposed the outline of the reservoir's pool on the aerials and traced the homogeneous vegetation polygons onto the pool plot by hand. This method proved unsatisfactory because the aerial photos were not orthophotos but rather unrectified aerials. The photos did not register well with the quad data. We therefore modified our procedure. The major roads (state and federal) from 1:100 000-scale USGS DLG files were plotted in addition to the pool outlines. This added material provided the air photo interpreter with better ground control. David further modified the resulting plots by tracing, in pencil, various fence lines from the 1:24k quads that were also on the aerials for additional control.

To utilize DLGs required some processing. The DLGs (6 for the Cibolo site; 16 for the Goliad site) had to be converted into pcARC/INFO format from DLG format. USGS distributes DLGs in two formats, standard and optional. The DLGs we had were in the standard format. pcARC/INFO 3.3 wouldn't process standard format DLGs. After several phone calls we determined that pcARC/INFO 3.3 could only convert optional format DLGs into ARC/INFO format. pcARC/INFO 3.4D, on the other hand could convert standard format DLGs into ARC/INFO format. After converting the necessary files, the DLG data were then exported from pcARC/INFO 3.4D and imported into version 3.3 for further processing. This processing included projecting the coordinates from UTM to Texas State Plane, South Central Zone coordinates. The effort expended was worth while because as has already been mentioned, the DLGs proved valuable for providing control needed to orient and shape vegetation polygons whose shape was distorted on the unrectified aerial photos. In addition, I plotted the hydrography from the DLGs over the hydrography I had digitized from the quads as a check on our digitizing accuracy. The digital hydrographic data from the two sources matched very well. The few barely discernable discrepancies seemed due to the lower accuracy of the 1:100k product.

After David (and Mark) had drawn the polygons for the Cibolo site, I digitized them into the reservoir files. I did this on a quad by quad basis for the Cibolo site. David helped by digitizing many of the Goliad site polygons, again, on a quad by quad basis. I then edge matched all of the quads for each site, two quads at a time. Next, the reservoir pieces were appended so a seamless digital outline of each reservoir was obtained. Proof plots containing all polygons for the whole Cibolo Creek site were generated and overlaid onto the 1:24k USGS quads to assure an accurate digital product. Next, David and I checked each polygon by overlaying the digital test plot onto the manually generated polygon outline map that David had produced. We corrected any remaining polygon discrepancies at this time.

After digitizing the polygons for Cibolo Creek and verifying the integrity of the arcs and polygons, I began building the attribute files. For each polygon, pcARC/INFO provided the attributes of area and perimeter. We added two new attributes: one for the vegetation cover code number and the second containing the name of the vegetation cover type. I added these two attributes to the 207 polygons for the Cibolo site. David helped me do the same for the 222 Goliad site polygons. A third attribute, acres, was added later. Because we used state plane coordinates, the area variable that pcARC/INFO generated was in square feet. The new variable, acres, that we added was calculated by dividing AREA by 43560 (the number of square feet in an acre).

I next wrote the macros to plot the two maps with colored patterns assigned to each polygon (see attached). I also had to experiment with the HP pen plotter's positioning parameters to get each map to orient correctly on the sheet of plotter paper.

We generated plots at two scales: 1:24 000 and publication scale. For the Cibolo site, publication scale was 1:95 000; for the Goliad site, 1:135 000. At these scales, the Cibolo site map fit on an "A" size sheet (8.5"x11") and the Goliad reservoir fit on a 11"x17" (B-size) sheet.

pcARC/INFO SML to produce plot of Goliad Reservoir (eastern portion)

```
&REM
&REM     5.VI.92
&REM   This SML is the first of two needed to plot the complete Goliad
&REM   reservoir site at 1:24,000-scale on E-size pen plotter.
&REM  This SML generates a plot file for the eastern 3/4 of the Goliad
&REM   Reservoir site.  The MapExtent command neatly slices the site into 2
&REM   lop-sided pieces.
&REM  Eight different vegetation cover types plus islands of high ground that
&REM  won't get inundated when the reservoir fills are mapped.
&REM

&ECHO &OFF
DISPLAY 1039
GEAST
MAPE 2422756 286566 2496009 349933
MAPUNITS FEET
MAPSCALE 24000
MAPSHIFT 1 0 PAGE
SHADESET RESERV.SHD
LINESET RES.LIN

&REM TICS GOLRES
&REM CLEARSEL

RESEL GOLRES POLYS COVERTYPE# = 1
POLYGONSHADES GOLRES 51
CLEARSEL

RESEL GOLRES POLYS COVERTYPE# = 2
POLYGONSHADES GOLRES 47
CLEARSEL

RESEL GOLRES POLYS COVERTYPE# = 3
POLYGONSHADES GOLRES 48
CLEARSEL

RESEL GOLRES POLYS COVERTYPE# = 4
POLYGONSHADES GOLRES 82
CLEARSEL

RESEL GOLRES POLYS COVERTYPE# = 5
POLYGONSHADES GOLRES 33
CLEARSEL

RESEL GOLRES POLYS COVERTYPE# = 6
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RESEL GOLRES POLYS COVERTYPE# = 7
POLYGONSHADES GOLRES 4
CLEARSEL
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RESEL GOLRES POLYS COVERTYPE# = 8
POLYGONSHADES GOLRES 21
CLEARSEL

LINESYMBOL 1
POLYS GOLRES
CLEARSEL

RESEL GSCALE ARCS GSCALE-ID > 0
ARCS GSCALE
CLEARSEL
ANNOTEXT GSCALE
CLEARSEL

QUIT

&REM
&REM  ** The following section generates hydrography and roads from
&REM  1:100 000-scale DLGs.  Unrem as needed.
&REM

&REM LINESYMBOL 4
&REM RESELECT F:\PASCHALL\DLG\G3SP ARCS G3SP-ID > 0
&REM ARCS F:\PASCHALL\DLG\G3SP
&REM CLEARSEL

&REM RESELECT F:\PASCHALL\DLG\G4SP ARCS G4SP-ID > 0
&REM ARCS F:\PASCHALL\DLG\G4SP
&REM CLEARSEL

&REM RESELECT F:\PASCHALL\DLG\G19SP ARCS G19SP-ID > 0
&REM ARCS F:\PASCHALL\DLG\G19SP
&REM CLEARSEL

&REM RESELECT F:\PASCHALL\DLG\G15SP ARCS G15SP-ID > 0
&REM ARCS F:\PASCHALL\DLG\G15SP
&REM CLEARSEL

&REM RESELECT F:\PASCHALL\DLG\G5SP ARCS G5SP-ID > 0
&REM ARCS F:\PASCHALL\DLG\G5SP
&REM CLEARSEL

&REM **
&REM  The following portion of this SML plots the numbered federal and state
&REM  road arcs from the 1:100 000-scale DLGs that cover the Goliad
&REM  reservoir site.  Also, state and federal highway route numbers
&REM  are plotted for all road segments longer than 4000 feet.
&REM

LINESYMBOL 1
RESELECT F:\PASCHALL\DLG\G9SP ARCS MAJOR1 = 173 OR MAJOR1 = 174 RESELECT
F:\PASCHALL\DLG\G9SP ARCS LENGTH > 4000
ARCTEXT F:\PASCHALL\DLG\G9SP MINOR1 # POINT1 CR NOFLIP
CLEARSEL
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RESELECT F:\PASCHALL\DLG\G10SP ARCS MAJOR1 = 173 OR MAJOR1 = 174 RESELECT
F:\PASCHALL\DLG\G10SP ARCS LENGTH > 4000
ARCTEXT F:\PASCHALL\DLG\G10SP MINOR1 # POINT1 CR NOFLIP
CLEARSEL

RESELECT F:\PASCHALL\DLG\G11SP ARCS MAJOR1 = 173 OR MAJOR1 = 174 RESELECT
F:\PASCHALL\DLG\G11SP ARCS LENGTH > 4000
ARCTEXT F:\PASCHALL\DLG\G11SP MINOR1 # POINT1 CR NOFLIP
CLEARSEL

RESELECT F:\PASCHALL\DLG\G16SP ARCS MAJOR1 = 173 OR MAJOR1 = 174 RESELECT
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CLEARSEL

QUIT
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Report of Activities: Reservoir Mapping Project
David Deibel
June 1, 1992

My primary duties at the beginning of the project consisted of the interpretation of false color infrared vertical aerial photographs for the purpose of delineating vegetation categories. These duties expanded into preparing manuscript drawings of each site (used for digitizing polygons), digitizing the polygons of the Goliad reservoir site, adding attributes to the polygon data base, and final review of the maps and data base for both reservoir sites.

I began my activities by reviewing and comparing the photos (approximate scale was 1:24 000) to the matching 1:24 000-scale USGS 7.5 minute quadrangle sheets. I wanted to establish the extent of the riparian forest within the high banks of Cibolo Creek and the San Antonio River. To do this I needed to know elevation. We didn't have stereo pairs with which to delineate contours which is how elevations of visible features are usually determined. I found that it was fairly easy to interpret isohypses from the terraces used in contour farming in the area.

Next, for the Cibolo reservoir, I picked out several sites of diverse vegetation that were difficult to classify from the imagery alone and were accessible by vehicle, for field review. I wanted to develop a set of selective keys for the interpretation of all of the aerial photographs. After establishing the vegetation types in the Cibolo reservoir area by field examinations on March 29 and April 12, I then went through the set of photographs for the Cibolo site and outlined the boundary of each homogeneous vegetation area on an acetate overlay on each of the six aerial photographs for better clarity. Mark Kainer then reviewed my work.

After his review, I made a manuscript drawing/tracing of all the polygons on a plot of the reservoir produced by Scott Paschall. (Scott had digitized the outline of the Cibolo Creek reservoir from 1:24k-scale USGS quads provided by the Texas Water Development Board through Texas Parks and Wildlife Department.) After I discerned that the scale of the aerial photographs was not 1:24 000, I proceeded to distribute the error on the photographs by overlaying the plot of the site which Scott had generated onto the corresponding USGS quadrangle sheets and tracing the highly visible features such as fences and roads, lightly, in pencil (see attachment 1). I then overlaid this modified plot onto the aerial photos, and proceeded to distribute the error proportionally around these existing control features. Scott aided this process by providing me with reservoir plots that contained the pool outline and roads from 1:100 000-scale DLG files of the area. The first plot he generated had too many roads on it, so Scott remade the map, this time plotting only the main routes, i.e. state and federal roads. These plots helped me considerably in delineating the vegetation polygons. I identified 207 distinct vegetation polygons in the Cibolo Creek site. To make the polygon digitizing step easier, faster, and less prone to error, I colored in each polygon with its own characteristic color.

Having developed a "workable" methodology for the polygon identification and mapping process, I decided to eliminate the step of drawing the polygons on the acetate overlay. For the larger Goliad site that measure saved time and simplified my job without compromising accuracy. We made two trips to the Goliad site; one was an orientation trip on April 12.

The second, on May 18, was expressly for the purpose of field checking those polygons that exhibited a vegetation diversity that was difficult to interpret from the aerials alone. After we settled on which categories these areas belonged to, I began delineating the polygons with china marker directly on the eleven aerials that covered the reservoir site. Mark also outlined vegetation polygons on the Goliad site aerials.

While Mark completed drawing the outlines, I assisted Scott in digitizing the pool boundaries for the Goliad site. When I completed this task, I reviewed Mark's work. Meanwhile, Scott generated plots of the reservoir's outline quad by quad. These eight quad-plots also contained state and federal highways from the DLG files for the area to help establish control. I again traced fence lines on the plots from the 1:24k quads for additional control . Then I began the task of tracing vegetation polygons onto those plots and filling in each polygon with the distinctive color of the vegetation category defined by the polygon. After Mark and I finished that step we checked each other's work to be sure the pencil drawn polygon outlines and their vegetation color were correct. I next began digitizing the polygons. After the polygons had been digitized, Scott digitally assembled the eight pieces into one seamless file for the entire site. We again generated plots of the polygons and overlaid them on our manuscript map to confirm that polygon boundaries had been drawn correctly and that none had been missed. After cleaning and building the polygon coverages, I began assigning attributes to each of the 222 polygons for the Goliad site. Working with color coded polygons made this step easier. Just as in the Cibolo data base, three attributes were added: vegetation category, vegetation category number, and area in acres. Following this came the process of final cartographic and data base review of the Cibolo and Goliad sites.

In following this series of steps for the entire project, we, as a team, were able to attain a degree of precision for the size and shape of the parcels of land equal to that of the features shown on a 7.5 minute USGS quadrangle sheet while maintaining the level of generalization specified by the Texas Parks and Wildlife Department.

Attachment A -- An Assessment of Aerial Photo Distortion
David Deibel

At the beginning of the project, I assumed that the scale of the photos to be within 2% of that of the quadrangle sheets, which are 1:24 000 or 1" = 2000'. This is a normal amount of distortion one can expect when using aerial photos due to the effects of tilt, difference in elevation, and lens distortion. The preliminary field work for the project was completed before a careful analysis of the photo scale was done, because it was unnecessary to know the scale of the photos for that step to be completed.

I began my analysis with the three black and white (b/w) photos by overlaying each photo with the computer plot, which was based on USGS DLG files. I then noticed that when the principal point of the photo was paired with its match on the plot, there was an overlap of approximately 1/2 inch on the roads at the edge of the photos. This is equivalent to a distortion of +/- 1 000 feet in all directions at the photo edges. A continuous distortion at the edge of the photos amounted to an area 1 000' x 30 000'(1/2" x 15") or 689 acres short per side, which is much more than the nominal amount originally assumed.

It was then decided by the team, because of the type of problem encountered and the tools at hand, that the best solution was to overlay the aerial photos with the computer plot and to distribute the error equally by drafting techniques, using DLG data (roads and transmission lines) and the appropriate 1:24 000-scale USGS 7.5 minute quadrangle sheet as a cross check for the location of fixed features such as fence lines and roads.

The distortion on the color infrared photos was much less than that of the black and white ones. The overlap at the edge of the IR photo is +/- 250 feet or +/- 200 acres per side. This degree of accuracy makes it much easier to distribute the error over the site using conventional drafting techniques.