



Contract Study: Number. 1; Part II

*A Vegetation Inventory and Habitat
Quality Assessment for the Proposed
Cuero and Lindenau Reservoir Sites*



**A VEGETATION INVENTORY AND
HABITAT QUALITY ASSESSMENT FOR**

***THE PROPOSED
CUERO AND LINDENAU
RESERVOIR SITES***

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Texas Parks and Wildlife Department**

**Texas Water Development Board
Interagency Contract No. 91-483-797**

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INTRODUCTION

The purpose of this study was to classify, delineate and map major vegetational communities and obtain wildlife habitat quality assessment data for the proposed Lindenau and Cuero reservoir sites in Gonzales and Dewitt Counties. The study was conducted through an interagency contract (TWDB Contract No. 91-483-797) 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. 331-0237) with the Geography Department, University of Texas at Austin. The work was conducted under the supervision of Dr. Robert Holz. Assessments of habitat quality were conducted by staff of the Environmental Assessment Branch, Resource Protection Division, TPWD. Vegetation inventory data and habitat quality assessment information 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. Additional natural resource data for these reservoir sites have been compiled under other provisions of the interagency contract and are contained in separate reports.

STUDY AREA

The Cuero Reservoir site lies principally within the floodplain of the Guadalupe River in Gonzales and DeWitt Counties between the cities of Gonzales and Cuero (Figure 1). The southern portion of the site lies within the South Texas Plains ecological region, while the northern portion is contained within the Post oak Savannah (Gould et.al. 1960). The Lindenau Reservoir site lies slightly west of the Cuero site, being mostly contained within the floodplains of Sandies Creek and its tributaries including Clear, Five-mile, Brushy, Elm and Salty Creeks. (Figure 2). This site is within portions of both Gonzales and DeWitt Counties. The northern portion of the site is partially contained within the Post oak Savannah ecological region while the southern portion is within the South Texas Plains. Climate for both sites is subtropical, humid, with warm summers and mild winters. The average annual precipitation ranges between 32 and 36 inches; average annual high temperature is 82 degrees F, while average annual low temperature is 58 degrees F. The annual average gross lake surface evaporation rate for this region is 60 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, live oak, hackberry and cedar elm woods and forests interspersed with both native and tame grasslands. Mesquite and huisache brush also commonly occurs and is scattered throughout the region. 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. Croplands are also common to the region. Principal crops include agricultural row crops and hay pastures.

Previous vegetation mapping efforts involving the classification of digital multispectral scanner data from the Landsat satellite system delineated 5 major cover types for the Lindenau site (Frye and Curtis 1990). These included mesquite-granjeno brush, mixed riparian forest, grasses, mesquite-granjeno parks, and post oak-live oak woods. Similar studies for the Cuero site produced maps which delineated grasses, mesquite brush, mixed riparian forest, post oak-mesquite woods, and mesquite-granjeno parks.

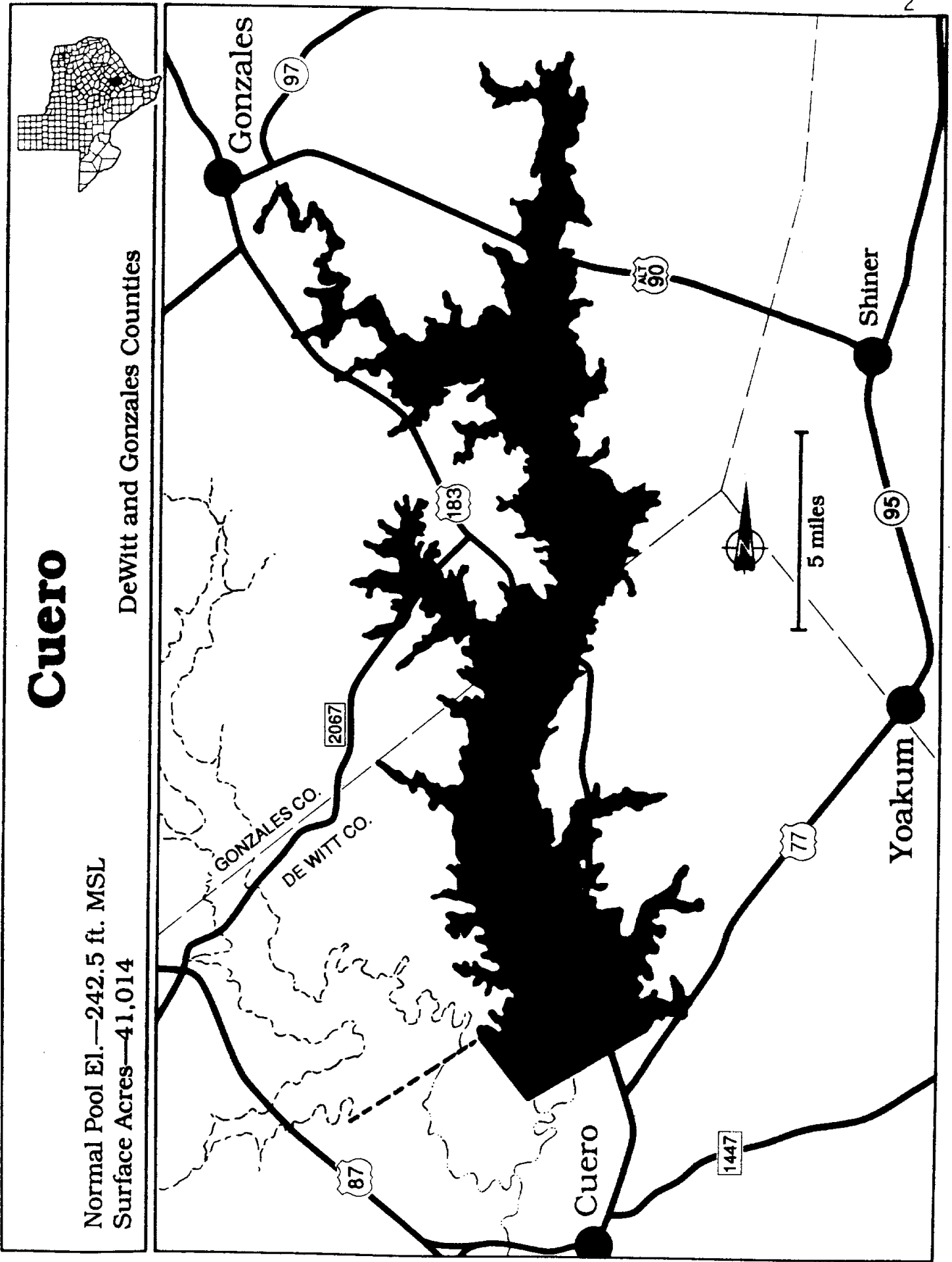


Figure 1. Site Location for Cuero Reservoir.

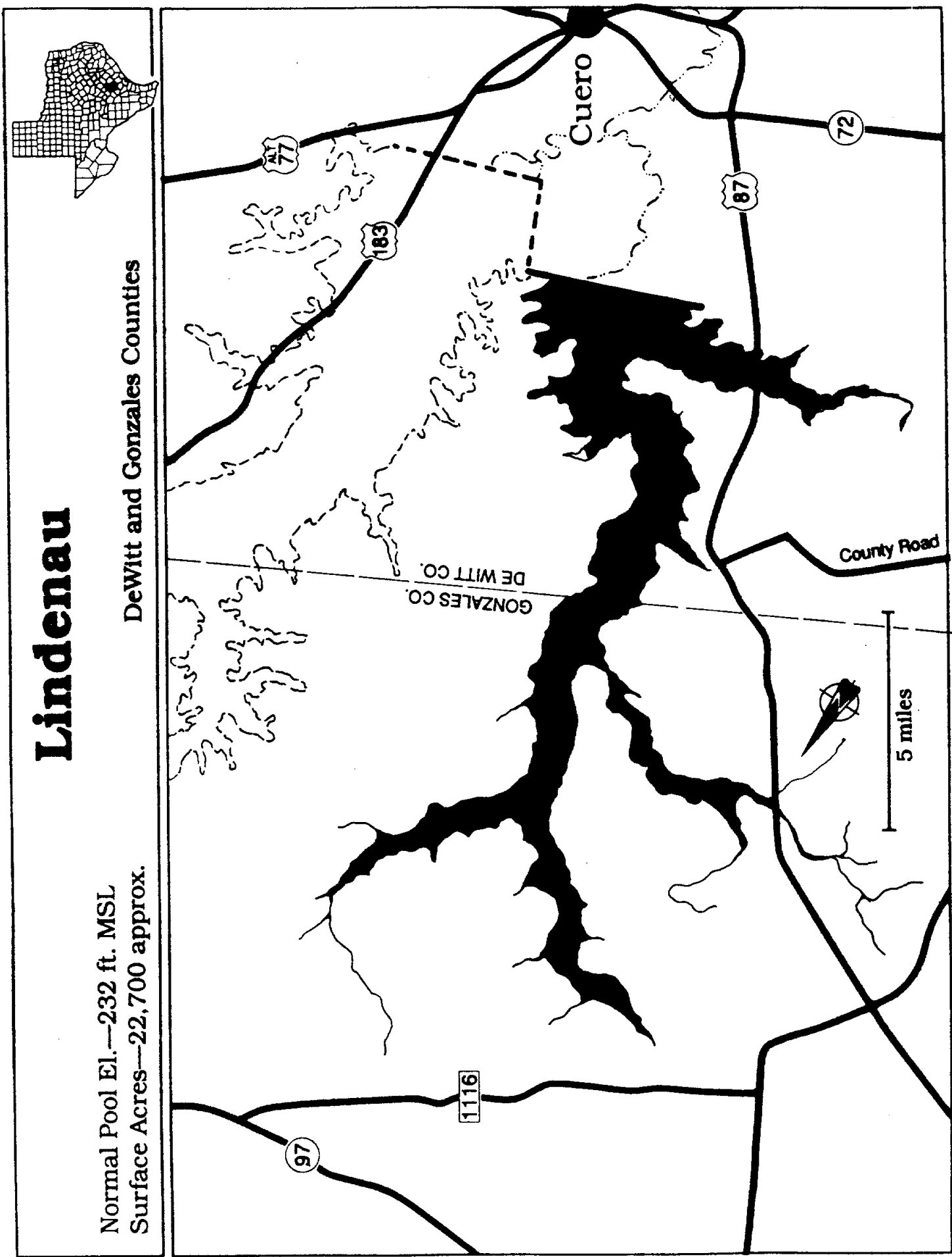


Figure 2. Site Location for Lindenau Reservoir.

METHODS

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 field maps. A total of 36 individual prints were required to ensure total coverage. Date of acquisition was February and March 1989. 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 Lindenau and Cuero Reservoirs were provided by the TWDB.

A series of preliminary field vegetation maps were prepared by delineating boundaries of vegetation types specifically identified and located in the field. Vegetation boundaries were superimposed over individual aerial photos. Attempts were made to visit representative vegetation types by examining the available photos and travelling to specific sites. Field trips were conducted during the period February through June, 1991. 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. 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 Texas Parks and Wildlife Department was also utilized. The preliminary field maps were subsequently revised and modified as necessary to provide final manually drafted map products with well defined ground cover boundaries suitable for digitizing. A total of 11 individual vegetation maps, each corresponding to a USGS 7.5 minute quadrangle map, were produced during this stage.

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

Generation of accurate inventory summary data and production of composite vegetation maps at varying scales required the digitization of each of the 11 handdrawn vegetation maps and subsequent transferral of this data into an appropriate Geographic Information System (GIS). The Texas Water Development Board provided data processing support for this phase of the study.

Digitization was conducted using a 36" x 48" Numonics digitizing pad linked to a Tandy 386 20mhz computer and Autocad software. Approximately 40 hours were required to complete the digitization process. The digital data was then exported into the TWDB GIS system utilizing ArcInfo software running on a Sun 4 Workstation. After export of the data into the GIS was completed, data checks were made to ensure polygon boundaries were matched and correctly rectified for each 7.5 minute quadrangle map. All polygons were labeled according to established classification names. Inventory data was then tabulated for each reservoir and map products were plotted.

Assessment of Wildlife Habitat Quality

The overall quality of the occurring habitat for wildlife resources was evaluated for the Cuero and Lindenau reservoir sites using a wildlife habitat appraisal procedure (WHAP) (Appendix 1). The technique measures key components which contribute to the ecological condition of the classified cover types within each reservoir site and resulting overall suitability for wildlife. Habitat quality values obtained from site evaluation criteria are combined with acreage figures for each cover type to provide available Habitat Units (HU).

The method is based on the following assumptions:

1. that vegetative structure including species composition and physiognomy is itself sufficient to define the habitat suitability for wildlife;
2. that a positive relationship exists between vegetation diversity and wildlife species diversity
3. that vegetative composition and primary productivity directly influence population densities of wildlife species.

Habitat quality scores for each cover type represent baseline conditions. Total Habitat Units (HU) lost is a numerical value that quantifies initial direct impacts of reservoir construction, and to facilitate comparison with other projects, assumes complete loss of existing vegetation cover below the proposed normal pool elevations. This number does not reflect annualized losses calculated over the life of the project nor accounts for any potential habitat gains that could be created as a result of the reservoirs. Consequently, the compensation estimates may not be the same as estimates calculated in future site specific evaluations. Other factors which can influence these differences include changes in project assumptions, variations in project design, land use changes, and priorities for certain habitat types. The compensation estimates calculated for this report are intended to provide preliminary data in a format to allow comparison of reservoir site alternatives. The estimates only address direct impacts. Long term indirect impacts such as increased landuse change around the proximity of the reservoirs or any changes to vegetation

composition or quality below the dams as a result of altered instream flows are not included in this assessment.

Compensation requirements for each of the impacted cover types were calculated according to three hypothetical values representing proportional amounts (25%, 50%, and 100%) of the total potential gain in habitat quality of a compensation area which could be obtained with management. Raising the potential gain in habitat quality of a compensation area by 25% assumes relatively minimal management; an increase of 50% assumes moderate management; while achieving 100% of the potential gain assumes intensive management. Minimal management could include marking wildlife management area boundaries, providing protection by periodic surveillance, incorporating grazing control and allowing the habitat quality to increase through natural succession. Annual estimated costs per acre for this level of management according to expenditures by TPWD (1989 estimates) would be less than \$5.00 per acre. Moderate management might include the above measures with the addition of some selected herbaceous seedings and limited vegetation manipulation through controlled burning, disking, thinning, or other means. Cost estimates for this level would range between \$5.00 and \$10.00 per acre. Intensive management would include the above measures with the addition of significant efforts to reestablish communities of grasses, forbs, woody shrubs or trees through supplemental plantings and vegetation maintenance; establishing indices of relative abundance of wildlife species and conducting research associated with wildlife needs. Annual costs for this level are estimated to fall within the range of \$10.00 to \$20.00 per acre. All three levels of management would likely include wildlife-oriented public recreational use.

Resource Categories

All cover types evaluated for habitat quality were also classified into resource categories to denote mitigation planning goals. Such goals will be pursued by the U.S. Fish and Wildlife Service within the Federal permitting process and TPWD during the review of state water use permit applications and formulation of recommendations to the Texas Water Commission (TWC). A description of each resource category, designation criteria, and mitigation planning goals are provided in Table 2.

Table 2. Resource Categories and Mitigation Planning Goals.

Resource Category	Designation Criteria	Resource Planning Goal
1	High value for evaluation species or habitats, unique or irreplaceable.	No loss of habitat value.
2	High value for evaluation species or habitats and scarce or becoming scarce.	No net loss of in-kind habitat value.
3	High to medium value for evaluation species or habitats and commonly occurs.	No net loss of habitat value while minimizing loss of in-kind habitat value.
4	Medium to low value for evaluation species or habitats.	Minimize loss of habitat value.

Field evaluation forms used to rate the existing cover types within the two reservoir sites are provided in Appendix 2.

A total of 20 individual sites were evaluated during the period June 17-18, 1991 for the Lindenau Reservoir site. During the period June 17-19, 1991 a total of 23 sites were evaluated for the Cuero Reservoir site. The location of each site in relation to the approximate normal pool level of each reservoir is provided in Figure 3. All site assessments were performed by Dr. Ray C. Telfair, II and Roy G. Frye of the Texas Parks and Wildlife Department's Resource Protection Division.

RESULTS

Vegetation Mapping

Six cover types were delineated for the Cuero site. These included: 1) Grasses/Forbs; 2) Mesquite-Huisache Brush/Woods; 3) Liveoak-Pecan-Hackberry Parks/Forest; 4) Mixed Riparian Forest; 5) Crops; and 6) Ponds/Water. An "Other" category was also included that accounted for delineated polygons that were not identified.

Six cover types were delineated for the Lindenau site. These included : 1) Grasses/Forbs; 2) Mesquite-Hackberry-Huisache Brush/Woods; 3) Elm-Hackberry-Mesquite Parks/Woods; 4) Mixed Riparian Forest; 5) Crops; and 6) Ponds/Water. As in the Cuero site an "Other" category was also included for unknown polygon delineations.

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. Occurrence of all observed woody species for each evaluated site has been documented on the field evaluation forms (Appendix 2).

Composite vegetation maps for the Cuero and Lindenau site are provided respectively in Figures 4 and 5.

Tabulated Data Summaries

Tabulated data for the Cuero and Lindenau sites are contained respectively within Tables 3 and 4. Information includes the name of the cover type evaluated, resource category of the cover type (in parenthesis following the cover type name), acres impacted within the normal pool elevation, habitat quality rating obtained by field evaluation, habitat units lost, hypothetical management options, potential gain in habitat quality, and compensation requirements for each management option. Mitigation goals in regard to habitat losses can be obtained by noting the resource category designation after the cover type name and referencing Table 2.

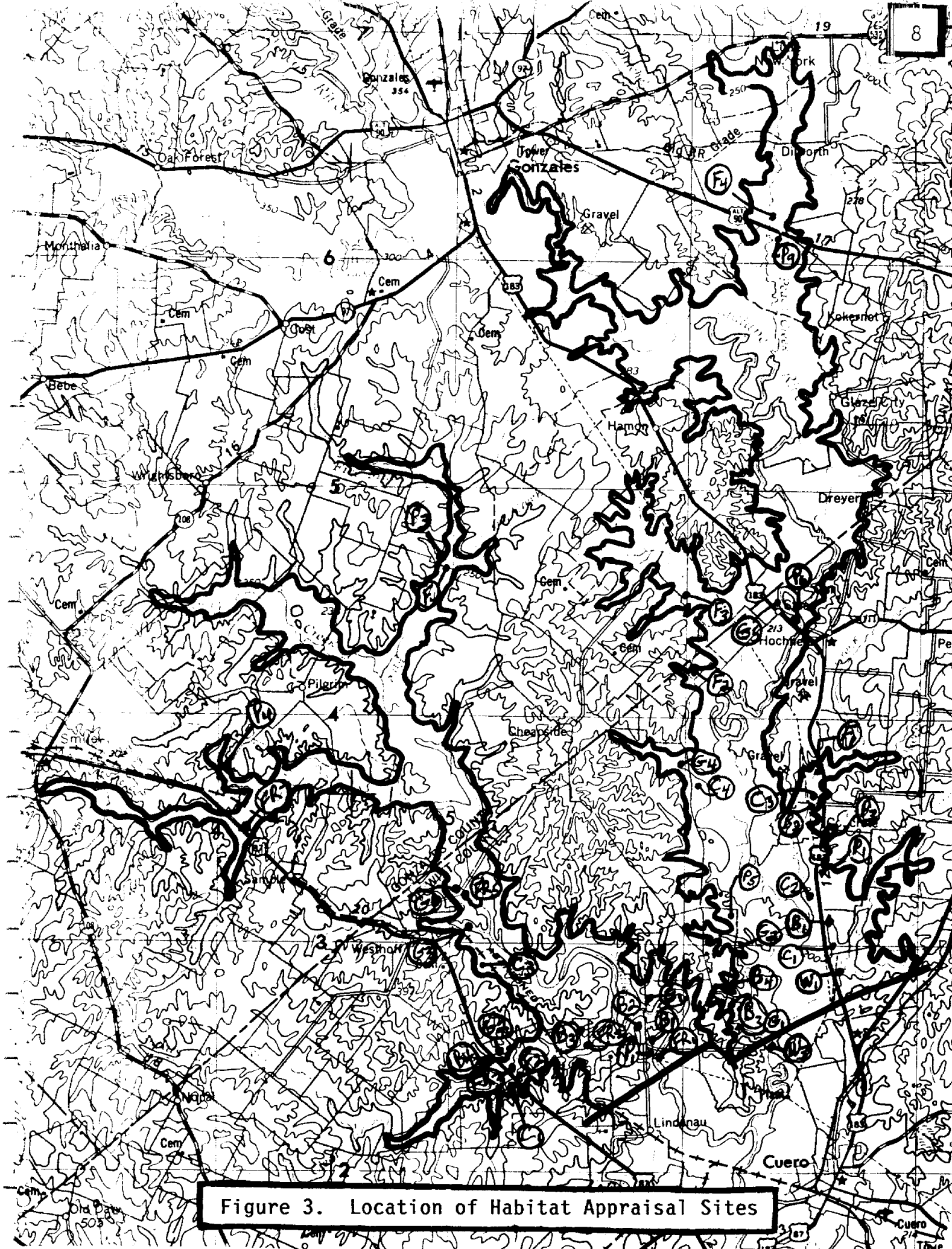


Figure 3. Location of Habitat Appraisal Sites

Vegetation Map Cuero Reservoir

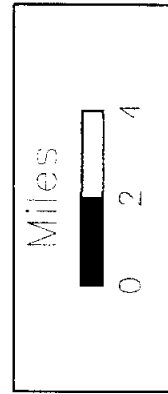
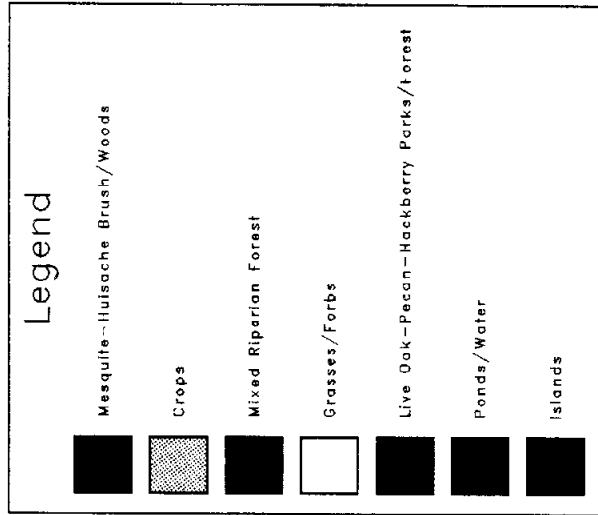
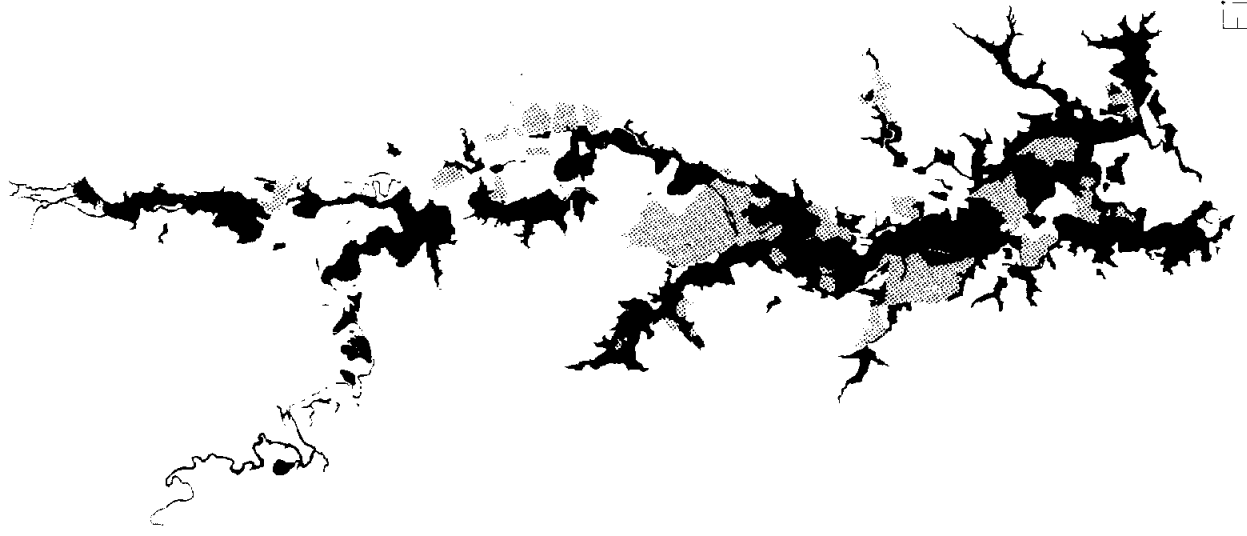


Figure 4.

Vegetation Map Lindenau Reservoir

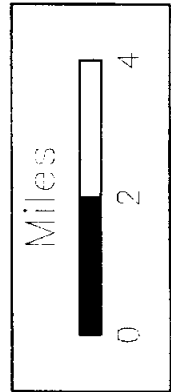
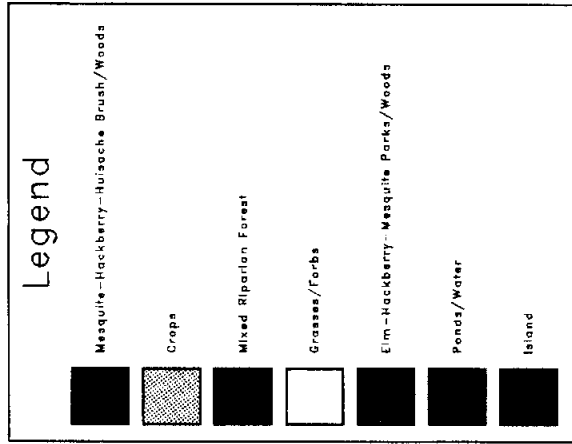
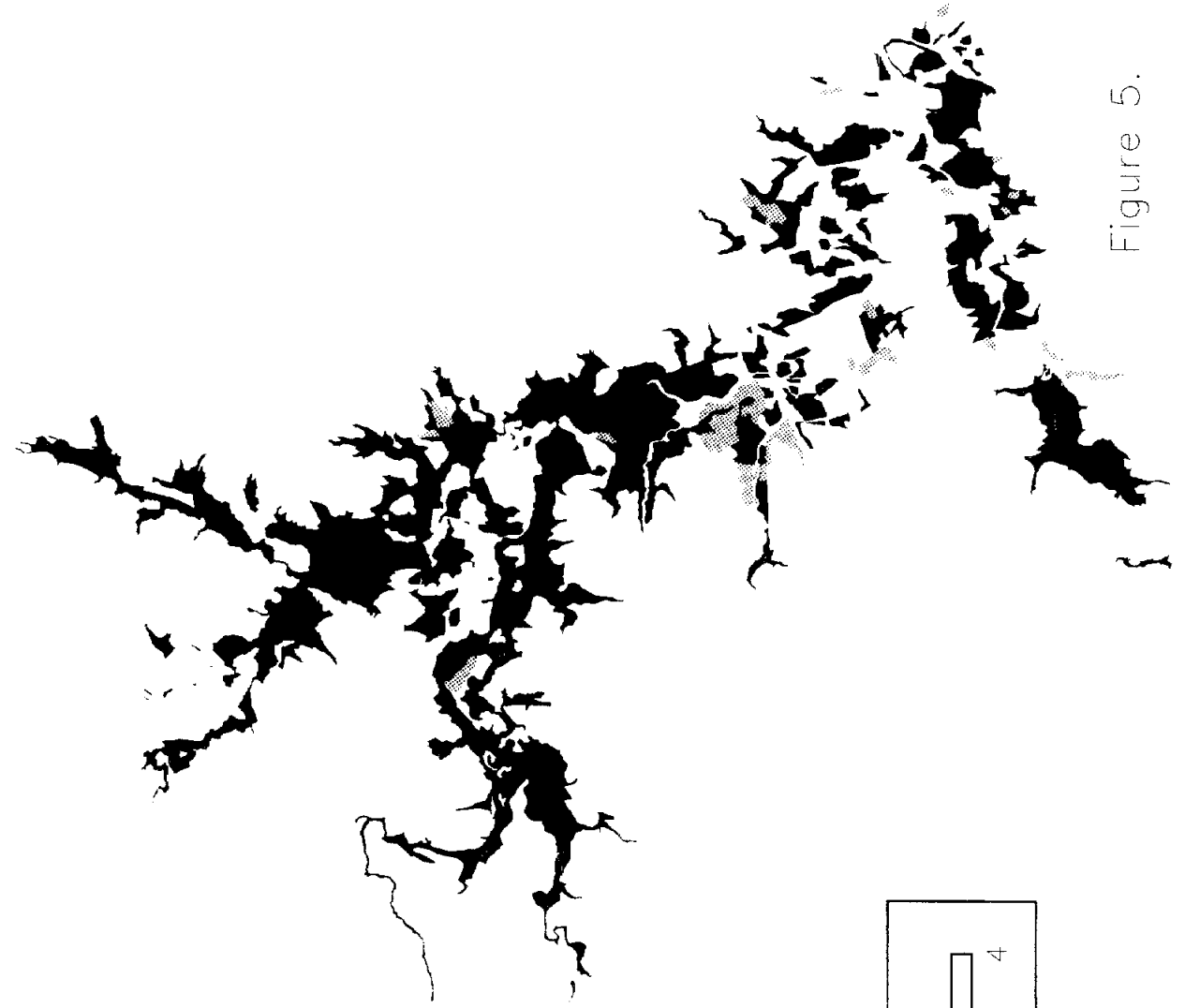


Figure 5.

Table 3. Inventory of Cover Types and Habitat Quality Assessment for the Proposed Cuero Reservoir Site, Normal Pool Elevation = 242.5' msl.

Cover Type/ Resource Category ()	Acres Inventoried	Habitat Quality Value	Habitat Units Lost	Management Option	Potential Habitat Quality Gain	Compensation Requirements (Acres)
Grasses/Forbs (4)	14,523	.46	6,681	Minimum 25%	.103	64,864
				Moderate 50%	.205	32,590
				Maximum 100%	.410	16,295
Mesquite-Huisache Brush/Woods (3)	7,277	.56	4,075	Minimum 25%	.098	41,582
				Moderate 50%	.195	20,897
				Maximum 100%	.390	10,449
Live Oak - Pecan - Hackberry Parks/Forest (3)	6,393	.67	4,283	Minimum 25%	.070	61,186
				Moderate 50%	.140	30,593
				Maximum 100%	.280	15,296
Mixed Riparian Forest (2)	5,747	.75	4,310	Minimum 25%	.050	86,200
				Moderate 50%	.100	43,100
				Maximum 100%	.200	21,550
Crops (4)	6,778	.28	1,898	Minimum 25%	.093	20,409
				Moderate 50%	.185	10,259
				Maximum 100%	.370	5,130
Ponds/Water	1,058					
Reservoir Islands	441					
Other	263					
Total	42,480			Minimum 25%		274,241
				Moderate 50%		137,439
				Maximum 100%		68,720

Table 4. Inventory of Cover Types and Habitat Quality Assessment for the Proposed Lindenau Reservoir Site, Normal Pool Elevation = 232' msl.

Cover Type/ Resource Category ()	Acres Inventoried	Habitat Quality Value	Habitat Units Lost	Management Option	Potential Habitat Quality Gain	Compensation Requirements (Acres)
Grasses/Forbs (4)	11,800	.38	4,484	Minimum 25% Moderate 50% Maximum 100%	.123 .245 .490	36,455 18,302 9,151
Mesquite - Hackberry - Huisache Brush/Woods (3)	10,076	.52	5,240	Minimum 25% Moderate 50% Maximum 100%	.108 .215 .430	48,519 24,372 12,186
Elm - Hackberry - Mesquite Parks/Woods (3)	3,694	.64	2,364	Minimum 25% Moderate 50% Maximum 100%	.078 .155 .310	30,308 15,252 7,626
Mixed Riparian Forest (2)	2,388	.74	1,767	Minimum 25% Moderate 50% Maximum 100%	.053 .105 .210	33,340 16,829 8,414
Crops (4)	980	.31	304	Minimum 25% Moderate 50% Maximum 100%	.085 .170 .340	3,576 1,788 894
Ponds/Water	37					
Reservoir Islands	347					
Total	29,322			Minimum 25% Moderate 50% Maximum 100%		152,198 76,543 38,271

CONCLUSIONS

The total area inundated by Cuero Reservoir at the proposed normal pool elevation and subsequently digitized was 42,480 acres. Total acreage within the proposed Lindenau reservoir normal pool elevation was calculated at 29,322 acres. Cuero has the largest surface acreage among the 20 proposed reservoirs identified in the Texas Water Plan (1990), while Lindenau is the fourth largest. Mixed riparian forests within the Cuero site account for approximately 5,747 acres (14 percent) of the total area. Within the Lindenau site this type accounts for approximately 2,388 acres (8 percent). While overall habitat quality varied among cover types within and between the two reservoir sites, quality ratings were similar for the mixed riparian forests occurring within the two sites. Compensation acreage estimates also varied significantly depending on particular cover types and proposed levels of management. As the levels of management intensity for compensation tracts doubled, the required acreage amounts were reduced by approximately one-half. Even at high levels of management intensity, compensation requirements remained high. Overall compensation for the Cuero site was approximately 1.6 acres for each acre lost while the Lindenau site indicated 1.3 acres for each acre lost. The lower value for the Lindenau site is a reflection of smaller acreage and slightly lower habitat quality ratings for the vegetation cover types.

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.
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APPENDIX 1
Wildlife Habitat Appraisal

TEXAS PARKS AND WILDLIFE DEPARTMENT
WILDLIFE HABITAT APPRAISAL PROCEDURE (WHAP)

Background: The Wildlife Habitat Appraisal Procedure was developed to allow a qualitative, holistic evaluation of wildlife habitat for particular tracts of land statewide without imposing significant time requirements in regard to field work and compilation of data.

Section I measures key components which contribute to the ecological condition of the evaluated tract and resulting overall suitability for wildlife. Habitat quality values are generated and combined with acreage figures to provide available Habitat Units (HU) and/or a Biological Habitat Components Score (BC) for each evaluated tract. Section II addresses the degree of presence or absence of Protected Fauna and Flora. In Section III, factors which may affect acquisition priority or overall suitability of the evaluated tract for management are addressed. Scores derived from evaluation parameters from each Section are integrated into a final summary for the evaluated tract.

The method is based on the following assumptions.

1. that vegetative structure including species composition and physiognomy is itself sufficient to define the habitat suitability for wildlife;
2. that a positive relationship exists between vegetation diversity and wildlife species diversity;
3. that vegetative composition and primary productivity directly influence population densities of wildlife species.

As designed, the Wildlife Habitat Appraisal Procedure is intended to be used for the following applications:

1. Evaluating impacts upon wildlife populations from various water development project alternatives.
2. Establishing base line data prior to anticipated or proposed changes in habitat conditions for specific areas.
3. Comparing tracts of land which are candidates for land acquisition or mitigation.
4. Evaluating general habitat quality and wildlife management potential for tracts of land over large geographical areas, including wildlife planning units.

The WHAP was not designed to evaluate habitat quality in relation to specific wildlife species. Other procedures exist or are currently being developed which utilize this approach. Such species-oriented evaluations generally require more detailed life requisite information, may not portray overall ecological conditions and could be subject to change within different geographical locations.

SECTION I

BIOLOGICAL HABITAT COMPONENTS

Procedures:

1. The WHAP method requires evaluating representative sites of each cover type present within the area of interest. Obtain or produce a vegetation/cover map of the entire tract to be evaluated. Procurement of aerial photography may be required. Cover types are delineated according to floristics that signify dominant plant species and physiognomy according to the categories listed in Appendix 1.
2. A minimum number of sites representing each delineated cover type must be inspected to ensure an acceptable appraisal. Detailed statistical analyses would require establishment of a compatible sampling procedure. Determination of the number of inspection sites for each cover type should be governed by the objective of the evaluation, size of the area to be evaluated, and constraints imposed by available time and resources.
3. View each site sufficiently to assure that an overall evaluation can be made. Consider each habitat component carefully as provided by the Field Evaluation Key. Confine search effort for criteria A & B of Component 4 to an area representative of the site but not larger than one acre (circle with 39 yd. diameter).
4. Determine the number of points to assign various habitat components according to the listed criteria on the Evaluation Key.
5. Enter the number of points assigned to each of the components on the appropriate line of the Field Evaluation Form (p. 16).
NOTE: A Field Evaluation Form must be completed for each delineated cover type. Data for up to 7 inspection sites of a particular cover type may be included on the form.
6. After all sites are inspected, calculate average habitat quality for each cover type as guided by the Field Evaluation Form.
7. Average habitat quality values are summarized on the Wildlife Habitat Appraisal Summary Sheet. Total Habitat Units (HU) and an overall Biological Habitat Components (BC) score are also computed. Overall value of the tract is obtained by examining the scores of the Biological Habitat Components, Protected Fauna and Flora, and Acquisition/Administration sections either individually or in combination.
8. Where impacts due to changes in future conditions are anticipated, habitat components for each cover type may be reevaluated with different "projected" numerical ratings. This tabulated data will yield values which may be compared with baseline conditions to determine the extent of projected impacts. To allow such comparisons Average Annual Habitat Units (AAHU) may also be computed in a manner similar to the USFWS Habitat Evaluation Procedure (HEP) 1980 version (USFWS 1980).^{1/} (See footnote citations, Appendix 2)

BIOLOGICAL HABITAT COMPONENTS
EVALUATION KEY

**Biological Habitat Components
Evaluation Key**

Component 1 - Site Potential

Evaluate for all cover types.

Criteria^{2/}

Value

Substrate is composed or exhibits one or more of the following: 1) at least periodically supports predominately hydrophytic vegetation; 2) is predominately undrained hydric soil and supports or is capable of supporting hydrophytic vegetation; 3) is saturated with water or covered by shallow water during 1-2 months during the growing season of each year (swamps, bogs, marshes, and hardwood bottomlands exhibiting a high frequency of flooding).

25

Alluvial substrate although less hydric than above; only temporarily or intermittently inundated or saturated for short periods (higher terraces of hardwood bottoms, riparian drainages).

20

Uplands with thick surface layer (generally greater than or equal to 10 inches) consisting of unrestricted loam (including sandy loam) or dark well structured (granulated) clay (including sandy clay).

12

Uplands with shallow surface layer (generally less than 10 inches) consisting of shallow soil over restrictive layer (rock, gravel, claypan, etc.) or deep, leached, droughty sand or, relatively light colored, poorly structured clay or gravelly/stony sand or clay.

7

Organic matter minimal or absent at the surface. (Includes undrained or saturated hydric soils not supporting vegetation i.e., mud flats).

3

Surface contains chemical compounds which would potentially limit growth of primary producers (salt, mine overburden containing heavy metals or acid compounds, surface pollution).

1

Component 2 - Temporal Development of Existing Successional Stage

Determine currently existing successional stage (Criteria A); evaluate for all cover types except marshes. For this habitat type use Criteria B.

Criteria A^{3/}

	<u>Value</u>
Old timber (100 or more years)	20
Mature timber, old brush, climax prairie (40-99 years)	12
Pole and young timber, mature brush (11-39 years)	6
Grasslands in grazing disclimax* or early and mid-successional perennial grasses and forbs	5
Seedlings, saplings, young brush (3-10 years)	3
Annual native or introduced grasses, forbs, crops	1

* Example: Texas wintergrass-silver bluestem grasslands

Criteria B

(Marsh wetlands)

Value

Established mature communities within or adjacent to an enclosed coastal water body with a free connection to the sea and a measurable quantity of salt in its waters but with abundant or semi-abundant freshwater inflow (estuarine areas).	20
Established mature communities or intermediate to well advanced successional stages occurring in fresh, brackish, or saline environments; freshwater inflow limited to generally small tributaries and localized runoff or overflow from flood conditions.	10
Aquatic or semi-aquatic communities occurring in generally early to intermediate successional stages as a result of periodic changes in moisture gradients; highly dependent on seasonal weather conditions.	5

Component 3 - Uniqueness and Relative Abundance

1. Evaluate the habitat within the site according to the categories below. Enter the value on the Acquisition Components Evaluation Summary.

<u>Category</u>	<u>Value</u>
Highly valuable for wildlife and is very uncommon, unique or irreplaceable (USFWS Mitigation Resource Category 1*)	20

*Corresponds to scarcity and abundance criteria as contained in U.S. Fish and Wildlife Service Mitigation Policy; Federal Register Vol. 46:15, Jan. 23, 1981.

Highly valuable for wildlife but is relatively scarce or becoming scarce (USFWS Mitigation Resource Category 2)	15
Exhibits high to medium value for wildlife and is relatively abundant (USFWS Mitigation Resource Category 3)	10
Exhibits medium to low value for wildlife and is relatively abundant (USFWS Mitigation Resource Category 4)	5
Exhibits very low wildlife value regardless of abundance or scarcity	0

Component 4 - Vegetative Species Diversity

Criteria A

Diversity of Woody Species

Evaluate the composition of readily observable woody species in the overstory, midstory, and understory by determining the number of species groups as represented by the following categories. Evaluate for all cover types except Swamps (Criteria C) and Marsh wetlands (Criteria D). Confine search effort for Criteria A & B to an area not larger than 1 acre (circle with 39 yd. diameter). Worksheet for Criteria A & B provided on page 26.

Species Group^{4/}

Examples

Berry/Drupe	hackberry, mulberry, paw paw, hawthorn, winterberry, black haw, soapberry, persimmon, choke cherry, yaupon.
Legume/Pod	mesquite, locust, redbud, <u>Acacia</u> spp.
Acorn	white oak, red oak, live oak, water oak
Nut/Nutlike	hickory, pecan, walnut
Samara (Winged Fruit)	elm, ash, box elder
Cone	pinos, cypress
Achene	sycamore, <u>Baccharis</u> spp., sandsage
All others (capsules, follicles, burs, hairy seeds)	willow, cottonwood, sweetgum, salt cedar yucca, cactus

Value assigned is equivalent to the number of groups represented (Maximum=8, If none is represented then value is 0)

Criteria B**Total Number of Occurring Woody Species**

Determine the total number of readily observable woody species and assign value according to the following categories. Do not use for Swamps (Criteria C) or Marsh wetlands (Criteria D)

	<u>Value</u>
15 or more species	7
10-14 species	5
5-9 species	3
1-4 species	1
None occurring	0

Criteria C**Diversity of Vegetation in Swamps**

Evaluate swamp areas according to the following categories:^{5/}

	<u>Value</u>
Seasonally flooded mixed bottomland hardwoods; inundation resulting from freshwater inflow	15
Seasonally flooded vegetation dominated by cypress-tupelo; inundation resulting from freshwater inflow	10
Continually flooded or infrequent, abrasively flooded vegetation comprised of one or more species; inundation resulting from freshwater, brackish or saline inflow	6
Continually flooded vegetation; inundation resulting from stagnant or impounded freshwater, brackish, or saline water conditions	2

Criteria D**Diversity of Vegetation in Marshes and other similar wetland areas**

Determine the major types of wetland vegetation present according to the following categories: rooted emergent vegetation, rooted submergent vegetation, rooted vegetation with floating leaves, algal mat communities (microalgae), benthic or drifting seaweeds (macroalgae).

	<u>Value</u>
<u>High</u> - includes three or more of above categories.	20
<u>Medium</u> - includes two of the above categories.	15
<u>Low</u> - includes one of the above categories.	5

Component 5 - Vertical Vegetation Stratification

Evaluate canopy coverage of the following three categories of vegetation for all cover types except crops and marsh wetlands.

- Categories:
- 1) Vegetation greater than 12 feet high
 - 2) Vegetation 3-12 feet high
 - 3) Vegetation less than 3 feet high

<u>Criteria</u>	<u>Value</u>
All three categories present, each accounting for at least 25 percent of ground cover	5
Any two of the above categories present, each accounting for at least 25 percent of ground coverage	4
Only one of the above categories present and accounting for at least 25 percent of ground coverage	3
None of the categories together account for more than 25 percent of ground cover	1

Component 6 - Additional Structural Diversity Components

Evaluate for all cover types except crops. Determine the presence of brush piles, rock piles, rocky crevices, snags, fallen logs, thick grass cover, brambles or thickets according to the following categories.

<u>Criteria</u>	<u>Value</u>
<u>Abundant</u> - Three or more of the above components readily apparent and observable from most locations within the site	5
<u>Moderate</u> - Any of the above components present, and observable with very little search effort	3

Sparse - Any of the above components present, but occurring infrequently or requiring significant search effort to locate 1

Absent - None of the above components observed 0

Component 7 - Condition of Existing Vegetation - Other

Use: Criteria A&B for cover types (other than crops and marsh wetlands) containing woody and/or herbaceous vegetation.
Criteria C for cropland only.
Criteria D for marsh wetlands.

Criteria A **Value**
Degree of Utilization of Woody Vegetation by vertebrates and invertebrates

Not evident - little or no evidence of plant utilization 5

Moderate - Plant utilization observable with minimal damage to leaves and/or stems. 3

Severe - Damage to leaves and/or stems readily observable. 1

Criteria B **Value**
Availability of Herbaceous Vegetation. Do not evaluate for Crops (Criteria C) or Marsh Wetlands (Criteria D)

Good - Eight or more combined species of grasses and forbs readily observable. 5

Fair - Four to seven combined species of grasses and forbs readily observable. 3

Poor - One to three combined species of grasses and forbs readily observable 1

None - Herbaceous vegetation lacking or absent 0

Criteria C **Value**
Available Biomass (Evaluate for croplands only)

High - Biomass removed periodically, although not necessarily annually; removed biomass supplanted by other vegetation resulting from natural succession of invading species or overseeding of introduced species; (Ex. Rice or other crop on multi-year rotational system allowing for additional biomass accumulations between harvests). 10

Moderate - Most biomass removed annually or semi-annually but with some residual amount remaining during portions of the rotational period. Minimal bare ground conditions (Hay operations, crops grown for pasture or grazing, chiseled crops). 5

Low - Most biomass removed annually due to clean farming practices creating significant bare ground conditions (intensive row crop farming). 1

Criteria D Value
 Condition of Marsh Wetlands

Unaltered - Quality of water and/or associated vegetation good, no immediate danger of environmental intrusion including pollution, contamination, sedimentation, or stagnation. 10

Stable - Quality of water and/or associated vegetation good, although evidence exists that pollution, contamination sedimentation or stagnation could occur in the future or has occurred in the past. 5

Degraded - Quality of water and/or associated vegetation poor or declining or degradation imminent. 1

APPENDIX 2
Field Evaluation Forms

**WHAP
Biological Components
Field Evaluation Form**

Project Cuero Date: 6-19-91

Cover Type or Plant Association Grasses/Forbs

Habitat Components		Component Points (From Key)					
		Site No.	G ₁	G ₂	G ₄	G ₅	TOTAL
1.	Site Potential		12	12	20	12	56
2.	Temporal Development						
	Criteria A		5	5	5	5	20
	Criteria B (Marsh Wetlands Only)						
3.	Uniqueness and Relative Abundance		10	10	10	10	40
4.	Vegetative Species Diversity						
	Criteria A		2	2	2	2	8
	Criteria B		1	1	1	1	4
	Criteria C (Swamps Only)						
	Criteria D (Marsh Wetlands Only)						
5.	Vertical Stratification		3	4	3	3	13
6.	Additional Structural Diversity Components		3	1	1	1	6
7.	Condition of Existing Vegetation						
	Criteria A (Woody Vegetation)		5	5	5	5	20
	Criteria B (Herbaceous Vegetation)		5	5	5	3	18
	Criteria C (Croplands Only)						
	Criteria D (Marsh Wetlands Only)						

Average Habitat Quality Score for all sites within this cover type = $\frac{\text{Total Points } 185}{\text{Total number of sites}} \times \frac{1}{100} = \underline{.46}$

Enter this score in column 3, Wildlife Habitat Appraisal Summary Sheet.

Cueso
 Cover Type GRASES / FORBS

Site No.	G ₁	G ₂	G ₄		
Berry/Drupe	hackberry Grape	Tx Persimmon Brazil	hackberry		
Legume/Pod	Huisache mesquite	mesquite huisache	huisache mesquite	mesquite huisache	
Acorn				Liveoak	
Nut/Nutlike					
Samara					
Cone					
Achene					
All Others					

**WHAP
Biological Components
Field Evaluation Form**

Project Cues Date: 6-19-91

Cover Type or Plant Association Mesquite - Herbaceous Bush/Wetlands

Habitat Components

photo
Component Points (From Key)

	Site No.	B ₃	B ₄	B ₁	B ₂				TOTAL
1. Site Potential		12	12	12	20				56
2. Temporal Development									
Criteria A		12	12	6	6				36
Criteria B (Marsh Wetlands Only)									
3. Uniqueness and Relative Abundance		10	10	10	10				40
4. Vegetative Species Diversity									
Criteria A		3	3	3	2				11
Criteria B		3	3	3	3				12
Criteria C (Swamps Only)									
Criteria D (Marsh Wetlands Only)									
5. Vertical Stratification		5	5	4	5				19
6. Additional Structural Diversity Components		5	5	1	5				16
7. Condition of Existing Vegetation									
Criteria A (Woody Vegetation)		5	5	5	5				20
Criteria B (Herbaceous Vegetation)		3	3	5	3				14
Criteria C (Croplands Only)									
Criteria D (Marsh Wetlands Only)									

Average Habitat Quality Score for all sites within this cover type = $\frac{\text{Total Points } 224}{\text{Total number of sites}} \times \frac{1}{100} = 56$

Enter this score in column 3, Wildlife Habitat Appraisal Summary Sheet.

Cover Type Mesquite-Huirache brush/Woods

Site No.	B ₃	B ₄	B ₁	B ₂	
Berry/Drupe	hackberry Brazil Tx persimmon Granjeno	hackberry Brazil Tx persimmon Bumelia	bumelia hackberry	hackberry bois d'arc grape	
Legume/Pod	Mesquite huirache	Mesquite	Mesquite huirache	huirache mesquite locust	
Acorn					
Nut/Nutlike					
Samara					
Cone					
Achene					
All Others	Prickly pear	Prickly pear	Prickly Pear		

**WHAP
Biological Components
Field Evaluation Form**

Project Cuesco

Date: 6-7-91

Cover Type or Plant Association live oak-pecan - Hackberry Park/Forest

Habitat Components

8 ^{all sites} Component Points (From Key) 8 - Omitted ^{Impaired} _{undesirable} ^{observed} _{not 4}

	Site No.	Component Points (From Key)						TOTAL
		P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	
1. Site Potential		20	20	12	12	20	20	84
2. Temporal Development								
Criteria A		15	12	20	20	15	12	82
Criteria B (Marsh Wetlands Only)								
3. Uniqueness and Relative Abundance		15	15	10	10	15	15	65
4. Vegetative Species Diversity								
Criteria A		2	2	3	5	6	4	18
Criteria B		1	3	1	3	5	3	13
Criteria C (Swamps Only)								
Criteria D (Marsh Wetlands Only)								
5. Vertical Stratification		1	4	4	5	5	5	19
6. Additional Structural Diversity Components		3	3	1	3	3	3	13
7. Condition of Existing Vegetation								
Criteria A (Woody Vegetation)		5	1	5	5	5	3	21
Criteria B (Herbaceous Vegetation)		5	3	3	5	3	1	19
Criteria C (Croplands Only)								
Criteria D (Marsh Wetlands Only)								

Average Habitat Quality Score for all sites within this cover type = $\frac{\text{Total Points } 334}{\text{Total number of sites } 100} \times \frac{1}{100} = .67$

Enter this score in column 3, Wildlife Habitat Appraisal Summary Sheet.

Census
 Cover Type Live oak - Pecan - Hackberry Park/Forest

Site No.	P ₉	P ₅	P ₁	P ₃	P ₆	P ₈
Berry/Drupe		Rough Leaf hackberry Sugar hackberry Yupon Grape	hackberry	hackberry	Dewberry P. Ivy Hawthorne hackberry V. Creeper Smilax	Sapberry hackberry Grape Chinaberry
Legume/Pod		hairsache	mesquite	mesquite hairsache locust		
Acorn	Live oak		Live oak Post oak	Live oak		
Nut/Nutlike				Pecan	Pecan	Pecan
Samara	Cedar elm				Am elm Box elder Green ash cedar elm	Cedar elm Green ash
Cone					Bald cypress	
Achene					Sycamore	
All Others				Prickly pear	black willow	cottonwood

**WHAP
Biological Components
Field Evaluation Form**

Project Cues Date: 6-17, 1991

Cover Type or Plant Association Mixed Riparian Forest

Habitat Components

Plt. #9
Component Points (From Key)

	Site No.	F ₁	F ₂	F ₃	W ₃	W ₁	TOTAL	
1. Site Potential		20	20	20	20	20	120	
2. Temporal Development								
Criteria A		12	12	12	20	12	80	
Criteria B (Marsh Wetlands Only)								
3. Uniqueness and Relative Abundance		15	15	15	15	15	90	
4. Vegetative Species Diversity								
Criteria A		5	6	3	4	5	5	28
Criteria B		5	7	3	3	7	7	32
Criteria C (Swamps Only)								
Criteria D (Marsh Wetlands Only)								
5. Vertical Stratification		5	5	5	5	5	5	30
6. Additional Structural Diversity Components		5	5	5	3	5	5	28
7. Condition of Existing Vegetation								
Criteria A (Woody Vegetation)		3	5	5	1	5	5	24
Criteria B (Herbaceous Vegetation)		3	3	1	3	5	1	16
Criteria C (Croplands Only)								
Criteria D (Marsh Wetlands Only)								

Average Habitat Quality Score for all sites within this cover type = $\frac{\text{Total Points } 448}{\text{Total number of sites}} \times \frac{1}{100} = .75$

Enter this score in column 3, Wildlife Habitat Appraisal Summary Sheet.

Cover Type B. Forest

Site No.	F ₄	F ₁	F ₂	F ₃		
Berry/Drupe	P. Ivy Dewberry Smilax Grape Hackberry Trumpet Creeper	Youpon Grape Bumelia hackberry Soapberry P. Ivy Pigeonvine Mulberry	Smilax Grape hackberry	hackberry hawthorne Smilax Plum		
Legume/Pod		Huisache		Retama Mesquite		
Acorn	Willow oak Bur oak Water oak	Live oak	Live oak Port oak	Live oak		
Nut/Nutlike	Pecan	Pecan				
Samara	G. Ash Cedar Elm	Cedar Elm Am Elm G. Ash	Cedar Elm Am Elm	Cedar elm		
Cone						
Achene						
All Others	B. Willow	Willow				

Cover Type B₁ Forest / wetlands

Site No.	W ₃	W ₁			
Berry/Drupe	Trumpet Vine Red Mulberry Peppercorn P. Ivy Dewberry Basswood Elderberry Grape Chinberry Smilax	Basswood V. Creeper Smilax Yucca Peppercorn Grape Soapberry Mulberry P. Ivy			
Legume/Pod		hairshe			
Acorn					
Nut/Nutlike	Pecan	Pecan			
Samara	Green ash Am Elm Box elder Cedar elm	Cedar elm Am elm box elder			
Cone					
Achene	Sycamore				
All Others	Black willow Cottonwood Bois d'Arc	Cottonwood			

**WHAP
Biological Components
Field Evaluation Form**

Project Cuero Date: 6-19-91

Cover Type or Plant Association Cropland

Habitat Components Bermuda Country
Habitat Component Points (From Key)

	Site No.	C ₄	C ₁	C ₂	C ₃				TOTAL
1. Site Potential		20	12	12	20				64
2. Temporal Development									
Criteria A		1	1	1	1				4
Criteria B (Marsh Wetlands Only)									
3. Uniqueness and Relative Abundance		5	5	5	5				20
4. Vegetative Species Diversity									
Criteria A		0	2	0	0				2
Criteria B		0	1	0	0				1
Criteria C (Swamps Only)									
Criteria D (Marsh Wetlands Only)									
5. Vertical Stratification		-	-	-					0
6. Additional Structural Diversity Components		-	-	-					0
7. Condition of Existing Vegetation									
Criteria A (Woody Vegetation)									
Criteria B (Herbaceous Vegetation)									
Criteria C (Croplands Only)		5	5	5	5				20
Criteria D (Marsh Wetlands Only)									

Average Habitat Quality Score for all sites within this cover type = $\frac{\text{Total Points}}{\text{Total number of sites}} \times \frac{1}{100} = \frac{111}{100} = .28$

Enter this score in column 3, Wildlife Habitat Appraisal Summary Sheet.

**WHAP
Biological Components
Field Evaluation Form**

Project Lindeman Date: 6-17-91

Cover Type or Plant Association Grass/Forbs


Habitat Components ^{Photo #} Component Points (From Key)

	Site No.	G ₁	G ₂	G ₆	G ₃			TOTAL
1. Site Potential		12	12	12	20			56
2. Temporal Development								
Criteria A		1	1	5	5	5		16
Criteria B (Marsh Wetlands Only)								
3. Uniqueness and Relative Abundance		0	0	5	5	10		20
4. Vegetative Species Diversity								
Criteria A		0	1	2	2	3		8
Criteria B		0	1	1	1			3
Criteria C (Swamps Only)								
Criteria D (Marsh Wetlands Only)								
5. Vertical Stratification		3	3	3	3	3		12
6. Additional Structural Diversity Components		1	1	1	1	3		6
7. Condition of Existing Vegetation								
Criteria A (Woody Vegetation)		5	5	5	5	5		20
Criteria B (Herbaceous Vegetation)		1	5	3	3			12
Criteria C (Croplands Only)								
Criteria D (Marsh Wetlands Only)								

Average Habitat Quality Score for all sites within this cover type = $\frac{\text{Total Points } 153}{\text{Total number of sites}} \times \frac{1}{100} = 0.38$

Enter this score in column 3, Wildlife Habitat Appraisal Summary Sheet.

Cover Type LINDENAY
GRASSES/Forbs

Site No.	G ₁	G ₂	G ₆	G ₃	
Berry/Drupe			hackberry	Lime prickly ash Bumelia	
Legume/Pod		mesquite	mesquite	mesquite	
Acorn		Live oak		Live oak	
Nut/Nutlike		Pecan			
Samara					
Cone					
Achene					
All Others					

**WHAP
Biological Components
Field Evaluation Form**

Project Lindeman Date: 6-18-91

Cover Type or Plant Association Mesquite - Hackberry - Huicache Brush/Woods

Habitat Components	Site No.	Points						Component Points (From Key)	TOTAL
		B ₁	B ₂	B ₃	B ₄				
1. Site Potential		12	12	12	12				48
2. Temporal Development									
Criteria A		6	6	6	6				24
Criteria B (Marsh Wetlands Only)									
3. Uniqueness and Relative Abundance		10	10	10	10				40
4. Vegetative Species Diversity									
Criteria A		4	4	4	3				15
Criteria B		3	3	3	3				12
Criteria C (Swamps Only)									
Criteria D (Marsh Wetlands Only)									
5. Vertical Stratification		5	5	5	5				20
6. Additional Structural Diversity Components		3	3	3	3				12
7. Condition of Existing Vegetation									
Criteria A (Woody Vegetation)		5	5	5	3				18
Criteria B (Herbaceous Vegetation)		5	5	5	5				20
Criteria C (Croplands Only)									
Criteria D (Marsh Wetlands Only)									

Average Habitat Quality Score for all sites within this cover type = $\frac{\text{Total Points } (209)}{\text{Total number of sites}} \times \frac{1}{100} = 0.52$

Enter this score in column 3, Wildlife Habitat Appraisal Summary Sheet.

Lindenau
 Cover Type Mesquite - Hackberry - Huisache Brush/Woods

Site No.	B ₁	B ₂	B ₃	B ₄	
Berry/Drupe	Lime prickly ash bumelia Ivy treebine	brazil hackberry bumelia	bumelia hackberry	bumelia hackberry	
Legume/Pod	mesquite	mesquite	mesquite huisache	mesquite huisache	
Acorn	Post oak	Live oak	Live oak	.	
Nut/Nutlike					
Samara		cedar elm		cedar elm	
Cone					
Achene					
All Others	pencil cactus prickly pear		Prickly Pear	.	

LINDENAU

Cover Type Elm-Hackberry-Mesquite Parks/Woods

Site No.	P ₃	P ₁ (drainage)	P ₄		
Berry/Drupe	Virginia Creeper Trumpet Vine hackberry grape Am. beauty berry Yaupon Smilax	Brazil Yaupon Tx Persimmon hackberry Smilax dewberry	Yaupon lime prickly ash grape hackberry		
Legume/Pod		mesquite huisache	mesquite		
Acorn	walnut pecan		Live oak		
Nut/Nutlike	cedar elm ash	cedar elm	Am. elm		
Samara					
Cone					
Achene					
All Others			Prickly Pear Yucca		

**WHAP
Biological Components
Field Evaluation Form**

Project Lindenow Date: 6-17-91

Cover Type or Plant Association Elm. Herbaceous-Mesquite Parks/Woods

Habitat Components	Site No.	Component Points (From Key)						TOTAL
		P ₃	P ₁	P ₄	P ₅	P ₆	P ₇	
1. Site Potential		20	15	20				55
2. Temporal Development								
Criteria A		9	12	6				27
Criteria B (Marsh Wetlands Only)								
3. Uniqueness and Relative Abundance		15	10	10				35
4. Vegetative Species Diversity								
Criteria A		3	3	5				11
Criteria B		5	3	3				11
Criteria C (Swamps Only)								
Criteria D (Marsh Wetlands Only)								
5. Vertical Stratification		5	5	4				14
6. Additional Structural Diversity Components		3	3	3				9
7. Condition of Existing Vegetation								
Criteria A (Woody Vegetation)		5	5	5				15
Criteria B (Herbaceous Vegetation)		5	5	5				15
Criteria C (Croplands Only)								
Criteria D (Marsh Wetlands Only)								

Average Habitat Quality Score for all sites within this cover type = $\frac{\text{Total Points } 192}{\text{Total number of sites } 100} \times \frac{1}{100} = 0.64$

Enter this score in column 3, Wildlife Habitat Appraisal Summary Sheet.

Lindenau
 Cover Type Mesquite - Hackberry - Huisache Brush/Woods

Site No.	B ₁	B ₂	B ₃	B ₄	
Berry/Drupe	Lime prickly ash bumelia Ivy treebine	brazil hackberry bumelia	bumelia hackberry	bumelia hackberry	
Legume/Pod	mesquite	mesquite	mesquite huisache	mesquite huisache	
Acorn	Post oak	Live oak	Live oak	.	
Nut/Nutlike					
Samara		cedar elm		cedar elm	
Cone					
Achene					
All Others	penicill cactus prickly pear		Prickly Pear		

LINDENAU

Cover Type Elm-Hackberry-Mesquite Parks/Woods

Site No.	P ₃	P ₁ (orange)	P ₄		
Berry/Drupe	Virginia Creeper Trumpet Vine hackberry grape Am. beauty berry Yupon Smilax	Brazil Yupon Tx Persimmon hackberry Smilax dewberry	Yupon lime prickly ash grape hackberry		
Legume/Pod		mesquite huisache	mesquite		
Acorn	walnut pecan		Live oak		
Nut/Nutlike	cedar elm ash	cedar elm	Am. elm		
Samara					
Cone					
Achene					
All Others			Prickly Pear Yucca		

**WHAP
Biological Components
Field Evaluation Form**

Project Linderoose Date: 6-17/89

Cover Type or Plant Association Mixed Riparian Forest

Habitat Components photo #13 #16 photo #19
Component Points (From Key)

	Site No.	F4	FR ₁	FR ₂	FR ₃	FR ₅	F2	TOTAL	
1. Site Potential		20	20	20	20	20	20	140	
2. Temporal Development									
Criteria A		6	12	20	12	20	12	94	
Criteria B (Marsh Wetlands Only)									
3. Uniqueness and Relative Abundance		15	15	15	15	15	15	105	
4. Vegetative Species Diversity									
Criteria A		2	5	5	5	4	5	4	30
Criteria B		5	7	5	5	3	5	3	33
Criteria C (Swamps Only)									
Criteria D (Marsh Wetlands Only)									
5. Vertical Stratification		5	5	5	4	5	5	5	34
6. Additional Structural Diversity Components		3	5	3	3	5	5	3	27
7. Condition of Existing Vegetation									
Criteria A (Woody Vegetation)		3	3	5	1	5	5	5	27
Criteria B (Herbaceous Vegetation)		3	3	5	3	3	3	5	25
Criteria C (Croplands Only)									
Criteria D (Marsh Wetlands Only)									

Average Habitat Quality Score for all sites within this cover type = $\frac{\text{Total Points } 515}{\text{Total number of sites } 7} \times \frac{1}{100} = 0.74$

Enter this score in column 3, Wildlife Habitat Appraisal Summary Sheet.

Cover Type Mixed Riparian Forest

Site No.	FR ₄	FR ₇	FR ₁	FR ₂	FR ₃
Berry/Drupe	Evel's necklace grape Yupon plum Smilax Trumpet vine hackberry dewberry hawthorn	Am beauty berry china berry Carolina buckthorn Yupon hawthorn Smilax grape red mulberry P. Ivy Virginia Creeper hackberry low wood	Grape dewberry Smilax red mulberry P. Ivy bumelia Yupon	hawthorn hackberry mulberry P. Ivy Soapberry grape Smilax	mulberry hackberry Smilax Anagua P. Ivy
Legume/Pod			mesquite huisache	huisache leadplant	
Acorn		Live oak Unknown oak			
Nut/Nutlike		Pecan	Pecan	Pecan	Pecan walnut
Samara	cedar elm box elder Am. Elm	cedar elm	cedar elm green ash box elder	Am. elm cedar elm	cedar elm
Cone					
Achene					
All Others		black willow	black willow	cottonwood	cottonwood

Cover Type Mixed Riparian Forest

Site No.	FR5	F2			
Berry/Drupe	Trumpet Vine P. Ivy Smilax red mulberry hawthorn	hackberry Yaupon mulberry live prickly ash grape			
Legume/Pod		mesquite			
Acorn	Bur oak Live oak				
Nut/Nutlike	Pecan	Pecan			
Samara	Cedar elm Green ash box elder	Cedar elm			
Cone					
Achene					
All Others	black willow				

**WHAP
Biological Components
Field Evaluation Form**

Project Lindenau Date: 6-18-91

Cover Type or Plant Association Crops

Habitat Components		Component Points (From Key)						
Site No.		C ₁	C ₃					TOTAL
1.	Site Potential	20	20					40
2.	Temporal Development							
	Criteria A	1	1					2
	Criteria B (Marsh Wetlands Only)							
3.	Uniqueness and Relative Abundance	5	5					10
4.	Vegetative Species Diversity							
	Criteria A	0	0					
	Criteria B	0	0					
	Criteria C (Swamps Only)							
	Criteria D (Marsh Wetlands Only)							
5.	Vertical Stratification							
6.	Additional Structural Diversity Components							
7.	Condition of Existing Vegetation							
	Criteria A (Woody Vegetation)							
	Criteria B (Herbaceous Vegetation)							
	Criteria C (Croplands Only)	5	5					10
	Criteria D (Marsh Wetlands Only)							

Average Habitat Quality Score for all sites within this cover type = $\frac{\text{Total Points } (66)}{\text{Total number of sites}} \times \frac{1}{100} = 0.31$

Enter this score in column 3, Wildlife Habitat Appraisal Summary Sheet.