VEGETATION SURVEY OF THE YEGUA KNOBBS PRESERVE, BASTROP AND LEE COUNTIES, TEXAS

by

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ABSTRACT

The Yegua Knobbs Preserve (YKP) is a private, nearly rectangular 122-hectare tract that sits on the Bastrop and Lee County lines in the Oak Woods and Prairies natural region of east-central Texas. This region is considered an ecotone where communities from the bordering natural regions, the Pineywoods to the east and the Blackland Prairies to the west, merge. A species inventory was done to identify the vascular plants present at the preserve for a growing season. Woody vegetation was sampled using the line intercept method, and herbaceous components were sampled using the quadrat method. Analysis of the qualitative and quantitative data led to the recognition of six plant communities at YKP, four dominated by woody vegetation and two by herbaceous vegetation. The rare presence of exotic species on the preserve was noted. These communities were referred to others previously discussed for the Oak Woods and Prairies, Pineywoods and Blackland Prairies natural regions.

I. INTRODUCTION

Biologists have long recognized a strong correlation between the physical and chemical characteristics and the types of vegetation that exist in an area (Bailey, 1905; McBryde, 1933; Tharp, 1939; Blair, 1950; Gould, 1960; L.B.J. School of Public Affairs, 1978; Diamond et al., 1987). This has led to classification systems based on similarities of abiotic and biotic factors, such as climate, topography, geology, soils, fauna and flora (Bailey, 1905; Tharp, 1939; Blair, 1950; Gould, 1960; L.B.J. School of Public Affairs, 1978; Diamond et al., 1987). Many different classification systems have been developed for Texas; for the purpose of this study, the one established by the L.B.J. School of Public Affairs (1978) will be used. In this system, the Oak Woods and Prairies runs along the north Texas border from Bowie County to Montague County with three arms that extend southward into east-central Texas.

The Oak Woods and Prairies natural region, also referred to as the Post Oak Savannah, covers more than 50,000 km^2 and occupies close to 8% of the state's landmass. The average annual precipitation is 90–114 cm with the amount decreasing westward (L.B.J. School of Public Affairs, 1978; Diggs et al., 2006). The underlying geological formations of the Oak Woods and Prairies were formed during the Tertiary Period and include alternating layers of marine and continental sediments that have eroded to form the sandy soils that are characteristic for the region. The dominant soils are alfisols. Alfisols occur in forested areas and usually have a sandy surface layer and clayey subsurface horizon. They occur on uplands with nearly flat to moderately sloping topography, which is typical of the Oak Woods and Prairies with elevations ranging from 90–250 m (L.B.J. School of Public Affairs, 1978; Diggs et al., 2006; USDA-NRCS,

2019). These soils are known for their fertility, which is why this area has largely been plowed and cultivated (Diggs et al., 2006).

Bailey (1905) worked to define the ranges of Texas' native flora and fauna. The basis for his work was that of his mentor, C. Hart Merriam, whose previous work had primarily mapped regions based on agricultural zones (1898). The Oak Woods and Prairies lies in Bailey's Austroriparian zone, which he described as consisting of lowlands with coniferous and deciduous forest, thick with vines that create dense understories. At higher elevations, the habitat is open with deciduous forests or thick pine forest. He noted that in terms of flora and fauna, Texas is considered an ecotone housing species from cooler climates in the north and tropical species from the south.

McBryde (1933) was the first to complete a quantitative vegetation study in the Oak Woods and Prairies region, studying the vegetation that correlated to the primary geologic formation, the Carrizo Sand. Woody dominants in the area were found to be post oak (*Quercus stellata*), blackjack oak (*Q. marilandica*), hickory (*Carya texana*), and sandjack oak (*Q. incana*).

Tharp (1939) delimited the state into 18 vegetational regions based on similarities in soils, geology, climate and physiographic features. He emphasized the Oak-Hickory region as being composed of stands of timber intermixed with pockets of prairie. He also described the area as an ecotone or transition zone where dominant species from each adjacent region are present but gradually phased out as one moves across the region.

Blair (1950) divided Texas into seven biotic provinces, delineating the boundaries based on "the distribution of topographic features, climate, vegetation types,

and terrestrial vertebrates exclusive of birds." In his analysis, the Oak Woods and Prairies was part of a large transitional area of the state that he referred to as the Texan province. In this region, there is the occurrence of species at the eastern and western limits of their ranges because of the area being bordered between the Austroriparian forest to the east and drier grasslands to the west.

Gould (1960) divided the state into ten vegetational areas based on similarities in climate, soil and topography, as well as existing knowledge of native vegetation. His description of the Post Oak Savannah includes the dominant woody species as *Q. stellata* and *Q. marilandica* and includes the issue of heavy grazing as the reason the area is presently inhabited by shrubby oaks with an understory of yaupon (*Ilex vomitoria*).

In 1978, the LBJ Public School of Affairs sponsored a conference to develop a useful classification for natural regions of the state that would promote data sharing as well as locate areas in Texas in need of preservation to protect and enhance the state's biodiversity. Conference participants organized Texas into eleven natural regions based on physiographic and biotic differences: Blackland Prairies, Coastal Sand Plains, Edwards Plateau, Gulf Coast Prairies and Marshes, High Plains, Llano Uplift, Oak Woods and Prairies, Piney Woods, Rolling Plains, South Texas Brush Country, and Trans Pecos. The Oak Woods and Prairies ecoregion is bordered on its eastern side by the Pineywoods natural region, which is characterized by pine-hardwood forest. To the west is the Blackland Prairies natural region, which was at one time dominated by open grasslands. The LBJ Public School of Affairs' description of this region is an "oak-hickory forest [that] interdigitates with tall-grass prairies," that is, an area where the two bordering ecoregions mix. Two of the three subregions in the Oak Woods and Prairies are

the Western and Eastern Cross Timbers where oak-hickory woodlands dominate the landscape. The third is the Oak Woodlands which, while incorporating a well-developed oak-hickory forest, also has the greatest occurrence of grasslands (1978). The study site for this thesis, Yegua Knobbs Preserve (YKP), lies in the Oak Woodlands subregion of the Oak Woods and Prairies natural region.

The story of how YKP came to be a preserve, as well as its use prior to becoming a preserve, are two tales of discord. In the late 1800s, the wooded outcrops known as the Yegua Knobbs made for excellent hideouts for a gang, known as the "notch-cutters," that terrorized nearby McDade, Texas, stole cattle and engaged in other nefarious activities. The land's proximity to McDade as well as its thicketed uplands meant it was a nearby, uninhabited place to go to avoid the law (Gfeller, 2016).

The land that is now YKP was acquired because of a legal battle that began in the late 1990s when environmental groups sued the Alcoa Corporation for violations of the Clean Air Act at its plant in Rockdale, Texas. In 2003, Alcoa signed a consent decree that required them to install pollution controls at their Rockdale facility and to donate $1.75 million to fund several environmental projects, specifically ones in Bastrop and Lee counties that would contribute to clean air and protect habitat for the endangered Houston toad. In 2004, the Land for Public Trust purchased YKP from private landowners who wanted the land to be preserved and safe from development. Currently, the land is managed by the Pines and Prairies Land Trust (PPLT) and is closed to the public except for special events, preserve maintenance and for educational and research purposes. There are over 6 kilometers of trails that are maintained by the land steward(s) and other volunteers. PPLT's management plan states the property cannot be developed

and that its intended purpose is to protect air quality and habitat for the endangered Houston toad, as well as preservation of habitat for all native flora and fauna, protection of water quality and a space for educational and recreational opportunities for the community that are in accordance with the preservation of habitat (Pines and Prairies Land Trust, 2015; Gfeller, 2016).

In 1987, Diamond et al. recognized that the vegetation of the Post Oak Savannah was not well known and that there was a need for more vegetation studies to be completed, especially ones incorporating quantitative data, in order to have a better understanding of the plant communities in Texas. In 2002, MacRoberts et al. reiterated this saying "the post oak savannah region of east Texas is one of the poorest known." Bergman (2017) published the most recent, comprehensive floristic treatment for this region, but it does not include any quantitative data on plant community composition. The purpose of this thesis is to carry out a vegetation study in the Oak Woods and Prairies region that 1) will catalog the vascular plant species present during an entire growing season, 2) provide qualitative and quantitative data on the flora at YKP, 3) use these data to assess the plant communities present at YKP, and 4) determine if YKP serves as an intact remnant of the Oak Woods and Prairies natural region.

II. MATERIALS AND METHODS

SITE DESCRIPTION

The Yegua Knobbs Preserve is a private, nearly rectangular 122-hectare tract situated on the Bastrop and Lee County line in east-central Texas. It is located eight kilometers north of McDade, off Private Ranch Road 3051, and the entrance is located at 30° 20' N latitude and 97° 11' W longitude. The tract was purchased by The Trust for Public Land in 2004 to primarily preserve land for the protection of air quality and habitat for the endangered Houston Toad. Today it is managed by the Pines and Prairies Land Trust, whose management plan states that approximately twenty-four hectares on the north side of the preserve are leased for grazing; this part of the property will not be included in this study (Pines and Prairies Land Trust, 2015).

Climate

The Oak Woods and Prairies ecoregion is mesothermal. As an ecotone, it has a range of climatic types from moist subhumid with moderate seasonal moisture variation in the east to dry subhumid with large seasonal moisture variation in the west (Thornthwaite, 1948). Fronts from the Gulf Coast bring in warm, moist air causing this gradient in moisture across the region (Bomar, 1983). For the Oak Woods and Prairies, the average precipitation ranges from 86-114 cm annually with increased precipitation on the eastern side of the ecoregion (L.B.J. School of Public Affairs,1978; Swanson, 1995).

The closest national weather station is located at Lexington, Texas, approximately 27.5 km from YKP and has a mean annual precipitation of 98.3 cm (Figure 1) and

average annual temperature of 19.5°C (Figure 2) (National Oceanic and Atmospheric Association, 2019a; National Oceanic and Atmospheric Association 2019b).

Topography

The Yegua Knobbs are seven sandstone outcrops dominated by loblolly pines (*Pinus taeda)* and post oaks (*Q. stellata)* that provide topographical relief in the drainage region between the Colorado and Brazos rivers (Pines and Prairies Land Trust, 2015). Two of these outcrops are present within the preserve; they provide the highest points in the preserve at elevations of approximately 226 and 219 m. From these points, the land rolls into a mosaic of woodlands and prairie blanketed in little bluestem and other forbs. Elevation continues to drop moving eastward across the preserve and the lowest point is found on the east side of the preserve in the wetland at approximately 183 m (Collins, 2001) (Figure 3).

Geology

Yegua Knobbs Preserve lies in the Gulf Coastal Plain physiographic region of Texas. During the Cretaceous Period, this region was formed by an influx of continental material that was carried from the Rocky Mountains and deposited by rivers and streams. In the Tertiary Period, as these sedimentary layers were being deposited the coastline was advancing and receding, creating alternating layers of marine and continental material. Moving inland from the present-day coast, each of these layers is recognized as a separate geological formation (Sellards et al. 1931; Eargle, 1968; Spearing, 1991). The dominant formation that is exposed at Yegua Knobbs Preserve is the Carrizo Sand or Carrizo formation, which was described by Sellards (1931?) as “a continental deposit laid

down by streams that dropped their loads on a flat coastal plain and built up a broad alluvial apron all along the coast." The Carrizo Sand, as mapped by McBryde (1933), runs nearly parallel with the Texas coastline from Bowie County in the northeastern part of the state to Maverick and Webb counties on the Texas-Mexico border. This formation is characterized by slightly coarse sand with clay intermixed at lower levels (Sellards et al., 1931).

The younger geological formation in the preserve is the Reklaw Formation which is exposed at the top of the outcrops (Collins, 2001). It consists of a mix of sand and clay and is characterized by its reddish color due to its iron components (Eargle, 1968).

Soils

The soils of Yegua Knobbs Preserve are classified as upland sandy and loamy savannah soils. They are a part of the claypan soils that occur in rolling plains dissected by rivers and streams and generally have an upper sandy layer with a sandy clay sublayer that provides good infiltration in the upper layers and moderate to slow permeability in the subsoils. All five of the soil series in the preserve (Padina, Jedd, Robco, Tabor and Silstid) are categorized as claypan soils (USDA-NRCS, 2008).

Padina soils form from weathered sandstone. They are deep, drain well, and have little runoff. These brown-hued soils form on ridges in coastal plains that are divided by rivers and streams. This series covers 68.9% of the preserve and the main soil phases are Padina fine sand and Padina loamy fine sand (Jurena, 2007; National Cooperative Soil Survey, 2014).

The Jedd series is formed from sandstones and shales of Eocene age. They are well drained and have a brownish hue. They are found in upland areas along ridges, hillsides and peaks. This series makes up 11.8% of the soils at Yegua Knobbs Preserve. The main soil phase that is found at the preserve is Jedd fine sandy loam (Jurena, 2007; National Cooperative Soil Survey, 2014).

The Robco soil series is the third most widespread series at Yegua Knobbs Preserve at 9.7%. It is a deep, fine loamy sand with a 30-35 percent clay content. This upland soil is primarily brown, drains moderately well and has a slow permeability rate (Jurena, 2007; National Cooperative Soil Survey, 2014).

On the east side of the preserve, the Tabor soils are derived from sandstone and shale. This soil series covers 7.6% of the preserve and is classified as a fine sandy loam (Jurena, 2007; National Cooperative Soil Survey, 2014).

The Silstid series occupies 2% of the preserve and is characterized by well drained and fairly porous soils derived from weathered sandstone. Silstid soils generally occur on the backslopes of ridges (Jurena, 2007; National Cooperative Soil Survey, 2014) (Figure 4).

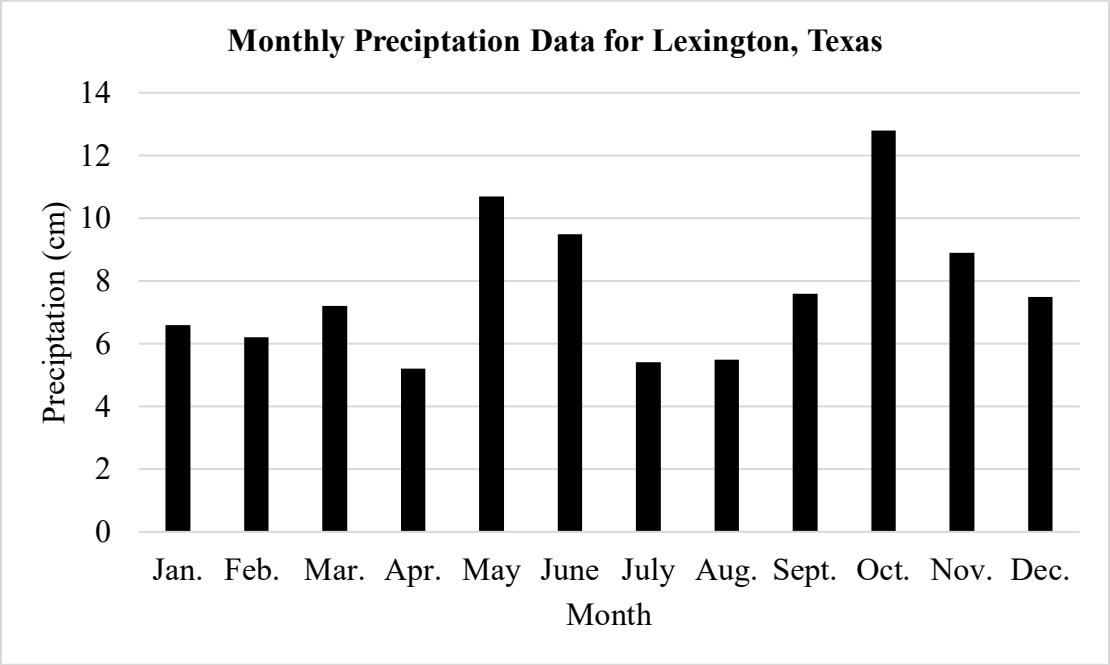


Figure 1. Monthly precipitation data (cm) for Lexington, Texas, 1981–2010. Data provided by National Oceanic and Atmospheric Association.

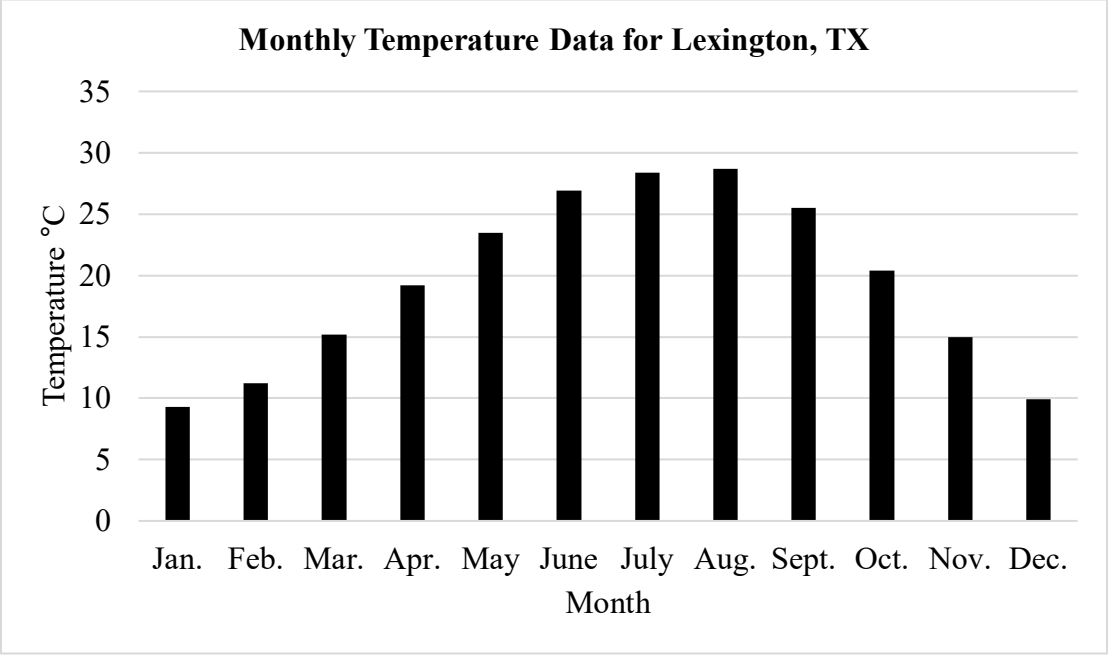


Figure 2. Monthly temperature data (°C) for Lexington, Texas, 1981–2010. Data provided by National Oceanic and Atmospheric Association.

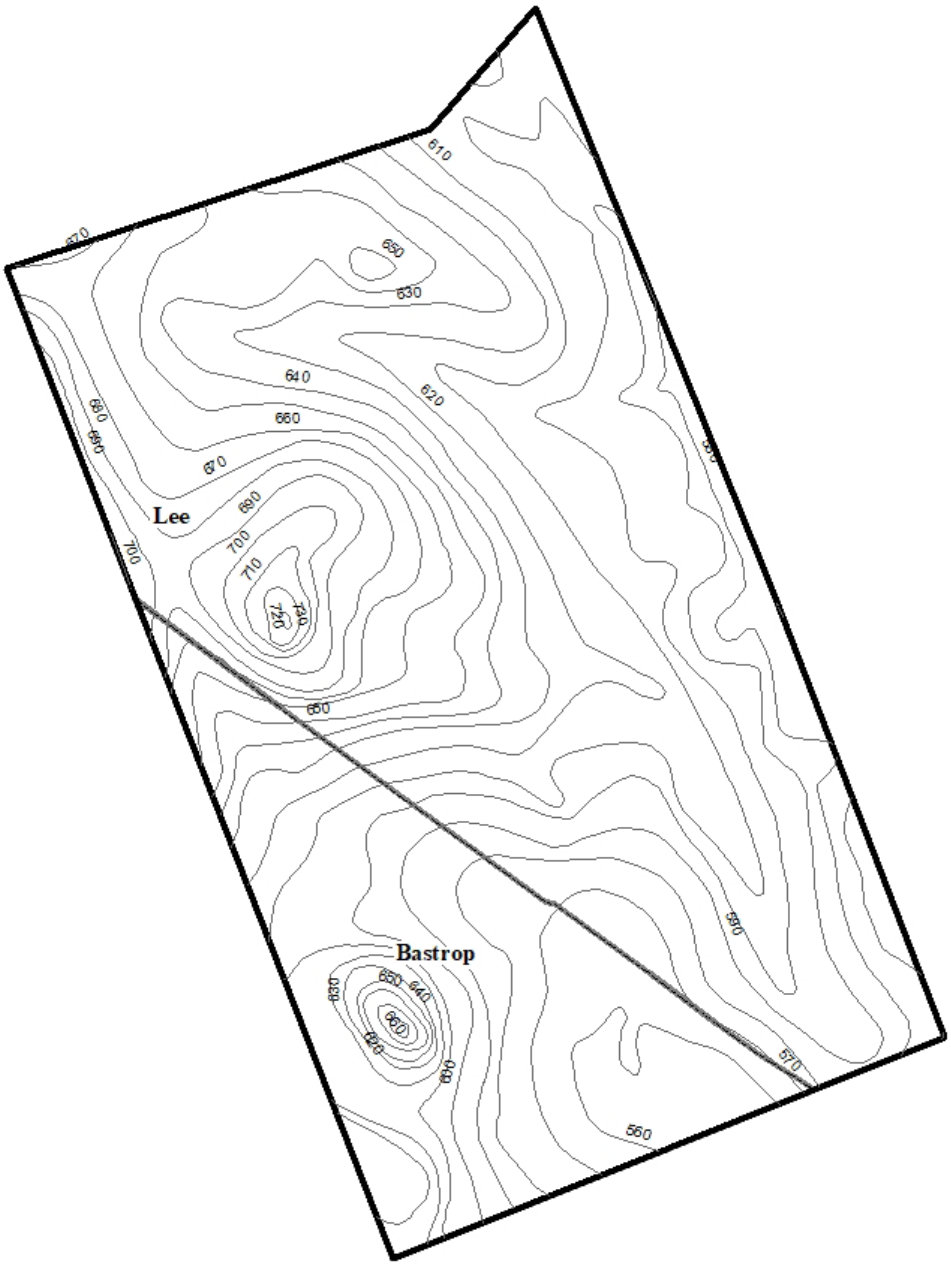
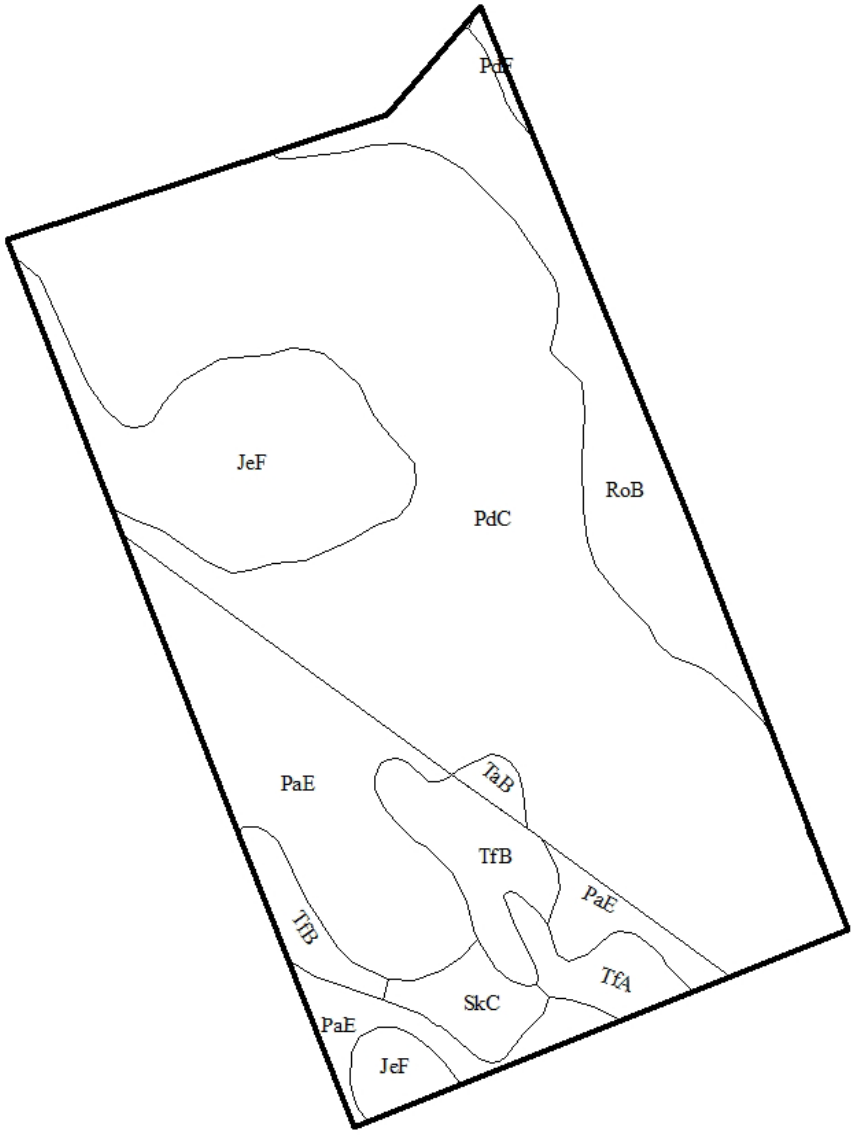


Figure 3. Topographic map of Yegua Knobbs Preserve.



Map Unit Symbol	Map Unit Name
JeF	Jedd gravelly fine sandy loam, 5 to 20 percent
PaE	Padina fine sand, 1 to 12 percent slopes
PdC	Padina loamy fine sand, 1 to 5 percent slopes
PdF	Padina loamy fine sand, 5 to 15 percent slopes
RoB	Robco loamy fine sand, 1 to 3 percent slopes
SkC	Silstid loamy fine sand, 1 to 5 percent slopes
TaB	Tabor fine sandy loam, 1 to 3 percent slopes
TfA	Tabor fine sandy loam, 1 to 3 percent slopes
TfB	Tabor fine sandy loam, 1 to 3 percent slopes

Figure 4. Soil series map for Yegua Knobbs Preserve. Data provided by National Cooperative Soil Survey.

SAMPLING METHODS

Species Inventory

An inventory of the vascular plant species was compiled beginning in March 2017 and continuing monthly through November 2018. All species that were found in flowering or fruiting condition were collected and pressed as voucher specimens and deposited in the Texas State University herbarium. Duplicates were collected when possible to be shared with other herbaria. Identifications were made using one or more of the following works: Correll and Johnston (1970), Gould (1975) and Diggs et al. (1999). Nomenclature follows the Biota of North America Program (BONAP) database (Kartesz, 2015). Plant distribution ranges and occurrences were verified with BONAP and a recently published floristic treatment of Lee County (Bergman, 2017). Specimens with uncertain identifications were compared to and verified with specimens from the Texas State University herbarium.

Quantitative Sampling

Woody vegetation was sampled using the line intercept method. Sites for the transects were chosen based on the occurrence of visually similar vegetative assemblages and the GPS coordinates logged for the starting location (Figure 5). Three 100 m transects were laid out in each area and the woody species touching the tape measure or located above or below it were recorded for the length of tape where they occurred. These data were used to calculate the raw cover and relative cover for each species:

$$\text{Raw Cover} = \frac{\text{length of tape covered by a species}}{\text{total length of transect}} \times 100\%$$

$$\text{Relative Cover} = \frac{\text{length of tape covered by a species}}{\text{total length covered by all species}} \times 100\%$$

In fall 2018, the herbaceous flora was sampled using the quadrat method and stratified random sampling (Baxter, 2014). Locations were chosen based on soil type and visible vegetation composition. Once a location was selected, a 0.5 m^2 quadrat was placed randomly, the GPS coordinates logged for the starting location (Figure 6), and the following information recorded for vegetation found in each square: name of each species observed and how many individual plants of that species were present, percentage of quadrat that each species covered, as well as percent coverage of bare ground and litter. The quadrat was then moved approximately 5 meters and the steps repeated. Ten quadrats were sampled at each location. These data were then used to calculate the following:

$$\text{Frequency} = \frac{\text{\# of quadrants in which a species occurred}}{\text{Total \# of quadrats}} \times 100\%$$

$$\text{Relative Frequency} = \frac{\text{\# of quadrats in which a species occurred}}{\text{\# of quadrats in which any species occurred}} \times 100\%$$

$$\text{Relative Density} = \frac{\text{\# of individuals of a species}}{\text{Total \# of individuals of all species}} \times 100\%$$

$$\text{Raw Cover} = \frac{\text{Area covered by a species}}{\text{Total area sampled}} \times 100\%$$

$$\text{Relative Cover} = \frac{\text{Area covered by a species}}{\text{Total area covered by all species}} \times 100\%$$

$$\text{Importance Value} = \frac{\text{Relative Frequency} + \text{Relative Density} + \text{Relative Cover}}{3}$$

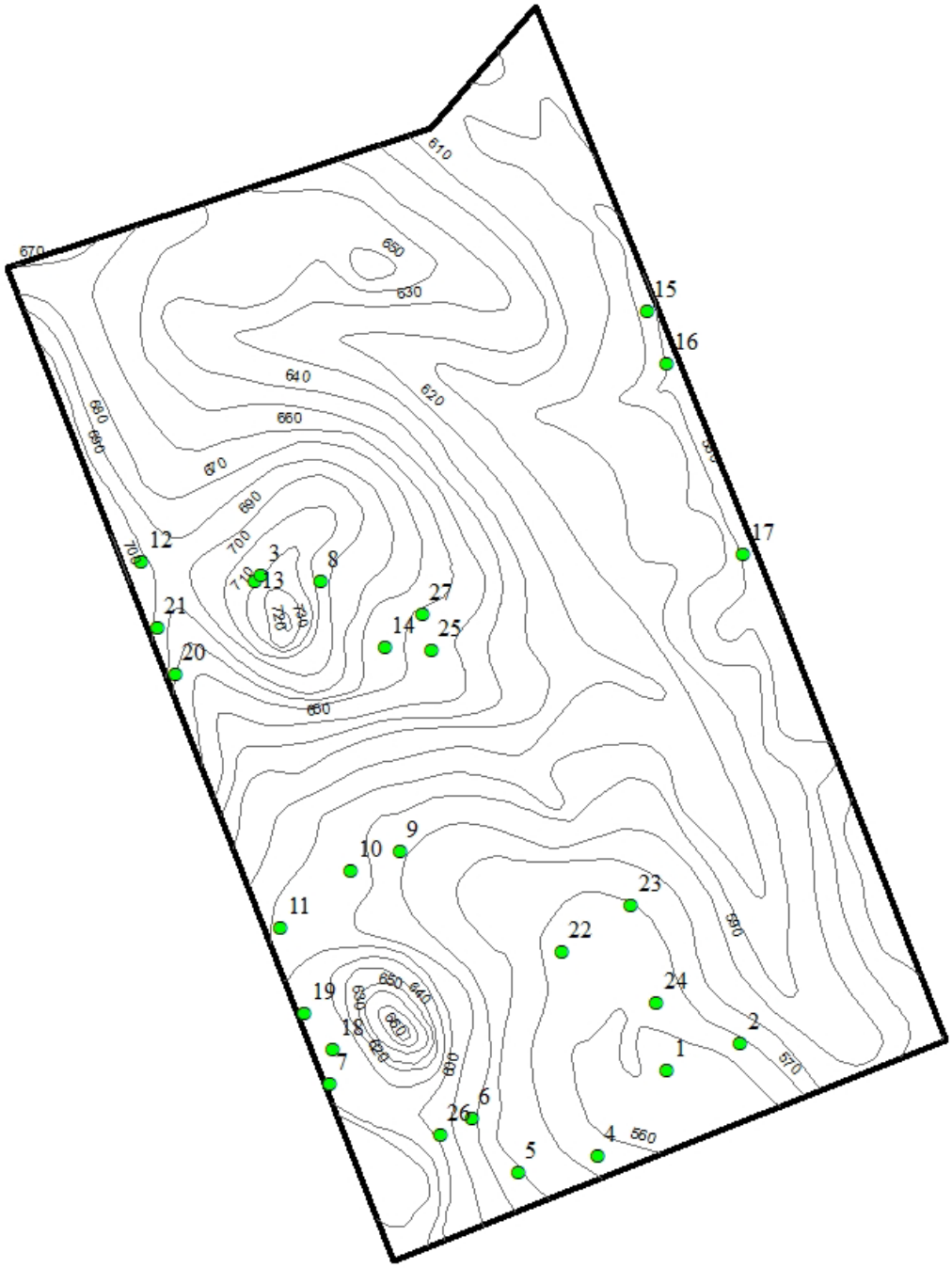


Figure 5. Starting locations of woody transects at Yegua Knobbs Preserve.

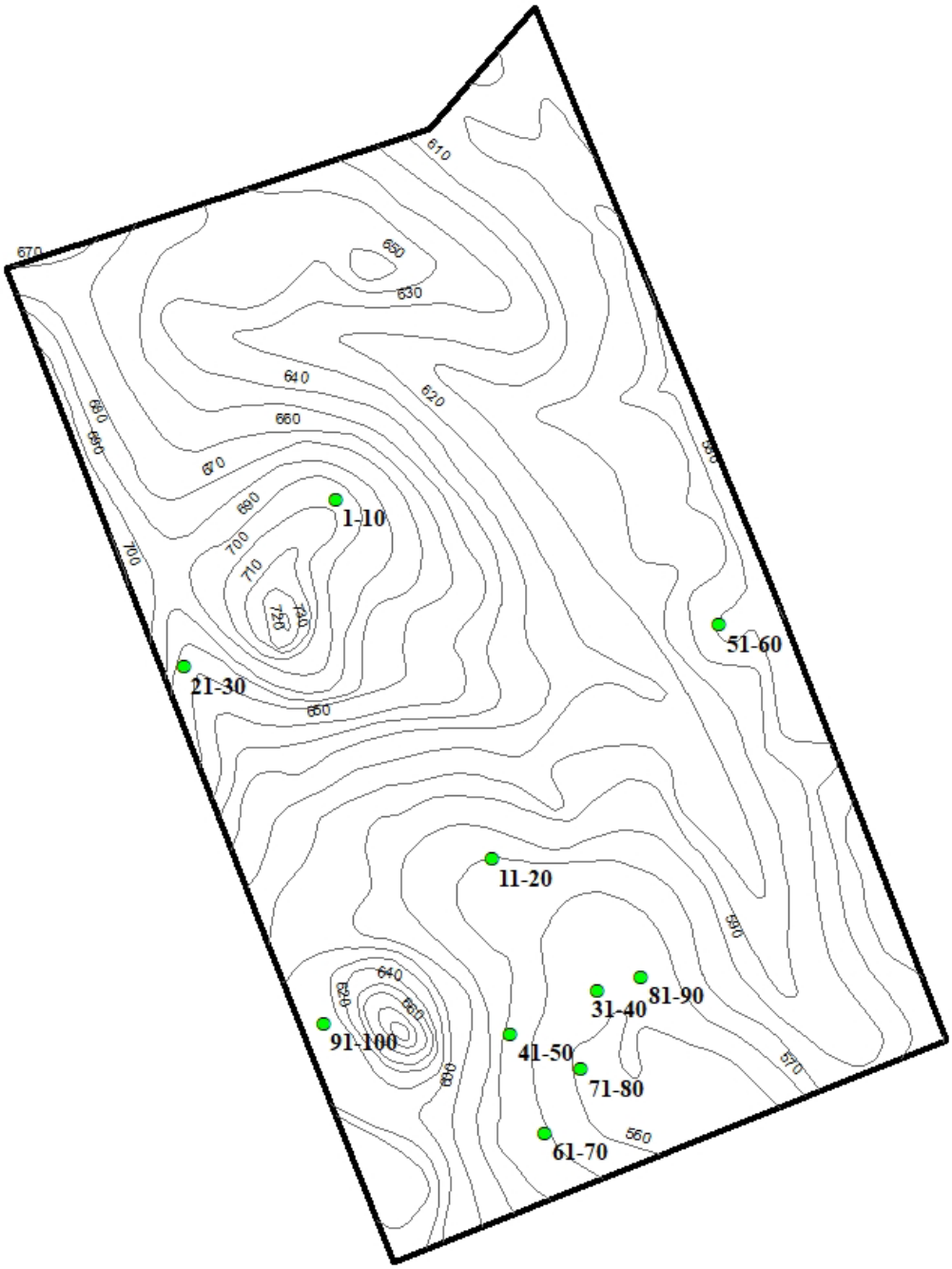


Figure 6. Starting locations of herbaceous transects at Yegua Knobbs Preserve.

III. RESULTS

Species Inventory

The results of the species inventory yielded approximately 260 species that represent 74 families (Table 1). The exact number of species is approximated because the identifications for species in the families Cyperaceae and Juncaceae are waiting to be verified by an authority on those families. The five families with the highest species richness are Poaceae (43 species), Asteraceae (40 species), Cyperaceae (approximately 26 species), Fabaceae (20 species), and Euphorbiaceae (10 species).

Of the 260 species found, only eleven are reported as exotic/non-native in BONAP; they are lesser quaking grass (*Briza minor*), field brome (*Bromus arvensis*), rye brome (*B. secalinus*), Bermudagrass (*Cynodon dactylon*), southern crabgrass (*Digitaria ciliaris*), chickenfoot grass (*Eustachys caribaea*), Vaseygrass (*Paspalum urvillei*), Japanese honeysuckle (*Lonicera japonica*), mouse-ear chickweed (*Cerastium glomeratum*), Johnson grass (*Sorghum halepense)* and Chinese tallowtree (*Triadica sebifera*).

Table 1. Vascular plant species inventory.

Scientific Name	Common Name	Voucher
ADOXACEAE	MUSKROOT FAMILY	
Viburnum rufidulum Raf.	Rusty Blackhaw	*Digges 221*
AGAVACEAE	CENTURY-PLANT FAMILY	
Yucca louisianensis Trel.	Gulf Coast Yucca	
ALLIACEAE	ONION FAMILY	
Allium canadense L. var. *mobilense* (Regal) Ownbey	Meadow Garlic	*Digges 051*
Nothoscordum bivalve (L.) Britt.	Crowpoison	*Digges 197*
AMARANTHACEAE	AMARANTH FAMILY	
Froelichia floridana (Nutt.) Moq.	Florida Snake-cotton	*Digges 142*
F. gracilis (Hook.) Moq.	Slender Snake-cotton	*Digges 151*
ANACARDIACEAE	SUMAC FAMILY	
Rhus aromatica Ait. var. *serotina* (Greene) Rehder	Fragrant Sumac	*Digges 112*
Rhus copallinum L.	Winged Sumac	
Toxicodendron radicans (L.) Kuntze	Poison Ivy	*Digges 261*
APIACEAE	CARROT FAMILY	
Daucus pusillus Michx.	American Wild Carrot	*Digges 107*
Ptilimnium capillaceum (Michx.) Raf.	Mock Bishop's Weed	*Digges 021*
APOCYNACEAE	DOGBANE FAMILY	
Asclepias lineraris Scheele	Slim Milkweed	*Digges 166*
A. tuberosa L.	Butterfly Milkweed	*Digges 076*
A. verticillata L.	Whorled Milkweed	*Digges 311*
Cynanchum racemosum (Jacq.) Jacq. var. *unifarium* (Scheele) E. Sundell	Talayote	*Digges 114*
Matelea biflora (Raf.) Woods.	Two-flower Milkweed Vine	*Digges 039*
AQUIFOLIACEAE	HOLLY FAMILY	
Ilex vomitoria Ait.	Yaupon	*Digges 054*
ARALIACEAE	GINSENG FAMILY	
Hydrocotyle umbellata L.	Umbrella Water-pennywort	*Digges 146*
H. verticillata Thunb.	Whorled water-pennywort	*Digges 293*
ARISTOLOCHIACEAE	BIRTHWORT FAMILY	
Aristolochia erecta L.	Swanflower	*Digges 296*
ASTERACEAE	ASTER FAMILY	
Ambrosia psilostachya DC.	Western Ragweed	*Digges 184*
Aphanostephus skirrhobasis (DC.) Trel.	Arkansas Lazy Daisy	*Digges 003*
Berlandiera pumila (Michx.) Nutt.	Soft Greeneyes	*Digges 007*
Boltonia diffusa Ell.	False Aster	*Digges 324*
Bradburia pilosa (Nutt.) Semple	Soft Golden Aster	*Digges 096*
Cirsium texanum Buckl.	Texas Thistle	*Digges 104*
Conoclinium coelestinum (L.) DC.	Blue Mistflower	*Digges 173*

Table 1. Continued

Coreopsis basalis (A. Dietr.) Blake	Golden-Mane Tickseed	*Digges 111*
Croptilon rigidifolium (E.B. Sm.) E.B. Sm.	Stiff-leaf Scratchdaisy	*Digges 183*
Diaperia candida (Torr. & Gray) Benth. & Hook. f.	Silver Pygmy-cudweed	*Digges 059*
Erigeron canadensis L.	Canadian Horseweed	*Digges 189*
E. strigosus Muhl. ex Willd. var. *strigosus*	Prairie Fleabane	*Digges 071*
Eupatorium capillifolium (Lam.) Small	Dog-fennel	*Digges 185*
E. serotinum Michx.	Fall Boneset	*Digges 168*
Gaillardia aestivalis (Walt.) H. Rock var. *aestivalis*	Prairie Gaillardia	*Digges 064*
G. pulchella Foug.	Indian Blanket	*Digges 148*
Gamochaeta purpurea (L.) Cabrera	Purple Cudweed	*Digges 052*
Helenium amarum (Raf.) H. Rock var. amarum	Yellow Bitterweed	*Digges 161*
Helianthus debilis Nutt.	Cucumber-leaf Sunflower	*Digges 078*
Heterotheca subaxillaris (Lam.) Britt. & Rusby	Camphorweed	*Digges 160*
Hymenopappus artemisiifolius DC.	Old-plainsman	*Digges 025*
Iva annua L.	Sumpweed	*Digges 195*
Krigia virginica (L.) Willd.	Virginia Dwarf-dandelion	*Digges 001*
Liatris aspera Michx.	Tall Gayfeather	*Digges 163*
L. elegans (Walt.) Michx.	Pink-Scale Gayfeather	*Digges 152*
Mikania scandens (L.) Willd.	Climbing Hempweed	*Digges 198*
Palafoxia hookeriana Torr & A. Gray	Sand Palafoxia	*Digges 178*
Pluchea foetida (L.) DC.	Stinking-fleabane	*Digges 169*
Pseudognaphalium obtusifolium (L.) Hilliard & Burtt	Blunt-leaf Rabbit-tobacco	*Digges 182*
Pyrrhopappus pauciflorus (D. Don) DC.	Small-flower Desert-chicory	*Digges 044*
Rudbeckia hirta L.	Black-eyed Susan	*Digges 100*
Senecio ampullaceus Hook.	Texas Groundsel	*Digges 006*
Solidago radula Nutt.	Western Rough Goldenrod	*Digges 176*
Symphyotrichum ericoides (L.) Nesom	Heath Aster	*Digges 164*
S. pratense (Raf.) Nesom	Silky Aster	*Digges 345*
Thelesperma filifolium Less.	Stiff Greenthread	*Digges 128*
Verbesina encelioides (Cav.) Benth. & Hook. f. ex Gray	Cowpen Daisy	*Digges 150*
V. virginica L.	Frostweed	*Digges 179*
Vernonia texana (Gray) Small	Texas Ironweed	*Digges 157*
Xanthisma texanum DC.	Texas Sleepy Daisy	*Digges 180*
BLECHNACEAE	CHAIN FERN FAMILY	
Woodwardia areolata (L.) T. Moore	Netted Chain Fern	*Digges 203*
BORAGINACEAE	BORAGE FAMILY	
Lithospermum caroliniense (Walter ex J.F. Gmel.) MacM.	Carolina Puccoon	*Digges 031*
BRASSICACEAE	MUSTARD FAMILY	
Lepidium virginicum L.	Peppergrass	*Digges 034*
CABOMBACEAE	FANWORT FAMILY	
Brasenia schreberi J.F. Gmel	Watershield	*Digges 246*
CACTACEAE	CACTUS FAMILY	
Opuntia humifusa (Raf.) Raf.	Eastern Prickly Pear	*Digges 276*
CAMPANULACEAE	BELLFLOWER FAMILY	
Triodanis perfoliata (L.) Nieuwl.	Venus' Looking-glass	*Digges 061*

Table 1. Continued

CANNABACEAE	HEMP FAMILY	
Celtis laevigata Willd.	Sugar-berry	
CAPRIFOLIACEAE	HONEYSUCKLE FAMILY	
Lonicera japonica Thunb.	Japanese Honeysuckle	*Digges 237*
CARYOPHYLLACEAE	PINK FAMILY	
Cerastium glomeratum Thuill.	Mouse-ear Chickweed	*Digges 013*
Loeflingia squarrosa Nutt.	Spreading Pygmyleaf	*Digges 045*
CISTACEAE	ROCK-ROSE FAMILY	
Crocanthemum georgianum (Chapman) Barnh.	Georgia Frostweed	*Digges 079*
Lechea mucronata Raf.	Hairy Pinweed	*Digges 153*
L. tenuifolia Michx.	Narrow-leaf Pinweed	*Digges 310*
CLEOMACEAE	SPIDER-FLOWER FAMILY	
Polanisia erosa (Nutt.) Iltis	Large Clammyweed	*Digges 132*
COMMELINACEAE	SPIDERWORT FAMILY	
Commelina erecta L.	Erect Dayflower	*Digges 108*
Tradescantia hirsutiflora Bush	Hairy-flower Spiderwort	*Digges 057*
T. occidentalis (Britt.) Smyth	Stemless Spiderwort	*Digges 056*
T. reverchonii Bush	Reverchon's Spiderwort	*Digges 255*
CONVOLVULACEAE	MORNING-GLORY FAMILY	
Stylisma pickeringii (Torr. ex M.A. Curtis) Gray	Pickering's Dawnflower	*Digges 098*
CORNACEAE	DOGWOOD FAMILY	
Cornus florida L.	Flowering Dogwood	*Digges 069*
CUPRESSACEAE	CYPRESS FAMILY	
Juniperus virginiana L.	Eastern Red Cedar	*Digges 129*
CYPERACEAE	SEDGE FAMILY	
Carex leavenworthii Dewey	Leavenworth's Sedge	*Digges 068*
Cyperus odoratus L.	Fragrant Flatsedge	*Digges 119*
Eleocharis flavescens (Poir.) Urban	Yellow Spikerush	*Digges 046*
E. quadrangulata (Michx.) Roem. & Schult.	Square-stem Spikerush	*Digges 238*
Fuirena squarrosa Michx.	Hairy Umbrella Sedge	*Digges 302*
DENNSTAEDTIACEAE	BRACKEN FERN FAMILY	
Pteridium aquilinum (L.) Kuhn	Northern Bracken Fern	
DROSERACEAE	SPIKE-MOSS FAMILY	
Drosera brevifolia Pursh	Dwarf Sundew	
EBENACEAE	EBONY FAMILY	
Diospyros virginiana L.	Common Persimmon	*Digges 271*
ERICACEAE	HEATH FAMILY	
Vaccinium arboreum Marsh	Farkleberry	*Digges 95*
EUPHORBIACEAE	SPURGE FAMILY	
Acalypha gracilens Gray	Slender Three-seed Mercury	*Digges 317*

Table 1. Continued

Cnidoscolus texanus (Muell.-Arg.) Small	Texas Bull Nettle	*Digges 024*
Croton argyranthemus Michx.	Silverleaf Croton	*Digges 032*
C. capitatus Michx.	Hog Croton	*Digges 143*
C. glandulosus L. var. *lindheimeri* Muell.-Arg.	Lindheimer's Croton	*Digges 156*
Euphorbia cordifolia Ell.	Heart-leaf Sandmat	*Digges 155*
E. corollata L.	Flowering Spurge	*Digges 154*
Stillingia texana I.M. Johnston	Queen's Delight	*Digges 091*
Tragia betonicifolia Nutt.	Betony-leaf Noseburn	*Digges 123*
Triadica sebifera (L.) Small	Chinese Tallowtree	
FABACEAE	PEA FAMILY	
Baptisia bracteata Muhl. ex Ell.	Long-bract Wild Indigo	*Digges 036*
Centrosema virginianum (L.) Benth.	Spurred Butterfly-pea	*Digges 141*
Chamaecrista fasciculata (Michx.) Greene	Partridge Pea	*Digges 126*
Dalea phleoides (Torr. & Gray) Shinners var. *microphylla* (Torr. & Gray) Barneby	Slim-spike Prairie-clover	*Digges 285*
Desmodium obtusum (Muhl. Ex Willd.) DC.	Stiff Tick-trefoil	*Digges 137*
D. sessilifolium (Torr.) Torr. & A. Gray	Sessile-leaf Tick-clover	*Digges 264*
Galactia volubilis (L.) Britt.	Downy Milk-pea	*Digges 147*
Lespedeza hirta (L.) Hornem	Hairy Bush-clover	*Digges 130*
L. procumbens Michx.	Trailing Bush-clover	*Digges 268*
L. stuevei Nutt.	Tall Bush-clover	*Digges 167*
Lupinus subcarnosus Hook.	East Texas Bluebonnet	*Digges 017*
Mimosa nuttallii (DC.) B.L. Turner	Nuttall's Mimosa	*Digges 085*
Pediomelum hypogaeum (Nutt. ex Torr. & Gray) Rydb. var. *subulatum* (Bush) J. Grimes	Indian-breadroot	*Digges 030*
Rhynchosia latifolia Nutt. ex Torr. & Gray	Prairie Snoutbean	*Digges 287*
Sesbania drummondii (Rydb.) Cory	Rattlebush	*Digges 318*
Strophostyles helvula (L.) Ell.	Trailing Fuzzy-bean	*Digges 286*
Stylosanthes biflora (L.) Britton, Sterns & Poggenb.	Side-Beak Pencil-flower	*Digges 280*
Tephrosia onobrychoides Nutt.	Multi-Bloom Hoary-pea	*Digges 144*
T. virginiana (L.) Pers.	Goat's-rue	*Digges 070*
Vicia ludoviciana Nutt. subsp. *ludoviciana*	Deer Pea Vetch	*Digges 011*
FAGACEAE	BEECH FAMILY	
Quercus incana Bartr.	Sandjack Oak	*Digges 008*
Q. marilandica (L.) Muenchh.	Blackjack Oak	*Digges 005*
Q. nigra L.	Water Oak	*Digges 016*
Q. stellata Wangenh.	Post Oak	*Digges 022*
FUMARIACEAE	FUMITORY FAMILY	
Corydalis micrantha (Engelm. ex Gray) Gray	Scrambled Eggs	*Digges 015*
GENTIANACEAE	GENTIAN FAMILY	
Sabatia campestris Nutt.	Meadow-pink	*Digges 102*
GERANIACEAE	GERANIUM FAMILY	
Geranium carolinianum L.	Carolina Crane's Bill	*Digges 023*
HYDROLEACEAE	FALSE FIDDLELEAF FAMILY	
Hydrolea ovata Nutt. ex Choisy	Ovate False Fiddleleaf	*Digges 320*

Table 1. Continued

HYPERICACEAE	ST. JOHN'S-WORT FAMILY	
Hypericum drummondii (Grev. & Hook.) Torr. & Gray	Nits-and-lice	*Digges 136*
H. hypericoides (L.) Crantz	St. Andrew's Cross	*Digges 009*
H. punctatum Lam.	Spotted St. John's Wort	*Digges 270*
IRIDACEAE	IRIS FAMILY	
Alophia drummondii (Graham) R.C. Foster	Propeller-flower	*Digges 109*
Sisyrinchium rosulatum Bickn.	Annual Blue-eyed Grass	*Digges 067*
JUGLANDACEAE	WALNUT FAMILY	
Carya texana Buckl.	Black Hickory	*Digges 063*
JUNCACEAE	RUSH FAMILY	
Juncus brachycarpus Engelm.	White-root Rush	*Digges 116*
J. effusus L.	Soft Rush	*Digges 047*
J. marginatus Rostk.	Grass-leaf Rush	*Digges 115*
J. filipendulus Buckl.	Ring-seed Rush	*Digges 117*
LAMIACEAE	MINT FAMILY	
Brazoria truncata (Benth.) Engelm. & Gray var. *truncata*	Rattlesnake-flower	*Digges 092*
Callicarpa americana L.	American Beautyberry	*Digges 106*
Lycopus rubellus Moench	Water-horehound	*Digges 172*
Monarda clinopodioides Gray	Basil Beebalm	*Digges 080*
M. viridissima Correll	Green Beebalm	*Digges 122*
Scutellaria drummondii Benth. var. *drummondii*	Drummond's Skullcap	*Digges 038*
Trichostema dichotomum L.	Forked Bluecurls	*Digges 333*
LENTIBULARIACEAE	BLADDERWORT FAMILY	
Utricularia subulata L.	Zigzag Bladderwort	*Digges 223*
LILIACEAE	LILY FAMILY	
Nothoscordum bivalve (L.) Britt.	Crowpoison	*Digges 010*
MALVACEAE	MALLOW FAMILY	
Hibiscus moscheutos L. ssp. *lasiocarpos* (Cav.) O.J. Blanchard	Swamp Rose-mallow	*Digges 304*
MELASTOMATACEAE	MELASTOME FAMILY	
Rhexia mariana L.	Meadow-beauty	*Digges 298*
MOLLUGINACEAE	CARPETWEED FAMILY	
Mollugo verticillata L.	Green Carpetweed	*Digges 191*
MORACEAE	MULBERRY FAMILY	
Morus rubra L.	Red Mulberry	
MYRICACEAE	BAYBERRY FAMILY	
Morella cerifera (L.) Small	Wax Myrtle	*Digges 090*
ONAGRACEAE	EVENING-PRIMROSE FAMILY	
Ludwigia alternifolia L.	Bushy Seedbox	*Digges 171*
L. leptocarpa (Nutt.) Hara	Angle-stem Water-primrose	*Digges 174*
L. palustris (L.) Ell.	Marsh Primrose-willow	*Digges 307*
Oenothera laciniata Hill	Cut-leaf Evening Primrose	*Digges 093*

Table 1. Continued

OROBANCHACEAE	BROOM-RAPE FAMILY	
Agalinis tenuifolia (Vahl) Raf.	Slender-leaf False Foxglove	*Digges 200*
Castilleja indivisa Engelm.	Texas Indian Paintbrush	*Digges 012*
OXALIDACEAE	WOOD-SORREL FAMILY	
Oxalis corniculata L.	Creeping Ladies'-sorrel	*Digges 216*
O. dillenii Jacq.	Yellow Wood Sorrel	*Digges 014*
PAPAVERACEAE	POPPY FAMILY	
Argemone albiflora Hornem. ssp. *texana* G.B. Ownbey	White Prickly Poppy	*Digges 277*
PASSIFLORACEAE	PASSION-FLOWER FAMILY	
Passiflora incarnata L.	Maypop	*Digges 177*
P. lutea L.	Yellow Passion-flower	*Digges 149*
PINACEAE	PINE FAMILY	
Pinus taeda L.	Loblolly Pine	*Digges 053*
PLANTAGINACEAE	PLANTAIN FAMILY	
Gratiola virginiana L.	Virginia Hedge-hyssop	*Digges 020*
Mecardonia acuminata (Walt.) Small	Axil-flower	*Digges 306*
Nuttallanthus texanus (Scheele) D.A. Sutton	Texas Toadflax	*Digges 018*
Penstemon laxiflorus Pennell	Nodding Beardtongue	*Digges 050*
Plantago hookeriana Fisch. & C.A. Mey.	Hooker's Plantain	*Digges 082*
P. virginica L.	Pale-Seed Plantain	*Digges 228*
PHYTOLACCACEAE	POKEWEED FAMILY	
Phytolacca americana L.	American Pokeweed	*Digges 105*
POACEAE	GRASS FAMILY	
Andropogon glomeratus (Walt.) B.S.P.	Bushy Bluestem	*Digges 204*
A. ternarius Michx.	Split-beard Bluestem	*Digges 348*
Aristida desmantha Trin. & Rupr.	Curly Threeawn	*Digges 187*
A. lanosa Muhl. ex Ell.	Woolly-Sheath Threeawn	*Digges 340*
Bothriochloa laguroides (DC.) Herter ssp. *torreyana* (Steud.) Allred & Gould	Silver Bluestem	*Digges 165*
Briza minor L.	Lesser Quakinggrass	*Digges 002*
Bromus arvensis L.	Field Brome	*Digges 263*
B. secalinus L.	Rye Brome	*Digges 042*
Cenchrus spinifex A. Cav.	Coastal Sandbur	*Digges 088*
Coleataenia anceps (Michx.) Soreng	Beaked Panicum	*Digges 158*
Cynodon dactylon (L.) Pers.	Bermudagrass	*Digges 337*
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark	Tapered Rosettegrass	*Digges 029*
D. laxiflorum (Lam.) Gould	Open-flower Rosettegrass	*Digges 028*
D. linearifolium (Scribn. ex Nash) Gould	Slim-leaf Rosettegrass	*Digges 097*
D. oligosanthes (J.A. Schultes) Gould	Heller's Rosettegrass	*Digges 344*
D. scoparium (Lam.) Gould	Velvet Rosettegrass	*Digges 120*
D. sphaerocarpon (Ell.) Gould var. *sphaerocarpon*	Round-seed Rosettegrass	*Digges 075*
Digitaria ciliaris (Retz.) Koel.	Southern Crabgrass	*Digges 319*
D. cognata (J.A. Schultes) Pilger	Fall Witchgrass	*Digges 190*
Eragrostis elliottii S. Wats.	Elliott's Lovegrass	*Digges 322*
E. hirsuta (Michx.) Nees	Big-top Lovegrass	*Digges 325*

Table 1. Continued

E. intermedia A.S. Hitchc.	Plains Lovegrass	*Digges 193*
E. secundiflora J. Presl	Red Lovegrass	*Digges 086*
E. spectabilis (Pursh) Steud.	Purple Lovegrass	*Digges 192*
Eustachys caribeae (Spreng.) Hester	Chickenfoot Grass	*Digges 139*
Panicum brachyanthum Steud.	Pimple Panicum	*Digges 326*
P. verrucosum Muhl.	Warty Panicgrass	*Digges 328*
Paspalum botterii (Fourn.) Chase	Rusty-seed Paspalum	*Digges 312*
P. floridanum Michx.	Florida Paspalum	*Digges 335*
P. laeve Michx.	Field Crowngrass	*Digges 330*
P. notatum Flueggé	Bahiagrass	*Digges 110*
P. plicatulum Michx.	Brownseed Paspalum	*Digges 295*
P. setaceum Michx.	Thin Paspalum	*Digges 089*
P. urvillei Steud.	Vaseygrass	*Digges 118*
Phalaris caroliniana Walt.	Canarygrass	*Digges 072*
Schizachyrium scoparium (Michx.) Nash	Little Bluestem	*Digges 186*
Setaria parviflora (Poir.) Kerguélen	Knotroot Bristlegrass	*Digges 175*
Sorghum halepense (L.) Pers.	Johnson Grass	
Tridens flavus (L.) A.S. Hitchc.	Purpletop	*Digges 159*
T. strictus (Nutt.) Nash	Longspike Tridens	*Digges 170*
Triplasis purpurea (Walt.) Chapman	Purple Sand Grass	*Digges 188*
Vulpia octoflora (Walt.) Rydb.	Sixweeksgrass	*Digges 087*
POLEMONIACEAE	PHLOX FAMILY	
Phlox drummondii Hook.	Annual Phlox	*Digges 281*
POLYGONACEAE	BUCKWHEAT FAMILY	
Eriogonum multiflorum Benth.	Wild Buckwheat	*Digges 181*
Persicaria hydropiperoides (Michx.) Small	Swamp Smartweed	*Digges 199*
Polygonum americanum (Fisch. & C.A. Mey.) T.M. Schust. & Reveal	South Jointweed	*Digges 099*
Rumex hastatulus Baldw.	Heartwing Sorrel	*Digges 125*
RANUNCULACEAE	BUTTERCUP FAMILY	
Delphinium carolinianum Walt.	Carolina Larkspur	*Digges 121*
RHAMNACEAE	BUCKTHORN FAMILY	
Berchemia scandens (Hill) K. Koch	Alabama Supplejack	
ROSACEAE	ROSE FAMILY	
Rubus trivialis Michx.	Southern Dewberry	*Digges 230*
RUBIACEAE	MADDER FAMILY	
Diodia teres Walt.	Poorjoe	*Digges 124*
Houstonia pusilla Schoepf	Tiny Bluet	*Digges 004*
Oldenlandia uniflora L.	Clustered Mille-graines	*Digges 329*
RUTACEAE	RUE FAMILY	
Ptelea trifoliata L. ssp. *trifoliata* var. *mollis* Torr. & Gray	Wafer Ash	*Digges 048*
Zanthoxylum clava-herculis L.	Hercules' Club	*Digges 239*
SAPOTACEAE	SAPODILLA FAMILY	
Sideroxylon lanuginosum Michx. ssp. *oblongifolium* (Nutt.) T.D. Pennington	Gum Bumelia	*Digges 289*

Table 1. Continued

SELAGINELLACEAE	SPIKE-MOSS FAMILY	
Selaginella arenicola Underwood	Sand Spike-Moss	
SMILACACEAE	GREENBRIER FAMILY	
Smilax bona-nox L.	Saw Greenbrier	*Digges 253*
S. smallii Morong	Lance-leaf Greenbrier	*Digges 049*
SOLANACEAE	NIGHTSHADE FAMILY	
Physalis cinerascens (Dunal) A.S. Hitchc.	Yellow Ground Cherry	*Digges 066*
TETRACHONDRACEAE	JUNIPER-LEAF FAMILY	
Paronychia drummondii Torr. & Gray	Drummond's Nailwort	*Digges 026*
URTICACEAE	NETTLE FAMILY	
Boehmeria cylindrica (L.) Sw.	Bog Hemp	*Digges 331*
Parietaria pensylvanica Muhl. ex Willd.	Pennsylvania Pellitory	*Digges 103*
VERBENACEAE	VERVAIN FAMILY	
Verbena halei Small	Texas Vervain	*Digges 084*
VITACEAE	GRAPE FAMILY	
Ampelopsis arborea (L.)Koehne	Peppervine	*Digges 145*
Vitis mustangensis Buckl.	Mustang Grape	*Digges 236*
V. rotundifolia Michx.	Muscadine Grape	*Digges 266*
XYRIDACEAE	YELLOW-EYED-GRASS FAMILY	
Xyris jupicai L.C. Rich.	Yellow-Eyed Grass	*Digges 284*

COMMUNITY CLASSIFICATION

Analysis of the qualitative and quantitative data led to the recognition of six plant communities at YKP, four dominated by woody vegetation and two herbaceous. The communities were named based on the dominant or codominant species in the association. These are the post oak-yaupon (*Quercus stellata-Ilex vomitoria*) community, loblolly pine community (*Pinus taeda*), water oak (*Quercus nigra*) community, sandjack oak (*Quercus incana*) community, little bluestem (*Schizachyrium scoparium*) community and bog community.

WOODY PLANT COMMUNITY DATA

Twenty woody species were found along the 27 transects. The top five woody species: yaupon, post oak, loblolly pine, eastern red cedar, and water oak had relative cover values of 27.7, 24.1, 15.3, 13.1, and 7.9 percent, respectively. Yaupon occurred on all twenty-seven transects. Both post oak and eastern red cedar occurred on twenty-four. Loblolly pine occurred on twenty-three transects, and water oak occurred on seven. Other species of importance that had relative cover values greater than one percent were blackjack oak (*Quercus marilandica*), sandjack oak, and farkleberry (*Vaccinium arboreum*). Blackjack oak was recorded on thirteen transects; sandjack oak occurred on ten and farkleberry on seventeen.

Post Oak-Yaupon (*Quercus stellata-Ilex vomitoria*) Community (Tables 2 and 3)

The post oak-yaupon community covers the largest area of any of the communities in the preserve. It occurs on level to gently sloping ridges and hillsides with well-drained soil. It primarily corresponds with the Padina and Robco series. The oak and

pine trees visually dominate the canopy with dense thickets of yaupon in the understory. The codominant trees are post oak with a relative cover value of 32.9 percent and yaupon with relative cover value of 35.7 percent. Both occurred on every transect that is part of this community. Other woody species of significance in this community are: eastern red cedar, loblolly pine, sandjack oak, blackjack oak and farkleberry with relative cover values of 17.5, 6.4, 2.0, 1.7 and 1.6 percent, respectively. Twelve of the 27 transects surveyed (5, 6, 9, 10, 11, 14, 15, 16, 17, 25, 26, and 27) sampled this community.

The herbaceous species in this community were sampled in canopy openings where pockets of herbaceous-dominated vegetation occur. With an importance value of 19.1, little bluestem (*Schizachyrium scoparium*) is the dominant grass of these areas. The other dominant grasses with importance values greater than 2.0 are purple sandgrass (*Triplasis purpurea*), velvet rosette grass (*Dichanthelium scoparium*), thin paspalum (*Paspalum setaceum*), and tapered rosette grass (*D. acuminatum*), with importance values of 10.5, 4.9, 4.6, and 2.4, respectively. The two dominant forbs with the highest importance values in this community are slender snake-cotton (*Froelichia gracilis*) and camphorweed (*Heterotheca subaxillaris*) with importance values of 5.0 and 4.9, respectively. Twenty of the one hundred quadrats sampled (1–10 and 51–60) were in this community.

Loblolly Pine (*Pinus taeda*) Community (Tables 4 and 5)

The loblolly pine community is in the upland region of the preserve and is associated with the northern knob. It is found on well-drained, sandy soils derived from the eroded sandstone that occurs on highly to moderately sloping hillsides. It primarily

corresponds with the Jedd and Padina series. Loblolly pine and oak trees visually dominate the canopy, and the understory is more open than in the post oak-yaupon community. On the top of the knob, the canopy is fairly closed and on the slope of the knob the canopy becomes slightly more open and the shrubby understory increases as this association grades into the post oak association. Loblolly pine is the dominant species of this community with a relative cover value of 39.7 percent, and it occurred on every transect in this community. Other woody species of significance in this community are: yaupon, post oak, blackjack oak, eastern red cedar, sandjack oak and farkleberry with relative cover values of 18.5, 17.0, 12.8, 8.4, 2.2, and 1.2 percent, respectively. Six of the 27 transects (3, 8, 12, 13, 20, and 21) were in this community.

Exposed ground in the higher elevations of the loblolly pine community is blanketed in pine needles and has little herbaceous vegetation, so the herbaceous quadrats that were sampled were done on the west side of the northern knob where the canopy was slightly more open. With an importance value of 19.1, tapered rosette grass (*D. acuminatum*) is the dominant grass of this community. The other dominant grass in this community is little bluestem (*Schizachyrium scoparium*), with an importance value of 18.9. The two dominant forbs with the highest importance values in this community are slender snake-cotton (*Froelichia gracilis*) and spreading pygmyleaf (*Loeflingia squarrosa*) with importance values of 10.7 and 4.9. Ten of the one hundred quadrats sampled (21–30) were in this community.

Water Oak (*Quercus nigra*) Community (Tables 6 and 7)

The water oak community is in the southeastern region of the preserve. It is found on well drained to moderately well drained, fine sandy loams that occur on moderately sloping ridges and level alluvial deposits from eroded sandstone and shales. It primarily corresponds with the Tabor and Padina series. Oak and loblolly pine trees visually dominate the canopy, and an understory of shrubs, woody vines and various graminoids and forbs is present. The main difference between this community and the post oak-yaupon community is the shift in dominance from post oak to water oak, as well as a change in understory composition. In the water oak community, the canopy is closed with slight openings scattered throughout, similar to the post oak-yaupon community. The transition from the post oak-yaupon community to the water oak community entails a visual decrease in the shrubby understory and increase in abundance and diversity of vines. This shift in the density is visibly noticeable and reflected in the total raw cover values for the woody transects evaluated for these two communities. Total raw cover for the water oak community is 117.6 percent and 160.6 percent for the post oak-yaupon community. Water oak is the dominant species of this community with a relative cover value of 34.8 percent, and it occurred on every transect that is part of this community. Other woody species of significance in this community are: yaupon, eastern red cedar, loblolly pine, post oak, wax myrtle, American beautyberry and southern dewberry with relative cover values of 23.1, 13.9, 9.7, 7.8, 4.3, 2.7, and 1.9 percent, respectively. Six of the 27 transects surveyed (1, 2, 4, 22, 23, and 24) were in this community.

The herbaceous flora in this community was sampled beneath the canopy and in slight openings of the canopy and understory. The quadrats were sampled in fall when the

grasses were dominant, although during spring and summer a diversity of sedges and rushes was common in this area. With an importance value of 14.9, velvet rosette grass (*Dichanthelium scoparium*) is the dominant grass of this community. The other dominant grasses within this community are beaked panicum (*Coleataenia anceps*) and tapered rosette grass (*D. acuminatum*) with importance values of 6.0 and 5.2 respectively. The two dominant forbs with the highest importance values in this community are western ragweed (*Ambrosia psilostachya*) and Japanese honeysuckle (*Lonicera japonica*) with importance values of 10.2 and 4.3. Twenty of the one hundred quadrats sampled (31–40, 81–90) were in this community.

Sandjack Oak (*Quercus incana*) Community (Tables 6 and 7)

The sandjack oak community is in the southwestern region of the preserve and is associated with the southern knob. It is found on moderately well drained, fine sandy loam that occurs on level to moderately sloping ridges. It primarily corresponds with the Tabor and Padina series. Oak and loblolly pine trees are visually dominant but with significantly less canopy cover than the other wooded communities. This is verified by the total raw cover of the sandjack oak community in comparison to the post oak-yaupon community with 68.9 and 160.6 percent, respectively. The sandjack oak is one of the main species of this community with a relative cover value of 16.6 percent, and it occurred on every transect that is part of this community. Other woody species of significance in this community are: post oak, yaupon, loblolly pine, blackjack oak, eastern red cedar and farkleberry with relative cover values of 35.7, 23.5, 12.9, 6.6, 3.4, and 1.3 percent, respectively. Three of the 27 transects surveyed (7, 18, and 19) were in this community.

The herbaceous flora in this community occurs primarily in openings of the canopy and understory. With an importance value of 20.1, purple sandgrass (*Triplasis purpurea*) is the dominant grass of this community. The other dominant grasses in this community are little bluestem (*Schizachyrium scoparium*), curly three-awn (*Aristida desmantha*), tapered rosette grass (*D. acuminatum*), and thin paspalum (*Paspalum setaceum*), with importance values of 14.5, 5.3, 5.2, and 4.2, respectively. The two dominant forbs with the highest importance values in this community are hairy pinweed (*Lechea mucronata*) and silverleaf croton (*Croton argyranthemus*) with importance values of 8.1 and 7.3. Ten of the one hundred quadrats sampled (91–100) were in this community.

Little Bluestem (*Schizachyrium scoparium*) Community (Table 10)

This community is dominated by grasses and forbs with minimal woody vegetation so only herbaceous data was collected. It occurs in the south-central portion of the preserve on fairly level fine sandy loam of an alluvial nature. It primarily corresponds with the Tabor and Silstid series. With an importance value of 27.3, little bluestem (*Schizachyrium scoparium*) is the dominant grass of this community. The other dominant grasses in this community with importance values greater than 2.0 are thin paspalum (*Paspalum setaceum*) and curly three-awn (*Aristida desmantha*), with importance values of 4.6 and 4.5, respectively. The two dominant forbs with the highest importance values in this community are slender snake-cotton (*Froelichia gracilis*) and poorjoe (*Diodia teres*) with importance values of 3.7 and 2.6. Thirty of the one hundred quadrats sampled (11–20, 41–50 and 61–70) were in this community.

Bog Community (Table 11)

This community is dominated by graminoids and forbs with minimal woody vegetation so only herbaceous data were collected. It occurs in the portion of the preserve with the lowest elevation and on fairly level fine sandy loam that retains moisture throughout the year. It primarily corresponds with the Tabor series. With an importance value of 21.6, unidentified sedge 8 is the dominant graminoid of this community. The other dominant graminoids with importance values greater than 2.0 are warty panic grass (*Panicum verrucosum*), beaked panicum (*Coleataenia anceps*), velvet rosette grass (*Dichanthelium scoparium*), unidentified sedge 21, Vaseygrass (*Paspalum urvillei*), bushy bluestem (*Andropogon glomeratus*), and Elliott's lovegrass (*Eragrostis elliottii*) with importance values of 16.2, 7.2, 3.0, 2.8, 2.7, 2.4, and 2.4, respectively. The two dominant forbs with the highest importance values in this community are Maryland meadow-beauty (*Rhexia mariana*) and prairie fleabane (*Erigeron strigosus*) with importance values of 10.8 and 4.7, respectively. Ten of the one hundred quadrats sampled (71–80) were in this community.

Table 2. Woody plant data for Post Oak-Yaupon Community.

Species	Raw Cover	Relative Cover
Ilex vomitoria	57.1	35.7
Quercus stellata	51.0	32.9
Juniperus virginiana	29.9	17.5
Pinus taeda	11.6	6.4
Quercus incana	3.2	2.0
Quercus marilandica	2.3	1.7
Vaccinium arboreum	1.8	1.6
Callicarpa americana	1.2	0.7
Carya texana	0.9	0.7
Quercus nigra	0.6	0.3
Berchemia scandens	0.3	0.3
Smilax smallii	0.5	0.3
Rhus aromatica	0.1	0.1
Rubus trivialis	0.1	0.1
Sideroxylon lanuginosum	0.01	0.01
Totals:	160.6%	100.4%

Table 3. Herbaceous plant data for Post Oak-Yaupon Community.

	Freq.	Rel. Freq.	Rel. Dens	Indivi-duals	Raw Cover	Rel. Cover	Imp. Value
Grasses							
Aristida desmantha	10.0	1.6	0.5	3	0.1	0.2	0.8
Dichanthelium acuminatum	20.0	3.3	2.5	15	0.8	1.5	2.4
D. scoparium	30.0	4.9	4.6	28	2.9	5.3	4.9
Paspalum setaceum	50.0	8.1	2.6	16	1.6	3.0	4.6
Schizachyrium scoparium	55.0	8.9	5.1	31	23.5	43.4	19.1
Triplasis purpurea	45.0	7.3	8.2	50	8.6	15.9	10.5
Forbs							
Acalypha gracilens	10.0	1.6	0.3	2	0.1	0.2	0.7
Ampelopsis arborea	5.0	0.8	0.2	1	0.5	0.9	0.6
Bradburia pilosa	10.0	1.6	0.3	2	0.1	0.2	0.7
Chamaecrista fasciculata	15.0	2.4	0.8	5	0.2	0.3	1.2
Commelina erecta	10.0	1.6	0.8	5	0.1	0.2	0.9
Croptilon rigidifolium	15.0	2.4	0.8	5	0.2	0.3	1.2
Croton capitatus	15.0	2.4	0.7	4	0.2	0.3	1.1
C. glandulosus	5.0	0.8	0.2	1	0.1	0.1	0.4
Diodia teres	5.0	0.8	0.3	2	0.1	0.1	0.4
Eriogonum multiflorum	25.0	4.1	2.3	14	1.4	2.6	3.0
Eupatorium capillifolium	30.0	4.9	3.1	19	2.6	4.7	4.2
Froelichia floridana	15.0	2.4	0.7	4	0.4	0.6	1.2
F. gracilis	45.0	7.3	4.6	28	1.7	3.1	5.0
Gaillardia aestivalis	10.0	1.6	0.5	3	0.3	0.6	0.9
Galactia volubilis	5.0	0.8	0.2	1	0.1	0.1	0.4
Gamochaeta purpurea	5.0	0.8	0.2	1	0.3	0.5	0.5
Heterotheca subaxillaris	25.0	4.1	5.4	33	2.8	5.2	4.9
Hypericum drummondii	5.0	0.8	0.2	1	0.1	0.1	0.4
Lechea mucronata	15.0	2.4	1.0	6	0.2	0.3	1.2
Loeflingia squarrosa	5.0	0.8	0.2	1	0.1	0.1	0.4
Monarda clinopodioides	5.0	0.8	0.2	1	0.1	0.1	0.4
Palafoxia hookeriana	5.0	0.8	0.2	1	0.1	0.1	0.4
Tradescantia occidentalis	5.0	0.8	0.2	1	0.1	0.1	0.4
Tragia betonicifolia	5.0	0.8	0.2	1	0.1	0.1	0.4
Woody seedlings							
Rubus trivialis	40.0	6.5	2.6	16	1.7	3.0	4.0
Unidentified moss	10.0	1.6	0.3	2	0.3	0.6	0.8

Table 3. Continued

Unidentified sedge 19	10.0	1.6	1.5	9	0.3	0.6	1.2
Unidentified sedge 20	5.0	0.8	0.3	2	0.1	0.1	0.4
Unidentified seedlings	45.0	7.3	48.6	297	3.2	5.9	20.6
Bare Ground					16.7		
Litter					29.2		
Totals:		99.5%	100.0%	611	101.0%	100.3%	100.0

Table 4. Woody plant data for Loblolly Pine Community.

Species	Raw Cover	Relative Cover
Pinus taeda	42.6	39.7
Ilex vomitoria	25.1	18.5
Quercus stellata	24.1	17.0
Quercus marilandica	13.1	12.8
Juniperus virginiana	10.8	8.4
Quercus incana	3.3	2.2
Vaccinium arboreum	1.2	1.2
Rhus aromatica	0.2	0.1
Sideroxylon lanuginosum	0.1	0.03
Totals:	120.5%	100.0%

Table 5. Herbaceous plant data for Loblolly Pine Community.

	Freq.	Rel. Freq.	Rel. Dens.	Indivi-duals	Raw Cover	Rel. Cover	Imp. Value
Grasses							
Aristida desmantha	10.0	2.4	2.2	2	0.5	2.1	2.2
Dichanthelium acuminatum	70.0	17.1	14.1	13	6.2	26.1	19.1
Eragrostis secundiflora	10.0	2.4	1.1	1	0.1	0.4	1.3
Paspalum setaceum	20.0	4.9	2.2	2	0.2	0.8	2.6
Schizachyrium scoparium	60.0	14.6	20.7	19	5.1	21.4	18.9
Forbs							
Croptilon rigidifolium	10.0	2.4	2.2	2	0.1	0.4	1.7
Diodia teres	10.0	2.4	1.1	1	0.1	0.4	1.3
Euphorbia corollata	10.0	2.4	1.1	1	0.1	0.4	1.3
Froelichia gracilis	40.0	9.8	15.2	14	1.7	7.1	10.7
Galactia volubilis	20.0	4.9	2.2	2	0.2	0.8	2.6
Hypericum hypericoides	10.0	2.4	1.1	1	2.0	8.4	4.0
Loeflingia squarrosa	30.0	7.3	4.3	4	0.7	2.9	4.9
Monarda viridissima	10.0	2.4	1.1	1	0.1	0.4	1.3
Yucca louisianensis	10.0	2.4	1.1	1	0.1	0.4	1.3
Woody seedlings							
Ilex vomitoria	30.0	7.3	10.9	10	5.1	21.4	13.2
Quercus incana	10.0	2.4	1.1	1	1.0	4.2	2.6
Rhus aromatica	10.0	2.4	4.3	4	0.1	0.4	2.4
Smilax bona-nox	10.0	2.4	1.1	1	0.1	0.4	1.3
Unidentified seedlings	30.0	7.3	13.0	12	0.3	1.3	7.2
Bare Ground					13.3		
Litter					62.9		
Totals:		99.6%	100.0%	92	100.0%	99.7%	99.9

Table 6. Woody plant data for Water Oak Community.

Species	Raw Cover	Relative Cover
Quercus nigra	39.6	34.8
Ilex vomitoria	27.7	23.1
Juniperus virginiana	16.9	13.9
Pinus taeda	10.6	9.7
Quercus stellata	10.1	7.8
Morella cerifera	5.5	4.3
Callicarpa americana	3.0	2.7
Rubus trivialis	2.0	1.9
Smilax smallii	0.7	0.5
Morus rubra	0.6	0.5
Quercus marilandica	0.3	0.3
Vaccinium arboreum	0.3	0.3
Berchemia scandens	0.2	0.2
Ampelopsis arborea	0.1	0.1
Lonicera japonica	0.1	0.1
Smilax bona-nox	0.03	0.03
Totals:	117.6%	100.0%

Table 7. Herbaceous plant data for Water Oak Community.

	Freq.	Rel. Freq.	Rel. Dens	Indivi-duals	Raw Cover	Rel. Cover	Imp. Value
Grasses							
Coleataenia anceps	15.0	4.0	2.1	11	4.0	12.0	6.0
Dichanthelium acuminatum	25.0	6.7	1.9	10	2.4	7.1	5.2
D. scoparium	50.0	13.3	9.3	49	7.4	22.1	14.9
Paspalum setaceum	5.0	1.3	0.2	1	0.3	0.8	0.8
Tridens flavus	10.0	2.7	1.1	6	0.8	2.3	2.0
Forbs							
Ambrosia psilostachya	40.0	10.7	9.1	48	3.6	10.8	10.2
Ampelopsis arborea	5.0	1.3	0.4	2	1.0	3.0	1.6
Boltonia diffusa	15.0	4.0	2.3	12	1.5	4.5	3.6
Croton capitatus	10.0	2.7	1.1	6	0.8	2.3	2.0
Diodia teres	10.0	2.7	1.3	7	0.3	0.9	1.6
Eupatorium capillifolium	15.0	4.0	1.9	10	1.5	4.5	3.5
Hypericum drummondii	5.0	1.3	0.4	2	0.1	0.2	0.6
H. hypericoides	5.0	1.3	0.2	1	0.3	0.8	0.8
Lonicera japonica	20.0	5.3	2.3	12	1.8	5.4	4.3
Woody seedlings							
Pinus taeda	5.0	1.3	0.4	2	0.1	0.2	0.6
Rubus trivialis	45.0	12.0	5.9	31	6.4	19.1	12.3
Frog	5.0	1.3	0.2	1	0.1	0.2	0.6
Unidentified moss	25.0	6.7	0.9	5	0.3	0.8	2.8
Unidentified seedlings	65.0	17.3	59.2	313	1.1	3.2	26.6
Bare Ground					12.4		
Litter					54.5		
Totals:		99.9%	100.0%	529	100.7%	100.2%	100.0

Table 8. Woody plant data for Sandjack Oak Community.

Species	Raw Cover	Relative Cover
Quercus stellata	20.5	35.7
Ilex vomitoria	15.9	23.5
Quercus incana	11.1	16.6
Pinus taeda	11.2	12.9
Quercus marilandica	5.4	6.6
Juniperus virginiana	3.2	3.4
Vaccinium arboreum	1.5	1.3
Totals:	68.9%	100.0%

Table 9. Herbaceous plant data for Sandjack Oak Community.

	Freq.	Rel. Freq.	Rel. Dens	Indivi-duals	Raw Cover	Rel. Cover	Imp. Value
Grasses							
Aristida desmantha	30.0	6.7	5.0	9	1.1	4.3	5.3
Cenchrus incertus	10.0	2.2	0.6	1	0.1	0.4	1.1
Dichanthelium acuminatum	30.0	6.7	2.8	5	1.6	6.2	5.2
Paspalum setaceum	40.0	8.9	2.2	4	0.4	1.6	4.2
Schizachyrium scoparium	50.0	11.1	8.3	15	6.2	24.1	14.5
Triplasis purpurea	80.0	17.8	22.7	41	5.1	19.8	20.1
Forbs							
Chamaecrista fasciculata	10.0	2.2	1.1	2	0.1	0.4	1.2
Croptilon rigidifolium	10.0	2.2	1.1	2	0.5	1.9	1.7
Croton argyranthemus	10.0	2.2	2.2	4	4.5	17.5	7.3
Diodia teres	10.0	2.2	0.6	1	0.1	0.4	1.1
Hypericum hypericoides	20.0	4.4	1.1	2	1.5	5.8	3.8
Lechea mucronata	60.0	13.3	7.2	13	1.0	3.9	8.1
Woody seedlings							
Polygonum americanum	30.0	6.7	1.7	3	2.5	9.7	6.0
Quercus incana	10.0	2.2	0.6	1	0.5	1.9	1.6
Unidentified seedlings	50.0	11.1	43.1	78	0.5	1.9	18.7
Bare Ground					41.5		
Litter					32.8		
Totals:		99.9%	100.0%	181	100.0%	99.8%	99.9

Table 10. Herbaceous plant data for Little Bluestem Community.

	Freq.	Rel. Freq.	Rel. Dens.	Indivi-duals	Raw Cover	Rel. Cover	Imp. Value
Grasses							
Aristida desmantha	26.7	4.0	3.6	36	3.5	5.8	4.5
Cenchrus incertus	6.7	1.0	0.3	3	0.5	0.9	0.7
Dichanthelium acuminatum	20.0	3.0	1.4	14	0.7	1.0	1.8
D. scoparium	13.3	2.0	1.1	11	0.7	1.0	1.4
Digitaria cognata	10.0	1.5	0.7	7	0.5	0.9	1.0
Paspalum setaceum	60.0	9.0	3.0	30	1.1	1.7	4.6
Schizachyrium scoparium	83.3	12.4	8.7	88	35.9	60.9	27.3
Triplasis purpurea	16.7	2.5	1.1	11	0.4	0.7	1.4
Forbs							
Acalypha gracilens	13.3	2.0	0.5	5	0.1	0.2	0.9
Agalinis strictifolia	6.7	1.0	0.2	2	0.9	1.5	0.9
Chamaecrista fasciculata	26.7	4.0	2.0	20	0.7	1.2	2.4
Commelina erecta	3.3	0.5	0.1	1	0.03	0.1	0.2
Croptilon rigidifolium	23.3	3.5	1.5	15	0.7	1.2	2.1
Croton capitatus	16.7	2.5	1.1	11	0.9	1.5	1.7
C. glandulosus	16.7	2.5	0.7	7	0.4	0.7	1.3
Diodia teres	30.0	4.5	1.8	18	0.8	1.4	2.6
Eriogonum multiflorum	3.3	0.5	0.1	1	0.3	0.3	0.3
Froelichia floridana	13.3	2.0	0.5	5	0.4	0.7	1.1
F. gracilis	43.3	6.5	2.5	25	1.3	2.2	3.7
Gaillardia aestivalis	13.3	2.0	1.0	10	0.7	1.2	1.4
Gamochaeta purpurea	3.3	0.5	0.1	1	0.3	0.3	0.3
Hypericum drummondii	26.7	4.0	1.5	15	0.3	0.5	2.0
H. hypericoides	23.3	3.5	1.3	13	0.3	0.3	1.7
Lechea mucronata	13.3	2.0	2.6	26	0.4	0.7	1.8
Loeflingia squarrosa	20.0	3.0	1.3	13	0.8	1.4	1.9
Matelea biflora	3.3	0.5	0.1	1	0.03	0.1	0.2
Monarda clinopodioides	3.3	0.5	0.4	4	0.3	0.5	0.5
Oxalis dillenii	10.0	1.5	0.4	4	0.1	0.2	0.7
Tradescantia hirsutiflora	3.3	0.5	0.2	2	0.03	0.1	0.3
T. subacaulis	6.7	1.0	0.2	2	1.3	0.2	0.5

Table 10. Continued

Woody seedlings							
Rubus trivialis	13.3	2.0	0.8	8	1.3	2.2	1.7
Toxicodendron radicans	3.3	0.5	0.1	1	0.03	0.1	0.2
Unidentified moss	30.0	4.5	0.9	9	1.2	2.0	2.5
Unidentified seedlings	63.3	9.5	58.5	590	3.9	6.6	24.9
Bare Ground					13.0		
Litter					28.0		
Totals:		100.4%	100.0%	1009	101.8%	100.3%	100.2

Table 11. Herbaceous plant data for Bog Community.

	Freq.	Rel. Freq.	Rel. Dens.	Indivi-duals	Raw Cover	Rel. Cover	Imp. Value
Grasses							
Andropogon glomeratus	20.0	3.5	1.0	2	2.0	2.6	2.4
Coleataenia anceps	50.0	8.8	4.8	10	6.0	7.9	7.2
Dichanthelium scoparium	20.0	3.5	3.4	7	1.6	2.1	3.0
Eragrostis elliottii	20.0	3.5	1.4	3	1.6	2.1	2.4
Panicum verrucosum	60.0	10.5	18.8	39	14.5	19.2	16.2
Paspalum plicatulum	10.0	1.8	0.5	1	0.1	0.1	0.8
P. urvillei	30.0	5.3	1.9	4	0.7	0.9	2.7
Forbs							
Erigeron strigosus	30.0	5.3	2.9	6	4.4	6.0	4.7
Eupatorium capillifolium	10.0	1.8	1.0	2	0.1	0.1	0.9
Lycopus rubellus	10.0	1.8	2.4	5	2.5	3.3	2.5
Oldenlandia uniflora	10.0	1.8	1.0	2	0.1	0.1	0.9
Rhexia mariana	60.0	10.5	18.8	39	2.3	3.0	10.8
Woody seedlings							
Pinus taeda seedling	10.0	1.8	0.5	1	0.1	0.1	0.8
Unidentified sedge 8	100.0	17.5	4.8	10	32.1	42.5	21.6
Unidentified sedge 20	10.0	1.8	0.5	1	0.1	0.1	0.8
Unidentified sedge 21	20.0	3.5	3.4	7	1.1	1.5	2.8
Unidentified seedlings	100.0	17.5	33.2	69	6.2	8.2	19.6
Bare Ground					20.0		
Litter					4.4		
Totals:		100.2%	100.0%	208	99.9%	99.8%	100.0

IV. DISCUSSION

In the framework presented by Diamond et al. (1987), when classifying a plant community there is a hierarchy, the highest level is the class which is based on the dominant growth form. Next is the subclass which is based on the dominant species' morphological attributes, followed by the group and the formation. At the lowest level of the framework are the series and the association. Diamond et al. defined the series as being "characterized by specificity of structure and physiognomy of the vegetation" but allowed variation in dominant species as well as overall flora composition. The association is a type of plant community that occurs in uniform habitats and has a definitive species composition. Following Diamond et al. (1987), the term "community" is used for both the series and association in this study.

Diamond et al. (1987) recognized six classes for Texas: forest, woodland, shrubland, herbaceous vegetation, swamps and marshes. Three of these classes were observed at YKP: forest, woodland, and herbaceous vegetation. A forest is a community where trees with heights of 3 meters or more are dominant and there is a canopy cover of 61 percent or more. A woodland is a community where trees are the dominant growth form and the canopy cover is 26 to 60 percent. An herbaceous community is where the dominant growth forms are graminoids or forbs, and the woody vegetation has a canopy cover of less than 25 percent. Diamond et al. (1987) recognized five forest and woodland, one herb-dominated and two marsh series in the Oak Woods and Prairies regions: overcup oak series, post oak-black hickory series, sugarberry-elm series, bluejack oak-pine series and post oak-blackjack oak series, *Sphagnum-Rhynchospora* series, rush-sedge series and gulf cordgrass series. Diamond (1993) described these series in greater

detail in a paper for the Texas Natural Heritage Program. Three of these series are directly referable to communities at YKP: bluejack oak-pine series, post oak-blackjack series, and *Sphagnum-Rhynchospora* series.

The Oak Woods and Prairies natural region is considered an ecotone where the Blackland Prairie and Pineywoods meet and grade into each other (Tharp,1939; Blair, 1950; L.B.J. School of Public Affairs, 1978; MacRoberts & MacRoberts, 2004; Diggs et al., 2006). Inclusion of series from these two natural regions provide two more series to be incorporated into the plant communities of YKP: the loblolly pine-oak series and little bluestem-indiangrass series. MacRoberts and MacRoberts (2004) discussed the need for a community classification system for the Oak Woods and Prairies region that includes loblolly pine. Their floristic assessment of this region stated that pine not only occurs in this region but can also be a dominant canopy species, especially in western Bastrop County. Many authors have discussed the Oak Woods and Prairies as an area that interdigitates forest or woodlands with prairies; therefore, the prairie series is included (Tharp, 1939; L.B.J. School of Public Affairs, 1978; Bezanson, 2000; MacRoberts and MacRoberts, 2004; Diggs et al., 2006).

Diggs et al. (2006) also classified the plant communities in the Oak Woods and Prairies natural region, which they referred to as the Post Oak Savannah. Their classification included post oak-blackjack oak upland savannahs, woodlands and forests, dry-mesic mixed pine-hardwood uplands, xeric sandylands, loblolly pine-post oak upland forest, eastern red-cedar chalk glades and herbaceous seeps and bogs, water oak-post oak floodplain forest, sugarberry-elm floodplain forest, and sandstone outcrop communities. Five of these communities are directly referable to communities at YKP: post oak-

blackjack oak upland savannahs, woodlands and forests, xeric sandylands, loblolly pine-post oak upland forest, herbaceous seeps and bogs, and water oak-post oak floodplain forest. Bezanson (2000) used a similar classification system for the Post Oak Savannah as did Diggs et al. (2006). In his thesis, he provided more comprehensive descriptions of the communities. Table 12 compares the names of the plant communities at YKP to those proposed by the three classification systems.

According to Diamond (1993), the post oak-blackjack oak series is an upland deciduous forest or woodland located in east and east central Texas. It is found in four natural regions and has a high variability of species based on the climate of the region and the soil types it occurs on. In the more mesic soils to the east, the canopy cover is greater and decreases with the moisture level in the more western regions. The woody dominants of the canopy are post oak, blackjack oak and black hickory (McBryde, 1933; Tharp, 1939; Blair, 1950; Smeins and Diamond, 1986; Diamond et al., 1987; Diggs et al., 2006).

Diamond's (1993) post oak-blackjack oak series is comparable to the post oak-yaupon community. Post oak has been included as the dominant woody species in many descriptions of the Oak Woods and Prairies (Tharp, 1926; McBryde, 1933; Blair, 1950; Gould, 1960, Smeins and Diamond, 1986; Diamond et al., 1987; Diamond, 1993; Diggs et al., 2006). Yaupon is a native species to this region and typically part of the understory that created the thickets associated with this area (Gould, 1960; Smeins and Diamond, 1986). The abundance of yaupon has increased due to the suppression of fire and of heavy grazing in this region (Gould, 1960; Diggs et al., 2006; Cathey et al., 2006). Eastern red cedar is a prominent, native component of the post oak-yaupon community

and has been noted as a common invader in this community (Diamond, 1993; Bezanson, 2000). Many authors have also included black hickory as a dominant tree for this region, (Tharp, 1926; McBryde, 1933; Tharp, 1939; LBJ School of Public Affairs, 1978). It occurs in the post oak-yaupon community but is not a dominant species. According to Smeins and Diamond (1986), its abundance depends on locality.

In 1926, Tharp classified this region as the Oak-Hickory forest but in 1939 noted that as an ecotone the dominant species may gradually decrease moving across the region and most of the black hickory's range occurs to the east of Bastrop County (Kartesz, 2015). The grass most frequently discussed in association with this community and region is little bluestem (Tharp, 1926; LBJ School of Public Affairs, 1978; Smeins and Diamond, 1986; Bezanson, 2000; Diggs et al., 2006). Bezanson (2000) includes panicums (*Panicum* spp.), rosettegrasses (*Dichanthelium* spp.), purpletop (*Tridens flavus)* and whip nutrush (*Scleria triglomerata*) in his description of the herbaceous flora in the post oak-blackjack oak upland forest/woodlands, which is similar to the community composition at YKP.

Diamond et al. (1987) limited the little bluestem-indiangrass series to two subregions in the Blackland Praires and Gulf Coast Praires and Marshes natural regions. He describes the series as an herbaceous dominated upland tallgrass prairie that has been restricted to isolated areas. It has a diversity of grasses, forbs and sometimes sedges with the species composition varying depending on the soil type it occurs on.

At YKP, the little bluestem community is a subset of the plant community that Diggs et al. (2006) referred to as the post oak-blackjack oak upland savannahs, woodlands and forests. The little bluestem community is closest to Diamond's (1993)

little bluestem-indiangrass series. Various authors have referred to this type of area as a prairie/grassland inclusion; these areas are dominated by little bluestem and other components of the tallgrass prairie (Tharp, 1926; Smeins and Diamond, 1986; Diggs et al., 2006). The typical dominants include little bluestem, Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*) and big bluestem (*Andropogon gerardi*). Of these four, little bluestem and switchgrass have been documented in Lee County, and all have been found in Bastrop County (Diamond, 1993; Diggs et al., 2006; Kartesz, 2015). Various authors have noted little bluestem as the dominant grass in the Oak Woods and Prairies natural region (Gould, 1960; Smeins and Diamond, 1986; Diggs et al., 2006).

Lauchbaugh (1955) studied the San Antonio Prairie, a disjunct section of the Blackland Prairie that occurs in Lee and Bastrop counties where he noted the importance of little bluestem as a dominant in this community. Collins et al. (1975) studied the plant communities of the Blackland Prairies and assigned seven community types to the region. The *Schizachyrium* type resides over Alfisols and Vertisols with little bluestem as the sole dominant.

The description of the upland Alfisol tall grasslands by Bezanson (2000) and the description of the little bluestem-brown-seed paspalum-Indian grass community by Diggs et al. (2006) included a list of important species in this community that share many species in common with the little bluestem community at YKP. Some of the notable ones were observed in this prairie inclusion are little bluestem, rosettegrasses, woolly croton (*Croton capitatus*), woodsorrel (*Oxalis* spp.), sunflowers (*Helianthus* spp.), camphorweeds (*Heterotheca* spp.), firewheels (*Gaillardia* spp.), sensitive-briers (*Mimosa* spp.), and pinweeds (*Lechea* spp.).

Diamond et al. (1987) limited the loblolly pine-oak series to the two subregions of the Pineywoods. The loblolly pine-oak series was described as an upland forest dominated by loblolly pines and various oak species with an emphasize on post oak and blackjack oak in this region. It occurs over loamy or sandy, acidic soils (Diamond, 1993). It is known for the presence of an understory composed frequently of yaupon, American beautyberry (*Callicarpa americana)*, flowering dogwood (*Cornus florida)*, wax myrtle (*Morella cerifera*), and farkleberry with common herbaceous species including little bluestem, threeawns (*Aristida* spp.) , and bracken fern (*Pteridium* sp.) (Bezanson, 2000; Diggs et al., 2006).

The loblolly pine community at YKP is comparable to the loblolly pine-oak series. Though the loblolly pine-oak series was not included in the Oak Woods and Prairies by Diamond et al. (1987), previous authors have noted the presence of pine in this natural region. Tharp's (1939) description of the pine-oak forest noted that loblolly is co-dominant in the canopy of the sandy uplands and mapped a fragment of this community type in Bastrop, Lee and Caldwell counties. Blair (1950) noted that loblolly pine, a characteristic species of the Austroriparian province, which lies directly east of the Texan province, was found in Bastrop County. MacRoberts and MacRoberts (2004) floristic assessment of the Post Oak Savannah also included loblolly pine in this natural region.

Bezanson (2000) noted that where the hills that commonly house these isolated loblolly pine forest reach soils with a higher clay content there is an increase in "eastern species such as blackgum, water oak, American holly, southern wax-myrtle and netted

chain-fern. It is interesting to note that three of these species, water oak, southern wax-myrtle and netted-chain fern were observed in the water oak community at YKP.

The only riparian forests Diamond et al. (1993) assigned to the Oak Woods and Prairies are the sugarberry-elm series and overcup oak series. Neither of these are comparable to the water oak community at YKP. Diggs et al. (2006) and Bezanson (2000) both identified a water oak-post oak floodplain forest in the Oak Woods and Prairies region. This deciduous forest occurs in floodplains, in drainages and low-lying flatwoods with a variable composition of oaks and other species that occur in mesic soils. Water oak and post oak are commonly the dominant tree species, but the overall composition depends on the area's closeness to the Pineywoods. Common vines include grapevines (*Vitis* spp.), poison-ivy (*Toxicodendron radicans*) and Alabama supplejack (*Berchemia scandens*). The ground layer is typically a composition of sedges, grasses and forest forbs.

Diamond et al.'s (1993) bluejack oak-pine series is a deciduous woodland occurring on well-drained, deep, sandy soils. It is associated with the formations over the Eocene sandstones, specially the Carrizo formation (McBryde, 1933; Bezanson, 2000; Diggs et al., 2006). These areas typically have a mix of pines, oaks, farkleberry, gum bumelia and yaupon (Diamond et al., 1983). The dominant woody species are sandjack oak, sand post oak (*Q. margarettae*), post oak and black hickory (MacRoberts et al., 2002).

The sandjack oak community is comparable to Diamond et al.'s (1993) bluejack oak-pine series. The openness of the canopy and understory, as well as the prevalence of sandjack oak in this area are some of the defining characteristics of this community. In

Bezanson's (2000) description of the xeric sandhill woodlands, there are three dominant grass species for this community: purple sand grass (*Triplasis purpurea*), little bluestem and curly threeawn (*Aristida desmantha*). These are the three dominant grasses that were found in the quadrats for this area.

MacRoberts et al. (2002) proposed an interesting idea about the xeric sandylands. Despite evidence that fire suppression decreases woody encroachment in this community, they proposed that even when fire suppression occurs, the woody vegetation does not become as dense as with some communities in this region. This seems to suggest that the xeric nature of the soil in this area is also a contributing factor to the openness of this community. This openness and increase in abundance of sandjack oak are some of the factors that differentiate it from the surrounding post oak-yaupon community. Multiple authors have discussed how these xeric sandylands supply the water to lower surrounding regions through seeps in the sandhills that create the hydric soils of the bogs found in these regions (MacRoberts and MacRoberts, 1998; Bezanson, 2000; MacRoberts et al., 2002; Diggs et al., 2006).

Traveling east and downwards of the sandjack oak community is the bog community, which most closely resembles Diamond et al.'s (1987) Sphagnum-Beakrush series. This series is an herbaceous community that includes a variety of seepage bogs, typically found in east Texas in the Pineywoods and Oak Woods and Prairies natural regions. A diversity of graminoids occur including beakrushes, yellow-eyed grass, sedges and grasses and may include the presence of sphagnum mosses. They occur in areas surrounded by uplands dominated by oak or pine woodlands that occur on sandy soils and are usually in small, isolated patches (Diamond et al., 1987; Diamond, 1993). A report by

the L.B.J. School of Public Affairs (1978) noted that peat bogs occur in the Oak Woodlands subregion, corresponding with the Carrizo formation. Several studies documented the correlation between the Carrizo formation and the existence of these bogs, including one in Lee County (Potzger and Tharp, 1947; Larson et al., 1972). In MacRoberts and MacRoberts (1998) floristic study of two bogs in east central Texas, there is a similarity in the floristic composition they observed and the one at YKP; they also emphasize the diversity of grasses, sedges, xyrids and carnivorous plants. Of the twelve species identified in the herbaceous quadrats of the bog community, six of them are included in the MacRoberts' floristic study: bushy bluestem (*Andropogon glomeratus*), velvet rosette grass (*Dichanthelium scoparium)*, taper-leaf water-horehound (*Lycopus rubellus*), warty panic grass (*Panicum verrucosum*), brown-seed paspalum (*Paspalum plicatulum*) and Maryland meadow-beauty (*Rhexia mariana*). There were a number of other species and genera that were observed or collected in this area that are also on the MacRoberts' species list; notable species include yellow-eyed-grass (*Xyris jupicai*) and a carnivorous plant, zigzag bladderwort (*Utricularia subulata*).

CONCLUSION

This study supplies the qualitative and quantitative data needed to help identify the plant communities that occur at YKP and assess if they are comparable to the typical communities found in the Oak Woods and Prairies region. This information, in conjunction with a species inventory that is consistent with species found in Bastrop and Lee counties and shows minimal presence of exotic species, helps to verify that YKP is an intact remnant of the Oak Woods and Prairies natural region.

Table 12. Comparison of Names of Plant Community Classification Systems. Material adapted from Bezanson, 2000.

YKP community	Diamond et al., 1987	Diggs et al., 2006	Bezanson, 2000
Post oak-yaupon community	Post oak-blackjack series	Post oak-blackjack oak upland savannahs, woodlands and forests	Post oak-blackjack oak upland forest/woodlands
Loblolly pine community	Loblolly pine-oak series	Loblolly pine-post oak upland forest	Loblolly pine-post oak upland forest
Bluejack oak community	Bluejack oak-pine series	Xeric sandylands	Xeric sandhill woodlands (Post Oak Savannah)
Water oak community	None	Water oak-post oak floodplain forest	Water oak-post oak floodplain forest
Little bluestem community	Little bluestem-indiangrass series	Little bluestem-brown-seed paspalum-Indian grass community	Upland Alfisol tall grasslands
Bog community	Sphagnum-Beakrush series	Herbaceous seeps and bogs	Herbaceous seeps (Post Oak Savannah)

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