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Distribution of Grasslands in 19th Century Florida

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ABSTRACT.—Presettlement Florida had a variety of open habitats, including grasslands and savannas. This study examined the historic distribution of the Florida grasslands using U.S. General Land Office land surveys made during the 19th century. All survey maps with areas labeled ''prairie'' or ''savanna'' were compiled into a composite map. A total of 791,140 ha of prairies and 15,820 ha of savanna were shown on the maps. The most extensive prairies were located in central Florida stretching from the west coast of Lake Okeechobee into Hillsboro and Manatee counties. Patches of prairie and savanna extended north into Clay County. South of Lake Okeechobee, prairies were found in the Big Cypress Swamp, along the western edge of the Everglades and along the eastern coast. Surveyor's notes and historical documents were then used to find additional references to grasslands. These references indicate that there were extensive prairies and savannas in the northern part of the peninsula and in the panhandle. Areas with prairie and savanna were compared to soil descriptions found in county soil surveys by the U.S. Department of Agriculture. Soils typical of forested areas (spodosols and alfisols) were more common in Florida prairies and savannas than mollisol soils that are characteristic of grasslands. The soil data, in addition with the proximity of prairies to pine forests, supports the hypothesis that these ecosystems are determined more by topography, fire frequency and flooding patterns than by soil type.

INTRODUCTION

Over the past 150 y, human activities have considerably altered Florida's landscape, and as a result, there has been a decline in many of the state's ecosystems, to include its grasslands. These open, largely treeless habitats are disappearing from the state because of changes to the frequency and extent of fires and floods as well as agricultural and urban development (Frost *et al.*, 1986; Knetsch, 1992). For example, 81% of the area of historic dry prairie has been converted to other uses (Bridges, 2004a), and Florida's dry prairies have been classified as a globally imperiled community type (Abrahamson and Hartnett, 1990; Perkins and Vickery, 2007).

Florida's grasslands are broadly divided into two types, dry prairies and wet prairies. In northern and central Florida, dry prairies are closely associated with pine flatwoods and open savannas, and all three ecosystems occur where the topography is flat, and the soil is poorly drained, acidic and sandy (Abrahamson and Hartnett, 1990). The water table in dry prairies can be a meter below the surface during the winter dry season. However, during the rainy season (Jun. through Oct.), water may cover the prairie to a depth of several centimeters (Abrahamson and Harnett, 1990). Wet prairies, in contrast, hold standing water long enough to be considered a type of marsh in the Florida Natural Areas Inventory (Kushlan, 1990; Whitney *et al.*, 2004). They are characterized by a water depth of less than 1.25 m during the wet season, and a water table that does not recede to more than 30 cm below the soil surface in the dry season (Wade *et al.*, 1980).

The meaning of the term ''savanna'' has changed over time. To the writers and naturalists of the 18th and early 19th centuries, a savanna was a flat, treeless plain, similar to what would be called a prairie today (Frost *et al.*, 1986). According to Bridges (2004a), the GLO

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surveyors during the mid to late 19th century used the term ''savanna'' to indicate the presence of trees and grasses although there is no guidance as to the tree density. Today, ''savanna'' describes an area that has a tree density low enough to permit light to reach the ground and allow the growth of grasses (Platt *et al.*, 2006).

Because of their increasing rarity, there has been growing interest in the conservation and restoration of Florida's grasslands. Successful ecological restorations often require a predisturbance reference condition, making it important to know what the early historical landscape was like. A valuable source of information on the historic landscape of Florida comes from the surveys made by the General Landscape Office (GLO) during the mid to late 19th century. The GLO was charged by the U.S. Congress with surveying newly acquired public lands. The surveys represent one of the earliest descriptions of the landscape that were collected with a systematic and replicable method (Knetsch, 2006). Data from GLO surveys have proved useful in a variety of studies on historic landscapes (Bourdo, 1956; Wang, 2005).

The GLO surveyors used a rectangular mapping system to divide Florida into a grid of 9.7 km by 9.7 km (6 mile by 6 mile) townships, each with a set of coordinates. They produced ''plat maps'' that showed many of the features of the landscape, such as rivers, marshes and grasslands, for each township. These maps were supplemented by the surveyors' notes, which often included observations of the landscape not found on the plat maps (Hawes, 1873).

This study had two main goals. The first was to create a map showing the historical distribution of grasslands in Florida. This map was compiled using data from the GLO plat maps and surveyors' notes as well as descriptions from other historical sources. The second goal was to compare the composite prairie map with a soils map to better understand how edaphic factors influenced the distribution of the state's historic grasslands.

METHODS

GLO plat maps for each township in Florida were examined for types of open habitats. In recent years, the original surveyor plat maps have been digitized and are now accessible through the U.S. Bureau of Land Management website (http://www.glorecords.blm.gov) and the Florida Public Lands Office website (http://data.labins.org/2003/SURVEYDATA/LANDRECORDS/glo/index.cfm). The surveyors' field notes are also accessible through the Florida Public Lands Office website.

Initially, 259 plats with prairies and 40 plats with savanna were downloaded from the above websites. Due to its history and climate, Florida was surveyed in phases over a 50 y period. Land surveys could only be done during the 4 to 6 mo winter dry season. As a result, this study used the plats completed from the 1820s through 1840s for north Florida, the 1850s for the central part and the 1870s and 1880s for south Florida. The types of ecosystems and symbols found on each of the plats were recorded.

Using the Geographic Information System program ArcMap 9.2 (ESRI, 2009), a composite map showing the distribution and extent of prairie and savanna in Florida was constructed. ArcMap was used to georeference the plat maps, create shapefiles of the historical prairies and produce a larger map of Florida showing the locations of historic prairie.

The resulting composite map was then modified to correct for problems with the plat maps. Grasslands on some plat maps clearly continued to the adjacent plat but were not shown, generating a straight edge on the composite map. In addition, on some plat maps, the outline of potential grassland was shown but not labeled. In these instances, the plat

TABLE 1.—Area (ha) of prairie and savanna found on the U.S. General Land Office (GLO) Florida surveys during the 19th century by grassland type

Type of grassland	Area (ha)
Prairie	
Dry prairie	41,530
Wet prairie	73,870
Undefined prairie	675,740
Total prairie	791,140
Savanna	
Wet savanna	120
Undefined savanna	15,700
Total savanna	15,820
Total prairie and savanna	806,960

maps were reexamined along with the corresponding field notes for evidence of grassland. Field notes were required to contain a general description of the land (Hawes, 1873), and the term ''prairie'' was commonly used in the notes. Additional shapefiles were created for those plats where the prairie observed in field notes corresponded to markings on the plat maps. The areas of specific types of grasslands, as well as total area of grassland, were calculated in ArcMap.

A soil profile for the state of Florida was downloaded from the Natural Resources Conservation Service (http://soildatamart.nrcs.usda.gov). Areas with prairie and savanna were compared to soil descriptions found in county soil surveys by the U.S. Department of Agriculture, Southeastern Coastal Plain and Caribbean, Soil Region #15, Florida Soils (http://www.mo15.nrcs.suda.gov/states/fl.html). The areas of grassland with different types of soils were calculated.

Finally, historical accounts of Florida were reviewed to find additional descriptions of prairie and savanna. For areas that appear to have had these habitats, the corresponding plat maps and field notes were re-evaluated. Shapefiles were created for those additional prairies that corresponded to markings on the plat maps.

RESULTS & DISCUSSION

Distribution of prairie.—There were 791,140 ha of prairie and 15,820 ha of savanna in three distinct regions of the Florida peninsula, according to the GLO plat maps (Tables 1, 2; Fig. 1). The first region of grasslands in the northern portion of the peninsula had 38,710 ha of prairie and 9140 ha of savanna. Small areas of prairie and savanna on the plat maps extended to the north of Gainesville into Clay County (Fig. 2). This section contained the largest percentage of savanna to prairie (19.1%). These results agreed with Abrahamson and Hartnett's (1990) description of Florida's prairie distribution, in which the prairies are described as continuing from Desoto County to areas as far north as Volusia and Wakulla Counties.

The second and most extensive region included 615,190 ha of prairie and 4060 ha of savanna in an area stretching from the west coast of Lake Okeechobee through Manatee County and to the Tampa Bay area in Central Florida (Fig. 3). These grasslands included the Kissimmee Prairie, the Indian Prairie (Bridges, 2004b) and an expanse of prairie to the west of Lake Okeechobee. Bridges (2004a) estimated that there were 203,732 ha of prairie

TABLE 2.—Area (ha) of prairie and savanna found on the U.S. General Land Office (GLO) Florida surveys during the 19th century by location

Location	Area (ha)
Northern peninsula	
Prairie	38,710
Savanna	8,140
Central peninsula	
Prairie	639,540
Savanna	4,060
Southern peninsula	
Prairie	116,510

within the Kissimmee Prairie, which is about one-third of the prairie area calculated for the entire central region in the current study. There were an additional 24,350 ha of scattered prairies to the east of Lake Okeechobee (Fig. 3).

A third region of grasslands was found to the south of Lake Okeechobee where there were 116,510 ha of prairie (Fig. 4). This number includes 34,660 ha in the Big Cypress Swamp, 58,520 ha on the western edge of the Everglades and 23,330 ha along the southeastern coast. No savannas were found in this area according to the GLO surveys. The distribution found in this study agrees with maps of contemporary ecosystems that show wet prairie to the south of the Big Cypress Swamp and to the east of the Everglades (Odum *et al.*, 1998). In the Big Cypress Swamp, much of the prairie was found through the surveyor's notes. In some cases, the noted prairies corresponded to markings on the plat maps. However, most did not, and they are not shown on the composite map (Fig. 4). As a result, the distribution of prairie in this area according to the GLO surveyors is less patchy than the composite map indicates. The observations of the surveyors correspond to the distribution of limestone outcroppings in this area. According to Snyder *et al.* (1990), the limestone outcroppings are generally covered with pinelands and tropical hardwoods and are bordered by wet prairies.

Grasslands and soils.—The soils found under most of the prairies and savannas were sandy and poorly to very poorly drained (>90%) and generally, deep (>70%). The slope of the land was nearly level (0–2%) in more than 90% of the grasslands. However, 12% of the savannas were on soils that were excessively drained and on a higher slope (0–8%). The soils found in most of the prairies and savanna (>65%) consisted of spodosols and alfisols, which are normally found in forested sites (Soil Survey Staff, 2008). The typical soil of grasslands, mollisols, were found in <20% of the prairies and savannas (Table 3).

Prairies tended to be located toward the low end of topographical gradients between pines in the upland areas and wetlands in the lower areas (Platt *et al.*, 2006). The proximity of prairies to pine areas is consistent with Bridges' (2004a) hypothesis that prairies are maintained in areas where fires have either destroyed existing pines or kept new pines from developing. Platt *et al.* (2006) found that fires followed by floods can produce conditions unfavorable for pine trees and that small topographical differences can produce local variations in fire and flooding. As noted above, both wet and dry prairies can be flooded during the rainy season, so it seems probable that a combination of fire and flooding produced the mosaic of prairies and savannas indicated by the GLO surveys.

Possible discrepancies.—The GLO land surveys provide a valuable source of information for vegetation studies prior to European settlement (Bourdo, 1956). However, the primary

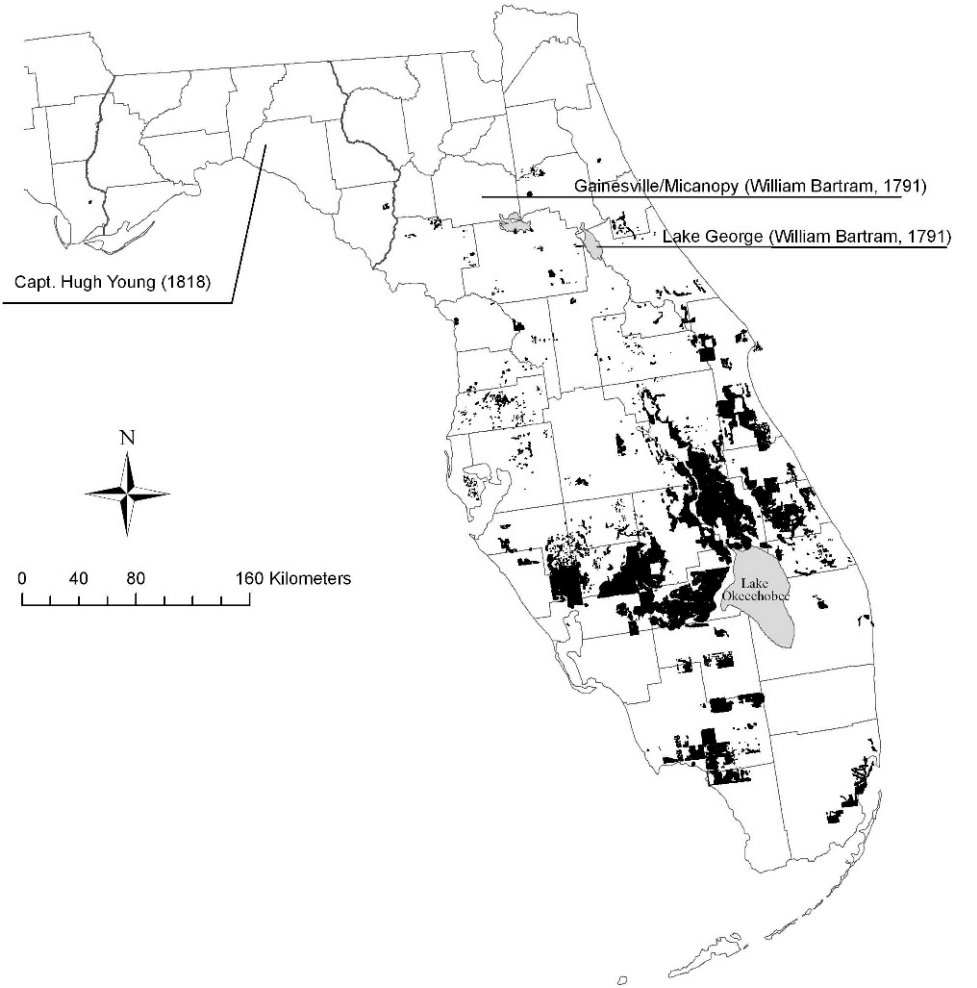

FIG. 1.—Distribution of prairies and savannas as recorded on the U.S. General Land Office surveys of Florida in the 19th century. Prairies and savannas are shown in black. Lines indicate approximate location of observations by Capt. Hugh Young and William Bartram as discussed in the text. Date of initial publications are in parentheses

purpose of the surveys was to inventory land quality and establish landmarks for sale and settlement (Wang, 2005), and as a result, there are limitations to using the surveys for ecological studies. First, plat maps are not always complete. This can be seen where the prairies on one plat should have continued onto an adjacent map but were absent, indicating that some areas were not marked. Second, surveys were only conducted during the dry season, so at the time of surveying, many marshes may have been dry and mistakenly marked as prairie by the surveyors (Bridges, 2004a). Third, wetland drainage programs may have changed the area of wetlands and grasslands during the course of the surveys (Knetsch, 1992). Fourth, Spain granted land to private parties at the end of the 18th century. The

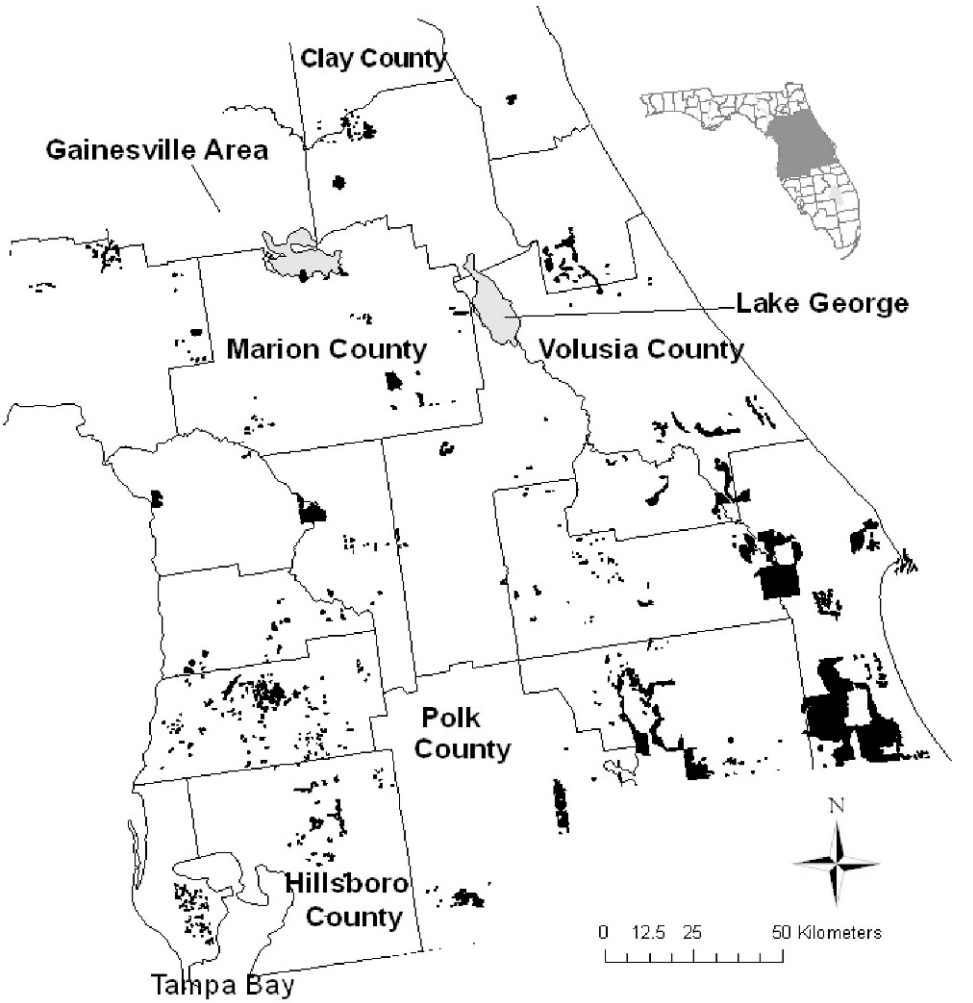

FIG. 2.—Patchy distribution of prairies and savannas in the north Florida peninsula as recorded on the U.S. General Land Office surveys of the 19th century

boundaries and ownership of these lands were contested when Florida was ceded to the United States, and the surveyors of the GLO were typically not permitted to survey these lands (Rohrbough, 1968; Knetsch, 1991, 2002, 2004; Gannon, 1993).

Wang (2005) suggests several ways that limitations of land surveys can be reduced. For example, comparison of original field notes with the maps and looking for discrepancies, including additional information such as topography, slope, tree density to determine habitat type, comparison of natural vs. manmade structures to indicate level of land development at the time of the survey and research who collected the data and how long the survey took to assess the quality of the survey (Wang, 2005). In this study, I have included each of these approaches to reduce sources of error. Additional information on the quality

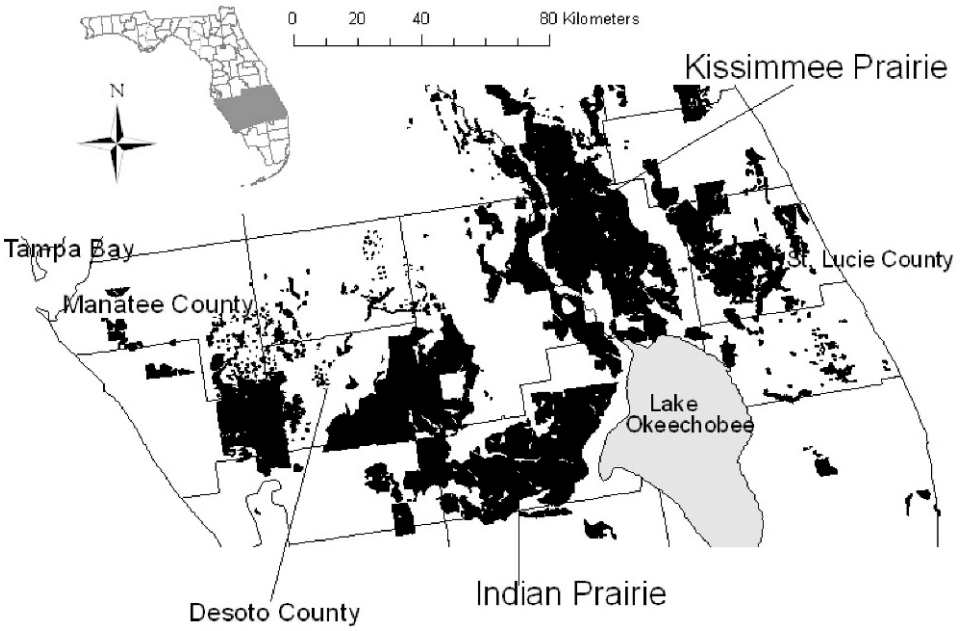

FIG. 3.—Central Florida continuous prairies and savannas of the 19th century as recorded on the U.S. General Land Office surveys. The location of the Kissimmee and Indian Prairies are shown

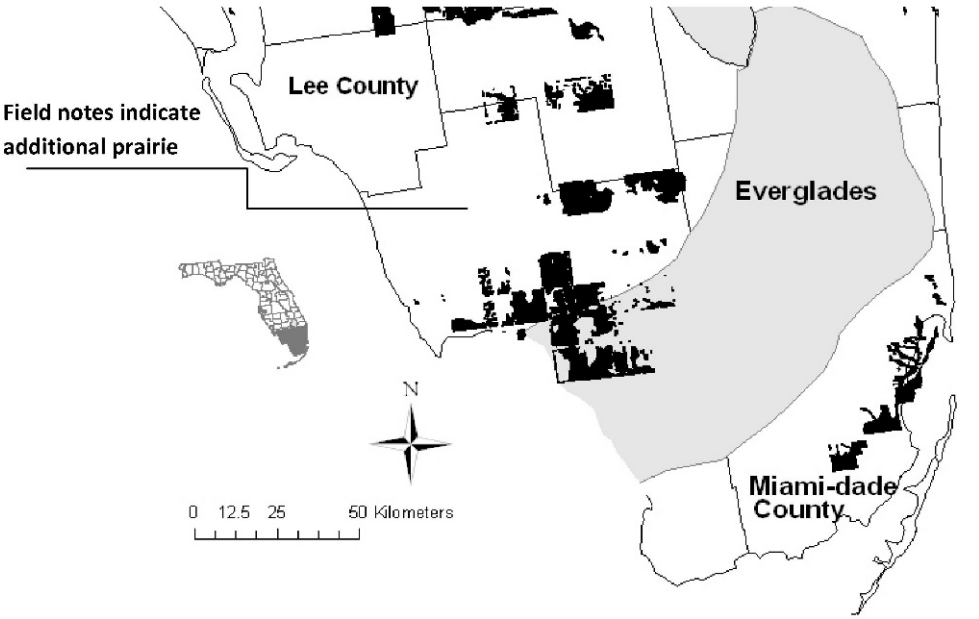

FIG. 4.—Distribution of prairies as recorded on the 19th century U.S. General Land Office surveys of the southern Florida peninsula. The 19th century border of the Everglades is shown

TABLE 3.—Soil composition found in prairies and savannas on the presettlement surveys in Florida. Representative soil orders are presented in the same order as the series

Soil orders represented by the soil series	Soil series	Total (ha)	Percentage
Spodosol – spodosol-entisol	Smyrna -immokalee -basinger (s1547)	270,900	36.8
Alfisol-spodosol-spodosol-spodosol	Popash -pomona -myakka –immokalee (s1544)	118,300	16.1
Alfisol- alfisol- alfisol	Riviera –pineda –felda (s1595)	62,500	8.5
Alfisol-mollisol- alfisol	Riviera –copeland -boca (s1593)	51,500	7.0
Histosol-alfisol-mollisol	Terra ceia -riviera –floridana (s1546)	29,600	4.0
Histosol-alfisol-mollisol	Kaliga -floridana-felda –chobee (s1556)	28,600	3.9
Alfisol-spodosol-alfisol-alfisol	Winder -wabasso-pineda–felda (s1545)	20,900	2.8
Histosol-histosol-histosol-histosol	Tomoka -terra ceia –samsula –hontoon (s1548)	14,500	2.0
Entisol-inceptisols	Pennsuco - ochopee (s1592)	14,200	1.9
Spodosol-histosol-alfisol-spodosol – mollisol-alfisol	s1549:Wabasso -terra ceia –pineda -eaugallie -demory -boca (s1549)	13,300	1.8
	other soil series	113,400	15.3

of the land survey and the use of additional historical records are discussed in the next section.

Historical data.—Paynes Prairie in the Gainesville/Micanopy area was located within the boundaries of the Arredondo Grant (Fig. 1). While the plat map for this area was not with the original surveyor plats, the Arredondo Grant was surveyed in 1846 by Henry Washington, a GLO surveyor who was known for his persistence and accuracy. Washington was able to successfully survey areas that were politically disputed (Knetsch, 1991, 2006; Andersen, 1994). His plat maps indicate many patches of prairie within the borders of the Arredondo Grant; however, they also show land ownership indicating that much of the land may not have been in its original state.

Paynes Prairie was known as the Alachua Savanna in the late 1700s/early 1800s when it was visited and described by the noted naturalist, William Bartram. According to Bartram (1791), ''The extensive Alachua savanna is a level, green plain, above fifteen miles over, fifty miles in circumference, and scarcely a tree or bush of any kind to be seen on it.'' As noted earlier, the term ''savanna'' used by Bartram was synonymous with the term ''prairie'' as used today. The observations of Bartram and Washington make it clear that this was an extensive area of prairie that was not shown on the original GLO maps.

The GLO maps indicated patches of prairie and savanna in the Lake George area even though sand pine scrublands dominated this area (Abrahamson and Harnett, 1990). William Bartram (1791) traveled along Lake George and noted grasslands in the area: ''I penetrated the grove, and afterwards entered some almost unlimited savannas and plains…''

The Forbes Grant (526,000 ha) in the Florida panhandle (Knetsch, 1991, 2002, 2004; Gannon, 1993), was not surveyed, but other historical data indicate that there were extensive prairies in this area. In 1818, Capt. Hugh Young, with the Corps of Topographical Engineers of General Andrew Jackson's army, noted savanna and prairie throughout the area between the Sahwanne or St. Juan River and the Apalachicola River (Young, 1934). He writes, ''The glades or Savannas are tracts a little lower than the palmetto land … They extend, with great variation of length and breadth through the whole country, sometimes forming long and narrow vistas through the pineland covered with luxuriant and nutritious

herbage and in places, spreading into ponds or lakes many miles in extent only dry in the warmest seasons.'' He further notes of the area around Tallahassee: ''The Savannas are interspersed through the high and fertile as well as the flat pine districts, and in some parts of the former make prairies and lakes of considerable size.''

CONCLUSIONS

Florida had extensive areas of grasslands in the 19th century, as evidenced by the GLO plat maps. These prairies and savannas seemed to be concentrated in central and south Florida; however, other historical records indicate extensive grasslands in north Florida and in the panhandle. Prairies and savannas were situated in flat areas with deep but poorly drained soils. Used in conjunction with other eye witness reports, the presettlement surveys provide a good picture of the Florida landscape as it existed 150 y ago.

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