FLORISTIC INVENTORY OF TIGER CREEK PRESERVE AND SADDLE BLANKET SCRUB PRESERVE, POLK COUNTY, FLORIDA

By

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A floristic inventory of vascular plants for The Nature Conservancy's Tiger Creek Preserve and Saddle Blanket Scrub Preserve, Polk County, Florida was conducted from August 2004 through February 2008. Twelve plant communities were characterized: scrub, scrubby flatwoods, sandhill, xeric hammock, mesic flatwoods, wet flatwoods, bayhead, seepage slope, depression marsh, floodplain wetlands, blackwater stream, and ruderal. The 2308 combined hectares of the Preserves yielded vouchers for 541 taxa, of which 51 are non-native to Florida, 37 are at or near the southern or northern limits of their ranges in Florida, and 24 are new Polk County records. The Preserves are located on the Lake Wales Ridge. This area's unique geological history has contributed to the evolution of a high number of endemic taxa, many of which are rare and of conservation concern. This study found 55 taxa endemic to Florida, of which 27 are restricted to Florida peninsular scrubs or scrub/sandhill ecotonal habitats. Of these 27 taxa, 15 are restricted to Florida's central ridges, especially to the ancient scrubs on the Lake Wales, Lake Henry, and Winter Haven Ridges. Nine of these taxa are restricted to four or fewer counties. Twenty-seven are listed in Florida, and 18 are listed federally, as endangered, threatened, or of management concern. Endemism on Florida's sand ridges is discussed.

CHAPTER 1
INTRODUCTION

The Preserves

Tiger Creek Preserve and Saddle Blanket Scrub Preserve are two conservation properties in Polk County, Florida, owned and operated by The Nature Conservancy (TNC). Tiger Creek Preserve is located about eight km southeast of the town of Lake Wales (population 15,000), on the eastern edge of the Lake Wales Ridge (Figures 1-1, 1-2), a sandy upland region of central Florida noted for its unique ecosystems and large number of rare endemic species, both animal and plant (Ward 1979). The area containing the Preserve is bounded on the north by State Road 60, on the east by Walk-in-Water Road and Lake Weohyakapka, on the south by County Road 630, and on the west by State Road 17. To the west of the Preserve are citrus groves, to the north and east are low-density residential developments interspersed with native vegetation, and to the south is a mosaic of pasture, citrus groves, and residential development. The Preserve was established in 1971 to protect the watershed of Tiger Creek. Since then the Preserve has grown through the piecemeal acquisition of parcels of surrounding land (Figure 1-3), to 1974 hectares (ha), including upland habitats. At its current extent, encompassing a blackwater stream and its adjacent uplands, the Preserve represents an outstanding remnant of Lake Wales Ridge habitats, harboring 15 species of plants and seven species of animals with Natural Heritage Inventory element rankings of G3 or higher (Chafin 2000; TNC 2006a).

Saddle Blanket Scrub Preserve is located in extreme southern Polk County near the Highlands County line, at the western edge of the Lake Wales Ridge, approximately 24 km southwest of Tiger Creek Preserve (Figure 1-2). The northern boundary of the Preserve fronts on Avon Park Cutoff Road approximately 1.6 km west of its intersection with U.S. Highway 27. To the north and east are citrus groves, and to the south and west are moist grassy pasture lands.

This Preserve was acquired by TNC in 1988. A 36 ha parcel was added in 1992, bringing the total area to 334 ha. It is primarily a mosaic of upland habitats, including scrub, punctuated by a few depression wetlands. The Preserve features one of the largest, most intact, and biologically diverse tracts of ancient scrub habitat remaining on the Lake Wales Ridge. It harbors 18 of the rare plant species and eight of the rare animal species that are restricted to these habitats. This is one of the largest concentrations of these species now remaining (TNC 2006b, 2006c).

Because of their locations on the Lake Wales Ridge, these Preserves are at the center of ongoing conservation efforts. The habitats of the Ridge and their unique biological denizens have long been under severe threat from human land-use changes; the already naturally fragmented Lake Wales Ridge scrub community has been reduced to less than 10% of its original extent (Christman and Judd 1990; Huck et al. 1989). The accelerated pace of human encroachment injects an urgency into efforts to understand and preserve these areas. Over the last several decades, conservationists at the federal, state, county, and private levels have risen to the challenge, acquiring land for preservation and devising strategies for studying and protecting what remains of these species and their vanishing habitats (FWCC 2002). One result of these efforts is the Lake Wales Ridge Protected Areas Network, a patchwork of protected lands both public and private, totaling some 34,400 ha that includes Tiger Creek and Saddle Blanket Preserves (Martin 1998). These two Preserves comprise the centerpiece of TNC's Lake Wales Ridge Program, whose goal is to preserve biodiversity in this region, using the preserves as a platform to promote ecological management practices on conservation lands of the Lake Wales Ridge, and as a laboratory for study of the Ridge's ecosystems (TNC 2006a).

Despite efforts to promote research, prior to this investigation, no vouchered floristic inventories had been published for these two Preserves. This is surprising, in view of the biological importance of this area and the urgency of its preservation. With this in mind, a vouchered floristic inventory of Tiger Creek and Saddle Blanket Scrub Preserves was conducted over a three-year period, from August 2004 through February 2008. The objective of this study was to catalog the flora and plant communities of these preserves as they now occur, providing a baseline of information for use by current and future researchers and managers in their efforts to understand and conserve the biota of these unique ecosystems. In addition, phylogenetic relationships and biogeographical patterns of the area's endemic species are briefly assessed.

Geology and Physiography

Florida today presents a seemingly simple tableau – a sandy peninsula of low relief, recently emerged from the sea, suggesting a simple biogeography - yet since its emergence from the sea, it has undergone a variety of geologic processes including numerous changes in size and shape (Webb 1990). To understand its biogeography, therefore, one must understand Florida's geological history.

Modern peninsular Florida is the exposed portion of a larger block known as the Florida Platform, measuring some 560 by 720 km in size, extending southeast from continental North America (Scott 2001). The Florida Platform had its beginnings in the Paleozoic era, in the Cambrian period [ca. 600 million years before present (MYBP)], as undersea volcanic rocks attached to the Gondwana land mass near what is now the West African continental margin. Over these igneous basement rocks were deposited sedimentary layers of Ordovician through Devonian age (ca. 500 – 350 MYBP). In the Triassic period (ca. 240 MYBP), processes of rifting began to separate Africa from North and South America, creating the Atlantic Ocean, and the Florida Platform separated from Africa and became attached to the North American plate (Smith and Lord 1997).

By the mid-Jurassic (ca. 180 MYBP), the Florida platform had ceased to undergo violent tectonic movements and to this day it remains one of the most stable areas of the earth's crust (Cooke 1939). From the Jurassic until at least the mid-Oligocene (ca. 28 MYBP), the platform underwent a long period of marine deposition of carbonate sediments in shallow seas, building up the thick limestone bedrocks characteristic of Florida (Randazzo 1997; Scott 1997). Rainwater is slightly acidic (Jordan 1984), and these carbonate limestone bedrocks, when above sea level, are subject to dissolution when exposed to these acidic surface waters. This leads either to denudation (general lowering of land surface) or to karst formation. The latter occurs when surface water flows down through cracks, joints, and softer places in the rock, dissolving the rock, forming cavities, depressions, and sinkholes. Karst topography is widespread in Florida due to this process. Terrestrial vertebrate fossils deposited in sinkholes indicate that karst formation had taken place by the late Oligocene in some areas of peninsular limestone, suggesting this as the earliest emergence of Florida from the sea, during low sea-level stands associated with climatic cooling. The limestone layers formed in the Eocene, Oligocene, and early Miocene (ca. 56-24 MYBP) form the Floridan aquifer. These limestone layers, made porous by karst-forming solution processes, carry huge amounts of groundwater throughout much of the peninsula. (Brown et al. 1990; Upchurch and Randazzo 1997; Webb 1990).

By the end of the Oligocene, renewed uplift and erosion in the Appalachian region brought increasing loads of siliclastic sediments washing out onto the Florida platform. This deposition predominated from mid-Oligocene to Holocene (recent) times, covering much of the limestone bedrock with sand- and clay-containing sediments, which form relatively impermeable confining layers over the limestones of the Floridan aquifer (Brown et al. 1990; Scott 1997, 2001; Scott et al. 2001; Webb 1990). These deposits, often lying over older karstic features, have been worked and re-worked by wave action over ages of sea-level fluctuations, and subjected to erosion while above ground, to shape the surficial formations recognized in modern Florida (Scott 2001).

Polk County lies within the Central Highlands physiographic province of Florida (Cooke 1945). The central and southern parts of Polk County, including the Lake Wales Ridge, lie within the Central Lake District, an area of karst terrain with sandhills and numerous lakes and solution basins (Brooks 1982; Brown et al. 1990). Underlying Polk County, and forming the Floridan aquifer, are the Eocene Avon Park and Ocala Group limestones, and the Oligocene Suwannee limestone. Over these are the less permeable siliclastic-containing Miocene sediments of the Hawthorne Group, which include the Arcadia formation, in the southwestern part of Polk County, forming an intermediate aquifer, overlain by the Peace River formation, which is present over much of the county, forming the upper confining layer for the intermediate aquifer. Over this formation are undifferentiated sandy to clayey sediments forming the unconfined surficial aquifer of Pliocene to Holocene age (Campbell 1986; Tighe 1987). Overlying the entire county are quartz sands from which the surface soils have developed (Tighe 1987).

The Lake Wales Ridge, along with the similar Winter Haven and Lake Henry Ridges to its west, are prominent features rising from the surrounding Polk Upland (Figure 2). The topography of all the ridges is quite irregular due to karstic processes, erosion, and dune building; elevations on the Lake Wales Ridge range from 46 to 93 m above mean sea level (Campbell 1986; White 1958). These ridges are capped with sediments once thought to be of Miocene origin (White 1958), but now recognized as sandy sediments of the Cypresshead Formation, deposited when sea level rose dramatically in the Pliocene, inundating much of peninsular Florida (Scott 1997, 2001). White (1970) considered these ridges remnants of a once more extensive upland, preserved as ridges because they sit in places where siliclastic sediments were thicker over underlying limestone, limiting dissolution in those places while surrounding limestone, with thinner overlying layers, dissolved, and subsided. Surrounding the ridges are undifferentiated reworked Cypresshead sediments of Pliocene to Pleistocene age (Scott 2001). The ridges are oriented parallel to the current Atlantic coast; in aerial view they exhibit a striped pattern typical of beach ridges, with dunes on the eastern flank of the Lake Wales Ridge, indicating that they were shaped by wave and wind action along an ancient shoreline (White 1970). The maturity of karst on the ridges (deeper lakes, rougher and more dissected terrain) compared with that of the surrounding areas suggests that the ridges have been above sea level for a considerable period of time (White 1970). Of several ancient Florida shorelines recognized by geologists (e.g., MacNeil 1950), the most prominent is the Wicomico, which encircles the Central Highlands and represents a high sea-level stand probably in the early Pleistocene (Webb 1990). A higher and older shoreline, the Okefenokee, occupies some higher elevations on the ridges, and may date from the late Pliocene (Webb 1990). These high points on the ridges may have once formed a string of islands, or a narrow peninsula, in a shallow Pliocene sea, their flora and fauna evolving in isolation, a possible explanation for the large number of endemic species restricted to these ridges (Christman 1988a; Myers 1990).

Tiger Creek Preserve lies on the eastern flank of the Lake Wales Ridge, occupying an area covered by Pleistocene dunes extending to the east shore of Lake Weohyakapka. The creek system has cut into these dunes forming a broad floodplain in the northern and western portions of the Preserve, while downstream to the east the creek is more steeply incised in the dunes as it flows into Lake Weohyakapka. The upland areas of the Preserve are undulating sandhills with numerous depressions, remnants of the Pleistocene dune and swale system. The swales are now ephemeral depression wetlands. Elevations within the Preserve range from 21 to 41 m, the highest point being on the northwest side of the Preserve where it abuts the steep eastern escarpment of the Lake Wales Ridge proper. (Tighe 1987; TNC 2006a).

Saddle Blanket Scrub Preserve lies on the western edge of the Lake Wales Ridge. The eastern portion of the Preserve is on the ridge proper, on sediments of the Pliocene-aged Cypresshead formation, while the western part lies in the Polk Upland, on an area of undifferentiated reworked Cypresshead sediments of Pliocene to Pleistocene age (Scott et al. 2001). At the surface are quartz sands from which the soils have developed. With the exception of a few depression wetlands, the Preserve is a relatively flat sandy upland, with elevations ranging from 41 m over a broad central area, to 32 m at its southwestern edges (Namm 1997). Two small lakes, the Saddle Blanket Lakes, are located at the northern edge of the Preserve.

Climate

Although peninsular Florida lies at a latitude dominated by dry high-pressure air, its proximity to maritime tropical air masses over the Caribbean Sea and the Gulf of Mexico makes its climate humid and subtropical (Chen and Gerber 1990). Based on a 29-year averaging period (1971-2000) at Mountain Lake near Tiger Creek, the mean annual temperature in Polk County is 22.1 degrees C, and mean annual rainfall is 1212 mm; mean monthly temperatures vary from 16.1 degrees C in January, to 27.3 degrees C in August (NOAA 2005). Frost or freezing temperatures generally occur at least once a year in the Lake Wales Ridge area (Waldron et al. 1984).

Central peninsular Florida experiences a distinct summer rainy season from June through September, and a dry season from November through April. The region receives more than 60% of its annual rainfall in the summer (Jordan 1984). Most of this rain comes from thunderstorms that develop along seabreezes through convergence, or inland through convection; both processes cause sun-heated, moisture-laden air to rise, and the moisture condenses to form rainstorms (Winsberg 1990). These storm-generating processes result from solar heating of the land surface. Air over land heats and rises faster than air over water, creating low pressure over land, whereupon moist air from over water rushes toward the low pressure, creating the seabreezes (Chen and Gerber 1990). Florida's narrow peninsular shape assures overall good coverage of storm rainfall throughout, as no part of the peninsula is far from water. The distribution of rainfall from thunderstorms, however, is naturally irregular, and unusual rainfall events can cause localized flooding that can affect low-lying plant communities (Jordan 1984). Florida's thunderstorm activity is the greatest of anywhere in the United States, and it ranks with the world's other high thunderstorm areas (Winsberg 1990). This abundance of thunderstorms creates a vast amount of lightning, which can and does start fires in flammable vegetation. Over evolutionary time, natural fires have been a dominant ecological disturbance in central Florida's sandy upland ecosystems, greatly influencing plant species characteristics and the makeup and distribution of plant communities (Menges and Kohfeldt 1995; Myers 1990).

Tropical weather systems are another significant source of rainfall in summer and early fall in this region. Between 1852 and 2007, 53 hurricanes have passed within 40 km of the town of Lake Wales (NOAA 2007). Three of these, Charley, Frances, and Jeanne, occurred in 2004, near the start of this study period. Flooding and wind damage from such events can have pronounced disturbance effects on plant communities.

By November, the rainy season has ended in central Florida, and winter rainfall is dependent upon occasional low-pressure systems, and the passage of continental cold fronts, which drop rain in north Florida but often dissipate over the central peninsula, making winter drier there than in north Florida (Chen and Gerber 1990). In spring, the Bermuda high, a semipermanent subtropical high-pressure ridge, extends westward from the Atlantic Ocean, creating dry sunny conditions that can persist through May. The strength of this high can delay the onset of the rainy season. Drought conditions can occur when a dry spring follows a dry winter (Jordan 1984).

Hydrology and Soils

The ultimate source of all fresh water in central peninsular Florida is rainfall (Clemens et al. 1984). Some of this water flows as runoff, entering streams and lakes. The rest filters through the soil into the surficial aquifers where it can percolate laterally, entering wetlands and water bodies, or downward, to recharge the deep aquifers (Miller 1997). The Central Lake District, where the limestone bedrocks are overlain by deep, permeable sands, discontinuous and leaky confining beds, and numerous deep lakes, is an important recharge area for the Floridan aquifer (Barcelo et al. 1990; Brown et al. 1990). At Tiger Creek and Saddle Blanket Preserves, the deeper aquifers do not contribute directly to water in wetlands, streams or ponds; these are fed by runoff and seepage from the surficial (water table) aquifer (Tighe 1987; TNC 2006c).

Politically, Tiger Creek and Saddle blanket Preserves fall within the Southwest Florida Water Management District (Barcelo et al. 1990). Hydrologically, Tiger Creek is part of the Kissimmee River basin. It drains a 13,786 ha drainage basin situated to the west of, and draining into, Lake Weohyakapka, which in turn drains into the Kissimmee River through a series of streams and lakes (Tighe 1987; TNC 2006a). Tighe, who conducted a detailed two-year hydrological study of Tiger Creek, considered it a "relatively undisturbed" seepage blackwater stream system (1987, p. 85). Its southern branch, Patrick Creek, flows northeastward from its source, Lake Patrick (Lake Leonore on some maps), through a culvert under Murray Road, to its confluence with Tiger Creek. Its floodplain is quite broad except where it flows through some upland areas. The source of the northern branch is groundwater seepage from surrounding uplands into a bayhead north of the Preserve. For the first 1.6 km of its southward flow, its floodplain is relatively narrow, surrounded by xeric uplands, after which the floodplain broadens to about 0.8 km in width, remaining broad up to the confluence. From the confluence it flows eastward into Lake Weohyakapka, through sandy uplands where its banks are high and its floodplain narrow. The channels of the creek system are flat and sandy-bottomed, choked in many places with fallen trees. The terrain of the Preserve outside the creek floodplain is an undulating mosaic of uplands and ephemeral depression wetlands. Upland soils are deep, permeable sands, while those of depressions and flatwoods may be underlain by a hardpan that holds the water table perched, where water can stand for some time following rainfall (Tighe 1987). Some of these wetlands, especially several bayheads at the base of sandy slopes, contribute flow to the creeks via small tributary streams. These tributary wetlands have a large water storage capacity, and can discharge water to the creeks at steady rates during much of the year (Tighe 1987). Central Florida receives more than 50% of its total yearly rainfall during the summer (June-September), leaving the water table highest in September, lowest in May.

The hydrology of Saddle Blanket Scrub Preserve is similar to that of Tiger Creek, except for the absence of a creek system at Saddle Blanket. Rainwater runs off or percolates into the permeable upland sands, where it flows laterally to feed several depression wetlands and the small lakes, or downward to recharge the Floridan aquifer. The average level of the water table of this surficial aquifer, 34-37m, corresponds to the ground level of the bayheads and the water level of the small lakes (TNC 2006c). At higher elevations than the bayheads are some wet-prairie depressions whose water tables are probably perched above hardpan layers. Surface water in the area of this Preserve, on the western side of the Lake Wales Ridge, drains westward toward the Peace River (Barcelo et al. 1990).

Of the various land uses surrounding Tiger Creek and Saddle Blanket Preserves, citrus groves have the greatest potential to affect the hydrology due to their enormous consumption of water for irrigation, most of which is drawn from deeper aquifers (Tighe 1987; TNC 2006a, 2006c). General widespread declines in regional lake levels in recent decades have been linked to reduced rainfall and groundwater pumpage (Barcelo et al. 1990). Because the confining beds of the surficial aquifer are leaky in this region, withdrawals from the deeper aquifers can cause local declines in the surficial water table, potentially threatening the plant communities of the wetland areas of these Preserves. Another land use that occurs near Tiger Creek Preserve is sand mining. Hydrological monitoring is ongoing at Tiger Creek in response to concerns about the possible effects on the hydrology of the creek system of proposed new sand mines near the Preserve (TNC 2006a).

Variations in rainfall patterns over the years have had dramatic effects on the hydrology of Tiger Creek Preserve, and this probably affected the composition of wetland plant communities. The first half of the 20th century was generally wetter than the second half (Tighe 1987). Of interest in this regard are some aerial photos from 1922 commissioned by Edward Bok, founder of Historic Bok Sanctuary near Lake Wales (on file at TNC office at Tiger Creek Preserve), showing that a large area of the floodplain at the confluence of Tiger and Patrick Creeks was open grassland at that time, perhaps a sawgrass *(Cladium jamaicense)* marsh. In 2004 this same area was forested wetland with sparse occurrences of sawgrass in the understory. The drier period from the 1950s through 1985 had seen wetland areas going dry sometimes for decades, with mesic and xeric species invading (Tighe 1987; TNC 2006a). During 1998-2007, rainfall was on the increase, and in 2004-2005, during the period of this floristic study, three close-passing hurricanes followed by an unusually wet summer left all floodplains and depression wetlands inundated, some for up to 18 months (NOAA 2004, 2005; TNC 2006a). This inundation exceeded the limits of flooding tolerance for many mesic and hydric tree species in the forested creek floodplains, causing a remarkable die-off of canopy trees. This was in addition to the considerable number of trees downed by hurricane winds. Patterns of rainfall and fire in the decades following this event will determine whether these areas become reforested, or remain more open and marshy. Evidently, hydrologic processes have contributed to wholesale changes in wetland community makeup, and time will tell if we are witnessing another such change in the making.

Soils of Lake Wales Ridge uplands are deep, well-drained sands. At Tiger Creek Preserve, upland soils are mainly of the yellow sand Astatula series, which typically support sandhill and yellow sand scrub vegetation. Poorly drained sandy soils of the Smyrna and Myakka series are found in pine flatwoods areas. Basinger mucky fine sands occur in seasonal depression wetlands, while bayheads and the creek floodplain are dominated by organic soils of Samsula and Hontoon muck series. (TNC 2006a; USDA 1990). At Saddle Blanket, the predominant upland soils are of the Archbold sand series, coarse white well-drained sands that support scrub vegetation. In wet prairies and flatwoods areas are poorly-drained Placid and Myakka depressional sands, and in the bayheads is Samsula muck (TNC 2006c; USDA 1990).

History

The biota of Florida evolved over millions of years through many environmental changes before human beings came on the scene. The arrival of humans ushered in an era of changes that continue at an ever-increasing pace to the present day. To set the stage for the snapshot in time that this study represents, I offer the following synopsis of the biotic history of terrestrial Florida, divided into three parts. My account of pre-human Florida is based primarily on Webb (1990), with other references as noted. In summarizing human Florida, I have consulted Milanich (1994,

1995) for the pre-European period; for the rest I have drawn upon various authors as cited. For the local history of Tiger Creek and Saddle Blanket Preserves, I have drawn heavily from anecdotal information collected by Preserve managers.

Pre-Human Florida

The oldest fossil evidence for a land biota in peninsular Florida dates to the late Oligocene (ca. 25MYBP), consisting of two vertebrate fossil sites, one near Gainesville in north Florida, and the other in Hillsborough County east of Tampa. The kinds of animals represented suggest that mesic forest may have been the predominant habitat at that time. Vertebrate fossils from the early to middle Miocene (23-11 MYBP) are found in the panhandle and in Polk and Hillsborough Counties; they suggest a tropical climate and a mosaic of mesic forest and open savanna habitat. Middle Miocene plant fossils from the Alum Bluff area of the panhandle include a mixture of temperate and tropical species. According to Graham (1964), the flora of eastern North America was undergoing a change from tropical to temperate throughout the Tertiary period, and the Alum Bluff flora was about 42 percent tropical by the middle Miocene. In the late Miocene (11-5 MYBP), two dramatic drops in sea-level occurred, during which Florida reached perhaps its greatest land area, and the climate probably was dry. Vertebrate fossils from this period show a great diversity of savanna-adapted species. A high sea-level stand in the early Pliocene (5-4 MYBP) reduced Florida's land area, and corresponds to the deposition of siliclastic sediments like the Cypresshead formation in the central peninsula, which underlies the Lake Wales Ridge. Vertebrate fossils from this time suggest Florida still supported tropical savanna and forest habitats. Florida vertebrate fossils dating from the late Pliocene (ca. 2.5 MYBP) record extinctions of Miocene fauna, and give evidence of the wave of immigrant species that had begun to arrive from South America over the newly-formed isthmus of Panama. Tropical savanna probably predominated, along with some forested areas.

Whether parts of the central peninsula were once islands, or were always a peninsula, has been debated. Based on the existence of endemism in the biota of the central peninsula, many researchers have postulated the existence of a "Suwannee Strait" cutting across north Florida even as late as the Pliocene. But geologists (*e.g.,* Hine 1997) believe this seaway had filled in with sediments by the Oligocene. Webb (1990) argues that Florida has probably always been a peninsula, and that central Florida's endemism can be explained as easily by the existence of habitat islands as by geographical ones.

Fossils from the early Pleistocene (ca. 2 MYBP) indicate that, especially during periods of low sea level, there was likely a continuous corridor of semi-arid subtropical savanna habitat connecting Florida with western North America. This connection was broken in the mid-Pleistocene, as evidenced by the disappearance of many western taxa from the Florida fossil record, although a number of reptiles, birds, and plants have remained as disjunct relics, separated from their western relatives by wetter habitats of the Mississippi delta region. This period also saw the development of longleaf pine habitats, inferred from certain vertebrate fossils. Numerous oscillations of sea level throughout the Pleistocene corresponded to cycles of glaciation, and these created various relict shorelines visible today in Florida. Florida's Central Highlands region was above water for much of the Pleistocene, and the Lake Wales Ridge probably for all of it. During low sea-level stands the water table dropped, wetlands disappeared, and the uplands became more xeric than today, supporting a scrublike vegetation that was likely quite extensive. Late Pleistocene pollen records from Lake Annie on the Lake Wales Ridge indicate the presence during the last glacial period of grasslands, and a xeric scrub vegetation analogous to today's rosemary scrub, which is found on the driest dune tops in that area (Watts 1980). At the end of the last glacial period, this pollen record shows changes in the composition of the flora, with pines and mesic and wetland species increasing, and grasses decreasing, as water tables rose and climate became wetter (Watts 1980). Today's lakes, bayheads, and swamps were formed relatively recently, beginning around 5000 years before present (YBP) as water tables reached near present levels. The presumed increase in thunderstorms as the climate warmed and moistened, as well as probably the actions of newly-arrived humans, increased the importance of fire. Upland ecosystems began to assume their modern aspects, with longleaf pine savannas becoming more widespread across upland Florida (Myers 1990).

Human Florida

Humans entered Florida at least 12,000 YBP, during the late Pleistocene, when the climate was much drier than today, and the land area much greater. These early Paleoindian nomadic hunter-gatherers hunted Pleistocene megafauna, perhaps leading to the extinction of these large vertebrates by the end of the last glaciation. Before ca. 9500 YBP, water sources were scarce in the interior peninsula due to lower water tables; artifacts from this period are largely restricted to sites where there were watering holes, mostly in the karstic Tertiary limestone regions of the northwest peninsula, and along old coastal areas that are now submerged. The earliest evidence of human habitation near the Lake Wales Ridge is at Nalcrest in Polk County, on Lake Weohyakapka, dating from around 9500 YBP, a time when the environment was beginning to change, becoming warmer and less arid, although still drier than today. Between 9500 and 5000 YBP, gradually moistening climate, rising sea level, and shrinking land area characterized the Archaic period, when human populations increased and people found a greater number of well-watered places to settle. By around 5000 YBP, climate and habitat conditions had become similar to those of today. Humans had become less nomadic, settling throughout the peninsula. By the end of the Archaic period (2500 YBP), pottery was widespread and regional cultures had proliferated. With the spread of agriculture after A.D. 750, many cultures became more complex. Certain areas of Polk and Highlands Counties are associated with scattered archaeological remains from the Belle Glade culture, which flourished from the Archaic period up until colonial times, in the Okeechobee basin and Kissimmee River drainage regions.

At the time of first European contact, and throughout the Spanish mission period, a hunter-gatherer tribe known as the Jororo lived in the area of Polk and Highlands Counties. This inland area was relatively isolated from Spanish colonial activity until the late 17th century, when the Spanish established several missions among the Jororo, which were abandoned after only a few years (Hann 1996; Milanich 1995). By the late 18th century, the Jororo, along with the rest of Florida's indigenous peoples, their populations decimated by diseases and slaving raids, had all but vanished from Florida (Hann 1996). As these populations were dwindling, Creek Indians from Georgia began settling in north Florida, eventually becoming the Seminoles. After Florida became a U.S. territory in 1819, American settlers moved into north Florida, and the resulting friction between settlers and Seminoles led to the Seminole Wars, which forced a few hundred remnant Indians to flee south toward the Everglades, passing through a virtually unsettled central Florida (Milanich 1995). Schafer (1996) states that the Armed Occupation Act of 1842 encouraged white people to settle in the Hillsborough County area, "the edge of wilderness" (p. 218), where they established cattle ranches and slowly pushed inland toward what was to become Polk County. By the time of the Civil War, there was a fledgling open-range cattle industry in the area, which became Polk County in 1861 (Brown 1996). By 1880, Polk County had a population of just over 3000 people, but the arrival of railroads in the 1880s spurred an explosion of growth and development; population expanded, and the citrus industry especially thrived (Frisbie 1976). After recouping from disastrous freezes in the 1890s, the citrus industry has prospered throughout the 20th century (Proctor 1996). After the 1970s, new farming techniques accelerated the conversion of scrub lands to citrus groves, increasingly imperiling this already fragmented ecosystem (TNC 2006c). Due mostly to immigration, Florida's population has increased more than sixfold since 1950, and the building of Disney World and other theme-park tourist attractions near Orlando since 1971 has brought accelerated urban development to central Florida, which is spilling into Polk County (Mohl and Mormino 1996). Since 1950, more than 70 percent of Lake Wales Ridge xeric upland habitats have been lost to citrus groves and, increasingly, residential development (Myers 1990; Peroni and Abrahamson 1985). For conservationists, this human impact injects some urgency into the task of preserving the remnants of these habitats and the constellation of rare species they support.

History of the Preserves

In the areas of Tiger Creek and Saddle Blanket Preserves, human impacts have been relatively light, given the surrounding changes. The following account is based primarily on the Tiger Creek and Saddle Blanket management plan documents (TNC 2006a, 2006b), which in turn draw upon largely anecdotal information from local sources. One such source, for Tiger Creek, is a 1992 interview by preserve managers of Mr. Bob Byrd, a land manager since 1949 for Alico, Inc., a citrus company that owns groves and other land in the area.

At both Preserves there is evidence of prehistoric Native American habitation. Preserve staff have found projectile points, pottery sherds, and mounds that may be shell middens within Tiger Creek Preserve boundaries; these have never been formally studied. At Saddle Blanket, artifacts from a mound were unearthed in 1971 by Talbot Lewis, owner of the property at the time, which were donated to the University of Florida. Settlement of the Lake Weohyakapka area did not begin until the turn of the 20th century; by the 1940s there were just a few scattered homesteads around Tiger Creek. There is also some evidence of a few early-20th century homesteads in the vicinity of Saddle Blanket Preserve. From colonial times through the 19th

century, human-related impacts on Preserve lands were primarily by way of introduced animals. The Spanish did not create settlements in these areas, but they had introduced feral hogs to Florida, whose impacts on vegetation can be significant. Hog-rooted soil is still a fairly common sight in the Preserves; managers regularly hire local residents to trap and remove these animals. By the 1850s, open-range cattle grazing was common in both Preserves, and this continued until 1947, when fence laws were enacted. Grazing continued at Tiger Creek until 1957, when the area west of the Preserve was converted to citrus groves. At Saddle Blanket, grazing continued in the scrublands until the 1970s; westernmost areas of this Preserve had been converted to pasture and are still being grazed.

One of the earliest recorded owners of the land that now includes Tiger Creek Preserve was Consolidated Land Co., or Consolidated Tomoka, which owned large tracts of Lake Wales Ridge land in the early 1900s. The company supplied naval stores, and although it carried out extensive turpentine extraction from longleaf pines, reportedly no turpentining was ever done at Tiger Creek. Railroad companies at that time were among the largest users of timber, and in 1906 the Atlantic Coastline Railroad Co. bought the Tiger Creek area from Consolidated as an investment in the timber resources of the land. Timber was not harvested from the Tiger Creek area until 1940, when the L.D. Mullins Lumber Co. cut most of the longleaf pine *(Pinus palustris)* in the uplands of the Preserve, leaving perhaps only two pine trees per hectare, with no replanting. Additional harvests were done by other companies in 1949 and 1950, taking remaining longleaf and some slash pines *(Pinus elliottii)*. Other than the timber harvests, Mr. Byrd asserted that the land was otherwise undisturbed. No ditches had been dug, no pesticides or fertilizers had been used, nor had any roller-chopping or root-raking been done. In the early 1960s, the Hercules Company harvested the old pine stumps for their resin, which was used as a binder in dynamite. This activity probably damaged some of the vegetation; it left some scars and depressions in the soft sand that are still visible today. In 1960, Alico, Inc. was formed as a company separate from the railroad company, to oversee the land holdings.

Mr. Byrd did not recall any large wildfires at Tiger Creek in his time, but from 1970 to 1985, Don McLean, who held a cattle and hunting lease on 324 ha of what would become the Preserve, conducted periodic controlled burns in what is now the Preserve's central highlands. Besides these burns, fires were generally suppressed in the Tiger Creek area. Mr. Byrd and Steve Morrison, the current manager of Tiger Creek Preserve, recollect two occasions of people harvesting *Osmunda* from the creek floodplain for its fiber, which was sold as a potting medium for orchids. Until the 1960s, the lands around Tiger Creek were also used by the public for hunting.

Lands now bordering Tiger Creek Preserve on the north, east, and south were largely undeveloped until the 1980s, when low-density rural housing developments were established. Citrus groves on the west side were well established by 1960.

Interest in preserving Tiger Creek began in the 1920s when Edward Bok, founder of Bok Tower Gardens (now Historic Bok Sanctuary), began efforts to acquire the property, but he gave up in 1929 when Polk County would not promise never to build a road through it. In the 1960s, interest was rekindled when Ken Morrison, director of Historic Bok Sanctuary, and Cary Bok, Edward Bok's son, convinced The Nature Conservancy of the importance of the property, and in 1971 TNC purchased the first 235 ha from Otto and Dora Pfundstein. By 1986, five additional purchases from Alico, Inc. brought the total area to 1821 ha. Additional purchases have been added since then (Figure 1-3). From 1985 to 1988 the Preserve was managed by Historic Bok Sanctuary, then TNC established a staffed office at the Preserve. Managers hope to acquire additional lands as buffers for the island-like Preserve, as development steadily encroaches upon it.

The land that became Saddle Blanket Scrub Preserve was used primarily as pasture until 1971, when Talbot Lewis purchased the land and began clearing ground for a water-park tourist attraction. The project was never completed, but significant clearing was done around the larger of the two lakes, and in the large bayhead fronting Avon Park Cutoff Road. The wetland has largely recovered, but ditches and earthworks are still apparent amid the forested growth. Logging probably never occurred in the scrub uplands because of the low commercial value of its sand pine trees *(Pinus clausa)*, but according to a local resident, a temporary logging railroad had been built through the property in 1922 for hauling logs from nearby stands. This old railroad bed still exists as a berm and ditch cutting east-west through the Preserve's uplands. In 1972, the property was bought by a south Florida company, subdivided into small lots, and named Frostproof Estates. This probably spared the property from being converted to citrus groves, and the fact that roads were never built prevented access to the lots, so no houses were ever built. The present Preserve lands, totaling 334 ha, were acquired over more than a decade by TNC starting in 1988. The original intention was to transfer all these acquisitions to the Florida Division of State Lands to be managed by the Florida Department of Environmental Protection. However, the TNC Florida Chapter decided to retain ownership of the Saddle Blanket property, and keep it as one of its Lake Wales Ridge Preserves. In 1996 the Florida Cabinet approved canceling its option to purchase Saddle Blanket, allowing the Conservancy to retain it as a Preserve. Ownership of a 36 ha segment that was previously transferred to the State of Florida in 1992 was transferred back to the Conservancy after it decided to keep the property. All surrounding lands today are agricultural. Uplands to the north and east, probably formerly scrub and sandhill habitats, have been in citrus production for decades, and lower lying lands to the west and south are cattle pastures. A 40 ha area bordering the south of the Preserve features scrub degraded by grazing, which still harbors some listed endemic plant species that are found in the Preserve. This area is being considered for acquisition.

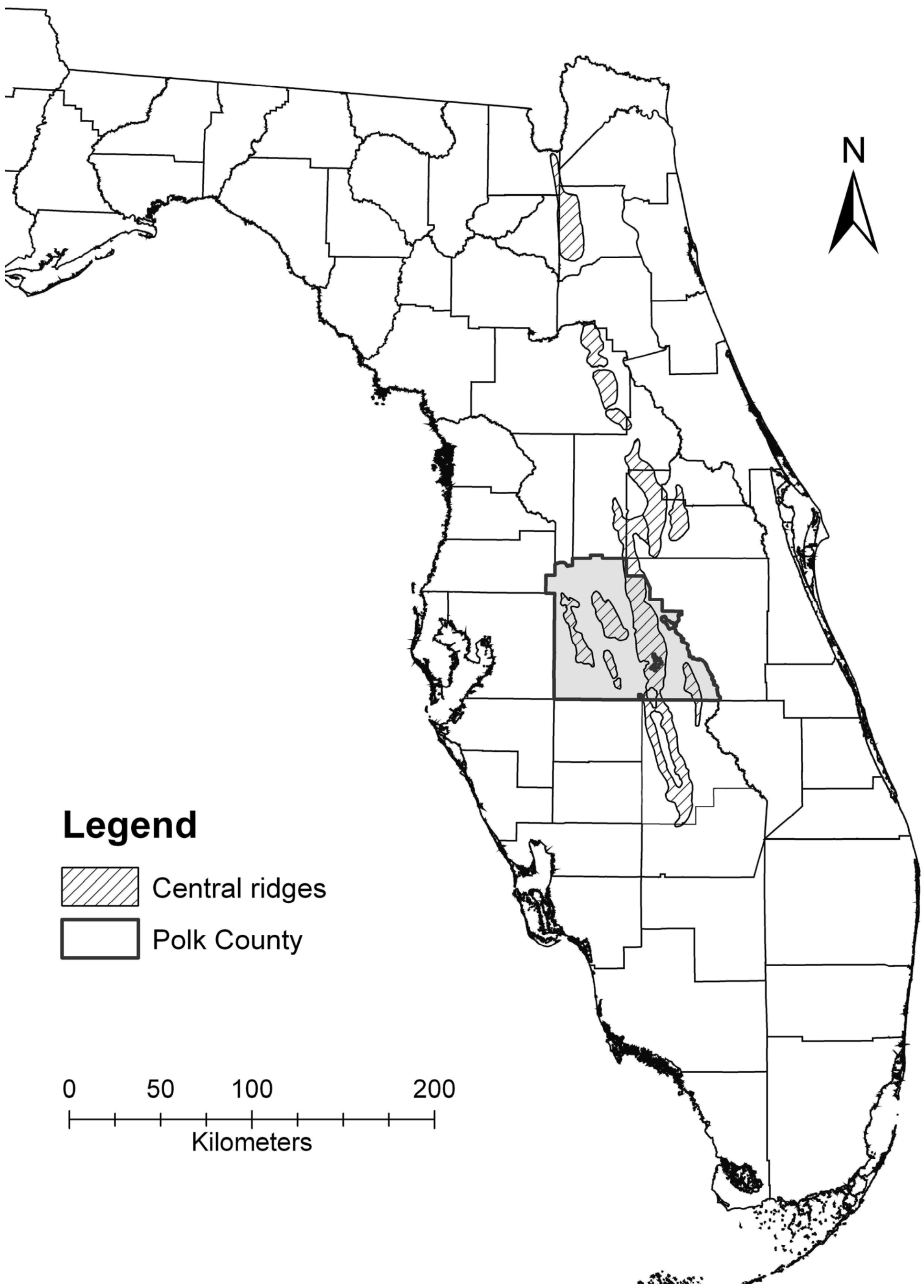

Figure 1-1. Peninsular Florida, showing the central ridge system and Polk County. (Data source: Florida Geographic Data Library: http://www.fgdl.org/).

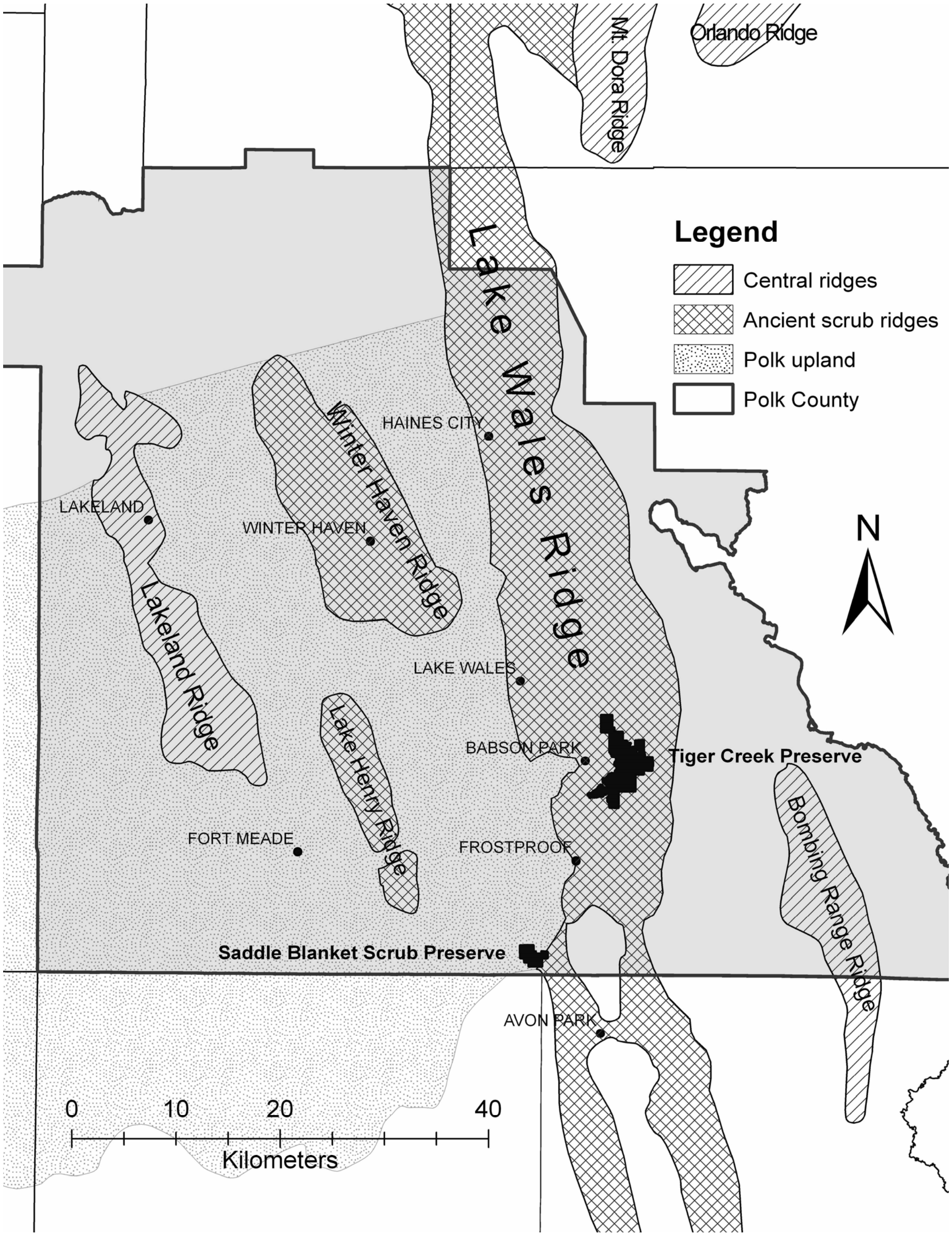

Figure 1-2. Polk County area, showing the Polk Upland, ridges, and locations of Tiger Creek and Saddle Blanket Preserves. (Data source: Florida Geographic Data Library – http://www.fgdl.org/).

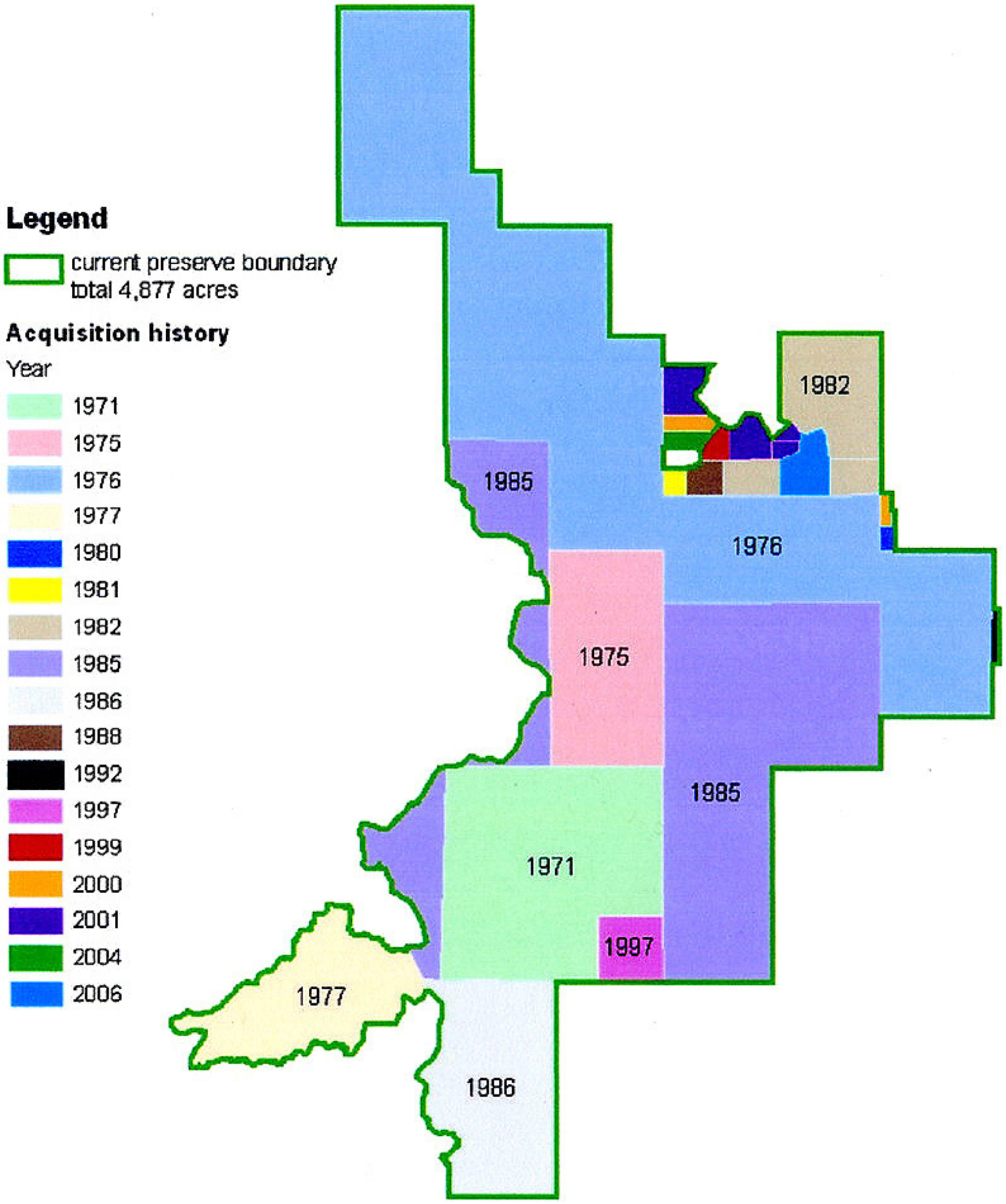

Figure 1-3. Tiger Creek Preserve acquisition map (TNC 2006a).

CHAPTER 2
PLANT COMMUNITIES

What exactly is a plant community? Early in the 20th century, F. E. Clements propounded the idea of the plant community as a tightly integrated, well-defined entity which, like an organism, is born, lives, and dies through the process of succession, along a predictable trajectory, to a predictable end-point or climax, "having an ontogeny and phylogeny that can be…experimentally studied" (Clements 1936, p. 17). The cooperative interrelationships among the species making up a Clementsian community work together to give the community a distinct set of emergent properties, and the boundaries of the species' ranges equal the boundary of the community (Gurevitch et al. 2002). In counterpoint was the view of H.A. Gleason, who believed that plant communities are simply aggregations of individual plants; each plant species has its own environmental tolerances and responses, and its presence in the community is governed by chance events (Gleason 1917). The properties of a Gleasonian community are simply the aggregate of the properties of the individuals that make it up, and its boundaries are indistinct, the ranges of its individual species being independent of each other (Gleason 1926).

Work since the mid 20th century has tended to vindicate Gleason in certain respects, but not in others. Curtis and McIntosh (1951) mapped vegetation in Wisconsin, showing that species do appear to be distributed individualistically according to their tolerances, making community boundaries often indistinct, as Gleason thought. Other work, however, supports the idea that communities are more than just the Gleasonian sums of their constituent species. Interactions among these species may lend certain properties to the community. For example, fire-dependent associations like Florida's grassy longleaf pine sandhills appear to have emergent properties influenced by the flammability of some of their member species (see Kerr et al. 1999; Mutch 1970). Yet, studies of pollen records from lake bottoms (*e.g.,* Davis 1981, 1983; Watts 1980) show that plant species that occur together today did not necessarily occur together in the past, supporting Gleason's individualistic view of communities. While definable associations of species do sometimes exist and can persist over time, and can even display emergent properties, the communities we see today are clearly snapshots in time, and frequently intergrade. Our various designations of them are likely arbitrary, but useful, human constructs.

These human constructs are never more useful than when they are put to the service of conservation. Recognizing that conservation is often more effective when focused on communities rather than individual species, The Nature Conservancy makes extensive use of the U. S. National Vegetation Classification (USNVC), a vegetation-based system the Conservancy helped to develop (Maybury 1999). This system draws together information on ecosystems and rare species compiled by groups at state and local levels, one of which is the Florida Natural Areas Inventory (FNAI). Managers of Tiger Creek and Saddle Blanket Preserves, more or less following FNAI's Guide to the Natural Communities of Florida (1990), recognize the following major plant communities at Tiger Creek: sandhill, xeric hammock, scrubby flatwoods, yellow sand scrub, mesic flatwoods, wet flatwoods, bayhead, floodplain forest, depression marsh, and seepage slope (TNC 2006a) (Figure 2-1). At Saddle Blanket, the following communities are recognized: scrub, sandhill, xeric hammock, scrubby flatwoods, mesic flatwoods, bayhead, depression marsh (wet prairie), seepage slope, sandhill upland lake, and disturbed areas (TNC 2006b; Figure 2-2). In this study, I have generally adhered to these designations, with some additions and modifications as will be seen below. My descriptions of the communities are based on FNAI (1990), various authors, and my own field observations.

Upland Communities

The upland communities at Tiger Creek and Saddle Blanket Preserves are where many rare and/or endemic taxa are found, thus most management is focused on their maintenance or restoration. These communities are scrub, scrubby flatwoods, flatwoods, sandhill, and xeric hammock. All of these are affected in one way or another by fire.

Fire caused by lightning is the most common natural disturbance in Florida's upland habitats, shaping and maintaining their composition and structure (Menges et al. 1993; Reinhart and Menges 2004). Disturbance has often been seen as upsetting to a stable ecosystem, creating chaos and initiating the process of succession (Clements 1936). Certain communities, however, rapidly recover their pre-fire composition after a burn; few if any invasive or disturbance-loving species arrive. Thus fire does not initiate succession in the Clementsian sense; rather, it is the absence of fire that leads to successional changes in this kind of plant community (Abrahamson 1984). These communities are pyrogenic associations, historically maintained by natural fires. Each kind of pyrogenic community depends for its continued persistence on an optimal range of fire intensities and fire-return intervals to which it has become uniquely adapted. Of the upland habitats at both Preserves, scrub, scrubby flatwoods, flatwoods, and sandhill are pyrogenic and managed using fire. (Xeric hammock on the Preserves is considered by managers to be successional to the other three habitats due to the longtime absence of fire; these areas are being aggressively managed for restoration to one of these other upland habitats.) Natural fires are patchy and variable, creating a diversity of fire regimes across the landscape to which the various communities, along with their unique species, are adapted (Menges 2007). Based on this understanding, managers of both Preserves have drafted elaborate fire management plans (Peterson 2006; TNC 2006c), with the aim of ensuring the persistence of the unique species on the Preserves whose fire requirements are diverse and often narrow. Plant communities on both Preserves were overgrown at the time of acquisition due to decades of fire suppression. By 2007, most upland areas and adjacent wetlands on both Preserves had received prescribed burning with the aim of preserving, or in many cases restoring, these habitats. It should be noted that the current appearance of the plant communities on these Preserves (with the exception of areas of creek floodplain habitat) has been shaped to a great extent by more than two decades of prescribed burning.

Complex interactions of fire patterns, soils, elevation, hydrology, and species dispersal characteristics cause these upland communities to occur in an intricate mosaic. Where one community grades into another, ecotones and seemingly "hybrid habitats" can occur, which defy attempts to characterize them. This is particularly true at Tiger Creek, where a patchwork of upland and wetland, created by the undulating terrain of an ancient dune and swale system, has probably caused historical irregularities in the frequency and intensity of natural fires (Christman 1988b; Myers and Boettcher 1987). These peculiarities will be discussed in the community descriptions below.

Scrub

Scrubs generally are xeromorphic communities dominated by sclerophyllous shrubs that lack a groundcover of grasses or herbs (Christman 1988a). Florida scrubs and scrubby flatwoods, in terms of their vegetation structure, relationships with fire, and life history characteristics of their plant species, are similar to dry shrublands in other parts of the world, such as chaparral in California, and the fynbos of South Africa (Menges and Kohfeldt 1995). Scrubs, once more extensive in Florida than they are today, occupy droughtier areas of the inland sand ridge system, as well as some coastal dune environments. Ocala National Forest features the largest single block of inland scrub, while the second largest, now reduced to fragments by human development, occupies the Lake Wales Ridge (Myers 1990). Although Florida scrubs vary in species composition, most of those on the Lake Wales Ridge include the following: a dense shrub layer of xerophytic evergreen oaks (*Quercus chapmanii, Q. geminata, Q. inopina,* and *Q. myrtifolia*), along with *Lyonia ferruginea*, *Lyonia fruticosa*, *Serenoa repens*, and often *Ceratiola ericoides*, with or without an overstory of *Pinus clausa* (Myers 1990). Other species often found in scrub include *Carya floridana*, *Galactia elliottii*, *Ilex opaca* var. *arenicola*, *Persea humilis*, *Rhynchospora megalocarpa*, *Sabal etonia*, *Selaginella arenicola*, *Sideroxylon tenax*, and ground lichens (especially species of *Cladonia* and *Cladina*). Open patches of bare sand are common, and herbs and grasses are sparse if present at all.

Florida scrubs are remnants of a xeric habitat that was more widespread in the geological past, when climate was drier and water tables lower (Christman 1988a). Over the last 5000 years, as climate moistened, water tables rose, and lightning-caused fires became more common, the range of scrub has contracted, becoming fragmented, existing today as patches in a complex mosaic of vegetation types (Myers 1990). The large number of endemic plant and animal species in Florida scrub suggest that it is an ancient association. There are 56 endemic plant species found in Florida scrub; some 45 of these are listed, either federally or by the state, as endangered or threatened (Stout 2001). Scrubs on the Lake Wales, Lake Henry, and Winter Haven Ridges in Polk and Highlands Counties contain the highest number of endemic plant species of any Florida scrub; many of these endemics occur only on these three ridges, thus these scrubs, about 200 in number, are referred to as ancient scrubs (Christman 1988a; Christman and Judd 1990). Other scrubs can be called pioneer scrubs, presumably being younger and thus lacking the slow-dispersing ancient endemic species (Christman 1988a). Since no single scrub contains all of the rare species, and no one rare species occurs in all the scrubs, many patches must be preserved in order to prevent the extinction of these taxa (Christman and Judd 1990). Saddle Blanket Preserve is part of a small number of protected areas where ancient scrubs are found. Tiger Creek Preserve has only pioneer scrubs (Christman 1988b).

Scrub soils are deep, well-drained, nutrient-poor sands, either white sand (*e.g.,* Archbold series, as at Saddle Blanket,), or yellow sand (*e.g.,* Astatula series, as at Tiger Creek, which also supports sandhill vegetation). Most ancient scrubs are white sand scrubs, rarely sharing species with sandhills, while yellow sand scrubs are more likely to be pioneer scrubs, often with some species in common with sandhills (Christman 1988a, 1988b). It was once thought that these vegetation differences were due to differences in fertility between the two soils, but research by Kalisz and Stone (1984) on sandy upland soils in Ocala National Forest failed to find any such differences. Myers (1990) suggested that white sands are just yellow sands that have been bleached by leaching of rainwater made more acidic by leaf litter in scrubs; in sandhills such acidic leaf litter is burned off in frequent ground fires and cannot build up as it can in scrub, whose fires are infrequent. Thus, a deeper white sand substrate may indicate that the site has supported scrub for a longer period of time than one with yellow sand.

Scrubs depend on fire for their persistence. The relatively non-flammable scrub vegetation burns when the fuel load is sufficient, at an interval now thought to be from 15 – 30 years for white sand scrubs (rosemary scrubs), 5 – 12 years for yellow-sand scrubs (oak-hickory scrubs), and 8 – 16 years for scrubby flatwoods (Menges 2007). The fires can be catastrophic, top-killing all vegetation. Scrub plants have various life-history strategies in response to fires. Most of the shrub layer resprouts from extensive root systems, while other species regenerate from seeds; *Ceratiola ericoides* and some of the woody and herbaceous rare endemics have seed banks in the soil, while *Pinus clausa* regenerates from fire-induced seed release from serotinous cones (Menges and Kohfeldt 1995). Without fire, *Ceratiola ericoides* and the short-lived *Pinus clausa* eventually fail to regenerate, as do certain rare endemic plants, which require fire-cleared bare sand patches, and the habitat becomes a xeric hammock dominated by mixed evergreen oaks

(Menges et al. 1993; Myers 1990; Peroni and Abrahamson 1986). Scrubs often occur in the fire shadows of wetlands; natural fires usually spread to scrubs from more flammable adjacent vegetation, such as sandhills, flatwoods, or grassy depressions (Christman 1988a). Fires burn somewhat unevenly in scrubs with many open sandy patches, helping maintain a mosaic of patchiness in the vegetation.

Scrub is the predominant vegetative community at Saddle Blanket Scrub Preserve, occupying most sites between 38-41 m above mean sea level, covering about 198 ha, a large percentage of the entire preserve area (TNC 2006b). Of this total area, Preserve managers designate 32 ha as sand pine or rosemary-oak scrub, and 158 ha as scrubby flatwoods (TNC 2006c). *Pinus clausa* is widely scattered over much of the area; fires and hurricanes have thinned what was once a denser overstory. Subtle changes in elevation, and thus hydrology, affect the shrub composition of scrubs (Christman 1988a). At higher elevations, where water table is deep, are areas referred to as rosemary-oak scrub (denoted as scrub in Figure 2-2). Here, shrubs are somewhat widely spaced and often dwarfed, and open bare sandy patches are abundant. Frequent species include *Carya floridana, Ceratiola ericoides, Ilex opaca* var. *arenicola, Lyonia fruticosa, Persea humilis, Quercus chapmanii, Q. geminata, Q. inopina, Q. myrtifolia, Sabal etonia,* and *Sideroxylon tenax*. Less frequent are *Asimina obovata*, *Chionanthus pygmaeus*, *Conradina brevifolia*, *Licania michauxii*, *Lyonia ferruginea, Mimosa quadrivalvis* var. *floridana, Opuntia humifusa,* and *Serenoa repens. Prunus geniculata* (an endemic) is encountered only rarely. Ground cover is sparse, and includes *Cnidoscolus stimulosus, Dichanthelium chamaelonche* subsp. *breve, Euphorbia polyphylla, Galactia elliottii*, *Lechea deckertii, Paronychia americana, Polygonella polygama, Rhynchospora megalocarpa, Selaginella arenicola, Sisyrinchium xerophyllum, Stipulicida setacea* var. *setacea,* and ground lichens. Non-native taxa are rarely encountered. Scattered about in open sandy patches, and earning these high elevation areas the designation of ancient scrub, are the scrub endemics *Asclepias curtissii, Bonamia grandiflora*, *Crocanthemum nashii, Crotalaria avonensis*, *Hypericum cumulicola*, *Lechea cernua, Liatris ohlingerae*, *Paronychia chartacea*, *Polygonella basiramia,* and *P. myriophylla.* Many of these endemics, as well as *Ceratiola ericoides,* are restricted to bare-sand gaps, which are created and maintained mainly by fires (Hawkes and Menges 1996). Along a gradient toward lower elevations, closer to the water table, shrub vegetation becomes more dense, with a greater abundance of *Lyonia fruticosa* and *Serenoa repens,* and often *Bejaria racemosa*, *Ilex glabra, Lyonia lucida*, *Smilax auriculata, Vaccinium darrowii, V. myrsinites*, and *Vitis rotundifolia*. Many of the dominant shrubs in these areas, such as sclerophyllous oaks, blueberries, and *Lyonia* spp., are resprouters and clonal spreaders, which aggressively close any open sandy patches (Menges and Kohfeldt 1995), hence these areas generally lack the rare scrub endemics and *Ceratiola ericoides.* Christman (1988a) calls these areas "low scrubs," but Preserve managers designate much of this as scrubby flatwoods (Figure 2-2).

At Tiger Creek Preserve, the only type of scrub recognized by managers is yellow sand scrub, in patches totaling about 5.7 ha. This is considered a pioneer scrub as it lacks the rare endemics found at Saddle Blanket. Christman (1988a) thought that some of Tiger Creek's scrublike vegetation was old pioneer scrubs succeeding to xeric hammock due to fire exclusion. Christman and others have noted that yellow sand scrub could also be seen as intermediate between scrub and sandhill, possessing some species found in sandhill but rarely in white sand scrub, including the endemic taxa *Clitoria fragrans, Eriogonum longifolium* var. *gnaphalifolium,* and *Polygala lewtonii*, species that are actually more typical of ecotonal habitats than of either scrub or sandhill (Christman 1988a, 1988b; USFWS 1996). Also characteristic of ecotones are the endemics *Chionanthus pygmaeus, Nolina brittoniana*, and *Prunus geniculata* (Christman 1988b). Yellow sand scrubs at Tiger Creek (see Figure 2-1) feature a dense shrub layer dominated by *Quercus geminata, Q. myrtifolia,* and *Serenoa repens,* with abundant *Carya floridana* and widely scattered *Pinus clausa*. Other frequent species include *Callicarpa americana*, *Diospyros virginiana*, *Garberia heterophylla, Osmanthus megacarpus, Sideroxylon tenax, Vaccinium stamineum,* and *Vitis rotundifolia*. Less frequent are *Clitoria fragrans, Opuntia humifusa, Persea humilis, Rhus copallinum*, and *Rhynchospora megalocarpa.* Christman (1988a) observed that scrubs often form ecotones with xeric hammock, in which *Chionanthus pygmaeus, Ilex ambigua,* and *Osmanthus megacarpus* are abundant. There are areas on the Preserve that fit this description quite well.

Besides yellow sand scrub, other scrublike vegetation on Tiger Creek Preserve is placed by managers in the scrubby flatwoods category, after consultations with scientists at Archbold Biological Station (TNC 2006a). My own observations suggest that "scrubby flatwoods" tends to be a rather flexible category. For example, certain scrublike areas in the far eastern part of the Preserve near the creek appear more like overgrown pioneer scrubs than scrubby flatwoods, resembling the extensive sand pine dominated scrub forests found in Ocala National Forest. These areas feature the frequent occurrence of species such as *Carya floridana, Ilex opaca* var. *arenicola, Persea humilis,* and *Sabal etonia,* along with sclerophyllous oaks, and a fairly dense canopy of *Pinus clausa.* Chasteen (1982) surveyed areas of "sand pine scrub forest" just southeast of this part of the Preserve, and reported these species plus *Bonamia grandiflora,* an endemic species found in both white sand and yellow sand scrubs, and *Nolina brittoniana* and *Polygala lewtonii,* endemic species found in scrubs and sandhills and their ecotones. Currently, Preserve managers consider the areas described above as scrubby flatwoods, and they are designated as such on the vegetation map (Figure 2-1). Community designation of such areas is problematic and probably somewhat arbitrary, given the intergrading nature of scrub, scrubby flatwoods, and sandhill. Although it is beyond the scope of this study to re-draw the Preserve vegetation maps, I believe further study of scrublike vegetation could bring some finer resolution to a currently somewhat catch-all concept of scrubby flatwoods.

Scrubby Flatwoods

Preserve managers consider scrubby flatwoods to be a type of scrub, although Myers (1990) speaks of it as a form of flatwoods, illustrating the fact that it has characteristics of both, often occurring as an ecotone between the two. This category, as used at Tiger Creek, can be seemingly arbitrary and somewhat of a catch-all, including habitats that are ecotones or "hybrids" between scrubs, sandhills, and flatwoods. Managers consider it to be the most common shrub-dominated habitat at both Tiger Creek (166 ha) and Saddle Blanket (158 ha). Scrubby flatwoods occur on deep well-drained sandy soils but with the water table higher than that of scrub or sandhill, and consist of a shrubby understory of moderate to high density that includes species typical of both scrub and mesic flatwoods, with or without a scattered pine overstory (FNAI 1990; Myers 1990). At Tiger Creek, much of the scrubby flatwoods is ecotonal between depression marshes or flatwoods, and higher elevation sandhills, and is dominated by sclerophyllous oaks (*Quercus chapmanii, Q. geminata, Q. inopina, Q. myrtifolia*)*, Lyonia fruticosa, Lyonia lucida, Serenoa repens, Vaccinium myrsinites,* and *V. darrowii*. Less frequent are *Bejaria racemosa, Garberia heterophylla, Gaylussacia nana, Licania michauxii,* and *Quercus minima.* A scattered overstory of pines (either *Pinus elliottii, P. palustris, or P. clausa*) may or may not be present. Herbaceous ground cover is sparse and patchy, and may include *Aristida stricta*, *A. purpurascens, Andropogon* spp.*, Lechea deckertii, Palafoxia feayi, Pityopsis* *graminifolia,* and *Smilax auriculata.* The rare endemic annual herb *Warea carteri* is found mainly in scrubby flatwoods at Tiger Creek.

At Saddle Blanket, many areas designated as scrubby flatwoods could also be thought of as "low scrubs" as defined by Christman (1988a). I have described these above, under the scrub category. Management for scrubby flatwoods is similar to that of scrub, including prescribed burning to simulate a natural fire interval of 8 – 16 years. Scrubby flatwoods burns more frequently than "high" scrub due to the higher shrub density, with fewer open sandy gaps, allowing fires to carry somewhat more evenly through the habitat. Some of what is currently xeric hammock at Tiger Creek may have been scrubby flatwoods prior to decades of fire exclusion.

Sandhill

Sandhill, also known as high pine, or longleaf pine savanna, occurs on deep, well-drained yellow sand soils, often on the tops and slopes of ridges. It is a pyrogenic savanna-like community whose most classic form is dominated by a scattered overstory of *Pinus palustris,* and deciduous oaks such as *Quercus laevis* and *Q. incana*, with *Q. geminata* occurring singly or in clonal "oak domes," a grassy ground cover of *Aristida stricta* (wiregrass), and a great diversity of herbs (FNAI 1990).

In contrast to scrubs, whose high-intensity fires are infrequent due to the relative non-flammability of their shrub-dominated vegetation, sandhills are adapted to low-intensity ground fires occurring roughly every one to five years (Reinhart and Menges 2004). Historically these fires were caused by lightning, and most likely also by human beings. The dense flammable carpet of wiregrass, herbs, and fallen pine needles provides the perfect fuel for this kind of fire, which keeps the shrub layer sparse, giving the habitat an open, parklike aspect, and providing bare mineral soil for the germination of pine seeds (Myers 1990).

Not all sandhill communities conform exactly to the “classic” pattern of scattered pines with grassy ground cover. One common variant is known as “turkey oak barrens”, in which pines are few or absent, wiregrass ground cover is sparse and patchy, and the dominant overstory tree is *Quercus laevis*. In many cases this arrangement undoubtedly resulted from removal of pines by logging after which pines failed to regenerate, but some turkey oak barrens are probably natural (Myers 1990). Of the150 ha of sandhill at Tiger Creek Preserve, very little is classic sandhill; much of it is turkey oak barrens or shrubby ecotonal “hybrids” between sandhill, scrub, or scrubby flatwoods, or is becoming dominated by *Quercus geminata* and beginning to look more like xeric hammock than sandhill. Logging of longleaf pines from the preserve in the 1940s, along with a history of cattle grazing, feral hog rooting, and fire suppression, has no doubt helped shape these habitats, but much of their current appearance is probably the natural consequence of the intricate mosaic of undulating uplands and swales creating a historically variable fire and ecotone pattern in the area (Christman 1988a). Characterizing the sandhills at Tiger Creek is thus difficult, and choosing the state to which to restore and manage them may be somewhat arbitrary.

At Tiger Creek, the few areas of “classic” sandhill have the typical structure, with scattered *Pinus palustris*, *Quercus laevis, Q. geminata,* and in some areas *Q. incana,* with abundant wiregrass, and species such as *Chamaecrista fasciculata*, *Croton argyranthemus*, *Garberia heterophylla, Licania michauxii, Opuntia humifusa, Pityopsis graminifolia, Polanisia tenuifolia, Pteridium aquilinum* subsp. *pseudocaudatum*, *Quercus minima, Stillingia sylvatica*, *Stylisma villosa*, *Tephrosia chrysophylla, Tragia urens, Yucca flaccida,* and the rare endemic *Clitoria fragrans.* Grasses are abundant, and include *Andropogon floridanus, A. glomeratus* var. *glomeratus, A. ternarius* var. *cabanisii, A. virginicus* var. *decipiens, Aristida stricta, A.*

purpurascens, A. condensata, Muhlenbergia capillaris, Piptochaetium avenacioides, Schizachyrium scoparium, Sporobolus junceus, and *Tridens flavus.* Sedges include *Bulbostylis ciliatifolia, B. warei, Cyperus retrorsus, C. croceus,* and *Rhynchospora megalocarpa.* Less frequent are *Asclepias humistrata*, *Berlandiera subacaulis*, *Carphephorus corymbosus*, *Dalea carnea, D. feayi, D. pinnata, Lespedeza hirta, Liatris tenuifolia, Lygodesmia aphylla, Physalis arenicola*, *P. walteri,* and *Rubus cuneifolius.* Areas of turkey oak barrens and other ecotonal sandhills include many of these species, but scattered much more sparsely, with frequent areas of relatively bare ground. Christman (1988a) noted that certain rare endemic species are actually more common in ecotones and "hybrid" sandhill than they are in classic sandhill or scrubs, and these do occur in such habitats at Tiger Creek (*e.g., Clitoria fragrans, Eriogonum longifolium* var. *gnaphalifolium, Nolina brittoniana, Polygala lewtonii,* and *Prunus geniculata).*

At Saddle Blanket, the few hectares of sandhill remnants present are severely overgrown, appearing in two separate areas, featuring a few longleaf pines and turkey oaks, with sand pines and scrub vegetation mixed in with patches of wiregrass and a few sandhill herbs. Their appearance resembles changes in sandhill due to longtime fire exclusion as described in a study by Myers and White (1987), suggesting that sandhill vegetation once existed there. Several endemic, mostly scrub, species are found in these places, including *Bonamia grandiflora, Chionanthus pygmaeus, Conradina brevifolia, Ilex opaca* var. *arenicola, Paronychia chartacea, Polygonella myriophylla,* and *Prunus geniculata.*

Longleaf pine sandhills once covered approximately 37 million hectares across southeastern North America, but human encroachment has reduced this ecosystem to about 3% of its original range, making it one of the most endangered habitats in the world (Condon and Putz 2007; Landers et al. 1995). Managers of the Preserves place a high priority on restoring and maintaining sandhill, with the hope that some of today's xeric hammock and turkey oak barrens could be restored to a more classic longleaf pine and wiregrass association. They are using prescribed springtime restoration fires and manual tree removal to reduce the dominance of *Quercus geminata* in xeric hammocks that were once sandhills, and prescribed fires every three to ten years in other sandhill areas (TNC 2006a).

Xeric Hammock

Xeric hammock is an oak-dominated hardwood forest occurring on deep, well-drained sandy soils (FNAI 1990). "Hammock," a term meaning hardwood forest, has been in use in the southeastern United States for at least a century (Harper 1905). The species composition of xeric hammocks varies, and depends on how the association formed. It has long been understood that sandhill and scrub vegetation, in the long-term absence of fire, will succeed to a form of xeric hammock dominated by *Quercus geminata* and other oaks (Abrahamson et al. 1984; Menges et al. 1993; Myers 1985). On the Lake Wales Ridge, the shift to xeric hammock from sandhill or scrub is mostly just a shift in dominance, rather than a qualitative change in species composition; *Quercus geminata* is already part of these ecosystems, and without fire it can attain tree size, forming an overstory that partially shades out understory vegetation (Menges et al. 1993). Preserve managers list 210 ha of xeric hammock at Tiger Creek, and 34 ha at Saddle Blanket (TNC 2006a, 2006b). At Tiger Creek, there is an overstory of *Quercus geminata* with a variable understory of scattered low shrubs and sparse grasses, whose species composition suggests in most cases a sandhill origin. Preserve managers consider most of this acreage to be overgrown sandhill, not a separate community in its own right, and are actively working to remove the oak overstory through fire and mechanical means. The goal is to convert most of it to sandhill and scrubby flatwoods, from which it is presumed derived. At Saddle Blanket, some of the xeric hammock features a closed canopy of mature *Quercus geminata, Q. virginiana,* along with some sand pines that have invaded, with a very sparse understory including *Serenoa repens* and a few scattered grasses, and is assumed to be successional to sandhill and scrub.

Mesic Flatwoods

Pine flatwoods, considered the most widespread natural Florida ecosystem, occurs on low, flat ground, on poorly drained, acidic sandy soils often underlain by a relatively impermeable hardpan layer which creates conditions for standing water during wet periods (Abrahamson and Hartnett 1990). Flatwoods are a pyrogenic association, with a fire return interval of one to five years (FNAI 1990). Flatwoods often occur in zones of transition between wetter habitats such as swamps and marshes, and drier ones such as scrubby flatwoods, sandhills, and scrub (Myers 1990). Following FNAI (1990), preserve managers recognize two kinds of pine flatwoods: mesic and wet, whose species composition varies due to hydrological differences.

Mesic flatwoods at Tiger Creek (258 ha) and Saddle Blanket (24 ha) feature an open overstory of *Pinus palustris* (on slightly higher elevations) or *Pinus elliottii,* with an understory dominated by shrubs such as *Serenoa repens, Ilex glabra, Lyonia lucida, L. fruticosa, Vaccinium myrsinites, Quercus minima,* and *Myrica cerifera* var. *pumila.* Certain of these flatwoods areas tend to have a relatively abundant herb and grass cover, including *Aristida stricta, A. purpurascens, A. spiciformis, Andropogon brachystachyus, A. glomeratus* var. *glaucopsis, A. virginicus, Dichanthelium* spp., *Paspalum setaceum, Schzachyrium scoparium, Sporobolus floridanus;* various sedges, including *Cyperus retrorsus, C. croceus, Rhynchospora ciliaris, R. pineticola, R. plumosa, Scleria triglomerata,* and *S. reticularis;* herbs including *Asclepias pedicellata, Galactia elliottii, Piloblephis rigida, Pterocaulon pycnostachyum, Sabatia brevifolia, S. difformis,* and in a few cases, the rare endemic *Panicum abscissum* (cutthroat grass). At Tiger Creek, most of the mesic flatwoods understory is dominated by dense thickets of *Serenoa repens*, and sometimes abundant *Rubus argutus* and *Vitis rotundifolia,* while herbs and grasses are sparse or absent. This condition is probably due to a history of grazing, logging, and hog-rooting, followed by long-term fire exclusion, as well as perhaps nutrient runoff from citrus groves on the west side of the Preserve. Where flatwoods are adjacent to wetlands, fire exclusion resulted over the decades in the encroachment of bayhead hardwood vegetation into considerable portions of the flatwoods, a successional pattern documented in similar habitats by Menges et al. (1993). Preserve managers have introduced prescribed burning, which has eliminated the bayhead species, opening up the flatwoods. However, once hardwoods have invaded, they may cause changes that compromise the integrity of the hardpan soil, altering the hydrology, making it possibly difficult for these flatwoods to recover their pre-alteration composition (Abrahamson and Hartnett 1990).

Lowland Communities

Lowland communities occur at both Tiger Creek and Saddle Blanket Preserves. At Tiger Creek they are quite extensive due to the vast floodplain areas surrounding the creek system. They include wet pine flatwoods, bayhead, seepage slope, depression marsh (or wet prairie), floodplain forest, and blackwater stream.

Wet Flatwoods

At Tiger Creek, at lower elevations on the west side of the preserve and bordering creek floodplain areas near the confluence of Tiger and Patrick Creeks, are about 31 ha of wet flatwoods, characterized by a variably dense canopy of *Pinus elliottii*. Presumably because it is more often flooded, the understory lacks palmettos, but often supports some bayhead species such as *Gordonia lasianthus*, *Magnolia virginiana*, and *Persea palustris*, with scattered shrubs including *Ilex glabra, Lyonia ligustrina* var. *foliosiflora*, *L. lucida, Myrica cerifera* var. *cerifera,* and a variable ground cover of *Osmunda cinnamomea*, *Woodwardia virginica*, *Polygala rugelii, Rhexia mariana,* and a few sedges and grasses, including *Cyperus retrorsus, Eleocharis* *baldwinii, Scleria triglomerata, Andropogon glomeratus* var. *glaucopsis, Aristida spiciformis, Dichanthelium* spp., and *Sporobolus floridanus*.

Bayhead

A bayhead, or baygall, is a forested, acidic, peat-filled seepage wetland located at the base of sandy slopes (FNAI 1990). Tiger Creek has 65 ha, and Saddle Blanket has 16 ha, of bayheads. The dominant tree species of these bayheads, forming a dense canopy, are the evergreen broadleaved *Gordonia lasianthus* and *Magnolia virginiana,* with a subcanopy of *Ilex cassine* and *Persea palustris*. Scattered shrubs include *Itea virginica, Myrica cerifera* var. *cerifera, Vaccinium corymbosum,* and *Viburnum nudum,* with a ground cover dominated by ferns (*Blechnum serrulatum, Osmunda cinnamomea, O. regalis, and Woodwardia virginica*). In more open areas, one can find *Peltandra saggitifolia, P. virginica,* and a few sedges including *Eleocharis baldwinii, Rhynchospora fascicularis,* and *Scleria triglomerata. Tillandsia setacea, T. simulata,* and *T. utriculata* are common epiphytes on tree trunks. Around the edges, *Rhododendron viscosum, Smilax laurifolia, Gelsemium sempervirens,* and *Vitis rotundifolia* may be found. Bayheads are seasonally inundated, fed by seepage from surrounding uplands, and most of the time they are too wet to burn, so their fire interval is long, on the order of 50-100 years (FNAI 1990). Their hydrology is dependent on the surficial water table; there is some concern that continued water withdrawals from deeper aquifers by surrounding land uses, especially citrus irrigation, could endanger the bayhead community (TNC 2006b). Preserve managers are using prescribed fire to burn into the bayheads, as long as they remain wet enough to prevent smoldering peat fires which could permanently damage their vegetation, thus keeping bayhead species from invading surrounding habitats (TNC 2006a, 2006b).

Seepage Slope

A seepage slope is an acidic open wetland at the base of a sandy slope, fed by seepage so that it is saturated but seldom inundated (FNAI 1990). Species composition can vary between shrubby and grassy. These habitats at Tiger Creek and Saddle Blanket are dominated by the rare endemic *Panicum abscissum* (cutthroat grass), along with a few other graminoids (*e.g., Andropogon glomeratus, Aristida stricta, Rhynchospora fascicularis, Scleria triglomerata,* and *Xyris ambigua*), and are called cutthroat seeps, a type of seepage slope found only in the region of the Lake Wales Ridge (TNC 2006a; FNAI 1990). These wetlands are very small and few in number at the Preserves, comprising less than 2 ha. Managers are using prescribed growing-season fires every one to four years, which stimulate cutthroat grass to bloom and prevent invasion of shrubs. Hog rooting is a problem in these areas. Monitoring over several years has shown that cutthroat grass does not readily recolonize hog-rooted areas, suggesting that such damage is long lasting. Hog-rooted cutthroat seeps often become dominated by *Lachnanthes caroliana.* Some of the cutthroat seeps at Tiger Creek have been fenced to exclude hogs.

Depression Marsh

Depression marshes (also known as ephemeral ponds, or wet prairies) are shallow, somewhat rounded depressions in sandy soils, characterized by grassy and herbaceous vegetation in concentric bands, with soil organic matter increasing toward the center, inundated with water for 50 to 200 days per year (FNAI 1990). Tiger Creek Preserve has 40 ha of depression marshes, most occupying swales between dunes in the undulating uplands of the preserve. Saddle Blanket has about 4.9 ha of depression marshes. At Tiger Creek, typical species include an outer ring of *Serenoa repens,* then a broad area of graminoids, including *Amphicarpum muhlenbergianum, Coelorachis tuberculosa, Cyperus lecontei, Fimbristylis puberula, Fuirena scirpoidea, Panicum hemitomon, Rhynchospora cephalantha, R. ciliaris, R. chapmanii, R. fascicularis, R. latifolia,* *Scleria reticularis, Xyris brevifolia, X. elliottii,* and *X. ambigua.* Herbs are diverse, and include *Aletris lutea, Drosera capillaris, Eriocaulon decangulare, Lachnanthes caroliana, Lachnocaulon beyrichianum, L. minus, Lycopodiella alopecuroides, L. appressa, Pinguicula pumila, Pluchea baccharis, P. foetida, Polygala cymosa, P. rugelii, P. nana, Proserpinaca pectinata, Rhexia petiolata, Sabatia grandiflora,* and *Syngonanthus flavidulus.* There are usually a few scattered shrubs, including *Cephalanthus occidentalis, Hypericum fasciculatum,* and *H. myrtifolium. Panicum abscissum* also occurs in a few depression marshes at Tiger Creek. In one particular depression marsh, near some flatwoods south of the preserve's undulating central highlands, I found the endemic species *Hartwrightia floridana* and *Lilium catesbei*. At Saddle Blanket, the depression marshes are similar, but less rich in species.

Floodplain Wetlands

Floodplain wetlands comprise by far the largest proportion of Tiger Creek Preserve, occupying more than 971 ha, surrounding the creek system. This category is a complex patchwork of floodplain wetland types considered as an aggregate for purposes of this study because of the difficulty of access for surveying and characterizing in detail its various aspects. It most closely resembles "blackwater floodplain forests" as described by Ewel (1990). In those areas I visited and surveyed, it appears that vast portions of these floodplains are forested and swampy, supporting swamp and bottomland forest vegetation and experiencing inundation for substantial periods each year. In certain areas of the floodplain, charring on *Sabal palmetto* trunks indicates that fire has reached these areas at times in the past. A few areas of slightly higher elevation, especially around the steeper edges of the wetland, have a more or less narrow band of drier forests, which resemble mesic hammocks. The floodplain is bordered by large swaths of pine flatwoods on the west side of the preserve, and south and east of the confluence of the two creeks. There are also some more open areas supporting a more marsh-like vegetation.

Before the hurricanes and unusual flooding of 2004 and 2005, these open areas were few, but afterwards, in considerable portions of the floodplain, the whole aspect changed. Many trees were blown down by the hurricanes, and the flooding lasted long enough to essentially drown the forest in places. These areas present a jumble of fallen trees with newly opened gaps, and herbaceous colonizing vegetation is rampant, making passage difficult in the mucky terrain.

The nature of future changes in the floodplain habitat will depend on rainfall patterns in the coming decades. Aerial photos from 1922 show that a huge area around the creek confluence was grassy marsh, possibly a *Cladium jamaicense* (sawgrass) marsh; today there are still scattered patches of *Cladium jamaicense* in the forest understory. There is one area of intact sawgrass marsh northeast of Tiger Creek near the Red Gum Trail area. Preserve managers have speculated that continued decades of high water may favor the return of sawgrass marsh over large areas, whereas a return to dry conditions will favor re-establishment of forested wetlands. Differences in hydroperiod, fire frequency, and soil organic matter accumulation all have effects on the species makeup of swampy wetlands (Ewel 1990). Preserve managers want to study these wetlands further to clarify the relative importance of such factors before crafting specific management plans for the floodplains. Currently, prescribed fire is used to burn into the edges of the wetlands to encourage development of healthy ecotones (TNC 2006a).

In the lower lying areas, typical canopy species include *Acer rubrum*, *Liquidambar styraciflua*, *Magnolia virginiana Nyssa biflora*, *Pinus elliottii, Quercus nigra*, *Q. laurifolia, Sabal palmetto*, and *Ulmus americana.* Subcanopy and shrub species include *Baccharis halimifolia, Cephalanthus occidentalis*, *Cornus foemina*, *Ilex cassine, Itea virginica, Persea palustris, Sambucus nigra* subsp. *canadensis,* and *Viburnum nudum.* At slightly higher elevations, species such as *Ampelopsis arborea, Asimina parviflora, Callicarpa americana,* *Carya glabra, Diospyros virginiana, Gelsemium sempervirens, Prunus serotina, Psychotria nervosa, P. sulzneri, Quercus virginiana, Rhododendron viscosum, Rubus argutus, Sabal minor, Serenoa repens, Smilax bona-nox, S. laurifolia, S. pumila, S. walteri, Toxicodendron radicans,* and *Vitis rotundifolia* are found. There is one area near the Red Gum Trail area north of Tiger Creek with a population of *Rhapidophyllum hystrix*, which is not common on the Lake Wales Ridge. Herbaceous species, some becoming more abundant in recently opened areas, include *Apios americana, Arisaema triphyllum, Boehmeria cylindrica, Encyclia tampensis* (epiphytic), *Eupatorium capillifolium, Habenaria odontopetala, Hypericum hypericoides, H. mutilum, Hydrocotyle umbellata, H. verticillata, Ludwigia lanceolata, L. leptocarpa, L. peruviana, L. repens, Mikania scandens, Peltandra virginica, P. sagittifolia, Persicaria punctata, P. hydropiperoides, Saururus cernuus,* and the ferns *Blechnum serrulatum, Dryopteris ludoviciana, Nephrolepis exaltata, N. cordifolia, Osmunda cinnamomea, O. regalis, Thelypteris interrupta, T. kunthii ,Woodwardia virginica,* and *W. areolata.* Grasses and sedges include *Arundinaria gigantea, Carex comosa, C. vexans, Chasmanthium laxum, Cyperus tetragonus, C. virens, Dichanthelium* spp., *Echinochloa muricata, Eleocharis baldwinii, Oplismenus hirtellus, Panicum rigidulum* subsp. *rigidulum, P. hemitomon, Rhynchospora corniculata, R. fascicularis, R. miliacea, Sacciolepis striata, Scirpus cyperinus, Scleria triglomerata, S. muhlenbergii, Setaria magna, Tripsacum dactyloides,* and *Urochloa maxima.* Epiphytic bromeliads (*e.g., Tillandsia setacea, T. simulata, T. usneoides,* and *T. utriculata)* are common in places. The dominant canopy species varies from place to place, with *Magnolia virginiana* in some places, and *Acer rubrum,* or *Sabal palmetto,* in others.

Blackwater Stream

Tiger Creek is a blackwater stream originating in deep sandy lowlands where extensive wetlands with organic soils collect and store water, discharging it slowly. The water is teacolored with dissolved tannins (FNAI 1990), and its acidity and dark color inhibit growth of submersed aquatic vegetation. Emergent and floating plants are common, however, in the shallower places and near the banks. Typical species are *Azolla caroliniana, Cephalanthus occidentalis, Cicuta maculata, Eichhornia crassipes, Eleocharis baldwinii, Hydrocotyle umbellata, H. verticillata, Landoltia punctata, Lemna aequinoctialis, Ludwigia peruviana, Micranthemum glomeratum, Nuphar advena, Persicaria hydropiperoides, P. punctata, Pontederia cordata, Sagittaria lancifolia, S. latifolia, Salvinia minima,* and *Typha domingensis.* Exotic invasive species seen in and along the creeks include *Eichhornia crassipes, Ludwigia peruviana,* and the possibly native and often invasive *Pistia stratiotes.*

Tighe (1987) considered the creek system relatively undisturbed (by humans), although nutrient runoff from surrounding lands, especially citrus groves around Lake Patrick, the source of Patrick Creek, may be having an impact on water quality.

Ruderal

There are few disturbed (ruderal) areas at Tiger Creek; they include the Preserve boundaries, and a small stretch of roadsides where Murray and Pfundstein Roads cut through the preserve. Various common roadside weeds are found here, as well as most occurrences of certain invasive exotic pest plants. Roadside weeds include such species as *Bidens alba, Desmodium incanum, Emilia fosbergii, E. sonchifolia, Gomphrena serrata, Lantana camara, Medicago lupulina, Oxalis corniculata, Paspalum notatum, Richardia brasiliensis, Salvia lyrata, Spermacoce remota, Zeuxine strateumatica,* and others (see Chapter 4), most of which are not found within the preserve. Invasive exotic species that are being actively monitored and eradicated when possible include *Abrus precatorius, Imperata cylindrica, Lygodium japonicum, L. microphyllum, Melaleuca quinquenervia, Melinis repens*, *Schinus terebinthifolius,* and

Solanum viarum. With the exception of *Imperata cylindrica,* which is spotted occasionally within the preserve, these species are mainly found along its edges.

At Saddle Blanket, disturbed areas include the Preserve edges and certain areas recently used as cattle pasture. Species of the edges are many of the same ones found on Tiger Creek roadsides, and within the Preserve are some non-native grasses such as *Eremochloa ophiuroides, Melinis repens,* and *Paspalum notatum*. With the exception of *Imperata cylindrica* and *Melinis repens,* which are found occasionally, the Preserve interior appears to be relatively free of non-native or ruderal species.

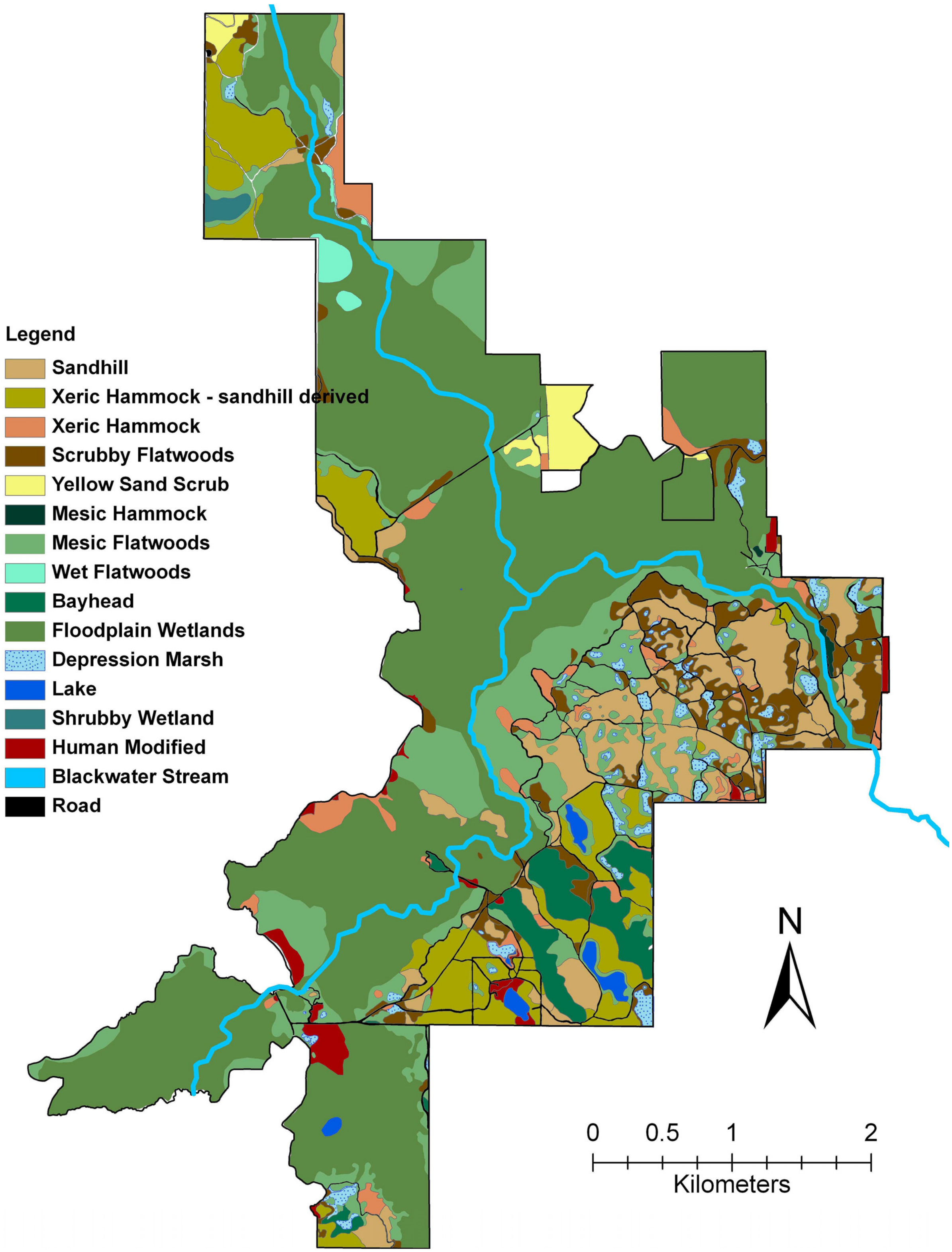

Figure 2-1. Vegetation map of Tiger Creek Preserve (Data source: The Nature Conservancy2007).

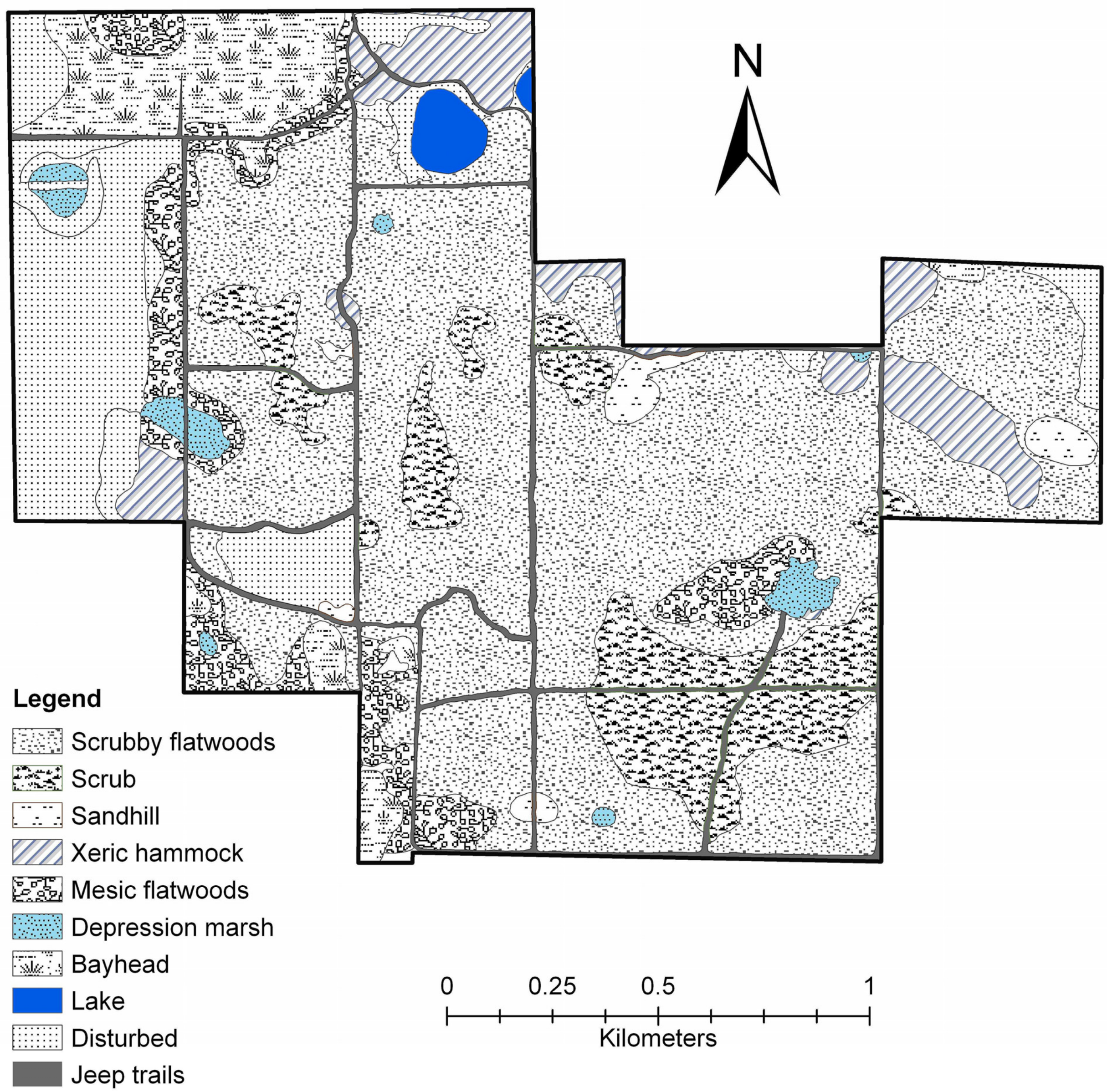

Figure 2-2. Vegetation map of Saddle Blanket Scrub Preserve (Data source: The Nature Conservancy 2007).

CHAPTER 3
FLORISTIC METHODS AND RESULTS

Methods

Field work was conducted in Tiger Creek and Saddle Blanket Scrub Preserves from September 2004 to February 2008. Aerial photos, along with vegetation maps prepared by preserve staff, were used to ensure adequate coverage of plant communities. A compass and handheld global positioning unit were of great assistance in marking points where plant collections were made, and in navigating areas of difficult access. Most upland and adjacent wetland areas on Tiger Creek and Saddle Blanket Preserves are crisscrossed by jeep trails, from which access is relatively easy by foot and all-terrain vehicle (ATV). From these trails, numerous forays and transects were initiated into and through surrounding areas. Where accessible, Tiger Creek Preserve's extensive boundaries were traversed by ATV and on foot, with transects and forays into areas of interest. Tiger Creek's vast floodplain wetlands were sampled by walking, often with great difficulty, from wetland edges toward the creeks in numerous locations. The creeks themselves were too choked with fallen trees to allow passage of a canoe or kayak, so sampling was done by walking along the creek banks for distances of varying length as the terrain permitted.

Plant specimens were prepared following standard field and herbarium techniques (*e.g.,* Judd et al. 2008), and vouchers were deposited in the University of Florida Herbarium (FLAS). Plants were identified using primarily Wunderlin and Hansen (2003), Tobe et al. (1998), Hall (1978), the University of South Florida Plant Atlas website (Wunderlin and Hansen 2004), as well as keys in the Flora of North America volumes (Flora of North America Editorial Committee 1993-2007). Recent taxonomic revisions were consulted when appropriate, as cited in the species list (Chapter 4).

Results

From the combined areas of both preserves, 554 species or subspecific taxa of vascular plants were documented, representing 306 genera and 112 families. Of these species or subspecific taxa, 18 are ferns, 3 are lycophytes, 3 are conifers, and 530 are angiosperms. Of this total, Tiger Creek Preserve yielded 520 taxa, in 303 genera and 112 families, while Saddle Blanket yielded 242 taxa, in 160 genera and 76 families. The largest families, in terms of total number of species or subspecific taxa from both Preserves, are Poaceae (74 taxa), Asteraceae (63 taxa), Fabaceae (39 taxa), Cyperaceae (36 taxa), Ericaceae (16 taxa), Euphorbiaceae and Fagaceae (13 taxa each), Rubiaceae (12 taxa), Polygonaceae (11 taxa), Hypericaceae and Onagraceae (10 taxa each), and Lamiaceae, Plantaginaceae, and Rosaceae (8 taxa each). The largest genera are *Rhynchospora* (15 taxa), *Andropogon* (13 taxa), *Quercus* (13 taxa), *Hypericum* (10 taxa), *Ludwigia* and *Dichanthelium* (9 taxa each), *Polygala* (7 taxa), *Asclepias, Panicum,* and *Smilax* (6 taxa each), and *Chamaesyce, Cyperus, Eupatorium, Polygonella,* and *Tillandsia* (5 taxa each).

Taxa of Special Interest or Concern

Quite a number of species or subspecific taxa found on these preserves are of special interest or concern: 37 taxa are at or near the southern or northern limits of their ranges relative to their distributions in Florida; 24 taxa are new Polk County records, having never been vouchered in the county before; 54 taxa are non-native to Florida. Fifty-five taxa are endemic to Florida, of which 27 are listed as endangered or threatened in Florida, while 18 are federally listed as endangered, threatened, or of special management concern. These taxa are discussed in detail below.

Taxa at the limits of their ranges: Today's scientific consensus is that global climate is rapidly warming, that human activity is likely a major cause, and that one effect of this climate change is that the ranges of many plant species will be altered in the coming centuries (Field et al 2007). Meta-analyses have documented significant poleward range shifts of many species in the last century, and although other factors besides climate affect species distribution, the fingerprint of climate change is now considered unmistakable (Lavergne et al 2006; Parmesan and Yohe 2003). Throughout geological history, vegetation has migrated in response to changes in climate, but those changes typically occurred at a much slower rate than the rapid pace being observed today and projected for the future, suggesting that plant species will face unprecedented challenges (Davis and Shaw 2001). Conservation of rare species may therefore require human intervention as ranges shift and old habitats become unsuitable (Maschinski et al. 2006). For these reasons, information on range limits is important.

Wunderlin and Hansen (2004) was used to determine species ranges in Florida. For purposes of this study, taxa at the limit of their ranges reach to Polk County from the north or the south, but no further. Taxa near their range limits occur no more than two counties to the north or south of Polk County. Non-native taxa are marked with an asterisk.

Five taxa are at their southern limits: *Albizia julibrissin**, *Arundinaria gigantea, Croton argyranthemus, Eryngium prostratum,* and *Hieracium gronovii.* Twenty-eight taxa are near their southern limits: *Andropogon glomeratus, Arnoglossum floridanum, Aronia arbutifolia, Asclepias humistrata, Asimina pygmaea, Clematis reticulata, Dalea pinnata, Eriogonum tomentosum, Garberia heterophylla, Gaylussacia nana, Gelsemium sempervirens, Gratiola virginiana, Krameria lanceolata, Lespedeza hirta, Lycopodiella alopecuroides, Lyonia ferruginea, Lyonia ligustrina* var. *foliosiflora, Peltandra saggitifolia, Persicaria hirsuta, Prunus serotina, Prunus umbellata, Quercus incana, Rhapidophyllum hystrix, Rhododendron viscosum, Rumex hastatulus, Smilax glauca, S. walteri,* and *Viburnum nudum.* One taxon, *Croton glandulosus* var.

floridanus, is at its northern limit. Three taxa, *Carphephorus odoratissimus var. subtropicanus, Euphorbia polyphylla,* and *Melaleuca quinquenervia*,* are near their northern limits.

New records for Polk County: Twenty-four taxa are Polk County records: *Albizia julibrissin*, Andropogon tracyi, Arundinaria gigantea, Catalpa bignonioides, Chamaecrista nictitans, Chamaesyce ophthalmica, Cucumis anguria*, Desmodium floridanum, Elephantopus carolinianus, Landoltia punctata*, Lechea minor, Matelea floridana, Melochia spicata, Mimosa strigillosa, Oplismenus hirtellus, Paspalum urvillei*, Polygala polygama, Pyrostegia venusta*, Quercus minima, Rhynchospora scirpoides, Sabal minor, Smilax walteri, Sporobolus jacquemontii*,* and *Verbena brasiliensis*.* For one study to produce so many new county records suggests that floristic work in this part of Florida is as yet incomplete.

Taxa non-native to Florida: Fifty-four taxa found in the Preserves are non-native to Florida. Many of these are considered invasive (FLEPPC 2007), and Preserve staff are actively working to control and eradicate some of them (*Abrus precatorius, Imperata cylindrica, Lygodium microphyllum, Melaleuca quinquenervia, Rhyncheletrum repens,* and *Solanum viarum).* Most of these exotics are found mainly around the Preserve boundaries, although *Solanum viarum* and *Lygodium microphyllum* are also found deep within the floodplain wetlands, and *Imperata cylindrica* is found occasionally in the Preserve interior. Also subject to these control efforts, but not collected in this study, are *Dioscorea bulbifera*, *Lygodium japonicum*, *Schinus terebinthifolius,* and *Sorghum halepense*. Other exotic species considered invasive but not being actively treated at this time are *Albizia julibrissin, Alternanthera philoxeroides, Lantana camara, Ludwigia peruviana, Momordica charantia, Nephrolepis cordifolia, Urochloa maxima,* and *Urena lobata.* One non-native species, *Pyrostegia venusta,* was collected at Tiger Creek, then subsequently, as far as is known, eradicated. *Pistia stratiotes,* an invasive species listed in this study as native (see Wunderlin and Hansen 2003), is considered non-native by some experts (FLEPPC 2007). For additional non-native taxa found naturalized on the Preserves, see Chapter 4, where all non-native taxa are denoted by an asterisk in front of the species name.

Taxa endemic to Florida: Fifty-five taxa found on Tiger Creek and Saddle Blanket Preserves are endemic to Florida. Twenty-seven of these are restricted to Florida peninsular scrubs or scrub/sandhill ecotonal habitats (Table 3-1). Of these 27 taxa, 15 are restricted to Florida's central ridges, especially to the ancient scrubs on the Lake Wales, Lake Henry, and Winter Haven Ridges (Christman and Judd 1990). Of these, nine species are restricted to four or fewer counties: *Clitoria fragrans, Conradina brevifolia, Crotalaria avonensis, Hypericum cumulicola, Liatris ohlingerae, Polygonella basiramia, P. myriophylla, Prunus geniculata, and Ziziphus celata.* The remaining 28 taxa are Florida endemics not restricted to scrubs (Table 3-2). Of all 55 endemics, 27 are listed as endangered or threatened in Florida, and 18 are listed federally as endangered, threatened, or of management concern (Coile and Garland 2003; USFWS 2007; see Tables 3-1 and 3-2). One of these species, *Ziziphus celata,* was not found growing naturally on either of the Preserves, but it is being deliberately re-introduced at Tiger Creek as part of a recovery effort in an experimental framework.

Six species found on the Preserves are considered nearly endemic, with at least 90% of their distribution being within Florida's state boundaries: *Andropogon floridanus, A. brachystachyus, Callisia ornata, Palafoxia integrifolia, Pinus clausa,* and *Sisyrinchium xerophyllum* (Muller et al. 1989).

Six non-endemic species found on the Preserves are protected by listings at the state level: *Coelorachis tuberculosa* – threatened; *Tillandsia utriculata* – endangered; and *Encyclia* *tampensis, Osmunda cinnamomea, O. regalis,* and *Rhapidophyllum hystrix* – commercially exploited (Coile and Garland 2003).

Endemism on Florida's Ancient Sand Ridges

Of all the abovementioned taxa of special interest, the endemics are remarkable for their sheer numbers in such a small study area. Florida, as a whole, contains numerous endemic plant species; why this is so has been the subject of much study over the years. Harper (1949), tabulating the discoveries of botanists since colonial times, attributed 427 endemics to Florida. A more recent study suggests a figure of 235 endemic vascular species, and 40 nearly endemic, with ranges extending slightly beyond Florida's political boundaries (Muller et al. 1989). Harper (1949) attributed Florida's high endemism to three characteristics that make it unique: first, it is a peninsula; second, it projects southward to where there are no large land masses nearby with similar climate; and third, it features sandy soils unlike those of the continent to the north. Florida's endemic species are concentrated in three distinct areas or hotspots: the Apalachicola Bluffs and other areas in the panhandle, the subtropical tip of the peninsula, and the Lake Wales Ridge (Ward 1979). The degree of endemism in the Lake Wales Ridge area is high by continental standards, exceeded only by islands such as Hawaii (Chaplin et al. 2000; Christman 1988a). Thus it is no surprise that a survey of Tiger Creek and Saddle Blanket Preserves should turn up so many endemics.

Human beings are generally fascinated with rare things, so it follows that it is the narrow endemics, the rare plants, which often capture the interest of botanists and lay people alike (Kruckeberg and Rabinowitz 1985). Ward (1979) recognized 170 Florida species as rare, and noted that many are becoming rarer due to habitat loss as humans encroach upon the land. Florida scrubs are high in endemics, especially those on the Lake Wales, Lake Henry, and Winter Haven Ridges (Christman and Judd 1990). Stout (2001) identified 56 endemics associated with Florida scrubs, 48 of which he considered rare. Of Stout's 48 rare scrub species, 21 are found on Tiger Creek and Saddle Blanket Preserves (these are the first 21 taxa listed in Table 3-1). Ward et al. (2003) used a variety of criteria to rank Florida's threatened and endangered plants in terms of rarity, giving each species a numerical rating between one (most rare) and 12 (least rare). Of the species at Tiger Creek and Saddle Blanket for which such a rating was given (see Tables 3-1 and 3-2), most fall somewhere along the less-rare half of the scale (6.0 or greater), except for *Ziziphus celata* (1.5), *Clitoria fragrans* (3.5), *Crotalaria avonensis* (4.5), *Polygala lewtonii* (4.5), and *Liatris ohlingerae* (5.5).

An endemic, be it narrow or broad, is simply a species of limited or restricted distribution (James 1961). Mason (1946) points out that all plant species have their areas restricted to some extent by various conditions, and are thus, in some sense, endemics. But it is the narrow endemics that catch people's attention. A variety of factors work to define the limits of the area that a given species can occupy. Mason (1946) emphasized the importance of an individual plant's responses to environmental factors, as determined by its genetic makeup. Environmental parameters, such as climate and edaphic (soil) factors, are geographically distributed. Edaphic factors can occur in small, localized, sharply defined areas, which can limit the range of a species whose tolerances are narrow (Mason 1946). Historical factors are also important to understanding endemism. For example, changes in climate and sea level over geological time can shrink or expand habitats, affecting the distribution of species (Woodson 1947; James 1961). Stebbins (1942) stressed the importance of population genetics, observing that narrowly endemic rare species often lack genetic variability and thus cannot adapt to a wide variety of niches as can a more genetically variable, widespread species. Yet noting, decades later, that rarity or commonness of a species appears to have no correlation with genetic variability, Stebbins (1980) advocated, in his gene pool / niche interaction theory, a synthetic approach that considers environmental, genetic, and historical factors. No one factor alone can account for endemism.

Habitat specialization is often cited as a factor in rarity and narrow endemism (Maliakal-Witt et al. 2005). Kruckeberg and Rabinowitz (1985) asserted that perhaps the ultimate cause of rarity and narrow endemism are geological processes that create fractionated landscapes with numerous discrete habitats and unusual environmental characteristics. Florida, of course, has undergone many such processes (see Chapter 1), which have altered its climate and landforms through time, shaping features like the Lake Wales Ridge, whose deep, infertile sands were characterized by Mulvania (1931, p. 424) as little more than "…a bed of silica, to which the term soil is but remotely applicable." Many narrow endemics around the world are edaphic specialists associated with peculiar soils (Kruckeberg and Rabinowitz 1985). Stout (2001) regarded many, perhaps even most, of Florida's rare endemic scrub plants as edaphic specialists, their ranges limited by the extent of the patches of peculiar soils (habitat islands) to which they are uniquely adapted. But are these soils so peculiar? Referring to the southeastern coastal plain of North America, of which Florida is a part, Sorrie and Weakley (2001, p. 69) state that "the casual observer may be inclined to consider the coastal plain devoid of many characteristics considered likely to generate evolutionary innovation. The coastal plain has few obvious geographic dividers, has very subdued topography..., is of relative geologic youth, has an absence of striking edaphic factors (such as serpentine geology), and has a relatively homogeneous climate." Yet the coastal plain contains several centers of high endemism, including those in Florida. Some of these areas, including the Fall-line sandhills of the Carolinas and Georgia, the Carrizo sands of Texas, and Florida's Lake Wales Ridge, feature deep, porous, coarse sandy soils (Sorrie and Weakley 2001). Other notable areas of high local endemism featuring deep, nutrient-poor sandy soils are the white sandlands of southwest Pinar del Rio and the Isle of Youth in Cuba (Alain 1953; Borhidi and Muniz 1986), and areas of Amazonian forest featuring white-sand patches in otherwise nutrient-rich clay soils near Iquitos, Peru (Fine et al. 2006). But in the Cuban and Amazonian examples, the white-sand areas are surrounded by very dissimilar soils, creating obvious edaphic islands. In Florida, in contrast, the soil differences are often not so great. But other factors, such as differences in fire regime, hydrology, and genetically determined predispositions of a plant, can act to limit the ability of a given species to disperse beyond a particular area. Here are some examples: Flammable longleaf pine sandhill "islands" persist in Ocala National Forest amid a "sea" of less flammable sand pine scrub, even though the soils differ little between the two habitats (Kalisz and Stone 1984; Myers 1985, 1990). Areas of rosemary scrub, featuring rare endemic plants that depend on bare-sand gaps, are often hemmed in by areas of slightly lower elevation where the soil is essentially identical, but the higher water table favors dense thickets of gap-closing shrubs, effectively confining the gap-dependent endemics to restricted areas (Menges and Kohfeldt 1995). And some rare scrub endemics appear to be microhabitat specialists, unable, for perhaps genetically determined reasons, to effectively colonize areas that their habitat-generalist congeners can inhabit easily (Maliakal-Witt et al. 2005). Recent work by Fine et al. (2006) has shown that herbivory, too, can be a selective force that encourages the evolution of habitat specialization. It would seem, perhaps, that although Florida's sandy upland soils may seem homogeneous, there are many factors at work, other than edaphic factors, that can create habitat islands upon which narrowly endemic species can evolve, and to which they can remain restricted.

Many of Florida's endemic species appear to be what Stebbins (1942) calls "insular species," *i.e.,* species adapted to restricted habitats (either true islands or habitat islands) that have diverged from, and are closely related to, more widespread species located on adjacent land areas. Some may be neo-endemics, having diverged from a relatively recent common ancestor, perhaps during times of high sea level when the Lake Wales Ridge likely was a refuge for populations effectively isolated from their relatives (Huck et al. 1989). A good number of the endemics found on Tiger Creek and Saddle Blanket Preserves fit this description, appearing to be specialized variants of more common southeastern North American species. These include *Asclepias curtissii* (related to *A. purpurascens,* Woodson 1954), *Chionanthus pygmaeus* (*C. virginicus,* Hardin 1974), *Conradina brevifolia* (*C. canescens,* Kral and McCartney 1991), *Crotalaria avonensis* (*C. rotundifolia,* DeLaney and Wunderlin 1989), *Hypericum cumulicola* (*H. gentianoides,* Adams 1962), *Ilex opaca* var. *arenicola* (*Ilex opaca* var. *opaca,* Wunderlin 1982), *Osmanthus megacarpus* (*O. americanus,* Hardin 1974), *Persea humilis* (*P. borbonia,* Wofford 1973), *Polygonella basiramia* (*P. ciliata,* Nesom and Bates 1984), *P. robusta* (*P. fimbriata,* Nesom and Bates 1984), *Prunus geniculata* (*P. maritima,* Shaw and Small 2005), *Quercus inopina* (*Q. myrtifolia,* Johnson and Abrahamson 1982), *Sabal etonia* (*S. palmetto,* Zona and Judd 1986 ; Zona 1990), and *Stylisma abdita* (*S. aquatica,* Myint 1966). These species, having diverged from their more widespread ancestors, have become habitat specialists. They have remained more or less isolated in their habitat islands, often being poor dispersers, and their distinctive genotypes have persisted (Zona and Judd 1986).

Historical factors, too, are an important to understanding Florida scrub endemism. Although at first glance the southeastern coastal plain flora may seem geologically young, it is probable that parts of the coastal plain have been habitable by plants since the Eocene (ca. 50 MYBP), and parts of Florida since at least the middle Miocene (Sorrie and Weakley 2001). During that immense time span, the area has had climates ranging from tropical to cool temperate, wet to dry, and has received inputs from older floras in Appalachia, the Caribbean, and western North America (Sorrie and Weakley 2001; Webb 1990). Not all Florida endemics appear to have the same biogeographic origin. Stebbins (1942) defined another kind of endemic, the "depleted species." These are species that were once more widespread, but have become rare due to shrinkage of available habitat. Such species may lack close living relatives, or else their closest relatives are disjunct and geographically distant. Also known as paleo-endemics, these species are often relics, ancient holdovers from the geological past (Stebbins and Major 1965). Certain scrub endemics found on the Preserves seem to fit this pattern, and they appear to have their closest relatives in southwestern North America. These include *Bonamia grandiflora* (Myint and Ward 1968), *Carya floridana* (Hardin and Stone 1984), *Eriogonum longifolium* var. *gnaphalifolium* (Horton 1972), *Nolina brittoniana* (Judd and Hall 1984), *Palafoxia feayi* (Turner and Morris 1976), and *Ziziphus celata* (Judd and Hall 1984; Islam and Simmons 2006). During Pleistocene glacial maxima, and probably in the Tertiary period before that, Florida was likely connected to southwestern North America by a continuous corridor of xeric habitat. As sea levels rose and climate moistened, these members of a once widespread xeric flora underwent a reduction in available suitable habitat, becoming cut off by areas of unsuitable habitat from their now far-away relatives. The Lake Wales Ridge, above sea level since at least the Pliocene, has likely served as a refugium for such plant species when much of the rest of Florida was inundated or otherwise inhospitable. Several other endemics found on Tiger Creek and Saddle Blanket Preserves were considered by James (1961) also to be possible paleo-endemics, whose distributions suggest they had been reduced to central ridge refugia during high sea-level stands, but have now expanded back somewhat from these refugia. These include *Asclepias feayi, Garberia heterophylla, Hartwrightia floridana* (a wetland species), and the genus *Phoebanthus,* comprised of two endemic Florida species, one of which, *P. grandiflorus,* is found on the preserves.

A study of insect endemism on the Florida scrub ridges (Deyrup 1990) reveals patterns similar to those seen with plants: some species have western affinities, and the highest diversity of endemics occurs on the southern Lake Wales Ridge, with endemic diversity decreasing northwards on the ridges. Changes in climate associated with glacial cooling episodes may have reduced biodiversity on the more northern parts of the peninsular ridge system.

Although people speak of rare species as genuine entities in nature, their designation depends upon taxonomic judgments made by human beings. A rare species attracts admiration and attention, as well as efforts directed toward its preservation, yet one taxonomic opinion can change its status, reducing it to a mere synonym, relegating it overnight to the quotidian obscurity of the unremarkable and commonplace. A species collected at Saddle Blanket for this study provides a case in point. *Conradina brevifolia,* first described by Shinners (1962), is one of several shrubby mints endemic to Florida scrubs. Over the decades it has enjoyed both state and federal protection as an endangered species of extremely narrow distribution (Polk and Highlands Counties). But Wunderlin (1982) included it within the more widespread and non-endemic *C. canescens,* where it remains, at the time of this writing, in certain widely consulted references (*i.e.,* Wunderlin and Hansen 2003, 2007). Despite this taxonomic ambiguity, its listed status as a protected endemic has not changed (Coile and Garland 2003; USFWS 1996, 2007). Meanwhile, systematic / phylogenetic work on Florida scrub mints supports the recognition of *C. brevifolia* as a separate species (Edwards 2007). This rare endemic scrub mint will likely keep its protected status, and its place in the public awareness. Two other rare taxa collected in this study also illustrate this issue. *Crataegus lepida,* currently included by some taxonomists within the more common *C. michauxii,* and a scrub variant of *Sideroxylon tenax,* once recognized as *Bumelia lacuum,* await further study to clarify their taxonomic status (see Chapter 4).

The existence of rare endemic species, and their evolution and persistence, are particular facets of the larger questions of evolutionary biology, so the study of rare species will continue to be important (Stebbins 1980). Molecular studies, in particular, are beginning to enrich our understanding of rare plants, and of endemism in general. Many molecular studies have been directed toward assessing genetic variability within populations of rare taxa, with an eye toward conservation planning (*e.g.,* Dolan et al. 1995; Evans et al. 2000; Lienert et al. 2002). A study of the genus *Prunus* in North America using chloroplast DNA revealed that the closest living relative of the scrub endemic *Prunus geniculata* is *P. maritima* (Shaw and Small 2005). And in a study of a type that has great potential for elucidating processes leading to endemism, Maskas and Cruzan (2000) used chloroplast DNA and phylogeographic analyses to infer historical processes leading to the diversification of a complex of morphotypes of *Piriqueta cistoides* subsp. *caroliniana* in Florida and the Bahamas. More studies such as these are needed. As human development continues to destroy the habitats of rare species, the need for systematic research becomes ever more urgent. It is hoped that this study will have contributed in some small way to that ongoing effort.

Table 3-1. Endemic vascular plant species found on Tiger Creek and Saddle Blanket preserves that are restricted to Florida peninsular scrubs or scrub/sandhill ecotones. Species marked with an asterisk are restricted to the Lake Wales, Lake Henry, and Winter Haven Ridges. Dashes indicate no listing or designation available.

		Listed status[b]			
Species	Preserve[a]	FNAI	FL	USA	Rarity[c]
Asclepias curtissii	SB	G3/S3	E	-	8.0
**Bonamia grandiflora*	TC, SB	G3/S3	E	T	7.0
**Chionanthus pygmaeus*	TC, SB	G3/S3	E	E	6.0
**Clitoria fragrans*	TC	G3/S3	E	T	3.5
**Conradina brevifolia*	SB	G2/S2	E	E	7.5
**Crotalaria avonensis*	SB	G1/S1	E	E	4.5
Eriogonum longifolium var. *gnaphalifolium*	TC, SB	G4T3/S3	E	T	8.5
Garberia heterophylla	TC, SB	-	T	-	10.0
**Hypericum cumulicola*	SB	G2/S2	E	E	7.5
Lechea cernua	SB	G3/S3	T	-	10.0
**Liatris ohlingerae*	SB	G3/S3	E	E	5.5
**Nolina brittoniana*	TC, SB	G2/S2	E	E	7.0
**Paronychia chartacea*	TC, SB	G2/S2	E	T	8.0
Polygala lewtonii	TC	G3/S3	E	E	4.5
**Polygonella basiramia*	SB	G3/S3	E	E	8.0
**Polygonella myriophylla*	SB	G3/S3	E	E	11.0
**Prunus geniculata*	TC, SB	G3/S3	E	E	8.0
**Schizachyrium niveum*	TC, SB	G1/S1	E	MC	7.0
Stylisma abdita	TC	-	E	-	7.0
**Warea carteri*	TC	G3/S3	E	E	6.5
**Ziziphus celata*	TC (intro)	G1/S1	E	E	1.5
Carya floridana	TC, SB	-	-	-	-
Ilex opaca var. arenicola	TC, SB	-	-	-	-
Osmanthus megacarpus	TC	-	-	-	-
Persea humilis	TC, SB	-	-	-	-
Quercus inopina	TC, SB	-	-	-	-
Sabal etonia	TC, SB	-	-	-	-

[a]Preserve: TC = Tiger Creek; SB = Saddle Blanket. [b]Status key: FNAI: Gx/Sx = Global and State endangerment rankings for Special Element species of the Florida Natural Areas Inventory, from 1 (critically imperiled) to 5 (demonstrably secure). T = rank for taxonomic subgroup. FL: E, T = Listed by the State of Florida as Endangered or Threatened. USA: E, T = Protected by federal law as Endangered or Threatened. MC = federally designated as being of Management Concern. (Chafin 2000, Coile and Garland 2003, Christman and Judd 1990). [c]Rarity: Numerical ratings denoting relative rarity of listed species: 1 = most rare, 12 = least rare (Ward et al. 2003).

Table 3-2. Endemic vascular plant species found on Tiger Creek and Saddle Blanket preserves that are not restricted to peninsular scrubs.

Species	Preserve[a]	Listed status[b] FNAI	FL	USA	Rarity[c]
Carex vexans					
Centrosema arenicola	TC	G2/S2	E	-	8.0
Dichanthelium chamaelonche subsp. *breve*	SB	-	-	-	-
Hartwrightia floridana	TC	G2/S2	T	-	9.0
Lechea divaricata	TC	G2/S2	E	-	7.0
Lilium catesbaei	TC	-	T	-	12.0
Matelea floridana	TC	-	E	-	7.0
Panicum abscissum	TC, SB	G3/S3	E	MC	8.5
Arnoglossum floridanum	TC	-	-	-	-
Asclepias feayi	TC	-	-	-	-
Asimina obovata	TC, SB	-	-	-	-
Asimina reticulata	TC, SB	-	-	-	-
Berlandiera subacaulis	TC	-	-	-	-
Callisia ornata	TC	-	-	-	-
Carphephorus odoratissimus var. *subtropicanus*	SB	-	-	-	-
Chapmannia floridana	TC, SB	-	-	-	-
Chrysopsis subulata	TC	-	-	-	-
Crataegus lepida	TC	-	-	-	-
Crocanthemum nashii	TC, SB	-	-	-	-
Croton glandulosus var. *floridanus*	TC	-	-	-	-
Palafoxia feayi	TC, SB	-	-	-	-
Phoebanthus grandiflorus	TC, SB	-	-	-	-
Piptochaetium avenacioides	TC, SB	-	-	-	-
Polygala rugelii	TC, SB	-	-	-	-
Polygonella robusta	TC, SB	-	-	-	-
Rhynchosia cinerea	TC, SB	-	-	-	-
Scutellaria arenicola	TC, SB	-	-	-	-
Tillandsia simulata	TC, SB	-	-	-	-

[a]Preserve: TC = Tiger Creek; SB = Saddle Blanket. [b]Status key: FNAI: Gx/Sx = Global and State endangerment rankings for Special Element species of the Florida Natural Areas Inventory, from 1 (critically imperiled) to 5 (demonstrably secure). T = rank for taxonomic subgroup. FL: E, T = Listed by the State of Florida as Endangered or Threatened. USA: E, T = Protected by federal law as Endangered or Threatened. MC = federally designated as being of Management Concern. (Chafin 2000, Coile and Garland 2003, Christman and Judd 1990). [c]Rarity: Numerical ratings denoting relative rarity of listed species: 1 = most rare, 12 = least rare (Ward et al. 2003).

CHAPTER 4
ANNOTATED LIST OF VASCULAR PLANTS

Just as this floristic inventory represents a momentary snapshot of a dynamic flux of organisms and environments, so also does its product – a list of plant names – represent a snapshot of current taxonomy, itself a somewhat dynamic and changing thing. A taxonomic classification aims for stability, for too much change would render it useless, especially for information retrieval purposes. Yet who can deny that the best system of classification is one that reflects our best understanding of phylogeny, based upon all the evidence we can muster (see Judd et al. 2008)? New evidence, especially from molecular phylogenetics, is pouring in, nudging inertia-bound plant taxonomy into a reluctant state of motion. The following species list is therefore a "frozen frame," in which I have hopefully captured a sense of our current understanding. It should be kept in mind that each species name is a taxonomic statement, representing a hypothesis of lineage delimitation among the organisms being studied, while each generic name is a hypothesis of phylogenetic relationships. As our understanding improves, species and generic names will continue to change.

For family names and circumscriptions, I have followed the Angiosperm Phylogeny Group (APG II 2003, Stevens 2007) for flowering plants. For ferns, I have followed Smith et al. (2006), and for lycophytes and gymnosperms, Kramer and Green (1990). For species names, (including common names), I have followed, wherever possible, those given in the Flora of North America (Flora of North America Editorial Committee 1993-2007). For taxa not covered in the Flora of North America, I have followed Wunderlin and Hansen (2003, 2004). In some cases I have deviated from the above authorities, citing recent (or more convincing) sources in the species list. Author abbreviations follow Brummitt and Powell (1992). Taxa are listed alphabetically by family, then by genus and species.

Each species name is followed by an author abbreviation, a preferred common name, one or more habitat designations denoting where the species occurs, an abundance designation, and specimen numbers. Habitat designations are as follows: SC (scrub, including yellow sand scrub); SF (scrubby flatwoods); SH (sandhill); XH (xeric hammock); MF (mesic flatwoods); WF (wet flatwoods); BH (bayhead); SS (seepage slope); DM (depression marsh or ephemeral pond); FP (floodplain wetlands); BW (blackwater stream); and RU (ruderal, or disturbed areas). Estimates of the abundance of each species within these communities are based upon my observations of the plants in the field, and are therefore subjective. Abundance of occurrence is denoted by the following abbreviations and numerical values: R (rare) – 1-4 occurrences; I (infrequent) – 5-9 occurrences; O (occasional) – 10-24 occurrences; F (frequent) – 25 or more occurrences; A (abundant) – when a species is dominant in its community and occurs more or less continuously throughout. Specimen numbers given are my own collection numbers except where otherwise noted. Numbers beginning with *TC* denote specimens collected at Tiger Creek; those beginning with *SB* were collected at Saddle Blanket Preserve. When a different collector's specimen is cited, the Preserve is specified by (TC) or (SB) before the specimen number. Non-native taxa are denoted by an asterisk in front of the species name.

For Tiger Creek Preserve, an unvouchered checklist of plant species was prepared in 1990, but the identity of the preparer is unknown. A number of species from that checklist were not collected in the present study and do not appear in the list below. But some of these species have been collected by others in areas near the Preserve containing comparable habitats; therefore it is reasonable to suppose that they might still occur on the Preserve. For this reason I mention them here: *Baccharis glomeruliflora* Pers., *Carphephorus paniculatus* (J.F. Gmel.) H. Hebert, *Ceanothus microphyllus* Michx., *Cirsium horridulum* Michx., *Crinum americanum* L., *Cynanchum scoparium* Nutt., *Digitaria ciliaris* (Retz.) Koeler, * *Digitaria longiflora* (Retz.) Pers., *Eryngium aromaticum* Baldwin, *Eustachys petraea* (Sw.) Desv., *Fimbristylis caroliniana* (Lam.) Fernald, *Fraxinus caroliniana* Mill., *Lachnocaulon anceps* (Walter) Morong, *Luziola fluitans* (Michx.) Terrell & H. Rob., *Orontium aquaticum* L., *Panicum dichotomiflorum* Michx., *Panicum tenerum* Beyrich ex Trin., *Paspalum praecox* Walter, *Paspalum repens* P.J. Bergius, *Pediomelum canescens* (Michx.) Rydb., *Quercus pumila* Walter, *Rhynchospora cephalantha* A. Gray, *Rhynchospora divergens* Chapm. ex M.A. Curtis, *Rhynchospora pusilla* Chapm. ex M.A. Curtis, *Rubus trivialis* Michx., *Sarcostemma clausum* (Jacq.) Schult., *Stylisma patens* (Desr.) Myint, *Thalia geniculata* L., *Thelypteris palustris* Schott, and *Vittaria lineata* (L.) Sm.

ACANTHACEAE

Ruellia carolinensis (J.F.Gmel.) Steud.: Wild petunia. SH, XH O. *TC111.*

ADOXACEAE

Sambucus nigra L. subsp. *canadensis* (L.) Bolli: Elderberry. FP, Wetland edges O. *TC044.*

Viburnum nudum L.: Possum haw. BH, FP O. *TC200, TC465, SB251, SB277, SB293.*

AGAVACEAE

Yucca flaccida Haw.: Adam's needle. SH, SC, XH F. *TC346, SB156.* (Ward 2006).

ALISMATACEAE

Sagittaria isoetiformis J.G. Sm.: Quillwort arrowhead. DM O. *TC401, SB284.*

Sagittaria lancifolia L. subsp. *lancifolia*: Bulltongue arrowhead. FP F. *TC252.*

Sagittaria latifolia Willd.: Duck potato. FP O. *TC546.*

ALTINGIACEAE

Liquidambar styraciflua L.: Sweetgum. FP F. *TC197.*

AMARANTHACEAE

* *Alternanthera philoxeroides* (Mart.) Griseb.: Alligator weed. BW I. *TC603.*

Dysphania ambrosioides (L.) Mosyakin & Clemants: Mexican tea. RU F. *TC528, SB100.*

Froelichia floridana (Nutt.) Moq.: Cottonweed. SH, RU O. *TC169, SB102.*

* *Gomphrena serrata* L.: Globe amaranth. RU F. *TC226.*

Iresine diffusa Humb. & Bonpl. ex Willd.: Juba's bush. RU O. *TC540.*

ANACARDIACEAE

Rhus copallinum L.: Winged sumac. SH, SC, MF, XH F. *TC198, SB148.*

Toxicodendron radicans (L.) Kuntze: Poison ivy. FP, XH, RU F. *TC397, SB235.*

ANNONACEAE

Asimina obovata (Willd.) Nash: Flag pawpaw. SC, SH, SF O. *TC074, SB276, SB287.*

Asimina parviflora (Michx.) Dunal: Smallflower pawpaw. FP O. *TC556.*

Asimina pygmaea (W. Bartram) Dunal: Dwarf pawpaw. SH R. *SB012.*
Asimina reticulata Shuttlew. ex Chapm.: Netted pawpaw. SH, SC F. *TC070, SB005.*

APIACEAE
Centella asiatica (L.) Urb.: Coinwort. DM, FP F. *TC406, TC500, SB225.*
Cicuta maculata L.: Water hemlock. BW, FP F. *TC191.*
Eryngium prostratum Nutt. ex DC.: Creeping eryngo. FP I. *TC387.*
Oxypolis filiformis (Walter) Britton var. *filiformis*: Water dropwort. FP I. *TC445.*
Ptilimnium capillaceum (Michx.) Raf.: Mock bishopsweed. FP O. *TC386.*

APOCYNACEAE
Asclepias curtissii A. Gray: Curtiss's milkweed. SC, SF F. *SB046.*
Asclepias feayi Chapm. ex A.Gray: Florida milkweed. SH I. *TC112.*
Asclepias humistrata Walter: Sandhill milkweed. SH I. *TC509.*
Asclepias pedicellata Walter: Savannah milkweed. MF I. *SB294.*
Asclepias tomentosa Elliott: Velvetleaf milkweed. SH I. (TC) *Abbott 22681.*
Asclepias tuberosa L.: Butterfly milkweed. SH, XH O. *TC106, SB105.*
* *Catharanthus roseus* (L.) G. Don: Madagascar periwinkle. RU O. *TC524.*
Matelea floridana (Vail) Woodson: Florida milkvine. XH O. *TC218, TC249.*

AQUIFOLIACEAE
Ilex ambigua (Michx.) Torr. var. *ambigua*: Sand holly. SC, XH O. *TC133, TC258, SB049.*
Ilex cassine L.: Dahoon holly. FP, BH F. *TC012, SB174.*
Ilex glabra (L.) A.Gray: Gallberry. MF, WF, DM F. *TC029, SB038, SB078.*
Ilex opaca Aiton var. *arenicola* (Ashe) Ashe: Scrub holly. SC F. *TC476, SB144.*

ARACEAE
Arisaema triphyllum (L.) Schott: Jack-in-the-pulpit. FP I. *TC557.*
* *Landoltia punctata* (G. Mey.) Les & D.J. Crawford: Dotted duckweed. BW, FP F. *TC552.* (Les and Crawford 1999).
Lemna aequinoctialis Welw.: Lesser duckweed. BW, FP F. *TC569, SB265.*
Peltandra sagittifolia (Michx.) Morong: Spoonflower. FP O. *TC503.*
Peltandra virginica (Michx.) (L.) Schott: Green arum. FP O. *TC392.*
Pistia stratiotes L.: Water lettuce. BW O. *TC547.* [Experts disagree as to whether this species is native or introduced. William Bartram (1791) observed well-established populations in Florida.]

ARALIACEAE
Hydrocotyle umbellata L.: Marsh pennywort. DM O. *TC499, SB298.*
Hydrocotyle verticillata Thunb. var. *verticillata*: Whorled marsh pennywort. FP O. *TC422.*

ASTERACEAE
Ageratina jucunda (Greene) Clewell & Wooten: Hammock snakeroot. XH, SH O. *TC351.*
Ambrosia artemisiifolia L.: Ragweed. RU F. *TC166.*
Ampelaster carolinianus (Walter) G.L. Nesom: Climbing aster. FP O. *TC349.*
Arnoglossum floridanum (A. Gray) H. Rob.: Florida Indian-plantain. SH O. *TC174.*
Baccharis halimifolia L.: Groundsel tree. DM, RU, Wetland edges F. *TC031, TC459.*
Balduina angustifolia (Pursh) B.L. Rob.: Honeycomb-head. SH, XH F. *TC007, SB203.*

Berlandiera subacaulis (Nutt.) Nutt.: Greeneyes. SH O. *TC120.*
Bidens alba (L.) DC. var. *radiata* (Sch. Bip.) R.E. Ballard ex Melchert: Beggarticks. RU F. *TC227.* (Ballard 1986).
Bidens laevis (L.) Britton et al.: Bur marigold. FP O. *TC430.*
Bidens mitis (Michx.) Sherff: Smallfruit beggarticks. DM I. *SB250.*
Carphephorus corymbosus (Nutt.) Torr. & A. Gray: Florida paintbrush. SH, XH F. *TC018, SB186.*
Carphephorus odoratissimus (J.F. Gmel.) H. Hebert var. *subtropicanus* (DeLaney et al.) Wunderlin & B.F. Hansen: False vanillaleaf. MF R. *SB215.*
Chrysopsis scabrella Torr. & A. Gray: Coastalplain goldenaster. SH O. *TC451.*
Chrysopsis subulata Small: Scrubland goldenaster. MF I. *TC523.*
Cirsium nuttallii DC.: Nuttall's thistle. RU O. *TC381.*
Conyza canadensis (L.) Cronquist var. *pusilla* (Nutt.) Cronquist: Dwarf horseweed. RU F. *TC019, SB142.* (Nesom 1990).
Eclipta prostrata (L.) L.: False daisy. FP, RU O. *TC202.*
Elephantopus carolinianus Raeusch.: Carolina elephant's foot. FP I. *TC309.*
Elephantopus elatus Bertol.: Tall elephant's foot. SH, XH F. *TC206, SB121.*
* *Emilia fosbergii* Nicolson: Florida tasselflower. RU O. *TC442, SB161.*
* *Emilia sonchifolia* (L.) DC.: Lilac tasselflower. RU O. *TC224.*
Erechtites hieraciifolius (L.) Raf. ex DC. var. *hieraciifolius*: Fireweed. FP, DM, MF F. *TC352, SB032, SB220.*
Erigeron quercifolius Poir.: Oakleaf fleabane. RU F. *TC383.*
Erigeron vernus (L.) Torr. & A. Gray: Early whitetop fleabane. DM I. *TC403.*
Eupatorium capillifolium (Lam.) Small ex Porter & Britton: Dog-fennel. DM, FP, RU F. *TC348, SB224.*
Eupatorium compositifolium Walter: Yankeeweed. SH O. *TC371, SB205.*
Eupatorium leptophyllum DC.: False fennel. DM I. *TC013, SB211.*
Eupatorium mohrii Greene: Mohr's thoroughwort. MF, DM O. *TC093, SB306.*
Eupatorium rotundfolium L. var. *rotundifolium*: Roundleaf thoroughwort. DM, MF I. *TC254, SB209.*
Euthamia caroliniana (L.) Greene ex Porter & Britton: Flattop goldenrod. DM, MF, SH F. *TC021, SB222.*
Gamochaeta antillana (Urban) Anderberg: Narrowleaf everlasting. DM I. *TC426.*
* *Gamochaeta pensylvanica* (Willd.) Cabrera: Pennsylvania everlasting. FP I. *TC491.*
Gamochaeta purpurea (L.) Cabrera: Purple cudweed. FP I. *TC471.*
Garberia heterophylla (W. Bartram) Merr. & F. Harper: Garberia. SH, SC, XH F. *TC027.*
Hartwrightia floridana Gray ex S. Wats.: Florida hartwrightia. DM O. *TC336.*
Helianthus angustifolius L.: Swamp sunflower. MF I. *TC338.*
Heterotheca subaxillaris (Lam.) Britton & Rusby subsp. *subaxillaris*: Camphorweed. RU I. *SB204.*
Hieracium gronovii L.: Queen-devil. SH R. *SB187.*
Hieracium megacephalon Nash: Coastalplain hawkweed. SH I. *TC071, SB145, SB279.*
Krigia virginica (L.) Willd.: Virginia dwarf dandelion. MF R. *TC378.*
Liatris chapmanii Torr. & A. Gray: Chapman's blazing star. SH O. *TC242.*
Liatris ohlingerae (S.F. Blake) B.L. Rob.: Scrub blazing-star. SC F. *SB111.*

Liatris laevigata Nutt.: Blazing star. SH, XH F. *TC005, TC294, SB185.*
Liatris tenuifolia Nutt.: Blazing star. SH, XH O. *TC315.*
Lygodesmia aphylla (Nutt.) DC.: Rose-rush. SH O. *TC347, SB289.*
Mikania scandens (L.) Willd.: Climbing hempvine. FP, BH F. *TC245, TC468.*
Oclemena reticulata (Pursh) G.L. Nesom: Pinebarren aster. MF I. *TC497, SB286.*
Palafoxia feayi A. Gray: Feay's palafox. SH, XH, SF, SC F. *TC003, SB035, SB080.*
Palafoxia integrifolia (Nutt.) Torr. & Gray: Coastal-plain palafox. SH I. *TC331.*
Pectis prostrata Cav.: Spreading cinchweed RU, O. *TC612, TC633.*
Phoebanthus grandiflorus (Torr. & A.Gray) S.F. Blake: Florida false sunflower. SH O. *TC150, SB129.*
Pityopsis graminifolia (Michx.) Nutt. var. *aequilifolia* F.D. Bowers & Semple: Goldenaster. SH, XH F. *TC004, SB202.*
Pluchea baccharis (Mill.) Pruski: Marsh fleabane. DM F. *TC141.*
Pluchea foetida (L.)DC.: Stinking camphorweed. DM I. *TC207.*
Pluchea odorata (L.) Cass. var. *odorata*: Annual marsh fleabane. FP O. *TC272, TC369, TC427, SB301.*
Pterocaulon pycnostachyum (Michx.) Elliott: Blackroot. SH, MF O. *TC116, SB055.*
Sericocarpus tortifolius (Michx.) Nees: White-top aster . SH, XH, MF O. *TC025, TC255, SB221.*
Solidago fistulosa Mill.: Pinebarren goldenrod. DM, MF O. *TC020, SB201.*
Solidago odora Aiton var. *chapmanii* (A.Gray) Cronquist: Chapman's goldenrod. SH, XH F. *TC168, SB109.*
Symphyotrichum dumosum (L.) G.L. Nesom: Ricebutton aster. SH I. *TC332.*
Symphyotrichum simmondsii (Small) G.L. Nesom: Simmonds's aster. Wetland edge I. *TC365.*
Verbesina virginica L.: White crownbeard. XH F. *TC312.*
* *Youngia japonica* (L.) DC.: Oriental false hawksbeard. RU O. *TC441.*

BIGNONIACEAE

Catalpa bignonioides Walter: Southern catalpa. SH R. *TC593.* (Probably resprouted from ornamental planting by a previous property owner.)
* *Pyrostegia venusta* (KerGawl.) Miers: Flame vine. FP R. *TC046.* (Probably extirpated subsequent to collection of specimen.)

BLECHNACEAE

Blechnum serrulatum Rich.: Toothed midsorus fern. BH, FP F. *TC035, SB233.*
Woodwardia areolata (L.) T. Moore: Netted chain fern. BH, FP O. *TC094, SB256.*
Woodwardia virginica (L.) Sm.: Virginia chain fern. BH, FP, WF F. *TC045, TC222, TC390, SB232.*

BRASSICACEAE

Lepidium virginicum L.: Poorman's pepper. RU F. *TC483.*
Polanisia tenuifolia Torr. & A. Gray: Slenderleaf clammyweed. SH, XH F. *TC109, SB300.*
Warea carteri Small: Carter's Warea. SF I. *TC316.*

BROMELIACEAE

Tillandsia recurvata (L.) L.: Ball-moss. SH, XH, SC, FP F. *TC205, SB140.*
Tillandsia setacea Sw.: Southern needleleaf. FP F. *TC057, SB139.*
Tillandsia simulata Small: Florida air plant. BH, FP F. *TC201.*

Tillandsia usneoides (L.) L.: Spanish moss. SH, FP, XH, SC F. *TC204, SB141.*
Tillandsia utriculata L.: Giant air plant. FP, BH I. *TC377, SB183.*

CACTACEAE

Opuntia humifusa (Raf.) Raf. var. *humifusa*: Prickly-pear. SH, SC, XH F. *TC480, SB292.*
Opuntia humifusa (Raf.) Raf. var. *ammophila* (Small) L.D. Benson: Prickly-pear. SH, SC, XH F. *TC600.*

CAMPANULACEAE

Lobelia paludosa Nutt.: White lobelia. DM I. *TC090.*

CANNACEAE

Canna flaccida Salisb.: Bandana-of-the-Everglades. FP O. *TC223, TC470.*

CARYOPHYLLACEAE

Paronychia americana (Nutt.) Fenzl ex Walp.: American nailwort. SC, RU F. SB051, SB091, *SB208.*
Paronychia chartacea Fernald var. *chartacea*: Papery whitlow-wort . SH R *TC009. SB095.*
Paronychia hemiarioides (Michx.) Nutt.: Coastalplain nailwort. SH I. *TC525.*
Stipulicida setacea Michx. var. *setacea*: Pineland scalypink. SH, SC, XH F. *TC040, SB021.*

CHRYSOBALANACEAE

Licania michauxii Prance: Gopher apple. SH, SC, XH F. *TC099, SB042.*

CISTACEAE

Crocanthemum corymbosum (Michx.) Britton: Pinebarren frostweed. SH O. *TC477, SB025.* (Arrington and Kubitzki 2003).

Crocanthemum nashii (Britton) Barnhart: Florida scrub frostweed. SH, SC F. *TC088, SB014.* (Arrington and Kubitzki 2003).
Lechea cernua Small: Nodding pinweed. SC O. *SB119, SB191.*
Lechea deckertii Small: Deckert's pinweed. SH O. *TC156, SB108, SB128.*
Lechea divaricata Shuttlew. ex Britton: Drysand pinweed. MF R. (TC) *Christman 1933.*
Lechea sessiliflora Raf.: Pineland pinweed. SC, SH O. *TC299, TC310, TC341, SB192.*
Lechea torreyi (Chapm.) Legg. ex Britton: Piedmont pinweed. MF O. *TC613, SB147, SB212.*

COMMELINACEAE

Callisia ornata (Small) G.C. Tucker: Florida scrub roseling. SC, SH O. *TC144, SB288.*
* *Commelina diffusa* Burm. f. var. *diffusa*: Common dayflower. RU, FP O. *TC439.*
Commelina erecta L.: Whitemouth dayflower. SH, XH, SF F. *TC001, SB024.*
Tradescantia roseolens Small: Longleaf spiderwort. SH, XH I. *TC510, SB082.*

CONVOLVULACEAE

Bonamia grandiflora (A. Gray) Hallier f.: Scrub morning glory. SC, SH O. *TC508, SB040.*
Calystegia sepium (L.) R. Br. subsp. *limnophila* (Greene) Brummitt: Hedge false bindweeed. FP I. *TC478.*
Dichondra carolinensis Michx.: Carolina ponyfoot. RU, FP O. *TC385.*
Ipomoea pandurata (L.) G. Mey.: Man-of-the-earth. XH R. *TC267.*

Stylisma abdita Myint: Hidden dawnflower. SH I. *TC513.*
Stylisma villosa (Nash) House: Hairy dawnflower. SH, XH, SC F. *TC006, SB041, SB136.*

CORNACEAE

Cornus foemina Mill.: Swamp dogwood. FP F. *TC449, TC464.*
Nyssa biflora Walter: Swamp tupelo. FP F. *TC160, SB236.* (Ward 2001).

CRASSULACEAE

* *Kalanchoe delagoensis* Eckl. & Zeyh.: Chandelier plant. RU I. *TC626.*

CUCURBITACEAE

* *Cucumis anguria* L.: Gooseberry gourd. FP I. *TC467.*
* *Momordica charantia* L.: Balsampear. RU F. *TC376.*

CYPERACEAE

Bulbostylis barbata (Rottb.) C.B. Clarke: Watergrass. SH, XH, MF F. *TC587.*
Bulbostylis ciliatifolia (Elliott) Fernald: Capillary hairsedge. SH, XH F. *TC011, TC129.*
Bulbostylis stenophylla (Elliott) C.B. Clarke: Sandyfield hairsedge. SC O. *SB150.*
Bulbostylis warei (Torr.) C.B. Clarke: Ware's hairsedge. SH F. *TC119, TC130.*
Carex comosa Boott: Longhair sedge. FP O. *TC474.*
Carex longii Mack.: Long's sedge. DM O. *SB303.*
Carex vexans F.J. Herm.: Florida hammock sedge. FP O. *TC493.*
Cladium jamaicense Crantz: Sawgrass. FP O/F. *TC507.*
Cyperus croceus Vahl: Baldwin's flatsedge. SH, XH, MF F. *TC281.*
Cyperus lecontei Torr. ex Steud.: Leconte's flatsedge. DM O. *TC185, SB018, SB127.*
Cyperus retrorsus Chapm.: Pinebarren flatsedge. SH, XH, MF F. *TC148, TC531, SB029, SB067.*
Cyperus tetragonus Elliott: Fourangle flatsedge. FP O. *TC248.*
Cyperus virens Michx.: Green flatsedge. FP F. *TC416, TC461.*
Eleocharis baldwinii (Torr.) Chapm.: Road-grass. DM F. *TC318, TC405, TC431, SB162.*
Eleocharis microcarpa Torr.: Smallfruit spikerush. DM I. *TC319.*
Fimbristylis puberula (Michx.) Vahl: Hairy fimbry. DM F. *TC117, TC414.*
Fuirena scirpoidea Michx.: Southern umbrella sedge. DM, Pond margins F. *TC286, SB028.*
Rhynchospora chapmanii M.A. Curtis: Chapman's beaksedge. DM O. *TC233, TC340.*
Rhynchospora ciliaris (Michx.) C. Mohr: Fringed beaksedge. DM, SS, MF F. *TC114, TC280.*
Rhynchospora corniculata (Lam.) A. Gray: Shortbristle horned beaksedge. FP F. *TC415, TC436, TC458.*
Rhynchospora fascicularis (Michx.) Vahl: Fascicled beaksedge. DM, BH, FP F. *TC98, TC359, TC622, SB126, SB167, SB259.*
Rhynchospora inundata (Oakes) Fernald: Narrowfruit horned beaksedge. DM F. *TC147, TC597.*
Rhynchospora latifolia (Baldwin) W.W. Thomas: Giant white-top sedge. DM O. *TC208, TC410.*
Rhynchospora megalocarpa A. Gray: Sandyfield beaksedge. SH, XH, SC F. *TC083, TC118, SB022, SB154.*

Rhynchospora microcarpa Baldwin ex A. Gray: Southern beaksedge. DM, MF F. *TC522.*
Rhynchospora microcephala (Britton) Britton ex Small: Bunched beaksedge. DM O. *SB304.*
Rhynchospora miliacea (Lam.) A. Gray: Millet beaksedge. FP F. *TC469, TC567.*
Rhynchospora pineticola C.B. Clarke: Pinebarren beaksedge. MF O. *SB059.*
Rhynchospora plumosa Elliott: Plumed beaksedge. MF I. *SB068, SB280.*
Rhynchospora rariflora (Michx.) Elliott: Fewflower beaksedge. DM F. *TC632.*
Rhynchospora scirpoides (Torr.) A. Gray: Longbeak beaksedge. DM I. *TC517.*
Rhynchospora tracyi Britton: Tracy's beaksedge. DM F. *TC515.*
Scirpus cyperinus (L.) Kunth: Woolgrass. FP I. *TC566.*
Scleria muehlenbergii Steud.: Nutrush. SS, MF, FP O. *TC279.*
Scleria reticularis Michx.: Netted nutrush. DM F. *TC516.*
Scleria triglomerata Michx.: Tall nutgrass. MF, WF, FP F. *TC151, SB151, SB241.*

DENNSTAEDTIACEAE

Hypolepis repens (L.) C. Presl: Creeping bramble fern. BH R. *TC535.*
Pteridium aquilinum (L.) Kuhn var. *pseudocaudatum* (Clute) Clute ex A. Heller: Tailed bracken fern. SH, XH, MF F. *TC145, SB034, SB063.*

DROSERACEAE

Drosera capillaris Poir.: Pink sundew. DM, WF F. *TC053.*

DRYOPTERIDACEAE

Dryopteris ludoviciana (Kunze) Small: Southern wood fern. FP F. *TC565.*

EBENACEAE

Diospyros virginiana L.: Common persimmon. SC, XH, SF, MF F. *TC178, SB123.*

ERICACEAE

Bejaria racemosa Vent.: Tarflower. MF, SF F. *TC110, SB048.*
Ceratiola ericoides Michx.: Florida rosemary. SC F. *SB056.*
Gaylussacia dumosa (J. Kenn.) Torr. & A. Gray: Dwarf huckleberry. SH, MF O. *TC060, SB003.*
Gaylussacia nana A. Gray: Blue huckleberry. MF F. *TC079, TC621, SB004.* (Luteyn et al. 1996).
Lyonia ferruginea (Walter) Nutt.: Rusty lyonia. SC F. *TC353, SB207.*
Lyonia fruticosa (Michx.) G.S. Torr.: Staggerbush. SF, SC, MF F. *TC028, SB047.*
Lyonia ligustrina (L.) DC. var. *foliosiflora* (Michx.) Fernald: Maleberry. BH, WF O. *TC162, TC505, TC594, SB227, SB239, SB296.*
Lyonia lucida (Lam.) K. Koch: Fetterbush. MF, WF, DM, SF F. *TC008, TC051, SB009.*
Monotropa uniflora L.: Indianpipe. XH I. *Christman 1930.*
Rhododendron viscosum (L.) Torr.: Swamp azalea. FP I. *TC573, SB249, SB281.*
Vaccinium corymbosum L.: Highbush blueberry. BH, FP O. *TC059, TC184, SB242.*
Vaccinium cf. corymbosum L.: Hybrid blueberry. MF I. *TC617.*
Vaccinium darrowii Camp: Darrow's blueberry. SH, MF F. *TC056, SB008.*
Vaccinium myrsinites Lam.: Shiny blueberry. SH, SF, MF F. *TC050, SB274.*
Vaccinium stamineum L.: Deerberry. SH, SC, XH F. *TC413.*
Vaccinium corymbosum x V. darrowii: Hybrid blueberry. MF, DM O. *TC618, TC625.*

ERIOCAULACEAE

Eriocaulon decangulare L.: Pipewort. DM F. *TC139.*

Lachnocaulon beyrichianum Sporl. ex Koern.: Southern bog button. DM I. *TC521, SB291.*

Lachnocaulon minus (Chapm.) Small: Small's bog button. DM F. *TC113, TC501, SB019.*

Syngonanthus flavidulus (Michx.) Ruhland: Hatpins. DM F. *TC054, SB290.*

EUPHORBIACEAE

Chamaesyce hirta (L.) Millsp.: Pillpod sandmat. RU F. *TC443.* (Some authors, *e.g.,* Steinmann and Porter 2002, Park and Elisens 2000, point out that recognizing *Chamaesyce* renders *Euphorbia* paraphyletic, and favor including *Chamaesyce* within an expanded genus *Euphorbia.*)

Chamaesyce hyssopifolia (L.) Small: Hyssopleaf sandmat. RU O. *TC288.*

Chamaesyce maculata (L.) Small: Spotted sandmat. RU O. *TC289.*

Chamaesyce ophthalmica (Pers.) D.G. Burch: Florida hammock sandmat. RU O. *TC555.*

Chamaesyce prostrata (Aiton) Small: Prostrate sandmat. RU O. *TC554.*

Cnidoscolus stimulosus (Michx.) Engelm. & A. Gray: Tread-softly. SH, SC O. *TC072, SB077.*

Croton argyranthemus Michx.: Healing croton. SH O. *TC062.*

Croton glandulosus L. var. *floridanus* (A.M. Ferguson) R.W. Long: Vente conmigo. SH R. *TC287.*

Croton glandulosus L. var. *glandulosus*: Vente conmigo. XH I. *TC534.*

Croton michauxii G.L. Webster: Michaux's croton. SH O. *TC407, SB054.*

Euphorbia polyphylla Engelm. ex Chapm.: Lesser Florida spurge. SC F. *SB053, SB149.*

Stillingia sylvatica L.: Queen's delight. SH F. *TC122, SB033.*

Tragia urens L.: Wavyleaf noseburn. SH O. *TC512, SB158.*

FABACEAE

* *Abrus precatorius* L.: Rosary pea. RU F. *TC589.*

** Albizia julibrissin* Durazz.: Mimosa tree. RU R. *TC538.*

Amorpha fruticosa L.: Bastard false indigo. SC, Streambanks O. *TC131.*

Amorpha herbacea Walter: Clusterspike false indigo. SH I. (TC) *Christman 1970.*

Apios americana Medik.: Groundnut. FP O. *TC228.*

Centrosema arenicola (Small) F.J. Herm.: Sand butterfly pea. SH, SF O. *TC588.*

Centrosema virginianum (L.) Benth.: Spurred butterfly-pea. SH, XH F. *TC190, SB130.*

Chamaecrista fasciculata (Michx.) Greene: Partridge-pea. SH, XH F. *TC167, SB110.*

Chamaecrista nictitans (L.) Moench var. *aspera* (Muhl. ex Elliott) H.S. Irwin & Barneby : Sensitive pea. *SH, MF, RU O. TC306, SB210.*

Chamaecrista nictitans (L.) Moench var. *nictitans*: Wild sensitive-pea. SH, XH, RU O. *TC022.*

Chapmannia floridana Torr. & A. Gray: Alicia. SH, SC F. *TC153, SB013.*

Clitoria fragrans Small: Pigeon-wing. SH, XH O. *TC137.*

Crotalaria avonensis DeLaney & Wunderlin: Avon Park rattlebox. SC O. *SB094.*

* *Crotalaria pallida* Aiton var. *obovata* (G. Don) Polhill: Smooth rattlebox. RU O. *TC024.*

* *Crotalaria retusa* L.: Rattleweed. RU O. *TC219.*
Crotalaria rotundifolia J.F. Gmel.: Rabbit bells. SH, XH O. *TC082, SB159.*
Dalea carnea (Michx.) Poir. var. *carnea*: Whitetassels. MF O. *SB196, SB302.*
Dalea feayi (Chapm.) Barneby: Feay's prairie-clover. SF, SH I. *TC313.*
Dalea pinnata (J.F. Gmel.) Barneby var. *pinnata*: Summer farewell. SH O. *TC320.*
Desmodium floridanum Chapm.: Florida ticktrefoil. SH O. *TC213, TC580.*
* *Desmodium incanum* DC.: Zarzabacoa comun. RU O. *TC212.*
Desmodium tortuosum (Sw.) DC.: Dixie ticktrefoil. RU I. *TC213.*
* *Desmodium triflorum* (L.) DC.: Threeflower ticktrefoil. RU O. *TC270.*
* *Enterolobium contortisiliquum* (Vell.) Morong: Earpod tree. Former homesite. Single large tree, a few saplings. *TC456.*
Erythrina herbacea L.: Coral bean. XH O. *TC244.*
Galactia elliottii Nutt.: Elliott's milkpea. SH, SC, MF F. *TC108, SB017.*
Galactia regularis (L.) Britton et al.: Eastern milkpea. SH, SC, XH F. *TC203, SB132.*
Indigofera caroliniana Mill.: Carolina indigo. SH, SC, XH F. *TC123, SB090.*
* *Indigofera hirsuta* L.: Hairy indigo. RU O. *TC256, TC368.*
Lespedeza hirta (L.) Hornem.: Hairy bush-clover. SH I, *TC350.*
Lupinus diffusus Nutt.: Sky-blue lupine. SH F. *TC061.*
* *Macroptilium lathyroides* (L.) Urb.: Wild bushbean. SH, XH I. *TC581.*
* *Medicago lupulina* L.: Black medick. RU O. *TC485.*
Mimosa quadrivalvis L. var. *angustata* (Torr. & A. Gray) Barneby: Sensitive briar. SH O. *TC579.*
Mimosa quadrivalvis L. var. *floridana* (Chapm.) Barneby: Fla. sensitive briar. SC, SF O. *TC520, SB076.*
Mimosa strigillosa Torr. & A. Gray: Powderpuff. RU I. *TC601.*
Phaseolus polystachios (L.) Britton et al. var. *sinuatus* (Nutt. ex Torr. & A. Gray) Marechal et al.: Thicket bean. SH I. *TC269.*
Rhynchosia cinerea Nash: Brown-haired snoutbean. SH O. *TC121, SB115.*
Tephrosia chrysophylla Pursh: Scurf hoarypea. SH F. *TC155, SB143.*

FAGACEAE

Quercus chapmanii Sarg.: Chapman's oak. SH, SF, SC F. *TC175, SB011, SB057, SB217.*
Quercus cf. pumila Walter: Running oak. MF I. *SB216.* (Ward 2007).
Quercus geminata Small: Sand live oak. XH A; SH, SC, SF F. *TC125, SB062.*
Quercus cf. hemisphaerica W. Bartram ex Willd.: Laurel oak hybrid. MF I. *TC620.*
Quercus incana W. Bartram: Bluejack oak. SH F. *TC127, SB282.*
Quercus inopina Ashe: Scrub oak. SF, SC F. *TC126, SB044.*
Quercus laevis Walter: Turkey oak. SH A. *TC075, SB093.*
Quercus laurifolia Michx.: Laurel oak. FP F. *TC194.*
Quercus minima (Sarg.) Small: Dwarf live oak. MF F. *TC195, SB195.*
Quercus myrtifolia Willd.: Myrtle oak. SC, SF, SH, XH F. *TC077.*
Quercus nigra L.: Water oak. FP F. *TC196, SB066, SB124, SB246, SB267.*
Quercus virginiana Mill.: Live oak. High creek banks F. *TC176.*
Quercus laevis x Q. incana: Hybrid oak. MF I. *TC619.*

GELSEMIACEAE

Gelsemium sempervirens (L.) Aiton f.: Yellow jessamine. MF, FP O. *TC041.*

GENTIANACEAE

Sabatia brevifolia Raf.: Shortleaf rosegentian. MF, WF, DM O. *TC032, SB172.*

Sabatia difformis (L.) Druce: Lanceleaf rosegentian. MF O. *TC135.*

Sabatia grandiflora (A.Gray) Small: Marsh-pink. DM F. *TC402, SB075.*

GERANIACEAE

Geranium carolinianum L.: Cranesbill. RU O. *TC066.*

HAEMODORACEAE

Lachnanthes caroliana (Lam.) Dandy: Carolina redroot. DM, WF F. *TC142, SB103.*

HALORAGACEAE

Proserpinaca pectinata Lam.: Mermaid weed. DM F. *TC389.*

HYPERICACEAE

Hypericum brachyphyllum (Spach) Steud.: Coastalplain St. John's wort. DM O. *TC091.*

Hypericum cistifolium Lam.: Roundpod St. John's wort. FP, WF, DM O. *TC023, SB071.*

Hypericum cumulicola (Small) W.P. Adams: Highlands scrub St. John's wort. SC O. *SB092.*

Hypericum fasciculatum Lam.: Sandweed. DM F. *TC596, SB027.*

Hypericum gentianoides (L.) Britton et al.: Pineweed. *DM O. TC230.*

Hypericum hypericoides (L.) Crantz: St. Peter's Wort. FP O. *TC370, TC435.*

Hypericum mutilum L.: Dwarf St. John's wort. FP O. *TC419, TC488.*

Hypericum mytrifolium Lam.: Myrtleleaf St. John's wort. DM O. *TC092.*

Hypericum reductum (Svenson) W.P. Adams: Atlantic St. John's wort. SH O. *TC157, SB036, SB096, SB173.*

Hypericum tetrapetalum Lam.: Fourpetal St. John's wort. MF I. *SB097.*

HYPOXIDACEAE

Hypoxis juncea Sm.: Fringed yellow star grass. DM O. *TC337, SB086.*

IRIDACEAE

Sisyrinchium nashii E.P.Bicknell: Nash's blue-eyed grass. SC I. *SB213.*

Sisyrinchium xerophyllum Greene: Scrub blue-eyed grass. SC, SH, XH O. *TC261, SB175, SB194.*

ITEACEAE

Itea virginica L.: Sweetspire. FP, BH F. *TC068, TC163, SB226.*

JUGLANDACEAE

Carya floridana Sarg.: Scrub hickory. SC, SH F. *TC085, TC475, SB006.*

Carya glabra (Mill.) Sweet: Pignut hickory. XH O. *TC078, TC578.*

JUNCACEAE

Juncus effusus L. subsp. *solutus* (Fernald & Wiegand) Hämet-Ahti: Soft rush. FP O. *TC171, SB258.*

Juncus marginatus Rostk.: Grassleaf rush. DM, MF O. *TC210, TC623, SB116, SB247.*

Juncus megacephalus M.A. Curtis: Bighead rush. FP, DM I. *TC172.*

Juncus repens Michx.: Lesser creeping rush. WF I. *TC502.*

Juncus scirpoides Lam.: Needlepod rush. DM O. *TC164, SB064, SB117.*

KRAMERIACEAE

Krameria lanceolata Torr.: Sandspur. SH O. *TC103.*

LAMIACEAE

Callicarpa americana L.: Beautyberry. SC F. *TC132, SB050.*

Conradina brevifolia Shinners: Short-leaved rosemary. SC F. *SB001.* (Edwards 2007; Shinners 1962).
Hyptis alata (Raf.) Shinners: Clustered bushmint. WF I. *TC575.*
* *Hyptis mutabilis* (Rich.) Briq.: Tropical bushmint. RU O. *TC158.*
Piloblephis rigida (W. Bartram ex Benth.) Raf.: Wild pennyroyal. MF O. *SB248.*
Salvia lyrata L.: Lyreleaf sage. RU F. *TC447.*
Scutellaria arenicola Small: Florida scrub scullcap. SH, XH O. *TC533, SB104.*
Trichostema dichotomum L.: Blue curls. SC, SH O. *TC042, TC333, SB184.*

LAURACEAE
Persea borbonia (L.) Spreng.: Red bay. XH, MF O. *TC246.*
Persea humilis Nash: Silk bay. SC F; SH O. *TC134, SB043.* (Wofford 1973; Christman & Judd 1990)
Persea palustris (Raf.) Sarg.: Swamp bay. BH, FP, WF F. *TC183, SB58, SB107.*

LENTIBULARIACEAE
Pinguicula pumila Michx.: Dwarf butterwort. DM O. *TC339.*
Utricularia subulata L.: Zigzag bladderwort. DM O. *TC317, SB200.*

LILIACEAE
Lilium catesbei Walter: Catesby's lily. DM R. *TC602.*

LINDERNIACEAE
Micranthemum umbrosum (J.F. Gmel.) S.F. Blake: Shade mudflower. FP O. *TC425.*

LOMARIOPSIDACEAE
* *Nephrolepis cordifolia* (L.) C. Presl: Tuberous sword fern. FP O. *TC472.*
Nephrolepis exaltata (L.) Schott: Wild boston fern. FP O. *TC564.*

LYCOPODIACEAE
Lycopodiella alopecuroides (L.) Cranfill: Foxtail clubmoss. DM O. *TC047.*
Lycopodiella appressa (Chapm.)Cranfill: Southern clubmoss. DM O. *TC607.*

LYGODIACEAE
* *Lygodium microphyllum* (Cav.) R. Br.: Old-world climbing fern. FP I. *TC568.*

LYTHRACEAE
Rotala ramosior (L.) Koehne: Toothcup. DM O. *TC400.*

MAGNOLIACEAE
Magnolia grandiflora L.: Southern magnolia. In office yard, possibly planted. *TC297.*
Magnolia virginiana L.: Sweetbay magnolia. BH A; FP F. *TC173, SB087.*

MALVACEAE
Hibiscus grandiflorus Michx.: Swamp rosemallow. FP O. *TC576.*
Melochia spicata (L.) Fryxell: Bretonica peluda. RU I. *TC229.*
Sida rhombifolia L.: Indian hemp. RU F. *TC159, SB261.*
* *Urena lobata* L.: Caesarweed. RU, Wetland edges F. *TC253, SB253.*

MELASTOMATACEAE
Rhexia mariana L.: Pale meadow beauty. MF, WF, DM, FP F. *TC033, TC036, SB073.*
Rhexia nuttallii C.W. James: Nuttall's meadow beauty. DM I. *Orzell & Bridges 16667.*
Rhexia petiolata Walter: Fringed meadow beauty. MF, DM O. *TC165.*

MELIACEAE
* *Melia azedarach* L.: Chinaberry tree. RU R. *TC454.*

MOLLUGINACEAE

* *Mollugo verticillata* L.: Indian chickweed. RU I. *TC585.*

MORACEAE

Morus rubra L.: Red mulberry. FP O. *TC466.*

MYRICACEAE

Myrica cerifera L. var. *cerifera*: Wax myrtle. FP, BH, WF, SF, MF, XH F. *TC076, SB146.*

Myrica cerifera L. var. *pumila* Michx.: Dwarf wax myrtle. MF, SF O. *TC606.* (Ward 2000).

MYRTACEAE

* *Melaleuca quinquenervia* (Cav.) S.T. Blake: Punktree; melaleuca. Pond edge R. *TC296.*

NARTHECIACEAE

Aletris lutea Small: Yellow colic-root. DM, WF O. *TC089, TC100.*

NYMPHAEACEAE

Nuphar advena (Aiton) Aiton f.: Spatterdock. BW, DM O. *TC179, SB120.*

Nymphaea odorata Aiton subsp. *odorata*: White water lily. Ponds, BW F. *TC284, SB262.*

OLACACEAE

Ximenia americana L.: Tallowwood. XH, SC, SH F. *TC243, SB240.*

OLEACEAE

Chionanthus pygmaeus Small: Pygmy fringe tree. SH I. *TC080, SB002, SB106.*

Osmanthus megacarpus (Small) Small ex Little: Scrub wild olive. SC, XH F. *TC192, TC457.*

ONAGRACEAE

Ludwigia erecta (L.) H. Hara: Yerba de jicotea. FP O. *TC290.*

Ludwigia lanceolata Elliott: Lanceleaf primrose willow. FP O. *TC506, SB206.*

Ludwigia leptocarpa (Nutt.) H. Hara: Anglestem primrose willow. FP F. *TC292, TC366, TC482.*

Ludwigia maritima Harper: Seaside primrose willow. *DM F. TC335, TC572, SB138.*

Ludwigia octovalvis (Jacq.) P.H. Raven: Mexican primrose willow. FP O. *TC440.*

* *Ludwigia peruviana* (L.) H. Hara: Peruvian primrose willow. FP, Wetland edges F. *TC064, TC367.*

Ludwigia repens J.R. Forst.: Creeping primrose willow. FP F. *TC424.*

Ludwigia suffruticosa Walter: Shrubby primrose willow. DM F. *TC526, SB122.*

Ludwigia virgata Michx.: Savanna primrose willow. DM O. *TC140, TC322.*

Oenothera simulans (Small) W.L. Wagner & Hoch: Southern beeblossom. RU O. *TC541.* (Wagner et al. 2007). (= *Gaura angustifolia* Michx.).

ORCHIDACEAE

Encyclia tampensis (Lindl.) Small: Butterfly orchid. FP I. *TC494.*

Habenaria odontopetala Reichenbach f.: False rein orchid. FP O. *TC375, SB255.*

* *Oeceoclades maculata* (Lindl.) Lindl.: Monk orchid. XH R. *TC285.*

* *Zeuxine strateumatica* (L.) Schltr.: Lawn orchid. RU I. *TC444.*

OROBANCHACEAE

Agalinis fasciculata (Elliott) Raf.: Beach false foxglove. SH O. *TC209.*

Buchnera americana L.: Blueheart. RU O. *TC136, SB297.*

Seymeria pectinata Pursh: Piedmont blacksenna. SF, SC, SH F. *TC266, TC323, SB088.*

OSMUNDACEAE

Osmudastrum cinnamomeum (L.) C. Presl: Cinnamon fem. FP, BH, WF F. *TC015, SB234, SB268.*

Osmunda regalis L. var. *spectabilis* (Willd.) A. Gray: Royal fem. BH, FP O. *TC063, SB254.*

OXALIDACEAE

Oxalis corniculata L.: Wood sorrel. RU O. *TC065,*

PALMAE

Rhapidophyllum hystrix (Pursh) H. Wendl. & Drude ex Drude: Needle palm. FP F (only in one area). *TC374.*

Sabal etonia Swingle ex Nash: Scrub palmetto. SC F. *TC188, SB030.*

Sabal minor (Jacq.) Pers.: Bluestem palm. FP F. *TC473.*

Sabal palmetto (Walter) Lodd. ex Schult. & Schult. f.: Cabbage palm. FP F. *TC527.*

Serenoa repens (W. Bartram) Small: Saw palmetto. MF A; SF, SH, XH F; Pond margins A. *TC189, SB031.*

PASSIFLORACEAE

Passiflora incarnata L.: Purple passionflower. RU F. *TC536.*

PHYLLANTHACEAE

* *Phyllanthus tenellus* Roxb.: Mascarene Island leafflower. RU F. *TC615.*

* *Phyllanthus urinaria* L.: Chamber bitter. RU F. *TC616.*

PHYTOLACCACEAE

Phytolacca americana L. var. *rigida* (Small) Caulkins & Wyatt: Pokeweed. RU, FP O. *TC220, TC605, SB015.*

Rivina humilis L.: Rouge plant. XH, RU I. *TC043.*

PINACEAE

Pinus clausa (Chapm. ex Engelm.) Vasey ex Sarg.: Sand pine. SC A; RU O. *TC030, SB074.*

Pinus elliottii Engelm.: Slash pine. MF, WF, SF A. *TC399, SB074.*

Pinus palustris Mill.: Longleaf pine. SH F. *TC283, SB170.*

PLANTAGINACEAE

Gratiola hispida (Benth. ex Lindl.) Pollard: Rough hedge-hyssop. SH I. *TC115, SB060.*

Gratiola ramosa Walter: Branched hedge-hyssop. DM I. *TC417.*

Gratiola virginiana L.: Roundfruit hedge-hyssop. FP I. *TC487.*

Nuttallanthus canadensis (L.) D.A. Sutton: Blue toadflax. RU O. *TC067.* (Crawford and Elisens 2006; Sutton 1988). (= *Linaria canadensis* (L.) Chaz.)

Nuttallanthus floridanus (Chapm.) D.A. Sutton: Apalachicola toadflax. SH, SC F. *TC049, TC182, SB007.* (Crawford and Elisens 2006; Sutton 1988). (= *Linaria floridana* Chapm.)

Penstemon multiflorus (Benth.) Chapm. ex Small: Beard-tongue. SH, SF I. *TC101.*

Scoparia dulcis L.: Sweetbroom. RU, FP F. *TC519, SB089.*

POACEAE

Amphicarpum muhlenbergianum (Schult.) Hitchc.: Blue maidencane. DM F. *TC275, SB182.*

Andropogon brachystachyus Chapm.: Shortspike bluestem. MF F. *TC326.*

Andropogon floridanus Scribn.: Florida bluestem. SH, SC F. *TC241, TC327, TC343, TC356, TC609, SB197.*

Andropogon glomeratus (Walter) Britton, Sterns & Poggenb. var. *glaucopsis* (Elliott) C. Mohr: Purple bluestem. DM, MF O. *TC344, TC361, SB264, SB272.*

Andropogon glomeratus (Walter) Britton, Sterns & Poggenb. var. *glomeratus*: Bushy bluestem. SH, MF O. *TC311.*

Andropogon glomeratus (Walter) Britton, Sterns & Poggenb. var. *pumilus* (Vasey) Vasey ex L.H. Dewey: Bushy bluestem. DM O. *TC016.*

Andropogon gyrans Ashe var. *gyrans*: Elliott's bluestem. SH O. *TC437.*

Andropogon gyrans Ashe var. *stenophyllus* (Hack.)C.S.Campb.: Elliott's bluestem. DM I. *TC342.*

Andropogon ternarius Michx. var. *cabanisii* (Hack.) Fernald & Griscom: Splitbeard bluestem. SH, SC F. *TC146, TC325, SB101.*

Andropogon ternarius Michx. var. *ternarius*: Splitbeard bluestem. SH, SC O. *SB190.*

Andropogon tracyi Nash: Tracy's bluestem. SH I. *TC026.*

Andropogon virginicus L. var. *decipiens* C.S. Campb.: Broomsedge bluestem SH, MF, RU F. *TC265, TC329.*

Andropogon virginicus L. var. *glaucus* Hack.: Chalky bluestem. SH, SC F. *TC330, SB214.*

Andropogon virginicus L. var. *virginicus*: Broomsedge bluestem. SH, MF, RU F. *SB169, SB176.*

Aristida condensata Chapm.: Big threeawn. SH O. *TC300, TC308.*

Aristida gyrans Chapm.: Corkscrew threeawn. SC, SF F. *SB178, SB199, SB218, SB230, SB231.*

Aristida lanosa Muhl. ex Elliott: Woolysheath threeawn. SH I. *TC355.*

Aristida purpurascens Poir. var. *purpurascens*: Arrowfeather threeawn. SH, MF O. *TC328.*

Aristida purpurascens Poir. var. *tenuispica* (Hitchc.) Allred: Hillsboro threeawn. MF O. *TC276.*

Aristida spiciformis Elliott: Bottlebrush threeawn. DM, MF F. *TC324, SB133.*

Aristida stricta Michx.var. *beyrichiana* (Trin. & Rupr.) D.B. Ward: Wiregrass. SH A; XH, MF O. *TC039, TC263, SB160.*

Arundinaria gigantea (Walter) Muhl.: Switch cane. FP F. *TC362, TC539.*

Axonopus fissifolius (Raddi) Kuhlm.: Common carpet grass. FP O. *TC628.*

Bambusa multiplex (Lour.) Raeusch. ex Schult. & Schult. f.: Hedge bamboo. Pond edge I. *TC302.* (Plant eradicated since collection was made.)

Cenchrus echinatus L.: Southern sandbur. RU O. *TC592.*

Cenchrus spinifex Cav.: Coastal sandbur. RU, SH O. *TC298, SB193.*

Chasmanthium laxum (L.) Yates var. *laxum*: Slender woodoats. FP O. *TC549.*

Coelorachis tuberculosa (Nash) Nash: Florida jointtail grass. DM F. *TC599.*

* *Cynodon dactylon* (L.) Pers.: Bermuda grass. RU O. *TC627.*

Dichanthelium aciculare (Desv. ex Poir.) Gould & C.A. Clark subsp. *angustifolium* (Elliott) Freckmann & Lelong: Needleleaf panicgrass. XH O. *SB135.*

Dichanthelium acuminatum (Sw.) Gould & Clark.: Tapered witchgrass. SH, MF F. *TC301, SB152.*

Dichanthelium chamaelonche (Trin.) Freckmann & Lelong subsp. *breve* (Hitchc. & Chase) Freckmann & Lelong: Small-seeded panicgrass. SC, SF I. *SB079.*
Dichanthelium commutatum (Schult.) Gould: Variable witchgrass. FP O. *TC186, TC260, TC391.*
Dichanthelium ensifolium (Baldwin ex Elliott) Gould: Cypress witchgrass. DM, MF O. *TC496.*
Dichanthelium erectifolium (Nash) Gould & C.A. Clark: Erectleaf witchgrass. DM F. *TC514.*
Dichanthelium laxiflorum (Lam.) Gould: Roughhair witchgrass. SH, MF O. *TC238.*
Dichanthelium portoricense (Desv. ex Ham.) B.F. Hansen & Wunderlin: Hemlock witchgrass. SH, MF F. *TC010, TC237, TC398, TC479, SB069, SB153, SB275, SB305.*
Dichanthelium strigosum (Muhl. ex ell.) Freckmann.: Roughhair witchgrass. SH, MF F. TC408.
Echinochloa muricata (P.Beauv.) Fernald var. *muricata*: Rough barnyard grass. FP O. *TC492.*
* *Eleusine indica* (L.) Gaertn.: Indian goosegrass. RU, DM O. *TC307, TC610.*
* *Eragrostis amabilis* (L.) Wight & Arn. ex Nees: Feather lovegrass. RU O. *TC291.*
Eragrostis refracta (Muhl.) Scribn.: Coastal lovegrass. MF O. *SB163, SB180, SB198.*
Eragrostis spectabilis (Pursh) Steud.: Purple lovegrass. MF I. *TC631.*
* *Eremochloa ophiuroides* (Munro) Hack.: Centipede grass. RU O. *TC629, SB181.*
* *Imperata cylindrica* (L.) P. Beauv.: Cogon grass. SH O. *TC433, TC543.*
* *Melinis repens* (Willd.) Zizka: Natal grass. RU, SH F. *TC017, TC278, SB083, SB114, SB228.*
Muhlenbergia capillaris (Lam.) Trin. var. *capillaris*: Hairawn muhly. SH, XH O. *TC305.*
Oplismenus hirtellus (L.) P. Beauv.: Woodsgrass. FP F. *TC373.*
Panicum anceps Michx. subsp. *rhizomatum* (Hitchc. & Chase) Freckmann & Lelong: Beaked panicgrass. RU O. *SB166, SB179.*
Panicum hemitomon Schult.: Maidencane. DM, FP F. *TC334, TC409.*
Panicum rigidulum Bosc ex Nees subsp. *abscissum* (Swallen) Freckmann & Lelong: Cutthroat grass. SS F. *TC143, TC262, SB113, SB164, SB177.* (= *P. abscissum* Swallen).
Panicum rigidulum Bosc ex Nees subsp. *combsii* (Scribn. & C.R. Ball) Freckmann & Lelong: Redtop panicum. DM O. *TC411.*
Panicum rigidulum Bosc ex Nees subsp. *rigidulum*: Redtop panicum. FP O. *TC438, TC460, TC550.*
Panicum verrucosum Muhl.: Warty panicgrass. DM, SS O. *TC274.*
Paspalum conjugatum P.J. Bergius: Sour paspalum. RU F. *TC532, TC574.*
* *Paspalum notatum* Flüggé: Bahiagrass. RU F. *TC234, TC530, SB118.*
* *Paspalum urvillei* Steud.: Vaseygrass. RU I. *TC396.*
Piptochaetium avenacioides (Nash) Valencia & Costas: Florida needlegrass. SH O. *TC380, TC462, SB283.*
Saccharum giganteum (Walter) Pers.: Sugarcane plumegrass. DM O. *TC345, TC611.*
Sacciolepis striata (L.) Nash: American cupscale. FP O. *TC259, TC303, SB165.*

Schizachyrium niveum (Swallen) Gould: Pinescrub bluestem. SC I. (TC) *Christman 2086.*

Schizachyrium scoparium (Michx.) Nash var. *scoparium*: Little bluestem. SH, SF, MF F. *TC236, TC273, TC358, SB168, SB229.*

Setaria corrugata (Elliott) Schult.: Coastal bristlegrass. SH, RU O. *TC257, TC277.*

Setaria magna Griseb.: Giant bristlegrass. FP I. *TC577.*

Setaria parviflora (Poir.) Kerguélen: Knotroot foxtail. RU, XH O. *TC239.*

Sorghastrum secundum (Elliott) Nash: Lopsided indiangrass. SH F. *TC304, TC357, SB189.*

Spartina bakeri Merr.: Sand cordgrass. DM O. *TC634, SB263.*

Sporobolus floridanus Chapm.: Florida dropseed. MF O. *SB260.*

* *Sporobolus jacquemontii* Kunth: Smutgrass. RU, MF O. *TC211, TC235 SB219.*

Sporobolus junceus (P. Beauv.) Kunth: Pineywoods dropseed. SH O. *TC293, SB244.*

Stenotaphrum secundatum (Walter) Kuntze: St. Augustine grass. RU O. *TC630.*

Tridens flavus (L.) Hitchc. var. *chapmanii* (Small) Shinners: Chapman's purpletop tridens. SH I. *TC354.*

Tripsacum dactyloides (L.) L.: Eastern gamagrass. FP I. *TC548.*

* *Urochloa maxima* (Jacq.) R.D. Webster: Guinea grass. RU, FP O. *TC247, TC264, TC545, TC591.*

POLYGALACEAE

Polygala cymosa Walter: Tall pinebarren milkwort. DM F. *TC105.*

Polygala incarnata L.: Procession flower. SH I. *TC199.*

Polygala lewtonii Small: Lewton's polygala. SH O. *TC052.*

Polygala nana (Michx.) DC: Wild batchelor's button. DM I. *TC097.*

Polygala polygama Walter: Racemed milkwort. SH O. *TC463.*

Polygala rugelii Shuttlew. ex Chapm.: Yellow milkwort. DM, WF F. *TC096, SB072.*

Polygala setacea Michx.: Coastalplain milkwort. DM O. *TC495, SB070.*

POLYGONACEAE

Eriogonum tomentosum Michx.: Wild buckwheat. SH, XH O. *TC034.*

Eriogonum longifolium Nutt. var. *gnaphalifolium* Gand.: Scrub buckwheat. SH F. *TC104.*

Persicaria hirsuta (Walter) Small: Hairy smartweed. DM F. *SB016.* (Lamb Frye and Kron 2003).

Persicaria hydropiperoides (Michx.) Small: Mild water pepper. FP O. *TC418, TC489 SB245.* (Lamb Frye and Kron 2003).

Persicaria punctata (Elliott) Small: Dotted smartweed. FP F. *TC271.* (Lamb Frye and Kron 2003).

Polygonella basiramia (Small) G.L. Nesom & V.M. Bates: Florida jointweed. SC, SF O. *SB125, SB157.*

Polygonella gracilis Meisn.: Tall jointweed. SH, XH I. *TC014.*

Polygonella myriophylla (Small) Horton: Sandlace. SC F. *SB023.*

Polygonella polygama (Vent.) Engelm. & A. Gray var. *polygama*: October flower. SH, SC, SF F. *TC321, SB188.*

Polygonella robusta (Small) G.L. Nesom & V.M. Bates: Sandhill wireweed. *SH, SF F TC002, SB112.*

Rumex hastatulus Baldwin: Heartwing dock. FP I. *TC412.*

POLYPODIACEAE

Phlebodium aureum (L.) J. Sm.: Golden polypody. FP, Creek banks (epiphytic on *Quercus virginiana* and *Sabal palmetto*) I. *TC180.*

Pleopeltis polypodioides (L.) E.G. Andrews & Windham var. *michauxiana* (Weath.) E.G. Andrews & Windham: Resurrection fern. FP, XH F. *TC187, SB134.*

PONTEDERIACEAE

* *Eichhornia crassipes* (Mart.) Solms: Water hyacinth. BW O. *TC250.*

Pontederia cordata L.: Pickerelweed. FP, DM O. *TC087, SB299.*

PORTULACACEAE

* *Portulaca amilis* Speg.: Paraguayan purslane. RU I. *TC614.*

Portulaca pilosa L.: Pink purslane. RU I. *TC553.*

RANUNCULACEAE

Clematis reticulata Walter: Leatherflower. SH, SF O. *TC102, TC542*.

ROSACEAE

Aronia arbutifolia (L.) Pers.: Red chokeberry. MF O. TC058, SB098. (Kalkman 2004). (= *Photinia pyrifolia* (Lam.) K.R. Robertson & J.B. Phipps).

Crataegus lepida Beadle: Scrub hawthorn. SH I. *TC154.* [Wunderlin and Hansen (2003) include this taxon within *C. michauxii* Pers., but Phipps (*e.g.,* Phipps and Dvorsky 2007) follows Beadle in considering southeastern North America to be an area of extreme species richness for *Crataegus.* He recognizes several of Beadle's species, and has annotated specimens at FLAS as *C. lepida.* Although one could criticize the naming of hundreds of *Crataegus* morphotypes, I believe in this case that the distinctive morphology and narrow habitat preference of this taxon justifies recognizing it as a distinct species (Beadle 1901), pending further study. As such, it qualifies as another Florida scrub endemic].

Prunus caroliniana (Mill.) Aiton: Carolina laurel cherry. RU I. *TC363.*

Prunus geniculata R.M. Harper: Scrub plum. SH, XH O. *TC504, SB273.*

Prunus serotina Ehrh.: Wild cherry. FP, RU O. *TC559.*

Prunus umbellata Elliott: Flatwoods plum. RU O. *TC221, TC481.*

Rubus cuneifolius Pursh: Sand blackberry. SH, SF I. *TC590.*

Rubus argutus Link: Sawtooth blackberry. FP, WF, MF F. *TC069, SB026, SB238, SB271.*

RUBIACEAE

Cephalanthus occidentalis L.: Buttonbush. DM, FP F. *TC124, SB307.*

Diodia teres Walter: Poor Joe. SH, MF O. *TC231, SB131.*

Diodia virginiana L.: Buttonweed. WF I. *TC571.*

Galium hispidulum Michx.: Coastal bedstraw. SH I. *TC583.*

Galium tinctorium L.: Stiff bedstraw. FP I. *TC423.*

Houstonia procumbens (J.F .Gmel.) Standl.: Innocence. SH, XH I. *TC073.*

Mitchella repens L.: Partridge berry. FP, XH I. *TC421.*

Oldenlandia uniflora L.: Clustered mille graines. FP, RU, DM F. *TC232, SB137.*

Psychotria nervosa Sw.: Wild coffee. FP F. *TC372, TC560.*

Psychotria sulzneri Small: Shortleaf wild coffee. FP F. *TC561.*

* *Richardia brasiliensis* Gomes: Mexican clover. RU O. *TC215.*

Spermacoce remota Lam.: Woodland false buttonweed. RU O. *TC225.*

RUSCACEAE

Nolina brittoniana Nash: Britton's bear-grass. SH, SF O. *TC518, SB155.*

SALICACEAE

Salix caroliniana Michx.: Carolina willow. FP, Wetland edges F. *TC388, SB257.*

SALVINIACEAE

Azolla caroliniana Willd.: Carolina mosquito fern. BW, FP F. *TC551, TC570.*

* *Salvinia minima* Baker: Water spangles. BW, FP F. *TC434, SB278.*

SAPINDACEAE

Acer rubrum L.: Red maple. FP F. *TC382, SB237.*

SAPOTACEAE

Sideroxylon tenax L.: Tough bumelia. SC, SH F. *TC107, TC216, TC217, SB045.* [At least two of these specimens (*i.e., TC107, SB045*) may represent the morphologically distinct "*lacuum* entity," once recognized as *Bumelia lacuum* Small (see Lakela 1963) but now included within *S. tenax.* More study is needed].

SAURURACEAE

Saururus cernuus L.: Lizard's tail. FP F. *TC086.*

SELAGINELLACEAE

Selaginella arenicola Underw.: Sand spikemoss. SC, SH F. *TC314, SB020.*

SMILACACEAE

Smilax auriculata Walter: Earleaf greenbrier. SH, XH, SC, SF, MF, RU F. *TC193, SB010, SB039.*

Smilax bona-nox L.: Saw greenbrier. FP F. *TC455.*

Smilax glauca Walter: Greenbrier. MF, SH O. *TC095.*

Smilax laurifolia L.: Laurel greenbrier. FP, BH O. *TC081, SB085.*

Smilax pumila Walter: Sarsaparilla vine. FP, XH O. *TC452.*

Smilax walteri Pursh: Coral greenbrier. FP I. *TC394.*

SOLANACEAE

Physalis arenicola Kearney: Sand ground-cherry. SH O. *TC537, TC582.*

Physalis walteri Nutt.: Walter's ground-cherry. SH, XH I. *TC268, TC511.*

Solanum americanum Mill.: Common nightshade. RU O. *TC364.*

* *Solanum viarum* Dunal: Tropical soda apple. FP, XH, RU I. *TC214, SB252.*

TETRACHONDRACEAE

Polypremum procumbens L.: Rustweed. DM, RU F. *TC152, SB052.*

THEACEAE

Gordonia lasianthus (L.) J. Ellis: Loblolly bay. BH A. *TC038, SB061.*

THELYPTERIDACEAE

* *Thelypteris dentata* (Forssk.) E.P. St. John: Downy shield fern. FP O. *TC563.*

Thelypteris interrupta (Willd.) K. Iwats.: Hottentot fern. FP F. *TC448, TC453.*

Thelypteris kunthii (Desv.) C.V. Morton: Southern shield fern. FP O. *TC562.*

TURNERACEAE

Piriqueta cistoides (L.) Griseb. subsp. *caroliniana* (Walter) Arbo (Hybrid morphotype): Piriqueta. SH I. *TC149, TC584.* [J.K. Small (1933) recognized four species of *Piriqueta,* including *P. caroliniana* of northern Florida sandy uplands, and *P. viridis* of calcareous soils of southern Florida. Arbo (1995) grouped all four of Small's species into *P. cistoides* subsp. *caroliniana.* Maskas and Cruzan (2000) and Martin and Cruzan (1999) recognize these taxa as distinct morphotypes. The *P. viridis* and *P. caroliniana* morphotypes interbreed, with a broad hybrid zone in central Florida. These specimens, with erect habit, oblong leaves, and stellate hairs only, are intermediate between the decumbent, hirsute, elliptic-leaved *P. caroliniana* morphotype and the erect, glabrous, linear-leaved *P. viridis* morphotype].

TYPHACEAE

Typha domingensis Pers.: Southern cattail. FP O. *TC428.*

Typha latifolia L.: Common cattail. FP O. *TC251.*

ULMACEAE

Ulmus americana L.: American elm. FP O. *TC558.*

URTICACEAE

Boehmeria cylindrica (L.) Sw.: Bog hemp. FP F. *TC429.*

VERBENACEAE

* *Lantana camara* L.: Lantana. RU O. *TC161, SB285.*

Phyla nodiflora (L.) Greene: Fogfruit. RU F. *TC170.*

* *Verbena brasiliensis* Vell.: Brazilian vervain. RU O. *TC384.*

VIOLACEAE

Viola lanceolata L.: Longleaf violet. DM F. *TC446, SB269.*

Viola primulifolia L.: Primroseleaf violet. BH, MF I. *TC048, SB270.*

VISCACEAE

Phoradendron leucarpum (Raf.) Reveal & M.C. Johnst.: Oak mistletoe. SH, XH, FP O. *TC084.*

VITACEAE

Ampelopsis arborea (L.) Koehne: Peppervine. FP, RU O. *TC486.*

Parthenocissus quinquefolia (L.) Planch.: Virginia creeper. XH, FP, RU F. *TC295, SB243.*

Vitis aestivalis Michx.: Summer grape. RU O. *TC484.*

Vitis cinerea (Engelm.) Engelm. ex Millardet var. *floridana* Munson: Florida grape. RU, XH O. *TC181, TC544.*

Vitis rotundifolia Michx.: Muscadine grape. SH, MF, SF, SC, FP, BH, RU F. *TC177, SB037, SB081, SB295.*

XYRIDACEAE

Xyris ambigua Beyr. ex Kunth: Coastalplain yellow-eyed grass. DM O. *TC138, TC282.*

Xyris brevifolia Michx.: Shortleaf yellow-eyed grass. DM O. *TC379, TC404.*

Xyris caroliniana Walter: Carolina yellow-eyed grass. DM O. *SB099.*

Xyris elliottii Chapm.: Elliott's yellow-eyed grass. DM, WF F. *TC498, SB084.*

Xyris jupicai Rich.: Richard's yellow-eyed grass. DM O. *TC055, TC608.*

LITERATURE CITED

ABRAHAMSON, W. G. 1984. Post-fire recovery of Florida Lake Wales Ridge vegetation. Amer. J. Bot. 71: 9-21.

———, A. F. JOHNSON, J. N. LAYNE, AND P. A. PERONI. 1984. Vegetation of the Archbold Biological Station, Florida: an example of the southern Lake Wales Ridge. Florida Sci. 47: 209-250.

——— AND D. C. HARTNETT. 1990. Pine Flatwoods and Dry Prairies, pp. 103-149. *In:* R. L. MYERS AND J. J. EWEL, eds. Ecosystems of Florida. University of Central Florida Press, Orlando, FL.

ADAMS, P. 1962. Studies in the Guttiferae. II. Taxonomic and distributional observations on North American taxa. Rhodora 64: 231-242.

ALAIN, HERMANO (= ALAIN H. LIOGIER). 1953. El endemismo en la flora de Cuba. Mem. Soc. Cub. Hist. Nat. "Felipe Poey" 21: 187-193.

ANGIOSPERM PHYLOGENY GROUP. 2003. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG II. Bot. J. Linn. Soc. 141: 399-436.

ARBO, M. M. 1995. Turneraceae. Part I. *Piriqueta.* Monograph No. 67, Flora Neatropica. The New York Botanical Garden, Bronx, NY.

ARRINGTON, J. M. AND K. KUBITZKI. 2003. Cistaceae, pp. 62-70. *In:* K. KUBITZKI AND C. BAYER, volume eds. Malvales, Capparales, and Non-Betalain Caryophyllales, Vol. 5. *In:* K. KUBITZKI, ed. The Families and Genera of Vascular Plants. Springer-Verlag, Berlin.

BALLARD, R. 1986. *Bidens pilosa* complex (Asteraceae) in North and Central America. Amer. J. Bot. 73: 1452-1465.

BARCELO, M. D., D. L. SLONENA, S. C. CAMP, AND J. D. WATSON. 1990. Ridge II: A Hydrogeologic Investigation of the Lake Wales Ridge. Southwest Florida Water Management District, Brooksville, FL.

BARTRAM, W. 1791. The travels of William Bartram. M. Van Doren, ed. Dover, New York, 1928.

BEADLE, C. D. 1901. *Crataegus lepida.* Biltmore Bot. Stud. 1:36.

BORHIDI, A. AND O. MUNIZ. 1986. The phytogeographic survey of Cuba II. Floristic relationships and phytogeographic subdivision. Acta Bot. Hung. 32: 3-48.

BROOKS, H. K. 1982. Physiographic Divisions. Institute of Food and Agricultural Sciences, Cooperative Extension Service, University of Florida, Gainesville, FL.

BROWN, C. 1996. The Civil War, 1861-1865, pp. 231-248. *In:* M. GANNON, ed. 1996. The New History of Florida. University Press of Florida, Gainesville, FL.

BROWN, R. B., E. L. STONE, AND V. W. CARLISLE. 1990. Soils, pp. 35-69. *In:* R. L. MYERS AND J. J. EWEL, eds. Ecosystems of Florida. University of Central Florida Press, Orlando, FL.

BRUMMITT, R. K. AND C. E. POWELL. 1992. Authors of Plant Names. Royal Botanical Gardens, Kew, U.K.

CAMPBELL, K. M. 1986. Geology of Polk County, Florida. Open File Report 13. Florida Geological Survey, Tallahassee, FL.

CHAFIN, L. G. 2000. Field Guide to the Rare Plants of Florida. Florida Natural Areas Inventory, Tallahassee, FL.

CHAPLIN, S. J., R. A. GERRARD, H. M. WATSON, L. L. MASTER, AND S. R. FLACK. The Geography of Imperilment, pp. 159-199. *In:* B. A. STEIN, L. S. KUTNER, AND J. S. ADAMS, eds. 2000. Precious Heritage: The Status of Biodiversity in the United States. Oxford University Press, Inc., New York.

CHASTEEN, D. 1982. Final report on sand pine scrub vegetation survey near Tiger Creek Preserve. Report to The Nature Conservancy, Babson Park, FL.

CHEN, E. AND J. F. GERBER. 1990, Climate, pp. 11-34. *In:* R. L. MYERS AND J. J. EWEL, eds. Ecosystems of Florida. University of Central Florida Press, Orlando, FL.

CHRISTMAN, S. P. 1988a. Endemism and Florida's Interior Sand Pine Scrub. Final project report, Project No. GFC-84-101. Submitted to Florida Game and Freshwater Fish Commission, Division of Wildlife, Nongame Wildlife Section, Tallahassee, FL.

———. 1988b. Rare Vascular Plants and Vertebrate Animals of the Uplands of Tiger Creek Preserve. Report to The Nature Conservancy, Babson Park, FL

——— AND W. S. JUDD. 1990. Notes on plants endemic to Florida scrub. Florida Sci. 53: 52-73.

CLEMENS, L. A., D. P. SPANGLER, AND D. J. PATTON. 1984. The Hydrologic Cycle, pp. 10-17. *In:* E. A. FERNALD AND D. J. PATTON, eds. Water Resources Atlas of Florida. Institute of Science and Public Affairs, Florida State University, Tallahassee, FL.

CLEMENTS, F. E. 1936. Nature and structure of the climax. J. Ecol. 24: 252-284.

COILE, N. C. AND M. A. GARLAND. 2003. Notes on Florida's Endangered and Threatened Plants. Bureau of Entomology, Nematology and Plant Pathology - Botany Section, Contribution No. 38, 4th Edition. Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Gainesville, FL.

CONDON, B. AND F. E. PUTZ. 2007. Countering the broadleaf invasion: financial and carbon consequences of removing hardwoods during longleaf pine savanna restoration. Restorat. Ecol. 15: 296-303.

COOKE, C. W. 1939. Scenery of Florida Interpreted by a Geologist. Geological Bulletin No. 17. Florida Geological Survey, Tallahassee, FL.

———. 1945. Geology of Florida. Geological Bulletin No. 29. Florida Geological Survey, Tallahassee, FL.

CRAWFORD, P. T. AND W. J. ELISENS. 2006. Genetic variation and reproductive system among North American species of *Nuttallanthus* (Plantaginaceae). Amer. J. Bot. 93: 582-591.

CURTIS, J. T. AND R. P. MCINTOSH. 1951. An upland continuum in the prairie-forest border region of Wisconsin. Ecology 32: 476-496.

DAVIS, M. B. 1981. Quaternary History and the Stability of Forest Communities, pp. 132-153. *In:* D. C. WEST, H. H. SHUGART, AND D. B. BOTKIN, eds. Forest Succession Concepts and Applications. Springer-Verlag, New York.

———. 1983. Quaternary history of deciduous forests of eastern North America and Europe. Ann. Missouri Bot. Gard. 70: 550-563.

——— AND R. G. SHAW. 2001. Range shifts and adaptive responses to Quaternary climate change. Science 292: 673-679.

DELANEY, K. R. AND R. P. WUNDERLIN. 1989. A new species of *Crotalaria* (Fabaceae) from the Florida Central Ridge. Sida 13: 315-324.

DEYRUP, M. 1990. Arthropod footprints in the sands of time. Florida Entomol. 73: 529-538.

DOLAN, R. W., R. YAHR, E. S. MENGES, AND M. D. HALFHILL. 1999. Conservation implications of genetic variation in three rare species endemic to Florida rosemary scrub. Amer. J. Bot. 86: 1556-1562.

EDWARDS, C. E. 2007. Phylogeny reconstruction and conservation genetics of *Conradina* and related southeastern U. S. endemic mints (Lamiaceae). Ph.D. dissertation, University of Florida, Gainesville, FL.

EVANS, M. E. K., R. W. DOLAN, E. S. MENGES, AND D. R. GORDON. 2000. Genetic diversity and reproductive biology in *Warea Carteri* (Brassicaceae), a narrowly endemic Florida scrub annual. Amer. J. Bot. 87: 372-381.

EWEL, K. C. 1990. Swamps, pp. 281-323. *In:* R. L. MYERS AND J. J. EWEL, eds. Ecosystems of Florida. University of Central Florida Press, Orlando, FL.

FERNALD, E. A. AND D. J. PATTON, eds. 1984. Water Resources Atlas of Florida. Institute of Science and Public Affairs, Florida State University, Tallahassee, FL.

FIELD, C. B., L. D. MORTSCH, M. BRKLACICH, D. L. FORBES, P. KOVACS, J. A. PATZ, S. W. RUNNING, AND M. J. SCOTT. 2007. North America, pp. 617-652. *In:* M. L. PARRY, O. F. CANZIANI, J. P. PALUTIKOF, P. J. VAN DER LINDEN, AND C. E. HANSON, eds. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK.

FINE, P. V. A., Z. J. MILLER, I. MESONES, S. IRAZUZTA, H. M. APPEL, M. HENRY, H. STEVENS, I. SAAKSJARVI, J. C. SCHULTZ, AND P. D. COLEY. 2006. The growth-defense trade-off and habitat specialization by plants in Amazonian forests. Ecol. 87(7) Suppl.: S150-S162.

FLORIDA EXOTIC PEST PLANT COUNCIL (FLEPPC). 2007. List of Florida's Invasive Plant Species. FLEPPC, Gainesville, FL. http://www.fleppc.org/list/07list_ctrfld.pdf. (Last accessed April 2008).

FLORIDA GEOGRAPHIC DATA LIBRARY (FGDL). Version 2006. GeoPlan Center, University of Florida, Gainesville, FL. http://www.fgdl.org/. (Last accessed December 2007).

FLORA OF NORTH AMERICA EDITORIAL COMMITTEE. 1993-2007. Flora of North America North of Mexico, Vols. 1-5, 19-26. Oxford University Press, New York.

FLORIDA NATURAL AREAS INVENTORY (FNAI) AND FLORIDA DEPARTMENT OF NATURAL RESOURCES (FDNR). 1990. Guide to the Natural Communities of Florida. Tallahassee, FL.

FRISBIE, L. K. 1976. Yesterday's Polk County. E.A. Seemann Publishing Co., Inc., Miami, FL.

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION (FWCC). 2002. A Conceptual Management Plan for Lake Wales Ridge Wildlife and Environmental Area, 2002-2007. FWCC, Tallahassee, FL.

GANNON, M., ed. 1996. The New History of Florida. University Press of Florida, Gainesville, FL.

GLEASON, H. A. 1917. The structure and development of the plant association. Bull. Torrey Bot. Club 44: 463-481.

———. 1926. The individualistic concept of the plant association. Bull. Torrey Bot. Club 53: 7-26.

GRAHAM, A. 1964. Origin and evolution of the biota of southeastern North America: Evidence from the fossil plant record. Evolution 18: 571-585.

GUREVITCH, J., S. M. SCHEINER, AND G. A. FOX. The Ecology of Plants. Sinauer Associates, Inc., Sunderland, MA.

HALL, D. W. 1978. The grasses of Florida. Ph.D. Dissertation, University of Florida, Gainesville, Fl. University Microfilms International #7913279, Ann Arbor, MI.

HANN, J. H. The Missions of Spanish Florida, pp. 78-99. *In:* GANNON, M., ed. 1996. The New History of Florida. University Press of Florida, Gainesville, FL.

HARDIN, J. W. 1974. Studies in southeastern United States flora. IV. Oleaceae. Sida 5: 274-285.

——— AND D.E. STONE. 1984. Atlas of foliar surface features in woody plants, VI. *Carya* (Juglandaceae) of North America. Brittonia 36: 140-153.

HARPER, R. M. 1905. 'Hammock', 'hommock' or 'hummock'? Science 22: 400-402.

———. 1949. A preliminary list of the endemic flowering plants of Florida. Quart. J. Florida Acad. Sci. 11: 25-35, 39-57; 12: 1-19.

HAWKES, C. V. AND E. S. MENGES. 1996. The relationship between open space and fire for species in a xeric Florida shrubland. Bull. Torrey Bot. Club 123: 81-92.

HINE, A. C. 1997. Structural and Paleoceanographic Evolution of the Margins of the Florida Platform, pp. 169-194. *In:* A. F. RANDAZZO AND D. S. JONES, eds. 1997. The Geology of Florida. University Press of Florida, Gainesville, Florida.

HORTON, J. H. 1972. Studies of the southeastern United States flora. IV. Polygonaceae. J. Elisha Mitchell Sci. Soc. 88: 92-102.

HUCK, R. B., W. S. JUDD, W. M. WHITTEN, J. D. SKEAN, R. P. WUNDERLIN, AND K. R. DELANEY. 1989. A new *Dicerandra* (Labiatae) from the Lake Wales Ridge of Florida, with a cladistic analysis and discussion of endemism. Syst. Bot. 14: 197-213.

ISLAM, M. B. AND M. P. SIMMONS. 2006. A thorny dilemma: testing alternative intrageneric classifications within *Ziziphus* (Rhamnaceae). Syst. Bot. 31: 826-842.

JAMES, C. W. 1961. Endemism in Florida. Brittonia 13: 225-244.

JOHNSON, A. F. AND W. G. ABRAHAMSON. 1982. *Quercus inopina*: A species to be recognized from south-central Florida. Bull. Torrey Bot. Club 109: 392-395.

JORDAN, C. L. 1984. Florida's Weather and Climate: Implications for Water, pp. 18-35. *In:* E.A. FERNALD AND D.J. PATTON, eds. Water Resources Atlas of Florida. Institute of Science and Public Affairs, Florida State University, Tallahassee, FL.

JUDD, W. S. AND D. W. HALL. 1984. A new species of *Ziziphus* (Rhamnaceae) from Florida. Rhodora 86: 381-387.

JUDD, W. S., C. S. CAMPBELL, E. A. KELLOGG, P. F. STEVENS, AND M. J. DONOGHUE. 2008. Plant Systematics: A Phylogenetic Approach, Third Edition. Sinauer Associates, Inc., Sunderland, MA.

KALISZ, P. AND E. L. STONE. 1984. The longleaf pine islands of the Ocala National Forest, Florida: a soil study. Ecology 65: 1743-1754.

KALKMAN, C. 2004. Rosaceae, pp. 343-386. *In:* K. KUBITZKI, volume ed. Celastrales, Oxalidales, Rosales, Cornales, Ericales, Vol. 6. *In:* K. KUBITZKI, ed. Families and Genera of Vascular Plants. Springer-Verlag, Berlin.

KERR, B., D. W. SCHWILK, A. BERGMAN, AND M. W. FELDMAN. 1999. Rekindling an old flame: A haploid model for the evolution and impact of flammability in resprouting plants. Evol. Ecol. Res. 1: 807-833.

KRAL, R. AND R. B. MCCARTNEY. 1991. A new species of *Conradina* (Lamiaceae) from northeastern peninsular Florida. Sida 14: 391-398.

KRAMER, K. U. AND P. S. GREEN, eds. 1990. Pteridophytes and Gymnosperms, Vol. 1. *In:* K. KUBITZKI, ed. The Families and Genera of Vascular Plants. Springer-Verlag, Berlin.

KRUCKEBERG, A. R. AND D. RABINOWITZ. 1985. Biological aspects of endemism in higher plants. Ann. Rev. Ecol. Syst. 16: 447-479.

KUBITZKI, K., volume ed. 2004. Celastrales, Oxalidales, Rosales, Cornales, Ericales, Vol. 6. *In:* K. KUBITZKI, ed. The Families and Genera of Vascular Plants. Springer-Verlag, Berlin.

KUBITZKI, K. AND C. BAYER, volume eds. 2003. Malvales, Capparales, and Non-Betalain Caryophyllales, Vol. 5. *In:* K. KUBITZKI, ed. The Families and Genera of Vascular Plants. Springer-Verlag, Berlin.

LAKELA, O. 1963. The identity of *Bumelia lacuum* Small. Rhodora 65: 280-282.

LAMB FRYE, A. S. AND K. A. KRON. 2003. *rbcL* phylogeny and character evolution in Polygonaceae. Syst. Bot. 28: 326-332.

LANDERS, J. L., D. H. VAN LEAR, AND W. D. BOYER. 1995. The longleaf pine forest of the southeast: requiem or renaissance? J. Forest. 93: 39-43.

LAVERGNE, S., J. MOLINA, AND M. DEBUSSCHE. 2006. Fingerprints of environmental change on the rare mediterranean flora: a 115-year study. Global Change Biol. 12: 1466-1478.

LES, D. H. AND D. J. CRAWFORD. *Landoltia* (Lemnaceae), a new genus of duckweeds. Novon 9: 530-533.

LIENERT, H., M. FISCHER, J. SCHNELLER, AND M. DIEMER. 2002. Isozyme variability of the wetland specialist *Swertia perennis* (Gentianaceae) in relation to habitat size, isolation, and plant fitness. Amer. J. Bot. 89: 801-811.

LUTEYN, J. L., W. S. JUDD, S. P. VANDERKLOET, L. J. DORR, G. D. WALLACE, K. A. KRON, P. F. STEVENS, AND S. E. CLEMANTS. 1996. Ericaceae of the southeastern United States. Castanea 61: 101-144.

MACNEIL, F. S. 1950. Pleistocene Shorelines in Florida and Georgia. USGS Professional Paper No. 221-F. http://pubs.er.usgs.gov/usgspubs/pp/pp221F. (Last accessed October 2007).

MALIAKAL-WITT, S., E. S. MENGES, AND J. S. DENSLOW. 2005. Microhabitat distribution of two Florida scrub endemic plants in comparison to their habitat-generalist congeners. Amer. J. Bot. 92: 411-421.

MARTIN, L. J. AND M. B. CRUZAN. 1999. Patterns of hybridization in the *Piriqueta caroliniana* complex in central Florida: evidence for an expanding hybrid zone. Evolution 53: 1037-1049.

MARTIN, T. 1998. Florida's Ancient Islands. The Lake Wales Ridge Ecosystem Working Group. Archbold Biological Station, Lake Placid, FL.

MASCHINSKI, J., J. E. BAGGS, P. F. QUINTANA-ASCENCIO, AND E. S. MENGES. 2006. Using population viability analysis to predict the effects of climate change on the extinction risk of an endangered limestone endemic shrub, Arizona cliffrose. Conservation Biol. 20: 218-228.

MASKAS, S. D. AND M. B. CRUZAN. 2000. Patterns of intraspecific diversification in the *Piriqueta caroliniana* complex in southeastern North America and the Bahamas. Evolution 54: 815-827.

MASON, H. L. 1946. The edaphic factor in narrow endemism. Madroño 8: 209-226.

MAYBURY, K. P., ed. 1999. Seeing The Forest And The Trees: Ecological Classification For Conservation. The Nature Conservancy, Arlington, VA.

MENGES, E. S. 2007. Integrating demography and fire management: an example from Florida scrub. Austral. J. Bot. 55: 261-272.

———, W. G. ABRAHAMSON, K. T. GIVENS, N. P. GALLO, AND J. N. LAYNE. 1993. Twenty years of vegetation change in five long-unburned Florida plant communities. J. Veg. Sci. 4: 375-386.

——— AND N. KOHFELDT. 1995. Life history strategies of Florida scrub plants in relation to fire. Bull. Torrey Bot. Club 122: 282-297.

MILANICH, J. T. 1994. Archaeology of Precolumbian Florida. University Press of Florida, Gainesville, FL.

———. 1995. Florida Indians and the Invasion From Europe. University Press of Florida, Gainesville, FL.

MILLER, J. A. 1997. Hydrogeology of Florida, pp. 69-88. *In:* A. F. RANDAZZO AND D.S. JONES, eds. 1997. The Geology of Florida. University Press of Florida, Gainesville, FL.

MOHL, R. A. AND G. R. MORMINO. 1996. The Big Change In The Sunshine State: A Social History Of Modern Florida, pp. 418-447. *In:* M. GANNON, ed. 1996. The New History of Florida. University Press of Florida, Gainesville, FL.

MULLER, J. W., E. D. HARDIN, D. R. JACKSON, S. E. GATEWOOD, AND N. CAIRE. 1989. Summary Report on the Vascular Plants, Animals and Plant Communities Endemic to Florida, Nongame Wildlife Program Technical Report No. 7. Florida Game and Freshwater Fish Commission, Tallahassee, FL.

MULVANIA, M. 1931. Ecological survey of a Florida scrub. Ecology 12: 528-540.

MUTCH, R. W. 1970. Wildland fires and ecosystems – a hypothesis. Ecology 51: 1046-1051.

MYERS, R. L. 1985. Fire and the dynamic relationship between Florida sandhill and sand pine scrub vegetation. Bull. Torrey Bot. Club 112: 241-252.

———. 1990. Scrub and High Pine, pp. 150-193. *In:* R.L. MYERS, AND J.J. EWEL, eds. Ecosystems of Florida. University of Central Florida Press, Orlando, FL.

——— AND S. BOETTCHER. 1987. Provisional Fire Management Plan for a Portion of Tiger Creek Preserve. Report to The Nature Conservancy, Babson Park, FL.

——— AND D. L. WHITE. 1987. Landscape history and changes in sandhill vegetation in north-central and south-central Florida. Bull. Torrey Bot. Club 114: 21-32.

——— AND J. J. EWEL, eds. 1990. Ecosystems of Florida. University of Central Florida Press, Orlando, FL.

MYINT, T. 1966. Revision of the genus *Stylisma* (Convolvulaceae). Brittonia 18: 97-117.

MYINT, T. and D. B. Ward. 1968. A taxonomic revision of the genus *Bonamia* (Convolvulaceae). Phytologia 17: 121-239.

NAMM, L. A. 1997. Environmental interpretation for Saddle Blanket Lakes Preserve. Master of Landscape Architecture thesis, University of Florida, Gainesville, FL.

THE NATURE CONSERVANCY (TNC). 2006a. Tiger Creek Preserve Management Plan. Report of The Nature Conservancy, Lake Wales Ridge Program, Babson Park, FL.

———. 2006b. Saddle Blanket Scrub Preserve Management Plan. Report of The Nature Conservancy, Lake Wales Ridge Program, Babson Park, FL.

———. 2006c. Saddle Blanket Scrub Preserve Fire Management Plan. Report of The Nature Conservancy, Lake Wales Ridge Program, Babson Park, FL.

NESOM, G. L. 1990. Further definition of *Conyza* (Asteraceae: Astereae). Phytologia 68: 229-233.

———. 2004. New distribution records for *Gamochaeta* (Asteraceae: Gnaphalieae) in the United States. Sida 21: 1175-1185.

——— AND V. M. BATES. 1984. Reevaluations of infraspecific taxonomy in *Polygonella* (Polygonaceae). Brittonia 36: 34-77.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA). 2004. Climatological Data Annual Summary, Florida, Vol. 108, No. 13. NOAA National Climatic Data Center, Asheville, NC. http://www7.ncdc.noaa.gov/IPS/CDPubs?action=getstate. (Last accessed December 2007).

———. 2005. Climatological data annual summary, Florida, Vol. 109, No. 13. NOAA National Climatic Data Center, Asheville, NC. http://www7.ncdc.noaa.gov/IPS/CDPubs?action=getstate. (Last accessed December 2007).

———. 2007. Coastal Services Center website. Historical hurricane tracks. http://maps.csc.noaa.gov/hurricanes/viewer.html. (Last accessed October 2007).

PARK, K.-R. AND W. J. ELISENS. 2000. A phylogenetic study of tribe Euphorbieae (Euphorbiaceae). Int. J. Pl. Sci. 161: 425-434.

PARMESAN, C. AND G. YOHE. 2003. A globally coherent fingerprint of climate change impacts across natural systems. Nature 421: 37-42.

PERONI, P. A. AND W. G. ABRAHAMSON. 1985. Vegetation loss on the southern Lake Wales Ridge. Palmetto 5: 6-7.

———. 1986. Succession in Florida sandridge vegetation: a retrospective study. Florida Sci. 49: 176-191.

PETERSON, A. 2006. Tiger Creek Preserve Fire Management Plan. Report of The Nature Conservancy, Lake Wales Ridge Program, Babson Park, FL.

PHIPPS, J. B. AND K. A. DVORSKY. 2007. Review of *Crataegus* series *Apricae*, ser. nov., and *C. flava* (Rosaceae). J. Bot. Res. Inst. Texas 1: 171-202.

PROCTOR, S. 1996. Prelude to the New Florida, pp. 266-286. *In:* M. GANNON, ed. 1996. The New History of Florida. University Press of Florida, Gainesville, FL.

RANDAZZO, A. F. 1997. The Sedimentary Platform of Florida: Mesozoic to Cenozoic, pp. 39-56. *In:* A. F. RANDAZZO AND D. S. JONES, eds. 1997. The Geology of Florida. University Press of Florida, Gainesville, FL.

RANDAZZO, A. F. AND D. S. JONES, eds. 1997. The Geology of Florida. University Press of Florida, Gainesville, FL.

REINHART, K. O. AND E. S. MENGES. 2004. Effects of re-introducing fire to a central Florida sandhill community. Appl. Veg. Sci. 7: 141-150.

SCHAFER, D. L. 1996. U.S. Territory and State, pp. 207-230. *In:* M. GANNON, ed. 1996. The New History of Florida. University Press of Florida, Gainesville, FL.

SCOTT, T. M. 1997. Miocene to Holocene History of Florida, pp. 57-67. *In:* A. F. RANDAZZO AND D. S. JONES, eds. 1997. The Geology of Florida. University Press of Florida, Gainesville, FL.

———. 2001. Text to Accompany the Geologic Map of Florida. Open-File Report 80. Florida Geological Survey, Tallahassee, FL.

———, K. M. CAMPBELL, F. R. RUPERT, J. D. ARTHUR, T. M. MISSIMER, J. M. LLOYD, J. W. YON, AND J. G. DUNCAN. 2001. Geologic Map of the State of Florida. Florida Geological Survey, Tallahassee, FL.

SHAW, J. AND R. L. SMALL. 2005. Chloroplast DNA phylogeny and phylogeography of the North American plums (*Prunus* subgenus *Prunus* section *Prunocerasus*, Rosaceae). Amer. J. Bot. 92: 2011-2030.

SHINNERS, L. H. 1962. Synopsis of *Conradina* (Labiatae). Sida 1: 84-88.

SMALL, J. K. 1933. Manual of the Southeastern Flora. University of North Carolina Press, Chapell Hill.

SMITH, D. L. AND K. M. LORD. 1997. Tectonic Evolution and Geophysics of the Florida Basement, pp. 13-26. *In:* A. F. RANDAZZO, AND D. S. JONES, eds. 1997. The Geology of Florida. University Press of Florida, Gainesville, FL.

SMITH, A. R., K. M. PRYER, E. SCHUETTPELZ, P. KORALL, H. SCHNEIDER, AND P. G. WOLF. 2006. A classification for extant ferns. Taxon 55: 705-731.

SORRIE, B. A. AND A. S. WEAKLEY. 2001. Coastal plain vascular plant endemics: phytogeographic patterns. Castanea 66: 50-82.

STEBBINS, G. L. 1942. The genetic approach to problems of rare and endemic species. Madroño 6: 241-272.

———. 1980. Rarity of plant species: A synthetic viewpoint. Rhodora 82: 77-86.

———AND J. MAJOR. 1965. Endemism and speciation in California flora. Ecol. Monogr. 35: 1-35.

STEIN, B. A., L. S. KUTNER, AND J. S. ADAMS, eds. 2000. Precious Heritage: The Status of Biodiversity in the United States. Oxford University Press, Inc., New York.

STEINMANN, V. W. AND J. M. PORTER. 2002. Phylogenetic relationships in Euphorbieae (Euphorbiaceae) based on ITS and *ndhF* sequence data. Ann. Missouri Bot. Gard. 89: 453-490.

STEVENS, P. F. 2001 onwards. Angiosperm Phylogeny Website, Version 8, June 2007 [and more or less continuously updated since]. http://www.mobot.org/MOBOT/research/APweb/. (Last accessed December 2007).

STOUT, I. J. 2001. Rare plants of the Florida scrub, USA. Nat. Areas J. 21: 50-60.

SUTTON, D. A. 1988. A Revision of the Tribe Antirrhineae. Oxford University Press, Oxford, UK.

TIGHE, R. E. 1987. Hydrology of Tiger Creek Preserve, Polk County, Florida: Report for The Nature Conservancy, Babson Park, FL.

TOBE, J. T., K. C. BURKS, R. W. CANTRELL, M. A. GARLAND, M. E. SWEELEY, D. W. HALL, P. WALLACE, G. ANGLIN, G. NELSON, J. R. COOPER, D. BICKNER, K. GILBERT, N. AYMOND, K. GREENWOOD, N. RAYMOND. 1998. Florida Wetland Plants: An Identification Manual. Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL.

TURNER, B. L. AND M. I. MORRIS. 1976. Systematics of *Palafoxia* (Asteraceae: Helenieae). Rhodora 78: 567-628.

UPCHURCH, S. B. AND A. F. RANDAZZO. 1997. Environmental Geology of Florida, pp. 217-250. *In:* A. F. RANDAZZO AND D. S. JONES, eds. 1997. The Geology of Florida. University Press of Florida, Gainesville, FL.

UNITED STATES DEPARTMENT OF AGRICULTURE (USDA). 1990. Soil Survey of Polk County, Florida. USDA, Soil Conservation Service.

U.S. FISH AND WILDLIFE SERVICE (USFWS). 1996. Recovery Plan for Nineteen Central Florida Scrub and High Pineland Plants (Revised). U.S. Fish and Wildlife Service, Atlanta, GA.

———. 2007. USFWS Threatened and Endangered Species System. http://ecos.fws.gov/tess_public/SpeciesReport.do?dsource=plants. (Last accessed December 2007).

WAGNER, W. L., P. C. HOCH, AND P. H. RAVEN. 2007. Revised classification of the Onagraceae. Syst. Bot. Monogr. Vol. 83.

WALDRON, P. W., L. R. CANNON, G. S. COMP, P. M. DOORIS, R. P. EVANS, A. E. GILBOY, J. W. HEUER, JR., L. MILLER, R. P. NORBERG, R. S. OWEN, D. K. PARKIN-WELZ, D. L. SLONENA, R. W. SCHULTZ, J. K. WHALEN, D. A. WILEY, AND B. C. WIRTH. 1984. Southwest Florida Water Management District, pp. 178-197. *In:* E. A. FERNALD AND D. J. PATTON, eds. Water Resources Atlas of Florida. Institute of Science and Public Affairs, Florida State University, Tallahassee, FL.

WARD, D. B., volume ed. 1979. Plants, Vol. 5. *In:* P. C. H. PRITCHARD, series ed. Rare and Endangered Biota of Florida, University Presses of Florida, Gainesville, FL.

———. 2000. Mesic : xeric species-pairs in peninsular Florida. Castanea 65: 78-80.

———. 2001. New combinations in the Florida flora. Novon 11: 360-365.

———. 2006. Scientific note. Castanea 71: 80-84.

———. 2007. Scientific note: *Quercus sinuata* Walter - the hybrid of *Q. falcata* and *Q. phellos* - rediscovered and neotypified. Castanea 72: 177-181.

———, D. F. AUSTIN, AND N. C. COILE. 2003. Endangered and threatened plants of Florida, ranked in order of rarity. Castanea 68: 160-174.

WATTS, W. A. 1980. The late quaternary vegetation history of the southeastern United States. Annual Rev. Ecol. Syst. 11: 387-409.

WEBB, S. D. 1990. Historical Biogeography, pp. 70-100. *In:* R. L. Myers and J. J. Ewel, eds. Ecosystems of Florida. University of Central Florida Press, Orlando, FL.

WEST, D. C., H. H. SHUGART, AND D. B. BOTKIN, eds. 1981. Forest Succession Concepts and Applications. Springer-Verlag, New York.

WHITE, W. H. 1958. Some Geomorphic Features of Central Peninsular Florida. Geological Bulletin 41. Bureau of Geology, Division of Interior Resources, Florida Dept. of Natural Resources, Tallahassee, FL.

———. 1970. The Geomorphology of the Florida Peninsula. Geological Bulletin 51. Bureau of Geology, Division of Interior Resources, Florida Dept. of Natural Resources, Tallahassee, FL.

WINSBERG, M. D. 1990. Florida Weather. University of Central Florida Press, Orlando, FL.

WOFFORD, B. E. 1973. A biosystematic study of the genus *Persea* (Lauraceae) in the southeastern United States. Ph.D. dissertation, University of Tennessee, Knoxville, TN.

WOODSON, R. E. 1947. Notes on the "historical factor" in plant geography. Contr. Gray Herb. 165: 12-25.

———. 1954. The North American species of *Asclepias*. Ann. Missouri Bot. Gard. 41:1-211.

WUNDERLIN, R. P. 1982. Guide to the Vascular Plants of Central Florida. University Presses of Florida, Tampa, FL.

——— AND B. F. HANSEN. 2003. Guide to the Vascular Plants of Florida, Second Edition. University Press of Florida, Gainesville, FL.

———. 2004. Atlas of Florida Vascular Plants Institute for Systematic Botany, University of South Florida, Tampa, FL. http://www.plantatlas.usf.edu/. (Last accessed February 2008).

ZONA, S. 1990. A Monograph of *Sabal* (Arecaceae: Coryphoideae). Rancho Santa Ana Botanic Garden, Claremont, CA.

ZONA, S. AND W. S. JUDD. 1986. *Sabal etonia* (Palmae): Systematics, distribution, ecology, and comparisons to other Florida scrub endemics. Sida 11: 417-427.

BIOGRAPHICAL SKETCH

Paul Corogin was born in Columbus, Ohio. He grew up near the shores of Lake Erie. After earning a Bachelor of Science in zoology from The Ohio State University in 1983, he moved to Gainesville, Florida, where he became a massage therapist and worked in landscaping. Years of working outdoors deepened his interest in plants, and during a stint of volunteer field work in Ocala National Forest, he crystallized a longstanding desire to return to school and study botany. He earned a second bachelor's degree, in botany, at the University of Florida, where he then began his graduate studies, earning a Master of Science in botany in May 2008.