Miami-Dade County's Management Plan for the Richmond Pine Rocklands

Second Edition

2018

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Cover photos by Jennifer Possley and Sonya Thompson. All other photos throughout this document have initials in their captions, crediting the following photographers:

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

APPENDICES

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

Pine rockland is a globally critically imperiled natural community that is "extremely limited in distribution," having a designation of "G1/S1"—the rarest rank possible, shy of extinction (FNAI 2010). Pine rockland is also an exceptionally diverse community, known to support approximately 440 native plant species (Gann et al. 2018), which are in turn complemented by high animal diversity.

Miami's Richmond area is a critically important remnant of the rich diversity of pine rockland flora and fauna that was once found throughout the Miami Ridge. With rapid urban growth beginning in the mid-20th century, nearly all upland natural communities in Miami were developed. Because Richmond was owned by the federal government and used for a Naval Air Base during World War II, much of it was protected from development. Today, this 4 square mile area contains the largest contiguous fragment of pine rockland in Miami-Dade County, outside of Everglades National Park.

Richmond is situated at the boundary between two soil types: Biscayne soils to the north, and Redland soils to the south. This diversity in substrates is reflected in extraordinary plant diversity. One can find more than 300 native plant species there, ranging from tiny orchids to the South Florida slash pine. There are eight federally listed plant species in Richmond, including the bulk of the world's populations of deltoid spurge (*Euphorbia deltoidea* ssp. *deltoidea*), Tiny polygala (*Polygala smalllii*), and Brickell bush (*Brickellia mosieri*). Many exceedingly rare but unlisted species also call Richmond home. For example, Shyvine (*Zornia bracteata*) is found throughout the Southeastern US but its southernmost known population is in Richmond. Similarly, Little strongback (*Bourreria cassinifolia*) is primarily found in Cuba but reaches its northernmost extent in the Richmond/Redland area.

As with plants, animal diversity in Richmond is higher than in surrounding areas. Richmond has supported seven federally listed animal species (two of which, the Eastern indigo snake and the Florida leafwing are now believed to be extirpated), and one species which is a candidate for federal listing, the gopher tortoise. In 2007, the rare Miami tiger beetle was rediscovered here (Brzoska et al. 2011), having been thought to be extinct for decades. The area is also one of only a handful of documented locations for the Bartram's scrub hairstreak butterfly, the lesser wasp moth, the Florida duskywing butterfly, and the rim rock crowned snake. Richmond also provides significant habitat for several bat species including the federally endangered Florida bonneted bat.

The natural areas that remain in Richmond are important to people, as well. The undeveloped land provides a critical point for aquifer recharge, noise reduction, and carbon sequestration. The trails in Larry & Penny Thompson Memorial Park are one of the only areas for miles where people can experience nature; this park is one of the few publicly-accessible pine rocklands in urban Miami. Richmond's unique forests are frequented by nature lovers, bird watchers, teachers, school groups, outdoor sports enthusiasts, ecologists, botanists, and entomologists.

This second edition of Miami-Dade County's Management Plan for the Richmond Pine Rocklands has been completed 24 years after the first edition (DERM 1994). Since that edition, there have been many new ecological discoveries, new laws, changing landownership, and other developments. This revision was created to serve as a reference for Richmond land owners, land managers, neighbors, and other interested parties for information on the area's natural resources. It is also intended to standardize management practices, to ensure that this invaluable resource is protected and cared for in the best way possible. To that end, the last section of this document is dedicated to a strategic action plan for

management of the pinelands. This strategic action is based on the following vision for management of Richmond's pine rocklands:

Vision statement

Richmond's unparalleled diversity of plants, animals, and habitats is widely embraced as a priceless piece of South Florida's natural heritage, and merits the highest standards for protection, restoration, and management, now and for future generations.

This document was created through the cooperative efforts of land managers, land owners, regulators, expert biologists, neighbors, and other stakeholders. The majority of persons who provided feedback throughout document development expressed concern about biodiversity loss in the Richmond pine rocklands. Several themes emerged throughout discussions, which bear emphasizing here:

1. Fires do not occur frequently enough in Richmond to preserve the unique native biodiversity, which is being lost as a consequence. Regular prescribed fire must be reintroduced to all pine rockland preservation areas to preserve rare species and curtail further biodiversity loss.
2. Not all pine rockland preservation areas with covenants or declarations of restrictions are being maintained as per the conservation agreements. These include properties owned by the County as well as properties under federal and private ownership. Failure to properly maintain preservation areas is also negatively impacting biodiversity in the region and contributing to the problem of fire-suppression.
3. Communication between separate management, regulatory, and other entities needs to be improved and maintained—especially regarding the implementation of fire.

Sound protection and management of the natural resources within Richmond is critically important to the flora, fauna, and people of South Florida. By working together, the area's various stakeholders can achieve the vision and protect the resources described herein.

I. SOCIO-POLITICAL BACKGROUND

A. Introduction

Richmond is located approximately 16 miles southwest of downtown Miami. This 2x2-mile, 2,560-acre square is bounded by Coral Reef Drive (SW 152nd Street) on the north, Eureka Drive (SW 184th Street) on the south, SW 117th Avenue on the east, and SW 137th Avenue on the west. The area was named for a sawmill community that existed there previously (Macfie 1977).

Richmond has been the site of unique human-made and natural occurrences in an endemic ecology. It was once the site of the world's largest blimp base, the first agricultural testing grounds for frozen lime and pineapple juice, the central missile base during the Cuban Missile Crisis, and a zoo planned to be the largest in area in the United States. Understanding the political history of Richmond is helpful in interpreting the vegetation patterns of the area, as well as in understanding the current and future management needs. Richmond's past land uses can be observed today in field studies of vegetation and in aerial photography.

B. Richmond Naval Air Station (1942-1945)

Richmond was relatively undisturbed until the 1940s, when war efforts initiated development of the 2,107 acre Richmond Naval Air Station (NAS). The site was an ideal military location due to its strategic, southern continental location, proximity to the Atlantic Ocean, and optimal flying weather. On September 15, 1942, official orders were read, establishing Richmond Naval Air Station which was the largest Navy Air Blimp Base in the world during World War II (**Fig. 1**). Its range of operation extended to the Caribbean, South America and the Gulf of Mexico (Macfie 1977). In a July 1943 incident, an airship from the station engaged in the only known battle of a blimp with a submarine, leaving the U-boat damaged, nine of ten airship crewmen surviving, and the loss at sea of the airship's bomber, petty officer Isadore Stessel (Barton 2014).

Richmond NAS was designed to be self-sufficient, including its own firehouse, incinerator, storage, maintenance, water and sewage (Macfie 1977). Large areas of pine rockland were cleared to create blimp pads. Construction costs exceeded $13 million (Macfie 1977). Historic photographs of the area show the natural landscape, though cut back and thinned, incorporated into the construction of bunkers and administrative headquarters.

The Richmond Naval Air Station was operational through the end of World War II, which officially ceased on September 2nd, 1945. Less than two weeks later, on September 15th, a powerful hurricane struck South Florida, directly striking the Richmond NAS. The storm had 94 mph sustained winds, tore the roofs from the blimp hangars, and caused a fire which quickly became catastrophic (Macfie 1977). Fanned by hurricane force-winds, the fire swept through the blimp base, destroying three hangers. Each hanger was 16 stories tall, 1000 feet long by 270 feet wide, housing 25 blimps, 366 airplanes and 150 vehicles. The catastrophe totaled millions of dollars in damage (Beekman 1962) (**Fig. 2**). The US Navy continued to work in portions of the station, but it was never fully operational again.

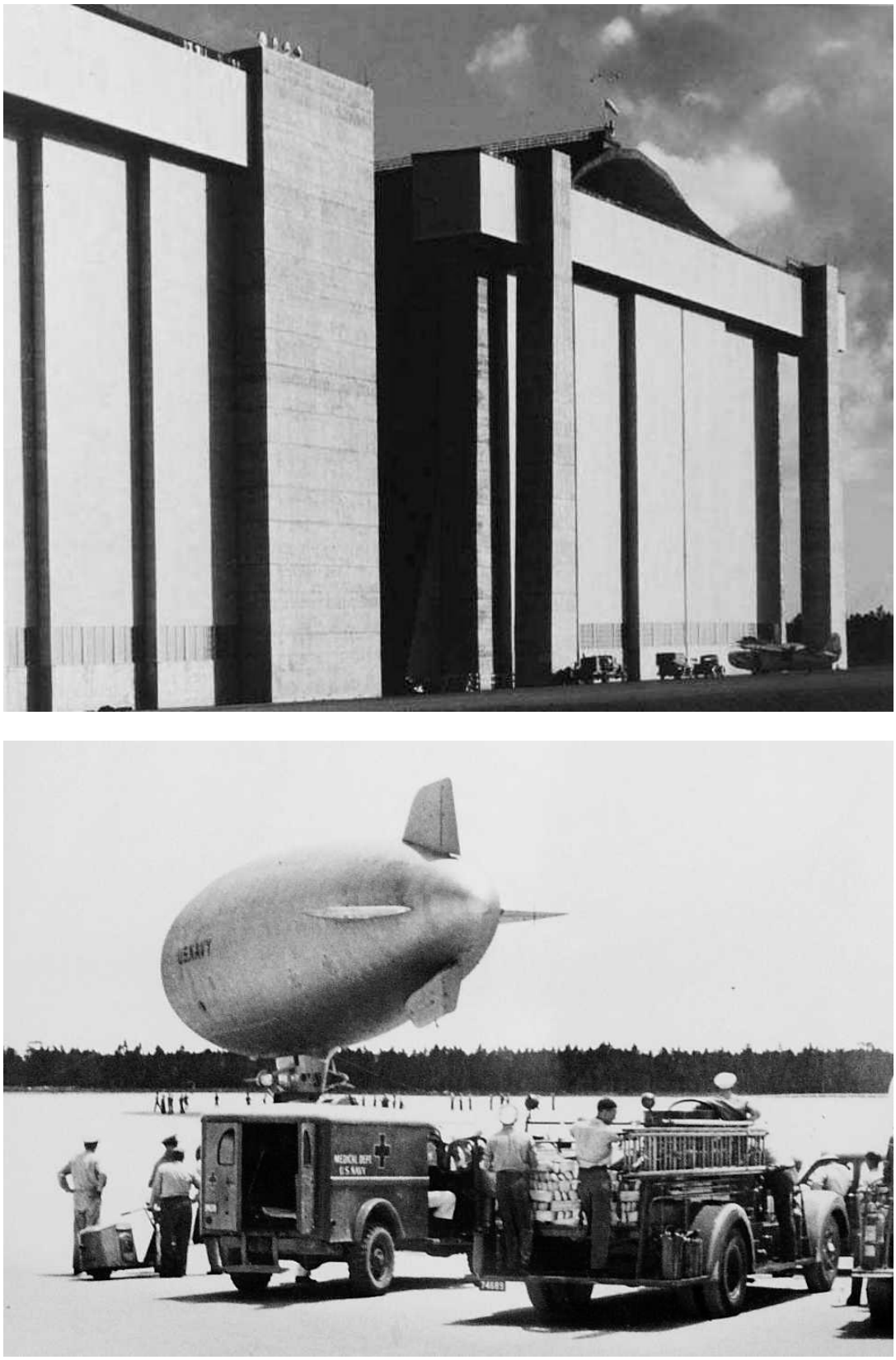


Figure 1. Richmond Naval Air Station, operating during World War II (Freeman 2017).

Figure 2. Devastation of Richmond NAS following the hurricane and fire of September 15th 1945 (Freeman 2017).

C. Disposition of Federal Properties and Current Land Ownership (1946 - 2017)

After the close of World War II, portions of Richmond were deemed surplus by the federal government, which began formal disposition of portions of the property through what would become the office of the General Services Administration (GSA, founded in 1949). Throughout the process of land disposition, the federal government continued to maintain a strong presence in Richmond. Beginning in 1946, the Navy maintained its Naval Observatory, which housed the world backup atomic clock. In 1960, the Air Force established a low altitude radar tracking station, which in part tracked missiles from Eglin Air Force Base (Macfie 1977). Soon after, the House Armed Services Committee approved apportionment of 474 acres in Richmond to be split between the four branches of the military: Army, Marines, Air Force and Navy (Macfie 1977). The Central Intelligence Agency established a base here in approximately 1960, under the front name "Zenith Technological Services" (Macfie 1977). Richmond was the central CIA base during the Cuban Missile Crisis during 1960 and 1961. Other federal properties in Richmond include The Federal Correctional Institution Miami, a minimum security facility for male prisoners which opened in 1976, and the Federal Aviation Administration (FAA), which once maintained an office in the area.

Post-war disposition saw the transfer of more than half of Richmond's land area to the University of Miami and eventually to Miami-Dade County. The County is now the largest landowner in Richmond, where it owns six contiguous properties, comprising approximately 58% of Richmond (**Table 1**). Further details on disposition and changing ownership of parcels within Richmond are addressed below and illustrated in **Map 1.**

Table 1. Summary of Richmond land ownership, as of 2018 (excluding residences and commercial establishments). Acreages are approximate and were derived from Miami-Dade County property appraiser's online GIS, and/or from mapping layers shared by staff from the Miami-Dade County DERM. This table corresponds to **Map 1** at the end of this plan. Note that "NFC Acres" does not include high-quality mowed habitat such as the antenna fields at the US Coast Guard Communication Station, and excludes some areas that have restoration potential.

	Total Acres	**NFC Acres**
County (58% of Richmond)		
Zoo Miami	644	223
Larry & Penny Thompson Memorial Park	270	177
Martinez Pineland	138	93
Gold Coast Railroad Museum	55	3
Former USCG "Southern Anchor" housing unit	41	2
Miami-Dade County Public Schools (Robert Morgan)	32	4.5
Federal (30%)		
US Coast Guard Station	248	80
Federal Correctional Institution	217	21
US Army Corps of Engineers/Dept. of Defense	138	54
LTC Luis E. Martinez US Army Reserve Center	18	0
National Oceanic and Atmospheric Administration	10	8
Private/Other (12%)		
Coral Reef Commons (ownership includes Coral Reef Retail LLC, Coral Reef Resi Ph 1 LLC, RamDev LLC and University of Miami)	138	51

University of Miami CSTARS	78	68
Florida Power & Light	29	0
CSX (Railroad)	7	0
South Florida Water Management District	7	0

* Excludes antennae fields, which are native-plant dominated and occupy approximately 150 acres of the station

Properties owned by Miami-Dade County

Miami-Dade County owns a majority (approximately 58%) of the land within Richmond, and a majority of the undeveloped land. These undeveloped lands—primarily pine rocklands—are managed as preserves to maintain the integrity of Miami-Dade County's imperiled ecosystems and the species they protect. The managing agency for most of these pine rocklands is Miami-Dade County's Environmentally Endangered Lands (EEL) Program (see **Map 12**), which funds the operations of the County's Natural Areas Management Division (NAM), part of the Department of Parks, Recreation, and Open Spaces (PROS). Additional funding for management is provided directly to NAM from Zoo Miami as part of a voluntary conservation covenant for additional parcels of environmentally sensitive land, including portions designated by Miami-Dade County as Natural Forest Community (NFC—see page 14 for a complete discussion of NFC designation). A discussion of the history of ownership for County-owned parts of Richmond follows.

Zoo Miami

For several decades, beginning in the late 1940s, Miami's zoo was located at Crandon Park on Key Biscayne. But by the late 1960s, interest in relocating the zoo began to mount. With disposition of the Richmond land from the federal government to the County, several hundred acres would soon be available—cost-free, readily accessible to the public, and believed to be less threatened by hurricanes (Carr Smith 1976).

The relocation and expansion project, funded in part through a bond in 1972, was to cost taxpayers $8 million by its 1976 completion date. At the time it was proposed, Miami Metro Zoo was to be the largest zoo in the United States. In 1973, $1 million from the bond was used to fund the relocation of Dade County's zoo from Crandon Park on Key Biscayne, as well as animal habitat studies in various parts of the world (Volker 1973). Financial problems mounted by 1975, however, when costs to finish the zoo soared from the original $8 million to $50 million. The opening date was moved from 1976 to 1977 with the completion of only two-thirds of the zoo costing nearly $20 million. Members from the Zoological Society of Florida raised more than 200,000 seedlings in their backyards to help landscape the zoo (Nolan 1975).

Approximately half of the acreage at Zoo Miami is dedicated to exhibit, staff, and parking. Surrounding this developed core are 252 acres of pine rockland. Slightly more than half of the 252 acres is managed by Miami-Dade County's Environmentally Endangered Lands Program; the remainder is managed by Zoo Miami.

Larry & Penny Thompson Memorial Park

In 1974, through the National Park Service's 'Federal Lands to Parks' program, Dade County acquired 270 additional acres of Richmond land which it dedicated as Larry & Penny Thompson Memorial Park. Larry Thompson was a daily humor columnist for the Miami Herald for 28 years, while his wife Penny

was a leader in women's aviation. She was, in fact, one of the pilots whose plane was destroyed in the 1945 fire at Richmond NAS (McRae 1946). The pair were proponents of outdoor recreation and champions for creating parks and planting trees in Miami.

As a condition of federal property transfer the United States Department of Interior required a submittal of a recreational plan known as the Program of Utilization (POU) (Babb et al. 1991). The POU for Larry and Penny Thompson Park indicated that 200 acres of the property was to remain as undisturbed natural areas with no active organized recreation. This POU also included a trailer campground and store, a lake with a waterslide and boat ramp, picnic shelters, bicycle and bridle paths, parking lots and roadways, a meadow for passive recreational activities, maintenance facilities and office buildings, playground facilities, and maintenance of the fruit groves that once belonged to University of Miami's Tropical Foods Research Center. Currently these trees—mangos, avocados, and lychees—are leased to local fruit growers to harvest and maintain.

The 200 acres of natural area at Larry & Penny Thompson Park are primarily pine rockland, but also contain some remnant transverse glade. The entire acreage is managed by the County's EEL program.

Martinez Preserve

Martinez Preserve was created in 2004 when the federal government deemed the 133-acre US Army outdoor training facility as surplus land and ownership was transferred to Miami-Dade County for environmental preservation through the NPS Federal Lands to Parks program. This preserve contains approximately 113 acres of pine rockland and 20 acres of former transverse glade-- the largest remnant of this rare plant community in Miami-Dade County. Martinez Preserve is also managed by the County's EEL program.

Gold Coast Railroad Museum

The Seaboard Railroad, which once ended at the present-day Gold Coast Railroad site, received trains during World War II and served as a major military supply distribution center. After the war, the site was leased to University of Miami for its "South Campus." The concept for a railroad museum began in 1956, though the efforts of a UM student named William J. Godfrey (GCRR 2017). The museum officially opened in 1957, and operated in Richmond until the Cuban Missile Crisis, when it was forced give up its land for a CIA base. In 1966, the museum moved to Broward County, where it stayed until 1983, when construction of I-595 again forced it to relocate, this time back to Richmond, occupying nearly the same location (GCRR 2017).

In 1992 Hurricane Andrew caused significant damage to the Gold Coast Railroad Museum. Some buildings and train cars were permanently destroyed. Rebuilding took 8 years and was funded largely by the Federal Emergency Management Agency (FEMA) (GCRR 2017). The Gold Coast Railroad Museum is owned by Zoo Miami; the non-profit historical museum is leased. The museum is run by volunteers who elect a governing board from their membership. The GCRR property contains approximately 9 acres of undeveloped pine rockland, which it is required to preserve and manage through a Declaration of Restrictions (Official Records Book 26521, pages 4319-4327). The 5-acre triangular unit on the property's west end is part of the EEL program (see **Map 12**), and is managed for exotic species by EEL and NAM.

Former "Southern Anchor" Coast Guard housing unit

In 2006, Miami-Dade County purchased a parcel of land from the US Coast Guard, which was formerly the agency's "Southern Anchor" personnel housing unit. Most of this approximately 41-acre parcel has been developed, though it contains 5 acres of unmanaged natural area.

Robert Morgan Educational Center & Technical College

Miami-Dade County Public Schools also has ownership in the Richmond area, with the Robert Morgan Educational Center & Technical College. The Educational Center, which opened in 1979, is a public high school with strong vocational program. The Technical College provides secondary education to adult students.

The campus was built on 32 acres of donated surplus federal land. Four and a half acres were left as undeveloped pine rockland (in two separate parcels), which is under a conservation covenant with Miami-Dade County (i.e., management is required). The largest parcel is 3-acres along the south property line which is immediately adjacent to EEL property and has long been managed by the EEL program. A separate 1.5-acre parcel is in the northeast corner of the property, adjacent to 122nd Ave., has not had invasive plant management. Officials from the school and DERM are currently undergoing discussion on management of that parcel.

<u>Properties under federal ownership</u>

After Miami-Dade County, the US Government is the largest landholder in Richmond, with approximately 30% of the acreage. A discussion follows of the history of ownership for Richmond parcels that are still federally owned.

US Coast Guard

Approximately 248 acres of Richmond are currently under the jurisdiction of the US Coast Guard. This single property is separated into two main areas: the Communication Station (COMMSTA) Miami and the Civil Engineering Unit (CEU). The COMMSTA houses transmitting and receiving antennas. The CEU plans and executes projects at regional shore facilities, such as construction and post-disaster assessments.

Eighty-six of the 248 acres include pine rockland and fire-suppressed former pine rockland. A portion of the COMMSTA property (approximately 150 acres) is occupied by fields that were scraped in the early 1940s to create the Richmond blimp base and were maintained as native-dominated "meadows" for decades by periodic mowing (Possley 2015). In-house mowing ceased in late 2016 and is now conducted by contractors. A management plan for the undeveloped portions of the preserve is currently being prepared.

Federal Bureau of Prisons

The Federal Correctional Institution Miami owns 217 acres of Richmond. This low-security federal facility, which opened in 1976, houses approximately 1300 inmates at the prison and an adjacent minimum security camp. The property includes 21 acres of pine rockland understory; a management

plan for this area is not publicly available. Prison staff periodically removes all trees and mows the entire parcel for security reasons.

US Army Corps of Engineers/Dept. of Defense

The US Army Corps of Engineers and Department of Defense retain ownership of a 138-acre parcel of land in northwestern Richmond that is sandwiched between Coral Reef Commons and the Gold Coast Railroad Museum. Eighty-five acres of this parcel is forested, though it is not managed for preservation of natural resources.

US Army Reserve Center

Luis E. Martinez Army Reserve Center is an 18-acre parcel located on the western edge of Richmond. The center was constructed in 1985 and once included a 138-acre outdoor training facility composed of undeveloped pine rockland and transverse glade. In 2004, these 138 acres were deemed federal surplus land and transferred to Miami-Dade County, which dedicated the area as "Martinez Preserve." The 18 acres retained by the US Army do not contain any natural area.

National Oceanic and Atmospheric Administration (NOAA)

The weather radar antenna for southeast Florida is located on the western edge of Richmond in a facility operated by NOAA. This 9.7-acre property includes approximately 9 acres of pine rockland. Construction on the facility began in 1993 to replace the previous antenna array that was housed on top of the Gables One Tower along South Dixie Highway in Coral Gables until it was destroyed in 1992 by Hurricane Andrew (Pfost and Santos 2013). The entirety of southeast Florida depends on this property and the sophisticated equipment inside for daily local and regional weather updates, as well as updates on hurricanes and other storms.

The NOAA property contains 9 acres of pine rockland, which is managed for some non-native species at intermittent intervals (funded at times by Miami-Dade County DERM). Hardwood reduction is also conducted intermittently, to promote natural fire behavior. However, a prescribed burn has not been applied to the property, nor has a wildfire occurred. Non-native, invasive species are a continuing issue in this parcel, which is contiguous with Martinez Preserve. A management plan for this area is not publicly available.

<u>Properties under other ownership (including private)</u>

Coral Reef Commons

The 93-acre property known as "Coral Reef Commons" was purchased from University of Miami by Coral Reef Retail LLC, Coral Reef Resi Ph1 LLC, and RamDev LLC in 2014. UM retains ownership of a portion of this property, their former "South Campus," in three parcels within the 138-acre footprint that is displayed in **Map 1**. These three, non-contiguous parcels total approximately 45 acres and include both forested and unforested land. Coral Reef Commons is planned as a mixed-use community with 900 apartments and several hundred thousand square feet of retail space and parking. The development's Habitat Conservation Plan preserves 51.54 acres of natural area (primarily the areas designated as "Natural Forest Community" by Miami-Dade County), and proposes adding 3.77 acres of pine rockland "stepping stone" plantings (Johnson Engineering 2017). Most of the 51.54 acres that will be preserved

are pine rockland, though approximately 3.72 acres of rockland hammock (the only such remnant of this habitat in Richmond) will also be retained.

University of Miami

In 1946 the University of Miami (UM) leased a portion of the Richmond NAS to form its "South Campus," with research focusing on food science, medicine, entomology, and industrial science (Macfie 1977). UM designated 350 acres for a horticultural farm and established a Tropical Foods Research Center in what is now the southeastern portion of Zoo Miami and northeastern portions of Larry & Penny Thompson Memorial Park. This research program contributed to the development of the frozen food industry as it studied handling and preservation of tropical foods. Many varieties of citrus were grown, as well as lychees, mangos, avocados, and the Barbados cherry (*Malpighia emarginata*), which was cultivated for its high vitamin C content (Smith 1957). In the early 1950s, the northwestern portion of the UM property was the location of a biomedical research center that focused on polio and cancer. UM medical scientists Drs. Wilhemina Dunning and Maymie Curtis were the first to produce cancer cells in embryonic chicks (Macfie 1977). Dr. Murray Sanders conducted polio research, with primates as test subjects. Despite the productive research, the South Campus gradually faded in popularity, with students "considering it too remote and inaccessible" (Macfie 1977). By the 1980s the property fell into disuse.

The federal lease of UM's South Campus terminated after 30 years, and ownership transferred to UM, encumbered with a transfer deed restriction that expired in 2012. In the 1990s the University of Miami announced plans to re-invent its former South Campus as a mixed-use "education village" that included off-campus housing. Toward that end, in 2005, the property went through a rezoning process. However, the off-campus housing/education plans never came to fruition, and the zoning application was then modified. In 2012, final zoning approval for a mixed commercial/residential development was obtained. In 2014, portions of the property were sold to Coral Reef Retail LLC, Coral Reef Resi Ph1 LLC, and RamDev LLC (see the Coral Reef Commons section, below, for further information). UM retained ownership of some inholdings, as described above. In 1996, Miami-Dade County nominated the sensitive forests on portions of Richmond owned by UM to make these lands eligible for purchase through the Environmentally Endangered Lands (EEL) Program, a willing seller acquisition program. This application was not supported by UM and the application was withdrawn.

The University of Miami gained a second parcel within Richmond in 2000 when it purchased the former Naval Observatory and surrounding property. Here, UM created the Center for Southeastern Tropical Advanced Remote Sensing (CSTARS, also known as the UM Richmond Campus), which produces high-resolution satellite imagery for science and industry. Of this approximately 78-acre property, 73 acres are forested pine rockland. Fifty-one acres (essentially the western 2/3 of the property) are protected under a conservation covenant with Miami-Dade County DERM which was enacted upon transfer from the GSA to UM. These Fifty-one acres are also governed by the Habitat Conservation Plan for Coral Reef Commons, which was issued by USFWS in December 2017 (Johnson Engineering 2017).

Private Residential and Commercial Ownership

From 1960 through the early 2000s, approximately 19% of the total area of Richmond was sold to developers and apportioned off for residential and commercial uses. This includes the northwest, southwest, and southeast corners as illustrated in **Map 1.** Residents within the four-square mile

Richmond area include more than 1600 single-family homes and two large multi-unit apartment complexes. The northwest corner of Richmond includes approximately 12 businesses including restaurants, a gas station, and a US post office. Other minor landholders in Richmond include Florida Power and Light, CSX railroad, and the South Florida Water Management District (see **Map 1**).

D. Regulations

Numerous federal, state, and local regulations exist which pertain to the protection and management of forested lands and/or rare species in Richmond. In general, federal and state laws afford protection to certain rare species while local (i.e., Miami-Dade County) laws regulate development. Miami-Dade County development regulations afford some protection to some undeveloped lands, but not all. State and local laws which apply to prescribed burning are also included in this section.

Federal Regulations

The 1973 Endangered Species Act (ESA) is the federal law that is most relevant to management and protection of forested areas in Richmond. The ESA pertains to listed plant and animal species and, in some cases, their designated critical habitat. See sections IIC and IID of this report for lists and descriptions of all federally listed species known to be present in Richmond.

Federally listed animal species are afforded greater legal protection than plants under federal law. It is illegal to 'take' federally listed animals or to impact their critical habitat without permission from USFWS; this is true for animals (but not plants) anywhere in Richmond, regardless of property ownership. The term 'take' means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or to attempt to engage in any such conduct. In a few cases, other federal laws have been enacted to protect animals. The Bald Eagle and Golden Eagle Protection Act (enacted in 1940 and amended several times) prohibits the take of bald eagles, including their eggs, nests, or nesting trees. Violations of this act are punishable by large fines and even jail time. Bald Eagles are frequently spotted in Richmond. The Migratory Bird Treaty Act (enacted in 1918) prohibits the take of migratory birds, including eggs and nests. There are more than 1000 migratory bird species protected by this act (USFWS 2013b); many of which are found in Richmond.

Under Section 9 of the ESA, it is unlawful to remove and reduce to possession plants from areas under federal jurisdiction. For endangered plants, it is unlawful to "remove, cut, dig up, or destroy" in knowing violation of any state law or regulation, or in the course of any violation of a state criminal trespass law. Under Section 7 of the ESA, all listed plants are subject to full consultation requirements for any federal activity that may affect those listed species. This consultation requirement applies to all federally listed plants where there is a federal nexus (i.e., the federal government will authorize, fund, or carry out the activity), even if critical habitat has not been designated. Persons wishing to harvest federally listed plants from federal property may apply for a permit from the USFWS. Richmond is under the jurisdiction of the USFWS South Florida Ecological Services Field Office in Vero Beach, Florida. Note that ESA protections for listed plant species do not apply under federal law if plants are located on property not owned by the federal government, and if federal funding is not involved.

When a federal consultation is required, USFWS biologists evaluate whether jeopardy will occur for a listed species and if critical habitat (if it has been designated) would be lost or adversely modified from a proposed project. If it is determined that jeopardy to the species or adverse modifications to critical

habitat would result, USFWS works with the client to modify their project to remove jeopardy. If it is determined that an action removing listed species or critical habitat does not constitute jeopardy, then USFWS may issue an Incidental Take Permit (ITP). An ITP cannot be issued unless it has been determined by the FWS that:

- The take will be incidental,
- The impact of such taking has been minimized and mitigated to the maximum extent,
- An acceptable Habitat Conservation Plan (HCP) has been developed that includes adequate funding to carry out the HCP,
- The take will not appreciably reduce the likelihood of the survival and recovery of the species in the wild, and
- The developer/property owner will carry out any other measures that the Secretary of the Interior may require as being necessary or appropriate for the purposes of the permit.

It is important to understand the limitations under the ESA and the role of USFWS for properties where land clearing or development is proposed. USFWS does not regulate or authorize development on private lands or on nonfederal public lands, nor does it issue development or building permits. However, proposed projects with a federal nexus and anticipated impacts to listed species are reviewed under Section 7 of the ESA during consultations. For projects with expected impacts to listed species and no federal nexus, Section 10 of the ESA applies (i.e., the developer must develop an HCP in order to apply for an ITP). Developments and development permits are generally approved by local government. In the case of Richmond, permits to develop land are issued by Miami-Dade County.

State Regulations

The Florida Statute with most direct bearing on rare plants in Richmond is Chapter 5B-40 of the Florida Administrative Code, entitled "Preservation of Native Flora of Florida." These regulations, first passed in 1991, require that persons wishing to collect regulated plants from "the private land of another, or . . . any public land or water" first must apply for and receive a harvest permit from the Florida Department of Agriculture and Consumer Services (FDACS). Regulated plants are listed in the state Regulated Plant Index, section 5B-40.0055, and include the categories "endangered," "threatened," or "commercially exploited." Section 5B-40.008 details the procedures for suspected violations of the act, and includes seizure of illegally collected materials by FDACS and donation of surviving material to a non-profit plant conservation agency such as a botanic garden.

Non-game wildlife is protected by Title 68A of the Florida Administrative Code, which affords protection to a variety of animals. Several rules within Title 68A have direct bearing on wildlife of Richmond. Under Rule 68A-27.003, it is illegal to take, harass, touch or sell gopher tortoises or their eggs without a permit, and it is also illegal to damage or destroy gopher tortoise burrows. It is also illegal to collect ceraunus blue or cassius blue butterflies, rim rock crowned snakes, and numerous native bird species, including most wading birds, birds of prey, white crowned pigeons, and others.

Rule 68A-9.010 specifies that bats may not be taken as nuisance wildlife unless (a) "the take is incidental to the use of an exclusion device, a device which allows escape from and blocks re-entry into a roost site located within a structure, or incidental to the use of a registered chemical repellant, at any time from August 15 to April 15" or (b) "the take is incidental to permanent repairs which prohibit the egress of bats from a roost site located within a structure provided an exclusion device . . . is used for a minimum of four consecutive days/nights for which the low temperature is forecasted by the U.S. National

Weather Service to remain above 50° F prior to repairs and during the time-period specified." Exclusion of Florida bonneted bats cannot be done at any time unless a federal take permit is granted.

Finally, there are aspects of the Florida State Statutes which pertain to prescribed fire. Laws regarding the safe use of prescribed burning in Florida were passed in 1977 and 1990 and amended in 1999 (Brenner & Wade 2003). The 1990 'Prescribed Burning Act' was created to encourage prescribed burning. It states that (1) a certified prescribed burn manager must be present during a prescribed burn, (2) a written prescribed plan must be prepared which includes an evaluation of impact to smoke-sensitive areas, (3) prescribed burning should be considered in the public interest and not constitute a nuisance, (4) prescribed burning is a property owner's right. Another aspect of the law is that if burning is conducted according to the act, the owner or his/her agent cannot be held liable for damage by fire or smoke unless gross negligence is proven. It is important to understand that the law is on the side of prescribed burning, because burns are a critical need for maintaining the health of the Richmond's pine rocklands. Prescribed burning cannot be conducted without official permission. The State of Florida Statute 590.125 requires the Florida Forest Service issue a permit prior to conducting prescribed burning activities. The Florida Forest Service currently conducts or participates in most of the prescribed burning of wildlands in urbanized Miami-Dade County.

Local Regulations

Several Miami-Dade County regulations and planning documents have bearing on the development, management and preservation of Richmond pine rocklands. These include (1) the Conservation Element of Miami-Dade County's CDMP, (2) Chapter 18A of the Miami-Dade County Code (the Miami-Dade County Landscaping Ordinance), (3) Miami-Dade County's Park Rules and Regulations, and especially (4) Chapter 24 of the Miami-Dade County Code (also known as the Miami-Dade County Environmental Protection Ordinance). Each of these is addressed below in turn. It should be noted that regulations in Chapters 8 (Building Code) and 33 (Zoning) of the Miami-Dade County Code apply to all zoning and construction, and would also have relevance to new construction projects in Richmond.

(1) The Conservation Element of Miami-Dade County's CDMP – This document is the County's official development policy. It includes requirements for the protection of forested areas as well as listed plant and animal species. These requirements are typically implemented and enforced through zoning approvals and permits issued by Miami-Dade County. No permit can be issued (and no development order can be approved) that is inconsistent with the CDMP. Further reading about the CDMP is available on the County's web portal: http://www.miamidade.gov/planning/cdmp.asp.

(2) Landscape Ordinance – The Miami-Dade County Landscaping Ordinance (Chapter 18A) sets standards for landscape practices and provides prohibitions (Chapter 18-12) which are intended to protect natural resources. These prohibitions include a ban on installing prohibited plants (see **Table 2**) and a requirement that controlled plant species are not planted within 500 feet of a Natural Forest Community. Tree abuse is also prohibited.

(3) Park Rules and Regulations - Richmond properties that are under the purview of Miami-Dade County's Department of Parks, Recreation and Open Spaces (PROS) are subject to further regulation, under Chapter 26 of the Miami-Dade County Code. PROS has several rules and regulations which pertain to Richmond pine rocklands. Rule 8(c) prohibits removal of plants or plant parts without landowner permission. Rule 9 protects wildlife from molestation, harassment, poaching or other harm, and Rule 10 prohibits the dumping and/or feeding of non-native nuisance animals, which it

defines as: "a non-native animal species that occurs in South Florida, as a result of direct or indirect, deliberate or accidental actions by humans, which shall include, but not be limited to, all domestic, semi-domestic or feral animals." Further reading about the Park Rules and Regulations is available online: http://www.miamidade.gov/parks/rules-regulations.asp

(4) *The Miami-Dade County Environmental Protection Ordinance (Chapter 24)* – This chapter of the official County Code contains several elements that pertain to environmental regulations in Richmond, which are described below. Further reading about this and all other County Code is available on the Municode web portal: https://library.municode.com/fl/miami_-_dade_county/codes/code_of_ordinances.

Under the County's Tree Ordinance (Chapter 24-49), permits and canopy mitigation are required to remove or relocate trees throughout unincorporated portions of Miami-Dade County; this includes Richmond. Tree permits are also required within municipalities that do not have their own tree protection ordinance. The tree ordinance assesses fines for removal of trees without a permit. It applies to all native and certain non-native trees with a diameter equal to or greater than 3 inches, when measured at 4.5 feet from the ground, or with an overall height of 12 feet or more. Non-native trees that are exempt from these requirements are included in the County's list of Prohibited Plant Species (**Table 2**).

The County's Tree Ordinance includes language establishing the extent of Miami-Dade's **Natural Forest Communities (NFC)**. Designation of NFC is intended to protect the County's highest-quality forest. Criteria used to evaluate whether a parcel should be designated as NFC include:

a. The presence of endangered, threatened, rare or endemic species included on the Federal List of Endangered and Threatened Species, the Florida Game and Fresh Water Fish Commission List of Endangered and Potentially Endangered Fauna and Flora in Florida, or the Miami-Dade County Comprehensive Development Master Plan List of Endangered, Threatened, Rare and Endemic Plants in Miami-Dade County.
b. Overall plant species diversity of the site.
c. Size of the trees.
d. Size of the site.
e. Wildlife habitat value of the site.
f. Geological features of the site.
g. Percentage of the site covered by exotic (non-native) species

The County Tree Ordinance requires a permit to clear and/or develop in certain forested areas that have been designated by the Board of Miami-Dade County Commissioners as **Natural Forest Communities** (NFC). The goal is to ensure that development impacts are avoided and minimized within these designated NFC areas. NFC designation does not apply to all forested areas but rather only to those that have been designated by the Board of County Commissioners. Legally, anyone wishing to remove or damage vegetation within designated NFC must apply to Miami-Dade County for an NFC removal permit. Removing or effectively destroying NFC without a permit typically results in the issuance of a citation or notice of violation, with the violators subject to corrective action, mitigation requirements, and potentially penalties.

For sites where NFC has been authorized for removal under a permit, a **covenant** is typically required to insure the maintenance and preservation of the portions of the NFC that are not

permitted to be cleared from the site. Covenants requiring protection and management of sensitive forested areas may also be required by zoning, site plan approvals, or other County development approval processes. Portions of Richmond are subject to maintenance requirements under existing NFC covenants. "Maintenance" under the terms of these covenants includes removal of exotic plant species and management of the pine rockland preservation area(s) on the site. Properties in Richmond that currently have pine rockland maintenance requirements include: Zoo Miami, Martinez Pineland, Larry & Penny Thompson Park, the Gold Coast Railroad Museum, Robert Morgan School, and Coral Reef Commons. The covenant that restricts development in most of the County-owned portions of Richmond is included in **Appendix 1** of this document; **Map 10** shows the current location of designated Natural Forest Communities in the Richmond area.

It is important to note that significant amounts of federally designated critical habitat in Richmond (**Map 11**) are located outside of designated NFCs and therefore are not protected under local NFC regulations. In addition, some of the pine rockland habitat at Richmond that could still be restored is not designated NFC or critical habitat. In general, these areas are particularly vulnerable to further development.

The Miami-Dade County Environmental Protection Code includes a list of 58 plant species that must be removed prior to development, and which are banned from sale, planting, propagation, or transport on a development site (**Table 2**). According to the code (Chapter 24-49.9), developed sites shall be maintained to prevent the growth or accumulation of prohibited species including grass, weeds, and non-native undergrowth.

Areas of the Richmond pine rocklands managed by the EEL Program (Martinez Preserve, Larry and Penny Thompson Memorial Park, and portions of Zoo Miami and the Gold Coast Railroad Museum) are subject to the EEL Ordinance, Chapter 24-50 of the Miami-Dade County Environmental Protection Code. The purpose of the EEL Program is to acquire, preserve, enhance, restore, conserve, and maintain environmentally endangered lands for the benefit of present and future generations. In 2004-2008, the EEL Program assumed the responsibility of managing the natural areas of 18 Parks in perpetuity. Thus, some of the natural areas of Zoo Miami, Gold Coast Railroad, Larry & Penny Thompson Park are under the purview of the EEL Program, per Board of County Commission Resolutions: R-552-04, R-05-50, and R-413-08.

Table 2. Miami-Dade County prohibited plant species. **Species present in Richmond are shown in bold font**. According to County Code, "the following exotic pest plant and nuisance species may not be sold, propagated or planted anywhere in Miami-Dade County. If present on a development or redevelopment site, they shall be removed prior to development or redevelopment, and their sale, propagation, planting, importation or transportation shall be prohibited. Pursuant to this subsection and in accordance with Chapter 19 of the Code of Miami-Dade County, Florida, developed sites shall be maintained to prevent the growth or accumulation of prohibited species including grass, weeds and non-native undergrowth."

Scientific Name	Common Name	Habit
Abrus precatorius	**Rosary pea**	**Vine**
Acacia auriculiformis	**Earleaf acacia**	**Tree**
Adenanthera pavonina	Red sandalwood	Tree
Albizia lebbeck	**Woman's tongue**	**Tree**
Antigonon leptopus	Coral vine	Vine
Ardisia crenata	Coral ardisia	Shrub
Ardisia elliptica	**Shoebutton ardisia**	**Shrub**

Bischofia javanica	**Bishopwood**	**Tree**
***Casuarina* spp.**	**Australian pine**	**Tree**
Cestrum diurnum	Day jessamine	Shrub
Cinnamomum camphora	Camphor tree	Tree
Colubrina asiatica	Latherleaf	Vine
Cupaniopsis anacardioides	Carrotwood	Tree
Dalbergia sissoo	**Indian rosewood**	**Tree**
Dioscorea alata	Winged yam	Vine
Dioscorea bulbifera	**Air potato**	**Vine**
Eichhornia crassipes	Water-hyacinth	Aquatic
Ficus altissima	Council tree	Tree
Ficus benghalensis	Banyan tree	Tree
Ficus microcarpa	**Laurel fig**	**Shrub**
Flacourtia indica	Governor's plum	Shrub
Hydrilla verticillata	Hydrilla	Aquatic
Hygrophila polysperma	Green hygro	Aquatic
Hymenachne amplexicaulis	West Indian marsh grass	Aquatic
Imperata cylindrica	Cogongrass	Grass/Herb
Ipomoea aquatica	Water-spinach	Aquatic
Jasminum dichotomum	Gold Coast jasmine	Vine
Jasminum fluminense	**Brazilian jasmine**	**Vine**
Leucaena leucocephala	**Lead tree**	**Tree**
Ludwigia peruviana	Peruvian primrosewillow	Shrub
Lygodium* spp. except *L. palmatum	**Old World & Japanese climbing ferns**	**Vine**
Macfadyena unguis-cati	Catclaw vine	Vine
Melaleuca quinquenervia	**Melaleuca**	**Tree**
Melia azedarach	Chinaberry	Tree
Merremia tuberosa	Woodrose	Vine
Mikania micrantha	Mile-a-minute	Vine
Mimosa pigra	Catclaw mimosa	Tree
Neyraudia reynaudiana	**Burma reed**	**Grass/Herb**
***Paederia* spp.**	**Sewervine, skunkvine**	**Vine**
Panicum repens	**Torpedograss**	**Grass/Herb**
Pennisetum purpureum	**Napier grass, Elephant grass**	**Grass/Herb**
Pistia stratiotes	Water lettuce	Aquatic
Pueraria montana var. *lobata*	Kudzu	Vine
Rhodomyrtus tomentosa	Downy rose-myrtle	Shrub
Rhynchelytrum repens	**Natal grass**	**Grass/Herb**
Ricinus communis	**Castorbean**	**Grass/Herb**
Sapium sebiferum	Chinese tallow	Tree
Scaevola taccada	Beach naupaka	Shrub
Schefflera actinophylla	**Australian umbrella tree**	**Tree**
Schinus terebinthifolia	**Brazilian pepper**	**Tree**
Senna pendula var. *glabrata*	Christmas senna	Shrub
Solanum tampicense	Wetland nightshade	Grass/Herb
Solanum viarum	Tropical soda apple	Grass/Herb
Taliparitiliaceum	Mahoe	Tree
Tectaria incisa	Incised halberd fern	Grass/Herb
Thespesia populnea	Portia tree	Tree
Tribulus cistoides	Puncture vine	Grass/Herb
Urochloa mutica	Paragrass	Grass/Herb

II. PINE ROCKLAND ECOLOGY

A. Introduction

In order to manage the habitats in Richmond in their urban context, one must understand the species and fundamental processes that influence their natural history. This section describes the basic physical and biological information known about pine rocklands. Management priorities and recommendations are then derived from interpretation of this information.

Also critical to understanding pine rockland management is its rarity. Pine rockland is a globally critically imperiled plant community that is "extremely limited in distribution," having a designation of "G1/S1"—the rarest rank possible, shy of extinction (FNAI 2010). A globally critically imperiled rank indicates both extreme rarity and extreme vulnerability to extinction. Pine rockland is also an exceptionally diverse plant community, with over 440 native species (Gann et al. 2018).

B. Physiography

Miami-Dade County's pine rockland forests are associated with a geologic formation called the Miami Rock Ridge. This Pleistocene topographic feature, composed of exposed or partially-exposed oolitic limestone bedrock, extends for nearly 70 miles from northeastern Miami-Dade County to the Mahogany Hammock region of Everglades National Park (**Fig. 3**). The Miami Rock Ridge averages nine feet and is no more than 25 feet in elevation and varies between 4 and 10 miles in width (Davis 1943; USDA 1947). Miami-Dade County's pine rocklands occupied approximately 180,000 acres before settlement of Europeans (USDA 1947).

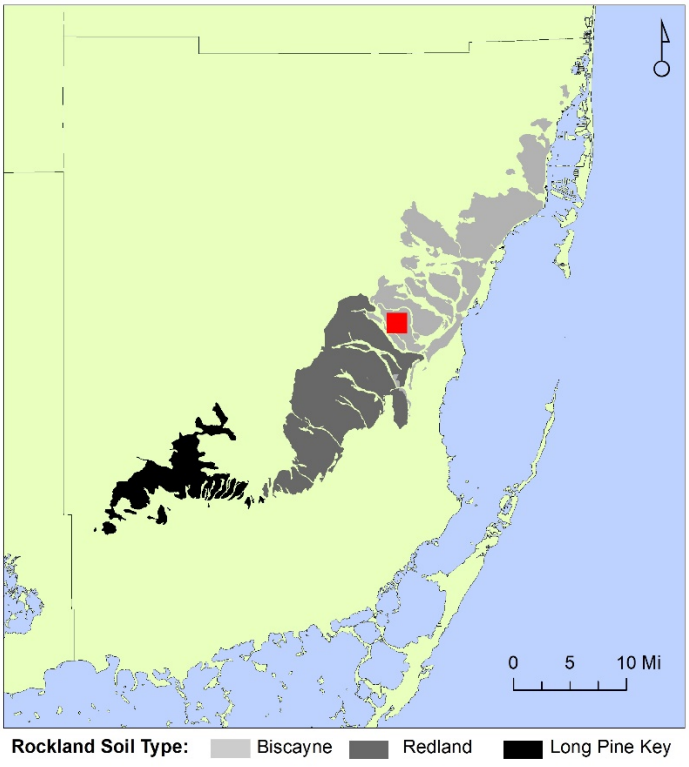


Figure 3. Areas of limestone outcropping in Miami-Dade County, referred to as "The Miami Rock Ridge."

There are three major soil types found in the Ridge, as indicated above. Richmond is shown as a red square.

The surface of the Miami Rock Ridge is irregular with frequent pinnacle rock and solution hole formations. Numerous transverse drainages existed where ancient tidal waters eroded portions of the oolite shoal. These transverse drainages, underlain by marl soils, contained freshwater graminoid wetland vegetation and divided the rock ridge into a series of "islands" which were historically covered by pine rockland forest. Beginning in the early 1900s, efforts began to lower the water table in southeast Florida, making it more inhabitable for a rapidly growing population. The US Army Corps of Engineers constructed a system of drainage canals throughout the county, funneling water from the north into Biscayne Bay. The existing natural transverse drainages were deepened and widened for this effort, creating a system of canals. As a result, most of the natural transverse glade geology and habitat were destroyed.

Richmond is located in the north central portion of the Miami Rock Ridge. Two major transverse glades were historically located in Richmond (**Map 2**); one followed the path now taken by present-day Coral Reef Drive, bending southward between the area between SW 117th Avenue and the Florida Turnpike. The headwater area of the other transverse glade was never destroyed and is now within Miami-Dade County's Martinez Preserve. This is the most extensive and intact transverse glade remnant remaining in Miami-Dade County. However, water levels are much lower due to drainage and development, and hydrologic restoration of this feature should be considered.

The topography of Richmond is variable by Miami-Dade County standards. The lowest elevations (between 7 and 8 feet above sea level) are found in the areas formerly occupied by transverse glades. The highest elevations are oolite dome or mound formations adjacent to the glades. These formations approach 18 feet above sea level (Dade County 1954). Pinelands in the Richmond area contain soils classified as Opalocka Sand-Rock Outcrop Complex (USDA 1990); these soils are described as quartz sands overlaying exposed oolitic limestone. Robertson (1955) called these rocky pineland forests associated with sand deposits "Northern Biscayne Pinelands." Approximately two miles south of Richmond, sand deposits cease and the soils are much rockier. These soils are termed Cardsound Rock Outcrop series soils and Robertson (1955) termed the pine forests there "Southern Biscayne Pinelands." These two categories of pine rockland are relatively distinct. Many plant species that are common in the sandy pine flatwoods and scrub of central Florida reach their southern limits in the sandy pine rocklands in the Richmond area.

Soil characteristics are very important to the management of the Richmond pine rocklands. Soils influence the distribution of native plants and undesirable exotic plant species, and understanding the underlying soil types can help to guide restoration strategies. For example, the endangered Tiny Polygala (*Polygala smallii*) is only found in sandy areas, and the non-native invasive grass Burma reed (*Neyraudia reynaudiana*) also is found more abundantly in sand and in disturbed areas.

Today, the remaining plant communities in Richmond include pine rockland, disturbed upland, remnant transverse glade, and hammock. "Disturbed upland" includes some areas which currently have or formerly had high incidences of invasive non-native plants, while others have always consisted primarily of native grasses and forbs. These latter areas include land which was scraped in the 1930s and 40s but never built upon, including the antenna fields at the USCG property, a portion of the interior of Larry & Penny Thompson Park's management unit #2, Portions of Zoo Miami management unit #18, the eastern half of the NOAA parcel, and many roadsides. These scraped areas, referred to in the first edition of this

management plan as "pine rockland with modified substrate," can serve as models for current pine rockland restoration.

C. Flora

The Miami Rock Ridge was historically dominated by pine rockland—a plant community "characterized by an open canopy of South Florida slash pine (*Pinus elliottii* var. *densa*) with a patchy understory of tropical and temperate shrubs and palms and a rich herbaceous layer of mostly perennial species including numerous species endemic to South Florida" (FNAI 2010). This unique floral composition can be attributed to Miami's proximity to the West Indies, peninsular connection to the Southeastern Coastal Plain of the United States, and the underlying limestone substrate. There are 40 plant taxa endemic to (i.e., found nowhere else) South Florida pine rocklands (this figure comes from comparison of data available at Gann et al. 2018 and Wunderlin et al. 2017). Many of these endemic taxa occur only in pine rocklands of Miami-Dade County, outside of Everglades National Park, including Richmond.

The Richmond pine rocklands are among the most diverse in southern Florida. As of 2018, more than 300 native vascular plant species have been recorded there (Gann et al. 2018). Due to the extreme rarity of pine rockland forest, many of the plant species in Richmond are also very rare. For example, in Larry & Penny Thompson Park, 14% of the flora is listed as endangered, threatened, or commercially exploited by the state of Florida (from Gann et al. 2018), and the number of plant species present in just one square meter alone averaged 17, in one study (Possley et al. 2008).

Richmond is home to eight federally listed plant taxa, as well as dozens of rare plant taxa that are listed as threatened or endangered by the state of Florida, and/or as critically imperiled by Florida Natural Areas Inventory (FNAI) or The Institute for Regional Conservation (IRC), and/or are endemic to Florida (**Table 3, Fig. 4, Fig. 5**). The eight federally listed species are discussed briefly in the remainder of this section, as are nine additional species which are considered to be critically imperiled by FNAI or IRC, yet are not federally listed.

Federally listed plant species (Refer to **Figure 4** for images)

Blodgett's Wild Mercury – Blodgett's Wild Mercury (*Argythamnia blodgettii* (Torr.) Chapm., Euphorbiaceae), is **federally threatened** (USFWS 2016a). The plant varies widely throughout its South Florida range, from small herb to suffrutescent shrub. In Richmond, it is generally a sparsely-branched herb to 1 foot tall. Flowers are inconspicuous yellow-green, and fruits are an inconspicuous yellow-green capsule with up to three seeds. Blodgett's Wild Mercury is endemic to pine rocklands, hammocks, coastal rock barrens, and disturbed uplands in Miami-Dade and Monroe Counties. In Richmond, it is known only from Larry & Penny Thompson Park, where there are several hundred plants (Fairchild, unpubl. Data).

Brickell bush – Brickell Bush (*Brickellia mosieri* (Small) Shinners, Asteraceae) is **federally endangered** (USFWS 2014c). This inconspicuous herb typically grows to 2 feet and has short narrow leaves arranged alternately along a suffrutescent stem. Flowers are cream-colored to ½ inch across and fruits are tiny achenes. Brickell Bush is a perennial with a thick woody taproot; above-ground parts often die back in the winter dry season, after fall seed set. The species is endemic to the eastern portion of the Miami Rock Ridge, from present-day downtown Miami south to Florida City. Populations in portions of Richmond were mapped by biologists from Fairchild in 2004-2016. Brickell Bush is present in Larry &

Penny Thompson Park, Martinez Preserve, Zoo Miami, and the UM CSTARS property (Gann et al. 2018, Bradley et al. 2000). It is likely to be present in all other Richmond parcels.

Carter's Flax – Carter's Flax (*Linum carteri* Small, Linaceae) is **federally endangered** (USFWS 2014c). It is a small herbaceous plant, usually with few branches, not exceeding 6-7 inches tall. Flowers and fruits are produced year-round, but peak in the early rainy season (Possley et al. 2016). Yellow flowers to ¾ inch across across open near dawn and are very short-lived, with the corolla usually dehiscing or shriveling up after only 2-3 hours. Fruits are papery brown capsules. Carter's Flax superficially resembles a much more common pine rockland plant, Pitted Stripeseed (*Piriqueta cistoides* (L.) Griseb ssp. *caroliniana* (Walter) Arbo, family Turneraceae), but the latter species has divided styles and usually much thicker leaves. Carter's Flax is endemic to Miami-Dade County. Richmond is geographically centered between the core populations of Carter's Sand Flax (most of which are found to the east) and Small's Sand Flax (primarily found in Everglades National Park and Big Cypress National Preserve). The only known population in Richmond is within Martinez Preserve, and appears to be morphologically intermediate between these two forms (Possley herbarium specimens FTG66 and FTG158).

Crenulate Lead Plant – Crenulate Lead Plant (*Amorpha herbacea* Walter var. *crenulata* (Rydb.) Isley, Fabaceae), is **federally endangered** (USFWS 1985). It is a leggy perennial woody shrub to 4 feet tall with a thick taproot; some individuals may die back partially or completely during the winter dry season. Flowers appear in the peak of the summer rainy season or after fire or disturbance, can be white or purple, and are arranged in terminal racemes. Fruits are brown, papery 1-seeded legumes. Crenulate Lead Plant is endemic to the ecotone between pine rocklands and marl prairies in only a small portion of the Miami Rock Ridge, from just north of present-day Bird Rd. (SW 40th St.) to approximately 168th St. Crenulate Lead Plant was not historically found in Richmond. In 2006 and 2007, biologists from Fairchild Tropical Botanic Garden worked with Miami-Dade County and University of Florida's Tropical Research and Education Center to introduce 345 individuals to Martinez Preserve (Roncal et al. 2012). Martinez Preserve contains the most suitable marl prairie/pine rockland ecotone in all of urban Miami. As of 2018, 150 Crenulate Lead Plants remain, with no surviving recruits. In 2017, Zoo Miami installed ten Crenulate Lead Plants in restoration and display areas within Zoo property.

Deltoid Spurge – Deltoid Spurge (*Euphorbia deltoidea* (Engelm. Ex Chapm.) Small ssp. *deltoidea*, Euphorbiaceae) is **federally endangered** (USFWS 1985). Deltoid Spurge is a tiny-leaved, mat-forming, perennial species with a thick taproot. Flowers are tiny inconspicuous yellow-green cyathia (specialized compound flowers possessed by many members of the Euphorbiaceae); fruits are an inconspicuous yellow-green capsule with up to three seeds. Deltoid Spurge is endemic to pine rocklands in the Northern Biscayne Pinelands of the Miami Rock Ridge, and found in areas with a history of frequent fire and very low tree cover. The Richmond population of Deltoid Spurge is the world's largest. Populations were mapped by DERM staff in 1994 as part of the first edition of this management plan. Populations were re-mapped in portions of Richmond in 2004-2016 by biologists at Fairchild. Deltoid Spurge is present throughout the Richmond pine rocklands (Bradley et al. 2000, Gann et al. 2018).

Everglades Bully – Everglades Bully (*Sideroxylon reclinatum* Michx. ssp. *austrofloridense* (Whetstone) Kartesz & Gandhi, Sapotaceae), is **federally threatened** (USFWS 2017). Everglades bully is a small woody shrub, with or without thorns, and with fascicles of short oval leaves. Flowers are inconspicuous, white axillary cymes; fruits are small purple drupes. The species is endemic to pine rocklands and rockland/prairie ecotone in Miami-Dade and Monroe Counties. In Richmond, it is known only from Larry & Penny Thompson Park (Gann et al. 2018) and was documented in the UM South Campus (now Coral

Reef Commons) (Bradley et al. 2000). The Richmond population of Everglades Bully represents the northern- and eastern-most extent of the subspecies' range.

Sand Flax – Sand Flax (*Linum arenicola* (Small) Winkl., Linaceae), is **federally endangered** (USFWS 2016a). Like Carter's Flax, Sand Flax is a small herb with yellow, short-lived flowers. However, Sand Flax differs from that species in having greatly reduced leaves, much smaller flowers and capsules (< 5mm), and (usually) more branching. Sand flax is endemic to pine rocklands, marl prairie, and disturbed uplands in Miami-Dade and Monroe Counties. In Richmond, it has been documented in Zoo Miami and in Martinez Preserve. These populations represent the westernmost extent of this species.

Tiny Polygala – Tiny Polygala (*Polygala smallii* R.R. Sm. & D.B. Ward, Polygalaceae), is **federally endangered** (USFWS 1985). It is an annual (or biennial) herb with a somewhat succulent basal rosette which produces compound, yellow "drumhead" flowers. Fruits are tiny two-seeded capsules. Tiny Polygala is endemic to southeastern Florida, and in Miami is found only in North Biscayne pine rocklands, and specifically in areas with significant patches of white sand. The Richmond population of Tiny Polygala is confined to the northern third of the area, and extends in a band from the US Coast Guard property, through Zoo Miami, and into Coral Reef Commons and the Army Corps/Dept. of Defense properties (Bradley et al. 2000, Gann et al. 2018). Richmond represents by far the bulk of Tiny Polygala's population in Miami, and represents the southernmost of all occurrences.

Figure 4. Federally listed plant species found in Richmond: **A**. Blodgett's wild mercury (JL) **B**. Brickell bush (JP), **C**. Carter's sand flax, **D.** Crenulate lead plant (AM), **E.** Sand flax (FR), **F**. Everglades Bully (JP), **G.** Deltoid Spurge (JP), **H**. Tiny Polygala (JJM). Initials indicate photo credits (see Acknowledgments section for full names).

Other notable rare plant species (Refer to **Figure 5** for illustrations)

The nine rare species discussed below are extremely rare in Richmond and are considered to be at critical risk of local extinction by FNAI and/or IRC. In most cases, the Richmond populations of these taxa represent either the southernmost or northernmost extent of that species' range. Because most of these species are found outside of South Florida, they are not potential candidates for federal listing (federal listing is usually reserved for species with a very narrow home range). However, most of the species listed below are in general far less abundant in the Richmond area than the previously discussed federally listed species.

Bearded skeletongrass - Bearded skeletongrass (*Gymnopogon ambiguus* (Michx.) Britton, Sterns & Poggenb., Poaceae) is a perennial, rhizomatous grass native to the southeastern and central United States. Leaves grow to 4 inches long and are arranged distichously about a stiff culm (i.e., leaves are arranged alternately in two opposite rows along the culm). The inflorescence, which appears in the fall, is significantly larger than the vegetative portions of the plant. In Richmond, Bearded skeletongrass has been documented, always in small populations, in the UM CSTARS property, the US Coast Guard Station, and Larry & Penny Thompson Memorial Park (Bradley et al. 2000, Gann et al 2018). It is not listed by the state of Florida.

Coker's creeper - Coker's creeper (*Ernodea cokeri* Britton ex Coker) is a low, suffrutescent shrub native only to Miami-Dade County and The Bahamas. It is similar in appearance to the beach creeper (*Ernodea littoralis*), but that species has wider leaves with 3 or more veins, while leaves of Coker's creeper have only a single vein. Flowers are small, with 4 petals and may be orange, pink or red. Fruits are orange-yellow berries. Small populations of Coker's creeper have been documented in Larry & Penny Thompson Memorial Park and Martinez Preserve (Gann et al. 2018, Fairchild unpub. data). Coker's creeper is listed as **endangered** by the state of Florida.

Pineland lantana - Pineland lantana (*Lantana depressa* Small var. *depressa*) is a low, spreading shrub endemic to the pine rocklands of Miami-Dade County, including Richmond, where it is an occasional element of the flora. The taxon is threatened with extinction through hybridization with the widely-sold commercial Lantana (*Lantana strigocamara* R.W. Sanders), a non-native invasive species. Many of the Pineland lantana plants present in pine rocklands contain genes of the exotic Lantana (Maschinski et al. 2010). It is difficult to distinguish the endemic native from the exotic Lantana, since the morphology of the hybrids spans the range between the two taxa. The non-native species has a more erect, vigorous growth form, and leaves are green with flat bases. Compound flower heads usually have yellow flowers toward the center and pink flowers toward the edges (**Fig. 5**) but cultivars with other color forms exist. Often, the non-native is found on preserve edges. In contrast, the native species is low-growing, leaves often curl slightly inward and are yellow-green with v-shaped bases. Flowers are yellow, fading to orange-yellow with age. Both the native and the non-native produce clusters of small, dark blue drupes. Pineland lantana has been documented in all portions of Richmond with natural area (Bradley et al. 2000, Gann et al 2018). It is listed as **endangered** by the state of Florida.

Pineland strongback - Pineland strongback (*Bourreria cassinifolia* (A.Rich.) Griseb., Boraginaceae) is a shrub found only in extreme South Florida and Cuba. Plants are typically to 5 or 6 feet tall, or smaller in a frequently-burned pineland. Throughout the year, small, white flowers are produced which, when pollinated, develop into orange 5-seeded berries. The small leaves are rough like sandpaper. In Richmond, pineland strongback is known only from two small, disjunct populations in Larry & Penny

Thompson Memorial Park (Gann et al. 2018, Fairchild unpub. data). It is listed as **endangered** by the state of Florida.

Rockland morningglory - Rockland morningglory (*Ipomoea tenuissima* Choisy, Convolvulaceae) is a diminutive, herbaceous vine native to Miami-Dade County and the Greater Antilles, and a close relative of commercial sweet potato (Gao et al. 2011). Plants can grow vigorously in response to fire, but otherwise may be a hard-to-spot component of the pine rockland understory. Thin, vining stems bear very pubescent sagittate (arrow-head shaped) leaves. Pink trumpet-shaped flowers about an inch across open the morning and begin to shrivel with afternoon heat. Rockland morningglory has been documented in most of Richmond (Bradley et al. 2000, Gann et al. 2018) and is likely present throughout, though in low numbers (Fairchild unpub. data). It is listed as endangered by the state of Florida.

Sand ticktrefoil - Sand ticktrefoil (*Desmodium lineatum* DC) is an herb that is native to the Southeastern United States. The species' range extends south to pine flatwoods in Lake and Sumter Counties in Central Florida, with disjunct populations approximately 200 miles to the south, in pine rocklands in the Miami Rock Ridge—including Richmond. Plants have trifoliate leaves with round leaflets and a panicle of tiny pink flowers in the fall, followed by loments. Over the winter dry season, above-ground portions of the plant die back. Sand ticktrefoil has been documented, always in low numbers, at the UM CSTARS property, in Larry & Penny Thompson Memorial Park, and Martinez Preserve (Bradley et al. 2000, Gann et al. 2018). It is not listed by the state of Florida.

Shyvine - Shyvine (*Zornia bracteata* J.F. Gmel., Fabaceae) is a trailing herb native to the Southeastern United States. The species' range extends to south/central Florida, with disjunct populations to the south in sandy pine rockland of the Miami Rock Ridge—including Richmond. Plants have leaves in whorls of 4. Flowering branches have conspicuous paired bracts at the base. Flowers are yellow; fruits are loments. Shyvine has been documented, always in very low numbers, at Larry & Penny Thompson Memorial Park, Zoo Miami, the UM CSTARS property, UM South Campus (now Coral Reef Commons), and the US Army Corps/Dept. of Defense property (Bradley et al. 2000, Fairchild unpub. data, Gann et al. 2018). It is not listed by the state of Florida.

Southern lady's tresses - Southern lady's tresses (*Spiranthes torta* (Thunb.) Garay & H.R. Sweet) is a terrestrial orchid whose native range includes South Florida, the West Indies, Central America, and Bermuda. In South Florida, it is primarily found in transverse glades; in Richmond a few hundred plants are present in the remnant glades in Martinez Preserve (Bradley et al. 2000, Fairchild unpub. data). Southern lady's tresses have a wand-like inflorescence of tiny white orchid flowers, arranged vertically along the end of the "wand." Blooms emerge in the late spring; plants are very inconspicuous during most of the year when they are not flowering. It is listed as **endangered** by the state of Florida.

Yankeeweed – Yankeeweed (*Eupatorium compositifolium* Walter) is an erect, perennial, semi-woody herb in the aster family that is common throughout the southeastern United States. Populations of yankeeweed in Miami-Dade County and Everglades National Park are found only in pine rockland and are disjunct from the next closest populations in central Florida. In Richmond, the only location where yankeeweed has been documented is the federal prison property (Bradley et al. 2000). It is not listed by the state of Florida.

It should be noted that each of the above listed species is dependent on fire to persist. Fire is extremely important to maintain the appropriate habitat for nearly all of the rare species found in Richmond. Fire

is known to stimulate germination of seeds from the soil seed bank in the case of the Tiny Polygala (Koptur et al. 1998, Fellows 2002), and perhaps in other species.

Figure 5. Plants found in Richmond considered "critically imperiled" by FNAI and/or IRC but which are not federally listed: **A**. Pineland Lantana (KW), **B**. Bearded skeletongrass (JP), **C**. Yankeeweed (BH), **D**. Little strongback (JP), **E**. Rockland morningglory (JP), **F**. Sand ticktrefoil (JP), **G.** Shyvine (JP), **H**. Coker's creeper (JP), **I**. Southern ladies' tresses (RH). Initials indicate photo credits (see Acknowledgments section for full names).

Table 3. **Rare and/or listed native plant species in Richmond.** Column headings are explained below, in the order in which they appear in the table. Taxa in bold font are federally listed and/or considered to be critically imperiled.

FL = Taxa listed as endangered (E), threatened (T), or commercially exploited (C) by the state of Florida
US = Taxa listed as endangered (E) or threatened (T) by the US Fish and Wildlife Service
FNAI = Global (**G**) and State (**S**) rankings for taxa which are tracked by the Florida Natural Areas Inventory. Numbers 1-5 indicate rarity as follows: 1 = critically imperiled, 2= imperiled, 3= rare, 4= apparently secure, 5= secure. For further explanation of FNAI rankings, see http://fnai.org/ranks.cfm.
IRC = South Florida (SF) ranking for taxa from the Institute for Regional Conservation (Gann et al. 2018). Numeric scores follow the FNAI ranking system, whereby "SF1" indicates critically imperiled.
ENDM = Indicates which taxa are endemic to Florida (FL), South Florida (SFL) or Miami-Dade County (Miami)

	Scientific Name	Common Name	FL	US	FNAI		IRC	ENDM
					G	S		
1	*Aletris bracteata*	White colic root	E		G2	S2	SF2	
2	***Amorpha herbacea* var. *crenulata*** (introduced)	**Crenulate lead plant** (introduced)	E	E	G4T1	S1	SF1	Miami
3	*Angadenia berteroi*	Pineland allamanda	T				SF2	
4	***Argythamnia blodgettii***	**Blodgett's wild mercury**	E	T	GNR	S2	SF2	SFL
5	*Berlandiera subacaulis*	Florida greeneyes					SF1	FL
6	*Bletia purpurea*	Pine pink	T				SF3	
7	***Bourreria cassinifolia***	**Pineland strongback**	E		G3?	S1	SF1	
8	***Brickellia mosieri***	**Brickell bush**	E	E	G5T1	S1	SF1	Miami
9	*Byrsonima lucida*	Locustberry	T		G4G5	S3	SF3	
10	*Chaptalia albicans*	White sunbonnets	T				SF2	
11	*Chrysophyllum oliviforme*	Satin leaf	T				SF3	
12	*Clematis baldwinii*	Pine hyacinth					SF3	FL
13	*Coccothrinax argentata*	Silver palm	T				SF3	
14	*Crossopetalum ilicifolium*	Quailberry	T		G3	S3	SF2	
15	*Crossopetalum rhacoma**	Maidenberry*	T		G5	S3	SF3	
16	***Desmodium lineatum***	**Sand ticktrefoil**					SF1	
17	*Digitaria filiformis* var. *dolichophylla*	Caribbean crabgrass	T				SF2	
18	***Digitaria pauciflora****	**Everglades crabgrass***	E	T	G1	S1	SF1	SFL
19	*Elytraria caroliniensis* var. *angustifolia*	Carolina scalystem			G4T2	S2	SF3	SFL
20	***Ernodea cokeri***	**Coker's creeper**	E		G4Q	S1	SF1	
21	***Eupatorium compositifolium***	**Yankeeweed**					SF1	
22	*Eupatorium mikanioides*	Semaphore thoroughwort					SF4	FL
23	*Euphorbia conferta*	Everglades keys sand mat					SF2	SFL
24	***Euphorbia deltoidea* ssp. *deltoidea***	**Deltoid spurge**	E	E	G2T1	S1	SF1	Miami
25	*Euphorbia pergamena*	Rockland sandmat	T				SF2	
26	*Euphorbia polyphylla*	Lesser Florida spurge					SF3	FL
27	*Euphorbia porteriana*	Porter's sandmat	E		G2	S2	SF2	SFL
28	*Galactia pinetorum*	Florida milkpea			G2Q	S2	SF2	Miami
29	***Gymnopogon ambiguus***	**Bearded skeletongrass**					SF1	
30	*Ilex krugiana **	Krug's holly *	E		G4	S3	SF3	
31	*Ipomoea microdactyla*	Man-in-the-ground	E		G2	S2	SF2	
32	***Ipomoea tenuissima***	**Rockland morningglory**	E		G3	S1	SF2	
33	*Jacquemontia curtisii*	Pineland clustervine	T		G2	S2	SF2	SFL
34	*Koanophyllon villosum*	Florida shrub thoroughwort	E		G4G5	S2	SF2	
35	***Lantana depressa* var. *depressa***	**Pineland lantana**	E		G2T1	S1	SF1	SFL
36	***Linum arenicola***	**Sand flax**	E	E	G1G2	S1S2	SF2	SFL
37	***Linum carteri* var. *carteri*** [+]	**Carter's flax** [+]	E	E	G2T1	S1	SF1	SFL

38	*Melanthera parvifolia*	Pineland black anthers	T				SF3	SFL
39	*Metastelma blodgettii*	Blodgett's swallowwort	T				SF2	
40	*Mosiera longipes*	Long-stalked stopper	T		G4	S2	SF2	
41	*Ocimum campechianum*	Wild basil	E				SF2	
42	*Poinsettia pinetorum*	Pineland poinsettia	E		G2	S2	SF2	SFL
43	***Polygala smallii***	**Tiny polygala**	E	E	G1	S1	SF1	FL
44	*Psychotria ligustrifolia*	Bahama wild coffee	E			S1	SF1	
45	*Pteris bahamensis*	Bahama ladder brake	T		G4	S3	SF2	
46	*Pteroglossaspis ecristata*	Giant orchid	T		G2G3	S2	SF2	
47	*Rhynchosia cinerea*	Brown hair snoutbean					SF2	FL
48	*Rhynchosia parvifolia*	Small leaf snoutbean	T				SF2	
49	*Ruellia succulenta*	Pineland petunia					SF3	FL
50	*Sachsia polycephala*	Bahama sachsia	T		G2	S2	SF2	
51	*Scutellaria havanensis*	Havana skullcap	E		G3G4	S2	SF2	
52	*Selaginella eatonii*	Eaton's spikemoss	E		G2G3	S2	SF2	
53	*Senna mexicana* var. *chapmanii*	Bahama senna	T				SF2	
54	*Serenoa repens*	Saw palmetto	C				SF5	
55	***Sideroxylon reclinatum* ssp. *austrofloridense***	**Everglades Bully**	E	T	G4G5T1	S1	SF2	SFL
56	*Smilax havanensis*	Havana greenbrier	T				SF3	
57	*Solanum donianum*	Mullein nightshade	T				SF3	
58	*Spermacoce neoterminalis*	Everglades keys false buttonweed	T				SF2	SFL
59	*Sphenomeris clavata*	Wedgelet fern	E		G4	S2	SF2	
60	***Spiranthes torta***	**Southern lady's tresses**	E		G5	S1	SF1	
61	*Tectaria fimbriata*	Least halberd fern	E		G4	S2	SF2	
62	*Tetrazygia bicolor*	West Indian lilac	T				SF2	
63	*Thelypteris augescens*	Abrupt-tipped maiden fern	T				SF3	
64	*Tillandsia balbisiana*	Northern needleleaf	T				SF5	
65	*Tillandsia fasciculata* var. *densispica*	Cardinal air plant	E				SF4	
66	*Tillandsia flexuosa*	Twisted air plant	T		G5	S3	SF3	
67	*Tillandsia utriculata*	Giant air plant	E				SF4	
68	*Tragia saxicola*	Pineland noseburn	T		G2	S2	SF2	SFL
69	*Trema lamarckiana*	West Indian trema	E		G5	S2	SF2	
70	*Tripsacum floridanum*	Florida gama grass	T		G2	S2	SF2	
71	*Zamia integrifolia*	Coontie	C				SF3	
72	***Zornia bracteata***	**Shyvine**					SF1	

* Possibly extirpated (Gann et al. 2018)

[+] Plants are morphologically (and geographically) intermediate between *L. carteri* var. *carteri and L. carteri* var. *smallii*.

D. Fauna

As the largest forested area within urban Miami, Richmond is an extremely important refuge for wildlife. Several rare species with very restricted ranges are found in Richmond, including four federally endangered species. In addition, there are several state-listed species, and other species of note which, while not officially listed, are of local management concern. Rare wildlife species are listed and discussed below, summarized in **Table 4**, and illustrated in **Figure 6**.

Federally listed wildlife

Note: Any modification of habitat in Richmond that is on federal property, is federally funded, requires a federal permit, or may impact a federally listed species constitutes a "federal nexus" and will require a consultation with USFWS, per Section 7 of the ESA. For more information, see **Section I-D**, above.

Bartram's Scrub Hairstreak – Bartram's scrub hairstreak (*Strymon acis bartramii*) is a **federally endangered** butterfly (USFWS 2014a) that is endemic to pine rocklands in Miami-Dade and Monroe County. The only larval host plant for the butterfly is pineland croton (*Croton linearis*). The pineland croton and dozens of pine rockland parcels that support it (or could potentially support it) are designated **critical habitat** for the Bartram's scrub hairstreak under the US Endangered Species Act (USFWS 2014b). Designation of critical habitat means that federal agencies are required to consult with USFWS prior to any actions that may impact critical habitat. Adult Bartram's scrub hairstreaks are rarely found very far from pineland crotons, thus in Richmond they are found most abundantly in croton habitat: frequently-burned pine rockland with relatively sparse pine canopy, low leaf litter, and low palm and shrub height. The species has been documented in most of Richmond, including Larry & Penny, Zoo Miami, Martinez, and the US Coast Guard Station.

Florida Leafwing – The Florida leafwing (*Anaea troglodyte floridalis*) is a **federally endangered** butterfly (USFWS 2014a) that is endemic to pine rocklands in Miami-Dade and Monroe County. As with the Bartram's scrub hairstreak, the only known larval host plant for the Florida leafwing is pineland croton (*Croton linearis*), and many of the pine rocklands in South Florida are designated **critical habitat** for the Florida leafwing. This butterfly was occasionally documented in Richmond through the 1980s, but recent surveys show that the Long Pine Key region of Everglades National Park is the only area that currently supports a breeding population.

Miami Tiger Beetle – The Miami tiger beetle (*Cicindelidia floridana*) is a **federally endangered** beetle (USFWS 2016b) known only from Miami. The species was thought to be extinct until 2007 when a population was discovered in in the pine rocklands surrounding Zoo Miami (Brzoska et al. 2011). Since that time, extensive surveys by biologists from county, state, federal, and nonprofit agencies have determined that the beetle is present in several management units of Zoo Miami, portions of Larry & Penny Thompson Park, the U.S. Coast Guard Station, the UM CSTARS property, and is likely to be present in other units. As of early 2018, USFWS has not yet designated critical habitat for the beetle, pending further studies and analysis to determine the impacts of designation. In general, Miami tiger beetle habitat includes sandy pockets in pine rocklands and fire breaks and lightly trafficked roads and road edges with natural substrate and full or partial-sun. The species has a complex life cycle and is less than ½ inch long, making surveys difficult; winters are spent in below-ground burrows in the larval and pupal stages.

Florida Bonneted Bat –The Florida bonneted bat (*Eumops floridanus*) is a **federally endangered** bat (USFWS 2013a) known only from South Florida and South-Central Florida. The species reportedly has one of the most restricted distributions of any bat in the New World (Timm and Genoways 2004), though recent work by Bailey et al. (2017a, 2017b) suggests the range is larger than previously known. The species has been confirmed from several counties, and the range includes portions of 16 counties in Florida. Several natural roosts have been located in recent years (e.g., Ober et al. 2016, Braun de Torrez et al. 2017; Bailey et al. 2017a, 2017b; Gore et al. 2015; Angell and Thompson 2015). Florida bonneted bat calls have been recorded on multiple properties within Richmond. The species uses Richmond for foraging and one roost site within Richmond is known. Pine rockland fragments have been shown to be critically important for bat diversity and activity, including the Florida bonneted bat (Braun de Torrez et al 2017). Critical habitat has not yet been proposed for this species, as of publication of this document.

Cassius Blue Butterfly and Ceraunus Blue Butterfly – These small blue butterflies (*Leptotes cassius* and *Hemiargus ceraunus*, repectively) are listed as **federally threatened** (USFWS 2011) due to the fact that they are very similar in appearance to the federally endangered Miami Blue Butterfly. The Miami Blue

has not been documented from the Miami Rock Ridge, including the Richmond area, for over 30 years. It was last documented in Homestead in the 1980s. However, the Cassius and Ceraunus Blue butterflies are found there, and are within the region where collection of these species is prohibited.

Wood stork – The wood stork (*Mycteria americana*) was listed as federally endangered in 1984 and was reclassified to **federally threatened** in 2012 (USFWS 1984, USFWS 2012). Wood storks are frequently seen in Richmond's open grassy areas and around artificial lakes during the migratory season. They occur on the properties during the spring and fall migrations and usually stay for a few weeks up to a few months. No nesting has ever been documented in the Richmond area.

Audubon's crested caracara – The Audubon crested caracara (C*aracara plancus audubonii*) was listed as **federally threatened** in 1987 (USFWS 1987). This large, boldly-patterned raptor is found mostly in prairies of south central Florida. It has only been vouchered at Richmond in 2014 with an additional reported sighting early in 2017. It likely utilizes open grassy mowed fields and fire maintained open patches within the Richmond Tract.

Eastern Indigo Snake – The Eastern indigo snake (*Drymarchon couperi*) was listed as **federally threatened** in 1978 (USFWS 1978). Florida's largest native snake was documented to occur in the Richmond Tract within the last 20 years but, like the Florida leafwing, it has likely been extirpated. All of the remaining pine rocklands in the Richmond Tract is not enough to sustain a population of indigo snakes since they maintain very large home ranges. The closest known extant population in Miami-Dade County is in Homestead.

Gopher tortoise – The gopher tortoise (*Gopherus polyphemus*) has been a **candidate for federal listing** in the Eastern portion of its range since 2006 (USFWS 2006) and it is an FWC **threatened** species. Gopher tortoises are likely present throughout all Richmond pine rocklands; they have been documented in Zoo Miami, Martinez Preserve, Gold Coast Railroad and Military History Museum, the Department of Defense station, Robert Morgan, and Larry & Penny Thompson Park. Richmond is the southernmost population of gopher tortoises in Florida, outside of Everglades National Park. Florida Statute 68A has very specific language regarding the protections of gopher tortoises:

> *No person shall take, attempt to take, pursue, hunt, harass, capture, possess, sell or transport any gopher tortoise or parts thereof or their eggs, or molest, damage, or destroy gopher tortoise burrows, except as authorized by Commission permit or when complying with Commission approved guidelines for specific actions which may impact gopher tortoises and their burrows. A gopher tortoise burrow is a tunnel with a cross-section that closely approximates the shape of a gopher tortoise.*

Gopher tortoises are considered to be a keystone species, with more than 350 other "commensal" species benefitting from their burrows, including snakes, rodents, and hundreds of invertebrate species (FFWCC 2012). Yet major threats to the gopher tortoise in Richmond (and throughout its range) abound. These include habitat loss (this includes succession to hardwood forest in the face of fire suppression), road mortality, predation, especially by domestic dogs, and disease. A highly contagious upper respiratory tract disease can cause mortality in tortoises. Human intervention is also a major threat; people have been known to poach tortoises for food or pets, to vandalize them with paint, and to move them to inappropriate habitat such lakes or oceans (believing they are aquatic animals).

Other species – it should be noted that there are other wildlife species in Richmond that have federal protection, despite not being federally listed as endangered or threatened under the Endangered Species Act. The Bald Eagle and Golden Eagle Protection Act and the Migratory Bird Treaty Act expressly prohibit the take of bald eagles and migratory songbirds or their eggs, nests, or nest locations. Bald eagles are regularly spotted in Richmond, though no nest has ever been officially documented. The list of protected migratory songbirds exceeds 1000 species (USFWS 2013b), many of which are found throughout Richmond on a regular basis.

State listed wildlife

In addition to the federally listed wildlife species present in Richmond, there are several species found in Richmond which are listed by Florida's Fish and Wildlife Conservation Commission as "threatened;" this is the FWC's highest degree of rarity. Descriptions for state-listed wildlife species found in Richmond follow.

Rim Rock Crowned Snake – The rim rock crowned snake (*Tantilla oolitica*) is a tiny, extremely rare snake that is found only in pine rockland and hammock habitats of Miami-Dade and Monroe Counties (FFWCC 2013). It is listed as **threatened** by the Florida Fish and Wildlife Conservation Commission, under Florida Statute 68A-27.003, the Florida endangered and threatened species list. This snake was documented in 2009 and 2012 as present in Richmond by Zoo Miami herpetologists. The USFWS has been petitioned to list the rim rock crowned snake under the ESA and is scheduled to make a listing decision in Fiscal Year 2020.

Birds – Several state-listed bird species are commonly or occasionally found in Richmond, and are thus protected by state law. These include the little blue heron, tricolored heron, the southeastern American kestrel, and the white-crowned pigeon. Florida burrowing owls were reported to have been present on Zoo Miami grounds when the zoo first opened, but are believed to have been extirpated.

Unlisted wildlife

Finally, there are other noteworthy wildlife species present in Richmond that are not listed by state or federal authorities. A bobcat was seen in Zoo Miami in 2017; this beautiful native mammal was thought to have been extirpated from the area. Coyotes first appeared in the area (on camera traps) in late 2013 (Frank Ridgley, Zoo Miami, pers. comm.). There is a resident population of Eastern coachwhip snakes in Richmond; this is an unlisted snake species near the southern extent of its range in the southeastern US. The Eastern diamondback rattlesnake, whose decreasing numbers range-wide make this species a concern to wildlife managers, has been documented in Richmond in the recent past. The atala hairstreak butterfly was considered to be extirpated from South Florida's from the 1930s to 1950s (Rawson 1961), but its numbers have rebounded substantially so that it is not currently listed by any agency. Another butterfly, the Florida duskywing, is not currently a state or federally listed species but studies by University of Florida show that its numbers are decreasing. Richmond is one of the only locations where this taxon has a stable population. Staff at Zoo Miami have documented a trapdoor spider in the genus *Ummidia* that may be a species new to science, according to researchers at Auburn University. Florida Natural Areas Inventory, administered by Florida State University, lists the Cuban crescent butterfly, the Florida white butterfly, the Miami cave crayfish, and the short-tailed hawk as **critically imperiled,** and the martial scrub hairstreak butterfly, statira sulphur butterfly, malachite butterfly, swallow-tailed kite, Louisiana waterthrush, American redstart, peregrine falcon, merlin, and great white heron as **imperiled**; all of these species have been documented to occur within the Richmond area. In recent years,

discoveries of new species or re-discoveries of previously extirpated wildlife species (especially of invertebrates) in Richmond occur almost annually.

Extirpated wildlife

It bears noting that there are many animals which were present in Richmond area as recently as the late 1800s, but which completely disappeared with European settlement and development of the area. These included white-tailed deer, red wolves, Florida panther, black bear, fox squirrel, mink, river otters, striped skunk, spotted skunk, and bobwhite quail. The landscape that remains today was shaped in part by these species, and their absence should be considered as an aspect of restoration that will likely never be achieved.

Table 4: Rare and/or listed native animal species in Richmond. Species are included here if they are listed by the federal or state government, tracked by Florida Natural Areas Inventory, or if local experts reported their presence. Common species are not included here. Historic species that are no longer thought to be present are included if they were documented in the past 50 years.

Column headings are explained below, in the order in which they appear in the table. Taxa in bold font are federally listed.

FL = Taxa listed as threatened (T) by the Florida Fish and Wildlife Conservation Commission
US = Taxa listed as endangered (E), threatened (T), or candidate (C) for listing by the US Fish and Wildlife Service
FNAI = Global (**G**) and State (**S**) rankings for taxa which are tracked by the Florida Natural Areas Inventory. Numbers 1-5 indicate rarity as follows: 1 = critically imperiled, 2= imperiled, 3= rare, 4= apparently secure, 5= secure. For further explanation of FNAI rankings, see http://fnai.org/ranks.cfm.
ENDM = Indicates which taxa are endemic to Florida (FL), South Florida (SFL) or Miami-Dade County (Miami)

Category	Scientific Name	Common Name	FL	US	FNAI		ENDM
					G	S	
Mammals	*Canis latrans*	Coyote	-	-	-	-	
	Eumops floridanus	**Florida bonneted bat**	**T**	**E**	**G1**	**S1**	**FL**
	Lynx rufus	Bobcat	-	-	-	-	
Birds	*Aramus guarauna*	Limpkin			G5	S3	
	Ardea herodias occidentalis	Great white heron			G5T2	S2	
	Athene cunicularia floridana	Florida burrowing owls *	T	-	G4T3	S2	FL
	Buteo brachyurus	Short-tailed hawk			G4G5	S1	
	Caracara cheriway	Crested caracara			G5	S2	
	Caracara plancus audubonii	**Audubon's crested caracara**	**T**	**T**	**-**	**-**	
	Egretta caerulea	Little blue heron	T	-	G5	S4	
	Egretta thula	Snowy egret			G5	S3	
	Egretta tricolor	Tricolored heron	T	-	G5	S4	
	Eudocimus albus	White ibis	-	-	G5	S4	
	Falco columbaris	Merlin			G5	S2	
	Falco peregrinus	Peregrine falcon			G4	S2	
	Falco sparverius paulus	Southeastern American kestrel	T	-	G5T4	S3	
	Haliaeetus leucocephalus	Bald eagle	-	-	G5	S3	
	Mycteria americana	**Wood stork**	**T**	**T**	**G4**	**S2**	
	Nyctanassa nycticorax	Black-crowned night-heron			G5	S3	
	Pandion haliaetus	Osprey	SSC		G5	S3S4	
	Parkesia motacilla	Louisiana waterthrush			G5	S2	
	Passerina ciris	Painted bunting			G5	S3	
	Patagioenas leucocephala	White-crowned pigeon	T	-	G3	S3	
	Picoides villosus	Hairy woodpecker	-	-	G5	S3	

	Setophaga ruticilla	American redstart			G5	S2	
	Sternula antillarum	Least tern			G4	S3	
Reptiles	*Crotalus admanteus*	Eastern diamondback	-	-	G4	S3	
	Drymarchon couperi	**Eastern indigo snake ***	**T**	**T**	**G5T1**	**S3**	
	Gopherus polyphemus	**Gopher tortoise**	**T**	**C**	**G3**	**S3**	
	Masticophis flagellum flagellum	Eastern coachwhip	-	-	-	-	
	Tantilla oolitica	Rim rock crowned snake	T	-	G1G2	S1S2	S FL
Inverteb.	***Anaea troglodyte floridalis***	**Florida leafwing**	**T**	**E**	**G4?T1**	**S1**	**S FL**
	Cicindelidia floridana	**Miami tiger beetle**	**T**	**E**	**G1**	**S1**	**Miami**
	Cyclocephala miamiensis	Miami chafer beetle **			G1?	S1?	
	Ephyriades brunnea floridensis	Florida duskywing			G5T2	S2	
	Eumaeus atala	Atala hairstreak	-	-	G4	S2	
	Leptotes cassius	Cassius blue		T	-	-	
	Hemiargus ceraunus	Ceraunus blue		T	-	-	
	Procambarus milleri	Miami cave crayfish			G1	S1	
	Pseudocharis minima	Lesser wasp moth			G3G4	S2S3	
	Strymon acis bartramii	**Bartram's scrub hairstreak**	**T**	**E**	**G4?T1**	**S1**	**S FL**
	Strymon martialis	Martial scrub hairstreak			G3G5	S2S3	
	Ummidia sp.	Undescribed spider	-	-	-	-	unknown

* extirpated within the past 50 years

** possibly present (per general range description in Ratcliffe and Cave 2017).

Figure 6. Some of the federal and state listed wildlife species found in Richmond. **A**. White crowned pigeon (TW), **B**. Miami Tiger Beetles (JF), **C**. Bartram's scrub hairstreak (DS), **D**., Florida duskywing (MT), **E**. Florida bonneted bat (AB), **F**. Eastern gopher tortoise (JP), **G**. Rim rock crowned snake (DS). Initials indicate photo credits (see Acknowledgments section for full names).

E. Biology of South Florida Slash Pine

An understanding of the life history and reproductive biology of the South Florida slash pine is critical for planning reforestation projects. South Florida slash pine (*Pinus elliottii* var. *densa*) is the foundation species of the pine rockland community (**Fig. 7**). Pine trees strongly influence species diversity and composition as well as physical processes maintaining the pine rocklands. Slash pine provides nesting and foraging habitat for wildlife. Fallen pine needles form a fine fuel that increases the frequency of fire. In turn, fire in pine rocklands helps maintain an open understory for pine seedlings and numerous endemic plant species. Pine needles comprise the majority of fine fuels in pine forests (O'Brien et al. 2010), and are extremely important part of this fire-adapted ecosystem. Pine litter accumulation begins to increase about one month before wet season begins and is continuous, but greater, in the wet (growing) season (Herndon and Taylor 1985; Snyder 1986).

The reproductive cycle of slash pine takes essentially two years to complete. Pine reproduction begins between January and March, before the spring flush of leaves. Pollen release also takes place during this period (Little and Dorman 1952). Fertilization occurs approximately one year after pollination. Maturing female cones remain small and green, with tightly overlapping scales. Cones mature in August-September of the second year; the ripened cones are woody and much larger (Tomlinson 1980). Generally, trees seldom bear cones before 10 years of age and 4 inches in diameter. Most trees begin to bear large numbers of cones after 20 years. Heavy seed crops (masts) usually occur every three years, however in South Florida, some amount of seed is usually produced annually.

Most South Florida slash pine seed release occurs in September, although some cones with seed may remain on the tree until March. Ninety percent of seeds fall within 150 feet of parent tree (Lohrey and Kossuth 1990). No extended seed dormancy is exhibited by slash pine. Under suitable conditions, viable seed generally germinates within six months (J. Klein, pers. comm.) In other parts of the southern United States, slash pine (*Pinus elliottii* var. *elliottii*) seeds germinate in warm periods of fall if adequate soil moisture exists. Some seed over-winters and germinates in spring. In warmer regions, germination occurs throughout winter (Derr and Mann 1971).

South Florida slash pine seedling establishment criteria are unknown in the wild, though arbuscular mycorrhizal fungi are known to play a critical role in establishment and root development of pine seedlings, including *P. elliottii* (Jorgensen and Shoulders 1967). Seedlings of several varieties of *P. elliottii* go through a one to three year "grass stage" in which roots and stems thicken. Evidence shows that the South Florida Slash pine does not have a true grass stage, but exhibits some characteristics—namely very slow growth for several years, but unlike true "grass stage" pines, this is not accompanied by high fire tolerance (O'Brien et al. 2008). Pine seedlings store carbohydrates in roots during fall. These reserves are important for spring needle flush as low starch levels in roots has been correlated with seeding mortality in slash pine (McNabb 1985). Mature trees are protected from fire by thick, insulating, multi-layered bark comprised of expanded vascular cells (Landers 1989). Fire also controls spot fungus, a pest of slash pine (Hardin 1993).

Figure 7. The South Florida slash pine, *Pinus elliottii* var. *densa*: **A**. young tree showing male cones (JP), **B**. bark (JP), **C.** closer view of male cones (JP), **D**. young female cones (JM), **E**. old female cone (JP), **F**. newly germinated seed (JP), **G**. young seedling with seed coat still attached (JP). Initials indicate photo credits (see Acknowledgments section for full names).

F. Fire, vegetation structure, and understory dynamics

Fire has played a critical role in the evolution of pine rockland forests (Robertson 1955; Wade et al. 1980; Platt et al. 1990; Snyder et al. 1990; Doren et al. 1993). The role of fire in shaping the structure and composition of this ecosystem cannot be overemphasized. Restoring a fire regime that is acceptable both ecologically and politically is critical for the future of Richmond pine rocklands. Thus, it is important to understand the natural fire ecology of the region, and its impacts on pine rockland structure and understory dynamics. This section summarizes the latest information on fire frequency and methodology as well as the effects of vegetation on fire behavior, the importance of fire season, and finally, cost considerations.

Fire frequency

The fire return interval best suited to maintaining a healthy pine rockland is thought to be between 2 and 7 years. Intervals as long as 10 years may have been adequate in the past, when the landscape was less fragmented, however a 10-year fire interval is not recommended in pine rockland fragments. Possley et al. (2014) showed that Miami's urban pine rockland fragments that experienced a fire in the past 3 years had significantly higher herbaceous diversity and lower cover of hardwood, leaf litter, and palms when compared to more fire-suppressed parcels. After a fire, pine rockland vegetation recovers very quickly, and accumulation of pine needles and other fuels begins almost immediately (O'Brien et al. 2010).

Increased fire frequency is thought to promote the development of grass or forb-dominated understory plant associations (Kozlowski and Ahlgren 1974, Daubenmire 1968, Waldrop et al. 1992). Establishing and maintaining grassy fuels is critical to maintenance of an appropriate fire regime in Richmond, especially in areas of low pine density, which have fewer fine fuels. Grass and pine needles are ideal fuel for several reasons: less smoke is produced than in the burning of woody fuels, mop-up and suppression are easier, an open, grassy understory is ideal for rare endemic herbs as well as pine reproduction. Many of Richmond's pine rockland units already have extensive grass and forb dominated areas; these correspond with concentrations of rare endemic species, especially Deltoid Spurge and Tiny Polygala (**Map 7**).

Firing method

The firing method can have a profound effect on pine rockland structure. Natural fires occur as wind-driven events that create great variability of fire behavior, with the largest acreages consumed by head fires and flanking fires, which usually have greater flame heights and short residence time in the understory. Adult slash pines are rarely killed by head fires since they can refoliate if scorched by fires during the growing season. In addition, the short residence time of the flame front spares most pine tree seedlings. Head fires burn vegetation in a patchy manner thereby sparing a variable portion of the vulnerable trees.

Backing fires, which are the predominant method employed during prescribed burns, are relatively "cool" compared to head fires. They have lower flame heights, and thereby reduced crown scorch to adult trees. Backing fires also move slowly into the wind and the flame front has a longer residence time in the understory. This can result in the roots of mature trees being overheated. Backing fires are very effective in consuming the majority of fuels in the stand. Seedling are usually completely consumed in a backing fire.

Due to the urban setting of the Richmond complex, prescribed burning with head fire is not feasible in most situations. However, during a backing burn, ignition procedures may be used that can produce similar fire activity in limited sections of the burn area.

Influence of vegetation on fire

Just as fire behavior influences vegetation structure, the vegetation structure also influences fire behavior. This is especially true of the South Florida slash pine, whose needles provide critical "fuel continuity," helping to carry fire quickly and effectively though the system (O'Brien et al. 2008). Dead pine "snags," downed pine logs, and even pine cones are important sources of heterogeneity in pine rocklands because they can smolder at high temperatures when burned, opening canopy and shrub gaps by killing surrounding vegetation (Mitchell et al., 2009). Pine rocklands with very dense growth of saw palmetto can cause undesirable fire behavior such as high temperatures and smoke output (O'Brien et al. 2010). Long-unburned pine rockland stands which have several inches of pine needle accumulation and/or are invaded by hardwood trees or woody vines are less flammable (Possley et al. 2014). When such fire-suppressed pinelands do burn, they are much more likely to smolder, reignite, and/or cause mortality of mature pine trees (O'Brien et al. 2010).

Like pine needles, grasses are also "fine fuels" which have a profound impact on fire behavior, providing fuel continuity and promoting quick, low-intensity fire. Promoting a grassy understory in pine rocklands can help to promote future prescribed fires. However, large, non-native grasses such as Burma reed (*Neyraudia reynaudiana*) and Napier grass (*Pennisetum purpureum*) do *not* promote quick, low-intensity fires. They tend to promote extremely intense fires in the dry season, and they may suppress fires in the wet season.

Fire season

The season in which a fire occurs influences both the structure and composition of pine rocklands. The seasonality of South Florida's fire regime prior to the 1800s is the source of some debate, but it was certainly influenced by pre-Colombian people as well as by lightning. Human-caused fires probably included both accidental and intentionally-set fires, the latter to open up habitat for hunting. It is likely that human caused fires occurred more frequently in the dry season. On the other hand, most lightning-caused fires in south Florida occur between May and September (Snyder et al. 1990). Lightning strikes at the transition from dry to wet season are the most likely to ignite and burn vegetation. In Everglades National Park, between 1948 and 1988, by far more acreage burned annually in May and June compared to other months (Snyder 1989). Throughout Florida, more wildland acreage burns in early summer (May-July) since fuel moisture is usually at an annual low during this period (Brenner 1991). These "transition season" fires burn large acreages and burn with greater intensity than late wet season fires.

Fire season has a significant impact on pine trees, as summarized by Robbins and Myers (1989). Southern pines (including South Florida slash pine) are multinodal, meaning new buds and needles are formed 3-4 times per year in the growing season. Young and mature pines are less likely to die from crown scorch early in the growing season. If defoliated after the last flush of needles late in the growing season, southern pines cannot flush again until spring. Pines injured by fire in the fall are more likely to die because carbohydrate reserves are at their annual low. Roots growing in needle duff are susceptible to fire, especially in the dormant (winter) season. Given the differential effects of fire on pines in growing season versus winter, a history of summer versus winter burns will result in vastly different age

stands of pines. This was demonstrated by Doren et al. (1993), who examined pine rockland stands in Everglades National Park and found that a stand (Lostman's pines) with a history of only summer burns had a much lower density of adult pines, with the majority of pines being immature. In contrast, stands subject to winter burns (Long Pine Key, Pines West) had many more mature pines and fewer juveniles, and thus a more closed canopy.

In regards to hardwoods, it is widely believed that growing season burns are more effective than winter burns to reduce hardwood biomass. However, work by Snyder (1986) showed that recovery of hardwoods was not significantly affected by burn season. Snyder suggests that fire temperature may be a more important factor than season for reducing hardwood biomass.

Burn season has not been shown to have a strong effect on pine rockland understory recovery. Many understory species flower and set fruit after a fire, regardless of season (Robertson 1953, Waldrop et al. 1992, Snyder 1986). This phenomenon is shown across a wide range of plants from many different plant families; these include but are not limited to grasses (*Tripsacum floridanum*, *Schizachyrium* spp., *Andropogon* spp., others), blazingstars (*Liatris* spp.), and the endangered morningglory "man-in-the-ground" (*Ipomoea microdactyla*) (Snyder et al. 1990).

Understanding the effects of burn season on pine rockland structure is important for Richmond land managers, however, as noted by O'Brien et al. (2010), the point may be somewhat moot, because "*the contemporary landscape is unprecedented, the climate is changing, and management guided by specific objectives is replacing management to achieve historical targets*." Given the severity of fire suppression in most areas of urban Miami, achieving fire during <u>any</u> season is more important than waiting for the perfect conditions to conduct burns that more closely approximate the historic fire regime.

Cost considerations

Safe, carefully-planned prescribed fires can maximize biodiversity in Richmond while preventing the establishment of hardwoods and non-native invasive plants. Fire "surrogates" such as manual hardwood reduction are sometimes conducted in lieu of fire, but these treatments should be minimized, and used primarily to promote stand flammability so that fire may be employed effectively (Possley et al. 2014). Fire is by far the best choice for pine rockland management for ecological reasons as well as economic reasons; at $10-20 per acre (O'Brien et al. 2010), fire is the only way to cost-effectively manage an assemblage of forest fragments like Richmond. The cost of hardwood reduction in pine rockland preserves can range from $600 to $6500 per acre, depending on conditions (Possley et al. 2014).

G. Fire History of Richmond

The pine rocklands and transverse glades in Richmond are all adapted to—and therefore prone to—wildfire, although certain areas have burned more than others. Human access, location, and fuel conditions have strongly influenced the pine rockland structure.

Aerial photographic evidence indicates that infrequent severe, crown-reducing incendiary fires occurred historically at Richmond. In fact, the northern third of Richmond (west of Zoo Miami) apparently experienced a wildfire of this type in the 1950s. Although most canopy trees were killed, canopy recovery was apparent some 30 years later. Presumably, surviving and peripheral trees re-seeded the affected area.

Recurrent dry season incendiary fires have occurred in portions of Richmond, particularly in Larry & Penny Thompson Park's southwest management unit (#2). These fires occur almost every year and are clearly correlated with public access and use. As a result, Management Unit #2 has very low pine density, contrasted with a high density of pine rockland herbs and shrubs, including many endangered species (Possley et al. 2014).

It should be noted that invasion of pine rockland by non-native plants can completely alter the natural fire regime. This was once the case in Richmond with the tall exotic grass, Burma reed (*Neyraudia reynaudiana*) (**Fig. 8**). Dense stands of Burma reed dominated much of Richmond by 1991, when Miami-Dade's Natural Areas Management Division was formed and tasked with restoring the pine rocklands. Since that time, Burma reed has been reduced to <1% cover in County-owned portions of Richmond, while native plants have rebounded.

Figure 8. Various stages of pine rockland restoration at Larry & Penny Thompson Park. **Left:** Dense Burma reed in the understory in 1991 (JM). **Center:** a 1996 fire in the preserve, illustrating how Burma reed affects the fire regime (JM). **Right:** Unit 2 of the preserve in 2013 (JP).

In the late-1980s, Miami-Dade County's Natural Areas Management Division began tracking the occurrence and spatial extent of fires in all County natural areas. Events are logged into a spreadsheet and associated information is recorded, including date, acres burned, and whether the fire was prescribed or unintentional. In all of Richmond, from 1987 through 2016, wildfires (64 total) have been much more common than prescription fires (18 total). Larry & Penny Thompson Memorial Park has experienced many more fires than have other properties, Zoo Miami, Martinez Preserve, and the Gold Coast Railroad Museum. Larry & Penny Park had 52 of the 64 wildfires and 8 of the 18 prescription fires.

In considering County-wide fire records, wildfires and prescribed fires have shown strong seasonal patterns. Wildfires tend to be rare in late summer due to frequent rains, and more abundant at the end of the dry season when fuel moisture is low (**Fig. 9**). Prescribed fires have been more frequent in the winter months, due to easily ignitable fuel and greater availability of wildland firefighting staff from the Florida Forest Service.

Proper fire management of Richmond sets the stage for many of the management recommendations in the final section of this plan. The public and land managers must accept the fact that growing season

fires, which may kill some pine trees, are a critical part of this natural process in pine rocklands. Without appropriate fire, pine rocklands will become even-aged stands with low diversity of the understory species which make pine rocklands unique.

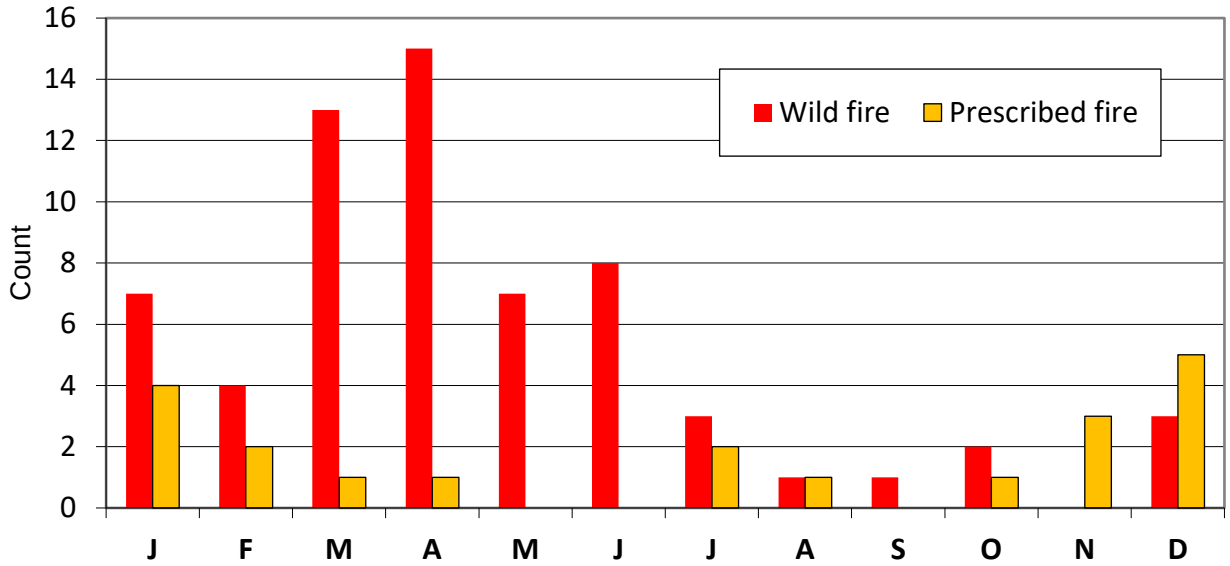


Figure 9. Summary of all known wild fire and prescribed burn occurrence in Richmond pine rocklands from 1987 to 2016, grouped by month. Totals are 64 wild fires and 20 prescribed fires. Data provided by Dallas Hazelton, Miami-Dade County Natural Areas Management.

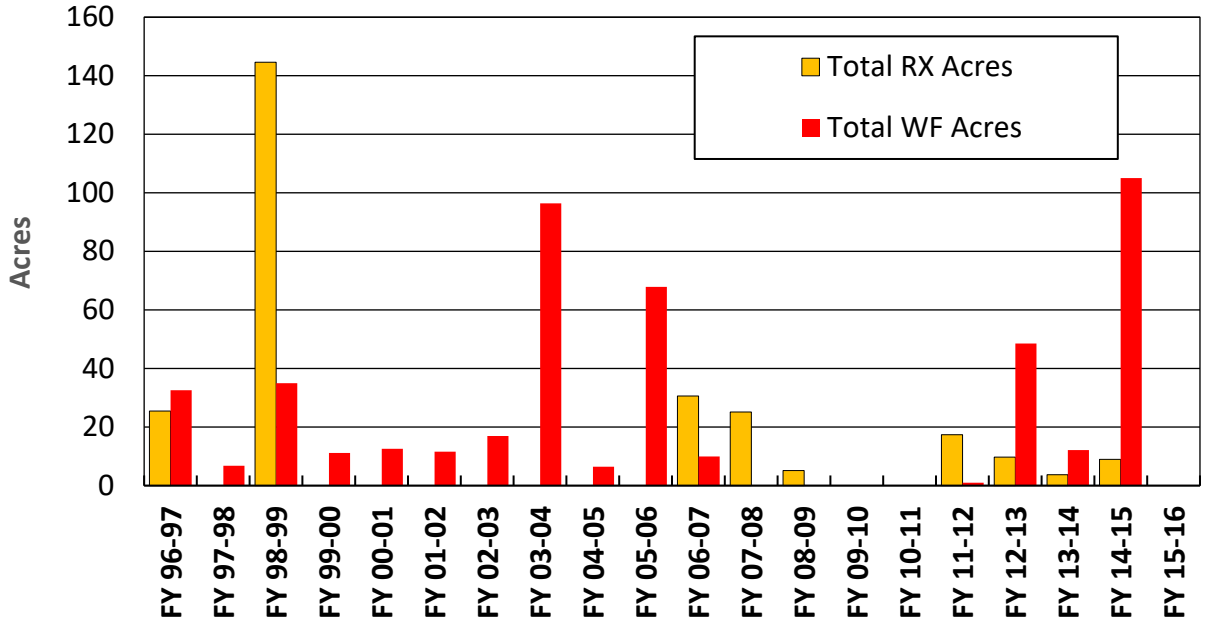


Figure 10. Summary of the acres burned in all known wild fire and prescribed burns in Richmond pine rocklands from 1996 to 2016, grouped by fiscal year. Total wild fire acreage burned is 474; total prescribed fire acres burned was 270. The FY99 prescribed fires include 98.7 acres of the Martinez pineland, which at the time was owned by the US Army, not Miami-Dade County.

H. Hurricanes

Hurricanes are another important factor affecting pine rockland structure in Richmond, albeit less frequently than fires. 1992's Hurricane Andrew was the most destructive storm ever known to have struck Miami-Dade County. Andrew's immediate impacts to pine rocklands were mostly limited to the canopy. In Everglades National Park and Big Cypress National Preserve, Platt et al. (2000) found that pine mortality averaged 17-25%, with large trees experiencing far greater mortality. Mortality was likely higher in smaller, more eastern pine rockland fragments like Richmond. Understory woody shrubs were defoliated and top-killed by the storm.

In the months following Hurricane Andrew, slash pines continued to die across the County. Pines that were not directly snapped in half by the storm succumbed to mortality through other means **(Fig. 11)**. Within one year, 98% of pines were dead (J. Klein, pers. comm.). This was attributed to a combination of physical tree damage, insect infestations, and drought (which reduced abundance of "pitch tubes" which act as a natural defense against insects). Three species of bark beetles, *Ips calligraphus*, *Ips avulsus* and *Ips grandicollis* were found to be present in damaged slash pines, the latter two species in very high numbers. The presence of bark beetles made dying pines more susceptible, in turn, to other insect pests. It should be noted that bark beetles are native species and part of a natural response to damaged trees; little can be done to prevent a similar future beetle outbreak.

Figure 11. Loss of the slash pine canopy in Larry & Penny Thompson Park, two years after Hurricane Andrew, in 1994 (MF).

I. Canopy Restoration

In the aftermath of Hurricane Andrew, Miami-Dade County quickly initiated a reforestation program to return pine trees to urban pine rockland preserves, including Richmond. This section reviews the reforestation methods the County employed in Richmond from 1993 to 2001, considers lessons learned from that process, and references data from large stands of pine rocklands in Everglades National Park in order to generate recommendations about best reforestation practices.

As the first step toward pine reforestation after Hurricane Andrew, County staffers identified potential sources of slash pine seed that remained in the region after the hurricane and subsequent pest outbreaks. Sites in north and north-central Miami-Dade County held the closest available mature, reproductive pine trees. St. Thomas University and the neighboring Marion Center, A.D. Barnes Park, Tropical Park, and the Girl Scouts "Little House" property in South Miami were some of the most important sites for seed collection. Approximately 284 pounds of pine cones were collected from 10 sites from 1993 through 1996; an additional collection from St. Thomas University was made in 2000 (McHargue 2000).

Locally-sourced seed was used to ensure that pines would be well-adapted to the harsh rockland conditions, and also to prevent any potential negative genetic effects (e.g., outbreeding depression) that might result if trees grown from distant seed collections interbred with surviving local plants. Research by Mayo (2000) confirmed that pines from locally-sourced seeds did in fact perform better (in terms of growth rate) than pines grown from seed collected in Palm Beach County. There were questions at the time as to whether there may be genetic differences in pines from rocky versus sandy preserves. However, subsequent research showed that there are no great differences in pine genetics between urban fragments or between these two substrate types (Williams et al. 2007).

Miami-Dade County used two methods to reforest its preserves: direct seeding, and planting of young pines, known as "tubelings" (**Fig. 12**). Both methods were employed at Richmond. Direct seeding was used only in 1997, in Zoo Miami's management units 1, 6, and 7, all of which are on the property's east side. The bulk of this seed was from A.D. Barnes Park. Approximately 942,400 seeds were hand-scattered by county staff who walked transects through these units (Mayo 2000). Nursery trials indicated that just under half of these seeds were viable at the time of broadcast. After two years, a random sampling of 10x10 meter plots found that only 32 seedlings had established per acre. This was much lower establishment compared to direct seeding trials performed elsewhere in the County; the difference was attributed to the fact that seeds used at the Zoo were not pre-treated with Gustafon 42, a bird and rodent repellant (Mayo 2000).

Due to low success of direct-seeding (and potential harm to wildlife from pre-treating seeds with rodent repellant), planting of pine tubelings was used more widely as a post-Hurricane Andrew reforestation strategy, throughout the County and in Richmond. Portions of Richmond receiving pine tubelings between 1995 and 2001 included Zoo Miami (9504 trees), Larry & Penny Thompson Park (20,929 trees), the federal prison (5376 trees), and Martinez Army Reserve base (5952 trees) (McHargue 2000). Survivorship of tubelings was relatively high, at 83% (J. Klein, pers. comm.).

An economic analysis of the reforestation efforts by Mayo (2000) found that the cost of direct seeding (10 cents per seedling when repellant was used) was generally much lower than that of planting tubelings (43-72 cents per seedling), but the success rate of direct seeding was also much lower. Mayo

recommended using direct seeding for large areas when cost was a factor, but planting tubelings in small areas when possible.

Looking back to post-Andrew restoration efforts, several lessons can be drawn to improve future reforestation method for Richmond, should they be required. First are spatial considerations. There is expert consensus that the resulting tree densities were far too high, post-Andrew. The goal recommended from timber industry professionals at the time was 200 trees per acre (Mayo 2000). The most ecologically appropriate recommendation for reforesting pine rockland varies among experts, but lies between 50 and 100 trees per acre (J. Maguire, J. Klein, pers. comm.). Doren et al. (1993) reported a density of 59 trees per acre in Lostman's Pines, which (as an unlogged stand which experienced only growing-season fires) is the most natural pine rockland stand remaining in South Florida. This figure included only trees $\geq$4 inches in diameter at breast height. The stand was further described by Doren et al. as consisting of patchy, uneven-aged trees, with juvenile trees comprising 75% of the stand. This stand structure provides an excellent model for reforestation goals for Richmond.

Another spatial consideration is that reforestation efforts should result in a natural tree distribution pattern, with some areas having sparse tree coverage and others a more densely clumped coverage. This is especially true if forestry professionals are replanting. Many of the initial post-Andrew plantings were made in straight, evenly spaced lines which are clearly visible in aerial photos, especially in Zoo Miami and in Martinez Preserve (**Fig. 12**). Later, reforestation techniques were incorporated to ensure a more natural distribution, with tree locations selected using random number tables (J. Klein, pers. comm.).

A third lesson that can be drawn from post-Andrew reforestation efforts relates to temporal considerations. Trees should be planted in pulses separated by several years, to generate a more natural, uneven-aged stand structure. For example, planting at densities of 20 trees per acre, 5-10 years apart, over the span of two decades. Since post-Andrew plantings were temporally clustered within just 2-3 years, Miami-Dade County needed to begin thinning pine trees in many preserves by the mid-2000s due to the dense, even-aged stand structure. Richmond has not required as much pine thinning as other areas of the County largely due to frequent wildfires in Larry & Penny Thompson Park. However, thinning may be needed in other properties in the future.

Figure 12. Canopy restoration after Hurricane Andrew. Left: A Natural Areas Management crew member uses a dibble to plant a tubeling South Florida slash pine (DERM). Right: Pine trees planted in rows in the mid-1990s are visible in this 2017 Google Earth image from the northeast corner of Martinez Preserve.

A final lesson regarding reforestation of the Richmond pine rocklands involves substrate. Post-Andrew pine plantings were conducted primarily in sandy areas (J. Klein, J. Maguire, pers. comm.) because work crews favored that substrate for ease of digging. However, favoring sandy areas for pine plantings creates an unnatural pine distribution and threatens rare species which are found only in patches of sand, such as federally endangered Miami Tiger Beetle, Tiny polygala or critically imperiled Bearded skeleton grass.

In summary, reforestation of pine rocklands is a complicated process, and is best achieved by embracing spatial and temporal heterogeneity and not over-planting in sandy substrate. This plan recommends setting target densities for Richmond at 50-70 four-inch-diameter trees per acre, following 59 trees per acre described in natural stands by Doren et al. (1993). It is important to bear in mind that a "correct" pine tree density is not the desired end product, but a means to the end of maximizing native understory biodiversity in pine rocklands.

J. Exotic and Invasive Plant Species

If left unmanaged, the pine rocklands of South Florida have a serious problem with invasion of non-native aggressive plant species. In Miami-Dade County, 569 non-native plant species have been documented as established in County natural areas (Gann et al. 2018). Proximity to abundant exotic seed sources from our region's nursery industry as well as from adjacent landscapes contributes to the problem, which is exacerbated by a high degree of fragmentation. Soil disturbance on the pine rockland edge creates ideal conditions for the establishment of exotic plants, which then have a greater potential to spread (by seeding or vegetatively) into adjacent undisturbed habitat. In addition to exotic pest plants, many native pioneer species have weedy characteristics. In some instances, these "weedy natives" may be considered invasive in pine rocklands, and should be factored into vegetation control programs in pine rockland vegetation.

It should be noted that even heavily invaded pine rocklands can be brought under maintenance control (i.e., <1% cover of exotic species) within a few years of continued effort, at which point costs become much lower (Possley et al. 2014). For example, Miami-Dade County's Natural Areas Management Division brought Burma reed beneath 1% cover in Larry & Penny Thompson Park within several years of its inception, and currently re-treats this species annually (or approximately so) to maintain it at this level. Pine rocklands that have become dominated by exotic species are sometimes discounted as "degraded," or "not restorable." However, if soil is undisturbed (or was disturbed decades ago), and if some native biodiversity remains, restoration to a functioning pine rockland stand is fully achievable. In cases of piles of fill dominated by non-native weeds, removal of the fill by scraping down to natural rock elevation (with heavy equipment) and replanting with native species has shown preliminary success in restoring some native vegetation, albeit with higher incidence of non-native species. It is unclear whether these areas will become fully functional as pine rockland, in the short- or long-term. If they retain higher infestation of non-native species, they still hold value as a buffer to the adjacent intact habitat, protecting it from undesirable edge effects such as influx of exotic seeds, pollution, and herbivory.

Categorization schemes have been developed as a basis to prioritize the treatment of exotic plant infestations. Florida's Exotic Pest Plant Council (FLEPPC) publishes a bi-annual list of the most invasive plants in Florida (FLEPPC 2017). FLEPPC's list divides exotic plants into two categories based upon each plant's ability to invade intact, undisturbed areas and its range in Florida. Category I species are widespread and have been shown to invade undisturbed ecosystems. Category II species have localized, rapidly expanding populations and the potential to invade natural areas. While the FLEPPC list focuses on Florida as a whole, the Everglades Cooperative Invasive Species Management Area (ECISMA) is concerned with invasive species (both plant and animal) that are problems in South Florida, particularly new introductions that may not yet be on the FLEPPC list (ECISMA 2017). The invasive species lists developed by FLEPPC and ECISMA are both used to inform the list of prohibited plant species in Miami-Dade County (**Table 2**).

The categorizations utilized by FLEPPC and ECISMA are useful in developing control priorities and strategies. Species which alter pine rockland habitat structure (e.g., Brazilian pepper) or alter natural ecosystem processes such as fire (e.g., Burma reed, **Fig. 8**) should be considered a high priority for treatment, however more cryptic effects of invasion such as hybridization (e.g., *Lantana camara*), soil enrichment (e.g., exotic legumes), and allelopathy (e.g., *Casuarina* spp.) should be considered. On a site-specific basis, resource or habitat quality and severity of infestation should be evaluated in order to develop exotic control priorities.

The most prevalent non-native invasive plant species that should be prioritized for control in Richmond are illustrated in **Figure 13** and described more fully below. Other species may need addressing on a site-by-site basis. Those species that can invade undisturbed pine rockland and alter structure and abiotic processes should be the highest priority, along with exotics which directly threaten listed or imperiled species. Also high priority should be invasive species that now occur in only isolated patches. Continuing effort, through a monitoring program, needs to be made to locate isolated patches of invasive plants.

Recommended control methods for the most prevalent invasive plants in Richmond are summarized in **Table 2**, after the species descriptions. In general, seedlings occurring in low abundance should be pulled by hand and disposed of. Larger and more abundant plants may need to be treated with

herbicide. Most hardwoods (including vines) are susceptible to systemic herbicides applied to their vascular systems. The optimal application method usually depends on the size and vigor of the plant. Fire is a very effective means to control most of these species when they grow in low densities; however, when dense stands of exotic species burn, they are likely to create excess smoke and flame height. Investment in exotic invasive plant control is necessary for preserving native pine rockland biodiversity and can be extremely effective. As restoration progresses and invasive plant densities decrease, prescribed fire will be increasingly effective in controlling most invasive plant populations.

Figure 13. Non-native invasive plant species that are common in Richmond: **A**. Australian pine (*C. glauca*) (JP), **B**. Brazilian pepper (JP), **C**. Earleaf acacia (GGa), **D.** Exotic lantana (RH), **E**. Pods from cow itch vine (JP), **F.** Napier grass (JP), **G**. sewer vine (JP). **H.** Rose natal grass (JP). **I.** Leaf from Indian rosewood (JP). See **Figure 8** for images of Burma reed.

Australian pine – Australian pines (*Casuarina equisetifolia, C. glauca*) are very large trees, growing to 100 feet tall or more. Australian pines are not true pines, but flowering trees which superficially resemble pines. Seed are borne in cone-like fruits and are readily dispersed by both wind and birds. Due to their combination of shallow roots and excessive height, Australian pines can cause significant damage when toppled by winds. Stands of *C. glauca* can rapidly expand from vegetative runners sent out by larger trees. Rapid "needle" shedding creates dense layers of dead needles beneath trees. The mulching effect from needles as well as the leaching of chemicals which prevent growth of other plants (a process known as "allelopathy") often results in the area surrounding Australian pines being devoid of any other plant species. Both *C. equisetifolia* and *C. glauca* are FLEPPC Category-I.

Burma reed – Burma reed (*Neyraudia reynaudiana*) is a very large grass that is well-adapted to pine rocklands of Richmond, where it grows, sets seed, and spreads very rapidly. The cane-like grass topped by a large feathery plume can grow to 15 feet tall. Individual plants have short-creeping rhizomes and what begins as a single stalk can form a many-stalked cluster with significant below-ground starch reserves, making the grass resistant to control. In sandy areas, Burma reed can form a dense monoculture, excluding any native plants, completely changing the community structure, and forming a major fire hazard. FLEPPC Category-I (**Fig. 8**).

Brazilian pepper – Brazilian pepper (*Schinus terebinthifolius*) is the most abundant non-native pest plant in South Florida (Bradley and Gann 1999). Sometimes called the "Florida holly," this tree was widely planted as an ornamental and hedgerow for decades. Female trees produce abundant red berries in the winter, which are dispersed by a wide variety of bird and mammal species. One study (Morgan and Overholt 2005) showed that extracts of Brazilian pepper stunted the growth of the native herbs Spanish needle and rouge berry. This allelopathic effect likely prevents most native species from establishing nearby, giving Brazilian pepper a strong competitive advantage. Brazilian pepper is in the same plant family as poison ivy and poisonwood; some people will develop dermatitis after contacting sap or inhaling the smoke from burning logs. FLEPPC Category-I.

Cow itch – Cow itch (*Mucuna pruriens*) gets its name from the painfully irritating needle-like hairs that cover the fruiting pods (leaves and stems do not cause itching). In Richmond, this trifoliate vine can be very aggressive in disturbed areas and on fencelines, but it does not tend to be a major invader of undisturbed pine rockland. Not listed by FLEPPC.

Earleaf acacia – Earleaf acacia (*Acacia auriculiformis*) is a medium-sized, fast-growing ornamental tree that may have been planted for Zoo forage, and has spread throughout much of Richmond. The unique "ear-leaf" pods of this species bear black seeds with a bright fleshy aril that attracts birds, which help to disperse the seeds. FLEPPC Category-I.

Indian rosewood – Indian rosewood (*Dalbergia sissoo*) is not a common pest plant species in Miami or elsewhere in Florida, though it is known to be invasive in other regions (Australia, Africa). It is quite abundant in portions of Richmond. Indian rosewood can grow to be a large tree, to nearly 100 feet tall. Its fruits (3-4-seeded pods) can disperse in the wind and have high viability. Trees reproduce vegetatively by root suckers. FLEPPC Category-II.

Lantana – Lantana (*Lantana camara*), also known as shrubverbena, is the second most abundant non-native plant in south Florida natural areas (Bradley and Gann 1999). It is also one of the least controlled, in part because it can be difficult to distinguish from the Florida endangered, endemic pineland lantana

(*Lantana depressa* var. *depressa*). The continued presence of the exotic lantana in Richmond is a threat to the survival of the rare native, due to the fact that these species hybridize. The genes of the more aggressive non-native species swamp those of the native species. As a result, non-native lantana genes were present in the majority of apparently "native" lantana sampled in a study by Maschinski et al. (2010) which included samples from Richmond. FLEPPC Category-II.

Sewer vine – Sewer vine (*Paederia cruddasiana*) gets its name from the pungent, highly unpleasant smell it emits when the leaves or stems are crushed or damaged. This vine in the coffee family, introduced by the USDA for potential as a fiber crop, is one of the most prevalent weeds in Miami-Dade County. If left untreated, vines become woody, may exceed one inch in diameter, and can engulf entire trees. In Richmond, sewer vine is mostly confined to disturbed areas and fencelines. FLEPPC Category-I.

Showy rattlebox – Showy rattlebox (*Crotalaria spectabilils*) is a large (to 5 feet) annual herb with a prominent display of yellow flowers at the crown. It was introduced by the USDA (per Dr. David Fairchild) to add nitrogen to soil and deter nematodes. Seeds are borne in woody, air-filled pods that rattle when shaken. Like most legumes, seeds of showy rattlebox are very long-lived and can persist in soil for decades, germinating after disturbance. Showy rattlebox can dominate the understory vegetation in some portions of Richmond, especially after fire or disturbance. If left untreated, the stand will diminish as shade increases, however not before hundreds of seeds are released. Not listed by FLEPPC.

Other grasses – Many other species of non-native grasses are problematic in portions of Richmond. Some, such as smut grass (*Sporobolus indicus*), two-hole grass (*Bothriochloa pertusa*), Jaragua (*Hyparrhenia rufa*) and Rose natal grass (*Melinis repens*) are mostly confined to disturbed edges and fire breaks. Napier grass (*Pennisetum purpureum*) and Guinea grass (*Panicum maximum*) are more concerning due to a more aggressive nature as well as to their larger size. Guinea grass can reach 8 feet tall, while Napier grass – also known as elephant grass—can reach 15 feet tall. It should be noted that many native grasses are present throughout Richmond, some of which are very rare. In cases where ID is uncertain, it is advised that an expert is consulted before control is implemented.

Table 5. Recommended control methods for major non-native invasive pest plants in Richmond. All information follows recommendations of Enloe et al. (2018), except for showy rattlebox and "other grasses." Common trade names for the chemicals listed below include: Roundup (glyphosate), Garlon 4 or Pathfinder (triclopyr ester), Garlon 3A (triclopyr amine), Stalker (imazapyr), and Plateau (imazapic).

Pest Plant	**Control Options**
Australian pine	A. Basal bark: 10-20% triclopyr ester. Larger trees should be frilled (i.e., downward cuts into the cambium to allow herbicide to penetrate). The addition of 3% imazapyr will improve effectiveness for older trees. B. Cut stump: 50% triclopyr amine or 10-20% triclopyr ester.
Brazilian pepper	A. Basal bark: 10%-20% triclopyr ester. B. Foliar: Triclopyr ester, triclopyr amine, or glyphosate according to label directions. Glyphosate products such as Roundup are less effective when

	used alone in spring and early summer. Do not use foliar treatments near sensitive (native, imperiled) species. C. Cut stump: 50% triclopyr amine, 10% triclopyr ester, or 50%-100% glyphosate. D. Manual: seedlings should be hand-pulled. Comment: Brazilian pepper trees are dioecious, with plants bearing only male or female flowers. In cases where cost is limited or complete removal of canopy is a concern, female plants may be removed first to stop seed production.
Burma reed & Napier grass	A. Foliar: 5% glyphosate (use this method only in non-sensitive areas, due to potential off-target damage when spraying these very large grass species) B. Cut stem: 50% glyphosate, applied as 1-2 drips to cut C. Cut/flush/spray: In areas with surrounding desirable vegetation, the culms can be cut to ground level (or nearly so) with a metal-bladed weed-whacker. Remove cut stalks immediately from the treatment area if they are reproductive. When regrowth reaches 12-18 inches tall (3-6 weeks later), spray it with 5% glyphosate. Browning may take 6 weeks or more. An adjuvent (surfactant) can be used to increase the herbicide uptake. Utilize the concentrations posted on the herbicide product label. Marker dyes can be used in conjunction with herbicides to temporarily color treated plants. D. Burn/flush/spray: treat as above, after plants flush out post-fire. This technique is best when cover of the exotic grass is <30%. At higher densities, fires can be catastrophic. E. Mow: in areas dominated by Burma reed or Napier grass, mowing can be effective but it must be often enough to prevent seed set: monthly during the rainy season, and every 2-4 months in the dry season. Fill piles should be removed when possible to facilitate mowing in these cases.
Cow itch	A. Basal bark: 10% triclopyr ester B. Foliar: 5% glyphosate. Do not use foliar treatments near sensitive (native, imperiled) species. C. Manual: hand pull mature vines and seedlings; does not resprout from roots. It is important to continue pulling seedlings until seed bank is exhausted.
Earleaf acacia	D. Basal bark: 10% triclopyr ester E. Cut stump: 50% triclopyr amine. Add 3% imazapyr for added effectiveness.
Indian rosewood	A. Basal bark: 10% triclopyr ester B. Cut stump: 50% triclopyr amine
Lantana	A. Basal bark: 10% triclopyr ester B. Cut stump: 50% triclopyr amine or 10% triclopyr ester

Sewer vine	A. Foliar: 3%-5% glyphosate. Do not use foliar treatments near sensitive (native, imperiled) species. B. Basal bark: 10% triclopyr ester. Within 2-4 weeks re-treat the area with basal applications of 10% triclopyr ester. This second treatment can be time-consuming because many underground runners sprout. The area should continue to be monitored for follow-up treatments
Showy rattlebox	A. Manual: hand pull isolated plants and remove them from site if seed pods are present. It is important to continue pulling seedlings until seed bank is exhausted. C. Foliar: 5% glyphosate. Do not use foliar treatments near sensitive (native, imperiled) species.
Other grasses	A. Mowing: Regular mowing can be an excellent way to prevent small non-native grasses on firebreaks and edges from spreading further. Care should be taken to mow prior to seed set and to not damage adjacent vegetation or soil. B. Foliar: Use 3-5% glyphosate is an option if there aren't any native species that might suffer off-target damage. When the exotic grass is intermixed with natives, repeated applications of imazapic at the maximum label rate will be more effective in the long-run because less off-target damage from this selective herbicide will allow natives to recolonize (personal communication from Courtney Stokes, former University of Florida MS student, specifically in regard to control of *Melinis repens*).

K. Exotic and Invasive Animal Species

As with plants, there are several non-native animal species present in Richmond, some of which have significant negative impact on the native system. Non-native wildlife species that have been documented in Richmond are discussed below, along with their known and/or potential impacts.

Mammals - Feral domestic cats are present throughout Richmond, and there is a well-established feeding colony in Larry & Penny Thompson Park made up of dozens of cats. Trap/neuter/release colonies have been shown to be ineffective (or to even cause an increase in colony size) in Miami (Castillo and Clarke 2003). Nationally, feral cats have been shown to be extremely harmful to native fauna, especially birds and small mammals (Loss et al. 2013). Thus, feral cats are paramount to consider when managing Richmond's native wildlife. It is illegal (per Miami-Dade County code, Chapter 26) for park visitors to drop-off and/or feed feral cats (thus cat feeding colonies are prohibited in parks). Feral cats not only have negative impacts on native wildlife, but they also pose a potential danger to human health. Cat bites and scratches can result in serious infection, and exposure to cat feces may result in contraction of toxoplasmosis, a parasitic disease that can be especially dangerous (even lethal) for young children, pregnant women, and people with suppressed immune systems. Toxoplasmosis may also affect other animals. At Zoo Miami, toxoplasmosis from feral cats has resulted in the illness and

death of tree kangaroos and other members of the zoo collections (F. Ridgley, pers. comm). When possible, cats should be trapped and removed from preserves.

Other exotic mammals present in Richmond include the Norway rat (*Rattus norvegicus*) and black rat (*Rattus rattus*). These species compete for resources with native rodents and serve as disease reservoirs and vectors. Additionally, feral domestic dogs have become established at times within Richmond. These, too, can have negative effects upon native wildlife and may harbor diseases such as rabies and distemper.

Reptiles and Amphibians - Many non-native reptiles and amphibians are established in Richmond; some have known negative effects on native flora and fauna, as well as humans. Giant toads (*Rhinella marina*, also called marine, bufo, or cane toads) outcompete, prey upon, and displace native amphibian species. They are also highly toxic and may kill or injure predators. Green iguanas (*Iguana iguana*) can heavily impact plants with grazing, can incidentally eat the eggs and larvae of endangered butterflies (FFWCC, pers. comm.), and have been shown to spread salmonella. Red-eared sliders (*Trachemys scripta elegans*, a turtle) can displace native turtle species. Other introduced reptiles and amphibians include the brown anole (*Anolis sagrei*), bark anole (*Anolis distichus*), Puerto Rican crested anole (*Anolis cristatellus cristatellus*), the knight anole (*Anolis equestris*), Mediterranean gecko (*Hemidactylus turcicus*), house gecko (*Hemidactylus frenatus*), greenhouse frog (*Eleutherodactylus planirostris*), Cuban tree frog (*Osteopilus septentrionalis*), Northern curlytail lizard (*Leiocephalus carinatus armouri*), Chiapas giant musk turtle (*Staurotypus salvinii*), brown basilisk (*Basiliscus vittatus*), and the red headed agama (*Agama agama*).

Birds - Exotic birds that are present in Richmond include the domestic chicken (*Gallus gallus domesticus*), common myna (*Acridotheres tristis*), Egyptian goose (*Alopochen aegyptiaca*), muscovy duck (*Cairina moschata*), European starling (*Sturnus vulgaris*), Eurasian collared-dove (*Streptopelia decaocto*), house sparrow (*Passer domesticus*), monk parakeet (*Myiopsitta monachus*), yellow-chevroned parakeet (*Brotogeris chiriri*), and orange-cheeked waxbill (*Estrilda melpoda*). The sacred ibis (*Threskironis aethiopicus*) was present but extirpated from the area through a cooperative effort with Zoo Miami and USDA Wildlife Services staff.

Invertebrates - There are a multitude of exotic invertebrates present in Richmind that compete with, induce and spread disease, or predate on our native species. The most notable and likely impactful species are the European honey bee (*Apis mellifera*), red imported fire ant (*Solenopsis invicta*), little fire ant (*Wasmannia auropunctata*), yellow fever mosquito (*Aedes aegypti*), and Mexican twig ant (*Pseudomyrmex gracilis*).

L. Ecosystem Services

World-wide, natural areas provide a suite of ecosystem services which are crucial to human life, yet are yet difficult to monetize. The ecosystem services provided by the Richmond pine rocklands to the citizens of South Florida should be considered as part of any urban planning in the surrounding area. Richmond stands out in Miami as a key provider of ecosystem services. This is in part due its inland location and relatively high elevation, making it one of the least vulnerable areas in South Florida for flooding, saltwater intrusion, and hurricane damage. Looking to the future and anticipated accelerated global climate change, Richmond's importance to South Florida's clean drinking water, air quality, flood

control, and quality of life for surrounding residents etc. cannot be overstated. Some of these services are considered separately, below.

Carbon sequestration – Carbon sequestration—specifically the capture of carbon dioxide—is critical for maintaining high air quality and slowing global warming. Any natural area (i.e., not high-maintenance lawns) within a city, no matter how small, play a role in carbon sequestration. A study by Hostetler and Escobedo (2010) showed that pine rocklands in Miami sequester 1745 kilograms of carbon dioxide per hectare per year, in contrast to residential areas which actually emit carbon dioxide.

Stormwater drainage – Undeveloped expanses nested within urban areas like the Richmond pine rocklands are also crucial in preventing urban flooding after heavy rains. One Swedish study showed that 85-95% of rainwater is absorbed by or evaporates from vegetated areas, but in contrast, cities with few parks must use stormwater systems to drain away 60% of rain water (Bolund and Hunhammar 1999). In a low-lying city like Miami, stormwater drainage is critical.

Drinking water supply – In South Florida, groundwater from the Biscayne Aquifer is the primary source of fresh water. Fresh water is constantly being withdrawn from the Aquifer for human, agricultural, and industrial use. It is also lost through seepage into canals, due to our region's porous limestone. This combination of groundwater withdrawals coupled with sea level rise makes the intrusion of salt water into Miami's drinking water an increasing likelihood. Recharge (replenishment) of our freshwater aquifer through natural precipitation is critical for maintaining South Florida's drinking water supply. Because rain water cannot penetrate impervious surfaces such as pavement, urban forests are critical for groundwater recharge. As the largest contiguous tract of pine rockland in urban Miami, Richmond plays a significant role in recharging and protecting Miami's drinking water.

Biodiversity and research –The biodiversity within any natural area is invaluable to biological and medical research and food crop science. For example, one very important biomedical compound comes from a plant very common in Richmond: the saw palmetto (*Serenoa repens*). A compound extracted from saw palmetto fruit is used as an herbal supplement as well as in the prescription drug Permixon™ to treat benign prostatic hyperplasia. Other species serve as close relatives to important food crops. Florida gamagrass (*Tripsacum floridanum*) is a close relative of commercial corn (Doebley 1983), and Rockland morningglory (*Ipomoea tenuissima*) is a close relative of commercial sweet potato (Gao et al. 2011). Both species are listed as threatened or endangered by the state of Florida, but are present in Richmond. Genes from these rare species could potentially be used to breed strains of crops which are resistant to a pathogen or to global climate change.

Other benefits – Urban natural areas like Richmond provide a myriad of other ecosystem services to nearby residents, including pollination, noise-reduction, and temperature reduction. Eco-tourism brings economic benefit, when tourists wishing to see migratory birds or our region's unique plant life come to Miami for vacation. Cultural benefits of our urban natural areas may be among the most significant benefits for residents, but may also be the hardest to monetize. Many studies have shown the benefits to society of urban greenspaces; the psychological benefits are demonstrably better with increased biodiversity (Fuller et al. 2007). Exposure to nature may be especially important for children growing up in cities, where a disconnect from nature is tied to depression, obesity, and attention deficit disorders (Louv 2008). At any rate, experiencing and learning about nature is something that children and adults often appreciate immensely.

MAPS

A. Introduction

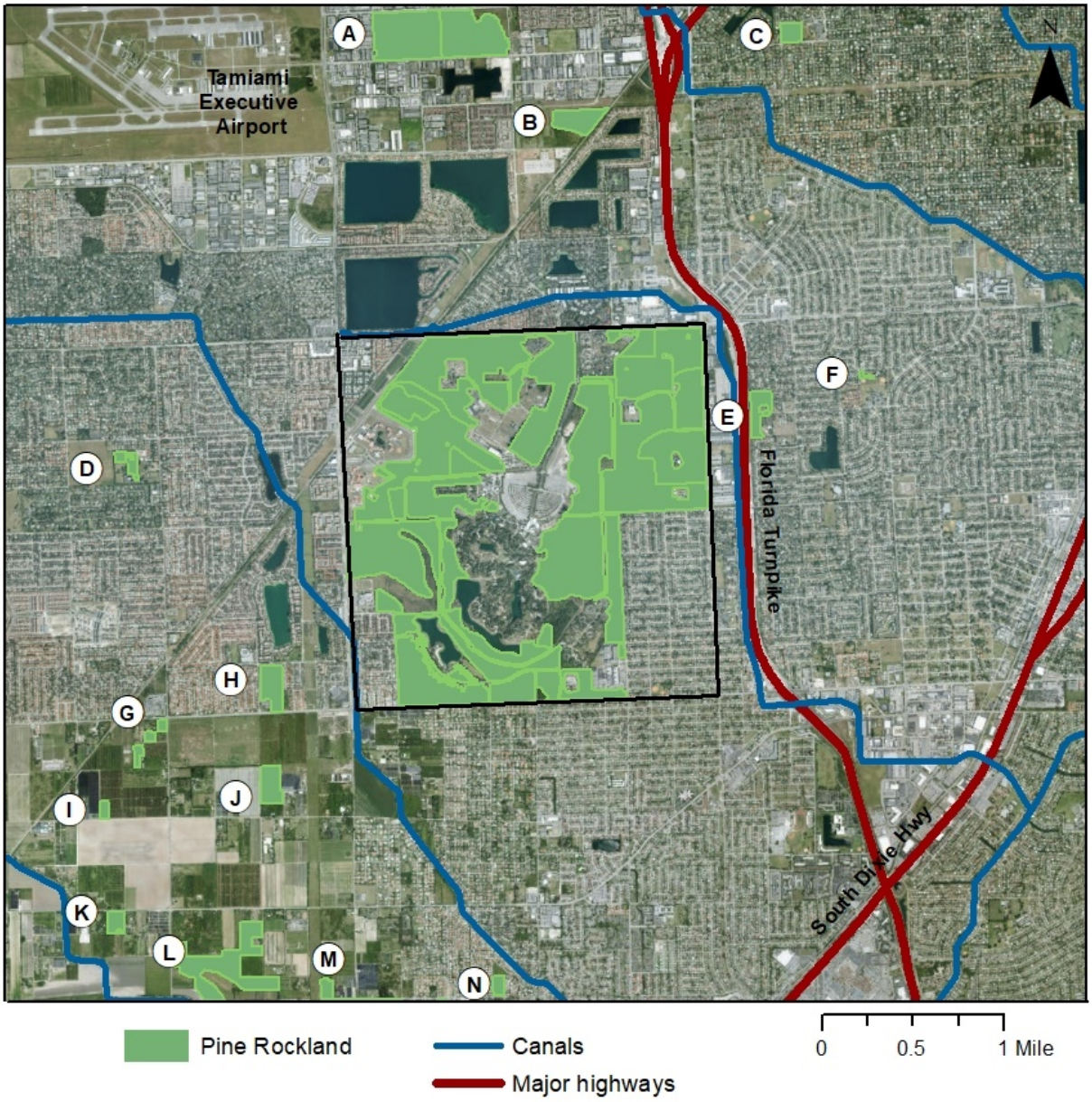
Maps can be powerful tools to convey spatial information and to aid in decision-making. As with the first edition of the Management plan for Richmond Pine Rocklands (DERM 1994), this edition includes several maps which display different aspects of Richmond (**Table 5**). Map 4 is reprinted in entirety from the first edition. With this second edition, we are presenting historical aerial photos and new information. When relevant, methods used in creating a map are included in the caption beneath.

Table 5. List of Richmond maps in this section

1. Land ownership
2. 1938 aerial photograph
3. Richmond in context
4. 1994 vegetation communities and endangered species
5. 2018 vegetation communities
6. 2018 vegetation communities and management status
7. Federally listed plant populations
8. Florida endangered plant populations
9. Fire history
10. Natural Forest Communities
11. Federally designated Critical Habitat
12. Environmentally Endangered Lands

Map 1. Richmond property boundaries and land ownership, 2018. County ownership is represented in blue font; federal is red and private is black. Homes and businesses are shown as gray polygons. GIS layers from the Miami-Dade County Property Appraiser's office were provided to Fairchild by James Duncan, Miami-Dade County Department of Regulatory and Economic Resources.

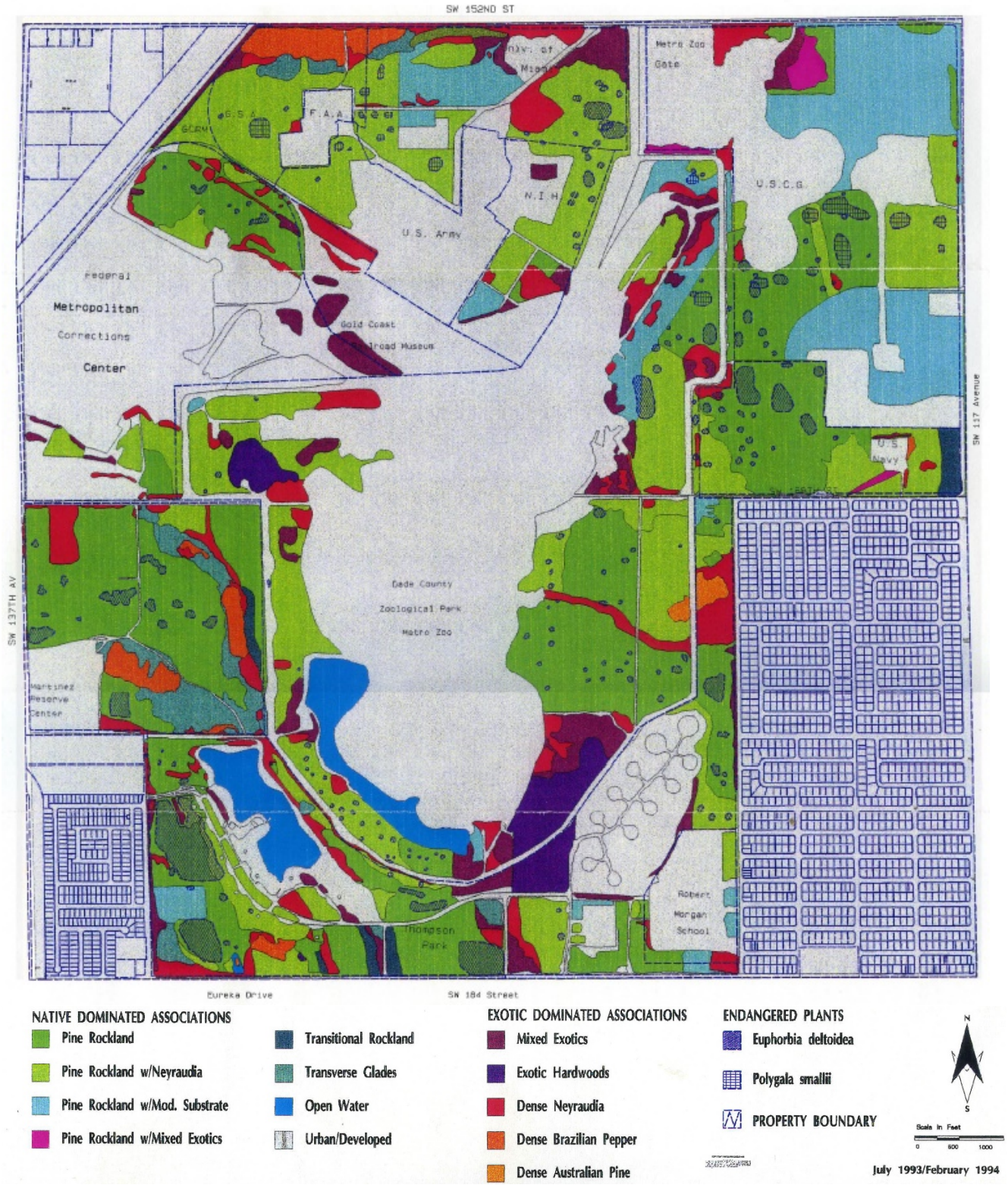
Map 2. 1938 Aerial photo of Richmond. Present-day property boundaries are added for reference. Transverse glades (often with evidence of farming) are visible near the northeast and southwest corners. The diagonal line near the northwest corner is railroad tracks. All other undeveloped area is pine rockland. Images were obtained from Miami-Dade County by Keith Bradley from The Institute for Regional Conservation and georeferenced by Dallas Hazelton of Miami-Dade Natural Areas Management.



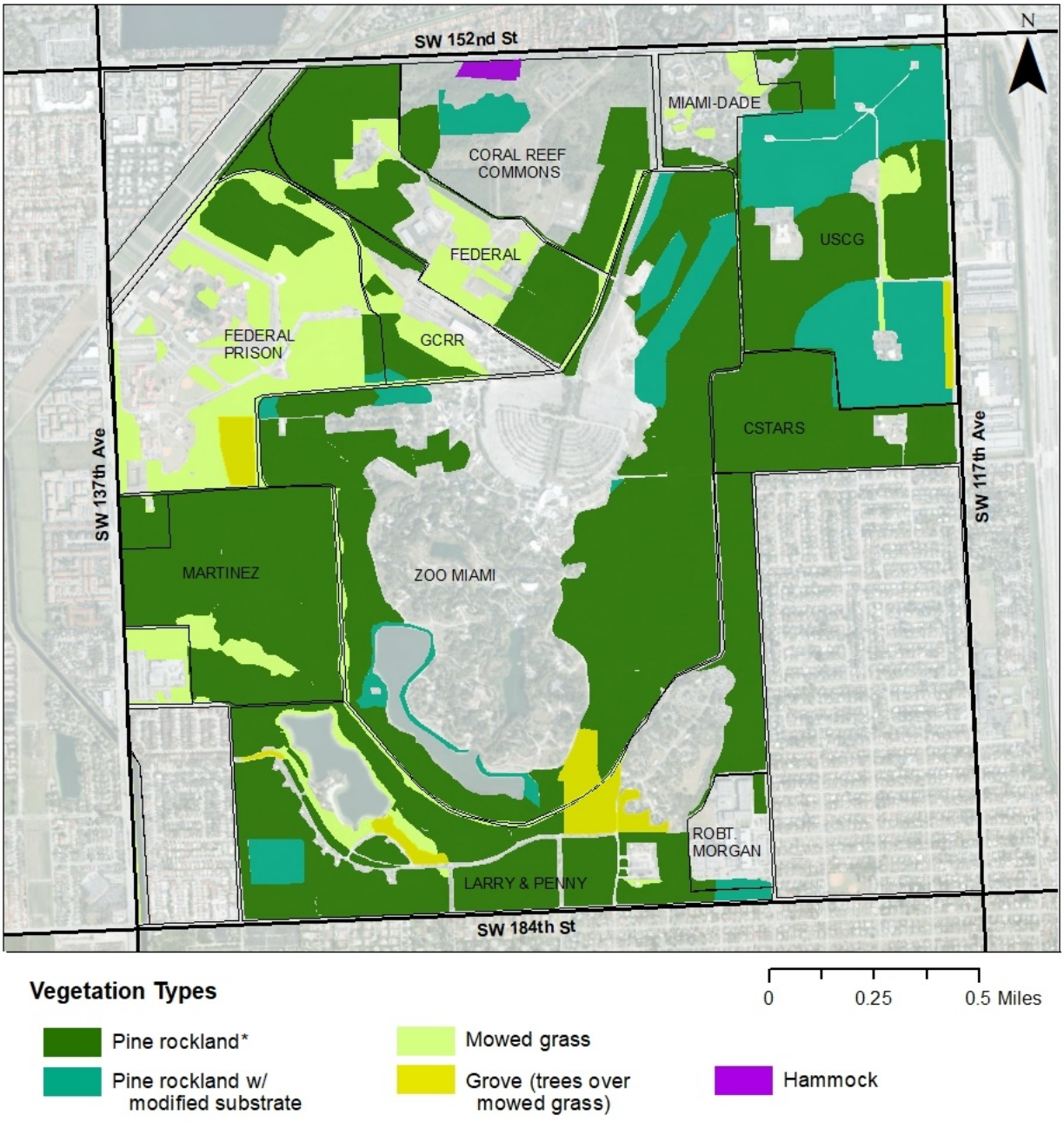
Map 3. Richmond in context. The two-miles surrounding Richmond, including pine rocklands, major highways, and canals. 2018 aerial photo from ESRI. Pine rockland layer obtained from USFWS in 2015 and some information is out of date (for example, pine rockland in the Coral Reef Commons). Non-Richmond pine rockland parcels within two miles of Richmond shown include:

A	Nixon Smiley Pineland Preserve (EEL)
B	Tamiami Pineland Complex Addition (EEL)
C	Pine Shore Preserve (EEL)
D	Private parcel
E	Camp Choee (Girl Scouts of America)
F	Colonial Drive Park (PROS)
G	Private parcel (on EEL B-List)

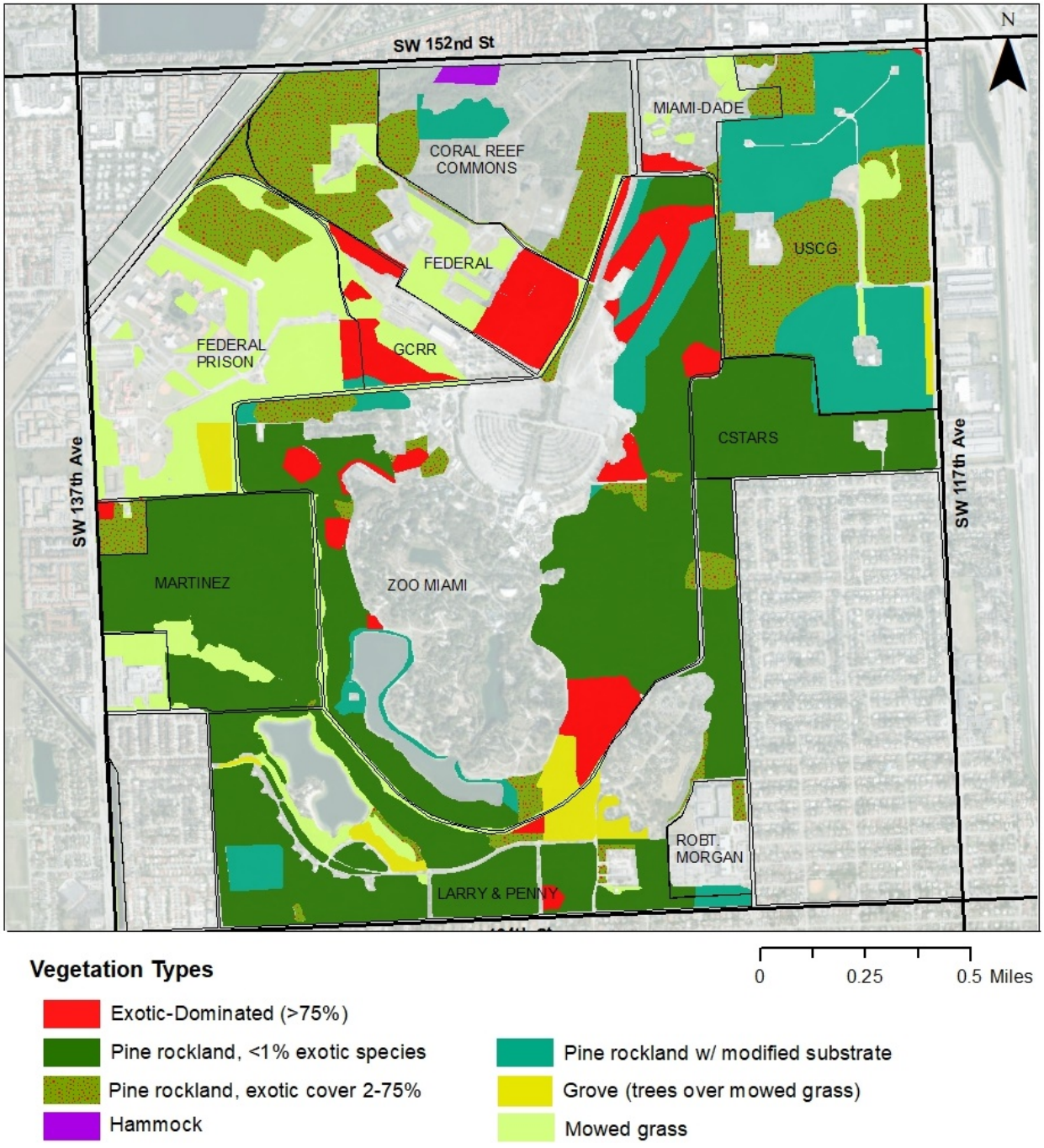
H	Eachus Pineland (EEL)
I	Private parcel
J	Private (on EEL A-List)
K	Private parcel
L	Quail Roost Pineland (EEL)
M	Private parcel
N	Medsouth Park (PROS)



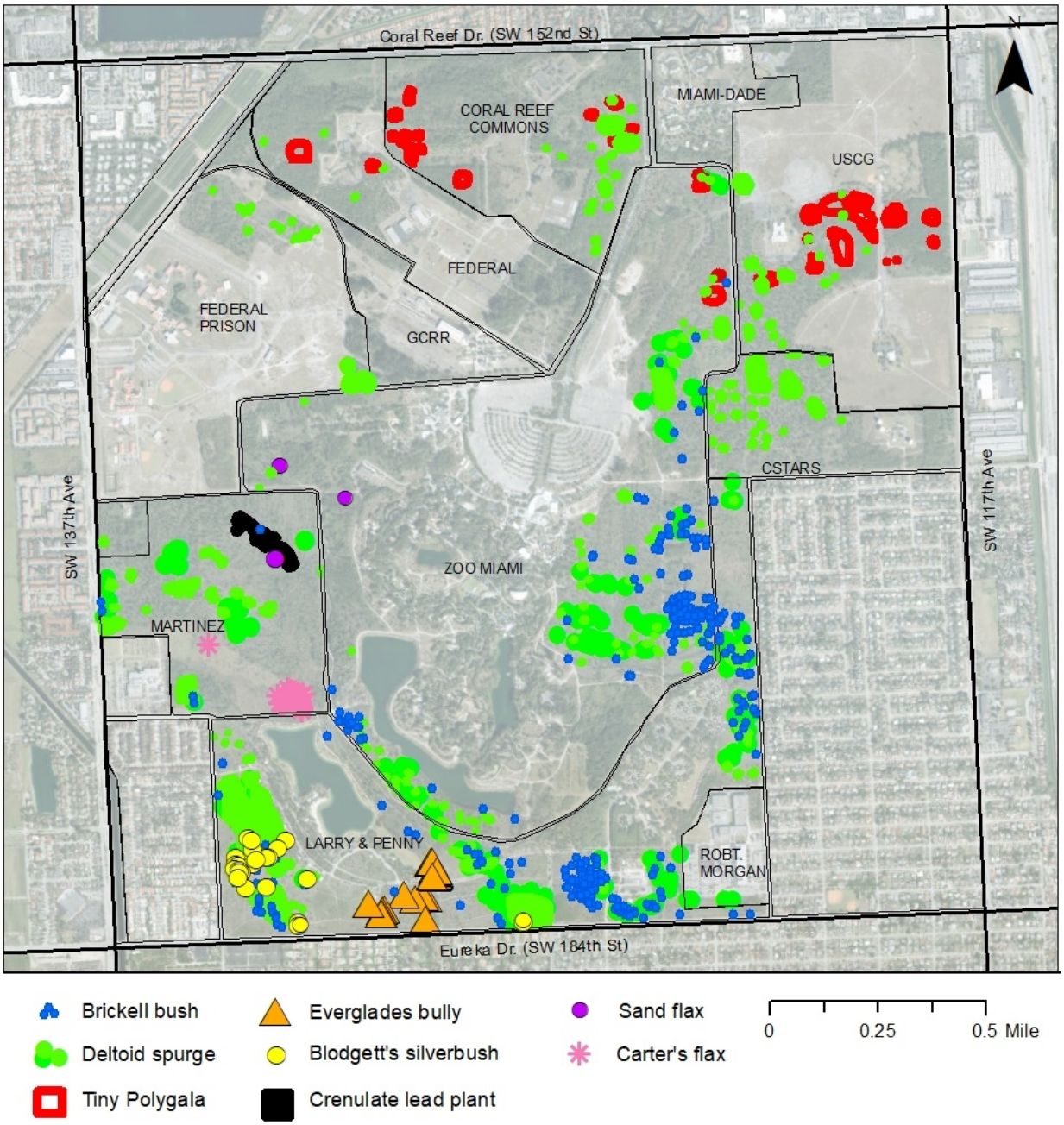
Map 4. Richmond vegetation communities and endangered species, 1994. This map was created by DERM staff in 1994; for an extended discussion of the methodologies used in their development, see the 1994 DERM report.



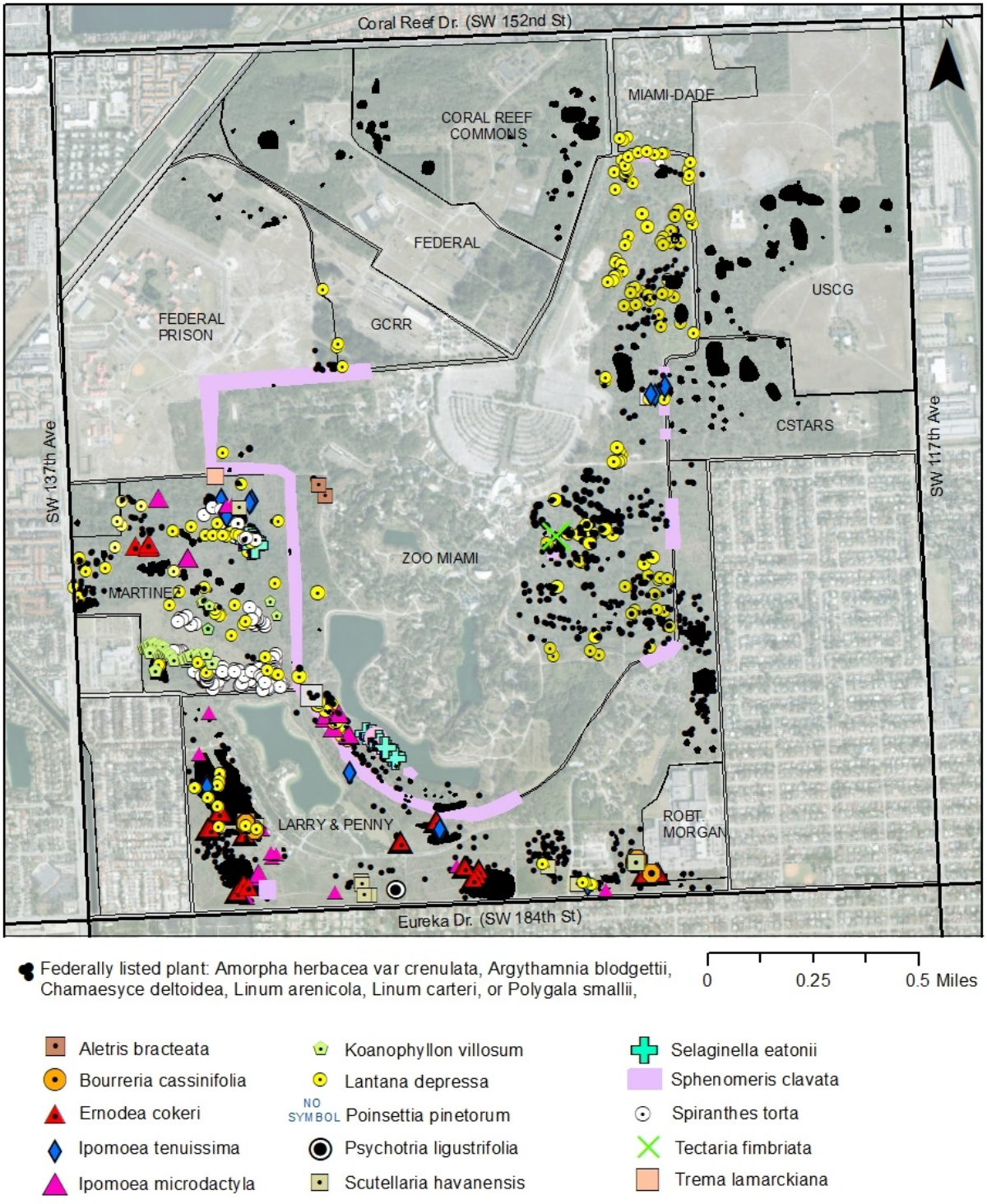
Map 5. **Vegetation communities, 2018**. This map was created by combining information from the 1994 DERM map (Map 4) and recent aerial images from ESRI. Areas that were uncertain were ground-truthed if they were accessible. *The Pine Rockland vegetation type also includes limited amount of marl prairie (primarily in Martinez Preserve) that is not indicated separately on this map.



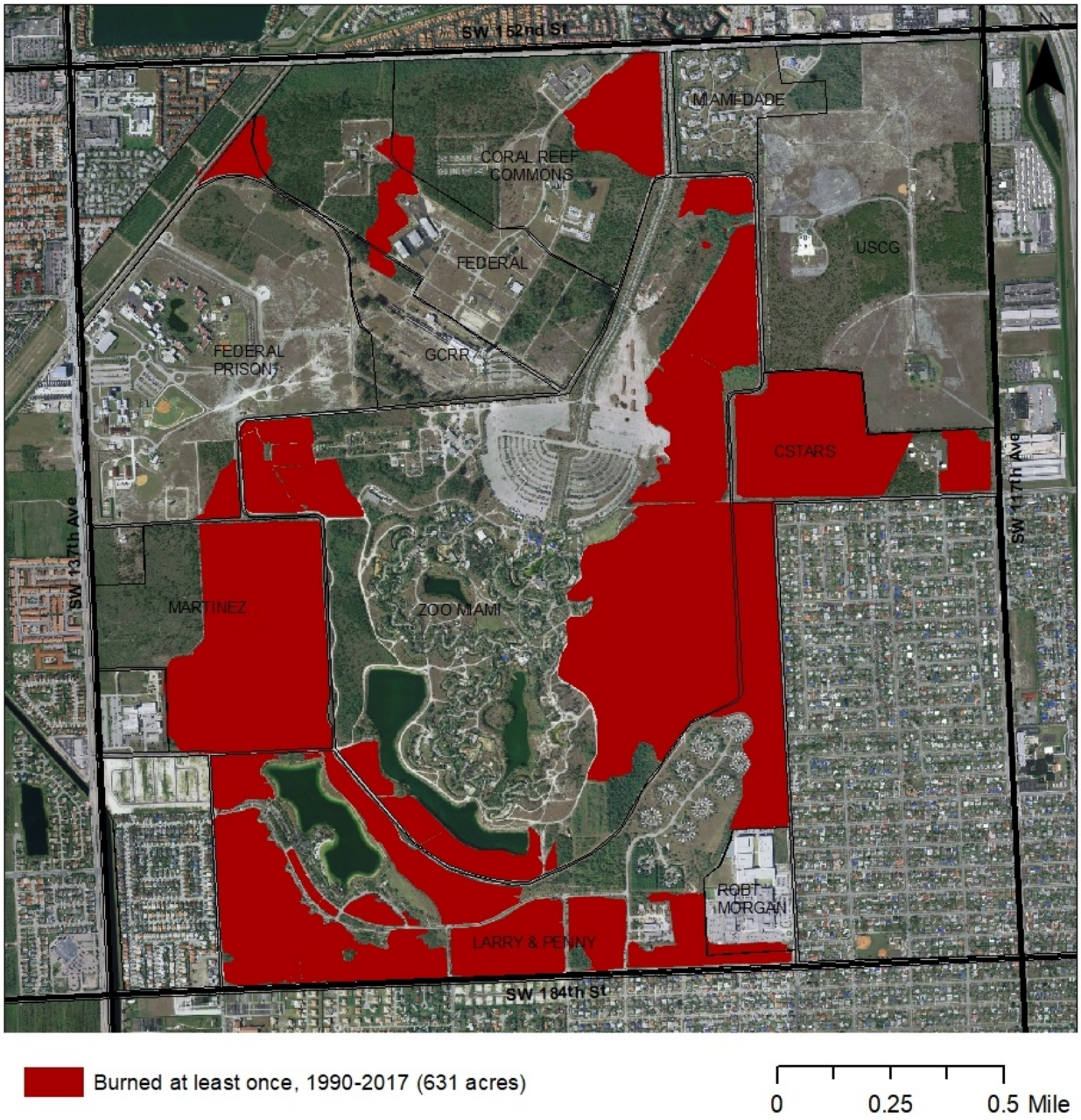
Map 6. **Vegetation communities in 2018, indicating maintenance condition**. This map was created by combining information from the 1994 DERM map, recent aerial images from ESRI. Areas that were uncertain were ground-truthed if accessible. Further refinement of this map by each property owner is needed, especially on non-County properties. The Pine Rockland vegetation type also includes limited amount of marl prairie (primarily in Martinez Preserve) that is not indicated separately on this map.



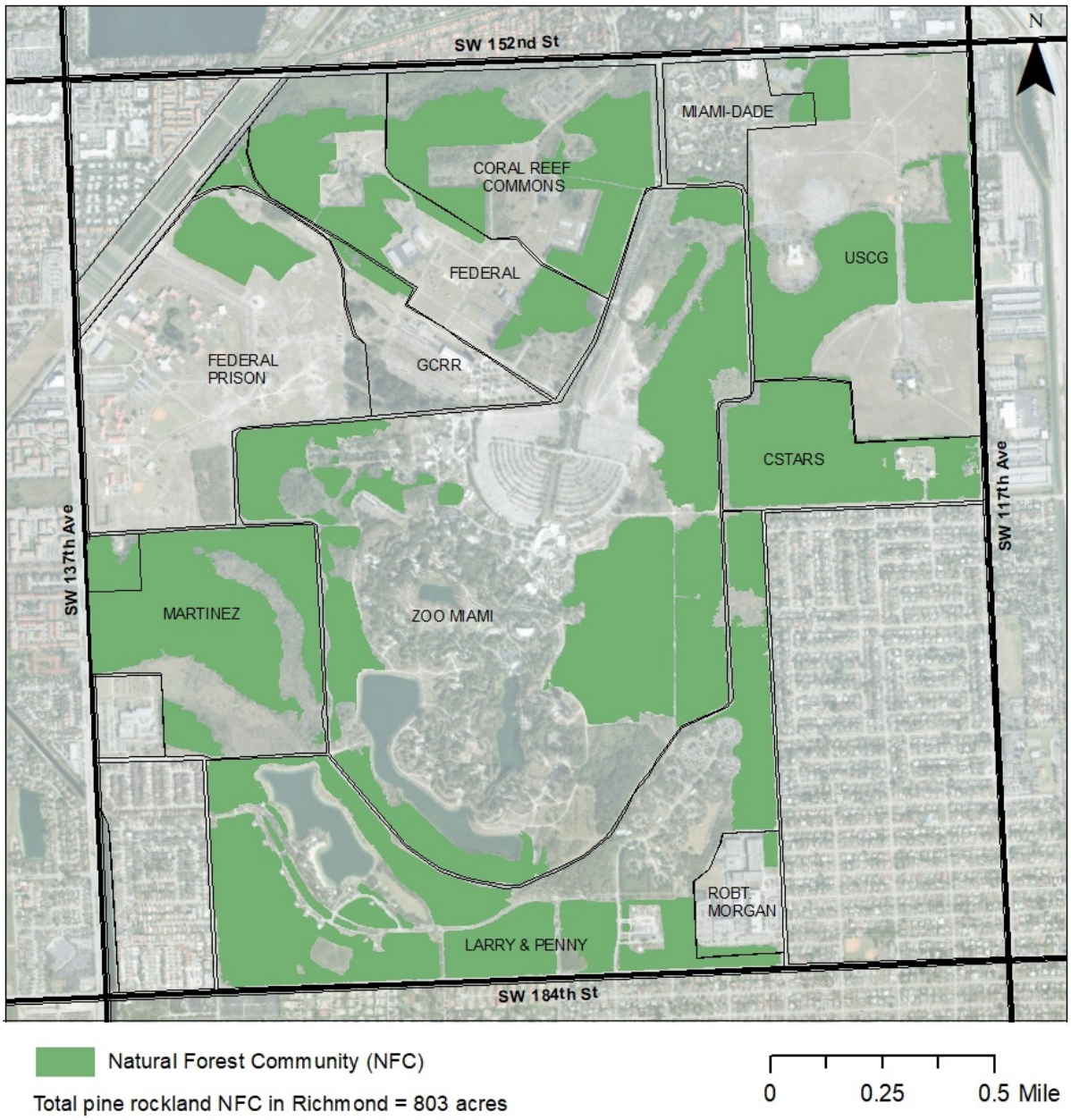
Map 7. Richmond federally listed plant species, 2018. Most data points from non-County locations are from the early 1990s (DERM 1994), when deltoid spurge and tiny polygala were the only rare species in Richmond that were federally listed. Within County preserves, data were gathered during systematic surveys by Fairchild Tropical Botanic Garden and others from 2002-2017. Note that the Carter's flax present in Martinez Preserve is morphologically intermediate between *L. carteri* var. *carteri* and var. *smallii,* and the Crenulate lead plant there was introduced.



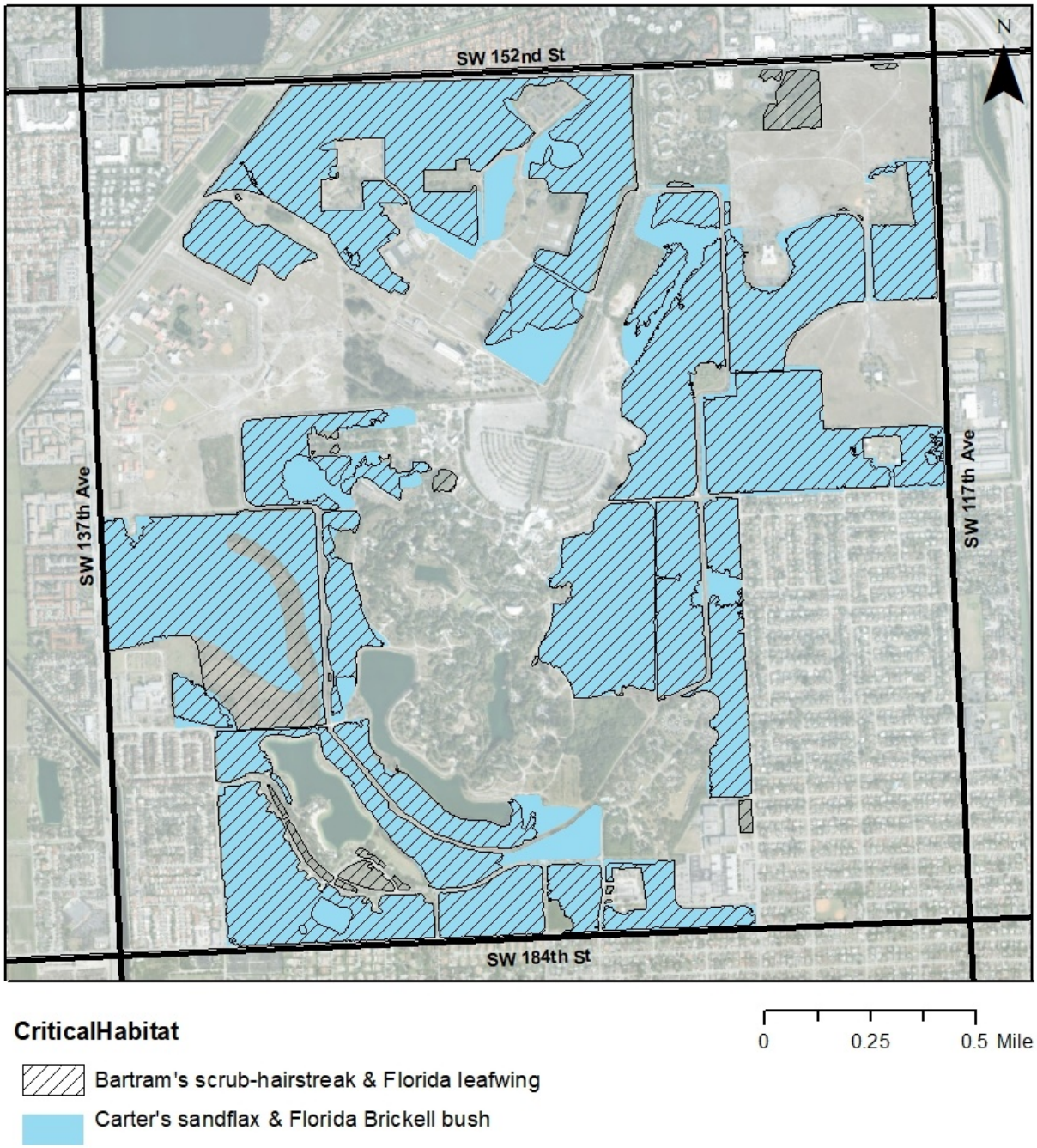
Map 8. Known locations of Florida endangered plant species in Richmond, Miami-Dade County Properties only. Surveys by Fairchild Tropical Botanic Garden and cooperators, 2002-2017. Data were gathered via systematic transects. Details for federally listed species shown as black dots are illustrated in Map 7 on the previous page. Note that all federally listed species are also state listed. *Poinsettia pinetorum* (=*Euphorbia pinetorum*) is not included on this map due to very high abundance in Richmond.



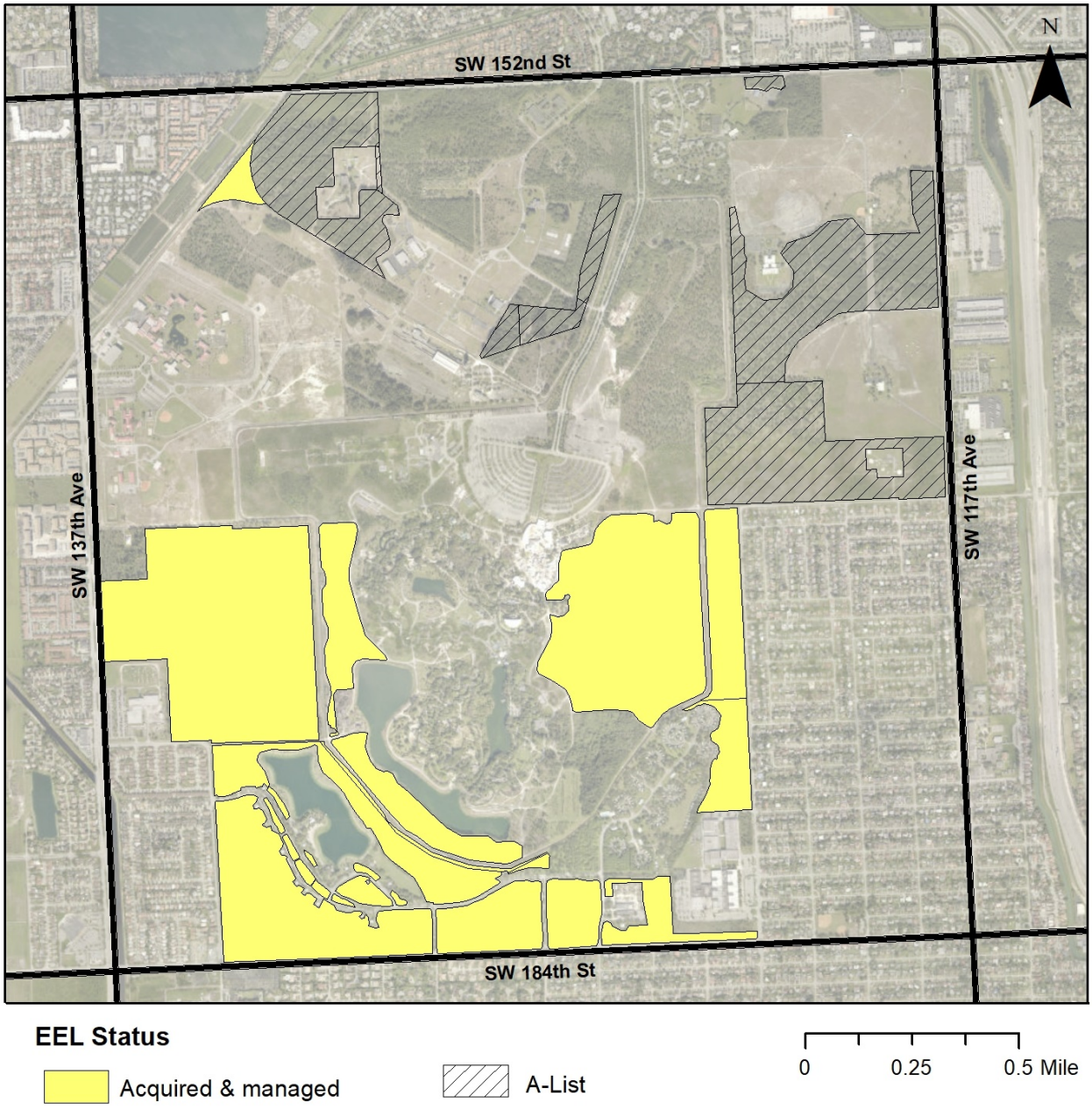
Map 9. Known fires in Richmond, 1990-2017. Areas that have burned at least once are shown in red. Areas containing pine rockland but which have not been known to burn during this 27-year span are visible in Martinez Preserve, Zoo Miami, the Federal Prison, Gold Coast Railroad Museum, the north Federal property, Coral Reef Commons, and the USCG Station. Fire data provided by Dallas Hazelton, Miami-Dade County Natural Areas Management.



Map 10. Areas of Richmond designated as Natural Forest Community. Designation and data layer from Miami-Dade County Dept. of Environmental Resources Management (DERM). The criteria for NFC designation are listed on page 15 of this plan.



Map 11. Federal critical habitat in Richmond, for species with habitat designated as of early 2018. The Miami tiger beetle, the Florida bonneted bat, and most federally listed plant species do not yet have designated critical habitat. It is illegal to impact federal critical habitat without permission from USFWS, regardless of property ownership. The blue polygon toward the upper right is part of Girl Scout Camp Choee. Data layers from USFWS.



Map 12. **Environmentally Endangered Lands in Richmond.** Data provided by Robin Gray-Urgellés, Miami-Dade EEL Program. "A-List" indicates lands that are priorities for acquisition.

IV. MIAMI-DADE COUNTY'S STRATEGIC ACTION PLAN FOR RESTORING COUNTY-OWNED PORTIONS OF THE RICHMOND PINE ROCKLANDS

Because the Richmond pine rocklands are a unique and important resource, this document includes a strategic action plan with goals, objectives and actions to ensure that Richmond is managed and restored in the best way possible. Primary to carrying out the plan is understanding its overall vision:

Vision statement:

Richmond's unparalleled diversity of plants, animals, and habitats is widely embraced as a priceless piece of South Florida's natural heritage, and merits the highest standards for protection, restoration, and management, now and for future generations.

Management of natural areas in Richmond will need to happen in perpetuity, but native biodiversity can be maximized and costs can be minimized if optimal management techniques are employed. The operational goal of habitat management at Richmond is to achieve a "maintenance level," whereby management treatments are conducted to sustain the conditions achieved through restoration efforts.

Miami-Dade County Goals for Restoring Richmond Pine Rocklands

GOAL 1: Restore
Restore and maintain habitat structure and function to maximize native biodiversity and preserve natural resources

GOAL 2: Monitor
Implement monitoring to ensure that Goal 1 objectives are being met

GOAL 3: Communicate
Foster communication within separate County-owned properties and with non-County properties to ensure that Goal 1 objectives are being met

GOAL 4: Best Practices
Develop best practices for habitats consistent with other stated goals.

This section consists of four management goals. The primary goal is to restore and maintain habitat, in order to preserve Richmond's native biodiversity. Goals 2-4 relate to monitoring, communicating, and best practices. Monitoring is essential for choosing the best management techniques. For example, monitoring rare species periodically can inform a manager whether that population is increasing or decreasing, and allow him or her to modify techniques to promote population growth. For agencies that do not have staff with expertise to conduct monitoring, a list of potential monitoring resources and contractors is included in **Appendix 3**, and training resources are listed in **Appendix 4**. Communication with other Richmond land managers is essential for sharing information on effective (or ineffective) restoration methods and is paramount in conducting safe and effective prescribed fires, which is by far the most needed restoration activity in Richmond. To help foster communication, a list of all current Richmond land owners and regulating agencies and contact information is included in **Appendix 5**. Finally, the Best Practices section seeks to ensure that management efforts are executed in ways that are not counter-productive to the other goals in this strategic action plan.

GOAL 1: Restore and maintain habitat structure and function to maximize native biodiversity and preserve natural resources.

OBJECTIVES AND RECOMMENDED ACTIONS:

1.1 Establish the appropriate fire regime for all management units possible, using prescribed fire with other techniques if needed, to approximate the natural fire return interval between 2 and 7 years, always leaving a mosaic of burned and unburned areas.

- Complete burn plans for approval by the Florida Forest Service, Miami-Dade County, and US Fish and Wildlife Service. See **Appendix 6** for an example.
- If a 2-7 year fire interval cannot be achieved for a given management unit, alternative techniques shall be applied. These may include thinning trees and shrubs by hand or other mechanical means, removal of thick moisture-retaining litter, and any other actions necessary to maintain the flammability of vegetation.
- Unless and until fire suppression is no longer an issue in the Richmond pine rocklands, conduct prescribed burns whenever possible, regardless of season.
- Use a variety of firing techniques, including head-firing or strip head-firing wherever possible, to promote a mosaic of burned and unburned areas.
- Avoid burning multiple units at once, to promote a mosaic of burned and unburned areas.
- Establish an onsite fire cache (supply of fire management tools and equipment) in Richmond which can be used by multiple agencies including Miami-Dade Parks, Miami-Dade Fire Rescue, and the Florida Forest Service.

1.2 Respond to wildfires in an appropriate way and use them to restoration advantage when safe and practical.

- When a wildfire is observed, staff should immediately call 911. Miami-Dade Fire Rescue will respond and will contact the Florida Forest Service for fires that are beyond their scope. After 911 is notified, the NAM Fire Program manager should be notified (305-257-0933) if the fire is located on or adjacent to County-owned property.
- Whenever possible, the responding agency should not extinguish the fire, but rather allow it to burn to a fire break, consuming all unburned fuel in that unit.
- Whenever possible, the responding agency should coordinate with the preserve manager to eliminate or mitigate the impact to listed species from heavy machinery used in firefighting (e.g., bombardiers).
- Only properly trained personnel should attempt to extinguish a wildfire. See **Appendix 4** for training resources.
- Do not create new fire breaks unless absolutely necessary. An abundance of roads and fire breaks already exist in most of Richmond.

1.3 In pine rocklands with little or no pine trees, consider restoring the appropriate canopy (pine) structure, with 50-70 mature trees (>4") per acre, in an irregularly-spaced, uneven-aged stand. Unit 2, the southwest management unit of Larry & Penny Thompson Memorial Park, provides an example, as the most frequently burned parcel in all of Richmond.

- Maintain a supply of genetically appropriate (i.e., from Miami-Dade County) pine seed for use in canopy reestablishment following a catastrophic event (e.g., hurricane, pest outbreak) (currently this responsibility is carried out by the EEL Program).
- When collecting local pine seed, use methods that minimize damage to trees and pine rockland habitat (e.g., no heavy equipment).
- Avoid restoring pine trees via direct-seeding, as this method is less successful than planting tubelings, and often requires pre-treating seeds with poison to deter herbivory, which can harm wildlife.
- When restoring pine canopy by planting tubelings, ensure that trees are planted in a variety of substrates (not just sandy areas), and that native herbaceous plants are not destroyed by planting activities.
- When restoring pine canopy via planting tubelings, implement a strategy for uneven-aged stands to reach the goal of 50-70 mature trees per acre. For example, plant 10 trees per acre once a year for 5 years (or more, if mortality is high).

1.4 In pine rockland areas with excessive pine density, if the appropriate fire regime cannot feasibly be re-established, then consider thinning pines to achieve the appropriate canopy (pine) structure, with 50-70 mature trees per acre (≥4"), in an irregularly-spaced, uneven-aged stand. Unit 2, the southwest management unit of Larry & Penny Thompson Memorial Park, provides an example.

- Manually remove pines with chainsaws, not heavy equipment, to minimize damage to adjacent vegetation.
- Remove felled pines from pine rockland to prevent smothering of sensitive vegetation and excess fuel build-up.
- Consider duff (needle) removal in areas to improve habitat for threatened and endangered species such as the Miami Tiger Beetle.

1.5 In pine rockland areas with excessive palm density, consider thinning palms to achieve the appropriate structure, with approximately 25% cover, and with presence of *Serenoa repens, Sabal palmetto*, and *Coccothrinax argentata*. Palms should be naturally spaced, with some "islands" and some gaps to allow for intermittent expanses of grasses, herbs, and bare mineral soil.

- Manually remove palms with chainsaws, not heavy equipment, to minimize damage to adjacent vegetation.
- Avoid leaving palm material on the ground to prevent smothering of sensitive vegetation and excess fuel build-up.

1.6 In pine rockland units with excessive density of native hardwoods, consider thinning hardwoods to achieve the appropriate structure in pine rocklands, ranging between 5 and 25% cover. Hardwoods should be naturally spaced, with some "islands" and some gaps to allow for intermittent expanses of grasses, herbs, and bare mineral soil.

- Manually remove hardwoods with chainsaws, not heavy equipment, to minimize damage to adjacent vegetation.
- Removal efforts should focus on common hardwoods such as live oak (*Quercus virginiana*) and sumac (*Rhus coppalinum*).

- Do not remove all individuals of native hardwoods that are important sources of nectar or wildlife food such as willow bustic (*Sideroxylon reclinatum*) or poisonwood (*Metopium toxiferum*).
- Use caution when reducing hardwoods in areas with Florida endangered shrubs (such as *Koanophyllon villosum* or *Bourreria cassinifolia*), shrubs that are the larval host plants for rare butterflies (*Croton linearis*, *Byrsonima lucida*) or uncommon shrubs (such as *Lyonia fruticosa*). Preserve managers may flag rare shrubs prior to crew work to ensure they are not removed.

1.7 In areas with few trees and shrubs that are dominated by native herbs and forbs, ensure that changes to mowing regime does not harm rare native plant or animal species.

- Do not stop mowing in long-mowed areas without consulting with rare plant and/or rare animal experts to consider impacts to rare butterflies, the Miami Tiger Beetle, or other rare species.
- Consult with USFWS as needed if *Croton linearis* is present in mowed areas, since it is the larval host plant for the federally endangered Bartram's scrub hairstreak and Florida leafwing.

1.8 Maintain and/or restore populations of rare and endemic native plant species (see Table 3). Note that federally listed species may have Recovery Plans in place (or in development) which can act as guidelines.

- Obtain (with permission) germplasm from a nearby population, to grow plants for introduction.
- Reintroduce populations of extirpated species, and augment existing populations where appropriate.

1.9 Maintain and/or restore populations of rare and endemic native animal species when possible/practical. Note that federally listed species may have Recovery Plans in place (or in development) which can act as guidelines.

- Coordinate with federal Recovery Biologists or local wildlife experts where possible to augment or reintroduce declining or extirpated wildlife species.

1.10 Control populations of non-native invasive plants to <2% cover (i.e., "maintenance condition") in all natural areas.

- When resources are limited, prioritize the highest-quality areas (i.e., those with highest native biodiversity and less abundant weeds) and/or those with rare species.
- Conduct herbicide application after burns (both prescribed burns and wildfires) to target aggressive invasive plants like Burma reed. Herbicide applications are likely to be most effective soon after a burn when plants are resprouting and non-target impacts will be minimized.
- When controlling non-native vegetation, prioritize species which are actively setting seed, any stands of non-native species that exceed 25 square feet, and species listed in **Table 2.**
- Due to the abundance of rare species in pine rocklands, extreme care should be taken during herbicide applications, to ensure that native species are not harmed, by direct spraying, drift, or soil activity.

- Ensure that non-native plant management includes buffer areas adjacent to higher-quality habitat. For example, fencelines, roadsides, and the moats in and around Zoo Miami.
- Non-selective herbicide (e.g., glyphosate/Roundup) should never be broadcast over native vegetation along pine rockland edges (including moats).
- Ensure that only applicators licensed in natural areas management apply herbicide to plants. Applicator certification is granted by the Florida Dept. of Agriculture and Consumer Services, with exams administered through the County extension office.
- Ensure that all herbicide is applied consistent with the Miami-Dade Parks manual and Enloe et al. (2018). Links are provided in Literature Cited.
- Do not use soil-active herbicides such as imazapyr (Arsenal).
- Do not use triclopyr (Garlon and other trade names) near native Ficus trees, because Ficus are highly sensitive to this chemical and off-target damage can easily occur.
- Continue to review and update invasive species management techniques.

1.11 Control and/or extirpate populations of exotic and nuisance animals. Note that state rules for taking of nuisance wildlife are published under F.A.C. chapter 68A–9.010.

- Miami-Dade Parks Dept. should actively facilitate and oversee the humane removal and euthanization of invasive animal species by staff or contractors.
- Identify disproportionately large populations of native wildlife and eliminate human activities that increase those populations, such as feeding.
- Manage refuse in parks and neighboring areas so that it is not available for consumption by wildlife.
- Maintain signage in public access areas that explains the illegality of releasing exotic animals into preserves and encourages visitors to report releases.
- Bats found in buildings or other structures should never be touched or harassed. They cannot be legally trapped and relocated. If any bats are found that may potentially cause a concern for human health and safety, the exact species must be identified by a qualified wildlife professional. Questions about bats should be communicated to FWC and USFWS (see **Appendix 5** of this plan).

1.12 Protect natural areas from point and non-point source pollution whenever possible.

- Reduce or eliminate drifting pesticide spray and dust from agricultural and commercial operations.
- Pesticide application on all Richmond properties must use best management practices.
- Buffer natural areas from known adjacent pollution sources by retaining existing vegetation or planting native vegetation that is appropriate to the habitat.

1.13 Protect natural areas from inappropriate/harmful use whenever possible.

- Inappropriate uses such as collecting plants or animals is prohibited (per Park Rules and Regulations 8(c) and 9) and should be enforced by park staff and/or law enforcement.
- Poaching of state-listed plant species (**Table 3**) or animal species (**Table 4**) species should be reported to FWC's alert hotline: 888-404-FWCC
- The use of off-road vehicles (ORVs) in natural areas is prohibited (per Park Rules and Regulations 3).

1.14 Insect control within and adjacent to Richmond shall not have negative effects on native insects, nor the plants and animals that depend on them.

- No insecticides shall be applied except as allowed by the Arthropod Control Plan (**Appendix 2**).
- Mosquito control efforts targeting larva (i.e., larvicides) may be used to meet mosquito control goals and requirements within Richmond only in accordance with the aforementioned Arthropod Control Plan.
- Coordinate with the County's EEL program prior to conducting (or allowing others to conduct) any arthropod treatments.
- Aerial adulticide spraying is prohibited within 400 meters of Richmond to prevent impacts to sensitive resources. The U.S. Fish and Wildlife Service has developed recommendations relating to truck spraying within a 200 meter buffer and aerial adulticide application within a 400 meter buffer from designated critical habitat. Based upon these studies and in accordance with this management plan, adulticides shall be prohibited within these buffer areas at and adjacent to Richmond. These prohibitions shall also apply to all other pine rockland at Richmond that is covered under this management plan including pine rockland that has not been designated as critical habitat.

1.15 Increase size, connectivity, and diversity of natural areas.

- When possible, the County's Environmentally Endangered Lands program should acquire any pine rockland or other undeveloped land in or adjacent to Richmond that is or may become available.
- When possible, the County's Dept. of Environmental Resources Management should work with non-County pine rocklands to create conservation easements, with management guidance provided when necessary.
- In fallow, weedy areas with disturbed substrate, remove non-native species and promote or restore native species that are disturbance-adapted or otherwise appropriate.
- Promote site-appropriate native landscaping in developed areas around a site to increase the habitat footprint.

1.16 To the extent possible (considering the presence of moats), restore historic hydrological conditions by rehydrating former transverse glades with quality water, thereby increasing availability of water for species requiring more mesic or hydric conditions.

- Identify areas in Richmond that will be appropriate for hydrologic restoration.
- Pump water in, dike, install wells, etc., to approximate historic, pre-drainage hydrology.
- Work with water agencies to maintain the water table as high as possible, and water quality as high as possible.
- Monitor soil moisture before and after hydrologic restoration.
- Consider whether nearby rare plant populations should be monitored for effects due to the change in hydrology.
- Reconnect natural areas with water sources where possible as an alternative to full-scale hydrologic restoration.
- Pursue collaborations with researchers to address hydrological questions.

1.17 Review and update knowledge about restoration and management.

- Natural resource managers should periodically review pertinent literature on pine rockland ecology and natural history, fire management, mapping and remote sensing technologies, invasive plant management, etc.
- Encourage natural resource staff to attend relevant educational seminars and training sessions.

1.18 Protect and mitigate any expected effects to natural resources from climate change.

- Ensure that Richmond is included in regional studies and plans regarding climate change impacts.

GOAL 2: Implement monitoring to ensure that Goal 1 objectives are being met.

OBJECTIVES AND RECOMMENDED ACTIONS

2. 1 Monitor all fires to assess effects on natural areas.

- Identify the staff and/or contractors responsible for fire monitoring.
- Conduct pre- and post-burn monitoring for prescribed fires. Establish and utilize a procedure to evaluate the prescribed burn (e.g., fire behavior, smoke dispersion, safety, public response) and assess whether objectives set in the prescription were met.
- Use GPS to map the spatial extent of all fires.

2.2 Establish a regular monitoring program for federally listed species and any other rare native species of management concern

- Identify the staff and/or contractors responsible for monitoring.
- Through monitoring and GPS/GIS, document which rare species are present and where they are located.
- Monitor rare species at regular intervals appropriate to that species and after major management events, weather events, or disasters.
- Identify rare species that are declining or extirpated, mitigate threats if possible.

2.3 Establish a regular monitoring program for new invasive species and new populations of familiar invasive species. Strive for EDRR: Early Detection and Rapid Response.

- Identify the staff and/or contractors responsible for invasive species monitoring.
- Crew leaders and/or grounds managers should be vigilant for new infestations of invasive species, make sweeps on at least a bi-annual basis, and address new species/infestations immediately.
- Work crews should also be encouraged to constantly be observant in the field. Locations of new infestations that cannot be immediately treated should be flagged and mapped with a GPS unit

- Preserve managers, crew leaders and others should coordinate with ECISMA, the Everglades Cooperative Invasive Species Management Area to learn about potential new invasive species and to share information.

2.4 Establish fixed photopoints to document management progress.

- Identify the preserve managers responsible for photopoint monitoring.
- Use permanent markers (such as a PVC pole over rebar) and take photos in cardinal directions (N,S,E,W) to ensure photopoint locations are repeatable.
- Map photopoint locations with GPS and ensure point locations are accessible to others in the agency.

2.5 Establish monitoring protocols for any major restoration activity.

- Identify the staff and/or contractors responsible for restoration monitoring.
- Projects such as canopy restoration and understory restoration will require monitoring tailored to the project objectives. Combinations of permanent plots and GPS mapping are excellent means to monitor for these specific projects.

GOAL 3: Foster communication within separate County-owned properties and between the County and non-County properties to ensure that Goal 1 objectives are being met.

OBJECTIVES AND RECOMMENDED ACTIONS

3.1 Stakeholders should collaborate to promote the use of and communication about safe prescribed fires.

- Each property manager should have maps readily available for fire responders that show all fire breaks, fences, buildings, and any other areas of concern. Maps should be sent to MDFR and FFS.
- In planning for fire management, consider ways to cooperatively fund and manage an on-site fire cache at Richmond with fire-suppressing equipment, gear and personnel.

3.2 Potential areas for enhancement and restoration of pine rockland in Richmond will be identified, as well as areas where pine rockland could be recreated.

- RER, NAM, and/or subcontractors should assess landscaped areas within County-owned portions of Richmond, evaluate whether or not they enhance pine rocklands, and make recommendations about how plantings could be improved.
- RER, NAM and/or subcontractors should assess mowed areas and determine whether altering of the mowing regime could promote establishment of pine rockland species, and alter mowing regimes if appropriate.
- Fallow/disturbed areas should be evaluated for restoration and restored to pine rockland to the extent possible.

3.3 Miami-Dade County DERM (Dept. of Environmental Resources Management) shall take the lead in restoring as much of the unmanaged pine rocklands and other undeveloped land as possible throughout Richmond.

- DERM should evaluate all County-owned areas that are not currently being managed and facilitate bringing them into maintenance condition by 2020. This includes the Internal Services Department Property (formerly the USCG Southern Anchor Housing Unit) and portions of Zoo Miami, Robert Morgan School, and the Gold Coast Railroad Museum.
- DERM should approach the US Coast Guard to determine whether a joint management agreement or strategy can be developed to manage the mowed areas of the antennae field in an appropriate way to improve habitat and reduce maintenance costs without impacting the operation of the antennae field.
- DERM should assess all areas in Richmond (public and private) that are subject to preservation covenants, determine compliance, identify deficiencies, and facilitate corrective action by 2020. All covenanted areas should be maintained at all times to prevent the growth or accumulation of prohibited species.
- DERM should approach federal properties with pine rockland (the Federal Correctional Facility and the Dept. of Defense property) to assess current NFC status and boundaries and determine whether a joint management strategy can be implemented that would be consistent with USFWS requirements and NFC regulations.
- DERM should approach private properties with pine rockland to assess current NFC status and boundaries and determine whether a joint management strategy can be implemented that would be consistent with USFWS requirements and NFC regulations.

3.4 Technical assistance will be available to facility managers in preparing management plans, rare species monitoring, invasive species control, fire management, and training for all the above.

- Miami-Dade Parks' Natural Areas Management Division and/or DERM can advise other managing agencies about invasive plant control, fire management, and training for both activities.
- Consultants (See **Appendix 3**) should be approached if help is needed with monitoring or evaluation, or to develop monitoring plans for onsite staff.
- If funding is an issue, land owners should seek funding to help with management planning, management and/or training (See **Appendix 7**).

3.5 All stakeholders should promote opportunities for interagency cooperation to accomplish the objectives in this plan

- The Environmentally Endangered Lands (EEL) program schedules volunteer workdays during the non-summer months; when these events occur in the Richmond pineland, EEL should advise other stakeholders.
- Zoo Miami has a volunteer/intern program, with the potential to conduct research or tasks in other Richmond properties.
- The Federal Correctional Institution (FCI) has a large number of inmates that could be trained to conduct resource management throughout Richmond given appropriate supervision.

3.6 All stakeholders should promote opportunities to cooperate to reduce pollution.

- Investigate avenues to prevent dumping of pollutants such as automotive oil, paint and pesticide containers, home chemicals, roofing and construction materials, landscape debris, automobile parts, trash, and contaminated stormwater.
- Potential solutions include coordinating with law enforcement, increased signage, starting a neighborhood watch or Friends of the Park group focused on picking up litter and/or reporting violations.

3.1 This Richmond Management Plan will be shared with all potential stakeholders and interest groups.

- The County held an advertised public meeting to invite feedback on this Management Plan.
- The final draft of the Management Plan will be made available online.
- A stakeholder meeting should be held periodically (at least every 3 years) to address issues and report successes

GOAL 4: Develop best practices for habitats consistent with other stated goals.

OBJECTIVES AND RECOMMENDED ACTIONS:

4.1 Minimize habitat loss and damage from development and/or maintenance of trails, infrastructure, and utilities.

- Any construction or utility repair in Richmond should go through a regulatory evaluation to ensure natural areas will not be impacted. Any permitted impacts shall be mitigated.
- Any new construction should be staged outside of the pine rockland footprint, on existing roads, trails, or mowed rights of ways where the impacts can be contained.
- No fill, runoff, or machinery should be placed in the pine rockland footprint. Barriers may be required prior to commencement of activities.
- When there is no demonstrated alternative, design standard such as directional boring should be utilized to minimize impacts to pine rockland.
- Conduct management activities such as invasive plant removal, fence construction, etc., away from rare plants when possible. When such actions cannot be prevented, consider alternatives to minimize the impacts to rare species.
- Do not establish trails in sensitive areas containing rare species.
- Established trails should double as fire breaks.
- Mowing activities should not reduce the pine rockland footprint, and cut grass should not be dumped into the pineland

4.2 Protect the integrity of natural areas in the layout, design, and management of development projects adjacent to natural area

- Ensure that projects account for fire management needs of pine rockland preserves.
- Encourage the use of local native plant material in preserves adjacent to natural areas. Use species beneficial to pine rocklands, appropriate wildlife attractors, ecotonal species, etc.

- Minimize potential impacts at the interface between natural areas and developed landscapes, such as creeping sod grasses, polluted runoff, alterations in drainage and elevation, creation of fire hazards, dispersal of invasive plant propagules, litter, fill disposal, and trash dumping.
- Revise zoning codes to protect natural areas from adverse impacts from development.
- Ensure that all management practices on public property account for the protection of natural areas.
- Designate management zones around existing natural areas (including all preserves) to identify potential management concerns, such as smoke dispersion, wild and domestic animals, invasive plants, dumping, and inappropriate use.
- Notify developers during the planning process when planned developments are in a management zone as described above, to ensure that management activities can continue once the project is complete.
- Develop procedures to address concerns within management zones in existing developed areas.
- Notify developers that, due to federally designated Critical Habitat as well as the number of federally listed species in Richmond, they will need to contact the USFWS before proceeding with development plans (necessary to ensure compliance under the ESA).

4.3 Use best practices in conducting prescribed fires to ensure safety for staff and residents and to reduce impacts to neighboring urban Miami.

- Richmond stakeholders should work together to establish a comprehensive public education program for neighboring residents, with highly visible signage about fires and fire safety in heavily trafficked areas.
- Utilize site preparation and firing techniques that are safe and will reduce negative impacts to the public, staff, and property (see: www.nfpa.org/Public-Education/By-topic/Wildfire/Firewise-USA)
- Create and maintain fire breaks around the perimeter of pine rockland stands. Fire breaks should be wide enough (at least 10 feet wide) to permit the passage of fire suppression equipment (note: Richmond already has an abundance of fire breaks. Clearing forest to create new fire breaks requires authorization from the U.S. Fish & Wildlife Service and/or Miami-Dade County DERM).
- Areas with dense stands of Burma reed or other non-native invasive species that have the potential to create excessive flame height and temperatures should be treated prior to the burn, by cutting down and removing the bulk of the plant material.
- Prior to prescribed burns, form fire breaks around areas that should not burn, if any (e.g., known populations of rare butterflies; rare plants that are about to set seed).
- Prior to prescribed burns, remove large piles of logs that may smolder and create excess smoke.
- Prior to prescribed burns, trees and snags that are potential roosts for Florida bonneted bats should be closely inspected and, if roosts are found or suspected, protected during prescribed fire.
- Never conduct ring fires, as they trap and kill wildlife.
- When practical, avoid backing fires in areas with sensitive species (e.g., Tiny polygala) because the longer residence time can cause mortality.
- Adjust burn unit size to minimize smoke management problems and facilitate post-burn mop-up.

- Always coordinate fire management with neighboring properties

4.4 Ensure that restoration and monitoring practices in natural areas minimize deleterious off-target effects to native plant and animal species.

- When possible, schedule and conduct prescribed burns to avoid negative long-term impact on rare species during critical life history phases.
- If needed (for example at Martinez Preserve), divide preserves into multiple burn units to minimize impacts to native animals.
- Consider relocating rare species such as epiphytes and *Liguus* tree snails when critical populations may be harmed by fire.
- Prior to burning areas with dense hardwoods, hand-remove hardwoods and remove cut trees from the preserve, to reduce fire intensity and smoke, and minimize mortality of rare species.
- Use herbicide application methods such as spot-treatment whenever possible to reduce non-target impacts.
- Limit herbicide application to known, identifiable targets.
- Select herbicides that are safe, effective, have minimal impacts to non-target species, have minimal soil persistence, and degrade rapidly.
- Provide maps of rare species locations to project managers and crew supervisors.
- Combine rare species monitoring with invasive species control to minimize impact on rare species.
- Plan timing of restoration activities to avoid impact on rare species during critical life history phases.
- Develop procedures for staff use of ORVs to minimize impact to sensitive areas; ORVs should be limited to roads and fire breaks.
- Conduct management activities such as large-scale invasive plant removal, fence construction, etc., away from rare plants when possible. When such actions cannot be prevented, consider alternatives to minimize the impacts to rare species.

4.5 Avoid or remove invasive species propagules to prevent new infestations and the spread of existing invasive species.

- Remove mud, dirt, and plant parts from equipment before moving it into a project area.
- Clean mowers on-site before moving to another location to prevent spread of invasive species.
- Minimize soil disturbance in natural areas when conducting restoration activities.
- Before ground-disturbing activities begin, assess and prioritize treatment of invasive species.
- Expand invasive plant control activities to include areas outside of natural areas, including fallow fields, nature centers, administrative grounds, and parking lots.
- Staging areas and access routes should avoid areas with heavy infestations of non-native plants.
- Always begin invasive species control in lightly infested areas and then move to heavily infested areas.
- Avoid driving and walking through preserves infested with highly invasive species, most notably climbing ferns (*Lygodium* spp.). If these activities must occur, then staff should change clothing (including footwear) after exiting such areas.
- Keep equipment used on preserves contaminated with *Lygodium* and other species with highly mobile propagules separate from "clean" equipment.

- Consider developing a wash station area at preserves infested with *Lygodium.*
- Crews need to inspect, remove, and properly dispose of invasive plant seed and plant parts found on their clothing and equipment, after being trained to recognize the priority species in the area.
- Proper disposal of invasive species propagules should be assessed to prevent contamination.
- Inform outside agencies of protocols to prevent the spread of invasive species and require that outside agencies working in natural areas adhere to them.
- Coordinate with the Florida Department of Transportation, FPL, Public Works, SFWMD, etc., to eliminate dumping and maintain easements free of invasive plants.

4.6 Prevent the introduction and spread of invasive plants caused by transport of infested mulch, sand, and gravel, borrow, and fill material.

- Inspect and document in the first year after project completion the areas where materials are used to ensure that any invasive plants transported to the preserve are promptly detected and controlled.
- Maintain stockpiled material in an invasive plant-free condition, in a configuration conducive to mowing and maintenance.

4.7 Where project disturbance creates bare ground, develop restoration protocols for the appropriate plant community.

- Monitor and document all ground-disturbing operations for invasive plants. Incorporate disturbed areas into ongoing restoration.
- Develop guidelines and protocols for the establishment of native plants and influx of native plant propagules in areas to be restored.
- Treat disturbed soil in a manner that facilitates the establishment of the appropriate plant community.
- Use locally-obtained fill where appropriate and feasible.

4.8 Protect geologic, pre-historic, archaeological, and historic preserves within all management areas.

- Obtain a certificate of appropriateness when performing substrate disturbance, including digging.
- Maintain GIS records of all known geologic, pre-historic, archaeological, and historic preserves, and distribute to land managers and crew leaders to ensure protection of these preserves.
- Direct work crews to not disturb archaeological material.
- Evaluate public impact to geologic, pre-historic, archaeological, and historic preserves, and modify public use, if appropriate.

4.9 Develop plans to respond to disasters such as hurricanes, tornadoes, catastrophic fires, major pest outbreaks, etc. while preserving natural resources.

- In the event of a natural disaster, coordinate with the Miami-Dade County Emergency Operations Center's command team.

- Ensure that environmentally sensitive areas of Richmond are not designated as "temporary approved solid waste dump sites" for post-storm recovery.
- Ensure that post-storm staging areas and activities (such as Zoo Miami parking lots) do not impact adjacent environmentally sensitive areas.
- For catastrophic fires, coordinate with the pre-determined incident command team (FFS, M-D Fire Rescue, ENP, PROS, RER, etc.)
- For major pest outbreaks, coordinate with other concerned agencies and research facilities such as UF-IFAS and USDA.
- Develop disaster-response site plans and keep them in multiple, easily accessible locations. Plans should include maps (vegetation types, rare species, property surveys, fire breaks), site inventories, emergency signage, and contact information for project managers.
- Prioritize recovery tasks on a per-site basis, including clearing of fire breaks, identifying and treating populations of invasive plants that are likely to spread quickly, and identifying areas where wildfire risk is heightened.
- In areas prone to dumping, managers should consider posting No Dumping signs and patrolling as possible.
- The EEL program should coordinate with USFWS regarding the status and recovery actions required for federally listed species following disaster events.

V. LITERATURE CITED

Babb, G., J. Duquesnel, S. Gatewood, R. Line and C. Lippincott. 1991. Larry and Penny Thompson Memorial Park: Natural Areas Protection Plan. Report compiled by the Dade County Conservation Partnership of Miami-Dade County Park & Recreation, The Nature Conservancy, and Fairchild Tropical Garden. 26 pp.

Bailey, A.M., H.K. Ober, A.R. Sovie and R.A. McCleery. 2017a. Impact of land use and climate on the distribution of the endangered Florida bonneted bat. Journal of Mammalogy 98(6):1586-1593

Bailey, A.M., R.A. McCleery, H.K. Ober, and W.E. Pine. 2017b. First demographic estimates for endangered Florida bonneted bats suggest year-round recruitment and low apparent survival. Journal of Mammalogy 98(2):551-559.

Barton, E. 2014. Anthony Atwood MA'03, PhD '12, leads effort to open the South Florida Military Museum. FIU News Magazine. Fall 2014 issue.

Beekman, L. 1962. "When the hurricane wiped out the blimp base." News release, Miami Railroad Historical Society.

Bradley, K. and G. Gann. 1999. The status of exotic plants in the preserves of Southern Florida. Pages 35-41 *in*: D.T. Jones and B.W. Gamble (eds). Florida's garden of good and evil. Proceedings of a joint conference of the Florida Exotic Pest Plant Council and the Florida Native Plant Society, Held June 4-7, 1998.

Bradley, K., S. Woodmansee and G. Gann. 2000. Floristic survey and rare species assessment of the non-County owned properties in the Richmond Pine Rocklands. Report to Miami-Dade County DERM.
URL: http://www.regionalconservation.org/ircs/pdf/publications/2000_01.pdf

Braun De Torrez, E.C., H.K. Ober and R.A. Mccleery. 2017. Critically imperiled forest fragment supports bat diversity and activity within a subtropical grassland. Journal of Mammalogy 99(1).

Brenner, J. 1991. Southern oscillation anomalies and their relationship to wildfire activity in Florida. International Journal of Wildland Fire 1(1):73-78.

Brenner, J., and D. Wade. 2003. Florida's revised prescribed fire law: protection for responsible burners. Pages 132-136 *in* K.E.M. Galley, R.C. Klinger, and N.G. Sugihara (eds.). Proceedings of Fire Conference 2000: The First National Congress on Fire Ecology, Prevention, and Management. Miscellaneous Publication No. 13, Tall Timbers Research Station, Tallahassee, FL.

Bolund, P. and S. Hunhammar. 1999. Ecosystem services in urban areas. Ecological Economics 29:293-301.

Brzoska, D., C.B. Knisley and J. Slotten. 2011. Rediscovery of *Cicindela scabrosa floridana* Cartwright (Coleoptera: Cicindelidae) and its elevation to species level. Insecta Mundi 0162: 1-7.

Carr Smith and Associates. 1976. Dade County Zoological Park Master Plan. 178pp.

Castillo, D., and A.L. Clarke. 2003. Trap/neuter/release methods ineffective in controlling domestic cat "colonies" on public lands. Natural Areas Journal 23:247–253.

Daubenmire, R. 1968. Ecology of fire in grasslands. Advances in Ecological Research 5: 209-266.

Davis, J.H. 1943. The natural features of southern Florida. Florida Geological Survey Bulletin 25: 311.

DERM. 1994. Management plan for the Richmond pine rocklands. Plan prepared by Dade County's Dept. of Environmental Resources Management, with funding from USFWS, Grant #14-16-0004-92-987. 61 pp.

Derr, H.J. and W.F. Mann, Jr. 1971. Direct-seeding pines in the South. USDA Forest Service Handbook #391.

Doebley, J. F. 1983. The taxonomy and evolution of *Tripsacum* and Teosinte, the closest relatives of maize. Paper No. 8456 of the Journal series of the North Carolina Agricultural Research Service, Raleigh, NC.

Doren, R.F., W.J. Platt, and L.D. Whiteaker. 1993. Density and size structure of slash pine stands in the Everglades region of South Florida. Forest Ecology and Management 59(3-4):295-311.

ECISMA (Everglades Cooperative Invasive Species Management Area). 2017. URL: www.evergladescisma.org. Accessed April 2017.

Fellows, M. 2002. Appendix C5: Smoke treatment of *Polygala smallii* seeds. *In*: Conservation of south Florida endangered and threatened flora. Final report to the Endangered Plant Advisory Council, Florida Department of Agriculture and Consumer Services FDACS contract #006466. December 2002. Fairchild Tropical Garden.

FFWCC (Florida Fish and Wildlife Conservation Commission). 2012. Gopher tortoise management plan. Tallahassee, Florida. URL https://www.nbbd.com/gophertortoise/1209-ManagementPlan.pdf

FFWCC (Florida Fish and Wildlife Conservation Commission). 2013. A species action plan for the rim rock crowned snake. Tallahassee, Florida. URL: http://myfwc.com/media/2738843/Rim-Rock-Crowned-Snake-Species-Action-Plan-Final-Draft.pdf

FLEPPC (Florida Exotic Pest Plant Council). 2017. List of Invasive Plant Species. URL: www.fleppc.org. Accessed June 2017.

FNAI (Florida Natural Areas Inventory). 2010. Guide to the Natural Communities of Florida: 2010 edition. URL: www.fnai.org. Accessed April 2018.

Freeman, P. 2017. Images from the website: "Abandoned and little known airfields: Richmond Naval Air Station, Richmond Heights, FL. URL: www.airfields-freeman.com/FL/Airfields_FL_Miami_S.htm#richmond. Accessed 3/28/17

Fuller, R.A., K.N. Irvine, P. Devine-Wright, P.H. Warren, K.J. Gaston. 2007. Psychological benefits of greenspace increase with biodiversity. Biology Letters 3(4):390-394.

Gann, G.D., Stocking, C.G., and collaborators. 2001-2018. The Floristic Inventory of South Florida Database Online. [http://regionalconservation.org/ircs/database/database.asp]. The Institute for Regional Conservation. Delray Beach, Florida USA.

Gao, M., G.M. Ashu, L. Stewart, W.A. Akwe, V. Njiti, S. Barnes. 2011. Wx intron variations support an allohexaploid origin of the sweetpotato [*Ipomoea batatas* (L.) Lam]. Euphytica 177(1):111-133.

GCRR (Gold Coast Railroad Museum). 2017. URL: http://www.gcrm.org/extended-about. Accessed 8/23/17.

Hardin, D. 1993. Pine rocklands after Andrew: damage, response and recovery. Abstracts, Dade County Natural Areas: Post-Hurricane Research and Resource Management Workshop, October 8, 1993.

Herndon, A. 1993. Proceedings of the South Florida Endemic Plant Workshop, Fairchild Tropical Garden. Unpublished.

Herndon. A. and D. Taylor. 1985. Litterfall in pinelands of Everglades National Park. South Florida Research Center Report SFRC-85/01, 41 pp.

Hostetler, M. and F. Escobedo. 2010. What types of urban greenspace are better for carbon dioxide sequestration? Publication WEC279 from the Wildlife Ecology and Conservation Department, UF/IFAS Extension, 3 pp.

Johnson Engineering. 2017. Coral Reef Commons Habitat Conservation Plan. Submitted October 2017, approved by USFWS in December 2017. Prepared for Coral Reef Retail LLC, Coral Reef Resi Ph I LLC, and RamDev LLC. 172 pp.

Jorgensen, J.R. and E. Shoulders. 1967. Mycorrhizal root development vital to survival of slash pine nursery stock. Tree Planters' Notes 18(2):7-11.

Koptur, S., C. Kernan, and S. Kennedy. 1998. Final Report for the Project: Feasibility of Relocating Tiny Polygala. State Study No. 0745, WPI # 0510745, State Job No. 99700-3308-010, Contract No. B-9919.

Kozlowski, T.T. and C.E. Ahlgren (Eds). 1974. Fire and Ecosystems. New York, New York. Academic Press.

Landers, J.L. 1989. Disturbance influences on pine tracts in the southeastern United States. Pages 61-109 *in* Proceedings of the 17th Tall Timbers Fire Ecology Conference.

Enloe, S.F., K. Langeland, J. Ferrell, B. Sellers, and G.E. MacDonald. 2018. Integrated management of nonnative plants in natural areas of Florida. Publication SP242 from the Agronomy Department, UF/IFAS Extension, 35 pp. URL: http://edis.ifas.ufl.edu/wg209

Little, E.L. and K.W. Dorman. 1952. Slash Pine (*Pinus elliottii*), its nomenclature and varieties. Journal of Forestry 50: 918-923.

Lohrey, R.E. and S.V. Kossuth. 1990. Pinus elliottii Engelm. *In*: R.M. Burns and B.H. Honkala, Eds. Silvics of North America: 1. Conifers. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. Volume 2. 877 pp.

Loss, S.R., T. Will and P.P. Marra. 2013. The impact of free-ranging domestic cats on wildlife of the United States. Nature Communications 4:1396 doi: 10.1038/ncomms2380 (2012).

Louv, R. 2008. Last child in the woods: Saving our children from nature-deficit disorder. Algonquin Books of Chapel Hill, Chapel Hill, North Carolina. 416 pp.

Macfie, D. 1977. Richmond Naval Air Station, 1942-1961. Tequesta, The Journal of the Historical Association of Southern Florida 3(7):38-50. URL: http://digitalcollections.fiu.edu/tequesta/files/1977/77_1_03.pdf

Maschinski, J., E. Sirkin and J. Fant. 2010. Using genetic and morphological analysis to distinguish endangered taxa from their hybrids with the cultivated exotic pest plant *Lantana strigocamara* (syn: *Lantana camara*). Conservation Genetics 11:1607-1621.

Mayo, E. 2000. Reforestation of *Pinus elliottii* var. *densa* on the Miami Rock Ridge: Field experiment and economic analysis of two alternative methods. MS Thesis, Florida International University.

McHargue, L.A. 2000. Records on post-Andrew pine seeding and planting. Unpublished spreadsheet maintained in files of Miami-Dade County, Natural Areas Management Division.

McNabb, K.L. 1985. The relationship of carbohydrate reserves to the quality of bare-root *Pinus elliottii* var. *elliottii* (Engelm) seedlings produced in a northern Florida Nursery. Ph.D. Dissertation, University of Florida.

McRae, E.C. 1946. Florida Chapter. Page 2 *in:* Ninety Nines Newsletter of the International Organization of Women Pilots. January 15, 1946.

Mitchell, R.J., J.K. Hiers, J. O'Brien and G. Starr. 2009. Ecological forestry in the southeast: Understanding the ecology of fuels. Journal of Forestry 107:391-397.

Morgan, E.C. and W.A. Overholt. 2005. Potential allelopathic effects of Brazilian pepper (*Schinus terebinthifolius* Raddi, Anacardiaceae) aqueous extract on germination and growth of selected Florida native plants. The Journal of the Torrey Botanical Society 132(1):11-15.

Nolan, J. 1975. Dade zoo price tag soars to $50 million; cutbacks considered. The Miami Herald. November 2, 1975.

Ober, H.K., Braun de Torrez, E., J.A. Gore, A. Bailey, J.K. Myers, K.N. Smith and R. Mccleery. 2016. Social organization of an endangered subtropical species, *Eumops floridanus*, the Florida bonneted bat. Mammalia 81(4).

O'Brien, J.J., J.K. Kiers, M.A. Callaham, R.J. Mitchell and S.B. Jack. 2008. Interactions among overstory structure, seedling life-history traits, and fire in frequently burned neotropical pine forests. Ambio 37(7-8):542-547.

O'Brien, J.J., K.A. Mordecai, L. Wolcott, J. Snyder and K. Outcalt. 2010. Hazardous fuels management in subtropical pine flatwoods and tropical pine rocklands. USDA Forest Services Southern Research Station General Technical Report SRS-123.

Pfost, R. and P. Santos. 2013. History of National Weather Service Forecast Office Miami, Florida. Online resource. URL: http://www.weather.gov/mfl/floridahistorypage.

Platt, W.J., J. Stenberg, S. Husari, and D. Lentz. 1990. Fire ecology of everglades habitats: experimental study of effects of differences in fire regimes on short-hydroperiod savannas and imbedded rockridge habitats. Unpublished Report to Everglades National Park. 57 pp.

Platt, W.J., R.F. Doren and T.V. Armentano. 2000. Effects of Hurricane Andrew on stands of slash pine (*Pinus elliottii* var. *densa*) in the everglades region of south Florida (USA). Plant Ecology 146:43-60.

Possley, J., Woodmansee, S., Maschinski, J. 2008. Patterns of plant diversity in fragments of globally imperiled pine rockland forest: effects of recent fire frequency and fragment size. Natural Areas Journal 28(4):379-394.

Possley, J., J. Maschinski, J. Maguire and C. Guerra. 2014. Vegetation monitoring to guide management decisions in Miami's urban pine rockland preserves. Natural Areas Journal 34(2):154-165.

Possley, J. 2015. Priceless Pieces. The Tropical Garden, 70(1):17-19.

Ratcliffe, B.C. and R.D. Cave. 2017. The dynastine scarab beetles of the United States and Canada (Coleoptera: Scarabadidae: Dynastinae). Bulletin of the University of Nebraska State Museum vol. 30. 298 pp.

Rawson G. 1961. The recent rediscovery of *Eumaeus atala* (Lycaenidae) in Florida. Journal of the Lepidopterists' Society 15: 237-244.

Robbins, L.E. and R.L. Myers. 1989. Seasonal effects of prescribed burning in Florida: a review. Prepared for the Florida Game and Freshwater Fish Commission Nongame Wildlife Program by the Nature Conservancy Fire Management and Research Program. 86 pp.

Robertson, W.B. 1953. A survey of the effects of fire In Everglades National Park. Unpublished report to Everglades National Park.

Robertson, W.B. 1955. An analysis of the breeding-bird populations of tropical in relation to the vegetation. Ph.D. Dissertation. University of Illinois.

Roncal, J., J. Maschinski, B. Schaffer, S.M. Gutierrez and D. Walters. 2012. Testing appropriate habitat outside of historic range: The case of *Amorpha herbacea* var. *crenulata* (Fabaceae). Journal for Nature Conservation 20:109-116.

Smith, M. 1957. South Florida Frontiers. Published as a Community Service by Florida Power & Light Company, Miami, Florida.

Snyder, J.R. 1986. The impact of wet season and dry season prescribed fires on Miami Rock Ridge pineland. Report SFRC 86106. Everglades National Park: South Florida Research Center.

Snyder, J.R. 1989. Fire regimes in subtropical South Florida. *In:* Proceedings of the 17th Tall Timbers Fire Ecology Conference, pp. 303-319.

Snyder, J.R., A. Herndon, and W.B. Robertson. 1990. South Florida Rocklands. Chapter 8 *in:* Ecosystems of Florida. J.J. Ewel and R. Myers, eds., 765 pp.

Timm, R.T. and H.H. Genoways. 2004. The Florida bonneted bat, *Eumops floridanus* (Chiroptera: Molossidae): Distribution, morphometrics, systematics and ecology. Journal of Mammalogy 85(5):852-865. URL: https://academic.oup.com/jmammal/article/85/5/852/859206

Tomlinson, P.B. 1980. The biology of trees native to tropical Florida. Harvard University Printing Office, 480 pp.

USDA, Soil Conservation Service. 1947. Soil Survey: Dade County, Florida.

USDA, Soll Conservation Service. 1990. Soil Survey of Dade County, Florida.

USFWS. 1978. Listing of the Eastern indigo snake as a threatened species. Federal Register 43(21):4026-4029.

USFWS. 1984. US breeding population of the wood stork determined to be endangered. Federal Register 49(40):7332-7335.

USFWS. 1985. Endangered and threatened status for five Florida pine rockland plants. Federal Register 50(138):29345-29349.

USFWS. 1987. Threatened status for the Florida population of Audubon's crested caracara. Federal Register 52(128):25229-25232.

USFWS. 2006. 90-Day finding on a petition to list the Eastern population of the gopher tortoise (*Gopherus Polyphemus*) as Threatened. Federal Register 74(173):46401-46406.

USFWS. 2011. Listing of the Miami Blue Butterfly as Endangered Throughout Its Range; Listing of the Cassius Blue, Ceraunus Blue, and Nickerbean Blue Butterflies as Threatened Due to Similarity of Appearance to the Miami Blue Butterfly in Coastal South and Central Florida; Final Rule. Federal Register 77(67):20948-20986.

USFWS. 2012. Reclassification of the Continental U.S. Breeding Population of the Wood Stork From Endangered to Threatened. Federal Register 77(247):75947-75966.

USFWS. 2013a. Endangered species status for the Florida bonneted bat; final rule. Federal Register 78(191):61004-61043.

USFWS. 2013 b. Revised list of migratory birds. Final Rule. Federal Register 78(212):65844-65864.

USFWS. 2014a. Endangered status for the Florida leafwing and Bartram's scrub-hairstreak butterflies; final rule. Federal Register 79(155):47222-47244.

USFWS. 2014b. Designation of critical habitat for Florida leafwing and Bartram's scrub-hairstreak butterflies; final rule. Federal Register 79(155):47180-47220.

USFWS. 2014c. Endangered species status for *Brickellia mosieri* (Florida Brickell-bush) and *Linum carteri* var. *carteri* (Carter's Small-flowered Flax). Federal Register 79(171):52567-52575.

USFWS. 2016a. Endangered species status for *Chamaecrista lineata* var. *keyensis* (Big Pine Partridge Pea), *Chamaesyce deltoidea* ssp. *serpyllum* (Wedge Spurge) and *Linum arenicola* (Sand Flax) and Threatened Species Status for *Argythamnia blodgettii* (Blodgett's Silverbush). Federal Register 81(189):66842-66865

USFWS. 2016b. Endangered species status for the Miami tiger beetle (Cicindela floridana). Federal Register 81(193):68985-69007.

USFWS. 2017. Endangered Species Status for *Dalea carthagenensis* var. *floridana* (Florida Prairie-clover), and Threatened Species Status for *Sideroxylon reclinatum* ssp. *austrofloridense* (Everglades Bully), *Digitaria pauciflora* (Florida Pineland Crabgrass), and *Chamaesyce deltoidea* ssp. *pinetorum* (Pineland Sandmat). Federal Register 82(193):46691-46715.

Volker, A. 1973. Work expected to start next month on new zoo. The Miami News. July 15, 1973.

Wade, D., J. Ewel, and R.H. Hofstetter. 1980. Fire in South Florida Ecosystems. US Forest Service Technical Report SE-17. Southeastern Forest Research Station. Asheville, North Carolina.

Waldrop, A.T., D.L. White, and S.M. Jones. 1992. Fire regimes for pine-grassland communities in the southeastern United States. Forest Ecology and Management 47:195-210.

Whiteaker, L.D. and R.F. Doren. 1989. Exotic plant species management strategies and list of exotic species in prioritized categories for Everglades National Park. U.S. Department of the Interior, National Park Service, Research Resources Management Report SER-89/04. Southeast Regional Office, Atlanta, GA, 30303. 21 pp.

Williams, D.A., Y. Wang, M. Borchetta and M.S. Gaines. 2007. Genetic diversity and spatial structure of a keystone species in fragmented pine rockland habitat. Biological Conservation 138(1-2):256-268.

Wunderlin, R. P., B. F. Hansen, A. R. Franck, and F. B. Essig. 2017. Atlas of Florida Plants (http://florida.plantatlas.usf.edu/).[S. M. Landry and K. N. Campbell (application development), USF Water Institute.] Institute for Systematic Botany, University of South Florida, Tampa.

APPENDIX 1: Miami-Dade County land covenant for County preserves in Richmond

CFN 2008R0661288
OR Bk 26521 Pgs 4319 - 4327; (9pgs)
RECORDED 08/12/2008 15:04:55
HARVEY RUVIN, CLERK OF COURT
MIAMI-DADE COUNTY, FLORIDA

This instrument was prepared by:
Name: Dennis A. Kerbel, Assistant County Attorney
Address: 111 N.W. 1st Street, Suite 2810
Miami, FL 33128

(Space reserved for Clerk)

DECLARATION OF RESTRICTIONS

WHEREAS, Miami-Dade County holds the fee simple title to the land in Miami-Dade County, Florida, described in Exhibits "A1-A4," attached hereto and hereinafter called the "Property,"

NOW, THEREFORE, Miami-Dade County makes the following Declaration of Restrictions covering and running with the Property:

1. Environmentally Endangered Land (EEL) lands and Natural Forest Community (NFC) lands of the Property, as shown on the map attached hereto as Exhibit B and incorporated herein by reference (EEL and NFC Lands), shall be preserved in a natural condition so that existing pineland canopy, pineland understory vegetation and transverse glade wetlands are maintained and enhanced pursuant to EEL land management activities and in accordance with the Miami-Dade County Natural Areas Management Plan (Department of Environmental Resources Management (DERM) Technical Report 2004-1) (the DERM Natural Area Management Plan). The boundary shown on Exhibit B delineates specific EEL and NFC lands and does not depict the extent of all environmentally sensitive lands on the Property.

2. EEL lands, as shown on attachment C, shall be managed by the EEL program and in accordance with EEL-approved management plans.

3. Within the EEL and NFC lands, only activities that do not adversely disturb the substrate or native vegetation shall be allowed, and all activities shall be compatible with management strategies included in the DERM Natural Areas Management Plan and, where applicable, EEL management plans.

4. DERM shall have the right to inspect the Property at reasonable times to determine whether the Property is being used and maintained in compliance with this covenant and in compliance with Chapter 24-49 of the Code of Miami-Dade County.

(Public Hearing)

Section-Township-Range: Sections 26 and 26-Township 55-Range 39
Folio numbers: 3059360000050, 3059260000070, 3059360000030, 3059350000015

4

Declaration of Restrictions
Page 2

5. No trees, understory, or wetlands shall be removed from the NFC or EEL Lands, beyond the scope of removal allowed by the DERM Natural Forest Community Exotic Removal Permit (permit number 2007-015), issued to the Miami-Dade Park and Recreation Department's Natural Areas Management, without additional prior written consent of DERM. This Covenant and the provisions contained herein shall be enforced by the Director of DERM.

County Inspection. As further part of this Declaration, it is hereby understood and agreed that any official inspector of Miami-Dade County, or its agents duly authorized, may have the privilege at any time during normal working hours of entering and inspecting the use of the premises to determine whether or not the requirements of the building and zoning regulations and the conditions herein agreed to are being complied with.

Covenant Running with the Land. This Declaration on the part of the Owner shall constitute a covenant running with the land and may be recorded, at Owner's expense, in the public records of Miami-Dade County, Florida and shall remain in full force and effect and be binding upon the undersigned Owner, and their heirs, successors and assigns until such time as the same is modified or released. These restrictions during their lifetime shall be for the benefit of, and limitation upon, all present and future owners of the real property and for the benefit of Miami-Dade County and the public welfare. Owner, and their heirs, successors and assigns, acknowledge that acceptance of this Declaration does not in any way obligate or provide a limitation on the County.

Term. This Declaration is to run with the land and shall be binding on all parties and all persons claiming under it unless modified, amended or released by the Board of County Commissioners of Miami-Dade County.

Modification, Amendment, Release. This Declaration of Restrictions may be modified, amended or released as to the land herein described, or any portion thereof, by a written instrument executed by the, then, owner(s) of all of the Property, including joinders of all mortgagees, if any, provided that the same is also approved by the Board of County Commissioners of Miami-Dade County, Florida.

Should this Declaration of Restrictions be so modified, amended or released by the Board of County Commissioners of Miami-Dade County, the Director of DERM or the executive officer of the successor of DERM, or in the absence of such director or executive officer by his assistant in charge of the office in his absence, shall forthwith execute a written instrument effectuating and acknowledging such modification, amendment or release.

Enforcement. Enforcement shall be by action against the property owner, as well as any parties or person violating, or attempting to violate, any covenants. The prevailing party in any action or suit pertaining to or arising out of this declaration shall be entitled to recover, in addition to costs and disbursements

(Public Hearing)

Section-Township-Range: Sections 26 and 26-Township 55-Range 39
Folio numbers: 3059360000050, 3059260000070, 3059360000030, 3059350000015

Declaration of Restrictions
Page 3

allowed by law, such sum as the Court may adjudge to be reasonable for the services of his attorney. This enforcement provision shall be in addition to any other remedies available at law, in equity or both.

Authorization for Miami-Dade County to Withhold Permits and Inspections. In the event the terms of this Declaration are not being complied with, in addition to any other remedies available, the County is hereby authorized to withhold any further permits, and refuse to make any inspections or grant any approvals, until such time as this declaration is complied with.

Election of Remedies. All rights, remedies and privileges granted herein shall be deemed to be cumulative and the exercise of any one or more shall neither be deemed to constitute an election of remedies, nor shall it preclude the party exercising the same from exercising such other additional rights, remedies or privileges.

Severability. Invalidation of any one of these covenants, by judgment of Court, shall not affect any of the other provisions which shall remain in full force and effect. However, if any material portion is invalidated, the County shall be entitled to revoke any approval predicated upon the invalidated portion

Recording. This Declaration shall be filed of record in the public records of Miami-Dade County, Florida at the cost of the Owners following the approval of the Application and prior to any additional development of the Property. This Declaration shall become effective immediately upon recordation. Notwithstanding the previous sentence, if any appeal is filed, and the disposition of such appeal results in the denial of the application, in its entirety, then this Declaration shall be null and void and of no further effect. Upon the disposition of an appeal that results in the denial of the Application, in its entirety, and upon written request, the Director of DERM or the executive officer of the successor of DERM, or in the absence of such director or executive officer by his/her assistant in charge of the office in his/her absence, shall forthwith execute a written instrument, in recordable form, acknowledging that this Declaration is null and void and of no further effect.

Owner. The term Owner shall include the Owner, and its heirs, successors and assigns.

ATTEST:
HARVEY RUVIN, CLERK

By: _____
Deputy Clerk

MIAMI-DADE COUNTY
A political subdivision of the
State of Florida
By its Board of County
Commissioners:

By: _____
County Mayor

COUNTY COMMISSIONERS DADE COUNTY FLORIDA

(Public Hearing)

Section-Township-Range: Sections 26 and 26-Township 55-Range 39
Folio numbers: 3059360000050, 3059260000070, 3059360000030, 3059350000015

Declaration of Restrictions
Page 4

Exhibit A-1

LEGAL DESCRIPTION FOR THE MIAMI METROZOO

A PORTION OF SECTIONS 25, 26, 35, AND 36, TOWNSHIP 55 SOUTH, RANGE 39 EAST, MIAMI DADE COUNTY, FLORIDA.

Commence at the Northwest corner of the Northeast 1/4, of Section 26; Thence S 01°44'01" E, along the West line of the Northeast 1/4 of said Section 26, for a distance of 35.00 feet; Thence S 88°05'03" W, along a line parallel with and 35.00 feet South of and measured at right angle to the North line of the Northwest 1/4 of said Section 26, for a distance of 42.17 feet; Thence S 38°47'18" W, along the Southeasterly Right of way line of the Seaboard Railroad, for a distance of 4,124.57 feet; Thence S 03°07'03" E, along a line parallel with and 35.00 feet East of as measured at right angle to the West line of the Southwest 1/4 of said Section 26, for a distance of 603.63 feet; Thence N 87°59'41" E, along a line parallel with the South line of the Southwest 1/4 of said Section 26, for a distance of 1,725.00 feet; Thence S 03°07'03" E, along a line parallel with the West line of the Southwest 1/4 of said Section 26, for a distance of 308.25 feet to the Point of Beginning; Thence N 85°39'01" E, for a distance of 3,904.77 feet; Thence N 31°09'08" E, for a distance of 750.00 feet; Thence N 06°32'05" E, for a distance of 929.04 feet; Thence N 16°48'39" E, for a distance of 986.03 feet; Thence N 87°29'25" E, along a line parallel with the North line of the Northwest 1/4 of said Section 25, for a distance of 1,554.39 feet; Thence S 02°06'52" E, along the East line of the West 1/2 of said Section 35, for a distance of 2,705.53 feet; Thence S 87°53'39" W, along a line parallel with the South line of the Southwest 1/4 of said Section 25, for a distance of 400.00 feet; Thence S 02°06'52" E, along a line parallel with the East line of the aforementioned West 1/2 of said Section 25, for a distance of 1,200.00 feet; Thence N 87°53'39" E, along a line parallel with and 35.00 feet North of as measured at right angles to the aforementioned South line of the Southwest 1/4 of said Section 25, for a distance of 365.00 feet; Thence S 02°06'52" E, along a line parallel with and 35.00 feet of the East line of the aforementioned West 1/2 of said Section 25, for a distance of 35.00 feet; Thence S 02°42'05" E, along a line parallel with and 35.00 feet West of the East line of the Northwest 1/4 of said Section 36, for a distance of 2,704.08 feet; Thence S 02°42'17" E, along a line parallel with and 35.00 feet West of as measured at right angles to the East line of the Southwest 1/4 of said Section 36, for a distance of 2,666.54 feet; Thence S 87°42'31" W, along a line parallel with and 35.00 feet North of as measured at right angles to the South line of the Southwest 1/4 of said Section 36, for a distance of 2,628.51 feet; Thence S 87°44'01" W, along a line parallel with and 35.00 feet to the North of as measured at right angles to the South line of the Southeast 1/4 of said Section 35, for a distance of 2,691.22 feet; Thence S 87°43'49" W, along a line parallel with and 35.00 feet North of the South line of the East 1/2 of the Southwest 1/4 of said Section 35, for a distance of 1,310.35 feet; Thence N 02°55'38" W, along a line parallel with and 35.00 feet East of the West line of the East 1/2 of the Southwest 1/4 of said Section 35, for a distance of 2,715.09 feet; Thence N 88°19'11" E, along the North line of the East 1/2 of the Southwest 1/4 of said Section 35, for a distance of 1,318.24 feet; Thence N 02°45'54" W, along the East line of the Northwest 1/4 of said Section 35, for a distance of 2,655.01 feet; Thence S 87°59'41" W, along a line parallel with and 35.00 feet South of the North line of the Northwest 1/4 of said Section 35, for a distance of 943.88 feet; Thence N 03°07'03" W, parallel with the West line of the Southwest 1/4 of said Section 25, for a distance of 1,291.75 feet to the Point of Beginning, lying and being in Miami Dade County, Florida, containing 740.34 Acres more or less.

(Public Hearing)

Section-Township-Range: Sections 26 and 26-Township 55-Range 39
Folio numbers: 3059360000050, 3059260000070, 3059360000030, 3059350000015

Declaration of Restrictions
Page 5

Exhibit A-2

LEGAL DESCRIPTION FOR GOLD COAST RAILROAD MUSEUM.

A PORTION OF SECTIONS 25 AND 26, TOWNSHIP 55 SOUTH, RANGE 39 EAST, MIAMI DADE COUNTY, FLORIDA.

Commence at the Northwest corner of the Northeast 1/4, of Section 26; Thence S 01°44'01" E, along the West line of the Northeast 1/4 of said Section 26, for a distance of 35.00 feet; Thence S 88°05'03" W, along a line parallel with and 35.00 feet South of, as measured at right angles to, the North line of the Northwest 1/4 of said Section 26, for a distance of 42.17 feet; Thence S 38°47'18" W, along the Southeasterly Right of Way line of CSX Transportation, Inc., for a distance of 712.14 feet to the Point of Beginning; Thence Southwesterly, and Southeasterly, along a circular curve to the left, having a radius of 731.10 feet, and a central angle of 77°17'46", for an arc distance of 986.31 feet to a point of tangency; Thence S 51°44'51" E, for a distance of 79.24 feet; Thence S 58°51'18" E, for a distance of 1,917.17 feet to a point hereinafter called point "E"; Thence continue S 58°51'18" E, for a distance of 40.00 feet (the last four courses being along the Northeasterly Right of Way line of the CSX Transportation, inc. spur line); Thence S 31°08'07" W, for a distance of 260.87 feet; Thence S 58°51'08" E, for a distance of 2,009.93 feet; Thence S 85°39'01" W, for a distance of 1,366.98 feet; Thence N 58°55'54 W, for 906.55 feet; Thence N 28°48'50" W, for a distance of 492.59 feet to a point of curvature; Thence Northwesterly along a circular curve to the right having a radius of 771.10 feet and a central angle of 24°32'45", for an arc distance of 330.34 feet to a point of tangency; Thence N 04°16'05" W, for a distance of 290.73 feet to a point of curvature; Thence Northwesterly, along a circular curve to the left having a radius of 741.10 feet an a central angle of 54°35'13", for an arc distance of 706.06 feet to a point of tangency; Thence N 58°51'18" W, for a distance of 696.41 feet to a point of curvature; Thence Northwesterly and Southwesterly, along a curve to the left, having a radius of 741.10 feet and a central angle of 66°36'06", for an arc distance of 861.46 feet; Thence N 38°47'18" E, along the Southeasterly Right of Way line of the CSX Transportation, Inc. railroad, for a distance of 1,161.10 feet to the Point of Beginning, lying and being in Miami Dade County, Florida, containing 49.67 Acres more or less.

(Public Hearing)

Section-Township-Range: Sections 26 and 26-Township 55-Range 39
Folio numbers: 3059360000050, 3059260000070, 3059360000030, 3059350000015

Declaration of Restrictions
Page 6

Exhibit A-3

LEGAL DESCRIPTION FOR LARRY AND PENNY THOMPSON PARK

A PORTION OF SECTIONS 25, 26, 35, AND 36, TOWNSHIP 55 SOUTH, RANGE 39 EAST, MIAMI DADE COUNTY, FLORIDA.

Beginning at the Center of Section 35, Township 55 South, Range 39 East, Miami Dade County, Florida; Thence S 88°18'52" W, along the South line of the Northwest 1/4 of said Section 35, for a distance of 1318.46 feet to a line parallel to and 35.00 feet East of the West line of the East 1/2 of the Southwest 1/4 of said Section 35; Thence S 02°55'39" E, along a line parallel to and 35.00 feet East of the West line of the East 1/2 of the Southwest 1/4 of said Section 35, for a distance of 2,715.34 feet to a line parallel to and 35.00 feet North of the South line of the Southwest 1/4 of said Section 35; Thence N 87°43'44" E, along a line parallel to and 35.00 feet to the North of the South line of the Southwest 1/4 of said Section 35, for a distance of 1,310.70 feet to the West line of the Southeast 1/4 of said Section 35; Thence N 87°43'54" E, along a line parallel to and 35.00 feet North of the South line of the Southeast 1/4 of said Section 35, for a distance of 2,690.80 feet to the West line of the Southwest 1/4 of Section 36, Township 55 South, Range 39 East, Miami Dade County, Florida; Thence N 87°42'27" E, along a line parallel to and 35.00 feet North of the South line of the Southwest 1/4 of said Section 36, for a distance of 2,628.41 feet, to a line parallel to and 35.00 feet West of the East line of the Southwest 1/4 of said Section 36; Thence N 02°42'06" W, along a line parallel to and 35.00 feet West of the East line of the Southwest 1/4 of said Section 36, for a distance of 132.00 feet; Thence S 87°42'27" W, along a line parallel to the South line of the Southwest 1/4 of said Section 36, for a distance of 1,050.00 feet; Thence N 02°42'06" W, along a line parallel to the East line of the Southwest 1/4 of said Section 36, for a distance of 750.00 feet; Thence N 28°50'34" E, for a distance of 864.51 feet; Thence N 87°42'27" E, along a line parallel to the South line of the Southwest 1/4 of said Section 36, for a distance of 597.71 feet, to a line parallel to and 35.00 feet West of the East line of the Southwest 1/4 of said Section 36; Thence N 02°42'06" W, along a line parallel to and 35.00 feet West of the East line of the Southwest 1/4 of said Section 36, for a distance of 1,043.65 feet to the South line of the Northwest 1/4 of said Section 36; Thence N 02°42'00" W, along a line parallel to and 35.00 West of the East line of the Northwest 1/4 of said Section 36, for a distance of 342.57 feet; Thence S 87°42'27" W, along a line parallel to the South line of the Southwest 1/4 of said Section 36, for a distance of 531.73 feet; Thence S 64°04'00" W, for a distance of 500.00 feet; Thence S 36°51'30" W, for a distance of 999.71 feet; Thence S 30°59'00" W, for a distance of 500.00 feet; Thence S 50°09'00" W, for a distance of 500.00 feet; Thence S 64°03'56" W, for a distance of 797.07 feet; Thence N 84°31'00" W, for a distance of 500.00 feet; Thence N 71°31'00" W, for a distance of 500.00 feet; Thence N 56°31'00" W, for a distance of 500.00 feet; Thence N 40°37'56" W, for a distance of 1,498.83 feet to the Point of Beginning.

LESS, Commence at the Southeast corner of the Southwest 1/4 of said Section 36; Thence N 02°42'17" W, along the East line of the Southwest 1/4 of said Section 36 (Southwest 122nd Avenue), for a distance of 167.00 feet; Thence S 87°42'31" W, along a line 167.00 feet North of and parallel with the South line of the Southwest 1/4 of said Section 36, for a distance of 35.00 feet to the Point of Beginning; Thence continue S 87°42'31" W, for a distance of 1,045.00 feet; Thence N 02°42'17" W, parallel with the East line of said Southwest 1/4 of Section 36, for a distance of 750.00 feet; Thence N 28°49'46" E, for a distance of 864.77 feet; Thence N 87°44'27" E, for a distance of 597.71 feet to the intersection with a line 35 feet West and parallel with the East line of the Southwest 1/4 of said Section 36; Thence S 02°42'17" E, along said line 35 from and parallel with the East line of the Southwest 1/4 of Section 36, for a distance of 1490.00 feet to the Point of Beginning having 270.94 Acres more or less.

(Public Hearing)

Section-Township-Range: Sections 26 and 26-Township 55-Range 39
Folio numbers: 3059360000050, 3059260000070, 3059360000030, 3059350000015

Declaration of Restrictions
Page 7

Exhibit A-4

LEGAL DESCRIPTION FOR LARRY AND PENNY THOMPSON PARK - MARTINEZ PROPERTY ADDITION

A PORTION OF SECTION 35, TOWNSHIP 55 SOUTH, RANGE 39 EAST, MIAMI DADE COUNTY, FLORIDA.

Beginning at the Southeast corner of the Northwest 1/4 of Section 35, Township 55 South, Range 39 East and at plane coordinate position North 462170.77 feet and East 695816.19 feet (N: 462170, E: 695896.19), based on State Plane Coordinate System Florida East Zone-1974 Adjustment; Thence run S88°19'01" W, along the South line of the Northwest 1/4 of said Section 35, for a distance of 1,318.09 feet to a point(N: 462132.06 feet, E: 694498.67 feet); Thence run N02°44'30" W, for a distance of 35.01 feet to a point (N: 462167.03 feet, E:694497.00 feet); Thence run S88°19'01" W, along a line parallel to and 35 feet North of the South line of the Northwest 1/4 of said Section 35, for a distance of 504.12 feet to a point (N: 462152.22 feet, E: 693993.09 feet); Thence run N02°34'35" W, for a distance of 1,024.72 feet to a point(N: 462152.22 feet, E: 693947.04 feet); Thence run S88°16'36" W, for a distance of 851.86 feet to a point (N: 463150.04 feet, E: 693095.56 feet); Thence run N02°43'00" W, along a line parallel to and 35 feet East of the West line of the Northwest 1/4 of said Section 35, for a distance of 1,655.75 feet to a point (N: 464803.94 feet, E: 693017.09 feet); Thence run N87°59'24" E, along a line parallel to and 40 feet North of the North line of the Northwest 1/4 of said Section 35, for a distance of 1,725.28 feet to a point (N: 464864.45 feet, E: 694741.30 feet); Thence run S02°44'30" E, for a distance of 75.01 feet to a point (N: 464789.53 feet, E: 694744.89 feet); Thence run N87°59'24" E, along a line parallel to and 35 feet South of the North line of the Northwest 1/4 of said Section 35, for a distance of 943.73 feet to a point (N: 464822.63 feet, E: 695688.04 feet), said point being on the East line of the Northwest 1/4 of said Section 35; Thence run S02°46'00" E, along the East line of the Northwest 1/4 of said Section 35, for a distance of 2,654.95 feet to the Point of Beginning.

Less those lands conveyed for right-of way pursuant to O.R. Book 18546 Page 552 of the Miami Dade County Public Records.

Less the North 660 feet and the West 660 feet of the Northwest 1/4 of the Northwest 1/4 of the Northwest 1/4 of Section 35, Township 55 South, Range 39 East thereof containing 136.2 acres more or less.

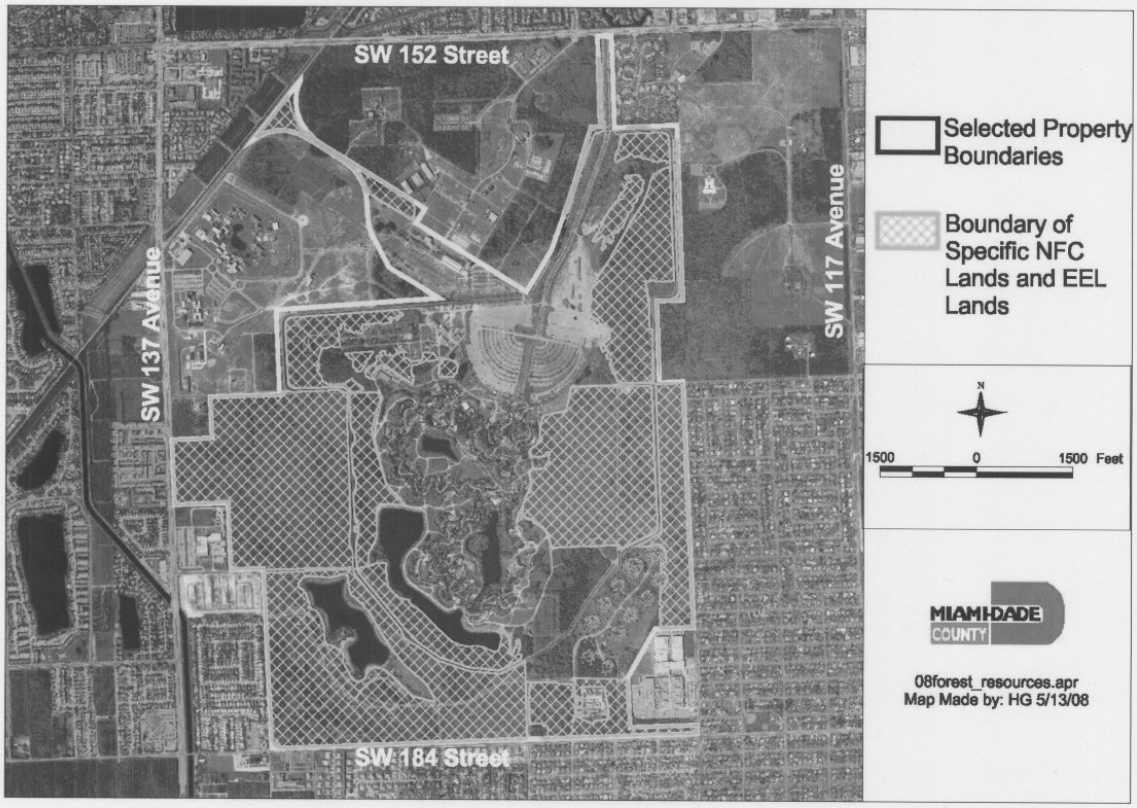
(Public Hearing)

Section-Township-Range: Sections 26 and 26-Township 55-Range 39
Folio numbers: 3059360000050, 3059260000070, 3059360000030, 3059350000015

Declaration of Restrictions
Page 8

Exhibit B
Natural Forest Canopy and Environmentally Endangered Lands

Folios 30-5935-000-0015 & 30-5936-000-0050 & 30-5926-000-0070 & 30-5936-000-0030



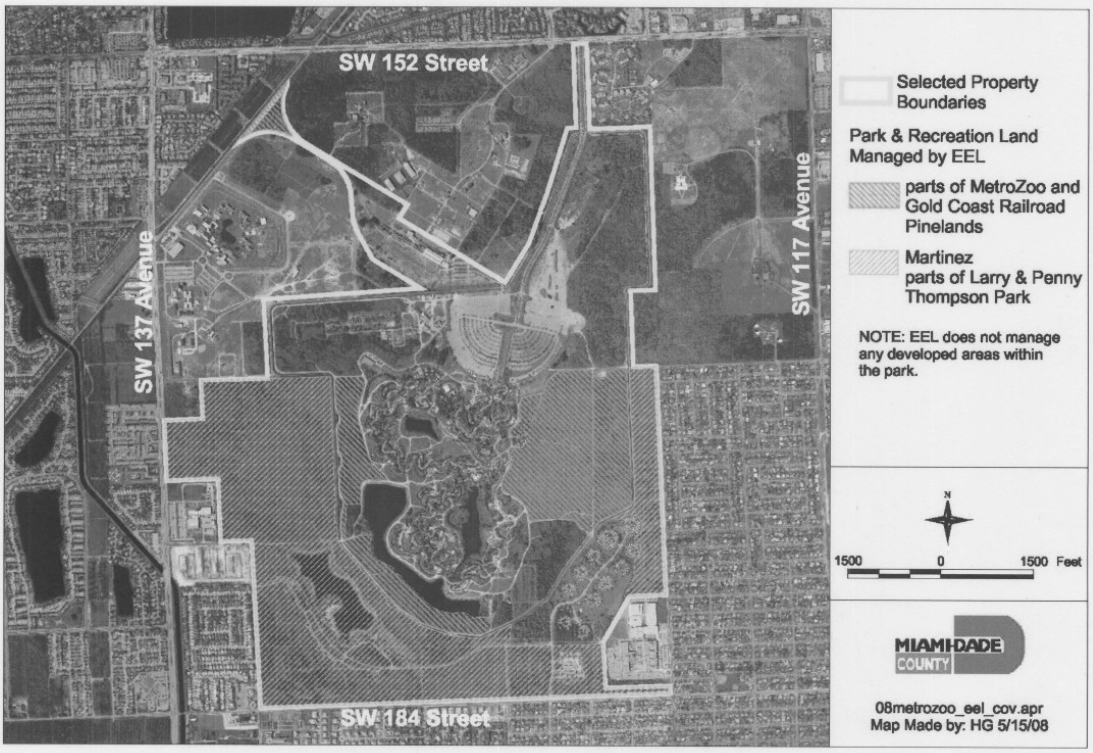
(Public Hearing)

Section-Township-Range: Sections 26 and 26-Township 55-Range 39
Folio numbers: 3059360000050, 3059260000070, 3059360000030, 3059350000015

Declaration of Restrictions
Page 9

Exhibit C

Metrozoo Complex



(Public Hearing)

Section-Township-Range: Sections 26 and 26-Township 55-Range 39
Folio numbers: 3059360000050, 3059260000070, 3059360000030, 3059350000015

APPENDIX 2: Miami-Dade County Arthropod Control Plan

ADAM H. PUTNAM
COMMISSIONER

Florida Department of Agriculture and Consumer Services
Division of Agricultural Environmental Services

ARTHROPOD MANAGEMENT PLAN - PUBLIC LANDS

Section 388.4111, F.S.
Telephone: (850) 617-7995

Return to:
Mosquito Control Program
3125 Conner Blvd, Bldg 6,
Tallahassee, Florida 32399-1650

For use in documenting an Arthropod Control Pan for lands designated by the State of Florida or any political subdivision thereof as being environmentally sensitive and biologically highly productive therein. Fill this form out if control work is necessary or planned.

Name of Designated Land: County managed forested areas within Richmond (see location) and associated buffers.

Is Control Work Necessary:
☒Yes ☐No

Location: Richmond is located approximately 16 miles southwest of downtown Miami. This 2x2-mile, 2,560-acre square is bounded by Coral Reef Drive (SW 152nd Street) on the north, Eureka Drive (SW 184th Street) on the south, SW 117th Avenue on the east, and SW 137th Avenue on the west.

Land Management Agency: Miami-Dade County EEL and PROS

Are Arthropod Surveillance Activities Necessary? X Yes ☐No
If "Yes", please explain:

Which Surveillance Techniques Are Proposed?
Please Check All That Apply:

☐ Landing Rate Counts	☐ Light Traps	☐Sentinel Chickens
X Citizen Complaints	☐ Larval Dips	X Other

If "Other", please explain:

BG Sentinel Traps to monitor the Aedes aegypti and Aedes albopictus adult population.

FDACS-13668 Rev. 05/15
Page 1 of 4

ArthropodSpeciesforWhichControlisProposed:

Proposed Larval Control:

Proposed larval monitoring procedure:

Are post treatment counts being obtained: ❑Yes ❑No

Biological Control of Larvae:

Might predacious fish be stocked: ❑Yes X No

Other biological controls that might be used:

Material to be Used for Larviciding Applications:

(Please Check All That Apply:)

X Bti

X Bs

❑ Methoprene

❑ Non-Petroleum SurfaceFilm

❑ Other,please specify:

Please specify the following for each larvicide:

Chemical or Common name:

X Ground ❑Aerial

Rate of application: Within recommended label rate.

Method of application: Manual or backpack sprayer

FDACS-13668 Rev. 05/15
Page 2 of 4

Proposed Adult Mosquito Control:

Aerial adulticiding ☐Yes X No

Ground adulticiding ☐ Yes X No

Please specify the following for each adulticide:

Chemical or common name:

Rate of application:

Method of application:

Proposed Modifications for Public Health Emergency Control: Arthropod control agency may request special exception to this plan during a threat to public or animal health declared by State Health Officer or Commissioner of Agriculture.

Upon mutual agreement between the land manager and the arthropod control agency, during designated emergency public health status by the Florida Department of Health, mosquito control efforts for MDC county-managed areas the following control measures may include:

- Larvacide ground application of Bacillus thuringiensis israelensis (Bti).
- Larvacide ground application of Bacillus sphaericus (Bs).
- Larvicide aerial application of Bacillus thuringiensis israelensis (Bti)
- Ground ULV adulticiding applications of pyrethroids insecticides or Malathion
- Aerial ULV adulticiding applications of naled.

Proposed Notification Procedure for Control Activities:

Records:

Are records being kept in accordance with Chapter 388, F.S.:

X Yes ☐No

Records Location:

8901 NW 58 Street

Miami, Fl.

How long are records maintained: Indefinitely

Vegetation Modification:

What trimming or altering of vegetation to conduct surveillance or treatment is proposed? None

Proposed Land Modifications:

Is any land modification, i.e., rotary ditching, proposed: No

Include proposed operational schedules for water fluctuations: None

List any periodic restrictions, as applicable, for example peak fish spawning times.

Proposed Modification of Aquatic Vegetation: None.

Land Manager Comments: Aerial adulticide spraying shall be prohibited within 400 meters of Richmond (see location) in order to prevent impacts to sensitive resources. The U.S. Fish and Wildlife Service has developed recommendations relating to truck spraying within a 200 meter buffer and aerial adulticide application within a 400 meter buffer from designated critical habitat. Based upon these studies and in accordance with Miami-Dade County Richmond management plan, adulticides shall be prohibited within these buffer areas at and adjacent to Richmond.

Arthropod Control Agency Comments:

Signature of Lands Manager or Representative Date 10/29/18

Signature of Mosquito Control Director/Manager Date 10 29 18

FDACS-13668 Rev. 05/15
Page 4 of 4

APPENDIX 3: Monitoring and research resources

Natural resource monitoring can take on many forms and vary greatly in intensity depending on the objectives of restoration. Combinations of qualitative (e.g., photographs), semi-quantitative (e.g., mapping, cover estimating), and quantitative (e.g., plots, life history studies) are effective in detecting short- and long-term environmental changes.

In Richmond, a significant amount of rare plant monitoring is already underway. Since 2002, Miami-Dade County has contracted biologists at Fairchild Tropical Botanic Garden to create comprehensive rare plant maps in its Richmond preserves (see **Maps 6 and 7**). Fairchild also cooperates with Miami-Dade and, in the past, the US Coast Guard, to conduct detailed endangered species monitoring of Tiny polygala, Carter's flax, and sand flax. In the 1990s, DERM biologists conducted thorough surveys for Tiny polygala and deltoid spurge throughout Richmond; these data (see **Map 2**) are useful to compare to present distribution of these federally endangered species. Finally, Fairchild conducted surveys for the pineland croton, host of the federally endangered butterflies Bartram's scrub hairstreak and the Florida leafwing, in 2013 (Possley et al. 2014). They used sampling techniques to generate estimates of the abundance of croton plants in County-owned portions of Richmond (plants were abundant throughout).

Rare wildlife monitoring is also well underway in portions of Richmond, led by Zoo Miami, University of Florida, and others. Herpetological surveys and monitoring have been conducted on Zoo Miami property since 2005 using drift fences, pitfall traps, funnel traps and opportunistic capture to document the diversity and trends in populations. Butterfly transects of Zoo Miami's pine rocklands and developed areas have been regularly conducted since 2013 by Zoo Miami, Zoo Miami Foundation and FIU interns. Zoo Miami Conservation and Research Department staff conducted a yearlong acoustic survey of Martinez Preserve, Zoo Miami and Larry and Penny Thompson Memorial park to discover how the Florida bonneted bat is utilizing the areas in Richmond; USFWS has also conducted bonneted bat monitoring. Since 2015, Zoo Miami Conservation and Research Department with interns from FIU are studying the ecology of gopher tortoises within the pine rocklands of the Richmond area. USFWS, FWC, Zoo Miami, NAM, Fairchild, and Dr. Barry Knisley have been conducting surveys for the Miami tiger beetle to better describe its range, population size and habitat requirements since 2007.

In addition to monitoring focused on rare species, other long-term monitoring projects have been initiated in Richmond. Such projects, often in combination with GIS data, are useful in detecting long-term community change. Fairchild installed permanent pine rockland monitoring plots in several County pine rockland preserves, including Larry and Penny Thompson Park. The data they collected in 1995 and again in 2003 included species diversity and coverage in herb, shrub, and canopy plots; results were published in 2008 (Possley et al. 2008). In a separate study, Fairchild installed permanent monitoring transects in twelve pine rockland fragments around Miami-Dade County, including Larry & Penny Thompson Park and Zoo Miami. The goal of this project was to compare diversity, forest structure, and abundance of indicator species among preserves with different fire and management histories; this study was published in 2014 (Possley et al. 2014). All Fairchild plot locations and data are available upon request, for resampling in the future.

Although it is not a quantitative technique, photography is an extremely useful monitoring tool. Time-series photographs, taken from fixed points, are important to track large scale changes that can result from invasive plant control and burning. Additionally, photographs and slides are excellent educational tools.

When contracting for services such as natural resource management, some discussion of specifications is necessary. A monitoring program can help determine whether a component conforms to the required specifications. Monitoring procedures need to be rapid, yet sensitive enough to detect conformance with the specifications of each component. Local agencies that may provide monitoring services or which might be able to suggest potential monitoring services are included below.

Potential Biological Monitoring/Research/Advisory Contacts

Agency	Contact Information	Potential services
Fairchild Tropical Botanic Garden	Jennifer Possley, Field Biologist 305-667-1651 ext. 3514 jpossley@fairchildgarden.org	Rare plant mapping and monitoring. Seed collecting/ banking. Seed germination research. Propagation of orchids, ferns.
Florida Bat Conservancy	Cynthia and George Marks (727) 710-2287	Bat monitoring and research
Florida International University Dept. of Earth & Environment	Dr. Mike Ross, 305-348-1420, rossm@fiu.edu Dr. Hong Liu , 305-348-6799 hlilu@fiu.edu	Forest structure, understory community relationships Pollinator (bee/butterfly) activities, rare plant pollination, rare plant demography, invasive bees
Florida Natural Areas Inventory	Dan Hipes, Director dhipes@fnai.fsu.edu	Natural resource inventory, ecospatial analysis, conservation planning, ecological monitoring
The Institute for Regional Conservation	George Gann, Chief Conservation Strategist gann@regionalconservation.org	Floristic inventories, rare plant monitoring, management planning, etc.
Miami-Dade DERM Water Resources Coordination and Education Division	Craig Grossenbacher, 305-372-6522 Craig.grossenbacher@miamidade.gov	County, state, and federal listed species coordination, outreach and education. Intergovernmental coordination regarding habitat conservation and management.
Miami-Dade DERM Tree and Forest Resources Section	Lazaro Quintino, 305-372-6626 Lazaro.quintino@miamidade.gov	Activities related to Miami-Dade County Natural Forest Communities or EEL Covenants.
Miami-Dade EEL	Janet Gil, Director, 305-372-6645 Janet.gil@miamidade.gov	Activities related to Environmentally Endangered Lands
Miami-Dade NAM	Joe Maguire, Director, 305-257-0933 Joe.maguire@miamidade.gov	Activities related to vegetation management
Pro Native Consulting	Steven Woodmansee, 786-488-3101 steve@pronative.com	Vascular plant inventory and monitoring, seed and germplasm harvesting and contract horticulture.
University of Florida	Jaret Daniels, Assoc. Prof., jcdnls@ufl.edu Dr. Holly Ober, Assoc. Prof. holly.ober@ufl.edu	Butterfly monitoring Wildlife monitoring and research

	Dr. Bob McCleery, Assoc. Prof. ramccleery@ufl.edu	Wildlife monitoring and research
Zoo Miami	Dr. Frank Ridgley 305-251-0500 ext. 5084944 Frank.Ridgley@miamidade.gov	Florida bonneted bat, butterflies, reptiles and amphibians, invasive animal species, tiger beetles

APPENDIX 4: Training resources

Wildland Fire

The Southern Fire Exchange is a regional wildland fire science communication program and a member of the national Fire Science Exchange Network, funded by the Joint Fire Science Program. http://southernfireexchange.org/EdTrain/CoWo.html

The Florida Forest Service offers training classes at regional training centers. https://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Education/For-the-Community/Withlacoochee-Training-Center-WTC/Class-Schedule

The National Wildfire Coordinating Group provides national leadership to enable interoperable wildland fire operations among federal, state, local, tribal, and territorial partners. https://www.nwcg.gov/

The Natural Areas Training Academy is run by University of Florida to train land managers with resource management skills; they offer a number of courses including wildland fire. http://wec.ufl.edu/nata/

Pesticide Application

In Florida, pesticide applicator licenses (termed Natural Areas Pesticide License) are granted by the Florida Dept. of Agriculture and Consumer Services, with exams administered through the County extension office.
https://www.freshfromflorida.com/Business-Services/Pesticide-Licensing/Pesticide-Applicator-Licenses/Pesticide-Applicator-Certification-and-Licensing

APPENDIX 5: Landowner/regulator contacts

Richmond is the largest and most politically complex natural area in urban Miami-Dade County. Interagency communication and coordination is vital to the success of its restoration and management. Recent contact information for Richmond landowners/regulators is included here when available.

Agency	**Contact Information**
Federal Bureau of Prisons	305-259-2100, MIA/ExecAssistant@bop.gov
Florida Dept. of Agriculture and Consumer Services, Native plant harvesting permit	352-395-718, terri.hymes@freshfromflorida.com
Florida Forest Service	305-257-0875, Terrance.Gadson@FreshFromFlorida.com
Florida Fish and Wildlife Conservation Commission (has jurisdiction over most wildlife, including nuisance species)	561-625-5122 for South Regional Office, see website for more contacts: http://myfwc.com/contact/fwc-staff
Florida Power & Light	305-442-8770
MDC Regulatory & Economic Resources (RER)	305-372-6574
MDC Environmentally Endangered Lands (EEL)	305-372-6687, eel@miamidade.gov
MDC Fire Rescue	786-331-5000, mdfrd@miamidade.gov
MDC Natural Areas Management (NAM)	305-257-0933
MDC Parks, Recreation and Open Spaces (PROS)	305-755-7800
MDC Public Schools	305-995-1000
NOAA	305-229-4522
Ram Realty (Coral Reef Commons)	561-630-6110 (Main office)
Robert Morgan School	305-253-9920
South Florida Water Management District	561-686-8800 (Main office)
University of Miami CSTARS	305-421-4950, Cstars-admin@cstars.miami.edu
US Army, LTC Luis E. Martinez Center	305-378-4800 786-573-7882 Kevin.M.Williams20.ctr@mail.mil
US Coast Guard, Civil Engineering Unit	305-278-6700
US Coast Guard Communication Station Miami	Keith.W.Wright@uscg.mil
US Fish and Wildlife Services, South Florida Ecological Services Field Office, Vero Beach, FL	772-562-3909, verobeach@fws.gov, Roxanna_hinzman@fws.gov
Zoo Miami	305-251-0400, J.Carol.Kruse@miamidade.gov

APPENDIX 6: Sample Burn Plan for Miami-Dade County

Miami-Dade County
Parks, Recreation and Open Spaces
Environmentally Endangered Lands

PRESCRIBED BURNING PLAN
(PRESCRIPTION)

Forestry Center/ District: D-18			**Authorization Number:**		
Landowner: Miami-Dade County / Parks, Recreation and Open Spaces					
Site Name: **Address:**			**Telephone Number:** (305)257-0933 **ext:**		
- LOCATION -					
County: Miami- Dade	**Section**	**Township**	**Range**		
	34	55	40		
Latitude			**Longitude**		
Deg: 25	**Min:** 36	**Sec:** 25.74	**Deg:** W80	**Min:** 19	**Sec:** 07.07
Acres to Burn: 0.5				**Previous Burn Date:** N A	
Stand Description: Open South Florida Slash Pine Rockland. Also called- Pinus elliottii var. densa					
Overstory Type: South Florida Slash moderate overstory	**Understory Type:** Palmetto interspersed with Herbaceous grasses and some exotic grasses,		**Height to Bottom of Crown:** 5-30 feet		
Fuel Description: Grasses and herbaceous shrubs with pockets of palmettos.	**Fuel Model:** 7		**Topography and Soil:** Southern aspect with no topography. inorganic soil bed.		
Purpose of the Burn: Maintenance and restoration of rare plants.	**Burn Objectives:** Create patches of bare ground conducive to the growth of rare plant species.				
Firing Techniques & Ignition Methods: Burn Box. All Ground ignition Backing fires, Strip head fires ,Flanking fires, Spot fires, head fires.					
Personnel Needs: Crew, minimum of 4 fire crew personnel.	**Equipment Needs:** 1 Type 6 engine, 1 1500-gallon tanker, burn box.				
Maximum Crown Scorch Acceptable: 10-40%	**Passed Smoke Screening System:** ☒ YES ☐ NO				
List Possible Smoke-Sensitive Areas: surrounding dense housing.					
Special Precautions: Dehydration , Poisionwood , uneven footing if inside burn unit, Keep hydrated throughout the duration of RX burn.					
Adjacent Landowners to Notify: Landowner has notified adjacent landowners					

WEATHER FACTORS	PREFERRED	ACTUAL
Surface Winds	<20 , Any	
Transport Winds	Any	
Minimum Mixing Height	Any	
Dispersion Index (DAY)	70 Max 24 Min	
Dispersion Index (NIGHT)	6 Min	
Maximum Temperature	< 95 Max 90 under Stand	
Minimum Relative Humidity	> 35%	
Fine Fuel Moisture	6% Min	
Rate of Spread	1-5 Chains per hour	
Starting Time	10:00 Am	
Burn Technique	Test fire, Burn Box	
Flame Length	1-10 Feet	

MONITORING & EVALUATION PROCEDURES

PRE-BURN	BURN	POST BURN
Check weather parameters and burn line hazzards	Safety of Personel, Moniter ROS , flame height and intensity- Moniter weather wind speed, RH , Tempature, and Direction.	

Days Since Rain: 1-10 days	**Date Burned**:	

BURN CHECK LIST

FIRE BOSS: Check each item to indicate compliance.

- ☐ All prescription requisites met (preparation and day of burn).
- ☐ Authorization obtained.
- ☐ Adjacent landowners notified within past seven days of plan to burn.
- ☐ Local contacts made day of burn to advise (FHP, SO, Fire Dept., media, etc.)
- ☐ Smoke screening performed and documented.
- ☐ All equipment required on scene and fully operational.
- ☐ Each crew member has proper personal gear and clothing.
- ☐ Low Visibility Risk Index checked.
- ☐ Smoke on the Highway signs in place, if needed.
- ☐ Test burn performed and fire behavior within expectations.

CREW BRIEFING

- ☐ Objectives of burn.
- ☐ Exact area of burn.
- ☐ Hazards discussed (volatile fuels, spotting potential, weak points in perimeter lines, terrain features, etc.).
- ☐ Crew Assignments made.
- ☐ Ignition technique and pattern. Holding method(s).
- ☐ Location of extra equipment, fuel, water, vehicle keys.
- ☐ Authority and communications.
- ☐ Contingencies covered including escape routes or procedures.
- ☐ Sources of nearest assistance. Nearest phone and emergency numbers.
- ☐ Special instructions regarding smoke management, contact with the public and others.
- ☐ Questions.
- ☐ Crew members given opportunity to decline participation (is there anything that is going to prevent full physical performance?).

Prescription Done by: Dallas Hazelton	**Certification Number**:20023098
Title: Project Supervisor	**Date**:08/12/2014
CERTIFIED BURN MANAGER SIGNATURE:	
Reviewed by:	**Date:**

APPENDIX 7: Funding resources

Many resources are available to fund native habitat restoration. Two important, larger funding sources are listed below. Other funds are often available for research and outreach. For example, both the Florida Native Plant Society and the Florida Exotic Pest Plant Council have several small grant program (under $2500) for small projects. Additionally, the Florida Invasive Species Partnership keeps an updated list of potential funding assistance on their website, www.floridainvasives.org.

1. Florida Fish and Wildlife Conservation Commission's Upland Invasive Plant Management Program. The Uplands Program funds invasive plant control projects on public conservation land, based upon the recommendations from its eleven Regional Working Groups. To maximize operational funding of projects, the Uplands Program contracts with private vegetation management companies on a per-acre, lowest bid basis to perform work. The program also contracts on a limited basis with five other government agencies. No funds are granted to the managing agency; rather, all financial obligations are handled by the Uplands Program. Funding for the program is provided as set forth in Section 369.252(4), Florida Statutes, which reads: "Use funds in the Invasive Plant Control Trust Fund as authorized by the Legislature for carrying out activities under this section on public lands. A minimum of 20 percent of the amount appropriated by the Legislature for invasive plant control from the Land Acquisition Trust Fund shall be used for the purpose of controlling nonnative, upland, invasive plant species on public lands." Total funding for the Uplands Program in 2017 was $18 million.
http://myfwc.com/media/3006665/uplands-program-proposals-handbook.pdf

2. Florida statewide endangered and threatened plant conservation program. The Florida Endangered and Threatened Plant Conservation Program originated in 1992 to work toward the recovery of federally-listed endangered and threatened plant species in Florida. This program is open to any individual or non-federal institution planning to conduct a project to conserve federal- and state-regulated rare plants. These projects are funded on an annual basis only, and multi-year projects have no guarantee of successive funding. No projects may occur on federal lands.
The program is funded through grants from the U. S. Department of Interior, Fish and Wildlife Service (USFWS) under Section 6 of the U. S. Endangered Species Act. The program issues small to medium-size grants commonly ranging from $1,000 to $20,000 per year. These grants are given as 75:25 matching funds. Each project is responsible for acquiring the project's match (25%) for the federal funds (75%). The goal of the Florida Plant Conservation Program is to restore and maintain existing populations of listed plants on public land and on private lands managed for conservation purposes. Previous or ongoing projects address demography, monitoring, reintroduction, germination, pollination, and other aspects of population ecology.
http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Our-Forests/Forest-Health/Florida-Statewide-Endangered-and-Threatened-Plant-Conservation-Program

3. USFWS Partners for Fish and Wildlife Program. This nationwide program, which began in 1987, provides technical and financial assistance to private landowners who are willing to work with USFWS and other partners on a voluntary basis to help meet the habitat needs of federally listed species. The Partners program can assist with planning, implementation, and monitoring of projects. Contact Nicole Adimey, Southeast Regional Coordinator. 404-679-7138, Nicole_Adimey@fws.gov.
https://www.fws.gov/partners/aboutus.html

4. USFWS Coastal Program. Like the Partners program, the USFWS Coastal Program strives to conserve rare species habitat. However, this program is not limited to private landowners. Locally-based staff provide technical assistance for habitat conservation design and planning, as well as financial assistance for habitat restoration and protection projects. Contact Kevin Kalasz, Coastal Program Coordinator - South Florida/Everglades, U.S. Fish and Wildlife Service, for more information. Office: 305-872-2239 x231, Cell: 772-205-7140.

APPENDIX 8: Floristic inventory of the Richmond pine rocklands from The Institute for Regional Conservation

The following table lists all of the vascular plants currently found Richmond pine rocklands, as well as some species that were previously known to be present but are now considered to be possibly extirpated. The "Presence" column indicates County preserves were each taxon is found: Larry & Penny Thompson Memorial Park, Martinez Preserve, Zoo Miami, or the Gold Coast Railroad Museum. Some species are listed here which are not present on County property; these were documented in non-County lands (see Bradley et al. 2000). These data were provided by The Institute for Regional Conservation, and are available online at https://regionalconservation.org/ircs/database/database.asp.

		Presence			
Scientific Name	**Native Status**	**L&PT**	**MART**	**ZOO**	**GCRR**
Abildgaardia ovata	Native	X		X	
Abrus precatorius	Not Native, Naturalized	X	X	X	
Acacia auriculiformis	Not Native, Naturalized	X	X	X	
Acalypha chamaedrifolia	Native	X	X	X	X
Acalypha ostryifolia	Native	X			
Acer rubrum	Not Native, Naturalized			X	
Acrostichum danaeifolium	Native	X			
Aeschynomene viscidula	Native	X	X	X	
Agalinis fasciculata	Native	X	X	X	X
Agave sisalana	Not Native, Naturalized	X	X		
Albizia lebbeck	Not Native, Naturalized	X	X	X	
Aletris bracteata	Native	X		X	
Aletris lutea	Native		X		
Allamanda cathartica	Not Native, Naturalized	X			
Alysicarpus vaginalis	Not Native, Naturalized	X	X	X	
Amaranthus spinosus	Not Native, Naturalized	X			
Ambrosia artemisiifolia	Native	X	X	X	X
Ampelopsis arborea	Native	X			
Andropogon glomeratus var. *pumilus*	Native	X	X	X	X
Andropogon longiberbis	Native	X	X	X	
Andropogon ternarius	Native	X	X	X	
Andropogon tracyi	Native	X			
Andropogon virginicus var. *decipiens*	Native	X			
Anemia adiantifolia	Native	X	X	X	X
Angadenia berteroi	Native	X	X	X	X
Ardisia elliptica	Not Native, Naturalized	X	X		X
Ardisia escallonioides	Native	X		X	
Argemone mexicana	Native	X			
Argythamnia blodgettii	Native	X			
Aristida condensata	Native		X		
Aristida purpurascens	Native	X	X	X	X
Aristida stricta	Native	X		X	
Arnoglossum ovatum	Native		X		
Asclepias tuberosa	Native	X	X	X	X
Asclepias viridis	Native	X		X	

Asparagus aethiopicus	Not Native, Naturalized	X			
Ayenia euphrasiifolia	Native	X	X	X	X
Baccharis angustifolia	Native			X	
Baccharis glomeruliflora	Native	X		X	
Baccharis halimifolia	Native	X	X	X	
Bacopa monnieri	Native	X	X		
Bauhinia purpurea	Not Native, Cultiv. Only			X	
Berlandiera subacaulis	Native	X		X	
Bidens alba var. radiata	Native	X	X	X	X
Bischofia javanica	Not Native, Naturalized	X	X		
Blechnum serrulatum	Native	X			
Bletia purpurea	Native	X	X		
Boehmeria cylindrica	Native	X		X	
Bothriochloa pertusa	Not Native, Naturalized			X	
Bourreria cassinifolia	Native	X			
Brickellia mosieri	Native	X	X	X	
Buchnera americana	Native	X	X	X	X
Bulbostylis barbata	Not Native, Naturalized	X			
Bulbostylis ciliatifolia	Native	X	X	X	X
Bulbostylis stenophylla	Native	X			
Bursera simaruba	Native	X		X	X
Byrsonima lucida	Native	X	X	X	X
Callicarpa americana	Native	X	X	X	X
Canavalia brasiliensis	Not Native, Naturalized		X		X
Capraria biflora	Native	X			
Cardiospermum halicacabum var. *microcarpum*	Native	X			
Cassytha filiformis	Native	X	X	X	X
Casuarina equisetifolia	Not Native, Naturalized	X		X	X
Casuarina glauca	Not Native, Naturalized	X		X	
Catharanthus roseus	Not Native, Naturalized	X	X	X	X
Cenchrus echinatus	Native	X			
Cenchrus gracillimus	Native	X	X	X	
Centella asiatica	Native		X		X
Centrosema virginianum	Native	X	X	X	X
Chamaecrista deeringiana	Native	X	X	X	X
Chamaecrista nictitans var. *aspera*	Native	X	X	X	X
Chaptalia albicans	Native	X	X	X	
Chiococca parvifolia	Native	X	X	X	X
Chromolaena odorata	Native	X	X	X	X
Chrysobalanus icaco	Native	X			
Chrysophyllum oliviforme	Native	X			
Cirsium horridulum	Native	X	X	X	X
Cissus verticillata	Native	X	X	X	
Citrullus lanatus	Not Native, Naturalized	X			
Cladium jamaicense	Native	X	X		
Clematis baldwinii	Native	X	X	X	X
Cnidoscolus stimulosus	Native	X	X	X	X
Coccoloba uvifera	Not Native, Naturalized	X			
Coccothrinax argentata	Native	X	X	X	X
Commelina erecta	Native	X	X	X	

Conoclinium coelestinum	Native	X	X		
Conyza canadensis	Native	X	X	X	X
Corchorus hirsutus	Not Native, Naturalized	X			
Coreopsis leavenworthii	Native	X			
Crinum americanum	Native	X			
Crossopetalum ilicifolium	Native	X	X	X	X
Crossopetalum rhacoma	Native, Poss. Extirpated			X	
Crotalaria incana	Not Native, Naturalized	X			X
Crotalaria pallida var. *obovata*	Not Native, Naturalized	X	X	X	X
Crotalaria pumila	Native	X	X	X	X
Crotalaria retusa	Not Native, Naturalized			X	
Crotalaria rotundifolia	Native	X		X	
Crotalaria spectabilis	Not Native, Naturalized	X	X	X	
Croton glandulosus var. *septentrionalis*	Native	X	X	X	X
Croton linearis	Native	X	X	X	X
Cyanthillium cinereum	Not Native, Naturalized		X		
Cyperus compressus	Native	X			
Cyperus croceus	Native	X			
Cyperus filiculmis	Native			X	
Cyperus ligularis	Native	X		X	
Cyperus ochraceus	Not Native, Naturalized			X	
Cyperus ovatus	Native	X			
Cyperus polystachyos	Native	X			
Cyperus surinamensis	Native	X			
Cyrtopodium flavum	Not Native, Naturalized		X		
Dactyloctenium aegyptium	Not Native, Naturalized			X	
Dalbergia sissoo	Not Native, Naturalized		X	X	
Dalea carnea var. carnea	Native	X	X	X	
Delonix regia	Not Native, Naturalized		X		
Desmanthus virgatus	Native	X			
Desmodium floridanum				X	
Desmodium incanum	Native	X	X	X	X
Desmodium lineatum	Native	X	X		
Desmodium marilandicum	Native	X	X	X	X
Desmodium tortuosum	Not Native, Naturalized	X	X	X	
Desmodium triflorum	Not Native, Naturalized	X	X	X	
Dichanthelium aciculare	Native	X	X	X	
Dichanthelium ensifolium var. *unciphyllum*	Native	X		X	
Dichanthelium erectifolium	Native	X			
Dichanthelium ovale	Native	X	X	X	
Dichanthelium strigosum var. *glabrescens*	Native	X	X	X	
Digitaria bicornis	Not Native, Naturalized	X			
Digitaria ciliaris	Native			X	
Digitaria filiformis var. *dolichophylla*	Native	X			
Digitaria pauciflora	Native, Possibly Extirpated		X		
Diodia teres	Native	X		X	X
Diodia virginiana	Native	X			
Dioscorea bulbifera	Not Native, Naturalized		X		
Dodonaea viscosa var. *angustifolia*	Native	X			

Dyschoriste angusta	Native	X	X	X	X
Echites umbellatus	Native	X	X	X	X
Eleocharis geniculata	Native	X		X	
Eleusine indica	Not Native, Naturalized	X		X	
Elytraria caroliniensis var. *angustifolia*	Native	X	X		
Emilia fosbergii	Not Native, Naturalized	X			
Emilia sonchifolia	Not Native, Naturalized		X		
Eragrostis ciliaris	Not Native, Naturalized			X	
Eragrostis elliottii	Native	X	X	X	X
Erechtites hieraciifolius	Native				X
Eremochloa ophiuroides	Not Native, Naturalized	X		X	
Erigeron quercifolius	Native	X	X	X	
Ernodea cokeri	Native	X	X		
Eryngium baldwinii	Native	X	X		X
Eugenia uniflora	Not Native, Naturalized		X		
Eupatorium capillifolium	Native	X	X	X	X
Eupatorium compositifolium	Native				
Eupatorium leptophyllum	Native	X			
Eupatorium mikanioides	Native	X			
Eupatorium serotinum	Native	X			
Euphorbia blodgettii	Native	X			
Euphorbia conferta	Native	X	X	X	X
Euphorbia cyathophora	Native		X	X	X
Euphorbia deltoidea subsp. *deltoidea*	Native	X	X	X	
Euphorbia heterophylla	Native	X		X	
Euphorbia hirta	Native	X	X	X	
Euphorbia hypericifolia	Native	X	X	X	X
Euphorbia hyssopifolia	Native	X			
Euphorbia lasiocarpa	Not Native, Naturalized			X	
Euphorbia ophthalmica	Native	X			
Euphorbia pergamena	Native	X			X
Euphorbia pinetorum	Native	X	X	X	X
Euphorbia polyphylla	Native	X	X	X	X
Euphorbia porteriana	Native	X	X		
Eustachys glauca	Native	X	X		
Eustachys petraea	Native	X	X	X	X
Evolvulus sericeus	Native	X	X	X	
Ficus aurea	Native	X	X	X	X
Ficus citrifolia	Native	X	X	X	X
Ficus microcarpa	Not Native, Naturalized	X	X		X
Fimbristylis caroliniana	Native	X			
Fimbristylis cymosa	Not Native, Naturalized			X	
Flacourtia indica	Not Native, Naturalized		X		
Flaveria linearis	Native	X	X	X	X
Flaveria trinervia	Native		X		
Forestiera segregata	Native, Poss. Extirpated			X	
Galactia parvifolia	Native	X			X
Galactia pinetorum	Native	X	X	X	X
Galium bermudense	Native	X	X		
Guettarda scabra	Native	X	X	X	X

Gymnopogon ambiguus	Native	X			
Habenaria quinqueseta	Native	X	X		
Helenium pinnatifidum	Native	X			
Heliotropium polyphyllum	Native	X	X	X	X
Herissantia crispa	Native	X	X		
Heteropogon contortus	Doubtfully Native			X	
Hibiscus tiliaceus var. *tiliaceus*	Not Native, Naturalized			X	
Hieracium megacephalon	Native	X	X	X	X
Hymenocallis palmeri	Native	X			
Hypericum brachyphyllum	Native		X		
Hypericum hypericoides	Native	X			
Hypoxis sessilis	Native	X			
Hyptis alata	Native	X	X		
Ilex cassine	Native	X			
Imperata brasiliensis	Native	X	X		
Indigofera hirsuta	Not Native, Naturalized	X			
Indigofera spicata	Not Native, Naturalized	X		X	
Indigofera suffruticosa	Not Native, Naturalized	X	X	X	
Ipomoea alba	Native	X			
Ipomoea indica	Native	X	X		X
Ipomoea microdactyla	Native	X	X		
Ipomoea tenuissima	Native	X	X		X
Ipomoea triloba	Not Native, Naturalized	X		X	
Iresine diffusa	Native	X			
Iva microcephala	Native	X		X	
Jacquemontia curtisii	Native	X	X	X	X
Jasminum fluminense	Not Native, Naturalized	X			
Juncus megacephalus	Native			X	
Juniperus virginiana	Not Native, Naturalized		X		
Kalanchoe pinnata	Not Native, Naturalized		X		
Koanophyllon villosum	Native	X	X		
Lactuca graminifolia	Native	X			X
Lantana camara	Not Native, Naturalized	X	X	X	X
Lantana depressa var. *depressa*	Native	X	X	X	X
Lantana involucrata	Native	X	X	X	X
Lechea sessiliflora	Native	X			
Lechea torreyi	Native		X		
Lepidium virginicum	Native	X			
Leucaena leucocephala	Not Native, Naturalized	X	X	X	
Liatris gracilis	Native	X	X		X
Liatris tenuifolia var. *quadriflora*	Native	X	X	X	X
Licania michauxii	Native	X	X	X	
Linum arenicola	Native		X	X	
Linum carteri var. *smallii*	Native		X		
Lobelia glandulosa	Native	X			
Lobelia paludosa	Native	X			
Ludwigia octovalvis	Native	X			
Lyonia fruticosa	Native	X	X	X	
Lysiloma sabicu	Not Native, Naturalized			X	
Macroptilium lathyroides	Not Native, Naturalized	X	X	X	X

Malvastrum corchorifolium	Native	X			
Mangifera indica	Not Native, Cultiv. Only	X		X	
Mecardonia acuminata subsp. *peninsularis*	Native	X	X	X	X
Melaleuca quinquenervia	Not Native, Naturalized			X	
Melaleuca viminalis	Not Native, Naturalized			X	
Melanthera angustifolia	Native	X			
Melanthera parvifolia	Native	X	X	X	X
Melilotus albus	Not Native, Naturalized	X			
Melinis minutiflora	Not Native, Naturalized	X	X		
Melinis repens	Not Native, Naturalized	X	X	X	
Melothria pendula	Native	X			
Merremia dissecta	Not Native, Naturalized	X	X	X	X
Merremia tuberosa	Not Native, Naturalized		X		
Metastelma blodgettii	Native	X	X	X	X
Metopium toxiferum	Native	X	X	X	X
Mikania scandens	Native	X	X	X	X
Millettia pinnata	Not Native, Naturalized			X	
Momordica charantia	Not Native, Naturalized	X	X	X	X
Morinda royoc	Native	X	X	X	X
Mosiera longipes	Native	X	X	X	X
Mucuna pruriens	Not Native, Naturalized	X	X	X	
Muhlenbergia capillaris	Native	X	X	X	X
Muntingia calabura	Not Native, Naturalized	X			
Murraya paniculata	Not Native, Cultiv. Only			X	
Myrica cerifera	Native	X	X	X	X
Myrsine cubana	Native	X	X	X	X
Nephrolepis brownii	Not Native, Naturalized	X	X		
Nephrolepis exaltata	Native	X	X	X	X
Neptunia pubescens	Native	X	X	X	
Neyraudia reynaudiana	Not Native, Naturalized	X	X	X	X
Ocimum campechianum	Native	X			
Oeceoclades maculata	Not Native, Naturalized	X	X	X	X
Oenothera simulans	Native	X	X	X	X
Opuntia humifusa	Native	X	X	X	X
Oxalis corniculata	Native	X			
Paederia cruddasiana	Not Native, Naturalized	X		X	
Panicum dichotomiflorum var. *dichotomiflorum*	Native			X	
Panicum hemitomon	Native		X		
Panicum maximum	Not Native, Naturalized	X		X	
Panicum repens	Not Native, Naturalized		X		
Panicum rigidulum	Native	X			
Panicum tenerum	Native	X			
Parthenium hysterophorus	Not Native, Naturalized	X			X
Parthenocissus quinquefolia	Native	X	X	X	X
Paspalum blodgettii	Native	X			
Paspalum caespitosum	Native	X	X	X	X
Paspalum malacophyllum	Not Native, Naturalized			X	
Paspalum monostachyum	Native	X	X	X	X
Paspalum notatum	Not Native, Naturalized	X		X	

Paspalum paniculatum	Not Native, Naturalized		X		
Paspalum setaceum	Native	X	X	X	X
Paspalum urvillei	Not Native, Naturalized	X			
Passiflora suberosa	Native	X	X	X	X
Pectis glaucescens	Native	X	X	X	X
Pectis x floridana	Native	X			
Pennisetum purpureum	Not Native, Naturalized	X		X	
Penstemon multiflorus	Native	X			
Pentalinon luteum	Native	X			
Persea americana	Not Native, Cultiv. Only		X	X	
Persea palustris	Native	X	X		
Phlebodium aureum	Native	X	X	X	X
Phyla nodiflora	Native	X	X	X	X
Phyllanthus amarus	Not Native, Naturalized		X		
Phyllanthus caroliniensis subsp. *saxicola*	Native	X	X		
Phyllanthus pentaphyllus var. *floridanus*	Native	X	X	X	X
Phyllanthus tenellus	Not Native, Naturalized	X			
Phymatosorus grossus	Not Native, Naturalized		X		
Physalis walteri	Native	X	X	X	X
Physostegia purpurea	Native	X			
Phytolacca americana	Native	X	X		
Pilea microphylla	Native	X	X	X	
Piloblephis rigida	Native	X	X	X	
Pinus elliottii var. densa	Native	X	X	X	X
Piriqueta cistoides subsp. *caroliniana*	Native	X	X	X	X
Pityopsis graminifolia	Native	X	X	X	X
Pityrogramma trifoliata	Native	X			
Pleopeltis polypodioides var. *michauxiana*	Native		X		
Pluchea baccharis	Native	X	X	X	X
Pluchea carolinensis	Not Native, Naturalized	X	X	X	X
Pluchea odorata	Native	X			
Polygala balduinii	Native	X			
Polygala incarnata	Native	X	X		
Polygala smallii	Native			X	
Polygala violacea	Native	X	X	X	X
Polypremum procumbens	Native	X	X	X	X
Psidium guajava	Not Native, Naturalized	X		X	X
Psilotum nudum	Native	X	X	X	X
Psychotria ligustrifolia	Native	X			
Psychotria nervosa	Native		X		
Psychotria tenuifolia	Native		X		
Pteridium caudatum	Native	X	X	X	X
Pteris bahamensis	Native	X	X	X	X
Pteris vittata	Not Native, Naturalized	X	X	X	X
Pteris x delchampsii	Not Native, Naturalized	X	X		X
Pterocaulon pycnostachyum	Native	X	X	X	X
Pteroglossaspis ecristata	Native	X		X	
Quercus minima	Native	X	X	X	
Quercus pumila	Native	X	X	X	X
Quercus virginiana	Native	X	X	X	X

Randia aculeata	Native	X	X	X	
Rhus copallinum	Native	X	X	X	
Rhynchosia cinerea	Native			X	
Rhynchosia minima	Native	X	X	X	X
Rhynchosia parvifolia	Native	X			
Rhynchosia reniformis	Native	X	X	X	X
Rhynchospora colorata	Native	X	X		X
Rhynchospora divergens	Native		X		
Rhynchospora floridensis	Native	X	X	X	X
Rhynchospora grayi	Native	X	X	X	
Rhynchospora plumosa	Native	X			
Richardia brasiliensis	Not Native, Naturalized	X			
Richardia grandiflora	Not Native, Naturalized	X	X	X	
Ricinus communis	Not Native, Naturalized	X	X	X	X
Rottboellia cochinchinensis	Not Native, Naturalized	X			
Ruellia blechum	Not Native, Naturalized	X			
Ruellia succulenta	Native	X	X	X	X
Sabal palmetto	Native	X	X	X	X
Sabatia stellaris	Native	X			
Saccharum giganteum	Native	X			
Sachsia polycephala	Native	X	X		
Salix caroliniana	Native	X		X	
Sambucus nigra subsp. *canadensis*	Native	X		X	
Samolus ebracteatus	Native	X	X		X
Sansevieria hyacinthoides	Not Native, Naturalized	X			
Schefflera actinophylla	Not Native, Naturalized	X	X	X	X
Schinus terebinthifolius	Not Native, Naturalized	X	X	X	X
Schizachyrium gracile	Native	X	X	X	X
Schizachyrium rhizomatum	Native	X	X	X	X
Schizachyrium sanguineum	Native	X	X	X	X
Schoenus nigricans	Native		X		
Scleria ciliata var. ciliata	Native	X	X	X	
Scleria ciliata var. curtissii	Native	X			
Scoparia dulcis	Native	X			
Scutellaria havanensis	Native	X			
Selaginella arenicola	Native			X	
Selaginella eatonii	Native		X	X	
Senna mexicana var. *chapmanii*	Native	X		X	
Senna obtusifolia	Native	X		X	
Senna occidentalis	Not Native, Naturalized	X			
Serenoa repens	Native	X	X	X	X
Sesbania herbacea	Native	X			
Setaria parviflora	Native	X	X	X	X
Sida acuta	Native	X	X	X	X
Sida elliottii	Native	X	X	X	X
Sida rhombifolia	Native	X	X		
Sideroxylon reclinatum subsp. *austrofloridense*	Native	X			
Sideroxylon salicifolium	Native	X			X
Sisyrinchium angustifolium	Native	X		X	
Sisyrinchium nashii	Native		X		X

Smilax auriculata	Native	X	X	X	X
Smilax bona-nox	Native		X		X
Smilax havanensis	Native	X	X	X	
Solanum donianum	Native	X		X	
Solanum lycopersicum	Not Native, Naturalized	X			
Solidago leavenworthii	Native	X	X	X	X
Solidago odora var. *chapmanii*	Native	X	X	X	X
Solidago stricta	Native	X	X		X
Sonchus asper	Not Native, Naturalized	X			
Sonchus oleraceus	Not Native, Naturalized	X		X	
Sorghastrum secundum	Native	X	X	X	X
Spartina bakeri	Native	X			
Spermacoce neoterminalis	Native	X	X	X	X
Spermacoce prostrata	Native	X			
Spermacoce remota	Native	X			
Spermacoce tetraquetra	Native	X		X	
Spermacoce verticillata	Not Native, Naturalized	X	X	X	X
Sphagneticola trilobata	Not Native, Naturalized	X	X	X	X
Sphenomeris clavata	Native	X		X	
Spigelia anthelmia	Native	X	X	X	
Spiranthes torta	Native		X		
Sporobolus junceus	Native	X	X	X	
Sporobolus pyramidalis	Not Native, Naturalized	X	X	X	
Stachytarpheta cayennensis	Not Native, Naturalized	X			
Stachytarpheta jamaicensis	Native	X	X	X	X
Stenandrium dulce	Native	X	X		
Stenaria nigricans var. *floridana*	Native	X	X	X	
Stenotaphrum secundatum	Not Native, Naturalized	X		X	X
Stillingia sylvatica	Native	X	X	X	X
Stylosanthes hamata	Native			X	
Swietenia mahagoni	Not Native, Naturalized	X	X	X	
Symphyotrichum adnatum	Native	X	X	X	X
Symphyotrichum bahamense	Native	X		X	
Symphyotrichum concolor	Native	X	X	X	
Symphyotrichum dumosum	Native	X			X
Symphyotrichum elliottii	Native	X			
Syzygium jambos	Not Native, Cultiv. Only		X		
Tabebuia aurea	Not Native, Naturalized	X		X	
Tabebuia heterophylla	Not Native, Naturalized			X	
Tecoma stans	Not Native, Naturalized	X			
Tectaria fimbriata	Native, Possibly Extirpated			X	
Tephrosia florida	Native	X	X	X	
Terminalia buceras	Not Native, Naturalized			X	
Tetrazygia bicolor	Native	X	X	X	X
Teucrium canadense	Native	X			
Thelypteris augescens	Native, Possibly Extirpated			X	
Thelypteris kunthii	Native	X	X	X	X
Thespesia populnea	Not Native, Naturalized	X			
Tiedmannia filiformis	Native	X			

Tillandsia paucifolia	Native	X			
Toxicodendron radicans	Native	X	X	X	X
Tradescantia spathacea	Not Native, Naturalized	X			
Tragia saxicola	Native	X	X	X	X
Tragia urens	Native	X	X	X	X
Trema lamarckiana	Native	X			
Trema micrantha	Native	X	X	X	X
Trichostema dichotomum	Native	X		X	
Tridax procumbens	Not Native, Naturalized	X		X	
Tripsacum floridanum	Native	X		X	
Triumfetta semitriloba	Not Native, Naturalized	X	X		
Turnera ulmifolia	Not Native, Naturalized	X			
Typha domingensis	Native	X		X	
Urena lobata	Not Native, Naturalized	X	X	X	
Vaccinium myrsinites	Native	X	X	X	X
Vachellia farnesiana var. *farnesiana*	Native	X		X	
Vachellia farnesiana var. *pinetorum*	Native	X			
Verbesina virginica	Native	X			
Vernonia blodgettii	Native	X	X	X	X
Vigna luteola	Native	X	X		X
Vitis cinerea var. *floridana*	Native			X	
Vitis rotundifolia	Native	X	X	X	X
Vitis shuttleworthii	Native		X		
Vittaria lineata	Native	X	X		
Waltheria indica	Native	X	X	X	X
Ximenia americana	Native	X			
Youngia japonica	Not Native, Naturalized	X			
Zamia integrifolia	Native	X	X	X	X
Zornia bracteata	Native	X			
Zoysia japonica	Not Native, Naturalized			X	

APPENDIX 9: Letters of Support

During the development of this management plan, all Richmond land owners, managers, regulators, and other stakeholders (to the extent possible) were contacted and invited to submit a letter of support for an earlier draft of this management plan. The letters we received are included in the remainder of this document, and include submissions from:

- The US Fish and Wildlife Service, South Florida Ecological Services Office
- The Center for Biological Diversity
- University of Florida, Imperiled Butterflies of Florida Work Group
- The Institute for Regional Conservation
- The Nature Conservancy, South Florida Land Conservation Office
- Florida Natural Areas Inventory
- Dade Chapter of the Florida Native Plant Society

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

April 26, 2018

Jennifer Possley
Field Biologist and Conservation Team Leader
Fairchild Tropical Botanic Garden
10901 Old Cutler Road
Coral Gables, Florida 33156

Dear Ms. Possley:

The South Florida Ecological Services Office of the U.S. Fish and Wildlife Service (Service) has reviewed the Management Plan for the Richmond Pine Rocklands (Plan) drafted in collaboration with experts and land managers by scientists at Fairchild Tropical Botanic Gardens (FTBG).

The Richmond Pine Rocklands retain the largest contiguous areas of pine rockland habitat outside of the Everglades, a habitat that has been reduced by over 90 percent of its former extent in southern Florida. The Plan aims to restore, conserve, and protect this unique area of remaining habitat through coordination among land owners. The management goals and objectives outlined in the Plan are similar to those outlined in the Service's draft Pine Rockland Recovery Plan that is under development. Specifically, both plans recommend a suite of restoration activities (e.g., prescribed burns, removal of nonnative invasive plants, mechanical clearing) that will be implemented, reviewed, and adjusted, as needed, to maintain and protect the Richmond Pine Rocklands. These actions are necessary to help recover the numerous federally listed species endemic to the pine rocklands.

The actions outlined in the Plan, including habitat management and restoration, listed species surveys, monitoring, research, reintroductions, and public outreach are entirely congruent with the goals of the Service. Likewise, the Service believes that conservation organizations and local governments are well positioned to achieve the objectives of this Plan. The Service values these activities because they address specific needs for the conservation and recovery of Florida's imperiled pine rockland species.

We encourage activities that further the conservation of rare and imperiled pine rockland species, and we believe the management goals and objectives described in the Plan will benefit south Florida's most imperiled habitat.

If you have any questions, please contact David Bender at 772-469-4294 (plants), Mark Salvato at 772-469-4340 (butterflies), or Emily Bauer at 772-469-4335 (beetles).

Sincerely,

Constance L Cassler

acting for

Roxanna Hinzman
Field Supervisor
South Florida Ecological Services Office

CENTER for BIOLOGICAL DIVERSITY Because life is good.

July 5, 2018

Jennifer Possley
10901 Old Cutler Rd.
Miami, FL 33156
jpossley@fairchildgarden.org

RE: Miami-Dade County's Management Plan for Richmond Pine Rocklands, 2nd Edition

To Whom It May Concern:

On behalf of the Center for Biological Diversity (Center) and its more than 1.5 million members and supporters, I am pleased to offer this letter in support of Miami-Dade County's Management Plan for the Richmond Pine Rocklands, 2nd Edition. The Center is a nonprofit, public interest environmental organization dedicated to the protection of imperiled species and the habitat and climate they need to survive. With its Southeast office headquartered in St. Petersburg, Florida, the Center and its thousands of Florida members support the strongest protections for Florida's environment and wildlife, including Florida's imperiled pine rocklands.

Florida's Richmond Pine Rocklands are regarded as critically imperiled due to significant ecological degradation, conversion to other land uses, and outright destruction.[1] They are vital to the survival of many imperiled species.[2] As sea level rise becomes more intense, many species will lose their lower-lying pine rockland habitat, making the relatively high-elevation of the Richmond Pine Rocklands even more valuable to the survival of many rare South Florida species.

Over 300 species of native plants occur in the Richmond Pine Rocklands, 40 of which are endemic to South Florida.[3] Eight plant species and seven animal species are federally listed as endangered or threatened, and four of these species have critical habitat designated with in the Richmond Pine Rocklands – the Florida Brickell-bush, Carter's small-flowered flax, Bartram's scrub-hairstreak butterfly, and the Florida leafwing butterfly. As sea levels rise and flood coastal Florida, the inland Richmond Pine Rocklands will become even more important for these species' survival.

[1] Bergh, C. and J. Wisby, Fire History of Lower Keys Pine Rocklands, The Nature Conservancy, Florida Keys Initiative, May 1996 at 1.
[2] *Id.*
[3] Gann, G.D. Stocking C.G., and collaborator. 2001-2018. The floristic inventory of South Florida Database Online. The Institute for Regional Conservation. Delray Beach, Florida USA.

Alaska . Arizona . California . Florida . Minnesota . Nevada . New Mexico . New York . Oregon . Vermont . Washington, DC
Jaclyn Lopez, Staff Attorney Florida Director • P.O. Box 2155 • St. Petersburg, FL 33731
Phone: 727-490-9190 • jlopez@biologicaldiversity.org

In 2015, the U.S. Fish and Wildlife Service (FWS) designated critical habitat for the Florida Brickell-bush and Carter's small-flowered flax,[4] two plants native to pine rockland habitat in Miami-Dade County.[5] The designated habitat in the Richmond Pine Rocklands will provide habitat as sea level rise inundates the lowering lying habitat.[6]

Once abundant throughout Miami-Dade and Monroe counties, the Bartram's scrub-hairstreak butterfly population has significantly declined. This butterfly's entire lifecycle occurs within pine rockland habitat. Due to its decline and the extreme importance of its pine rockland habitat, FWS designated over 11,000 acres of critical habitat. As rising sea levels will likely swallow up part of its habitat on Big Pine Key in the Florida Keys in the next 50 to 100 years,[7] the preservation of the remaining Richmond Pine Rocklands is critical to prevent the butterfly's extinction.

The Florida leafwing butterfly was once abundant on Big Pine Key, Long Pine Key and the South Florida Pine Rocklands, is but due to habitat destruction, nonnative species invasion, insecticide use, and butterfly collecting, FWS designated over 10,000 acres of critical habitat.[8] The Richmond Pine Rocklands will be a lifeboat to this butterfly when the habitat on Long Pine Key is lost to the rising sea.[9]

We have reviewed Miami-Dade County's Management Plan for the Richmond Pine Rockland, 2nd Edition, and agree with the background information presented in Sections I, II and III of the plan. We support the County's management goals, objectives and actions that are described in Section IV of the plan.

We look forward to working with you in pursuit of the plan's vision.

Please don't hesitate to contact Jaclyn Lopez, Florida Director, at (727) 490-9190 or jlopez@biologicaldiversity.org about this letter.

Sincerely,
Kaitlynn Reneke | Policy Intern
kreneke@biologicaldiversity.org

On behalf of
Jaclyn Lopez
Senior Attorney | Florida director
Center for Biological Diversity
P.O. Box 2155 | St. Petersburg, Florida 33731
jlopez@biologicaldiversity.org | 727-490-9190

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[4] Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Brickellia mosieri (Florida Brickell-bush) and Linum carteri var. carteri (Carter's Small-flowered Flax). Vol. 80 No. 158. 50 CFR Part 17. August 17, 2015. https://www.gpo.gov/fdsys/pkg/FR-2015-08-17/pdf/2015-19533.pdf
[5] *Id.*
[6] *Id.*
[7] *Id.*
[8] *Id.*
[9] *Id.*

UF UNIVERSITY of FLORIDA

Florida Museum of Natural History
McGuire Center for Lepidoptera and Biodiversity

308 Hull Road
PO Box 112710
Gainesville, FL 32611-2710
352-392-5894
352-392-0479 Fax

June 25, 2018

Re: Second edition of Miami-Dade County's Management Plan for the Richmond Pine Rockland

Dear Review Committee:

I am writing on behalf of Florida's Imperiled Butterflies Work Group (IBWG) in strong support of the Miami-Dade County Management Plan for the Richmond Pine Rockland. This Plan will address the conservation needs of multiple species, including the federally endangered Bartram's scrub hairstreak (*Strymon acis bartrami*) along with the critical habitat that was also designated in 2014 within Miami-Dade County. The Bartram's scrub-hairstreak, like many endemics, occurs only within pine rocklands, specifically those that retain the only known larval hostplant, pineland croton.

In addition to federally listed species, many other imperiled butterflies that depend on pine rockland habitat for their survival will benefit from this Management Plan. The proposed Plan will help enhance the long-term conservation of Florida's butterflies through directed land management and recovery planning in pine rocklands. This Plan will directly support the IBWG mission: To increase or stabilize imperiled butterfly populations in Florida, safeguard important habitats, and strategically plan, using an adaptive management process. Specifically, it will provide coordinated management recommendations that are necessary for the persistence of species with host plant dependencies and limited dispersal abilities like many butterflies and other critical pollinators.

The IBWG includes representatives from Federal, State, local and private agencies, entities and organizations that strongly support this worthwhile effort and will look forward to participating in the implementation of this Plan.

Sincerely;

Mary R Truglio
Imperiled Butterflies of Florida Work Group Leader
561-628-1553
mrtruglio@flmnh.ufl.edu

THE INSTITUTE FOR REGIONAL CONSERVATION

100 E. LINTON BLVD. SUITE 302B DELRAY BEACH, FL 33483

June 30, 2018

To Whom It May Concern:

The Institute for Regional Conservation (IRC) has participated in the review of Miami-Dade County's Management Plan for the Richmond Pine Rockland, 2nd Edition. We agree in principle with the background information presented in Sections I, II and III of the plan, and commend the authors and contributors for the extensive detail. Furthermore, we support the County's management goals, objectives and actions that are described in section IV of the plan, and applaud in advance the official approval of this excellent and timely guidance document.

Our primary recommendation is that this plan be reviewed and updated no less than every three years concerning the technical detail in the management objectives and actions. The restoration and management of native ecosystems is a rapidly evolving field, and only through regular and frequent adaptive management will be successful in meeting our goals. This is especially true of quantitative objectives (e.g., % cover of natives and exotics) and specific techniques mentioned in the plan.
IRC looks forward to partnering with Miami-Dade County and other agencies in pursuit of the plan's vision and providing technical expertise in its implementation.

Sincerely,

George

George D. Gann

Chief Conservation Strategist & Chair of the Board, The Institute for Regional Conservation
Chair, Science and Policy Committee, Society for Ecological Restoration
Global Restoration Ambassador & Emeritus Chair of the Board, Society for Ecological Restoration
Member, North American Plant Red List Authority, IUCN Species Survival Commission

www.regionalconservation.org

The Nature Conservancy
Protecting nature. Preserving life.™

South Florida Land Conservation
574 South Beach Rd.
Hobe Sound, Florida 33455

Tel: (561) 744-6668
nature.org

June 1, 2018

To Whom It May Concern:

The Nature Conservancy has reviewed Miami-Dade County's Management Plan for the Richmond Pine Rockland, 2nd. Edition. Based on our longstanding efforts to study, protect, and manage pine rocklands and other natural communities in Florida and the Bahamas, we agree with the background information presented in Sections I, II and III of the plan. Furthermore, we support the County's management goals, objectives and actions that are described in section IV of the plan.

We look forward to working with Miami-Dade County and other agencies and organizations in pursuit of the plan's vision.

Please feel free to contact me by phone at (561) 744-6668 ext. 104 or by email at sarah.martin@tnc.org if you have further questions for The Nature Conservancy regarding management of pine rockland habitat.

Sincerely,

Sarah Martin, South Florida Land Conservation Coordinator

FLORIDA
Natural Areas
INVENTORY

1018 Thomasville Road
Suite 200-C
Tallahassee, FL 32303
850-224-8207
fax 850-681-9364
www.fnai.org

June 14, 2018

To Whom It May Concern,

Florida Natural Areas Inventory (FNAI) reviewed the Miami-Dade County's Management Plan for the Richmond Pine Rockland, 2nd. Edition and appreciate that our comments were considered in its revision. We applaud Miami-Dade County's efforts to conserve the rare species and habitats which they manage through these planning efforts.

We support the County's management goals, objectives, concepts, and intentions in this plan. Furthermore, we appreciate that the plan includes measureable objectives and an ambitious monitoring effort planned to quantitatively evaluate success of the management efforts.

FNAI serves as Florida's natural heritage program and retains the largest and most comprehensive database of rare species and natural communities. As such, FNAI believes that the biological element and natural community descriptions in this plan are comprehensive and the imperiled species section is thorough and informative.

FNAI recognizes proper management of pine rockland habitat to be priority to protect Florida's natural heritage. For this reason, comprehensive management plans such as this provide an invaluable contribution to promoting conservation and protecting biodiversity. FNAI looks forward to working with Miami-Dade County and other agencies in pursuit of the plan's vision as a partner to promote science for conservation. Please feel free to contact me with any questions.

Sincerely.

Dan Hipes, Director

Florida Resources
and Environmental
Analysis Center

Institute of Science
and Public Affairs

The Florida State University

Tracking Florida's Biodiversity

Dade Chapter of the
Florida Native Plant Society
6619 South Dixie Highway, #181
Miami, FL 33143

June 25, 2018

To Whom It May Concern:

The Dade Chapter of the Florida Native Plant Society (DCFNPS) has reviewed Miami-Dade County's Management Plan for the Richmond Pine Rockland, 2nd. Edition. We agree with the background information presented in Sections I, II and III of the plan. Furthermore, we support the County's management goals, objectives and actions that are described in section IV of the plan.

DCFNPS looks forward to working with Miami-Dade County and other agencies in pursuit of the plan's vision.

If you have further questions about management of pine rockland on property, the Native Plant Society and its Chapters, please contact me at 305-985-3677 or dadefnps@gmail.com.

Sincerely,

Kurt Birchenough

Chapter President

DCFNPS

FNPS promotes preservation, conservation, and restoration of Florida's native plants and native plant communities.

http://dade.fnpschapters.org (305) 985-FNPS