Vascular Plant Species of Management Concern in Everglades National Park

Final Report

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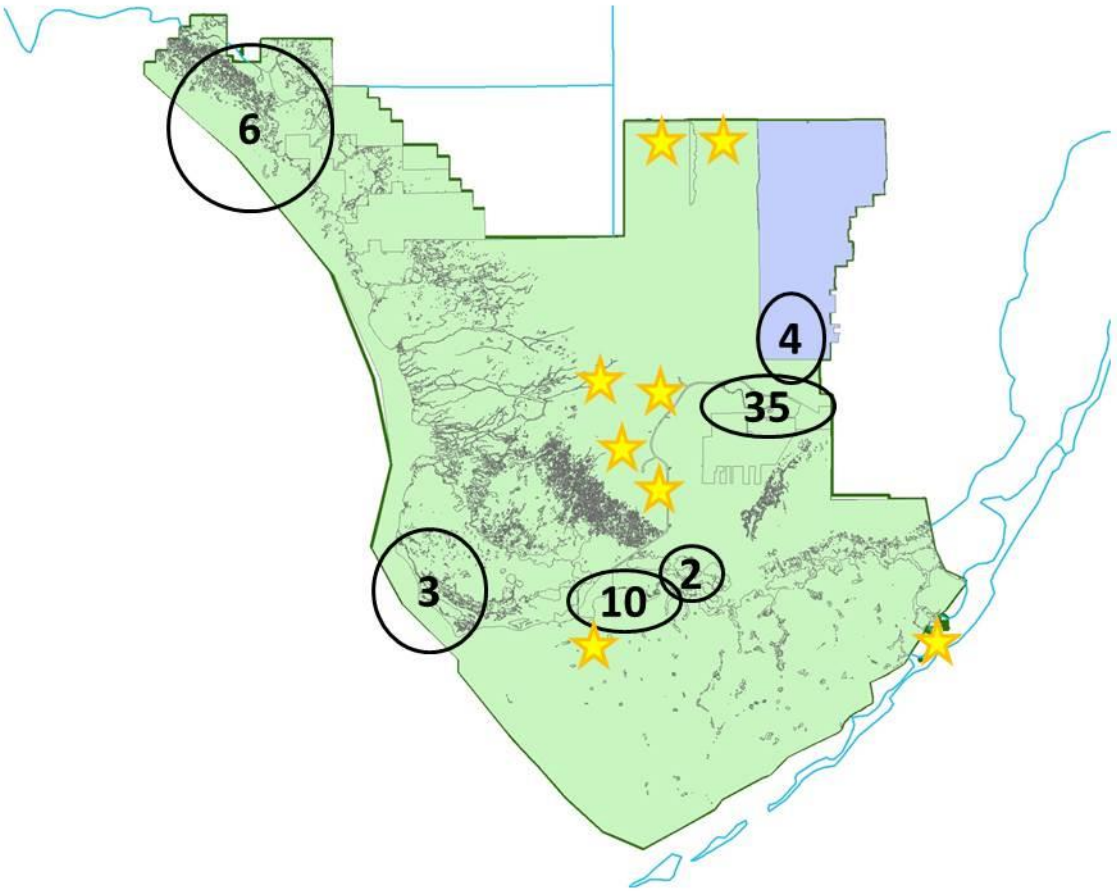

Submitted to
Jimi Sadle, Botanist
Everglades and Dry Tortugas National Parks

Executive Summary

This document compiles and summarizes existing published and unpublished literature, collection records and observational data on rare plant species that are currently or were previously reported as naturally occurring in Everglades National Park (EVER). It also serves as a framework for implementing National Park Service policy concerning the management of threatened and endangered species and other species of special management concern, identified herein as vascular plant Species of Management Concern (SOMCs). This document provides a baseline list of plant SOMCs that are a known part of the EVER flora, historically and in the present. Because of the overwhelming number of rare vascular plant species protected in EVER, the intent of this report is to use the SOMC designation to focus attention and resources on the most vulnerable plants in the region and those species of regulatory interest to the federal government. However, gaps in knowledge and vulnerabilities of other rare plants not designated as SOMCs are also discussed.

A review of the entire native flora of Everglades National Park (762 taxa) is presented, divided into ten logical groups (e.g., trees, ferns, graminoids). Areas of special geographic interest for each group are indicated (e.g., a special concentration of species limited to the Long Pine Key area) as well as the general distribution of rare plants within EVER for each group. Potential vulnerabilities to sea level rise are indicated where relevant. Species accounts for 59 SOMC plants are provided, including background, conservation status, history in EVER, and a summary of recommendations for research and management.

Forty-six percent of the orchids in EVER are SOMCs. This group has been most impacted by human activities during documented history. Orchids are followed by ferns (24%) and other epiphytes (18%), and these results are consistent with those published for all of South Florida in Rare Plants of South Florida (Gann *et al.* 2002). The monocot forb group was the only group with no classified SOMCs, and all of the taxa in that group have at least some wetland affinity. SOMCs found exclusively in wetlands account for only six taxa (10%), and these are scattered in a variety of vegetation types. SOMC populations are found in several areas in the park, but there are three areas of primary concentration. The Long Pine Key area has the greatest number of documented taxa (35), followed by the Flamingo area (10) and the northwestern coastal regions (6). Estimated numbers of plants for SOMC species ranged from zero (extirpated or extinct) to more than 1 million. Two taxa apparently extirpated from the park, one terrestrial orchid and one grass, may represent global extinctions.

Historical damage to rare plant populations in EVER is primarily linked to poaching and/or over collecting (e.g., orchids) and to hydrological modifications, especially drainage (e.g., ferns). Although poorly documented, habitat destruction related to charcoal making may have contributed to population declines in the Flamingo area, fire may have contributed to historical declines of populations in Long Pine Key hammocks, and hurricanes may have negatively affected some species in the Flamingo area and elsewhere in the park. Past concerns about fire management causing harm to rare plants in EVER do not appear to be valid at this time. Yet, current threats abound. Poaching (or over collecting) is still a potential threat for some orchid and fern species, as well as the long-term results of drainage. Of increasing concern are threats

from sea level rise (including storm surges) to coastal populations and competition from invasive exotic species. More than one-half of the remaining SOMCs have populations so small or localized that they are inherently at higher risk of localized extinction.

Much has been learned about rare plants in EVER in the last decade, but significant works remains. Some plant groups (e.g., grasses and other herbaceous plants) are not well documented in the park and more scientific vouchering is needed. Additional surveying work is also needed in large, remote areas of the park. The mitigation of threats to SOMC plants is a major management challenge. Most pressing in the short term is enhanced invasive species control, especially in the coastal and backcounty regions of the park. Poaching and collecting also has the potential to significantly affect a subset of these imperiled species and needs to be prevented, reduced or eliminated. Priority should be given to species where these threats overlap.

Dealing with historical population losses and long-term threats such as sea level rise and historical modifications to regional hydrology will require even more thought and planning. In some cases, the restoration of extirpated populations and the augmentation of depleted populations has already begun, but it will be years before the outcome of these efforts will really be known. For ferns and other hammock plants in the Long Pine Key area, the theory is still that more water delivery, which would provide both more water and higher humidity, would be desirable. Only one fern may just now be experiencing a shift in regional water delivery, but its long-term response is not yet known. Similarly, efforts to plug canals and restore the historic freshwater hydrology of the southern coastline in advance of sea level rise would almost certainly have benefits for many rare plants in that region.

While there are many challenges to managing and even restoring populations of rare plants in EVER, many opportunities also present themselves. What is needed is to elevate the issue of plant biodiversity conservation to a level equivalent to that of other concerns, such as the restoration of regional hydrology and depleted wildlife populations or invasive animal control. In fact, achieving the goal of protecting this unique and diverse ecosystem requires it.

Acknowledgements

This document could not have been prepared without the extraordinary collaboration of EVER Botanist Jimi Sadle, who worked with IRC on the methods and structure of this project, provided critical review, collaborated on fieldwork, and supplied observational and herbarium specimen data, photographs and general support. Thanks also to former EVER Ecologist Thomas Armentano, who first invited IRC to submit a joint CESI proposal for the Long Pine Key rare plant work, from which many other projects sprang. IRC Research Associate Sonali Saha and former IRC biologist Keith Bradley helped design the project, worked on early drafts of this report and conducted a preliminary literature search. Saha and former IRC biologist Jesse Hoffman are to be acknowledged as filling the Everglades vegetation biologist position and conducting many of the rare plant surveys, especially in the coastal areas of the park. Saha also was the lead scientist (2010-2013) for IRC's sea level rise project, which first evaluated the potential vulnerability of rare plants to sea level rise in the park. From 2013 to 2014, IRC CEO Craig van der Heiden filled the role of lead scientist for that project, while IRC biologists James Johnson and James Lange conducted field work. Johnson, Lange and van der Heiden also assisted with fieldwork specific to this report. From 2003 to 2008, numerous individuals assisted with IRC's rare plant study on Long Pine Key (see Gann *et al.* 2009), but of special note were Jimi Sadle, Emilie Verdon Grahl, Kirsten Hines, Stephen Hodges and Steven Woodmansee. Woodmansee and Keith Bradley were coauthors both on IRC's book Rare Plants of South Florida (Gann *et al.* 2002) and Floristic Inventory of South Florida Database Online (Gann *et al.* 2001-2014), without which this project would not have been possible.

Bruce Hansen at the University of South Florida readily supplied herbarium label data and helped resolve confusing historical and taxonomic problems. Alan Franck, also at USF, and Mark Strong at the Smithsonian Institution, also provided herbarium label data, scans of images and other taxonomic assistance. The FNPS herbarium database online, which is managed by Fairchild Tropical Botanic Garden and the National Park Service, was indispensable to the project. Brett Jestrow at Fairchild provided label data and a review of specimens at FTG, and Fairchild interns Kristen Finch and Brittany Harris helped with rare plant ranking using the new NatureServe methodology, literature searches, and other tasks. Special thanks to Anne Frances and Amanda Treher of NatureServe and Amy Jenkins of FNAI for helping to normalize and update global, national and state ranks of rare plants. Jennifer Possley of Fairchild was of particular help working through some of the fern accounts. Celio Moya assisted with obtaining updated rare plant data from Cuba. Keith Bradley, James Johnson, Jennifer Possley, Roger Hammer, Keith Buttry, Sarah Martin, Paul Craft, and Shirley Denton supplied much needed additional images. Lindsey Nieratka and Robert Heinzman from IRC provided editorial review of the introductory sections, and Amy Jenkins of FNAI reviewed the orchid accounts for data sensitivity. Tim Pinion, Wildlife Biologist and Endangered Species Coordinator for the National Park Service, Southeast Region, and Joyce Maschinski, Conservation Ecologist at Fairchild Tropical Botanic Garden, reviewed the final draft.

Of special note is the collaboration between IRC, EVER and Marie Selby Botanical Gardens to continue the work on restoring rare plant populations in the Long Pine Key area despite the lack of direct funding to support this effort. Bruce Holst and his team from Selby have continued to

curate rare plants, assist with fieldwork, organize outplanting and monitoring events, and generally moving things forward on this important front.

Primary funding for this report came from the National Park Service. The U.S. Fish and Wildlife Service funded several separate projects that have added to the body of knowledge included herein. Additional resources have come from IRC and the author.

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Background

Everglades National Park (EVER) was established in 1947 in part to protect the unique flora of South Florida. The geographic location of EVER captures a representative sample of many of the unusual assemblage of plant species found in the area, including tropical species at the northern limits of their range and temperate species at the southern end of their range. Unique habitats in South Florida, particularly pine rocklands, are also habitat for endemic species, some of which occur in EVER. In total, just over half (53%) of all of the native plant taxa recorded for South Florida have been found in EVER (Gann *et al.* 2014a). Of the 762 plant taxa native to EVER, one species is listed as endangered under the Endangered Species Act (*Chromolaena frustrata*)[1], one as threatened (*Chamaesyce garberi*), and an additional six species are candidates for federal listing (*Argythamnia blodgettii*, *Chamaesyce deltoidea* ssp. *pinetorum*, *Dalea carthagenensis* var. *floridana*, *Digitaria pauciflora*, *Sideroxylon reclinatum* ssp. *austrofloridense*, *Trichomanes punctatum* ssp. *floridanum*). One hundred and sixty-six species (22%) are listed by the State of Florida as threatened, endangered or commercially exploited, and 113 taxa (15%) are ranked by the Florida Natural Areas Inventory (FNAI) as very rare, imperiled, critically imperiled or presumed extirpated in the state. About one-half of the native flora of the park has been ranked by The Institute for Regional Conservation (IRC) as secure in South Florida, while the other one-half is ranked as rare, imperiled, critically imperiled, possibly extirpated, or presumed extirpated in the region.

The plight of rare plants in South Florida and in what is now EVER has been long-discussed (e.g., Small 1929, Craighead 1966, Loope and Avery 1979, Gann *et al.* 2002). In addition, significant work has been conducted since the park's inception to catalogue the flora of the park, including a park-wide checklist and lists covering specific geographic locations and habitats. In particular, the early herbarium specimen vouchering work of Frank C. Craighead during the 1950s and early 1960s, and the cataloging and ecological work of George N. Avery, Lloyd L. Loope, Ingrid Olmsted and colleagues during the late 1970s and early 1980s (e.g., Loope and Avery 1979, Loope *et al.* 1979, Avery and Loope 1980a, Avery and Loope 1980b, Olmstead *et al.* 1981, Olmsted *et al.* 1983), were critical in gaining an understanding of the park's flora and vegetation. In the 1980s and 1990s, the team of Rick and Jean Seavey made significant contributions to the park herbarium (now FNPS), and Richard Reimus both vouchered specimens and took over editing of the park checklist in the mid- to late-1990s (Reimus 1996, 1999). Since 2006, EVER Botanist Jimi Sadle has added substantially to the understanding of vascular plants in the park, including the discovery of species new to the flora of North America (*Xylosma buxifolia*, see account below), and the documentation of plants previously thought to be extirpated in South Florida (*Bletia patula*, see account below). Roger Hammer and Chuck McCartney have made numerous contributions over several decades.

In 1979, a preliminary list of rare plants in EVER was completed as part of an assessment of rare plants throughout National Park Service Areas in South Florida (Loope and Avery 1979). This list included a brief assessment of 171 taxa, including 148 which have been recorded for EVER. However, the Loope & Avery list included a wide variety of species, including very rare plants

[1] *Chromolaena frustrata* was listed as Endangered in 2014.

documented in the park, plants known from outside of the park thought to be possibly present in the park (e.g., *Brickellia mosieri*[2]), and plants that are now known to be both widespread both in the park and in South Florida (e.g., *Encyclia tampensis*). This report contained both brief comments about the history and status of each taxon in the park as well as preliminary management recommendations. To date, this is the only park-wide treatment of rare plants which has been completed.

In the late 1990s, IRC established a ranking system for the conservation status of native plant species in South Florida modeled on the system developed by the Natural Heritage Program (now NatureServe) and used in Florida by the Florida Natural Areas Inventory (Gann *et al.* 2002). Ranks were assigned based on number of documented occurrences both within and outside of established conservation areas and the number of individuals found in each occurrence. In 2001, IRC launched the Floristic Inventory of South Florida Database Online (now Gann *et al.* 2014a), which included an online checklist for EVER, including links to references and voucher specimens. In 2002, IRC published the book Rare Plants of South Florida: Their History, Conservation, and Restoration (Gann *et al.* 2002), which ranked the conservation status of all native plant species in South Florida, briefly documented the history of those species ranked as critically imperiled, possibly extirpated, or presumed extirpated in the region, and made preliminary recommendations for research, conservation, restoration and management.

In 2003, IRC and the National Park Service entered into a five year agreement to study the 30 species ranked as critically imperiled, possibly extirpated or presumed extirpated in South Florida that had previously been documented in the Long Pine Key region of EVER, a region that had been highlighted as especially important to rare plant conservation in South Florida (Gann *et al.* 2009). In 2006, the existing cooperative agreement was modified to allow for the hiring of an Everglades vegetation biologist under IRC to work cooperatively with EVER staff on the monitoring of vegetation in Taylor Slough, the establishment of long-term vegetation monitoring plots in tropical hardwood hammocks in several regions of the park, and to conduct rare plant surveys throughout the park. The focus of the expanded surveys was on species previously documented for EVER which had been ranked by IRC as critically imperiled, possibly extirpated or presumed extirpated in South Florida. While the Long Pine Key project was concluded in 2009, the cooperative vegetation biologist project continued until 2013. In 2010, IRC also began work in EVER on the potential effects of sea level rise on both plant species and vegetation in the coastal regions of the park. During that project a preliminary ranking of the vulnerability of 21 critically imperiled plant species (*sensu* Gann *et al.* 2002) to sea level rise was published (Saha *et al.* 2011).

This report was initially conceived as a deliverable under IRC's Everglades vegetation biologist cooperative agreement, but was significantly expanded to include research conducted as part of IRC's sea level rise project and to provide more comprehensive documentation of the rarest plants in South Florida protected in EVER. The term Species of Management Concern (SOMC) as used here was initially defined within the Government Results and Performance Act (GPRA), which translated into goals for EVER to develop a list and report on maintaining sustainable populations of species of management concern. The term SOMC was not originally limited to

[2] *Brickellia mosieri* was listed as Endangered under the Endangered Species Act in 2014.

species listed by the federal government or any other entity, but was recommended to include those species "having special significance to the park, often including endemic species and state-listed Threatened and Endangered Species…" Current NPS Management Policy (4.4.2.3) discusses management of threatened and endangered species and includes "other species that are of special management concern (such as rare, declining, sensitive or unique species and their habitats)…" Because of the overwhelming number of regionally rare vascular plant species protected in EVER (almost 400 *sensu* Gann *et al.* 2014a), the intent of this report has been to use the SOMC designation to focus attention and resources on the most vulnerable plants in the region protected in the park and those species of regulatory interest to the federal government. In addition, by organizing plants into definable groups and reviewing all native species in the park, attention is drawn to other species that may be vulnerable in the park or in need of more scientific or conservation attention.

Methods

This report is the result of cooperative work between IRC and EVER and all methods have been developed jointly. Because the overwhelming number of plant taxa that could potentially be listed as SOMCs in EVER, the decision was made to limit the preliminary list to the rarest species in South Florida as defined by IRC (*sensu* Gann *et al.* 2002 and subsequent), as had been done both with the Long Pine Key and the sea level rise projects in EVER (Gann *et al.* 2009, Saha *et al.* 2011), and to those species listed or officially proposed for listing under the Endangered Species Act (endangered, threatened, candidate). Gann *et al.* (2002) and Gann *et al.* (2014a and previous) were used to generate preliminary lists of species ranked as critically imperiled, possibly extirpated or presumed extirpated in South Florida that had been reported or documented for EVER[3]. The known park flora was also reviewed to determine if there were additional species to be considered for listing as critically imperiled in South Florida by IRC. In early 2012, a preliminary review of 65 species was conducted and an additional eight species were identified for consideration. One new SOMC (*Eupatorium compositifolium*) was newly discovered in EVER by park Botanist Jimi Sadle in November, 2013. A review of the status of each potential SOMC taxon in EVER was completed, followed by a review of regional and global data and literature where appropriate. In some cases, updated listing criteria developed by NatureServe (Faber-Langendoen *et al.* 2012) were used to review and modify ranks of species for which IRC's 2002 ranking systems appeared too coarse. A mapping tool developed by the Royal Botanic Garden Kew was also utilized in this new ranking process (see www.geocat.kew.org).

The native flora of EVER was divided into ten logical units (trees, shrubs, vines, ferns, orchids, other epiphytes, graminoids, monocot forbs, dicot forbs, gymnosperm forb) consistent with categories used in Gann *et al.* (2014a). A review of all vascular plant taxa in EVER within each group was conducted, including a review of herbarium records at the South Florida Collections Management Center, Everglades National Park (FNPS) managed online by Fairchild Tropical Botanic Garden. Species with limited ranges within EVER were identified (e.g., primarily coastal, primarily limited to the Long Pine Key area) as well as the distribution of all rare species within EVER (e.g., primarily coastal, widespread, scattered). Species that did not qualify as SOMCs but were otherwise very rare in EVER or poorly documented were identified as candidates for further work. In addition, several species currently listed as imperiled in South Florida based on 2002 IRC criteria were identified for updated review using NatureServe's 2012 methods. These species may be up-ranked to critically imperiled in South Florida and thus qualify as SOMCs in EVER in the future. In the presentation for each group, the taxonomy

[3] A critically imperiled taxon in South Florida using IRC's 2002 criteria is defined as any taxon with fewer than 1,000 individuals, a taxon with two to five occurrences and fewer than 3000 individuals, or one occurrence and fewer than 10,000 individuals in the South Florida floristic area. A plant that is possibly extirpated is defined as a taxon that has been surveyed for, but has not been seen in 10 to 20 years. A plant that is presumed extirpated is defined as a species that has been surveyed for, but has not seen for at least 20 years. Because of large remote areas in EVER, defining whether something has or has not been adequately searched for in the park can be problematic, and we have defaulted to "possibly extirpated" in many cases.

generally follows ITIS (2014) unless otherwise discussed. Where relevant, extensive footnotes were also prepared to clarify or expand upon taxonomic, geographic or historical issues.

Within each plant group, species accounts for each SOMC were prepared, including background, conservation status, history in EVER, discussion, and a summary of research and management recommendations. Images are by the author unless otherwise indicated. Geographic data in the background sections were obtained from numerous sources including the Atlas of Florida Vascular Plants (Wunderlin and Hansen 2014), the Flora of the West Indies (Acevedo-Rodríguez and Strong 2014), TROPICOS (2014) and Ackerman & Collaborators (2014) for orchids. A review of major habitats for each SOMC was done and the description of habitat vegetation types follows Rutchey *et al.* (2006), unless otherwise indicated. Conservation status includes ranking data from the IUCN Red List, NatureServe, the U.S. Fish and Wildlife Service, State of Florida, Florida Natural Areas Inventory and IRC (see text and Appendix A). History in EVER includes a review of the discovery, geographic distribution, habitats and abundance using published and unpublished literature, herbarium collections, and field data collected by IRC and EVER. In particular, recent data collected as part of IRC's rare plant study on Long Pine Key (Gann *et al.* 2009) are discussed, along with data collected as part of IRC's vegetation biologist and sea level rise cooperative agreements (2006-2014). Of note is that four species included in this report that are historically known from the Long Pine Key area were not included in the Long Pine Key study because they were not ranked as critically imperiled in South Florida by IRC (*Argythamnia blodgettii*, *Chamaesyce deltoidea* ssp. *pinetorum*, *Chamaesyce garberi*, *Cyrtopodium punctatum*). Data from other sources were acquired for each of these taxa, all of which are federally listed or candidate species except for *C. punctatum.* Historic damage to and current threats to each SOMC are also discussed. To avoid obvious redundancy, the assumption is made that basic management activities, such as prescribed burning and exotic plant control, will take place and that no major new hydrological features will be constructed without additional studies being undertaken. When special needs are identified they are discussed. The summaries of recommendations do not seek to prescribe specific activities except when called for, but instead are intended as guides. Designing specific detailed monitoring protocols for each species, for instance, is beyond the scope of this report.

Caveats are many. Every flora is dynamic. New populations of rare plants will be discovered and known populations will be lost. Species may be re-ranked based on new information from both inside and outside of the park. Our understanding of individual species will change and hopefully improve over time. As a consequence, this document will be most useful if periodically updated to reflect the most current information available.

Box 1. Acronyms used in this report.

BICY – Big Cypress National Preserve
BISC – Biscayne National Park
EVER – Everglades National Park
FISF – Floristic Inventory of South Florida Database Online
FNAI – Florida Natural Areas Inventory
GBIF - Global Biodiversity Information Facility
IRC – The Institute for Regional Conservation
ITIS – Integrated Taxonomic Information System

LOX – Arthur R. Marshall Loxahatchee National Wildlife Refuge
NPS – National Park Service
PLANTS – USDA, NRCS, PLANTS Database
TROPICOS – Tropicos.org., Missouri Botanical Garden
USFWS – United States Fish and Wildlife Service

Results

Fifty-nine vascular plant taxa are classified as SOMCs in Everglades National Park, about 8% of the native flora (Table 1, Appendix A). Of these, 16 species are ranked as possibly or presumed extirpated in the park, with a subset of 10 of these ranked by IRC as possibly or presumed extirpated in South Florida. Two from the latter group possibly represent global extinctions – the terrestrial orchid *Govenia floridana* and the grass *Eriochloa michauxii* var. *simpsonii*. Species from a number of plant groups comprise the SOMCs and they grow in a variety of habitats and geographic locations.

Table 1: Preliminary list of vascular plant species of management concern (SOMCs) native to the flora of Everglades National Park.

Taxon	Primary Habitat(s) in EVER	Estimated Population in EVER	Group	Page
Actinostachys pennula	Tropical Hardwood Hammock	Presumed extirpated	Fern	49
Adiantum melanoleucum	Tropical Hardwood Hammock	2-10	Fern	52
Anemia wrightii	Graminoid Freshwater Prairie, Bayhead Forest edges	1,001-10,000	Fern	54
Argythamnia blodgettii	Pine Rockland	ca. 2,000	Dicot forb	162
Asplenium platyneuron	Bayhead Forest	Possibly extirpated	Fern	58
Astraea lobata	Pine Rockland	101-1,000	Dicot forb	164
Basiphyllaea corallicola	Pine Rockland	11-100	Orchid	79
Beloglottis costaricensis	Tropical Hardwood Hammock	101-1,000	Orchid	82
Bletia patula	Modified Graminoid Freshwater Prairie (HID)	2-10	Orchid	84
Bourreria cassinifolia	Pine Rockland	100-200	Shrub	23
Brassia caudata	Tropical Hardwood Hammock	Presumed extirpated	Orchid	101
Celtis iguanaea	Coastal Hardwood Hammock on shell mounds	11-100	Vine	39
Cenchrus myosuroides	Coastal Graminoid Uplands (not in Rutchey *et al.*)	101-1,000	Graminoid	140
Ceratopteris pteridoides	Disturbed Wetlands	11-100	Fern	60
Chamaesyce deltoidea ssp. *pinetorum*	Pine Rockland	10,001- 100,000	Dicot forb	167
Chamaesyce garberi	Graminoid Dune, Coastal Grassland, Pine Rockland	2,000,000-3,000,000	Dicot forb	169
Cheilanthes microphylla	Coastal Hardwood Hammock on shell mounds	11-100	Fern	62
Chromolaena frustrata	Coastal Hardwood Hammock, Buttonwood Woodland	100,001-1,000,000	Dicot forb	172
Cyrtopodium punctatum	Buttonwood Woodland and other forests	11-100	Orchid	104
Dalea carthagenensis var. *floridana*	Hammock Forest margins	Possibly extirpated	Shrub	25

Desmodium lineatum	Pine Rockland	101-1,000	Dicot forb	177
Didymoglossum punctatum	Tropical Hardwood Hammock	Presumed extirpated	Fern	64
Digitaria pauciflora	Graminoid Freshwater Prairie/Pine Rockland ecotones	10,001-100,000	Graminoid	142
Eltroplectris calcarata	Tropical Hardwood Hammock	1,000-2,000	Orchid	86
Eriochloa michauxii var. *simpsonii*	Graminoid Dune	Presumed extinct	Graminoid	145
Eupatorium compositifolium	Pine Rockland	100-200	Dicot forb	179
Exostema caribaeum	Tropical Hardwood Hammock	11-100	Tree	18
Galeandra bicarinata	Tropical Hardwood Hammock	2-10	Orchid	88
Govenia floridana	Tropical Hardwood Hammock	Possibly extinct	Orchid	91
Helenium flexuosum	Pine Rockland, Graminoid Freshwater Prairie	1,001-10,000	Dicot forb	181
Hypelate trifoliata	Pine Rockland, Tropical Hardwood Hammock	11-100	Shrub	27
Ionopsis utricularioides	Swamp Forest	Possibly extirpated	Orchid	108
Kosteletzkya depressa	Buttonwood Woodland, Disturbed Upland	1,001-10,000	Dicot forb	183
Leersia monandra	Coastal Hardwood Scrub/Hammock on shell mound	Presumed extirpated	Graminoid	147
Leptochloa fusca ssp. *uninervia*	Graminoid Freshwater Prairie	Possibly extirpated	Graminoid	149
Lomariopsis kunzeana	Tropical Hardwood Hammock in solution holes	2-10	Fern	66
Macradenia lutescens	Tropical Hardwood Hammock	Presumed extirpated	Orchid	110
Oncidium ensatum	Tropical Hardwood Hammock, Coastal Hardwood Hammock, Buttonwood Woodland	101-1,000	Orchid	93
Passiflora sexflora	Tropical Hardwood Hammock	11-100	Vine	43
Pecluma plumula	Tropical Hardwood Hammock, Temperate Hardwood Hammock (Prairie Mesic Hammock in FNAI)	100-200	Fern	71
Peperomia humilis	Buttonwood Woodland	11-100	Other epiphyte	128
Physalis cordata	Buttonwood Woodland, Coastal Hardwood Hammock on shell mound, Disturbed Upland	101-1,000	Dicot forb	186
Pleurothallis gelida	Swamp Forest	Presumed extirpated	Orchid	111
Ponthieva brittoniae	Pine Rockland	11-100	Orchid	96
Rhipsalis baccifera	Buttonwood Woodland	Possibly extirpated	Other epiphyte	130
Sideroxylon reclinatum ssp. *austrofloridense*	Graminoid Freshwater Prairie margins, Pine Rockland	10,001-100,000	Shrub	29
Spiranthes torta	Pine Rockland	2-10	Orchid	99
Sporobolus clandestinus	Pine Rockland, Disturbed	101-1,000	Graminoid	151

Tephrosia corallicola	Coastal Hardwood Scrub/Hammock on shell mound	101-1,000	Dicot forb	189
Thelypteris reticulata	Tropical Hardwood Hammock, Swamp Forest	11-100	Fern	74
Tillandsia fasciculata var. *clavispica*	Tropical Hardwood Hammock	Possibly extirpated	Other epiphyte	133
Trichocentrum carthagenense	Coastal Hardwood Hammock or Buttonwood Woodland	Presumed extirpated	Orchid	113
Trichocentrum undulatum	Coastal Hardwood Hammock, Buttonwood Woodland, Mangrove Forest, Tropical Hardwood Hammock	500-1,000	Orchid	115
Trichostigma octandrum	Coastal Hardwood Hammock on black earth mound and shell mound	2-10	Vine	45
Vachellia tortuosa	Coastal Hardwood Hammock on shell mounds	11-100	Shrub	31
Vallesia antillana	Coastal Hardwood Hammock on black earth mound	101-1,000	Shrub	34
Vanilla dilloniana	Coastal Hardwood Hammock	Possibly extirpated	Orchid	120
Vanilla phaeantha	Bayhead Forest	11-100	Orchid	125
Xylosma buxifolia	Pine Rockland	101-1,000 clonal stems	Shrub	35

Review of data within and outside of the park during this project resulted in the down-ranking of a number of taxa from critically imperiled to imperiled in South Florida (*Bolboschoenus robustus*, *Cyperus filiformis*, *Malachra fasciata*, *Pavonia paludicola*, *Persicaria setacea*, *Salvia misella*, *Thelypteris serrata*). In contrast, the orchid *Cyrtopodium punctatum* was up-ranked to critically imperiled and included as a SOMC. Action on other species chosen for review was deferred until they can be re-ranked using new NatureServe criteria (e.g., *Aeschynomene pratensis*, *Lantana depressa* var. *sanibelensis*) and additional species warranting review are indicated below. Other species ranked as critically imperiled in South Florida were found to be erroneously reported for the park due to mislabeled specimens and data transcription errors (*Leptochloa virgata*, *Najas wrightiana*, *Wolffiella oblongata*). One federally-listed species is treated as of doubtful occurrence in the park (*Galactia smallii*) and one species was not classified as a SOMC due to its disputed nativity in South Florida (*Rhynchosia precatoria*). One terrestrial orchid (*Prescotia oligantha*), which is not known to be native to the park, is discussed as a benign introduction as it has apparently been otherwise extirpated in the wild in South Florida. A review of listing data from NatureServe and FNAI resulted in recommended edits for more than 30 species. These recommendations were forwarded to NatureServe and FNAI and action on many had been taken by the time of publication of this report.

Forty-six percent of the orchids in EVER are SOMCs and this group has been most impacted by human activities during documented history. Orchids are followed by ferns (24%) and other epiphytes (18%), and these results are consistent with those published for all of South Florida in Rare Plants of South Florida (Gann *et al.* 2002). The monocot forb group was the only multi-species group with no classified SOMCs, and all of the taxa in that group have at least some wetland affinity. The gymnosperm forb category has a single cycad, *Zamia integrifolia*, which is reasonably common in South Florida and the park. A review of geographic distributions and

habitat preferences shows species clustered into several primary groups. More SOMCs are found only in the interior of the park (64%) than exclusively in coastal areas (29%) or in both (7%). In terms of broad habitat preferences, more than half (56%) of SOMCs grow in mesic hammock forests (tropical and temperate combined), followed by pine rocklands (27%), and coastal buttonwood woodlands (15%). SOMCs found exclusively in wetlands account for only six taxa (10%), and these are scattered in a variety of vegetation types including swamp forests, bayheads, graminoid freshwater prairies and disturbed wetlands. Two orchids were found to have broad geographic ranges and habitat tolerances (*Cyrtopodium punctatum*, *Oncidium ensatum*) along with one federally listed dicot forb (*Chamaesyce garberi*). SOMC populations are found in several areas in the park, but there are three areas of primary concentration (Figure 1). The Long Pine Key area has the greatest number of documented taxa (35), followed by the Flamingo area (10), the northwestern coastal regions (6), the rocky glades north of Long Pine Key (4), Cape Sable (3), and the Madeira Bay/Monroe Lake region (2). Estimated numbers of plants for extant species ranged from 2-10 individuals (*Adiantum melanoleucum*, *Lomariopsis kunzeana*, *Spiranthes torta*) to more than 1 million individuals (*Chamaesyce garberi*) based on an earlier study.

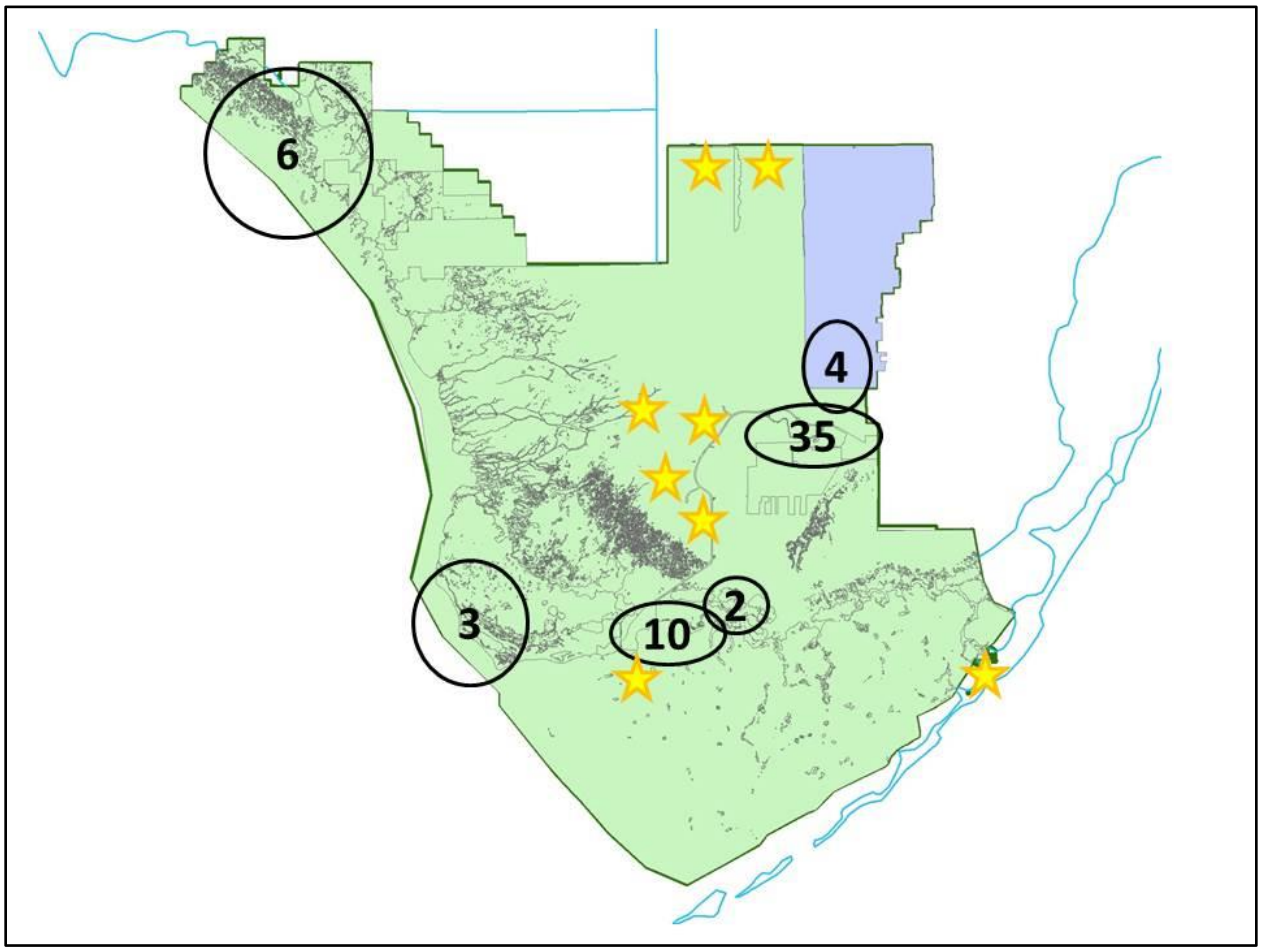

Figure 1. Confirmed or hypothesized locations of SOMCs in EVER. Numbers in circles indicate the number of taxa recorded; stars indicate a single taxon. Locations are approximate.

Historical damage to rare plant populations in EVER was primarily linked to poaching and/or over collecting (e.g., *Govenia floridana*, *Trichocentrum undulatum*) and to hydrological modifications, especially drainage (e.g., ferns native to tropical hardwood hammocks). Although poorly documented, habitat destruction related to charcoal-making, and collateral damage from wild cotton (*Gossypium hirsutum*) eradication programs (including collecting) may have contributed to population declines in the Flamingo area. Also poorly documented, fire may have contributed to declines of populations in Long Pine Key hammocks and hurricanes may have negatively affected some species in the Flamingo area (e.g., *Rhipsalis baccifera*) and elsewhere in the park. Past concerns about fire management causing harm to rare plants in EVER (e.g., in Loope and Avery 1979) may have been valid at that time, but do not appear to true at this time due to changed fire management practices.

Current threats abound. Poaching (or over collecting) is still a potential threat for some orchid and fern species as well as the long-term results of drainage, including more mesic conditions in hammocks and lower humidity. Only one SOMC species, *Anemia wrightii*, may be showing negative stress from increasing water levels from the Everglades Restoration, but this could be temporary and/or related to exceptionally high rainfall. Of increasing concern are threats from sea level rise (including storm surges) to coastal populations and competition from exotic species everywhere in the park, but especially in the coastal regions where Brazilian-pepper (*Schinus terebinthifolius*) and latherleaf (*Colubrina asiatica*) remain unchecked. More than one-half of the remaining SOMCs have populations so small or localized that they are inherently at higher risk of localized extinction.

Many more species are rare within the park than have been identified as SOMCs here. To the extent that information has been available, these are discussed in the plant group accounts below. In addition to the 16 SOMC species ranked as possibly or presumed extirpated in the park, an additional 13 non-SOMC native plant taxa have been identified as possibly extirpated in the park, or 3.9% of the documented native park flora (Table 2). That number may change following additional research.

Table 2. Native plants presumed or possibly extirpated in EVER.

Native plant taxa presumed extirpated in EVER	**IRC South Florida rank**	**Group**
Actinostachys pennula	Critically Imperiled	Fern
Brassia caudata	Presumed Extirpated	Orchid
Didymoglossum punctatum	Critically Imperiled	Fern
Eriochloa michauxii var. *simpsonii*	Presumed Extinct	Graminoid
Leersia monandra	Presumed Extirpated	Graminoid
Macradenia lutescens	Presumed Extirpated	Orchid
Pleurothallis gelida	Critically Imperiled	Orchid
Trichocentrum carthagenense	Presumed Extirpated	Orchid
Native plant taxa possibly extirpated in EVER	**IRC South Florida rank**	**Group**
Arnoglossum ovatum	Rare	Dicot Forb
Asplenium platyneuron	Possibly Extirpated	Fern
Berchemia scandens	Rare	Vine
Ctenitis sloanei	Imperiled	Fern

Dalea carthagenensis var. *floridana*	Critically Imperiled	Shrub
Epidendrum anceps	Imperiled	Orchid
Eryngium yuccifolium	Rare	Dicot Forb
Eupatorium mohrii	Rare	Dicot Forb
Govenia floridana	Possibly Extinct	Orchid
Hypericum tetrapetalum	Apparently Secure	Shrub
Ionopsis utricularioides	Critically Imperiled	Orchid
Leptochloa fusca ssp. *uninervia*	Critically Imperiled	Graminoid
Okenia hypogaea	Imperiled	Dicot Forb
Persicaria setacea	Imperiled	Dicot Forb
Pilea herniarioides	Imperiled	Dicot Forb
Rhipsalis baccifera	Possibly Extirpated	Other Epiphyte
Symphyotrichum concolor	Rare	Dicot Forb
Thelypteris serrata	Imperiled	Fern
Tillandsia fasciculata var. *clavispica*	Possibly Extirpated	Other Epiphyte
Vallisneria americana	Imperiled	Monocot Forb
Vanilla dilloniana	Possibly Extirpated	Orchid

Discussion

Much has been learned about rare plants in EVER in the last decade, but significant works remains. One of the most obvious issues affecting our understanding of EVER floristics and rare plants in general is the uneven collection of herbarium specimens in the park. Although a quantitative analysis was not conducted, it is obvious that the Long Pine Key area of the park has been heavily collected and the rest of the park less so. Even so, Long Pine Key harbors the most rare plant species, which is more related to phytogeography than to the intensity of botanical research there. For coastal plants, most collecting has been done in the Flamingo area, while much less has been done to the east of Flamingo and along the western fringe of the park. Few collections from the Shark Slough area or any of the expansive wetland areas are deposited at FNPS. Thus, some species that appear limited in distribution in the park or rare within the park flora may just be poorly documented. While some species are well known and additional vouchers would be redundant (e.g., *Bursera simaruba*, *Encyclia tampensis*), other taxa are in need of vouchering because they are difficult to identify (e.g., graminoids, some monocot forbs), ephemeral (annual dicot forbs), or both. In some cases, further vouchering will only lead to population decline and eventual extirpation (e.g., some terrestrial orchids). In these cases, other forms of documentation are needed, such as photo-documentation and/or the collection of genetic material for eventual genetic fingerprinting and/or barcoding. There is also more information in the form of checklists and reports for trees and other woody plants, epiphytes, and to a lesser extent ferns. Much less is known about herbaceous plants, and in particular grasses and sedges. The scrape down and restoration of short hydroperiod graminoid marsh in the historic farming area of the Hole-in-the Donut may have introduced several South Florida ruderal natives that may not be a historical part of the park flora. Additional work is needed to identify these taxa and classify them as presumed introduced to the park.

It is interesting to note the difference in management concerns between Loope & Avery's 1979 rare plant report and today. In the earlier report, there was tremendous concern about fire and fire management in the park. There is little evidence today that current or recent fire management practices are deleterious to rare plant populations. For instance, fires entering the interior of tropical hardwood hammocks in Long Pine Key have either been greatly reduced, or documentation has not occurred to the same degree as the past – in some cases fires are actively suppressed to prevent that from occurring (J. Sadle, email comm. 2014). On the other hand, Loope and Avery seemed less concerned about coastal populations of rare plants. Pearlberry (*Vallesia antillana*), for instance, was classified as a species of least concern, a species whose populations should be rather stable for the foreseeable future without active management by the NPS. Today, it is known in the park from a single occurrence which is threatened both by sea level rise and exotic species invasions. Some management concerns, such as poaching and regional modifications to hydrology, remain concerns from the earlier period.

Although the surveying for SOMC species is mostly complete for parts of EVER, significant areas of cypress and hardwood hammock communities in the western part of the park and large areas of southwestern EVER have not been surveyed well. There are several other important gaps in knowledge that are discussed in the plant group and species accounts below. These should be addressed, and resources such as laminated identification cards and/or PDF files

should be prepared to increase the number of trained people searching for rare plants, especially in the vast backcountry. In addition, robust long-term monitoring programs that can track populations of rare plants or even individual rare plants into the future are needed. In some cases, the long-term monitoring plots established for SOMC species in the Long Pine Key area from 2003-2008 offer a good starting point, but ultimately long-term demographic monitoring needs to be tailored to individual species. This is especially needed for species with very small populations, which inherently have a higher risk of extinction from inbreeding depression and environmental stochasticity. A population viability management approach that links monitoring to management actions would help ensure the conservation of rare species' populations (Bakker and Doak 2009).

The mitigation of threats to SOMC plants is a major management challenge. Most pressing in the short term is enhanced invasive species control, especially in the coastal and backcounty regions of the park – particularly Florida Exotic Pest Plant Council listed plants which compete directly with SOMC plants. Poaching and collecting also has the potential to significantly affect a subset of these imperiled species and needs to be prevented, reduced or eliminated. Priority should be given to species where these threats overlap. Although the general areas of orchid concentrations are well known, specific locality data should be carefully protected. The recent explosion in electronic information sharing, particularly mapping capabilities via smart phones, could be increasing rapid and focused access to SOMC populations (J. Sadle, email comm. 2014). While generally a positive thing for management, information sharing should be regularly evaluated to assess threats. If poaching is documented or an elevated threat of poaching is suspected, then the National Park Service should consider public closures of key areas, similar to what has been done for endangered animals in the park.

Dealing with historical population losses and long-term threats such as sea level rise and historical modifications to regional hydrology will require even more thought and planning. In some cases, the restoration of extirpated populations (e.g., *Trichocentrum undulatum* in Royal Palm Hammock) and the augmentation of depleted populations (e.g., *Adiantum melanoleucum*, *Passiflora sexflora*) has already begun (see accounts below). But preliminary results are mixed and it will be years, if not decades, before the outcome of these efforts will really be known. In the case of at least one coastal species, the dicot epiphyte *Peperomia humilis*, a managed relocation (*sensu* Maschinski *et al.* 2011, Haskins and Keel 2012) to the interior of the park may need to be considered sooner than later. For ferns and other hammock plants in the Long Pine Key area, the theory is still that more water delivery, which would provide both more water and higher humidity, would be desirable. Only one fern, *Anemia wrightii*, may just now be experiencing a shift in regional water delivery, but its long-term response is not yet known. Similarly, efforts to plug canals and restore the historic hydrology of the southern coastline in advance of sea level rise would almost certainly have benefits for many rare plants in that region.

In conclusion, while there are many challenges to managing and even restoring populations of rare plants in EVER, many opportunities also present themselves. What is needed is to elevate the issue of plant biodiversity conservation to a level equivalent to that of other concerns, such as the restoration of regional hydrology and depleted wildlife populations or invasive animal control. In fact, achieving the goal of protecting this unique and diverse ecosystem requires it.

Trees

There are 74 species of native trees[4] that have been documented as native to EVER (Gann *et al.* 2014a). About two-thirds (50) of these species are relatively common in South Florida, while the remainder are considered regionally rare, imperiled or critically imperiled. The majority in the latter group are primarily of tropical origin and known in the continental United States only from South Florida. Only one tree species, *Exostema caribaeum*, is classified as a SOMC in this report and its distribution in the park is limited to Key Largo in the Florida Keys. In total, seven tree species native to the Florida Keys are currently known in EVER only on Key Largo at the Key Largo Ranger Station and/or North Tarpon Basin Parcel[5]: *Amyris elemifera*[6], *Bourreria succulenta*[7], *Colubrina elliptica*[8], *Drypetes diversifolia*, *E. caribaeum*[9], *Reynosia septentrionalis*[10] and *Schaefferia frutescens*[11]. These trees are all rare in South Florida and known almost exclusively from the Florida Keys except for *A. elemifera*, which extends to the north along the eastern coastline of peninsular Florida. Nine other rare upland trees are known from EVER primarily or exclusively from coastal areas vulnerable to sea level rise, in some cases including Key Largo: *Acoelorraphe wrightii*, *Canella winterana*, *Cordia sebestana*, *Hippomane manchinella*, *Manilkara jaimiqui* ssp. *emarginata*, *Swietenia mahagoni*[12], *Thrinax*

[4] *Hypelate trifoliata*, which can become a substantial tree, is predominantly a shrub in EVER and is discussed in the shrub section below.

[5] The North Tarpon Basin Parcel is located approximately at mile marker 102.5 immediately adjacent to US 1 on the Florida Bay side.

[6] *Amyris elemifera* – Little (1978) mapped a single location on the mainland in EVER north of Flamingo, but this is uncorroborated by other authors. In 2009, EVER Botanist Jimi Sadle and Charles Lawson made an observation of several sterile plants of an *Amyris* in the northern Shark River Slough area. This could be *A. elemifera* or *A. balsamifera*, which is considered presumed extirpated in South Florida by IRC (Gann *et al.* 2014a).

[7] *Bourreria succulenta* – Frank Craighead made a single collection in EVER on the mainland along the Bear Lake Road in 1955 (s.n., FNPS), and this occurrence was referred to by Craighead (1957) and Taylor (1964). Little (1978) mapped a single location on the mainland in that same area and Avery & Loope (1980b, 1983) included this on the main EVER list. No recent observations on the mainland area are known, but this species is still extant at the Key Largo Ranger Station.

[8] *Colubrina elliptica* – John Kunkel Small made a single collection on the mainland in Miami-Dade County in 1904 near what is now Castellow Hammock Park north of Homestead (Gann *et al.* 2014a). There are no other records from the mainland or offshore barrier islands.

[9] *Exostema caribaeum* – J.W. Harshberger made a single collection on the mainland in Brickell Hammock near what is now downtown Miami in 1910 (Gann *et al.* 2014a). There are no other records from South Florida outside of the Florida Keys.

[10] *Reynosia septentrionalis* – One small population is known just north of the Florida Keys from the north end of Key Biscayne and adjacent Virginia Key (Gann *et al.* 2014a). Avery & Loope (1980b, 1983) did not record this species for EVER, apparently in error. It was recorded for the Key Largo Ranger Station by Craighead (1957) and Taylor (1964) and is present at both the Key Largo Ranger Station and Tarpon Basin parcels.

[11] *Schaefferia frutescens* – John Kunkel Small and Joel J. Carter made a single collection in Brickell Hammock near what is now downtown Miami in 1906 (Gann *et al.* 2014a). There are no other records from South Florida outside of the Florida Keys.

[12] *Swietenia mahagoni* is known from the upper Florida Keys and extreme South Florida mainland in Everglades National Park as far north as Mahogany Hammock. Only one record exists for the interior of the park at Royal Palm Hammock (Craighead 1957, Taylor 1964), a location noted for species otherwise restricted to the coast. It has been planted at the Ernest F. Coe Visitors Center where it is spreading into nearby pinelands. It is also cultivated at the Royal Palm Hammock Visitors Center, and has recently been observed recruiting along the disturbed hammock edge. It is treated as an invasive species by land managers in Miami-Dade County and in the lower Florida Keys in

morrisii, *T. radiata* and *Trema lamarkianum*[13]. Additional upland trees limited to vulnerable coastal areas in the park are *Coccoloba uvifera*, *Piscidia piscipula*, *Quadrella cynophallophora*[14] and *Sideroxylon celastrinum*. The tree with the smallest population in EVER is *Thrinax morrisii*, which was collected once on Murray Key off of Flamingo in 1965 (Olga Lakela 28592 USF with Frank Craighead and Robert W. Long) and was recently discovered at Cape Sable by EVER Botanist Jimi Sadle, lepidopterist Marc Minno and others (Gann *et al.* 2014a).

Four rare tree species at EVER are currently known from South Florida only from the Miami Rock Ridge, which extends from near present-day downtown Miami into the Long Pine Key area of EVER: *Alvaradoa amorphoides*, *Colubrina cubensis* var. *floridana*[15], *Ilex krugiana* and *Prunus myrtifolia*. Other trees limited in the park to the Long Pine Key area are the rare *Drypetes lateriflora*, and the regionally common *Citharexylum spinosum*, *Morus rubra* and *Pinus elliottii* var. *densa*. One palm, *Roystonea regia*, is known as a native in South Florida only from the Royal Palm Hammock area of Long Pine Key, Small Hammock near the western edge of Long Pine Key (J. Sadle, email comm. 2013), several isolated coastal areas of EVER, and from Collier County[16]. Other rare tropical species in EVER include *Calyptranthes pallens*[17], *Calyptranthes zuzygium* and *Colubrina arborescens*, all with restricted ranges in Miami-Dade and Monroe counties, and *Sapindus saponaria*, rare but with a broader range in South Florida. Finally, three trees are temperate species at the southern ends of their ranges in the northern part of EVER: *Acer rubrum*, *Fraxinus caroliniana* and *Quercus laurifolia*, of which *F. caroliniana* is considered regionally rare.

Problematic tree species reported for EVER are as follows. Two South Florida trees have apparently been reported from EVER in error: *Quercus nigra*[18] and *Persea borbonia*[19], both temperate trees at the ends of their ranges on the South Florida mainland. Dilley & Craighead (1957) also reported *Cornus alternifolia*, a species not in South Florida, for the Loop Road area, but this was probably a misidentification of *Cornus foemina*, which is known from just outside of the park in BICY. The critically imperiled *Guaiacum sanctum* was listed by Diley & Craighead (1957) for the Key Largo Ranger Station, along with the critically imperiled shrub *Vallesia antillana*, but not by Taylor (1964) or any subsequent authors. It is possible that these plants

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Monroe County where it has spread from cultivated plants into pine rocklands on Big Pine Key, including the National Key Deer Refuge.

[13] *Trema lamarckiana* – This is also known from a collection from Long Pine Key (Seavey & Seavey 819, FNPS) but was not included on the Long Pine Key list by Olmstead *et al.* (1983).

[14] *Capparis cynophallophora* in the FISF.

[15] *Colubrina cubensis* var. *floridana* – Collected once on Key Largo by Frank Craighead in 1961 and presumed extirpated in the Florida Keys (Gann *et al.* 2014a).

[16] *Roystonea regia* – Little (1978) mapped several small populations on the Monroe County mainland in EVER, which were also described by Craighead (1957): Mahogany Hammock, Seven Palm Lake and Johnson Mound. EVER Botanist Jimi Sadle observed plants at Johnson Mound in 2014 (email comm.). The Mahogany Hammock and Seven Palm Lake populations may both be extirpated.

[17] *Calyptranthes pallens* – Little (1978) mapped a single location on the mainland in Hendry County, but this is uncorroborated by other authors. Otherwise, it is known only from the Miami-Dade County and the Florida Keys.

[18] *Quercus nigra* – Reported by Craighead (1957) for Loop Road, but not by subsequent authors. Craighead's list apparently included some plants located outside of present-day park boundaries.

[19] *Persea borbonia* – Little (1978) and later authors lumped *P. palustris* into *P. borbonia*, and the map illustrated by Little is a composite on those two species. Most, if not all, plants in EVER are *P. palustris* (e.g., Long 2870 USF), which grows in wetlands, instead of *P. borbonia*, which grows in coastal uplands on sandy substrate.

were located nearby but just outside park boundaries. *Guaiacum sanctum*, however, is currently cultivated at the Key Largo Ranger Station. *Eugenia confusa*, a tree native to South Florida outside of EVER, was reported as naturalized in a hammock on Parachute Key from cultivated plants along with the rare shrub *Picramnia pentandra* (Avery and Loope 1980b and subsequent). Earlier, Taylor (1964) reported *E. confusa* from the Bear Lake Road area of EVER and this location was also mapped by Little (1978) but no herbarium specimens or other corroborating evidence is known. Both of these are treated as not native and possibly extirpated in the park in the FISF (Gann *et al.* 2014a).

In 2015, IRC intends to re-assess the South Florida rank of three trees using the 2012 NatureServe criteria as they may qualify as critically imperiled in South Florida and thus as SOMCs in EVER: *Alvaradoa amorphoides*, *Colubrina cubensis* var. *floridana* and *Colubrina elliptica*[20]. In 2007, seeds from *A. amorphoides* and *C. cubensis* var. *floridana* were collected in EVER by Fairchild Tropical Botanic Garden and sent to the National Center for Genetic Resources Preservation for storage (Goodman *et al.* 2007).

Exostema caribaeum (Jacq.) Roem. & Schult. – Caribbean Princewood

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	11-100

Background

Caribbean princewood is a small tree or shrub in the Rubiaceae. It is a primarily Neotropical species at the northern end of its range in South Florida and the northern Bahamas, occurring also in the Antilles, Mexico and Central America. In South Florida, it is known only from the Florida Keys in Miami-Dade and Monroe counties. It is currently known from nine conservation areas on six islands in the Florida Keys, including BISC and EVER (Gann *et al.* 2014a), but it is not abundant anywhere except in BISC, where it was recorded in 20% of the sampling cells in the Florida Keys section of the park (unpublished IRC data summarized in Bradley *et al.* 2004). Historically it ranged from Elliott Key in BISC in the north to the island of Key West in the south, but plants at many stations have been destroyed by development, including on Key Largo, Plantation Key, Upper Matecumbe Key and Key West. In South Florida, Caribbean princewood grows almost exclusively along the margins of tropical hardwood hammocks, but in the West Indies it grows in a variety of upland habitats including tropical hardwoods hammocks[21], pinelands and dry thickets, generally in habitats with abundant available light for adult trees. Mortellaro *et al.* (2012) ranked it as having a high affinity to high quality natural areas in South Florida.

In South Florida, flowering occurs for most of the year with a decline from March to May (Tomlinson 2001) and in the Bahamas it flowers all year (Correll and Correll 1982). Members of the genus are pollinated by Lepidoptera or Hymenoptera (McDowell and Bremer 1998), but

[20] All three of these trees were ranked as imperiled in Rare Plants of South Florida (Gann *et al.* 2002) due to the number of known occurrences at that time. FNAI (2014) ranks *Alvaradoa amorphoides* and *Colubrina cubensis var. floridana* as critically imperiled in Florida. *Colubrina elliptica* has not been ranked by FNAI for Florida but has a limited range and should be assessed. *Alvaradoa amorphoides* and *C. cubensis* var. *floridana* were both ranked as species of highest concern in NPS Areas in South Florida by Avery & Loope (1979); *C. elliptica* was not assessed.

[21] Equal to "coppice" in Correll & Correll (1982).

Figure 2. *Exostema caribaeum* in the Dominican Republic in 2011 (l) and on Key Largo in 2013 (r).

no specific pollinators of *E. caribaeum* have been documented. Caribbean princewood is occasionally cultivated in South Florida by native plant nurseries and botanical gardens, but it has not been recorded naturalizing outside of its historical range. Fairchild Tropical Botanic Garden maintains one tree from germplasm collected in 1970 by George Avery and George Stevenson from Cactus Hammock on Big Pine Key in what is now the National Key Deer Refuge (FTBG accession #70533). This individual has flowered many times but has never produced seeds (M. Collins, email comm. 2013), indicating possible self-incompatibility. Cultivation from seed is not difficult, but germination may take up to two months and the overall growth rate is relatively slow (J. Lawson, email comm. 2013). Similar to its preference in habitat, young cultivated plants prefer partial shade.

Conservation Status

Exostema caribaeum has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as globally secure, but it is not yet ranked for the United States. It is not listed under the Endangered Species Act, but it is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as imperiled in Florida, but IRC ranks it as critically imperiled in South Florida[22].

[22] In Rare Plants of South Florida (Gann *et al.* 2002), *Exostema caribaeum* was ranked as imperiled in South Florida, but extensive subsequent work in the Florida Keys between 2002 and 2007 resulted in its up-ranking to critically imperiled. In 2013, this rank was reviewed utilizing the 2012 NatureServe methodology and the rank remained the same. In 2015, IRC plans to submit new ranking information to the Florida Natural Areas Inventory and NatureServe for consideration.

History in EVER

Caribbean princewood was first reported for EVER at the Key Largo Ranger station on the Dilley & Craighead (1957) tree list. It has never been reported for the mainland portion of the park, but has been documented on all the major plant lists since Avery & Loope (1980b). Richard Reimus made a voucher of the Key Largo Ranger Station population in 2000 (Reimus 1490 FNPS), stating on the label "Very little of this plant Remaining in ENP." In 2007, ENP Botanist Jimi Sadle estimated that more than 100 plants were present at the site, but recent brief surveys of the Key Largo Ranger Station by Sadle, the author and others on October 24, 2013 recorded only about 10 adults scattered on both sides of the main clearing. Surveys in 2012 by Sadle and Dave Fowler at the recently acquired North Tarpon Basin Parcel resulted in the discovery of Caribbean princewood there. Sadle and the author also visited that site in October, 2013 and estimated that fewer than 10 reproductive individuals were located along the southeastern edge of the hammock along the parking lot of the D-Hookers restaurant. The current National Champion Nominee is a tree at the Key Largo Ranger Station, with a height of 30 feet and a crown spread of 18 feet, measured in 2008 (Florida Forest Service 2013). A search for this specific tree and its remeasurement is planned by the Florida Forest Service for 2015 (M. Torok, email comm. 2014). Saha *et al.* (2011) ranked *Exostema caribaeum* among the species most threatened by sea level rise in EVER, heavily influenced by the number of occurrences in the park (1), its small population, and lack of inland populations.

Discussion

In South Florida, Caribbean princewood is almost always found along the edges of tropical hardwood hammocks, but it is widespread in the West Indies and elsewhere where it is found in a variety of drier habitats, especially in situations with abundant sunlight for adult plants. It is possible that Caribbean princewood became temporarily more abundant in the Florida Keys during periods following land clearing activities, but adults may not be able to compete following canopy closure except along the edges. Unlike many hammock edge species it is not a fast growing tree and may be impacted by repeated cutting and/or mowing along hammock edges. Recruitment may also be limited due to the length of time it takes seeds to sprout and competition with other more aggressive edge species. Because the population at both sites is so small, tagging, mapping and monitoring individual trees and establishing a protocol to assess recruitment is recommended. Although sea level rise and other factors may be a threat in the long term, it is far more likely that individual plants could be impacted in the short term by infrastructure development or maintenance activities such as mowing and weed whacking. At present, there are other viable populations in the area so developing an ex-situ collection of germplasm is not pressing but may be reexamined in the future.

Summary of Recommendations

- Tag, map and monitor individual trees at the Key Largo Ranger Station and North Tarpon Bay Parcel. Establish a monitoring protocol to assess recruitment.
- Protect Caribbean princewood at the Key Largo Ranger Station and North Tarpon Basin Parcel from infrastructure development and maintenance activities.
- Collaborate with other conservation land managers to assess sea level rise threats to this species throughout the Florida Keys.

Shrubs

There are 88 taxa of native shrubs that have been recorded as native for EVER (Gann *et al.* 2014a)[23]. More than half of these taxa (48) are relatively common in South Florida, while the remainder are considered regionally rare, imperiled, or critically imperiled. The majority of the species in the latter group are of tropical origin and known in the continental United States only from South Florida. Seven shrub species are classified as SOMCs in this report[24], including four from the Long Pine Key area. One SOMC shrub, *Xylosma buxifolia*, is a newly discovered species for South Florida known from a single patch on Long Pine Key (Sadle 2012b). Other SOMC shrubs primarily documented from the Long Pine Key area of EVER are *Bourreria cassinifolia, Hypelate trifoliata* and *Sideroxylon reclinatum* ssp. *austrofloridense*. In addition to a significant population on Long Pine Key, *H. trifoliata* is possibly present at the Key Largo Ranger Station, but the one known individual may be across the park boundary on non-federal land. Other rare shrubs apparently limited in EVER to the Long Pine Key area are *Byrsonima lucida, Chamaecrista deeringiana, Crossopetalum ilicifolium, C. rhacoma, Dodonaea viscosa*[25], *Hibiscus grandiflorus, Koanophyllon villosum, Lantana depressa* var. *depressa, Forestiera segregata* var. *pinetorum*[26], *Psidium longipes, Senna mexicana* var. *chapmanii* and *Tetrazygia bicolor*. Shrubs which are ranked as secure in South Florida but substantially limited to the Long Pine Key area of the park are *Coccothrinax argentata*[27], *Croton linearis, Hypericum hypericoides, Licania michauxii, Psidium longipes* and *Rhus copallina*[28]. The SOMC *Dalea carthagenensis* var. *floridana* has only been collected in the Context Road area to the north of Long Pine Key and is possibly extirpated in the park (see account below).

One SOMC shrub, *Vallesia antillana*[29], is known from EVER only from coastal areas on the mainland vulnerable to sea level rise and one other, *Vachellia tortuosa*, is known only from shell

[23] Ninety if *Forestiera segregata* var. *pinetorum* is recognized. See note below. The South Florida endemic *Amorpha herbacea* var. *crenulata* was reported for EVER by Reimus (1996, 1999), but this represented a formerly cultivated individual planted outside of its historical range (see Gann *et al.* 2014a). Reimus (1996, 1999) inexplicably listed *Eugenia rhombea* as possibly extirpated in the park in Appendix 6, but it is not on the main park list, nor are there any other records; perhaps this was a transcription error of *E. confusa* (see Trees above). *Harrisia fragrans* was reportedly collected east of Flamingo by Lyman Benson (1982), but the specimen at the Rancho Santa Ana Botanical Garden has not been located despite efforts from staff at that facility. The number cited (16578 RSA-POM) is the same as that cited for *Rhipsalis baccifera* from the same area (see account below). *Harrisia* plants in that area are *H. simpsonii.* See also note on *Sideroxylon reclinatum* below.

[24] *Malachra fasciata* and *Pavonia paludicola* were ranked as critically imperiled in South Florida in 2002, but were down-ranked to imperiled by IRC in 2014 based on additional data compiled in preparation for this report.

[25] *Dodonaea viscosa* – IRC treats these plants as the segregate taxon, *D. viscosa* var. *angustifolia*, which is ranked as rare in South Florida (Gann *et al.* 2014a). The typical coastal form of *D. viscosa* with large lanceolate leaves is not known from the park.

[26] *Forestiera segregata* var. *pinetorum* – Many modern authors including IRC and the Atlas of Florida Vascular Plants place this into synonymy under *F. segregata*, but both ITIS and FNAI currently recognize it as a valid taxon. It is a smaller-leaved form from South Florida pine rocklands and is ranked as imperiled by FNAI in Florida and by NatureServe in the United States.

[27] *Coccothrinax argentata* – J. Sadle has also recorded three individuals at Middle Cape Sable (email comm. 2013).

[28] *Rhus copallina* – Taylor (1964) also cited this for the Bear Lake Road area, but this is uncorroborated by any other sources.

[29] *Vallesia antillana* – Craighead (1959) also reported this for the Key Largo Ranger Station, but this has not been verified by other sources nor has it been found at the North Tarpon Basin parcel.

mounds in the northwestern part of the park. Other rare upland shrubs known exclusively or primarily from lowland coastal areas in EVER including Key Largo, islands in Florida Bay, the southern shores of the mainland, and the western coastline of the park (including shell mounds) are *Abutilon permolle, Acanthocereus tetragonus, Agave decipiens, Argusia gnaphalodes, Cordia globosa, Erithalis fruticosa, Gossypium hirsutum, Harrisia simpsonii, Lantana depressa* var. *sanibelensis, Malachra fasciata, Maytenus phyllanthoides, Pavonia paludicola, Scaevola plumieri, Solanum bahamense, Sophora tomentosa* var. *truncata* and *Vachellia farnesiana*. Additional shrubs which are common in South Florida, but may be threatened in the park from sea level rise include *Casasia clusiifolia, Cynophalla flexuosa*[30], *Opuntia humifusa, Pithecellobium keyense, P. unguis-cati* and *Suriana maritima*[31]. Upland shrubs most vulnerable to sea level rise include *Lantana depressa* var. *sanibelensis,* which is also threatened by hybridization with the invasive *L. camara*. Common coastal shrubs presumably capable of migrating with geographic shifts of coastal uplands are *Iva imbricata*, *Opuntia stricta* and *Yucca aloifolia*. One coastal wetland shrub assumed to be capable of migrating with sea level rise, *Borrichia* x *cubana,* is worth noting as a species to monitor due to its cryptic nature and rarity.

Other rare tropical species with broader distributions in EVER area are *Acacia pinetorum, Corchorus siliquosus, Jacquinia keyense, Schoepfia schreberi*[32], *Senna ligustrina* and *Solanum donianum*. One common temperate species with a restricted range in EVER is *Hypericum tetrapetalum,* which is known in the park from a 1961 collection by Frank Craighead along the Turner River in EVER (s.n. FNPS); it may be extirpated in the park[33].

There are several problematic shrubs. Craighead (1959) reported *Bumelia texana,* a synonym of *Sideroxylon lanuginosum* ssp. *rigidum*, for "Marco Island and probably western park." with the common name tough-buckthorn. This was likely a misidentification of *Sideroxylon tenax* (or even a typographical error), which has never been found in the park. Craighead (1959) also reported *Cassia keyensis,* a synonym of *Chamaecrista lineata* var. *keyensis,* for Long Pine Key, but this was likely a misidentification of *Chamaecrista deeringiana*.

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[30] *Capparis flexuosa* in the FISF.

[31] *Sideroxylon reclinatum* was also collected a single time by John Kunkel Small, John H. Small and John B. DeWinkeler in 1924 from "Hammock back of Flamingo, Cape Sable Region" (Small *et al.* s.n., US). With the publication of R.D. Whetstone's (1985) paper describing *Bumelia reclinata* ssp. *austrofloridense*, all *S. reclinatum* in EVER were assumed to be *S. reclinatum* ssp. *austrofloridense* (e.g., Reimus 1999). However, Small's specimen from the Flamingo area was collected as *Bumelia microcarpa* Small and annotated by Whetstone as *Bumelia reclinata* in 1983. In contrast, Corogin and Judd (2014) have recently determined that this specimen is *S. reclinatum* ssp. *austrofloridense*, based on new micromorphological research. See *S. reclinatum* ssp. *austrofloridense* account below.

[32] *Schoepfia schreberi* – IRC and the Florida Atlas of Vascular Plants treat the South Florida plants as the segregate species *S. chrysophylloides* from peninsular Florida and the Greater Antilles. *S. schreberi* is a more widespread entity also in the Lesser Antilles, Mexico, Central America and South America. Although most records of *S. schreberi* in EVER are from the Long Pine Key area (e.g., Dilley and Craighead 1957, Taylor 1964), plants have also been recorded from shell mounds on the west coast and on earth middens in Shark Valley (J. Sadle, email comm. 2013).

[33] *Hypericum tetrapetalum* – it is also possible that this freshwater wetland species vouchered by Frank Craighead along the Turner River was actually collected along what is now the BICY portion of the river; no suitable habitat is known to exist for this species in that region of EVER (J. Sadle, email comm. 2014).

In 2015, IRC intends to re-assess the South Florida rank of *Lantana depressa* var. *depressa* and *Lantana depressa* var. *sanibelensis* using the 2012 NatureServe criteria as they may qualify as critically imperiled in South Florida and thus as SOMCs in EVER[34]. Both are threatened by hybridization with the invasive exotic *Lantana camara* (Sanders 1987, Maschinski *et al*. 2010), and *L. depressa* var. *sanibelensis* is further threatened by sea level rise as mentioned above.

Bourreria cassinifolia (A. Rich.) Griseb. – Pineland Strongback

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	100-200

Figure 3. *Bourreria cassinifolia* in Miami-Dade County. Image by Keith Bradley, 2008.

Figure 4. *Bourreria cassinifolia* on Long Pine Key. Image by Jimi Sadle, 2007.

Background

Pineland strongback is a shrub in the Boraginaceae. It is endemic to South Florida and Cuba. In South Florida, it has only been recorded from Miami-Dade County and the Monroe County Keys. It is currently known from eight conservation areas – seven on the mainland including EVER, and in the Florida Keys at the National Key Deer Refuge in the lower Florida Keys (Gann *et al.* 2014a). It is not abundant anywhere in South Florida. In Cuba, it is more widespread and found in a variety of habitats including savannas and serpentine shrublands. In South Florida, pineland strongback grows primarily in pine rocklands and along the edges of tropical hardwood hammocks. It was ranked by Mortellaro *et al.* (2012) to have a moderate affinity to high quality natural areas, but large populations are known from scraped pine rockland sites in Miami-Dade County (e.g., Old Dixie Pineland as discussed in Gann *et al.* 2002).

Wunderlin and Hansen (2011) reported flowering throughout the year. In the Bahamas, Rathcke (2001) found that animal pollination was required for fruit set and that butterflies were probably the major pollinator of the related *B. succulenta*. Self-incompatibility has been reported for congeners, including *B. succulenta* in the Bahamas (Rathcke 2001) and *B. quirosii* in Costa Rica (Bawa 1974), but this may not be a limitation for *B. cassinifolia.* The species was found by Fisher & Jayachandran (2005) to be associated with arbuscular mycorrhizal fungi. They also found that seedlings inoculated with arbuscular mycorrhizal fungi had enhanced growth rates in nutrient poor soils (Jayachandran and Fisher 2008). In South Florida, pineland strongback is

[34] Both of these taxa were ranked as imperiled in Rare Plants of South Florida (Gann *et al.* 2002) due to the number of known occurrences at that time. FNAI (2014) ranks both as critically imperiled in Florida.

cultivated by native plant nurseries, in botanical gardens and by native plant enthusiasts both within and outside of its historical range. It sometimes recruits from cultivated plants (pers. obs. of the author).

Conservation Status

Bourreria cassinifolia has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as globally vulnerable and critically imperiled in the United States. It is not listed under the Endangered Species Act, but it is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC for South Florida. Loope & Avery (1979) listed it as a species of highest concern in National Park Service Areas in South Florida, with a small known population on Long Pine Key in EVER.

History in EVER

Pineland strongback was first vouchered in EVER in 1959 by Frank Craighead (s.n. FNPS), who collected it to the west of Palma Vista #2 Hammock in Pine Block J on Long Pine Key (Craighead 1959). It is still extant at this station and was subsequently observed at a number of additional sites on Long Pine Key including along the edge of Bootlegger Hammock and in pinelands in Pine Block J, and in pinelands in pine blocks E and H. A previous report from Pine Block F was not verified by IRC surveys from 2003 to 2008 (Gann *et al.* 2009). Based on historical data, Gann *et al.* (2002) estimated that there were fewer than 100 plants extant in the park and that estimate was retained by IRC at the end of 2008 (Gann *et al.* 2009). Through September 2008, IRC recorded 13 stations with GIS coordinates, but eight of those stations had only two or three plants (IRC and EVER unpublished data). In 2008, EVER Botanist Jimi Sadle discovered an additional station with three fertile plants in Pine Block B, but noted that this area needed further surveying (IRC and EVER unpublished data). A review of existing data indicates that there may be just over 100 adult plants present in EVER, but a new census is needed. In 2007, 163 seeds from five maternal lines were collected in EVER by Fairchild Tropical Botanic Garden and sent to the National Center for Genetic Resources Preservation for storage (Goodman *et al.* 2007).

Discussion

While the population of *Bourreria cassinifolia* in EVER is small, it is widespread on Long Pine Key and appears both stable and healthy – the missing station from Pineblock F could easily be overlooked. It has been observed in the same location to the west of Palma Vista #2 Hammock for 50 years, with only fire management and perhaps some minor exotic plant control occurring in that area. Loope & Avery (1979) described it as a species requiring periodic burning of immediate habitat for preservation. Between its discovery in 1957 and the last time it was monitored in 2007, Pine Block J burned 13 times in the vicinity of pineland strongback, or an average of once every 4 years (EVER Fire Management Program, unpublished data). In the last 30 years, the area has burned on average every 3 years with no apparent positive or negative effects. The three plots established by IRC in the 2003-2008 study and the 14 existing GIS coordinates provide an excellent baseline for monitoring this species in EVER. Since it has been nearly a decade since some of these stations have been visited, a complete census in 2015 would be timely. If no significant change is detected in the population, then a five-year interval monitoring program is recommended.

Summary of Recommendations

- Continue surveys for pineland strongback in Pine Block F, especially south of Wright Hammock, and other suitable habitats. Record new GIS coordinates where appropriate and census newly discovered stations.
- Revisit the 14 known stations of pineland strongback in 2015 and initiate a 5-year interval monitoring program at all or a subset of the stations.

Dalea carthagenensis (Jacq.) J.F. Macbr. var. ***floridana*** (Rydb.) Barneby – Florida Prairieclover

Federal Status	State Status	IRC SF Status	EVER Population
Candidate	Endangered	Critically Imperiled	Possibly Extirpated

Figure 5. *Dalea carthagenensis* var. *floridana*. Image by Jennifer Possley, 2006.

Figure 6. D. *carthagenensis* var. *floridana* at Crandon Park, Miami-Dade County, 2012.

Background

Florida prairieclover is a small shrub in the Fabaceae. It is endemic to South Florida where it is known from Miami-Dade County, the Monroe County mainland, and Collier and Palm Beach counties[35]. It is extirpated in Palm Beach County, but extant in three discrete populations in BICY, one in Monroe and two in Collier (Bradley and Abdo 2543 FNPS, Woodmansee and Sadle 1295 FNPS, EVER unpublished data), and at three coastal conservation areas in Miami-

[35] The species is widespread in the West Indies, Mexico, Central America and South America. A number of infraspecific taxa have been described.

Dade County (Possley *et al.* 2013, Gann *et al.* 2014a). It is apparently extirpated in EVER and at a number of other previously documented locations (Gann *et al.* 2002). It grows in a confusing variety of habitats for a critically imperiled plant, including pine rocklands, the edges of tropical hardwood hammocks and coastal hardwood shrubland; in some cases those habitats are disturbed. Its original habitat in EVER is unclear but the area where it was collected is dominated by short-hydroperiod graminoid freshwater prairies with extensive exposed limestone rock and small hardwood hammocks. Mortellaro *et al.* (2012) ranked it as being obligate to natural areas in South Florida, but the quality of those areas may be low. Wunderlin & Hansen (2011) reported flowering all year. Fairchild Tropical Botanic Garden has worked extensively with Florida prairie clover in Miami-Dade County since 2003, including demographic monitoring, nursery cultivation and outplanting trials (for a summary see Possley *et al.* 2013).

Conservation Status

Dalea carthagenensis var. *floridana* has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as critically imperiled globally and in the United States. It is a candidate for listing under the Endangered Species Act (petitioned 2009) and is listed as endangered by the State of Florida[36]. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC for South Florida.

History in EVER

Florida prairieclover is known in the park from two specimens collected by Frank Craighead and Maxie Simmons in the Context Road area in 1964 (Craighead and Simmons s.n. FTG, Simmons s.n. FNPS)[37]. Although the labels state that the collections were made from the eastern boundary of the park "west of Mowry Rd.", the boundary at that time was inside an area of undisturbed graminoid freshwater prairies and hammocks. In the 1970s, a tomato field (Herman Walker's Tomato Patch) was cleared to the northeast of this area just outside what was then the park boundary (G. Donald Gann, pers. comm. 2013). Loope and Avery did not list Florida prairieclover in their 1979 rare plant report for National Park Service Areas in South Florida but did include it on the 1980 EVER checklist. Although numerous botanical surveys have been conducted along Context Road, it is not clear that the area where Florida prairieclover was collected has been thoroughly surveyed for this species.

Discussion

There is no doubt that this species is difficult to understand and that more work is needed. As a South Florida endemic and candidate for listing under the Endangered Species Act, a thorough search in the western Context Road area is needed.

Summary of Recommendations

- A dedicated search for *Dalea carthagenensis* var. *floridana* should be conducted in the western Context Road area, especially southwest of Herman Walker's Tomato Patch; searches may be timed to follow disturbances such fire or tropical cyclones. It is also possible that plants could be found elsewhere in the eastern and northern sections of the

[36] As *Dalea carthagenensis*. The State of Florida does not list infraspecific taxa.

[37] Rare Plants of South Florida (Gann *et al.* 2002), reported a collection of *D. carthagenensis* var. *floridana* by Ellsworth P. Killip (41210, US). This report was incorrect due to a transcription error. Killip's specimen was of *Aeschynomene pratensis*.

park in graminoid freshwater prairies or on the edges of prairie hammocks. Park service personnel should be supplied with identification resources and encouraged to search for plants. Any new populations should be vouchered and fully documented.

Hypelate trifoliata Sw. – White Ironwood

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	11-100

Figure 7. *Hypelate trifoliata* on Key Largo (l) and on Long Pine Key (r), 2013.

Background

White ironwood is a shrub or tree in the Sapindaceae. It is a primarily West Indian species at the northern end of its range in South Florida and the northern Bahamas. In South Florida it is known from the mainland in Miami-Dade County and from Monroe County in the Florida Keys. Currently, it is known from eight conservation areas, including EVER, one private conservation area in Miami-Dade County, and six conservation areas in the upper and middle Florida Keys (Gann *et al.* 2014a). Historically, it ranged in the Florida Keys from Key Largo in the north to Key West, but it may be extirpated in the lower Keys, including the National Key Deer Refuge. In South Florida, it is most abundant in the pinelands of Long Pine Key in EVER, but is also know from tropical hardwood hammocks on Long Pine Key and in the Florida Keys. Mortellaro *et al.* (2012) ranked it as being obligate to having a high affinity to high quality natural areas.

Flowering in South Florida is from April through July, followed shortly thereafter by fruit development (Tomlinson 2001). Correll & Correll (1982) reported it to flower "mainly" from November to August in the Bahamas. It is a known host for lobate lac scale (Howard *et al.* 2006). White ironwood is occasionally cultivated in Miami-Dade County by native plant nurseries, in botanical gardens and by native plant enthusiasts both within and outside of its historical range, but it has not been recorded naturalizing outside of its historical range. It is a very slow growing species.

Conservation Status

Hypelate trifoliata has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as apparently secure globally and as critically imperiled in the United States. It is not listed under the Endangered Species Act, but it is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC for South Florida[38]. Loope & Avery (1979) ranked white ironwood as a species of highest concern in National Park Service Areas in South Florida, with a small known population on Long Pine Key in EVER.

History in EVER

White ironwood was first collected in EVER by Frank Craighead in 1956 (Craighead s.n. FNPS) and reported by Dilley & Craighead (1957) for the western end of Long Pine Key and the Key Largo Ranger Station. The largest tree was reported to have a 4" DBH. It was not included on Taylor's (1964) checklist of trees for the park. On Long Pine Key, it is historically known from the Deer Hammock area in Pine Block A, the Torre Hammock area of Pine Block A and from the western half of Pine Block B. IRC surveys from 2003 to 2008 confirmed these locations and discovered new occurrences in the pinelands of Pine Block A, at an unnamed hammock west of Baker Hammock in Pine Block A and in pinelands in Pine Block F (Gann *et al.* 2009). Through September 2008, IRC recorded 14 stations with GIS coordinates, but only two of these stations had more than three plants (IRC and EVER unpublished data). Long-term monitoring plots were established by IRC in Pine Block A (2), Pine Block B (1), Deer Hammock (2) and Torre Hammock (1), each containing between one and three adult plants. In 2007, a single large tree was located near the boundary of the Key Largo Ranger Station, which was photographed by the author, Sadle and others in 2013, but no adults are currently known with certainty to be inside park boundaries in the Florida Keys. IRC (2009) estimated that there were 11-100 adult plants in the Long Pine Key area at the end of 2008 and that estimate remains current pending a new census.

Discussion

White ironwood grows in both pine rockland and tropical hardwood hammocks and its survival appears to be indifferent to recent fire management. While the population is small on Long Pine Key, it appears to be stable. The three plots established by IRC in the 2003-2008 study and the 14 existing GIS coordinates provide an excellent baseline for monitoring this species in EVER. Since it has been nearly a decade since some of these stations have been visited, a complete

[38] *Hypelate trifoliata* – In Rare Plants of South Florida (Gann *et al.* 2002), this was ranked as imperiled in South Florida, but in 2003 it was up-ranked to critically imperiled and included in IRC's project Rare Plant Monitoring and Restoration on Long Pine Key, Everglades National Park (Gann *et al.* 2009).

census in 2015 would be timely. If no significant change is detected in the population, then a five-year interval monitoring program is recommended.

Summary of Recommendations

- Continue searches for white ironwood on Long Pine Key and Key Largo. Record new GIS coordinates where appropriate and census newly discovered stations.
- Revisit the 14 known stations of white ironwood in 2015 and initiate a 5-year interval monitoring program at all or a subset of the stations.

Sideroxylon reclinatum Michx. ssp. ***austrofloridense*** (Whetstone) Kartesz & Gandhi – Everglades Bully

Federal Status	**State Status**	**IRC SF Status**	**EVER Population**
Candidate	NA	Imperiled	10,001-100,000
Synonyms: *Bumelia reclinata* var. *austrofloridensis* Whetstone			

Figure 8. *Sideroxylon reclinatum* ssp. *austrofloridense* on Long Pine Key. Images by Jimi Sadle, 2014 (l) and the author, 2013 (r).

Background

Everglades bully is a thorny shrub in the Sapotaceae. It is endemic to South Florida in Miami-Dade County, and possibly Monroe and Collier counties (see Corogin and Judd 2014). It is currently known only from EVER and the adjacent Frog Pond, a few plants in pine rockland

fragments in urban Miami-Dade County, and possibly one or more small populations in BICY[39] (Gann *et al.* 2014a). It grows in pine rocklands and graminoid freshwater prairies. Mortellaro *et al.* (2012) ranked it as having a very high affinity to high quality natural areas. Wunderlin & Hansen (2011) reported it to flower in the spring, but flowering specimens have also been collected in the winter. A review of Everglades bully can be found in U.S. Fish and Wildlife Service (2013d).

Conservation Status

Sideroxylon reclinatum ssp. *austrofloridense* has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as critically imperiled globally and in the United States. It is a candidate for listing under the Endangered Species Act (petitioned 2007), but is not listed by the State of Florida since it is an infraspecific taxon within a common species. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, but IRC lists as imperiled in South Florida due to the number of extant occurrences and estimated total population.

Taxonomic Notes

The Everglades taxon of *Sideroxylon reclinatum* was first recognized by David Whetstone in 1985 and published as *Bumelia reclinata* (Michx.) Vent. var. *austrofloridensis* Whetstone. It was transferred to the genus *Sideroxylon* by Kartesz & Gandhi in 1990. The primary character distinguishing this from typical *Sideroxylon reclinatum* by Whetstone relates to leaf pubescence (lower surface of the leaf blades persistently pubescent in ssp. *austrofloridense* versus lower surface of leaf blades glabrous or pubescent only along the midvein in ssp. *reclinatum*). Plants with mixed and/or indeterminate features have been found in BICY. Corogin & Judd (2014) have recently published new micromorphological characters distinguishing ssp. *austrofloridense* from ssp. *reclinatum*, and have extended the known range of *S. reclinatum* ssp. *austrofloridense* into Collier County to the west and Key Largo in the Monroe County Keys to the east. A specimen previously determined as *S. reclinatum* var. *reclinatum* from the Flamingo area in EVER (Small *et al*. s.n. US), was also re-determined as var. *austrofloridense* based on this new research. Forthcoming molecular work and a complete taxonomic review are anticipated.

History in EVER

Everglades bully is historically known in the park from Long Pine Key where it was first collected in 1904 by John Kunkel Small and Percy Wilson (1852 NY in Gann *et al.* 2002). It has been collected repeatedly since the early 1900s (Gann *et al.* 2002). IRC surveys of the Long Pine Key area from 2003 to 2008 recorded 14 occurrences at 162 GPS stations, with a total estimated population of 10,001-100,000 individuals in the park (Gann *et al.* 2009). Plants were found in all pine blocks, in prairies north of Long Pine Key, in prairies and transitional pinelands west of Pine Block D, to the east of Pine Block J and on Paradise Key. Twelve long-term monitoring plots were established for Everglades bully, including six in pineland (three north of Main Park Road and three south of Main Park Road) and six in prairie (same configuration). Six

[39] Although IRC currently considers *Sideroxylon reclinatum* ssp. *austrofloridense* as present in BICY and Monroe County based on Woodmansee 1121 FTG (Gann *et al.* 2014a) and other specimens, the characters of this species in BICY are confusing. Corogin and Judd (2014) document a number of additional specimens in Monroe and Collier counties based on new micromorphological research (see Taxonomic Notes).

50 m belt transects were also installed along the pineland/prairie ecotone, three north of Main Park Road and three south of Main Park Road.

Discussion

Everglades bully is abundant in the Long Pine Key area of EVER, but it is a taxon with a narrow global range which is listed as a candidate for federal listing under the Endangered Species Act. Results from the 2003-2008 IRC Long Pine Key rare plant study showed that Everglades bully was a habitat generalist growing both in pine rocklands and graminoid prairies, but little else is known about its life history including pollination, recruitment, long-term vulnerability to hydrological changes, adaptability to different fire regimes and so on. Since it has been more than five years since the long-term monitoring plots and transects established by IRC have been visited, a re-sampling in 2015 would be timely. If no significant change is detected in the population, then a five-year interval monitoring program is recommended.

Summary of Recommendations

- Re-sample the 12 long-term monitoring plots and six belt transects in 2015 and initiate a 5-year interval monitoring program.

Vachellia tortuosa (L.) Seigler & Ebinger – Poponax

Federal Status	**State Status**	**IRC SF Status**	**EVER Population**
NA	Endangered	Critically Imperiled	11-100
Synonyms: *Acacia tortuosa* (L.) Willd.			

Figure 9. *Vachellia tortuosa* in EVER. Image by Jimi Sadle, 2007.

Figure 10. *Vachellia tortuosa* thorns showing fused bases. Image by Jimi Sadle, 2007.

Background

Poponax is a shrub or small tree in the Fabaceae. It is a primarily Neotropical species at the northern end of its range in South Florida and the northern Bahamas, otherwise known from the Antilles, Mexico, Central America (Guatemala) and northern South America. In South Florida, it is historically known only from the Ten Thousand Islands region of Collier County on Chokoloskee Island, and on Ferguson's Mound in what is now Everglades National Park (Gann *et al.* 2002). Plants on Chokoloskee Island were thought extirpated (Gann *et al.* 2002), rediscovered in 2003 (Gann 1131 FTG) and those plants were subsequently destroyed (Gann 2014c); it may or may not be extant on Chokoloskee Island. A new population was discovered on Dismal Key, located within both the Ten Thousand Islands National Wildlife Refuge and Cape Romano – Ten Thousand Islands Aquatic Preserve, the later which is part of the Rookery Bay National Estuarine Research Reserve (Wilder and Barry 2012). In South Florida, poponax grows in tropical hardwood hammocks on shell mounds and in disturbed areas (Chokoloskee Island), but elsewhere within its native range it grows in a wide variety of habitats, including thickets, dry disturbed sites, rocky and gravelly soils, open pastures, and successional fields (Correll and Correll 1982, Clarke *et al.* 1989, Ebinger *et al.* 2000). Mortellaro *et al.* (2012) ranked it as occurring more frequently in ruderal areas than natural areas. Wunderlin & Hansen (2011) reported it to flower from spring through summer in Florida. Correll and Correll (1982) reported it to flower mostly from August to January in the Bahamas and it is known to flower throughout the year elsewhere in its range (Clarke *et al.* 1989, Ebinger *et al.* 2000). It is cultivated at Fairchild Tropical Botanic Garden (see below), but has never been observed to set fruit (M. Collins, pers. comm. 2014), suggesting self-incompatibility.

Conservation Status

Vachellia tortuosa has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as apparently secure globally and as critically imperiled in the United

States. It is not listed under the Endangered Species Act, but it is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC in South Florida.

Taxonomic Notes

Vachellia tortuosa is most easily distinguished from native congeners in EVER by its elliptic petiole gland, versus a circular petiole gland in *V. farnesiana* and *V. farnesiana* var. *pinetorum*.

History in EVER

Poponax was first collected in EVER on Ferguson's Mound in 1960 by Frank Craighead, who reported it to be "well established" (Craighead s.n. FLAS in Gann *et al.* 2002). John Popenoe collected seeds from this population and accessioned them at Fairchild Tropical Botanic Garden (Gann *et al.* 2002); a tree from that accession is still alive. IRC biologist Steven Woodmansee made a brief survey of Ferguson's Mound in 2001, but did not find any plants (Gann *et al.* 2002). EVER Botanist Jimi Sadle made another survey of Ferguson's Mound in 2010 and relocated a single individual (EVER unpublished data). Sadle also discovered a population of 12 individuals on Sandfly Island in 2005, which was partially resurveyed by EVER and IRC staff in 2011. Ten plants were recorded (EVER and IRC unpublished data) and a voucher specimen was collected (Sadle 603 FNPS). Five individuals were also observed on Russell Key in 2006 (Sadle 494 FNPS, EVER unpublished data). Flowering and fruiting plants have been observed at both Russell Key and Sandfly Island between October and March, but the individual observed on Ferguson's Mound was sterile at the time. Fruiting has been observed between December and March but no recruitment has been observed. Significant infestations of exotic species occur in the vicinity of poponax at all three sites in EVER. In addition, a single plant occurs along the nature trail at Sandfly Island and is at risk of unintentional damage from trail clearing. Apparent frost damage was observed on the individual at Ferguson's mound in 2010. Saha *et al.* (2011) ranked *Vachellia tortuosa* among the species most threatened by sea level rise in EVER, heavily influenced by its small population and lack of inland populations.

Discussion

Although invasive plants and sea level rise both pose threats to poponax in EVER, of greater immediate concern is the apparent lack of reproduction in the park. Systematic surveys and mapping of individual plants encountered during a relatively simultaneous period (e.g., within 1 month) is recommended on all three islands. Preferably, this would be timed to coincide with fruiting, so that seeds could be collected for viability trials and seed banking. Invasive plant control efforts are currently underway and should be completed with special care to avoid off-target damage. Finally, along with other rare species that grow on shell mounds (such as *Celtis iguanaea* - see below), poponax is threatened by sea level rise and associated storm surges. A systematic and coordinated process is needed to determine the extent of this threat, including elevations of individual plants and the salt water tolerances of individual species.

Summary of Recommendations

- Conduct systematic surveys of Ferguson's Mound, Russell Key and Sandfly Island to determine a total baseline population. Map individual plants and initiate a 3- to 5-year interval monitoring program.

- Complete invasive species control programs in the vicinity of poponax, especially *Agave sisalana* on Sandfly Island.
- Coordinate research on rare species threatened by sea level rise on shell mounds, including documenting elevations of individual plants and determining salt water tolerances of species at various life stages.

Vallesia antillana Woodson – Pearlberry, Tearshrub

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	101-1,000

Figure 11. *Vallesia antillana* in the Florida Keys. Images by Keith A. Bradley, 2005.

Background

Pearlberry is a shrub in the Apocynaceae. It is a primarily West Indian species at the northern end of its range in South Florida and the northern Bahamas, known otherwise from the Greater Antilles and southern Mexico (Yucatan Peninsula). In South Florida, it is known only from Miami-Dade and Monroe counties. It is present in four conservation areas outside of EVER, including BISC, all in the Florida Keys (Gann *et al.* 2014a). It may also be present on some private lands in the Florida Keys (e.g., Boot Key), but is presumed extirpated at a number of locations including Key West, Sugarloaf Key and portions of Key Largo (Gann *et al.* 2002). In South Florida, it grows in tropical hardwood hammocks, mostly on coastal berms but also on earth middens and on limestone rock. Fairly large populations have been reported from Big Pine Key in the National Key Deer Refuge and from El Radabob Key in John Pennekamp Coral Reef State Park (Gann *et al.* 2002). Mortellaro *et al.* (2012) ranked it as having a very high affinity to high quality natural areas. Tomlinson (2001) reported records of flowering and fruiting for most months, stating that it probably flowers year-round. Wunderlin & Hansen (2011) reported it to flower throughout the year. Pearlberry is cultivated at botanical gardens and by native plant enthusiasts, but it is not known to naturalize outside of its native range. It is considered to have a slow to very slow growth rate and a moderate tolerance to salt water, tolerating brackish water or occasional inundation by salt water (Gann *et al.* 2014b).

Conservation Status

Vallesia antillana has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as apparently secure globally, but critically imperiled in the United States. It is not listed under the Endangered Species Act, but it is listed as endangered by the

State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC for South Florida.

History in EVER
Pearlberry was first collected in EVER at Monroe Lake Mound by Frank Craighead in 1955 (s.n. FNPS in Gann *et al.* 2002). Craighead subsequently make a collection at "Cape Sable" in 1959 (s.n. FNPS) and at "East Cape Sable" in 1961 (s.n. FTG), presumably from the same location (Gann *et al.* 2002). Despite multiple surveys of the area, no plants have been recorded since that time at Cape Sable, but EVER and IRC biologists surveyed Monroe Lake Mound in 2007 and found a healthy population of 135 plants (EVER and IRC unpublished data). Recruitment was evident and plants in all life stages were observed (Sadle 538 FNPS, EVER and IRC unpublished data). Monroe Lake Mound is a coastal earth midden with an elevation of approximately 1-1.5 m in the mangrove zone. Loope & Avery (1979) ranked pearlberry as a rare species of least concern in National Park Service Areas in South Florida, a species whose populations should be rather stable for the foreseeable future without active management by the NPS. In contrast, Saha *et al.* (2011) ranked *Vallesia antillana* among the species most threatened by sea level rise in EVER, heavily influenced by the number of known occurrences in the park (1), its small population, and lack of inland populations.

Discussion
While it is entirely possible that pearlberry is still extant in the Cape Sable region, this is a massive area that is difficult to survey. Nevertheless, searches for this species can be coordinated with those for other species in the area. Monroe Lake Mound is a coastal earth midden, and along with other rare species that grow in this habitat (such as *Trichostigma octandrum* - see Vines below), pearlberry is threatened by long-term sea level rise. However, this species may be fairly tolerant of occasional storm surges. A coordinated monitoring program between EVER, the National Key Deer Refuge and the Florida Park Service could shed light on the long-term prognosis for this species in South Florida and inform management decisions.

Summary of Recommendations
- Search for *Vallesia antillana* whenever botanical surveys of the Cape Sable region are conducted. Map any plants which are located.
- Develop cooperative monitoring program with the U.S. Fish & Wildlife Service and the Florida Park Service to assess threats of sea level rise throughout South Florida.

Xylosma buxifolia A. Gray – Mucha-gente

Federal Status	State Status	IRC SF Status	EVER Population
NA	NA	Critically Imperiled	1 patch, 101-1,000 clonal stems

Background
Mucha-gente is a dioecious shrub in the Salicaceae (formerly Flacourtiaceae). It is a primarily West Indian species at the northwestern end of its range in South Florida where it is known from a single patch in EVER in Miami-Dade County. Otherwise, it is known from the central and northern Bahamas (including Andros and New Providence), central and eastern Cuba, and

Figure 12. *Xylosma buxifolia* on Long Pine Key, 2013.

elsewhere in the Antilles (Correll and Correll 1982, Acevedo-Rodríguez and Strong 2012, TROPICOS 2014). In South Florida it grows in the pine rocklands of Long Pine Key, but in the West Indies it is native to pinelands and hardwood forests on both limestone and serpentine soils. It flowers throughout the year in the Bahamas (Correll and Correll 1982). *Xylosma buxifolia* appears to be a dioecious species (Sleumer 1980). However the genus *Xylosma* contains members that are polygamodioecious, in which male plants may occasionally produce female flowers and subsequently fertile fruit.

Conservation Status

Xylosma buxifolia has not yet been assessed for the IUCN Red List and is not included in the Catalogue of Life, but it is an accepted name in ITIS and the Flora of the West Indies (Acevedo-Rodríguez and Strong 2012). NatureServe ranks it as secure globally, but critically imperiled in the United States. It is not listed under the Endangered Species Act or by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC for South Florida.

History in EVER

Mucha-gente was newly discovered for the flora of North America by EVER Botanist Jimi Sadle in 2008 (Sadle 2012b). He found a single large patch of plants in the high pine rocklands of Pine Block A on Long Pine Key. It appears to be confined to an area of approximately 200 m^2 (EVER unpublished data). This occurrence is believed to be represented by a single clone that is spreading via root sprouts, but there are several hundred erect stems present in the patch, most

growing very close together (e.g., <10 cm between stems)[40]. In a recent survey by Sadle, the author and IRC biologist James Johnson, several lateral "veins" were observed radiating several meters out from the main patch, indicating that the patch might eventually form secondary patches. In 2008, Sadle mapped the outer edge of the patch in order to track its expansion or retraction over time (EVER unpublished data). All reproductive parts observed to date in EVER have been male, but as suggested above, female flowers may be possible. Flowers have been observed in December and February (EVER and IRC unpublished data). Recent fire history, visible fire scars on plants and its rhizomatous habit suggest that mucha-gente is fire tolerant (J. Sadle, email comm. 2014), which is consistent with habitat data reported from the West Indies.

Discussion

Mucha-gente on Long Pine Key appears to be a long-distance introduction from the northern Bahamas or central Cuba, which is consistent with its distribution in the West Indies. There is no indication that it is an artificial introduction by humans. That said, there is little that can be done with regard to management other than establishing a long-term monitoring protocol and conducting normal management activities, including prescribed burning and invasive species control. As a recent introduction, there are opportunities to study a woody shrub at the early stage of its expansion into a new geographic area.

Summary of Recommendations

- Conduct regular monitoring of *X. buxifolia* to detect changes in colony size and whether sexual reproduction occurs.
- Continue management practice in Pine Block A including prescribed burning and invasive plant control.

[40] The term "mucha-gente" means "many people" in Spanish, and is an excellent description of the habit of this plant in EVER. The patch on Long Pine Key is reminiscent of hundreds of people standing very close together in a crowd.

Vines (excluding Pteridophytes and orchids)

Excluding one fern and three orchids, there are 64 species of vines that have been recorded as native in EVER (Gann *et al.* 2014a)[41]. Over half (37) of these species are relatively common both in South Florida and in EVER, while the remainder are considered regionally rare, imperiled, critically imperiled or possibly extirpated. The majority of the rare species are of tropical origin and known in the continental United States only from South Florida. Of the rare vines, three are considered as SOMCs in this report*: Passiflora sexflora* from the Long Pine Key area, and *Celtis iguanaea* and *Trichostigma octandrum* from coastal areas in the northwestern section of the park.

One rare vine species has been recorded in EVER only on Key Largo at the Key Largo Ranger Station and North Tarpon Bay Parcel: *Passiflora multiflora*. *Passiflora multiflora* is a tropical species at the northern edge of its range in peninsular Florida and the northern Bahamas. In South Florida, it ranges north into BISC. In addition to *Celtis iguanaea* and *Trichostigma octandrum*, other rare upland vines known exclusively or primarily from lowland coastal areas in EVER are *Cardiospermum corindum*[42], *Cissus trifoliata*, *Dalbergia brownei*[43], *Evolvulus convolvuloides*, *Gouania lupuloides*, *Plumbago zeylanica* and *Tournefortia volubilis*. Only two common upland vines are restricted to coastal areas and both would be expected to migrate with sea level rise: *Canavalia rosea* and *Ipomoea pes-caprae* ssp. *brasiliensis*.

As with trees and shrubs there are a number of rare vines apparently limited in EVER to the Long Pine Key area, including the SOMC *Passiflora sexflora* and *Cynanchum blodgettii*, *Ipomoea microdactyla*, *I. tenuissima*, *Rhynchosia parvifolia* and *Vitis aestivalis*. Common South Florida vines apparently limited to the Long Pine Key area are *Centrosema virginianum*, *Smilax havanensis*, *Vicia acutifolia* and *Vitis shuttleworthii*. *Apios americana*, a temperate species at the end of its range on the South Florida mainland, was collected once in 1957 by Frank Craighead at Jo Ree Hammock to the west of the Long Pine Key area, and has been observed at four

[41] An additional vine, *Rhynchosia precatoria*, is treated as assumed native in Gann *et al.* (2014a). A recent discovery (Woodmansee and Sadle 2011), its nativity is unclear but there is no evidence that it was introduced to EVER. ITIS also recognizes *Galactia parvifolia* as distinct from *G. volubilis*, but it is currently treated as a synonym of *G. volubilis* in the Floristic Inventory of South Florida (Gann *et al.* 2014a). Both of these taxa are treated as *G. regularis* in Wunderlin & Hansen (2011) due to the misapplication of type specimens, while the name *G. volubilis* has been applied to plants previously determined as *G. regularis* (including a number of other taxa segregated by others). This "switching" of *G. regularis* and *G. volubilis* has apparently not been accepted by ITIS. If *G. parvifolia* and *G. volubilis* (*sensu* ITIS not Wunderlin & Hansen 2011) are split, then *G. volubilis* may be limited to the Highland Beach area of the Park (see Craighead 1959) and Middle Cape Sable (based on Seavey and Seavey 1165, FNPS).

[42] *Cardiospermum corindum* – This is mostly found in the Florida Keys, but Frank Craighead made a collection on the mainland in EVER at Gopher Mound in 1961 (s.n., FNPS), a population which has also been observed by EVER Botanist Jimi Sadle along with one other on the mainland (email comm. 2014). This species, along with *C. microcarpum*, has been commonly misidentified as the exotic *C. halicacabum*, and the entire collection of *Cardiospermum* in FNPS needs updating and a thorough review.

[43] *Dalbergia brownei* – This is mostly known from the Florida Keys, but there are a few records from the mainland both inside and outside of EVER. Frank Craighead (1959) reported this for "banks of streams and hammocks in salt water areas and far inland on Indian sites. Both of these species [this and *D. ecastaphyllum*] form impenetrable thickets." There is one specimen in FNPS collected by Craighead in 1955 from the mouth of the Taylor River.

stations in the Shark River Slough by EVER Botanist Jimi Sadle (email comm. 2014). *Berchemia scandens*, another temperate species, was observed by Frank Craighead at Radius Rod Hammock in the Context Road area to the north of Long Pine Key (J. Sadle email comm. 2013)[44]. It has apparently not been seen in several decades and is possibly extirpated in the park.

There are several vines that are rare in South Florida, but found in more than one region of EVER: *Cardiospermum microcarpum, Hippocratea volubilis*, *Ipomoea sagittata*, *Passiflora pallens, Smilax bona-nox, Symphyotrichum carolinianum* and *Tournefortia hirsutissima*. One tropical vine, *Jacquemontia pentanthos*, is known from a single outlier collection in the Shark River basin, but is also known from just outside of the park in the Frog Pond. Three rare vines have been collected only as weeds in disturbed areas in EVER: *Cuscuta pentagona*[45], *Ipomoea cordatotriloba* and *I. hederifolia*. Although native to South Florida and considered native to the park by Avery & Loop (1980) and subsequent authors, these vines may not be a permanent part of the park flora.

In 2015, IRC intends to re-assess the South Florida rank of *Passiflora multiflora* using the 2012 NatureServe criteria as it may qualify as critically imperiled in South Florida and thus as a SOMC in EVER[46].

Celtis iguanaea (Jacq.) Sarg. – Iguana Hackberry

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	11-100

Background

Iguana hackberry is a clambering woody vine, shrub or tree in the Cannabaceae (formerly the Ulmaceae). Florida plants are more lianescent than shrub-like with stems approaching 100 feet long reported (Wilder and Barry 2012). It is a primarily Neotropical species occurring in peninsular Florida, the West Indies, Mexico, Central America and South America south to Paraguay and Uruguay. Reports of iguana hackberry from Texas (NatureServe 2014, PLANTS 2014) may be based on misidentifications of *C. pallida*[47]. There are also unconfirmed reports from Alabama (Kartesz 2013, PLANTS 2014) that appear to be originally based on Wilhelm's (1984) Vascular Flora of the Pensacola Region. In Florida, iguana hackberry is presently known

[44] *Berchemia scandens* – A specimen collected by Craighead on February 20, 1955 (s.n., FNPS) on Loop Road was attributed to EVER in Craighead (1959), but was later annotated as being collected in BICY.

[45] Craighead (1959) attributed *Cuscuta americana* to EVER in the Loop Road area, but this could have been a misidentification of *C. pentagona*, another *Cuscuta* species never vouchered for the park, or it could have been another *Cuscuta* species in what is now BICY. In South Florida, *C. americana* has only been collected in eastern Miami-Dade County and the Monroe County Keys (Gann *et al.* 2002).

[46] *Passiflora multiflora* was ranked as imperiled in Rare Plants of South Florida (Gann *et al.* 2002) due to the number of known occurrences at that time. FNAI (2014) ranks it as critically imperiled in Florida.

[47] Reports of *C. iguanaea* from Texas may be originally based on Standley and Steyermark (1946) in the Flora of Guatemala. Berg and Dahlberg (2001) cited *C. iguanaea* from the United States only from Florida, and the Flora of North America (1997) stated that reports from Texas and Florida were both unconfirmed. *C. iguanaea* is closely related to and sometimes confused with *C. pallida*, a species from South Florida, Texas and Mexico. Berg and Dalberg and others place *C. pallida* into synonymy under *C. ehrenbergiana*, a species otherwise known from central South America.

Figure 13. *Celtis iguanaea* at Dismal Key, Ten Thousand Islands National Wildlife Refuge. Images by Jimi Sadle, 2008.

Figure 14. *Celtis iguanaea* at Dismal Key showing vining habit. Image by Jimi Sadle, 2008.

only from western coastal South Florida in Monroe, Collier, Lee and Charlotte counties. It was collected to the north in Manatee County in 1891, where it is now presumed extirpated (Gann *et al.* 2002). Iguana hackberry is extant in South Florida on four islands: Gopher Key (Monroe County in EVER), Dismal Key (Collier County in the Ten Thousand Islands National Wildlife Refuge[48]), Mound Key (Lee County in Mound Key Archeological State Park) and Big Mound Key (Charlotte County in Charlotte Harbor Preserve State Park) (Gann *et al.* 2014a). It is presumed extirpated due to development on Horr's Island in Collier County and on Captiva Island in Lee County, and for unknown reasons at the J.N. "Ding" Darling National Wildlife Refuge in Lee County (Gann *et al.* 2002). In South Florida, it is known to occur only in tropical hardwood hammocks on shell mounds, but in the West Indies it is known from a wide variety of tropical forest and shrubland habitats. Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas in South Florida.

Wunderlin & Hansen (2011) reported flowering in the spring in Florida and Correll & Correll (1982) reported it to flower from April to July in the Bahamas. The genus *Celtis* is wind pollinated and some species are self-compatible (Whittemore and Townsend 2007). De Arruda and Sazima (1988) also found *Celtis iguanaea* to be wind pollinated. It is not definitely known if it is self-compatible, but Wilder & Barry (2012) believed that there was one clone on Dismal Key bearing a few fruits, suggesting a possible absence of cross pollination but not incompatibility. Other populations in South Florida may also be mostly or all one clonal individual. Austin (2004) included iguana hackberry in the Florida ethnoflora, but did not indicate a specific use by indigenous people. The fact that it is known only from shell mounds

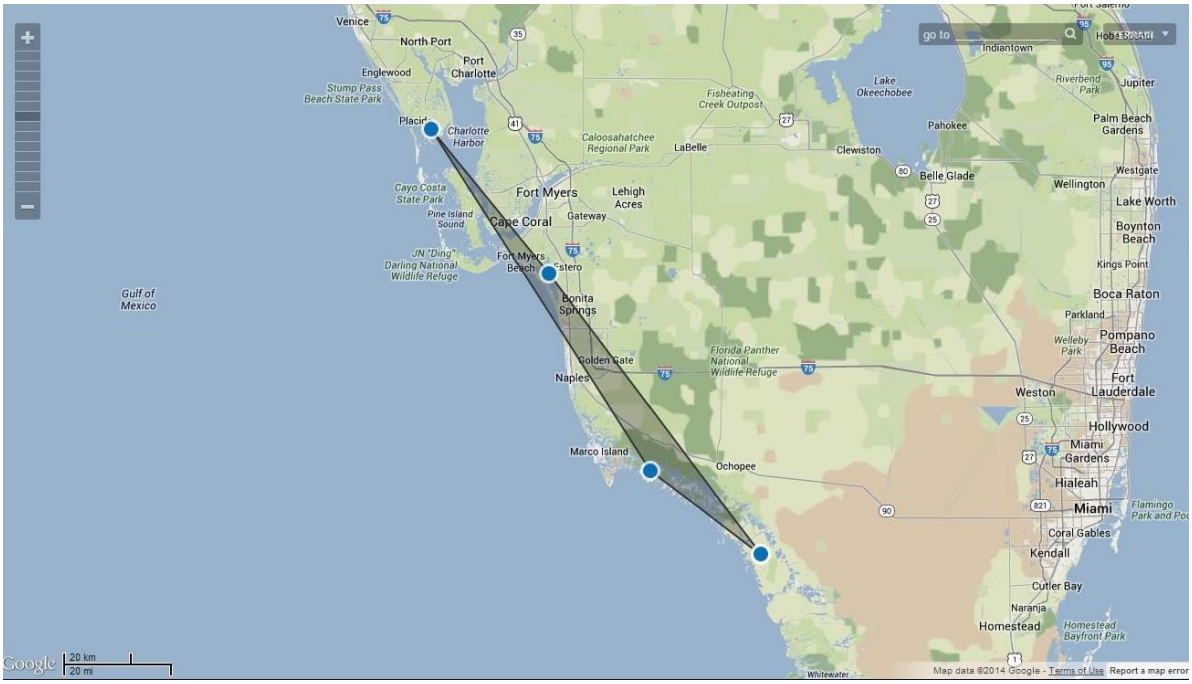

Figure 15. *Celtis iguanaea* South Florida Extent of Occurrence map using Kew GeoCAT tool. Map by Kristen N. Finch and the author, 2014.

[48] Dismal Key is also managed as part of the State of Florida's Cape Romano – Ten Thousand Islands Aquatic Preserve, which is subsequently managed as part of the Rookery Bay National Estuarine Research Reserve.

suggests that the South Florida plants were moved from elsewhere to South Florida and from shell mound to shell mound by indigenous people.

Conservation Status

Celtis iguanaea has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as globally secure and imperiled (rounded) in the United States. It is not listed under the Endangered Species Act, but it is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC for South Florida. At present, the only known living plants in the continental United States are in South Florida. Interestingly, iguana hackberry is also very rare in the Bahamas, known only from Andros Island, but with a completely different habit. Correll & Correll (1982) described the Bahamian plants as "…disturbingly different from typical *C. iguanaea*. It is a rigidly erect, somewhat cylindrical shrub with short branches and small, untoothed, apically blunt leaves…"

History in EVER

IRC biologist Mike Barry and colleague Ian Bartoszek discovered iguana hackberry on Gopher Key in EVER in 2010 (Wilder and Barry 2012), about 40 km southeast of Chokoloskee Island in the northwestern corner of the park. In 2010, EVER Botanist Jimi Sadle, BICY biologist Jim Burch and IRC biologist Sonali Saha mapped three separate colonies on Gopher Key (EVER and IRC unpublished data). Two stations were recorded as one individual each while a third was recorded as having 11-20 plants, including 1 juvenile. It is unknown if the juvenile was a seedling or a root sucker (J. Sadle, email comm. 2013). As with other South Florida populations, the entire Gopher Key population could be composed of one or a few clones. Despite extensive surveys of shell mounds in EVER by Sadle and others, no additional populations have been discovered. Saha *et al.* (2011) ranked *Celtis iguanaea* among the species most threatened by sea level rise in EVER, heavily influenced by the number of occurrences in the park (1), its small population, and lack of inland populations. A herbarium voucher specimen is needed for the park and for the Monroe County mainland.

Discussion

Iguana hackberry is one of the most common shrubs in the Neotropics, growing in a wide variety of upland forests and shrublands. It is uncertain why it occupies such a narrow habitat and range in South Florida, but there could be reproductive limitations. Nevertheless, there could be additional populations in the park and searches can be coordinated with those for other species in the area. Iguana hackberry is vulnerable to a number of threats, including invasive exotics and collateral damage from archeological excavations and research, but these threats can be avoided or mitigated. Along with other rare species that grow on shell mounds (such as *Vachellia tortuosa,* see shrubs above, and *Cheilanthes microphylla,* see ferns below), iguana hackberry is threatened over the long-term by sea level rise and associated storm surges. A systematic and coordinated process is needed to determine the extent of this threat, including elevations of individual plants and the salt water tolerances of individual species.

Summary of Recommendations

- Collect a herbarium voucher specimen to document the occurrence in EVER and Monroe County.
- Coordinate research on rare species threatened by sea level rise on shell mounds, including documenting elevations of individual plants and determining salt water tolerances of species at various life stages.
- Alert archaeologists and other researchers to the occurrence of iguana hackberry on Gopher Key and prevent avoidable damage.

Passiflora sexflora Juss. – Goatsfoot Passionflower

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	2-10

Figure 16. *Passiflora sexflora* in Osteen Hammock, 2014.

Background

Goatsfoot passionflower is a vine in the Passifloraceae. It is a primarily Neotropical species at the northern end of its range in South Florida, where it is known only from Miami-Dade County. It is also known from the West Indies, Mexico, Central America and northern South America. Outside of EVER goatsfoot passionflower is known from several small populations in urban forest fragments managed as conservation areas by Miami-Dade County (Gann *et al.* 2002, Gann *et al.* 2014a). It grows in tropical hardwood hammocks, particularly in canopy gaps. Mortellaro *et al.* (2012) ranked it as having a high affinity to high quality natural areas. It is cultivated in South Florida in botanical gardens and by enthusiasts, but is not known to naturalize outside of its historic range. A reintroduction in a Miami-Dade County-owned conservation area and at Royal Palm Hammock in EVER was conducted by Fairchild Tropical Botanic Garden, IRC and collaborators in 2006 (Possley *et al.* 2007). Wunderlin & Hansen (2011) reported it to flower throughout the year.

Conservation Status
Passiflora sexflora has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as secure globally, but as critically imperiled in the United States. It is not listed under the Endangered Species Act, but it is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it critically imperiled in Florida, as does IRC for South Florida. Loope & Avery (1979) ranked goatsfoot passionflower as a species of highest concern in National Park Service Areas in South Florida, with a small, possibly extirpated population in Royal Palm Hammock in EVER.

History in EVER
Goatsfoot passionflower was first collected in EVER by Frank C. Craighead in 1954 in Royal Palm Hammock (s.n. FNPS). Loope & Avery (1979) reported that population to be possibly extirpated. IRC surveys of Long Pine Key hammocks from 2003 to 2008 failed to locate the Royal Palm population, but located and vouchered a population of 2-10 plants in Osteen Hammock (Sadle 397 FNPS with S.W. Woodmansee, Gann *et al.* 2009). Two stations were observed in 2004 (one with one plant and one with four plants) and a third in 2005 (two plants). Plants were also recorded in 2007 in the same general area in a habitat plot (tag #486) established for the SOMC orchid *Beloglottis costaricensis* (Gann *et al.* 2009, IRC and EVER unpublished data). All of these stations are within a 55 m x 15 m area and constitute a single occurrence. In 2010, EVER Botanist Jimi Sadle observed two additional stations about 100 and 150 m to the south of the above stations (EVER unpublished data) – one plant was seen at each location. In February 2014, Sadle, the author and colleagues found two plants in association with a recent tree fall adjacent to tag #486, one a juvenile and one a fruiting adult (Figure 16). Together, all of these observations represent a single shifting population in the southern half of Osteen Hammock.

In 2006, 30 goatsfoot passionflower individuals were outplanted into Royal Palm Hammock by IRC and Fairchild Tropical Botanic Garden (Possley *et al.* 2007, Gann *et al.* 2009). A few flowers and fruits were observed in the first few months, but afterward ceased. By August, 2008 seven plants were reported (Gann *et al.* 2009), but afterward an eighth plant was observed (IRC and EVER unpublished data). The outplanting was severely impacted by the January 2010 South Florida freeze event and 50% of the individuals lost all leaves; one of the eight plants was recorded as dead. In 2011 only two plants were observed, but in 2013 surveys by the author and IRC biologist James Johnson failed to locate any plants. However, no major cyclonic events have occurred in this area of EVER since Hurricane Wilma in 2005 and the plants may be dormant or persisting in the seed bank. These results are consistent with other goatsfoot passionflower outplantings in Miami-Dade County, where outplanted individuals typically die within 6-7 years (J. Possley, email comm. 2014).

Discussion
Goatsfoot passionflower appears to be an ephemeral species that responds positively to tree fall gap formation. However, the long-term absence of disturbance may lead to a temporary loss of plants above ground. Although there are few plants at any one time in Osteen Hammock, the population appears stable. At least in the case of tag #486, plants have remained within a few meters of the same area for at least seven years. Despite the apparent failure of the Royal Palm outplanting, fruits were recorded and viable seeds may still be present in the seed bank.

Summary of Recommendations

- Conduct annual monitoring of the Osteen hammock population.
- Continue to monitor reintroduction area in Royal Palm Hammock for outplanted individuals and/or their progeny.
- Continue reintroduction efforts at Royal Palm Hammock until recruitment and long-term viability is observed.

Trichostigma octandrum (L.) H. Walter – Hoopvine

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	2-10

Figure 17. *Trichostigma octandrum* in habitat, northern Cuba, 2014.

Figure 18. *T. octandrum* in habitat, central Bahamas. Image by Keith Bradley, 2007.

Background

Hoopvine is a shrubby vine in the Phytolaccaceae. It is a primarily Neotropical species at the northern end of its range in South Florida where it is historically known from Miami-Dade, Monroe, Broward and Collier counties. It is apparently extirpated in Miami-Dade County, the Monroe County Keys and Collier County (Gann *et al.* 2002), but is extant in EVER and the Everglades and Francis S. Taylor Wildlife Management Area in Broward County (Gann *et al.* 2014a). It is also known from the West Indies, Mexico, Central America and South America. Morton (1981) considered the plants recorded from the central Bahamas to be introduced, but Correll & Correll (1982) and the Flora of the West Indies (Acevedo-Rodríguez and Strong 2012)

treated it as native there. It is abundant in other parts of the West Indies including the northern coast of Cuba. In South Florida, it has been recorded growing in a variety of tropical hardwood hammocks and in a red maple forest in Broward County (Gann *et al.* 2002). Mortellaro *et al.* (2012) ranked it as having a very high affinity to high quality natural areas in South Florida, but it grows in both disturbed and undisturbed areas in the West Indies. Wunderlin & Hansen (2011) reported it to flower throughout the year. Percival (1974) reported that flowers can be pollinated even by dew because of the small gap between anther pore and stigma. The fruits are spread by birds (Austin 2004). It is cultivated in South Florida and has been observed in Homestead and near the Miami River; plants in Homestead produce flowers and fruits, but it is not clear if the seeds are viable (J. Sadle, email comm. 2014). Austin (2004) documented a long list of human uses in the Neotropics, including medicinal, utilitarian (e.g., for weaving) and for ornamental purposes. To date, it has not been recorded naturalizing from cultivated plants in Florida (IRC unpublished data).

Conservation Status

Trichostigma octandrum has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as apparently secure globally, but as critically imperiled in the United States. It is not listed under the Endangered Species Act, but it is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it critically imperiled in Florida, as does IRC for South Florida.

History in EVER

Hoopvine was discovered in EVER in 2007 by IRC biologist Jesse Hoffman. One plant was observed at House Hammock on an earth midden in the northwestern part of the park. EVER Botanist Jimi Sadle and Hoffman returned to the site and vouchered the occurrence in 2008 (Sadle 553 FNPS). In 2010, Sadle along with IRC biologist Sonali Saha and BICY Botanist Jim Burch also observed a single, sterile plant at Gopher Key. On January 8, 2013, Sadle and ENP Interpretive Rangers Andy Webb and Joe Sterchele observed a single, sterile plant at a shell mound just east of the mouth of the Lopez River. A voucher was made of this occurrence (Sadle 611 FNPS). Saha *et al.* (2011) ranked *Trichostigma octandrum* among the species most threatened by sea level rise in EVER, heavily influenced by its small population and lack of inland populations.

Discussion

Hoopvine has been recorded over a wide area and in a wide range of forest habitats in South Florida. Due to its somewhat cryptic nature (it can easily be confused with *Rivina humilis*), other plants may be present in the area but overlooked. As in the Bahamas, there have been discussions about its nativity in South Florida (e.g., Austin and McJunkin 1978, Austin 2004), but most plants have been collected in natural areas and it is considered native to Florida by IRC, the Atlas of Florida Vascular Plants (Wunderlin and Hansen 2014) and the State of Florida. Nevertheless, hoopvine can be an aggressive grower once established and may overwhelm nearby vegetation. Any translocation proposal for this species should be treated with caution.

Along with other rare species that grow on earth middens (such as *Vallesia antillana* – see Shrubs above) and shell mounds (such as *Vachellia tortuosa*, see Shrubs above, and *Cheilanthes microphylla*, see Ferns below), hoopvine is threatened by long-term sea level rise in EVER.

However, this species may be fairly tolerant of occasional storm surges, and is not limited to coastal sites in South Florida.

Summary of Recommendations

- Coordinate monitoring of hoopvine with other species known from earth middens and shell mounds in the western part of the park and threatened by sea level rise.
- Search for hoopvine whenever botanical surveys of tropical hardwood hammocks in the park are conducted. Map and voucher any plants which are located.

Ferns (including Selaginella)[49]

There are 41 native fern species in EVER[50], of which only 14 are common in South Florida. Of the 27 rare species 10 are SOMCs[51], seven centered on the Long Pine Key area: *Actinostachys pennula, Adiantum melanoleucum, Anemia wrightii* (also in the Context Road area and perhaps as far north as the Chekika Hammock area), *Lomariopsis kunzeana*, *Pecluma plumula* (also in a hammock to the west of Mahogany Hammock), *Thelypteris reticulata*, and *Trichomanes punctatum* ssp. *floridanum*. Of the Long Pine Key area SOMCs, *Actinostachys pennula* and *Trichomanes punctatum* ssp. *floridanum* are presumed extirpated in the park. Other rare ferns from the Long Pine Key area are *Adiantum tenerum, Ctenitis sloanei*, *Sphenomeris clavata*, *Tectaria fimbriata*, *T. heraceifolia*, *Thelypteris augescens, T. ovata* (also in Chekika Hammock), *T. reptans*, *Thelypteris serrata*, and the spike-moss *Selaginella eatonii*. Of these, *C. sloanei* is also possibly extirpated[52]. More abundant ferns limited in EVER to the Long Pine Key area and adjacent rocky glades are *Anemia adiantifolia* and *Pteris bahamensis*. The remaining three SOMC ferns in EVER are scattered in the park: *Asplenium platyneuron* is known from a single specimen collected to the north of Long Pine Key in the Context Road area and from a report from a hammock southwest of Mahogany Hammock; *Ceratopteris pteridoides* is known in EVER only from a canal at Shark Valley; and *Cheilanthes microphylla* is known only from shell mounds in the Ten Thousand Islands area of the park. Of the remaining rare ferns, three are fairly widespread in the park (*Nephrolepis biserrata*, *Pityrogramma trifoliata* and *Thelypteris palustris* var. *pubescens*), one is primarily limited to hammocks in the Loop Road area (*Microgramma heterophylla*[53]), two have been found on opposite sides of Shark Slough (*Cheiroglossa palmata*, *Thelypteris serrata*), one has only been observed twice in a remote location on the western side of the park (*Osmunda cinnamomea*)[54] and one is known only from coastal wetlands (*Acrostichum aureum*).

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[49] This group includes the classic Pteridophytes, which has now been divided by many authors into the ferns and the Lycopodiophytes, the latter of which there is only one native representative in EVER – the spike-moss *Selaginella eatonii*.

[50] Not including the apparent hybrid between *Anemia adiantifolia* and *A. wrightii* (see *A. wrightii* account below). John Kunkel Small (1918b) also reported *Woodwardia virginica* for Royal Palm Hammock (as *Anchistea virginica*), along with *Dryopteris patens*, a name that was misapplied to one or more *Thelypteris* species. There is also an unconfirmed report of *Ctenitis submarginalis* by Alan Cressler from Grossman Ridge Hammocks to the west of Chekika Hammock. A single small plant was reported from a shallow "soiled" solution hole, meaning without exposed limestone. *Polypodium triseriale* was collected once near Naples in 1924 and has been attributed to EVER many times in error (Gann *et al.* 2002). There are several ferns that are native and rare in South Florida that were apparently introduced into the park by Frank Craighead: *Asplenium dentatum*, *A.* x *biscaynianum*, *Thelypteris sclerophylla* and *Trichomanes krausii* (Gann *et al.* 2002, Gann 2013, Gann *et al.* 2014a). Of these, only *A. dentatum* is apparently still extant in the park in Palma Vista #2 Hammock (IRC and EVER unpublished data).

[51] *Thelypteris serrata* was ranked as critically imperiled in South Florida, but was down-ranked to imperiled based on new information compiled in preparation of this report.

[52] *Ctenitis sloanei* – This was not reported by Avery & Loope (1980b, 1983) or Hammer (1994), but appears on checklist by Don Keller (1988) and then on park lists by Reimus (1996, 1999). Roger Hammer (email comm. 2014) reports that he saw this in Palma Vista #2 Hammock with Keller many years ago. Neither the author nor EVER Botanist Jimi Sadle have ever seen this in EVER.

[53] *Microgramma heterophylla* – There is also a record from Lopez Mound near the coast (Sadle 587 FNPS).

[54] *Osmunda cinnamomea* – Then-IRC biologists Jimi Sadle and Keith Bradley discovered *O. cinnamomea* between the Broad and Shark rivers in a *Juncus roemerianus-Spartina* marsh (as indicated on the specimen label for *Eleocharis flavescens* Sadle and Bradley 430 FTG). Sadle and IRC biologist Steven Woodmansee also observed *O.*

Only one fern (*Cheilanthes microphylla*), which grows only on coastal shell mounds, appears to be immediately threatened by sea level rise. Other extant rare ferns, including the SOMCs *Adiantum melanoleucum* and *Lomariopsis kunzeana* may be threatened by long-term modifications to Everglades' hydrology and resultant lower humidity levels in tropical hardwood hammocks. *Actinostachys pennula* and *Trichomanes punctatum* ssp. *floridanum* may be extirpated for the same reason, but none of these species were ever abundant in the park. In contrast, *Anemia wrightii*, which grows on limestone rock outcrops in the so-called "rocky glades" and nearby hammock edges, may be threatened by short-term fluctuations in the water table due to the implementation of CERP. Other ferns may be rare due to climatic limitations (e.g., *Asplenium platyneuron*) or for unknown reasons. Extant populations of native ferns may be underestimated in EVER because large populations of gametophytes may be present yet not observed due to their cryptic nature (see discussions below). On the other hand, the long-term decline of ferns in the park has long been documented and discussed and deserves serious attention.

Actinostachys pennula (Sw.) Hook. – Ray Fern

Federal Status	**State Status**	**IRC SF Status**	**EVER Population**
NA	Endangered	Critically Imperiled	Presumed Extirpated
Synonyms: *A. germanii* Fée, *Schizaea pennula* Sw.			

Background

Ray fern is a diminutive, grass-like fern in the Schizaeaceae. It is a primarily Neotropical species at the northern end of its range in South Florida, occurring also in scattered localities in the West Indies, southern Mexico and Central America, and as a more common species in South America. In South Florida, it is currently known only from four conservation areas in Miami-Dade, Palm Beach (Arthur R. Marshall Loxahatchee National Wildlife Refuge), Collier (BICY) and Lee counties (Gann *et al.* 2014a). Other historical populations, including one reported for what is now EVER (Small 1918b), have been extirpated. The extant Miami-Dade population, consisting of only a few individuals, occurs just over five km to the east of EVER in Miami-Dade County's South Dade Wetlands complex of conservation lands (Gann *et al.* 2014a, IRC unpublished data)[55]. In South Florida, ray fern grows terrestrially or semi-epiphytically in a wide variety of swamp, hammock and pine flatwoods habitats, almost always in moist undisturbed environments. It often grows on rotting logs or on the bases of other ferns such as royal fern (*Osmunda regalis*) or cinnamon fern (*Osmunda cinnamomea*), or on or at the base of saw palmetto (*Serenoa repens*) trunks. Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas. Wunderlin and Hansen (2011) reported it to be fertile throughout the year. This and related species have been observed to have long-lived, subterranean, tuberous gametophytes, and above-ground sporophytes may be rare (Bierhorst 1975). Florida material of *A. pennula* has been cultivated in the laboratory (Boughton *et al.* 2009), and the related but

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cinnamomea while performing field work via helicopter in 2005 (Sadle and Woodmansee, email comm. 2014). The *Osmunda* was growing along the edge of a *Juncus roemerianus* marsh between the Broad and Woods rivers. Unfortunately, no herbarium specimen was collected at either location and this fern still needs to be vouchered for EVER and the Monroe County mainland.

[55] IRC biologist Keith Bradley and Miami-Dade County biologist Gwen Burzycki first recorded ray fern in the South Dade Wetlands in April, 2006.

1. **A. Germani** Fée. Leaves rigidly erect, 1 or several from a bristly tuber usually buried in rotten wood, borne upon a slender chestnut-brown rootstock, 5–15 cm. long, about 1 mm. in diameter, triangular or flattish in drying: spore-bearing segments linear, 1–4 pairs, 8–15 mm. long, the sporangia in 2 rows, often appearing in 4's from crowding, the mid-vein pilose. —Low hammocks.—Figure 3, reduced.

This relative of the northern curly-grass has been found but twice in Florida. It was discovered in low hammocks about the headwaters of the Miami River in 1904. About a decade later it was found on Royal Palm Hammock, where it occurred very sparingly in the northern part of the forest. It grows in decaying wood, sometimes in stumps over a meter from the ground. Outside of Florida it is known only in the West Indies.

Figure 19. Species account from John Kunkel Small's Ferns of Royal Palm Hammock (1918b, in the public domain).

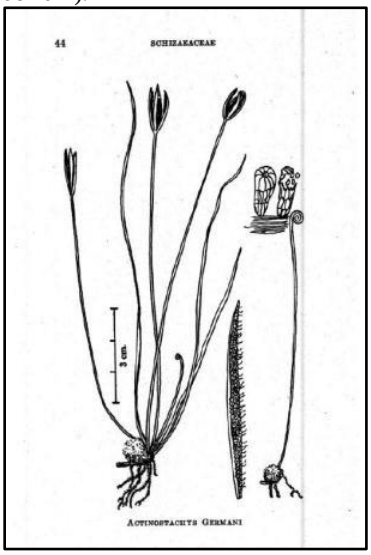

Figure 20. Illustration from John Kunkel Small's Ferns of Florida (1931, in the public domain).

Figure 21. *Actinostachys pennula* in Costa Rica, 2006.

temperate *A. pusilla* has long been cultivated and studied. Britton and Taylor (1901) reported mycorrhizal associations of both the gametophyte and sporophyte stages of *A. pusilla*, and this association was further described as an obligatory relationship for the gametophyte by Swatzell *et al.* (1996), which was further supported by Merckx and Freudenstein (2010) who reported that the gametophytes of *Schizaea* (including *Actinostachys*) are mycoheterotrophic.

Conservation Status

Actinostachys pennula has not yet been assessed for the IUCN Red List, but is in the Catalogue of Life. NatureServe ranks it as globally secure, but critically imperiled in the United States. It

is not listed under the Endangered Species Act, but is listed as endangered by the state of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC in South Florida.

History in EVER

Ray fern was first collected in North America along the banks of the Miami River by Alvah A. Eaton in 1904 (Gann *et al.* 2002). In 1918, John Kunkel Small reported it for what is now EVER in his book Ferns of Royal Palm Hammock, where he stated that it "…occurred very sparingly in the northern part of the forest." Although he reported ray fern for Royal Palm Hammock again in 1931 and 1938, it is not clear that Small ever personally observed it in what is now EVER, nor was it ever vouchered. From historical records, it seems likely that it was observed only once around 1914 (see Small 1918b, 1931, 1938). While it is possible that this record is based on a misidentification, the nearby occurrence in the South Dade Wetlands, presence of suitable habitat, unique appearance and cryptic nature of the species makes this historical record credible.

Systematic surveys of Royal Palm Hammock were conducted beginning in 2003 in an attempt to find this and other rare species, but searches for ray fern have proven unsuccessful (Gann *et al.* 2009). In 2008 and 2011, surveys were also conducted by IRC biologists in tree islands along the eastern border of the park, also without success. Fires, land clearing, and hydrological alterations in Royal Palm Hammock and eastern EVER may have caused its disappearance. However, it may also be present in the park, but in an underground phase or simply undetected.

Discussion

Ray fern is a rare but also cryptic element of the South Florida flora. Nevertheless, since the publication of Rare Plants of South Florida in 2002, the number of known occurrences has quadrupled (Gann *et al.* 2014a), suggesting that more plants may be discovered in the future if focused searches are conducted. As such, surveys for ray fern should be continued, both in and around Royal Palm Hammock and in other areas where suitable habitat occurs; the area of potential habitat is very large. It would also be advantageous to conduct more surveys in the South Dade Wetlands and collaborate with Miami-Dade County to monitor that population. Ray fern is also a conservative element of the flora and was ranked as a 10 (species obligate to high quality natural areas) by Mortellaro *et al.* (2012). This makes ray fern a potential indicator of ecosystem health, and a species that could be used experimentally to measure the outcomes of CERP. Based on this, we recommend that an experimental reintroduction be considered, both to restore a viable population of ray fern to EVER, and for its heuristic value. South Florida germplasm for such an experimental reintroduction should be available from federal agencies including the National Park Service (BICY) and the Fish and Wildlife Service (LOX), but it may be more appropriate to secure germplasm from the nearby population within the South Dade Wetlands.

Summary of Recommendations

- Continue surveys in the vicinity of Royal Palm Hammock and in other areas with suitable habitat within Everglades National Park.
- Assist Miami-Dade County with additional surveys in the South Dade Wetlands, and in monitoring the ray fern population there.

- Consider experimental reintroductions utilizing germplasm collected outside of EVER, including the South Dade Wetlands.

Adiantum melanoleucum Willd. – Fragrant Maidenhair Fern

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	2-10

Figure 22. *Adiantum melanoleucum* cultivated sporophytes and plant in habitat in Osteen Hammock, 2011 (l) and 2012 (r).

Background

Fragrant maidenhair fern is a lithophytic or terrestrial herb in the Pteridaceae. It is primarily a West Indian species at the northern end of its range in South Florida and the Bahamas, otherwise occurring in the Greater Antilles where it is relatively common. In South Florida it is known only from Miami-Dade County where, outside of EVER, it is known from four populations, two of which are protected (Gann et al. 2002, Gann 2014a, Gann *et al*. 2014a). It grows on exposed limestone surfaces or in accumulated leaf litter on the edges of solution holes in tropical hardwood hammocks. Mortellaro *et al*. (2012) ranked it as being obligate to high quality natural areas. Wunderlin & Hansen (2011) reported it to be fertile in South Florida throughout the year. Fragrant maidenhair fern was brought into cultivation in South Florida as part of IRC's Rare Plant Monitoring and Restoration on Long Pine Key study (see below), although it may have been cultivated by enthusiasts before that time.

Conservation Status
Adiantum melanoleucum has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as apparently secure globally, but as critically imperiled in the continental United States. It is not listed under the Endangered Species Act, but it is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC for South Florida. Loope & Avery (1979) ranked fragrant maidenhair fern as a species of highest concern in National Park Service Areas in South Florida, with a small known population on Long Pine Key in EVER.

History in EVER
Fragrant maidenhair fern was discovered in South Florida in what is now EVER in 1915 (Small 1931, Gann *et al.* 2002). As far as is known, all historic observations in EVER prior to 2005 were from Osteen Hammock on Long Pine Key, where it was collected several times between 1916 and 1963 (see Gann *et al.* 2002). The Osteen Hammock population was severely impacted by Hurricane Donna in 1960, and subsequent observations up to 2002 recorded between two and eight (Gann *et al.* 2002) or possibly nine plants. Cressler (1991) reported observations in 1987 of plants from two solution holes, one with three plants and one with five plants, and possibly a third with one plant. He described in detail that no plants were observed on the edges of large solution holes with exposed rock, but rather only from shallow solution holes with "soil" on the surface. A 1991 specimen (Seavey and Seavey 543 FNPS) reported that the population had expanded over the previous two years, but no number of individuals was noted. IRC surveys of Long Pine Key hammocks from 2003 to 2008 relocated fragrant maidenhair fern in Osteen Hammock and recorded a new station nearby in Rattlesnake Hammock (Gann *et al.* 2009)[56]. One adult plant and six possible juveniles were recorded at Rattlesnake Hammock, but a tree fall event in 2006 may have destroyed that population (Gann *et al.* 2006). Between the two stations, a maximum of five adults has been recorded since 2003 (Gann *et al.* 2009, IRC and EVER unpublished data). Since 2011, only two plants have been observed in Osteen Hammock during several surveys conducted by IRC, EVER and Marie Selby Botanical Gardens (IRC and EVER unpublished data).

Fertile material of fragrant maidenhair fern in EVER has rarely been recorded (one fertile plant in Osteen was observed by Cressler in 1987 (Cressler 1991) and one fertile plant in Osteen Hammock was recorded by IRC in 2004. No recruitment has been confirmed. In 2004, IRC recommended the augmentation of *A. melanoleucum* in EVER (Gann *et al.* 2004). IRC and EVER initiated propagation trials in 2005 in collaboration with Marie Selby Botanical Gardens, Fairchild Tropical Botanic Garden and Miami-Dade County (Gann *et al.* 2009). Germplasm was collected outside EVER in a Miami-Dade County conservation area. In July 2011, IRC, EVER and Marie Selby Botanical Gardens outplanted 12 individuals of *A. melanoleucum* in Osteen hammock and eight more were added in July 2012 (IRC and EVER unpublished data). Unfortunately by October, 2012 only two plants remained and by November, 2013 all outplanted individuals appeared dead (IRC and EVER unpublished data).

Discussion
Despite the current known presence of only two plants, *A. melanoleucum* appears to be remarkably persistent in EVER. After near total destruction by Hurricane Donna, this fern has

[56] IRC biologists Stephen Hodges and Eric Fleites made this discovery.

remained extant in the park for more than 50 years. Although the apparent loss at Rattlesnake Hammock from a single storm event appears to demonstrate the vulnerability of this species to extirpation, plants may persist undetected. However, just based on the population size there is a high likelihood that fragrant maidenhair will be lost from the park flora unless additional actions are taken. The most immediate activities needed are to: 1) thoroughly survey Rattlesnake Hammock to ascertain if that population has persisted, and 2) establish a regular monitoring program for the known stations in Osteen and Rattlesnake hammocks. We also know that plants can readily be grown from spores within a reasonable period of time and augmentation trials should continue. One thing to note, however, is that the two extant individuals of fragrant maidenhair fern are growing in humus on the margins of a small, moderately sloped solution hole. It is not a strict lithophyte and therefore its potential habitat is large. The question is then, why is it so rare? Cressler (1991) suggested that the plants may prefer the deeper humus of the shallow solution holes, but that recruitment may be difficult in that environment.

Summary of Recommendations

- Establish a regular monitoring program at known locations in Osteen and Rattlesnake hammocks. Because it is reported to sporulate throughout the year (Wunderlin and Hansen 2011), surveys can be conducted in any month. Extreme caution should be exercised when monitoring this species as a single careless trampling event could kill an adult plant.
- Monitor outplanting at least annually, coinciding with monitoring of wild plants.
- If fertile material is observed in EVER, it should be collected to establish an ex-situ conservation collection, provided doing so does not jeopardize the population. Collection of material should be limited to 5% or less of the material observed. This may amount to one or perhaps two fertile pinnules.
- Continue augmentation trials to reduce the threat of extirpation due to stochastic events.

Anemia wrightii Baker – Wright's Pineland Fern

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	1,001-10,000

Background

Wright's pineland fern is a lithophytic herb in the Anemiaceae. It is endemic to South Florida, the Bahamas and the western half of Cuba (Correll and Correll 1982, Caluff *et al.* 2008, TROPICOS 2014). In South Florida it is known only from Miami-Dade County. Until recently, just two small populations were known from outside of EVER, immediately to the east of the park (Gann *et al.* 2014a), but the bulk of the South Florida population is within the park. A new population was recently discovered more than 15 km to the northeast of the eastern Context Road area on private land in Miami-Dade County (J. Possley, email comm. 2014)[57]. Wright's pineland fern grows on exposed limestone, both in rocky graminoid freshwater prairies, along the edges of tropical hardwood hammocks, and rarely in hammock interiors. In the Bahamas it grows on the moist edges and walls of sinkholes and on rock ledges in open hammocks (Correll

[57] In March, 2014 Jennifer Possley and Stephen Hodges of Fairchild Tropical Botanic Garden discovered a small population of Wright's pineland fern at Cox Hammock, in the portion managed as the tourist attraction The Monkey Jungle).

Figure 23. *Anemia wrightii* in habitat in the Long Pine Key area. Images by James Johnson, 2013.

and Correll 1982). In Cuba it has been collected on the banks of a small stream (Alain 1527 MO in TROPICOS). Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas. Wunderlin & Hansen (2011) reported it to be fertile throughout the year as did Correll & Correll (1982). Florida material has been cultivated in the laboratory (Boughton *et al.* 2009).

Conservation Status

Anemia wrightii has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as imperiled globally and as critically imperiled in the continental United States. It is not listed under the Endangered Species Act, but it is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it critically imperiled in Florida, as does IRC for South Florida. Loope & Avery (1979) ranked Wright's pineland fern as a species of highest concern in National Park Service Areas in South Florida, with a small known population on along the margins of Taylor Slough in EVER.

History in EVER

Frank C. Craighead first collected Wright's pineland fern in 1962 at "Simmon Camp" in Everglades National Park (Gann *et al.* 2002), which was presumably located within the old park boundaries west of Context Road. According to Loope & Avery (1979), it had "recently" been discovered along the margins of Taylor Slough, but they made no mention of plants within old park boundaries in the Context Road area. Wright's pineland fern is known from the park from an area extending from northeastern Long Pine Key north and northwest to the rocky glades along Context Road and east to the park boundary (Gann *et al.* 2002). A small population was also reported from Grossman Ridge Hammocks to the west of Chekika Hammock by Alan Cressler (1991). It was identified as one of the species that might be affected by the Everglades restoration in Rare Plants of South Florida (Gann *et al.* 2002), and one of the few critically imperiled species known from both north and south of Main Park Road. At least a thousand plants are thought to be present in EVER, but the entire potential range has not been surveyed nor mapped. IRC surveys of the Long Pine Key area from 2003 to 2008 relocated Wright's pineland fern along the edges of Pfleuger and Warren hammocks at the extreme northeastern end of Long Pine Key along the western edge of Taylor Slough (Gann *et al.* 2009). Five long-term monitoring plots were established in that area, two north of and three south of Main Park Road. Separate brief surveys of the Context Road area were conducted by IRC in 2006 and two plots were established there that same year (Gann *et al.* 2009, IRC and EVER unpublished data). In November 2013, the author and IRC biologist James Johnson revisited the Pfleuger and Warren hammocks area and no plants of *A. wrightii* were observed in two of the monitoring plots: Station 1 (tag #3427) north of Main Park Road and Station 7 (tag #3426) south of Main Park Road. Both of these plots are located along the shrubby edge of the prairie, and recent water levels may have been high enough to kill sporophytes. However, the remaining three Long Pine Key plots are on the edges of the hammocks and healthy populations of *A. wrightii* were located both north and south of Main Park Road along the hammock edges.

Taxonomic Notes

During surveys by IRC from 2003 to 2008, possible hybrids between *A. wrightii* and the common *A. adiantifolia* were observed near Pfleuger and Warren hammocks (e.g., Woodmansee 1363 FTG). Similar observations were made by Alan Cressler (1991) in the Context Road area. In Cuba, *A. adiantifolia* is known to hybridize with *A. cuneata* (Caluff *et al.* 2008) and other *Anemia* hybrids have been recorded from the Brazil, Costa Rica, the Dominican Republic and Mexico (TROPICOS 2014). The primary difference between *A. adiantifolia* and *A. wrightii* is that in *A. adiantifolia* the leaves are partially dimorphic with a basal pair of fertile pinnae while the leaves of *A. wrightii* are completely dimorphic with the blade tissue lacking on the fertile leaves (Correll and Correll 1982, Wunderlin and Hansen 2011). During the 2013 surveys of the Pfleuger and Warren hammocks area, the author and Johnson documented that some of the plants in this area did not conform to this dichotomy (Figure 24). Instead, several plants have partially developed blade tissue emerging from just beneath the fertile portion of the fronds. Additional work on this issue is needed.

Figure 24. Possible *Anemia adiantifolia* x *wrightii* plants in habitat in the Long Pine Key area. Images by James Johnson with the author, 2013.

Discussion

Because of the difficulty of the terrain and lack of comprehensive surveys we have an incomplete understanding of Wright's pineland fern in EVER. A recent brief survey indicated that mortality of sporophytes occurred between 2006 and 2014 in eastern Long Pine Key on the western edge of Taylor Slough. During this time period, construction and operation of pump stations and detention basins associated with the C111 Spreader Canal Western Project also occurred. One purpose of that project was to increase water levels and hydroperiod in Taylor Slough. Sufficient data is not yet available to determine if water levels in Taylor Slough changed as a direct result of implementing this project. However, increased freshwater flow to Florida Bay has already been suggested (Audubon of Florida 2014), and, if correct, this would imply that upstream (e.g., Taylor Slough) hydrologic conditions have also already occurred. Marsh vegetation in adjacent Taylor Slough has been shown to change rapidly due to water delivery modifications aimed at restoring historic conditions in the region (Armentano *et al.* 2006, Saha *et al.* 2014b).

Wright's pineland fern usually grows on exposed rock very close to annual high water levels. At some point inundation or reduced water availability leads to the mortality in *A. wrightii*, but tolerances to flooding and desiccation are not known. Small changes in water levels probably result in periodic shifts in the local distribution of sporophytes and gametophytes, provided suitable conditions remain present nearby. Larger changes in water depth and duration would be expected to lead to significant redistribution of suitable conditions required to support *A. wrightii* and may lead to regional distribution shifts or extirpations if plants are unable to shift with conditions. It is possible that the distribution of *A. wrightii* expanded into previously unsuitable habitat in response to reduced water levels in the Taylor Slough and Long Pine Key area associated with regional drainage, particularly the installation of the L31W canal. Previous and ongoing hydrological restoration efforts in Taylor Slough continue to modify water levels in the area (Kotun and Renshaw 2013). As water levels increase, occurrences of A. *wrightii* may be shifting back to more historic distributions, including expansion along hammock edges.

Although, some data are available from the Long Pine Key area, there has been no significant recent monitoring of the much larger Context Road population. In addition, it is unknown if plants in the Frog Pond just outside of EVER have been impacted by restoration-related such as the creation of the detention basins in the Frog Pond. Studies specific to *A. wrightii* should be conducted to directly track the influence of hydrologic modifications in Taylor Slough on this species.

Summary of Recommendations

- Re-monitor plots established by IRC between 2003 and 2007 both on Long Pine Key and in the Context Road area. Determine if hydrological modifications resulting from the S332A-D and other C-111 spreader canal projects are resulting in mortality of plants or populations of *A. wrightii*.
- Collect high accuracy elevation data that could be used to determine the relationship of plants to high water levels as a surrogate for tolerances to flooding and desiccation.
- Determine duration of flooding tolerated by *A. wrightii* sporophytes and gametophytes, the lifespan of sporophytes, and if gametophytes can be reliably detected in the field.
- Survey from Grossman Ridge Hammocks south to Long Pine Key and east to the park boundary. Map the outer boundaries of the *A. wrightii* metapopulation in EVER. Support efforts to survey within the Frog Pond outside of EVER to determine the status of *A. wrightii* there.
- Determine long-term monitoring methods and frequency for the entire EVER metapopulation.
- Establish whether or not hybrids between *A. wrightii* and *A. adiantifolia* are present in EVER.
- Establish an ex-situ population which can be used in part to conduct experiments to test tolerance of *A. wrightii* to inundation.

Asplenium platyneuron (L.) Britton *et al.* **– Ebony Spleenwort**

Federal Status	State Status	IRC SF Status	EVER Population
NA	NA	Possibly Extirpated	Possibly Extirpated

Background

Ebony spleenwort is a terrestrial or sometimes lithophytic fern in the Aspleniaceae. It is a common and widespread temperate to subtropical species of eastern and central North America and southern Africa. In addition, isolated populations have been recorded in South Florida (Gann *et al.* 2002), the southwestern United States (Small 1938, Lellinger 1985, Wagner *et al.* 1993, Kartesz 2013) and Madagascar (Hochreutiner 1908, TROPICOS 2014). It was also recently discovered in Slovakia in central Europe (Ekrt and Hrivnák 2010). It has the most unique distribution of any North America fern. In South Florida it is historically known only from Everglades National Park – this occurrence is disjunct from central Florida. Throughout most of its range, ebony spleenwort is considered a generalist, growing in soil or on rocks in forests or disturbed sites over a wide range of ecological conditions. In South Florida, it has been recorded in a single tropical hardwood hammock, which falls well within the ecological conditions found within its core range. Climatically, however, this is an outlier occurrence and

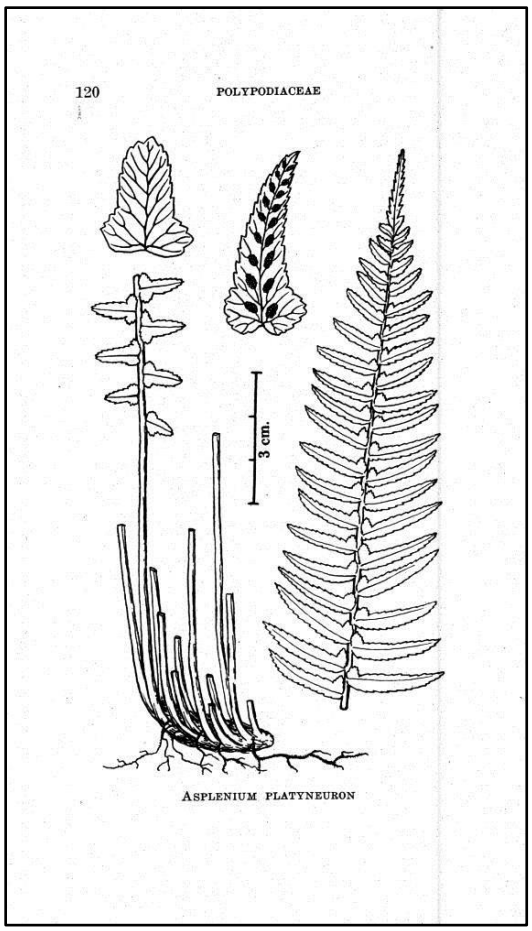

Figure 25. Illustration of *Asplenium platyneuron* from John Kunkel Small's Ferns of Florida (1931, in the public domain).

Figure 26. *A. platyneuron*. Image by Shirley Denton, 2010.

the South Florida climate may fall outside of the parameters needed for long-term survival. Mortellaro *et al.* (2012) ranked ebony spleenwort as being obligate to high quality natural areas, but this was based on the single verified occurrence. In Florida, Wunderlin & Hansen (2011) reported it to be fertile in the summer and fall; the sole specimen collected in South Florida was made in early November. The reproduction and dispersal of ebony spleenwort has been extensively studied (e.g., Wagner and Johnson 1981, Crist and Farrar 1983) and was reviewed in detail by Ekrt and Hrivnák (2010). In summary, *Asplenium platyneuron* is remarkably adapted for and successful in colonizing distant habitats through long-range spore dispersal. Specifically, ebony spleenwort is able to colonize over large distances because of its ability to form sporophytes through self-fertilization of a gametophyte produced by a single spore.

Conservation Status

Asplenium platyneuron has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as secure globally and in the United States. It is not listed under the Endangered Species Act or by the State of Florida. It has not been ranked by The Florida Natural Areas Inventory for Florida. IRC ranks it as possibly extirpated in South Florida.

History in EVER
Ebony spleenwort was first documented in South Florida in 1976 by George Avery, who discovered a single plant in Shark Net Hammock[58] west of the west end of Context Road within the pre-1989 boundaries of EVER (Avery 1683 FNPS, FLAS, Gann *et al.* 2002). Two fertile fronds were collected leaving several sterile fronds. As reported in Gann *et al.* (2002), EVER volunteer botanist Rick Seavey visited this station around 1987 and also observed a single plant. Seavey also reported finding plants at an additional station southwest of Mahogany Hammock in the late 1980s, but never revisited the site. This station was located in a bayhead forest on the edge of the Shark River Slough, but precise locality data is lacking. IRC biologists surveyed for ebony spleenwort in hammocks along Context Road numerous times between 2003 and 2008 and southwest of Mahogany Hammock with EVER staff in 2008. No plants were found in these surveys, but searches in the Context Road area may have all concentrated too far to the east. The lack of more precise locality information southwest of Mahogany Hammock makes it impossible to determine if the historical location was surveyed or not.

Discussion
Ebony spleenwort is an outlier in EVER and may never have been a permanent part of the flora. Other than continuing to search for this species, no other action is warranted.

Summary of Recommendations
- Survey hammocks southwest of Mahogany Hammock and hammocks at the west end of Context Road.

Ceratopteris pteridoides (Hook.) Hieron. – Water Horn Fern

Federal Status	State Status	IRC SF Status	EVER Population
NA	NA	Critically Imperiled	11-100

Background
Water horn fern is an annual or short-lived perennial aquatic fern in the Pteridaceae (formerly Parkeriaceae). It is a widespread species, native to the southeastern United States (Florida, Georgia, Louisiana), the West Indies (Cuba, Hispaniola), Mexico, Central America and South America. While more common elsewhere in Florida, it is very rare in South Florida. It is known from three populations, one in EVER and one each in Martin and Charlotte counties (Gann *et al.* 2002, Gann *et al.* 2014a). In Florida it grows in cypress swamps, slow-moving streams and rivers, ditches and canals. Mortellaro *et al.* (2012) ranked it as being more frequent in natural areas than ruderal areas. Wunderlin & Hansen (2011) reported it to fertile throughout the year. Hickok & Klekowski (1973) found that populations of the species in Florida and other parts of the southeastern United States sometimes exhibit characteristics suggesting a hybrid origin, suggested by morphology, low spore viability and cytological irregularities. Warne & Lloyd

[58] Avery called the hammock Shark Net Hammock "because of *Dalbergia* tangle on periphery…", and it was referred to as Lay Camp by Glenn Simmons (Avery 1983). He described it as a medium-sized hammock. Using Google Earth, there are only two medium-sized hammocks to the west of the west end of Context Road within what would have been park boundaries in 1976. It should be possible to relocate this hammock by looking for *Dalbergia ecastaphyllum*, which would have been the species referred to by Avery in his notes.

Figure 27. Illustration from John Kunkel Small's Ferns of Florida (1931, in the public domain).

(2008) reported that *C. pteridoides* is inbreeding but can reproduce vegetatively; characteristics that have given rise to many geographically isolated populations.

Conservation Status

Ceratopteris pteridoides has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life (as *C. pteridioides*). NatureServe ranks it as secure globally, but it has not been ranked for the United States. It is not listed under the Endangered Species Act or by the State of Florida. It has not been ranked by the Florida Natural Areas Inventory for Florida. IRC ranks it as critically imperiled in South Florida.

History in EVER

Although reported to have been discovered in EVER in the early 1990s by Roger Hammer and Don Keller (Gann *et al.* 2002), Cressler (1991) reported that the similar *C. thalictroides* had been found in the same region of the park by Alan Herndon in 1988[59]. Herndon's reported station was from "swamp forest vegetation" south of the first culvert west of water control structure S-12D on US 41 (Tamiami Trail) in the Shark River Slough area of EVER. Hammer and Keller's station was from a ditch, more accurately a man-made canal, that runs along the western edge of the tram road, at Shark Valley, possibly representing the same station. Sixteen plants were observed in surveys conducted in 2007 by IRC biologist Jesse Hoffman (IRC and EVER unpublished data) and Hoffman and EVER Botanist Jimi Sadle vouchered this population in

[59] No other reports of *C. thalictroides* are known from EVER and it is presumed here that *C. pteridoides* was the taxon noted by Herndon.

2007 (Sadle 571 FNPS). All plants were from the Hammer and Keller station along the canal at Shark Valley.

Discussion
The absence of verified records from an undisturbed area within EVER makes it difficult to determine whether or not this species occurs naturally in EVER or if its presence there is solely an artifact of canal construction. However, EVER is well within the native range of this species and it has been treated as native in the park by Reimus (1996, 1999) and by IRC (Gann *et al.* 2002, Gann *et al.* 2014a). The invasive plant species alligator weed (*Alternanthera philoxeroides*) was found at the north end of this canal system in 2012 and could threaten the population if it expands to the south.

Summary of Recommendations
- Conduct searches for water horn fern in natural habitats in Shark River Slough area, including the Herndon station reported by Cressler.
- Monitor known populations on a regular basis.
- Treat invasive plants in the Shark Valley canal system. Water horn fern may be dormant in winter. Timing of invasive species control could be timed to coincide with dormancy.

Cheilanthes microphylla (Sw.) Sw. – Southern Lip Fern

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	101-1,000

Background
Southern lip fern is a terrestrial herb in the Pteridaceae. It is a primarily Neotropical species native to Florida[60], the West Indies, Mexico, Central America and South America. It is most common in the West Indies and scattered elsewhere. It is rare in Florida, known only from South Florida and four counties scattered in the central and northern part of the state (Wunderlin and Hansen 2014). In South Florida, it is known from Collier County in EVER and two islands in the Ten Thousand Islands region (Wilder and Barry 2012, Gann *et al.* 2014a). It has been extirpated on Horr's Island in Collier County and at one outlier station in Miami-Dade County where it is not certain it was native (Gann *et al.* 2002). In South Florida it grows in tropical hardwood hammocks on shell mounds but elsewhere it grows in a wide range of habitats from dry shrublands and forests to rocky cliffs, old walls and ravines from near sea level to 2000 m. Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas, which is correct if you exclude the historic Miami-Dade station where it grew on a limestone wall. Wunderlin & Hansen (2011) reported it to be fertile from spring through summer.

Conservation Status
Cheilanthes microphylla has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as secure globally, but as vulnerable in the United States. It is not listed under the Endangered Species Act, but it is listed as endangered by

[60] Other records from the southern United States are apparently misidentifications of *C. alabamensis* (see Windham and Rabe 1993, Gann *et al.* 2014a).

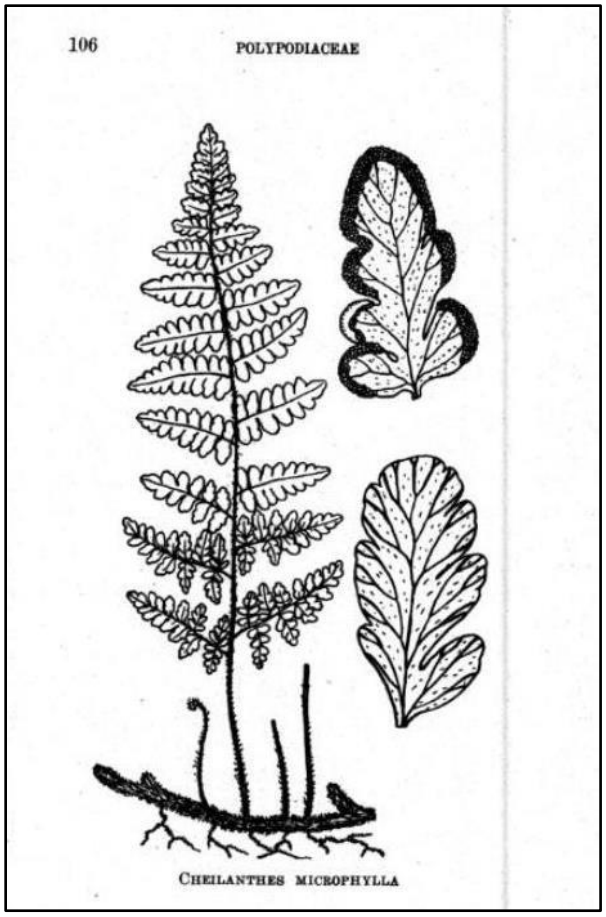

Figure 28. Illustration from John Kunkel Small's Ferns of Florida (1931, in the public domain).

Figure 29. *Cheilanthes microphylla* at Russell Key, EVER. Image by Jimi Sadle, 2007.

the State of Florida. The Florida Natural Areas Inventory ranks it as vulnerable in Florida. IRC ranks it as critically imperiled in South Florida.

History in EVER

Southern lip fern was first documented in EVER in 1916 on Turner River Mound at the mouth of the Turner River in the Ten Thousand Islands region of the park (Gann *et al.* 2002). This population was observed and vouchered several times in the 1930s and 1960s, and was visited by IRC biologists Keith Bradley and Steven Woodmansee in 1997 (Gann *et al.* 2002). The population size at that time was estimated at fewer than 100 plants. EVER Botanist Jimi Sadle and colleagues observed this population again in 2008, when 49 plants were counted (IRC and EVER unpublished data). This was not a thorough survey and more plants were likely present (J. Sadle, email comm. 2014). Additional occurrences were discovered by EVER Botanist Jimi Sadle in 2006 on Russell Key and in 2007 on Sandfly Island (with Margo Schwadron), both in the Ten Thousand Islands (EVER unpublished data, Sadle 540 FNPS). The Russell Key population contained fewer than 20 plants, while three plants were counted on Sandfly Island. However, comprehensive surveying and mapping has not taken place on either of these mounds. Saha *et al.* (2011) ranked *Cheilanthes microphylla* among the species most threatened by sea level rise in EVER, heavily influenced by its small population and lack of inland populations.

Discussion

There could be additional populations of southern lip fern in the park and searches can be coordinated with those for other species in the area. Southern lip fern is vulnerable to a number of threats, including invasive exotics and collateral damage from archeological excavations and research, but these threats can be avoided or mitigated. Along with other rare species that grow on shell mounds (such as *Celtis iguanaea* and *Vachellia tortuosa* above), southern lip fern is threatened over the long-term by sea level rise and associated storm surges. A systematic and coordinated process is needed to determine the extent of this threat, including elevations of individual plants and the salt water tolerances of individual species. Plants on Russell Key occur in relatively low open sites which may be particularly vulnerable to small increases in sea level. On Sandfly Island, plants are located along an eroding bank and are vulnerable to extirpation from a single event. Plans for stabilization were considered by NPS cultural resources staff and deemed infeasible (J. Sadle, email comm. 2014).

Summary of Recommendations

- Coordinate research on rare species threatened by sea level rise on shell mounds, including documenting elevations of individual plants and determining salt water tolerances of species at various life stages.
- Alert archaeologists and other researchers to the occurrences of southern lip fern and prevent inadvertent damage.

Didymoglossum punctatum (Poir.) Desv. – Florida Bristle Fern

Federal Status	**State Status**	**IRC SF Status**	**EVER Population**
Candidate	Endangered	Critically Imperiled	Presumed Extirpated
Synonyms: *Trichomanes punctatum* Poir. ssp. *floridanum* Wess. Boer			

Figure 30. *Didymoglossum punctatum* in habitat in Florida. Image by James Johnson, 2013.

Figure 31. *D. punctatum* in habitat. Image by Jennifer Possley, 2010.

Background
Florida bristle fern is a diminutive lithophytic or epiphytic fern in the Hymenophyllaceae. It is a primarily Neotropical species at the northern end of its range in peninsular Florida, otherwise known from the West Indies, Central America and South America, where its populations are scattered. The Florida population has been described as an endemic subspecies (as *Trichomanes punctatum* ssp. *floridanum*) with disjunct populations in South Florida and Sumter County in Central Florida. In South Florida it is known only from Miami-Dade County where, outside of EVER, it is known from three small populations in four conservation areas; a number of other occurrences have been extirpated (Gann 2013, Gann *et al.* 2014a). It grows on the exposed limestone walls of solution holes or on roots or nearby lower trunks of trees. Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas. Wunderlin and Hansen (2011) reported it to be fertile in South Florida from spring to summer. During dry periods plants become desiccated and almost unobservable. Florida bristle fern was brought into cultivation in South Florida as part of IRC's rare plant project on Long Pine Key study (see below).

Taxonomic Notes
The combination *Didymoglossum punctatum* ssp. *floridanum* has never been published, but it is accepted as a provisional name by the Catalogue of Life. Until the new combination is published, the acceptance by ITIS of *Didymoglossum* as an accepted genus rather than as a subgenus of *Trichomanes* requires that the subspecies *floridanum* be subsumed into the species *D. punctatum*. USDA PLANTS, the Atlas of Florida Vascular Plants and the US Fish & Wildlife Service all treat the Florida entity as *Trichomanes punctatum* ssp. *floridanum*.

Conservation Status
Florida bristle fern has not yet been assessed for the IUCN Red List, but is in the Catalogue of Life. NatureServe ranks subspecies *floridanum* as critically imperiled globally and in the United States. It is a candidate for listing under the Endangered Species Act and is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida as does IRC in South Florida. It was petitioned as a candidate for listing under the Endangered Species Act in 2009 and is currently under review for listing (see Federal Register, Vol. 78 No. 226).

History in EVER
Florida bristle fern is known from a single collection made in 1909 in Royal Palm Hammock by John Kunkel Small and Joel J. Carter and from a 1917 report by W.E. Safford (Safford 1917, Gann *et al.* 2002, Gann 2013). Florida bristle fern has not been seen in the park since that time. Interestingly, Safford reported Florida bristle fern as an epiphyte "growing among moss on the trunks and limbs of trees" and not as a lithophyte. Surveys by IRC from 2003 to 2008 failed to locate any plants in EVER (Gann *et al.* 2009). However, in 2004, IRC recommended the reintroduction of *D. punctatum* to Royal Palm Hammock (Gann *et al.* 2004). IRC and EVER initiated propagation trials in 2005 in collaboration with Marie Selby Botanical Gardens, Fairchild Tropical Botanic Garden and Miami-Dade County (Gann *et al.* 2009). Germplasm was collected outside EVER in a Miami-Dade County conservation area. Fairchild Tropical Botanic Garden, Marie Selby Botanical Gardens and Cincinnati Zoo and Botanic Garden have been collaborating on its cultivation since that time (Gann 2013). Discussions between IRC, EVER and Marie Selby Botanical Gardens have resulted in the proposal to attempt the reintroduction of

D. punctatum to Royal Palm Hammock by attaching limestone inoculated with Florida bristle fern sporophytes directly to limestone in a solution hole. Internal review of this method has been completed by EVER (J. Sadle, email comm. 2014) and plans to move forward with this technique are in progress.

Discussion

As with other ferns, Florida bristle fern may be present in EVER but undetected. However, the extirpation in the park is consistent with an overall contraction in the range of this species since the early 1900s. As a candidate for federal listing, experiments to reintroduce Florida bristle fern will contribute to the overall knowledge of the species and, hopefully, its long-term survival.

Summary of Recommendations

- Proceed with reintroduction trials at Royal Palm Hammock.

Lomariopsis kunzeana (Underw.) Holttum – Holly Vine Fern, Climbing Holly-Fern

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	<100 juvenile sporophytes

Figure 32. *Lomariopsis kunzeana* in a private yard in Miami and immature sporophytes in Osteen Hammock. Images by Keith Bradley in 2009 (l) and the author in 2011 (r).

Background

Holly vine fern is a terrestrial or lithophytic rhizomatous vining herb in the Lomariopsidaceae. It is a primarily West Indian species at the northern end of its range in South Florida where it has been found only in Miami-Dade County. It is also known from the Greater Antilles in Cuba, Hispaniola and Puerto Rico. It was recently reported as extirpated in Puerto Rico (Axelrod 2011), but was previously rediscovered in 2004 (Christenhusz 3555 NY with J. Carlos Trejo-Torres). It is also very rare in Hispaniola, where it has been collected between 800 and 1800 m elevation (TROPICOS 2014). Outside of EVER, in South Florida sporophytes are currently known from four small populations in urban forest fragments in Miami-Dade County, three from conservation areas and one from a private property (Gann *et al.* 2014a[61]). In South Florida it grows in tropical hardwood hammocks on the walls of moist limestone solution holes and on limestone outcrops, ultimately becoming a vine on lower tree trunks. Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas. In Cuba it is found mostly in the mountains scattered throughout the main island (Caluff 2008), but it is not common. Plants in South Florida differ from those in the Greater Antilles by their small size and more deeply serrate sterile pinnae; they also rarely climb trees and readily produce fertile leaves from the terrestrial stems (Moran 1993). Wunderlin & Hansen (2011) reported it to be fertile in the summer. Unlike most ferns, the spores are green, containing chlorophyll (Figure 33). Spores of the congener *L. sorbifolia* also contain chlorophyll and, as with spores of other chlorophyll-bearing fern species, are viable for less than one year (Lloyd and Klekowski 1970). Gametophytes have been observed to grow among rhizome scales of the mature plants in Florida (Moran 1993, Moran 2000). It was brought into cultivation in South Florida as part of IRC's rare plant project on Long Pine Key study (see below).

Conservation Status

Lomariopsis kunzeana has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as vulnerable (rounded) globally and critically imperiled in the United States. It is not listed under the Endangered Species Act, but it is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC in South Florida. Loope & Avery (1979) ranked holly vine fern as a species of highest concern in National Park Service Areas in South Florida, with a small known population on Long Pine Key.

History in EVER

Holly vine fern is known in the park only from Long Pine Key where it was first collected by John Kunkel Small in 1916 (Gann *et al.* 2002). Presumably all known collections and observations have been from Osteen Hammock where it was vouchered in 1991 (Seavey and Seavey 544 FNPS), but this cannot be verified. Small made three collections in 1916 and 1917 and all three say "Hammocks" (not Hammock) on Long Pine Key, with the third narrowed to eastern Long Pine Key. All modern observations appear to be focused on a single large individual in Osteen Hammock first reported by Eugene Delchamps to George Avery in 1975, which Avery subsequently observed that same year

[61] Jennifer Possley of Fairchild Tropical Botanic rediscovered holly vine fern at Castellow Hammock Park in 2014 (email comm. 2014). The last known previous siting was from before Hurricane Andrew in 1992 (Gann *et al.* 2002).

Figure 33. Fertile frond of *Lomariopsis kunzeana* and green spores below. Image by Jennifer Possley, 2013.

(Avery 1983, Gann *et al.* 2002). This appears to be the same plant observed by Don Keller in 1988 and 1990 (Gann *et al.* 2002) and vouchered by Seavey & Seavey in 1991. The Seavey specimen states that there were six plants seen on the edge of a solution hole at the time of collection but does not mention plant sizes. The specimen itself is a large leaf which could only be produced by an old mature plant. IRC surveys in 2003 identified plants in two solution holes within Osteen Hammock. One solution hole contained one large individual with nine live leaves and four dead leaves and a single small dead individual immediately beneath. The second hole, less than 100 m away, contained two juvenile sporophytes. When the area was resurveyed in 2005 the large individual was found dead and no live individuals were found in that hole (tag #3896). A reason for mortality was not determined. The second hole (tag #3895) contained seven juvenile sporophytes. Visits in 2011 and after have confirmed juvenile plants in hole #3895, but counts of individuals are problematic (see Discussion below). An additional solution hole was discovered by Bruce Holst of Marie Selby Botanical Gardens in 2011, within just a few meters of hole #3896. It also contains small juvenile sporophytes.

In 2004, IRC recommended the augmentation of *L. kunzeana* in Osteen Hammock (Gann *et al.* 2004). IRC and EVER initiated propagation trials in 2005 in collaboration with Marie Selby Botanical Gardens, Fairchild Tropical Botanic Garden and Miami-Dade County (Gann *et al.* 2009). Germplasm was collected outside EVER in a Miami-Dade County conservation area. In July 2012, EVER, IRC and Marie Selby Botanical Gardens outplanted five individuals of *L.*

kunzeana in two solution holes in Osteen Hammock. As of October of that year, five plants were still alive (Figure 34) (IRC and EVER unpublished data). Surveys by IRC in November 2013 failed to locate any plants but a follow up in February 2014 by IRC, EVER and Marie Selby Botanical Gardens found a single surviving individual in poor condition.

Figure 34. Surviving outplanted individual of *Lomariopsis kunzeana* in October, 2012.

Discussion

While it is unknown why the one large adult plant died in 2005 it is possible that this was the same individual originally observed in 1975. If so this is a long-lived species. While no adult sporophytes are currently known from the park, there may be thousands of gametophytes and hundreds of small juvenile sporophytes present in Osteen Hammock or elsewhere on Long Pine Key. Climatically, South Florida may be marginal habitat for holly vine fern and the transition from juvenile to adult may be rare. However, a large individual could produce millions of spores in its lifetime and we have to assume that the area around hole #3896 is well inoculated. A review of the count data in hole #3895 suggests that plants are difficult to detect and that observer variability may explain changes in plant numbers. On the other hand, there may be significant turnover in the small juvenile sporophytes stage. A modification of the survey protocol may be necessary to understand this species in EVER. Perhaps searches for the gametophyte might provide a wider context for the species in Osteen and hammocks in EVER. Jennifer Possley of Fairchild Tropical Botanic Garden has identified the gametophyte in habitat in Miami-Dade County (Figure 35), which bears a striking resemblance to plant material surrounding small sporophytes in hole #3895 (Figure 36). Surveys for this gametophyte could be conducted. Furthermore, because of the difficulty of detecting very small sporophytes in the field, high resolution photography could be employed to document the solution hole walls for later evaluation in the lab. Finally, based on experience this is a slow growing species. It took nearly 10 years for plants to grow to a size that they could be planted out, which is extremely slow for a fern. More work on cultivated plants designed to understand the growth requirements of holly vine fern and how to stimulate optimal growth might shed some light on its rarity in habitat.

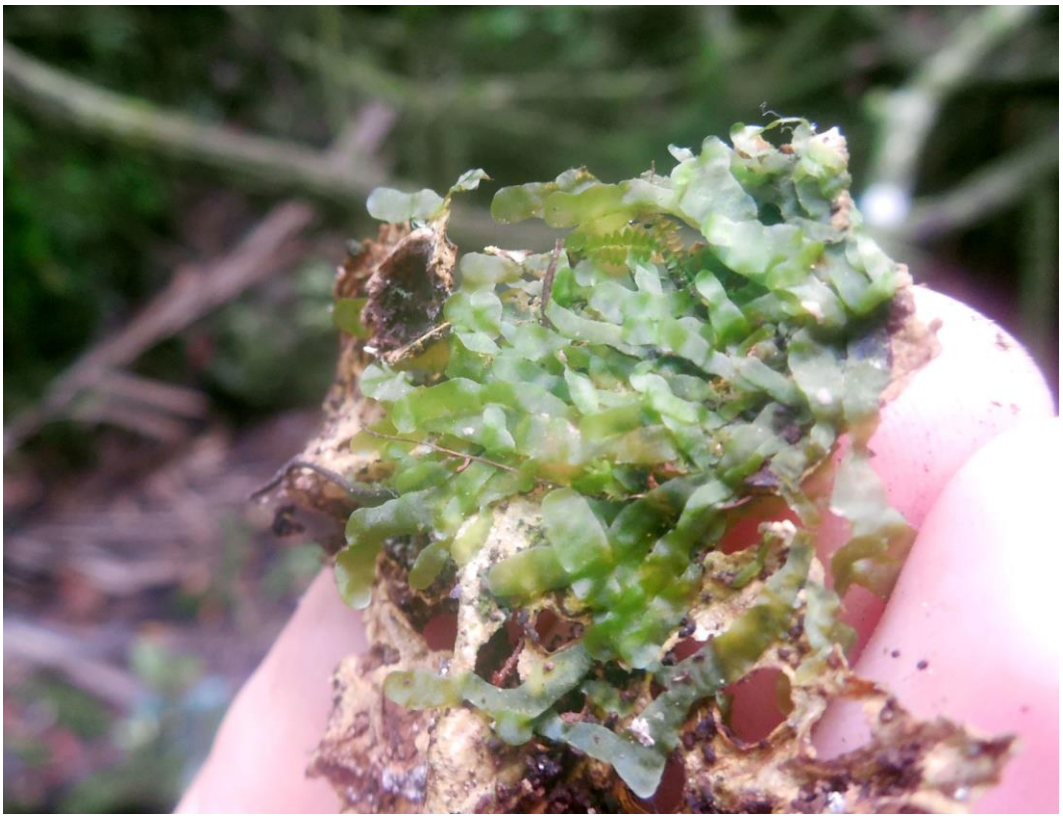

Figure 35. Gametophytes of *Lomariopsis kunzeana* at Ross Hammock in Miami-Dade County. Image by Jennifer Possley, 2013.

Figure 36. Probable gametophytes of *Lomariopsis kunzeana* surrounding small sporophytes in Osteen Hammock, 2011.

Summary of Recommendations

- Establish a regular monitoring program in Osteen Hammock using high resolution photography. Time surveys to occur at the end of the rainy season, when plants should be most visible.
- Monitor outplanting at least annually, coinciding with monitoring of wild plants.
- If fertile material is observed in EVER, it should be collected to establish an ex-situ conservation collection, provided doing so does not jeopardize the population.
- Collect potential gametophyte material from Osteen Hammock and cultivate ex-situ in an effort to confirm identification, and potentially produce sporophytes and spores that could be used in future reintroduction efforts.
- Continue augmentation trials to reduce the threat of extirpation due to stochastic events. Conduct horticultural experiments to determine optimal growth conditions and overall environmental requirements in order to increase understanding of plants in habitat.

Pecluma plumula (Humb. & Bonpl. ex Willd.) M.G. Price – Plume Polypody

Federal Status	**State Status**	**IRC SF Status**	**EVER Population**
NA	Endangered	Critically Imperiled	100-200 clumps
Synonyms: *Polypodium plumula* Humb. & Bonpl. ex Willd.			

Background

Plume polypody is a fern in the Polypodiaceae, often epiphytic on live or dead trees, but also growing terrestrially or on rocks. It is a primarily Neotropical species at the northern end of its range in peninsular Florida and the northern Bahamas. It is also widespread but somewhat scattered in the West Indies, Mexico, Central America and South America. In peninsular Florida, it ranges as far north as Duval County and in South Florida it is known from scattered collections in Miami-Dade, Monroe and Lee counties (Wunderlin and Hansen 2014, Gann *et al.* 2014a).[62] Outside of EVER, plume polypody is perhaps extant in South Florida only at Koreshan State Historic site in Lee County (Gann *et al.* 2014a). In South Florida it grows in tropical hardwood hammocks, although elsewhere in its range it grows in a wide variety of habitats from near sea level to more than 2000 m elevation. Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas in South Florida. Wunderlin & Hansen (2011) reported it to be fertile from spring through fall. Plume polypody is cultivated in South Florida, but it has not been recorded naturalizing outside of its historical range. It was also brought into cultivation as part of IRC's rare plant study on Long Pine Key study (Gann *et al.* 2009).

Conservation Status

Pecluma plumula has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as secure globally, but imperiled in the United States. It is not listed under the Endangered Species Act, but it is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as imperiled in Florida. IRC ranks it as critically imperiled in South Florida.

[62] Wunderlin & Hanson (2014) also reported a specimen of *P. plumula* from Martin County at FAU (now housed at FTG) as well as a specimen of *P. ptilodon* from Martin County at FAU. These specimens need to be checked and their identity confirmed.

Figure 37. *Pecluma plumula* in Dewhurst (China) Hammock. Image by Jimi Sadle, 2013.

History in EVER

Plume polypody was first collected in EVER several miles southwest of Royal Palm Hammock by John Kunkel Small in 1919 (Gann *et al.* 2002). This is now believed to be the Dewhurst Hammock[63] station reported by EVER volunteer Rick Seavey in 2001 (Gann *et al.* 2002) and observed by IRC in 2004 (Gann *et al.* 2004). As pointed out by EVER Botanist Jimi Sadle, the trunk photographed by Small in 1919[64] could be the very same trunk observed by IRC in 2004 and photographed by Sadle in 2013 (Figures 37 and 38). A second population is known from Long Pine Key, which was first vouchered by Walter M. Buswell in 1938 and again by Frank C. Craighead in 1961 (Gann *et al.* 2002). Although these collections did not give a precise location, Carol Lippincott rediscovered plume polypody on Long Pine Key in Cadwalader Hammock to the north of Main Park Road and showed this population to Rick Seavey (Gann *et al.* 2002). Surveys by IRC from 2003 to 2008 located two stations in Cadwalader Hammock and long-term monitoring plots were established in both Dewhurst and Cadwalader hammocks (one in

[63] Dewhurst Hammock is also known as China Hammock.

[64] There are three photographs of *P. plumula* taken by John Kunkel Small in 1919 stored in www.floridamemory.com. They are labeled as from Hammer Key, 16 miles southwest of Royal Palm Hammock. Dewhurst Hammock is about 13 miles southwest of Royal Palm Hammock.

Figure 38. *Pecluma plumula* documented from Hammer Key, 16 miles southwest of Royal Palm Hammock. Image by John Kunkel Small, 1919. Archives of Florida, *Florida Memory*, http://floridamemory.com/items/show/49761. This is now believed to be the same as Dewhurst Hammock and possibly the same population of ferns on the same log as is present there now. Note the temporarily desiccated leaves, typical for a *Pecluma* during the dry season.

Dewhurst and two in Cadwalader). An additional station was vouchered "2 miles west from Whiskey Creek" by Frank Craighead in 1958 (s.n. FNPS)[65], but this population has not been relocated as of the present. Loope & Avery (1979) reported plume polypody as possibly extirpated in the park. Although no augmentation has been conducted in EVER, germplasm from park plants is being temporarily maintained at Marie Selby Botanical Gardens.

Discussion

Although counts of individuals showed a slightly higher number, the EVER population estimate given at the end of IRC's Long Pine Key rare plant project was 11-100 (Gann *et al.* 2009). However, it appears that both populations are relatively stable and are protected from any immediate threat of inundation (from sea level rise or Everglades restoration) by its habitat of growing on elevated tree trunks (see Figures 37 and 38 above). Although it is very rare, there is no evidence that any localized extirpations have occurred or that the metapopulation has been depleted in EVER. More thought is needed, however, to establish a long-term monitoring methodology that takes into account the rhizomatous nature of the species and the difficulty of counting and measuring individuals. Although originally recommended for augmentation in EVER, no outplantings were ever conducted. Because the total park population is so small, the

[65] Whiskey Creek is located between Hells Bay and Paurotis Pond and this entire area is poorly explored for rare plants. This population could easily be extant.

establishment of a formalized ex-situ collection would be advantageous in case of an unforeseen extirpation (e.g., from poaching).

Summary of Recommendations

- Search for Whiskey Creek population.
- Establish a regular monitoring program in Cadwalader and Dewhurst hammocks.
- Establish a formalized ex-situ collection to protect EVER germplasm.

Thelypteris reticulata (L.) Proctor – Lattice-vein Fern

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	11-100
Synonyms: *Meniscium reticulatum* (L.) Sw.			

Figure 39. *Thelypteris reticulata* in the Pine Island area. Image by Keith Buttry, 2013.

Lattice-vein fern is a terrestrial fern in the Thelypteridaceae. It is a primarily Neotropical species at the northern end of its range in South Florida. It is also known from the West Indies, Mexico and South America. Outside of EVER there are five known stations in South Florida in Miami-Dade and Collier counties, including BICY and two just to the east of EVER in Miami-Dade County (Gann *et al.* 2014a). It grows in swamp forests, tropical hardwood hammocks and in wet disturbed sites. Mortellaro *et al.* (2012) ranked it as a being much more frequent in natural areas than ruderal areas. Wunderlin & Hansen (2011) reported it to be fertile throughout the year. Lattice-vein fern is cultivated in South Florida, but it has not been recorded naturalizing outside of its historical range.

Conservation Status
Thelypteris reticulata has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as apparently secure globally, but as critically imperiled in the United States. It is not listed under the Endangered Species Act, but it is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC in South Florida.

History in EVER
Lattice-vein fern was first found in EVER in 1963 by Olga Lakela, who collected it in an unknown hammock (Gann *et al.* 2002). It has been observed numerous times in several locations between the eastern edge of the Hole-in-the-Donut and Pine Island (Gann *et al.* 2002, Gann *et al.* 2009). A new station was discovered by then-IRC biologists Jimi Sadle and Emilie Verdon Grahl in a cypress dome near the eastern boundary of the park in 2004 (Gann *et al.* 2009) and lattice-vein fern has been collected immediately to the east of this area in what is now the Southern Glades (Gann *et al.* 2002). Sadle also found a single plant in Palma Vista #2 Hammock in 2009 (IRC and EVER unpublished data). In EVER it has been found growing in a wide variety of moist habitats, from tropical hardwood hammocks and cypress forests to highly disturbed sites dominated by the invasive exotic *Schinus terebinthifolius*. Population estimates have reached a low of 2-10 plants (Gann *et al.* 2009), but a recent survey by EVER Botanist Jimi Sadle, IRC biologist James Johnson and colleagues indicated that there are closer to 100 plants in the park at present (see Discussion below). Four long-term monitoring plots were established by IRC between 2003 and 2008 (Gann *et al.* 2009, but see below). It was unwittingly brought into cultivation as part of IRC's 2003-2008 rare plant study on Long Pine Key from germplasm collected in the Long Pine Key area (as *T. serrata*, see Taxonomic Notes below). Although no augmentation has been conducted in EVER, germplasm from park plants is being temporarily maintained at Marie Selby Botanical Gardens.

Taxonomic Notes
T. reticulata and *T. serrata* can be difficult to tell apart and herbarium specimens often contain multiple annotations between the two species. They are the only representatives of the subgenus *Meniscium* in South Florida and while they are similar to each other they are quite different from other *Thelypteris* species in South Florida.

Discussion
Apparently, all reports of *T. serrata* by IRC during the Rare Plant Monitoring and Restoration on Long Pine Key study (summarized in Gann *et al.* 2009 and including material provided to Marie Selby Botanical Gardens for cultivation) were misidentifications of *T. reticulata*. Therefore, *T. reticulata* is more numerous than reported in 2009. On the other hand *T. serrata*, which was collected and observed in the same general area between 1979 and 1983 (Gann *et al.* 2002), may be extirpated in the Long Pine Key area in contrast to what was reported in 2009.

While *T. serrata* is the more abundant than *T. reticulata* in South Florida, *T. reticulata* appears to be doing well within a limited area of the park. However, the largest part of the metapopulation is found in the disturbed *Schinus* thicket at Pine Island. Because the other sub-populations are small, some thought must be given to managing this species when exotics species control is proposed for the Pine Island area.

Summary of Recommendations

- Establish a regular monitoring program in both disturbed and undisturbed areas.
- Consider mitigation procedures to protect lattice-vein fern in EVER when exotic species control is planned in the Pine Island area.

Orchids

There are 39 species of native orchids that have been recorded as native to EVER (Gann *et al.* 2014a)[66]. Only two of these species are relatively common both in South Florida and in EVER (*Encyclia tampensis*, *Habenaria floribunda*), while the remainder are considered regionally rare, imperiled, critically imperiled, possibly extirpated or presumed extirpated. The majority of native orchid species in EVER are of tropical origin and known in the continental United States only from South Florida. For purposes of this report, the orchids are separated into two groups: terrestrial orchids, of which there are 21, and epiphytic and vining orchids, of which there are 18. One additional terrestrial orchid, *Prescottia oligantha*, is native to South Florida and was translocated into EVER by Carlyle Luer in 1960 (Luer 1972, Gann *et al.* 2002). It is otherwise extirpated in South Florida and treated here as a benign introduction (see Terrestrial Orchids below). As a group, orchids are the rarest plants in EVER and have been most impacted by humans within the documented history of the park.

In 2015, IRC intends to re-assess the South Florida rank of the terrestrial orchid *Sacoila lanceolata* var. *paludicola* using the 2012 NatureServe criteria, as it may qualify as critically imperiled in South Florida and as a SOMC in EVER. The Florida Natural Areas Inventory ranks this as critically imperiled in Florida while IRC ranks it as imperiled.

Terrestrial Orchids

Of the 21 species of terrestrial, non-vining orchids recorded in EVER, only one is relatively abundant in South Florida and in EVER: *Habenaria floribunda*. Nine of the remaining 21 species are treated as SOMCs in this report and all are limited entirely or almost exclusively to the Long Pine Key area of the park: *Basiphyllaea corallicola*, *Beloglottis costaricensis*, *Bletia patula*, *Eltroplectris calcarata*, *Galeandra bicarinata*, *Govenia floridana*, *Oncidium ensatum*, *Ponthieva brittoniae* and *Spiranthes torta*. Other rare terrestrial orchids known exclusively from the Long Pine Key area of EVER are: *Cyclopogon cranichoides*[67], *Habenaria quinqueseta*, *Platythelys querceticola* and *Spiranthes laciniata*. The rare *Sacoila lanceolata* var. *paludicola* has only been recorded in the Long Pine Key area and the Chekika Hammock area, while the remaining rare species are found more widely in the park, including in some cases the historic East Everglades and 40-mile Bend areas: *Bletia purpurea*, *Calopogon tuberosus*, *Eulophia alata*,

[66] There are four dubious reports of rare terrestrial orchids from EVER which are discussed in Rare Plants of South Florida (Gann *et al.* 2002) and considered false records in the Floristic Inventory of South Florida Database Online (Gann *et al.* 2014a): *Cranichis muscosa*, *Liparis nervosa*, *Mesadenus lucayanus* (=*Spiranthes lucayana*) and *Pelexia adnata*. There are also two species of epiphytic orchids that were planted in the park long ago but apparently did not persist: *Dendrophylax lindenii* and *Maxillaria crassifolia* (Gann *et al.* 2002, Gann *et al.* 2014a). Reimus (1996, 1999) also reported *Epidendrum conopseum* in the park (in both cases as possibly extirpated). This species is not native to South Florida, but was planted in the park by Frank Craighead (R. Hammer, email comm. 2014) and is doubtfully still present.

[67] *Cyclopogon cranichoides* – this is treated as *Spiranthes cranichoides* in the Atlas of Florida Vascular Plants (Wunderlin and Hansen 2014) and the Floristic Inventory of South Florida Database Online (Gann *et al.* 2014a). The synonym *Beadlea cranichoides* has also been recently applied.

Ponthieva racemosa, *Spiranthes odorata* and *Spiranthes vernalis*. One SOMC terrestrial orchid is possibly extinct globally (*Govenia floridana*), while the remainder are believed to be extant in the Long Pine Key area.

Most terrestrial orchids in EVER have ephemeral above ground parts and, as a consequence, are difficult to survey for and monitor[68]. Others have very inconspicuous above ground parts (e.g., *Basiphyllaea corallicola*, *Spiranthes torta*), which also contributes to poor detection during surveys and monitoring even when above ground parts are present. As a consequence, some terrestrial orchids may be more numerous than thought, but others are probably just very rare. Ephemeral above ground parts are linked to reliance on mycorrhizal fungi for all or a significant part of a terrestrial orchid's life cycle. Myco-heterotrophy is well known in terrestrial orchids and has evolved independently in at least 20 different orchid lineages (Batty *et al.* 2002). In some cases terrestrial orchids rely entirely on myco-heterotrophy and remain achlorophyllous for their entire life cycle[69], while in most cases terrestrial orchids are strongly associated with a mycorrhizal partner during seed germination and early growth, but then become autotrophic for the completion of their life cycle. There are no completely achlorophyllous orchids known from EVER. Important here is that myco-heterotrophic orchids are known to go through periods of vegetative dormancy of one to 11 years (Shefferson 2009). It is thought that vegetative dormancy may allow orchids to recover from environmental stress, and if proper conditions are restored then flowering will re-occur. The exact parameters of when myco-heterotrophic orchids in EVER commence vegetative dormancy, the length they can persist undetected underground, and the environmental conditions needed for dormancy to end and flowering to occur is unknown.

Potential threats to terrestrial orchids are many, and include poaching, redundant herbarium specimen collection, unintentional trampling of both above ground and below ground parts, loss of pollinators, competition from exotic species, and, in the long-haul, sea level rise. Poaching of terrestrial orchids has been recently documented in EVER (see *Galeandra bicarinata* and *Eltroplectris calcarata* accounts below), but it is unknown if orchids per se were targeted, or if flowers were simply harvested because someone thought they were attractive. Damage of below ground parts by trampling may be exacerbated in the Long Pine Key area because most terrestrial orchids grow in a thin organic layer on top of limestone rock.[70] This could especially be a problem in association with long-term monitoring plots or repeated searches for "missing" populations that are actually persisting underground.

Prescottia oligantha was translocated from Hattie Bauer Hammock in Miami-Dade County to EVER in 1960 (Luer 1972) and was observed in Palma Vista #2 Hammock by Don Keller and Roger Hammer between 1989 and 1992 (Gann *et al.* 2002). If extant, this is the only population in South Florida. Around 2004, both Keller and Richard Reimus showed then-IRC biologists Jimi Sadle and Steven Woodmansee locations where plants had been observed (J. Sadle, email

[68] Only *Oncidium ensatum* does not lose all its leaves during part of its life cycle. *Bletia patula* and *B. purpurea* produce leaves each year but usually lose their leaves for part of the year during the dry season.
[69] In the past, these achlorophyllus orchids were incorrectly referred to as saprophytic orchids.
[70] While little is known about the conservation of terrestrial orchids in EVER, two recent publications discuss the conservation of terrestrial orchids in Australia in depth, including management recommendations (Brundrett 2007, Swarts *et al.* 2009).

comm. 2014). Although not found during IRC's rare plant project on Long Pine Key (2003-2008), searches for this species should continue. If found, then efforts should be made to collect seeds and/or plants for cultivation, with the intention of restoring the population at Hattie Bauer Hammock. Until a reintroduction into Miami-Dade County can be accomplished, the population in EVER should be acknowledged as introduced but conserved in-situ until material for reintroduction has been secured. See Luer (1972) for an image.

Basiphyllaea corallicola (Small) Ames – Carter's Orchid

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	11-100

Figure 40. *Basiphyllaea corallicola* with unusually open flowers from Miami-Dade county outside of EVER. Image by Roger Hammer, 2014.

Figure 41. *B. corallicola* capsules in EVER, November 2013.

Background

Carter's orchid is a small terrestrial herb in the Orchidaceae. It is a primarily West Indian species at the northern end of its range in South Florida and the northern Bahamas. It also occurs in the Greater Antilles in Cuba, Hispaniola and Puerto Rico. In South Florida it is known only from Miami-Dade and Monroe counties. Outside of EVER, it is known from two conservation areas in Miami-Dade County and at the National Key Deer Refuge in the Florida Keys[71]. In

[71] A current survey for Carter's orchid at the National Key Deer Refuge is needed. It may also be present at other sites in Miami-Dade County, such as the Naranja School Board pineland (Gann *et al.* 2002), or other sites where it has been undetected to present.

South Florida, it is most commonly found in pine rocklands where it grows in cracks or holes in limestone bedrock filled with organic material[72]. Mortellaro *et al.* (2012) ranked it as having a moderate affinity to high quality natural areas. In the West Indies, it grows in thick leaf litter in sclerophyllous thickets, broadleaf forests, and montane pine forests on both limestone and serpentine soils from 100-750 m elevation (Ackerman and Collaborators 2014). Luer (1972) reported it to flower in October and November, noting that it is unknown how frequently an individual may flower and whether or not plants die once they flower. Wunderlin & Hansen (2011) reported it to flower in the fall. Specimens have been collected in EVER from October to January. Correll & Correll (1982) reported flowering in the Bahamas from August to January and Ackerman & Collaborators (2014) reported flowering in the West Indies from August to March and fruiting from September to January; no pollinators or breeding systems were reported. Stewart & Hicks (2010) reported that Carter's orchid is easily cultivated asymbiotically and that it produces new pseudobulbs every few months. The leaves also contain chlorophyll, suggesting that it is not a myco-heterotrophic obligate.

Conservation Status

Basiphyllaea corallicola has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as imperiled globally (rounded), but critically imperiled in the United States. It is a not listed under the Endangered Species Act, but is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC in South Florida. Ackerman & Collaborators (2014) considered it to be rare in the West Indies, but some populations were protected.

Taxonomic Notes

Luer (1972), Correll & Correll (1982) and other authors considered *B. corallicola* as endemic to South Florida and the Bahamas. Ackerman (1995) placed *B. angustifolia* Schltr. into synonymy with *B. corallicola*, extending the range of the species into Cuba, Hispaniola, and Puerto Rico.

History in EVER

Carter's orchid was discovered in EVER by Frank Craighead in or before 1971 in pine rocklands in the eastern part of Long Pine Key (Avery 1983, Martin 2001, Gann *et al.* 2002). Between 1971 and 1999 it was found in two locations in eastern Long Pine Key and two locations in western Long Pine Key, with a total observed count of six plants (Gann *et al.* 2002). From 2003 to 2008, IRC recorded five occurrences at 11 stations with an estimated total population of 11-100 plants (Gann *et al.* 2009)[73]. All plants were found south of Main Park Road in pine blocks A, B, E, F and J. Previously recorded stations in pine blocks H and I were not relocated. Counts of Carter's orchid at these 11 stations at the time of their initial discovery were: 1 plant at each of nine stations, 2 plants at one station and 5 plants at one station (IRC and EVER unpublished

[72] Hammer (1992c) reported the discovery of Carter's orchid by the author and others in 1991 at the Deering Estate at Cutler. This population has sometimes been described as being found on the edge of a tropical hardwood hammock. In fact, it is persisting in a fire break road and adjacent fire-suppressed pine rockland (Gann *et al.* 2002), neither of which were historically tropical hardwood hammock. However, records from the West Indies suggest broader ecological tolerances would be expected.

[73] This included a station recorded by ENP Botanist Jimi Sadle and IRC biologist Keith Bradley in February, 2008 (IRC and EVER unpublished data). Only a dried dehisced capsule was observed.

data).[74] Three long-term monitoring plots were established in February, 2004. In one plot initially containing one individual, no plants were found in subsequent visits, but in the other two plots (initially containing three plants and one plant respectively) at least one additional observation of a plant was made in subsequent years. However, since individual plants were not tagged or marked, it is not known if the same plant was observed. Furthermore, in none of the plots were plants observed every year they were sampled. Since 2008, at least three sightings are known: EVER biologist Jonathan Taylor observed a single flowering plant in November 2010 (EVER unpublished data), EVER Botanist Jimi Sadle observed one plant in February 2013 and Sadle, IRC biologist James Johnson and the author observed a single plant with two immature capsules in November 2013 (Figure 41).

Discussion

Carter's orchid is a cryptic species that is extremely difficult to see. Only fertile plants are normally detectable as the sterile stage of above ground plants consists of one or two grass-like leaves (Figure 42). It is highly likely that many more plants are present than have been observed. Furthermore, the distribution of the species within the higher elevation pinelands of Long Pine Key is widespread, although it has not been found in the wetter pinelands north of Main Park Road. The three plots established by IRC in the 2003-2008 study and the 11 existing GIS coordinates provide an excellent baseline for monitoring this species in EVER. Since it has been nearly a decade since some of these stations have been visited, a complete census in the fall of 2015 would be timely. Because of the difficulty of detecting Carter's orchid, a method of marking and tracking individuals should be developed. Since it may undergo one or several years of vegetative dormancy, this method should take that into consideration. Because it produces new pseudobulbs every few months in the lab, it seems unlikely that Carter's orchid is a strict annual, although it is possible (but not likely) that it is short-lived.

Figure 42. *Basiphyllaea corallicola* in EVER showing base of spike on left and single leaf pointing to the right. Image by James Johnson, 2013.

[74] These counts were most certainly underestimates of plants present. Surveys after the first season or two following fire become extremely difficult due to grass and litter accumulation.

Summary of Recommendations

- Continue surveys for Carter's orchid in pine rocklands throughout Long Pine Key. Record new GIS coordinates where appropriate and census newly discovered stations. Photo document all sub-populations.
- Revisit the 11 known stations of Carter's orchid in the fall of 2015 and develop a method of tracking individuals at all or a subset of the stations. Determine basic life history characteristics and monitor trends in population size. Because of detectability challenges, censuses may need to be "rolling" through time to count plants from the last monitoring event when plants are most detectable, e.g., following the last fire to impact each station.
- As with other pine rockland species, monitor plants prior to and following fires to determine impacts.

Beloglottis costaricensis (Rchb. f.) Schltr. – Costa Rican Ladiestresses

Federal Status	**State Status**	**IRC SF Status**	**EVER Population**
NA	Endangered	Critically Imperiled	101-1,000
Synonyms: *Spiranthes costaricensis* Rchb. f.			

Figure 43. *Beloglottis costaricensis* in EVER. Images by Keith Bradley, 2007.

Background

Costa Rican ladiestresses is a terrestrial herb in the Orchidaceae. It is a primarily Neotropical species at the northern end of its range in South Florida where it is known only from Miami-Dade County in EVER. It was briefly observed in an additional conservation area in Miami-Dade County in the early 1980s, but has not been recently observed there (Gann *et al.* 2002,

Gann *et al.* 2014a). It is also known from the Greater Antilles (Cayman Islands, Dominican Republic), Mexico, Central America and northern South America. In South Florida it grows in tropical hardwood hammocks. Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas. Elsewhere in its range it grows in a wide variety of forested ecosystems from near sea level to around 1000 m elevation. Luer (1972) reported it to flower from March to April. Wunderlin & Hansen (2011) reported it to flower in the spring. It has been collected in flower in EVER from February to April. Ackerman & Collaborators (2014) reported flowering in the West Indies from February to April and fruiting from February to May; no pollinators or breeding systems were reported.

Conservation Status

Beloglottis costaricensis has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as apparently secure globally (rounded), but as critically imperiled in the United States. It is a not listed under the Endangered Species Act, but is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC in South Florida. Ackerman & Collaborators (2014) considered it to be very rare in the Greater Antilles with a high possibility of local extinction.

History in EVER

Costa Rican ladiestresses was discovered in the United States by John Beckner in EVER in 1953 (Luer 1972, Hammer 2001, Gann *et al.* 2002). It was reported as possibly extirpated by Loope & Avery (1979), but was subsequently vouchered by George Avery in 1980 (2215 FTG), and by Richard Reimus and Chuck McCartney in 1991 (s.n. FTG). Avery (1983) reported plants from five hammocks in the Long Pine Key area, while Hammer (2001) reported it to be extant in four. IRC surveys of Long Pine Key hammocks from 2003 to 2008 located populations of Costa Rican ladiestresses in seven hammocks: Fairchild, Osteen, Palma Vista #2, Pilsbry, Rattlesnake, Royal Palm and Winkley (Gann *et al.* 2009). GIS coordinates were recorded at 18 stations and the 2008 population in EVER was estimated at 101-1,000 plants. Long-term monitoring plots were established in Osteen, Palma Vista #2 and Pilsbry hammocks.

Discussion

Although limited spatially, the metapopulation of *S. costaricensis* appears healthy and plants have been located in the same general areas over multiple years (IRC and EVER unpublished data). The three plots established by IRC in the 2003-2008 study and the 18 existing GIS coordinates provide an excellent baseline for monitoring this species in EVER. As with other terrestrial orchids, the development of demographic monitoring methods that track individual plants would be optimal.

Summary of Recommendations

- Revisit the three monitoring plots and at least one station in each of the four remaining hammocks in 2015 and develop a method of tracking individuals at all or a subset of the stations visited. Determine basic life history characteristics and monitor trends in population size.
- Consider that *S. costaricensis* may be ephemeral in specific locations and moving across the landscape. Employ long-term monitoring techniques that can capture this movement over time.

Bletia patula Graham[75] – Flor de Pasmo

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	2-10

Figure 44. *Bletia patula* in the Dominican Republic, 2011.

Figure 45. *B. patula* capsule in EVER, May 2013. Image by Jimi Sadle.

Background

Flor de pasmo[76] is a perennial terrestrial herb in the Orchidaceae. It is presumed native to South Florida[77] and the West Indies but is apparently absent in the Bahama Archipelago (Gann *et al.* 2014a). In South Florida, it is currently known only from EVER. It was also collected once in 1947 in a pine rockland in Miami-Dade County by Roy Woodbury and Manley Boss (Hawkes 1950, Luer 1972, Hammer 2001, Gann *et al.* 2002, Sadle 2012a). A live plant was collected and flowered the following year (Luer 1972). Unlike the typical pink form, the Woodbury and Boss plant was albino (=*B. patula* var. *alba* A.D. Hawkes), a form that is also present in the Dominican Republic and Puerto Rico (Ackerman and Collaborators 2014). Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas, but this was based solely on the Woodbury and Boss collection. Elsewhere in its native range, flor de pasmo grows in a wide variety of mesic habitats, including disturbed sites, from about sea level to about 850 m elevation. Wunderlin & Hansen (2011) reported it to flower in the spring. Ackerman & Collaborators (2014) reported flowering in the West Indies all year, but mostly from March to June, and fruiting all year. Pollination is probably by large bees (Ackerman 1995). Pollinator attraction is by deception; fruit set is typically low and is independent of flower color frequency (Ackerman and Carromero 2005, Ackerman and Collaborators 2014).

[75] Many authors have considered Hooker as the legitimate author of *B. patula*. However, as pointed out by Frank Axelrod (2011) this was an error possibly caused by a misunderstanding of who the author was of the Botanical Magazine article in which the name was published.

[76] Roughly translated from Spanish flor de pasmo means "admirable flower" or "astonishing flower".

[77] Hawkes (1950) questioned the nativity of *B. patula* in South Florida but there is no compelling reason to do so. As discussed in Sadle (2012a), the distribution is similar to many other West Indian species that "barely maintain a foothold in North America within the unique habitats found in subtropical South Florida." Ackerman & Collaborators (2014), Wunderlin & Hansen (2011), IRC (Gann *et al.* 2014a) and others accept it as native to Florida.

Conservation Status
Bletia patula has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as apparently secure globally, but as critically imperiled in the United States[78]. It is a not listed under the Endangered Species Act, or by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC in South Florida. Ackerman & Collaborators (2014) reported it to be locally threatened in the Greater Antilles and possibly extinct in the Lesser Antilles.

History in EVER
Flor de pasmo was first reported for a roadside at Coot Bay in the early 1950s (Kuhn 1953) but this report was never confirmed (Sadle 2012a). It was not seen again until March, 2010 when EVER seasonal interpretive ranger Greg Reed found a single plant in the Hole-in-the-Donut and brought it to the attention of EVER Botanist Jimi Sadle. This discovery, its nativity status and possible pollinators are discussed in Sadle (2012a). As of 2014, viable capsules are being produced and two new plants have recruited in the vicinity of the original plant (J. Sadle, email comm. 2014).

Prescribed fire has been conducted twice since the initial discovery of the plants, and in both cases, all *B. patula* plants were burned (J. Sadle, email comm. 2014). In each case, leaves were lost on all plants and at least peripheral bulbs were scorched. Surviving bulbs produced new leaves and all plants survived both burns. Based on this limited observation, it appears that *B. patula* is at least tolerant of low intensity fires that are characteristic of current prescribed fire approach implemented in that area.

Discussion
B. patula is a documented part of the South Florida flora which has been reported previously from EVER. There is no evidence that it was introduced to the park by humans and it is possible that plants remain undetected in other parts of South Florida which have acted as a seed source. It is also possible that the current EVER population represents a recent re-introduction from Cuba or another West Indies island. It is not known why this species is so rare in South Florida, while its congener, *B. purpurea*, is widespread. It may be limited by climate. Unlike many terrestrial orchids, it has large pseudobulbs at or above the ground surface and theoretically it may be detected year round. However, its close appearance to *B. purpurea* makes this difficult when plants are not in flower.

Summary of Recommendations
- Establish a regular monitoring program to track the few known individuals and document the spread of the species if it occurs.

[78] Based on Sadle's rediscovery in EVER (see History in EVER).

Eltroplectris calcarata (Sw.) Garay & H.R. Sweet – Longclaw Orchid

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	1,000-2,000
Synonyms: *Centrogenium setaceum* (Lindl.) Schltr.			

Figure 46. *Eltroplectris calcarata* at a new station in Miami-Dade County. Images by Sarah Martin, 2014.

Background

Longclaw orchid is a terrestrial herb in the Orchidaceae. It is a primarily Neotropical species at the northern limit of its range in peninsular Florida and the northern Bahamas. It also occurs elsewhere in the West Indies and in South America. In Florida, it is known from Miami-Dade and Broward counties in South Florida and Highlands County in Central Florida. In South Florida outside of EVER, it is known from one conservation area in Miami-Dade County, one private site in Miami-Dade County which was discovered in 2014 by IRC team leader Rasheed Bradley and one site in Broward County discovered in 2009 (Gann 2014b, Gann *et al*. 2014a). It grows primarily in tropical and temperate hardwood hammocks, but has also been found in fire suppressed pine rocklands. Mortellaro *et al*. (2012) ranked it as being obligate to high quality natural areas. Elsewhere in its range, it grows in a wide variety of moist to wet ecosystems from near sea level to about 1800 m elevation (Ackerman and Collaborators 2014). Luer (1972) reported that longclaw orchid flowers from January to March, and flowering specimens have been collected in EVER in January and early February. Wunderlin & Hansen (2011) reported it to flower from winter to spring. Ackerman & Collaborators (2014) reported flowering in the West Indies from December to March and July and fruiting January to May, July and August; no pollinators or breeding systems were reported.

Conservation Status
Eltroplectris calcarata has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as apparently secure globally, but critically imperiled in the United States. It is a not listed under the Endangered Species Act, but is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC in South Florida. Although uncommonly encountered, Ackerman & Collaborators (2014) did not consider longclaw orchid to be threatened in the West Indies.

History in EVER
George Avery apparently made the first observations of longclaw orchid in EVER in two hammocks on Long Pine Key in 1981 and 1983 (Avery 1983, Gann *et al.* 2002). Alan Herndon vouchered it in Palma Vista #2 Hammock in 1984 (1020 FNPS) and it was re-vouchered there and vouchered at Mosier Hammock by Richard Reimus in 1991 (50 FNPS, 51 FNPS)[79]. In 2001, Paul Martin Brown reported plants in six hammocks on Long Pine Key and an estimated South Florida population of fewer than 200 plants (Gann *et al.* 2002). IRC surveys of Long Pine Key hammocks from 2003 to 2008 located populations of longclaw orchid in 14 hammocks, all south of Main Park Road: Clench, Currier, Craighead, Fairchild, Frampton, Grimshawe, Mosier, Osteen, Palma Vista #1, Palma Vista #2, Pilsbry, Rattlesnake, Redd, and Winkley (Gann *et al.* 2009). Previously recorded stations in Hammock #120 and Pay-Fee Hammock were not relocated. GIS coordinates were recorded at 48 stations and the 2008 population in EVER was estimated at 101-1,000 plants (Gann *et al.* 2009), although the sum of the counts and estimates would suggest the actual number was between 1,000 and 2,000 plants. The largest populations were recorded in Clench and Redd hammocks, where 100s of plants were found. Long-term monitoring plots were established in Grimshawe, Pilsbry and Rattlesnake hammocks. In October 2009, EVER Botanist Jimi Sadle and IRC biologist Keith Bradley discovered what was possibly a sterile colony of this species on a shell mound south of the mouth of the Lopez River in Collier County in the northwestern part of the park (IRC and EVER unpublished data). Approximately 100 plants were present. If verified, this population would represent a new habitat record as well as a significant range extension for the species.

Discussion
The large number of plants and the large number of hammocks in which they are found suggest that longclaw orchid is fairly secure in the park. Poaching of this species probably occurs in hammocks where hiking trails transects populations (J. Sadle, email comm. 2014). However, this represents a relatively small amount of pressure on the species. Hammer (2001) suggested that the population of *E. calcarata* was expanding in the park both preceding and following Hurricane Andrew in 1992. From the growing number of hammocks in which it has been recorded and the apparent range expansion one could surmise that this is true. However, the increase in known occurrences may be misleading. On average, IRC's rare plant study on Long Pine Key more than doubled the number of known extant occurrences of focal species in the study (Gann *et al.* 2009). Only through a more detailed study over a long period of time can long-term trends be ascertained. The three plots established by IRC in the 2003-2008 study and the 48 existing GIS coordinates provide an excellent baseline for monitoring this species in EVER.

[79] There is also a 1988 collection from Pay-Fee Hammock, which is also known as Entrance Hammock (Sauleda 9209 USF).

Summary of Recommendations

- Revisit the three monitoring plots and at least one station in each of the 11 remaining hammocks in 2015 and develop a method of tracking individuals at a subset of the stations visited. Determine basic life history characteristics and monitor trends in population size.
- Consider that *E. calcarata* may be ephemeral in specific locations and moving across the landscape. Employ long-term monitoring techniques that can capture this movement over time.
- Confirm identity of Lopez River population.

Galeandra bicarinata G.A. Romero & P.M. Br. – Helmet Orchid, Two-Keeled Hooded Orchid

Federal Status	**State Status**	**IRC SF Status**	**EVER Population**
NA	Endangered	Critically Imperiled	2-10
Synonyms: *Galeandra beyrichii* Rchb. f., misapplied (see Taxonomic Notes below)			

Figure 47. *Galeandra bicarinata* in EVER. Image by Roger Hammer, September, 2014.

Figure 48. *G. bicarinata* at Fuchs Hammock Preserve, Miami-Dade County. Image by Jennifer Possley, 2004.

Background

Helmet orchid is a terrestrial herb in the Orchidaceae. It is endemic to South Florida in Miami-Dade County and Cuba (Romero-González and Brown 2000, Ackerman and Collaborators

2014[80]). There are two populations known in Miami-Dade County conservation areas outside of EVER (Gann *et al.* 2014a[81]). In South Florida it grows only in tropical hardwood hammocks and Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas. Luer (1972) reported it to flower in September and October. It has been also observed and collected in flower during these months in EVER. Wunderlin & Hansen (2011) reported it to flower in the fall. Unlike the closely related *G. beyrichii* (see Ackerman 1995), *G. bicarinata* appears to be autogamous (Romero-González and Brown 2000, Ackerman and Collaborators 2014). Helmet orchid is apparently myco-heterotrophic (Romero-González 2002[82]) and rarely produces leaves (Luer 1972). Romero-González & Brown (2000) reported that the youngest pseudobulb produces a leafy shoot in the late spring to fall. The fully developed leaves last 6-8 weeks then disappear. One to two leaves are normally formed during each event. An inflorescence develops 4-12 weeks later.

Taxonomic Notes

Plants in Florida were previously identified as *G. beyrichii*, a wide-ranging species of the Greater Antilles (Jamaica, Hispaniola, Puerto Rico), Mexico, Central America and South America. Romero-González & Brown (2000) described plants from Florida and Cuba as a new species, *G. bicarinata*. As described in the original publication, *G. bicarinata* differs in the narrow, bicarinate callus versus the wide callus with four ridges in *G. beyrichii*. Plants identified as *G. beyrichii* on other West Indian islands may also be this species[83].

Conservation Status

Galeandra bicarinata has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as critically imperiled globally and in the United States. It is a not listed under the Endangered Species Act, but is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC in South Florida. Ackerman & Collaborators (2014) stated that the conservation status of *G. bicarinata* in Cuba was unknown. Email communications with Cuban botanists indicate that plants were extant in eastern Cuba as recently as 1989 but that the species is extremely rare (C. Moya, email comm. 2014).

[80] Ackerman & Collaborators (2014) only referred to "Oriente", which is not a political unit in modern-day Cuba, for the distribution of *G. bicarinata* in Cuba; *G. beyrichii* was not listed as being distributed in Cuba. The area formerly occupied by Oriente is now divided into five provinces: Las Tunas, Holguin, Granma, Santiago de Cuba and Guantanamo. The specimen cited for Cuba (Charles Wright 1698 AMES) in Romero-González and Brown (2000) is presumed to be the basis for Ackerman's locality. Charles Wright collected in Cuba between 1856 and 1867. León & Alain (1946-1953) listed *G. beyrichii* for Pinar del Rio in the west and Oriente in the east without further detail. *Galeandra* is not listed in either the Cuban Red List (González-Torres *et al.* 2013) or the regional Red List for Pinar del Rio (Urquiola Cruz *et al.* 2010). Llamacho & Larramendi (2005) listed *G. beyrichii* for Cuba from 200 m and above but did not discuss *Galeandra* in the text. Oddly, a Cuban postage stamp with an image of *Galeandra* was issued in 1995. *G. beyrichii* may still be extant in eastern Cuba (Granma), but extremely rare; there are no modern reports from Pinar del Rio (C. Moya, email comm. 2014).

[81] Although IRC still maintains *G. bicarinata* as present at Castellow and Fuchs hammocks, only one plant has been seen within the last decade – at Fuchs Hammock Preserve in 2004 (J. Possley, email comm. 2013).

[82] Romero-González actually used the term saprophytic, in error.

[83] One of the illustrations of *G. beyrichii* in Ackerman and Collaborators (2014, p. 199, Fig 53 C) based on Howard 9719 (NY) from the Dominican Republic appears to have two keels and may represent *G. bicarinata*.

History in EVER

Helmet orchid was discovered in EVER in 1974 by Eugene Delchamps and Roland Eves (Avery 1983, Gann *et al.* 2002). It was vouchered in a single hammock in 1990 (McCartney s.n. FNPS) and 1991 (Seavey and Seavey 1091 FNPS) when 38 plants were counted[84]. Prior to 2002, both Roger Hammer and Don Keller reported that plants were present in three hammocks on Long Pine Key including the known location (Gann *et al.* 2002, Gann *et al.* 2009), but populations outside of the current known station have remained unverified. IRC surveys from 2003 to 2008 located fertile plants in the known location and possible sterile plants in two additional hammocks. In 2005, IRC recommended the augmentation of *G. bicarinata* in EVER (Gann *et al.* 2005). One long-term monitoring plot was established that year and one plot was established at one of the hammocks with sterile plants. The most plants observed during the study was six in 2006 (IRC and EVER unpublished data). At the end of 2008, the total population in the park was estimated at 2-10 plants (Gann *et al.* 2009). Casual surveys of known locations of plants in the known location by EVER Botanist Jimi Sadle since 2008 failed to locate a single individual through 2012 (J. Sadle, email comm. 2014). A survey by Sadle, IRC biologist James Johnson and the author in November, 2013 also failed to locate any signs of above ground plants. However, in September 2014, Roger Hammer located and photographed *Galeandra bicarinata* again in the known location (Figure 47), counting five individuals. Sadle has verified this flowering event (email comm. 2014).

Discussion

Surveys and population estimates are likely to underestimate the number of plants actually present because helmet orchid likely undergoes significant periods of time with no above-ground parts. The related *G. beyrichii* was observed in one forest in Puerto Rico from 1980 to 1984, but was not observed between then and 2011 (Ackerman 1995, Axelrod 2011). Regardless of whether plants remain dormant for many years this species is extremely rare in the park and is threatened due to the extreme localization of the known occurrence. In 2008, at least one flowering plant of longclaw orchid (see *Eltroplectris calcarata* above) was apparently poached near the helmet orchid population[85]. Based on this observation and the fact that helmet orchid flowers are very showy and capsules are relatively conspicuous and slow to mature, poaching should be considered a serious threat to the species.

Summary of Recommendations

- Review for listing under the Endangered Species Act and petition for listing if warranted.
- Continue surveys for helmet orchid beginning in June to look for emerging leaves and then flowers as described by Romero-González & Brown (2000). Record new GIS coordinates where appropriate and census newly discovered stations. Photo document all sub-populations.
- Revisit the known location and develop a method of tracking individuals. Determine basic life history characteristics and monitor trends in population size.

[84] The precise location of this species in EVER is sensitive. For more information contact the park Botanist.

[85] One inflorescence with developing fruit of *G. bicarinata* was also broken, probably from unintentional trampling, in the same area also around 2008 (J. Sadle, email comm. 2014). The broken stem later produced a mature capsule that dehisced.

- In an effort to make the identification of this species easier for monitoring purposes photo monitor the vegetative and reproductive phases of plants.
- Consider fencing off or otherwise protecting known populations to avoid accidental trampling.
- Ensure that monitoring activities do not damage plants.
- Establish an ex-situ collection of *G. bicarinata* germplasm from EVER and move forward with previous IRC recommendations to augmentation the population in EVER.

Govenia floridana P.M. Br. – Florida Govenia

Federal Status	**State Status**	**IRC SF Status**	**EVER Population**
NA	Endangered	Possibly Extinct	Possibly Extinct
Synonyms: *Govenia utriculata* (Sw.) Lindl., misapplied (see Taxonomic Notes below)			

Images
For images, refer to Luer (1972 p. 245, photographs 1 & 2, not 3 & 4) and Brown (2000).

Background
Florida Govenia is a terrestrial herb in the Orchidaceae. It is endemic to South Florida in Miami-Dade County. It has been found only in Everglades National Park where it has been recorded in a single tropical hardwood hammock. Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas. Pansarin (2008) studied the pollination biology of the closely related *G. utriculata* in Brazil and found that the species is self-compatible but pollinator dependent. The Brazil plants were pollinated by hoverflies in the genus *Salpingogaster,* a genus with species in Florida. Luer (1972) reported it to flower in November and December and Wunderlin & Hansen (2011) reported it to flower in the fall. Herbarium specimens with seed capsules have been collected in April.

Conservation Status
Govenia floridana has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe does not rank *G. floridana*, but ranks *G. utriculata* as globally secure, but critically imperiled in the continental United States. It is a not listed under the Endangered Species Act, but is listed as endangered by the State of Florida (as *G. utriculata*). The Florida Natural Areas Inventory ranks it as critically imperiled in Florida (as *G. utriculata*). IRC ranks *G. floridana* as possibly extirpated in South Florida.[86]

Taxonomic Notes
Plants in Florida were previously identified as *G. utriculata*, a wide-ranging species of the West Indies, Mexico, Central America and South America. Paul Martin Brown (2000) described plants from South Florida as a new species, *G. floridana*. As described in the original publication, *G. floridana* differs in that the petals are spotted rather than barred, the sheath is angular and polygonal in cross section rather than inflated, and the column is prominently winged (Greenwood 1981, Brown 2000, Greenwood 2002). These differences had previously been noted by Luer and Greenwood (Brown 2000). In preparation for the Flora of North America, Greenwood (2002) accepted Brown's work but noted that fresh material was needed to

[86] Technically, this should be ranked as possibly extinct globally.

prove the uniqueness of the Florida plants. Ackerman & Collaborators (2014) did not list Florida as part of the range of *G. utriculata*, in effect accepting Brown's work.

History in EVER

Florida Govenia was discovered in in 1957 by Frank Craighead in EVER (Craighead s.n. AMES[87], Luer 1972, Brown 2000). Twenty-five or more plants were observed in Palma Vista #2 Hammock (letter from Frank Craighead to the Chief Ranger of Everglades National Park, 18 November 1966). All verified collections and observations from Florida have been from this station (Gann *et al.* 2002). In September 1960, the eye of Hurricane Donna passed to the west of Palma Vista #2 and Luer (1972) reported that the storm significantly altered the hammock but had little impact on the Florida Govenia plants.[88] Craighead made a second collection in April 1960 (s.n. FTG). In October 1961, 21 plants were counted, but by December of that year it appeared that many of the plants had died or had been removed by collectors. Craighead made two collections in 1962, the first in April with capsules (2564 FNPS) and the second in October with a stem and leaves (2159 FNPS)[89]. Only four plants were counted in October 1962 and it appeared as if collectors had trampled the area. On November 20, 1962 Craighead again visited the site and those four plants had been removed. In the fall of 1963 Craighead made another collection (s.n. FLAS in Brown 2000, Hammer 2001). On December 15, 1963 only one plant was seen. On November 22, 1964, Dan Ward made the last collection of Florida Govenia with Craighead (4354 FLAS)[90]. Only flowers were taken, and eight or nine plants were present (Craighead counted nine and Ward eight). Despite surveys by George Avery in 1976 and 1978 (Avery 1983) and subsequently by many others, no verified observations have been made since that time (Gann *et al.* 2002). Brown (2000) reported that Ruben Sauleda had photographed a fruiting plant in Osteen Hammock in 1990 and Brown had seen four small, immature plants of Florida Govenia in 2000 "in Craighead's original site." However, neither of these reports has been verified.

Discussion

Although the re-discovery of Florida Govenia in Everglades National Park seems highly unlikely, it should be searched for whenever botanical activity is undertaken in suitable habitat, and especially in Palma Vista #2 Hammock. Another South Florida terrestrial orchid, *Cranichis*

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[87] The label data states – Palma Vista Hammock, Everglades National Park; on new road near Palma Vista in deep shade.

[88] Luer went into great detail about Hurricane Donna and its impact on the habitat of Florida Govenia: "Before the arrival of Donna, the destructive hurricane of 1960, this hammock was unusually dark, with a nearly solid blanket of foliage above; rays of sunshine were scarce. Only a dim, diffused glow permeated the maze of tree trunks to reach the nearly barren, leaf-strewn floor. The distinctive barks on trunks of gumbo-limbo, fig, maple, and oak were there to be seen. Over about an acre, Dr Craighead was able to plot the location of several dozen individual plants, which were rather easily spotted by their large leaves, since competing growth was practically absent. After the hurricane, which toppled many trees and thinned out as many branches, conditions were changed. Sunlight now invaded the depths to support an undergrowth. The *Govenia* colony was actually little disturbed. Plants persisted in shady spots, which were quite plentiful, but became now much more difficult to find – perhaps a blessing in disguise." Interestingly, the native red maple of South Florida, *Acer rubrum*, has never been documented anywhere near Long Pine Key.

[89] At this point it is unclear why Craighead continued making specimens in the face of obvious over collecting. However, as pointed out in Brown (2000) all of Craighead's specimens were fragments of stems and leaves or dried capsules.

[90] This is the type specimen of *G. floridana*.

muscosa, was rediscovered in South Florida 100 years after it had been last seen (Gann *et al.* 2014a).

Summary of Recommendations

- Continue searches for Florida Govenia, especially in Palma Vista #2 Hammock.

Oncidium ensatum Lindl. – Florida Dancinglady Orchid

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	101-1,000
Synonyms: *Oncidium floridanum* Ames			

Figure 49. *Oncidium ensatum* in Osteen Hammock, 2011.

Figure 50. *O. ensatum* in central Belize. Image by Paul Craft with the author, 2011.

Background

Florida dancinglady orchid is a terrestrial or sometimes epiphytic[91] herb in the Orchidaceae. It is a tropical species at the northern end of its range in South Florida and the northern Bahamas. It is also known from the southern Bahamas, Cuba, southern Mexico and Central America. In South Florida, it is known only from Miami-Dade and Collier counties and the Monroe County

[91] *O. ensatum* is placed in the terrestrial orchid group in this report as this is its most common substrate in EVER. However, it does sometimes grow epiphytically in the Long Pine Key area (pers. observation of the author), on coastal berms in the Flamingo area and in the cypress forests of the Big Cypress. Luer (1972) commented – "They may be found dwelling terrestrially in the rich humus of densely shaded, relatively dry hammocks, or perched epiphytically within the collected debris upon the bases of cypress trees as well as on their knees in wet forests."

mainland. Outside of EVER it is extant only in BICY, where fewer than ten plants are estimated to be present (IRC unpublished data). It was historically present in Miami-Dade County including at Hattie Bauer Hammock and near the coast in the Black Creek area, but it has been extirpated in those locations for about a century (Gann *et al.* 2002). In South Florida, *O. ensatum* has been recorded growing in or more typically along the edges of tropical hardwood hammocks (both in the interior and on coastal berms), in cypress forests and historically in pine rocklands (e.g., Small and Wilson 980 NY[92]). Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas in South Florida. Elsewhere in its range, Florida dancinglady orchid is found in a wide variety of habitats from near sea level to about 700 m elevation, including in pine savannas, along streams, in mangrove swamps and on roadsides. Luer (1972) reported sporadic flowering throughout the year, but mainly from May to August. Wunderlin & Hansen (2011) reported it to flower from spring to fall. Ackerman & Collaborators (2014) reported flowering in the Greater Antilles throughout the year but mostly May through August and November to December, and fruiting throughout the year; no pollinators or breeding systems were reported. Luer (1972) stated that the flowers of *Oncidium ensatum* mimic the shape[93] and color of flowers of the family Malpighiaceae, which are attractive to bees in the genus *Centris*. Extrafloral nectaries have been found on the stem and branches of the inflorescence in South Florida (Koptur 1992). Florida dancinglady orchid is cultivated in South Florida but has not been recorded naturalizing from cultivated plants.

Taxonomic Notes

Historically, plants in Florida have been referred to as *O. floridanum* (e.g., Luer 1972) which was described as being endemic to South Florida and the Bahamas. Modern taxonomy places *O. floridanum* into synonymy under the wider ranging *O. ensatum*.

Conservation Status

Oncidium ensatum has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. It has not been ranked by NatureServe globally[94], but is ranked as critically imperiled in United States. It is a not listed under the Endangered Species Act, but is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC in South Florida. Loope & Avery (1979) ranked Florida dancing lady orchid as a species of highest concern in National Park Service Areas in South Florida, with a known population on Long Pine Key. Ackerman & Collaborators (2014) reported that the conservation status in Cuba was unknown, but from the distribution data presented it is (or was) widespread nearly throughout the main island and has also been recorded for the Isla de la Juventud[95].

History in EVER

Florida dancing lady orchid was first found in EVER in 1903 by Alvah Eaton on Paradise Key (Gann *et al.* 2002), presumably in or near the edge of Royal Palm Hammock. It was later found

[92] "In pinelands between Cutler and Black Point, Florida." Also Small & Wilson s.n., NY "Below Cutler. Black Point. Flowering in Hammocks and Pinelands."

[93] The variable callosities on the lip of *Oncidium* orchids (*sensu lato*) are evolutionary products for imitating stamens and pistils (Luer 1972).

[94] NatureServe is in the process of ranking *O. ensatum* globally and assessing it for the IUCN Red List. It has been assigned a tentative rank of apparently secure (G4) but review is not complete (A. Treher, email comm. 2014).

[95] Formerly the Isle of Pines.

in many hammocks on Long Pine Key where several vouchers were collected between 1904 and 1963 (Gann *et al.* 2002). George Avery recorded observing plants in eight hammocks between 1967 and 1978 (Avery 1983, Gann *et al.* 2002). In 2001, Roger Hammer estimated the total population in the Long Pine Key area at fewer than 100 individuals (Gann *et al.* 2002). Extensive surveys by IRC in the Long Pine Key area from 2003 to 2008 resulted in the documentation of 98 stations throughout the Long Pine Key area in the following hammocks[96]: Baker*, Bequart, Brookfield, Courier, Deer*, DeCamp, Frampton*, Gifford, Grimshawe*, Henderson, Jones, Junk, Mystery, Osteen*, Palma Vista #1, Palma Vista #2*, Poppenhager, Rattlesnake, Redd*, Robertson*, Royal Palm*, Simmons, Torre, Turkey*, Von Paulsen, Wild Lime*, Winkley*, Wright* and four unnamed hammocks including one north of Main Park Road (Gann *et al.* 1999). A previous report from Say Hammock was not confirmed, but 19 new hammocks were documented during the project, representing a 129% increase in the number of hammocks in which *O. ensatum* was known to be extant. Four long-term monitoring plots were established, two north of Main Park Road and two south of Main Park Road. The total population in the Long Pine Key region of the park at the end of 2008 was estimated at 101-1,000 individuals. In 2014, EVER Botanist Jimi Sadle and park biologist Jonathan Taylor found plants in two additional unnamed hammocks on Long Pine Key (J. Sadle, email comm. 2014). Florida dancing lady orchid was brought into cultivation as part of IRC's rare plant study on Long Pine Key from germplasm collected on Long Pine Key (Gann *et al.* 2009), but these plants are no longer alive (J. Sadle, email comm. 2014). Florida dancing lady orchid was also collected near Coot Bay in 1905 and again near Flamingo in 1925 (Gann *et al.* 2002). Plants were photographed near West Lake in 2004 by EVER biologists Taylor and Tony Pernas but a precise location was not recorded due to equipment malfunction (EVER unpublished data). No other records from this region are known.

Discussion

As with *Beloglottis costaricensis* and *Eltroplectris calcarata*, *O. ensatum* is known from many more locations following IRC's rare plant project on Long Pine Key (2003-2008) than before. However, this does not mean that more plants were present in 2008 than during earlier periods. It just means that much more effort was expended finding and recording plants. It does seem possible, or even nearly certain, that there was some historical poaching pressure on this obvious and beautiful orchid and that there has been some recovery. But there is no way to know the magnitude of the pressure or the recovery. Working with data collected by IRC, however, there is a way to measure changes from 2008 to present and into the future. More survey work in the West Lake area in needed and regular monitoring of this sub-population is highly recommended.

In Rare Plants of South Florida (Gann *et al.* 2002), it was suggested that more water delivery south of Main Park Road could have beneficial effects on *O. ensatum*, and this may or may not be true. More work on this question is needed, but *O. ensatum* does have the ability to adapt to higher water levels, including becoming epiphytic. But the vast majority of plants in South Florida grow in the interface between tropical hardwood hammocks and pine rocklands and this may be their preferred habitat here. The role of fire at the hammock interface is a topic of importance to this species and deserves more attention. Individual plants may perish in a fire event, but fire may play an important role in providing light at the hammock edges so that

[96] As asterisk indicates *O. ensatum* had been previously reported for that hammock as documented in Gann *et al.* 2009 page 10, Table 2. Hammocks without an asterisk were new records.

flowering and recruitment can occur. Frequent fire may also lead to the development of a sharper boundary between hammock and pineland and decrease the likelihood that fires will be hotter and enter the hammock proper (J. Sadle, email comm. 2012).

Summary of Recommendations

- Revisit the four long-term monitoring plots and at least one station in each of the 30 remaining hammocks in 2015 and develop a method of tracking individuals at a subset of the stations visited. Determine basic life history characteristics and monitor trends in population size.
- Resurvey area south of West Lake, relocate plants, set up a long-term monitoring protocol, and intensively survey the surrounding area.
- Develop a research protocol to investigate the role of fire at the interface between hammock and pineland and its effect on the long-term demography of *O. ensatum*, including flowering, fruiting, recruitment and survival.

Ponthieva brittoniae Ames – Mrs. Britton's Shadow Witch

Federal Status	**State Status**	**IRC SF Status**	**EVER Population**
NA	Endangered	Critically Imperiled	101-1,000
Synonyms: *Ponthieva racemosa* (Walter) C. Mohr var. *brittoniae* (Ames) Luer			

Figure 51. *Ponthieva brittoniae* in EVER. Image by Roger Hammer, 2013.

Figure 52. *P. brittoniae* in Pine Block A on the edge of a solution hole. Image by James Johnson with the author, 2013.

Background
Mrs. Britton's shadow witch is a terrestrial herb in the Orchidaceae. It is a rare species of South Florida (Luer 1972), the northern Bahamas (Correll and Correll 1982), Cuba and Hispaniola (Acevedo-Rodríguez and Strong 2012, Ackerman and Collaborators 2014). Its status in Cuba is uncertain and it is known only from two very old specimens in Hispaniola, one each from Haiti and the Dominican Republic (the type specimens of *P. ekmanii* and *P. poitaei* respectively). In South Florida the only known population occurs in EVER. It was also collected in Miami-Dade County in a pineland near Perrine in 1909, but has not been verified outside of what is now EVER since that time. It grows in pine rocklands, primarily on the edges of solution holes. Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas. In the Greater Antilles, it grows in leaf litter on wooded hillsides, especially on steep slopes (Ackerman and Collaborators 2014). Luer (1972) reported it to flower in January and February, matching observations and collections from EVER. Wunderlin & Hansen (2011) reported it to flower from winter to spring. Correll & Correll (1982) reported flowering from September to May. Ackerman & Collaborators (2014) reported flowering in the Greater Antilles from December to March and fruiting in March; no pollinators or breeding systems were reported. Studies of the closely related congener *P. racemosa* (Dressler 1993) suggested that it is pollinated by anthrophorid bees because the lip secretes oil, in contrast to Luer's (1972) observation of small halictid bees visiting flowers. Ackerman (1975) found that *P. racemosa* was self-compatible.

Taxonomic Notes
Ponthieva brittoniae has been reported as being difficult to distinguish from *P. racemosa* solely on the basis of herbarium specimens. Luer (1972), who treated *P. brittoniae* as a variety of *P. racemosa*, stated "dried specimens are indistinguishable from those of small individuals of the common var. *racemosa*..." However, Wunderlin & Hansen (2011) has a key with a number of characters that separate the two species, including characters that should be readily visible in dried specimens.

Conservation Status
Ponthieva brittoniae has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as vulnerable globally (rounded) and critically imperiled in the United States. It is a not listed under the Endangered Species Act, but is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC in South Florida. Ackerman & Collaborators (2014) considered it to be rare in the Greater Antilles as well as in Florida and the Bahamas and perhaps threatened by human development simply on the basis of its rarity.

History in EVER
Mrs. Britton's shadow witch was first found in EVER on Long Pine Key in 1909 by John Kunkel Small and later near Osteen Hammock by Frank C. Craighead in 1961 (Gann *et al.* 2002). An additional population was discovered by Roger Hammer near Wright Hammock in 1979 (Avery 1983, McCartney 1997, Gann *et al.* 2002). Plants were growing in rubble along a firebreak and may have been destroyed by fire break maintenance activities (McCartney 1997). Chuck McCartney, who was shown the Hammer station by George Avery in 1983, found an additional plant on the edge of a solution hole to the north of Wright Hammock in 1987. Mrs. Britton's shadow witch was not seen again until 2004 when it was rediscovered near Wright Hammock by

Jimi Sadle while conducting surveys for IRC's rare plant project on Long Pine Key (Sadle and Woodmansee 396 FNPS, Gann *et al.* 2004, Sadle *et al.* 2005). Extensive surveys by IRC in the Long Pine Key area from 2003 to 2008 resulted in the documentation of 49 stations in pine blocks A, B and E (Gann *et al.* 2009), but plants in the vicinity of Osteen Hammock were not relocated. Long-term monitoring plots were established in pine blocks A, B and E. Unlike with some other terrestrial orchids, sampling events have consistently recorded multiple plants at each station. The total population estimate at the end of 2008 was 101-1,000 individuals.

Discussion

IRC's rare plant study on Long Pine Key resulted in the documentation of a large number of plants of a species previously thought to be possibly extirpated in the park. Part of the reason for this might have been changing fire management which resulted in more accessibility to the pine rockland habitat. But the main reason is that focused intense surveys were conducted systematically over the entire potential habitat, not just along roadsides or in hammocks. As such, there is no way to know the historical status of Mrs. Britton's shadow witch in EVER prior to the IRC study. However, despite the limited range of the species the population appears fairly robust. The three plots established by IRC in the 2003-2008 study and the 49 existing GIS coordinates provide an excellent baseline for monitoring this species in EVER into the future.

Summary of Recommendations

- Continue surveys for Mrs. Britton's shadow witch throughout Long Pine Key. Record new GIS coordinates where appropriate and census newly discovered stations. Photo document all sub-populations.
- Revisit a subset of the 49 known stations of Mrs. Britton's shadow witch in 2015 and develop a method of tracking individuals. Determine basic life history characteristics and monitor trends in population size.
- As with other pine rockland species, monitor plants following fires to determine impacts.

Spiranthes torta (Thunb.) Garay & H.R. Sweet – Southern Ladiestresses

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	2-10

Background

Southern ladiestresses is a terrestrial herb in the Orchidaceae. It is a primarily Neotropical species at the northern end of its range in South Florida and the northern Bahamas. It is also known from elsewhere in the West Indies, southern Mexico and Central America. In South Florida there are four extant populations outside of EVER, scattered in Miami-Dade, Palm Beach and Collier counties and the Monroe County Keys (Gann *et al.* 2014a). Two populations in Miami-Dade County conservation areas may be extirpated. It grows in a wide variety of habitats including pine rocklands, pine flatwoods and graminoid freshwater prairies. Mortellaro *et al.* (2012) ranked it as having a high affinity to high quality natural areas in South Florida. In Puerto Rico it has been collected growing in mowed lawns (Axelrod 2283 MO) and in Nicaragua in a disturbed area just above sea level between the Caribbean Sea and a mangrove swamp (Stevens 10472 MO). In the Dominican Republic it has been collected in broadleaf wet forest at nearly 1300 m elevation (Zanoni *et al.* 19819 MO). Luer (1972) reported flowering from May to June. Wunderlin & Hansen (2011) reported flowering from spring to summer. Correll & Correll

Figure 53. *Spiranthes torta* in South Florida. Images by Keith Bradley, 2004.

(1982) reported flowering mainly in April and May in the Bahamas. Ackerman & Collaborators (2014) reported it to flower and fruit all year in the Greater Antilles.

Conservation Status

Spiranthes torta has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as apparently secure globally, but as critically imperiled in the United States. It is not listed under the Endangered Species Act, but is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC in South Florida. Ackerman & Collaborators (2014) consider this to be a weed in the Greater Antilles, often seen in infrequently mowed lawns.

History in EVER

Southern ladiestresses was first collected in EVER by J. Fanum in 1930 on Long Pine Key (Gann *et al.* 2002), but was not noted by George Avery and Lloyd Loope on their 1980 or 1983 park lists. However, Richard Reimus did report southern ladiestresses for EVER in his 1996 and 1999 revisions. Roger Hammer also reported six plants on Long Pine Key in 1998 (Gann *et al.* 2002). IRC surveys from 2003 to 2008 located a single population in pine block A. Two stations were located, both in the vicinity of Deer Hammock (IRC and EVER unpublished data). A total of five plants were counted in 2004 and plants were also recorded during re-visits in 2006 when two long-term monitoring plots were established. A re-monitoring of those plots in 2007 that did not record plants present was probably conducted too late in the year to be accurate (August 29 and 30). The total park population in 2008 was estimated at 2-10 plants (Gann *et al.* 2009).

Discussion
Southern ladiestresses is a cryptic plant that appears to flower for a very short period of time, perhaps only for one to two weeks, making detection extremely challenging. That said, extensive searches have failed to locate any additional populations other than the one in the vicinity of Deer Hammock. This is not inconsistent with its overall distribution in South Florida and elsewhere, where scattered small populations are the norm. There is no evidence that this species was ever more common on Long Pine Key than it is at present. In contrast, southern ladiestresses appears to be remarkably persistent in the park given its small population size. The two plots established by IRC in the 2003-2008 study provide an excellent baseline for monitoring this species in EVER. Since it has been nearly a decade since these stations were visited, a complete census in 2015 would be timely. Because of the difficulty of detecting southern ladiestresses, a method of marking and tracking individuals should be developed. Since it is possibly myco-heterotrophic and may undergo one or several years of vegetative dormancy, this method should take that into consideration.

Summary of Recommendations

- Continue surveys for southern ladiestresses throughout Long Pine Key in May and June. Record new GIS coordinates where appropriate and census newly discovered stations. Photo document all sub-populations.
- Revisit the two monitoring plots annually until such time as basic life history characteristics and population trends are understood. Because of detectability challenges, censuses may need to be "rolling" through time to count plants from the last monitoring event when plants were most detectable, e.g., following the last fire to impact each station.
- As with other pine rockland species, monitor plants following fires to determine impacts.

Epiphytic and Vining Orchids

Of the 18 species of epiphytic and vining orchids recorded in EVER, only one is relatively abundant in South Florida and in EVER: *Encyclia tampensis*. Nine of the remaining 17 species are treated as SOMCs in this report. Of the nine SOMC species, three are presumed extirpated both in the park and in South Florida: *Brassia caudata, Macradenia lutescens* and *Trichocentrum carthagenense*, the first two from the Long Pine Key area and the latter from near Flamingo. Three additional species are possibly extirpated in the park: *Ionopsis utricularioides, Pleurothallis gelida* and the vining *Vanilla dilloniana*, the first from near the Rogers River, the second possibly from the 40-mile bend area, and the third reported from near Flamingo. Only three SOMC epiphytic and vining orchids are known to be extant in the park: *Cyrtopodium punctatum, Trichocentrum undulatum* and *Vanilla phaeantha*, all primarily from the Flamingo area of the park, although *C. punctatum* has also been recorded inland in the vicinity of Long Pine Key and a few scattered populations to the west, and *Trichocentrum undulatum* was historically present in Royal Palm Hammock. Of the other rare orchids, *Prosthechea boothiana* var. *erythronioides* is limited in EVER to coastal areas in the southern part of the park and is potentially threatened by sea level rise. *Epidendrum anceps* was collected once in or near Coot Bay Hammock by John Kunkel Small in 1922 (10438 NY) but was not listed for the park by

Avery & Loope (1980b, 1983). It was reported for the park by Reimus (1996, 1999) but is possibly extirpated. *Epidendrum nocturnum*, *Polystachya concreta*, *Prosthechea cochleata* and *Vanilla barbellata* are known from both coastal and inland populations, but a census of the coastal populations would be timely. *Epidendrum rigidum* has been collected on Long Pine Key and is also presumably present elsewhere in the interior. Hammer (1994, 2001) and Reimus (1996, 1999) also reported *Epidendrum floridense* for the park, but this was based on plants introduced by Frank Craighead to Pine Island and unverified reports from the Flamingo area (R. Hammer, email comm. 2014). It was historically widespread in South Florida and is very possibly present in EVER. More work on this species is needed.

From 1900 to at least the 1960s, epiphytic orchids were impacted by heavy collecting pressure, including from commercial collectors prior the establishment of the park and later from poachers, and from the collection of herbarium specimens. Some poaching pressure surely still exists despite the best efforts of the National Park Service. The desire to save some orchids from poachers stimulated EVER biologist Frank Craighead to take extraordinary measures to save some species[97], but his efforts were not only unsuccessful they may actually have contributed to their rapid demise. Other human disturbances, such as off-season fires burning hammocks in the Long Pine Key area, habitat destruction related to charcoaling and wild cotton (*Gossypium hirsutum*) eradication efforts in the Flamingo area, surely contributed to the loss of orchids in the park. Less understood are the impacts of hurricanes and freeze events. Also, as with ferns, generally drier conditions and lower humidity levels resulting from drainage may have had, and may continue to have, a negative effect on moisture-loving orchids. Finally, other factors such as the depredation of orchids by mammals (Craighead 1963), the destruction of flowers by insects (Craighead 1963, Higgins and Gann 2007) and the possible depletion of pollinators or needed mycorrhizal fungi may place additional pressures on epiphytic and vining orchids. The good news is that orchids receive a lot of scientific and popular attention and that the technology and resources may be available to better understand orchids and to restore depleted or extirpated populations of epiphytic orchids in EVER.

In 2015, IRC intends to re-assess the South Florida rank of *Prosthechea boothiana* using the 2012 NatureServe criteria as it may qualify as critically imperiled in South Florida and as a SOMC in EVER. The Florida Natural Areas Inventory ranks this as critically imperiled in Florida while IRC ranks it as imperiled.

Brassia caudata (L.) Lindl. – Spider Orchid

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Presumed Extirpated	Presumed Extirpated

Background

Spider orchid is an epiphytic[98] herb in the Orchidaceae. It is a primarily Neotropical species at the northern end of its range in South Florida, otherwise known from the Greater Antilles (but

[97] See *Brassia caudata* and *Macradenia lutescens* accounts below.

[98] Craighead (1963) also mentioned that spider orchid may grow on the ground, but this may refer to plants persisting for a time after being dislodged from trees. Ackerman & Collaborators (2014) also reported that *Brassia caudata* sometimes grows in leaf mold on the forest floor or occasionally on limestone rock outcrops in the Greater Antilles.

Figure 54. Cultivated plant, South Florida. Image by Roger Hammer, 2013.

not Puerto Rico), Mexico, Central America and northern South America. In South Florida, it is known only from Miami-Dade County where it is presumed extirpated (Gann *et al.* 2002, Gann *et al.* 2014a). Outside of EVER, spider orchid is historically known only from nearby Nixon-Lewis Hammock, where the last herbarium specimen was collected in 1916 (Gann *et al.* 2002). It grew in tropical hardwood hammocks. Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas. Luer (1972) reported it to flower in May and June and Wunderlin & Hansen (2011) reported it to flower in the spring. Ackerman & Collaborators (2014) reported flowering from January to August, but mainly from April to August, with fruiting from June to August. It is cultivated in South Florida, but it has not been recorded to naturalize from cultivated plants. South Florida germplasm may still be extant (R. Hammer, email comm. 2014).

Conservation Status

Brassia caudata has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as vulnerable globally (rounded), but presumed extirpated in the United States. It is a not listed under the Endangered Species Act, but is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as presumed extirpated in Florida, as does IRC in South Florida. Loope & Avery (1979) ranked spider orchid as a species of highest concern in National Park Service Areas in South Florida, with a known population on Long Pine Key in EVER which was possibly extirpated. Ackerman & Collaborators (2014) reported that the conservation status in Greater Antilles was unknown.

History in EVER

Spider orchid was first collected in EVER by John Kunkel Small in 1916 and 1917 on Long Pine Key (Gann *et al.* 2002). Frank Craighead later reported that a population had been known from Royal Palm Hammock, but had been lost to poachers by 1955 (letter to the Chief Ranger of Everglades National Park on November 18, 1966). He found another small colony in Osteen Hammock in 1959 which he also reported in the same letter. As described in Gann *et al.* (2002), Craighead attempted to translocate *B. caudata* and *Macradenia lutescens* (see below) from Osteen Hammock, were they were being poached, to Deer, Turkey and Winkley hammocks. However, the entire population continued to decline from the combined effects of poaching, the collection of herbarium specimens (e.g., Cooley 9224 FTG, USF which were collected in 1962), Hurricane Donna (1960) and Craighead's translocation efforts. A remnant of the last plant in Osteen Hammock was collected in by Craighead in 1963 (s.n. FTG), after the plant was "eaten by rodents." Translocated plants persisted in Deer Hammock until 1977 when a freeze killed the last remaining individual (Loope & Avery 1979, Avery 1983, Hammer 2001, Gann *et al.* 2002). Craighead also introduced plants of unknown provenance to Pine Island Hammock in 1962, but these plants perished following Hurricane Betsy in 1965 (Gann *et al.* 2002).

Intensive surveys for spider orchid were conducted by IRC from 2003 to 2008 but no plants were found. Based on the results of initial surveys, IRC recommended the reintroduction of spider orchid to EVER (Gann *et al.* 2004). Because no local germplasm was apparently available, Marie Selby Botanical Gardens provided twelve plants of *B. caudata* of Jamaican germplasm and an outplanting trial was conducted in in 2008 at Hattie Bauer Hammock, a Miami-Dade County conservation area (Gann *et al.* 2009). None of these plants survived (IRC unpublished data).

Discussion

The extirpation of spider orchid from EVER is well documented and the likelihood of rediscovery is unlikely. Although initial trials were unsuccessful, *B. caudata* is relatively easy to grow and continued trials either inside of or outside of EVER are recommended. The closest wild germplasm to EVER would be from Cuba, followed by Jamaica, Hispaniola and Belize. *B. caudata* is a CITES Appendix II species. A report by Roger Hammer that South Florida germplasm may persist in cultivation should be explored.

Summary of Recommendations

- Although the re-discovery of this species in historical locations in Everglades National Park seems highly unlikely, it should be looked for whenever botanical activity is undertaken in suitable habitat.
- Consider reintroduction of spider orchid utilizing germplasm from South Florida or nearby islands in the Caribbean, especially Cuba. If foreign germplasm is utilized, attempt to match morphology and habitat preference to that of the South Florida plants.

Cyrtopodium punctatum (L.) Lindl. – Cowhorn Orchid, Cigar Orchid[99]

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	11-100

Figure 55. *Cyrtopodium punctatum* in the Flamingo area. Images by Keith Bradley, 2007.

Background

Cowhorn orchid is an epiphytic herb[100] in the Orchidaceae. It is a primarily Neotropical species at the northern end of its range in South Florida. It is also known from the Greater Antilles (but not Jamaica), and northern South America (Colombia, Venezuela)[101]. In South Florida it is known from EVER and five other conservation areas in Miami-Dade, Collier and Lee counties and the Monroe County mainland (Gann *et al.* 2014a). It is presumed extirpated in the Monroe County Keys and has been extirpated from numerous localities on the mainland. It was subject to intense collecting pressure in the 20th century (Correll 1950, Craighead 1963, Luer 1972) and poaching is still a problem to this day even in protected areas such as BICY (Downing and Lewis 2014, Giardina and Owen 2014). Cowhorn orchid grows most typically in cypress forests and woodlands, but it has also been documented in mangrove swamps and mangrove woodlands (especially buttonwood woodlands), as well as the ecotone between tropical hardwood hammock and pine rockland. Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural

[99] Correll (1950) referred to this as the bee-swarm orchid.
[100] It also grows terrestrially and as a lithophyte elsewhere in its native range.
[101] *Cyrtopodium punctatum* has historically also been reported from Mexico and Central America, but recently an old concept has been revived representing plants in Mexico and Central America, *C. macrobulbon* (La Llave & Lex.) G.A. Romero-González & Carnevali; numerous other distinct taxa are known from South America (Ackerman and Collaborators 2014). Luer (1972) mapped *C. punctatum* for the Bahamas in error.

areas. Elsewhere in its range, it grows in swamps, forests and woodlands as an epiphyte, from near sea level to 300 m elevation.

Luer (1972) reported cowhorn orchid to flower from March through May, and plants are typically observed flowering in EVER in March and April. Wunderlin & Hansen (2011) reported it to flower in the spring. Ackerman & Collaborators (2014) reported it to flower from February to April(-June), with fruiting from March to December; pollinators and breeding systems were unknown. In South Florida, Pemberton & Liu (2008) and Dutra *et al.* (2009b) both reported that *C. punctatum* is not autogamous. Important pollinators have been identified as the native oil collecting bee *Centris errans* (Pemberton and Liu 2008) and possibly carpenter bees in the genus *Xylocopa* (Dutra *et al.* 2009b). Pemberton & Liu reported high fruit set for cultivated plants at Fairchild Tropical Botanic Garden and low fruit set for wild populations in Everglades National Park. They attributed this difference to the diversity of cultivated members of the Malpighiaceae at the garden that provide nectar rewards for the pollinator bee *C. errans.* Because no native Malpighiaceae occur sympatrically with *C. punctatum* throughout most of its range in South Florida, other important pollinators seem highly likely where native Malpighiaceae was historically absent. Cowhorn orchid is widely cultivated in South Florida and recruits from cultivated plants at Fairchild Tropical Botanic Garden (obs. of the author). Craighead (1963) reported that it grows rapidly from seed, reaching 2-6 inches in height within two seasons and Dutra *et al.* (2009a) published a propagation protocol for *C. punctatum* in South Florida. The State of Florida and collaborators at the Atlanta Botanical Garden have initiated an ambitious project to augment cowhorn orchid at Fakahatchee Strand Preserve State Park (Giardina and Owen 2014) and Fairchild Tropical Botanic Garden has embarked on the Million Orchid Project, which will produce large quantities of cowhorn orchids intended for planting in urban South Florida (Downing and Lewis 2014).

Conservation Status

Cyrtopodium punctatum has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as secure globally (rounded), but as critically imperiled in the United States. It is a not listed under the Endangered Species Act, but is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC in South Florida[102]. Loope & Avery (1979) ranked cowhorn orchid as a species of highest concern in National Park Service Areas in South Florida, with populations in both BICY and EVER. Ackerman & Collaborators (2014) reported that *C. punctatum* is generally rare everywhere. In Puerto Rico it has been heavily collected and is very rare in the wild.

History in EVER

Cowhorn orchid was historically so abundant in South Florida that the first observations from what is now EVER may not have been recorded.[103] However, John Kunkel Small photographed

[102] IRC ranked *Cyrtopodium punctatum* as imperiled in Rare Plants of South Florida (Gann *et al.* 2002). It was re-ranked as critically imperiled in 2013 based on a reassessment of the number of plants and occurrences confirmed as present.

[103] The first collection of *C. punctatum* from South Florida was made by A.P. Garber near what is now downtown Miami in 1877 (Correll 1950, Luer 1972 [Luer wrote the year 1867 in error]). By the time the earliest botanists reached what is now EVER they would have likely seen dozens if not hundreds of plants in habitat.

a large plant in the Flamingo area in 1916 (Figure 56) and Frank Craighead collected a specimen from that same area in 1955 (748 FNPS). The bulk of the EVER population is in the coastal region north of Flamingo. However, surveys by IRC and EVER from 2006 to 2008 found fewer than 30 adult plants in that area (IRC and EVER unpublished data). A few plants also occur inland in cypress habitats to the west of Long Pine Key (IRC and EVER unpublished data); EVER Botanist Jimi Sadle counted six plants in one cypress dome in that area in 2007. It was also collected in dwarf cypress presumably to the west of Long Pine Key by Richard Reimus in 1995 (762 FNPS). In 2001, Sadle and IRC biologist Steven Woodmansee recorded a single plant on the north side of Osteen Hammock (IRC unpublished data), but no one has recently searched for this plant.[104] Loope & Avery (1979) also reported cowhorn orchid as "extremely rare in hammocks of Long Pine Key…" Saha *et al.* (2011) listed cowhorn orchid as being vulnerable to sea level rise, but it did not rank among the most vulnerable species in part because it is an epiphyte and it has inland populations. Its coastal habitat, however, was classified as vulnerable to sea level rise effects.

Discussion

There is little doubt that cowhorn orchid has been depleted by collecting and perhaps by historic habitat alterations in the Flamingo area. Collecting pressure is potentially still present based on observations of social trails that develop at one population during the flowering season and relatively frequent encounters with orchid enthusiasts there (J. Sadle, email comm. 2014). Social media and rapid information exchange are believed to have resulted in increased visitation at this site. Pollination of orchid flowers is being carried out by orchid enthusiasts, though the frequency is not understood. At least one large plant is groomed annually by photographers, who remove old leaves and old inflorescences. Cowhorn orchid is also vulnerable to sea level rise in the area north of Flamingo. In the interior, plants may have been lost from the effects of drainage, including more frequent and/or intense fires (J. Sadle, email comm. 2014). More intensive searches in the interior may yield more populations, but augmentation in the park should be seriously considered. Other cowhorn orchid augmentation projects have already worked out many of the protocols for augmenting this species in South Florida and germplasm from the park is available. In addition, the establishment of long-term monitoring plots, both in the coastal areas and in the interior, is needed to quantify long-term population conditions and to document damage from poaching, sea level rise or other factors.

Summary of Recommendations

- Search for cowhorn orchid in Osteen Hammock and intensify searches in the interior.
- Establish long-term monitoring plots in both coastal areas and the interior and monitor for demographic change, including causes of death (e.g., storm surge, fire) or plant removal (e.g., poaching).
- Inform law enforcement rangers of populations vulnerable to poaching.
- Consider remote monitoring to detect poaching, pollination, and other manipulation of plants. Consider public closures of important areas for this species if poaching is suspected or observed.
- Develop a quantitative plan for the augmentation of populations in EVER.

[104] Because *C. punctatum* was not listed as critically imperiled at the time, it was not included in IRC's 2003-2008 rare plant project on Long Pine Key. Therefore, intensive searches for this species were not conducted.

Figure 56. *Cyrtopodium punctatum* at Snake Hammock north of Flamingo. Image by John Kunkel Small, 1916. Archives of Florida, *Florida Memory*, http://floridamemory.com/items/show/49165.

Ionopsis utricularioides (Sw.) Lindl. – Delicate Ionopsis

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	Possibly Extirpated

Figure 57. *Ionopsis utricularioides* in South Florida Image by Keith Bradley, 2009.

Figure 58. *I. utricularioides* in the Fakahatchee Swamp. Image by Roger Hammer, 2013.

Background

Delicate Ionopsis is an epiphytic herb[105] in the Orchidaceae. It is primarily a Neotropical species at the northern end of its range in South Florida where disjunct populations have been found in the east (Palm Beach County) and the west (the Monroe County mainland and Collier County). It is widespread in the West Indies, Mexico, Central America, South America and the Galapagos, but is absent from the Bahamas. In South Florida, it has been recorded growing in cypress forests, on hardwoods along rivers and in citrus groves (Craighead 1963, Gann *et al.* 2002). Mortellaro *et al.* (2012) ranked it as having a very high affinity to high quality natural areas. Elsewhere in its range it grows in a wide variety of habitats from near sea level to 1700 m elevation, including dry and moist broadleaf forests, pine savannas, citrus groves and disturbed areas. Outside of EVER, delicate Ionopsis is known from Arthur R. Marshall Loxahatchee National Wildlife Refuge in Palm Beach County and in the swamps of southwestern Florida

[105] *Ionopsis utricularioides* is commonly described as a "twig epiphyte" as it attaches itself to the smallest branchlets of the host branch. Luer (1972) described this habit – "The plants…attach themselves rather loosely to their supporting tree-limb, often out on little twigs. Frequently the plant will crawl off the host branch and dangle by its roots at a rakish angle as an aerophyte." Also see McCartney (2013) for a description of its twig habitats in South Florida.

including BICY and the Fakahatchee Stand Preserve State Park (Gann *et al.* 2014a). Luer (1972) reported flowering beginning in December with a peak in March and April. It was collected in EVER in March. Wunderlin & Hansen (2011) reported it to flower from winter to spring. Ackerman & Collaborators (2014) reported flowing all year in the Greater Antilles, but mainly from March to October. Delicate Ionopsis reaches sexual maturity very quickly, with the ability to flower within a year of seed germination; it is self-compatible, but pollination frequency effects fruit set (Montalvo and Ackerman 1987). Otero *et al.* (2007) found a close association with a wide-ranging mycorrhizal fungal associate throughout the range of the species. It is cultivated in South Florida in botanical gardens and among orchid enthusiasts but has not been recorded naturalizing from cultivated plants.

Conservation Status

Ionopsis utricularioides has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as apparently secure globally (rounded), but as critically imperiled in the United States. It is a not listed under the Endangered Species Act, but is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC in South Florida. Ackerman & Collaborators (2014) reported *I. utricularioides* as not threatened in the Greater Antilles.

History in EVER

Frank Craighead made a single collection from along the Rogers River in 1956 (s.n. FLAS, Gann *et al.* 2002), and stated (1963) that it was in places "extremely abundant, as on some of the interior rivers of the Park where the banks are bordered with hammock hardwoods." Loope & Avery (1979) reported it as being present in mangrove forests in western EVER, but this could have been based solely on Craighead's data. Surveys of the Rogers River by Bass, EVER Botanist Jimi Sadle and others were carried out in March 2014, but no plants were observed (J. Sadle, email comm. 2014). EVER biologist Sonny Bass has also reported seeing delicate Ionopsis "along the very upper reaches of Roberts River" (email comm. 2014), but the date of this observation is unknown. Surveys of the Roberts River are not known to have been conducted in recent years. Given the abundance of similar tidal rivers with freshwater influence, potential habitat for *I. utricularioides* is abundant. To date, there have been no comprehensive surveys for this species and it may still persist in EVER.

Discussion

There is no evidence that delicate Ionopsis was ever abundant in the park, although the account in Craighead's 1963 book makes it seem that there were more than a handful of plants. His specimen is the only known collection from a strictly coastal area in South Florida, and it is possible that it briefly recruits in this region from more hospitable habitats in the interior. On the other hand, *Ionopsis utricularioides* can by cryptic when not in flower and it could easily still be present but undetected in the park, especially in remote areas like the upper reaches of the Roberts and Rogers rivers. EVER Botanist Jimi Sadle (email comm. 2014) has reported that there are still areas with heavy loads of epiphytes along the Rogers River and would not be surprised if *I. utricularioides* was still there.

Summary of Recommendations

- Conduct intensive surveys in the Roberts and Rogers river areas and search for delicate Ionopsis in other potential habitats in the western part of the park.

Macradenia lutescens R. Br. – Long-Gland Orchid, Trinidad Macradenia

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Presumed Extirpated	Presumed Extirpated

Images
For images, refer to Luer (1972 p. 267).

Background
Long-gland orchid is an epiphytic herb in the Orchidaceae. It is a primarily Neotropical species at the northern end of its range in South Florida where it has been found only in Miami-Dade County. It has only been collected and observed in tropical hardwood hammocks in the Long Pine Key area of EVER and is presumed extirpated in South Florida and the United States (Gann *et al.* 2002). Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas. It is also known from the Greater Antilles (Cuba, Jamaica, Hispaniola) and South America from near sea level to 500 m elevation – it does not appear to be common anywhere[106]. Luer (1972) reported it to flower in October and November. Specimens from EVER have been collected from December to February. Wunderlin & Hansen (2011) reported it to flower from summer to fall, apparently in error. Ackerman & Collaborators (2014) reported flowering from October to May with fruiting occurring nearly all year. Williams (1982) reported that the genus is pollinated by male euglossine bees in Central America, but only one species of this apid tribe has been recorded for the Greater Antilles, a Jamaican endemic, *Euglossa jamaicensis* Moure; outside of Jamaica, *M. lutescens* may be autogamous (Ackerman and Collaborators 2014). It is not known in cultivation in the continental United States (Gann *et al.* 2002), but plants are cultivated in the Orquídearia in Soroa, Cuba (Ackerman and Collaborators 2014).

Conservation Status
Macradenia lutescens has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as apparently secure globally (rounded), but as possibly extirpated in United States. It is a not listed under the Endangered Species Act, but is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as possibly extirpated in Florida, while IRC ranks it as presumed extirpated in South Florida. Loope & Avery (1979) ranked long-gland orchid as a species of highest concern in National Park Service Areas in South Florida, with a known population on Long Pine Key in EVER which was possibly extirpated.

[106] León & Alain (1946-1953) reported *Macradenia lutescens* from only two disjunct populations in Cuba, one in Camaguey and one on the Isle of Pines (now Isla de la Juventud), while Ackerman & Collaborators (2014) reported a more scattered distribution. Adams (1972) reported *M. lutescens* as widespread but nowhere common in Jamaica, from 500-1750 feet (150-530 m). Ackerman & Collaborators reported a few scattered occurrences in the Dominican Republic, but none from Haiti. In Trinidad, it is perhaps known only from one old collection by Broadway in 1931 (s.n. AMES in Shultes 1960). It is also scattered in South America.

Ackerman & Collaborators (2014) reported that its conservation status was unknown in the Greater Antilles.

History in EVER
Alvah A. Eaton discovered long-gland orchid in Royal Palm Hammock in 1903 (Gann *et al.* 2002). This population was possibly observed by Frank C. Craighead, but he reported that it had been eradicated by poachers by 1955 (letter to the Chief Ranger of Everglades National Park on November 18, 1966; Gann *et al.* 2002). Craighead found plants in Osteen Hammock in 1959 and counted 42 plants, which he reported in the same letter. He also vouchered this population (s.n. FTG). As described in Gann *et al.* (2002), in April of that year, Craighead translocated several individuals of *M. lutescens* and *Brassia caudata* (see above) to Deer, Turkey and Winkley hammocks. He made another voucher at Osteen Hammock in 1961 (s.n. FTG). By 1964, each of the four translocated populations was down to one individual but two plants remained in Osteen Hammock as late as 1966. It is not entirely clear when the last plants disappeared, but searches in 1977 failed to locate any plants (Avery 1983). Craighead also introduced plants of unknown provenance to Pine Island Hammock in 1962, but these plants perished following Hurricane Betsy in 1965 (Gann *et al.* 2002).

Intensive surveys for long-gland orchid were conducted by IRC from 2003 to 2008 but no plants were found. Based on the results of initial surveys, IRC recommended the reintroduction of long-gland orchid to EVER (Gann *et al.* 2004). However, no germplasm has been located and trials have not been initiated to date.

Discussion
As with spider orchid, the extirpation of long-gland orchid from EVER is well documented and the likelihood of rediscovery is extremely remote. If germplasm can be obtained, trials either inside or our outside EVER are recommended. The closest wild germplasm to EVER would be from Cuba, where plants are known to be cultivated, followed by Jamaica and Hispaniola. *M. lutescens* is a CITES Appendix II species.

Summary of Recommendations
- Although the re-discovery of this species in historical locations in Everglades National Park seems highly unlikely, it should be looked for whenever botanical activity is undertaken in suitable habitat.
- Consider reintroduction of long-gland orchid utilizing germplasm from nearby islands in the Caribbean, especially Cuba. Attempt to match morphology and habitat preference to that of the South Florida plants.

Pleurothallis gelida Lindl. – Flor de Llanten, Frosted Orchid

Federal Status	**State Status**	**IRC SF Status**	**EVER Population**
NA	Endangered	Critically Imperiled	Presumed Extirpated
Synonyms: *Stelis gelida* (Lindl.) Pridgeon & M.W. Chase			

Images
For images, refer to Luer (1972 p. 185).

Background
Flor de llanten is an epiphytic herb in the Orchidaceae. It is a tropical species at the northern end of its range in South Florida, where it has been found in Collier County and possibly in Miami-Dade County (see discussion below). It is also known from the Greater Antilles, Mexico, Central America and South America. In South Florida it is currently known only from strand swamps in the Fakahatchee Strand Preserve State Park (Gann *et al.* 2014a) where it is very rare (Gann *et al.* 2002). Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas. Luer (1972) reported it to flower from December to April. Wunderlin & Hansen (2011) reported it to flower from winter to spring. Ackerman & Collaborators (2014) reported flowering scattered nearly throughout the year (February-March, July, December) and fruiting was reported from December to March; no pollinators or breeding systems were reported. Species in the genus *Pleurothallis* are generally pollinated by small flies (Borba *et al.* 2001).

Conservation Status
Pleurothallis gelida has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as secure globally, but as critically imperiled in United States. It is a not listed under the Endangered Species Act, but is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC in South Florida. Ackerman & Collaborators (2014) reported its conservation status in the Greater Antilles as unknown, but in the discussion stated that it was "frequent or common throughout the Antilles…" and continental tropical America.

History in EVER
Flor de llanten was presumably collected in EVER a single time (Loope and Avery 1979) by W.R. Llewellyn in 1958 (s.n. FNPS), from an area described vaguely as a "Cypress Slough - West side of Park" (Figure 59). This specimen was most likely collected in the 40-mile bend area of the park, which would have been accessible to collectors during that time period[107]. Llewellyn collected the rare fern *Microgramma heterophylla* in that area in 1960 (s.n. FTG). Although *P. gelida* was included on all the early plant lists for the park (Avery and Loope 1980b, 1983; Reimus 1996, 1999), there is no evidence that any of these authors personally observed any plants. Rather, it seems most likely that these records were based on Llewellyn's specimen in the FNPS herbarium. Although no comprehensive surveys have been conducted for *P. gelida* in the 40-mile bend area, may botanists have worked in that general area without any additional reports of this species. It is presumed extirpated in the park.

Frank Craighead attempted to introduce Flor de llanten into the Long Pine Key area of Everglades National Park but this effort failed (Gann *et al.* 2002).

Discussion
It is worth noting that the Llewellyn specimen was not mounted by the collector. In fact, it has two labels, the first label attributing the collection to "Llew ellyn" with a determination of *Pleurothallis*. The second label, which was affixed when the specimen was annotated as *P.* cf. *gelida* by S.R. Hill in 1975, attributed the collection to "Llewellyn". Hill's hand-written annotation of *P. gelida* Lindl. is correct, but the type-written second label states *geldia*, in error.

[107] The alternative would be that Llewellyn collected *P. gelida* in the Stairsteps area, which is closer to the Fakahatchee Strand, but very remote and was nearly inaccessible during that period.

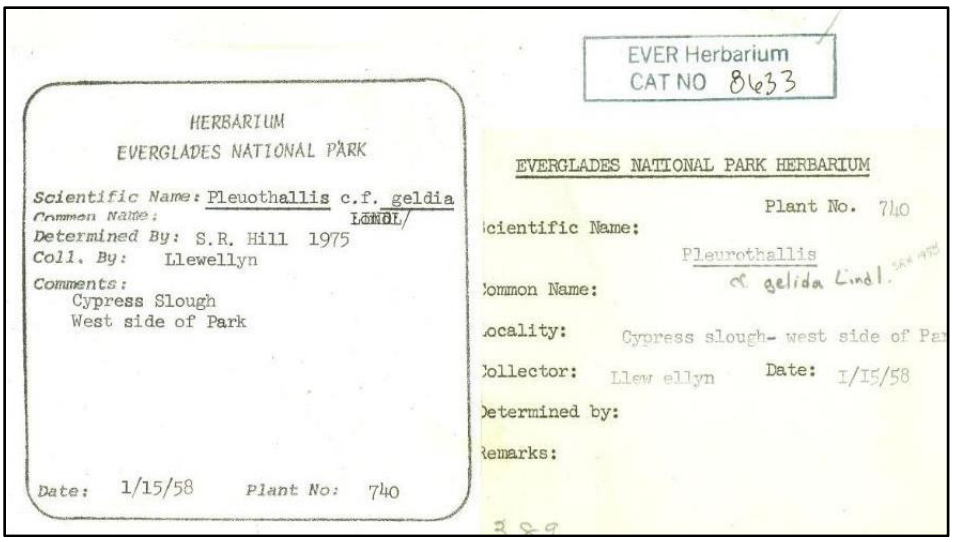

Figure 59. Llewellyn specimen presumably collected in EVER showing two labels. From FNPS.

FTG placed the initials W.R. in front of the last name Llewellyn when the specimen was databased, based on what was known about area collectors from that period. Because only a single specimen is known and the population was never corroborated, only additional searches are recommended.

Summary of Recommendations

- Although the re-discovery of this species in Everglades National Park seems unlikely, it should be searched for in suitable habitat, especially in cypress forests south of 40-mile bend.

Trichocentrum carthagenense (Jacq.) M.W. Chase & N.H. Williams – Coot Bay Dancinglady Orchid

Federal Status	State Status	IRC SF Status	EVER Population
NA	NA	Presumed Extirpated	Presumed Extirpated
Synonyms: *Oncidium carthagenense* (Jacq.) Sw., *O. carthaginense* (orthographic variant)			

Background

Coot bay dancinglady orchid is an epiphytic herb in the Orchidaceae. It is a primarily Neotropical species at the northern end of its range in South Florida where it has been collected once in Monroe County in what is now EVER. It is also known from Mexico, Central America and northern South America[108]. In South Florida it was presumably collected in a tropical hardwood hammock on a coastal berm. Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas. Luer (1972) reported it to flower from April to September throughout its range, and the single specimen known to have been collected in South Florida was made in April. Wunderlin & Hansen (2011) reported it to flower in the spring.

[108] Luer (1972) mapped *Trichocentrum carthagenense* also for Cuba, Jamaica and Hispaniola, an error which was duplicated in Gann *et al.* (2002).

Figure 60. *Trichocentrum carthagenense* as a cultivated plant in South Florida. Image by Roger Hammer, April 13, 2013.

Conservation Status

Trichocentrum carthagenense has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as apparently secure globally (rounded), but as possibly extirpated in United States. It is a not listed under the Endangered Species Act or by the State of Florida[109]. The Florida Natural Areas Inventory ranks it as possibly extirpated in Florida, while IRC ranks it as presumed extirpated in South Florida.

History in EVER

Coot bay dancinglady orchid was collected once from a hammock south of Coot Bay in April, 1916 by John Kunkel Small (Luer 1972, Gann *et al.* 2002). This species has not been seen or collected in the park since that time despite extensive botanical activities in hammocks near Coot Bay. However, it should be noted that in a vegetative state, this species resembles *T. undulatum* very closely (Correll 1950, Craighead 1963, Luer 1972). It can only be detected when in flower[110]. The species is presumed extirpated in the park and the United States.

[109] By rule, the State of Florida does not list extirpated species.

[110] Luer (1972) wrote the following concerning the identification of *T. carthagenense* versus *T. undulatum*: "The flowers are a little smaller, but one of the main differences lies in the shape of the lip. The middle lobe is not so wide, only approximating the width of the lip across the lateral lobes, and the blotches of color on the floral parts are lavender instead of reddish-brown."

Discussion
Because only a single specimen is known and the population was never corroborated, only additional searches are recommended.

Summary of Recommendations

- Although the re-discovery of this species in historical locations in Everglades National Park seems highly unlikely, it should be looked for during the later winter to spring whenever botanical activity is undertaken in suitable habitat.

Trichocentrum undulatum (Sw.) Ackerman & M.W. Chase – Mule Ear Orchid

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	500-1,000
Synonyms: *Oncidium undulatum* (Sw.) Salisb., *O. luridum* Lindl.[111]			

Figure 61. *Trichocentrum undulatum* in EVER. Images by Keith Bradley, 2005.

[111] Some authors have contended that *Oncidium luridum* (=*Trichocentrum luridum*), the name used for this species in Florida by Correll (1950), Craighead (1963), Luer (1972) and others, refers to plants from Mexico to South America, while *T. undulatum* refers to plant in South Florida and the West Indies. ITIS (2014), for instance, considers the name *O. luridum* as misapplied to *T. undulatum*. Ackerman & Collaborators (2014) reject this view and state that these plants are the same species. These and other messy taxonomic issues with this entity are explored at length in Ackerman & Collaborators (2014).

Background

Mule ear orchid is an epiphytic herb in the Orchidaceae. It is a primarily Neotropical species at the northern end of its range in Florida where it is known from Miami-Dade County and the Monroe County mainland. It is also known from the West Indies (Cuba, Jamaica, Lesser Antilles[112]), Mexico, Central America and South America. In South Florida it has been collected as native with certainty only in EVER (Gann *et al.* 2002). It grows in tropical hardwood hammocks and buttonwood forests and woodlands, especially on coastal berms[113]. Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas. Elsewhere in its range it grows in a variety of broadleaf forests from near sea level to 1700 m, including in mangroves and montane rain forests. It is rather common in mesic forests on limestone in western and northern Cuba. Luer (1972) reported flowering from December to June, but primarily in May. Wunderlin & Hansen (2011) reported it to flower from winter to summer. Plants have been observed to flower in EVER mainly in April and May. Ackerman & Collaborators (2014) reported flowering from March to October, with fruiting from April to January. The reproduction of mule ear orchid in Everglades National Park is disrupted by a fly, *Melanagromyza miamiensis*[114], which oviposits its eggs on the inflorescence stalk (Seavey and Seavey 2006, Higgins and Gann 2007). If ovipositing occurs below the 5th node, it usually results in an abortive inflorescence, but if the fly larva enters above the 5th node, the inflorescence generally develops side branches, some of which may flower and some of which may also be depredated by fly larvae (Higgins and Gann 2007). Even when flowering occurs, low rates of pollination have been reported (Higgins and Gann 2007), suggesting that pollinators may be few or missing (Gann *et al.* 2009). Luer (1972) stated that, like *Oncidium ensatum*, the flowers of *T. undulatum* mimic the shape[115] and color of flowers of the family Malpighiaceae, which are attractive to bees in the genus *Centris*. As with *Cyrtopodium punctatum* above, no member of the Malpighiaceae is known to grow sympatrically with *T. undulatum* within the majority of its historical ranges in South Florida. In EVER, the only native Malpighiaceae, *Byrsonima lucida*, has been recorded growing only in the Long Pine Key area. Thus, another pollinator or pollinators are presumably involved. *T. undulatum* is cultivated in South Florida in botanical gardens and by enthusiasts, but has not been recorded naturalizing outside of its natural range.

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[112] Luer (1972) mapped *T. undulatum* for the Bahamas and Ackerman & Collaborators (2014) also listed the Bahamas within the range of *T. undulatum*. Both of these appear to be mistakes.

[113] Curiously, Correll (1950) described it as growing on bald cypress (*Taxodium distichum*) trees and growing in cypress swamps in addition to hammocks. Craighead (1963) made reference to a population in Collier County and Luer (1972) make reference to a population reported from the Fakahatchee Swamp. None of these reports have been verified. Wunderlin & Hansen (2011) also listed cypress swamps as a habitat. Craighead (1963) also made reference to plants growing on pond-apple (*Annona glabra*) trees fringing brackish water lakes in the coastal part of the park. It does seem possible that pond-apple was historically present north of Flamingo before salinization and could have made an excellent host for *T. undulatum.*

[114] *Melanagromyza miamiensis* Spencer was described in 1973. The name is accepted by ITIS. Spencer (1973) proposed that *M. miamiensis* was a seed feeder that may feed on other epiphytic orchids in South Florida. *Melanagromyza* is a large genus which is widespread nearly worldwide. While it is possible that *M. miamiensis* is endemic to South Florida, it is also possible that this fly is present in Cuba where *T. undulatum* is much more common. Previously, Craighead (1963) reported that this destruction of the inflorescences was caused by a small bark beetle, *Xyleborus morstatti* (Hopk.), as determined by D.M. Anderson of the U.S. Department of Agriculture.

[115] The variable callosities on the lip of *T. undulatum* and other *Oncidium* orchids (*sensu lato*) are evolutionary products for imitating stamens and pistils (Luer 1972).

Conservation Status
Trichocentrum undulatum has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as apparently secure globally (rounded), but as critically imperiled in United States. It is a not listed under the Endangered Species Act, but is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC in South Florida. Loope & Avery (1979) ranked long-gland orchid as a species of highest concern in National Park Service Areas in South Florida, with a known population in the mangrove zone of EVER. Ackerman & Collaborators (2014) reported that *T. undulatum* is not endangered in the Greater Antilles.

History in EVER
Mule ear orchid was first collected in South Florida in Royal Palm Hammock in 1903 by Alvah A. Eaton (Ames 1904). It was reported as scarce and was not collected there again (Gann *et al.* 2002), but John Kunkel Small took a photograph of a plant there around 1916 (Figure 62). Eaton also collected mule ear orchid in the Flamingo area of the park in 1905, and it was vouchered there a number of times between 1905 and at least 1945 (Gann *et al.* 2002). Surveys by IRC biologist Jesse Hoffman between 2006 and 2008 documented 728 GPS coordinates of mule ear orchid plants in the Flamingo area (IRC and EVER unpublished data). EVER Botanist Jimi Sadle, IRC biologist Sonali Saha and other colleagues have also recorded a number of isolated populations in buttonwood hammocks east of Main Park Road from West Lake to Snake Bight and east to Seven Palm Lakes and Crocodile Point. At least three distinct populations are known, but estimates of plant numbers have varied greatly from fewer than 20 to several hundred (J. Sadle, email comm. 2014). Saha *et al.* (2011) listed mule ear orchid as being vulnerable to sea level rise, but it did not rank among the most vulnerable species in part because it is an epiphyte and because a relatively large number of individuals were known. Its coastal habitat, however, was classified as vulnerable to sea level rise effects.

Poaching of mule ear orchid in EVER has been well documented (e.g., Craighead 1963). The population north of Flamingo is well known to orchid enthusiasts, who likely are both pollinating flowers and poaching seed capsules.

In 2004, IRC recommended the reintroduction of mule ear orchid to Royal Palm Hammock based on its historic occurrence there (Gann *et al.* 2004). Because of previous observations of low pollination in the population north of Flamingo, a hand pollination trial was conducted in 2006, which was successful (Gann *et al.* 2009). This was followed with combination plant bagging and hand pollination trials which resulted in the production of viable capsules in 2007 and 2008 (Gann *et al.* 2009). Marie Selby Botanical Gardens, IRC and EVER subsequently collaborated on the production of and outplanting of nearly 200 mule ear orchids at Royal Palm Hammock in 2011 and 2012 (IRC and EVER unpublished data)[116]. In 2013 and 2014, IRC and

[116] 176 individuals were outplanted in 2011 and 14 plants were added in 2012. Almost half of the original plants were still present after one year and some were producing new roots, leaves and in some cases pseudobulbs.

Figure 62. *Trichocentrum undulatum* in live oak (*Quercus virginiana*), Royal Palm Hammock. Image by John Kunkel Small, 1916?. Archives of Florida, *Florida Memory*, http://floridamemory.com/items/show/49180.

EVER established a long-term monitoring baseline with a subset of 38 of the remaining plants, which could be monitored from the ground or a short free-standing ladder[117].

Discussion

Although the fly *Melanagromyza miamiensis*, poaching and sea level rise may all be affecting mule ear orchid in EVER, there is potentially still a large population in the park. More field work is needed to document the total population, especially east of Main Park Road. Collecting pressure is potentially present based on observations of social trails that develop at one population during the flowering season and relatively frequent encounters with orchid enthusiasts there (J. Sadle, email comm. 2014). Social media and rapid information exchange are believed to have resulted in increased visitation at this site. Pollination of orchid flowers is being carried out by orchid enthusiasts, though the frequency is not understood. The augmentation of this species in the park, already initiated at Royal Palm Hammock, could be expanded within an experimental framework in the Flamingo area within the historic range. In addition, the establishment of long-term monitoring plots and/or transects, on both sides of Main

[117] Many plants were placed high in the canopy using an extension ladder, in order to protect at least some reintroduced plants from poachers. However, it is not feasible to monitor these plants on a routine basis. Thus a subset of the plants that could be accessed near the ground was chosen for long-term monitoring.

Figure 63. Cultivated *Trichocentrum undulatum* outplanted in EVER (l) and in habitat, western Cuba (r), 2012.

Park Road and in Royal Palm Hammock, is needed to quantify long-term population conditions and to document population change from poaching, sea level rise or other factors.

Summary of Recommendations

- Expand and intensify searches for mule ear orchid east of Main Park Road. Searches should take into account that plants could conceivably be growing on a wide range of trees, including tropical hardwoods, buttonwood and mangroves.
- Establish long-term monitoring plots both east and west of Main Park Road and monitor for demographic change, including causes of death or plant removal (e.g., poaching).
- Formalize long-term monitoring of translocated plants in Royal Palm Hammock, including monitoring for flowering, fruiting, and the establishment of the fly, *Melanagromyza miamiensis.*
- Inform law enforcement rangers of populations vulnerable to poaching.
- Consider installation of remote monitoring devices to better understand poaching or other manipulation of plants and develop effective enforcement mechanisms.

Vanilla dilloniana Correll – Mrs. Lott's Vanilla, Dillon's Vanilla

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Possibly Extirpated	Possibly Extirpated

Figure 64. *Vanilla dilloniana*, plants originally from Mrs. Lott's collection. Image by Roger Hammer, 24 June 2013.

Figure 65. Sterile plant matching the description of *V. dilloniana*, western Cuba, 2012.

Background

Mrs. Lott's vanilla is an herbaceous vine in the Orchidaceae. It is a primarily Greater Antillean species at the northern end of its range in South Florida where it has only been found in Miami-Dade County and possibly the Monroe County mainland (see below). It is also known from Cuba, Hispaniola and Puerto Rico. There are currently no known populations in South Florida, although it was historically collected numerous times in Brickell Hammock near what is now downtown Miami until at least 1928 (Gann *et al.* 2002)[118]. Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas. In the Greater Antilles, it grows in moist forests on limestone and serpentine soils from 150-750 m elevation (Acevedo-Rodríguez 2005, Ackerman and Collaborators 2014). Luer (1972) reported it to flower in May and June, presumably referring to plants in South Florida. Wunderlin & Hansen (2011) reported it to flower in the summer – plants originally from Brickell Hammock raised in a greenhouse in Hillsborough County flowered in July in 1977 and 1980 (Lassiter s.n. USF, Lassiter 496 USF). Acevedo-

[118] The type specimen (Humes s.n. AMES) was collected in Brickell Hammock in 1928 according to Luer (1972).

Rodríguez (2005) reported flowering in Puerto Rico from March to May and fruiting from September to January, but Ackerman and Collaborators (2014) reported flowering in the Greater Antilles from May to June and fruiting from April to June and October. Nielsen & Siegismund (1999) found that in Puerto Rico only 0.5% of flowers set fruit, and Nielsen (2000) found that the plants are self-incompatible. Nielsen & Siegismund also found evidence of hybridization with two very closely related species, including *V. barbellata*, a frequent species in coastal areas of Everglades National Park and the upper Florida Keys, but noted that *V. barbellata* generally flowers earlier, which may reduce the chance of hybridization. Tremblay *et al.* (2005) reported that bees pollinate the flowers. Mrs. Lott's vanilla has been in cultivation in Florida since before the species was described (Luer 1972), but has never been reported to naturalize from cultivated plants. Plants of South Florida germplasm are still in cultivation (Hammer 2001; R. Hammer, email comm. 2014).

Conservation Status

Vanilla dilloniana has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as vulnerable globally (rounded), but it has not been ranked for the United States. It is a not listed under the Endangered Species Act, but is listed as endangered by the State of Florida. It has not been ranked by The Florida Natural Areas Inventory for Florida. IRC ranks it as possibly extirpated in South Florida.

Taxonomic Notes

Craighead (1963) and others have noted that *V. dilloniana* is virtually indistinguishable from the other native leafless orchid, *V. barbellata*, when not in flower, and it is true that identification is easiest when flowers are present, or even in bud. *V. dilloniana* has longer sepals (4.5-5 cm long), a longer lip (> 4 cm), and the lip is all reddish-purple while *V. barbellata* has shorter sepals (3-4 cm long), a shorter lip (< 4 cm), and the lip is reddish on the inner surface, but turning white toward the margins. However, there are a number of characters that can help distinguish the two when not in flower (see Acevedo-Rodríguez 2005, Ackerman and Collaborators 2014). In particular, some leaves are persistent in *V. dilloniana* and the apex is curved in the form of a hook while the leaves of *V. barbellata* are all deciduous (the leaf margins may be folded inward in both). The leaves of *V. dilloniana* are fleshy, to 8(-10) cm long, while those of *V. barbellata* are chartaceous, to 4 cm long[119]. The pod is also different, with those of *V. dilloniana* being fusiform-clavate, about 16 cm long and 12 mm in diameter, while those of *V. barbellata* are fusiform to cylindrical, slightly recurved or straight, 7-9 cm long and 9-16 mm in diameter[120].

History in EVER

In his publication of the name *Vanilla dilloniana*, Correll (1946) cited a 1944 collection from the "Cape Sable region" by Ralph Humes, which is the basis for the Monroe County mainland record in the Atlas of Florida Vascular Plants (Wunderlin and Hansen 2014). Although Craighead (1960) listed *V. dilloniana* and not *V. barbellata* for Noble Hammock, he later wrote (1963) that he could not distinguish between the two. Luer (1972) took a stronger view, stating "All leafless orchids that grow wild in the hammocks across the Everglades fit the description of

[119] Luer (1972) described the leaves of *V. dilloniana* as up to 10 cm long, presumably based on the Florida specimens.

[120] Craighead (1963) had the shape of the pods mixed up, describing those of *V. dilloniana* as being cylindrical and those of *V. barbellata* as clavate, both in the key and the text.

V. barbellata" and there have been no reliable reports of Mrs. Lott's vanilla in the park since Correll's 1946 description of the species. In 2014, EVER Botanist Jimi Sadle, the author, and IRC biologist James Johnson visited fertile populations of *Vanilla* in both the Noble Hammock area and an area west of Buttonwood Canal north of Flamingo (see discussion below). All plants keyed readily to *V. barbellata*.

Two specimens collected in the Flamingo region of EVER originally determined as *V. eggersii* (now a synonym of *V. claviculata* which is not in Florida) have also been annotated as or attributed to *V. dilloniana*. The first specimen was collected in 1903 at Madeira Hammock to the east of Flamingo by Alvah A. Eaton (Ames 1904 in Gann *et al.* 2002). However, the attribution of Eaton's collection of *V. eggersii* to *V. dilloniana* in Gann *et al.* (2002) may have been incorrect, as the name *V. eggersii* has been misapplied to both *V. dilloniana* and *V. barbellata* in South Florida[121]. The second specimen originally determined as *V. eggersii* was a sterile 1916 collection from Madeira Hammock by John Kunkel Small (8048 NY) annotated as "*V. dilloniana* (probably)" by Donovan Correll, and later annotated as *V. dilloniana* by Richard P. Wunderlin (IRC unpublished data).

Discussion

While some casual efforts have been made to locate *V. dilloniana*, no comprehensive surveys have been conducted using a combination of floral and sterile characteristics. In preparation for this report, the author developed a search parameter based on leaf persistence and size which was tested in the field with EVER Botanist Jimi Sadle and IRC biologist James Johnson in early June, 2014 while *Vanilla* plants in the Flamingo area were fertile. No persistent leaves were observed, and leaves on young stems measured between 1 cm and 3 cm in length (Figures 66 and 68). Flowers matching the measurements and color of *Vanilla barbellata* were also present (Figures 67 and 69). No fertile or sterile plants matching the description of *V. dilloniana* were observed.

The most important thing to occur at this time would be to re-examine the three specimens upon which the EVER record is based. If the Eaton or Small specimens appears to be valid, then searches could be focused on the Madeira Bay area. If not, then focused searches are not possible. In any case, an identification card should be developed and distributed to researchers and backcountry rangers so that the search for Mrs. Lott's vanilla in EVER can be expanded. It should be noted that elsewhere in its range *V. dilloniana* grows in forests on rocks and the Brickell Hammock occurrence is a more typical habitat. The possibility exists that *V. dilloniana* was never present in the park.

Summary of Recommendations

- Conduct surveys for Mrs. Lott's vanilla in Madeira Hammock and other suitable coastal areas.

[121] Wunderlin & Hansen (2011 and previous) listed *V. eggersii* as a misapplied synonym of *V. dilloniana*, but not *V. barbellata*. Gann *et al.* attributed Eaton's specimen to *V. dilloniana* based on that assignment of the name. But Buswell (1945) misapplied the name *V. eggersii* to *V. barbellata* on Big Pine Key and Correll (1946) commented on the mislabeling of *V. barbellata* specimens from Florida with the name *V. eggersii*. Therefore, the name *V. eggersii* has been misapplied to both *V. barbellata* and *V. dilloniana* in South Florida and the Eaton specimen must be checked.

- Re-examine the three herbarium specimens attributed to EVER as *V. dilloniana*.

Figure 66. *Vanilla barbellata* in the Noble Hammock area, EVER. June, 2014.

Figure 67. Flower of *V. barbellata* on same plant as Figure 66, showing white margin of lip.

Figure 68. *Vanilla barbellata* in the Buttonwood Canal area, EVER. June, 2014.


Figure 69. Dissected immature flower bud of *V. barbellata* on same plant as Figure 68, showing white margin of lip.

Vanilla phaeantha Rchb. f. – Leafy Vanilla

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	11-100

Figure 70. *Vanilla phaeantha* in EVER. Images by Keith Bradley, 2009.

Background

Leafy vanilla is an herbaceous vine in the Orchidaceae. It is a primarily West Indian species at the northern end of its range in South Florida[122]. In South Florida, it has been found in two disjunct areas, in the Fakahatchee Strand Preserve State Park in Collier County, and north of Flamingo in EVER in Miami-Dade County. It is also known from the West Indies and northern South America (Trinidad), where populations are scattered from near sea level to 300 m (Cuba, Jamaica, Dominican Republic, St. Vincent). In Florida, it primarily grows in cypress swamps, but in EVER it grows in a transitional area between mangrove forests/woodlands and transitional bayhead forests, including native-dominated forests growing on road fill adjacent to Main Park Road (J. Sadle, email comm. 2014). Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas, but it has apparently tolerated some disturbance in EVER. Luer (1972) reported it to flower from May through July. Wunderlin & Hansen (2011) reported it to flower from spring to summer. It has been observed flowering in EVER from May to June. Ackerman

[122] Luer (1972) mapped *V. phaeantha* for the Bahamas in error, and the Bahamas was also erroneously included in its range in the Catalogue of Seed Plants of the West Indies (Acevedo-Rodríguez and Strong 2012). Both of these were due a listing of *V. phaeantha* by Britton & Millspaugh (1920), which were subsequently described as a new species (*V. correllii* Sauleda & R.M. Adams), which was later placed into synonymy under *V. poitaei* (J. Ackerman, email comm. 2014).

& Collaborators (2014) reported flowering in the Greater Antilles from March to July and fruiting in February, September and December. It is presumed to be cultivated in South Florida, but has not been recorded naturalizing outside of its historic range.

Conservation Status

Vanilla phaeantha has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as apparently secure globally, but critically imperiled in the United States. It is a not listed under the Endangered Species Act, but is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC for South Florida. Ackerman and Collaborators (2014) reported the conservation status in the Greater Antilles as unknown, but it is apparently somewhat rare (e.g., habitat data was reported as "unknown"). James Ackerman (email comm. 2014) reported that it grows in numerous areas in Cuba, including along the northern coast.

History in EVER

Leafy vanilla was first reported for EVER by Frank Craighead (1958), who recorded it on a checklist for the Jungle Ridge area, a rock ridge located between Nine Mile Pond and Paurotis Pond (EVER unpublished data). Craighead also mentioned this locality in his 1963 book Orchids and Other Air Plants of the Everglades National Park and Loope & Avery (1979) reported leafy vanilla for hammocks on the north shore of Florida Bay. Craighead also attempted to transplant leafy vanilla from the Fakahatchee Strand into the Long Pine Key area (Hammer 2001). These introduced plants have not been seen since 1963. Unfortunately, knowledge of these introduced plants caused Hammer (2001) and Gann *et al.* (2002) to treat this species as not native to EVER, in error. However, in 2007 a small population near Jungle Ridge was rediscovered by orchid enthusiast Russ Clussman and EVER Botanist Jimi Sadle. The overall population estimate is 11-100 individuals. Saha *et al.* (2011) classified leafy vanilla as being vulnerable to sea level rise, but it did not rank among the most vulnerable because it was classified as an epiphyte and its habitat was not classified as highly vulnerable.

Discussion

More field work is needed to document the total population in EVER. In addition, the establishment of long-term monitoring plots is needed to quantify long-term population conditions and to document population change from sea level rise or other factors.

Summary of Recommendations

- Conduct a thorough survey for and map the Jungle Ridge population of leafy vanilla.
- Establish long-term monitoring plots both east and west of Main Park Road and monitor for demographic change.
- Assess threats from roadside vegetation management and fire and develop mitigation measures if necessary.

Other Epiphytes

Excluding ferns and orchids, there are 17 epiphyte taxa reported for EVER, representing three plant families: Bromeliaceae (14), Piperaceae (2) and Cactaceae (1) [123]. About 40 percent (7) are common in South Florida, while the remainder are rare, imperiled, critically imperiled or possibly extirpated (The SOMCs *Rhipsalis baccifera* and *Tillandsia fasciculata* var. *clavispica* are possibly extirpated in the park and South Florida). Three of these are treated as SOMCs in this report, representing one from each epiphyte family. The seven common species are all widespread in the park, along with the bromeliads *Tillandsia flexuosa* and *T. variabilis*, which are rare but widespread. The eight other rare species are geographically limited. Two SOMCs (*Peperomia humilis*, *Rhipsalis baccifera*) are known only from the Flamingo area and *P. humilis* is seriously threatened in the park by sea level rise, especially inundation from storm surge. The SOMC *Tillandsia fasciculata* var. *clavispica* and the rare *Guzmania monostachya* are only known from Long Pine Key, and the entire distribution of *G. monostachya* in the park may be limited to Dark Hammock[124]. *Peperomia obtusifolia* is currently know only from the Long Pine Key area, but was also collected by Frank Craighead at Snake Bight in 1954 (s.n. FNPS), where it is almost certainly extirpated. *Tillandsia* x *smalliana* is most common in mangrove swamps north of Flamingo, but has also been collected inland and was recently observed on Joe Kemp Key in Florida Bay by EVER botanist Jimi Sadle (email comm. 2013). *Catopsis berteroniana* is common in mangrove tree islands in the broad ecotone between freshwater marsh and mangrove swamps on the eastern side of Shark Slough, and has also been collected on Long Pine Key. *Catopsis floribunda* is very rare in the park and has only been collected at Snake Bight near Flamingo (Seavey and Seavey 1109 FNPS) and in Palma Vista #2 Hammock on Long Pine Key (Craighead s.n. FNPS). It is extant south of West Lake in the Flamingo area where it was most recently observed in 2008, and presumed extant and in two locations on Long Pine Key: the Palma Vista #2 area and the Osteen Hammock/Rattlesnake Hammock area (J. Sadle, email comm. 2013)[125].

In 2015, IRC intends to re-assess the South Florida rank of three epiphytes using the 2012 NatureServe criteria as they may qualify as critically imperiled in South Florida and thus as SOMCs in EVER: *Catopsis berteroniana, C. floribunda and Guzmania monostachya*[126].

[123] Another bromeliad taxon, which is not recognized as distinct by modern authors, is worth mentioning here. A white-bracted form of *T. fasciculata* var. *densispica (T. fasciculata* fo. *alba*) is known from the Flamingo area of EVER and was collected there as early as 1960 by Frank Craighead (s.n. FNPS, catalogue number 8798). The type specimen of *T. fasciculata* fo. *alba* was collected in the Big Cypress near Deep Lake in 1953 (Foster 2825 US). It is unknown if this color morph is found outside of South Florida. It is still commonly encountered in the buttonwood woodlands north of Flamingo.

[124] *Guzmania monostachya* – Frank Craighead made a collection from "near end of sawmill road" on Long Pine Key in 1957 (s.n. FNPS) and reported it as "very abundant locally" especially in hammocks near Homestead (Craighead 1963), presumably referring to Fuchs and Meisner hammocks outside of EVER. Jimi Sadle and Rick & Jean Seavey have only observed plants on Long Pine Key at Dark Hammock (J. Sadle, email comm. 2013).

[125] *Catopsis floribunda* –Craighead (1963) reported that this species was more common on the ground and the "tender" leaves were eaten by deer.

[126] All of these epiphytes were ranked as imperiled in Rare Plants of South Florida (Gann *et al.* 2002) due to the number of known occurrences at that time. FNAI ranks all three as critically imperiled in Florida (*Guzmania monostachya* has a rounded rank = S1S2), and recent communication with land managers in Miami-Dade County

Peperomia humilis A. Dietr. – Low Peperomia

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	11-100

Figure 71. *Peperomia humilis* in Coot Bay Hammock, growing on *Conocarpus erectus* with *Batis maritima.* Image by Jimi Sadle, 2012.

Figure 72. *P. humilis* in Coot Bay Hammock, February, 2014.

Background

Low peperomia is an epiphytic herb in the Piperaceae, although it often grows in accumulated organic debris. It is a primarily tropical species at the northern end of its range in peninsular Florida, also occurring in the Antilles, southern Mexico and northern Central America. In Florida, it is known from scattered populations in southern South Florida and three other regions of the state (derived from Wunderlin and Hansen 2014)[127]. In southern South Florida it is known historically from Miami-Dade County and the Monroe County mainland in EVER and in Collier County. Outside of EVER it is currently known in South Florida only from the Fakahatchee Strand Preserve State Park in Collier County and Jonathan Dickinson State Park in Martin County (Gann *et al.* 2002, Gann *et al.* 2014a), the latter which comprises the southern end of a population that extends north into Central Florida. In South Florida, low peperomia grows in buttonwood woodlands, temperate hardwood hammocks and cypress forests. Mortellaro *et al.*

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indicates that several populations in conservation areas outside of EVER may have seriously declined or been extirpated since 2002.

[127] *Peperomia humilis* – One group ranging from Martin County north along the east coast to Volusia County, another in Duval County, and a third north of Tampa in Citrus, Hernando and Sumter counties.

(2012) ranked it as being obligate to high quality natural areas. Wunderlin & Hansen (2011) reported low peperomia to flower in the summer, but it is likely fertile all year (e.g., see Figure 72). It is cultivated in South Florida at botanical gardens and by enthusiasts, but has only been reported as naturalized from cultivated plants at Hattie Bauer Hammock in Miami-Dade County (Hammer 1992b, Gann *et al.* 2014a)[128]. The Flora of North America (Boufford 1997) listed this as naturalized in South Florida in error (Gann *et al.* 2002), a mistake that has now expanded to ITIS.

Conservation Status

Peperomia humilis has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as secure globally, but as imperiled in the continental United States. It is not listed under the Endangered Species Act, but it is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as imperiled in Florida. IRC ranks it as critically imperiled in South Florida.

History in EVER

Low peperomia was first collected in EVER in 1905 by Alvah A. Eaton in the Flamingo area (Gann et al 2002). It has also been vouchered by a number of collectors in that part of the park in Coot Bay Hammock, in the Snake Bight area and near West Lake (detailed in Gann *et al.* 2002), where it grows in buttonwood woodlands on low coastal berms. Frank Craighead (1963) reported it only for the mangrove areas of the park and not from Long Pine Key or the Big Cypress. Allen (1976) reported that the entire population in EVER was wiped out by Hurricane Donna when "salt water covered the buttonwood-mangrove community that was its only known habitat. Only the fact that it was in limited cultivation kept it from extinction." Frank Craighead recorded in his personal notes that he translocated plants into EVER, but it is unknown if these were plants were cultivated from EVER germplasm or another source (Gann *et al.* 2002). In 1987, Rick and Jean Seavey again found plants in Coot Bay Hammock (Seavey and Seavey 961 FNPS), and Roger L. Hammer reported that he located and photographed several large populations in 2000 (Gann *et al.* 2002). Surveys in Coot Bay Hammock in 2007 by IRC biologist Jesse Hoffman, two years after Hurricane Wilma's storm surge had inundated the southern coast of the park, located a small population of 5-10 plants (IRC and EVER unpublished data). In 2014, the author and colleagues located three distinct patches[129] of plants in Coot Bay Hammock during a cursory search, raising the estimate of plants to at least 11-100. Plants in other areas from Flamingo to West Lake have not been recently seen. Saha *et al.* (2011) ranked *Peperomia humilis* among the species most threatened by sea level rise in EVER, heavily influenced by the number of occurrences in the park (1), its small population, and lack of inland populations.

Discussion

Low peperomia is one of the most threatened native plants in EVER and immediate action may be required if extirpation from the park is to be prevented. Its geographic range has apparently decreased to a single hammock, and the habitat quality of hammocks in that region has declined

[128] The conservation area Hattie Bauer Hammock is the site of the historic Orchid Jungle in the Naranja area of southern Miami-Dade County.

[129] One was probably the same as that observed by Hoffman in 2007.

Figure 73. *Peperomia humilis* in Coot Bay Hammock growing with *Pleopeltis polypodioides* var. *michauxiana*, 2014.

for non-halophytic plants in the period from 1999 to 2009 due to sea level rise (Saha *et al.* 2011). The population appears to be declining and is nearing extirpation. A thorough search for this species within its historical range and in other potentially suitable habitats is urgently needed. Because of its rarity, it would also seem prudent to establish an ex-situ population which could be used to re-establish or augment the population in EVER. As discussed earlier, this is one of the species that could be considered for managed relocation farther into the interior if deemed appropriate, as an additional safeguard if the Coot Bay Hammock population is lost.

Summary of Recommendations

- Re-visit last known patches and establish a regular monitoring protocol. If appropriate, collected germplasm to establish an ex-situ collection.
- Conduct a thorough search for this species throughout its historic range in appropriate habitat and in similar habitats throughout the northern Florida Bay region. Coordinate these searches with those for other SOMC species in the area (e.g., *Rhipsalis baccifera* below).
- Consider managed relocation into the interior.

Rhipsalis baccifera (J.S. Mill.) Stearn – Mistletoe Cactus

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Possibly Extirpated	Possibly Extirpated

Background

Mistletoe cactus is an epiphytic herb in the Cactaceae. It is a primarily tropical species at the

Figure 74. *Rhipsalis baccifera* in habitat near the coast in the eastern Dominican Republic, 2011.

Figure 75. Cultivated plant of material originally collected in EVER (image taken 2013).

northern end of its range in South Florida, also occurring in the Antilles, Mexico, Central America and South America. It is both the most widespread cactus in the New World and the only cactus species with native populations in the Old World (although these are infraspecific taxa). In South Florida, it is known as a wild native only from the Flamingo region of EVER and one collection in 1923 from the interior of Miami-Dade County (Gann *et al.* 2002). In South Florida, it grows in tropical hardwood hammocks and mangrove forests, but at present there are no known wild populations. Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas in South Florida.

Wunderlin & Hansen (2011) reported mistletoe cactus to flower throughout the year. Manzano & Briones (2010) studied the germination response of the species. They found that seeds were short-lived, with no seeds remaining viable after one year of storage. Seeds germinated in a wide variety of light conditions from deep shade to open canopy, and germination increased with increasing humidity. *Rhipsalis baccifera* is a common epiphyte in Cuba and Jamaica, especially in areas of higher rainfall, but is absent in drier regions of the West Indies, including the Bahama Archipelago and the Cayman Islands. It is widely cultivated in South Florida, but there are no long-term substantiated reports of it naturalizing anywhere within the region. Its distribution in South Florida may be constrained by limited precipitation and occasional freezing temperatures.

Conservation Status
Rhipsalis baccifera is ranked as a species of least concern on the IUCN Red List (ver. 3.1) with a stable global population trend. NatureServe ranks it as apparently secure globally, but as critically imperiled in the continental United States. It is not listed under the Endangered Species Act, but is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida. IRC ranks it as possibly extirpated in South Florida.

History in EVER
Mistletoe cactus was first found in the Flamingo area of EVER in the 1950s, either by John Beckner and Roy O. Woodbury (Ward 1978) or by Frank Craighead, who made a collection at "Crocodile Point near Snake Bight" in 1958 (258 FNPS). Lyman Benson also collected it at "Snakebight Road" in 1965 (16579 RSA in Benson 1982, Gann *et al.* 2002). Living material from that period was collected from "Cape Sable" by Walter M. Buswell and transferred to Fairchild Tropical Botanic Garden (FTBG) in 1990 by Taylor R. Alexander (FTBG Accession #9053, Figure 76) and presumably the University of Miami (Benson 1982). That material is extant at FTBG (M. Griffiths, email comm. 2013) and other institutions. Loope & Avery (1979) reported mistletoe cactus as possibly extirpated in the park due to hurricanes Donna in 1960 and Betsy in 1965. However, around 1990, Rob Campbell discovered a single plant on a dead buttonwood tree on the shore of West Lake (Campbell 1990). John Ogden and Carol Lippincott vouchered this station in 1991 (46 FTG) with Roger Hammer also present (Gann *et al.* 2002). FTBG once had germplasm from that station (Gann *et al.* 2002), but it is no longer living (M. Griffiths, email comm. 2013). Despite numerous surveys by IRC and EVER staff since 1991, mistletoe cactus has not been seen in the park since that time. However, no comprehensive surveys have been conducted in the region because if its inaccessibility and inhospitableness and it may still be present.

Discussion
In Rare Plants of South Florida (Gann *et al.* 2002), the distribution of mistletoe cactus in EVER was inferred to be south of West Lake and in a general sense that is true. But if Craighead's label data is geographically correct, then his collection was made several kilometers to the east of the eastern end of West Lake along the shore of Florida Bay. In fact, the entire region from Cape Sable east to the park boundary should be considered potential habitat. It could be found on trees almost anywhere in the region, both on coastal berms and in mangrove forests. In the Dominican Republic, this species grows within a few 100 m of the Caribbean shoreline in tropical hardwood forests (pers. obs. of the author 2011) and its distribution in the West Indies indicates significant salt tolerance. As with *Peperomia humilis*, a thorough search for this species is urgently needed. Because historic germplasm from EVER is available, a translocation back into the West Lake/Flamingo areas of EVER should be considered.

Summary of Recommendations
- Conduct a thorough search for this species in appropriate habitats throughout the northern Florida Bay region. Coordinate these searches with those for other SOMC species in the region (e.g., *Peperomia humilis* above).
- Consider reintroduction of FTBG material back into EVER into the historic habitat south of West Lake.

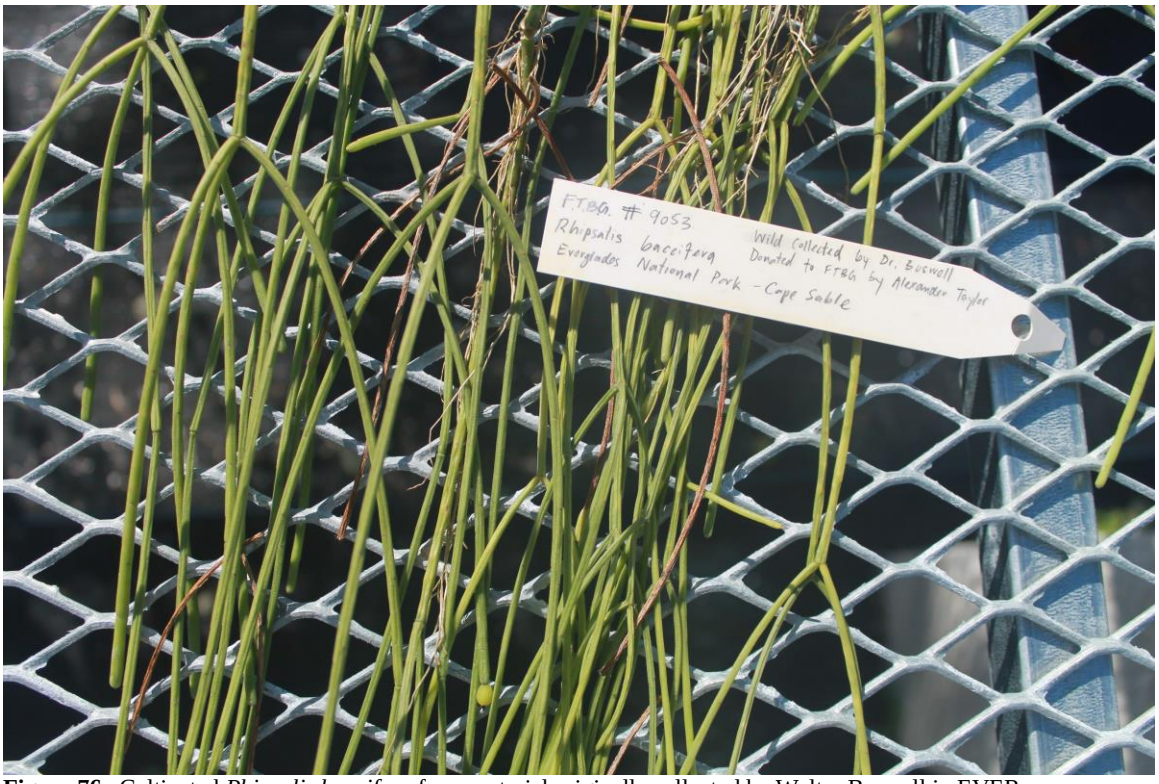

Figure 76. Cultivated *Rhipsalis baccifera* from material originally collected by Walter Buswell in EVER.

Tillandsia fasciculata Sw. var. ***clavispica*** Mez – Clubspike Cardinal Airplant

Federal Status	State Status	IRC SF Status	EVER Population
NA	NA	Possibly Extirpated	Possibly Extirpated

Background

Clubspike cardinal airplant is an epiphytic herb in the Bromeliaceae. It is a primarily tropical taxon mostly found in Cuba, with a small population on Little Cayman Island (Proctor 1984) and outlier collections from peninsular Florida (Smith and Downs 1977, Gann *et al.* 2002) and Oaxaca, Mexico (Smith and Downs 1977). In peninsular Florida, it was collected once in 1877 along the Indian River in what is now Brevard County (John Donnell Smith s.n. US in Gann *et al.* 2002), and in South Florida, where it has been found in Miami-Dade County and the Monroe County Keys (Gann *et al.* 2002)[130]. There are currently no known extant populations in Florida. The last know collection from the United States was made by Frank Craighead on Long Pine Key (Gann *et al.* 2002) in the late 1950s (see below). It grows in trees in or along the edges of tropical hardwood hammocks. Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas in South Florida. Although other *Tillandsia fasciculata* taxa are present in Cuba, *T. fasciculata* var. *clavispica* is the most common taxon and it is found in a wide variety of habitats

[130] Outside EVER, earlier collections in South Florida were limited to the Brickell Hammock area, where it was collected once by Abram P. Garber in 1877 and two collections from Key West from the early 1800s (Gann *et al.* 2002).

Figure 77. Sole specimen of *Tillandsia fasciculata* var. *clavispica* collected in EVER. Courtesy of the United State National Herbarium at the Smithsonian Institution.

Figure 78. *T. fasciculata* var. *clavispica* in eastern Cuba, with more pronounced elongated spike branches, 2013.

including coastal lowlands, freshwater wetlands, dry forests and shrublands, and tropical karstic forests (Hechavarria S. 2006). Wunderlin & Hansen (2011) reported flowering for the species *T. fasciculata* from summer to fall, but the specimen from EVER may have been collected in the winter (see below). It is cultivated in South Florida in botanical gardens and by enthusiasts, but has not been recorded naturalizing from cultivated plants. Cultivated plants of the variety *clavispica* observed by the author have failed to produce viable seeds in South Florida, but the species has shown high levels of autonomous selfing in a shadehouse in Costa Rica (Cascante-Marín *et al.* 2006). All *Tillandsia fasciculata* taxa in South Florida are affected by the exotic weevil *Metamasius callizona*, the larvae of which burrows inside the plant and kills it (Frank and Thomas 1994).

Conservation Status

Tillandsia fasciculata var. *clavispica* has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as apparently secure globally, but it has not been ranked for the United States. It is not listed under the Endangered Species Act, but it is listed as endangered by the State of Florida (as *T. fasciculata*[131]). It has not been ranked by The Florida Natural Areas Inventory for Florida. IRC ranks it as possibly extirpated in South Florida.

[131] The State of Florida does not list infraspecific taxa.

Taxonomic Notes

The taxonomy of the *Tillandsia fasciculata* complex is confusing and there has been much disagreement over whether or not to recognize infraspecific taxa. Wunderlin & Hansen (2011) and The Atlas of Florida Vascular Plants (Wunderlin and Hansen 2014) do not recognize infraspecific taxa, while ITIS and IRC do. The main problem is that, even if recognized, infraspecific taxa probably hybridize in nature, making field determinations problematic.

History in EVER

Clubspike cardinal airplant was apparently found in EVER on only one occasion in the late 1950s when Frank Craighead made a collection at Palma Vista #2 Hammock (s.n. US). Gann *et al.* (2002) reported two specimens, one collected in 1956 and one in 1958, but an examination by Mark Strong of the National Herbarium at the Smithsonian Institution revealed that there is a single specimen with two labels (Figure 79). Although the hand-written label by Craighead is dated 3/16/56, the specimen may have been collected in 1955[132]. This is the same period when Main Park Road was being realigned from Old Ingraham Highway to its current location (EVER Cultural Resources, unpublished data) [133]. This species has apparently not been seen in the park since at least 1958, despite surveys by IRC between 2003 and 2008, and several decades of botanical activity in that hammock by others[134].

Discussion

Clubspike cardinal airplant has been collected at four widely separated locations in peninsular Florida from the early 1800s through the 1950s, suggesting that seed rain from Cuba is occurring but populations are not spreading from their points of establishment. One possibility is that pioneer plants are self-incompatible individuals that cannot spread sexually. Another is that pioneer plants rapidly hybridize with the dominant *T. fasciculata* var. *densispica* and are subsumed into that population (see for instance Luther and Benzing 2009, p. 83)[135]. Regardless, *T. fasciculata* var. *clavispica* is part of the flora of South Florida and EVER and is an element of the expression of biodiversity here. Searches should continue, but more work is needed to identify characters that can used to quickly make determinations in the field[136].

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[132] The hand written note appears to state on the bottom "sec dried 1 yr old specimen".

[133] The Main Park Road originally followed historic Ingraham Highway, which still bisects Royal Palm Hammock, and ran south of Palma Vista #2 Hammock. When the Main Park Road was moved to the north to its present position, a new road was constructed from the new Main Park Road toward the south where it bisected Palma Vista #2 Hammock and then forked to go to Royal Palm Hammock (to the east) or into the historic Hole-in-the-Donut farming area (to the south and west). The construction period was 1955-1958. It is possible that *Tillandsia fasciculata* var. *clavispica* was extirpated from the park due to the construction of that new road.

[134] EVER Botanist Jimi Sadle reported a plant that may conform to this taxon from the Flamingo area, but the identity has not yet been confirmed (email comm. 2014).

[135] Luther and Benzing stated "In south Florida…Interbreeding is so extensive that mixed populations contain few individuals that comfortably match the formal descriptions of either of the parents. Many of the putative hybrids exhibit pale to pastel bract and petal coloration." As written on the label, the Craighead specimen had white flowers rather than the typical purple.

[136] The name "clavispica" means club-shaped. The description does not refer to the whole inflorescence, but to the individual spikes, or inflorescence branches. In *T. fasciculata* var. *clavispica*, the spike has a restricted base with several sterile bracts, which is a character that one cannot see easily walking through the field.

Summary of Recommendations

- Develop useful identification tools and continue searching around Palma Vista #2 Hammock and elsewhere on Long Pine Key.

Figure 79. Base of Craighead specimen at US showing two labels, the one on the left hand-written by Frank Craighead. Mark Strong of the Smithsonian (email comm. 2014) believes the second label may have been typed prior to distribution and the hand-written label is the original.

Graminoids

There are 132 native graminoids[137] (grasses – Poaceae, sedges – Cyperaceae, rushes – Juncaceae) in EVER, of which 68 are common in South Florida. The remaining 64 taxa are rare, imperiled, critically imperiled, presumed extirpated or presumed extinct in South Florida. Six graminoids (all grasses) are SOMCs[138], of which three are extant while the other three are possibly extirpated or presumed extirpated (or extinct) in the park. Three SOMC grasses are coastal species, *Cenchrus myosuroides*, *Eriochloa michauxii* var. *simpsonii* and *Leersia monandra*, but only *C. myosuroides* is known to be extant. *Eriochloa michauxii* var. *simpsonii* has not been collected in the park since 1905 and is presumed globally extinct, while *Leersia monandra* was collected once in the park in 1891 and is presumed extirpated. *Cenchrus myosuroides* is threatened by sea level rise, but the extent is not known. These SOMCs and 23 other graminoids completely or primarily limited to coastal areas in EVER are listed in Table 3, of which 16 are regionally rare. Of these, *Digitaria filiformis* var. *filiformis* and *Eleocharis flavescens* may be two of the rarest graminoids in the park, the first being collected only at Middle Cape Sable (Craighead s.n. FTG, Sadle 558 FNPS)[139] and the second collected once in

[137] *Andropogon glomeratus* var. *glaucopsis* (syn. *A. virginicus* var. *glaucopsis*) has been reported for EVER, but all specimens in the FNPS herbarium were annotated to *A. virginicus* var. *glaucus* by J.W. Horn III in 2006. Horn also annotated a specimen of *A. virginicus* collected by Frank Craighead in 1963 to *A. virginicus* var. *decipiens*, but this is the only record of variety *decipiens* from EVER and awaits confirmation. The author and Keith Bradley made one observation record of *A. longiberbis* in 2001, which is treated in Gann *et al.* (2014a) as reported as there are no corroborating records. *Axonopus fissifolius*, which is a native weed in South Florida, was observed at the Ernest F. Coe Visitors Center by Keith Bradley in 2000. This was the first record of the species in EVER and it is treated as introduced in the park (Gann *et al.* 2014a). Rick and Jean Seavey made three collections labelled as *Carex alata* in 1994 (619, 665, 797 FNPS) from the Hole-in-the-Donut, but these plants are treated as *C. vexans* in Gann *et al.* (2014a). *Carex alata* is not known from South Florida. EVER Botanist Jimi Sadle vouchered *C. vexans* in the same general location as the Seavey collections in 2014 (646, to be deposited at FNPS). The critically imperiled *Leptochloa virgata* was reported for EVER based on a 1961 specimen collected by Frank Craighead (s.n. USF), which was apparently mislabeled. Gann *et al.* (2002) reported this specimen labeled "Concrete bridge." as being from the park, possibly from the Taylor Slough Bridge, but a re-examination by the author in 2013 revealed that the specimen was labeled "Concrete Bridge, Homestead.", which was typed on a pre-printed label intended for Frank Craighead specimens from EVER (confirmed by B. Hansen, email comm. 2013). There are no other records from EVER and this is no longer considered part of the flora of the park. Gann *et al.* (2014a) lists *Scleria ciliata* for EVER, but there are two specimens at FNPS annotated as *S. curtissii* by J.W. Horn III in 2006 (Reimus 891, Seavey and Seavey 1193). A third specimen collected by then-IRC biologists Sadle and Steven Woodmansee (398 FNPS) was determined to be *S. ciliata* by the collectors. *Scleria curtissii* is recognized as valid by ITIS, but has been relegated to a synonym of *S. ciliata* in the Atlas of Florida Vascular Plants (Wunderlin and Hansen 2014) and BONAP (Kartesz 2013). *Scleria curtissii* is currently treated as a variety of *S. ciliata* and ranked as imperiled in South Florida by IRC (Gann *et al.* 2014a), but the *S. ciliata* group in South Florida (including *S. pauciflora*) is in need of review. If *S. curtissii* or *S. ciliata* var. *curtissii* is recognized as a valid taxon, then there are 133 native graminoids in EVER.

[138] One sedge, *Bolboschoenus robustus*, was previously ranked as critically imperiled in South Florida (Gann *et al.* 2002), but was down-ranked to imperiled by IRC in 2012 based on data collected since 2002 (Gann *et al.* 2014a). Another sedge, *Cyperus filiformis*, was also previously ranked as critically imperiled in South Florida, but was down-ranked to imperiled in 2014 based on new information collected during the preparation of this report. Updated NatureServe criteria were used.

[139] *D. filiformis* could be easily overlooked and more common on Cape Sable or elsewhere along the western coastline.

2004 by then-IRC biologists Jimi Sadle and Keith Bradley (430 FTG), between the Harney and Shark Rivers.

Two SOMC graminoids are limited to the Long Pine Key area of EVER: *Digitaria pauciflora* and *Sporobolus clandestinus*. These and 39 other graminoids collected in or reported for the park only in the Long Pine Key area are listed in Table 4, of which 30 are regionally rare. Graminoids from the Long Pine Key area that may be very rare in the park include *Carex vexans* (see footnote 137 above), *Cyperus distinctus*[140], *Cyperus strigosus*[141], *Juncus paludosus*[142] and *Luziola fluitans*[143].

The last SOMC grass, *Leptochloa fusca* ssp. *uninervia*, was collected once north of Main Park Road in a graminoid freshwater prairie near the eastern boundary of the park (Avery and McPherson 1691 USF). Several other rare graminoids are known primarily or only from prairies and/or marshes, mostly in the eastern part of the park: *Fuirena scirpoidea* (Shark Valley), *Leersia hexandra* (Taylor and Shark sloughs), *Leptochloa fascicularis*, *Rhynchospora corniculata*, *R. inundata*, *R. miliacea*, (Chekika-East Everglades area), *Sacciolepis striata* and *Schoenoplectus tabernaemontani*. Eight regionally rare species are scattered in the park: *Andropogon virginicus*, *Cyperus elegans*, *Fimbristylis autumnalis*, *Heteropogon contortus*, *Panicum dichotomiflorum*, *Paspalum distichum*, *Schoenus nigricans* and *Setaria magna*.

Table 3. Native graminoids primarily limited to coastal areas in EVER.

Scientific Name	**IRC South Florida rank**
Bolboschoenus robustus	Imperiled
Cenchrus myosuroides	Critically Imperiled
Cyperus filiformis	Critically Imperiled
Cyperus planifolius	Apparently Secure
Digitaria filiformis var. *filiformis*	Rare
Distichlis spicata	Rare
Eleocharis flavescens	Rare
Eriochloa michauxii var. *simpsonii*	Presumed Extirpated
Fimbristylis caroliniana	Imperiled
Fimbristylis spadicea	Secure
Juncus roemerianus	Rare
Leersia monandra	Presumed Extirpated
Leptochloa dubia	Rare
Monanthochloe littoralis	Rare
Panicum amarum	Apparently Secure
Paspalidium chapmanii	Rare

[140] *Cyperus distinctus* – first documented in the park in sinkholes on Long Pine Key by Rick and Jean Seavey in 1994 (893 FNPS). Collected again by the Seaveys the next year at a scrape-down site in the Hole-in-the-Donut (1105 FNPS).

[141] *Cyperus strigosus* – first documented in EVER in 1994 as a weed in the Hole-in-the-Donut (Seavey and Seavey 656 FNPS). This appears to be a native component of the South Florida flora, but now most common as a weed. Populations in EVER and to the east appear to constitute the southern limit of its range, which could be an artifact of disturbance.

[142] *Juncus paludosus* – first documented in EVER in 1994 in sinkholes on Long Pine Key (Seavey and Seavey 668 FNPS). Plants of this were previously reported for South Florida as *J. polycephalos*. The population in EVER appears to constitute the southern limit of its range.

[143] *Luziola fluitans* – Although reported by Avery & Loope (1980b) and subsequent, there is only one specimen at FNPS collected from Pine Glades Lake in 1995 (Seavey and Seavey 972).

Paspalum vaginatum	Secure
Setaria macrosperma	Rare
Spartina alterniflora var. *glabra*	Imperiled
Spartina patens	Secure
Spartina spartinae	Secure
Sporobolus domingensis	Secure
Sporobolus pyramidatus	Imperiled
Sporobolus virginicus	Secure
Uniola paniculata	Secure
Urochloa adspersa	Apparently Secure

Table 4. Native graminoids possibly limited to the Long Pine Key area of EVER.

Scientific Name	**IRC South Florida rank**
Abildgaardia ovata	Rare
Andropogon ternarius	Secure
Andropogon virginicus var. *glaucus*	Apparently Secure
Carex vexans	Imperiled
Cenchrus gracillimus	Rare
Coelorachis rugosa	Rare
Cyperus articulatus	Imperiled
Cyperus distinctus	Rare
Cyperus flavescens	Rare
Cyperus polystachyos	Secure
Cyperus strigosus	Imperiled
Cyperus tetragonus	Rare
Dichanthelium aciculare	Secure
Dichanthelium strigosum var. *glabrescens*	Secure
Digitaria filiformis var. *dolichophylla*	Rare
Digitaria insularis	Imperiled
Digitaria pauciflora	Critically Imperiled
Elionurus tripsacoides	Imperiled
Eriochloa michauxii	Imperiled
Fimbristylis dichotoma	Rare
Imperata brasiliensis	Rare
Juncus marginatus	Rare
Juncus megacephalus	Apparently Secure
Juncus paludosus	Rare
Lipocarpha micrantha	Imperiled
Luziola fluitans	Imperiled
Panicum hians	Rare
Paspalum floridanum	Imperiled
Rhynchospora divergens	Secure
Rhynchospora floridensis	Apparently Secure
Rhynchospora globularis	Imperiled
Rhynchospora grayi	Rare
Rhynchospora odorata	Rare
Schizachyrium gracile	Secure
Scleria ciliata	Apparently Secure
Scleria lithosperma	Rare
Scleria verticillata	Rare
Sorghastrum secundum	Secure
Sporobolus clandestinus	Critically Imperiled
Tripsacum dactyloides	Rare
Tripsacum floridanum	Rare

Cenchrus myosuroides Kunth – Big Sandbur

Federal Status	State Status	IRC SF Status	EVER Population
NA	NA	Critically Imperiled	101-1,000

Figure 80. *Cenchrus myosuroides* in EVER. Image by Craig van der Heiden, 2013.

Background

Big sandbur is a large perennial herb in the Poaceae. It is a widespread species occurring in the southeastern United States, the West Indies, Mexico, Central America and South America. It is rare in peninsular Florida, where it is currently known only from South Florida and Levy County[144]. In South Florida, it is native to Monroe and Collier counties, but has apparently been extirpated from a number of sites (Gann *et al.* 2002, Gann *et al.* 2014a)[145]. Currently, big sandbur is known in South Florida only from EVER and Dry Tortugas National Park (Gann *et al.* 2014a). Historically, plants have been found growing in a variety of coastal habitats including graminoid dunes, shell mounds and in disturbed areas. Elsewhere in its range, it grows along the coast as well as far into the continental interior (e.g., Mexico, Bolivia). Wunderlin & Hansen (2011) reported it to be fertile in the summer, but specimens have been collected in the park in January, February, March, and June. It is not known to be cultivated in South Florida.

[144] This was collected as recently as 1996 in Levy County (Gann *et al.* 2002). Chase (1920) also cited a specimen collected by Robert Combs in 1898 at Homosassa in Citrus County, where it is apparently extirpated (Gann *et al.* 2002).

[145] Abram P. Garber also collected big sandbur at "Caloosa" in 1878 (11906, MO), and Gann *et al.* (2002) suggested that this collection was from coastal Lee County. However, no corroborating evidence for this has been found.

Figure 81. *Cenchrus myosuroides* in EVER. Image by James Johnson, 2013.

Figure 82. *C. myosuroides* in EVER. Image by Craig van der Heiden, 2013.

Conservation Status

Cenchrus myosuroides has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as apparently secure globally, but it has not been ranked for the United States. It is not listed under the Endangered Species Act or by the State of Florida. It has not been ranked by The Florida Natural Areas Inventory for Florida. IRC ranks it as critically imperiled in South Florida.

History in EVER

Big sandbur is known from EVER only from a group of islands in Florida Bay to the south of Flamingo. It was first collected in this area in 1905 on Joe Kemp Key (Alvah A. Eaton 1345 US in Gann *et al.* 2002), followed by Clive Key in 1954 (Craighead s.n. FNPS) and Frank Key in 1969 (Robertson s.n. FNPS, FTG). Frank Craighead also recorded "tall sandspur" for Cluett Key (Craighead's unpublished botanical notes), which almost certainly referred to *C. myosuroides*. It was also collected twice in 1997, once on Buoy Key (Seavey and Seavey 1226 FNPS) and once on Clive Key (Snow and Terry s.n. FNPS). Populations on Buoy Key and Clive Key were verified as extant in 2013 by EVER Botanist Jimi Sadle and IRC biologists Craig van der Heiden and James Johnson. The habitat for big sandspur on islands in Florida Bay does not fit within the vegetation classification scheme of Rutchey *et al.* (2006). It occurs in low upland habitats just above typical Florida Bay saltmarsh vegetation and sometimes intergrades with low tropical hardwood hammock; it is almost certainly flooded by salt water on an infrequent basis (J. Sadle, email comm. 2013). The National Wetland Index (Lichvar *et al.* 2014) classified *C. myosuroides*

as facultative in the Atlantic and Gulf Coastal Plain region, but it is not ranked as a wetland species by the state of Florida, perhaps due to its rarity. Saha *et al.* (2011) ranked big sandbur at the lower end of 21 rare plant species evaluated for their vulnerability to sea level rise, the low score being affected by its salt tolerance, and the perceived lack of vulnerability of its habitat.

Discussion

Systematic surveys for this species in EVER have not been conducted. The existing occurrences on islands in Florida Bay may be useful in developing signatures from aerial photographs that could be used to identify possible habitats on islands and possibly on the mainland. Saha *et al.* may have assessed the habitat vulnerability (that is the lack of vulnerability) of big sandbur to sea level rise in error by incorrectly including it in the broader salt marsh community. Two of the five islands with historical occurrences of big sandbur (Frank Key, Joe Kemp Key) have apparently lost all upland big sandbur habitat (J. Sadle, email comm. 2013). The establishment of long-term monitoring plots is needed to quantify long-term population conditions and to document population change from sea level rise or other factors. Because of its limited range in EVER and vulnerability to sea level rise, long-term seed storage should be considered.

Summary of Recommendations

- Conduct a thorough survey for big sandbur on islands in Florida Bay, and on the mainland when conducting other coastal work.
- Establish long-term monitoring plots and monitor for demographic change.
- Collect seeds from EVER and deposit at the National Center for Genetic Resources Preservation for long-term storage.
- Review for listing by FNAI and the state of Florida.

Digitaria pauciflora Hitchc. – Twospike Crabgrass, Florida Pineland Crabgrass

Federal Status	State Status	IRC SF Status	EVER Population
Candidate	Endangered	Critically Imperiled	1,001-10,000

Background

Twospike crabgrass is a perennial (but possibly short-lived) herb in the Poaceae. It is endemic to South Florida in Miami-Dade and Monroe counties. Extant populations are known only from EVER and BICY[146] (Gann *et al.* 2014a), although it has also been collected several times and was observed outside the park on the Miami Rock Ridge as recently as 1996 (Gann *et al.* 2002). It grows in pine rocklands and graminoid freshwater prairies throughout its range. Mortellaro *et al.* (2012) ranked it as having a very high affinity to high quality natural areas. Wunderlin & Hansen (2011) reported it to flower from summer through fall, but specimens have been collected from April through September. The U.S. Fish and Wildlife Service (2013c) maintains a Species Assessment and Listing Priority Assignment Form for this candidate taxon which includes significant additional information. The latest form was completed March 4, 2013.

[146] Before the publication of Rare Plants of South Florida (Gann *et al.* 2002), *Digitaria pauciflora* was known only from Miami-Dade County. It was discovered in the Monroe County mainland in BICY in 2003 by IRC biologists Steven Woodmansee and Herbert Kessler (Gann and Woodmansee 2014). Later that year, IRC biologists Keith Bradley and Melissa Abdo vouchered it in the same general area (2553 FTG).

Figure 83. *Digitaria pauciflora* in EVER, 2013.

Figure 84. *Digitaria pauciflora* in BICY. Images by Keith A. Bradley, 2003.

Conservation Status

Digitaria pauciflora has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as critically imperiled globally and in the United States. It is a candidate for listing under the Endangered Species Act (petitioned 2007) and is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC in South Florida.

History in EVER

Twospike crabgrass was first collected in EVER in 1963 by Frank Craighead on Long Pine Key (Gann *et al.* 2002). It was subsequently collected there in the 1970s and 1980s by George Avery (1928, 1929, 1932 FNPS) and Alan Herndon (1519 USF), and Herndon (1998) published a report including some observations concerning fire and population dynamics. Herndon reported plants at 10 locations in the Long Pine Key area and estimated the total park population at between 1,000 and 5,000 plants. Numerous other botanists have also observed twospike crabgrass in EVER and Fairchild Tropical Botanic Garden and IRC did some preliminary mapping there in 2001 (Gann *et al.* 2002, Maschinski *et al.* 2002), together with some ecological evaluations (Maschinski *et al.* 2002). IRC surveys of the Long Pine Key area from 2003 to 2008 recorded 15 occurrences and 113 GPS stations, with a total estimated population of 1,001-10,000 individuals in the park (Gann *et al.* 2009)[147]. Plants were found in all pine blocks except Pine Block J, in pinelands west of pine blocks A and B[148], in prairies and transitional pinelands west and north of Pine Block D, and in the Hole-in-the-Donut area. More than half of these occurrences were new. Twelve long-term monitoring plots were established for twospike crabgrass, including six north and six south of Main Park Road. Twelve 50 m belt transects were also installed along the pineland/prairie ecotone, six north of Main Park Road and six south of Main Park Road. In 2007, 16,908 seeds from 226 maternal lines were collected in EVER by Fairchild Tropical Botanic Garden and sent to the National Center for Genetic Resources Preservation for storage (Goodman *et al.* 2007).

Discussion

Twospike crabgrass is widespread and apparently relatively abundant at the present time in the Long Pine Key area of EVER, but it is a taxon with a narrow global range which is listed as a candidate for federal listing under the Endangered Species Act. Results from the 2003-2008 IRC Long Pine Key rare plant study showed that, unlike Everglades bully (see *Sideroxylon reclinatum* ssp. *austrofloridense* account in Shrubs above), it is not a habitat generalist but grows almost exclusively on the prairie side of the ecotone between pine rocklands and graminoid freshwater prairies. This is consistent with results obtained earlier by Maschinski *et al.* (2002), who also found a preference of twospike crabgrass for mixed rock and marl substrate, a proximity to solution holes, and an association with other graminoids versus other types of vegetation. Herndon (1998) reported that fire followed by flooding led to localized population crashes, but preliminary data from IRC's study suggested instead that this species shows patch dynamics, colonizing new areas and undergoing local extinctions with high rates of turnover (Gann *et al.* 2009). Since it has been more than five years since the long-term monitoring plots and transects established by IRC have been visited, a re-sampling in 2015 would be timely. Because of potential high rates of turnover, sampling frequency may need to be every one or two years. Transect, plot and survey data combined with fire history data from EVER could also be used to determine what fire interval twospike crabgrass can tolerate (J Sadle, email comm. 2012).

[147] Bradley & Gann (1999) also estimated 1,001-10,000 plants present in the park.

[148] This occurrence runs west all the way to the Mahogany Hammock turnoff on Main Park Road (Bradley and Gann 1999; J. Sadle, email comm. 2012).

Summary of Recommendations

- Re-sample the 12 long-term monitoring plots and 12 belt transects in 2015 and determine monitoring interval needs.
- Compare plot, transect and survey data to fire history data to make a preliminary determination of fire interval tolerance.

Eriochloa michauxii (Poir.) Hitchc. var. ***simpsonii*** Hitchc. – Simpson's Cupgrass

Federal Status	State Status	IRC SF Status	EVER Population
NA	NA	Presumed Extinct	Presumed Extinct

Figure 85. 1964 collection of *Eriochloa michauxii* var. *simpsonii* from Lee County (Lakela 27094 USF). From Wunderlin, R. P., and B. F. Hansen. 2008. *Atlas of Florida Vascular Plants* (http://www.plantatlas.usf.edu/).[S. M. Landry and K. N. Campbell (application development), Florida Center for Community Design and Research.] Institute for Systematic Botany, University of South Florida, Tampa.

Background
Simpson's cupgrass is a perennial herb in the Poaceae. It is endemic to South Florida, where it has been documented in Monroe, Collier and Lee counties. It was last observed in 1966 and it may be globally extinct (Gann *et al.* 2002, Gann *et al.* 2014a). Historically, it was collected in moist areas on coastal dunes as well as on a dry roadside on Sanibel Island, where it may have persisted for a time following habitat alteration. Mortellaro *et al.* (2012) ranked it as having a high affinity to high quality natural areas. Wunderlin & Hansen (2011) reported it to flower from spring through fall, and specimens have been collected in March, April, and September.

Taxonomic Notes
The two *Eriochloa michauxii* South Florida taxa are distinguished as follows (from Wunderlin and Hansen 2011):
E. michauxii var. *simpsonii* – Lower floret neutral; rachis and inflorescence branches scabrous or puberulent; leaf blades involute to conduplicate, to 5 mm wide.
E. michauxii var. *michauxii* – Lower floret male; rachis and inflorescence branches usually pilose; leaf blade generally flat, more than 8 mm wide.

Figure 86. *Eriochloa michauxii* var. *michauxii* in EVER. Image by Keith A. Bradley, 2008.

Figure 87. *E. michauxii* var. *michauxii* in EVER, 2013.

Conservation Status
Eriochloa michauxii var. *simpsonii* has not yet been assessed for the IUCN Red List but it is listed as a synonym of *E. michauxii* in the Catalogue of Life; however, it is maintained as a distinct taxon in ITIS. NatureServe ranks it as possibly extinct globally. It is not listed under the

Endangered Species Act or by the State of Florida[149]. The Florida Natural Areas Inventory ranks it as possibly extinct in Florida. IRC ranks as presumed extinct in South Florida (and thus globally) based on extensive searches since 1995 (Gann *et al.* 2002, Gann *et al.* 2014a).

History in EVER
Simpson's cupgrass is historically known from the park from two collections, one from Cape Sable in 1891 and one from Flamingo in 1905 (Gann *et al.* 2002). These could actually represent collections from the same population because during that time period a large area encompassing the Flamingo area was sometimes referred to as Cape Sable. Loope & Avery (1979) reported it as presumably present in prairies in the western parts of EVER and BICY. Plant surveys throughout the Cape Sable/Flamingo area have been carried out numerous times by EVER and IRC staff since 2007, but no Simpson's cupgrass plants have been found.

Discussion
Grasses are easily overlooked, especially when sterile. Although Simpson's cupgrass has not been seen anywhere in nearly 50 years, the possibility remains that it could be rediscovered.

Summary of Recommendations
- Although the re-discovery of this species in historical locations in Everglades National Park seems highly unlikely, it should be looked for from spring to fall whenever botanical activity is undertaken in suitable habitat.
- If rediscovered, a voucher specimen should be collected if doing so does not impact more than 5% of the population.

Leersia monandra Sw. – Bunch Cutgrass

Federal Status	State Status	IRC SF Status	EVER Population
NA	NA	Critically Imperiled	Presumed Extirpated

Background
Bunch cutgrass is a perennial, caespitose herb in the Poaceae. It is a primarily tropical species at the northern end of its range in peninsular Florida and Texas, and otherwise known from the Antilles, Mexico and a disjunct specimen from Minas Gerais, Brazil collected in 1957 (Pereira 2729/3565, RB in GBIF 2014). In Florida, it has been collected in South Florida and Citrus County. The Citrus County specimen was collected in 1898 by R. Combs at Homosassa (981 NY), where it is apparently extirpated (Gann *et al.* 2002). In South Florida it has been collected in Miami-Dade County and Monroe County, both in the Florida Keys and on the mainland. It was last collected in 1903 in Buena Vista, just north of present-day downtown Miami and is presumed extirpated in the region (Gann *et al.* 2002). It grew on shell mounds, in open disturbed sites, and presumably in sandy pine rocklands (Gann *et al.* 2002). It is inexplicably listed as an obligate wetland species by the Florida Department of Environmental Protection. Mortellaro *et al.* (2012) did not rank this species for the Floristic Quality Index for South Florida. Wunderlin and Hansen (2011) reported it to flower in the fall, however, South Florida specimens have been collected in February, May, September, November, and December.

[149] The State of Florida does not list infraspecific taxa and E. michauxii var. michauxii is a common species in Florida.

Figure 88. *Leersia monandra* from USDA-NRCS PLANTS Database / Hitchcock, A.S. (rev. A. Chase). 1950. *Manual of the grasses of the United States*. USDA Miscellaneous Publication No. 200. Washington, DC.

Conservation Status

Leersia monandra has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as globally secure and imperiled in the United States (rounded). It is not listed under the Endangered Species Act or by the State of Florida[150]. It has not been ranked by The Florida Natural Areas Inventory for Florida. IRC ranks it as presumed extirpated in South Florida following extensive searches since 1995 (Gann *et al.* 2002, Gann *et al.* 2014a).

History in EVER

Bunch cutgrass was collected once in EVER on Lostmans Key, a shell mound at the mouth of the Lostmans River in 1891 (Simpson 202 US in Gann *et al.* 2002).

Discussion

Grasses are easily overlooked, especially when sterile. Although Bunch cutgrass has not been seen anywhere in Florida in more the 100 years, the possibility remains that it could be rediscovered.

[150] The State of Florida does not list species believed to be extirpated.

Summary of Recommendations

- Although the re-discovery of this species in historical locations in Everglades National Park seems highly unlikely, it should be looked for whenever botanical activity is undertaken in suitable habitat, especially on shell mounds in the western part of the park.
- If rediscovered, a voucher specimen should be collected if doing so does not impact more than 5% of the population.

Leptochloa fusca (L.) Kunth ssp. ***uninervia*** (J. Presl) N. Snow – Mexican Sprangletop

Federal Status	**State Status**	**IRC SF Status**	**EVER Population**
NA	NA	Critically Imperiled	Possibly Extirpated
Synonyms: *Leptochloa uninervia* (J. Presl) Hitchc. & Chase			

Figure 89. *Leptochloa fusca* ssp. *uninervia* from Robert H. Mohlenbrock, USDA-NRCS PLANTS Database/USDA SCS, 1991. *Southern wetland flora: Field office guide to plant species*. South National Technical Center, Fort Worth.

Background
Mexican sprangletop is a caespitose annual or short-lived perennial herb in the Poaceae. It is a widespread species, known from scattered populations in North America, the West Indies, Mexico, Central America and South America. It has been found nearly throughout Florida, but is rare in South Florida with scattered collections in Miami-Dade, Palm Beach, Martin and Lee counties (Gann *et al.* 2002, Gann *et al.* 2014a). It is presumed extant in Miami-Dade, Martin and Lee counties, but possibly extirpated in Palm Beach County. It was collected in 1997 just east of EVER in the Frog Pond on the edge of a farm field (Bradley 1186 FTG). It grows in graminoid freshwater prairies, salt marshes and wet disturbed areas. Mortellaro *et al.* (2012) did not rank this species in the Floristic Quality Index for South Florida, but recent collections have all been from disturbed areas. Wunderlin & Hansen (2011) reported it to flower from spring through fall. It was collected in EVER in December and Bradley's specimen from the Frog Pond was collected in November.

Conservation Status
Leptochloa fusca ssp. *uninervia* has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life[151]. NatureServe ranks it as secure globally and in the United States. It is a not listed under the Endangered Species Act or by the State of Florida. It has not been ranked by The Florida Natural Areas Inventory for Florida. IRC ranks it as critically imperiled in South Florida.

History in EVER
Mexican sprangletop was collected a single time in EVER in 1976 by George Avery (1691 USF in Gann *et al.* 2002). This collection was made near USGS well 3123 in the rocky glades (graminoid freshwater prairie) in a remote area 4-5 miles from the eastern boundary of the park.

Discussion
Bradley's collection of Mexican sprangletop in 1997 just miles from Avery's 1976 collection suggests that this grass may still be present in the park. However, it is scattered in South Florida and is found in disturbed areas. It may or may not be an original part of the park flora.

Summary of Recommendations
- Search for Mexican sprangletop whenever botanical activity is undertaken near the eastern boundary of the park.

[151] *Leptochloa fusca* ssp. *fusca* has been ranked as of least concern on the IUCN Red List (ver. 3.1).

Sporobolus clandestinus (Biehler) Hitchc. – Hidden Dropseed, Rough Dropseed

Federal Status	**State Status**	**IRC SF Status**	**EVER Population**
NA	NA	Critically Imperiled	101-1,000
Synonyms: *Sporobolus compositus* (Poir.) Merr. var. *clandestinus* (Biehler) Wipff & S.D. Jones			

Figure 90. *Sporobolus clandestinus* in EVER, 2012.

Background
Hidden dropseed is a perennial herb in the Poaceae. It is a temperate species at the southern end of its range in South Florida where it is known only from Miami-Dade County (Gann *et al.* 2002, Gann *et al.* 2014a). It is also known from the eastern and central United States. Outside of EVER it is present in two Miami-Dade County pine rockland conservation areas (Gann *et al.* 2014a). It grows in pine rocklands and along mowed firebreaks in pine rocklands. Mortellaro *et al.* (2012) ranked it as being facultative to ruderal areas and natural areas. Wunderlin & Hansen (2011) reported it to flower in the fall, and specimens have been collected in the park in September.

Conservation Status
Sporobolus clandestinus has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as globally secure, but it has not been ranked for the United States, although it has been ranked as apparently secure in Louisiana, North Carolina and Virginia. It is a not listed under the Endangered Species Act or by the State of Florida[152]. It has not been ranked by the Florida Natural Areas Inventory for Florida. IRC ranks it as critically imperiled in South Florida.

History in EVER
Hidden dropseed was unwittingly discovered in EVER in 1982 by George Avery along the edge of a mowed firebreak in Long Pine Key (2351 FTG in Gann *et al.* 2002)[153]. In 2004, during IRC surveys of Long Pine Key, then-IRC biologists Jimi Sadle and Emilie Verdon Grahl rediscovered and vouchered what was presumably the historical population growing along a firebreak road between pine blocks H and J near Osteen Hammock (Sadle and Verdon 415 FTG, Gann *et al.* 2009). A single long-term monitoring plot was installed in Pine Block H. A total of 106 plants were recorded in the plot in 2006, but no plants were observed in 2007, possibly because the flowering period was off-season that year. The overall population estimate at the end of 2008 was 101-1,000 individuals. Sadle, the author, Bruce Holst of Marie Selby Botanical Gardens and colleagues revisited this station in 2012 (see photos above) and a robust population was found.

Discussion
Hidden dropseed is a disjunct species at the end of its range in EVER and understanding its presence there is problematic since it is known only from a single area in a firebreak. However, there are a number of other rare temperate disjunct species in the pine rocklands of South Florida (e.g., *Desmodium lineatum*, *Eupatorium compositifolium*, *Zornia bracteata*)[154], most of which are known from very specific soil microhabitats (IRC unpublished data). In the case of *S. clandestinus*, outside of EVER it is known only from small patches in so-called "Redland soil pockets" (IRC unpublished data) and this is the same description reported for the plot substrate description in Gann et al (2009), except mixed with limestone and scraped. Even though the habitat of *S. clandestinus* in EVER is a firebreak, only one non-native species was recorded in

[152] The distribution of *Sporobolus clandestinus* in Florida is scattered and it may qualify for state listing or ranking by FNAI.
[153] As described in Gann *et al.* (2002), Avery's collection remained undetermined until IRC biologist Keith Bradley found the same species in a nearby pineland outside of the park in 1997 and brought it to the attention of Gerald "Stinger" Guala, then keeper of the herbarium at Fairchild Tropical Garden, who made the determination.
[154] *Desmodium lineatum* and *Eupatorium compositifolium* are SOMC dicot forbs – see accounts below.

Figure 91. Bruce Holst of Marie Selby Botanical Gardens and EVER Botanist Jimi Sadle showing length of *Sporobolus clandestinus* inflorescence near Osteen Hammock in EVER, 2012.

the plot (the widespread weedy grass *Bothriochloa pertusa*). Otherwise, the species composition was similar to undisturbed pine rockland but with a slightly lower Floristic Quality Index (Gann *et al.* 2009). Searches for more hidden dropseed in undisturbed Redland soil pockets should continue, using other Redland soil pocket associates (like *Desmodium lineatum*) to help narrow the search for this cryptic grass. Since it has been more than five years since the long-term plot established by IRC has been monitored, a re-sampling in the fall of 2015 would be timely.

Summary of Recommendations

- Re-sample the long-term monitoring plot in Pine Block H and determine monitoring interval needs.
- Continue searches for hidden dropseed in undisturbed Redland soil pockets in pine blocks H and J.

Monocot Forbs (excluding orchids)

There are 35 non-orchid, non-graminoid monocots native to EVER, of which 12 are common in South Florida and 23 are rare (Gann *et al.* 2014a). There are no SOMCs. Eleven of these are submerged or floating aquatics, both marine and in freshwater. Of the submerged marine monocots, three are common (*Halodule wrightii*, *Syringodium filiforme*, *Thalassia testudinum*) and one is rare both in South Florida and EVER (*Halophila engelmannii*). Both Avery & Loope (1980b, 1983) and Reimus (1996, 1999) listed *H. engelmannii* for the park without a voucher; its present status is unknown[155]. Of the remaining seven submerged or floating aquatic monocots all are considered rare in South Florida – one is found both along the coast and in the interior (*Najas guadalupensis*), two are primarily coastal (*Najas marina*, *Ruppia maritima*), one is widespread in the interior (*Potamogeton illinoensis*), one has only been collected in open water in the Long Pine Key area (*Spirodela polyrhiza*), and the status of two are uncertain (*Lemna obscura*, *Vallisneria americana*). Like with *Halophila engelmannii*, both Avery & Loope (1980b, 1983) and Reimus (1996, 1999) listed *Lemna obscura* for the park without a voucher. The only known specific locality for this species is an observation by Keith Bradley in the Chekika Hammock area in 1995. Avery & Loope also listed *Vallisneria americana* as new to the park list in the second (1983) edition, presumably with a voucher (no asterisk), but no voucher is extant at FNPS. There is one specimen collected in the Tamiami Canal by John Popenoe in 1979 (1559 FTG), but it is not clear if this collection was from within park boundaries. EVER Botanist J. Sadle (email comm. 2014) has also observed *V. americana* at the southern end of the L31W canal, but not within park boundaries. IRC treats *V. americana* as possibly extirpated in EVER (Gann *et al.* 2014a).

Of the 24 terrestrial or emergent monocots, nine are common in South Florida and 15 are rare. Regionally rare species widespread in the interior of the park are *Canna flaccida*, *Eriocaulon compressum*, *Hymenocallis tridentata*[156] and *Peltandra virginica*. Two species appear to be limited to the coast, but both are regionally common and neither should be threatened by sea level rise (*Commelina erecta* from the Cape Sable area and *Hymenocallis latifolia*). Five rare species have only been collected in or near the Long Pine Key area: *Aletris bracteata*, *A. lutea*, *Hypoxis wrightii*, *Schoenolirion albiflorum* (Ficus Pond) and *Typha latifolia* (also east to park boundary; J. Sadle, email comm. 2014). The common *Sisyrinchium angustifolium* also appears to be limited to the Long Pine Key area in the park. *Apteria aphylla* was probably collected in that same general area in "Cypress Slough" in 1963 (Craighead s.n. FNPS) and "Taylor Sough. In center of small cypress head on east side of Ingraham Highway." (Avery 1773 FNPS, collected by Chuck Hilsenbeck in 1977). What appears to be *Sagittaria graminea* was collected

[155] IRC treats this as assumed present for the time being (Gann *et al.* 2014a). Its presence should be verified or its status changed to possibly extirpated or reported.

[156] *Hymenocallis tridentata* – This was not listed by Avery & Loope (1980b, 1983), but was reported for the park by Herndon (1987) and included on park lists by Reimus (1996, 1999) as *H. floridana*. Reimus also made a collection in 1994 (460 FNPS). This is apparently widespread in South Florida but often overlooked (see Gann *et al.* 2014a), including in EVER. It was photographed in 2013 along the road to Pa Hay Okee overlook by Roger Hammer (email comm. 2014). Hammer estimated about 200 plants to be present in that locality.

at Paradise Key and reported nearby from the Chekika area[157]. Finally, *Sagittaria filiformis* is known for EVER from a single herbarium specimen collected in 1978 along the eastern border of the park about seven miles south of the Tamiami Trail (Avery 1994 FNPS with Lloyd Loope and Dale Taylor) and as reported from Shark Slough (Olmsted and Armentano 1997). It is currently treated as assumed to be present in EVER by IRC (Gann *et al.* 2014a), but verification is needed.

As a group, monocot forbs are poorly collected and understood in EVER, and substantially more work is needed. Many may be more widespread than the data indicate both in the park and in South Florida; all have some wetland affinity.

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[157] *Sagittaria graminea* – Neither Avery & Loope (1980b, 1983) nor Reimus (1996, 1999) listed *S. graminea* for the park. There is a single specimen at FNPS collected by Frank Craighead (s.n.) in 1959 which has was originally recorded as "*Sagittaria subulata* or *Chapmanii*" and a report of *S. graminea* from then Chekika State Recreation Area by Roger Hammer (1992a). *Sagittaria subulata* is not known from South Florida. *Sagittaria graminea* var. *graminea* and *S. graminea* var. *chapmanii* are both known from South Florida and either could be present. The Craighead specimen is problematic and remains undetermined. A specimen of *S. graminea* var. *chapmanii* attributed to the Monroe County mainland by the Atlas of Florida Vascular Plants (Lakela and Almeda 30500, USF collected December 21, 1966) is labelled "Loop Road (Jct. #94). Canal banks along cypress and pineland." It seems most likely this specimen was collected near the western junction of Loop Road with the Tamiami Trial (US 41), which is now in Collier County, and not the eastern boundary, which could be in EVER. At least two other specimens of *S. graminea* var. *chapmanii* have been collected in that immediate area (Tomlinson 25-I-64A FTG; B. Hansen, email comm. 2014). For now, IRC treats *S. graminea* var. *graminea* as assumed present in the park based on the Hammer Chekika report (Gann *et al.* 2014a), but more work is needed.

Dicot Forbs (excluding epiphytes)

There are 271 dicot forbs in ENP[158], of which 141 are common in South Florida. The remaining 130 taxa are rare, imperiled or critically imperiled in South Florida. Eleven dicot forbs are SOMCs, all extant in both South Florida and EVER[159]. Seven of these SOMCs are found in the Long Pine Key area, of which six are found there exclusively: *Argythamnia blodgettii*, *Astraea lobata*, *Chamaesyce deltoidea* ssp. *pinetorum*, *Desmodium lineatum*, *Eupatorium compositifolium* and *Helenium flexuosum*. The SOMC *Chamaesyce garberi* is found both in the Long Pine Key area and along the coast in the Cape Sable region. Excluding obvious weeds, 87 native taxa have been documented primarily or exclusively in the Long Pine Key area (Table 5). Of these, 60 are regionally rare. Several of these may be more widespread but need additional documentation. One species, *Persicaria setacea*[160], was collected once near Royal Palm Hammock by John Kunkel Small and colleagues in 1915 (6642 NY), but hasn't been recorded in the park since (Gann *et al.* 2002, Gann *et al.* 2014a). *Nymphaea elegans* was collected once in the same area by Frank Craighead in 1959 (s.n. FNPS) and its presence in the park needs verification. Other dicot forbs from the Long Pine Key area that may be very rare in the park include *Ageratina jucunda*[161], *Asclepias verticillata*[162] and *Desmodium marilandicum*[163].

Table 5. Native dicot forbs limited or possibly limited to the Long Pine Key area of EVER.

Scientific Name	IRC South Florida Rank
Acalypha chamaedrifolia[164]	Apparently Secure
Ageratina jucunda	Rare
Ammannia coccinea	Rare
Angadenia berteroi	Apparently Secure
Argythamnia blodgettii	Rare
Asclepias lanceolata	Rare
Asclepias longifolia	Rare
Asclepias tuberosa	Rare
Asclepias verticillata	Rare
Astraea lobatus	Critically Imperiled
Ayenia euphrasiifolia	Apparently Secure
Cabomba caroliniana	Rare
Chamaesyce conferta[165]	Rare

[158] This excludes unverified reports and apparent false records. The genus *Agalinis* has undergone numerous taxonomic revisions over time and needs review in EVER. Plants currently determined as *A. fasciculata* by IRC (Gann *et al.* 2014a) apparently represent three distinct taxa as they are now recognized by the Atlas of Florida Vascular Plants (Wunderlin and Hansen 2014) and ITIS: *A. fasciculata*, *A. harperi* and *A. purpurea.*

[159] *Persicaria setacea* and *Salvia misella* were ranked as critically imperiled in South Florida in 2002, but were down-ranked to imperiled by IRC in 2014 based on additional data compiled in preparation for this report.

[160] This and other *Polygonum* species are placed into the genus *Persicaria* in ITIS, but IRC and the Atlas of Florida Vascular Plants retain the genus *Polygonum.*

[161] *Ageratina jucunda* – First documented in EVER by Rick and Jean Seavey in 1989 near Bequaert Hammock (509 FNPS).

[162] *Asclepias verticillata* – Collected once at Pitcher Pump Prairie by George Avery and Lloyd Loope in 1977 (1888 FNPS).

[163] *Desmodium marilandicum* – This is associated with the SOMC *D. lineatum*, see below.

[164] *Acalypha chamaedrifolia* – There is also an outlier collection from a pile of limestone rubble along Buttonwood Canal (Seavey and Seavey 1115 FNPS).

Chamaesyce deltoidea ssp. *pinetorum*	Rare
Chamaesyce pergamena	Rare
Chamaesyce porteriana	Rare
Chaptalia albicans	Rare
Cirsium horridulum	Secure
Clematis baldwinii	Rare
Cnidoscolus stimulosus	Secure
Corchorus hirtus	Imperiled
Coreopsis leavenworthii	Secure
Crotalaria pumila	Secure
Desmodium lineatum	Imperiled
Desmodium marilandicum	Imperiled
Dyschoriste angusta	Secure
Elytraria caroliniensis var. *angustifolia*	Rare
Eupatorium compositifolium	Critically Imperiled
Eupatorium mikanioides	Apparently Secure
Evolvulus sericeus	Secure
Galactia pinetorum	Imperiled
Galium tinctorium	Rare
Glandularia maritima	Imperiled
Gratiola ramosa	Rare
Helenium flexuosum	Critically Imperiled
Heliotropium polyphyllum	Secure
Hibiscus poeppigii	Imperiled
Hieracium megacephalon	Apparently Secure
Indigofera miniata var. *florida*	Rare
Jacquemontia curtisii	Rare
Liatris gracilis	Apparently Secure
Liatris spicata	Rare
Liatris tenuifolia	Rare
Ludwigia erecta	Imperiled
Lythrum alatum var. *lanceolatum*	Apparently Secure
Mecardonia acuminata ssp. *peninsularis*	Secure
Mecardonia procumbens	Rare
Melanthera angustifolia	Rare
Melanthera parvifolia	Apparently Secure
Mitreola sessilifolia	Rare
Nymphaea elegans	Imperiled
Ocimum campechianum	Imperiled
Oldenlandia uniflora	Rare
Pentodon pentandrus	Imperiled
Persicaria densiflora	Rare
Persicaria setacea	Imperiled
Phyllanthus pentaphyllus var. *floridanus*	Apparently Secure
Physalis angustifolia	Imperiled
Pityopsis graminifolia	Secure
Poinsettia pinetorum	Rare
Polygala boykinii	Rare

[165] *Chamaesyce conferta* – There is also an outlier collection from 2.7 miles south of Nine Mile Pond along the Main Park Road (Reimus 1108 FNPS).

Polygala incarnata	Rare
Pterocaulon pycnostachyum	Secure
Ptilimnium capillaceum	Rare
Rhynchosia cinerea	Rare
Rhynchosia reniformis	Rare
Rorippa teres	Imperiled
Ruellia succulenta	Secure
Sabatia grandiflora	Rare
Sabatia stellaris	Apparently Secure
Sachsia polycephala	Rare
Scutellaria havanensis	Rare
Solidago leavenworthii	Apparently Secure
Solidago odora var. *chapmanii*	Secure
Spermacoce neoterminalis	Apparently Secure
Spermacoce tetraquetra	Rare
Stenandrium dulce	Rare
Stenaria nigricans var. *floridana*	Rare
Stillingia sylvatica	Secure
Stylosanthes calcicola	Imperiled
Symphyotrichum adnatum	Apparently Secure
Tephrosia florida	Rare
Tragia saxicola	Rare
Utricularia subulata	Rare
Verbena scabra	Rare
Vernonia blodgettii	Apparently Secure
Voyria parasitica	Rare

Four SOMCs are limited in their distribution in EVER to coastal areas from the Flamingo area to the northwestern corner of the park: *Chromolaena frustrata, Kosteletzkya depressa, Physalis cordata* and *Tephrosia corallicola*. In total, 40 dicot forbs are apparently limited to coastal areas in the park (Table 6), of which 22 are regionally rare. Many of these are very rare or perhaps extirpated in the park and work is needed on several to confirm their current presence or absence in the park. *Acalypha ostryifolia* has only been collected along the Snake Bight Trail by Craighead in 1961 (s.n. FNPS) and along the Coastal Prairie Trail by EVER Botanist Jimi Sadle in 2007 (524 FNPS). *Ambrosia hispida* was only reported by Richard Reimus in his 1999 checklist. *Eryngium yuccifolium* and *Eupatorium mohrii*, two species associated with freshwater wetlands and pine flatwoods, have only been recorded for the Turner River area (Atwater s.n. FNPS, Craighead s.n. FNPS), and may now be extirpated in the park[166]. *Euphorbia trichotoma* was collected by Craighead in 1956 at the Lostmans River Ranger Station (s.n. FNPS) and possibly in that same period by William G. Atwater (see note on Craighead specimen)[167]. *Limonium carolinianum* was collected by Craighead on Whipray Key in 1955 (s.n. FNPS; the only plant seen was collected) and was reported for Turner River Mound by Joan Borel in 1996, near an area where it was collected by IRC biologists in BICY (J. Sadle, email comm. 2014). *Priva lappulacea* is known only from the Key Largo Ranger Station, where it was documented

[166] It is also possible that these flatwoods species vouchered by Frank Craighead along the Turner River were actually collected along what is now the BICY portion of the river; no suitable habitat is known to exist for this species in that region of EVER (J. Sadle, email comm. 2014). It is also possible that these taxa have already succumbed to sea level rise. A review of historical aerial photography may shed some light.

[167] *Euphorbia trichotoma* – EVER Botanist Jimi Sadle (email comm. 2014) reported seeing this at Indian Key along the western shoreline of the park, but did not record a date or make a specimen.

by Richard Reimus in 1997 (1202 FNPS). It was not observed during a 2013 field survey by Sadle, the author and colleagues. *Okenia hypogaea* was reported for EVER by Avery & Loope (1980b, 1983) and Reimus (1996, 1999), but has not been recently observed (J. Sadle, email comm. 2014). *Pilea herniarioides* was collected a single time in Coot Bay Hammock by John Kunkel Small and colleagues in 1921 (10328 NY). And finally, *Solidago fistulosa* has been collected once in 2005 between the Broad and Wood rivers by then-IRC biologists Steven Woodmansee and Jimi Sadle (1683 FNPS).

Thirty-five regionally rare dicot forbs are found in more than one region of EVER (Table 7), some in both coastal and inland areas but others are found only in the interior in widespread areas. One of these is the SOMC and federally listed *Chamaesyce garberi*.

Four rare forbs have very limited or uncertain distributions in the interior of EVER. *Arnoglossum ovatum* was collected once by Frank Craighead at the "Concrete Bridge" (s.n. USF), which may refer to a bridge at the western end of the Old Ingraham Highway near the point where it intersects the current Main Park Road (Stewart *et al.* 2002); there is also a sight record by the author and IRC biologist Keith Bradley on Long Pine Key in 2001 (IRC unpublished data) but this has not been corroborated. *Asclepias incarnata* was collected once in 1978 seven miles south of the Tamiami Trail on the eastern boundary of the park (Avery, Loope and Taylor 1942 FNPS). *Bidens laevis* is known from the Chekika Hammock area and L-67 Canal area along the eastern border of the park (Avery 2089 FTG; J. Sadle, email comm. 2014). *Symphyotrichum concolor* was collected once at "East Boundary" by William G. Atwater in December, 1958 (FNPS). All four of these species are in need of additional documentation.

In 2015, IRC intends to re-assess the South Florida ranks of *Ipomoea tenuissima* and *Stylosanthes calcicola* using the 2012 NatureServe criteria as they may qualify as critically imperiled in South Florida and thus as SOMCs in EVER. FNAI ranks *Ipomoea tenuissima* as critically imperiled in Florida and *Stylosanthes calcicola* as imperiled, but *S. calcicola* is only protected in Everglades National Park and in conservation areas in the lower Florida Keys (Gann *et al.* 2014a).

Table 6. Native dicot forbs limited or possibly limited to coastal areas in EVER.

Scientific Name	**IRC South Florida Status**
Acalypha ostryifolia	Rare
Agalinis maritima	Rare
Alternanthera flavescens	Secure
Ambrosia hispida	Rare
Atriplex pentandra	Apparently Secure
Blutaparon vermiculare	Secure
Cakile lanceolata	Rare
Capsicum annuum var. *glabriusculum*	Rare
Celosia nitida	Rare
Chamaesyce mesembrianthemifolia	Secure
Chromolaena frustrata	Critically Imperiled
Crotalaria rotundifolia	Secure
Croton glandulosus	Secure
Dicliptera sexangularis	Apparently Secure
Eryngium yuccifolium	Rare
Eupatorium mohrii	Rare

Euphorbia trichotoma	Imperiled
Heliotropium angiospermum	Secure
Heliotropium curassavicum	Secure
Herissantia crispa	Secure
Iresine diffusa	Secure
Kosteletzkya depressa	Critically Imperiled
Limonium carolinianum	Apparently Secure
Melanthera nivea	Apparently Secure
Mentzelia floridana	Rare
Okenia hypogaea	Imperiled
Physalis cordata	Critically Imperiled
Pilea herniarioides	Imperiled
Portulaca pilosa	Apparently Secure
Priva lappulacea	Rare
Salicornia bigelovii	Rare
Salicornia perennis	Secure
Sesuvium maritimum	Imperiled
Sesuvium portulacastrum	Secure
Sida ulmifolia	Imperiled
Solidago fistulosa	Rare
Suaeda linearis	Secure
Tephrosia corallicola	Critically Imperiled
Trianthema portulacastrum	Imperiled
Trichostema dichotomum	Secure

Table 7. Regionally rare native dicot forbs found in more than one geographic area within EVER.

Scientific Name	**IRC South Florida Status**
Acmella oppositifolia var. *repens*	Rare
Aeschynomene pratensis	Imperiled
Agalinis linifolia	Rare
Amaranthus australis	Rare
Ammannia latifolia	Rare
Caperonia castaneifolia	Rare
Ceratophyllum demersum	Imperiled
Chamaesyce garberi	Imperiled
Helenium pinnatifidum	Rare
Hydrolea corymbosa	Rare
Iva microcephala	Rare
Justicia angusta	Rare
Linum carteri var. *smallii*	Imperiled
Linum medium var. *texanum*	Rare
Ludwigia alata	Rare
Ludwigia curtissii	Rare
Lythrum lineare	Imperiled
Packera glabella	Rare
Phlya stoechadifolia	Rare
Physalis pubescens	Rare
Pinguicula pumila	Rare
Polygala balduinii	Rare
Portulaca rubricaulis	Rare
Salvia misella	Imperiled
Salvia occidentalis	Rare
Samolus valerandi ssp. *parviflorus*	Rare
Saururus cernuus	Rare

Sesbania vesicaria	Imperiled
Spermacoce prostrata	Rare
Spigelia anthelmia	Rare
Utricularia cornuta	Rare
Utricularia gibba	Rare
Utricularia purpurea	Rare
Utricularia radiata	Imperiled
Utricularia resupinata	Imperiled

Argythamnia blodgettii (Torr.) Chapm. – Blodgett's Wild Mercury, Blodgett's Silverbush

Federal Status	State Status	IRC SF Status	EVER Population
Candidate	Endangered	Rare	ca. 2,000 plants

Figure 92. *Argythamnia blodgettii*. Image by Keith Bradley, 2005.

Figure 93. *A. blodgettii* in Monroe County. Image by Craig van der Heiden, 2013.

Background

Blodgett's wild mercury is a semi-woody perennial terrestrial herb in the Euphorbiaceae. It is endemic to South Florida in Miami-Dade County and Monroe County in the Florida Keys. Its historical range ran from Brickell Hammock, just south of modern-day downtown Miami, into Long Pine Key on the mainland, and Totten Key in the northern Florida Keys (now in BISC) south to Key West (Bradley and Gann 1999). It is still present throughout most of its historical range, but has apparently been extirpated north of the Deering Estate at Cutler on the mainland, in Biscayne National Park and on the island of Key West (Hodges and Bradley 2006, Gann *et al.*

2014a). It is currently known from about 20 conservation areas (Gann *et al.* 2014a) and a number of private sites in the Florida Keys (Hodges and Bradley 2006). Blodgett's wild mercury grows in pine rocklands, along the edges of tropical hardwood hammocks and occasionally in hardwood hammock gaps. Mortellaro *et al.* (2012) ranked it as having a high affinity to high quality natural areas. Wunderlin & Hansen (2011) reported it to be fertile throughout the year, which matches known collections. No reports of pollinators for Blodgett's wild mercury are known. The U.S. Fish and Wildlife Service (2013a) maintains a Species Assessment and Listing Priority Assignment Form for this candidate taxon which includes significant additional information.

Conservation Status

Argythamnia blodgettii has not been assessed for the IUCN Red List and is not an accepted name in the Catalogue of Life or ITIS – this name has been placed into synonymy under *Ditaxis argothamnoides* (see Taxonomic Notes below). NatureServe ranks it as imperiled globally and in the United States. It is a candidate for listing under the Endangered Species Act (petitioned 2004) and is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as imperiled for Florida. IRC ranks it as rare in South Florida[168]. Loope & Avery (1979) ranked Blodgett's wild mercury as a species of highest concern in National Park Service Areas in South Florida, with a small known population on Long Pine Key in EVER.

Taxonomic Notes

The Catalogue of Life and ITIS place the name *Argythamnia blodgettii* into synonymy under *Ditaxis argothamnoides*, a species otherwise known only from northern South America. The Atlas of Florida Vascular Plants (Wunderlin & Hansen 2013) accepts the placement of *A. blodgettii* into a wider ranging taxon, but use *Argythamnia argothamnoides*. The Flora of the West Indies (Acevedo-Rodríguez and Strong 2012) is silent on this issue as no West Indian taxa have been merged into this entity. On this matter IRC chooses to be conservative and maintain *A. blodgettii* as a separate taxonomic unit for conservation purposes.

History in EVER

Blodgett's wild mercury is known from EVER only from Long Pine Key, where it was first collected in 1909 by John Kunkel Small and his son George (Small and Small 3173 NY). Frank Craighead made collections east of Turkey Hammock in Pine Block B in 1959 (s.n. FNPS) and north of Deer Hammock in Pine Block A in 1963 (s.n. FTG). Rick and Jean Seavey (525 FNPS) and Richard Reimus (1062 FNPS) also made collections in Pine Block A in the 1990s. In 2008 surveys by EVER Botanist Jimi Sadle, plants were found in approximately 150 acres of pine rockland extending from southwest of Deer Hammock in Pine Block A into adjacent Pine Block B immediately to the north (EVER unpublished data). The total population in this area, which includes the Deer Hammock plants, is estimated to be approximately 1,000 individuals. Twenty plants were also found in 2008 by Sadle and Jim Brack east of Turkey Hammock (J. Sadle in

[168] Using IRC's 2002 criteria, taxa with more than 3,000 individuals were ranked as imperiled and those with more than 10,000 individuals were ranked as rare regardless of their geographic range. *Argythamnia blodgettii* was ranked as imperiled in 2002 based on an estimate of 1,001-10,000 individuals (Bradley & Gann 1999), but was down-ranked to rare following Hodges & Bradley's (2006) estimate of more than 10,000 plants in the Florida Keys alone. In 2015, IRC intends to reevaluate *A. blodgettii* using updated NatureServe methods.

U.S. Fish and Wildlife Service 2013a, EVER unpublished data). This is presumably the same station documented by Craighead in 1959 and is located approximately 1.5 km from the Deer Hammock station. In December 2013, Sadle and EVER biologist Jonathan Taylor discovered a third occurrence of Blodgett's wild mercury in Pine Block E, approximately 100 m south of Main Park Road (J. Sadle, email comm. 2014). This occurrence was revisited by Sadle in 2014 in an effort to estimate the population boundaries and size. During this effort, 231 plants were counted and 23 GPS coordinates were recorded. The total population in EVER is estimated at 2,000 plants (J. Sadle, email comm. 2014). Plants are primarily found in pine rocklands with some plants along the edges of tropical hardwood hammocks. Flowering, seed production and juvenile plants have all been observed in the population around Deer Hammock. In 2007, 402 seeds from 84 maternal lines were collected in EVER by Fairchild Tropical Botanic Garden and sent to the National Center for Genetic Resources Preservation for storage (Goodman *et al.* 2007). Although Blodgett's wild mercury was not included as a target species in IRC's 2003-2008 Long Pine Key rare plant study (Gann *et al.* 2009), it was recorded in one plot in Pine Block A where *Spiranthes torta* (see Terrestrial Orchids above) was the target species (IRC and EVER unpublished data).

Discussion

Excluding major environmental change such as long-term sea level rise, the metapopulation of Blodgett's wild mercury within EVER appears rare but stable. The two historical stations appear to be stable based on collection records. The third was likely present as well, but overlooked by previous workers. No specific threats to any of the occurrences have been noted (J. Sadle, email comm. 2014). However, the establishment of a set of long-term monitoring plots is needed since the total population is small and localized and this is a candidate for federal listing.

Summary of Recommendations

- Establish a systematic monitoring program to more accurately estimate population size and monitor metapopulation health.

Astraea lobata (L.) Klotzsch – Lobed Croton

Federal Status	**State Status**	**IRC SF Status**	**EVER Population**
NA	NA	Critically Imperiled	101-1,000
Synonyms: *Croton lobatus* L.			

Background

Lobed croton is an annual or short-lived terrestrial herb in the Euphorbiaceae. It is a primarily tropical species at the northern end of its range in peninsular Florida, also occurring in the West Indies, Mexico, Central America and South America, where it appears to be most common. It is often weedy and may be naturalized in central Florida and the northern Bahamas (see Correll and Correll 1982, Wunderlin and Hansen 2014[169]). In South Florida it is known only from Miami-

[169] The Atlas of Florida Vascular Plants (Wunderlin and Hansen 2014) treats *A. lobatus* as not native in Florida, but Wunderlin and Hansen (2011) treated it as native. USDA PLANTS treats it as native in the continental United States while ITIS treats it as introduced, presumably based on the work of the Flora of North America Expertise Network. NatureServe treats it as native to Florida. In South Florida, it has been found at a number of sites associated with tropical hardwood hammock edges and pine rocklands along the Miami Rock Ridge since 1962 (see Gann *et al.* 2002). This, together with its wide range in the West Indies and its ephemeral but non-weedy nature in South

Figure 94. *Astraea lobata* at privately-owned Pine Ridge Sanctuary. Image by Craig van der Heiden, 2014.

Dade County, where it was first collected by Frank Craighead on the margins of Fuchs Hammock in 1962 (Gann *et al.* 2002). In Miami-Dade County there are approximately five small populations in forest fragments and one in EVER (Gann *et al.* 2002, Gann *et al.* 2014a). It has been recorded mostly along the edges of tropical hardwood hammocks and in hammock gaps, but also in pine rocklands well away from hardwood hammock edges (e.g., at Pine Ridge Sanctuary). Although it has been recorded in disturbed areas in South Florida, all of these sites are associated with disturbed tropical hardwood hammock edges. Mortellaro *et al.* (2012) ranked it as having a very high affinity to high quality natural areas. Elsewhere in its range it grows in a wide variety of disturbed and undisturbed ecosystems from near sea level to more than 1500 m elevation. Wunderlin & Hansen (2011) reported it to be fertile in the summer. Fertile specimens have been collected in EVER in August and September, and specimens have been collected outside of the park from March to September.

Conservation Status

Astraea lobata has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as apparently secure globally (rounded), but as critically imperiled in the United States. It is a not listed under the Endangered Species Act or by the State of Florida. The Florida Natural Areas Inventory as critically imperiled for Florida, as does IRC for South Florida.

History in EVER

Lobed croton was discovered in Everglades National Park by Alan Herndon in 1988 (Gann *et al.* 2002). He found and vouchered plants in pine rockland near the edge of Mosier Hammock on Long Pine Key in September, about seven weeks following a prescribed fire (Herndon 2249 FNPS). An IRC survey relocated this population in 2005 (Gann *et al.* 2005). A massive germination of seedlings was recorded by IRC biologists Stephen Hodges and Emilie Verdon Grahl in August, 5-6 weeks following a prescribed fire (IRC and EVER unpublished data). Recruitment was estimated to be in the hundreds of plants (Hodges 118 FNPS). Other surveys were conducted by IRC and EVER in October 2006, September 2007 and November 2013 but no

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Florida (including at the Mosier Hammock site in EVER) have led the author and IRC to treat this as native to South Florida and critically imperiled in the region.

plants were found (IRC and EVER unpublished data). However, none of these surveys were conducted within a year of fire. In South Florida, lobed croton is extremely ephemeral, appearing mainly after disturbance events including fire, and although plants have not been recently seen, it is still considered extant in the park (Gann *et al.* 2014a). Although fire suppression is a theoretical threat, lobed croton appears to be able to persist for long periods of time in the seed bank[170]. Due to the proximity of this population to high density human site use (including GIS-based off-trail games), a more likely threat is direct human disturbance following a massive post-fire germination, reducing or eliminating the next round of seed production and dispersal.

Discussion

All indications are that lobed croton is very rare native component of the EVER flora. The population at Mosier Hammock could be the only one present, or there could be other populations as yet undetected. Two observations from the same locality, both 1-2 months following fire, indicate long-term stability of the Mosier Hammock population. The long-term monitoring plot established by IRC during the 2003-2008 study provides an excellent baseline for monitoring this species in EVER. However, this species cannot be monitored on a regular schedule. Instead, monitoring must take place following the next fire to affect the known population (prescribed or wild). While it in not known how long individuals persisted following the 1988 or 2005 fire events, lobed croton was collected about five months after a prescribed fire at the nearest known location outside of EVER, privately-owned Pine Ridge Sanctuary (Seavey and Seavey 487 FNPS, 608 FNPS)[171]. This station is about 16 km northeast of Mosier Hammock where lobed croton grows both on road edges and in well-managed pine rockland. Future surveys in the Long Pine Key area of EVER can be conducted both following fire events and along the edges of tropical hardwood hammocks following tropical cyclone events.

Summary of Recommendations

- Continue surveys for lobed croton in the Long Pine Key area 1-2 months following fire and after tropical cyclone events. Record new GIS coordinates and census newly discovered stations.
- Revisit the Mosier Hammock site 1-2 weeks following fire and establish a monitoring protocol designed to capture population dynamics of a short-lived ephemeral species.
- Survey the edges of Mosier Hammock following tropical cyclone events to determine if the population also exists in the tropical hardwood hammock community.
- Collect seeds the next time plants are observed and deposit at the National Center for Genetic Resources Preservation for long-term storage.
- Determine how long seeds are viable in an effort to make inferences about life history and fire return intervals suitable for long term survival.

[170] For instance, there is a 14 years gap in fire history at the Mosier Hammock site, between 1955 and 1969 (EVER unpublished fire data).

[171] The address of this station on the Seavey and Seavey 608 label is mixed up – it states S.W. 212 Street and 296 Avenue. It should say S.W. 296 Street and 212 Avenue. More accurately, this location is the privately-owned Pine Ridge Sanctuary.

Chamaesyce deltoidea (Engelm. ex Chapm.) Small ssp. ***pinetorum*** (Small) A. Herndon – Pineland Sandmat

Federal Status	**State Status**	**IRC SF Status**	**EVER Population**
Candidate	Endangered	Rare	10,001-100,000
Synonyms: *Chamaesyce pinetorum* Small, *Euphorbia smallii* Oudejans, *Euphorbia deltoidea* ssp. *pinetorum* (Small) Oudejans			

Figure 95. *Chamaesyce deltoidea* ssp. *pinetorum* on Long Pine Key, EVER, 2012.

Background

Pineland sandmat is a perennial terrestrial herb in the Euphorbiaceae. It is endemic to South Florida in Miami-Dade County. It is known only from the southern end of the Miami-Rock Ridge, from the vicinity of Homestead into Long Pine Key in EVER (Bradley and Gann 1999, US Fish and Wildlife Service 2013). Although limited in range, it is estimated that there are tens of thousands of plants present within the extant populations (US Fish and Wildlife Service 2013). Outside of the park it is restricted to a number of small pine rockland fragments, including at least nine conservation areas (US Fish and Wildlife Service 2013b, Gann *et al.* 2014). It grows in soil pockets and soil-filled crevices in the limestone bedrock of pine rocklands. Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas. Wunderlin & Hansen (2011) reported it to be fertile from spring through fall, but Wendelberger & Maschinski (2006) reported it to bear fruit all year. Herndon studied the life history and population trends of pineland sandmat at sites in EVER (1998) and a site in the Florida City area (2002). In his study populations 60-88% of plants survived more than three years, showing that it is a somewhat long-lived taxon. He also hypothesized that some of those recorded as having died may have instead been in a cryptic phase. The reproductive systems of *Chamaesyce* species

have been poorly studied but they are known to be highly variable (Ehrenfeld 1976 and 1979, Webster 1967). Some species are completely reliant on insects for pollination and seed production while others are self-pollinating. Pollinators may include bees, flies, ants, and wasps (Ehrenfeld 1979). Seed capsules of many members of the Euphorbiaceae are explosively dehiscent, ejecting seeds a short distance from the parent plant. The seeds of some species are dispersed by ants (Pemberton 1988). The U.S. Fish and Wildlife Service (2013b) maintains a Species Assessment and Listing Priority Assignment Form for this candidate taxon which includes significant additional information. The latest form was completed March 26, 2013. In addition, while *C. deltoidea* ssp. *pinetorum* has not been well-studied, there is a larger body of literature on the closely related federally listed *C. deltoidea* ssp. *deltoidea*.

Taxonomic Notes

Most modern authors place the genus *Chamaesyce* into the genus *Euphorbia sensu lato* (Yang and Berry 2011), while USDA PLANTS, NatureServe, the Atlas of Florida Vascular Plants (Wunderlin and Hansen 2014) and IRC retain the segregate genus *Chamaesyce* as a distinct unit in the flora of North America. If placed into *Euphorbia*, the correct name of pineland sandmat is *Euphorbia deltoidea* ssp. *pinetorum* (Small) Oudejans, which is the name accepted by ITIS.

Conservation Status

Chamaesyce deltoidea ssp. *pinetorum* has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as critically imperiled globally and in the United States. It is a candidate for listing under the Endangered Species Act (petitioned 2004)[172] and is listed as endangered by the State of Florida (as *C. deltoidea*)[173]. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida. IRC ranks it as rare in South Florida[174].

History in EVER

Pineland sandmat was first vouchered within what is now known to be EVER by John Kunkel Small and Joel J. Carter, who collected it on Long Pine Key in 1909 (2930 NY based on IRC unpublished data)[175]. It has been observed and collected repeatedly since that time, especially in Pine Blocks H and J. Other observations prior to 2003 were made from "western" Long Pine Key and the Boy Scouts of America pineland south of Research Road. Although pineland sandmat was not included as a target species in IRC's 2003-2008 Long Pine Key rare plant study (Gann *et al.* 2009), it was recorded in 14 long-term monitoring plots located in pine blocks A, B, E, H, I and J. It was associated with six target rare plant species, all covered elsewhere in this report: two shrubs (*Bourreria cassinifolia*, *Hypelate trifoliata*), three terrestrial orchids (*Basiphyllaea corallicola*, *Ponthieva brittoniae*, *Spiranthes torta*) and a dicot forb (*Desmodium lineatum*) (IRC and EVER unpublished data). In 2010, a disjunct occurrence was observed in pine block West of A by EVER Botanist Jimi Sadle and IRC biologist Sonali Saha, and

[172] The closely related taxon *C. deltoidea* ssp. *deltoidea* (including ssp. *adhaerens*) from farther north in Miami-Dade County is listed as endangered under the Endangered Species Act. The closely related taxon C. *deltoidea* ssp. *serpyllum* from the Florida Keys is also a candidate for federal listing.

[173] The State of Florida does not list infraspecific taxa.

[174] Using IRC's 2002 criteria, taxa with more than 3,000 individuals were ranked as imperiled and those with more than 10,000 individuals were ranked as rare regardless of their geographic range. In 2015, IRC intends to reevaluate *Chamaesyce deltoidea* ssp. *pinetorum* using updated NatureServe methods.

[175] There is an earlier specimen collected between Long Prairie and Camp Longview by Small and Carter in 1906 (2527 NY), but this was probably collected outside of modern park boundaries.

observations of pineland sandmat were also recorded by Sadle and EVER biologist Jonathan Taylor at a variety of locations within pine block F in 2013 and 2014 (EVER unpublished data). It has not been documented in the wetter pinelands north of Main Park Road (see Discussion below) and all observations of this species suggest that pineland sandmat is restricted to higher pine rockland habitat that does not annually flood. While no systematic survey has ever been conducted to determine the population size or distribution of this species within EVER, earlier reports (including label data) described pineland sandmat as being common on Long Pine Key. Recent occurrence data indicates a widespread distribution in Long Pine Key, with approximately 14 km between the two most distant observations. Bradley & Gann (1999) estimated the total population in the park at 10,000-100,000 plants, likely the vast majority of the global population. In 2007, 630 seeds from 117 maternal lines were collected in EVER by Fairchild Tropical Botanic Garden and sent to the National Center for Genetic Resources Preservation for storage (Goodman *et al.* 2007).

Discussion

Excluding major environmental change such as long-term sea level rise, pineland sandmat appears stable and healthy within the borders of EVER. While hydrologic change associated with the Everglades Restoration has been discussed as a potential threat (e.g., Bradley and Gann 1999, U.S. Fish and Wildlife Service 2013), the entire known metapopulation in EVER is located south of Main Park Road and away from potential impoundment effects such as those described by Gann *et al.* (2009). That said, the establishment of a set of long-term monitoring plots for pineland sandmat would be prudent, especially since the majority of the global population is probably contained within EVER.

Summary of Recommendations

- Establish a systematic sampling program throughout Long Pine Key to estimate population size and monitor metapopulation health. As suggested by Herndon (1998, 2002) surveys and counts 2-3 months post-fire may allow for more accurate censuses.

Chamaesyce garberi (Engelm. ex Chapm.) Small – Garber's Spurge, Garber's Sandmat

Federal Status	State Status	IRC SF Status	EVER Population
Threatened	Endangered	Rare	2,000,000-3,000,000
Synonyms: *Euphorbia garberi* Engelm. ex Chapm.			

Background

Garber's spurge is a perennial terrestrial herb in the Euphorbiaceae. It is endemic to South Florida in Miami-Dade, Monroe and Collier counties. IRC conducted a range-wide status survey from 2006-2007 funded by the U.S. Fish and Wildlife Service (Green *et al.* 2008). Populations were found mainly in the lower Florida Keys and in EVER, both in Miami-Dade County and in the Monroe County mainland. In Miami-Dade County, Garber's spurge is known only from EVER and one other small population in Miami-Dade County at the Deering Estate at Cutler. No plants were found extant in Collier County and numerous occurrences from nearly throughout the historical range are presumed or possibly extirpated. Garber's spurge grows on

Figure 96. *Chamaesyce garberi*, images by Keith Bradley, 2005.

dunes and in coastal grasslands[176], in pine rocklands, in Keys cactus barrens[177] and in disturbed uplands. Mortellaro *et al.* (2012) ranked it as having a very high affinity to high quality natural areas. The vast majority of plants known are in EVER in two widely separated localities (see below). Wunderlin & Hansen (2011) reported it to flower from spring through fall. The reproductive ecology of *Chamaesyce* species has been poorly studied but is known to be highly variable (Ehrenfeld 1976 and 1979, Webster 1967). Some species are completely reliant on insects for pollination and seed production while others are self-pollinating. Pollinators may include bees, flies, ants, and wasps (Ehrenfeld 1979). Seed capsules of many members of the Euphorbiaceae are explosively dehiscent, ejecting seeds a short distance from the parent plant. The seeds of some species are dispersed by ants (Pemberton 1988). Herndon (1998) carried out a short-term demographic study of Garber's spurge on Long Pine Key in EVER and concluded that the species was short-lived, with a lifespan no greater than five years. Additional information is available through the USFWS Species Profile and Federal Register documents.

Taxonomic Notes

Most modern authors place the genus *Chamaesyce* into the genus *Euphorbia sensu lato* (Yang and Berry 2011), while USDA PLANTS, NatureServe, the Atlas of Florida Vascular Plants

[176] Coastal grasslands is not a vegetation type recognized by Rutchey *et al.* (2006), but is recognized by FNAI and IRC.

[177] This habitat is found in the Florida Keys and is not covered by Rutchey *et al.* (2006). It is recognized by FNAI. IRC refers to this community as coastal rock barren.

(Wunderlin and Hansen 2014) and IRC retain the segregate genus *Chamaesyce* as a distinct unit in the flora of North America. If placed into *Euphorbia*, the correct name of pineland sandmat is *Euphorbia garberi* Engelm. ex Chapm., which is the name accepted by ITIS.

Conservation Status

Chamaesyce garberi has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as critically imperiled globally and in the United States. It is listed as threatened under the Endangered Species Act (1985) and as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida. IRC ranks it as rare in South Florida using updated NatureServe methods.

History in EVER

Garber's spurge is known from two disjunct and completely different habitats in EVER. Abraham P. Garber first collected Garber's spurge at Cape Sable in 1878 (Burch 1965). Allen H. Curtiss made an additional collection on Cape Sable sometime prior to his death in 1907 (Curtiss 3630 GH). This was followed by many specimens collected by John K. Small and others on Middle and East Cape Sable beginning in 1916 and on Northwest Cape Sable by Derek Burch and others beginning in 1964 (Green *et al.* 2008). In the interior of the park, Garber's spurge was first collected by Frank Craighead in 1956 on Long Pine Key without specific locality data (Green *et al.* 2008). Subsequent collections have been made in Pine Blocks A, B and C, Pine Block C being first vouchered by park botanist Hillary Cooley in 2007 (Green *et al.* 2008). On Cape Sable, Garber's spurge grows on beach dunes and in coastal grasslands, while on Long Pine Key it grows in pine rocklands and along the edges of fire roads. During the 2006-2007 IRC status surveys, Garber's spurge was found at all historical locations except for East Cape Sable, which had last been vouched in 2005 (Seavey & Seavey 1144 FNPS). Populations of Garber's spurge in EVER were estimated by Green *et al.* to be substantial, with approximately 1,000,000 plants on Cape Sable, the vast majority on Northwest Cape, and more than 1,000,000 on Long Pine Key in two distinct areas separated by about 1,000 m – Pine Block A with a few hundred plants and pine blocks B & C with more than 1,000,000 individuals. Both of these larger estimates were made using statistical sampling methods. In 2013, EVER Botanist Jimi Sadle (email comm. 2014) mapped a small population of Garber's spurge on East Cape Sable, but it is unknown if this is the same location as was documented in 2005. About 200 plants were observed. In 2007, 4240 seeds from 369 maternal lines were collected in EVER by Fairchild Tropical Botanic Garden and sent to the National Center for Genetic Resources Preservation for storage (Goodman *et al.* 2007). Both Cape Sable and Long Pine Key populations were sampled.

Discussion

Garber's spurge, like several species studied during IRC's 2003-2008 rare plant study on Long Pine Key, demonstrates how intensive surveying and sampling of a rare plant taxon can completely change our understanding. Prior to IRC's 2006-2007 study of *Chamaesyce garberi* throughout South Florida, the species was known from EVER from fewer than two dozen collections spread over four widely disjunct areas over 100 years of collecting history (IRC and EVER unpublished data). While it is far more abundant than previously thought, it is still potentially threatened by long-term sea-level rise, fire suppression, exotic species and so on. Populations may be numerically large, but they are very restricted in distribution and vulnerable to impacts, especially on Cape Sable where exotic plants directly compete with Garber's spurge

and the role of fire and storm surge in maintaining open, grass-dominated habitat is not well understood (J. Sadle, email comm. 2014). The establishment of a long-term monitoring system is needed to quantify long-term population conditions and to document population change from sea level rise or other factors. Garber's spurge is short-lived and turnover is high. This could either increase or decrease its vulnerability to sea level rise (adult plants could be killed easily but mass recruitment could follow storm events and assist with migration) or other disturbances. Population numbers could be temporarily inflated following disturbance events such as tropical cyclones (the 2005 and 2006 Atlantic hurricane seasons were both very active), which could cause an understatement of its vulnerability. In contrast, populations that have appeared to be extirpated (e.g at East Cape) could be extant but undetected during a single monitoring event.

Summary of Recommendations

- Resample Northwest Cape and Long Pine Key Pine Block B populations using the same techniques as Green *et al.* (2008) to help determine if the results of the previous study were unusual. Revisit East Cape to see if plants can be detected. Continue searches on Long Pine Key for new occurrences or larger population boundaries.
- Establish long-term monitoring plots and monitor for demographic change. Determine lifespan of Garber's spurge and salt tolerance of different life stages.
- Determine roles of fire and storm surge in maintaining open, grass dominated habitats on Cape Sable.
- Control *Agave sisalana*, *Schinus terebinthifolius* and other invasive exotics at Cape Sable.
- Review NatureServe national rank and Florida Natural Areas Inventory state rank.

Chromolaena frustrata (B.L. Rob.) R.M. King & H. Rob. – Cape Sable Thoroughwort

Federal Status	**State Status**	**IRC SF Status**	**EVER Population**
Endangered	Endangered	Critically Imperiled	>300,000 individuals estimated
Synonyms: *Eupatorium frustratum* B.L. Rob., *Osmia frustrata* (B.L. Rob.) Small			

Background

Cape Sable thoroughwort is a perennial terrestrial herb in the Asteraceae. It is endemic to South Florida in Miami-Dade and Monroe counties, both on the mainland and in the Florida Keys. A range-wide status survey funded by the U.S. Fish and Wildlife Service was conducted by IRC in 2004 (Bradley and Gann 2004). Cape Sable thoroughwort was located on five islands in the Florida Keys and in the Flamingo area of EVER, but was apparently extirpated at several locations both on the mainland and in the Florida Keys. It has been found in buttonwood forest, on the edges of coastal hardwood hammocks (on limestone, coastal berms and aboriginal earth middens), in buttonwood woodlands, in Keys cactus barrens[178], and along trails. It grows immediately adjacent to halophytic areas, but at slightly higher elevations (measured in centimeters). *Chromolaena frustrata* is considered a glycophyte due to its relatively low tolerance to salt when compared with halophytes, and has been shown to have lower germination

[178] This habitat is found in the Florida Keys and is not covered by Rutchey *et al.* (2006). It is recognized by FNAI. IRC refers to this community as coastal rock barren.

Figure 97. *Chromolaena* frustrata in EVER. Image by Keith Bradley, 2003.

Figure 98. *C. frustrata*, growing cryptically, 2014.

rates and display competitive inferiority to halophytes at higher salt concentrations (Wendelberger *et al.* 2012). Mortellaro *et al.* (2012) ranked it as having a very high affinity to high quality natural areas, but it is known to grow readily in disturbed areas along trails in EVER and may benefit from natural disturbances such as tropical cyclone events and storm surges. Wunderlin & Hansen (2011) reported it to flower all year, which conforms to known collections. Specimens have been collected in EVER from February through May and also in September. As a federally-listed endangered species, additional information is available through the USFWS Species Profile and Federal Register documents.

Conservation Status

Chromolaena frustrata has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as critically imperiled globally and in the United States. In 2013, it was listed as endangered under the Endangered Species Act (Federal Register 2013, 2014) and it is listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC in South Florida[179].

History in EVER

Cape Sable thoroughwort was first documented in EVER in a hammock along the western shore of Madeira Bay in 1916 by John Kunkel Small (Small 1918a, Gann *et al.* 2002). Small apparently did not collect a specimen there or it has been lost. Between 1921 and 1977, a

[179] In 2015, IRC intends to re-assess the rank of Cape Sable thoroughwort based on new information collected in EVER.

number of collections and reports were made from the Flamingo area, most without specific locality data (Gann *et al.* 2002). In 1977, George Avery observed plants at two localities in that region (Avery 1983, Gann *et al.* 2002). He observed it along the west side of the Buttonwood Canal north of Bear Lake Road and also south of West Lake, both in "low hammock". Cape Sable thoroughwort was also reported to have been collected at Turner River Mound in the northwestern part of the park, from Cape Sable, and from "Stream Bank, above Cape Sable" (Gann *et al*. 2002), but none of these localities have ever been verified. While Loope & Avery (1979) and Avery & Loope (1980a) stated that Cape Sable thoroughwort could be common on the mainland in EVER, Reimus (1999) listed it as possibly extirpated in the park. As a result IRC listed it as possibly extirpated in EVER in 2002 (Gann *et al.* 2002).

In 2003, IRC surveys rediscovered Cape Sable thoroughwort to the west of the Bear Lake Canal (Bradley *et al.* 2467 FTG) and also in the Rowdy Bend Trail area to the south of West Lake (Bradley and Gann 2004). Approximately 150 plants were reported to be present between those two locations. Surveys were also conducted in the Christian Point Trail area and in the water treatment area north of Flamingo, but no plants were found in either of those locations. The Coastal Prairie Trail was not surveyed at that time. In 2004, then-IRC biologists Jimi Sadle and Melissa Abdo observed a population of Cape Sable thoroughwort along the Coastal Prairie Trail while conducting unrelated field work (IRC unpublished data). Between 2007 and 2009, surveys by IRC and EVER recorded 48 locations for Cape Sable thoroughwort in the Flamingo region, including new populations in the Snake Bight and Coastal Prairie Trail areas (IRC and EVER unpublished data). In 2009, 15 vegetation monitoring plots were established in coastal hardwood hammocks on low coastal berms in EVER to track population trends and determine ecological and physiological characteristics of *C. frustrata* and its habitat (IRC and EVER unpublished data). These plots were re-monitored in 2014, but preliminary analysis indicates that no significant change in *C. frustrata* occurred over the five year period (C. van der Heiden, email comm. 2014). Also in 2014, IRC conducted systematic sampling of Cape Sable thoroughwort in the Coastal Prairie Trail area (van der Heiden *et al.* 2015) and made physical counts of adults and juveniles at Bear Lake (57), Rowdy Bend (329) and Snake Bight (37), the latter location where it was found in two distinct areas. The total population estimated in the Coastal Prairie Trail area was more than 350,000 individuals using a bootstrapping analysis. The largest population extended over a 4 km stretch of habitat west of Flamingo and south of the Coastal Prairie Trail (Figure 99). During this project, 26 transects were established along the Coastal Prairie Trail, which will assist in monitoring long-term population change of Cape Sable thoroughwort in this dynamic coastal ecosystem. Currently, the eastern limit of the range of Cape Sable thoroughwort is the vicinity of Middle Lake, to the North of Terrapin Bay (J. Sadle, email comm. 2014). EVER Botanist Jimi Sadle and IRC biologist Sonali Saha surveyed the hammock north of Little Madeira Bay but failed to locate any plants in that area. Surveys of coastal hardwood hammock surrounding Madeira Bay have not been carried out and would be helpful in determining the eastern range limit of this species in EVER.

In March 2012, Sadle and Saha observed almost complete defoliation of most *C. frustrata* plants from herbivory in the vicinity of Coastal Prairie Trail (J. Sadle, email comm. 2014; Figure 100). Searches for the cause over several days led to the detection of a single larva. A photograph was sent to lepidopterist Marc Minno who tentatively identified it as a tiger moth (Lepidoptera: Arctiidae), but Minno was unable to identify the species at the life stage photographed.

Following this event the population appeared to fully recover, although it is not clear if recovery was from seed or from the resprouting of damaged plants.

Loope & Avery (1979) ranked Cape Sable thoroughwort as a rare species of least concern in National Park Service Areas in South Florida, a species whose populations should be rather stable for the foreseeable future without active management by the NPS. In contrast, Saha *et al.* (2011) ranked it as moderately vulnerable to sea level rise (vulnerable habitat and coastal only populations, but more than one occurrence and many individuals). Additional discussions of potential habitat vulnerability to sea level rise effects are found in Saha *et al.* (2014a) and van der Heiden *et al.* (2015). In 2007, 4505 seeds from 42 maternal lines were collected in EVER by

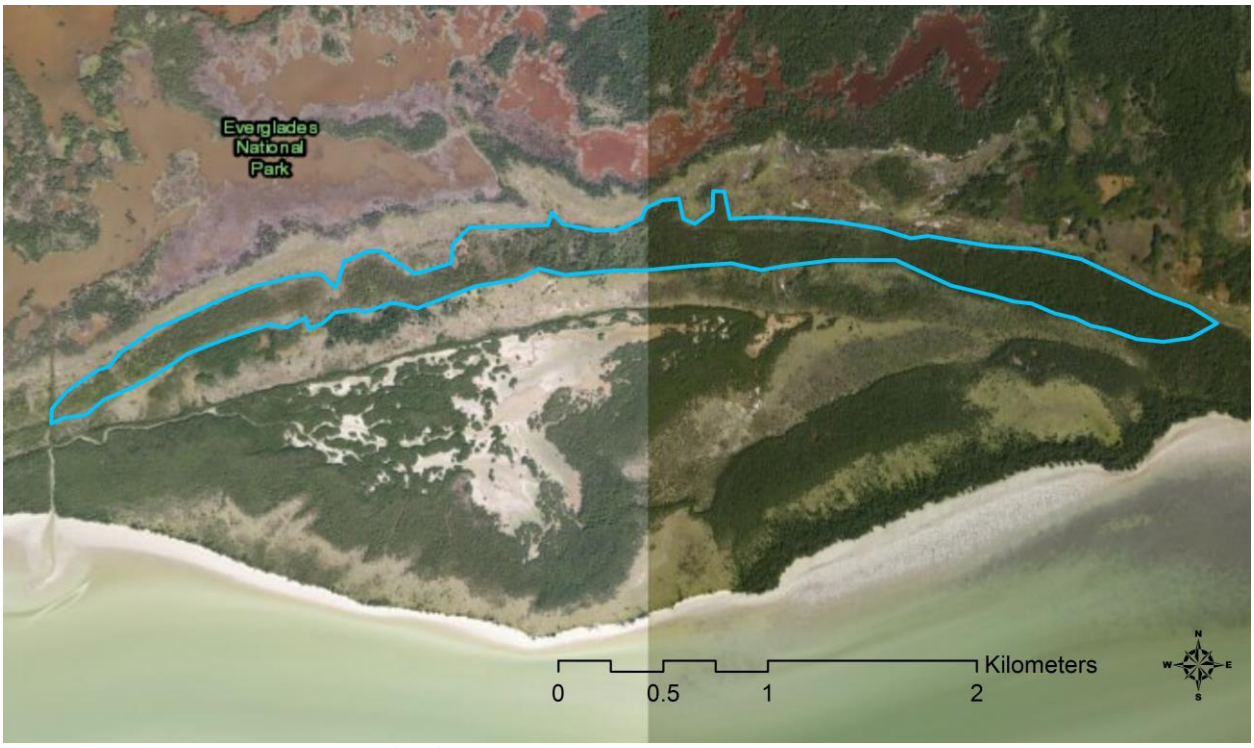

Figure 99. Largest known population of *C. frustrata* along the Coastal Prairie Trail (within blue outline). From van der Heiden *et al.* 2015.

Fairchild Tropical Botanic Garden and sent to the National Center for Genetic Resources Preservation for storage (Goodman *et al.* 2007).

Discussion

As with many other rare plants, the general trend of more and more intensive searches has yielded a larger known population. It is unknown why Richard Reimus thought this species was extirpated in EVER, especially following Avery & Loope's 1980 statement that it could be quite common on the mainland. While IRC found two of the smaller populations in 2003, searches were not conducted along the Coastal Prairie Trail where the vast majority of the plants have recently been found[180]. Perhaps Avery and Loope knew about this population, but did not document it for some reason. Or perhaps the population was historically larger in the Rowdy

[180] The author and many others had previously looked along that trail but had failed to observe any plants.

Figure 100. Herbivory damage to *C. frustrata* along the Coastal Prairie Trail. Image by J. Sadle, 5 March 2012.

Bend or Bear Lake areas, and when Reimus looked he did not see any plants. What is known is that this can be a cryptic species (Figure 98), which is difficult to detect under certain conditions. While it is tempting to state that the population has recently increased, it is impossible to do so. A similar result of a vastly larger population being documented following systematic sampling also occurred with *Chamaesyce garberi* (see account above). That said, it is entirely possible that Cape Sable thoroughwort experiences a boom and bust demographic cycle following hurricanes or other disturbance. As with *C. garberi*, it may be far more abundant than previously thought, but it is still potentially threatened by long-term sea-level rise, exotic species and so on. The establishment of a long-term monitoring system tailored to this species may be needed to quantify long-term population conditions life span and precise microhabitat requirements.

Summary of Recommendations

- Conduct searches beyond the current known population boundary limits, including along Madeira Bay.
- Annually for five years, resample Coastal Prairie Trail transects using the same techniques as van der Heiden (2015), to determine if the results of the previous study were unusual and if there is a significant change over time without disturbance.
- Annually for five years, estimate population at Bear Lake, Rowdy Bend and the two sub-populations at Snake Bight using the same techniques as van der Heiden (2015).
- Resample populations within one year following tropical cyclones that affect the area occupied by Cape Sable thoroughwort, to provide a better understanding of the response of this species to storms.
- Resample 15 plots hammock plots established in 2009 on a routine basis until when or if an alternative monitoring system is developed.
- Design a long-term monitoring system tailored to Cape Sable thoroughwort to determine life span and precise microhabitat requirements if possible, including elevation.

Desmodium lineatum DC. – Sand Ticktrefoil

Federal Status	State Status	IRC SF Status	EVER Population
NA	NA	Critically Imperiled	101-1,000

Figure 101. *Desmodium lineatum* on Long Pine Key, 2013.

Background

Sand ticktrefoil is a perennial terrestrial herb in the Fabaceae. It is endemic to the southeastern United States (Isely 1990) and disjunct in South Florida from the nearest known populations in Hernando, Sumter and Lake counties (Wunderlin and Hansen 2011), a distance of more than 300 km. In South Florida it is known only from the pine rocklands of Miami-Dade County, where it primarily grows in so-called Redland soil pockets (Gann *et al.* 2009). It is currently known from nine conservation areas in southern Miami-Dade County (Gann *et al.* 2014a), but has been extirpated throughout much of its range due to development. In South Florida, it grows almost exclusively in undisturbed pine rocklands and Mortellaro *et al.* (2012) ranked it as being obligate to high quality natural areas. However, one specimen from EVER (Avery 1759) was collected in an abandoned fire road. Elsewhere in its range it has been reported for open woodlands, savannas, sandhills and occasionally in open pastures or abandoned fields (Isely 1990). Wunderlin & Hansen (2011) reported it to flower from summer to fall, which matches the known collections from EVER. Hiers *et al.* (2000) reported that flower production of *D. lineatum* increased significantly following fire, but season of fire was not significant.

Conservation Status

Desmodium lineatum has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as globally secure, but it has not been ranked for the United States. It is not listed under the Endangered Species Act or by the State of Florida. It has not been

ranked by the Florida Natural Areas Inventory for Florida. IRC ranks it as critically imperiled in South Florida[181].

History in EVER

Sand ticktrefoil was first collected in EVER on Long Pine Key in 1963 by Frank Craighead and was vouchered again by George Avery in 1977 (Gann *et al.* 2002). Loope & Avery (1979) reported it as rare and local in the pinelands of Long Pine Key. Prior to IRC's 2003-2008 rare plant study on Long Pine Key, sand ticktrefoil had been documented for pine blocks H and J (Gann *et al.* 2009). IRC surveys from 2003-2008 relocated these stations as well as an additional station in Pine Block I. However, all of these stations are adjacent to one another within a 1 km square area and only divided by fire break roads (IRC and EVER unpublished data). Three long-term monitoring plots were established for sand ticktrefoil south of Main Park Road and a herbarium voucher was collected (Sadle 394 FNPS). In 2007, an additional station was found by EVER Botanist Jimi Sadle just north of Research Road, but within 1.6 km of the previously known stations (IRC and EVER unpublished data). The site was historically disturbed, but has recovered as pine rockland and Redland soils are found in association with *D. lineatum* (J. Sadle, email comm. 2014). The total population in EVER at the end of 2008 was estimated to be 101-1,000 individuals.

Discussion

As described by Loope and Avery in 1979, sand ticktrefoil is rare and local in the pine rocklands of Long Pine Key. Results from the 2003-2008 IRC Long Pine Key rare plant study showed that sand ticktrefoil was a habitat specialist, growing only in high quality pinelands in Redland soil pockets which are rare on Long Pine Key. It is associated with the SOMC grass *Sporobolus clandestinus* (see above). Little else is known about its life history including pollination, recruitment, lifespan, adaptability to different fire regimes and so on. Since it has been more than five years since the long-term monitoring plots established by IRC have been visited, a re-sampling in 2015 would be timely. Because the lifespan is not known, monitoring interval needs must be established. Because of its limited range in South Florida and its disjunct distribution, long-term seed storage should be considered.

Summary of Recommendations

- Re-sample the three long-term monitoring plots in 2015 and determine monitoring interval needs. Determine lifespan of sand ticktrefoil and precise microhabitat requirements if possible.
- Collect seeds from EVER and deposit at the National Center for Genetic Resources Preservation for long-term storage.

[181] *Desmodium lineatum* was included in Rare Plants of South Florida (Gann *et al.* 2002) as a critically imperiled species. It was briefly down-ranked to imperiled (2012-2014) because it was found in several additional sites in Miami-Dade County. However, it was re-assessed using updated NatureServe methods in 2014 and the critically imperiled rank was restored.

Eupatorium compositifolium Walter – Yankeeweed

Federal Status	State Status	IRC SF Status	EVER Population
NA	NA	Critically Imperiled	100-200

Figure 102. *Eupatorium compositifolium* on Pine Island. Image by Jimi Sadle, 2013.

Background

Yankeeweed is a perennial terrestrial herb in the Asteraceae. It is endemic to the southeastern United States (Cronquist 1980, PLANTS 2014). It is apparently disjunct in Miami-Dade County from Martin County, but has been reported on a number of occasions from Palm Beach County (Gann *et al.* 2014a)[182]. In South Florida it is currently known only from EVER (where recently discovered) and three occurrences outside of the park in Miami-Dade County (Gann *et al.* 2014a). In Miami-Dade County, it grows only in pine rocklands (Gann *et al.* 2002). Mortellaro *et al.* (2012) ranked it as having a high affinity to high quality natural areas. Elsewhere in its range it grows in open to lightly shaded places in dry to moist, often sandy soils (Cronquist 1980). Wunderlin & Hansen (2011) reported it to flower from summer through fall. Flowering has been observed in EVER in early December.

[182] The FISF includes several reports from Palm Beach County, but it has never been vouchered there (see Wunderlin and Hansen 2014). *Eupatorium compositifolium* could be present there, or these reports could represent other taxa in the Asteraceae.

Figure 103. *Eupatorium compositifolium* on Pine Island. Images by Jimi Sadle, 2013.

Conservation Status

Eupatorium compositifolium has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as secure globally and in the United States. It is not listed under the Endangered Species Act or by the State of Florida. It has not been ranked by the Florida Natural Areas Inventory for Florida. IRC ranks it as critically imperiled in South Florida.

History in EVER

Yankeeweed was first documented on Pine Island by EVER Botanist Jimi Sadle in November, 2013, within four months of a prescribed fire (J. Sadle, email comm. 2013, 2014). A small patch of 100-200 plants was observed growing with typical pine rockland species such as *Schizachyrium rhizomatum*, *Myrica cerifera*, *Serenoa repens*, *Andropogon glomeratus* var. *pumilis*, *Guettarda scabra*, *Rhynchospora floridensis* and *Pityopsis graminifolia*. Plants were growing in cracks in limestone and in soil pockets. A voucher was collected (Sadle 617 FNPS).

Discussion

Yankeeweed is rare and local in the pine rocklands of the Long Pine Key area. Like several other SOMC species (*Desmodium lineatum, Helenium flexuosum, Sporobolus clandestinus*), it is disjunct from populations to the north. Little else is known about its life history including pollination, recruitment, lifespan, adaptability to different fire regimes and so on. The establishment of long-term monitoring plots is needed to quantify long-term population

conditions and to document population changes. Because the lifespan is not known, monitoring interval needs must be established. Because of its limited range in South Florida and its disjunct distribution, long-term seed storage should be considered.

Summary of Recommendations

- Conduct searches beyond the current known population boundary limits.
- Establish long-term monitoring plots and monitor for demographic change. Determine lifespan of yankeeweed and precise microhabitat requirements if possible.
- Collect seeds from EVER and deposit at the National Center for Genetic Resources Preservation for long-term storage.

Helenium flexuosum Raf. – Purple Sneezeweed

Federal Status	State Status	IRC SF Status	EVER Population
NA	NA	Critically Imperiled	1,001-10,000

Figure 104. *Helenium flexuosum* on Long Pine Key, 2013.

Background

Purplehead sneezeweed is a perennial terrestrial herb in the Asteraceae. It is a temperate species which is widespread in the eastern and central United States, spreading as an introduction into eastern Canada. It is disjunct in South Florida from the nearest known populations in Polk County in central Florida (Gann *et al.* 2002). In South Florida it is currently known only from EVER, although it is possible that a few plants persist in pine rockland fragments outside of the

park in Miami-Dade County[183]. In Miami-Dade County, it grows only in low elevation pine rocklands (Gann *et al.* 2002) and on the upland side of pine rockland/graminoid freshwater prairie ecotones (Gann *et al.* 2009). It grows both in undisturbed pine rocklands as well as in disturbed areas within pinelands, such as along roads and trails. Mortellaro *et al.* (2012) ranked it as being facultative to ruderal areas and natural areas. Wunderlin & Hansen (2011) reported it to flower from spring through fall. Specimens have been collected in EVER from February through June. Self-incompatibility, common in the Asteraceae, has been documented in the congener *H. virginicum* (Messmore and Knox 1997).

Taxonomic Notes
As reported by Cronquist (1980), some plants of *Helenium flexuosum* lack ray flowers. Apparently, the entire South Florida population is morphologically unique in that respect (Gann *et al.* 2002), but it is not known if other discrete populations in the United States are completely rayless. Plants in central Florida bear prominent yellow ray flowers.

Conservation Status
Helenium flexuosum has not yet been assessed for the IUCN Red List, but it is a provisionally accepted name in the Catalogue of Life. NatureServe ranks it as globally secure, but it has not been ranked for the United States. It is not listed under the Endangered Species Act or by the State of Florida. It has not been ranked by the Florida Natural Areas Inventory for Florida. IRC ranks it as critically imperiled in South Florida.

History in EVER
Purplehead sneezeweed was first collected in EVER on Long Pine Key in 1959 by Frank Craighead (Gann *et al.* 2002). Several other collections were made in the Long Pine Key area between 1959 and 1985. Prior to IRC's 2003-2008 rare plant study on Long Pine Key, purplehead sneezeweed had been documented for pine blocks B, C and E (Gann *et al.* 2009). IRC surveys from 2003-2008 identified numerous plants in pinelands[184] nearly throughout the Long Pine Key area including all pine blocks except for Pine Block J and on Pine Island. Six long-term monitoring plots were established for purplehead sneezeweed (three north of Main Park Road and three south of Main Park Road). Plants of the SOMC shrub *Sideroxylon reclinatum* ssp. *austrofloridense* were documented in plots of *Helenium flexuosum* and vice versa, but *H. flexuosum* was not associated with the SOMC grass *Digitaria pauciflora*, which is found on the wetland side of the pine rockland/graminoid freshwater prairie ecotone on Long Pine Key (Gann *et al.* 2009). The substrate in the purplehead sneezeweed plots was described as marl soil over limestone. The total population in EVER at the end of 2008 was estimated to be 1,001-10,000 individuals.

Discussion
Purplehead sneezeweed is abundant in the Long Pine Key area of EVER, but plants in EVER represent a potentially unique morphological population with a very narrow range. Results from the 2003-2008 IRC Long Pine Key rare plant study showed that purplehead sneezeweed was a

[183] The last collection or observation known from outside of EVER was made by IRC biologist Keith Bradley in 1998 in Notre Dame Pineland, just west of the Homestead Air Reserve base (1824 FTG in Gann *et al.* 2002).
[184] As described in Gann *et al.* (2009), it also grows in linear bands along the edges of fire breaks on Long Pine Key, where it is likely dispersed by standing water in ruts during the wet season.

habitat specialist, growing in lower elevation seasonally flooded pine rocklands. Little else is known about its life history including pollination, recruitment, lifespan, adaptability to different fire regimes and so on. It is presumably sensitive to hydrological changes associated with the Everglades Restoration, but longer term studies are needed. Since it has been more than five years since the long-term monitoring plots and transects established by IRC have been visited, a re-sampling in 2015 would be timely. Because the lifespan is not known, monitoring interval needs must be established. Because of its limited range in South Florida and its morphological distinctiveness, long-term seed storage should be considered.

The taxonomy of the South Florida population of *H. flexuosum* should be revisited to determine if this entity is sufficiently distinct from the broader concept of *H. flexuosum* to warrant treatment as a distinct taxon. In his revision of *Helenium*, Rock (1957) included rayless plants originally described by Fernald as *H. floridanum*, as a synonym of *H. flexuosum*. He argued that, among other issues, the rayless character was not correlated with any other morphological character and variation of this type should be expected in a wide ranging and weedy species. However, the Florida material examined by Rock included only specimens from Duval and Hillsborough Counties. Given the frequent occurrence of endemic species in pine rocklands of South Florida, the apparent consistency of the rayless character in all pine rockland collections of *H. flexuosum*, the habitat specificity exhibited by South Florida plants and the fact that Rock did not examine material from this part of the state in his work, re-examination of the taxonomy may lead to a different conclusion. Regardless, it appears that the South Florida material of this species, which is largely, if not entirely restricted to Long Pine Key, represents a peripheral isolate of a widespread species. This condition is theorized to be a primary mechanism driving speciation in plant populations. If, as the taxonomy suggests, this species has not yet differentiated to the extent to describe it as distinct, then purple sneezeweed may represent an intermediate stage in the process of isolation and differentiation that is believed to have led to high endemism in South Florida pine rocklands. Research on the taxonomy and evolutionary significance of purple sneezeweed populations in EVER should be encouraged.

Summary of Recommendations

- Re-sample the six long-term monitoring plots in 2015 and determine monitoring interval needs. Determine lifespan of purplehead sneezeweed, water tolerance of different life stages, and precise microhabitat requirements if possible.
- Collect seeds from EVER and deposit at the National Center for Genetic Resources Preservation for long-term storage.

Kosteletzkya depressa (L.) O.J. Blanchard, Fryxell & Bates – White Fenrose

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	1,001-10,000

Background

White fenrose is a perennial terrestrial herb or subshrub in the Malvaceae. It is a primarily tropical species at the northern end of its range in South Florida and extreme southern Texas (Cameron County), where a population of about 10 plants was discovered in 1991 (Jones *et al.*

Figure 105. *Kosteletzkya depressa* in EVER. Image by Keith A. Bradley, 2009.

Figure 106. *K. depressa* in EVER, 2014.

1991). It is also known from the Greater Antilles (not Puerto Rico), Mexico, Central America and South America. In South Florida, it is known only from EVER in Miami-Dade County and the Monroe County mainland. It grows on low berms in salt marshes and open buttonwood forests, as well as in tropical hardwood hammocks on coastal berms and along trails and in others in disturbed sites within natural areas. Mortellaro *et al.* (2012) ranked it as being obligate to natural areas, but the quality of those areas might be low. Wunderlin & Hansen (2011) reported it to flower all year. However, specimens in EVER have only been collected from September through February. The congener *K. virginica* is reported to be pollinated by a wide variety of insects (Fenster & Martén-Rodríguez 2007). Seed capsules of white fenrose break off plants and stick to clothing (J. Sadle, email comm. 2014), which may be a dispersal mechanism via mammals.

Conservation Status

Kosteletzkya depressa has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as globally secure, but as vulnerable (rounded) in the United States. It is not listed under the Endangered Species Act, but it listed as endangered by the State of Florida. The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC for South Florida.

History in EVER

John Kunkel Small and colleagues first collected white fenrose in South Florida in 1921 between Flamingo and Coot Bay (Gann *et al.* 2002). A second collection was made by Small and others in that same general area in 1924. It was not collected again until 1954, when Frank Craighead made a collection at Alligator Creek to the east of Flamingo (s.n. FNPS), the first of several from that general area (Gann *et al*. 2002). In 1994, Rick and Jean Seavey made an outlier collection about five miles west of Flamingo near Slagle's Ditch[185]. During surveys by IRC and EVER from 2006 to 2008 a total of 107 coordinates were recorded between Flamingo and West Lake including the Coot Bay Hammock area. Most of these coordinates marked individual plants, but some documented larger populations, such as at the Rowdy Bend Trail area, where between 1,000 and 10,000 plants were estimated to be present. The total EVER metapopulation is estimated to contain 1,000-10,000 individuals, but probably closer to 10,000 than to 1,000. Saha *et al.* (2011) ranked *Kosteletzkya depressa* relatively low among the species most threatened by sea level rise in EVER, influenced by its salt tolerance, number of occurrences in the park and its relatively large population, but (together with *Peperomia humilis*) ranked its coastal berm habitat among the most vulnerable.

Discussion

Systematic surveys for white fenrose in EVER have not been conducted, but the general range appears to be well established – on coastal berms from Slagles's Ditch in the west to Alligator Creek in the east and north to West Lake. It would be useful to search more beyond these boundaries to see if the range is actually larger. The establishment of long-term monitoring plots is also needed to quantify long-term population conditions and to document population change from sea level rise or other factors. It is very possible that white fenrose is short-lived and that turnover is high and this could either increase or decrease its vulnerability to sea level rise (adult plants could be killed easily but mass recruitment could follow storm events and assist with migration). If at all possible, monitoring should be coordinated with that of *Chromolaena frustrata* (above) and other SOMC species in the area. Because of its limited range in EVER and its vulnerability to sea level rise, long-term seed storage should be considered.

Summary of Recommendations

- Conduct searches beyond the current known population boundary limits.
- Establish long-term monitoring plots and monitor for demographic change. Determine lifespan of white fenrose, salt tolerance of different life stages, and precise microhabitat requirements if possible.
- Collect seeds from EVER and deposit at the National Center for Genetic Resources Preservation for long-term storage.
- Review NatureServe national rank.

[185] It is about five miles from the starting point of the Coastal Prairie Trail on the western edge of the Flamingo area to Slagle's Ditch.

Physalis cordata Mill. – Heartleaf Groundcherry

Federal Status	State Status	IRC SF Status	EVER Population
NA	NA	Critically Imperiled	101-1,001

Figure 107. *Physalis cordata* in EVER, June 2007. Image by Jimi Sadle.

Background

Heartleaf groundcherry is an annual terrestrial herb in the Solanaceae. It is a widespread species of the United States (where it is scattered), the West Indies, Mexico, Central America and South America. It is relatively frequent in the West Indies and Central America, and has established itself as a weed in the Old World. In Florida, heartleaf groundcherry has only been recorded in three counties in South Florida (Miami-Dade, Monroe mainland and Collier) and nine other counties scattered throughout the state. Prior to 2003, it had been recorded for South Florida only once, as a weed in urbanized Miami-Dade County (Avery 891 USF, collected in 1971)[186].

[186] Avery reported the location for this specimen as "Ponce de Leon and Kendall Drive. T54S, R41E, Sec. 31." This refers to Ponce de Leon Road (theoretical southwest 49th Avenue), not the better known Ponce de Leon Boulevard in Coral Gables. Avery originally determined this specimen as *P. pubescens* but it was annotated as *P. angulata* by R.P. Wunderlin in 1980 and as *P. cordata* by J.R. Sullivan in 1983 and by M. Whitson in 1996. Avery reported it as a sprawling, nearly prostrate plant growing in piles of rubble. Woodmansee & Vardaman (1999) reported heartleaf groundcherry for the Muscara track in Martin County, but this was a visual only record that has been treated as reported due to the scarcity of collections in South Florida and the lack of corroborating evidence (e.g., in Gann *et al.* 2014a). It was not ranked by Mortellaro *et al.* (2012) because it was not clear at the time of the ranking that it was a persistent part of the flora.

In 2003, heartleaf groundcherry was also collected as a weed in urbanized Collier County to the north of the Golden Glades Estates (Brockington 423 FLAS[187]) and in 2007, EVER Botanist Jimi Sadle found a population of heartleaf groundcherry in an abandoned agricultural field in BICY (Sadle 508 FNPS) followed by several disjunct populations in EVER from 2007 to 2009, including in relatively undisturbed coastal areas and sites associated with aboriginal activity (see below). Elsewhere in its range it is mostly known as a weed of low elevations, but it has also been collected in tree fall gaps and along forest edges in the American tropics up to more than 1000 m elevation. In the Galapagos, it grows on mostly bare lava slopes (e.g., Fosberg 45066 MO in TROPICOS). Wunderlin & Hansen (2011) reported it to flower from summer through fall, although throughout its native range it is known to flower all year. Sadle 508 from BICY was collected in the winter (January). Martínez (1998) reported that *P. cordata* is probably dispersed by water, which would explain its presence as a native species in the Galapagos Islands and elsewhere. However, it seems as likely that *P. cordata* is bird dispersed, which would explain the distribution both in South Florida and the West Indies (J. Sadle, email comm. 2014).

Conservation Status

Physalis cordata has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life. NatureServe ranks it as secure globally and as apparently secure (rounded, = N4?) in the United States. It is not listed under the Endangered Species Act or by the State of Florida. It is not ranked by the Florida Natural Areas Inventory for Florida. IRC ranks it as critically imperiled in South Florida based on new discoveries since 2002[188].

Taxonomic Notes

Physalis cordata may be overlooked in South Florida due to its similarity to two common weedy species, *P. angulata* and *P. pubescens*. It differs from *P. angulata* in having 5-angled fruiting calyces (Figure 108) and from *P. pubescens* in having stems glabrous to minutely puberulous (following Martínez 1998). However, the Biota of North America Program's U.S. County Level Species Map (Kartesz 2013) shows that it is much less common than the two latter species throughout its range in the United States, indicating that it may in fact be rare in the United States. But this is also a confusing group, taxonomically. Ward (2008) also recognized *P. turbinata* in this group, which Wunderlin & Hansen (2011) placed into synonymy under *P. pubescens*. Some plants which key to *P. cordata* in Martínez and Wunderlin & Hansen key to *P. turbinata* in Ward's key (J. Sadle, email comm. 2014).

History in EVER

Heartleaf groundcherry was first collected by EVER Botanist Jimi Sadle together with IRC biologist Jesse Hoffman south of the Coastal Prairie Trail in June 2007 (Sadle 522 FNPS). It was growing in a relatively undisturbed buttonwood woodland. Sadle and Hoffman made a second collection in the same general area in July of that same year (Sadle 532 FNPS[189]). An

[187] The label data at FLAS online states "North on 95, 7 km north of junction with I75" but based on the coordinates the intended road is Collier Boulevard, State Road 951.

[188] Gann *et al.* (2002) did not treat *P. cordata* as a rare species in South Florida based on the evidence available at the time. Although this is mostly a weedy species, plants in EVER appear to be part of the native flora and thus worth tracking as a rare species.

[189] An additional specimen from the same station has been determined as this (Sadle 531 FNPS), but it has slightly different features and may be a different taxon (J. Sadle, email comm. 2014).

Figure 108. *Physalis* fruit and flowers in EVER: *P. pubescens* (l), *P. cordata* (m), *P. angulata* (r), 2007. Image by Jimi Sadle.

additional population was observed by Sadle, Hoffman and EVER biologist Jonathan Taylor in September 2007 on a black earth midden at Monroe Lake Mound. In September 2008, Sadle and IRC biologist Sonali Saha found populations on coastal beach dunes associated with archeological sites on the west coast at East Cape Sable and Highland Beach. In October 2008, Sadle and IRC biologist Mike Barry discovered plants growing on a shell mound on Dismal Key in the Ten Thousand Islands. All of these populations are believed to be small and possibly ephemeral.

Discussion

Although heartleaf groundcherry is poorly known in South Florida, collections and observations by Jimi Sadle and colleagues suggest that it is a persistent part of the South Florida flora and native to Everglades National Park. However, there is no significant threat identified for this species. It is a weedy species capable of persisting following human disturbance and its seeds are likely dispersed via seawater and/or birds. Thus, management needs are primarily to document its occurrences at reasonable intervals.

Summary of Recommendations

- Conduct surveys for and document populations every five years or when conducting other botanical work in the vicinity of known populations.
- Conduct surveys in the vicinity of known populations following storm events to evaluate the role of heartleaf groundcherry and other native weedy species (e.g., *Heliotropium angiospermum, Physalis angulata, P. pubescens, Rivina humilis, Solanum americanum*) in the recovery of native vegetation.

Tephrosia corallicola (Small) León – Coral Hoarypea

Federal Status	State Status	IRC SF Status	EVER Population
NA	Endangered	Critically Imperiled	101-1,000
Synonyms: *Tephrosia angustissima* Shuttlew. ex Chapm. var. *corallicola* (Small) Isely			


Figure 109. *Tephrosia corallicola* in Miami-Dade County. Images by Keith A. Bradley, 2009.

Background

Coral hoarypea is a terrestrial short-lived perennial herb in the Fabaceae, although it can also grow as a suffrutescent shrub (Beyra Matos 1998) or even become vine-like (J. Maschinski, email comm. 2013)[190]. It is a native to South Florida and western Cuba. In Cuba, it has been collected in Pinar del Rio, Matanzas and on the Isle of Youth (Barreto *et al.* 1985, Beyra Matos 1998), and its preliminary conservation status in Cuba is Threatened (González-Torres *et al.* 2013)[191]. In South Florida, it is known only from Miami-Dade and Collier counties. In Miami-Dade County, it is known only from a single wild population at the USDA Subtropical Horticulture Research Station (Gann *et al.* 2002, Possley *et al.* 2013), and from a single conservation area within its historical range (Ludlam Pineland) where it has been successfully introduced by Fairchild Tropical Botanic Garden in collaboration with Miami-Dade County (Possley *et al.* 2013). It historically ranged from the historic town of Cutler to at least as far

[190] Plants in Cuba are described as 40-70 cm in height, woody at the base (Beyra Matos 1998).

[191] In addition to several specimens collected in Pinar del Rio, a single specimen each has been collected in Matanzas and on the Isle of Youth (Beyra Matos 1998). The Matanzas locality was newly reported in 1985 (Barreto *et al.* 1985)

north as Fairchild Tropical Botanic Garden in Coral Gables, but all other populations in Miami-Dade County have apparently been destroyed (Gann *et al.* 2002, Gann *et al.* 2014a). In Collier County it is known from a recent collection made by EVER Botanist Jimi Sadle at Russell Key in EVER (519 FNPS) and possibly from BICY (Sadle 485 FNPS)[192]. In Miami-Dade County, it grows in pine rocklands and nutrient-poor disturbed uplands, specifically machine scraped and repeatedly mowed historic pine rocklands. In Collier County, it grows on an open coastal shell mound in EVER. Mortellaro *et al.* (2012) ranked it as being much more frequent in natural areas than ruderal areas, presumably based on its historic, not current, distribution. In Cuba, it has been reported to grow in pinelands on white sand (Beyra Matos 1998). Wunderlin & Hansen (2011) reported it to flower from spring through fall. Its phenology in Cuba is not known. In Florida, the genus *Tephrosia* is a known host of Asian pigeonpea pod fly (*Melanagromyza obtusa*), who's larvae feed on the seeds (Speck 2004). Presumably this is also a threat to coral hoarypea in Cuba. Fairchild Tropical Botanic Garden has maintained an ex-situ germplasm collection of coral hoarypea since before 2002 and it is cultivated in South Florida in botanical gardens and by native plant enthusiasts. It has a weedy tendency in the garden and readily recruits from seed in disturbed areas.

Conservation Status

Tephrosia corallicola has not yet been assessed for the IUCN Red List, but it is in the Catalogue of Life[193]. NatureServe ranks it as critically imperiled globally and in the United States. It is not listed under the Endangered Species Act, but it is listed as endangered by the State of Florida (as *T. angustissima*). The Florida Natural Areas Inventory ranks it as critically imperiled in Florida, as does IRC in South Florida.

Taxonomic Notes

Isely (1982, 1990) considered *Tephrosia angustissima* and its three subordinate taxa (var. *angustissima*, var. *corallicola*, and var. *curtissii*, the later including an additional published taxon *T. seminole*) to be "no more than phenotypic manifestations of a single complex" and perhaps "a peripheral variant of *T. purpurea* (L.) Persoon, a pantropical group of unknown dimensions." He distinguished *T. angustissima sensu lato* from other Florida *Tephrosia* based on its glabrous style, versus the obviously barbellate style of other Florida plants. Authors working in the West Indies have rejected the suggestion that *T. corallicola*, the only taxon of the *T. angustissima* group represented in the West Indies, is conspecific with *T. purpurea* or another related taxon, although some authors currently treat *T. corallicola* as a variety of *T. angustissima*. Beyra Matos (1998) used filament configuration rather than style pubescence to separate *T. corallicola* and related taxa (including *T. purpurea*) from obviously barbistyled *Tephrosia* in Cuba. At least in Cuba, the style of *T. corallicola* is twisted and barbellate at the base while glabrous in the apical 6-7 mm.

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[192] Both specimens have been determined as *T. corallicola* by Bruce Hansen of the University of South Florida. The specimen from EVER keys easily to *T. corallicola*. The specimen from BICY, however, may better represent the historic *T. seminole*, currently placed into synonymy under *T. curtissii* (J. Sadle, email comm. 2014; the author, pers. obs.). Systematic (including molecular) work is clearly needed for this group. See also Taxonomic Notes.

[193] There is a mistake in The Catalogue of Life in that both *T. corallicola* and *T. angustissima* var. *corallicola* are accepted names. Both names are based on the same basionym - *Cracca corallicola* Small 1909. ITIS accepts *T. corallicola* and correctly places *T. angustissima* var. *corallicola* into synonymy there.

In Florida and Cuba, *T. corallicola* is distinguished in taxonomic keys from other taxa without obvious barbellate styles by having villous pubescence on the stems. The Florida endemics *T. angustissima* and *T. curtissii* and the tropical species *T. cinerea* and *T. senna* in Cuba all have appressed strigose hairs on the stems. The only other non-barbistyled species in Cuba, the narrow endemic *T. clementis*, is completely glabrous. However, in the Bahamas (e.g., Vincent & Kwit 13304 FTG, Figure 110) and Nicaragua (e.g., Stevens 27569 in TROPICOS) at least some *T. cinerea* have obvious spreading hairs on the stems. Therefore, that character alone is not sufficient to separate *T. corallicola* from *T. cinerea*[194]. Finally, the Atlas of Florida Vascular Plants (Wunderlin and Hansen 2014) currently maps as *T. corallicola* a *Tephrosia* specimen collected on a spoil pile along Tampa Bay in 2012 (Dickman s.n. USF) and a specimen originally determined as *T. curtissii* from Miami Beach (Bradley 2039 USF), neither of which has obvious villous pubescence; both of these specimens should be reexamined. Systematic (including molecular) work is clearly needed for this group, but must include related material in the *T. purpurea* complex from nearby areas (e.g., the Bahamas, Cuba and the Yucatan Peninsula), including *T. cinerea*.

Figure 110. *Tephrosia cinerea* from the Bahamas with spreading hairs (Vincent & Kwit 13304 FTG).

History in EVER

EVER Botanist Jimi Sadle first observed coral hoarypea in September, 2006 at Russell Key in the Ten Thousand Islands region of EVER. This station was vouchered in 2007 (Sadle 519 FNPS), and the specimen was determined as *T. corallicola* by Bruce Hansen of the University of South Florida. The Atlas of Florida Vascular Plants maps this species for Collier County based on Sadle's collection. In 2006, Sadle estimated that more than 100 plants were present on Russell Key (EVER unpublished data). Saha *et al.* (2011) ranked *T. corallicola* among the

[194] *T. cinerea* and *T. senna* are also separated from *T. angustissima sensu lato* in having calyx lobes longer than the calyx tube, but this distinction may break down somewhat in the inland population described as *T. seminole* by Shinners (e.g., see *T. purpurea*, misapplied, in Small 1933).

Figure 111. *Tephrosia corallicola* on Russell Key in EVER. Image by Jimi Sadle. 2007.

species most threatened by sea level rise in EVER, but little is known about this species in the park and this is the only strictly coastal population in Florida.

Discussion

Tephrosia corallicola is one of the rarest taxa is the continental United States and the small population at Russell Key represents an important disjunct occurrence. Plants in South Florida, including those on Russell Key, differ somewhat from plants in Cuba (e.g., in upper leaflet pubescence) but represent the same taxon using modern taxonomic definitions (Shinners 1962, Isely 1990, Beyra Matos 1998). Although future systematic work may show that *T. corallicola* belongs within a broader taxonomic concept (e.g., placed into synonymy under *T. angustissima*) this is still a very rare group and the plants in EVER are important biological resources which should be protected and studied. Invasive plants pose a threat to coral hoarypea in EVER, and when control efforts are underway they should be completed with special care to avoid off-target damage. Along with other rare species that grow on shell mounds (such as *Celtis iguanaea* and *Vachellia tortuosa* - see above), coral hoarypea is presumably threatened by sea level rise and associated storm surges. A systematic and coordinated process is needed to determine the extent of this threat, including determination of elevations of individual plants and the salt water tolerances of individual species.

Summary of Recommendations

- Conduct molecular and systematic work on the *Tephrosia angustissima* group in South Florida and the nearby Caribbean, including plants from EVER and BICY.
- Conduct systematic surveys of Russell Key to determine a total baseline population. Map individual plants and initiate a 1- to 3-year interval monitoring program.
- Complete invasive species control programs in the vicinity of coral hoarypea.
- Coordinate research on rare species threatened by sea level rise on shell mounds, including documenting elevations of individual plants and determining salt water tolerances of species at various life stages.

Gymnosperm Forb

There is a single gymnosperm forb, the cycad *Zamia integrifolia*, which is ranked as apparently secure in South Florida by IRC (Gann et al. 2014a). It is relatively common in the Long Pine Key area, but is also found in hammocks to the north and west.

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Appendix A
Conservation Ranks of SOMC Plants in EVER

Taxon	NatureServe Global and National Ranks	Federal Rank	State Rank	FNAI Florida Rank	South Florida Rank
Actinostachys pennula	Globally secure; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Adiantum melanoleucum	Apparently secure globally; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Anemia wrightii	Globally imperiled; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Argythamnia blodgettii	Globally imperiled; imperiled in the United States	Candidate	Endangered	Imperiled	Rare
Asplenium platyneuron	Secure globally and in the United States	-	-	Not ranked	Critically imperiled
Astraea lobata	Apparently secure globally; critically imperiled in the United States	-	-	Critically imperiled	Critically imperiled
Basiphyllaea corallicola	Globally imperiled; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Beloglottis costaricensis	Apparently secure globally; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Bletia patula	Apparently secure globally; critically imperiled in the United States	-	-	Critically imperiled	Critically imperiled
Bourreria cassinifolia	Globally imperiled; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Brassia caudata	Globally vulnerable; presumed extirpated in the United States	-	Endangered	Presumed extirpated	Presumed extirpated in the United States[195]
Celtis iguanaea	Globally secure; imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Cenchrus myosuroides	Apparently secure globally; not ranked for the United States	-	-	Not ranked	Critically imperiled
Ceratopteris pteridoides	Globally secure; not ranked for the United	-	-	Not ranked	Critically imperiled

[195] The entire range of this taxon in the United States is in South Florida as defined by IRC (see account above), thus IRC's rank of presumed extirpated applies to the United States.

	States				
Chamaesyce deltoidea ssp. *pinetorum*	Critically imperiled globally and in the United States	Candidate	Endangered	Critically imperiled	Rare
Chamaesyce garberi	Critically imperiled globally and in the United States	Threatened	Endangered	Critically imperiled	Rare
Cheilanthes microphylla	Globally secure; vulnerable in the United States	-	Endangered	Vulnerable	Critically imperiled
Chromolaena frustrata	Critically imperiled globally and in the United States	Endangered	Endangered	Critically imperiled	Critically imperiled
Cyrtopodium punctatum	Apparently secure globally; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Dalea carthagenensis var. *floridana*	Critically imperiled globally and in the United States	Candidate	Endangered	Critically imperiled	Critically imperiled
Desmodium lineatum	Globally secure; not ranked for the United States	-	-	Not ranked	Critically imperiled
Didymoglossum punctatum (= *Trichomanes punctatum* ssp. *floridanum*)	Critically imperiled globally and in the United States	Candidate	Endangered	Critically imperiled	Critically imperiled
Digitaria pauciflora	Critically imperiled globally and in the United States	Candidate	Endangered	Critically imperiled	Critically imperiled
Eltroplectris calcarata	Apparently secure globally; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Eriochloa michauxii var. *simpsonii*	Possibly extinct globally	-	-	Possibly extinct	Presumed extinct globally[196]
Eupatorium compositifolium	Globally secure; not ranked for the United States	-	-	Not ranked	Critically imperiled
Exostema caribaeum	Globally secure; not ranked for the United States	-	Endangered	Imperiled	Critically imperiled
Galeandra bicarinata	Critically imperiled globally and in the United States	-	Endangered	Critically imperiled	Critically imperiled
Govenia floridana	Not ranked globally[197]; critically imperiled in the United States	-	Endangered	Critically imperiled	Possibly extinct globally[198]

[196] The entire range of this taxon is in South Florida as defined by IRC (see account above), thus IRC's rank of presumed extinct applies globally.

[197] NatureServe and FNAI do not recognize the segregate species *G. floridana*. They recognize the wider ranging species *G. utriculata*. Global ranks of *G. utriculata* cannot be applied to *G. floridana*, but *G. floridana* is the intended taxon for national and state ranks.

Helenium flexuosum	Globally secure; not ranked for the United States	-	-	Not ranked	Critically imperiled
Hypelate trifoliata	Apparently secure globally; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Ionopsis utricularioides	Apparently secure globally; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Kosteletzkya depressa	Secure globally; vulnerable in the United States (N3?)	-	Endangered	Critically imperiled	Critically imperiled
Leersia monandra	Secure globally; imperiled in the United States	-	-	Not ranked	Possibly extirpated
Leptochloa fusca ssp. *uninervia*	Secure globally and in the United States	-	-	Not ranked	Critically imperiled
Lomariopsis kunzeana	Globally vulnerable; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Macradenia lutescens	Apparently secure globally; possibly extirpated in the United States	-	Endangered	Possibly extirpated	Presumed extirpated in the United States[199]
Oncidium ensatum	Apparently secure globally (tentative); critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Passiflora sexflora	Globally secure; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Pecluma plumula	Globally secure; imperiled in the United States	-	Endangered	Imperiled	Critically imperiled
Peperomia humilis	Globally secure; imperiled in the United States	-	Endangered	Imperiled	Critically imperiled
Physalis cordata	Globally secure; apparently secure in the United States (N4?)	-	-	Not ranked	Critically imperiled
Pleurothallis gelida	Globally secure; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Ponthieva brittoniae	Globally vulnerable; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Rhipsalis baccifera	Apparently secure globally; critically	-	Endangered	Critically imperiled	Possibly extirpated in

[198] The entire range of this taxon is in South Florida as defined by IRC (see account above), thus IRC's rank of possibly extinct applies globally.
[199] The entire range of this taxon in the United States is in South Florida as defined by IRC (see account above), thus IRC's rank of presumed extirpated applies to the United States.

	imperiled in the United States				the United States[200]
Sideroxylon reclinatum ssp. *austrofloridense*	Critically imperiled globally and in the United States	Candidate	-[201]	Critically imperiled	Imperiled
Spiranthes torta	Apparently secure globally; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Sporobolus clandestinus	Globally secure; not ranked for the United States	-	-	Not ranked	Critically imperiled
Tephrosia corallicola	Critically imperiled globally and in the United States	-	Endangered	Critically imperiled	Critically imperiled
Thelypteris reticulata	Apparently secure globally; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Tillandsia fasciculata var. *clavispica*	Apparently secure globally; not ranked for the United States	-	Endangered[202]	Not ranked	Possibly extirpated in the United States[203]
Trichostigma octandrum	Apparently secure globally; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Trichocentrum carthagenense	Apparently secure globally; possibly extirpated in the United States	-	-[204]	Not listed	Presumed extirpated in the United States[205]
Trichocentrum undulatum	Apparently secure globally; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Vachellia tortuosa	Apparently secure globally; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Vallesia antillana	Apparently secure globally; critically imperiled in the United States	-	Endangered	Critically imperiled	Critically imperiled
Vanilla dilloniana	Globally vulnerable; not ranked for the	-	Endangered	Not ranked	

[200] The entire range of this taxon in the United States is in South Florida as defined by IRC (see account above), thus IRC's rank of possibly extirpated applies to the United States.
[201] The State of Florida does not list infraspecific taxa. The species *Sideroxylon reclinatum* is common in the state.
[202] The State of Florida ranks the species *Tillandsia fasciculata* as endangered. It does not list infraspecific taxa.
[203] The entire range of this taxon in the United States is in South Florida as defined by IRC (see account above), thus IRC's rank of possibly extirpated applies to the United States.
[204] The State of Florida does not list species thought to be extirpated or extinct.
[205] The entire range of this taxon in the United States is in South Florida as defined by IRC (see account above), thus IRC's rank of presumed extirpated applies to the United States.

	United States				
Vanilla phaeantha	Globally vulnerable; not ranked for the United States	-	Endangered	Critically imperiled	Critically imperiled
Xylosma buxifolia	Globally secure; critically imperiled in the United States	-	-	Critically imperiled	Critically imperiled