

Restoration of Privately Owned Pine Rockland Habitat in Miami-Dade County

Final Report
Grant Agreement Number: 401815G030

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Introduction

In 2005, The Institute for Regional Conservation (IRC) was awarded the Private Stewardship Grant (PSG) “Restoration of Privately Owned Pine Rockland Habitat,” Grant Agreement #401815G030. The project was designed to restore critically imperiled pine rockland habitat in urbanized Miami-Dade County, Florida. Pine rocklands are globally imperiled (Florida Natural Areas Inventory 1990), occurring only in South Florida and a few islands in the Bahamas (U.S. Fish and Wildlife Service 2000). In Florida, pine rocklands are primarily limited to Miami-Dade County and the lower Florida Keys in Monroe County.

Pine rocklands contain a diverse assemblage of Caribbean plant species that are at the northern ends of their ranges, temperate plant species at the southern ends of their ranges, and endemic species with narrow ranges restricted to southern Florida. Pine rocklands contain dozens of plant species found nowhere else in the United States. The forest canopy is dominated by a single species; *Pinus elliottii* var. *densa*. The sub canopy is dominated by palms and a mix of tropical and temperate hardwoods, and the ground cover is dominated by a rich diversity of herbs and grasses.

In Miami-Dade County, pine rocklands occur along the Miami Rock Ridge, a Pleistocene deposit of oolitic limestone. The southern 18% of the Miami Rock Ridge is protected in Everglades National Park and the northern 82% extends from the Park boundary some 45 miles northward into the vicinity of North Miami Beach (USFWS 2000). Fourteen federally-listed plant taxa are found in the project area. Five of these species are endemic to the project area, and are not protected in Everglades National Park (Bradley & Gann 1999). Six of these fourteen plant species are listed as endangered and eight are candidates for listing. These species are:

- *Amorpha herbacea* var. *crenulata* (endangered)*
- *Argythamnia blodgettii* (candidate)
- *Brickellia mosieri* (candidate)*
- *Chamaesyce deltoidea* subsp. *adhaerens* (endangered)*
- *Chamaesyce deltoidea* subsp. *deltoidea* (endangered)*
- *Chamaesyce deltoidea* subsp. *pinetorum* (candidate)
- *Chamaesyce garberi* (threatened)
- *Dalea carthagenensis* var. *floridana* (candidate)*
- *Digitaria pauciflora* (candidate)
- *Linum arenicola* (candidate)
- *Linum carteri* var. *carteri* (candidate)*
- *Polygala smallii* (endangered)
- *Sideroxylon reclinatum* subsp. *austrofloridense* (candidate)
- *Warea carteri* (endangered, extirpated in Miami-Dade)

*Not protected in Everglades National Park (Gann et. al. 2002)

The 45 miles of Miami Rock Ridge outside of Everglades National Park has been almost completely developed. Over 2.3 million people currently live in Miami-Dade County, and pine rocklands are found only as small, isolated patches of habitat surrounded by homes, agricultural lands, industrial parks, and roadways. Only 2,950 acres of pine rockland, 1.8% of the original extent, now exist in urbanized Miami-Dade County (IRC unpublished data). Of this, 680 acres are in private ownership (IRC unpublished data). Many of the publicly owned pine rockland fragments are being managed by county agencies, but almost all privately owned fragments go unmanaged, leading to habitat degradation.

While many owners are interested in restoring their forest fragments, most do not have the capabilities to undertake this costly and physically demanding venture. We have observed rapid declines in the past decade on most of these small forest fragments because of a lack of management. Federally-listed and candidate species have disappeared from sites where they once occurred. In order to prevent further loss, these sites require exotic plant control, reintroduction of fire, reestablishment of slash pine canopy, and site security.

IRC applied for the Private Stewardship Grant to provide technical assistance for the management of privately-owned pine rockland fragments. As detailed in the original grant proposal, this project was conceived to conduct restoration on private property in two ways. The first was the hiring of a two-person restoration crew to conduct day-to-day restoration, especially exotic plant control. We anticipated restoring a total of 21-35 acres during the three-year span of this project using this professional management crew. The second was to organize a series of volunteer workdays, using not only landowners but also community volunteers, to conduct restoration. Total restoration for this three-year project, including above crew estimates, was anticipated to be 60-65 acres. During this period we hoped to encourage a community restoration effort with mutual cooperation among landowners, state and local government, non-profit groups and other concerned citizens. Because IRC is a non-governmental entity, we hoped to create bridges in the midst of traditionally strained relationships, such as those between private citizens, county government and prescribed burn crews.

Methods

Establishment of the IRC restoration crew

Two full time staff members were hired as IRC professional restoration crew, to not only conduct physical restoration work, but also assist with monitoring transects and photo points, aid in interactions with landowners, enter data, and work with volunteers. We acquired equipment and supplies for their work, including a storage shed, brush cutter, chainsaw, hand saws, herbicides (Garlon 4® and RoundUp®), and sprayers.

Landowner Identification

Between 2004 and 2005 IRC conducted comprehensive mapping and plant inventories of all remaining pine rockland fragments in Miami-Dade County. Using these data, we identified suitable restoration sites and prioritized them based upon several factors, including landowner interest, presence of endangered or candidate plant species, and habitat quality. Once fragments were ranked, landowners of prioritized fragments were contacted and on-site meetings were arranged with those who were interested. Twenty-six potential landowners were identified during the first year of this project.

Creation of a Landowner Agreement

A landowner agreement packet for potential participants was prepared, containing the following items (see Appendix 1 for a sample):

- *Landowner Agreement Contract* - legal contract, modeled after a USFWS template, between the landowner and IRC, allowing IRC to conduct restoration, indicating the financial value of the restoration, and stipulating reimbursement of funds if the property is developed within 10 years of signature
- *Guide to the Restoration of Pine Rocklands* - information on general pine rockland restoration guidelines
- *Site-Specific Ecological Restoration Plan* - restoration plan for the individual landowner's property that outlines issues affecting the site, proposed IRC activities and proposed management units for the property
- *Management of Invasive Exotic Plants with Herbicides in Florida* (Kline and Duquesne, 1996) - information on exotic plant procedures
- *Miami-Dade County Natural Areas Management Plan* (Miami-Dade County Natural Areas Management Working Group 2004) – information on county management to provide larger context
- *Proposed Timeline* – for work at the given site
- *Plant List* - for the site
- *Aerial Photo* - with management areas outlined

Landowner agreements were signed before restoration work begun. Several conversations, mostly legal in nature, were often required. Agreements for parcels owned by groups, such as the Tropical Girl Scout Council, were typically more complicated to negotiate. This whole process, from first contact to the actual signing, typically took two to three months, and sometimes longer.

Establishment of Restoration Protocol

The following steps were established as IRC guidelines for pineland restoration, to be utilized once landowner interest is established:

- Develop a site-specific restoration plan, including species lists

- Identify management units and rank them by habitat quality
- Establish monitoring transects and photo points along transects in two of the highest quality management units to be used repeatedly during the study
 - Monitoring transects and photo points were established in two management units at each site. Two central points were placed in two high priority management areas. From each central point three transects were run at randomly chosen compass bearings. Transects were 25 m long and species presence was recorded every meter. Every five meters, a 1 m² quadrant was placed and the dominant plant species were recorded for both the herb and shrub layers. Photo points were placed at 1.7 m height in the four cardinal directions from each central point and a digital camera was used to take the photos.
- Protect the pine rockland from inappropriate use such as dumping, the abandonment of household pets, paintball, etc. and remove any foreign materials deposited on the site
- Minimize habitat damage and loss from trails, sewer lines, fire breaks etc.
- Control or remove invasive exotic plant species while minimizing any off target damage to rare, desirable or endemic species
- Maintain or restore populations of rare, desirable or endemic plant and animal species and monitor for new ones
- Establish an appropriate prescribed burn schedule
- Establish or restore the appropriate canopy and understory structure, including native hardwood reduction, thinning dense stands, replanting or augmenting plant populations, and removing weedy native species
- Plan for long-term management and care

It is important that management units be restored in a specific order with areas containing the most intact habitat being restored first. This prevents degradation of the highest quality habitat, allows us to maximize restored acreage, and provides a source for seed rain when adjacent degraded areas are restored. Highly degraded areas, particularly dense infestations of Brazilian-pepper (*Schinus terebinthifolius*) cannot be restored under this project due to high restoration costs per acre.

Results

Summary

Seven sites were incorporated into the PSG. These sites included 26.6 acres of pine rockland. Of this total, IRC was able to bring 20.4 acres of pine rockland into a management state, including 2.6 acres at Camp Choe Pineland with the help of community volunteers. These acreage totals are lower than anticipated. See Table 1 for a list of sites and acreage figures.

Table 1: Sites Incorporated into the PSG and Acreage

Site Name	Owner	Acres of Pine Rockland	Acres in Management
Camp Choe Pineland	Tropical Girl Scout Council	11.1	7.2
Massin Pineland	Barry Massin	3.2	2.6
Porter-Russell Pineland	Tropical Audubon Society	6.5	5.0
George N. Avery Pineland	IRC	1.5	1.8*
McGlothlin Pineland	Wanda McGlothlin	1.9	1.8
Lynn Pineland	John Lynn	1.7	1.4
John Kunkel Small Pineland	IRC	0.7	0.6
	Totals	26.6	20.4

*Areas of dense exotic plant infestations have been cleared at the George N. Avery preserve, but are not yet considered to be pine rockland natural forest community (NFC).

Of the seven sites managed under the PSGP, five sites contained populations of plants that are either listed as endangered by the USFWS, or are candidates for listing. These sites are the George N. Avery Pineland (IRC), John Kunkel Small Pineland (IRC), Lynn Pine Rockland, McGlothlin Pine Rockland, and Porter-Russell Pineland (Tropical Audubon Society). A total of six federally listed or candidate plant species are protected on these properties. These species are Everglades bully (*Sideroxylon reclinatum* subsp. *austrofloridense*), Goulds wedge sandmat (*Chamaesyce deltoidea* subsp. *adhaerens*), Mosier’s false boneset, pineland deltoid spurge (*Chamaesyce deltoidea* subsp. *pinetorum*), sand flax (*Linum arenicola*), and Small’s milkpea (*Galactia smallii*). In addition, all seven sites harbor dozens of plant species listed as endangered, threatened, or commercially exploited by the Florida Department of Agriculture and Consumer Services (FDACS). Aside from the rediscovery of Mosier’s false boneset at Porter-Russell Pineland, populations of all federally listed plants generally remained stable.

A total match of \$19,472 was received through volunteer workdays, cash and equipment donations, as well as through two separate grants from the Ross Foundation. This exceeded the required match of \$11,513.10. See Appendix C for a complete list of matches and the equivalent dollar amount.

Results from the monitoring transect data showed a decrease in the number of target exotic species (Burmareed (*Neyraudia reynaudiana*), Brazilian-pepper, and rattlepod (*Albizia lebbek*)). See Appendix D for before and after photographs from select sites. At all seven sites combined, Burmareed showed the most substantial decrease in frequency along transects, while the frequency of Brazilian-pepper showed a significant decrease along transects. The decrease in Brazilian-pepper had a P value of .044 for the Wilcoxon signed-rank test. See Table 2 and Appendix A for specific data. In addition to the decrease in target exotic species, these data also showed an overall increase in both native species diversity (7.9%) and density (Appendix B). Native pineland grass species showed a significant increase in abundance, with a P value of .008 for the Wilcoxon signed-rank test. Additionally, native diversity increased with a net gain of 6 native herbaceous or graminoid species recorded after restoration.

Table 2: Frequencies of Target Exotic Plant Species along Monitoring Transects Before and After Restoration

Scientific Name	Common Names	Frequency Before Restoration	Frequency After Restoration
<i>Neyraudia reynaudiana</i>	Burmareed, Silkreed	86	13
<i>Schinus terebinthifolius</i>	Brazilian-pepper	27	3
<i>Albizia lebbbeck</i>	Woman's tongue, Rattlepod	3	0

Two federally listed species were recorded on pre-restoration monitoring transects. These species are Mosier's false boneset (*Brickellia mosieri*) and pineland deltoid spurge (*Chamaesyce deltoidea* subsp. *pinetorum*). Mosier's false boneset occurred at one instance on one monitoring transect at the McGlothlin pineland. However, this species was not recorded during post restoration monitoring of this transect. This observation is not indicative of the entire population of Mosier's false boneset on this property. Pineland deltoid spurge occurred at two instances on monitoring transects during pre-restoration monitoring, at the Lynn Pine Rockland, and at the John Kunkel Small Pineland owned by IRC. Pineland deltoid spurge was not recorded during post-restoration monitoring at the Lynn Pine Rockland. It is notable that the pre and post restoration monitoring at the John Kunkel Small Pineland took place less than a year apart. Thus, there was less time for change to be reflected in these data. The absence of pineland deltoid spurge on the post-restoration monitoring transect at the Lynn Pine Rockland is not indicative of the entire population at this property. The small sample sizes of these rare plant species do not allow for accurate comparisons of pre- and post-restoration changes.

Analysis of quadrat data below 1 m (herbaceous layer) shows results similar to those of the transect data. Target exotic species were completely displaced as the dominant cover in the herb layer. Burmareed and Brazilian-pepper, dominant in ten quadrats and two quadrats respectively, prior to restoration, were not recorded as dominant species in the herb layer in any of the final monitoring quadrats. The only exotic species that showed an increase in the cover below 1 m was Jaragua (*Hyparrhenia rufa*). This occurrence was confined to Porter-Russell Pineland; the only site with this species present.

Shrubby species, including saw palmetto (*Serenoa repens*), cabbage palm (*Sabal palmetto*), and poisonwood (*Metopium toxiferum*) showed an increase in cover below 1 m. This corresponds with a decrease in diversity of dominant herbaceous species from 12 prior to restoration to eight species after restoration. Native grasses and forbs showed little to no change in dominance in the herbaceous layer. Many native herbaceous species were displaced by other native herbaceous species.

Analysis of the quadrat data above 1 m (shrub layer) shows results similar to that of the herbaceous layer data. Exotic plant species generally showed a decline in cover. Of the four exotic plant species recorded as dominant in the shrub layer of monitoring quadrats, Brazilian-pepper and Burmareed were the most frequently displaced. Burmareed dropped from shrub layer dominance in 19 quadrats to seven quadrats, and Brazilian-pepper dropped from shrub layer dominance in 14 quadrats to one quadrat. Two exotic plant

species increased in cover. These species are Jaragua (from zero to two), and rattlepod (from zero to one). Saw palmetto and cabbage palm showed the highest increase in frequency in this data set. Hardwood species, including poisonwood, Myrsine (*Rapanea punctata*), and live oak (*Quercus virginiana*) all showed a decrease in frequency as dominant species in the shrub layer of monitoring quadrats.

Camp Choe Pineland

The Camp Choe Pineland is an approximately 12 acre pine rockland in the Richmond Heights area of Miami-Dade County. This site was historically a high quality site that has been heavily invaded by exotic plant species. These primarily consist of Burma Reed, Brazilian-pepper, Queensland umbrella tree (*Schefflera actinophylla*) and Ear Leaf Acacia (*Acacia auriculiformis*). Aside from the exotic species invasions, one other concern was the density of pines on the site which essentially form a closed-canopy forest. Pine rocklands should have a healthy pine canopy, but when the canopy becomes too dense, it can shade out important herbaceous species which form the bulk of the diversity in these forests. The site is surrounded by residential areas on the northern, eastern and southern boundaries. To the west is the Florida Turnpike. Because of the high density of Burma Reed on the site, and the proximity to a major highway, there is a high risk of catastrophic fire, and prescribed burning is exceptionally difficult. There is a dense wall of Brazilian-pepper along the western edge of the property that provides an unsightly border on the turnpike. The northern section of the pineland is the highest quality area of the site, and our efforts were concentrated there. In total, we were able to bring roughly 7.2 acres of this property into a maintenance condition.

The quality of the site had begun to deteriorate prior to IRC's restoration efforts, signaled by the loss of 38 non weedy native species over the last two decades (Hammer 1992). Two of these, deltoid spurge (*Chamaesyce deltoidea* subsp. *deltoidea*) and Mosier's false boneset, are federally endangered and candidates for federal listing respectively. The majority of species lost are pine rockland herbs that indicate a healthy pineland. Although we were unable to relocate any populations of deltoid spurge or Mosier's false boneset during our restoration efforts, we did observe the locally rare giant orchid (*Pteroglossaspis ecristata*) annually recruiting into newly restored habitat.

The Camp Choe Pineland site offered an exceptional opportunity for community outreach and volunteerism. The site offers ample parking, and restroom facilities. Twelve of the fourteen volunteer workdays were held at this site, hosting 294 community volunteers from various organizations including Florida International University, Friends of IRC, Hands On Miami, and the Girl Scouts. In all, these volunteers donated over 800 person hours at this site, equaling a match of over \$6,500. In addition to the volunteer effort, the Florida Division of Forestry installed firebreaks across the western portion of the pineland. See Appendix C.

Monitoring transect data for exotic plant species (Table 3) show an 89% decrease in Buramreed across all monitoring transects on this site. Brazilian-pepper was eradicated

from all monitoring transects. One weedy exotic species, Florida tasselflower (*Emilia fosbergii*) was recorded a single time along one transect.

Table 3: Frequency of Exotic Plant Species along Transects at Camp Choe Pineland

Scientific Name	Common Names	Frequency Before Restoration	Frequency After Restoration	FLEPPC Status
<i>Emilia fosbergii</i>	Florida tasselflower	0	1	
<i>Neyraudia reynaudiana</i>	Burmareed, Silkreed	81	9	I
<i>Schinus terebinthifolius</i>	Brazilian-pepper	2	0	I

Monitoring transect data for native plant species show a general increase in native species diversity, particularly among grasses. A net gain of three native species was observed.

The trend for the quadrat data for Camp Choe Pineland is similar to the overall trend. Brazilian-pepper and Burmareed were completely displaced as dominant species below 1 m, while saw palmetto and poisonwood both showed increases in the number of quadrats in which they were dominant below 1 m. Shrub layer data shows a similar decrease in exotic species dominance with the cover of Burmareed decreasing by 64.3%, and Brazilian-pepper dropping from one quadrat to zero.

Future activities at Camp Choe Pineland will rely almost exclusively on volunteers. The priority at this site will be the remaining heavy infestations of exotic plant species. Once these infestations are under control throughout the entire property, the pine canopy should be thinned. Fire remains a logistical issue at this site. One option may be to divide the pineland into micro burn units to allow for more controllable conditions. Nonetheless, fire should be re-introduced as soon as the pine canopy is thinned, and the site no longer poses a threat of a conflagration. This will ultimately insure the health of the pine rockland. Once the site is burned, reintroducing species historically known from this site (such as deltoid spurge and Mosier’s false boneset) becomes a possibility.

George N. Avery Pineland

The George N. Avery Pineland is a property containing a 1.5 acre pine rockland. This site has a Florida Power and Light (FPL) easement running across the property from southwest to northeast, including an access road, which bisects the pineland into two distinct sections. The northwest section of the pineland is in overall good condition with only scattered infestations of Brazilian-pepper and Burmareed, with the exception of a dense hardwood and exotic edge on the western boundary of the property. The southeast portion of the property is in far worse condition. This portion of the property contains fire suppressed pine rockland and has extremely dense infestations of Brazilian-pepper and Burmareed extending out from the southern and eastern edges of the property. We were able to bring all 1.5 acres of pine rockland at this site into a maintenance condition, in addition to .3 acres of fire suppressed and exotic plant infested areas.

One federally listed plant species and one candidate species occur on this site. The endangered Goulds wedge sandmat (*Chamaesyce deltoidea* subsp. *adhaerens*) is fairly common along the access road of the FPL easement. This species also occurs in spotty patches in the northwest portion of the pineland. We estimate there to be 100-1000 individuals at this site. The candidate sand flax (*Linum arenicola*) also occurs on this site along the FPL easement. This ephemeral species regularly appears and disappears from this site. We have never noticed more than three plants occurring simultaneously at this site.

Analysis of transect data for the George N. Avery Preserve shows an increase in the frequency of shrubby species such as poisonwood (162.5%) and saw palmetto (50%). Dominant grass species also increased in frequency. Crimson bluestem, lopsided Indian grass, and wire bluestem showed increases in frequency of 25%, 41.7% and 8.3% respectively. Exotic plant species showed no change. Brazilian-pepper was recorded once during both pre and post restoration monitoring. Native species diversity remained relatively unchanged.

Quadrat data at this site was not collected. Protocol for restoration monitoring transects was changed after this transect was already installed.

We were able to procure two grants in the amounts of \$4,000 and \$4,957 from the Joseph and Frieda Ross Foundation to help with the restoration of this property. This funding allowed us to remove an illegally dumped tar kettle from the center of the pineland, clear the western portion of the preserve of hardwood and exotic plant species, and erect a fence to deter dumping and trespassing. In addition, we have a contract with the U.S. Department of Agriculture (USDA) Wildlife Habitat Incentive Program (WHIP) to further fund the restoration of this property.

The priority at this site is the removal of the remaining dense exotic plant infestations on the southeast portion of this preserve, in addition to follow-up treatments of exotic species throughout the pineland. Burning the northwest portion of this site is a realistic possibility, and we have obtained a grant from the USFWS to fund a prescribed burn and have contracted The Nature Conservancy (TNC) to conduct the prescribed burn at this site. Prescribed burning is set to commence in 2008. Candidate plant introductions are scheduled to begin following the prescribed burn.

John Kunkel Small Pineland

The John Kunkel Small Pineland is a 0.7 acre pine rockland parcel in the Florida City area near the Miami-Dade County owned Navy Wells Pineland. This site is bordered to the south by a heavy infestation of exotics, particularly Brazilian-pepper. This infestation radiates into the pine rockland habitat to the north. The site is bordered to the north by another pine rockland parcel that is slated for development. To the east lies 192 Ave. and to the west is a vacant lot. Our efforts at this site have focused primarily on treating the

Brazilian-pepper that has encroached into the pine rockland habitat.

One federally listed plant species and one candidate plant species occur on this property. Small's milkpea (*Galactia smallii*) was discovered on this property while installing monitoring transects in 2007. We estimate there to be 10-100 individuals on this site. Pineland deltoid spurge also occurs on this site. We estimate there to be 10 to 100 individuals on this site.

The transect data for the John Kunkel Small Preserve show a substantial decrease in the frequency of exotic species. Brazilian-pepper in particular decreased in frequency from 17 to one. Burmared also decreased in frequency from two to zero. Shrubby native species also showed a substantial increase in frequency. Saw palmetto, poisonwood, rough velvet seed and Florida silver palm showed increases in frequency of 34.5%, 27.3%, 57.1% and 133.3% respectively. Frequency of herbaceous native species and native species diversity showed little change.

Analysis of quadrat data for vegetation below 1 m at this site shows an increase in cover by shrubby species. Saw palmetto as a dominant species by 66.7%, and poisonwood increased as a dominant species from zero to two quadrats. Brazilian-pepper was recorded as the dominant species below 1 m in one quadrat prior to restoration, but was not recorded as dominant in any quadrats during post-restoration monitoring.

Shrub layer data for this site show similar results. Poisonwood and saw palmetto both increased in cover by 9.1% and 23.1% respectively. Brazilian-pepper was recorded as dominant in five quadrats prior to restoration, but was not recorded as dominant in any quadrats after restoration. These data also show a high rate of species displacement above 1 m. Saw palmetto, and wild button sage (*Lantana involucrata*) were the only two species recorded as dominant cover above 1 m during both pre and post restoration monitoring.

We were able to procure a grant in the amount of \$4,957 from the Joseph and Frieda Ross Foundation to help with the restoration of this property. This funding allowed us to begin treating the dense and moderate infestations of Brazilian-pepper on this site. In addition, this grant also funded a contractor to remove the dense exotic plant infestations on the southern border of the property.

The priority at this site is the removal of the remaining dense exotic plant infestations on the south portion of this preserve, in addition to continual follow-up treatments of exotic species throughout the pineland. Burning the entire site is a realistic possibility, and we have obtained a grant from the USFWS to conduct a prescribed burn and we have an agreement in place with TNC to conduct the prescribed burn at this site. Prescribed burning is set to commence in 2008. Candidate plant introductions are scheduled to begin following the prescribed burn

Lynn Pine Rockland

The Lynn Pine Rockland is an approximately 1.7 acre pineland located just west of Homestead. This property is separated from a much larger, high quality site (Pine Ridge Sanctuary) owned by Barbara and Terry Glancy. Between the two properties lies a dirt road which also contains natural forest community (NFC) along the right of way. An acre surrounding this site contains degraded pine rockland that was no longer considered to be NFC. In these areas, invasion by dense exotics, mostly Brazilian-pepper, and dense stands of native hardwoods have replaced pine rockland. These areas essentially form a ring around the healthy pineland on all sides but the south. Contained inside the ring of hardwoods and exotics is high quality pine rockland that is dominated by a diverse herbaceous layer, with many native grasses and other herbs, including the federal candidate species pineland deltoid spurge and Everglades bully, and federally endangered Small's milkpea. The pine canopy is extremely sparse in this pine rockland. Throughout the area are scattered shrubs and native hardwoods. Exotic infestations at this site include Burma reed, Brazilian-pepper, woman's tongue and rose natal grass (*Rhynchelytrum repens*). We were able to bring all 1.7 acres of this site into a maintenance condition.

Populations of the three federally listed or candidate species at this site remained unchanged. Everglades bully was represented by one individual while populations of pineland deltoid spurge and Small's milkpea remained in the 11-100 individuals range.

Analysis of transect data for the Lynn Pine Rockland shows a decrease in frequency of exotic plant species. The frequency of Burmared at this site dropped 33.3%, while Brazilian-pepper dropped from four records to zero. Both shrubby species and grasses showed increases in frequencies across monitoring transects at this site. Species such as poisonwood, rough velvetseed, and saw palmetto all showed increases in frequency. Grassy species, particularly lopsided indian grass, crimson bluestem, and rhizomatous bluestem (*Schizachyrium rhizomatum*) also showed increases in frequency. Additionally, coral paspalum (*Paspalum blodgettii*) appeared along the monitoring transects at three points where it had not been recorded during pre-restoration monitoring.

Analysis of quadrat data for the herbaceous layer shows a slight increase in cover by most grasses and shrubs. Crimson bluestem and wire bluestem were dominant in four and one quadrats respectively. This is a slight increase from three quadrats for crimson bluestem and zero quadrats for wire bluestem. Shrubby vegetation such as myrsine and cabbage palm also showed a similar increase in cover.

Analysis of the quadrat data for the shrub layer above 1 m shows an overall decrease in the cover of exotic species. Brazilian-pepper in particular decreased in cover above 1 m, by 80.0%. Burmared remained unchanged in the shrub layer at this site. All other species in the shrub layer generally remained unchanged.

Neither matching funds nor in-kind services were received for this site. The relatively small size and high quality of the management area at this site translated into minimal effort needing to be put forth on IRC's behalf. Future plans for this site should include

continued maintenance of the managed area by the land owner, and the eventual removal of the Brazilian-pepper and hardwood edge that borders the site. Fire should also be reintroduced at this site, ideally on the same burn schedule as Pine Ridge Sanctuary.

Massin Pineland

The Massin Pineland is a 3.25 acre pineland, in the Redlands area of Miami-Dade County, Florida. This pineland was scarified in the past, however pine rockland species remain. Restoration of this site focused on the removal of exotic species and the dense native hardwood layer that was suppressing the herbaceous layer. The primary focus of restoration was on removing large numbers of the native hardwoods. These were cut, some were treated with herbicide, and removed. The pine canopy is sparse, although some young pines have begun to cone and some recruitment has occurred. Because the pineland was scarified, there are very few palm species remaining on this site. We were able to bring 2.6 acres of this site into a maintenance condition.

There are no federally listed plant species that occur at the Massin Pineland, nor are any federally listed species historically known from this site. However, the disturbed nature of the soil at this site makes it ideal habitat for introductions of several federally listed or candidate species including Blodgett’s wild mercury (*Argythamnia blodgettii*), Carter’s flax (*Linum carteri* var. *carteri*), and sand flax (*Linum arenicola*).

Analysis of the transect data for the Massin Pineland shows a decrease in the abundance of hardwood species. See Table 4 for the abundance of hardwood species before and after restoration at the Massin Pineland. Herbaceous species showed both an increase in abundance and diversity. Dominant pineland grasses, particularly crimson bluestem, rhizomatous bluestem and wire bluestem showed an increase in frequency. Crimson bluestem and rhizomatous bluestem appeared along monitoring transects at 12 and four points respectively. These species were not present along transects during initial monitoring. Wire bluestem increased in frequency by 25%. In addition, twelve native herbaceous species were recorded during post-restoration monitoring that were not recorded during pre-restoration monitoring. One Brazilian-pepper was recorded along the monitoring transects that was not present during pre-restoration monitoring.

Table 4: Frequency of Hardwood Species along Monitoring Transects Before and After Restoration at the Massin Pineland

Full Name	Common Names	Frequency Before Restoration	Frequency After Restoration
<i>Metopium toxiferum</i>	Poisonwood, Florida poisontree	67	57
<i>Rapanea punctata</i>	Myrsine, Colicwood	18	14
<i>Forestiera segregata</i>	Florida privet, Florida swampprivet	18	12
<i>Quercus virginiana</i>	Virginia live oak	10	7

Analysis of quadrat data for the Massin Pineland for vegetation below 1 m shows a slight decrease in cover of shrubby species. This corresponds to a slight increase in herbaceous species cover. Additionally, ten different native species were recorded during post restoration monitoring compared to eight before restoration. Quadrat data for vegetation above 1 m show a decrease in the cover of poisonwood and myrsine. Poisonwood decreased as a dominant species in quadrats by 80%, while myrsine decreased by 50%. South Florida slash pine (*Pinus elliottii* var. *densa*) was dominant in two quadrats. This species had not been recorded as dominant during pre-restoration monitoring. Other vegetation remained relatively unchanged.

No matching funds or in-kind services were obtained for this site. However, Barry Massin is an enthusiastic and committed steward of his property and has demonstrated that he will do whatever it takes to complete the restoration of his property. Barry made in-kind contributions at both of IRC's sites through deeply discounted backhoe services. In addition, Barry Massin has a contract with the USDA WHIP to further fund the restoration of his property. The priority at the Massin Pineland is to get the property on a scheduled burn cycle. Fire will further thin out the hardwood species and create more open habitat for the introduction of federally endangered and candidate plant species.

McGlothlin Pineland

The McGlothlin pineland is a comparatively healthy tract of pine rockland, approximately 1.9 acres, in the Redlands area of Miami-Dade County. The McGlothlin pineland is a high quality site, however a dense infestation of Brazilian-pepper exists on disturbed soil on the eastern edge of the site. The pineland contains a diverse and healthy herbaceous layer. However, the pine canopy is essentially non-existent. Surrounding the site on the west and south is a large county owned pine rockland (West Biscayne Pineland). This site contributes to the quality of the privately owned portion, and buffers it from exotic plant invasions. To the north is the residential portion of the property, and to the east the pineland borders S.W. 190th Ave. The eastern border contains the highest density of invasive plants, primarily Brazilian-pepper, although scattered populations of other exotic plant species are present in the intact area as well. The northern edge, bordering the lawn and home area, also has a disturbed edge. We were able to bring 1.8 acres of this site into a maintenance condition.

The McGlothlin Pineland harbors a fairly large population of Mosier's false boneset. Size estimates for this population prior to restoration are in the 101-1000 individuals range. Mosier's false boneset was recorded at one point along a monitoring transect prior to restoration. This species was not observed along monitoring transects after restoration. Nonetheless, the population of Mosier's false boneset remains stable at this site.

Analysis of transect data for the McGlothlin Pineland shows a significant increase in native species diversity. A total of 23 native species were recorded along transects prior to restoration. Forty-two native species were recorded along monitoring transects after restoration (an 82.6% increase). In addition, these data also show a decrease in exotic

species frequency. Brazilian-pepper, present at two points prior to restoration, was eradicated from the monitoring transects.

Analysis of quadrat data for the McGlothlin Pineland shows little change in abundance of any species aside from Brazilian-pepper. Prior to restoration, Brazilian-pepper was recorded as dominant in three quadrats. This species was not recorded as dominant in any quadrats after restoration.

One volunteer workday was held at this site. In June of 2006, five volunteers helped remove scattered infestations of Brazilian-pepper and rattlepod from the McGlothlin Pineland. This is equivalent to a match of \$150.

The overall high quality and small size of this site allowed us to spend minimal time at this site while bringing nearly the entire site into a maintenance condition. The main focus at this site should be the removal of the dense Brazilian-pepper edge on the east side of the property, and follow-up treatments of Brazilian-pepper and rattlepod in the interior portions of the pineland. Given that this site is of such high quality, and borders another high quality site, the land owner may be able to form a successful partnership with Miami-Dade County to control exotic species and remove the dense Brazilian-pepper border on the east side of the property. Fire should also be reintroduced at this site, ideally on the same burn schedule as West Biscayne Pineland. This site may also benefit from participation in a private land owners restoration network.

Porter-Russell Pineland

The Tropical Audubon Society's (TAS) Porter-Russell Pineland is a 6.5 acre pineland situated to the west of the historic Cauley Square area of south Miami-Dade County. On three sides of the site are residential homeowners, most of which live in an area that has recently been developed. The east side borders the Cauley Square area. There has been little substrate disturbance in the site, with the exceptions mostly being along the fence lines. Illegal dumping has been occurring over the northern fence for some time, apparently coming from the residential homeowners that line this side of the property. The eastern portion of the preserve also suffers from illegal dumping, but to a lesser extent. We were able to bring 5 acres of this site into a maintenance condition.

Exotics and hardwoods were increasingly dense towards the northeastern corner of the property, and along the eastern and southern property lines. These areas entailed large amounts of debris removal from the site and the professional restoration crew was only able to partially restore these areas during this project. However, Tropical Audubon Society has committed over \$10,000 for professional arborists to remove the hardwoods from this area of the pineland.

Mosier's false boneset, a federal candidate species, was rediscovered on this site shortly after restoration began in 2005. This species had not been seen on this site in over ten years, and its rediscovery is attributable to the removal of exotic and hardwood infestations on this site. We estimate there to be 11 to 100 plants at this site. Federally

endangered Goulds wedge sandmat (*Chamaesyce deltoidea* subsp. *adhaerens*), was found during surveys in 2003 (IRC, Unpublished Data 2003) with an estimate of 10-100 individuals. This species has not been seen at this site since that time.

Transect data for Porter-Russell Pineland shows a general increase in frequency of shrubby species. Notably, cabbage palm, saw palmetto, and poisonwood increased in frequency by 48%, 14.2% 50%, respectively. Running oak was not recorded during initial monitoring, but was present along eight points during final transect monitoring. Virginia live oak, a hardwood species targeted for thinning, dropped in frequency by 87.1%. Native grasses also showed an increase in frequency with lopsided Indian grass increasing by 45.5%, rhizomatous bluestem increasing by 125%, and needleleaf witchgrass increasing by 600%. Native species diversity also increased. A total of 35 species were recorded prior to restoration, and 42 species were recorded after restoration.

Exotic species frequencies show mixed results. Woody exotic species such as Brazilian-pepper and rattlepod were eradicated from monitoring transects, while exotic grasses increased in frequency. Burmared was not recorded on any transects prior to restoration, but was recorded at two points along monitoring transects. Jaragua showed an increase in frequency by 177.9%.

Quadrat data for Porter-Russell Pineland show an increase in the cover of shrubby species, and a decrease in the cover of herbaceous species. Cabbage palm, and saw palmetto showed an increase in cover by 50% and 200% respectively. Poisonwood showed an increase by 25%. A total of seven native herbaceous species were displaced as dominant species in the herbaceous layer. Exotic species showed a decrease in cover; Burmared and rattlepod were not recorded in post-restoration monitoring quadrats, while Jaragua showed a 40% decrease in cover.

Few changes in the shrub layer quadrat data were observed. Of note is the decrease in cover of Burmared from two to zero quadrats.

One volunteer workday was held at Porter-Russell Pineland. This workday utilized students from Florida International University (FIU) to hand-pull infestations of Jaragua, resulting in a match of \$630. In addition, Tropical Audubon Society has a contract through the USDA WHIP program to further finance the restoration of this site. Furthermore, Tropical Audubon Society has spent over \$6,000 to date for removal of dense hardwood and exotic infestations along the borders of the property. An additional \$4,200 in professional arborist services has been approved by the TAS board of directors.

Removal of the remaining exotic plant and hardwood infestations is the priority at this site. Once these infestations are brought to a manageable level, prescribed burning should commence immediately. However, burning at Porter-Russell Pineland remains logistically complex. The site is essentially in the middle of a residential neighborhood, a short distance away from South Dixie Highway (US-1), and smoke is a major concern. There is much ground work to be laid with the neighbors, community officials, and the

Florida Division of Forestry (DOF) before the prescribed burn process can begin. However, this is the only way to ensure the long term health of this site.

Discussion

Seven sites were incorporated into the Private Stewardship Grant Program (PSGP). These sites included 26.6 acres of pine rockland. Of this total, IRC was able to bring 20.4 acres of pine rockland into a maintenance condition, including 2.6 acres at Camp Choe Pineland with the help of community volunteers. See Table 1 for a list of sites and acreage figures

The acreage totals are lower than anticipated due to several factors. First, the number of interested land owners is half of the anticipated number. The original proposal for this project sought to target approximately 14 sites, yet we were only able to find seven sites with interested land owners. Despite IRC's attempts to make the land owner agreement as straightforward as possible, many potential land owning partners in this project were wary of signing any sort of agreement. A contributing factor to this uneasiness over the ten year agreement outlined in the land owner agreement is the South Florida real estate market. Over the three year period of this grant agreement, property values in South Florida hit an all time high. This gave land owners economic incentive to sell and/or develop their properties. As an example, three sites, including properties owned by Ms.Carolynn Kern, Garden Walk Apartments, and Woodlawn Cemetery, all had a financial interest in either selling their property or attempting to develop their remaining land (against Miami-Dade County code).

Second, the overall quality of sites that we were able to incorporate into the PSGP was more deteriorated than we had anticipated. Large sites with light to moderate infestations of exotic plant species and hardwoods would have been ideal for this project. However, we were unable to incorporate any sites with both of these attributes. Instead, we were forced to settle on large sites with moderate and dense infestations of hardwood and exotic species (Camp Choe Pineland), or small sites with high quality habitat (McGlothlin Pineland).The estimated cost per acre of restoration for this agreement was \$2,500. In actuality, this cost was closer to \$3,000, and in some cases such as Camp Choe, up to \$4,000.

Another contributing factor to the total acreage being lower than anticipated was the requirement of the Private Stewardship Grant to only incorporate sites that have not undergone any previous management. There are a handful of landowners that actively manage their pine rocklands, and could have been valuable partners in this effort.

Lastly, the private land owners working group never materialized, leaving IRC the sole restoration practitioner on most of these sites. With very few exceptions, many landowners were unable or unwilling to participate in workdays at their properties, or lacked the financial resources to even do minimal site maintenance. Despite the lack of interest in a private land owner working group, we were able to build a base of community volunteers, and with the help of the Joseph and Frieda Ross Foundation, we

were able to equip these volunteers with hand tools. The community volunteer base that we have built through the PSGP is one of the most successful aspects of this project. We were able to partner with Hands on Miami (a local volunteer organization), Florida International University, the University of Miami, and the Girl Scouts to restore 2.6 acres of pine rockland at the Camp Choe Pineland. In addition, volunteer workdays provided a match of over \$7,385.

Results from the monitoring transect data showed a decrease in the number of target exotic species. These data also display the trend of native grasses and forbs becoming more abundant, but being displaced as dominant species in the herbaceous layer below 1 m. This tendency can be explained by the absence of fire on all seven sites. Fire serves the purpose of thinning shrubby species such as poisonwood, and saw palmetto, while simultaneously creating open habitat for grasses and forbs. This data demonstrates the need for prescribed burning at all seven sites.

The population sizes of the six federally listed or candidate species on the seven sites remained unchanged throughout the project period, with the exception of the rediscovery of Mosier's false boneset at Porter-Russell Pineland. By no means was this a demographic study, but we look for the populations of these plants to gradually increase as more habitat is created, and prescribed burning begins. In addition, we will be introducing three candidate species at three of these sites, after a prescribed burn: Blodgett's wild mercury, Carter's flax, and Mosier's false boneset. This aspect of the restoration will be funded under a separate USFWS grant.

The outlook for the future of these sites is good. We look to continue building on the success of our community volunteer workdays by actively recruiting more volunteers, and holding more frequent workdays. We will also try to expand our volunteer workdays beyond the Camp Choe Pineland. Additionally, we have plans to conduct prescribed burns and introduce candidate plant species at three of these sites including the George N. Avery Pineland, and the John Kunkel Small Pineland. Furthermore, we will actively seek more funding for further restoration on all of these sites, and we will look for ways to expand this program to other sites. Finally, pine rocklands in urban Miami-Dade County will not be able to survive in perpetuity without active participation in the management process by the land owners. This project has laid the foundation for private land owners, government organizations, and the community at large to come together and play an active role in conservation. With this cooperation in place, we are looking forward to building on the success of this program.

Acknowledgements

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Appendix A: Frequency* of Exotic Species along Monitoring Transects Before and After Restoration

Scientific Name	Common Names	FLEPPC Status	Frequency before Restoration	Frequency after Restoration
<i>Albizia lebbbeck</i>	Woman's tongue, Rattlepod	I	3	0
<i>Emilia fosbergii</i>	Florida tassel flower		0	1
<i>Hyparrhenia rufa</i>	Jaragua		9	25
<i>Jasminum dichotomum</i>	Gold Coast jasmine	I	1	0
<i>Lantana camara</i>	Shrubverbena	I	1	0
<i>Nephrolepis cordifolia</i>	Tuberous sword fern	I	1	1
<i>Neyraudia reynaudiana</i>	Burmareed, Silkreed	I	86	13
<i>Pteris xdelchampsii</i>	Delchamps' brake		1	0
<i>Schinus terebinthifolius</i>	Brazilian-pepper	I	27	3
<i>Sporobolus indicus</i> var. <i>pyramidalis</i>	West Indian dropseed		0	1

*Frequency is defined as the number of occurrences along monitoring transects.

Appendix B: Frequency of Native Species along Monitoring Transects Before and After Restoration

Scientific Name	Common Names	Records before Restoration	Records After Restoration	State Status	Federal Status
<i>Acalypha chamaedrifolia</i>	Three-seeded mercury, Bastard copperleaf	6	8		
<i>Aeschynomene viscidula</i>	Sticky joint-vetch	0	1		
<i>Agalinis fasciculata</i>	Beach false foxglove	1	1		
<i>Andropogon glomeratus</i> var. <i>pumilus</i>	Common bushy bluestem	1	0		
<i>Andropogon ternarius</i>	Splitbeard bluestem	4	0		
<i>Anemia adiantifolia</i>	Pine fern, Maidenhair pineland fern	6	2		
<i>Angadenia berteroi</i>	Pineland-allamanda, Pineland golden trumpet	1	0	T	
<i>Aristida purpurascens</i>	Arrowfeather threeawn	4	7		
<i>Aster adnatus</i>	Clasping aster, Scaleleaf aster	2	13		
<i>Ayenia euphrasiifolia</i>	Eyebright ayenia	0	3		
<i>Baccharis glomeruliflora</i>	Silverling	1	2		
<i>Berlandiera subacaulis</i>	Florida green-eyes	1	3		
<i>Bidens alba</i> var. <i>radiata</i>	Spanish-needles	1	7		
<i>Brickellia mosieri</i>	Mosier's false boneset	1	0	E	C
<i>Bursera simaruba</i>	Gumbo-limbo	3	0		
<i>Byrsonima lucida</i>	Locustberry	7	7	T	
<i>Callicarpa americana</i>	American beautyberry	1	0		
<i>Cassythra filiformis</i>	Lovevine, Devil's gut	43	37		
<i>Centrosema virginianum</i>	Spurred butterfly-pea	5	1		
<i>Chamaecrista deeringiana</i>	Deering partridge pea	5	2		
<i>Chamaesyce deltoidea</i> subsp. <i>pinetorum</i>	Pineland deltoid spurge, Pineland sandmat	2	1	E	C

Scientific Name	Common Names	Records before Restoration	Records After Restoration	State Status	Federal Status
<i>Chamaecrista nictitans</i> var. <i>aspera</i>	Hairy sensitive-pea, Hairy partridge-pea	2	0		
<i>Chaptalia albicans</i>	White sunbonnets	0	3	T	
<i>Chiococca alba</i>	Common snowberry, Milkberry	1	0		
<i>Chiococca parvifolia</i>	Pineland snowberry	12	29		
<i>Chromolaena odorata</i>	Jack-in-the-bush	0	1		
<i>Cnidocolus stimulosus</i>	Tread-softly, Finger-rot, 7-minute-itch	1	0		
<i>Coccothrinax argentata</i>	Florida silver palm	27	29	T	
<i>Coccoloba uvifera</i>	Seagrape	4	1		
<i>Crossopetalum ilicifolium</i>	Quailberry, Christmasberry	0	3	T	
<i>Croton glandulosus</i>	Vente conmigo	0	1		
<i>Croton linearis</i>	Pineland croton, Grannybush	1	1		
<i>Crotalaria pumila</i>	Low rattlebox	4	8		
<i>Cynanchum blodgettii</i>	Blodgett's swallowwort	2	1	T	
<i>Desmodium incanum</i>	Beggar's-ticks	0	1		
<i>Dichantherium aciculare</i>	Needleleaf witchgrass	1	11		
<i>Dichantherium ovale</i>	Eggleaf witchgrass	0	3		
<i>Dichantherium strigosum</i> var. <i>glabrescens</i>	Glabrescent roughhair witchgrass	0	4		
<i>Digitaria filiformis</i> var. <i>dolichophylla</i>	Caribbean crabgrass	0	1	T	
<i>Dyschoriste angusta</i>	Rockland twinflower, Pineland snakeherb	1	2		
<i>Echites umbellata</i>	Devil's-potato, Rubbervine	0	2		
<i>Eragrostis elliotii</i>	Elliott's love grass	0	6		

Scientific Name	Common Names	Records before Restoration	Records After Restoration	State Status	Federal Status
<i>Euphorbia polyphylla</i>	Pineland euphorbia, Lesser Florida spurge	0	3		
<i>Eustachys petraea</i>	Common fingergrass, Pinewoods fingergrass	1	3		
<i>Forestiera segregata</i>	Florida privet, Florida swampprivet	19	15		
<i>Galactia floridana</i>	Hairy milkpea	1	0		
<i>Galactia pinetorum</i>	Pineland milkpea	2	0		
<i>Galactia volubilis</i>	Downy milkpea	1	0		
<i>Galium hispidulum</i>	Coastal bedstraw	6	7		
<i>Guettarda scabra</i>	Rough velvetseed	15	27		
<i>Ilex krugiana</i>	Krug's holly, Tawnyberry holly	1	4	T	
<i>Ipomoea tenuissima</i>	Rockland morningglory	0	2	E	
<i>Jacquemontia curtisii</i>	Pineland clustervine	6	3	T	
<i>Koanophyllon villosum</i>	Shrub eupatorium	3	6	E	
<i>Lantana depressa</i>	Pineland lantana, Rockland shrubverbena	0	1	E	
<i>Lantana involucrata</i>	Wild-sage, Buttonsage	9	16		
<i>Licania michauxii</i>	Gopher-apple	3	2		
<i>Melanthera parvifolia</i>	Pineland blackanthers	3	4	T	
<i>Metopium toxiferum</i>	Poisonwood, Florida poisontree	118	139		
<i>Morinda royoc</i>	Yellowroot, Redgal, Mouse's pineapple	14	13		
<i>Muhlenbergia capillaris</i>	Muhlygrass, Hairawnmuhly	1	2		
<i>Myrica cerifera</i>	Wax myrtle, Southern Bayberry	5	7		

Scientific Name	Common Names	Records before Restoration	Records After Restoration	State Status	Federal Status
<i>Paspalum blodgettii</i>	Coral paspalum, Blodgett's crowngrass	0	17		
<i>Paspalum caespitosum</i>	Blue paspalum, Blue crowngrass	2	6		
<i>Paspalum monostachyum</i>	Gulfdune paspalum	1	0		
<i>Paspalum setaceum</i>	Thin paspalum	0	3		
<i>Passiflora suberosa</i>	Corkystem passionflower	3	3		
<i>Phyllanthus pentaphyllus</i> var. <i>floridanus</i>	Florida five-petalled leafflower	6	9		
<i>Physalis walteri</i>	Walter's groundcherry	2	0		
<i>Pinus elliotii</i> var. <i>densa</i>	South Florida slash pine	103	108		
<i>Piriqueta caroliniana</i>	Pitted stripeseed	1	2		
<i>Pityopsis graminifolia</i>	Narrowleaf silkgrass	0	1		
<i>Polygala grandiflora</i>	Candyweed, Showy milkwort	1	3		
<i>Psidium longipes</i>	Longstalked-stopper	3	0	T	
<i>Pteridium aquilinum</i> var. <i>caudatum</i>	Lacy bracken fern	19	30		
<i>Pteris bahamensis</i>	Bahama ladder brake	2	3	T	
<i>Quercus pumila</i>	Running oak	1	13		
<i>Quercus virginiana</i>	Virginia live oak	44	13		
<i>Randia aculeata</i>	White indigoberry	7	2		
<i>Rapanea punctata</i>	Myrsine, Colicwood	23	21		
<i>Rhus copallinum</i>	Winged sumac	12	5		
<i>Rhynchosia cinerea</i>	Brownhair snoutbean	0	1		
<i>Rhynchospora floridensis</i>	Florida whitetop	10	9		
<i>Rhynchospora grayi</i>	Gray's beaksedge	0	4		
<i>Rhynchosia minima</i>	Least snoutbean	2	0		
<i>Rhynchosia reniformis</i>	Dollarweed, Dollarleaf	1	1		

Scientific Name	Common Names	Records before Restoration	Records After Restoration	State Status	Federal Status
<i>Sabal palmetto</i>	Cabbage palm	42	60		
<i>Schizachyrium gracile</i>	Wire bluestem	62	80		
<i>Schizachyrium rhizomatum</i>	Rhizomatous bluestem	8	26		
<i>Schizachyrium sanguineum</i>	Crimson bluestem	22	45		
<i>Scleria ciliata</i>	Fringed nutrush	2	1		
<i>Scutellaria havanensis</i>	Havana skullcap	0	2	E	
<i>Serenoa repens</i>	Saw palmetto	125	178		
<i>Sideroxylon salicifolium</i>	Willow-bustic, White bully	13	4		
<i>Sisyrinchium nashii</i>	Nash's blueeyed-grass	0	2		
<i>Smilax auriculata</i>	Earleaf greenbrier	10	8		
<i>Smilax bona-nox</i>	Saw greenbrier	3	3		
<i>Smilax havanensis</i>	Havana greenbrier, Everglades greenbrier	14	1	T	
<i>Solidago odora</i> var. <i>chapmanii</i>	Chapman's goldenrod	3	2		
<i>Sorghastrum secundum</i>	Lopsided Indian grass	41	77		
<i>Swietenia mahagoni</i>	West Indian mahogany	1	0	T	
<i>Tephrosia florida</i>	Florida hoarypea	2	0		
<i>Tetrazygia bicolor</i>	West Indian-lilac, Florida clover ash	3	4	T	
<i>Toxicodendron radicans</i>	Eastern poison-ivy	19	12		
<i>Tragia saxicola</i>	Florida Keys noseburn	9	7	T	
<i>Trema micranthum</i>	Florida trema, Nettletree	3	1		
<i>Tripsacum floridanum</i>	Florida gamagrass	0	4	T	
<i>Vitis rotundifolia</i>	Muscadine, Muscadine grape	11	9		
<i>Waltheria indica</i>	Sleepy morning	0	1		
<i>Zamia integrifolia</i>	Coontie, Florida arrowroot	1	1	C	

Appendix C: Matching Funds

Type of Match	Donor				Amount
Other Services					
Fire Breaks	DOF				Unknown
Contractor (Hardwood Clearing)	TAS				\$2,100.00
Wildlife Habitat Incentive Program (WHIP)*	USDA				\$21,998.32
Sub-total					\$2,100.00
Equipment					
Herbicide (Garlon 4) attachment	Dow Agro				\$1,000.00
	FOIRC				\$30.00
Sub-total					\$1,030.00
Cash					
	FOIRC				\$250.00
Sub-total					\$250.00
Volunteer Hours					
	Group	# Adults	# Kids	Hours	Match Amount
Sunday, December 04, 2005	FIU	21		3	\$630.00
Saturday, April 22, 2006	HOM	45	12	3	\$1,530.00
Saturday, June 24, 2006	HOM/IRC	5		3	\$150.00
Saturday, August 05, 2006	HOM/IRC	5		3	\$150.00
Saturday, October 28, 2006	UM	17		1.5	\$255.00
Saturday, February 3, 2007	IRC	4		3	\$120.00
Saturday, March 3rd, 2007	IRC	2		2.5	\$50.00
Saturday, April 7th 2007	HOM/IRC	3		3	\$90.00
Saturday, May 22nd 2007	HOM	86		2.5	\$2,150.00
Saturday, July 7th 2007	IRC	1		2.5	\$25.00
Friday, July 13th, 2007	FIU	10	61	2	\$810.00
Wednesday, August 1st, 2007	HOM	28		3	\$840.00
Saturday, September 1st, 2007	HOM	3		2.5	\$75.00
Saturday, December 1st, 2007	HOM/IRC	17		3	\$510.00
	Sub-totals	247	73	37.5	\$7,385.00
Grants					
Ross Foundation (2006)	Ross Foundation				\$4,000.00
Ross Foundation (2007)	Ross Foundation				\$4,957.00
Sub-total					\$8,957.00
Acronyms					Total
					\$19,472.00
					Required Match
					\$11,513.10
DOF - Florida Division of Forestry					
FIU - Florida International University					
FOIRC - Friends of IRC					
HOM - Hands on Miami					
TAS - Tropical Audubon Society					
UM - University of Miami					
USDA - US Department of Agriculture					
*WHIP is federal money and does not count toward matching funds					

Appendix D: Before and After Restoration Photographs from Select Sites

Figure 1D: Camp Choee, Zone A, North Before



Figure 2D: Camp Choee, Zone A, North After



Figure 3D: Massin Pineland, Zone B, North Before



Figure 4D: Massin Pineland, Zone B, North After



Figure 5D: Porter-Russell Pineland, Zone B, South Before



Figure 6D: Porter-Russell Pineland, Zone B, South After

