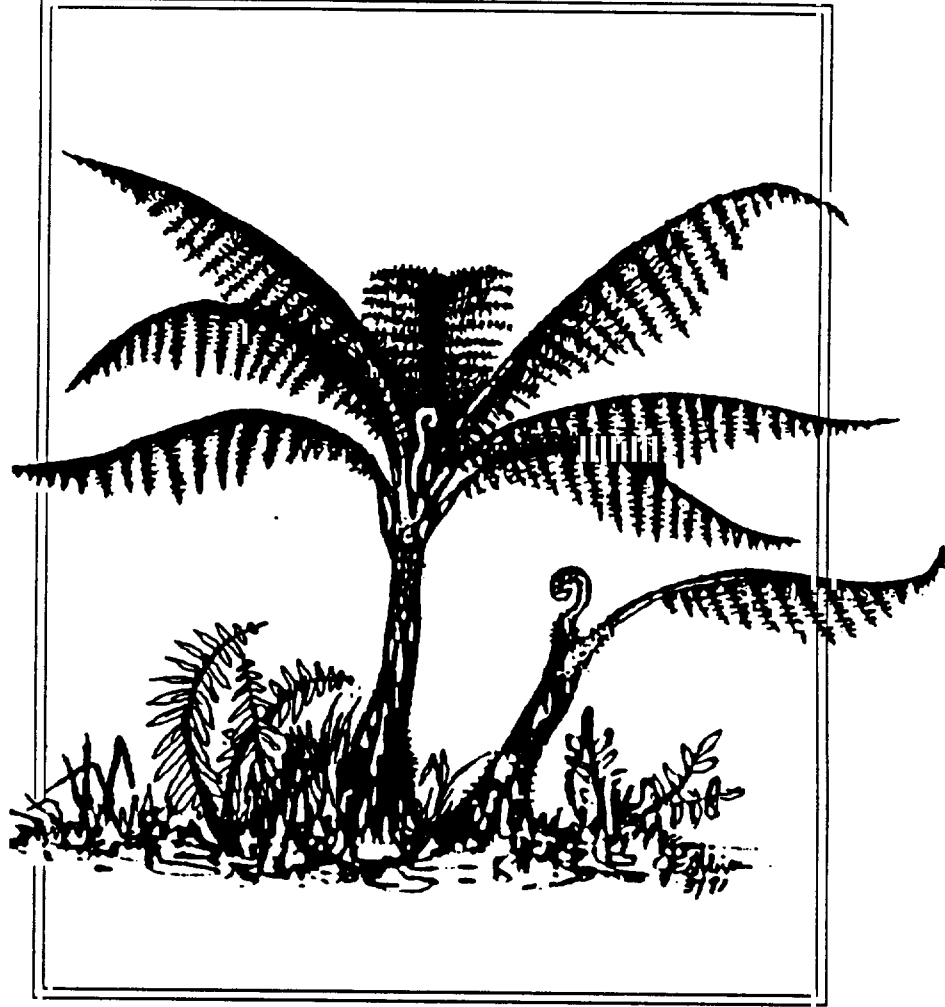


# RECOVERY PLAN

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*Ilex Cookii/Cyathea dryopteroides*



U.S. Fish and Wildlife Service



ILEX COOKII AND CYATHEA DRYOPTEROIDES RECOVERY PLAN

prepared by

U.S. Department of the Interior  
Fish and Wildlife Service  
Southeast Region  
Atlanta, Georgia

Approved:

  
Regional Director, U.S. Fish and Wildlife Service

Date:

January 31, 1991

Recovery plans delineate reasonable actions which are believed to be required to recovery and/or protect listed species. Plans are published by the U.S. Fish and Wildlife Service, sometimes prepared with the assistance of recovery teams, contractors, State agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director or Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature Citations should read as follows:

U.S. Fish and Wildlife Service. 1990. Ilex cookii and Cyathea dryopteroides Recovery Plan. Atlanta, Georgia. 22 pp.

Additional copies may be purchased from:

Fish and Wildlife Reference Service:

5430 Grosvenor Lane, Suite 110  
Bethesda, Maryland 20814  
301/492-6403  
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1-800-582-3421

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EXECUTIVE SUMMARY OF THE RECOVERY PLAN FOR  
CYATHEA DRYOPTEROIDES AND ILEX COOKII

**Current Status:** These species are endemic to the dwarf forests of the central mountains of Puerto Rico. At present only 3 populations are known for Cyathea dryopteroides or elfin tree fern: Monte Guilarte, Cerro Rosa; and Monte Jayuya. Ilex cookii or Cook's holly is found only on Cerro de Punta and Monte Jayuya.

**Habitat Requirements and Limiting Factors:** Both species are restricted to dwarf or elfin forests found at elevations greater than 830 meters. The vegetation is an evergreen montane forest type, seldom exceeding 7 meters in height. Historically, the most important factor affecting these species has been modification or destruction of habitat. At present, these peaks continue to be threatened by the expansion of communication facilities and by forest management practices.

**Recovery Objective:** Reclassification from endangered to threatened; possibly delisting.

**Recovery Criteria:** To protect existing populations and their habitats and establish new populations at other appropriate protected sites.

**Actions Needed:**

1. Monitor existing populations.
2. Protect current habitat.
3. Conduct research on the life history of these species, evaluate methods of propagation and to look for reintroduction sites.
4. Propagate and produce seedlings for enhancement of existing populations and the establishment of new populations.

**Date of Recovery:** Downlisting should be initiated in 2025, if recovery criteria are met.

**Recovery Costs:** Recovery costs for Ilex cookii and Cyathea dryopteroides have been estimated at \$102,000 for the first three years. Subsequent expenditures will depend on the results of these preliminary studies and therefore cannot be estimated at this time.

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## PART I. INTRODUCTION

The elfin tree fern (Cyathea dryopteroides) and Cook's holly (Ilex cookii), a small evergreen tree, are endemic to the dwarf or elfin forest of the central mountains of Puerto Rico. Only three populations are known for the elfin tree fern. It is found on three peaks located approximately 12 miles (20 kilometers) apart, Monte Guilarte, Cerro Rosa and Monte Jayuya. A total of approximately 95 individuals have been located at these three sites. Cook's holly is found on Cerro de Punta, the highest mountain in Puerto Rico, and scattered along the ridgetops of Monte Jayuya. Only one mature tree and about 35 sprouts or seedlings are known to exist at these sites. All sites are found within the Commonwealth Forests of Toro Negro and Monte Guilarte. These species have become endangered primarily due to the modification of habitat and the direct destruction of plants in the elfin forest, a unique vegetation type limited in distribution, for roads and communication facilities. In addition, the Monte Jayuya site has been utilized for military training exercises, further endangering these rare species. Both species are confined to geographically small areas and the specialized habitat of the dwarf forest and are therefore susceptible to natural disturbance such as landslides and hurricanes.

Ilex cookii and Cyathea dryopteroides were determined to be endangered species on July 16, 1987 (U.S. Fish and Wildlife Service 1987) pursuant to the Endangered Species Act of 1973, as amended. Critical habitat has not been designated for this species because of the risks of overcollecting or vandalism.

### Description

Ilex cookii, of the family Aquifoliaceae, was first collected in 1926 by H. A. Gleason and M. T. Cook during the early botanical explorations of Cerro Punta (elevation 4,402 feet or 1,338 meters), the highest mountain in Puerto Rico. The species was later found on Monte Jayuya, only about a mile (1.6 kilometers) to the east of Cerro Punta (Vivaldi et al. 1981a). Cyathea dryopteroides, of the family Cyatheaceae, was first discovered by Britton and Brown on Monte Cerrote in 1915, and thereafter collected on Monte Jayuya in 1943, and on Monte Guilarte in the 1960's (Vivaldi et al. 1981b). It has not been collected at any other sites and no longer occurs on Monte Cerrote. The elfin tree fern has been alternately placed in the genera Cyathea and Alsophila, depending on the relative importance placed on various morphologic characters. Utilizing the most recent classification and documentation of the ferns of Puerto Rico it is here designated as Cyathea (Proctor 1986).

Ilex cookii is an evergreen shrub or small tree reaching 8 feet (2.5 meters) in height. The leaves are alternate, simple, thin but leathery, glabrous, and entire. They are from 3/4 to 1 3/4 inches (2 to 4 centimeters) long and 3/8 to 7/8 inches (1 to 2.2 centimeters) wide and reach an abrupt point at the apex. The upper surface is dark shiny green and the lower a pale green with microscopic black dots. Ilex cookii is dioecious, male and female flowers are borne on different plants. Female flowers are minute (1/16 inch or 2 millimeters long) and white. Fruits are a drupe approximately 3/16 inch (5 millimeters) in diameter. Male flowers have not been observed.

Cyathea dryopteroides is a small or dwarf tree fern reaching 24 inches (60 centimeters) in height and approximately 1 inch (2 to 3 centimeters) in diameter. The fronds are bipinnate, nearly hairless, tape at both ends, and reach 36 inches (90 centimeters) in length and 10 inches (25 centimeters) in width. The sori are located dorsally and are enclosed in a cup-shaped indusium.

#### Distribution

Both Ilex cookii and Cyathea dryopteroides are restricted in distribution to the dwarf or elfin forest of the central mountains (elevations greater than 2700 feet or 830 meters) of Puerto Rico. Ilex cookii is found near the summits of Cerro de Punta and Monte Jayuya, both within the Toro Negro Commonwealth Forest. To date it has not been reported from other sites. Cyathea dryopteroides has been reported from four sites in this central mountain area; Monte Cerrote, Monte Jayuya, Cerro Rosa, and Monte Guilarte. The Monte Cerrote population has since been eliminated. The Monte Jayuya and Cerro Rosa sites lie within the Toro Negro Commonwealth Forest and the Monte Guilarte site within the Monte Guilarte Commonwealth Forest.

Due to the limited extension of this high elevation dwarf or elfin forest in Puerto Rico, both Ilex cookii and Cyathea dryopteroides appear to always have been rare or of limited distribution.

#### Population Status

As discussed above, both Ilex cookii and Cyathea dryopteroides are presently known to occur at only two and three locations, respectively, in Puerto Rico (Figures 1a and 1b). It is possible that other small populations survive

in other tracts of dwarf forest in the central mountains of Puerto Rico. The known sites can be described as follows:

Ilex cookii

1. Cerro Punta, Jayuya, Puerto Rico - the type locality of Cook's holly supports today only 1 mature individual and 4 sprouts. The elevation at this site ranges from 3,900 to 4,260 feet (1,200 to 1,300 meters). Communication facilities have been constructed at the summit and clearing for the construction of these was probably responsible for the loss of individuals. The site is located within the Toro Negro Commonwealth Forest.
2. Monte Jayuya, Jayuya, Puerto Rico - the largest population of this species consists of about 30 sprouts or seedlings that are scattered along the ridgetops in this area. The site is located within the Toro Negro Commonwealth Forest at an elevation of approximately 4,260 feet (1,300 meters). Communication facilities have been constructed at this site.

Cyathea dryopteroides

1. Monte Jayuya, Jayuya, Puerto Rico - the largest population of the elfin tree fern is found on Monte Jayuya and consists of more than 60 individuals observed to be in all stages of development. Communication facilities have been constructed at this site.
2. Cerro Rosa, Ciales, Puerto Rico - this population, consisting of more than 25 plants, was discovered on March 26, 1988, by George R. Proctor. The plants occur just east of the summit of Cerro Rosa at approximately 4050 feet (1,250 meters) elevation. This site is within a little-known and seldom-visited sector of the Toro Negro Commonwealth Forest, and is about 4 hours hiking distance from the nearest road.
3. Monte Guilarte, Adjuntas, Puerto Rico - this population was discovered in the late 1960's but only 10 plants remain at this site. The elevation is approximately 3,900 feet (1,200 meters). The site lies within the Monte Guilarte Commonwealth Forest.



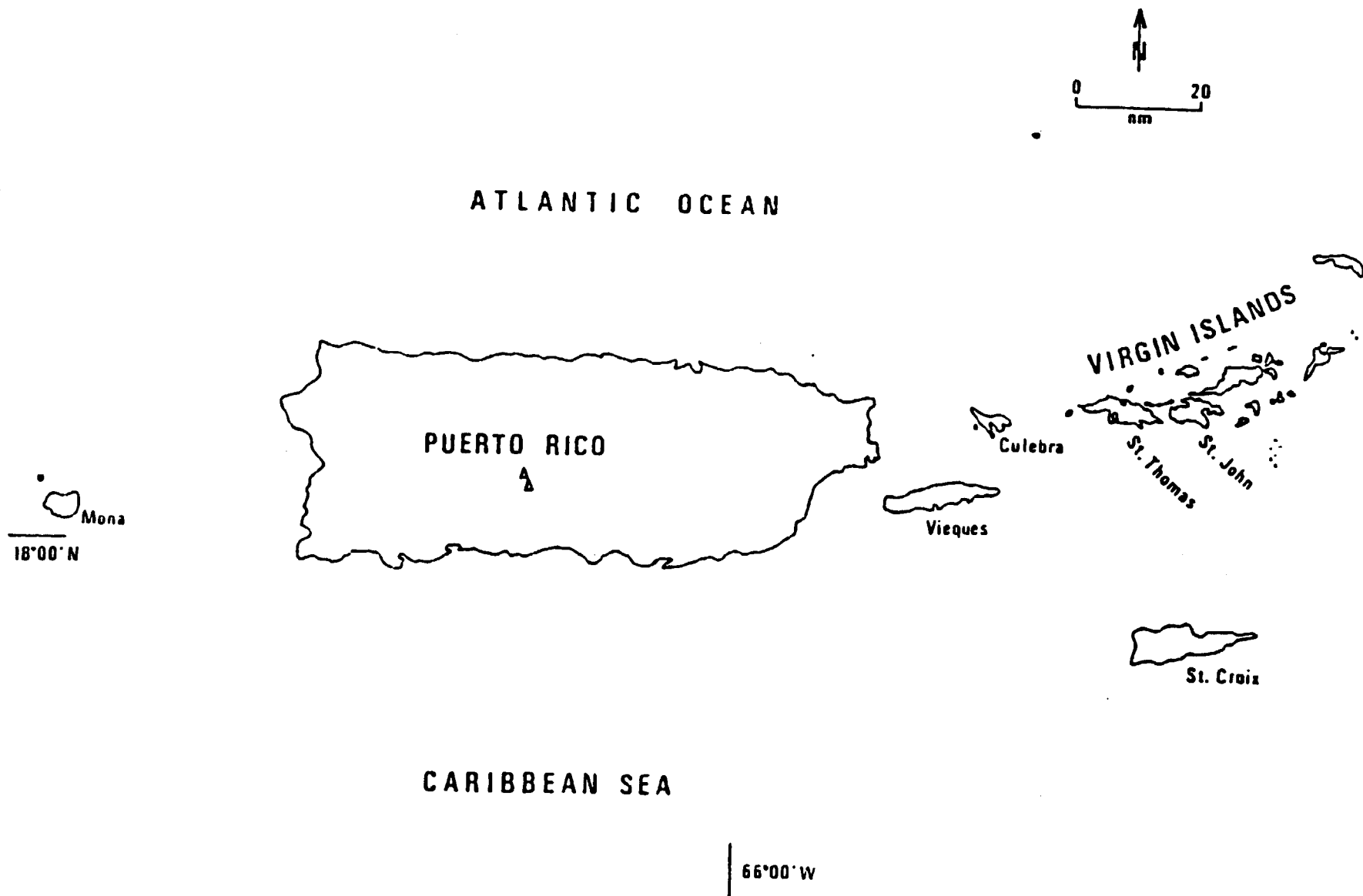


Figure 1a. Present distribution of *Ilex cookii*. Population locations indicated by (Δ).

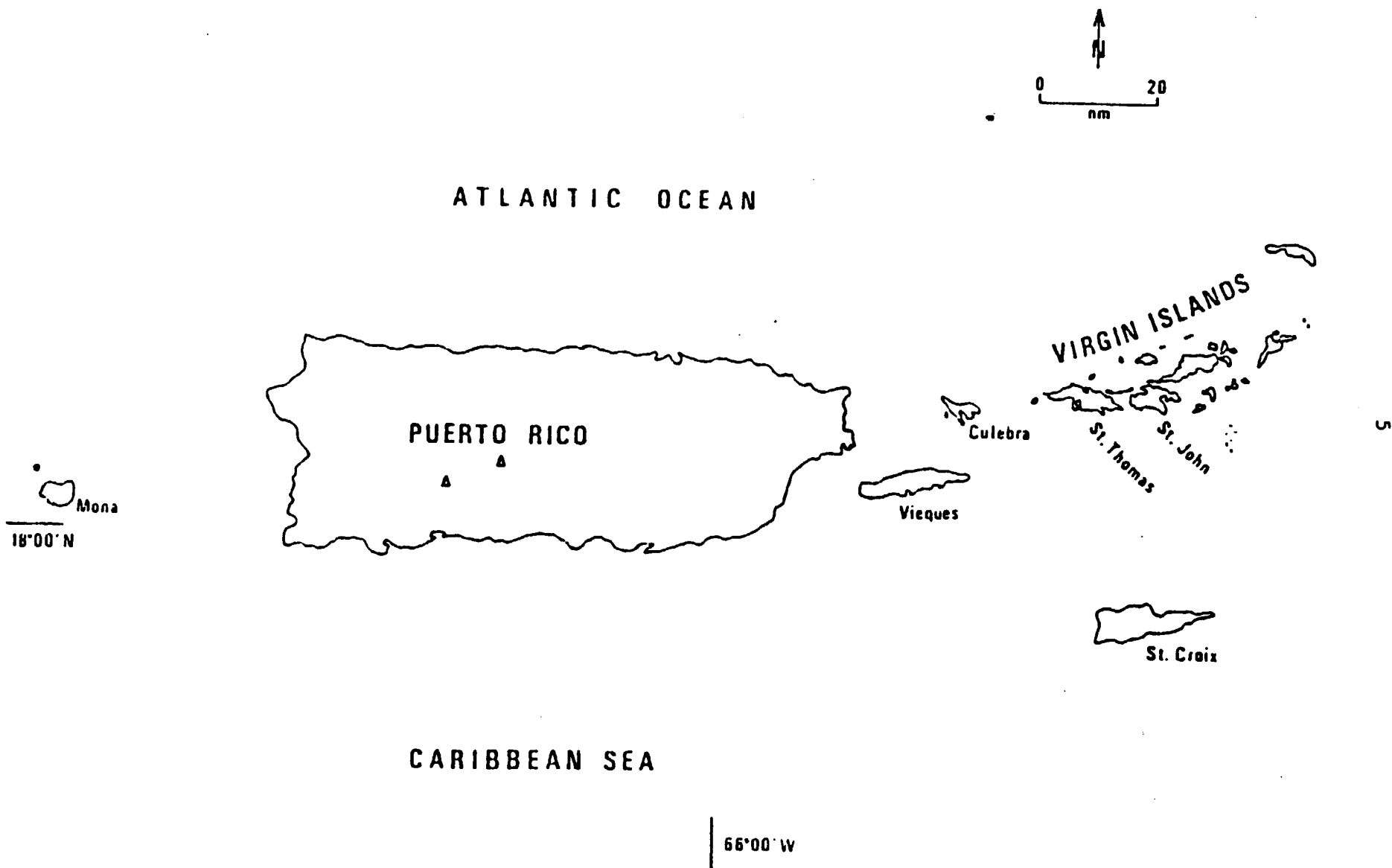


Figure 1b. Present distribution of *Cyathea dryopteroides*. Population locations indicated by (Δ).

Only 1 mature individual and about 34 sprouts or seedling of Ilex cookii are known to exist in two areas. Approximately 95 individuals of Cyathea dryopteroides have been found on three sites. It is possible that additional individuals may be found in adjacent areas of dwarf or elfin forest. However, given the low densities observed where the species have been found and the limited extension of the dwarf or elfin forest in Puerto Rico, it is unlikely that significant numbers of plants will be located in the future.

### Reproductive Status

Ilex cookii is dioecious, producing minute male and female flowers on separate plants. Pollination is probably effected by insects or wind, although the pollination biology of this species has not been studied. Male flowers and ripe fruit have never been observed and at present only one mature individual is known. The remaining plants are small, both sprouts or seedlings, suggesting that root sprouting or resprouting (coppicing) may occur and that viable seed is occasionally produced.

Fertile fronds have frequently been observed on Cyathea dryopteroides at both known sites. The presence of healthy, vigorous plants in all stages of development suggests that successful reproduction and establishment occurs regularly.

### Habitat Description

Both Ilex cookii and Cyathea dryopteroides are restricted to the dwarf or elfin forests of the highest elevations in the central mountains of Puerto Rico. Elevations at all known sites ranges from 3,900 to 4,260 feet (1,200 to 1,300 meters). Topography is rough and highly dissected by intermittent streams but the elfin forest is found on the more rounded mountain tops. The central mountains are upper Cretaceous, volcanic in origin. Igneous rocks, mostly andesitic types, cover the area. The clay soils are deep, well-drained, very strongly acid, and overlay a thick layer of highly weathered rock. A deep humus layer is present on the forest floor. Tree roots often form a tight superficial mat (Gierbolini 1973).

Average annual precipitation (1969-1979) at the nearby Cerro Maravilla (elevation 3,900 feet or 1,200 meters) is 92 inches (2338 millimeters). The major peak in rainfall occurs in September and October and a secondary peak in May. Average annual temperature at this same station is 18.4 Centigrade with an average monthly maximum of 19.8 Centigrade in July

and August and a minimum of 16.7 Centigrade in January. The estimated potential evapotranspiration is 1,140 millimeters, less than half of the annual precipitation received in this area (Silander et al. 1986).

The vegetation of the high elevations of the central mountains, as well as of the eastern Luquillo Mountains, has been called dwarf, elfin, or cloud forest (Howard 1968, Ewel and Whitmore 1973). Ewel and Whitmore (1973) have described this area as the subtropical lower montane wet forest (Toro Negro) and subtropical wet forest (Monte Guilarte) life zones. Within this forest type, Ilex cookii occurs on more exposed ridges at or below canopy height, while Cyathea dryopteroides is more often a component of the ground cover within almost pure stands of the sierra palm (Prestoea montana).

The vegetation, an evergreen montane forest type, is characterized by a single canopy layer that seldom exceeds 22 feet (7 meters) in height. Gnarled and much branching trees form a dense thicket and mosses, liverworts, bromeliads are abundant. Leaves are microphyllous, sclerophyllous, and clustered at the tips of branches. Gleason and Cook (1927) described differences between the dwarf forests of the eastern and the central mountains. Those of the central mountains, apparently subject to a less rigorous environment, were somewhat taller and supported a less dense cover of mosses and bromeliads. Among the causes cited as responsible for the dwarfed nature of the vegetation at these high elevations are strong wind, waterlogged soils and their poor nutrient contents, shallow and poorly developed root systems, and inefficient base pumping due to low transpiration rates (Howard 1968, Weaver et al. 1973).

Common trees in this forest are Cyrilla racemiflora, Didymopanax gleasonii, Rapanea ferruginea, Magnolia portoricensis, Clusia grisebachiana, Micropholis chrysophylloides, and Calypttranthes krugii. The herbaceous layer includes Pilea krugii, P. obtusata, P. yunquensis, Begonia decandra, Scleria secans, Arthostylidium sarmentosum, and Justicia martinsoniana. Epiphytic species include bromeliads, orchids, mosses, and liverworts. Other rare species also found in the area are Weinmannia pinnata, Solanum antillarum, Eugenia sintenisii, and E. Stewardsonii.

#### Known and Suspected Limiting Factors

Historically, the most important factor affecting the abundance and distribution of both Ilex cookii and Cyathea dryopteroides has been the modification of habitat or the direct destruction of plants. The increased human

disturbance of the montane forest due to the construction of roads and the installation of communication facilities on the highest peaks has resulted in the documented loss of individuals of both species. Already limited in aerial extent, the dwarf or elfin forest has been greatly reduced as a direct result of such activities. Although all sites are owned and managed as part of the Commonwealth Forest system, the summits of Monte Guilarte, Cerro Punta, and Monte Jayuya, as well as others, have been cleared for construction after being leased to communication companies. Cerro Rosa is the most remote and least-damaged high summit of the central mountains and needs further botanical investigation.

### Threats to Future Existence

The construction of new communication facilities or the expansion of existing ones would affect remaining populations of Cyathea dryopteroides and could possibly result in the extinction of Ilex cookii. In addition, many of the plants are close enough to roads that maintenance activities could directly or indirectly (creating slope instability) reduce numbers of both species. In addition, military training maneuvers which have repeatedly been conducted in this area could result in loss of individuals and habitat modification through trampling and cutting.

A serious threat to the dioecious species, Ilex cookii, is the effect low population numbers may have on successful reproduction. Only 1 mature individual is known to exist and neither male flowers nor mature fruit of this species have ever been reported. Regular pollination and viable seed production may rarely occur and recruitment may be too low to maintain or increase population numbers. Therefore, unless there are sufficient numbers of as yet undiscovered plants, the species could eventually become extinct.

### Cultivation Potential

The collecting of Ilex cookii or Cyathea dryopteroides for horticultural purposes has not been documented as a factor that might contribute to its decline. However, both species are attractive and may have ornamental value. Considerable commercial trade in fern species currently exists. All species of the family Cyatheaceae are included in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). To date, propagation of these two species has not been attempted. The successful introduction of Ilex cookii would be dependent on the propagation of both male and female plants and on the production of viable seed.

## PART II. RECOVERY

### A. Recovery Objective

The objective of this recovery plan is to provide guidance for reversing the decline of both Ilex cookii and Cyathea dryopteroides and restoring these species to a stable, secure, and self-sustaining status, permitting them to be reclassified from endangered to threatened, and perhaps eventually allowing their removal from the Federal list.

Ilex cookii and/or Cyathea dryopteroides could be considered for reclassification to threatened species when at least two new populations of each species capable of self-perpetuation have been established within protected units of the Commonwealth Forest (Monte Guilarte or Toro Negro) or on Federal land within the Caribbean National Forest. These should be considered minimum requirements, and may be modified if new populations of mature plants are discovered, particularly if on private land, thus creating the necessity to place greater emphasis on protection, rather than propagation.

B. Outline Narrative.

1. Prevent further habitat loss and population decline.

The habitat and plants at the known population sites must be protected to prevent the continued decline and possible extinction of the species and to maintain sources of propagative material.

11. Habitat protection.

Protection of existing population sites must be given highest priority.

111. Limit expansion of communication facilities and prevent the development of new facilities.

Work with the Puerto Rico Department of Natural Resources to prevent further modification and destruction of the unique vegetation of the elfin forest.

112. Develop cooperative agreements with the Puerto Rico Department of Transportation and Public Works (DTPW) and the Department of Natural Resources (DNR).

Road maintenance activities by both the DTPW and DNR may potentially affect both species. A cooperative agreement that would identify and protect individual plants should be prepared and implemented.

113. Prohibit the use of the area for military training maneuvers.

The use of these sites for such purposes should be prohibited through Section 7 of the Endangered Species Act and Section 10 of the Puerto Rico Regulation for the Management of Threatened and Endangered Species.

114. Coordinate with the Department of Natural Resources in developing a management plan for the protection and recovery of these species.

A management plan should be developed in cooperation with the DNR outlining

forest management techniques which would protect or enhance the populations of both species.

12. Plant protection.  
The population dynamics (recruitment and survival) should be monitored on a long-term basis.
  121. Monitor all known populations.  
All known populations of both species should be monitored at regular intervals on a long-term basis in order to determine recruitment and mortality rates. All individuals should be marked and measured. Regular observations should assess phenology and changes in site conditions which might impact plants.
  122. Enforce existing Commonwealth regulations prohibiting take and Federal regulations regarding project/activity impacts to endangered species.  
Both species are on the Commonwealth list of endangered species and are therefore subject to regulations which prohibit take as well as those which consider project/activity/forest management impacts.
  123. Educate the public on plant conservation values and regulations concerning endangered species.  
Federal and Commonwealth conservation agencies as well as private conservation organizations should design and implement an education program concerning endangered species in Puerto Rico. This should be prepared in both English and Spanish and should include an illustrated pamphlet on endangered species. Government agencies should be informed of their responsibilities as described in both the Federal and the Commonwealth endangered species legislation.



2. Continue to gather information on distribution and abundance of Ilex cookii and Cyathea dryopteroides in the central mountains of Puerto Rico.  
Previously unsurveyed areas may support populations or individuals of these species. Future decisions concerning the management of known populations and recovery priorities will be affected by the discovery of such areas.
21. Continue to search for new populations.  
Although the remaining area of elfin forest is not extensive, it is possible that undiscovered individuals or populations exist.
  211. Identify and survey potential sites.  
Potential sites should be identified and a systematic survey conducted in each.
  212. Characterize sites to determine their suitability for future recovery actions such as introduction of the species.  
If new populations are found, site and population information should be added to the data base. In addition, each site and population should be evaluated to determine its potential as a source of propagative material and its potential for protection. If no plants are found on the site identified, the possibility of reintroduction of the species should be considered.
  213. Develop protective status for newly discovered populations, if necessary.  
If the population is in need of protection or if the site appears suitable for introduction and population establishment, protective status should be developed through conservation easements, acquisition, etc.
3. Research.  
No information on the feasibility of propagation is available. This is essential to ensure recovery of the species. Little information is currently available concerning the phenology or

population dynamics of either Ilex cookii or Cyathea dryopteroides. Although many studies are long-term, these will provide the basic data necessary to make management decisions.

31. Evaluate feasibility of artificial propagation.

Initiate artificial propagation from both propagule and cuttings. Prior to this a preliminary study should evaluate the impacts of the source population, particularly where seed collection will occur.

311. Evaluate relative success of propagation from seed/spore versus cuttings (Ilex).

The most feasible method of propagation for each species should be determined taking into consideration the availability of propagative material, economic and logistical factors, and field success of transplanting.

312. Determine feasibility of ex situ production of propagative material.

The use of propagative material from cultivated plants should be considered as it would minimize impacts on existing wild populations.

32. Investigate reproductive biology and ecology of Ilex cookii and Cyathea dryopteroides.

Little information is available concerning the reproductive biology of either species. Male flowers and ripe fruit of Ilex cookii have not been observed.

321. Assess periodicity of flowering/spore production and pollination mechanisms (Ilex cookii).

Phenological studies should be initiated with all populations and observations made at regular intervals. Biological factors controlling timing and abundance may be identified.

322. Assess fruit/spore production and seed dispersal.  
Fruit predators and/or propagule dispersal agents should be identified. The conditions under which the propagule is successfully dispersed to biologically and physically adequate sites should be assessed.
323. Evaluate seed viability and germination requirements.  
The environmental conditions (including dispersal agents) required for germination should be assessed in laboratory and field experiments.
324. Evaluate seedling establishment and growth.  
In conjunction with 323. determine suitable microsite conditions for seedling establishment and identify critical factors which affect early seedling survival.
325. Evaluate role of vegetative regeneration.  
Determine what role, if any, vegetative regeneration plays in population maintenance and growth. A number of individuals of Ilex cookii have been identified as sprouts. Assess the relationships between these to determine their origin.
33. Define habitat requirements.  
Although detailed studies are not necessary, available information may be evaluated to better define habitat requirements.
34. Select appropriate sites for population enhancement or introduction, utilizing artificially propagated material.  
The success and ecological relevance of planting or transplanting propagative material depend upon adequate consideration of geography and habitat.
341. Assess habitat suitability.  
Identify potential sites for introduction of Ilex cookii and/or Cyathea dryopteroides and utilizing

information obtained in defining habitat requirements (Task 31), evaluate the potential of the site.

342. Assess site protection.

Just as important as habitat suitability is the protection of the reintroduction site.

3421. Develop protective status, if necessary.

If the site is not protected, implementation of protective status must be initiated.

3422. Develop management plans for new sites.

If the site is within an existing management area such as a Commonwealth Forest, existing management plans should be modified to incorporate consideration of the species. If the site is given new protective status, a management plan should be developed.

4. Refine recovery goals.

The accumulation of additional information on all aspects of the biology of Ilex cookii and Cyathea dryopteroides may necessitate the redefining and modification of existing recovery goals.

41. Determine number of populations and individuals necessary to ensure species' stability, security, and self perpetuation.

Based on results of the above-mentioned studies in conjunction with site protection, more precise recovery goals for these species may be established. Considerations such as the dioecious nature of Ilex cookii are essential.

411. Determine importance of continued propagation and introduction versus habitat protection.

If new, healthy populations are discovered the emphasis on propagation vs. protection should be re-evaluated.

42. Determine what additional actions, if any, are necessary to achieve recovery goals. Additional needs and/or potential management activities may be discovered during the recovery efforts. If these needs or actions are beneficial or essential to these species they will be incorporated into a revised recovery plan.

D. Literature Cited

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### PART III. IMPLEMENTATION SCHEDULE

The Implementation Schedule that follows outlines actions and estimated costs for the recovery program. It is a guide for meeting the objective discussed in Part II of this Plan. This schedule indicates task priorities, task numbers, task descriptions, duration of tasks, the responsible agencies, and lastly, estimated costs. These actions, when accomplished, should bring about the recovery of the species and protect its habitat. It should be noted that the estimated monetary needs for all parties involved in recovery are identified and, therefore, Part III reflects the total estimated financial requirements for the recovery of this species.

Priorities in Column 4 of the following Implementation Schedule are assigned as follows:

- Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
- Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.
- Priority 3 - All other actions necessary to provide for full recovery of the species.

## GENERAL CATEGORIES FOR IMPLEMENTATION SCHEDULE

### Information Gathering - I or R (research)

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant
13. Reintroduction
14. Other information

### Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Disease control
7. Other management

### Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

### Other - O

1. Information
2. Law enforcement
3. Regulations
4. Administration



IMPLEMENTATION SCHEDULE

PRIOR- ITY #	TASK #	TASK DESCRIPTION	TASK DURATION (Years)	RESPONSIBLE PARTY			COST ESTIMATES (\$000'S)			COMMENTS
				FWS		Other	FY 1	FY 2	FY 3	
				Region	Division					
1	111	Limit expansion and prevent further develop- ment	5	4	FWE	PRDNR				
1	112	Develop cooperative agreements	2	4	FWE	PRDNR PRTPW				
1	113	Prohibit use for military training manuevers	2	4	FWE	PRDNR				
1	114	Coordinate and develop management plan	3	4	FWE	PRDNR				
1	121	Monitor all known populations	Ongoing	4	FWE	PRDNR	3.0	3.0	3.0	
1	122	Enforce existing regulations	Ongoing	4	FWE	PRDNR	9.0	9.0	9.0	
1	123	Educate the public	Ongoing	4	FWE	PRDNR	1.0	1.0	1.0	

IMPLEMENTATION SCHEDULE

PRIOR- ITY #	TASK #	TASK DESCRIPTION	TASK DURATION (Years)	RESPONSIBLE PARTY			COST ESTIMATES (\$000'S)			COMMENTS
				FWS		Other	FY 1	FY 2	FY 3	
			Region	Division						
2	21	Continue to search for new populations	Ongoing	4	FWE	PRDNR USFS	3.0	3.0	3.0	
2	31	Evaluate feasibility of artificial propagation	Ongoing	4	FWE	Bot. Gar.	4.0	4.0	4.0	
2	32	Investigate reproductive biology and ecology	3-5	4	FWE	Univ.	12.0	12.0	12.0	Includes Tasks 321,322,323,324, 325
2	321	Assess periodicity and pollination mechanisms	3-5	4	FWE	Univ.				
2	322	Assess fruit/spore and seed dispersal	3-5	4	FWE	Univ.				
2	323	Evaluate seed viability and germination requirements	3-5	4	FWE	Univ. BotGar				
2	324	Evaluate seedling	3-5	4	FWE	Univ.				

IMPLEMENTATION SCHEDULE

PRIOR- ITY #	TASK #	TASK DESCRIPTION	TASK DURATION (Years)	RESPONSIBLE PARTY			COST ESTIMATES (\$000'S)			COMMENTS
				Region	FWS Division	Other	FY 1	FY 2	FY 3	
2	325	Evaluate role of vegetative regeneration	3-5	4	FWE	Univ.				
2	33	Define habitat requirements	3-5	4	FWE	PRDNR Univ.	2.0	2.0	2.0	
2	22 341	Assess site suitability	Ongoing	4	FWE	PRDNR	2.0	2.0	2.0	
2	342	Assess site protection	Ongoing	4	FWE CO	PRDNR				
2	4	Refine recovery goals	Ongoing	4	FWE	PRDNR				
LIST OF ABBREVIATIONS										
BotGar - Botanical Gardens										
CO - Conservation Organizations										
LE - Law Enforcement, Fish and Wildlife Service										
PRDNR - Puerto Rico Department of Natural Resources										
PRTPW - Puerto Rico Department of Transportation and Public Works										
FWE - Fish and Wildlife Service, Endangered Species										
Univ. - Universities										
USFS - U. S. Forest Service										