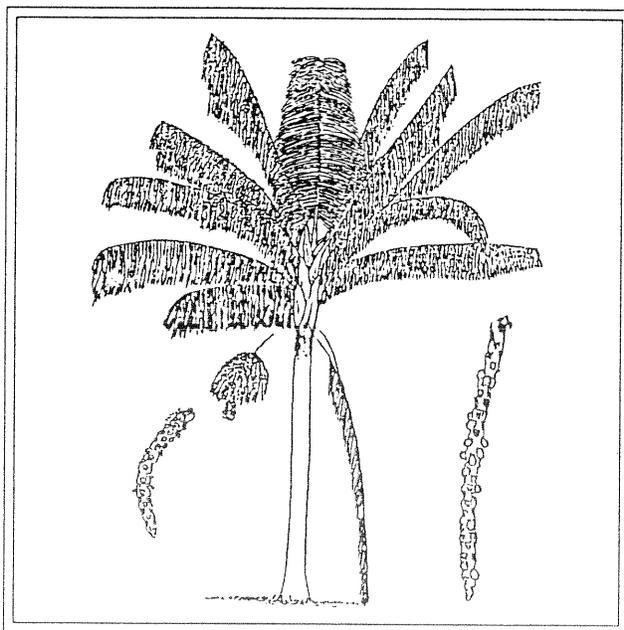


RECOVERY PLAN

(Palma De Manaca)

CALYPTRONOMA RIVALIS



U.S. Fish and Wildlife Service



CALYPTRONOMA RIVALIS (PALMA DE MANACA) RECOVERY PLAN

prepared by

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Date:

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Recovery plans delineate reasonable actions which are believed to be required to recover 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 (Commonwealth) 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. 1992. Calyptronoma rivalis
(palma de manaca) Recovery Plan. U.S. Fish and Wildlife
Service, Atlanta, Georgia. 18 pp.

Additional copies may be purchased from:

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Fees for recovery plans vary depending on the number of pages.

EXECUTIVE SUMMARY OF THE RECOVERY PLAN FOR CALYPTRONOMA RIVALIS

Current Status: The palma de manaca (Calyptronoma rivalis) is listed as threatened. Only three natural populations of this endemic palm, consisting of approximately 275 individuals, occur in the northwestern part of Puerto Rico.

Habitat Requirements and Limiting Factors: Calyptronoma rivalis, an arborescent palm, grows along streambanks in the semi-evergreen forests of the karst region of northwestern Puerto Rico. Three populations are known from San Sebastian, Camuy and Guajataca. The species is threatened by agricultural expansion, rural development and flash flooding caused by deforestation. Road construction resulted in the destruction of a large portion of the Camuy population.

Recovery Objective: Delisting.

Recovery Criteria: Existing populations and their habitats must be protected and at least three self-sustaining populations must be established in protected areas.

Actions Needed:

1. Monitor existing populations.
2. Provide protection for existing populations and their habitat.
3. Conduct research on the life history of the species, evaluate propagation methods, and locate introduction sites.
4. Propagate and produce seedlings for enhancement of existing populations and for the establishment of new ones.

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

Recovery Costs: Recovery costs for Calyptronoma rivalis have been estimated at \$111,000 for the first 3 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

Calyptronoma rivalis (palma de manaca) is an arborescent palm which may reach up to 40 feet (12 meters) in height. The palm is endemic to Puerto Rico, where it grows along streambanks in the semi-evergreen forests of the karst region. Three natural populations, composed of approximately 275 individuals, are known from the Camuy, Quebradillas, and San Sebastian area. Individuals have been planted at two additional sites, the Río Abajo Commonwealth Forest, managed by the Puerto Rico Department of Natural Resources, and the Guajataca Lake area, managed as a Boy Scout Camp. The species is threatened by flash flooding caused by deforestation in surrounding areas, agricultural expansion, and rural development. Road construction in the Camuy area resulted in the destruction of a large portion of that population.

On February 6, 1990, Calyptronoma rivalis (palma de manaca) was determined to be a threatened species (U.S. Fish and Wildlife Service 1990). Critical habitat has not been designated for this species because of the risks of overcollecting and vandalism.

Description

This species, a member of the palm family (Arecaceae), was first collected in 1901 by L. M. Underwood and R. F. Griggs in San Sebastian of western Puerto Rico. In 1923, N. Britton and P. Wilson referred to the palm as Calyptrogyne occidentalis; however, L. H. Bailey, in his 1938 monograph on the group provided sufficient evidence to place this species in a separate genus, Calyptronoma. Authorities on the palm family accept this opinion and view this palm to be an endemic species. Until 1981 this species was known only from the type locality, where 44 individuals were known to occur. Additional populations have been discovered along the Camuy River and later along the Guajataca River, both in northwestern Puerto Rico (Vivaldi and Woodbury 1981; Henderson 1984; Department of Natural Resources 1989).

Calyptronoma rivalis may grow from 14 to 22 centimeters in diameter. Rings may be from 4.4 to 14 centimeters apart. The palm's spineless, pinnate, glabrous leaves may reach 4 meters in length and have a petiole 60 centimeters long. The sheath may reach 60 centimeters long. Pinnae are up to 1 meter long and 5 centimeters wide, arranged in one plane and drooping on both sides. The inflorescence is a drooping panicle about 1 meter long. Flowers are in triads of two males and one female and are borne on sunken pits. Fruits are 6 millimeters in diameter and are subglobose and reddish when ripe. All fruits mature at approximately the same time and fall with the persistent flower parts still attached to the base.

Distribution/Population Status

Natural populations of Calyptronoma rivalis are known from only three privately-owned areas in Puerto Rico: San Sebastian, the Camuy River, and the Guajataca River (Figure 1). A total of approximately 275 individuals are known from these three sites. Additional individuals have been planted at the Guajataca Lake area and the Río Abajo Commonwealth Forests. The known sites may be described as follows:

1. **San Sebastian, San Sebastian municipality.** This is the type location, discovered in 1901. Forty-four individuals are known from the bank of the Collazo stream.
2. **Camuy, Hatillo and Camuy municipalities.** Approximately 200 individuals are known from the bank of the Camuy River.
3. **Guajataca River, Quebradillas municipality:** From 10 to 15 plants in three groups are known from the banks of the Guajataca River.

Reproductive Status

The inflorescence of Calyptronoma rivalis is a drooping panicle which may reach 1 meter in length. The flowers are borne on sunken pits, in triads of two males and one female. The subglobose red fruits are small, reaching up to 6 millimeters in diameter, and fall with the persistent flower parts attached.

Vivaldi and Woodbury (1981) reported that the palm flowers twice a year and produces abundant amounts of fruit. Seeds have been collected in the summer months. Bees and wasps were observed in the fresh inflorescences, presumably playing a role in pollination.

Seedlings were observed by the thousands under fruiting palms, however, very few appear to reach maturity. Germination has been reported to be 100 percent in the greenhouse (Vivaldi and Woodbury 1981). Two groups of the palm have been established in protected areas: the Río Abajo Commonwealth Forest and the Guajataca Lake area. Seeds were collected from the San Sebastian and Camuy populations and propagated in the Botanical Gardens of the University of Puerto Rico. The species is also currently being successfully propagated by the Fairchild Tropical Garden in Miami, Florida (C. Lippincott, Fairchild Tropical Garden, pers. comm.).

Information from propagation efforts indicates that although the seeds germinate easily, the seedlings are intolerant of alkaline conditions. Seedlings grew better in a medium with a

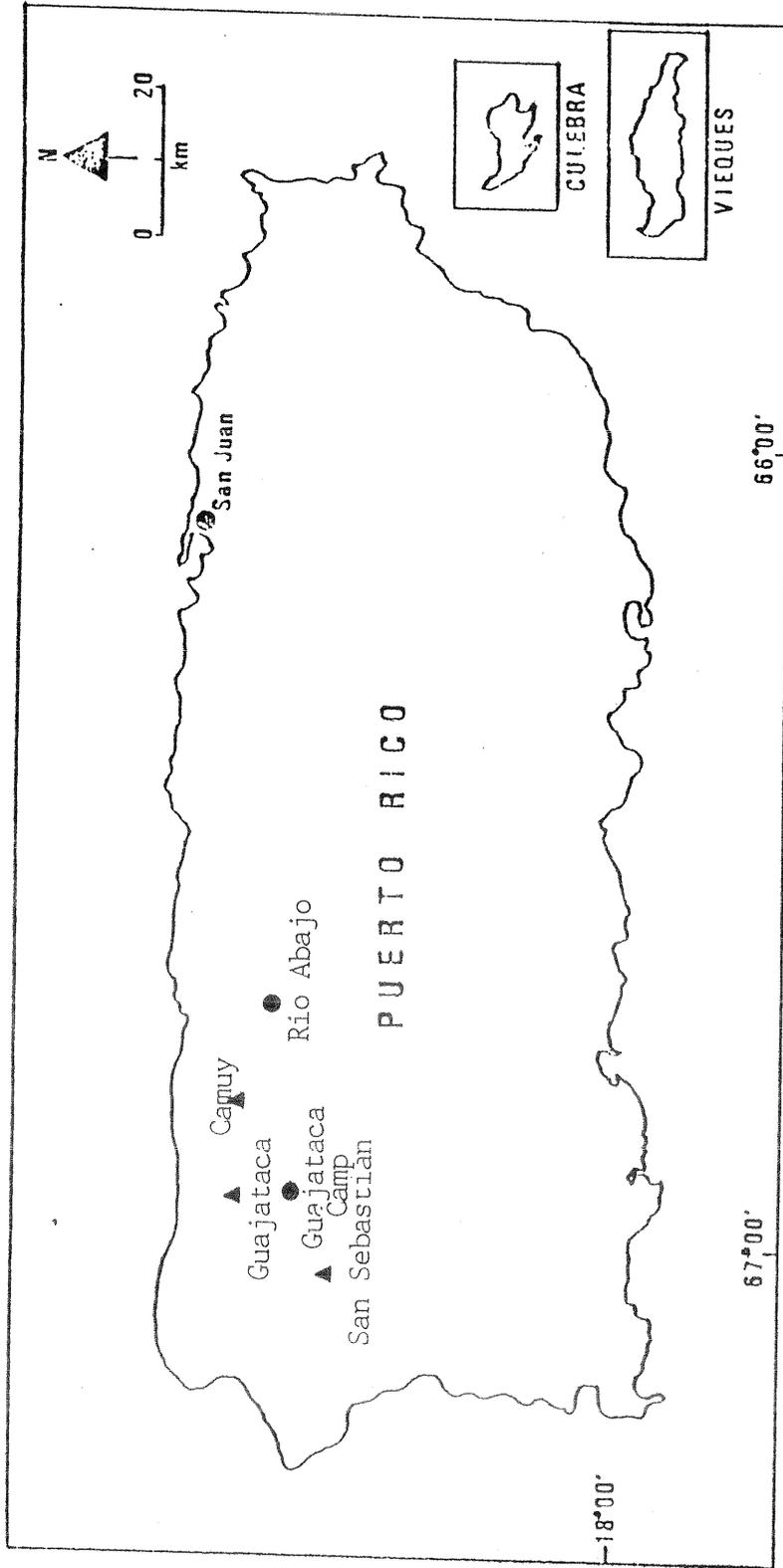


Figure 1. Distribution of *Calyptronoma rivalis*. Natural populations indicated by (▲) and introduced populations by (●).

high percent of peat moss, lowering the pH and increasing aeration of the soil. This appears to be different than the habitat described for mature plants and may be due to the removal of the humus layer by erosion and flooding (Chuck Hubbuch, Fairchild Tropical Garden, pers. comm.).

Habitat Description

Calyptronoma rivalis or the palma de manaca is found in the seasonal evergreen forests of the subtropical moist forest life zone (Ewel and Whitmore 1973). Elevations vary from 150 to 350 meters on these limestone hills of the northwest coast of Puerto Rico.

The limestone or karst region of northwestern Puerto Rico is underlain by limestone rocks of Oligocene or Miocene age. The palm is found in the Cibao and Aguada formations, the former is composed of very pale orange marl and chalk. Topography varies throughout the karst region, from extremely rugged to gentle rolling hills. Canyons, sinkholes, and subterranean rivers, as well as these rolling hills are the most common features of the region. Calyptronoma rivalis is found on the level or nearly level stream banks, sometimes at the bottom of deep canyons. This species is frequently found on exposed marl surfaces of the Cibao formation, with little or no soil. Permeability of the soil appears to be poor, and the area seems waterlogged most of the time. Larger amounts of shallow-reddish clays were observed nearby (Vivaldi and Woodbury 1981).

Calyptronoma rivalis is also found in the seasonal evergreen forests of the limestone region. These forests usually have two to three strata, with a well developed understory. Taller palms may reach 6 to 10 meters in height. Along these streambanks where the palm is found the introduced Syzygium jambos (pomarrosa) is common, along with Andira inermis (moca), Roystonea borinquena (palma real), and Guarea guidonia (guaraguao). Adjacent areas may be planted in agricultural crops such as coffee, yams, bananas, and sugar cane (Vivaldi and Woodbury 1981; Silander et al. 1986).

Reasons For Listing

Historically, the most important factors limiting the distribution of Calyptronoma rivalis have been deforestation and selective cutting for agriculture, grazing, production of charcoal, and the cutting of wood to provide construction materials. Although these activities primarily affected lowlands, they have also impacted the limestone hill and central mountain areas. More recent disturbances such as urban and industrial expansion and the accompanying increase in roads and service facilities have encroached on these previously inaccessible areas. A serious threat to these coastal

limestone hills is their complete elimination for extraction of construction material or for housing, roads, or factories. Such total destruction results in the elimination of whole populations as well as any habitat available for recolonization.

A large part of the Camuy River population was destroyed during the construction of a road in the area. Much of the remaining population could be eliminated by flooding that may result from the deforestation of the surrounding area. Fires in nearby sugar cane fields have resulted in the death of several individual plants in the San Sebastian population. In addition, cattle may affect the plants by both trampling and foraging.

Conservation Measures

Conservation and recovery measures for Calyptronoma rivalis are ongoing. The Puerto Rico Department of Natural Resources initiated propagation and introduction of the species as early as 1980. Seeds were collected from the San Sebastian and Camuy populations. Individual palms have been planted in the Rio Abajo Commonwealth Forest and the Guajataca Lake area, an area managed as a Boy Scout camp. However, it is not yet known whether these palms will reproduce and colonize the area naturally.

Fairchild Tropical Garden and local nurseries have been successful in their efforts to propagate the species from seed. Several palms have been planted on the grounds of Fairchild Garden.

The Commonwealth Department of Natural Resources passed a resolution in 1979, in response to a concern voiced by the mayor of San Sebastian, to protect this endemic palm. Following Federal listing it was included on the Commonwealth endangered species list and is considered by both the Department of Natural Resources and the Fish and Wildlife Service when reviewing development projects within the known range of the species or within its potential habitat.

PART II. RECOVERY

A. Recovery Objective

The objective of this recovery plan is to provide direction for reversing the decline of Calyptronoma rivalis and for restoring the species to a self-sustaining status, thereby permitting it to be eventually removed from the Federal Endangered Species List.

Calyptronoma rivalis (palma de manaca) could be considered for delisting when (1) the known populations are placed under protective status, and (2) at least three new populations capable of self perpetuation have been established within protective units, such as Conservation Trust property or Commonwealth Forests. These should be minimum requirements, and should be expanded upon if the regenerative or propagative potential of natural and ex situ populations proves to be insufficient. On the other hand, if new populations of the species are discovered, it may be preferable to place greater emphasis of protection, rather than on propagation, in order to achieve a minimum number of plants.

B. Outline Narrative

1. Prevent further habitat loss and population decline.

Protection of the habitat and the individual plants at the known population sites should be initiated by appropriate public agencies and private organizations. This will help prevent the complete extinction of the species, maintain genetic diversity, and provide a source of propagative material for future propagation efforts.

11. Protect habitat.

The protection of existing populations should be given the highest priority.

111. Obtain protective status for the privately-owned populations sites.

Privately-owned sites (San Sebastian, Camuy, Guajataca) should be protected through the establishment of conservation easements by either public or private agencies. Conservation easements are probably the most feasible mechanism for this species. Clarification of the status of those individuals growing on the stream bed, considered by some to be public land, should be made.

112. Incorporate protection measures for this species in the Rio Abajo Forest Management Plan.

The Río Abajo Commonwealth Forest management plan should be revised to include measures to protect the planted individuals and to monitor their growth and reproduction.

12. Protect plants.

Individual plants and recruitment of new individuals at all sites must be monitored on a long-term basis.

121. Monitor known populations.

Individual plants should be measured and marked. Basic field observations which will contribute to the information available on population behavior (including phenology, seed production, seed dispersal, recruitment success, site changes, and growth) should be made at regular intervals. Plots should be established and monitored on an annual basis. Those populations previously established in the Río Abajo Forest and the Guajataca Lake area

should be carefully monitored to determine their reproductive success and the ability to colonize the area naturally.

122. Enforce existing Commonwealth endangered species regulations.

The Commonwealth Department of Natural Resources' Regulation to Govern the Management of Threatened and Endangered Species of 1985 provides for criminal penalties for illegal take of listed plant species on public land. In addition, development projects which occur in these areas are often funded through local or Federal agencies or require local permits. The Regulation's Section 10 provides for consultations on endangered species which may be affected by a particular project similar to Section 7 of the Endangered Species Act.

123. Educate the public on plant conservation values and regulations.

Both Federal and Commonwealth agencies should become involved in the education of the public on general conservation values as well as on the importance of protecting endangered plants and of adhering to Federal and local regulations. Two initial steps might be the preparation of an illustrated brochure and a slide presentation (in Spanish) on endangered plants and plant communities for presentation to local school groups and organizations and agencies. This might be combined with a general presentation on all endangered species. Permitting and funding agencies should be made aware of endangered plants, the pertinent laws, and their responsibilities.

2. Continue to gather information on the distribution and abundance of *Calyptronoma rivalis* in northwestern Puerto Rico.

Future management decisions and the establishment of recovery priorities depends on obtaining additional information concerning distribution and abundance of the species.

21. Search for new populations.

Searches for new individuals and populations should be conducted in the limestone hill area.

211. Identify and inventory potential sites.
Based on a characterization of known habitat types, potential population sites should be identified and searched. Protected areas such as the Río Abajo, Cambalache, and Guajataca Commonwealth Forests should be thoroughly searched. Stream and riverbanks in the northwestern portion of the island should be checked. Agencies and organizations which should be involved in these efforts should include the Fish and Wildlife Service, the Department of Natural Resources (Forest Service area and the Natural Heritage Program), local universities and private conservation organizations.

212. Characterize sites to determine their suitability as future recovery sites.
If new populations are discovered, this information should be added to the database of the various agencies and organizations involved. In addition, sites should be evaluated for the availability of propagative material and the potential for protection.

3. Conduct research.

Little biological information is available on Calyptronoma rivalis. Preliminary studies indicate that abundant fruit is produced and the germination rate is high, but few seedlings survive. Studies should focus on aspects of life stages which may be critical to the recovery of the species.

31. Define habitat requirements.

Habitat requirements may be more clearly defined by evaluating information available from existing studies of the sites and from studies of similar sites (for example, abundant data is available for the Río Abajo Commonwealth Forest).

32. Study reproductive biology and ecology of Calyptronoma rivalis.

Preliminary information indicates that abundant fruit is produced, but very few seedlings survive. Effective management and recovery of Calyptronoma rivalis depends upon obtaining this information.

321. Assess periodicity of flowering and pollination mechanisms.

Vivaldi and Woodbury (1981) indicate that the species appears to flower twice a year and produces abundant fruit. Bees and wasps have

been observed in fresh inflorescences. However, further study is needed to determine the frequency, timing, and abundance of flowering, and the physical and biological factors controlling them.

322. Assess seed production and dispersal.
Although abundant fruit is produced, its dispersal should be assessed. Agents of seed predation and/or dispersal should be identified.

323. Evaluate seed viability and germination requirements.
Preliminary results from propagation efforts indicate that germination success is high. Additional information on environmental conditions required for germination should be obtained through field and laboratory studies.

324. Evaluate requirements for seedling establishment and growth.
Although abundant seeds are produced and these germinate readily, few seedlings survive. Field and laboratory experiments should be focused on this critical stage in order to determine the factors which affect seedling establishment and survival.

33. Develop artificial propagation program.
Continue ongoing work on propagation from seed. Develop a propagation program with local nurseries. The species may be included in the ongoing artificial propagation program at local nurseries (e.g., the Department of Natural Resources, University of Puerto Rico).

4. Establishment of new populations.
Areas for the establishment of new populations of Calyptronoma rivalis should be selected and new populations established.

41. Select appropriate sites for population introduction or enhancement using artificially propagated material.
Habitat requirements must be considered in order to assure the success and need of transplanting propagated material.

411. Select sites and assess habitat suitability.
Using information from Task No. 31 above,
inventory potential sites for the introduction
and establishment of new populations of
Calyptronoma rivalis.

412. Assure site protection.
If proposed sites are not already on protected
land, steps must be taken to alter the status
of such land in order to provide protection for
new populations. Management plans for these
new sites should be developed or modified to
include considerations for these species.

413. Introduction of plants.
Seedlings should be planted in those areas
selected for establishment of new populations.
Success should be carefully monitored.

5. Refine recovery goals.

As additional information on the biology, ecology,
propagation, and management of Calyptronoma rivalis is
accumulated, it will be necessary to better define, and
possibly modify, recovery goals.

51. Determine number of individuals and populations
necessary to ensure species' stability and self-
perpetuation.

Environmental and reproductive studies, together
with the relative success of population protection
measures, will allow more precise and realistic
recovery goals to be established.

52. Determine what additional actions, if any, are
necessary to achieve recovery goals.

If there are any actions not included in this
recovery plan which, during the recovery process
become recognized species' needs, they should be
incorporated into the plan.

D. Literature Cited and References

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PART III. IMPLEMENTATION SCHEDULE

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.

IMPLEMENTATION SCHEDULE

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party			Cost Estimates (\$K)			Comments
				FWS Region	Division	Other	FY 1	FY 2	FY 3	
1	111	Obtain protective status for the privately-owned sites	4	4	FWE	PRDNR				Should be done through conservation easements
2	112	Incorporate protection measures for this species in the Rio Abajo Forest Management Plan	2	4	FWE	PRDNR				No cost anticipated
1	121	Monitor known populations	Ongoing	4	FWE	PRDNR	2.5	2.5	2.5	
1	122	Enforce existing Commonwealth endangered species regulations	Ongoing	4	FWE	PRDNR LE	9	9	9	One DNR ranger half-time
1	123	Educate public on plant conservation values and regulations	Ongoing	4	FWE	PRDNR	3	3	3	

IMPLEMENTATION SCHEDULE

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimates (\$K)			Comments	
				FWS Region	Division	Other	FY 1	FY 2		FY 3
2	211	Identify and inventory potential sites	2-4	4	FWE	PRDNR Univ.	3	3	3	
2	212	Characterize sites to determine suitability as future recovery sites	2-4	4	FWE	PRDNR Univ.				
2	31	Define habitat requirements	2-4	4	FWE	PRDNR Univ.	3	3	3	
2	321	Assess periodicity of flowering and pollination mechanisms	2-4	4	FWE	PRDNR Univ.	12	12	12	12K/yr includes 321, 322, 323, and 324.
2	322	Assess seed production and dispersal	2-4	4	FWE	PRDNR Univ.				
2	323	Evaluate seed viability and germination requirements	2-4	4	FWE	PRDNR Univ.				

IMPLEMENTATION SCHEDULE

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimates (\$K)			Comments
				FWS Region	Division	Other	FY 1	FY 2	
2	324	Evaluate requirements for seedling establishment and growth	2-4	4	FWE	PRDNR Univ.			
1	33	Develop artificial propagation program	Ongoing	4	FWE	PRDNR Univ. BotGar	4	4	4
2	411	Select sites and assess habitat suitability	2-4	4	FWE	PRDNR Univ.		1.5	
2	412	Assure site protection	2-4	4	FWE	PRDNR			
2	413	Introduction of plants	Ongoing	4	FWE	PRDNR			
2	51	Determine number of individuals and populations to ensure self-perpetuation	Ongoing	4	FWE	PRDNR			

IMPLEMENTATION SCHEDULE

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party			Cost Estimates (\$K)			Comments
				FWS Region	Division	Other	FY 1	FY 2	FY 3	
2	52	Determine what additional actions are needed to achieve recovery objectives	Ongoing	4	FWE	PRDNR				
<p>LIST OF ABBREVIATIONS</p> <p>PRDNR - Puerto Rico Department of Natural Resources</p> <p>FWE - Fish and Wildlife Service, Endangered Species Division</p> <p>LE - Fish and Wildlife Service, Law Enforcement Division</p> <p>Univ. - Universities</p> <p>BotGar - Botanical Gardens</p>										

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