

CRESCENTIA PORTORICENSIS RECOVERY PLAN

prepared by

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Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect the species. Plans are prepared by the U.S. Fish and Wildlife Service, sometimes 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 approvals 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:

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EXECUTIVE SUMMARY OF THE RECOVERY PLAN
FOR CRESCENTIA PORTORICENSIS

Current Status: Crescentia portoricensis (higüero de sierra) is listed as endangered. This endemic species is found in only two areas of southwestern Puerto Rico: the Maricao Commonwealth Forest and the Susua Commonwealth Forest. In these areas, approximately 100 individuals are known from 7 sites.

Habitat Requirements and Limiting Factors: Crescentia portoricensis is an evergreen vine-like shrub or small tree found on serpentine-derived soils at elevations ranging from 250 to 800 meters in the subtropical moist and wet forest life zones. All are found along the banks of streams, many within only a meter of the water's edge. Crescentia portoricensis has become endangered as a direct result of extensive deforestation and management practices which have affected the species through flash-flooding and erosion.

Recovery Objective: First downlisting to threatened status, then delisting.

Recovery Criteria: The species will be considered for downlisting when the existing populations and their habitats are protected and at least four new populations are established in protected areas. Delisting criteria will be determined after suggested research is completed.

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 methods of propagation, and locate introduction sites.
4. Propagate and produce seedlings for enhancement of existing populations and for the establishment of new populations at identified sites.

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

Recovery Costs: Recovery costs for Crescentia portoricensis 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

Crescentia portoricensis (higüero de sierra) is an evergreen vine-like shrub or small tree endemic to the serpentine-derived soils of southwestern Puerto Rico. The species is known from two areas: the Maricao Commonwealth Forest and the Susua Commonwealth Forest. A total of approximately 100 individuals occur in the 7 populations known from these two general areas. Crescentia portoricensis has become endangered as a direct result of the extensive deforestation which occurred in the past and which today continues to affect the remaining populations through flash-flooding and erosion. It is believed that the latter factors were responsible for the elimination of two previously-reported populations in the Maricao Forest. All presently known populations occur within Commonwealth Forests.

Crescentia portoricensis was determined to be an endangered species on December 4, 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

Crescentia portoricensis, a member of the Bignoniaceae family, was first discovered by Nathaniel Britton in 1913 along the Maricao River in western Puerto Rico. It was described as a new species based on this collection. Following this it was collected on only a few other occasions from the western mountains of Puerto Rico in areas overlying serpentine rocks (Vivaldi and Woodbury 1981).

Crescentia portoricensis is a vine-like shrub or small tree which may reach up to 6 meters (20 feet) in height and 8 centimeters (3 inches) in diameter. The bark is gray and the branches long and slender. The glabrous leaves vary from 5 to 15 centimeters (2 to 6 inches) in length and 2 to 8 centimeters (3/4 to 3 inches) in width and are whorled in groups of 3 to 5 at the nodes. The leaves are simple, widest above the middle, entire, leathery, dark shiny-green above, with a rounded or blunt apex and a tapered base. The petiole is from 1 to 2 centimeters (1/4 to 5/8 inch) long (Little et al., 1974, Vivaldi and Woodbury 1981).

The perfect flowers are solitary at the axil of the leaves or along the branches. The calyx is leathery, tubular, 2-lobed, and about 2 centimeters (3/4 inch) long. The corolla is yellowish-white with the 5 united petals forming a bell-shaped tube approximately 4 centimeters (1 and 1/2 inches) long. The four stamens are attached to the base of the petals. The fruit is dark green when mature, cylindric, hard and leathery, indehiscent, approximately 10 centimeters (4 inches) long and 3 centimeters (1 and 1/4 inches) wide (Little et al. 1974, Vivaldi and Woodbury 1981).

Distribution

Crescentia portoricensis is presently known from only 7 sites: five within the Maricao Commonwealth Forest and two within the nearby Susua Commonwealth Forest. All are found on serpentine derived soils at elevations ranging from 250 to 800 meters. Although recent searches have resulted in the discovery of 3 of these 5 populations in Maricao, it continues to be an extremely rare species. All known individuals are found along the banks of streams, many within only a meter of the water's edge. Biologists of the Puerto Rico Department of Natural Resources working in these Forests have observed the loss of individuals as a result of the increasing erosion of these stream banks.

Population Status

As previously indicated, Crescentia portoricensis is found on only 7 sites in 2 areas of southwestern Puerto Rico (Figure 1). Although botanists have located several populations in relatively inaccessible areas during the past couple of years, due to its restricted habitat type it is expected that few new populations may be found. The known sites can be described as follows:

1. Maricao Commonwealth Forest, Puerto Rico - Five populations have are known from this Forest. All are found within the Forest boundaries, lands managed by the Puerto Rico Department of Natural Resources. A total of 36 mature individuals are known from these sites: Quebrada Piedras and Río Seco. All populations are threatened by increasing erosion as a result of deforestation and poor management practices upstream.
2. Susua Commonwealth Forest, Puerto Rico - Two small populations of approximately 66 individuals are located along the "Quebrada Peces", an intermittent stream which divides the municipalities of Sabana Grande and Yauco, and along "Quebrada del Tanque", a stream leading into the Río Loco. Individuals along the Quebrada Peces are located within 300 meters of the road and occupy only a small area, 300 meters in length and 5 meters in width. Plants appear to be healthy and some reach 5 meters in height. Both populations are threatened by stream bank erosion as well as by their proximity to the road. The Susua Forest is managed by the Puerto Rico Department of Natural Resources.

A total of only about 100 individuals are known to occur in Puerto Rico. Although other individuals or populations may be found, it is not likely that significant numbers of plants will be located in the future.

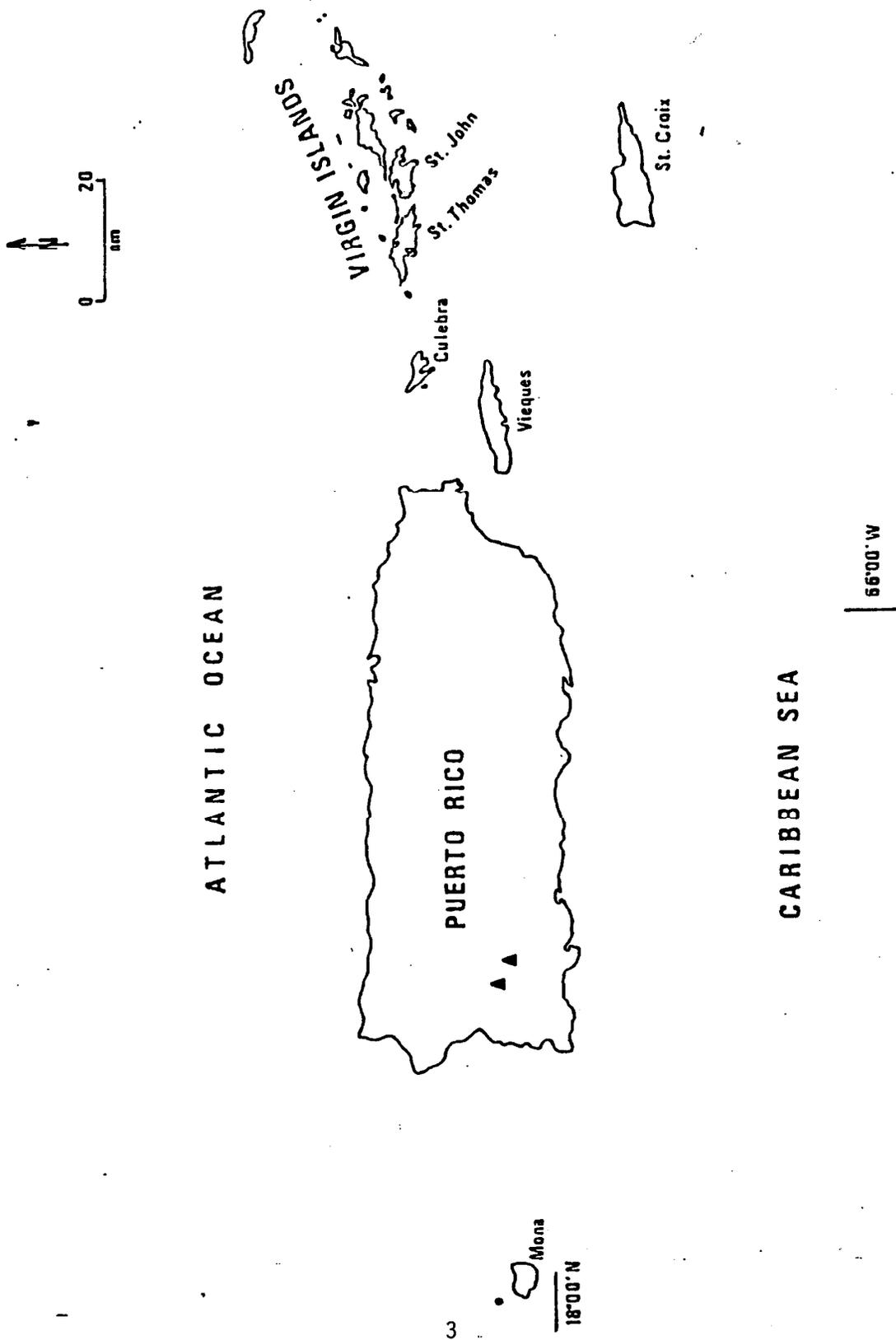


Figure 1. Distribution of Crescentia portoricensis. Known population locations indicated by (▲).

Reproductive Status

The flowers of Crescentia portoricensis are perfect and the fruit is hard and dry, cylindrical, and indehiscent. Pollination mechanisms are not known; however, based on floral morphology, time of flower opening and abscission and on the pollination system in the rest of the genus, C. portoricensis is probably pollinated by bats (G. Breckon, pers. comm.). Fruits may reach 10 centimeters in length and 3.5 centimeters in width.

Fruit has been observed on individuals in all populations throughout the year. However, the phenology of this species has not been studied. Seedlings have not been observed in any of the areas, possibly as a result of the dispersal of the heavy fruit downstream during flash floods. Sprouting has been observed on some individuals but the importance of this vegetative reproduction is not known.

Both cuttings and fruit were collected during 1989 for propagation by Fairchild Tropical Gardens in Miami, Florida. Germination of seeds collected in August 1989, was successful, however, the rate of survival of the seedlings produced is not known (C. Lippincott, pers. comm.).

Habitat Description

Crescentia portoricensis is known to occur only on serpentine soils in the western mountains of Puerto Rico. These serpentinite rocks are Cretaceous in origin and are black to pale green, soft, and friable and contain high amounts of olivine, clinopyroxene, and orthopyroxene. Elevations range from 200 meters in the Susua Forest to about 800 meters in Maricao.

The Susua Forest is found within the subtropical moist forest life zone, the most extensive life zone found on the island. The Maricao Forest is found within the subtropical moist and the subtropical wet forest life zones (Ewel and Whitmore 1973). The majority of the area of these Forests is covered by serpentine outcrops interspersed with Nipe and Rosario clay soils, the products of the weathering of serpentine rock. These areas have a poor water-holding capacity, therefore the vegetation is more xeric than might be expected based on the rainfall received in the region. Topography is mountainous in both forests, characterized by steep ravines and intermittent streams.

Mean annual precipitation near the Susua Forest has been reported to be 1339 millimeters with a dry season occurring from January to March and a wetter period from July to November. Mean annual precipitation at the Maricao Fish Hatchery (elevation 457 meters) was reported to be 2466 millimeters, with a dry period from December to March. The mean annual temperature in Maricao was

21.7°C (Silander et al., 1986). Although no records are available temperatures at Susua, located at a lower elevation, are expected to be higher.

Much of the vegetation in the Susua Forest was cut for cultivation, grazing, charcoal production, and wood prior to its designation as a public forest. The vegetation in the areas of the known populations in the Susua Forest may be described as semi-evergreen to deciduous forest. Trees are of small diameters and the open canopy rarely reaches greater than 12 meters in height. Most species are sclerophyllous and evergreen. In Susua, Crescentia portoricensis is found along stream banks or "gallery forests" associated with Coccothrynax alta (palma de abanico), Zamia portoricensis (maranguey), Rondeletia inermis, Randia aculeata (tintillo), Linociera holdridgeana (hueso prieto), Neolaugeria resinosa (aquilón), Scleria lithosperma, and Comocladia glabra (Vivaldi and Woodbury 1981, Silander et al., 1986).

In Maricao, the higüero de sierra has been found along stream banks and on steep slopes in the lower montane and montane forest types. In the lower montane forest three tree strata are found; the canopy at a height of 24 to 33 meters, an understory from 3 to 16 meters in height, and some emergent trees that may reach 37 meters. Simple leaves are dominant. At higher elevations in the montane forest tree height in the canopy rarely exceeds 15 meters. Only two tree strata are present in this forest type. Leaves are evergreen, small, thick, and leathery. Here it is found associated with Tabebuia heterophylla (roble blanco), T. schumaniana (roble colorado), Homalium racemosum (caracolillo), Coccoloba swartzii (ortegon), Bumelia cubensis (no common name), Rondeletia inermis (no common name), and Micropholis chrysophylloides (leche prieta).

Limiting Factors/Threats to Future Existence

Historically, the most important factors affecting the abundance and distribution of Crescentia portoricensis have been both the direct and indirect effects of deforestation. Much of the Susua Forest and parts of the Maricao Forest were cut for cultivation, grazing, charcoal production, and wood prior to their designation as public forests. Land use practices in upland areas resulted in increased flash flooding and erosion of stream banks, the habitat for this species.

The seven known populations of Crescentia portoricensis face a variety of specific threats related to the general problems outlined above. The "Quebrada Peces" population in Susua, composed of only six known individuals, although within a protected Commonwealth Forest, is located close to a heavily

traveled access road to the Forest. All known individuals are located on steep stream banks and are exposed to the threat of elimination by erosion and flash flooding.

The Maricao populations are also subject to a variety of threats. Here the species is found along drainage areas subject to flash floods which may uproot plants. Small intake dams, trails, and recreational use of the more accessible areas also threaten the species.

Neither of these Commonwealth Forests has a management plan that considers the presence and requirements of this and other rare plant species. These plans should discuss the possible impacts of management practices on threatened and endangered species and unique plant and animal communities.

Conservation Measures

Although there is no documentation that Crescentia portoricensis has been taken for horticultural purposes, it may be recognized as having ornamental potential in the future. Propagation has been attempted by cuttings and seed by the Fairchild Tropical Garden of Miami, Florida. Germination of the many small seeds collected in August 1989, has been successful, however, it is not known yet whether ex situ propagation could provide a source of material for reintroduction of the species in Puerto Rico (C. Lippincott pers. comm.).

The Puerto Rico Department of Natural Resources has constructed barriers along the Susua Forest access road in order to discourage parking. In addition, the Department has installed a fence at the entrance to the "Quebrada Peces" in order to reduce visitation to the area.

PART II. RECOVERY

A. Recovery Objective

The objective of this recovery plan is to provide guidance for reversing the decline of Crescentia portoricensis and restoring the species to a stable, secure, and self-sustaining status, thereby permitting it to be reclassified from endangered to threatened, and perhaps eventually allowing its removal from the Federal Endangered Species list.

Crescentia portoricensis could be considered for downlisting when at least four new populations capable of self-perpetuation have been established within suitable protected areas such as the Commonwealth Forests. These should be considered 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 on protection, rather than on propagation, in order to achieve a minimum number of plants. Delisting criteria will be established once further research is completed.

B. Outline Narrative

1. Prevent further habitat loss and population decline.
The protection of habitat and individual plants at the known population sites should be continued by 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.

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

112. Cooperate with the Puerto Rico Department of Natural Resources in the preparation of a management plan for the Maricao and Susua Commonwealth Forests.

Neither the Maricao nor the Susua Commonwealth Forest have an approved management plan. Although the Biologist at the Maricao Commonwealth Forest is aware of the presence of the species and considers it in any management activities to be implemented, there is no formal management document for the Forest providing for future protection of the species. The Service and the Department may cooperate in the preparation of such document. The Plan should consider protection of both habitat and individuals of Crescentia portoricensis and regulate management practices which might affect the species, particularly since plantations continue to be established in the Maricao Forest. Appropriate steps to avoid destroying individuals and adversely affecting habitat should be incorporated into plans, and thereafter, implemented.

12. Protect plants.
Individual plants and recruitment of new individuals at both sites must be monitored on a long term basis.

121. Monitor known populations.
Individual plants should be measured and marked. Basic field observations, which include gathering data on phenology, seed production, seed dispersal, recruitment success, site changes, and growth, should be made at regular intervals. Plots should be

established and monitored on a long-term basis.

122. Enforce existing Federal and 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. In Maricao and Susua, this species is found on public land and Crescentia portoricensis is on the Commonwealth list, therefore the regulation would be effective with respect to this species. 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. In addition, the 1988 Amendments to the Endangered Species Act prohibit the taking of plants when in violation of state (Commonwealth) law.

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. This might be combined with a general presentation on all endangered species. Permitting and funding agencies should be made aware of endangered plants, the laws involved, and their responsibilities. The Maricao and Susua Forest Biologist may incorporate information on this species in their education material and lectures.

2. Continue to gather information on the distribution and abundance of *Crescentia portoricensis* in southwestern and western Puerto Rico.
Additional information concerning the distribution and abundance of the species will affect future management decisions and the establishment of recovery priorities.
21. Continue to search for new populations.
New individuals have recently been discovered in the both Forests. It is possible that additional plants may be found in inaccessible areas in these Forests and adjacent privately-owned areas.
211. Identify and inventory potential sites.
Based on a characterization of both habitat types and on an evaluation of forests which have not been thoroughly surveyed, potential population sites should be identified and searched. Coordinating agencies and organizations involved in this effort might be the Forest Service Area of the Puerto Rico Department of Natural Resources, the U.S. Fish and Wildlife Service, the Puerto Rico Natural Heritage Program, local universities and private conservation organizations. The Maricao and Susua Forests should continue to be searched as well as adjacent privately-owned land on serpentine soils.
212. Characterize sites to determine their suitability for future recovery actions.
If new populations are discovered, this information should be added to the databases of the various agencies and organizations involved. In addition, the sites should be evaluated for propagative material and the potential for protection. On sites identified as having potential for protection, but where no plants are found, the suitability of the site for future reintroductions should be determined.
3. Research
Little basic biological information is currently available on *Crescentia portoricensis*. Preliminary studies indicate that fruit production is not abundant. Studies should focus on aspects of the population dynamics of life stages which may be critical in 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. Quite an extensive amount of information is available on both the Maricao and Susua Forest habitat and this combined with site-specific studies would assist in defining habitat requirements.
32. Examine reproductive biology and ecology of *Crescentia portoricensis*.
Only a small amount of information is currently available concerning the reproductive biology of the higüero de sierra. Preliminary studies indicate that although most flowering results in fruit production, few of the large, multi-seeded fruit are produced. Effective management and recovery depends upon obtaining this information.
321. Assess periodicity of flowering and pollination mechanisms.
The frequency, timing, and abundance of flowering, and the physical and biological factors controlling them should be determined. In addition, species' pollination mechanisms should be identified, and consideration given to the requirements for successful pollination in the development of management plans.
322. Assess seed production and dispersal.
The quantity of seed produced and its ultimate fate should be assessed. Agents of seed predation and/or dispersal should be identified.
323. Evaluate seed viability and germination requirements.
Initial studies by the Fairchild Tropical Garden in Miami, Florida, indicate that a high proportion of seeds germinate. However, both laboratory and field germination experiments need to be carried out. Because seedlings have not been observed in the field, this information is essential to understanding the species' life cycle.

324. Evaluate requirements for seedling establishment and growth.
Conduct field experiments in conjunction with Task Number 323. above, to determine suitable microsite conditions for seedling establishment and the factors affecting seedling survival, the most critical stage in recruitment.
325. Evaluate role of vegetative regeneration.
Determine what role, if any, vegetative regeneration plays in population dynamics. Preliminary observations indicate that resprouting occurs rapidly following cutting.
33. Evaluate feasibility of artificial propagation.
Continue ongoing work on artificial propagation from both cuttings and seed. Develop an artificial propagation program with local botanical gardens or nurseries.
331. Assess relative feasibility of propagation from seed versus cuttings.
Based on the availability of propagative material, economic and logistical considerations, and field success, continue to evaluate the most feasible methods of propagation and transplantation to existing or new sites.
332. Determine feasibility of ex situ production of seed and/or cuttings.
Determine whether there is sufficient material in ex situ cultivation to provide an alternative source of propagative material for use in the field.
34. Select appropriate sites for population introduction or enhancement using 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.
Using information from Task Number 31 above, inventory potential sites to determine their suitability for supporting new or additional plantings of Crescentia portoricensis.

342. Assure site protection.
In addition to a suitable biological environment, the feasibility of protection of introduction sites must also be considered.
3421. Proceed with designation of appropriate protective status, if necessary.
If proposed sites are not already on protected land, steps must be taken to alter the status of such land to provide protection for new species' populations.
3422. Develop management plans for new sites.
In accordance with the guidelines established in Tasks Numbers 111 and 112 above, develop appropriate plans for the management of new sites. If the site is already within an existing management area such as a Commonwealth Forest, plans should be modified to consider the presence and needs of this species.
4. Establishment of new populations.
Propagation will be conducted by designated entity and plants produced will be introduced into protected areas.
41. Propagation of plants.
Utilizing methodology identified above, propagation of higüero de sierra will be conducted. The number of individuals needed for each site identified will be established by the site management plan or by the agencies involved in the recovery efforts.
42. Introduction of propagated material.
Artificially propagated material will be introduced into the sites chosen above and monitored to determine the success of this introduction.
5. Refine recovery goals.
As additional information on the biology, ecology, propagation, and management of Crescentia portoricensis is gathered, it will be necessary to better define, and possibly modify, recovery goals.
51. Determine number of individuals and populations necessary to ensure species' stability, security, 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 objective.
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.

C. Literature Cited and References

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- Vivaldi, J. L. and R. O. Woodbury. 1981. Status report on Crescentia portoricensis. Status report submitted to the U.S. Fish and Wildlife Service, Mayaguez, P.R. 35pp.
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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	Program	Other	FY 1	FY 2		FY 3
1	112	Cooperate with PRDNR in the preparation of a management plan for Maricao and Susua Forests	2	4	FWE	PRDNR				No cost anticipated
2	121	Monitor known populations	Ongoing	4	FWE	PRDNR	2.5	2.5	2.5	
1	122	Enforce existing Federal and Commonwealth endangered species regulations	Ongoing	4	FWE LE	PRDNR	9	9	9	One DNR ranger half-time
2	123	Educate public on plant conservation and regulations	Ongoing	4	FWE	PRDNR	3	3	3	
2	211	Identify and inventory potential sites	2-4	4	FWE	PRDNR Univ.	3	3	3	Includes 211 and 212

IMPLEMENTATION SCHEDULE

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimates (\$K)			Comments
				FWS Region Program	Other	FY 1	FY 2	FY 3	
2	212	Characterize sites to determine suitability for future recovery actions	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	2-4	4	FWE	PRDNR Univ.	12	12	12
2	322	Assess seed production and dispersal	2-4	4	FWE	PRDNR Univ.			
2	323	Assess seed viability and germination	2-4	4	FWE	PRDNR Univ.			
2	324	Evaluate requirements for seedling establishment and growth	2-4	4	FWE	PRDNR Univ.			

The 12K/yr includes 321, 322, 323, 324 and 325

IMPLEMENTATION SCHEDULE

Prior-ity #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimates (\$K)			Comments
				FWS Region Program	Other	FY 1	FY 2	FY 3	
2	325	Evaluate role of vegetative re-generation	2-4	4	FWE	PRDNR Univ. BotGar	1	1	1K/yr covers 331 and 332
2	331	Assess relative propagation feasibility	2-4	4	FWE	PRDNR	1	1	
2	332	Determine feasibility of ex situ production	2-4	4	FWE	PRDNR Univ. BotGar			
2	341	Assess habitat suitability	Ongoing	4	FWE	PRDNR Univ.		1.5	
2	342	Assure site protection	Ongoing	4	FWE	PRDNR			
2	41	Propagation of plants	Ongoing	4	FWE	PRDNR BotGar	3	3	3K/yr covers 41 and 42
2	42	Introduction of propagated material	Ongoing	4	FWE	PRDNR			

IMPLEMENTATION SCHEDULE

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party		Cost Estimates (\$K)			Comments
				FWS Region Program	Other	FY 1	FY 2	FY 3	
2	51	Determine number of individuals and populations necessary to ensure species' self-perpetuation	Ongoing	4	FWE PRDNR				
2	52	Determine what additional actions are needed to achieve recovery objectives	Ongoing	4	FWE PRDNR				
LIST OF ABBREVIATIONS									
PRDNR - Puerto Rico Department of Natural Resources									
FWE - Fish and Wildlife Service, Endangered Species Division									
LE - Fish and Wildlife Service, Law Enforcement									
Univ. - Universities									
BotGar - Botanical Gardens									