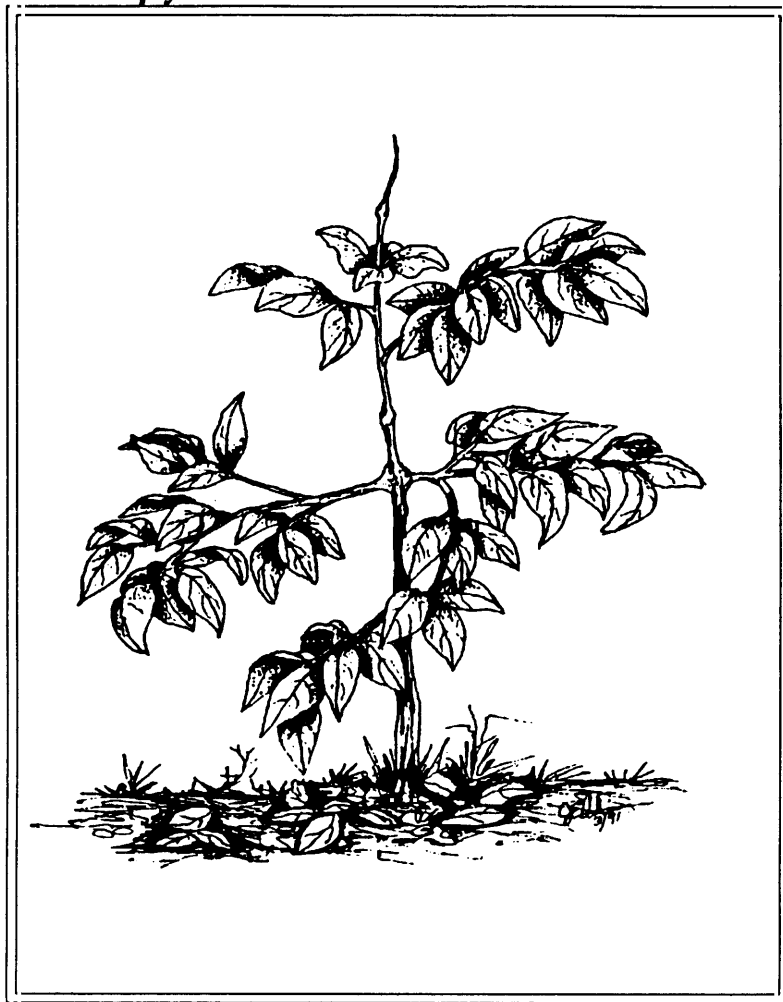


RECOVERY PLAN

Schoepfia arenaria



U.S. Fish and Wildlife Service



SCHOEPFIA ARENARIA RECOVERY PLAN


prepared by

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Approved: _____


Regional Director, U.S. Fish and Wildlife Service

Date: _____

January 10, 1992

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 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. 1991. Recovery Plan for Schoepfia arenaria. U.S. Fish and Wildlife Service, Atlanta, Georgia 26 pp.

Additional copies may be purchased from:

Fish and Wildlife Reference Service
5430 Grosvenor lane, Suite 110
Bethesda, Maryland 20814

Telephone: 301/492-6403 or 1-800-582-3421

The fee for the Plan varies depending on the number of pages.

Cover illustration by: Jorge Saliva, U.S. Fish and Wildlife Service, Boqueron, Puerto Rico

EXECUTIVE SUMMARY

Current Status: Schoepfia arenaria is listed as threatened. This endemic species is known from Isabela, Piñones, Fajardo, and the Río Abajo Commonwealth Forest. The species has also been reported from the Tortuguero Lagoon Natural Reserve.

Habitat Requirements and Limiting Factors: Schoepfia arenaria, an evergreen shrub or small tree, occurs in low elevation evergreen and semi-evergreen forests of the limestone hills of northern Puerto Rico. Deforestation and limestone hill destruction for industrial, urban, and tourist expansion have restricted this species to its present locations. It is threatened by development projects in Isabela, and by illegal land acquisition in Piñones.

Recovery Objective: Delisting

Recovery Criteria: To protect and enhance existing populations and their habitats and establish two new populations at other appropriate sites in Puerto Rico.

Actions Needed:

1. Monitor and protect existing populations to prevent further habitat loss and population decline.
2. Continue to gather information on the distribution and abundance of Schoepfia arenaria.
3. Conduct research on the life history of the species, methods of propagation, and possible introduction sites.
4. Refine recovery goals as additional information on Schoepfia arenaria is gathered.

Total Estimated Cost of Recovery: Recovery costs for Schoepfia arenaria have been estimated at \$193,500 for the first 3 years. Subsequent expenditures will depend on the results of preliminary studies and therefore cannot be estimated at this time.

Date of Recovery: Delisting should be initiated in 2012, if recovery criteria are met.

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I. INTRODUCTION

A. Background

Schoepfia arenaria (no common name) is a small evergreen tree endemic to Puerto Rico. The historical range of the species included the coastal forests of northern Puerto Rico; however, today it is known only from four localities: Isabela, Piñones, Fajardo and the Río Abajo Commonwealth Forest. Approximately 150 individuals occur on Isabela and Piñones (privately-owned lands), a single individual is found in the Río Abajo Commonwealth Forest, and approximately 50 individuals are found in Fajardo. This species has been also reported from the karst zone of the Tortuguero Lagoon Natural Reserve (Woodbury 1976). The species has become threatened as a result of deforestation in the coastal forests and limestone hills for urban, industrial, and tourist expansion in northern Puerto Rico.

Schoepfia arenaria was determined to be a threatened species on April 19, 1991, pursuant to the Endangered Species Act of 1973, as amended (U.S. Fish and Wildlife Service 1991). Critical habitat has not been designated for this species (op.cit.).

B. Description

Schoepfia arenaria is an evergreen shrub or small tree up to 20 feet or 6 meters (m) tall and with several trunks from the

base reaching 4 inches or 10 centimeters (cm) in diameter. The leaves are simple, alternate, without stipules, with petioles one-eighth of an inch or 4 millimeters (mm) long; the upper surface is green and slightly shiny, and the lower surface is light green. Schoepfia arenaria has been observed with flowers mainly in spring and fall, and with fruits in summer and winter. Usually two or three light yellow tubular-shaped flowers are borne on the end of the stalk at the leaf bases. The fruit is elliptic, one-seeded, shiny red, and one-half inch or 12 millimeters (mm) in diameter. The wood is light brown and hard.

C. Distribution

Schoepfia arenaria is known from four sites: Isabela, Piñones, Fajardo, and the Río Abajo Commonwealth Forest (Figure 1). In the Isabela area approximately 100 individuals of all size classes are known from the wooded upper slopes of the hills to the west of the mouth of the Guajataca Gorge. In Piñones, about 30 mature plants and numerous saplings and seedlings are known from Punta Maldonado. In Fajardo, approximately 50 individuals were estimated; however, 12 are found on one limestone hill at El Convento, Fajardo. In the Río Abajo Forest, one individual was found in 1985 at "cuesta de los perros" .

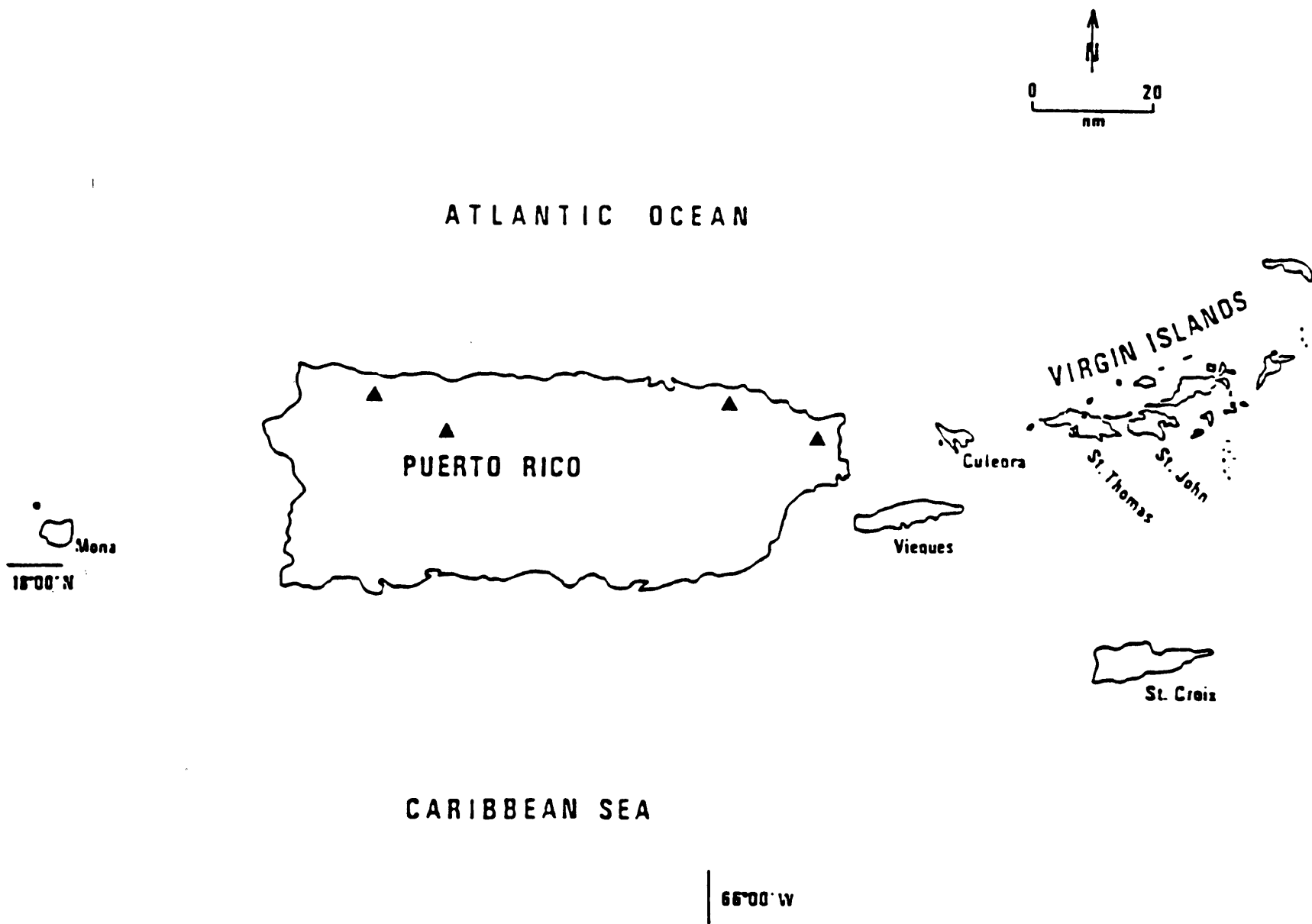


Figure 1. Present distribution of *Schoepfia arenaria*. Population locations indicated by (▲).

The information available indicates that historically the species was distributed throughout the limestone hills and coastal forests of northern Puerto Rico. Specimens were collected from sandy coastal thickets at San José Lagoon, Santurce in 1899 and 1939. More recently, this species has also been reported from Tortuguero Lagoon Natural Reserve.

D. Habitat

Schoepfia arenaria is found in low elevation evergreen and semi-evergreen forests of the limestone hills region of northern Puerto Rico at elevations which vary from 150 to 350 meters. The limestone hill zone (described also as haystack hills or "mogotes") is included in the subtropical moist forest life zone (Ewel and Whitmore 1973). These hills are oriented northeast to southwest, are quite moist on the gentle northern slopes, are even more humid on the extremely steep southwest slopes, and are quite xeric on top.

The limestone karst region (marine origin) of northern Puerto Rico is characterized by undulating topography of relatively low relief, but with typical karst features such as steep, rounded hills, sinkholes, caves, and subterranean streams (Monroe 1976). The soils are usually limestone-derived, poorly developed, and excessively drained, although a considerable amount of alluvial material originating in

uplands of volcanic origin has been incorporated into bottomland soils which show greater development and higher productivity.

In general, the limestone hills where Schoepfia arenaria is found are densely wooded areas, which support a rich assortment of shrubs and trees. Two strata are present in this seasonal evergreen forest. The upper strata is composed of a continuous layer with a few emergent trees reaching 25 meters. From one-third to two-thirds of the species are deciduous. The second strata reaches 10 meters in height and the number of deciduous species is low. Most species are evergreen, with simple, mycophyllous leaves. Palm species may be common in this strata. Common species in the upper layer are Bucida buceras (ucar); Bursera simaruba (almacigo); Clusia rosea (cupey); and Tabebuia heterophylla (roble blanco). The understory includes species such as Eugenia biflora (hoja menuda); E. foetida (anguila); E. axillaris (grajo); Guaiacum officinalis (guayacán); G. sanctum (guayacán blanco); Coccoloba diversifolia (cucubano); and C. microstachya (uvillo). Coccothrynax alta (uva de playa) is an indicator species for this seasonal evergreen forest.

Studies conducted in two limestone hills of Isabela indicate that other rare, threatened, and endangered species are

present in the same area as Schoepfia arenaria. These species include Daphnopsis helleriana (no common name); Ottoschulzia rhodoxylon (palo de rosa); Polygala cowellii (árbol de violeta); and the Puerto Rican boa (Epicrates inornatus).

Mean annual precipitation in the northern limestone hills ranges from 150-200 cm (Department of Natural Resources 1986). In Isabela, the mean annual precipitation is 160.5 cm, 162.1 cm in Fajardo, 150.1 cm near Piñones, and 215.8 cm in the Río Abajo Commonwealth Forest (National Oceanic and Atmospheric Administration 1973). The mean annual temperature in Isabela is 24.8°C, 26.1°C in Fajardo, 25.9°C near Piñones, and 24.3°C in Utuado (municipality of the Río Abajo Forest) (op.cit.).

E. Life History

Little information is currently available concerning the life history and reproductive biology of Schoepfia arenaria. This species has been observed with flowers mainly in spring and fall, and with fruits in summer and winter. Usually two or three light yellow tubular-shaped flowers are borne on the end of the stalk in the leaf bases. Many seedlings have been observed under mature trees, and plants of all size classes have been observed. Pollinization mechanisms, seed production and dispersal, seed viability and germination

requirements, and seedling establishment and growth should be studied. Other species in this genus are considered as hemiparasitic, due to their root interconnections with other woody species (hosts) nearby, from which they obtain soil minerals (Quevedo, pers. comm.). Future research should document interspecific relations with other native taxa in order to determine whether or not Schoepfia arenaria is also a hemiparasite.

F. Reasons for Listing

Among the factors which have historically limited the distribution of Schoepfia arenaria include deforestation and limestone hills destruction for agriculture, grazing, and more recently for urban, industrial and tourist developments, and associated roads and service facilities. These hills were also destroyed to provide construction materials. Some of these hills were destroyed and are being destroyed for the construction and the ongoing widening of Highway 2, and all of the area is under intense development pressure.

Of the approximately 150-200 individuals known from four localities in Puerto Rico, only a single individual is found in a Commonwealth Forest, and approximately 50 individuals are known from Fajardo. All the others occur on privately-owned lands. Although the area of El Convento in Fajardo is a public land, it is managed as the private beach property

for the Commonwealth Governor. This species has also been reported from the Tortuguero Lagoon Natural Reserve. This area is designated as a Natural Reserve by the Commonwealth Planning Board; however, it is not owned by the Puerto Rico Department of Natural Resources (PRDNR) and is subject to continuous development pressure.

G. Conservation Measures

Conservation and recovery measures for Schoepfia arenaria are ongoing. Both the Fish and Wildlife Service (Service) and the PRDNR consider the species when development projects are reviewed for these areas. The Service cooperated with PRDNR botanists to gather data on which the final rule was based. This species is included in the PRDNR Heritage Program critical plant list. Private developers in Isabela are currently in the process of donating some areas where Schoepfia arenaria and other rare, threatened, and endangered species are present. This areas will be donated to the PRDNR. This donation is one of the conservation measurements requested by the Service.

Ongoing conservation/recovery efforts also include propagation experiments by both local (University of Puerto Rico, Mayaguez Campus) and off-island (Fairchild Tropical Garden) nurseries.

RECOVERY

II.

A. Objective and Criteria

The objective of this recovery plan is to provide direction for reversing the decline of Schoepfia arenaria and for restoring this species to a self-sustaining status, thereby permitting it to eventually be removed from the list.

Delisting of Schoepfia arenaria will be considered when the privately-owned population sites are given protected status, and at least two self-sustaining populations in Commonwealth Forest units or other protected lands have been established. The estimated date for recovery is 2012.

B. Narrative Outline for Recovery Actions

1. Monitor and protect existing populations to prevent further habitat loss and population decline. The known populations and habitat should be monitored and protected by both public agencies and private conservation organizations in order that the decline of individuals does not continue and that the complete extinction of the species does not occur. It is essential as well to maintain a source of material for propagation.

11. Habitat protection. The protection of existing populations must be given the highest priority.

111. Protect privately-owned sites. The majority of plant individuals occur on privately-owned lands, all of them under intense development pressure. For this reason, habitat protection through land acquisition or protection easements should be considered as the best habitat protection mechanism. The limestone hill, located at the intersection between Highway 2 and Road 113, is the site which should have priority for acquisition, since it is where Schoepfia arenaria is very

numerous. In this area, continuous reproduction has been observed.

112. Evaluate and review development projects. An additional mechanism for habitat protection is to continue the evaluation and modification of development projects proposed within the range of the species, taking into consideration the survival of the plant. Protection mechanisms should be developed for privately-owned lands. The Service and PRDNR should work with The Puerto Rico Planning Board and the Puerto Rico Administration of Regulations and Permits to protect the Punta Maldonado area from land alteration/degradation for house construction and the illegal dumping of trash. Residents should be informed about the presence of Schoepfia arenaria in this area and other possible protection measures.

113. Exclusion of domestic animals. Domestic animals (cattles and goats) should be excluded from the area of Punta Maldonado in Piñones. Foraging by domestic animals alters the microhabitat conditions needed for

successful growth, and reproduction of the species. This activity may result in the destruction of individual plants.

12. Plant protection. Individual plants and recruitment of new individuals should be monitored on a long-term basis.

121. Monitor known populations. Conduct basic field observations which will contribute to the information available on population biology, including phenology, seed production, seed dispersal, recruitment success, site changes, and growth.

122. Enforce existing Commonwealth endangered species regulations. The PRDNR' Regulation to govern the management of threatened and Endangered Species of 1985 provides for criminal penalties for illegal take of listed plant species. Development projects which occur in these areas are often funded through local agencies or require local permits. The Regulation's Section 10, similar to Section 7 of the Federal Endangered Species Act, provides for consultations on

endangered/threatened species which may be affected by a particular project.

123. Educate the public on plant conservation values and regulations pertaining to endangered species. 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 the pertinent laws involved. Slide presentations and illustrated material (in Spanish) on endangered plants and plant communities for presentation to local school groups and organizations should be emphasized. This might be combined with a general presentation on all endangered species. Project consultants, and permitting and funding agencies should be made aware of endangered plants, the laws involved, and their responsibilities.

2. Continue to gather information on the distribution and abundance of Schoepfia arenaria. 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. The search for new populations in northern Puerto Rico should be continued.

211. Identify and inventory potential sites.

Based on a characterization of both habitat types and on an evaluation of coastal forests which have not been surveyed, potential population sites should be identified and searched. Coordinating agencies and organizations in this effort might be the U.S. Fish and Wildlife Service, Forest Service Area of the PRDNR, the Puerto Rico Natural Heritage Program, local universities and private conservation organizations.

212. Characterize sites to determine their suitability for future recovery actions. If new populations are discovered, this information should be added to the data base of the various agencies and organizations involved, and, in addition, the sites should be evaluated for propagative material and their potential for protection. On protected

sites identified as potential habitat but where no plants are found, the suitability of the site for introduction of individuals should be determined.

3. Research. Basic biological information is currently needed on Schoepfia arenaria. Studies should focus on aspects of life history, methods of propagation, and evaluation of possible introduction sites. These studies may be critical in the recovery of the species.

31. Determine reproductive biology and ecology of Schoepfia arenaria. Little information is currently available concerning the reproductive biology of this species in its natural habitat. Effective management and recovery depends upon obtaining this information.

312. Assess periodicity of flowering and pollination mechanisms. The frequency, timing, and the physical and biological factors controlling them in the species natural environment should be determined. In addition, the species' pollination mechanisms should be identified, and consideration given to the requirements for successful

pollination in the development of management plans.

313. 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.

314. Evaluate seed viability and germination requirements. Evaluate the proportion of viable seed produced and the environmental conditions required for germination. Preliminary studies indicate that the germination rate is low. This evaluation should include both laboratory and field germination experiments.

315. Evaluate seedling establishment and growth. Conduct field experiments in conjunction with task 314 to determine suitable microsite conditions for seedling establishment and factors affecting seedling survival, the most critical stage in recruitment.

316. Evaluate role of vegetative regeneration.
Determine what role, if any, vegetative regeneration plays in population dynamics.
32. Define habitat requirements. Habitat requirements may be more clearly defined by evaluating existing site information and data from studies of similar sites.
321. Document interspecific relations with other native taxa. Since other species in the genus are considered as hemiparasitic, interspecific relations with other taxa should be documented.
33. Evaluate feasibility of artificial propagation.
Begin work on artificial propagation from both cutting and seed. Develop a propagation program with local botanical gardens.
331. Assess relative feasibility of propagation from seed versus cuttings. Based on the availability of propagative material, economic and logistical considerations, and field success, determine the most feasible methods of propagation and transplantation to

existing or new sites (e.g. Río Abajo State Forest).

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, and potential conflicting uses on or near the sites.

341. Assess habitat suitability. Using information from task 32, inventory potential sites to determine their suitability for supporting new or additional plantings of Schoepfia arenaria.

342. Assure site protection. In addition to a suitable biological environment, the feasibility of site protection must be considered.

3421. Proceed with designation of appropriate protective status. If potential introduction 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 guideline established, develop appropriate plans for management of new sites. If the site is already within an existing management area, plans should be modified to consider the presence and needs of this species.

4. Refine recovery goals. As additional information on the biology, ecology, propagation, and management of

Schoepfia arenaria is gathered, it will be necessary to better define, and possible modify, recovery goals.

41. Determine numbers 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.

42. Determine what additional actions, if any, are necessary to achieve recovery objectives. If there are any actions not included in this recovery plan, which during the recovery program become recognized species' needs, they must be incorporated into the plan.

C. Literature Cited/References

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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.

Task Priority - Tasks in the Implementation Schedule are arranged in priority order.

Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversible 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 meet the recovery objectives.

Key to Acronyms used in Implementation Schedule

FWE - Fish and Wildlife Enhancement
LE - Law Enforcement
Univ. - Universities
BotGar - Botanical Gardens
PRDNR - Puerto Rico Department of Natural Resources

RECOVERY PLAN IMPLEMENTATION SCHEDULE

PRIOR- RITY #	TASK #	TASK DESCRIPTION	TASK DURA- TION (YRS)	RESPONSIBLE PARTY			COST ESTIMATES (\$K)			COMMENTS
				REGION	FWS DIVISION	OTHER	FY1	FY2	FY3	
1	111	Protect privately-owned sites	4	4	FWE	PRDNR			120	Could also accomplish by conservation easements.
1	112	Review and evaluate development projects	Cont.	4	FWE	PRDNR	3	3	3	
1	121	Monitor known populations	Cont.	4	FWE	PRDNR	3	3	3	
1	122	Enforce existing regulations	Cont.	4	FWE LE	PRDNR	4	4	4	
2	211	Identify and inventory potential sites for new populations	2-4	4	FWE	PRDNR Univ. Private conser- vation Org.	3	3	3	
2	212	Characterize sites to determine suitability for future recovery actions	2-4	4	FWE					

PRIO- RITY #	TASK #	TASK DESCRIPTION	TASK DURA- TION (YRS)	RESPONSIBLE PARTY			COST ESTIMATES (\$K)			COMMENTS
				FWS REGION	DIVISION	OTHER	FY1	FY2	FY3	
2	341	Assess habitat suitability	Cont	4	FWE	PRDNR Univ.	1.5	1.5	1.5	Should be combined with 322.
2	342	Assure site protection	Cont.	4	FWE	PRDNR				
2	41	Determine minimum viable populations to ensure self-perpetuation	Cont.	4	FWE	PRDNR Univ.				
2	42	Determine what additional actions are needed to achieve recovery goals	Cont.	4	FWE	PRDNR				
3	113	Exclusion of domestic animals	4	4	FWE	PRDNR	1	1	1	
3	123	Educate public on plant conservation and regulations	Cont.	4	FWE	PRDNR Univ.	.5	.5	.5	

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY			COST ESTIMATES (\$K)			COMMENTS
				REGION	FWS DIVISION	OTHER	FY1	FY2	FY3	
2	312	Assess phenology and pollination mechanism	2-4	4	FWE	PRDNR Univ.	5	5	5	Including 313, 314, 315, 316.
2	313	Assess seed production and dispersal	2-4	4	FWE	PRDNR Univ.				
2	314	Evaluate seed viability and germination requirements	2-4	4	FWE	PRDNR Univ.				
2	315	Evaluate seedling establishment and growth	2-4	4	FWE	PRDNR Univ.				
2	316	Evaluate role of vegetative regeneration	2-4	4	FWE	PRDNR Univ.				
2	32	Define habitat requirements	2-4	4	FWE	PRDNR Univ.	2	2	2	
2	331	Evaluate relative propagation feasibility	2-4	4	FWE	PRDNR Univ. BotGar	1.5	1.5	1.5	Should be combined with 322.
2	332	Determine feasibility of <u>ex situ</u> production	2-4	4	FWE	PRDNR Univ. BotGar				

IV. APPENDIX

List of Reviewers

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