

U.S. Fish & Wildlife Service

# Recovery Plan for *Gesneria pauciflora*



U.S. Fish and Wildlife Service  
Southeast Region  
Atlanta, Georgia

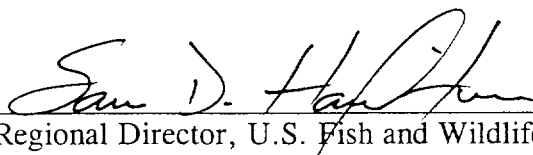
*GESNERIA PAUCIFLORA* RECOVERY PLAN

prepared by

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for the

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Southeast Region  
Atlanta, Georgia

Approved By:   
Regional Director, U.S. Fish and Wildlife Service

Date: 10-6-98

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.

By approving this document, the Regional Director certifies that the data used in its development represent the best scientific and commercial information available at the time it was written. Copies of all documents reviewed in the development of the plan are available in the administrative record, located at the Boquerón Field Office.

**Literature Citation should read as follows:**

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or 800-582-3421

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## EXECUTIVE SUMMARY OF THE RECOVERY PLAN FOR *GESNERIA PAUCIFLORA*

**Current Status:** *Gesneria pauciflora*, currently listed as threatened, is a small gregarious shrub known from only three populations in the western mountains of Puerto Rico. These three localities are found in the municipalities of Maricao and Sabana Grande. Two localities are found within the Maricao Commonwealth Forest, and the other is near the boundary of the Forest; therefore, it is uncertain whether the land is publicly or privately owned.

**Habitat Requirements and Limiting Factors:** *Gesneria pauciflora* is known to occur only on serpentine derived substrates. At all known localities, the plants are associated with wet habitats, which are on steep rock faces with little or no soil formation. They are within the spray zone of waterfalls or near deep pools. Most are in shady situations where direct sun is not received. Activities within the Forest may increase the potential for erosion of steep unstable slopes where the species occurs, and management activities such as trail construction may directly affect the species. Most individuals are found within 1 meter of water and may actually be submerged for brief periods of time. Removal of water upstream may adversely affect the species and its habitat.

**Recovery Objective:** Delisting.

**Recovery Criteria:** *Gesneria pauciflora* may be considered for delisting when (1) a management plan that considers the protection and recovery of the species has been prepared and implemented for the Maricao Commonwealth Forest, and (2) new populations (the number of which should be determined following the appropriate studies) capable of self perpetuation have been established in protected areas such as the Maricao or Susúa Commonwealth Forests.

### Actions Needed:

1. Protect the existing population and its habitat through the development and implementation of a management plan for the Maricao Commonwealth Forest.
2. Monitor known populations.
3. Enforce existing Commonwealth and Federal endangered species regulations.
4. Educate the public on conservation values and regulations.
5. Conduct research on the life history of the species and evaluate propagation techniques.
6. Conduct propagation and enhance existing populations or establish new ones on protected lands.

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

**Recovery Costs:** Recovery costs for *Gesneria pauciflora* have been estimated at \$80,000 for the first 3 years. Subsequent expenditures will depend upon the results of these preliminary studies and, therefore, cannot be estimated at this time.

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## PART I. INTRODUCTION

*Gesneria pauciflora*, a small gregarious shrub endemic to Puerto Rico, is currently known from only three populations in the western mountains of Puerto Rico. These three localities are found in the municipalities of Maricao and Sabana Grande. All known localities are in rocky stream beds on wet serpentine rock. Because of its location, the species is threatened by landslides and flood damage as well as forest management practices such as trail construction.

This species was determined to be a threatened species on March 7, 1995, pursuant to the Endangered Species Act of 1973, as amended (U.S. Fish and Wildlife Service 1995). Critical habitat has not been designated for this species because of the risks of vandalism, as well as its potential for overcollection.

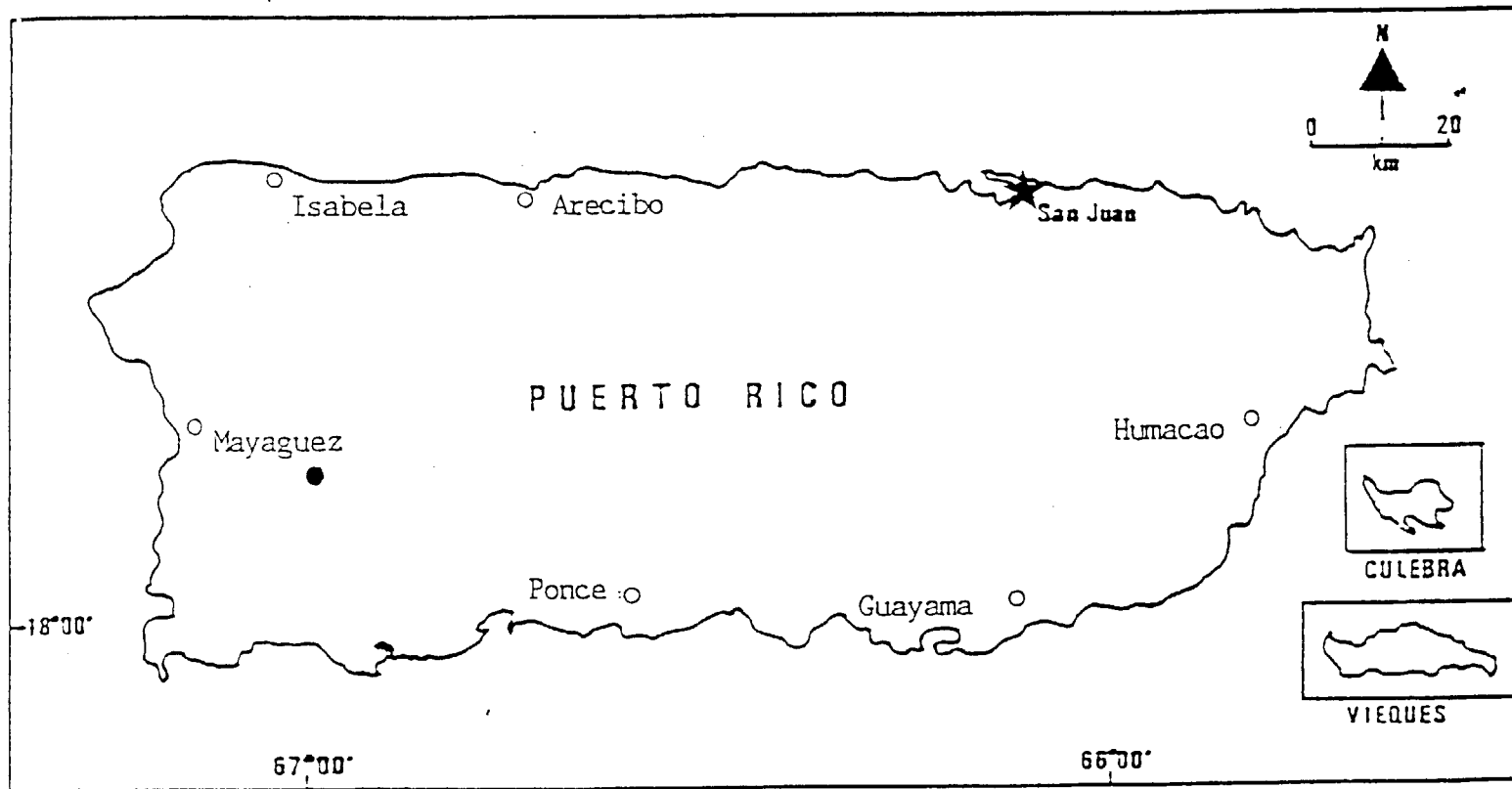
### Description

*Gesneria pauciflora*, of the family Gesneriaceae, was first discovered by the German botanical collector Paul Sintenis on December 3, 1884, in "Indiera Fria" in Maricao, Puerto Rico. Numerous other botanists collected the species from this same location for a number of years.

*Gesneria pauciflora* is a small gregarious shrub which may reach 30 centimeters in height and 8 millimeters in diameter. Stems may be erect or decumbent and the bark is smooth, gray-brown, and glabrous. The leaves are alternate, and the terets or flattened petioles are from 2 to 7 millimeters long. Leaf blades are shaped like a narrow trowel, 2.8 centimeters long and .9 to 2.3 centimeters wide, membranous, dark green and glossy above, and pilose along the prominent veins. The margin is subentire toward the cuneate base and serrate to sublobate above. The inflorescences are one to few flowered, and the peduncles are from 6.1 to 15.3 centimeters long and slightly curved. The pedicels are 1 to 2 centimeters long, reddish-brown, and pilose to glabrescent. The corolla is tubular, curved, 2 to 2.3 centimeters long, 4 millimeters wide at the base, narrowing to 3 millimeters but widening to 5 millimeters at the middle and again narrowing to 4 millimeters at the mouth. The five-lobed corolla is yellow to yellow-orange and densely pilose outside but glabrous inside. The fruit is a capsule containing numerous small seeds, approximately 4 millimeters long and wide, gray-brown, and glabrescent with 5 to 10 not prominent ridges (Liogier 1994, Proctor 1991).

### Distribution/Population Status

*Gesneria pauciflora* is currently known from three localities in the municipalities of Maricao and Sabana Grande of western Puerto Rico (Figure 1). The three areas are located along the Maricao River, the Seco River, and a small tributary of the Lajas River. At each locality, a number of clusters or colonies grow appressed to the wet rocks. Herbarium specimens indicate that the species also has been collected in the past from the Yagüez River and from Cerro Las Mesas. Apparently, both locations are located on serpentine derived soils (Breckon and Kolterman 1994).



Location of *Gesneria pauciflora* (●) in the Maricao Commonwealth Forest in Puerto Rico.

### Maricao River, Municipality of Maricao

This locality lies within the Maricao Commonwealth Forest and is managed by the Puerto Rico Department of Natural and Environmental Resources. At the Maricao River locality, 13 colonies or clusters have been found. These clusters are scattered along the river for a distance of approximately 1 kilometer. While it is difficult to estimate the number of individuals because of the plant's habit of growing in dense mats, there may be as many as 1,000 individuals at this locality (G. Breckon and D. Kolterman, pers. comm.; Breckon and Kolterman 1994).

### Seco River, Municipality of Sabana Grande

As with the Maricao River locality, the Seco River area lies within the Maricao Commonwealth Forest. At this locality, three colonies or clusters, consisting of perhaps 50 individuals, have been found. The clusters are found within a distance of about 100 meters of each other (Breckon and Kolterman 1994).

### Lajas River, Municipality of Maricao

Four colonies or clusters has been located in this small, narrow ravine that drains into the Lajas River. These clusters are found within a 200-meter area along the ravine. This locality lies on the edge of the Maricao Commonwealth Forest and, due to the uncertainty of the location of the forest's boundaries, it is not known whether the plants are on public or private land (Breckon and Kolterman 1994).

### **Reproductive Biology**

Field observations during a 2-year study of the species' phenology indicate that flowering and fruiting occur throughout the year. Nevertheless, there appear to be more abundant flowering and fruiting during the rainy months of August, September, and October. Flowering becomes less frequent and patchy during drier periods (Breckon and Kolterman 1994).

While the flower's tubular structure and orange-red color might indicate that they would be visited and pollinated by hummingbirds, no such visitation was made during preliminary observations. Nevertheless, fruit set appears to be high. Studies of pollination mechanisms are currently ongoing (Breckon and Kolterman 1994).

A total of 258 individuals in 13 clusters (separated by more than 10 meters) were sampled for morphometric analysis of the leaves and for electrophoresis. Eight of the clusters were from the Maricao River, two from the Lajas River, and three from the Seco River. Four clusters or colonies had smaller leaves than the other nine and all four were from more sunny or exposed sites. Differences in leaf shape defining components were found among colonies, suggesting that colonies or clusters may be genetically distinct from each other and each may be considered



a genetically distinct breeding population. Ongoing studies are being conducted to determine whether *Gesneria pauciflora* is apomictic (makes seeds asexually). Data from electrophoretic analysis and breeding system studies will provide additional information (Breckon and Kolterman 1994).

### **Habitat Description**

*Gesneria pauciflora* 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 reach up to 800 meters in the Maricao Commonwealth Forest.

The Maricao Forest falls within three life zones: subtropical wet forest, subtropical moist forest, and subtropical lower montane wet forest (Ewel and Whitmore 1973). The majority of the area of the Forest 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, characterized by steep ravines and intermittent streams.

Mean annual precipitation at the Maricao Fish Hatchery (elevation 457 meters), near the Maricao River locality, was reported to be 2,466 millimeters, with a dry period occurring from December to March. The mean annual temperature in Maricao was 21.7°C, with a mean minimum monthly temperature of 20.2°C in January and a maximum of 23.0°C in August (Silander *et al.* 1986).

In general, the plants occur on bare serpentine rock, and less often on river gravel derived from serpentine. At all localities, the plants are associated with wet habitats, which are predominantly on steep rock faces with little or no soil formation. They are within spray zones from waterfalls or on steep rock faces above deep pools. More infrequently, they occur in gravel above the water line of the river, but in two places there are seeps underneath the gravel. The majority of the colonies are on north, northeast, or northwest facing slopes and in shady situations where direct sun is not received. The species' restriction to a highly specific habitat where few other species occur suggests a combination of tolerance and poor competitive ability. The plant appears to be tolerant of low nitrogen and calcium and to toxicity of high levels of heavy metals found in serpentine (Breckon and Kolterman 1994).

### **Reasons For Listing**

*Gesneria pauciflora* was listed as threatened in 1995. At present, a management plan for the Maricao Commonwealth Forest that considers the management and protection of the species has not been prepared. Activities within the Forest may increase the potential for erosion of the

steep unstable slopes where the species occurs. Management practices such as trail construction may directly affect the species.

The majority of known plants are found within 1 meter of water and may actually be submerged for brief periods during high water (G. Breckon and D. Kolterman, pers. comm.). Any removal of water upstream or impoundment of water downstream may adversely affect the plant and its habitat. Due to water shortages on the island, the number of requests for additional water intakes has increased substantially.

The species has an extremely limited distribution; therefore, the magnitude of threat is high. *Gesneria pauciflora* is a serpentine restricted species and its present range and abundance are reduced from its historical range and abundance. Landslides, storm damages, and floods are natural occurrences that may affect the steep, unstable slopes associated with this species' habitat. The Center for Plant Conservation (1992) describes this miniature herb with beautiful yellow-orange or salmon colored flowers as having horticultural potential.

### **Conservation Measures**

Conservation measures provided to federally listed species include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing encourages and results in conservation actions by Federal, State, and private groups and individuals. The Endangered Species Act provides for possible land acquisition in cooperation with the States and requires that recovery actions be carried out for all listed species. Section 7(a) of the Act, as amended, requires Federal agencies to evaluate their actions with respect to any species that is listed as federally endangered or threatened. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with the Fish and Wildlife Service.

Studies of the distribution, abundance, population size and structure, and reproductive biology of *Gesneria pauciflora* have been ongoing since 1993. As a result, new individuals have been located and electrophoresis, leaf morphometrics, and phenology studies have been initiated. These studies have provided information on the reasons for the rarity of the species and recommendations for its recovery. Preliminary results from these studies have been incorporated into this recovery plan.

### **Summary of Comments Received**

Copies of the Technical/Agency Draft Recovery Plan for *Gesneria pauciflora* were sent to 10 reviewers, including three peer reviewers, for review and comments. A notice of availability of the Technical/Agency Draft was published in the *Federal Register*. No letters of comment were received.

## PART II. RECOVERY

### A. Recovery Objective and Criteria

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

*Gesneria pauciflora* could be considered for delisting when (1) a management plan that considers the protection and recovery of the species has been prepared and implemented for the Maricao Commonwealth Forest, and (2) new populations (the number of which should be determined following the appropriate studies) capable of self perpetuation have been established within protected areas, such as other areas in the Maricao Commonwealth Forest or in the Susúa Commonwealth Forest (similar geologically to the Maricao Forest). These are minimum requirements, and could be expanded upon if the regenerative or propagative potential of natural and *ex situ* populations proves to be insufficient. Alternatively, 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 the minimum number of plants necessary for recovery.

### B. Narrative Outline

1. **Prevent further habitat loss and population decline.** Protection of habitat and individual plants at the known population sites should be initiated by appropriate public agencies.
  11. **Protect habitat.** To prevent extinction, the protection of the existing populations should be given the highest priority.
    111. **Develop a management plan, which provides for the protection and recovery of *Gesneria pauciflora*, for the Maricao Commonwealth Forest.** A management plan should be developed that includes measures to protect known individuals and their habitat and provides for long-term monitoring of their growth and reproduction. It should be determined whether the population at the Lajas River is actually within the limits of the Maricao Commonwealth Forest. If not, the locality should be protected.
  12. **Protect and monitor plants.** Individual plants and the recruitment of new individuals must be monitored on a long-term basis.

121. **Monitor known population.** Individual plants should be measured and marked. Basic field observations that 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.
  122. **Enforce existing Commonwealth and Federal 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 the illegal take of listed plant species on public land. In addition, development projects that occur in these areas are often funded through local or Federal agencies or require local permits. Section 10 of the Regulation provides for consultations on endangered species that may be affected by a particular project similar to Section 7 of the Endangered Species Act. Section 7 of the Endangered Species Act would apply where Federal lands or federally funded or permitted projects are involved.
  123. **Educate the public on plant conservation values and regulations.** *Gesneria pauciflora* should be included in the illustrated brochure and slide presentation (in both English and Spanish) on endangered plants and plant communities that are presented to local school groups, organizations, and agencies. Permitting and funding agencies (those potentially involved in Section 7 consultations) should be made aware of endangered plants, the pertinent laws, and their responsibilities.
2. **Continue to gather information on the distribution and abundance of *Gesneria pauciflora*.** Future management decisions and the establishment of recovery implementation priorities depend on obtaining additional information concerning the distribution and abundance of this species.
    21. **Search for new populations.** Searches for new individuals and populations should be conducted in the Maricao Commonwealth Forest and the Susúa Commonwealth Forest.

211. **Identify and inventory potential sites.** Based on a characterization of known habitat types, potential population sites should be identified and searched. The species' known habitat is limited in extent, thereby facilitating searches.
  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, newly discovered sites should be evaluated for the availability of propagative material and the potential for protection.
3. **Conduct research.** While some studies have been initiated, relatively little biological information is available on *Gesneria pauciflora*. Studies should focus on those aspects of life history that may be critical to the recovery of the species.
31. **Define habitat requirements.** Information available from existing studies should be evaluated to more clearly define habitat requirements.
  32. **Study reproductive biology and ecology of *Gesneria pauciflora*.** Effective management and recovery of this species depends upon obtaining this information.
    321. **Assess periodicity of flowering.** Studies to determine the frequency, timing, and abundance of flowering; pollination mechanisms; and the physical and biological factors controlling these events should be continued.
    322. **Assess seed production and dispersal.** Agents of seed predation and/or dispersal should be identified.
    323. **Evaluate seed viability and germination requirements.** Information on the environmental conditions required for germination should be obtained through field and laboratory studies.
    324. **Evaluate requirements for establishment and growth.** Field and laboratory experiments should focus on this critical stage to determine the factors that affect establishment and survival.

325. **Determine genetic structure of the species.** Continue to study intra- and inter-population genetic diversity of the species using appropriate techniques.
33. **Evaluate techniques for artificial propagation and develop propagation program.** Propagation techniques should be evaluated so that a propagation program with local nurseries may be developed.
331. **Assess methods of propagation.** Based on the availability of propagative material, economic and logistical considerations, and results from the above research, determine the most feasible method of propagation and transplantation to existing or new sites. Sexual and asexual reproduction should be evaluated as alternatives.
332. **Develop artificial propagation program.** This species should be included in the ongoing artificial propagation program at local nurseries.
4. **Establish new populations.** Areas for the establishment of new populations of *Gesneria pauciflora* 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 ensure the success and relevance of transplanting propagated material.
411. **Select sites and assess habitat suitability.** Using information from Task 31, inventory potential sites for the introduction and establishment of new populations of *Gesneria pauciflora*. Consideration should be given to the introduction of this species in other areas of the Maricao Commonwealth Forest or in the Susúa Commonwealth Forest.
412. **Ensure site protection.** If proposed sites are not already on protected land, steps must be taken to provide for their protection. Management plans for these new sites should be developed or modified to include considerations for this species.
413. **Introduce and monitor plants.** Success of plantings should be carefully monitored.

5. **Refine recovery criteria.** As additional information on the biology, ecology, propagation, and management of *Gesneria pauciflora* is accumulated, it will be necessary to better define, and possibly modify, recovery criteria.
  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 criteria to be established.
  52. **Determine what additional actions, if any, are necessary to achieve recovery criteria.** If there are any actions not included in this recovery plan, which during the recovery process become recognized needs, they should be incorporated into the plan.

### C. Literature Cited and References

- Breckon, G. and D. Kolterman. 1994. *Gesneria pauciflora* Urban (Gesneriaceae). Final Report under Cooperative Agreement No. 1448-0004-93-973 between the U.S. Fish and Wildlife Service and the University of Puerto Rico, Mayaguez Campus. 18 pp.
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- Ewel, J.S. and J.L. Whitmore. 1973. Ecological life zones of Puerto Rico and the U.S. Virgin Islands. USDA Forest Serv. Res. Paper ITF-18. 72 pp.
- Liogier, H.L. 1994. Descriptive flora of Puerto Rico and adjacent islands. Volume III, Cyrillaceae to Myrtaceae. Editorial de la Universidad de Puerto Rico. Río Piedras, Puerto Rico.
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- Silander, S., H. Gil de Rubio, M. Miranda, and M. Vazquez. 1986. Los Bosques de Puerto Rico, Volume II. Compendio Enciclopédico de los Recursos Naturales de Puerto Rico. Puerto Rico Department of Natural Resources, San Juan, Puerto Rico.
- U.S. Fish and Wildlife Service. 1995. Endangered and threatened wildlife and plants; determination of endangered status for the plant *Gesneria pauciflora*. *Federal Register* Vol. 60: 12483.



### **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.

#### List of Abbreviations

- DNER - Puerto Rico Department of Natural and Environmental Resources
- ES - Fish and Wildlife Service, Ecological Services Division
- LE - Fish and Wildlife Service, Law Enforcement Division
- BotGar - Botanical Gardens
- Univ. - Universities

### IMPLEMENTATION SCHEDULE

Task Priority	Task Description	Task Number	Task Duration (Years)	Responsible Organization		Cost Estimates (\$000)			Comments
				FWS R4	Other	FY1	FY2	FY 3	
1	Develop a management plan, which provides for the protection and recovery of <i>Gesneria pauciflora</i> , for the Maricao Commonwealth Forest.	111	2	ES	DNER				No cost anticipated.
1	Monitor known populations.	121	Cont.	ES	DNER	3	3	3	
1	Enforce existing Commonwealth and Federal endangered species regulations.	122	Cont.	ES, LE	DNER	6	6	6	
2	Educate the public on plant conservation values and regulations.	123	Cont.	ES, LE	DNER	1	1	1	
2	Identify and inventory potential sites.	211	2-4	ES	DNER	3	3	3	
2	Characterize sites to determine their suitability as future recovery sites.	212	2-4	ES	DNER, Univ.				
2	Define habitat requirements.	31	2-4	ES	DNER, Univ.	3	3	3	
2	Assess periodicity of flowering.	321	2-4	ES	DNER, Univ.	6	6	6	6K/year includes 321, 322, 323, 324, and 325.
2	Assess seed production and dispersal.	322	2-4	ES	DNER, Univ.				

Task Priority	Task Description	Task Number	Task Duration (Years)	Responsible Organization		Cost Estimates (\$000)			Comments
				FWS R4	Other	FY1	FY2	FY 3	
2	Evaluate seed viability and germination requirements.	323	2-4	ES	DNER, Univ.				
2	Evaluate requirements for establishment and growth.	324	2-4	ES	DNER, Univ.				
2	Determine genetic structure of the species.	325	2-4	ES	DNER, Univ.				
2	Assess methods of propagation.	331	2-4	ES	DNER, Univ. BotGar.	2	2	2	
2	Develop artificial propagation program.	332	Cont.	ES	DNER, Univ. BotGar.	2	2	2	
2	Select sites and assess habitat suitability.	411	2-4	ES	DNER, Univ.		2		
2	Ensure site protection.	412	2-4	ES	DNER,				
2	Introduce plants.	413	2-4	ES	DNER				
2	Determine number of individuals and populations to ensure stability and self-perpetuation.	51	Cont.	ES	DNER, Univ.				
2	Determine what additional actions are needed to achieve recovery objectives.	52	Cont.	ES	DNER, Univ.				

#### **PART IV. LIST OF REVIEWERS**

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