

***Gesneria pauciflora* Recovery Plan**

U.S. Fish and Wildlife Service. 1998. *Gesneria pauciflora* Recovery Plan. U.S. Fish and Wildlife Service, Atlanta, Georgia. 16pp.

Original Approved: October 6, 1998
Original Prepared by: Susan Silander

AMENDMENT 1

We have identified best available information that indicates the need to amend recovery criteria for *Gesneria pauciflora* (no common name) since the recovery plan was completed. In this modification, we synthesize currently available information, identify amended recovery criteria, and present the rationale supporting the recovery plan modification. The modification is shown as an addendum that supplements the recovery plan (USFWS 1998), superseding portions of only the Executive Summary and Part II A (page 6) of the recovery plan. The recovery plan is a non-regulatory document that provides guidance on how best to achieve recovery for the species.

For
U.S. Fish and Wildlife Service
Atlanta, Georgia

Approved: Franklin J. Arnold
Acting Regional Director, U.S. Fish and Wildlife Service

Date: 9/24/19

METHODOLOGY USED TO COMPLETE THE RECOVERY PLAN AMENDMENT

The amendments to the recovery criteria are based on the most recent studies with the species and the information contained in the latest 5-year status review (USFWS 2013). This information was analyzed by U.S. Fish and Wildlife Service (Service) biologists and managers in the Caribbean Ecological Services Field Office in order to develop the delisting criteria for *G. pauciflora*.

ADEQUACY OF RECOVERY CRITERIA

Section 4(f)(1)(B)(ii) of the Endangered Species Act (Act) requires that each recovery plan shall incorporate, to the maximum extent practicable, "objective, measurable criteria which, when met, would result in a determination...that the species be removed from the list." Legal challenges to recovery plans (see *Fund for Animals v. Babbitt*, 903 F. Supp. 96 (D.D.C. 1995)) and a Government Accountability Audit (GAO 2006) also have affirmed the need to frame recovery criteria in terms of threats assessed under the five listing factors.

Recovery Criteria

See previous version of criteria in the [Gesneria pauciflora Recovery Plan](#) on page 6.

Synthesis

Gesneria pauciflora is a small shrub, growing in clusters, and known to occur only on serpentine derived substrates with little or no soil formation and is associated with wet habitats (e.g., river margins and waterfalls). It was listed as threatened in 1995 because of an extremely limited distribution and because of habitat threats.

At the time of listing and when the recovery plan was signed, 1,050 individuals in three discrete populations were known to exist in the mountain range of the municipalities of Maricao and Sabana Grande (Río Maricao, Río Seco, and a tributary of Río Lajas). Two of the three populations were located within the Maricao Commonwealth Forest (MCF) (USFWS 1998). Along the Río Maricao, the recovery plan reported thirteen colonies (clusters of individuals) scattered for a distance of approximately one kilometer (0.62 miles) of a stream corridor (USFWS 1998). Based on the information in the recovery plan, the population at the Río Lajas tributary consists of four colonies or clusters (USFWS 1998). The tributary and most of the river is located on private lands outside of the MCF boundaries. According to Center for Plant Conservation (1992), the largest population occurs at the headwaters of the Río Maricao, and has been estimated to have as many as 1,000 individuals.

During the most recent 5-year status review, the Service found that the Puerto Rico Division of Natural and Environmental Resources Natural Heritage Program identified a fourth population near the headwaters of Río Bonelli within the MCF (USFWS 2013). During the first week of November 2009, Service biologists visited a section of the Río Maricao locality for an assessment of the area. Biologists covered approximately 2.4 km (ca. 1.5 miles) along the Maricao River including areas that had not been previously searched. Service staff estimated a range of 780 to 1,425 individuals in 12 colonies, of which 6 were within areas not previously searched by Breckon and Kolterman (1994 and 1996) (University of Puerto Rico, Mayaguez Campus). Two large colonies were found by Service biologist Omar A. Monsegur-Rivera on small waterfalls along “vereda del infierno” within the upper watershed of Río Maricao. All colonies recorded in 2009 along the Río Maricao were in bloom and had juvenile plants (evidence of natural recruitment). The largest colonies were the most isolated and closer to the rivers’ headwater and associated drainages (steepest habitat and with shaded conditions). In November 2012, the same 2.4 km section along the Maricao River was surveyed and all except one colony were still present and healthy. One of the two colonies found off “vereda del infierno” was affected by a natural landslide, essentially eliminating nearly all known individuals from that colony. Further assessments by Omar A. Monsegur-Rivera showed this population extended above the landslide area, and overall appeared to be healthy and recovering. Although it appears some colonies have been affected by landslides and river overflow, other large colonies were found in areas that had not been searched before. Based on the information gathered in the 5-year status review and the observations in the field, the number of individuals in the Río Maricao seemed stable, but the

number of individuals in the Río Lajas may have decreased. As of the time of the species 5-year review (2013), the number of individuals in Río Seco and Río Bonelli remained unknown.

Further habitat assessments by Service and PRDNER staff associated with the establishment of a third population of Puerto Rican Parrot (*Amazona vittata*) on the MCF, found new populations of *G. pauciflora* along different watersheds and tributaries. Based on this report, the species appeared to be more widespread within the Río Maricao upper watershed, extending to some private lands (e.g., Santa Rita). These assessments also showed the populations along the tributaries of Río Lajas extended above the localities previously reported by Breckon and Kolterman (1994 and 1996). In fact, one of the largest populations corresponds to several extensive subpopulations along private lands at the upper watershed of Río Lajas (above Salto Curet). In addition, work by Dr. Mervin Pérez found new populations along Río Prieto and its tributaries. Based on the latest habitat assessments by Service and partners (PRDNER, UPRM and University of Puerto Rico Río Piedras), the species remains restricted to serpentine soils. However, it is more widespread within the MCF and its distribution appears to be correlated to north-facing watersheds.

Nonetheless, Hurricane Maria (category 4), affected the island of Puerto Rico on September 20, 2017. Hurricane María poured over 20 inches of rain within the area of the MCF, resulting in numerous landslides. As reported in USFWS (2017), the Service along with PRDNER staff conducted site visits between November and December of 2017 to survey the habitat along the Río Maricao, and Río Lajas (Salto Curet). Despite the high diversity and quality of the habitat at the MCF, there are no previous details on specific monitoring addressing the impacts of major hurricanes (i.e., Hurricane Georges in 1998) to *G. pauciflora* and its habitat. A rapid assessment of known populations determined that flash floods and landslides affected all known sites of the species within the Río Maricao and Río Lajas watersheds. It was estimated that the majority of these sites lost about 80% of the individuals per locality (clusters) in these two populations, and at least one of the surveyed clusters at Río Maricao was extirpated. The target area of one of the biggest known populations was deforested and eroded due to a landslide, and estimates suggest 75% of the individuals at this site were lost. The analysis of aerial images of other population localities suggests similar loss of individuals. However, impacts to populations were variable across the different watersheds, and survey teams did identify that at least three of the subpopulations recently identified by the Puerto Rican Parrot staff (upper watershed of Río Lajas) showed little impacts due to hurricane and demonstrated a healthy population structure. Apparently, due to the small size of this branch of the upper Río Lajas watershed, it was less affected by landslides and flooding, and overall it appeared that all localities located at the higher elevations of the watersheds suffer less impacts.

Evaluation of Factors B, C, and D, as part of *G. pauciflora*'s most recent 5-year status review, concluded that they are no longer threats to the species (USFWS 2013). The majority of localities of *G. pauciflora* are within protected forests, and colonies found in rocky wet habitat are generally associated with rivers and waterfalls. Primary threats to the species include landslides, storm damages, and floods that are natural factors and will continue to occur (Factor E). Forest management practices such as trail construction and/or maintenance activities, within the MCF, also have the potential to affect this species (Factor A); however, implementation of best management practices reduce the risk of affecting the steep, unstable slopes associated with

the species' habitat. Factor A is considered a low and non-imminent threat to the species.

AMENDED RECOVERY CRITERIA

Recovery criteria serve as objective, measurable guidelines to assist in determining when an endangered species has recovered to the point that it may be downlisted to threatened, or that the protections afforded by the Act are no longer necessary and the *G. pauciflora* may be delisted. Delisting is the removal of a species from the Federal Lists of Endangered and Threatened Wildlife and Plants. Downlisting is the reclassification of a species from an endangered species to a threatened species. The term "endangered species" means any species (species, sub-species, or DPS) which is in danger of extinction throughout all or a significant portion of its range. The term "threatened species" means any species, which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Revisions to the Lists, including delisting or downlisting a species, must reflect determinations made in accordance with sections 4(a)(1) and 4(b) of the Act. Section 4(a)(1) requires that the Secretary determine whether a species is an endangered species or threatened species (or not) because of threats to the species. Section 4(b) of the Act requires that the determination be made "solely on the basis of the best scientific and commercial data available." Thus, while recovery plans provide important guidance to the Service, States, and other partners on methods of minimizing threats to listed species and measurable objectives against which to measure progress towards recovery, they are guidance and not regulatory documents.

Recovery criteria should help indicate when we would anticipate that an analysis of the species' status under section 4(a)(1) would result in a determination that the species is no longer an endangered species or threatened species. A decision to revise the status of or remove a species from the Federal Lists of Endangered and Threatened Wildlife and Plants, however, is ultimately based on an analysis of the best scientific and commercial data then available, regardless of whether that information differs from the recovery plan, which triggers rulemaking. When changing the status of a species, we first propose the action in the *Federal Register* to seek public comment and peer review, followed by a final decision announced in the *Federal Register*.

We provide new delisting criteria for the *G. pauciflora*, which will supersede those included in its Recovery Plan. The recovery criteria presented below represent our best assessment of the conditions that would most likely result in a determination that delisting of *G. pauciflora* is warranted as the outcome of a formal five-factor analysis in a subsequent regulatory rulemaking. Achieving the prescribed recovery criteria is an indication that the species is no longer threatened or endangered, but this must be confirmed by a thorough analysis of the five delisting factors.

Amended Delisting Recovery Criteria

1. The existing six (6) populations of *G. pauciflora* within the Maricao Commonwealth Forests and adjacent private lands exhibit a stable or increasing population trend, evidenced by natural recruitment, and multiple age classes (addresses Factor A and E).

2. Of the six (6) currently known natural populations, the three (3) populations extending onto private lands adjacent to the MCF are protected through a long-term conservation mechanism (addresses Factors A and E).
3. Threats due to forest management activities (e.g., trail and dirt roads maintenance and improvements in areas adjacent drainage crossings) have been addressed and/or managed to the extent that the species will remain viable for the foreseeable future.

Justification:

Justification for criterion 1: The latest available information indicates the known populations of *G. pauciflora* extend into multiple localities within different watersheds at the MCF and adjacent private lands. Based on a population viability analysis, the subpopulations along the Río Maricao were stable before Hurricane María in 2017. Moreover, the core populations of this species occur within prime habitat characterized by a high diversity of native vegetation, and little evidence of intrusion by exotic plant species. However, these populations were diminished by flash floods, landslides, and further changes in habitat structure associated with Hurricane María. The majority of these sites lost about 80% of the *G. pauciflora* individuals, and some localities were extirpated. Therefore, the management and enhancement of known *G. pauciflora* populations is essential to increase the species viability (i.e., residency, redundancy and representation) so that the species maintains its capacity to adapt to changing environmental conditions and catastrophic events such as hurricanes and associated habitat changes (e.g., reduced forest cover, increased temperature, and changes in hydrology).

Justification for criterion 2: New information indicates *G. pauciflora* is more widespread than when it was listed, and even extends into private lands adjacent to the MCF. The upper watershed of Río Lajas (above Salto Curet) is outside the MCF and harbors one of the largest currently known populations of *G. pauciflora*. This area, including the *G. pauciflora* population, appears to have been the least affected by flooding and landslides caused by Hurricane María. The protection of *G. pauciflora* populations outside the MCF is important to maintain the species' redundancy and representation. Therefore, engaging private landowners on the implementation of conservation actions for *G. pauciflora* has been deemed an important action to maintain the species persistence into the future.

Justification for criterion 3: As stated above, the populations of *G. pauciflora* were diminished by flash floods and landslides associated to Hurricane María. The serpentine soils at the MCF and the prime habitat of *G. pauciflora* is extremely susceptible to landslides. Thus, forest management activities (e.g., trail and dirt roads maintenance and improvements) within areas adjacent to drainage crossings should include Best Management Practices to avoid actions that may result in unstable soil conditions that further promote landslides and erosion along drainages. For example, the opening of dirt roads with bulldozer at these areas should avoid depositing fill material down slope or into drainages, as this may promote landslides.

Rationale for Amended Recovery Criteria

Prior to Hurricane Maria, the population growth rate of the species was greater than one, suggesting the population was at equilibrium (Pérez et al., 2018). In addition, as stated above, the species has recently been discovered from multiple localities along different watersheds, thus, suggesting adequate representation. However, according to Pérez et al. (2018), post hurricane assessments suggested that species growth rate decreased by about 34% annually, leaving to question the resiliency of the species in the event of further extreme atmospheric events. Further, it was determined that seedlings were the most affected followed by non-reproductive plants from the flash floods and habitat modifications, while reproductive plants (i.e., larger plants) displayed greater resilience. It was also noted that colonies located in first order streams experienced more damage and mortality than colonies in the tributaries and upper parts of the watersheds. In addition, colonies in the upper parts of the watershed also had the largest plants, and may serve as donors for future reintroduction efforts.

Reintroduction methods have already been developed and modeling suggests that reintroductions have the potential to increase the total number of reproductive adult plants within the post-hurricane assessment study by 60% resulting in increased viability (resiliency, representation, redundancy). The reintroduction strategy would identify sites within the MCF as propagules sources, develop a propagation enhancement protocol, and provide details on the reintroduction of propagules in the wild on existing and newly identified sites. Seed viability and germination rates are known to be high and propagation is feasible. Enhancing the known populations with more individuals would increase the species viability knowing that some threats like hurricanes and associated flash floods and landslides are inevitable (Factor E). Since the known populations occurs on different watersheds with little or no interaction (e.g., cross-pollination), propagation and planting efforts will follow a watershed approach (e.g., planting material from the Río Maricao within the same watershed) in order to preserve the genetic integrity within river basins.

In addition to the protection and management of the six known populations (Río Maricao, Río Seco, Río Bonelli, Río Lajas (Tributary), Río Prieto and Río Lajas (above Salto Curet)), our recovery approach is to protect the localities (subpopulations) of *G. pauciflora* that extend to private lands (e.g., Santa Rita and Río Lajas) through long-term conservation mechanisms. These conservation mechanisms include land acquisition, conservation easements and land-owner conservation agreements. The implementation of these conservation mechanisms on private lands is vital for the species long-term viability.

ADDITIONAL SITE SPECIFIC RECOVERY ACTIONS

1. In collaboration with partners (e.g., UPRRP, KEW, Fairchild Tropical Botanic Garden and PRDNER), implement a project to propagate and reintroduce *G. pauciflora* to re-establish populations after Hurricane Maria. The project should address the feasibility of seed banking this species, and if deemed necessary, seed material should be stored at authorized institutions (e.g., Millennium Seed Bank (KEW) and USDA National Laboratory for Genetic Resources Preservation (NLGRP) in Ft. Collins).
Recovery Task: 31, 32, 33 and 34.

2. Refine and validate an existing GIS-based habitat predictability model to identify and further explore additional areas to locate more reintroduction sites for the species. Recovery Task: 21 and 41.
3. Continue, post hurricane monitoring of the eleven (11) colonies studied within the MCF, and expand it to other colonies in order to assess potential long-term effects of canopy cover loss on plant mortality, the potential effect of co-existing fast growing and exotic invasive species, and the colony recovery rates following canopy regeneration. Recovery Task: 32.
4. Studies in the species' population genetics should be conducted to determined patterns of genetic diversity across the species natural distribution, to provide baseline information for a sound management of *G. pauciflora* actions (e.g., need for enhancement of populations with material from different watersheds). Recovery Task: 32:

LITERATURE CITED

Breckon, G.J. and D.A. Kolterman. 1994. Final Report on *Gesneria pauciflora*. Cooperative Agreement No. 1448-0004-93-973 between the U.S. Fish and Wildlife Service and the University of Puerto Rico, Mayagüez Campus.

Breckon, G.J. and D.A. Kolterman. 1996. Final Report on *Gesneria pauciflora*. Cooperative Agreement No. 1448-0004-94-9113 between the U.S. Fish and Wildlife Service and the University of Puerto Rico, Mayagüez Campus.

Center for Plant Conservation. 1992. Report on the rare plants of Puerto Rico. Center for Plant Conservation, Missouri Botanical Garden, St. Louis, Missouri.

Pérez, M.E., E.J. Meléndez-Ackerman, L. Garcia, O.A. Monsegur-Rivera. 2018. Final Report on Post Maria Assessment of *Gesneria pauciflora* a threatened herbaceous species endemic to the Maricao Forest Reserve, Puerto Rico. Amended Agreement No. F16AC00894 between the U.S. Fish and Wildlife Service and the University of Puerto Rico at Rio Piedras.

U.S. Fish and Wildlife Service (USFWS). 1998. *Gesneria pauciflora* Recovery Plan. U.S. Fish and Wildlife Service, Atlanta, Georgia. 16pp.

U.S. Fish and Wildlife Service (USFWS). 2013. *Gesneria pauciflora* 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service Southeast Region Caribbean Ecological Services Field Office, Boquerón, Puerto Rico. 15pp.

U.S. Fish and Wildlife Service (USFWS). 2017. Assessment on the impacts due to Hurricane Maria on the known populations of *Gesneria pauciflora* the Maricao Commonwealth Forest and Adjacent Lands. U.S. Fish and Wildlife Service Southeast Region Caribbean Ecological Services Field Office, Boquerón, Puerto Rico. 8pp.