Recovery Plan for Higüero de Sierra (*Crescentia portoricensis*)
U.S. Fish and Wildlife Service (USFWS). 1991. *Crescentia portoricensis* Recovery Plan. Atlanta, Georgia. 20 pp.

Original Approved: September 23, 1991
Original Prepared by: Susan R. Silander

AMENDMENT 1

We have identified the best available information that indicates the need to amend recovery criteria for the endangered *Crescentia portoricensis* (common name in Spanish: Higüero de sierra) since the recovery plan was completed. In this modification, we synthesize the currently available information, assess the adequacy of the existing recovery criteria, show amended recovery criteria, and provide the rationale supporting the recovery plan modification. The modification is shown as an addendum that supplements the recovery plan (USFWS 1991), superseding only Part II A, page 7 of the recovery plan. Recovery plans are a non-regulatory document that provides guidance on how best to help recover the species.

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

Approved: _____
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 latest 5-year status review (USFWS 2017) and the most recent studies for this species. 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 the higüero de sierra.

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 Recovery Plan for Higüero de Sierra (*Crescentia portoricensis*) on page 7.

Synthesis

Higüero de sierra is a vine-like shrub or small tree (up to about seven meters (23 ft) in height) occurring in evergreen, semi-evergreen, and deciduous forests on serpentine soils in the lower Cordillera region of southwestern Puerto Rico. The species' distribution is limited to the Susúa Commonwealth Forest (SCF) and Maricao Commonwealth Forest (MCF). In 1987, the species was listed as endangered due the effects of deforestation (i.e., erosion of stream banks and landslides) and its low population size (USFWS 1987). The species also appears to be facing natural recruitment problems based on absence of seedlings in the wild (USFWS 2017).

The number of known populations of higüero de sierra has increased since listing, but that does not necessarily mean these are new individuals or that populations are expanding. Rather it could be due to increased survey efforts. At the time of listing (USFWS 1987), only 42 plants were known from six sites in the MCF and SCF. The recovery plan (USFWS 1991) then reported approximately 102 individuals occurring in three populations distributed across seven localities: 36 mature trees in five sites in Quebrada Piedras and Río Seco in the MCF, and 66 individuals located in two sites along Quebrada Peces in the SCF. Breckon and Kolterman (1994) had expanded the number of known individuals to about 334 individuals within the same forests, including some individuals outside forest boundaries. Cancel (2010) later reported at least 532 individuals of higüero de sierra in eleven populations. This data include new populations not previously described, all within the MCF (i.e., Quebrada Piedras, Río Bonelli, Río Cupeyes, and Río Postrero). It is likely that further undetected natural populations or individuals of higüero de sierra occur within and adjacent to the MCF and SCF, but the steep topography makes it difficult to search for the species. The Service specified there are at least 547 individuals of higüero de sierra in wild populations at the MCF and SCF (USFWS 2017).

Propagation efforts have resulted in several other higüero de sierra individuals being planted within and outside of the MCF and SCF (Cancel 2010). Although these reintroduction efforts lack more specific information and long-term monitoring, higüero de sierra does seem to have high seed viability and germination rates *ex situ*. Further studies are necessary to determine how many individuals are necessary to establish self-sustainable populations and guide propagation efforts.

Information gathered for the species 5-year status review (USFWS 2017) specified that higüero de sierra continues to be affected by some forest management practices. However, the majority of the suitable habitat for the species is protected and managed for conservation, and the impacts by forest management do not occur on a regular basis and are limited to maintenance of existing trails and recreational areas. Therefore, destruction, modification or curtailment of their habitat (Factor A) is considered a low and non-imminent threat for this species. In addition, since the majority of the prime habitat for the species is protected by Commonwealth laws and regulations

and as Commonwealth forests managed by the Puerto Rico Department of Natural and Environmental Resources, we no longer consider Factor D a threat. Factor B has never been identified to affect this species.
Factor C (predation) is currently considered the most significant threat. Since Breckon et al. (1992), no seedlings or juvenile plants have been detected in the natural populations that have been monitored. There is evidence that the absence of recruitment is being caused by rats preying on (Factor C) and/or damaging the fruits and seeds of higüero de sierra (USFWS 2017). It is likely that the majority of the fruits are eaten before the seed material has fully developed and any seed (embryo) left by rodents might be immature and not able to germinate.

Other natural or manmade factors (Factor E) such as hurricanes and landslides, possible low genetic diversity, and the risk of hybridization with other species of *Crescentia* are also considered as potential threats to higüero de sierra. The dangers of hybridization with another introduced *Crescentia* were mentioned by Breckon and Kolterman (1993) and documented in *ex situ* collections by Cancel (2010). Hybridization has not yet been detected in the known wild populations, and needs to be prevented.

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 higüero de sierra 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 higüero de sierra, which will supersede those included in its recovery plan (USFWS 1991). The recovery criteria presented below represent our best assessment of the conditions that would most likely result in a determination that delisting of higüero de sierra 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 factors.

Amended Delisting Recovery Criteria

The amended delisting criteria for higüero de sierra are:

1. Existing eleven (11) populations of higüero de sierra within the Maricao and Susúa Commonwealth Forests are enhanced and managed such that they show a stable or increasing population trend, evidenced by natural recruitment, and multiple age classes (addresses Factor A, C, and E).

2. Threats reduction and management activities (e.g., control of predation by rats, best management practices during forest management activities) have been implemented to a degree that the species will remain viable for the foreseeable future (addresses Factor A, C, and E).

Justification

Justification for criterion 1: Enhancing or augmenting the currently known 11 populations of higüero de sierra to the level they show a stable or increasing population trend, evidenced by natural recruitment, and multiple age classes will have immediate beneficial effects on the species viability. Augmenting the number of individuals of higüero de sierra will result on that the population as a whole will better withstand the risk of stochastic and catastrophic events, occupying a wider range within its already protected habitat. Since higüero de sierra propagates well, enhancement efforts with strategically selected seeds from all known populations will promote the highest diversity of traits possible into the future. Evidence of natural recruitment in these populations is essential for recovery of the species.

Justification for criterion 2: Presently, one of the most important threats to higüero de sierra is the predation of fruits by rats. Rats seem to be limiting the species recruitment to a level that does not allow new individuals to get established. This factor directly affects the species' persistence, hence, viability. Although the longevity of adult higüero de sierra is unknown, if the species does not recruit into the future, its probability of extinction will increase. Thus, threat reduction activities such as rat control programs throughout the Maricao and Susúa forests will be needed to reduce seed predation and promote recruitment. Other threats reduction mechanisms such as the establishment of best management practices during forest management activities would also contribute to increase the species' viability by avoiding accidental cutting of known individuals and avoiding hybridization.

Rationale for Amended Recovery Criteria

Despite occurring within protected forests, impacts to the species due to forest management practices in certain areas of the MCF and SCF continue to occur from accidental clearing and maintenance of recreational areas (USFWS 2017). However, with more than 500 individuals within two protected forests, habitat threats previously identified are considered minimal. Based on this information alone, the species current representation and redundancy seems substantial enough to implement actions towards achieving the recovery criteria, for example, augmenting the known populations in the wild and not requiring the establishment of new populations.

The absence of seedlings and juvenile life stages from all wild populations is the most important limiting factor and concern for this species. We believe rat predation on seeds of higüero de sierra may have a detrimental effect on the natural recruitment and long-term viability of the species. The Service is currently collaborating with the University of Puerto Rico to monitor rat predation and to conduct research on the factors affecting the species natural recruitment.

Unfortunately, complete eradication of exotic rats is not a feasible option to alleviate this threat on its own due to the large amount of habitat. Although controlling the rat population might be an option, it does not seem to be a sustainable long-term recovery solution. Therefore, population enhancement of higüero de sierra through propagation and supplemental planting should be priority actions to increase fruit survival, hence contribute to seedling recruitment, resulting in increased viability (resiliency, representation, redundancy) within populations and the species as a whole. The potential for some short-term rat control projects will be further assessed.

The recovery criteria would mostly be based on efforts to collect seeds from the wild, produce new individuals, and increase the number of the current populations. 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 predation and hurricanes are inevitable (Factor C and E). Due to the patchy distribution of higüero de sierra and the lack of connectivity among populations, planting of new individuals for the augmentation of existing populations will follow a watershed approach (e.g., planting material from the Río Maricao within the same watershed). The details of such reintroduction efforts will be contained in a propagation and population enhancement protocol. Since hybridization (Factor E) would also be detrimental to wild populations, specific management recommendations (e.g., preclude propagation efforts on areas where hybridization may occur) can be developed to avoid *in situ* and *ex situ* hybridization in order to safeguard the integrity of this endemic species.

ADDITIONAL SITE SPECIFIC RECOVERY ACTIONS

- Research should be conducted focused on the potential factors that affect higüero de sierra recruitment in the wild in order to assess the need to control rats in the wild or the need for other actions to enhance recruitment. This new action should be included within Task 3: *Research*.

- Assess higüero de sierra genetic structure along its known range that may inform the need for

specific propagation efforts and the need for long-term seed banking. This new action should be included within Task 3: *Research*.

- Develop a protocol for the propagation and reintroduction of higüero de sierra in collaboration with partners. The protocol should address avoiding hybridization and insect pests. This revised action supplements Task 4: *Establishment of new populations*.

LITERATURE CITED

Breckon, G.J., D.A. Kolterman, and E. Santiago. 1992. *Crescentia portoricensis* Britton (Bignoniaceae) Final Report under Cooperative Agreement No. 14-16-0004-91-958 between U.S. Department of the Interior Fish and Wildlife Service and Department of Biology, University of Puerto Rico, Mayaguez Campus. Mayaguez, PR. 25pp.

Breckon, G.J. and D.A. Kolterman. 1993. *Crescentia portoricensis* Britton (Bignoniaceae) Final Report under Cooperative Agreement No. 14-16-0004-92-970 between U.S. Department of the Interior Fish and Wildlife Service and Department of Biology, University of Puerto Rico, Mayaguez Campus. Mayaguez, PR. 21pp.

Breckon, G.J. and D.A. Kolterman. 1994. *Crescentia portoricensis* Britton (Bignoniaceae) Final Report under Cooperative Agreement No. 14-16-0004-93-973 between U.S. Department of the Interior Fish and Wildlife Service and Department of Biology, University of Puerto Rico, Mayaguez Campus. Mayaguez, PR. 9pp.

Cancel, J. 2010. Studies of the population ecology, reproductive biology and conservation status of *Crescentia portoricensis* (Britton) [Bignoniaceae]. M. S. Thesis, University of Puerto Rico, Mayaguez Campus. 141 pp.

U.S. Fish and Wildlife Service (USFWS). 1987. Endangered and Threatened Wildlife and Plants; Determination of endangered status for *Crescentia portoricensis*. *Federal Register* Vol. 52: 46085.

USFWS. 1991. *Crescentia portoricensis* Recovery Plan. Atlanta, Georgia. 20 pp.

USFWS. 2017. *Crescentia portoricensis* 5-Year Review: Summary and Evaluation. US Fish & Wildlife Service Southeast Region Caribbean Ecological Services Field Office, Boquerón, Puerto Rico. 25 pp.