

# U.S. FISH AND WILDLIFE SERVICE

## DRAFT Post-Delisting Monitoring Plan

### for *Lepanthes eltoroensis*

(no common name)

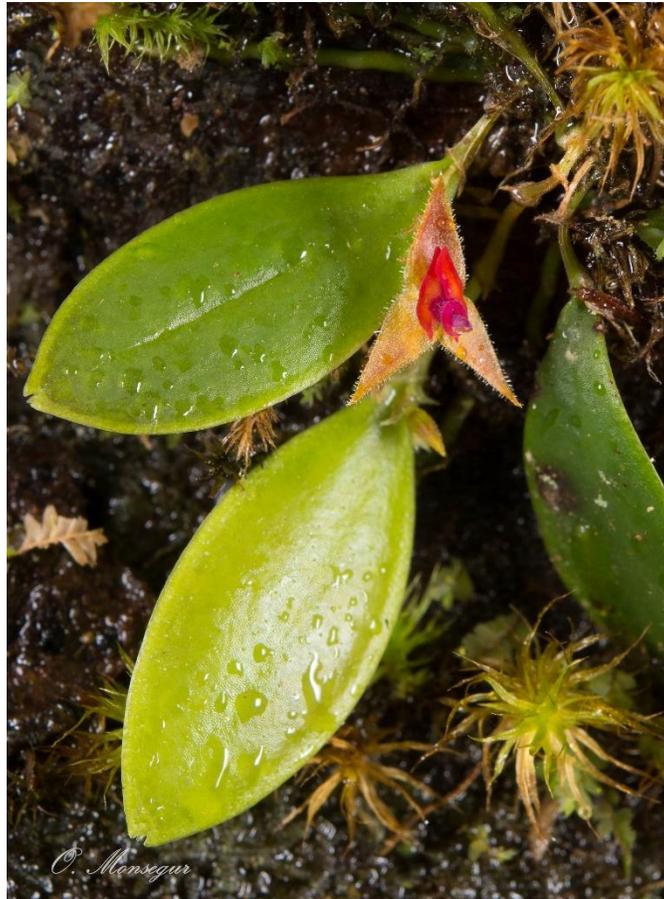


Photo: O. Monsegur, USFWS

#### Prepared by:

U.S. Fish and Wildlife Service  
Caribbean Ecological Services Field Office  
Boquerón, Puerto Rico

June 2019

# Draft Post-Delisting Monitoring Plan for *Lepanthes eltoroensis*

June 2019

## **Recommended Citation:**

U.S. Fish and Wildlife Service. 2019. Post-delisting monitoring plan for *Lepanthes eltroroensis*. Southeast Region, Atlanta, GA. 13 pp.

## **Acknowledgements**

The Post-Delisting Monitoring Plan for *Lepanthes eltoroensis* was written by biologists of the U.S. Fish and Wildlife Service, Caribbean Ecological Services Field Office, and the Southeast Regional Office. Valuable assistance was also provided by the U.S. Forest Service and the Puerto Rico Department of Natural and Environmental Resources. Dr. Raymond Tremblay (University of Puerto Rico, Humacao Campus) and Dr. Elvia Melendez-Ackerman (University of Puerto Rico, Río Piedras Campus) provided significant information on *Lepanthes eltoroensis* through their research with this species. In addition, information gathered by the U.S. Fish and Wildlife Service, the U.S. Forest Service, the Puerto Rico Department of Natural and Environmental Resources, Drs. Tremblay and Melendez-Ackerman, and graduate student Rayza Hernandez during a post-hurricane María assessment was used in this Post-Delisting Monitoring Plan.

## **Anti-deficiency Act Disclaimer**

Post-delisting monitoring is a cooperative effort between the U.S. Fish and Wildlife Service, U.S. Forest Service, Puerto Rico Department of Natural and Environmental Resources, and nongovernmental partners. Funding of post-delisting monitoring presents a challenge for all partners committed to ensuring the continued viability of the orchid *Lepanthes eltoroensis* following removal of protections afforded under the Endangered Species Act, as amended. To the extent feasible, the U.S. Fish and Wildlife Service and our partners intend to provide funding for post-delisting monitoring efforts through the annual appropriations process. Nonetheless, nothing in this Post-Delisting Monitoring Plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation.

## Table of Contents

I.	Introduction.....	6
II.	Role of PDM Cooperators.....	6
	A. Management Commitments for Post-delisting Conservation.....	7
III.	Summary of Species Status at The Time of Delisting.....	7
IV.	Post Delisting Monitoring.....	8
	A. Population Survey.....	9
	B. Habitat monitoring and threats .....	10
V.	Definition of Response Triggers and Potential Monitoring Outcomes and Conclusions.....	10
VI.	Data Compilation and Reporting Procedures.....	12
VII.	Estimating Funding Requirement and Sources.....	13
VIII.	PDM Implementation Schedule.....	13
IX.	Literature Cited.....	14

## I. Introduction

Post-delisting monitoring is a requirement of the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq.*). Section 4(g)(1) requires the Service to:

*implement a system in cooperation with the States to monitor effectively, for not less than five years, the status of all species which have recovered to the point at which the measures provided pursuant to this Act are no longer necessary.*

The purpose of this Post-Delisting Monitoring (PDM) plan (Plan) is to verify that *Lepanthes eltoensis* (no common name) remains secure from the risk of extinction after its removal from the protections of the Act. The U.S. Fish and Wildlife Service (Service) prepared this PDM Plan, in coordination with the Puerto Rico Department of Natural and Environmental Resources (PRDNER), the University of Puerto Rico (UPR), and the U.S. Forest Service (USFS). This Plan is designed to detect substantial declines in *L. eltoensis* populations with reasonable certainty. It meets the minimum requirement set forth by the Act by effectively monitoring the status of *L. eltoensis* using a minimum of five annual sampling events.

## II. Role of PDM Cooperators

The Service prepared this draft PDM plan with input from USFS and PRDNER, and requested comments on the plan during the public comment period of the proposed *L. eltoensis* delisting rule. Monitoring methodology included in this plan is designed to detect declines in the *L. eltoensis* population with reasonable certainty and precision. This PDM plan meets the minimum requirement set forth by the ESA by effectively monitoring the status of the *L. eltoensis* using population sampling events and monitoring of threats. The primary goal of this plan will be accomplished through cooperation with USFS, PRDNER, UPR, and non-governmental organizations.

### U.S. Forest Service

The USFS is responsible for managing El Yunque National Forest (EYNF) and the species therein, including the designated Wilderness Area in this forest where *L. eltoensis* is found. This agency is responsible for providing necessary research and access permits to partners working with the species, as well as to provide field and technical assistance during post-delisting monitoring activities. The USFS will participate and collaborate in the post-delisting monitoring activities and will provide comments on the results from monitoring activities, and will contribute with funding for post-delisting monitoring activities when funding is available.

### Puerto Rico Department of Natural and Environmental Resources

The PRDNER is committed to the conservation, protection, management, accessible use and enjoyment of the State's natural resources for current and future generations. Under the ESA Section 6 Cooperative Agreement between the Service and PRDNER, the PRDNER has the responsibility of implementing actions to benefit federally listed species, including collaborating on post-delisting monitoring of delisted species, and upon availability, providing funding from Section 6 appropriations for PDM purposes. In addition, the PRDNER is legally mandated to implement the provisions of the State endangered species legislation to protect federally listed

species. For this species, the PRDNER will participate and collaborate on the post-delisting monitoring activities, and will provide comments on reports resulting from monitoring activities, data analysis, as well as enforcing any applicable law or regulation under its jurisdiction to ensure the protection of *L. eltoroensis*, even after delisted.

#### U.S. Fish and Wildlife Service

The Service is required by section 4(g) of the ESA to monitor, in cooperation with states, any species delisted due to recovery. The Service's participation on this PDM plan includes regular coordination and collaboration with the USFS, PRDNER, and academia for post-delisting monitoring activities and data analysis. Also, the Service and other partners will review and provide input on draft reports resulting from post-delisting monitoring of *L. eltoroensis*, distribute final reports and other information to interested parties, approve and document any changes to the PDM plan, and will conduct any necessary future status reviews of the species. Also, upon availability the Service will provide funding for post-delisting monitoring activities, and determine when the PDM is complete.

### A. Management Commitments for Post-delisting Conservation

#### Interagency Memorandum of Understanding (Interagency MOU)

An MOU is an optional mechanism that can be implemented among the USFWS, USFS, and PRDNER to formalize their collaboration on the implementation of habitat management activities, monitoring, research, and outreach to maintain viable populations of *L. eltoroensis*.

## III. Summary of Species' Status at Time of Delisting

*Lepanthes eltoroensis* is a small, epiphytic orchid about 1.57 inches (4 centimeters) tall which is distinguished from other members of the genus by its obovate to oblanceolate leaves, ciliate sepals, and the length of the inflorescence (Vivaldi *et al.* 1981, Ackerman 1995, Luer 2014). The species is only known to occur in one general area within the sierra palm, palo colorado, and dwarf forests at EYNF. This orchid has a mean lifespan of around 5.2 years and grows low on moss covered tree trunks. It is locally common but geographically quite restricted (Luer 2014).

The population of *L. eltoroensis* was estimated to be about 1,000 individuals in six sub-populations (Ackerman 2007, pers. comm.), all within one specific trail of the two existing trails where *L. eltoroensis* is found. Based on his expert opinion, and surveys along only one of the trails where the species occurs, Tremblay (2008) suggested that the total number of *L. eltoroensis* could be in the range of 3,000 individuals. Although *L. eltoroensis* surveys are considered infrequent, sparse, and conducted with varying efforts and methods, making it difficult to compare results over time (USFWS 2019), overall data does not indicate a general pattern of population decline, rather natural fluctuations in which the species may be vulnerable to in the context of its threats (USFWS 2019).

The 2015 *L. eltoroensis* 5-year status review reported that its populations seemed to be improving. Nonetheless, hurricanes and climate change have been identified as main threats to the species (USFWS 2015, USFWS 2019). Hurricanes and climate change can result in changes in microclimatic conditions and reduce the number of suitable host trees that ultimately reduce the survival and recovery of the species. Nevertheless, although species is known to occur along

2 specific trails at EYNF, it is likely that a large portion of the species' habitat has not been surveyed (USFWS 2019). Hence, previous estimates are likely to underestimate the true abundance of *L. eltoroensis* (USFWS 2019).

For more information on *L. eltoroensis* biology and threats, refer to the recently completed SSA Report for *L. eltoroensis* (USFWS 2019). This report incorporates the best available scientific and commercial data, conducted through an in-depth review of the species' biology and threats, evaluates its biological status, and assessed the resources and conditions needed to maintain long-term viability of *L. eltoroensis*.

#### IV. Post- Delisting Monitoring

Current threats to *L. eltoroensis* are related to stochastic factors that include impacts to the species' habitat from hurricanes and climate change (USFWS 2019). Although this species has persisted despite past hurricane disturbance, since Hurricane Hugo in 1989, Puerto Rico has not witnessed a tropical system with the intensity and catastrophic effects than those caused by the recent category 4 Hurricane María, particularly on EYNF high elevation forests. Van Beusekom *et al.* (2018) found that, in the U.S. Caribbean, hurricane María caused the loss of 31% of the greenness, with higher loss percentages in EYNF. Moreover, other analysis conducted by Hu and Smith (2018) found that in Puerto Rico greater damages were seen on the cloud forest, where *L. eltoroensis* is found.

It has been found that hurricanes influence survival and growth rates on some species of *Lepanthes* and other orchids (Mujica *et al.* 2013, Crain *et al.* 2018), not only due to fallen hosts trees, whom they depend on, but also due to changes in microclimate conditions due to the opening of the canopy (e.g., higher temperatures, exposure to direct sunlight, and changes in humidity; Tremblay 2008). Also, the loss of suitable host trees decreases orchid colonization opportunities, reducing their ability to recover from intense hurricane impacts. For example, research on the impact of hurricanes on epiphytic orchids in Cuba found that some species are difficult to recover to pre-hurricane levels, and it might take them more than 8 years to recover reproductively (Mujica 2013).

The inherently low redundancy (the ability of a species to withstand catastrophic events) of *L. eltoroensis* due to its limited range makes hurricanes and tropical storms a primary risk factor. Although the overall data does not indicate a general pattern of population decline, the species appears to have natural fluctuations that make it vulnerable to its threats (USFWS 2019). The distribution of *L. eltoroensis* has not been investigated outside of traditional areas (i.e., El Toro and Trade Wind Trails); however, some researchers suggest that additional populations may occur within suitable habitat outside El Toro Trail where additional individuals have been found (Tremblay 2008, p. 90). Given that the estimated population size of the species is near 3,000 plants, it suggests the species has the ability to recover from normal stochastic disturbances (USFWS 2019). In addition, relocation of plants from fallen trees as a result of hurricanes is a viable conservation strategy for this species as it results in higher survival of those transplanted individuals (Benítez and Tremblay 2003, USFWS 2019).

Projections on climate change predict increases in temperature and reduction in precipitation,

particularly in wetter regions like EYNF, and a shift of the life zones of Puerto Rico from humid to drier (Khalyani *et al.* 2016). Such changes can reduce the range of *L. eltoroensis* and result in reduced abundance. However, downscaled climate change models analyzed out to 2100, indicate a divergence in temperature and precipitation projections increases dramatically after mid-century, depending on the scenario, making projections beyond 20 to 30 years much more speculative. Given the average lifespan of the species (approximately 5 years), a period of 20 to 30 years allows for multiple generations and detection of any population changes (USFWS 2019).

Based on the biology of *L. eltoroensis*, its limited geographic distribution, limited suitable habitat availability, and recent impacts from Hurricane María, this PDM plan will be implemented for a minimum of 5 years. We expect this time frame will allow to further determine the species' response to impacts from hurricane María as well as to monitor the response of the host trees that *L. eltoroensis* depend on. Nonetheless, based on results from this PDM, the Service, will determine whether to extend the PDM beyond the established 5 years. The focus of the PDM plan for *L. eltoroensis* will consist on implementing consistent and systematic methods using previous surveys as guidance (USFWS 2015, 2019).

## A. Population Survey

### Population status:

Twenty five percent (25%) or at least 15 trees (whichever is highest) of the occupied host trees along the currently known range of the species will be randomly selected and tagged for yearly post-delisting monitoring of *L. eltoroensis* upon availability of funds. A standardized survey data collection form will be developed to be used during this yearly monitoring events for the individuals selected and will include information as follows:

Geographic location (GPS coordinates) and DBH (Diameter and Breast Height) of the randomly selected host trees will be recorded. These host trees will be identified to at least the genus level. Counts of all life stages of *L. eltoroensis* on those host trees will be completed as follows (Figure 1): (A) seedlings, considered plants without petiole on leaf; (B) juveniles, individuals with at least one “lepanthes sheath (LS)” on the petiole and non-current or previously inflorescences; (C) non-reproductive adults, are individuals not flowering, but may carry the dried inflorescences from previous event; (D) reproductive adults, individuals with photosynthesizing inflorescences.

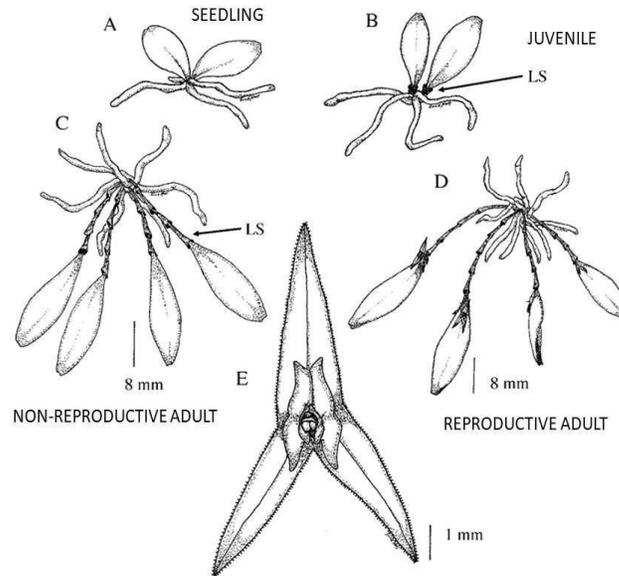


Figure 1. Diagram of *Lepanthes eltoroensis* stages (modified from Tremblay and Hutchings 2003).

#### Potential host trees monitoring:

In order to document the colonization of new unoccupied trees by *L. eltoroensis*, twenty five percent (25%) or at least 15 trees (whichever is highest) of potential host trees within the monitoring area will be tagged for yearly post-delisting monitoring. A standardized survey data collection form will be developed, to be used during this yearly monitoring events will include information on the potential host trees selected as follows:

Geographic location (GPS coordinates) of potential host trees will be recorded and trees will be identified at least to the genus level. Additionally, DBH and the absence or presence of *L. eltoroensis* on those potential host trees will be recorded.

#### **B. Habitat monitoring and threats:**

Habitat destruction, curtailment or modification is not considered a factor to be a factor currently threatening this species. Nevertheless, it has been observed that the species growth rate may be negatively affected by excess light from canopy gaps caused by felled trees possibly changing microclimate conditions (i.e., moss cover reduction). As described on the species SSA, important habitat components are related to temperature and moisture, which are related to moss presence and specific characteristics on canopy cover. Thus moss coverage percentage on host trees selected for monitoring during this PDM period will be recorded, as well as percentage of canopy cover.

### **V. Definition of Response Triggers and Potential Monitoring Outcomes and Conclusions**

In order to effectively implement this PDM plan and ensure timely response to observed trends,

it is essential to identify the circumstances that can be anticipated and could trigger concern about the species' status. Also, it is important to identify the circumstances under which there is no new concern for the species' status and whether requirements of the PDM have been fulfilled. Special consideration should be taken if climate anomalies are detected (e.g., prolonged periods of drought) and/or if hurricanes significantly affect the area where the species occurs.

Throughout the PDM period, the Service and partners will be collecting data on the species population and habitat in order to assess species persistence over that period. From this data collection and analysis, it will be possible to categorize observations into one of the following PDM outcomes:

A. Category 1:

*Lepanthes eltoroensis* metapopulations remain secure without ESA protection. This would be true if:

1. Species survival rate remains within the confidence interval of values observed for this species at the time of delisting. This would be considered a a stable population; and,
2. The percentage of canopy cover (hemispherical photography and LAI) on areas supporting current breeding populations and surrounding areas were potential host trees are found, remains stable or increasing as compared to the canopy cover when *L. eltoroensis* was delisted; and,
3. No new or increasing threat to the species is observed that is considered to be of a magnitude and imminence that may threaten the continued existence of *L. eltoroensis* within the foreseeable future.

In this case, the PDM would be concluded at the end of the timeframe identified in this Plan.

B. Category 2:

*Lepanthes eltoroensis* metapopulation or habitat may be less stable than anticipated at the time of delisting, but information does not indicate that the species meets the definition of threatened or endangered. This would be true if;

1. There is a loss of 30% or more of the occupied host trees monitored during the PDM plan and net colonization does not occur; or,
2. The percentage of canopy cover (hemispherical photography and LAI) currently supporting breeding populations (current host trees) and surrounding areas were potential host trees are found, has declined as compared to the percentage of canopy cover estimated at the time of delisting; or,
3. New or increasing threats to the species are observed that are NOT considered to be of a magnitude and imminence that may threaten the continued existence of *L.*

*eltoroensis* within the foreseeable future.

In this case, the Service and partners will complete a comprehensive assessment of the habitat and entire population (all currently known occupied host trees, and any new occupied host trees). From this data collection and analysis, it will be evaluated if the PDM period should be extended for an additional five years, and if sampling intensity should be increased to provide greater precision in detecting trends. Additionally, it will be determined if any management actions should be implemented that would be expected to reverse declines and stabilize or improve population trends for the species.

### C. Category 3

The PDM yields substantial information indicating that threats are causing a decline in the status of the *L. eltoroensis* since the time of delisting, such that listing the species as threatened or endangered may be warranted. This would be true if:

1. A 30% or more decline observed on the subset being monitored during the PDM timeframe is representative on the overall population. Therefore, significant decline on species population survival rate is detected ; or,
2. The amount of forested habitat (hemispherical photo and LAI) supporting breeding population and surrounding areas were potential host trees are be found, have decline to a degree that negative impacts to *L. eltoroensis* populations have been observed throughout the monitoring period; or,
3. There are new or increasing threats that are considered to be of a magnitude and imminence that they could threaten the continued existence of *L. eltoroensis* within the foreseeable future.

If any of these circumstances arise, the Service should initiate a formal status review to assess changes in threat to the species to determine whether an extended or intensified monitoring effort, additional research, and habitat management at known localities is needed or even if relisting is appropriated. This means that lead agencies (i.e., USFWS, USFS and PRDNER) should meet with species experts to discuss conservation and management strategies. However, if all of these conditions are true, then the Service should promptly propose that *L. eltoroensis* be relisted under the Act in accordance with procedures in section 4(b)(5).

Apart from this scenarios and responses, other responses may be proposed in the future, if warranted, based on the collection of new information arising from monitoring activities.

## VI. Data Compilation and Reporting Procedures

Annual reports summarizing the PDM activities accomplished, data collected, and results will be submitted to the USFWS Caribbean Ecological Services Field Office, after every monitoring event. These reports should be prepared in a timely manner (due no later than 90 days after

monitoring event) in accordance with this PDM plan to ensure that adequate data is being collected, to allow evaluation of the efficacy of the monitoring program, and to provide a periodic assessment of the status of the *L. eltoroensis*. Each annual report will synthesize habitat, species population and host trees collected data and will discuss observed trends and status in terms of species population growth, habitat changes (canopy cover), and threats. . The Service will annually review these data , within the context of the response triggers outlined above, and will determine if additional actions are necessary.

In collaboration with USFS and PRDNER, the USFWS will compile data reports into a final monitoring report that will be made available to the public at the end of the 5 year period. The final report will include a description of the areas surveyed, the survey protocol and, if applicable, updated population metrics for each site or location surveyed.

If the response triggers in Section V above are met or exceeded, the Service will consult with the PRDNER, USFS, and other partners to determine whether to conclude the PDM process or to pursue alternative actions as described in Section V. Our determination also will include, if necessary, an evaluation of the threats to the *L. eltoroensis* using the five factors required under the Act to list a species on the Federal List of Threatened and Endangered Wildlife and Plant

## VII. Estimated Funding Requirements and Sources

Post-delisting monitoring is a cooperative effort among the USFWS, USFS, PRDNER, and other partners and volunteers. Although the ESA authorizes expenditures of both recovery funds and Section 6 grants to the States to plan and implement PDM where appropriate, Congress has not allocated or earmarked any special funds for this purpose. To the extent feasible, the Service intends to provide funding for PDM efforts from annual Endangered Species general recovery appropriations. Nonetheless, nothing in this Plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention of the Anti-Deficiency Act (31 U.S.C. 1341) or any other law or regulation.

Funding of PDM activities will require trade-offs with other competing species needs. Most likely, much of the costs will be provided by cooperating agencies as in-kind contributions. We anticipate using grant programs to fund those activities that go beyond the resources available through in-kind services. The USFWS, USFS, PRDNER, and other cooperators will continue to work together to secure funding to implement this PDM plan.

Based on Service's costs associated with previous recovery monitoring efforts, the expenditures of this PDM plan should not exceed \$15,000 in 5 years or approximately \$3,000 per survey.

## VIII. PDM Implementation Schedule

A schedule will be developed in coordination with the PRDNER and USFS in order to ensure that it is feasible to accomplish PDM activities at all sites during a given year. The schedule will appear in the final PDM plan for *L. eltoensis* when published (see Table 1 of a draft proposed schedule).

## IX. Literature Cited

- Ackerman, J. D. 1995. An orchid flora of Puerto Rico and the Virgin Islands. New York, NY: Memories of the New York Botanical Garden.
- Ackerman, J. D. 2007. Personal Communication. Phone conversation between USFWS Boquerón Field Office, Puerto Rico and Dr. James Ackerman, University of Puerto Rico, Río Piedras Campus on September 18, 2007.
- Benítez Joubert, R. J. and R. L. Tremblay. 2003. Efecto de remoción y relocalización de *Lepanthes eltoroensis* Stimson, después de un huracán. Removal and Relocation effect to *Lepanthes eltoroensis* after a hurricane. *Lankesteriana*, 7, 67-69.
- Crain, B., R. L. Raymond, and J. Ferguson. 2018. Sheltered from the storm? Population viability analysis of a rare endemic under periodic catastrophe regimes. *Population Ecology* (1), 1-19.
- Luer, C. A. 2014. *Lepanthes*. In Ackerman, J. D. and Collaborators. Orchid flora of the Greater Antilles (pp. 232-300). Bronx, NY: Memoirs of the New York Botanical Garden.
- Melendez-Ackerman E. J., R. Hernandez, M. Perez, and R.L. Tremblay. 2018. Unpublished Annual Report submitted to the U.S. Fish and Wildlife Service. Grant agreement F16AC00894.
- Mújica, E., J. Raventós, E. González, and A. Bonet. 2013. Long-term hurricane effects on populations of two epiphytic orchid species from Guanahacabibes Peninsula, Cuba. *Lankesteriana*. 13 (1-2), 47-55.
- Hu, T. and R. Smith, 2018. The Impact of Hurricane Maria on the Vegetation of Dominica and Puerto Rico Using Multispectral Remote Sensing. *Remote Sensing*, 10(6), 827.
- Khalyani, A. H., W.A. Gould, E. Harmsen, A. Terando, M. Quinones, and J.A. Collazo. 2016. Climate change implications for tropical islands: interpolating and interpreting statistically downscaled GCM projections for management and planning. *American Meteorological Society*, 55, 265-282.
- Tremblay, R. L. 1997. Morphological variance among populations of three tropical orchids with restricted gene flow. *Plant Species Biology*, 12, 85-96.
- Tremblay, R. L. 2000. Plant longevity in four species of *Lepanthes* (Pleurothallidinae; Orchidaceae). *Lindleyana* 15, 257-266
- Tremblay, R. L. 2008. Ecological correlates and short-term effects of relocation of a rare epiphytic orchid after Hurricane Georges. *Endangered Species Research*, 5, 83-90.

- Tremblay, R. L., and M.J. Hutchings. 2002. Population dynamics in orchid conservation: a review of analytical methods, based on the rare species *Lepanthes eltoroensis*. In Dixon, K. W., Kell, S. P., Barrett, R. L. and P. Cribb (Eds.), *Orchid Conservation* (pp. 163–183). Natural History Publications, Kota Kinabalu, Malaysia.
- Tremblay, R. L., and J. Velazquez Castro. 2009. Circular distribution of an epiphytic herb on trees in a subtropical rain forest. *Tropical Ecology*, 25, 211-217.
- U.S. Fish and Wildlife Service (USFWS). 1996. *Lepanthes eltoroensis* and *Cranichis ricartii* Recovery Plan. Atlanta, Georgia. 21 pp.
- USFWS. 2015. *Lepanthes eltoroensis* Five Year Review: Summary and Evaluation. Southeast Region, 15 pp.
- USFWS. 2019. Species Status Assessment Report for *Lepanthes eltoroensis*. Atlanta, GA. 83 pp.
- Van Beusekom, A., N. Álvarez-Berrios, W. Gould, M. Quiñones, and G. González. (2018). Hurricane María in the U.S. Caribbean: Disturbance Forces, Variation of Effects, and Implications for Future Storms. *Remote Sensing*, 10 (9), 1386
- Vivaldi, J. L, R. O. Woodbury, and H. Díaz-Soltero. 1981. Status report on *Lepanthes eltoroensis* Stimson. Unpublished status report submitted to the U.S. Fish and Wildlife Service, Atlanta, Georgia. 31 pp.