

***Aristida chaseae*, *Lyonia truncata var. proctorii*, and *Vernonia proctorii* Recovery Plan**
U.S. Fish and Wildlife Service (USFWS). 1995. *Aristida chaseae*, *Lyonia truncata var. Proctorii*, and *Vernonia procotorii* Recovery Plan. Atlanta, Gerogia. 21 pp.

Original Approved: 1994

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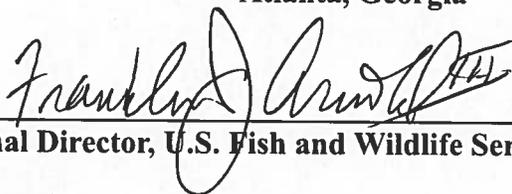
AMENDMENT 1

We have identified best available information that indicates the need to amend recovery criteria for *Vernonia proctorii*, *Lyonia truncata var. proctorii*, and *Aristida chaseae* since the multi-species recovery plan was completed in 1994. In this modification, we synthesize the information currently available on these species, assess the adequacy of the existing recovery criteria, show amended recovery criteria, and provide the rationale supporting the recovery plan modifications. The modifications is shown as an addendum that supplements the recovery plan for *A. chaseae*, *L truncata*, and *V. proctorii*, superseding only Part II A page 8. 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 recent studies with the species and the information contained in the 2010 5-year review for all three species. These were discussed with 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 *Vernonia proctorii*, *Lyonia truncata var. proctorii*, and *A. chaseae*.

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 *Aristida chaseae*, *Lyonia truncata* var. *proctorii*, and *Vernonia proctorii* Recovery Plan on pages 8-9.

Synthesis

The most recent 5-year status review of *Aristida chaseae*, *Lyonia truncata* var. *proctorii*, and *Vernonia proctorii* was finalized and signed by the Service on December 2, 2010, and it summarized the information that was gathered since these species were listed (USFWS 2010a). Information obtained after 2010 has been added and summarized in this synthesis.

As of the last signed 5-year status review, *V. proctorii* was only known from Cerro Marquita in the Laguna Cartagena National Wildlife Refuge (LCNWR) (USFWS 2010a). LCNWR falls inside the Sierra Bermeja mountain range, which extends between the municipalities of Cabo Rojo and Lajas in southwest Puerto Rico. Due to unclear survey sites location between different assessments, population size estimates of *V. proctorii* at Cerro Mariquita varied greatly, from 950 individuals in 1991 (Proctor 1991), 7 individuals in 1994 (Breckon and Kolterman 1994), and 150 individuals in 2008 (USFWS 2010a). However, Morales-Perez (2013) surveyed the LCNWR within Sierra Bermeja (including Cerro Mariquita), finding that 618 plants of *V. proctorii* spread throughout the area. Additionally, staff from the Fairchild Tropical Botanic Garden (Fairchild) reported individuals of *V. proctorii* on four different properties outside the LCNWR, also in the Sierra Bermeja area (Lange et al. 2017). The properties are: Finca Lozada, Rancho Hugo; Finca Escabi (also known as Finca María Luisa), which is a private property with a conservation easement managed by *Para La Naturaleza, Inc.* (PLN); and Finca Solins (also known as El Conuco), which is owned and managed for conservation by PLN (Lange et al. 2017). At El Conuco, *V. proctorii* shows healthy aggregations with recruitment (Pacheco, 2018, pers. comm.), while at Rancho Hugo there is a low number of individuals (Lange et al. 2017). Nevertheless, Fairchild did not collect data on the specific number of individuals for any of these properties.

Lyonia truncata var. *proctorii* was only known from a steep slope at Cerro Mariquita (USFWS 2010a), with population size estimates of roughly 126 plants (Breckon and Kolterman 1994). However, in 2013 Morales-Pérez found individuals of this species on different sites within LCNWR and at Finca Lozada (west and adjacent to LCNWR), and estimated the size of the population on approximately 280 individuals, including those at Cerro Mariquita. In addition, Service biologist C. Pacheco found more plants throughout Finca Lozada, but to this date no estimates have been reported, nor has recruitment been observed on this or any other site (Pacheco, 2018, pers. comm.). Apparently, the distribution of this species on Sierra Bermeja depends on microclimate conditions as its distribution seems to be restricted to steep slopes facing Cartagena Lagoon, where morning fog and associated moisture seems to favor its survival (Pacheco, 2018, pers. comm.). It is important to note that most *L. truncata* individuals have been seen parasitized by the invasive vine *Cassythia filiformis* (USFWS 1995; Mashinski and

Possley 2015; Pacheco, 2018, pers. comm.). However, there is no information on the effects of *C. filiformis* parasitism on *L. truncata* var. *proctorii*, nor on the *L. truncata* var. *proctorii* habitat needs.

Endemic grass, *A. chaseae*, found in western Puerto Rico is the only one, of the two species indicated above, to have a natural population outside of Sierra Bermeja. When listed *A. chaseae* was only known from Sierra Bermeja in an area that is part of the LCNWR and the Cabo Rojo National Wildlife Refuge (CRNWR) (USFWS 2010a; USFWS1995). Later in 1995, Dr. Axelrod re-discovered individuals on the type locality at Punta Melones (collection Voucher 8742 at the Herbarium of the University of Puerto Rico, Rio Piedras), but it was not until 2008 that Service biologist confirmed the information and reported individuals on a private property in Peñones de Melones, in western Cabo Rojo (USFWS 2010a). Moreover, Lange et al. (2017) and Service biologist C. Pacheco found individuals of *A. chaseae* on four private properties along Sierra Bermeja and outside LCNWR: Finca Lozada, Finca Escabi, El Conuco, and Rancho Hugo. No population size estimates were reported for any these sites. Current information suggests the healthiest *A. chaseae* population is the one found at the CRNWR (Lange et al. 2017), with approximately 474 individuals and evidence of recruitment (USFWS 2010a; USFWS 2010b). In contrast, the population from Peñones de Melones, once considered the healthiest, now seems to be the most in peril of extirpation due to habitat modification activities related to lots subdivision and urban development (USFWS 2010a; USFWS 2010b; Lange et al. 2017; Pacheco, 2018, pers. comm.).

Although the current distribution and number of individuals for these species have increased since their listing, the four species remain threatened by destruction, modification or curtailment of their habitat (Factor A), and by other natural and manmade factors (Factor E) (USFWS 2010a). Activities related to housing development, agriculture, livestock grazing, and human-induced fires are some of the threats these species face, particularly on private properties within the Sierra Bermeja area (Lange et al. 2017, USFWS 2010a). Within areas currently protected by the Service (e.g., LCNWR and CRNWR) and areas managed by PLN, impacts by road and trail improvements, accidental cutting, human-induced fires and livestock grazing have been documented. Many of these practices promote invasive plants colonization, which not only compete with native species for resources, but also homogenize the landscape (Lange et al. 2017). As a result, these exotic species dominate the landscapes and serve as fuel that facilitates the spread of wildfires through the area (Lange et al. 2017). Also, the species restricted distribution to steep slopes and access ways increases population threats associated with stochastic events (e.g., heavy rain), which could cause landslide and erosion (Lange et al. 2017). In addition, due to known low number of individuals and limited geographic distribution of all four species, factors related to species genetics can threaten their survival (e.g., genetic drift and inbreed depression) (Lange et al. 2017).

Lange et al. (2017) concluded that all species can be propagated from seeds, that seeds withstand long periods of time being frozen, and that all species show relative low seed germination and survival. On the other hand, they did observe that seed desiccation improved germination rate for all species except *V. proctorii*. (Lange et al. 2017). They also reported high numbers of seed depredation on *V. proctorii*, and empty seeds for *A. chaseae* (Lange et al. 2017), which could have influenced the low percentages of seed viability for this two species during their experiment.

Therefore, although Lange et al. (2017) observed low germination and survival rates in all species, they believe that careful and planned collection, seed care, and appropriate collection timing could improve seed germination rate and, consequently, propagation efforts (Lange et al. 2017).

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 *V. proctorii*, *L. truncata var proctorii*, and *A. chaseae* 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. 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 *V. proctorii*, *L. truncata var proctorii*, and *A. chaseae*, which will supersede those included in their Recovery Plans. The recovery criteria presented below represent our best assessment of the conditions that would most likely result in a determination that delisting of *V. proctorii*, *L. truncata var proctorii*, and *A. chaseae*, 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 listing factors.

Amended Delisting Recovery Criteria:

The amended delisting criteria for *Vernonia proctorii*, *Lyonia truncata var proctorii*, and *Aristida chaseae* are as follows:

1. Existing populations of *V. proctorii* (3), *L. truncata* (1), and *A. chaseae* (5) show a stable or increasing trend, evidenced by natural recruitment and multiple age classes, and populations extending onto private lands are protected via a conservation mechanism (Addresses Factor A and E).
2. At least one (1) new population of *V. proctorii*, two (2) new populations of *L. Truncata var proctorii*, and two (2) new populations of *A. chaseae*, are established or discovered within the historical range of the species. New populations show a stable or increasing trend, evidenced by natural recruitment and multiple age classes, and populations extending onto private lands are protected via a conservation mechanism (Addresses Factor A and E).
3. Threat reduction and management activities have been implemented to a degree that the species is viable for the foreseeable future (Addresses Factor A and E).

Justification for Criteria

Justification for criterion 1: All of these species occur in a limited geographic area in southwestern Puerto Rico, mostly on privately owned lands, making habitat loss the most important threat for all of them. By engaging with private landowners on conservation mechanisms will ensure the conservation of high quality habitat for the species, and the threat of habitat loss would be reduced to a point where it is no longer considered a threat. The protection of these natural populations is expected to result in an increase in the populations of *V. proctorii*, *L. truncata*, and *A. chaseae*, and therefore this would result in an increase to their resiliency and representation, enabling them to withstand and rebound from stochastic events such as landslides and erosion resulting from heavy rains. Habitat and species population enhancement will be accomplished through agreements with landowners and coupled with a monitoring plan to document recovery of the species. Progress towards meeting this criterion will be measured through a stable or increasing population trend, evidenced by natural recruitment and multiple age classes.

Justification for criterion 2: The second recovery criterion focuses on increasing the number of populations for each species aiming to improve their resiliency and redundancy. In order to expand species distribution, these new populations will be established on habitat similar to where natural population occur and within its geographic range and, if necessary, will represent populations that are currently on the verge to disappear, either due to development or small population size. Increasing the number of populations and broadening the species' distribution will enhance their ability to withstand catastrophic and stochastic events. This strategy will be met by implementing the germination and propagation protocols developed by the Fairchild Tropical Botanic Garden.

Justification for criterion 3: Threat reduction and management activities are key to the successful recovery of each of these species. For example, these species are not adapted to human-induced fires, which are considered a threat due to their location on dry forest habitat. Moreover, wildfires increase invasive species colonization and, therefore, competition for already limited resources. Implementing management actions to reduce fire threats to the maximum extent possible will not only reduce direct impact to the species, but also will reduce invasive species colonization and associated competition. Hence, the species can spread to other areas as population growth and recruitment increases. Additionally, fencing is another main action that needs to be implemented in order to reduce livestock trampling, another important threat affecting these species. Proper fencing installation will reduce direct impact to individuals and their habitat. The implementation of conservation agreements with landowners will help put these actions into effect on private lands where the species occur.

Rationale for Recovery Criteria

The delisting recovery criteria reflect the best available and most up-to-date information on the biology, distribution, and habitat of *V. proctorii*, *L. truncata var proctorii*, and *A. chaseae*.

Our main recovery approach is to protect all currently known natural populations occurring on privately owned lands by establishing long-term conservation mechanisms (e.g., land acquisition, conservation easements and conservation agreements). Conserving and protecting these individuals and their habitats, and maintaining species genetic integrity will result in increasing their viability (resiliency, redundancy and representation). Two private properties within Sierra Bermeja where conservation mechanisms could be implemented are Finca Lozada and Rancho Hugo, which currently hold individuals of most of these species in Sierra Bermeja. Educating private landowners about the species' conservation needs is also necessary in order to advance recovery.

The habitat of these species within the range of Sierra Bermeja remains vulnerable to agricultural practices, and the associated indirect threats (e.g., habitat intrusion by exotic plants and human induced fires). Thus, to ensure we maintain or increase representation of these populations occurring within private lands and whose habitats are vulnerable to development and/or agricultural or grazing activities, we propose the establishment of new populations for each of these species on protected lands within Sierra Bermeja or in other suitable habitats in Southern Puerto Rico. By broadening the species distribution within its historical range, increasing number of populations, and assuring new viable populations, we will increase the redundancy, representation, and resiliency of all four species.

For *V. proctorii*, one (1) new population could be established within the CRNWR or at other protected suitable habitat in Southern Puerto Rico, which would expand its distribution within the proximity of its geographic range in Sierra Bermeja. The reproductive biology of *V. proctorii* allows for a wider distribution within Sierra Bermeja, but having another population outside this area provides redundancy within an area currently managed for conservation and where threats are reduced (e.g., human induced fires, development and grazing).

For *A. chaseae* we aim to secure the species genetic pool from those individuals that are threatened by habitat destruction and modification (occurring on private lands). Therefore, genetic representation of *A. chaseae*, rescued from areas vulnerable to urban development (e.g., Peñones de Melones), will be used to establish at least two (2) new populations within areas managed for conservation, inside and in the proximity of its geographic range and which exhibits similar habitat characteristics to its current location (e.g., Plan Bonito area managed by PLN in the municipality of Cabo Rojo).

For *L. truncata var roctorii*, due to its small population size and restricted distribution within Sierra Bermeja, and lack of evidence of natural recruitment, we propose to establish two (2) new populations outside Sierra Bermeja. The lack of evidence of natural recruitment suggests changes in microhabitat conditions, due to the widespread deforestation that affected the island of Puerto Rico up to the 1930s and that also affected Lajas-Guánica valleys and the area of Cartagena Lagoon. Thus, we deem essential for the recovery of the species, the establishment of populations within areas managed for conservation with similar environmental conditions (e.g., serpentine soil and associated native vegetation), that provide the microhabitat conditions necessary for seedling recruitment. Recommended sites for new populations include the Susúa Commonwealth Forest and the land managed by PLN in Plan Bonito. These two areas have serpentine soils (Cedeño-Maldonado and Breckon 1996) and, Susúa in particular, exhibit similar plant species as in Sierra Bermeja (Aukema et al. 2006). In addition, Susúa and Plan Bonito are within the subtropical moist forest life zone (Ewel and Whitmore 1973) and, therefore, annual rainfall on both areas is higher than in Sierra Bermeja, which is within the subtropical dry forest life zone (Ewel and Whitmore 1973). This increase in precipitation could help enhance *L. truncata*'s seed germination rate and therefore promote recruitment (Pacheco, 2018, pers. comm.).

Another recovery criterion is the control or elimination of current threats on protected land through site-specific conservation mechanisms. Control or eradication of invasive plant species are deemed essential to reduce resource competition and to minimize fuels that feed wildfires. Moreover, the implementation of wildfire control protocols is needed to reduce the risks of human-induced fires on these lands. This management action will reduce direct impacts to the species and will further minimize the colonization of exotic plant species. The installation and monitoring of fences will help reduce or eliminate impacts related to livestock (e.g., grazing and trampling) within protected lands. Also, educating the maintenance workers on the species characteristics and implementing Best Management Practices on trail and road maintenance within protected lands, will reduce the possibility of accidental cutting and habitat alteration.

ADDITIONAL SITE SPECIFIC RECOVERY ACTIONS

1. Genetic material from all populations of all species is preserved through long-term seed storage and/or propagation efforts. The top priority for this effort is *L. truncata var roctorii*, due to evidence of a single population inside Sierra Bermeja, restricted range, and low number of individuals, coupled with lack of evidence of natural recruitment. Other priorities are collecting material from *A. chaseae* population at Peñones de Melones. This should be added as a new action in the recovery plan.

2. The ecology and biology of *L. truncata var proctorii* should be determined. Specifically, habitat requirements, and factors limiting seed dispersion and seedling recruitment should be studied. Establishing new populations within the historical range of the species needs a monitoring and propagation protocol, and pilot studies to ensure determination of suitable habitats for that purpose. Address recovery action 3 (31).
3. Careful planning for conservation and management needs to be developed and should include partners' education. To be added to recovery action 12 (123).
4. Add Susúa Commonwealth Forest and Plan Bonito as potential reintroduction sites to recovery action 4(411).
5. Start monitoring protocols and research to assess *Cassythia filiformis* parasitism on *L. truncata* and impacts to this species survival and dispersion. Needs to be added as a new research Task recovery action.
6. Implement fire management and control protocols in private lands. This should be added as a new action in the recovery plan.

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