

Puerto Rican Boa Recovery Plan (*Chilabothrus inornatus*, formerly *Epicrates inornatus*)
U.S. Fish and Wildlife Service. 1986. Puerto Rican Boa Recovery Plan. Atlanta, Georgia. 21 pp.

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AMENDMENT 1

We have identified the best available information that indicates the need to amend recovery criteria for the endangered *Chilabothrus inornatus* (Puerto Rican boa; formerly *Epicrates inornatus*) 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 1986), superseding only Part II, pages 9-11 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: Franklin J. Anderson
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METHODOLOGY USED TO COMPLETE THE RECOVERY PLAN AMENDMENT

The amendments to the recovery criteria are based on the latest 5-year status review and the most recent studies for this species. This information was discussed among the 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 Puerto Rican boa.

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 delisting factors.

Recovery Criteria

The [Puerto Rican boa Recovery Plan](#) did not provide criteria for downlisting or delisting. The plan's objective was to gather the necessary information to determine such criteria. You may refer to the recovery section of the plan on page 9.

Synthesis

The Puerto Rican boa (PR boa) was apparently abundant in Puerto Rico during the early years of colonization (Reagan 1984). PR boa populations presumably declined in both size and distribution during a period of intense deforestation on Puerto Rico in the late 1800s and beginning of 1900s (Reagan 1984). This decline and apparent rarity prompted the Federal government to include the PR boa in the Endangered Species list in 1970 (USFWS 1986). Since the time of listing, progress has been made to clarify the status of this species and various investigations have been conducted on foraging behavior, home range, movement patterns, habitat use and genetics, contributing to the knowledge on the species' ecology (USFWS 2011).

The species has been documented to be widely distributed across the island of Puerto Rico; however, its abundance is not uniform across the island, especially where threats are more prevalent. It is more often found in the northern limestone karst region, known from both protected areas and private lands (Moreno 1991, Tolson and Henderson 1993, Bird-Picó 1994, Wunderle et al. 2004). Although habitat destruction and modification are still considered a threat (Factor A), the species appears to be widely distributed and utilizes a wide variety of habitats, ranging from the mature forest to plantations and disturbed areas (Wiley 2003, USFWS 2011). The PR boa was recently described as: "widely considered to have recovered from the near-complete deforestation of the island of Puerto Rico in the early 20th century" (Reynolds and Henderson 2018).

Apparently, much of the lack of information and the PR boa's apparent rarity has been attributed to observer's difficulties in visually detecting the species due to its cryptic coloration and habits. Some authors have established that based on the amount of individuals they found in their study areas, and given the species detection difficulty, the PR boa is apparently more abundant than generally perceived (USFWS 2011). In fact, this species has been reported in about 97% of the municipalities of Puerto Rico (76 of the 78 municipalities: USFWS 2011; Puente, 2018, pers. comm.). Reynolds et al. (2014) stated that although the species is not presently known from either Vieques or Culebra Islands, it presumably used to occur on Vieques Island, and the only individual found on Culebra Island was apparently introduced by humans. In addition, the Puerto Rico GAP Analysis Project predicted nearly half (46.3% or 414,379 ha [1,023,952.8 acres]) of the surface area of Puerto Rico as potential habitat for the species, 9% of which are protected areas (Gould et al. 2008). However, there is still not enough information regarding the island-wide population status of this species.

Several studies have been conducted to gather information on the genetics of this species (i.e., Puente 2012, Puente et al. 2013, Reynolds et al. 2014, and Puente et al. 2016). These studies have confirmed that PR boas have undergone a population expansion within the past 30,000 years, but have recently shown a population decline and loss of genetic diversity. In addition, the studies

have shown that PR boas move widely across Puerto Rico, both naturally and transported by humans (Puente et al. 2013, Reynolds et al. 2014, and Puente et al. 2016). PR boa populations inhabiting caves are genetically diverse and represent excellent targets for conservation, particularly the northern karst region of the Island represents essential habitat for the PR boa and harbors the greatest degree of genetic diversity for the species (Reynolds et al. 2014, Puente et al. 2016).

The species is currently threatened by habitat destruction and modification (Factor A), competition with introduced species, and predation by invasive vertebrates (Factor C), and other natural or manmade factors such as malicious killings, road constructions, and road mortalities (Factor E) (USFWS 2011, Puente 2012, Puente et al. 2013). Although Puente (2012) suggested that climate change stressors (Factor E) might have a negative indirect effect in PR boas' reproduction due to changes in food availability, this is not currently considered as a threat to this species. Efforts are being carried out to preserve and restore areas in which the PR boa is commonly found, however, habitat modification and destruction in privately-owned areas still occurs. Based on the presence of local laws and regulations protecting this species and its habitat, we believe that inadequacy of existing regulatory mechanisms is not a threat to the species (Factor D). Moreover, although Factor B was considered a threat by the Service in the past (USFWS 2011), there is no evidence that PR boas have been over utilized for scientific and educational purposes, thus this factor is no longer considered as a threat. However, the extent or effect of illegal hunting or capture for the pet trade is unknown. Although malicious killings, road mortalities, competition with introduced species and climate change stressors are still considered threats to the PR boa, the extent and degree of these threats are considered low because the PR boa in general occupies a wide variety of habitats and has a wide distribution across its range.

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 PR boa 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 PR boa, which will supersede those included in its recovery plan (USFWS 1986). The recovery criteria presented below represent our best assessment of the conditions that would most likely result in a determination that delisting of PR boa 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 the PR boa are as follows:

1. At least three (3) PR boa populations (moist limestone, wet limestone, and montane forest regions) occupy at least 50% of its suitable habitat, and populations are distributed island wide (addresses Factors A, C and E).
2. Populations show a stable or increasing population trend, evidenced by natural recruitment and multiple age classes (addresses Factors A, C and E).
3. Threat reduction and management activities have been implemented to a degree that the species will remain viable for the foreseeable future (addresses Factor E).

Justification

Justification for criterion 1 and 2: The amended delisting criteria have the intention to maintain the species occurrence and resilient populations within habitats considered as suitable throughout the majority of its current range ($\geq 50\%$). The Puerto Rico GAP Analysis (Gould et al. 2008) predicted almost 47% of the Island as suitable habitat for the species and considered the following habitat types as prime habitat within its range: moist and wet forest, woodland, and shrubland, mangrove, *Pterocarpus*, and mature dry forest and dry forest near water bodies, at or below 1,000 m of elevation (3,280.84 ft.). The species has been currently observed in 76 of the 78 municipalities of Puerto Rico (97% of the Island), except for the offshore Vieques and Culebra Islands. Therefore, in the absence of reliable island-wide population status information, we consider the species well represented within the identified prime habitats across its range is essential to ensure the persistence of this species because it will have the ability to withstand

stochastic or catastrophic disturbances.

Justification for criterion 3: Although threats such as road mortalities, competition with introduced species and climate change stressors are considered low in extent and degree to the PR boa, the implementation of threat reduction and management activities still necessary to increase the viability of this species. It has been suggested by Puente (2012) that most translocation programs have a high probability of failure with respect to establishing self-sustaining populations and have the potential of causing deleterious effects in existing populations. A research conducted with the PR boa to evaluate the effect of translocation on home range size, movement patterns, and survivorship suggested that translocated PR boas increased their home range and activity patterns. This might also increase mortality (i.e., road mortality, predation) and competition with other species due to random movements searching for optimal habitats. Although this study did not suggest any difference in survival among translocated and resident PR boas, the boas were always translocated to what was considered optimal habitat. Therefore, the implementation of specific translocation guidance such as avoiding translocation to areas with suboptimal or fragmented habitats is essential to reduce the degree of these threats (i.e., road mortality, predation and competition with exotic species). It is also necessary to implement these management activities within protected lands and adjacent properties harboring cave-associated PR boa's populations, and implement long-term conservation mechanisms within these private lands. The invasive species control initiative will reduce potential competition with exotic species such as the *Boa constrictor* and predation pressure from mammals like cats. The implementation of conservation mechanisms in private lands may also help to promote its dispersion and recolonization of un-occupied habitats.

Rationale for Amended Recovery Criteria

The recovery approach is to maintain the species occurrence throughout suitable habitat (i.e., moist and wet limestone and montane forest regions) of at least 50% of its current range, sustain species viability (resiliency, representation, redundancy) in that prime habitat, and to reduce or eliminate the current threats the species is facing to ensure its persistence without human intervention. Furthermore, in order to maintain the genetic integrity of the PR boa, the recovery criteria have been designed to protect and manage the known populations and to provide adequate genetic representation throughout its range to ensure long-term viability of the species. This is particularly important given the absence of a reliable island-wide population estimate for the species. Ensuring PR boa are well represented across its range is essential to the persistence of resilient populations with the breadth of genetic makeup to adapt to changing environmental conditions.

Key to the species long-term viability is protecting populations in prime forest habitat within the moist and wet limestone, and montane forest regions of the Island, especially the northern and southern limestone regions and their adjacent montane forests. We are considering as prime habitat, the habitat classifications identified by Gould et al. (2008) as suitable predicted habitat for the species (i.e., Moist and wet forest, woodland, and shrubland, mangrove, *Pterocarpus*, and mature dry forest and dry forest near water bodies, at or below 1,000 m of elevation (3,280.84 ft.). However, although widely distributed, the species is more often found in the northern limestone karst region and adjacent lands. This region harbors the greatest degree of genetic diversity, and

represents essential habitat for the species (Puente 2012, Puente et al. 2013, Reynolds et al. 2014, and Puente et al. 2016). There are currently several protected areas within the karst region such as the Commonwealth Forests (e.g., Guajataca, Río Abajo, Tortuguero, Vega, San Patricio), Private Nature Reserves (e.g., Mata de Plátano, El Tallonal, Las Coccolobas) and Federal Lands (e.g., Fort Buchanan). In addition, the Puerto Rico Conservation Trust has acquired lands for conservation (~ 5,225 acres) within the northern (i.e., Río Encantado, Hacienda La Esperanza) and the southern (i.e., El Convento) karst regions of Puerto Rico. Moreover, since 2001, the Service's Habitat Restoration Programs (i.e., Partners for Wildlife and Coastal Programs) have been actively restoring private lands previously impacted mostly by agricultural activities in an effort to provide suitable habitat for this species within these regions.

The northern and the southern limestone regions of Puerto Rico also harbor the majority of the cave formations of the Island, formations that have also been identified as essential habitat for this species. Recent studies have shown that cave populations of Puerto Rican boas are genetically diverse, and represent excellent targets for conservation and for maintaining the species' genetic diversity. Therefore, the conservation, protection and the reduction of the threats in lands where these formations are located and their adjacent prime habitat is also essential to maintain resilient populations of this species, promote its dispersion and recolonization of un-occupied habitats, and to improve its potential to adapt to natural and anthropogenic changes.

Lastly, we propose to implement threat reduction and management activities to a degree that the species is viable. We are proposing to develop a translocation protocol, implement an invasive species control initiative within protected lands and adjacent properties harboring cave-associated PR boas populations, and implement long-term conservation mechanisms within private lands. The invasive species control initiative will reduce potential competition with exotic species such as the *Boa constrictor* and predation pressure from mammals like cats. Also, the implementation of conservation mechanisms in private lands will help maintain viable PR boa populations and promote its dispersion and recolonization of un-occupied habitats.

ADDITIONAL SITE SPECIFIC RECOVERY ACTIONS

1. Develop and implement monitoring protocols to ensure that the species' populations remain stable or with an increasing trend, and to have evidence of natural recruitment and multiple age classes. This action relates to recovery task 1: Determine status of present population.
2. Develop prime or suitable habitat maps to include specific translocations guidance as part of the conservation measures for the Puerto Rican boa. This action relates to recovery task 2: Conduct basic ecological studies.
3. Conduct a landscape analysis focusing on caves with resident populations and the connections of these caves with forested habitat. This action relates to recovery task 2: Conduct basic ecological studies.
4. Ensure that properties where the PR boa's cave-associated populations have been

identified and their adjacent prime habitats are protected by long-term conservation mechanisms. This action relates to recovery task 5: Protect remaining populations.

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