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DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R4–ES–2019–0069; FXES11130900000-189-FF0932000]

RIN 1018–BE14

Endangered and Threatened Wildlife and Plants; Reclassifying the Virgin Islands Tree Boa from Endangered to Threatened with a Section 4(d) Rule

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), propose to reclassify the Virgin Islands tree boa (Virgin Islands boa; *Chilabothrus* (= *Epicrates*) *granti*) from an endangered species to a threatened species with a rule issued under section 4(d) of the Endangered Species Act of 1973 (Act), as amended. If we finalize this rule as proposed, it would reclassify the Virgin Islands boa from endangered to threatened on the List of Endangered and Threatened Wildlife (List). This proposal is based on a thorough review of the best available scientific data, which indicate that the species' status has improved such that it is not currently in danger of extinction throughout all or a significant portion of its range. We are also proposing a rule under the authority of section 4(d) of the Act that provides measures that are necessary and advisable to provide for the conservation of the Virgin Islands boa. Further, we are correcting the List to change the scientific name of the Virgin Islands boa in the List from *Epicrates monensis granti* to *Chilabothrus granti* to reflect the currently accepted taxonomy. Virgin Islands boa is a distinct species, not a subspecies, and *Epicrates* is no longer the scientifically accepted genus for this

species.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]. Comments submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p.m. Eastern Time on the closing date. We must receive requests for a public hearing, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*].

ADDRESSES: *Written comments:* You may submit comments on this proposed rule by one of the following methods:

(1) *Electronically*: Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Search box, enter FWS–R4–ES–2019–0069, which is the docket number for this rulemaking. Then, click on the Search button. On the resulting page, in the Search panel on the left side of the screen, under the Document Type heading, click on the Proposed Rule box to locate this document. You may submit a comment by clicking on "Comment Now!"

(2) *By hard copy*: Submit by U.S. mail to: Public Comments Processing, Attn: FWS–R4–ES–2019–0069; U.S. Fish and Wildlife Service, MS: JAO/1N, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see **Information Requested**, below, for more information).

Document availability: The proposed rule and supporting documents (including the species status assessment (SSA) report and references cited) are available at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0069.

FOR FURTHER INFORMATION CONTACT: Edwin E. Muñiz, Field Supervisor, U.S. Fish and Wildlife Service, Caribbean Ecological Services Field Office, Road 301 Km 5.1, Corozo Ward, Boquerón, Puerto Rico 00622; or P.O. Box 491, Boquerón, Puerto Rico 00622; telephone 787–851–7297. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800–877–8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. Under the Act, a species may warrant reclassification from endangered to threatened if it no longer meets the definition of endangered (in danger of extinction). The Virgin Islands boa is listed as endangered, and we are proposing to reclassify it as threatened because we have determined it is no longer in danger of extinction. Reclassifications can only be made by issuing a rule. Furthermore, extending the "take" prohibitions in section 9 of the Act to threatened species, such as those we are proposing for this species under a section 4(d) rule, can only be made by issuing a rule. Finally, the change of the scientific name of the Virgin Islands boa in the List from *Epicrates monensis granti* to *Chilabothrus granti*, can only be made effective by issuing a rule.

What this rule does. We propose to reclassify the Virgin Islands tree boa from an endangered species to a threatened species with a rule issued under section 4(d) of the Act to provide measures that are necessary and advisable to provide for the conservation of this species. We also change the scientific name in the List to reflect the currently accepted taxonomy.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species because of any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We have determined that the Virgin Islands boa is not currently in danger of extinction and, therefore, does not meet the definition of an endangered species, but is still affected by the following current and ongoing stressors to the extent that the species meets the definition of a threatened species under the Act:

- Habitat loss and fragmentation from human development (Factor A).
- Direct and indirect predation/competition by exotic mammals such as rats, cats, and possibly, to a lesser extent, mongoose (Factor C).
- Stochastic events such as hurricanes and sea level rise, exacerbated by the cumulative effects of climate change (Factor E).
- Intentional harm due to fear of snakes (Factor E).

We are also proposing a section 4(d) rule. When we list a species as threatened, section 4(d) of the Act allows us to issue regulations that are necessary and advisable to provide for the conservation of the species. Accordingly, we are proposing a 4(d) rule for the Virgin Islands boa that would, among other things, prohibit take associated with capturing, handling, trapping, collecting, or other activities, including intentional or incidental introduction of exotic species, such as cats or rats that compete with, prey upon, or destroy the habitat of the Virgin Islands boa. The proposed 4(d) rule would also except from these prohibitions take associated with certain conservation efforts.

Peer review. In accordance with our joint policy on peer review published in the Federal Register on July 1, 1994 (59 FR 34270), and our August 22, 2016, memorandum updating and clarifying the role of peer review of listing actions under the Act, we sought the expert opinions of six appropriate specialists regarding the species status assessment report (SSA). We received responses from five specialists on the SSA report, which informed this proposed rule. The purpose of peer review is to ensure that our listing determinations, critical habitat designations, and 4(d) rules are based on scientifically sound data, assumptions, and analyses. The peer reviewers have expertise in the biology, habitat, and threats to the species.

Because we will consider all comments and information we receive during the comment period, our final determination may differ from this proposal. Based on the new information we receive (and any comments on that new information), we may conclude that the species is endangered instead of threatened, or we may conclude that the species does not warrant listing as either an endangered species or a threatened species. Such final decisions would be a logical outgrowth of this proposal, as long as we: (1) base the decisions on the best scientific and commercial data available, after considering all of the relevant factors; (2) do not rely on factors Congress has not intended us to consider; and (3) articulate a rational connection between the facts found and the conclusions made, including why we changed our conclusion.

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments and information from other concerned governmental agencies, Native American tribes, the scientific community, industry, or any other interested party concerning this proposed rule.

We particularly seek comments on:

(1) Information concerning the biology and ecology of the Virgin Islands boa.

(2) Relevant data concerning any stressors (or lack thereof) to the Virgin Islands boa, particularly any data on the possible effects of climate change as it relates to habitat, and the extent of Territorial protection and management that would be provided to this boa as a threatened species.

(3) Reasons why we should or should not reclassify the Virgin Islands boa from an endangered species to a threatened species under the Act.

(4) Information concerning activities that should be considered under a rule issued in accordance with section 4(d) of the Act (16 U.S.C. 1531 *et seq*.) as a prohibition or exception within U.S. territory that would contribute to the conservation of the species. In particular, we are seeking input from experts regarding species restoration and captive propagation practices and related activities, or whether take associated with any other activities should be considered excepted from the prohibitions in the 4(d) rule.

(5) Current or planned activities within the geographic range of the Virgin Islands boa that may either negatively impact or benefit the species.

Please include sufficient information with your submission (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include.

Please note that submissions merely stating support for, or opposition to, the action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to

whether any species is an endangered or a threatened species must be made "solely on the basis of the best scientific and commercial data available."

You may submit your comments and materials concerning this proposed rule by one of the methods listed in **ADDRESSES**. We request that you send comments only by the methods described in **ADDRESSES**.

If you submit information via *http://www.regulations.gov*, your entire submission—including any personal identifying information—will be posted on the website. If your submission is made via a hardcopy that includes personal identifying information, you may request at the top of your document that we withhold this information from public review. However, we cannot guarantee that we will be able to do so. We will post all hardcopy submissions on *http://www.regulations.gov*.

Comments and materials we receive, as well as supporting documentation we used in preparing this proposed rule, will be available for public inspection on *http://www.regulations.gov*, or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Caribbean Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Public Hearing

Section 4(b)(5) of the Act provides for a public hearing on this proposal, if requested. Requests must be received by the date specified in **DATES**. Such requests must be sent to the address shown in **FOR FURTHER INFORMATION CONTACT**. We will schedule a public hearing on this proposal, if requested, and announce the date, time, and place of the hearing, as well as how to obtain reasonable accommodations, in the *Federal Register* at least 15 days before the hearing. For the immediate future, we will provide these public hearings using

webinars that will be announced on the Service's website, in addition to the *Federal Register*. The use of these virtual public hearings is consistent with our regulation at 50 CFR 424.16(c)(3).

Previous Federal Actions

The Virgin Islands boa was originally listed as an endangered subspecies (*Epicrates inornatus granti*) of the Puerto Rican boa (*Epicrates inornatus* at time of listing, now *Chilabothrus inornatus*) on October 13, 1970 (35 FR 16047), under the Endangered Species Conservation Act of 1969, and remained listed with the passage of the Act in 1973. In 1979, we published a technical correction (44 FR 70677, December 7, 1979) revising the scientific name of the Virgin Islands boa from *Epicrates inornatus granti* to *Epicrates monensis granti.* A recovery plan for this species was completed in 1986 (Service 1986, entire) and updated in September 2019. The most recent 5-year review, completed in 2009, recommended reclassifying the Virgin Islands boa to a threatened species due to the population stabilizing (Service 2009, entire). Based on this recommendation, we initiated a species status assessment (SSA) and completed an SSA report in 2018 (Service 2018, entire).

Supporting Documents

A species status assessment (SSA) team prepared an SSA report for the Virgin Islands boa. The SSA team was composed of Service biologists, in consultation with other species experts. The SSA report represents a compilation of the best scientific and commercial data available concerning the status of the species, including the impacts of past, present, and future factors (both negative and beneficial) affecting the species. The Service sent the SSA report to six independent peer reviewers and received five responses. The Service also sent the SSA report to state partners, including scientists with expertise in Virgin Islands boa habitat, for review. We received review from two experts from the Puerto Rico Department of Natural and

Environmental Resources.

I. Proposed Reclassification Determination

Background

A thorough review of the taxonomy, life history, ecology, and overall viability of the Virgin Islands boa is presented in the SSA report (Service 2018, entire; available at *https://www.fws.gov/southeast/* and at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0069). A summary of this information follows:

The Virgin Islands boa is endemic to Puerto Rico and the Virgin Islands (U.S. and British). Originally, the Virgin Islands boa was considered a subspecies of the Puerto Rican boa (*Epicrates inornatus*; Stull 1933, pp. 1–2), but was later found to be more closely related to the Mona Island boa, and the nomenclature for the two snakes was altered to reflect two subspecies, *Epicrates monensis monensis* (Mona Island boa) and *E. m. granti* (Virgin Islands boa) (Sheplan and Schwartz 1974, pp. 94–104). More recently, molecular phylogeny work indicates that the genus *Epicrates* is paraphyletic (a group composed of a collection of organisms, including the most recent common ancestor of all those organisms), and the West Indian clade (as opposed to the mainland clade) was designated as *Chilabothrus* (Reynolds et al. 2013, entire). As a result, the Virgin Islands boa is now considered its own species. We accept the change of the Virgin Islands boa's classification from the subspecies *Epicrates monensis granti* to the species *Chilabothrus granti* and are amending the scientific name to match the currently accepted nomenclature.

The Virgin Islands boa is a medium-length, slender, nonvenomous snake. The largest snout-vent lengths (SVL) recorded for the species were 1,066 millimeters (mm; 42 inches (in)) for females and 1,112 mm (44 in) for males (total body lengths 1,203 mm (47 in) and 1,349 mm

(53 in), respectively; Tolson 2005, entire), although most specimens range between 600 and 800 mm (24–31 in) SVL, with an average mass of 165 grams (6 ounces) (USVI Division of Wildlife, unpub. data). Adults are gray-brown with dark-brown blotches that are partially edged with black, and feature a blue-purple iridescence on their dorsal surface; the ventral surface is creamy white or yellowish white. Newborns, on the other hand, have an almost grayish-white body color with black blotches and weigh 2.0–7.2 grams (0.07–0.25 ounces) with SVLs of 200–350 mm (approx. 8–14 inches) (Tolson 1992, pers. comm.).

The Virgin Islands boa occurs in subtropical dry forest and subtropical moist forest (Service 2009, p. 11). Subtropical dry forest covers approximately 14 percent (128,420 hectares (ha); 317,332 acres (ac)) of Puerto Rico and the U.S. Virgin Islands (USVI), typically receives less than 750 mm (29 in) rainfall annually (Ewel and Whitmore 1973, pp. 9–20), and is characterized by small (less than 5 meter (m; 16 feet (ft)) deciduous trees with high densities of interlocking branches and vines connecting adjacent tree canopies (Ewel and Whitmore 1973, p. 10). Subtropical moist forest covers approximately 58 percent (538,130 ha; 1,329,750 acres) of Puerto Rico and USVI and typically receives more than 1,100 mm (43 in) of annual rainfall. It is dominated by semi-evergreen and evergreen deciduous trees up to 20 m (66 ft) tall with rounded crowns. The Virgin Islands boa has also been reported to occur in mangrove forest, thicket/scrub, disturbed lower vegetation, and artificial structures (Harvey and Platenberg 2009, p. 114; Tolson 2003, entire).

Habitat needs for Virgin Islands boa can be divided into those for foraging and those for resting. Factors contributing to foraging habitat quality are tree density and connectivity, presence of arboreal and ground-level refugia, prey density, and rat presence/density (Tolson 1988, pp. 234–235). Tree density is more important than tree species or diversity; Virgin Islands

boas do not appear to prefer a particular tree species after accounting for availability and structure (Platenberg 2018, pers. comm.). The highest densities of Virgin Islands boas are found where there are few or no exotic predators and high densities of lizard prey (Tolson 1988, p. 233; Tolson 1996b, p. 410). Resting habitat includes refugia for inactive boas to use during the day. Refugia can be the axils (angles between trunk and branches) of *Cocos* or *Sabal* species, tree holes, termite nests, or under rocks and debris (Tolson 1988, p. 233).

The Virgin Islands boa forages at night by gliding slowly along small branches in search of sleeping lizards (Service 1986, p. 6). The primary prey for the Virgin Islands boa is the Puerto Rican crested anole (*Anolis cristatellus*), and the greatest concentrations of Virgin Islands boa are found where *Anolis* densities exceed 60 individuals/100 m^2 (1,076 ft^2; Tolson 1988, p. 233). Other prey species include ground lizard (*Ameiva exsul*), house mouse (*Mus musculus*), small birds, iguana (*Iguana iguana*) hatchlings, and likely other small animals encountered (Maclean 1982, pp. 30–31, 37; Tolson 1989, p. 165; Tolson 2005, p. 9; Platenberg 2018, pers. comm.). The Virgin Islands boa may also compete for prey and other niche components with the Puerto Rican racer (*Borikenophis portoricensis*), a snake native to Puerto Rico, the U.S. and British Virgin Islands, and surrounding cays.

Much of what is known about Virgin Islands boa life history comes from studies in captivity. Lifespans in captivity often exceed 20 years, and sometimes exceed 30 years (7% of captive Virgin Islands boas exceeded 30 years of age; Smith 2018, pers. comm.), but typical lifespans in the wild are not known. Sexual maturity is reached at 2–3 years of age (Tolson 1989, Tolson and Piñero 1985), and boas are still reproductive at >20 years of age (Tolson 2018, pers. comm.). Females breed biennially, but studies have suggested that annual breeding may occur in some conditions (Tolson and Piñero 1985). Courtship behaviors and copulation occur

from February through May, and interaction with conspecifics of the opposite sex appears to be necessary for reproductive cycling (Tolson 1989). The gestation period, observed from a single known copulation between two individuals, is about 132 days (Tolson 1989). Virgin Islands boas give birth to live young from late August through October to litters of 2–10 young, and litter size increases with female body size (Tolson 1992, pers. comm.).

The exact historical distribution of the Virgin Islands boa is unknown, but its present disjointed distribution suggests that it was once more widely distributed across small islands within its range. In the 1970s, when the Virgin Islands boa was originally listed, its range was identified as three islands: Puerto Rico (no specific site), St. Thomas, USVI (from a single record), and Tortola in the British Virgin Islands (BVI) (from one report) (44 FR 70677, December 7, 1979). When the recovery plan was written (1986), 71 individuals were reported in two populations: one on the eastern side of St. Thomas in the USVI, and one at Cayo Diablo, an offshore islet in Puerto Rico (Service 2009).

Currently, the Virgin Islands boa occurs on six islands between Puerto Rico, USVI, and BVI: the eastern Puerto Rican islands of Cayo Diablo and Culebra; Río Grande on the Puerto Rican main island; eastern St. Thomas and an offshore cay in USVI (USVI Cay; an introduced population); and Tortola. A seventh population (also introduced) on the Puerto Rican island of Cayo Ratones may still remain, although after the reestablishment of rats on this island after 2004, the status of this population is uncertain (Service 2018, p. 24). A recent survey did not find Virgin Islands boas on Cayo Ratones in 2018 (Island Conservation 2018, pp. 5, 17). However, because Virgin Islands boas are difficult to find, and the 2018 surveys were not extensive (e.g., did not survey the whole island), there is currently not enough evidence to conclude the Cayo Ratones population has been extirpated. Lastly, there is also one report from

2004 that the species occurs on Greater St. James Island in St. Thomas, but nothing is known about that potential population (Dempsey 2019, pers. comm.). In 2009, based on all known populations in Puerto Rico and the USVI, an estimated 1,300–1,500 Virgin Islands boas were thought to occur (Service 2009, p. 8), although many population sizes used for this estimate are highly speculative. Based on the 2018 SSA (Service 2018, entire), current population trend estimates for Puerto Rico and USVI are either declining, potentially declining, considered rare, or unknown and most populations are small or considered rare (Service 2018, p. 30).

The population in Tortola Island, BVI, was confirmed in 2018, but there are no specific data regarding the status of that population (McGowan 2018, pers. comm.). In addition, according to anecdotal reports, the species is thought to occur on Jost Van Dyke, Guana Island, Necker Cay, Great Camanoe, and Virgin Gorda of the BVI (Mayer and Lazell 1988, entire), but data and confirmed observations are limited. There is not enough information to reliably assess the status of Virgin Islands boa populations on those islands.

Regulatory and Analytical Framework

Regulatory Framework

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species is an "endangered species" or a "threatened species." The Act defines an endangered species as a species that is "in danger of extinction throughout all or a significant portion of its range," and a threatened species as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The Act requires that we determine whether any species is an "endangered species" or a "threatened species" because of any of the following factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;

(B) Overutilization for commercial, recreational, scientific, or educational purposes;

(C) Disease or predation;

(D) The inadequacy of existing regulatory mechanisms; or

(E) Other natural or manmade factors affecting its continued existence.

These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species' continued existence. In evaluating these actions and conditions, we look for those that may have a negative effect on individuals of the species, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects.

We use the term "threat" to refer in general to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term "threat" includes actions or conditions that have a direct impact on individuals (direct impacts), as well as those that affect individuals through alteration of their habitat or required resources (stressors). The term "threat" may encompass—either together or separately—the source of the action or condition or the action or condition itself.

However, the mere identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an "endangered species" or a "threatened species." In determining whether a species meets either definition, we must evaluate all identified threats by considering the expected response by the species, and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the

cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species—such as any existing regulatory mechanisms or conservation efforts. The Secretary determines whether the species meets the definition of an "endangered species" or a "threatened species" only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

The Act does not define the term "foreseeable future," which appears in the statutory definition of "threatened species." Our implementing regulations at 50 CFR 424.11(d) set forth a framework for evaluating the foreseeable future on a case-by-case basis. The term foreseeable future extends only so far into the future as the Services can reasonably determine that both the future threats and the species' responses to those threats are likely. In other words, the foreseeable future is the period of time in which we can make reliable predictions. "Reliable" does not mean "certain"; it means sufficient to provide a reasonable degree of confidence in the prediction. Thus, a prediction is reliable if it is reasonable to depend on it when making decisions.

It is not always possible or necessary to define foreseeable future as a particular number of years. Analysis of the foreseeable future uses the best scientific and commercial data available and should consider the timeframes applicable to the relevant threats and to the species' likely responses to those threats in view of its life-history characteristics. Data that are typically relevant to assessing the species' biological response include species-specific factors such as lifespan, reproductive rates or productivity, certain behaviors, and other demographic factors.

Analytical Framework

The SSA report documents the results of our comprehensive biological status review for the species, including an assessment of the potential threats to the species. The SSA report does not represent a decision by the Service on whether the species should be proposed for listing as an endangered or threatened species under the Act. It does, however, provide the scientific basis that informs our regulatory decisions, which involve the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found at Docket FWS–R4–ES–2019–0069 on *http://www.regulations.gov* and at *https://www.fws.gov/southeast/*.

To assess the Virgin Islands boa's viability, we used the three conservation biology principles of resiliency, redundancy, and representation (Shaffer and Stein 2000, pp. 306–310). Briefly, resiliency supports the ability of the species to withstand environmental and demographic stochasticity (for example, wet or dry, warm or cold years), redundancy supports the ability of the species to withstand catastrophic events (for example, droughts, large pollution events), and representation supports the ability of the species to adapt over time to long-term changes in the environment (for example, climate changes). In general, the more resilient and redundant a species is and the more representation it has, the more likely it is to sustain populations over time, even under changing environmental conditions. Using these principles, we identified the species' ecological requirements for survival and reproduction at the individual, population, and species levels, and described the beneficial and risk factors influencing the species' viability.

The SSA process can be categorized into three sequential stages. During the first stage, we evaluated the individual species' life-history needs. The next stage involved an assessment of the historical and current condition of the species' demographics and habitat characteristics,

including an explanation of how the species arrived at its current condition. The final stage of the SSA involved making predictions about the species' responses to positive and negative environmental and anthropogenic influences. This process used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time. We use this information to inform our regulatory decision.

Summary of Biological Status and Threats

In this discussion, we review the biological condition of the species and its resources, and the threats that influence the species' current and future condition, in order to assess the species' overall viability and the risks to that viability. In the SSA report (Service 2018, pp. 12–18), we reviewed all factors (*i.e*., threats, stressors) that could be affecting the Virgin Islands boa now or in the future. However, in this proposed rule, we will focus our discussion only on those factors that could meaningfully impact the status of the species. The risk factors affecting the status of the Virgin Islands boa vary from location to location, but generally include habitat loss and degradation from development, introduced predators, sea level rise (SLR) and a changing climate, and public attitudes towards snakes. Where habitat is available but the species is not present (i.e., most of the small islands in the eastern Puerto Rico bank and USVI), it is believed that absences are due to local extirpation resulting from habitat degradation and colonization of exotic species (Service 2009, p. 11). We discuss each of the risk factors below.

Development

Virgin Islands boas occur on both privately and publicly owned land. Virgin Islands boas have been observed living in developed areas around residences and can persist within developed areas if habitat patches are available, but only if no cats or rats are around (Platenberg and Harvey 2010, p. 552; Platenberg 2018, pers. comm.). Where boas coexist with urban

development, development continues to threaten populations via habitat destruction, especially in St. Thomas, Río Grande (Puerto Rico), and Culebra Island where habitat has declined throughout decades. In St. Thomas, available habitat has declined due to development for resorts, condos, and related infrastructure, and has become more constricted and isolated (Platenberg and Harvey 2010, p. 552). In Puerto Rico, human populations are decreasing, but residential development continues to increase island-wide, including around protected areas (Castro-Prieto et al. 2017, entire). Consequences of human development on the boa and its habitat not only include habitat loss and fragmentation due to deforestation, but also mortality from vehicular strikes, an increase in predators such as cats and rats, and an increase in human–boa conflicts that results in snakes being killed because of fear of snakes (Service 2018, pp. 13–14).

Both Puerto Rico and the USVI have regulatory mechanisms established to protect the species and its habitat throughout consultation processes for the authorization of development projects. Presently, the Virgin Islands boa is legally protected under Puerto Rico's Commonwealth Law No. 241-1999 (12 L.P.R.A. Sec.107), known as the New Wildlife Law of Puerto Rico. This law has provisions to protect habitat for all wildlife species, including plants and animals. In addition, the species is protected by Puerto Rico Department of Natural and Environmental Resources (PRDNER)'s Regulation 6766, which under Article 2.06 prohibits collecting, cutting, and removing, among other activities, listed plant and animal individuals within the jurisdiction of Puerto Rico (DRNA 2004). In USVI, Act No. 5665, known as the Virgin Islands' Indigenous and Endangered Species Act, which is enforced by the U.S. Virgin Islands Department of Planning and Natural Resources (VIDPNR), protects the species.

Despite these regulations being in place, including the requirement for developers to conduct environmental assessments and mitigate damage to the species and habitat, the

regulations have proved difficult to enforce, they are often ignored by developers, and they do not cover all development activities in all Virgin Islands boa habitat (Platenberg 2011, pers. comm.). For example, in St. Thomas, major permit applications submitted for projects in the coastal zone require an environmental impact assessment that addresses endangered species and protected habitat, but these requirements do not apply to smaller projects or those outside of the coastal zone. Furthermore, as noted in one study, even though a protocol was developed and applied to delineate habitat on protected sites and identify mitigation strategies, the absence of a legal mechanism to enforce mitigation has led to varying success as developers are slow to accept, and often ignore, the mitigation process (Platenberg and Harvey 2010, pp. 551–552).

Most offshore cays within the species' range are part of the Territorial Government or protected as wildlife refuges, thus formally protecting Virgin Islands boa habitat for three of the six populations (i.e., Cayo Diablo, Cayo Ratones, and USVI Cay). Cayo Ratones and Cayo Diablo are included in La Cordillera Natural Reserve managed by the PRDNER, and the offshore cay in USVI is managed and protected by the VIDPNR. Furthermore, even though Virgin Islands boa habitat on privately owned land on Culebra Island is currently under pressure from urban and tourism development and deforestation, more than 1,000 acres of suitable habitat on the island are protected within the Service's Culebra National Wildlife Refuge.

Predation and Competition

One of the primary threats to Virgin Islands boa populations is predation by exotic mammalian predators, mainly cats and rats, and possibly, to a lesser degree, mongoose. Mongoose are not likely a major predator of Virgin Islands boa because mongoose are terrestrial and active during the day, while Virgin Islands boas are arboreal and active primarily at night, although not exclusively (Service 2018, p. 14). Feral cats are known to prey upon boas (Tolson

1996b, p. 409), and cat populations around human development are further bolstered by cat feeding stations set up by residents. There has not been direct evidence of rats preying upon Virgin Islands boas, but boas are not present on islands with high densities of rats (Tolson 1986, unpaginated; Tolson 1988, p. 235). Rats likely negatively impact Virgin Islands boas by competing for prey, or by inducing behavioral changes in *Anolis* prey that make them less likely to be encountered by boas (Tolson 1988, p. 235). However, rats may also predate on neonate boas (Service 1986, p. 12). Complete predator removal on large developed islands is challenging, but is feasible on smaller cays. Prior to reintroduction of the boas, rats were eliminated from Cayo Ratones and the USVI Cay using anticoagulant poison (Tolson 1996b, p. 410), although Cayo Ratones was recolonized by rats sometime after August 2004, highlighting the importance of ongoing monitoring for rat presence after a removal project. Cayo Ratones was thought to harbor one of the most robust Virgin Islands boa populations, but during the recent 2018 survey, no boas were found (Island Conservation 2018, p. 20). There are no Virgin Islands boas present on islands with established rat populations and no rat predators (such as cats).

Effects of Climate Change, Including Sea Level Rise

Climate change will continue to influence Virgin Islands boa persistence into the future. Species that are dependent on specialized habitat types or limited in distribution (including the Virgin Islands boa) are most susceptible to the impacts of climate change (Byers and Norris 2011, p. 22).

The climate in the southeastern United States and Caribbean has warmed about two degrees Fahrenheit from a cool period in the 1960s and 1970s, and temperatures are expected to continue to rise (Carter et al. 2014, pp. 398–399). Projections for future precipitation trends in

this area are less certain than those for temperature, but suggest that overall annual precipitation will decrease, and that tropical storms will occur less frequently but with more force (i.e., more category 4 and 5 hurricanes) than historical averages (Carter et al. 2014, pp. 398–399; Knutson et al. 2010, pp. 161–162). With increasing temperatures and decreasing precipitation, drought could negatively influence Virgin Islands boa populations. After a severe drought in eastern Puerto Rico, *Anolis* populations crashed on Cayo Diablo and body condition indices of the boas plummeted (Tolson 2018, pers. comm.).

Sea levels are expected to rise globally, potentially exceeding 1 m (3 feet) of SLR by 2100 (Reynolds et al. 2012, p. 3). Local SLR impacts will depend not only on how much the ocean level itself rises, but also on land subsidence or changes in offshore currents (Carter et al. 2014, p. 400). Impacts on terrestrial ecosystems can be temporary, via submergence of habitat during storm surges, or permanent, via salt water intrusion into the water table, inundation of habitat, and erosion. SLR and hurricane storm surges in the Caribbean are predicted to inundate low-lying islands and parts of larger islands (Bellard et al. 2014, pp. 203–204). The low-lying islands of Cayo Diablo and the USVI Cay, which support Virgin Islands boa populations, and the island of Cayo Ratones, which may still support a population, are all vulnerable to SLR and storm surges in the future. Boa populations on Río Grande, Culebra, and St. Thomas are not considered at risk from SLR; however, the three cays (Cayo Diablo, Cayo Ratones, and USVI Cay) could see 10–23 percent loss due to SLR over the next 30 years (Service 2018, pp. 38–46). Past and current observations suggest that the species can survive major hurricane events, although lasting impacts to habitat, particularly die-off of vegetation inundated by storm surges, have been observed (Platenberg 2018, pers. comm.; Smith 2018, unpaginated; Tolson 1991, pp. 12, 16; Yrigoyen 2018, pers. comm.). Loss of habitat due to storm surge impacts is similar to

loss of habitat due to development; loss of low-lying forest habitat could result in decreased habitat availability for the Virgin Islands boas and their prey.

Persecution by Residents

Intentional killing of the more common and larger sized Puerto Rican boa (*Chilabothrus inornatus*) due to fear or superstitious beliefs has been well documented in the literature (Bird-Picó 1994, p. 35; Puente-Rolón and Bird-Picó 2004, p. 343; Joglar 2005, p. 146). Thus, Virgin Islands boas in proximity to developed areas where people fear snakes are susceptible to intentional killings. Public encounters with Virgin Islands boas in the more populated Río Grande and Culebra locations are considered questionable because of the rarity of boas in those populations, and there are only a couple of anecdotal records of intentional killings between those areas (Service 2009, pp. 15–16). In the highly developed east side of St. Thomas, about 10 percent of the Virgin Islands boa records in St. Thomas are from dead boas killed by humans on private property (Platenberg 2006, unpub. data). We have no further information to assess the magnitude of this threat, but it is likely that intentional killings of Virgin Islands boas still occur, are not being documented, and would be particularly detrimental to rare populations such as in Río Grande. The Service is not aware of a law enforcement case related to the boa in Puerto Rico or the USVI. Populations that occur within protected areas are not expected to be exposed to this threat.

Conservation Measures that Affect the Species

Positive influences on Virgin Islands boa viability have been habitat protection, predator control, and captive breeding and reintroduction. Two populations of Virgin Islands boa were reintroduced to protected cays after predators had been removed, one on Cayo Ratones (Puerto Rico) in 1993, and another on USVI Cay in 2002. Founders for these reintroductions came

largely from a cooperative captive-breeding program initiated in 1985 between the Service, DNER, VIDPNR, and the Toledo Zoological Garden. Cayo Diablo provided the founding individuals for the captive population that was reintroduced to Cayo Ratones (6 kilometers (3.5 miles) away from Cayo Diablo), and St. Thomas provided the founding individuals for the captive population that was reintroduced to the USVI Cay (4 kilometers (2.5 miles) away from St. Thomas).

The Cayo Ratones population originated from 41 captive-born boas (offspring of Cayo Diablo boas) released between 1993 and 1995. Post-release survival was high: 82.6 percent of individuals and 89 percent of neonates survived at least 1 year (Tolson 1996a, unpaginated). By 2004, the population had grown to an estimated 500 boas (Tolson et al. 2008, p. 68). Unfortunately, since 2004, Cayo Ratones has been recolonized by rats, and no boas were found during surveys in 2018 (Island Conservation 2018, pp. 5, 20). However, because Virgin Islands boas are difficult to find, and this survey was not exhaustive, we believe it is premature to conclude the population has been extirpated. Intensive follow-up surveys are needed to confirm whether a population still persists or is extirpated, but it is clear that the population has declined.

The USVI Cay reintroduction was initiated with the release of 42 Virgin Islands boas in 2002 and 2003, 11 from captivity and 31 from St. Thomas. Follow-up surveys in 2003–2004 provided an estimate of 168 boas (202 boas/ha), which researchers suspected was near carrying capacity for the island (Tolson 2005, p. 9). More recent surveys in 2018 detected 20 boas over 2 nights, resulting in an estimate of 26–33 boas across the island (Island Conservation 2018, pp. 20–30). Differences in survey and analysis methodologies complicate direct comparisons of population size between these time points. Recent surveys also indicate that there are no rats on the island.

Factors for consideration for future reintroduction sites include the presence and amount of suitable habitat (*e.g.,* appropriate forest structure, adequate prey base, available refugia), protection status or threat of development, the presence/absence/eradication of exotic predators, and geomorphology that provides protection from SLR and hurricane storm surges that are likely to affect the persistence of low-lying habitat. Potential sites for new introductions have been suggested (Reynolds et al. 2015, p. 499) and need to be further assessed, although one new effort is in the early stages of implementation. Some areas may require that predators be removed before boas are moved and future monitoring is ensured to prevent recolonization. In addition to reintroductions to new sites, augmentation of existing populations may prove beneficial or necessary for the persistence of existing populations, particularly on developed islands and cays where predators have become reestablished.

In conclusion, the Virgin Islands boa still faces the threat of development on St. Thomas, Río Grande, and Culebra Island, and regulatory mechanisms addressing this threat are difficult to enforce or do not cover all development actions affecting the species. Human development results in habitat loss from deforestation and fragmentation, mortality from vehicular strikes, and increased predation by cats and rats. In addition, impacts from changes in climate could affect habitat. Drought could negatively influence Virgin Islands boa populations through loss of prey. SLR and storm surges are expected to inundate low-lying islands, such as Cayo Diablo, Cayo Ratones, and the USVI Cay, which currently support Virgin Islands boa populations. Finally, persecution of boas by citizens, due to fear or superstition, can affect individual boas, although there has never been a systematic study of the impact of these events on the overall population. When considering conservation actions and how they influence the viability of Virgin Islands boa, about half of known localities where Virgin Islands boas occur are on small offshore islets

managed for conservation. In addition, predator removal has been successful at smaller cays, such as USVI Cay, although the reestablishment of rats on Cayo Ratones illustrates the need for continued monitoring and removal efforts. Lastly, successful reintroductions of Virgin Islands boas occurred on these islands after the eradication of predators; however, additional predator removal and augmentation of reintroduced boa populations may be needed on cays where predators have become reestablished.

Summary of Current Condition

For the Virgin Islands boa to maintain viability, its populations, or some portion thereof, must be resilient. For the SSA, our classification of resiliency relied heavily on habitat characteristics in the absence of highly certain population size or trend estimates. The habitat characteristics we assessed were: degree of habitat protection (or, conversely, development risk), presence of introduced predators, and vulnerability to storm surges (Service 2018, p. 31).

Representation can be measured by the breadth of genetic or environmental diversity within and among populations and gauges the probability that a species is capable of adapting to environmental changes. A range-wide genetic analysis of the Virgin Islands boa showed there was little genetic variation; however, the same study found that each sampled locality had unique mtDNA haplotypes, indicating a lack of gene flow between islands (Rodríguez-Robles et al. 2015, entire). Therefore, in the SSA we used genetics to delineate representative units.

The species also needs to exhibit some degree of redundancy in order to maintain viability. Catastrophic events that could affect both single and multiple populations of the Virgin Islands boa include drought, hurricanes, and colonization or recolonization of exotic predators. This species occurs in geographically isolated groups and does not disperse from island to island

to interact and interbreed; therefore, for purposes of analyzing redundancy, all boas within each island were considered to be individual populations.

Resiliency

Because resiliency is a population-level attribute, the key to assessing it is the ability to delineate populations. As discussed above, we considered all boas within each island to be single populations. On small offshore cays, what we define as a population might consist of a single interbreeding deme (or subdivision) of Virgin Islands boas. On larger islands, what we define as a population functions more as a metapopulation, with multiple interbreeding groups in isolated habitat patches that may interact weakly via dispersal and recolonization of extirpated patches. Alternately, multiple occupied patches on large islands may be completely isolated from one another (Service 2018, p. 20).

Six island populations were considered: Cayo Diablo, Cayo Ratones, Culebra Island, Río Grande (Puerto Rico), St. Thomas, and USVI Cay (USVI). We acknowledge the uncertainty about the persistence of Virgin Islands boas on Cayo Ratones due to the recolonization of the island by rats; however, because of reasons described previously, we included this island in our analysis. Further, one or more populations exist in the BVI, but data are severely limited, and for the SSA, we lacked sufficient data from these islands to incorporate them into our viability analysis. In addition, other populations may occur on islands in Puerto Rico and USVI, but Virgin Islands boa habitat and activity patterns make them difficult to find, and we could not confirm any to be extant at the time we completed our analysis.

Resiliency scores for each population were generated by combining scores for three habitat metrics (Protection/Development Risk, Exotic Mammals, and Storm Surge Risk) and one population metric (Population Size and/or Trend, dependent on availability). Each metric was

weighted equally, with the overall effect that habitat (three metrics) was weighted three times higher than population size/trend (one metric). For each metric, populations were assigned a score of -1, 0, or 1, as described below in table 1.

The scores were based on the best available information for each population, gathered from the literature and species experts. Monitoring data are scarce. The Virgin Islands boa recovery plan (Service 1986, pp. 16–19) called for periodic monitoring to estimate population sizes and trends, but surveys since then have been few and far between. Survey methodology and reporting have varied from population to population, with survey results given as estimated abundances, estimated densities, or encounter rates per person-hour of searching. The above-described factors in combination contribute to high levels of uncertainty in current and past population sizes, and how they have changed over time. Accordingly, resiliency classifications relied more heavily on habitat conditions than population size and trend estimates.

Table 1. Description of habitat and population factor scores to determine Virgin Islands boa population resiliency.

	Habitat Metrics			**Population Metric**
Score	**Habitat Protection/ Development Risk**	**Exotic Mammals**	**Storm Surge Risk**	**Population Size/Trend***
-1	Habitat not protected, at risk of being developed	Exotic mammals present	Topography and elevation leaves population vulnerable to storm surges	Relatively low population size and/or declining trend
0	Some habitat protected, some at risk of being developed	NA	NA	Relatively moderate population size and stable trend, OR High degree of uncertainty in population size/trends
1	Habitat protected in identified protected area	Exotic mammals absent	Protected by topography and elevation	Relatively high population size and/or growth

* Population size/trend scores are relative and were based on the best available information for each population, gathered from the literature and species experts.

The scores for each population across all metrics were summed, and final population resiliency categories were assigned as follows:

Low Resiliency:	-4 to -2
Moderately Low Resiliency:	-1
Moderate Resiliency:	0
Moderately High Resiliency:	1
High Resiliency:	2 to 4

Applying these resiliency categories to the six populations of Virgin Islands boa, we determined that one population has moderately high resiliency (Cayo Diablo), one has moderate resiliency (USVI Cay), one has moderately low resiliency (Culebra), and three have low resiliency (Cayo Ratones, Río Grande, and St. Thomas).

The population classified as having moderately high resiliency (Cayo Diablo) occurs on a small offshore island that is free of exotic rats and cats and is protected for conservation. In addition, Cayo Diablo was surveyed in 2018 with 10 boas being found (Island Conservation

2018). Extrapolating the density within the transect area (2.9 boas/ha) to the entire island, the model provides an estimate of 20 boas on the island (95% confidence interval 13–39), which is much lower than earlier unpublished survey results, however comparisons cannot be made between the surveys because of different survey and analytical methodologies (Service 2018, p.23). Primarily because of the protected and exotic-mammal-free state of the habitat, this population is considered to have moderately high resiliency to demographic and environmental stochastic events and disturbances (e.g., fluctuations in demographic rates, variation in climatic conditions, illegal human activities).

The USVI Cay population, also on a protected offshore island with no exotic mammals, was determined to have moderate resiliency. Recent surveys have revealed a potential decline in abundance and the loss of two prey species (Smith 2018a, pp. 7–8), possibly as a result of density dependence as the population approached carrying capacity after reintroduction. Over two separate survey efforts in 2018, researchers found a total of 64 boas (Smith 2018ab, entire).

Three of the populations (Río Grande, Culebra, and St. Thomas) with low or moderately low resiliency occur on larger and higher elevation islands, which provide more protection from storm surges, but have more human–boa interactions, habitat loss and fragmentation from development, and exotic cats and rats. Recent surveys in 2018 on Río Grande found three boas (three survey nights) (Island Conservation 2018, p. 20). For Culebra, surveys in 2018 found no boas (Island Conservation 2018, p. 20); however, two individuals were documented in February 2019 within the Culebra National Wildlife Refuge (Puente-Rolón and Vega-Castillo 2019, p. 18). On October 2019, another individual was confirmed in an area outside of the Refuge (Román 2019, pers. comm.). For St. Thomas, there have been no recent systematic surveys for the species as much of eastern St. Thomas is inaccessible due to private ownership or

impenetrable habitat; however, opportunistic observations have averaged about 10 observations of Virgin Islands boa per year since 2000. The remaining low-resiliency population (Cayo Ratones) is classified as such as a result of the recolonization of rats on the island and resulting declining trend—or possible extirpation—of boas, as no boas were detected during recent survey efforts (Island Conservation 2018).

Representation

A range-wide genetic analysis of Virgin Islands boa showed that there was little genetic variation within the species (Rodríguez-Robles et al. 2015, p. 150), supporting the idea that there is only one representative unit of Virgin Islands boa. However, each sampled island, and each sampled locality within the same island, had unique mtDNA haplotypes, indicating a lack of gene flow between islands/populations (Rodríguez-Robles et al. 2015, p. 150). These results suggest that each population has a different genetic signature, perhaps as a result of genetic adaptations to their local environment, or genetic drift with increasing isolation of small populations. The reintroduction program took this view, and managed captive populations sourced from Cayo Diablo and St. Thomas separately (Tolson 1996b, p. 412). To minimize the chances of introducing individuals poorly suited to their new environment, the captive population sourced from Cayo Diablo founded the reintroduced population on nearby Cayo Ratones, and the captive St. Thomas population founded the reintroduced population on the nearby USVI Cay (Tolson 1996b, p. 412).

In addition to genetic differences, the six populations also have noticeable phenotypic differences. These are not just limited to coloration differences between USVI and Puerto Rican populations (Tolson 1996b, p. 412); Cayo Diablo reportedly has lighter coloration than the Río Grande and Culebra populations (Tolson 2018, pers. comm.). The Río Grande population also

occurs in a different habitat type (subtropical moist forest) than the others (subtropical dry or littoral forest; Tolson 1996b, p. 410).

In light of this information, we considered each of the four natural populations in Puerto Rico and USVI as a representative unit (table 2). The Cayo Diablo population is considered to have moderately high resiliency. As this was the source for the low-resiliency Cayo Ratones population, there are two populations representing the Cayo Diablo genetic signature. Similarly, the USVI Cay population was sourced from St. Thomas, so there are two populations with St. Thomas representation, with neither considered to have high resiliency. The other two natural populations, Culebra and Río Grande, both characterized as having moderately low or low resiliency, have not been used for captive breeding and reintroduction, so have no additional populations on other islands with the same genetic characteristics. Overall, three of four representative units have at least one moderate resilient population.

While currently we could consider the USVI Cay and Cayo Ratones reintroduced populations (currently with moderate and low resiliency, respectively) to be redundant populations sharing the same genetic signature and adaptive potential as their source populations, all of the islands occupied by Virgin Islands boa are isolated from each other. Without human-mediated movement of boas between islands, the reintroduced populations are expected to diverge genetically from their source populations over time, and may at some point in the future (decades to centuries; Reynolds et al. 2015, entire) be different enough to be considered its own unique representative unit.

Table 2. Representation: Number of Virgin Islands boa populations of each resiliency class in each representative unit, corresponding to natural (not introduced) populations, which themselves correspond to unique genetic signatures.

Natural Population (Genetic Signature)	Moderately High Resiliency Populations	Moderate Resiliency Populations	Moderately Low Resiliency Populations	Low Resiliency Populations
Cayo Diablo	1	0	0	1
Culebra	0	0	1	0
Río Grande	0	0	0	1
St. Thomas	0	1	0	1

Redundancy

Redundancy describes the ability of a species to withstand catastrophic events. Measured by the number of populations, their resiliency (ability of a species to withstand environmental and demographic stochasticity (*e.g.*, wet or dry years)) and their distribution (and connectivity), redundancy gauges the probability that the species has a margin of safety to withstand or return from catastrophic events (such as a rare destructive natural event or episode involving many populations).

The exact historical distribution of the Virgin Islands boa is unknown, but their present disjointed distribution suggests that they were once more widely distributed across small islands within their range, which have been subject to local extirpations from habitat degradation, invasive species, and historical climate and sea level changes. However, for current redundancy, we identified the six populations in Puerto Rico and USVI (and one or more populations in the BVI of unknown status). As discussed above, three of these populations are considered to have resiliency; therefore, the species is moderately buffered against the effects of catastrophic events.

Summary

Of the six assessed populations, the Cayo Diablo population is the only one that currently has moderately high resiliency, the USVI Cay population has moderate resiliency, and the

Culebra population has moderately low resiliency. The other three assessed populations currently have low resiliency. Redundancy for the species includes populations on six islands in Puerto Rico and USVI, and possibly more in the BVI, although not part of this assessment. Representation consists of four representative units, two of which have two populations representing its genetic signature, and three of the four units have populations with some level of resiliency.

The Virgin Islands boa has demonstrated some ability to adapt to changing environmental conditions over time from both anthropogenic threats (*e.g.,* habitat disturbance due to development) and natural disturbances (*e.g.,* predation and hurricanes). Compared to historical distribution at the time of listing that included three locations (Puerto Rico, St. Thomas, and Tortola), the species currently has six populations (potentially more if the species persists in the BVI and others are eventually confirmed). Three of the six current populations exhibit varying levels of resiliency from moderately high to moderately low, whereas three exhibit low resiliency. Since the species was listed as an endangered species in 1970, it has demonstrated some degree of resiliency despite threats.

Future Conditions

To assess the future resiliency, redundancy, and representation for the Virgin Islands boa, we considered impacts of human development, habitat protection and restoration, reintroductions, public outreach and education, and SLR. We predicted resiliency at two future time points, 30 years and ~80 years in the future (2048 and 2100). Predictions made at the 80-year time point are based only on SLR and hurricane storm surges as predictions about the other factors are too uncertain to allow for a meaningful analysis. As discussed in **Determination of Status** below, all of the impacts were considered at the 30-year time step. With input from

species' experts, we chose the 30-year time step in order to encompass multiple generations of Virgin Islands boa (which can live past 20 years and reproduce at 2–3 years of age; Tolson 1989, p. 166; Tolson and Piñero 1985, unpaginated). In addition, we considered the time required to plan and execute a reintroduction (about 10 years; Tolson 2018, pers. comm.) and how a 30-year time step would allow us to see results of reintroduction efforts. Lastly, we considered the time required for habitat restoration to be realized (10 years or less; Platenberg 2018, pers. comm). The 30-year time step coincides with the foreseeable future for this analysis (i.e., the period of time in which we can make reliable predictions). For information on predictions made at the 80-year time step, see the SSA report (Service 2018, pp. 38-46).

We did not explicitly consider the role that genetics may play in the future. Although the absence of natural migration of boas between islands isolates these populations and makes them vulnerable to inbreeding and genetic drift, no genetic abnormalities or evidence of inbreeding depression have been observed in the boa (Tolson 1996b, p. 412). We also did not explicitly consider the impacts of climate change (other than SLR and hurricane storm surges) on the boas and their habitat. Species that are dependent on specialized habitat types and limited in distribution and migration ability, such as the Virgin Islands boa, are susceptible to the impacts of climate change (Byers and Norris 2011, p. 22), but the direction, magnitude, and timeframe of these impacts on the species are uncertain.

Below we present three plausible future scenarios for the Virgin Islands boa over the next 30 years (to 2048): Status Quo, Conservation, and Pessimistic. Impacts of climate change and SLR are treated the same across all three scenarios, as the trajectory of climate change will proceed regardless of different levels of local conservation for Virgin Islands boa. For all three scenarios, SLR is considered to occur at a rate of 0.30 meters (1 foot) by 2048, and 0.61–0.91

meters (2–3 feet) by 2100 (Church et al. 2013; Service 2018, pp. 38-41). Multiple major hurricanes are expected to strike within the Virgin Islands boa's range.

Under a status quo scenario: Development continues at the current pace, and development and exotic mammals continue to negatively impact Virgin Islands boa populations. Boa population sizes in these developed areas decline, as they are suspected to currently be in decline by species experts (but hard data are lacking to confirm trends). No new habitat is protected. Under this scenario, one new reintroduction that has already been initiated with the 2018 capture of snakes to reinvigorate captive breeding takes place.

Under a conservation scenario: While development continues on human-occupied islands, under this scenario new Virgin Islands boa habitat is protected from development on the Puerto Rico main island, and additional habitat is protected on Culebra and St. Thomas (where some habitat is already protected), to preserve and restore habitat and habitat connectivity. Because of the size of the islands and human populations there, exotic cats and rats remain problematic, but this risk would be reduced by conservation efforts including predator control and effective community outreach and education about the effect of free-roaming cats on native wildlife. Regulations and enforcement improve on protected lands. Rats are eradicated (and eradication efforts are monitored) from Cayo Ratones and, if necessary, more boas are translocated there. Reintroductions occur at a rate of one site per decade, including the one reintroduction already planned, and struggling populations on developed islands are augmented.

Under a pessimistic scenario: Under the Pessimistic scenario, no reintroductions occur, presumably due to reduced funds or changes in governmental or conservation priorities. No additional habitat is protected, and development continues to impact populations on human-

inhabited islands. Exotic mammals remain a threat where already present. Rats colonize Cayo Diablo and recolonize the USVI Cay.

Given current resources, priorities, and conservation momentum, the Status Quo scenario is the most likely scenario for the future. The Status Quo scenario includes the implementation of a new reintroduction, which is planned but contingent on continued funding (not yet secured) and a long-term commitment to manage and propagate a captive population, select a suitable site (which may involve rat eradication), reintroduce boas, and conduct post-release monitoring. The likelihoods of the Conservation and Pessimistic scenarios are contingent upon the decisions, resources, and priorities of management and conservation organizations, which are difficult to predict. The Pessimistic scenario is likely if funds and effort are not directed to captive breeding and reintroduction, community outreach and education, habitat protection and restoration, and ongoing monitoring of Virgin Islands boas, their habitat, and exotic species. The Conservation scenario is likely if abundant funds and effort are directed towards these initiatives.

Resiliency

Under all three future scenarios, the three populations on developed islands are predicted to remain at low resiliency or become extirpated by 2048 (table 3). Even with conservation efforts to prevent extirpation, none of the populations are expected to improve their resiliency because of the magnitude of the threats facing them. Cayo Diablo, the population with the highest resiliency, is expected to continue to have high resiliency unless the island is colonized by rats, which could drive the population to extirpation. Cayo Ratones, which presently has a robust rat population, will remain at low resiliency and potential extirpation unless rats are eradicated; supplemental translocations may also be necessary, but more surveys are necessary to determine the needs of the population. Given that the threats facing populations on developed

islands will be very difficult to surmount, the most effective way to increase the overall resiliency of populations range-wide is to reintroduce new populations in quality protected habitat, prevent future colonization by exotic predators, and have continual predator eradication monitoring.

Table 3. Summary table of future resiliency for Virgin Islands boa populations in 2048 under three scenarios.

Population	**Current Resiliency**	**Future—Status Quo (2048)**	**Future—Conservation (2048)**	**Future—Pessimistic (2048)**
Cayo Diablo	Moderately High	Moderately High	High	Low/ Extirpated
Cayo Ratones	Low	Low/ Extirpated	High	Low/ Extirpated
Culebra	Moderately Low	Low/ Extirpated	Moderately Low	Low/ Extirpated
Río Grande	Low	Low/ Extirpated	Low	Low/ Extirpated
St. Thomas	Low	Low/ Extirpated	Low	Low/ Extirpated
USVI Cay	Moderate	Moderate	High	Low/ Extirpated
New (introduced) populations (pops)	None	1 High	3 High	None
Summary (# pops)	6 pops Low: 3 Mod Low: 1 Moderate: 1 Mod High: 1	3–7 pops Low/ Extirpated: 4 Moderate: 1 Mod High:1 High: 1	9 pops Low: 2 Mod Low:1 High: 6	0–6 pops Low/ Extirpated: 6 High: 0

Redundancy

The total number of populations under the Status Quo scenario is three to seven depending on whether four populations become extirpated or remain at a low resiliency. Under the Pessimistic scenario, all populations are predicted to be extirpated or remain at low

resiliency. The Conservation scenario improves redundancy by introducing three new populations that are expected to have high resiliency, improving the resiliency of the Cayo Ratones population by eradicating rats and providing translocations if needed, and preventing low-resiliency populations from becoming extirpated, for a total of nine populations. As time goes on after the horizon of our 30-year scenarios, SLR becomes more important to consider, as current populations with the highest resiliency potential are the same populations that will be most at risk from SLR.

Representation

In the *Current Condition* section above, we identified each natural (not introduced) Virgin Islands boa population as a representative unit. Under this concept, a reintroduced population is of the same representative unit as the source population used for the reintroduction, and future representation for the species depends highly on how reintroductions are carried out (table 11 in Service 2018, p. 59).

The Status Quo scenario includes one reintroduction sourced from the USVI Cay population, which was originally sourced from the St. Thomas population. Therefore, the new reintroduced population would be considered part of the St. Thomas representative unit. The Conservation scenario includes two additional reintroductions, which could be sourced from any population. Sourcing new reintroductions from Culebra or Río Grande would improve redundancy within representative units, but other factors such as geographic proximity to the reintroduction site and availability of source boas also factor into the decision of where to source reintroductions. The Pessimistic scenario does not include any new reintroduced populations.

Summary

Conservation of existing populations of Virgin Islands boas and their habitat on developed islands, via population augmentation and habitat restoration (in occupied areas and to establish migration corridors), is important to contribute to resiliency and redundancy within representative areas for the species. The future condition of the Virgin Islands boa was assessed under three scenarios 30 years into the future. Under the Status Quo scenario, development continues to impact the populations on developed islands, no new habitat is protected, and one new reintroduction takes place. Two moderately high or high-resiliency populations are predicted to remain after 30 years (Cayo Diablo and a new reintroduced population), while USVI Cay remains in moderate resiliency, and the remaining four populations are predicted to have low resiliency or potentially be extirpated.

Under the Conservation scenario, some habitat on the three developed islands is protected for conservation/restoration, reintroductions occur at a rate of one per decade, and presence of exotic mammals are monitored and controlled (though likely not eradicated) via continuous eradication efforts and public outreach. Six high-resiliency populations are predicted to exist after 30 years. Under this scenario, three populations are expected to have moderately low or low resiliency, but are protected from complete extirpation by active conservation measures. Under the Pessimistic scenario, development continues to impact populations on developed islands, no reintroductions occur, and rats colonize/recolonize the islands where they are not currently present. No highly resilient populations are predicted to remain after 30 years, and all six current populations are at risk of extirpation.

Redundancy increases under the Status Quo and Conservation scenarios; however, under the Pessimistic scenario, no high-resiliency populations remain. Representation remains the same four units under the Status Quo scenario. Under the Conservation scenario, redundancy

may improve within representative units with the addition of two more reintroduced populations, depending on where those populations are sourced. Based on our analysis, we consider the Status Quo scenario to be the most likely scenario, and therefore expect the Virgin Islands boa will have three resilient populations at our 30-year timeframe, with continued redundancy and representation.

We also assessed the risk from SLR and hurricanes at 30 years into the future. In 30 years, SLR alone is unlikely to significantly impact Virgin Islands boa populations, with approximately 4–5 percent of land predicted to be inundated (Service 2018, p. 43). Habitat on low-lying cays (Cayo Diablo, Cayo Ratones, and USVI Cay) has proven to be resilient to hurricanes in the past, and likely will remain so with 0.30 meters (1 foot) of SLR expected over the next 30 years, although the exact impacts of any particular future storm are impossible to predict. Overall, USVI Cay is most at risk from SLR and storm impacts, while there is a moderate risk of SLR impacts to Virgin Islands boas and habitat on Cayo Diablo and Cayo Ratones, and low risk at Culebra, Río Grande, and St. Thomas.

We note that, by using the SSA framework to guide our analysis of the scientific information documented in the SSA report, we have not only analyzed individual effects on the species, but we have also analyzed their potential cumulative effects. We incorporate the cumulative effects into our SSA analysis when we characterize the current and future condition of the species. Our assessment of the current and future conditions encompasses and incorporates the threats individually and cumulatively. Our current and future condition assessment is iterative because it accumulates and evaluates the effects of all the factors that may be influencing the species, including threats and conservation efforts. Because the SSA framework considers not just the presence of the factors, but to what degree they collectively influence risk

to the entire species, our assessment integrates the cumulative effects of the factors and replaces a standalone cumulative effects analysis.

Recovery and Recovery Plan Implementation

Section 4(f) of the Act directs us to develop and implement recovery plans for the conservation and survival of endangered and threatened species unless we determine that such a plan will not promote the conservation of the species. Recovery plans are not regulatory documents and are instead intended to establish goals for long-term conservation of a listed species; define criteria that are designed to indicate when the threats facing a species have been removed or reduced to such an extent that the species may no longer need the protections of the Act; and provide guidance to our Federal, State, and other governmental and nongovernmental partners on methods to minimize threats to listed species.

There are many paths to accomplishing recovery of a species, and recovery may be achieved without all of the criteria in a recovery plan being fully met. For example, one or more criteria may be exceeded while other criteria may not yet be accomplished. In that instance, we may determine that the threats are minimized sufficiently and the species is robust enough to delist. In other cases, recovery opportunities may be discovered that were not known when the recovery plan was finalized. These opportunities may be used instead of methods identified in the recovery plan. Likewise, information on the species may be learned that was not known at the time the recovery plan was finalized. The new information may change the extent to which existing criteria are appropriate for recognizing recovery of the species. Recovery of a species is a dynamic process requiring adaptive management that may, or may not, follow all of the guidance provided in a recovery plan.

The Virgin Islands Tree Boa Recovery Plan, issued by the Service on March 27, 1986, did not contain measurable criteria. An amendment to the recovery plan was issued in September 2019 to include quantitative delisting criteria. The amended recovery plan suggests that recovery be defined in the following terms:

- *Delisting Criterion 1. Existing two (2) Virgin Islands boa populations with the highest resiliency (Cayo Diablo and USVI Cay) exhibit a stable or increasing trend, evidenced by natural recruitment and multiple age classes.* This criterion has been partially met. Ensuring the conservation of resilient populations is important for the recovery of the Virgin Islands boa as it will help those populations to further withstand catastrophic and stochastic events. The populations of the Virgin Islands boa at Cayo Diablo and USVI Cay are considered potentially declining (Tolson 2004, p. 11; Tolson et al. 2008, p. 68), and currently have moderately high and moderate resiliency, respectively (Service 2018, pp. 23, 28). Both Cayo Diablo and USVI cay are free of exotic predators/competitors and are protected as part of natural reserves. Habitat conditions are recovering following hurricanes, and Virgin Islands boas continue to persist, with upwards of 20 boas estimated on Cayo Diablo, and boas appear to be at carrying capacity on USVI Cay (Service 2018, pp. 23, 28). In addition, these resilient populations may serve as sources to establish the new populations outlined in Criterion 2, if maintained at their current level. Virgin Islands boas have already been collected from the USVI Cay population to establish a captive-breeding program in order to implement Criterion 2.

Five islands (Culebra, Río Grande (Puerto Rico), St. Thomas, Cayo Ratones, and Tortola) currently have Virgin Islands boas present, although population numbers and age class structures are unknown. Cayo Ratones had a thriving population, with 41 introduced boas in 1993–1995 having high survival and wild reproduction and were able to increase numbers to nearly 500 boas

by 2005 (Tolson et al. 2008, p. 68; Service 2018, p. 24). However, recent surveys in 2018 did not detect any boas, but did uncover a robust rat population (Island Conservation 2018, entire; Service 2018, p. 24). Because Virgin Islands boas are hard to find and habitat conditions remain in good condition post hurricanes, there is not enough evidence to indicate boa extirpation, although the reestablishment of rats is likely causing decline in this population. For Culebra, surveys in 2018 found no boas (Island Conservation 2018, p. 20); however, two individuals were documented in February 2019 within the Culebra National Wildlife Refuge (Puente-Rolón and Vega-Castillo 2019, p. 18). On October 2019, another individual was confirmed in an area outside of the Refuge (Román 2019, pers. comm.). The Puerto Rican Río Grande population has consistent but very low encounter rates for Virgin Islands boas, with three observed during recent 2018 surveys. These two populations were determined to have low (Río Grande) and moderately low (Culebra) resiliency. Similarly, the species has been sighted on St. Thomas (Platenberg and Harvey 2010, entire), and earlier estimates assessed the population to be about 400 individuals (Tolson 1991, p. 11). Despite lack of recent surveys on St. Thomas (primarily due to inaccessibility of habitat), opportunistic reports indicate approximately 10 Virgin Islands boa observations per year since 2000 (Service 2018, p. 27). The SSA classifies this population as having low resiliency. Virgin Islands boas are known to occur on Tortola (and likely several other British Virgin islands); however, no data are available about the size or status of those populations (Service 2018, p. 29).

- *Delisting Criterion 2. Establish three (3) additional populations that show a stable or increasing trend, evidenced by natural recruitment and multiple age classes*. This criterion has not been met. Increasing the number of resilient populations will improve the species' viability. In order to expand the species' distribution, these new populations will be established

on protected suitable habitat where threats from invasive mammals are not present and SLR will have minimal impact on the habitat. In addition, increasing the number of populations and broadening the species' distribution will enhance their ability to withstand catastrophic and stochastic events. For this species, it is believed that three additional populations exhibiting these traits is necessary to ensure sufficient redundancy such that the species will no longer require protection under the Act.

- *Delisting Criterion 3. Threats are reduced or eliminated to the degree that the species is viable for the foreseeable future.* This criterion has been partially met. The primary threats to Virgin Islands boa are development, predation/competition from exotic mammals, climate change, and persecution from the public. Virgin Islands boa populations have coexisted with urban development on Culebra, Río Grande, St. Thomas, and several British Virgin islands, although impacts from the development appear to cause a decline in these populations. Consequences of human development on the boa and its habitat include habitat loss and fragmentation due to deforestation, mortality from vehicular strikes, and an increase in predators/competitors, such as cats and rats. Three islands (Cayo Diablo, Cayo Ratones, and USVI Cay) are protected from development impacts. The threat of predation/competition by exotic mammals can be reduced/eliminated, but requires continual monitoring and eradication efforts. In 1985, a successful rat control program was started, and Cayo Ratones and USVI Cay were identified as potentially suitable for the reintroduction of the species. At one time, rats had been eliminated on Cayo Ratones, but they have since returned and are in robust numbers. Rats on USVI Cay have been eliminated, and Virgin Islands boas are established there. In areas where urban development is prevalent, it is unlikely that feral cats and rats will be fully eradicated. Storm surge and SLR are the effects of climate change that are projected to impact

Virgin Islands boa populations; however, the species has thus far proven to be resilient to severe storms (and associated storm surge) and SLR is not expected to significantly impact the species in the foreseeable future (see **Future Conditions**, above). Finally, intentional killing of Virgin Islands boas, whether due to fear of snakes or confusion with other snakes, has been identified as a threat; however, the extent of the effect of persecution on Virgin Islands boa populations is unknown.

Summary

The amended Virgin Islands boa recovery plan (Service 2019) contains three recovery criteria for delisting the species: Two Virgin Islands boa populations exhibit a stable or increasing trend, evidenced by natural recruitment and multiple age classes; three additional populations show a stable or increasing trend, evidenced by natural recruitment and multiple age classes; and threats are reduced or eliminated to the degree that the species is viable for the foreseeable future. Based on the information gathered and analyzed, two of these criteria have been partially met.

Determination of Virgin Islands Boa Status

Section 4 of the Act (16 U.S.C. 1533), and its implementing regulations at 50 CFR part 424, set forth the procedures for determining whether a species meets the definition of endangered species or threatened species. The Act defines an "endangered species" as a species "in danger of extinction throughout all or a significant portion of its range," and "threatened species" as a species "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The Act requires that we determine whether a species meets the definition of "endangered species" or "threatened species" because of any of the following factors: (A) The present or threatened destruction, modification, or

curtailment of its habitat or range; (B) Overutilization for commercial, recreational, scientific, or educational purposes; (C) Disease or predation; (D) The inadequacy of existing regulatory mechanisms; or (E) Other natural or manmade factors affecting its continued existence.

Status Throughout All of Its Range

After evaluating threats to the species and assessing the cumulative effects of the threats under the section 4(a)(1) factors, we find that, while the present or threatened destruction, modification, or curtailment of its habitat (Factor A) remains a threat for at least three of the populations, three of the six populations fully occur in protected areas, and we expect the species' population resiliency to ameliorate the threat in the future. The Virgin Islands boa's habitat is found on both private and publicly owned lands. Past, current and expanding urban development will continue to impact the Virgin Islands boa on the main islands (i.e., St. Thomas, Río Grande (Puerto Rico), and Culebra), which are under development pressure related to urban expansion and tourism; however, not all areas of the species' range occur near population centers. Half of the currently known populations are found on islands and small islets that are managed for conservation by the territorial governments of Puerto Rico and USVI, and the Culebra Island population occurs both within private and protected areas (i.e., Culebra National Wildlife Refuge).

Predation by exotic mammals, namely cats and rats, remains a threat to the Virgin Islands boa (Factor C). While there is no evidence of rats preying directly on the Virgin Islands boa, Virgin Islands boas are generally not present on islands with high densities of rats. This is likely due to competition for prey rather than predation. Reintroductions of Virgin Islands boas have been successful on islands where rat populations have been exterminated. Feral cats are known to prey on boas and are an ongoing threat to the species.

The fear of snakes, as well as superstitious beliefs and even confusion with other snakes, may contribute to the intentional killing of Virgin Islands boas (Factor E), although there has not yet been a systematic study done to determine if these individual deaths are having a species-wide effect.

Due to the limited distribution of Virgin Islands boas, climate change and SLR (Factor E) may also have an impact. Low-lying islands and parts of larger islands, where Virgin Islands boa populations are supported, are vulnerable to SLR and storm surge. The species has persisted despite major hurricane events, although there may be impacts to habitat (*e.g.,* die-off of vegetation) due to storm surge.

The Virgin Islands boa has demonstrated some ability to adapt to changing environmental conditions over time (representation) from both anthropogenic threats (*e.g.,* habitat disturbance due to development) and natural disturbances (*e.g.,* predation and hurricanes). Since the species was listed as an endangered species in 1970, it has demonstrated resiliency despite threats. Since the writing of the recovery plan (Service 1986, entire), two new populations have been reintroduced (Cayo Ratones and USVI Cay) and two previously unknown populations have been discovered (Culebra and Río Grande), although the continued persistence of the Cayo Ratones population is uncertain. There are currently at least six populations (not including those potentially on the BVI) with varying levels of resiliency; one population has moderately high resiliency, one has moderate resiliency, one has moderately low resiliency, and three have low resiliency. Based on the biology of the species and the documented responses to the development and reintroductions since listing, we expect the species to respond the same way in the foreseeable future.

Our implementing regulations at 50 CFR 424.11(d) set forth a framework within which we evaluate the foreseeable future on a case-by-case basis. The term foreseeable future extends only so far into the future as the Services can reasonably determine that both the future threats and the species' responses to those threats are likely. In other words, the foreseeable future is the period of time in which we can make reliable predictions. "Reliable" does not mean "certain"; it means sufficient to provide a reasonable degree of confidence in the prediction. Thus, a prediction is reliable if it is reasonable to depend on it when making decisions.

It is not always possible or necessary to define foreseeable future as a particular number of years. Analysis of the foreseeable future uses the best scientific and commercial data available and should consider the timeframes applicable to the relevant threats and to the species' likely responses to those threats in view of its life-history characteristics. Data that are typically relevant to assessing the species' biological response include species-specific factors such as lifespan, reproductive rates or productivity, certain behaviors, and other demographic factors.

The foreseeable future described here uses the best available data and considers the species' life-history characteristics, threat projection timeframes, and environmental variability, which may affect the reliability of projections. We also considered the timeframes applicable to the relevant threats and to the species' likely responses to those threats in view of its life-history characteristics. We determined the foreseeable future to be 30 years from present. As discussed above, the SSA's future scenarios considered impacts from development, habitat restoration and protection, reintroductions of the Virgin Islands boa, and SLR. Based on the modeling and scenarios evaluated for Virgin Islands boa, we considered our ability to make reliable predictions in the future and the uncertainty with regard to how and to what degree the species would respond to factors within this timeframe. In addition, the timing and response of habitat to

restoration efforts (presumably multiple efforts needed, and spaced out over time as funding and resources permit) and the species' response to those improved habitat conditions, as well as the lifespan of the species (which can exceed 20 years in captivity) also informed our foreseeable future timeframe.

Taking into account the impacts of the factors based on the Status Quo scenario, and because the Virgin Islands boa contains three relatively resilient populations now (i.e., having moderately high to moderately low resiliency), and two of those populations are predicted to maintain their moderate to moderately high resiliency in the future, especially in populations where exotic mammals are not present, we expect the species to maintain populations on two of the six islands within the foreseeable future. However, continuation of the current population trends for these two populations into the future is dependent on management (*e.g.,* habitat conservation/preservation and predator control/eradication). Under the Status Quo scenario, the three populations on developed islands are predicted to possibly become extirpated by 2048. Under the Conservation Scenario, up to six populations are predicted to become highly resilient within the foreseeable future. While threat intensity and management needs vary somewhat across the range of the species (*e.g.,* urban population areas versus non-populated conserved areas), Virgin Islands boa populations on islands throughout the range of the species continue to be reliant on active conservation management and require adequate implementation of regulatory mechanisms, and all remain vulnerable to threats that could cause substantial population declines in the foreseeable future (*e.g.,* feral cat predation).

Despite the existing regulatory mechanisms and conservation efforts, the factors identified above continue to affect the Virgin Islands boa. However, the species has persisted with varying degrees of resiliency since it was listed in 1970. Once known from three locations,

now known from at least six locations, the species was successfully introduced to two new locations (one possibly extirpated by uncontrolled exotic mammals) and discovered at two new locations, and could be at additional locations in the unsurveyed BVI and other areas in St. Thomas; thus, the known distribution has expanded since listing. Thus, after assessing the best available information, we determine that the Virgin Islands boa is not currently in danger of extinction, but is likely to become in danger of extinction within the foreseeable future, throughout all of its range.

Status Throughout a Significant Portion of its Range

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so within the foreseeable future throughout all or a significant portion of its range. The court in *Center for Biological Diversity v. Everson*, 2020 WL 437289 (D.D.C. Jan. 28, 2020) (*Center for Biological Diversity*), vacated the aspect of the 2014 Significant Portion of its Range Policy that provided that the Services do not undertake an analysis of significant portions of a species' range if the species warrants listing as threatened throughout all of its range. Therefore, we proceed to evaluating whether the species is endangered in a significant portion of its range—that is, whether there is any portion of the species' range for which both (1) the portion is significant; and, (2) the species is in danger of extinction in that portion. Depending on the case, it might be more efficient for us to address the "significance" question or the "status" question first. We can choose to address either question first. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the other question for that portion of the species' range.

Following the court's holding in *Center for Biological Diversity*, we now consider whether there are any significant portions of the species' range where the species is in danger of extinction now (i.e., endangered). In undertaking this analysis for Virgin Islands boa, we choose to address the status question first—we consider information pertaining to the geographic distribution of both the species and the threats that the species faces to identify any portions of the range where the species is endangered.

For Virgin Islands boa, we considered whether the threats are geographically concentrated in any portion of the species' range at a biologically meaningful scale. We examined the following threats: habitat loss and degradation from development, introduced predators, SLR and a changing climate, and public attitudes towards snakes, including cumulative effects. For detailed descriptions of each threat, see *Summary of Biological Status and Threats*, above.

Impacts from habitat loss and degradation are prevalent throughout the range of the Virgin Islands boa. The boas occur on both privately and publicly owned land. Habitat loss and fragmentation from deforestation happens with the development of privately owned land, and even occurs around protected areas. Habitat loss also happens from SLR. Loss of habitat due to SLR and storm surge impacts is similar to loss of habitat due to development where the loss of low-lying forest habitat could result in decreased habitat availability for the Virgin Islands boas and their prey. All known islands and cays that are occupied by Virgin Islands boas are threatened with habitat loss and fragmentation.

Similarly, the threat of introduced predators is of concern range-wide for the Virgin Islands boa. Feral cats are known to prey upon boas, and rats may predate on neonate boas or compete with boas for prey. Cats and rats are easily introduced to islands, usually via boat.

Efforts to eliminate exotic mammalian predators has been successful on some of the smaller cays, but requires continual removal and monitoring on the larger developed islands.

Climate change is expected to influence Virgin Islands boa persistence throughout its range into the future. Species that are limited in distribution, such as the Virgin Islands boa, are susceptible to the impacts of climate change. Temperatures throughout the Caribbean are expected to rise, precipitation is likely to decrease (resulting in drought), and tropical storms may occur less frequently but with more force. Every island and cay within the range of the Virgin Island boa is susceptible to these impacts from a changing climate.

The intentional killing of Virgin Islands boas is a threat to the species regardless of where it occurs. While those boas that live in proximity to developed areas are more susceptible to intentional killings, public fear towards snakes is a threat that can impact the boas throughout their range.

Low population numbers can be considered a threat such that the other threats acting on the species can result in a concentration of threats to extremely small populations. Data presented in the SSA indicate that current population trend estimates for Virgin Island boas in Puerto Rico and USVI are uncertain, indicating that they are either declining, potentially declining, considered rare, or unknown, but most populations are small or considered rare. Rarity does not necessarily equate to dangerously small population sizes, and because the survey methodologies and reporting has varied from population to population and over time, population size and trend estimates were not exclusively relied on to determine resiliency. Despite the rarity of Virgin Island boas on most islands, the species has demonstrated resiliency for decades, and is predicted to continue to maintain resiliency, despite threats. Therefore small population numbers across the range of the species are not considered to contribute to a concentration of threats.

We found no concentration of threats in any portion of the Virgin Islands boa's range at a biologically meaningful scale. Thus, there are no portions of the species' range where the species has a different status from its rangewide status. Therefore, no portion of the species' range provides a basis for determining that the species is in danger of extinction in a significant portion of its range, and we determine that the species is likely to become in danger of extinction within the foreseeable future throughout all of its range. This is consistent with the courts' holdings in *Desert Survivors* v. *Department of the Interior*, No. 16-cv-01165-JCS, 2018 WL 4053447 (N.D. Cal. Aug. 24, 2018), and *Center for Biological Diversity v. Jewell*, 248 F. Supp. 3d , 946, 959 (D. Ariz. 2017).

Determination of Status

Our review of the best available scientific and commercial information indicates that the Virgin Islands boa meets the definition of a threatened species. Therefore, we propose to reclassify the Virgin Islands boa as a threatened species in accordance with sections 3(20) and 4(a)(1) of the Act.

II. Proposed Rule Issued Under Section 4(d) of the Act

Background

Section 4(d) of the Act contains two sentences. The first sentence states that the "Secretary shall issue such regulations as he deems necessary and advisable to provide for the conservation" of species listed as threatened. The U.S. Supreme Court has noted that statutory language like "necessary and advisable" demonstrates a large degree of deference to the agency (see *Webster* v. *Doe*, 486 U.S. 592 (1988)). Conservation is defined in the Act to mean "the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to [the Act] are no longer

necessary." Additionally, the second sentence of section 4(d) of the Act states that the Secretary "may by regulation prohibit with respect to any threatened species any act prohibited under section 9(a)(1), in the case of fish or wildlife, or section 9(a)(2), in the case of plants." Thus, the combination of the two sentences of section 4(d) provides the Secretary with wide latitude of discretion to select and promulgate appropriate regulations tailored to the specific conservation needs of the threatened species. The second sentence grants particularly broad discretion to the Service when adopting the prohibitions under section 9.

The courts have recognized the extent of the Secretary's discretion under this standard to develop rules that are appropriate for the conservation of a species. For example, courts have upheld rules developed under section 4(d) as a valid exercise of agency authority where they prohibited take of threatened wildlife, or include a limited taking prohibition (see *Alsea Valley Alliance* v. *Lautenbacher*, 2007 U.S. Dist. Lexis 60203 (D. Or. 2007); *Washington Environmental Council* v. *National Marine Fisheries Service*, 2002 U.S. Dist. Lexis 5432 (W.D. Wash. 2002)). Courts have also upheld 4(d) rules that do not address all of the threats a species faces (see *State of Louisiana* v. *Verity*, 853 F.2d 322 (5th Cir. 1988)). As noted in the legislative history when the Act was initially enacted, "once an animal is on the threatened list, the Secretary has an almost infinite number of options available to him with regard to the permitted activities for those species. He may, for example, permit taking, but not importation of such species, or he may choose to forbid both taking and importation but allow the transportation of such species" (H.R. Rep. No. 412, 93rd Cong., 1st Sess. 1973).

Exercising our authority under section 4(d), we have developed a species-specific proposed rule that is designed to address the Virgin Islands boa's specific threats and conservation needs. Although the statute does not require the Service to make a "necessary and

advisable" finding with respect to the adoption of specific prohibitions under section 9, we find that this rule taken as a whole satisfies the requirement in section 4(d) of the Act to issue regulations deemed necessary and advisable to provide for the conservation of the Virgin Islands boa. As discussed above under **Summary of Biological Status and Threats**, the Service has concluded that the Virgin Islands boa is likely to become in danger of extinction within the foreseeable future primarily due to development-associated impacts (i.e., habitat fragmentation and loss, vehicular strikes), predation/competition by exotic species, climate change, and persecution by the public. In addition, the species is management reliant in that it depends on maintaining current levels of management and establishing new populations into suitable habitat. Therefore, the provisions of this proposed 4(d) rule would promote conservation of the Virgin Islands boa by encouraging species restoration efforts. The provisions of this proposed rule are one of many tools that the Service would use to promote the conservation of the Virgin Islands boa. The proposed 4(d) rule would apply only if and when the Service makes final the reclassification of the Virgin Islands boa as a threatened species.

Provisions of the Proposed 4(d) Rule

The proposed 4(d) rule would provide for the conservation of the Virgin Islands boa by prohibiting the following activities, except as otherwise authorized or permitted: import or export; take; possession and other acts with unlawfully taken specimens; delivery, receipt, transport, or shipment in interstate or foreign commerce in the course of commercial activity; or sale or offering for sale in interstate or foreign commerce. We also propose several exceptions to these prohibitions, which along with the prohibitions are set forth under **Proposed Regulation Promulgation**, below.

Under the Act, "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Some of these provisions have been further defined in regulation at 50 CFR 17.3. Take can result knowingly or otherwise, by direct and indirect impacts, intentionally or incidentally. Regulating incidental and intentional take would help preserve the species' remaining populations, enable beneficial management actions to occur, and decrease synergistic, negative effects from other stressors.

Protecting the Virgin Islands boa from direct and indirect forms of take, such as physical injury or killing, whether incidental or intentional, will help preserve and recover the remaining populations of the species. Therefore, we propose to prohibit intentional and incidental take of Virgin Islands boa, including, but not limited to, capturing, handling, trapping, collecting, destruction and modification of its habitat, or any other activities that would result in take of the species.

As discussed above under **Summary of Biological Status and Threats**, a range of activities have the potential to impact the species, including development, intentional killing of boas by private citizens, and introduction of exotic predators/competitors (e.g., cats, rats). Regulating these activities will help preserve the remaining populations and protect individual boas.

Protecting the Virgin Islands boa from incidental take, such as harm that results from habitat degradation, will likewise help preserve the species' populations and also decrease negative effects from other stressors impeding recovery of the species. The species' continuance may be dependent upon active management occurring on the islands and cays, especially as it concerns exotic predator control and human development. Most offshore islands and cays where the Virgin Islands boa is found are protected by municipal, territorial, and Federal agencies.

However, existing land protections provided by those agencies are not comprehensive for the Virgin Islands boa and are often not enforced.

We determined that one of the primary threats to the Virgin Islands boa is the presence of exotic mammals, which, when present in high densities, is indicative of a lack of boa populations. Therefore, any introduction of exotic species, such as cats or rats, that compete with, prey upon, or destroy the habitat of the Virgin Islands boa would further impact the species and its habitat and therefore will also be prohibited by the proposed 4(d) rule.

Maintaining and expanding existing populations, and creating new populations, is also vital to the conservation of the Virgin Islands boa. Therefore, the proposed 4(d) rule would provide for the conservation of the species by excepting from the take prohibitions conservation efforts by Federal, Commonwealth, Territory, and municipal wildlife agencies to benefit the Virgin Islands boa, including control and eradication of exotic mammals, habitat restoration, and collection of broodstock, tissue collection for genetic analysis, captive propagation, and reintroduction into currently occupied and unoccupied areas within the historical range of the species. Efforts by these wildlife agency entities to monitor and survey Virgin Islands boa populations and habitat that require handling, temporary holding, pit tagging, tissue sampling, and release would also be excepted from the take prohibitions under this proposed 4(d) rule.

The fear of snakes, as well as superstitious beliefs, may contribute to the intentional killing of boas. Although we cannot address fear or beliefs in a 4(d) rule, we can except from the prohibitions take associated with removing boas from houses and other structures to provide alternatives to killing individual boas. Therefore, the proposed 4(d) rule would except from the prohibitions take associated with nonlethal removal of Virgin Islands boas from human structures, and returning them to natural habitat.

Even for activities prohibited by the 4(d) rule, including those described above, we may issue permits to carry out those activities involving threatened wildlife under certain circumstances. Regulations governing permits are codified at 50 CFR 17.32. With regard to threatened wildlife, a permit may be issued for the following purposes: for scientific purposes, to enhance propagation or survival, for economic hardship, for zoological exhibition, for educational purposes, for incidental taking, or for special purposes consistent with the purposes of the Act. There are also certain statutory exemptions from the prohibitions, which are found in sections 9 and 10 of the Act.

The Service recognizes the special and unique relationship with our State, Commonwealth, and Territory natural resource agency partners in contributing to conservation of listed species. State, Commonwealth, and Territory agencies often possess scientific data and valuable expertise on the status and distribution of endangered, threatened, and candidate species of wildlife and plants. These agencies, because of their authorities and their close working relationships with local governments and landowners, are in a unique position to assist the Service in implementing all aspects of the Act. In this regard, section 6 of the Act provides that the Service shall cooperate to the maximum extent practicable with the States, Commonwealths, and Territories in carrying out programs authorized by the Act. Therefore, any qualified employee or agent of a Commonwealth or Territory conservation agency that is a party to a cooperative agreement with the Service in accordance with section 6(c) of the Act, who is designated by his or her agency for such purposes, would be able to conduct activities designed to conserve the Virgin Islands boa that may result in otherwise prohibited take without additional authorization.

Nothing in this proposed 4(d) rule would change in any way the recovery planning

provisions of section 4(f) of the Act, the consultation requirements under section 7 of the Act, or the ability of the Service to enter into partnerships for the management and protection of the Virgin Islands boa. However, interagency cooperation may be further streamlined through planned programmatic consultations for the species between Federal agencies and the Service. We ask the public, particularly Commonwealth and Territorial agencies and other interested stakeholders that may be affected by the proposed 4(d) rule, to provide comments and suggestions regarding additional guidance and methods that the Service could provide or use, respectively, to streamline the implementation of this proposed 4(d) rule (see **Information Requested**, above).

Effects of this Proposed Rule

This proposal, if made final, would revise 50 CFR 17.11 to reclassify the Virgin Islands boa from endangered to threatened on the List of Endangered and Threatened Wildlife. Additionally, if the proposed 4(d) rule is adopted in a final rule, the Service will detail prohibitions set forth at 50 CFR 17.21 and 17.32, except for incidental take associated with conservation efforts by Federal, Commonwealth, Territory, or municipal wildlife agencies; nonlethal removal from human structures; and monitoring and survey efforts of Virgin Islands boa. In addition, we will revise the List of Endangered and Threatened Wildlife to change the species' scientific name to *Chilabothrus granti*.

Required Determinations

Clarity of the Proposed Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(a) Be logically organized;

(b) Use the active voice to address readers directly;

(c) Use clear language rather than jargon;

(d) Be divided into short sections and sentences; and

(e) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help us revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

National Environmental Policy Act (42 U.S.C. 4321 et seq.)

It is our position that, outside the jurisdiction of the U.S. Court of Appeals for the Tenth Circuit, we do not need to prepare environmental analyses pursuant to the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq.*) in connection with designating critical habitat under the Act. We published a notice outlining our reasons for this determination in the *Federal Register* on October 25, 1983 (48 FR 49244). This position was upheld by the U.S. Court of Appeals for the Ninth Circuit (*Douglas County* v. *Babbitt*, 48 F.3d 1495 (9th Cir. 1995), cert. denied 516 U.S. 1042 (1996)).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments" (59 FR 22951), Executive Order 13175, and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. There are no tribal lands associated with this proposed rule.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* under Docket No. FWS–R4–ES–2019–0069 and upon request from the Field Supervisor, Caribbean Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**, above).

Authors

The primary authors of this proposed rule are staff members of the Service's Species Assessment Team and the Caribbean Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

AUTHORITY: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

§ 17.11 Endangered and threatened wildlife.

2. Amend § 17.11 in paragraph (h) by revising the entry for "Boa, Virgin Islands tree" under REPTILES in the List of Endangered and Threatened Wildlife to read as follows:

Common name	Scientific name	Where listed	Status	Listing citations and applicable rules
* * * * * * *				
REPTILES				
* * * * * * *				
Boa, Virgin Islands tree	*Chilabothrus granti*	Wherever found	T	35 FR 16047, 10/13/1970; 44 FR 70677, 12/7/1979; [*Federal Register* citation of the final rule]. 50 CFR 17.42(j).[4d]
* * * * * * *				

3. Amend § 17.42 by adding paragraph (j) to read as set forth below:

§ 17.42 Special rules—reptiles.

* * * * *

(j) Virgin Islands tree boa (*Chilabothrus granti*)—(1) *Prohibitions*. The following prohibitions that apply to endangered wildlife also apply to Virgin Islands tree boa. Except as provided under paragraph (j)(2) of this section and §§ 17.4 and 17.5, it is unlawful for any person subject to the jurisdiction of the United States to commit, to attempt to commit, to solicit another to commit, or cause to be committed, any of the following activities in regard to this species:

(i) Import or export, as set forth at § 17.21(b);

(ii) Take, as set forth at § 17.21(c)(1);

(iii) Possession and other acts with unlawfully taken specimens, as set forth at § 17.21(d)(1);

(iv) Interstate or foreign commerce in the course of commercial activity, as set forth at § 17.21(e); and

(v) Sale or offer for sale, as set forth at § 17.21(f).

(vi) The intentional or incidental introduction of exotic species, such as cats or rats, that compete with, prey upon, or destroy the habitat of the Virgin Islands boa is also prohibited.

(2) *Exceptions from prohibitions*. In regard to this species, you may:

(i) Conduct activities as authorized by a permit under § 17.32.

(ii) Take, as set forth at § 17.21(c)(2) through (c)(4) for endangered wildlife.

(iii) Take, as set forth at § 17.31(b).

(iv) Possess and engage in other acts with unlawfully taken endangered wildlife, as set forth at § 17.21(d)(2).

(v) Incidental take of Virgin Islands tree boa resulting from:

(A) Conservation efforts by Federal, Commonwealth, Territory, or municipal wildlife agencies, including, but not limited to, control and eradication of exotic mammals and habitat restoration, and collection of broodstock, tissue collection for genetic analysis, captive propagation, and reintroduction into currently occupied or unoccupied areas within the historical range of the Virgin Islands tree boa.

(B) Nonlethal removal (and return to natural habitat) of Virgin Islands tree boa from human structures, defense of human life, and authorized capture and handling of Virgin Islands tree boas.

(C) Efforts to monitor and survey Virgin Islands tree boa populations and habitat that may include handling, temporary holding, pit tagging, tissue sampling, and release.

Aurelia Skipwith
Director,
U.S. Fish and Wildlife Service.

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