U.S. Fish and Wildlife Service

Draft Recovery Plan
for
Marron bacora (*Solanum conocarpum*)

Photo by: O. Monsegur-Rivera, USFWS

Prepared by:
Caribbean Ecological Services Field Office
Puerto Rico
For:

Southeast Region
U.S. Fish and Wildlife Service
Atlanta, Georgia
2025

PURPOSE AND DISCLAIMER

This document presents the U.S. Fish and Wildlife Service's (Service) plan for the conservation of marron bacora. The recovery plan is the second part of the Service's 3-part recovery planning framework and includes the statutorily required elements pursuant to section 4(f) of the Endangered Species Act (Act). This recovery plan is informed by the first part of the framework, a Species Status Assessment (SSA). The SSA report delivers foundational science for informing decisions related to the Act and includes an analysis of the best available scientific and commercial information regarding a species' life history, biology, and current and future conditions that characterizes the species' viability (i.e., ability to sustain populations in the wild over time) and extinction risk. We have also prepared a Recovery Implementation Strategy (RIS), the third part of the framework. The RIS is an easily updateable operational plan that is separate and complimentary to the recovery plan that details the on-the-ground recovery activities needed to complete the recovery actions contained in the recovery plan.
Recovery plans describe the envisioned recovered state for a listed species (when it should no longer meet the Act's definitions of a threatened species or endangered species) and include a recovery strategy, recovery criteria, recovery actions, and the estimates of time and cost needed to achieve it. Plans are published by the Service and are often prepared with the assistance of recovery teams, contractors, State agencies, and others. Recovery plans do not necessarily represent the views, official positions, or approval of any individuals or agencies involved in plan formulation, other than the Service. They represent the official position of the Service only after they have been signed by the Regional Director as approved. Recovery plans are guiding and planning documents only; identification of an action to be implemented by any public or private party does not create a legal obligation beyond existing legal requirements. Nothing in this plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in any one fiscal year in excess of appropriations made by Congress for that fiscal year in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and completion of recovery actions.

ACKNOWLEDGEMENTS

The recovery plan was prepared by Omar A. Monsegur-Rivera of the U.S. Fish and Wildlife Service, Caribbean Ecological Service Field Office, Puerto Rico.

Approved: _____
Regional Director, U.S. Fish and Wildlife Service

Date: _____

Suggested literature citation:

U.S. Fish and Wildlife Service. 2025. Draft Recovery Plan for the Marron bacora *(Solanum conocarpum)*. Southeast Regional Office, Atlanta, Georgia. 11 pp.

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Draft Recovery Plan for Marron bacora (*Solanum conocarpum*)

This recovery plan describes criteria for determining when the marron bacora should be considered for delisting, lists site-specific actions that will be necessary to meet those criteria, and estimates the time and cost to achieve recovery. Additionally, a summary of information on the species' biology and status are included, along with a brief discussion of factors limiting its populations. A detailed discussion of these and other topics pertinent to the recovery of marron bacora can be found in the Species Status Assessment. Detailed on the ground activities implementing recovery actions can be found in the Recovery Implementation Strategy. These supplemental documents are available at https://ecos.fws.gov/ecp/species/2227. The Recovery Implementation Strategy (RIS) and Species Status Assessment (SSA) (Service, 2025) are finalized separately from the Recovery Plan and will be updated on a routine basis. The marron bacora was federally listed as an endangered species under the Act on July 18, 2022 (87 FR 36225).

CURRENT SPECIES' STATUS:

Marron bacora (*Solanum conocarpum*) is a dry-forest perennial shrub of the Solanaceae (nightshade) family that can reach a height of approximately 3 meters (m) (or 9.8 feet (ft)) (Service 2025). The species was first collected on Coral Bay at St. John in USVI by L.C. Richard in 1787 and described later by M. F. Dunal in 1813 (Acevedo-Rodríguez 1996, Knapp 2009). Currently, *S. conocarpum* is recognized as a valid, distinct species (https://www.itis.gov. Accessed on December 17, 2024). The common name, marron bacora, was given by Dunal in the original species description (Lamarck 1817), and it is adopted by the Service as an accepted common name (Service 2020).

Marron bacora is recognized as a Caribbean endemic species with occurrence only in the U.S. Virgin Islands (USVI) and the British Virgin Islands (BVI) (Service 2025). Since its discovery in Coral Bay, marron bacora has since been found in several locations on St. John and in another location on Tortola, British Virgin Islands (BVI) (87 FR 36226). In St. John, marron bacora occurs at: Nany Point, Friis Bay, John Folly, Brown Bay Trail, Reef Bay Trail, Base Hill, Brown Bay Ridge, Sabbat Point, Reef Bay Valley and Europa Ridge. In Tortola, marron bacora has been found only in Sabbath Hill. By 2020, The estimated numbers of individuals of marron bacora throughout its natural range was approximately 324 (230 adults, 54 juveniles and 40 seedlings), distributed in 8 populations: 7 populations in St. John and one population in Tortola (87 FR 36225). The population at Nanny Point harbors 201 of the 324 known individuals, representing about 62 percent of the estimated number for the species (Service 2020).

The genetic diversity of marron bacora has remained relatively high at the species level (species heterozygosity), and the variability falls within the natural range of variation that is common in wild plants (Stanford et al., 2013). The highest genetic diversity of marron bacora is found within the Nanny Point population located within the U.S. National Park Service-Virgin Islands National Park (NPS-VINP) (Stanford et al., 2013). However, given the extremely low known number of individuals of marron bacora in the other seven (7) populations and the lack of connectivity among them, it is highly likely that the genetic variability at population level is very low. Currently, no information about genetic diversity or adaptive capacity of the species to

overcome stochastic events is available. However, it is well known that gene flow influences genetic diversity by introducing new alleles into a population, and hence, increasing the gene pool size (Crandall et al. 2000; Honnay and Jacquemyn; Zackay 2007). We surmise that the species pollinators (i.e, carpenter bees (*Xylocopa mordax*), honeybees (*Apis mellifera*) and bananaquits (*Coereba flaveola*)) can promote crosspollination among closer individuals and nearby populations. However, it is unlikely that genetic exchange among the St. John populations and between St. John and Tortola populations occurs, due to the distance and landscape barriers (e.g. sea, livestock pastures, urban areas) between them. Based on the above, we consider the possible lack of genetic variation as a stressor to the species.
Marron bacora reproductive biology was first described to be a dioecious plant (i.e., separate male and female plants), and self-pollination was not expected (Anderson et al., 2015). New information based on field observation suggests that marron bacora poses the mechanism for self-pollination (Service 2025). Therefore, there is a chance that some isolated flowering individuals may be able to be self-pollinated. Since all marron bacora populations show little evidence of natural recruitment likely due to historical habitat destruction and modification, environmental stochasticity and ongoing predation by feral ungulates, the species is considered to have a low resiliency, redundancy, and representation (Service 2020).

The natural dispersal mechanism of marron bacora remains unknown, but fruit predation is suspected as the explanation of lack of natural recruitment in the wild (Service 2020). Although predators may also disperse the species, it is likely that the seeds have not adapted to passing through the gastrointestinal tracts of the exotic mammals currently occurring in the island of St. John (e.g., white-tailed deer, feral hogs, donkeys).

The 2020 marron bacora Species Status Assessment (SSA) ver. 1.1 evaluated the biological status of marron bacora, both currently and into the future (Service 2020). The 2025 marron bacora SSA ver. 1.2 updates information about the species' status and conditions to inform the three-part recovery planning framework, including the Recovery Plan (RP), and Recovery Implementation Strategy (RIS). Both SSAs summarize the available scientific information related to the biology and conservation status of the species and characterizes the species' viability by its resiliency, redundancy, and representation (i.e., 3R's). Marron bacora is known from 285 individuals distributed across four populations (three populations in St John, USVI and one in Tortola, BVI), each with low number of individuals ranging from 7 to 161 per population, all distributed in a narrow geographic area within a subtropical dry forest. Therefore, we believe the species has moderate representation and redundancy. However, because marron bacora has a small population size and is restricted to a narrow geographical area, its entire population is vulnerable to being affected simultaneously by stochastic natural and anthropogenic events such as hurricanes, wildfires, habitat removal, severe droughts, and genetic erosion (Service 2020, 87 FR 36225, Service 2025). Additionally, all known populations are most likely below the estimated minimum viable population level; thus, we believe the species' resilience is low.

Currently, marron bacora is protected by federal and local authorities and regulations. It was federally listed as an endangered species under the Endangered Species Act on July 18, 2022 (87 FR 36225). The Territory of the U.S. Virgin Islands also considers marron bacora as endangered under the Virgin Islands Indigenous and Endangered Species Act (V.I. Code, Title 12, Chapter 2). Additionally, the Territory has amended an existing regulation (Bill No. 18–0403) to provide

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for protection of endangered and threatened wildlife and plants by prohibiting the take, injury, or possession of indigenous plants.

Marron bacora was assigned a recovery priority number of 2c, which indicates the species faces a high degree of threat and a high recovery potential with conflict due to the threats of development projects. Recovery potential is considered high because the species has been consistently propagated both from seeds and cuttings, and plants have reached a reproductive size in a relative short time (1-2 years in nursery conditions). There is background information of the species' population genetics, and data on the factors precluding natural recruitment in the wild. Nevertheless, the recovery of marron bacora is, or may be, in conflict with development projects (i.e., rights-of way for utility infrastructure, housing projects, and hotels) or other forms of economic activity, hence the letter "c" in its recovery priority number. Despite most of the currently known individuals occurring on lands managed by NPS, the long-term modification of its habitat within protected and private lands may render marron bacora vulnerable to becoming extinct in the foreseeable future if known populations are not managed for conservation.

HABITAT REQUIREMENTS AND LIMITING FACTORS:

Marron bacora habitat is described as a dry, deciduous forest (Acevedo-Rodríguez, 1996; Heller et al., 2018), and the species has also been reported to occur on dry, poor soils (Ray and Stanford 2005). Furthermore, the species is noted to be more abundant in exposed topography, on sites disturbed by erosion (particularly in depositional zones at the toe of the slopes), in areas that have received moderate grazing, and around ridgelines as an understory component in diverse woodland communities (Carper and Ray, 2008).

By 1717, the forested landscape of St. John was divided into more than 100 estates managed for agriculture (i.e., sugarcane and cotton), resulting in significant deforestation. According to Acevedo-Rodríguez (pers. comm., 2002), the areas where surviving natural populations have been found (i.e., dense scrubland) may not represent optimum habitat.

Research by Ray and Stanford (2005) on the forest structure at the Reef Bay area shows a forest community invaded by numerous exotic woody and herbaceous plant species in an area subject to erosion. In the case of Europa Ridge, the area is dominated by black mampoo (*Guapira fragrans*), a fast-growing species, and the overall area is devoid of woody exotics, suggesting relative lack of perturbation (Ray and Stanford, 2005). The forest structure at Europa Ridge suggests this area was selectively logged for charcoal, but not subjected to intensive agriculture, likely due to the steep topography.

Currently, habitat descriptions are unavailable for the recently discovered population in the island of Tortola in BVI, but that habitat is widely used by feral mammals (e.g., goats) (Heller et. al., 2018).

Based on the above, marron bacora appears to occur naturally in vegetative communities with broadly varying suites of associated woody species and shows little fidelity to any suite of community associates (Ray and Stanford,2005). For example, none of the known populations of marron bacora are directly associated to remnant populations of other rare endemics (e.g.,

Eugenia earhartii and *Zanthoxylum thomasianum*) and it is thought that the species' habitat preference may involve some combination of abiotic factors (Ray and Stanford, 2005). Therefore, fidelity to a particular assemblage of community associations is not an indicator of marron bacora's habitat (Ray and Stanford, 2005), and the species appears to be adapted to open areas or naturally disturbed sites.

The stressors acting on the species as described in the SSA report include invasive species (plants and animals), predation, demographic and genetic consequences of small population size and density, human-induced fires, habitat loss/degradation, insect pests and pathogens, changes in phenology and breeding systems, recreation, and climate change and hurricanes (Service, 2022). The primary stressors affecting the species are impacts from nonnative and invasive species (including herbivory by feral ungulates) precluding natural recruitment. As mentioned above, the species is considered to show low resiliency, but moderate redundancy and representation.

RECOVERY STRATEGY:

The recovery of marron bacora will be achieved by implementing a variety of conservation strategies. The Service will work closely with partners (e.g. other Federal agencies, local government institutions, universities, Non-government Organizations (NGO's), and private sector, among others) with the goal of reducing the threats to the species, increase understanding on its biology and ecology, develop and implement *ex-situ* propagation programs, identify areas that are suitable habitat for establishing new populations, protect and enhance the currently occupied habitat, and educate the public about this species and the importance of its conservation. By augmenting the number of individuals at known marron bacora populations, the Service aims to increase the species' resiliency and redundancy. In addition, this recovery strategy aims to maintain species representation by protecting the currently known populations and by establishing new populations representing the currently known genetically unique populations, with emphasis on extremely small populations which may have alleles that are important for the long-term recovery of marron bacora. Also, research and management should be carried out to address questions on the species' population genetics by analyzing recently found populations on the island of Tortola, the species reproductive biology, seed dispersal, and the impacts from disease-predation, invasive species, and climate change. Furthermore, monitoring is necessary to assess population changes over time (long-term viability) and to measure the success of recovery actions.

RECOVERY CRITERIA:

Recovery criteria are statutorily required objective, measurable descriptions of a recovered state for marron bacora, as described in 4(f)(1)(b)(ii) of the Act. Recovery criteria describe the conditions of resiliency, redundancy, representation, and threat abatement that indicate when marron bacora may no longer meet the Act's definitions of an endangered species or threatened species. Recovery criteria present our best estimate of a species' recovered condition at the time of recovery plan development. Changes in available information, technologies, and our understanding of the species over time might mean that the recovered state envisioned by the recovery criteria differs from our assessment in a later status determination.

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The following recovery criteria for delisting, when met collectively, would indicate that marron bacora may no longer need the protections of the Act:
Recovery Criteria 1:

The genetic representation of marron bacora at seven (7) known populations in St. John (i.e., Nanny Point, Friis Bay, Johns Folly, Brown Bay Trail, Reef Bay Trail, Base Hill, and Brown Bay Ridge) and the one (1) in Tortola (Sabbat Hill) are protected and enhanced through habitat conservation practices that reduce threats identified in the species' Final Listing Rule (e.g., removal of exotic and invasive plant species, and removal/control exotic feral ungulates), and these populations are augmented to the point that they become self-sustained and remain viable into the future (Factors A and E; 87 FR 36225).

Recovery Criteria 2:

Establish Seven (7) or more new self-sustainable populations (representing each of the seven known natural populations of St. John) within suitable habitat in areas managed for conservation, and these populations show evidence of natural recruitment and multiple age classes over a timeframe of 10 -15years supporting a stable or increasing trend (Factor E; 87 FR 36225).

We define a viable marron bacora population as one that is large enough to exhibit and maintain a positive recruitment rate, without the need to enhance natural populations by planting additional individuals. Viable populations should consist of multiple age classes of individuals, including seedlings, saplings, and reproductive individuals. In addition, marron bacora populations should be supported by suitable habitat where intrusion by exotic invasive plants is reduced, and that provides favorable conditions for seed germination and seedling establishment.

Rationale for Recovery Criteria

The recovery criteria for marron bacora include criteria for delisting the species, incorporating conservation biology principles of representation, resiliency, and redundancy, and the current threats to the species (Smith *et al*., 2018). These recovery criteria reflect the best available and most up-to-date information on the biology of marron bacora, its status, and threats.

The Service has determined that the primary threats acting on marron bacora are habitat destruction or modification by exotic mammal species (e.g., white-tailed deer, goats, pigs, and donkeys) and invasive and exotic plants (e.g., guinea grass) (Factor A); herbivory by nonnative, feral ungulates and insect pests (Factor C); and the lack of natural recruitment, absence of dispersers, fragmented distribution and small population size, lack of genetic diversity, and climate change (Factor E) (87 FR 36225). Our first recovery approach is to ameliorate current threats to the species through site-specific conservation measures.

Previous efforts to conserve marron bacora have included a captive propagation program and planting of the material within the Virgin Islands National Park (Ray and Stanford, 2005; Ray and Stanford, 2003). In addition, a private landowner funded and implemented a conservation plan for marron bacora aiming to enhance the natural populations at Nanny Point, Brown Bay Trail, and Johns Folly (Ray and Carper, 2009; Ray and Stanford, 2005). While the species has

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been successfully propagated, the reintroductions have yielded mixed results with a low long-term survival rate of introduced plants, and mortality for most of the relocated adult plants. In this regard, the species dioecious reproductive biology (separate sexes) and low survival rate of seedlings pose a challenge for the species recovery and highlights the importance of protecting and enhancing existing populations to increase its viability (resiliency, representation, redundancy). In 2017, the Service's Coastal Program provided funding to assess the extent of impacts of invasive mammal species to marron bacora and its habitat, and to provide management recommendations for invasive mammals to advance the recovery of the species (IC Report, 2018). Fruit and seedling predation by feral ungulates (e.g., deer and goats) appear to be largely responsible for the low levels of seedling recruitment and the predominant old population structure of the species. In addition, despite the ability of marron bacora to colonize disturbed areas, seedlings and/or juveniles can be outcompeted by exotic, invasive plant species such as guinea grass (*Megathyrsus maximus*) and tan-tan (*Leucaena leucocephala*) (IC Report, 2018). Therefore, to secure viable populations of marron bacora, the species needs extensive forested habitat dominated by native plants that provides connectivity between populations ensuring crosspollination and gene flow, and habitat conditions for long-term recruitment that are absent of invasive plants and feral ungulates.

In addition, we aim to protect (through long-term conservation mechanisms) the known natural populations of marron bacora on Tortola, BVI. Considering the low number of populations (only one) and individuals (less than 50), these genetically distinct population are important for the recovery of marron bacora (e.g., individuals genetically adapted to drought stress). Apparently, the distance between the populations in St. John and Tortola is large enough (approximately 15 kilometers (9.3 miles)) to preclude genetic exchange (cross pollination) between these populations (Service 2025). Preserving the species' representation is important in reducing the likelihood of losing genetic variation due to genetic drift (Factor E).

ACTIONS NEEDED:

The recovery actions identified in Table 1 are those that, based on the best available science, we believe are necessary for the recovery of marron bacora. We have included an estimated cost to complete the action and the priority number. Further details of these recovery actions are provided in the Recovery Implementation Strategy.

Table 1. Recovery actions with estimated cost and priority number.

Recovery Action	Estimated Cost	Priority
1. Protect and manage marron bacora natural populations and its habitat by implementing conservation practices.	$225,000	1
2. Develop and implement a propagation program, reintroduction/enhancement of natural populations, and *ex situ* conservation efforts.	$285,000	1
3. Continue to gather information on the reproductive biology, ecology, distribution, and abundance of marron bacora along its range (USVI and BVI).	$200,000	2

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4. Facilitate recovery of marron bacora through public awareness and education	$5,000	2
5. Refine recovery criteria and determine what additional actions are necessary to achieve recovery criteria for marron bacora	$10,000	3
Total Estimated Cost:	**$725,000**	

Recovery actions are assigned numerical priorities to highlight the relative contribution they may make toward species recovery (48 FR 43098):

Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly.

Priority 2 – An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.

Priority 3 – All other actions necessary to provide for full recovery of the species.

ESTIMATED COST OF DELISTING:

The implementation of recovery actions, from which cost estimates can be made over a 5-year period of recovery efforts, will total approximately $**725,000.00.**

DATE OF DOWNLISTING AND DELISTING:

If all actions are fully funded and implemented as outlined, including full cooperation of all partners needed to achieve recovery, delisting is expected to be initiated in 2047. We anticipate that delisting could be achieved by 2050.

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