

Stahlia monosperma
(Cóbana negra)



**5-Year Review:
Summary and Evaluation**

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

***Please see Addendum I (page 23) for updated information on Cóbana negra and analyzed in a new 5-year review initiated in 2019 (84 FR 28850). The new signature page is included on page 50. What precedes this new information (pp. 2-22) is the 5-year review announced in September 21, 2007 (72 FR 54061) and completed and signed in 2014.*

5-YEAR REVIEW
***Stahlia monosperma* (Cóbana negra)**

I. GENERAL INFORMATION

A. Methodology used to complete the review: On September 21, 2007, the Service published a notice in the *Federal Register* (72 FR 54061) announcing the 5-year review of (*Stahlia monosperma*) Cóbana negra and requested new information concerning the biology and status of the species. A 60-day comment period was opened. However, no information on Cóbana negra was received from the public during the comment period.

A Service biologist prepared the 5-year review that summarizes new information that the Service has gathered since the plant's listing on April 5, 1990 and the signing of the recovery plan on November 1, 1996. New information consists of unpublished field survey results, reports of research projects, peer reviewed scientific publications, unpublished field observations by the Service, State and other experienced biologists, and personal communications. This draft 5-year review was shared with several peer reviewers. Comments received were evaluated and incorporated as appropriate (see Appendix A).

B. Reviewers

Lead Region: Kelly Bibb, Southeast Region. (404) 679-7132.

Lead Field Office: Maritza Vargas/José G. Martínez, Caribbean Ecological Services Field Office, Boquerón, Puerto Rico. (787) 851-7297, extension 215.

C. Background

1. Federal Register Notice citation announcing initiation of this review: September 21, 2007; 72 FR 54061.

2. Species Status: 2013: Improving. New natural populations have been reported in Guayanilla, Cabo Rojo and Lajas (Sierra Bermeja). The species is being introduced in various Commonwealth Forests, privately-owned lands under conservation status and National Wildlife Refuges (NWR) of Puerto Rico.

3. Recovery Achieved 2 (2 = 25-50 % of species recovery objectives achieved).

4. Listing History

Original Listing

FR notice: 55 FR 12790
Date listed: April 5, 1990
Entity listed: species
Classification: threatened

5. Associated rulemakings: Not Applicable.

6. Review History:

Cóbana negra was listed in 1990 as threatened (55 FR 12790). It was found in the municipalities of Cabo Rojo, Río Grande, and Vieques, with a population estimated on 380 individuals among the three localities (Figure 1; USFWS 1990). The recovery plan for the species was signed in 1996. At that time, population estimates were dropped to a little more than 110 individuals (USFWS 1996). Cóbana negra is also found in the Dominican Republic, but the number of populations and individuals on that Island is currently unknown.

A species review was conducted for Cóbana negra in 1991 (56 FR 56882). In this review, the status of various species was simultaneously evaluated with no in-depth assessment of the five factors or threats as they pertain to the individual species. The Service was seeking new or additional information reflecting the necessity of a change in the status of the species under review. The notice indicated that if significant data were available warranting a change in a species' classification, the Service would propose a rule to modify the species' status. No change in the listing classification of Cóbana negra was found to be appropriate.

The April 5, 1990, Final Rule (55 FR 12790), and the Recovery Plan for *Stahlia monosperma* (Cóbana negra), approved and signed on November 1, 1996 (USFWS 1996), are the most comprehensive analyses of the species status and are used as reference points for this 5-year review.

Every year the Service reviews the species' status and incorporates any new information in the Recovery Data Call. In the 2007, 2008 and 2013 Recovery Data Calls, we reported that the status of the species was improving. Planting has occurred in various Commonwealth Forests, NWRs and other private properties in Puerto Rico.

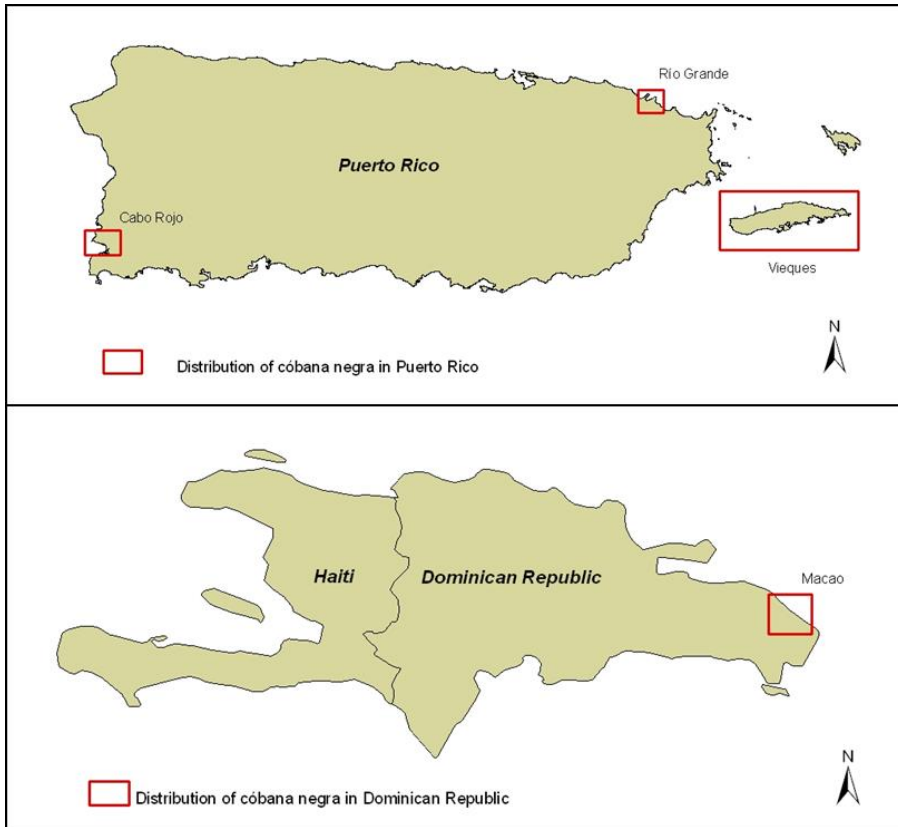


Figure 1. Known distribution of *Cóbana negra* in Puerto Rico and the Dominican Republic at the time of listing (USFWS 1996).

7. Species' Recovery Priority Number at start of review (48 FR 43098): 8. At the time of listing, *Cóbana negra* was recognized as a species with a moderate degree of threat and high recovery potential.

8. Recovery Plan:

Name of plan: Recovery Plan for *Stahlia monosperma* (*Cóbana negra*)

Date issued: November 1, 1996.

II. Review Analysis

A. Application of the 1996 Distinct Population Segment (DPS) policy

The Act defines species to include any distinct population segment of any species of vertebrate wildlife. This definition limits listings as distinct population segments (DPS) only to vertebrate species of fish and wildlife. Because the DPS policy is not applicable to this plant species, it is not addressed further in this review.

B. Recovery Criteria

1. Does the species have a final, approved recovery plan containing objective, measurable criteria?

The species has an approved recovery plan. However, it does not establish measurable criteria to delist the species. The plan does not define the number of individuals per population needed for a sustainable population nor the amount of new populations to be established in protected areas.

2. Adequacy of recovery criteria

a. Do the recovery criteria reflect the best available (most up-to-date) information on the biology of the species and its habitat?

No. The plan does not include up-to-date information about the species distribution. The knowledge on natural and introduced individuals has expanded.

b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria? No.

3. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information.

The recovery plan specifies that *Cóbana negra* may be considered for delisting when:

1. Self-sustaining new populations (following the appropriate ecological and genetic studies to determine self-sustainability) are established within protected areas.
2. Specimens or populations found in privately owned lands are placed under protective status.

Criterion 1 has been initiated. Propagation efforts are being conducted in various National Wildlife Refuges and Commonwealth Forests of Puerto Rico. In addition, there are planting efforts on private lands that are designated for conservation. This criterion is considered initiated because some of the individuals planted are small trees (treelets) and have not yet reached maturity. Other introduced individuals (mature individuals) do not constitute self-sustaining populations because recruitment, dispersion and natural expansion have not been documented, either because the individuals have been planted in urban areas, pasturelands, or other areas that do not constitute suitable habitat for the species. Thus, the Service does not consider that these plantings contribute to the recovery of the *Cóbana negra*.

The Service just initiated a project under the Cooperative Recovery Initiative (CRI) in the area of Sierra Bermeja in southwest Puerto Rico with the long-term goal of addressing the threats to *Cóbana negra* and other listed plant species by enhancing their existing populations and establishing new populations within both the Laguna Cartagena National

Wildlife Refuge and adjacent private lands. We believe that by addressing the threats to the species the Service will consider proposing a delisting of *Cóbana negra* in the future.

Criterion 2 is partially met. Several populations occur on private lands with conservation status. Laguna Guaniquilla is part of a reserve managed by Para La Naturaleza, a Unit of the Puerto Rico Conservation Trust, Punta Picúa is designated as a natural reserve by the Puerto Rico Planning Board, and Punta Ventana is part of a conservation area under a Habitat Conservation Plan for the San Francisco Windfarm (SFWF), LLC project (previously known as Windmar). The *Cóbana negra* populations at Laguna Yanuel and Laguna Kiani are within the Vieques NWR, and part of the population in Sierra Bermeja is within Laguna Cartagena NWR.

C. Updated Information and Current Species Status

1. Biology and Habitat

a. Abundance, population trends (*e.g.* increasing, decreasing, stable), demographic features, or demographic trends:

Cóbana negra is a medium size tree that reaches 7.6 to 15.2 m (25-50 ft) in height and 30.4 to 454.7 cm (1-1.5 ft) in trunk diameter. It belongs to a monotypic genus of the Leguminosae (Fabaceae) family and Caesalpinaceae subfamily endemic to Puerto Rico and the Dominican Republic (Little and Wadsworth 1964). *Cóbana negra* grows within the subtropical dry forest and subtropical moist forest life zones (Ewel and Whitmore 1973). The subtropical dry forest occurs along the south-southwest coast of Puerto Rico, most of Vieques Island, all of Culebra Island and the northeastern most part of Puerto Rico. Individuals grow in brackish, seasonally flooded wetlands in association with mangrove communities and along creeks.

Santiago-Valentín and Rojas-Vázquez (2000) surveyed three known natural populations of *Cóbana negra*: Laguna Yanuel in Vieques, Laguna Guaniquilla in Cabo Rojo, and Punta Picúa in Río Grande. The authors reported only 34 individuals, approximately one-third of the individuals reported in the recovery plan (Table 1). While reporting a decrease in numbers from previous reports, they also found three new individuals near the previously reported records located in Laguna Guaniquilla. The largest population was found in Laguna Yanuel with 18 individuals, followed by Punta Picúa with 11 individuals, and Laguna Guaniquilla with 5 individuals. Size classes range from <2 meters (6 feet) to >10 meters (33 feet) in height.

Santiago-Valentín and Rojas-Vázquez (2000) also surveyed other areas with suitable habitat for the species. They searched along Puerto Negro and Laguna Monte Largo in the northeast area of Vieques, and at the eastern and northeastern border of Laguna Joyuda in Cabo Rojo. However, efforts to locate *Cóbana negra* in these other areas were unsuccessful.

Table 1: Number of individuals in historical sites and size classes (height) of Cóbana negra (Santiago-Valentín and Rojas-Vázquez (2000).

Location	Number of Individuals	Size Classes (meters)
Laguna Yanuel	18	<2- 3.9
Laguna Guaniquilla	5	4-7.9
Punta Picúa	11	<2 - >10
Total	34	

Based on the information gathered for this review, close to 200 individuals of Cóbana negra with different size class are known to exist in nine natural populations (Table 2). Overall, all individuals have been poorly monitored, and currently the status of these populations is unknown. Four of these nine populations (80% of natural individuals) are located in protected areas: Punta Ventana, Vieques National Wildlife Refuge (VNWR), Punta Guaniquilla, and Punta Picúa. The population of Cóbana negra in Punta Guaniquilla is the smallest in a protected area. On the other hand, the Punta Ventana population is the largest natural population known in Puerto Rico with approximately 97 individuals of different age classes and seems to be healthy (J. Lazcano, former biologist for the WindMar project, now SFWF, pers. comm., 2009).

The populations in Cabo Rojo along Road PR 307 (Boquerón Country Club), Laguna Joyuda, Sierra Bermeja, Punta Melones, and near Villa Taina, are located on private lands. These populations consist of a small number of individuals growing sparsely. All these populations, except the population along Road PR 307, have been observed with fruits; however, no recruitment of seedlings has been documented.

The Service conducted a site visit to the population along Road PR 307 (Boquerón Country Club), where the individuals are found along a creek in the middle of a residential development project, and found that all individuals (17) are still present and alive. However, the population is enclosed by the urban development and the potential for the establishment of new individuals is limited.

Table 2. Natural populations of Cóbana negra currently known in Puerto Rico. Overall, all individuals have been poorly monitored, and the current status of these populations is unknown.

Location	Municipality	No. of individuals ^a	Land Use	Source
Road PR 307 (Boquerón Country Club)	Cabo Rojo	17	Private, Residential	Boquerón Country Club (Project file 72023-314)
Punta Ventana	Guayanilla	97	Private Conservation Area	J. Lazcano, former biologist for the WindMar project, now SFWF, pers. comm., 2009
Laguna Joyuda	Cabo Rojo	3	Private, near Natural Reserve area	Santiago-Valentín and Rojas-Vázquez (2000), O. Monsegur, USFWS, pers. comm., 2009

Sierra Bermeja	Cabo Rojo-Lajas	5	Private and Public (NWR)	C. Pacheco and O. Monsegur, USFWS, pers. comm., 2009
Vieques NWR	Vieques	40	Public (NWR)	Geo Marine Inc. 2006, USFWS 2007
Punta Guaniquilla	Cabo Rojo	5	Private Conservation Area	Santiago-Valentín and Rojas-Vázquez (2000)
Punta Picúa	Río Grande	11	Private	Santiago-Valentín and Rojas-Vázquez (2000)
Punta Melones	Cabo Rojo	8	Private, Residential	Bahía Campomar (Project 72023-420), Monte Carlo Resort (72023-023), C. Pacheco, USFWS, pers. comm., 2009
Near Villa Taina	Cabo Rojo	5	Private	C. Pacheco, USFWS, pers. comm., 2009
Total Number of individuals		191		

^a The number of individuals per population represents an estimate, and may include seedlings and saplings. The numbers of individuals came from different sources and were collected using different standards.

The Puerto Rico Department of Natural and Environmental Resources (PRDNER) has been propagating *Cóbana negra* for more than a decade at the nursery in the Cambalache Commonwealth Forest. *Cóbana negra* is one of the numerous listed species that PRDNER is propagating and reintroducing into different Commonwealth Forests, NWRs and Reserves. Other governmental and non-governmental organizations have also propagated *Cóbana negra*, including the University of Puerto Rico and the Puerto Rico Conservation Trust. The PRDNER has provided plants to the Caribbean Islands NWR Complex for reforestation within refuge lands. The PRDNER also provides *Cóbana negra* individuals to other Service’s programs such as Partners for Fish and Wildlife and the Coastal Program to be planted on private lands that have wildlife cooperative extension agreements, conservation easements, or other conservation mechanisms. The main purpose of these reforestation efforts is to enhance wildlife habitats in Puerto Rico and the U.S. Virgin Islands. Examples of these reforestation projects include: planting of 26 individuals of *Cóbana negra* in a property managed by Puerto Rico Conservation Trust, located near the natural populations of Guaniquilla in Cabo Rojo, and the planting of several individuals in the Altamira farm, a private property adjacent to the Cabo Rojo NWR. Overall, planted individuals have been poorly monitored, and their current status is unknown.

Based on the information available in our records, more than 2,000 individuals of *Cóbana negra* were planted during the last decade (Table 3). However, some of these populations cannot be considered as self-sustaining either because trees still too young or there have been no reports of recruitment or natural expansion. Other trees of *Cóbana negra* were planted on private and public land (i.e., pasturelands, farms, parks, and along roads) where they are maintained pruned regularly, and thus, are unable to recruit.

On January 2014, Service biologist José Martínez conducted a rapid assessment on one section of the Cóbana negra population planted at Laguna Cartagena NWR. A total of 42 healthy individuals of Cóbana negra were documented during the assessment. Approximately 20 adults had natural recruitment near the parental tree (USFWS 2014). However, it is unknown if these seedlings or saplings are developing into adult reproductive individuals or if they are being outcompeted by other predominant vegetation.

The Service is currently working on the CRI project for the implementation of recovery actions for the Cóbana negra species (i.e., propagation and planting, habitat enhancement with native species, cattle exclusion, fire breaks, enhancement and restoration on private lands, surveying and monitoring natural populations and outreach). These actions will help enhancing the Cóbana negra existing populations and establishing new populations within the southwestern area of Puerto Rico. The goals of these actions are to safeguard the genetic diversity, and to help recover the species for its possible proposed delisting.

Table 3: Cóbana negra localities and number of individuals planted in Puerto Rico (CF = Commonwealth Forest, CR = Commonwealth Refuge, NWR = National Wildlife Refuge).

Location	Municipality	No. of individuals^a	Land ownership	Source
Finca Gabia	Santa Isabel	400	Public	J. Casanova, PRDNER, pers. comm., 2009
Toa Vaca Lake	Juana Díaz	200	Public	J. Casanova, PRDNER, pers. comm., 2009
Guánica CF	Guánica	15	Public	C. Pacheco, USFWS, pers. comm., 2009
Cambalache CF	Arecibo	50	Public	J. Canabal, PRDNER, pers. comm., 2009
Piñones CF	Loíza	10	Public	V. Rodríguez, PRDNER, pers. comm., 2009
Guilarte CF	Adjuntas, Guayanilla, Peñuelas, Yauco	Data not available	Public	D. Torres, PRDNER, pers. comm., 2009
Susúa CF	Sabana Grande, Yauco	20	Public	V. Rodríguez, PRDNER, pers. comm., 2009
Boquerón CF	Cabo Rojo	14	Public	W. Morales, PRDNER, pers. comm., 2009
Boquerón CR	Cabo Rojo	5	Public	J.L. Carlo, PRDNER, pers. comm., 2009
Vega CF	Vega Alta	50	Public	J. Laureano, PRDNER, pers. comm., 1989
Julia de Burgos Park-AAA Plant near Piñones	Loiza	200 shared between the two areas	Private	V. Rodríguez, PRDNER, pers. comm., 2009
Playa Higuillar	Dorado	unknown	Private	V. Rodríguez, PRDNER, pers. comm., 2009
Palmas del	Humacao	unknown	Private	V. Rodríguez, PRDNER, pers. comm.,

Mar				2009
University of Puerto Rico, Humacao Campus	Humacao	250	Public	Raul A. Perez, Professor UPR-Humacao, 2005 (letter)
Cabo Rojo NWR	Cabo Rojo	448	Public	Weaver, P.L. and J. J. Schwagerl 2008,
Laguna Cartagena NWR	Lajas	380	Public	Weaver, P.L. and J. J. Schwagerl 2008, O. Diaz, USFWS, pers. comm., 2007
Along Road PR-116	Lajas	22	Public	C. Pacheco, USFWS, pers. comm., 2009
Along Road PR- 303	Cabo Rojo, Lajas	4	Public	C. Pacheco, USFWS, pers. comm., 2009
Along Roads PR-102, PR-117, PR-320	Lajas, Sabana Grande	76	Public	Santiago-Valentin and Rojas-Vazquez, 2000
Punta Guaniquilla-Puerto Rico Conservation Trust	Cabo Rojo	26	Private (conservation)	C. Pacheco, USFWS, pers. comm., 2009
Private Lot in Culebra	Culebra	10	Private	C. Pacheco, USFWS, pers. comm., 2009
Guánica Communal Center	Guanica	6	Public	C. Pacheco, USFWS, pers. comm., 2009
Private lot near Boquerón Forest	Cabo Rojo	5	Private	C. Pacheco, USFWS, pers. comm., 2009
University of Puerto Rico-Magueyes Island	Lajas	unknown	Public	J. Vivaldi, PRDNER, 1989 (letter)
University of Puerto Rico-Cayey Campus	Cayey	20	Public	O. Monsegur, USFWS, pers. comm., 2012
University of Puerto Rico-Mayagüez Campus	Mayagüez	20	Public	Internet site: http://web.me.com/jamarimutt.arbolesrum/indexareaingl.html ; O. Monsegur, USFWS, pers. comm., 2009
Altamira Farm	Cabo Rojo	25	Private	PRDNER and Partners for Fish and Wildlife Project (wildlife cooperative extension agreement)
Total Number of individuals		2,256		

^a The number of individuals per population represents an estimate, and may include seedlings and saplings. The numbers of individuals came from different sources and were collected using different standards.

In 1996, the Department of Botany of the Dr. Rafael M. Moscoso National Botanical Garden in the Dominican Republic conducted a survey to determine the status of *Cóbana negra* in Dominican Republic. They found a population of 100 individuals in Macao, Higüey, Provincia La Altagracia, which is the largest population of *Cóbana negra* documented in Dominican Republic (Table 4; Mejía et. al. 1997). Nonetheless, the National Botanical Garden has successfully reproduced the species and have restored two populations to their natural state in San Pedro de Macoris (Figure 2; Mejía et. al. 1997).

Table 4: Known populations in Dominican Republic.

Locality	# of individuals	Coordinates	Source
Macao - Provincia La Altagracia	100	18°46'N, 68°34'W	Mejía et. al. 1997, T.A. Zanoni and M. M. Mejía 1989
San Pedro de Macoris	Number not specified	18°26.5'N 69°16'W	Mejía et. al. 1997, T.A. Zanoni and M. M. Mejía 1989



Figure 2. Current locations of *Cóbana negra* in Dominican Republic.

b. Genetics, genetic variation, or trends in genetic variation:

The *Cóbana negra* seeds used for reforestation projects have come from only a few trees, accentuating a genetic bottleneck and probably a reduced genetic variation of the species. A study performed by Brian Dunphy (University of Georgia, pers. comm. 2002, in Center for Plant Conservation; http://www.centerforplantconservation.org/collection/cpc_view_profile.asp?CPCNum=4087), found that the amount of allozyme diversity observed is extremely low for a flowering plant and is consistent with a severe reduction in population size in the recent past (i.e., a population bottleneck).

c. Taxonomic classification or changes in nomenclature:

There is no new information regarding taxonomic classification or changes in nomenclature of *Cóbana negra*.

d. Spatial distribution, trends in spatial distribution (e.g., increasingly fragmented, increased numbers of corridors, etc.), or historic range:

The final listing rule and the recovery plan described the natural distribution of *Cóbana negra* as limited and only included populations from Cabo Rojo, Río Grande and Vieques Island. However, further surveys and studies have found a wider distribution of the species. At present, natural populations of *Cóbana negra* are found in nine areas: Punta Ventana, Punta Guaniquilla, Laguna Joyuda, Punta Melones, Road PR 307 (Boquerón Country Club), near Villa Taina, Sierra Bermeja, Punta Picúa, and Vieques Island (Table 2). Additionally, based on a propagation effort conducted for more than 13 years, the species has been planted at least 18 municipalities throughout Puerto Rico (Figure 3). This information does not include those individuals that have been planted as part of reforestation efforts and public education, and those that have been planted island-wide around public parks, and along state and rural roads and private parcels.

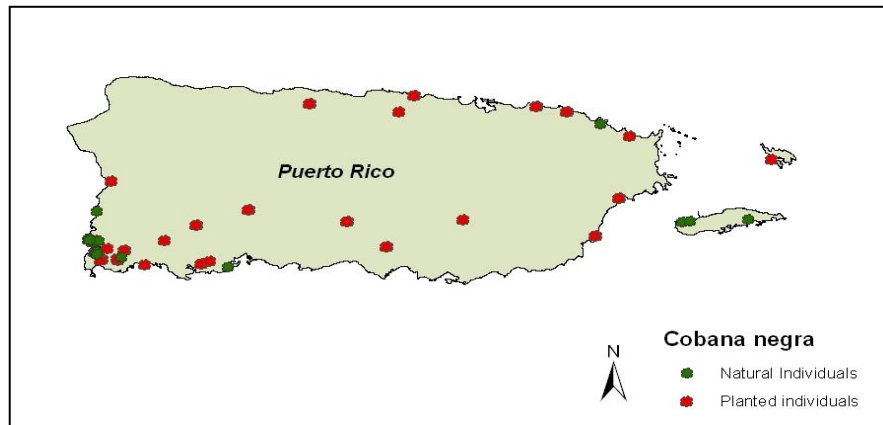


Figure 3. Natural and introduced populations of *Cóbana negra* in Puerto Rico.

e. Habitat:

In general, *Cóbana negra* grows in brackish, seasonally flooded wetlands along creeks and drainages, and in coastal plains. The species can tolerate high concentrations of salt (e.g., saltpeter (potassium nitrate) beds and land adjacent to mangrove communities). Predominant associate species are bottonwood mangrove (*Conocarpus erectus*), white mangrove (*Laguncularia racemosa*), black mangrove (*Avicennia germinans*), *Annona glabra*, *Pterocarpus officinalis*, *Acrostichum aureum*, almacigo (*Bursera simaruba*,) and

úcar (*Bucida burceras*) (Santiago-Valentín and Rojas-Vazquez 2000, Monsegur, USFWS, pers. comm., 2009).

In the Dominican Republic, Cóbana negra is known to grow in brackish, seasonally-flooded wetlands sometimes associated with mangroves and close to river mouths in low elevation areas. Associated species are *Guaiacum* spp. and *Bucida* spp. (Mejía et.al. 1997).

f. Other relevant information:

Santiago-Valentín and Rojas-Vázquez (2000) found records of planting of Cóbana negra since the 1920s, including a report by botanist N.L. Britton of a reforestation that included a planting of 12,000 individuals of Cóbana negra along the south coast of Puerto Rico. This information establishes uncertainty about the legitimacy of the known natural localities along the south coast of Puerto Rico. No other specific information was found on original stocks or the sites where seeds, seedlings, or saplings used for planting were obtained.

A study conducted by Brenda Cadiz Rivera from the University of Puerto Rico, Humacao Campus, evaluated the germination of Cóbana negra under different conditions. The scarification method resulted in a faster rate of seed germination (approximately 11 days) than seed germination in a natural environment (approximately 47 days) (Prof. Raúl A. Perez-Rivera, UPR-Humacao Campus, pers. comm., 2005).

2. Five Factor Analysis

(a) Present or threatened destruction, modification, or curtailment of its habitat or range;

In the final rule, destruction and modification of Cóbana negra's habitat was identified by the Service as the most significant factor affecting the species.

Santiago-Valentín and Rojas (2000) mentioned that areas such as Punta Picúa, Laguna Guaniquilla, and Laguna Joyuda are under enormous pressure for development. Although these areas are designated natural reserves by the PRDNER, the coastal areas adjacent to these reserves are privately-owned and are urbanized with residential and tourist projects. The development of these areas has resulted in habitat modification and fragmentation, and has limited the natural expansion of currently known populations of Cóbana negra. Furthermore, some of the wetland areas are commonly used as illegal dumping sites where used tires, mattresses, refrigerators, and other kind of trash are left in suitable areas for the species. These illegal actions affect the growth and health of Cóbana negra individuals.

During the last decade, the Service has recommended revisions to the plans for numerous development projects in coastal areas where suitable habitat for Cóbana negra is present. Additionally, the Service has evaluated projects with potential adverse effects on

individuals of *Cóbana negra*, particularly in coastal areas in the municipalities of Cabo Rojo and Río Grande. These areas include: Punta Melones (with the projects Bahía Campomar and Monte Carlo Resort), Punta Picúa, near Villa Taina, Laguna Joyuda, and private farms in Sierra Bermeja. These areas are of high value for the construction of second homes, hotels, villas, mega-resorts and associated infrastructure.

As part of the technical assistance and Section 7 consultation processes with local and Federal agencies for developmental projects, the Service recommends conservation measures to minimize possible adverse effects of projects on listed species and their habitat. For example, we provided comments to the U.S. Army Corps of Engineers for the residential project known as Boquerón Country Club along Road PR 307 in Cabo Rojo. A population consisting of about 17 adult trees was proposed to be affected by the construction of a road crossing structure associated with the project. The Service recommended avoiding impacts to the population, and the landowner followed our recommendations. However, the population of *Cóbana negra* is located in the middle of the residential project. Although a buffer zone was provided immediately adjacent to the population, the habitat is limited by development and these conditions are not suitable for natural expansion and dispersal of the population. Despite direct impacts to this population were avoided, the habitat modification and the development of the adjacent areas pose a barrier that may affect the natural expansion of the population and may also interfere with the connectivity with populations in nearby areas.

Based on the information gathered during this review, *Cóbana negra* is currently threatened by habitat modification and fragmentation associated with urban development.

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

Based on anecdotal information, the wood of *Cóbana negra* was highly valued for fence posts and furniture. This historic demand may have contributed to the reduction in numbers of the individuals of *Cóbana negra*. After listing the species, there have been no reports indicating these practices are a threat to known populations. In the Dominican Republic, they also believed that the species was in peril because of the overexploitation (for train rails and furniture uses).

We are not aware of any utilization of *Cóbana negra* for commercial, recreational or scientific purposes. Thus, we do not consider this to be a threat to the species.

(c) Disease or predation;

At the time of listing, browsing of seedlings was considered a threat to the species especially in the first year following establishment.

Currently, Sierra Bermeja, Villa Taina and Laguna Joyuda, are areas where livestock may still graze on *Cóbana negra*. The individuals in grazing areas grow sparse and only reach adulthood where cattle are limited.

Because most of the wild individuals are in protected areas restricted from livestock, and some have conservation measures for the protection of the species, we believe that the threat of predation is low.

The Service is not aware of any disease that may threaten *Cóbana negra*. However, natural populations of this species are comprised mostly of relic individuals and the propagated material has historically been collected from the same seed sources. Thus, as preliminary studies suggest (Dunphy, B. University of Georgia, pers. comm. 2002, in Center for Plant Conservation;

http://www.centerforplantconservation.org/collection/cpc_viewprofile.asp?CPCNum=4087), the species may be affected by low genetic diversity, which can make

Cóbana negra vulnerable to insect pests or pathogens. However, the Service has no evidence of any insect pest or pathogen currently affecting the species.

(d) Inadequacy of existing regulatory mechanisms:

When the Final Rule to list *Cóbana negra* was published, the species was not included in the Commonwealth's list of protected species. In 1999, the Commonwealth of Puerto Rico approved the Law No. 241 known as the "*Nueva Ley de Vida Silvestre de Puerto Rico*" (New Wildlife Law of Puerto Rico). The purpose of this law is to protect, conserve and enhance both native and migratory wildlife species, declare property of Puerto Rico all wildlife species within its jurisdiction, regulate permits, regulate hunting activities, and regulate exotic species among others. In 2004, the PRDNER approved the "*Reglamento para Regir el Manejo de las Especies Vulnerables y en Peligro de Extinción en el Estado Libre Asociado de Puerto Rico*" (Regulation 6766 to regulate the management of threatened and endangered species in the Commonwealth of Puerto Rico). *Cóbana negra* was listed as threatened in this Regulation. Article 2.06 of Regulation 6766 prohibits collecting, cutting, removing, among other activities, listed plant individuals within the jurisdiction of Puerto Rico.

In addition, the PRDNER included Punta Picúa as part of the Espiritu Santo Natural Reserve, and Laguna Joyuda as part of the Laguna Joyuda Natural Reserve, also considered a Critical Wildlife Area (CWA; PRDNER 2005). The CWA designation does not protect the species from the legal perspective, but acknowledges the importance of designated CWAs as important habitat resources in Puerto Rico and associated islands. It also acknowledges the intention to protect and preserve the resources from degradation due to incompatible land use *in situ* or adjacent to the areas (PRDNER 2005).

As for the *Cóbana negra* population at the Vieques NWR, one of the refuge's objectives is to maintain rare local subtropical dry forest habitat and wetlands ecosystem for resident and migratory birds and rare and endangered species. Furthermore, the deposit of fill material on wetland areas is regulated by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act.

The *Cóbana negra* population in Punta Ventana is located within a designated conservation area included in a Habitat Conservation Plan, as amended, for the San

Fransisco Wind Farm project (Guarnaccia 2005). The Punta Guaniquilla area is a reserve protected and managed by Puerto Rico Conservation Trust.

Suitable habitat of *Cóbana negra* certainly extends to private properties not managed for conservation. Thus, the enforcement of laws and regulations on these lands continues to be a challenge as accidental damage or extirpation of individuals has occurred with other federally listed species due to lack of knowledge of the species by private landowners and law enforcement officers. However, at this time we are unaware of any damage occurring to *Cóbana negra* on private properties. Furthermore, through the CRI project the Service will continue working with partners and private landowners and continue monitor for damage to individuals or removal. Therefore, based on the presence of Commonwealth and Federal laws and regulations protecting these species, and the protection of populations within private conservation lands, we believe that the inadequacy of existing regulatory mechanisms should no longer be considered a threat to *Cóbana negra*.

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

Lack of natural recruitment

The *Cóbana negra* populations have been affected by lack of natural recruitment despite the abundant fruit production and the fact that seeds germinate very well under nursery conditions. The best information available indicates that little recruitment is occurring on natural populations, and when present, seedlings and saplings are located just below the parent tree, suggesting problems of seed dispersal. Due to the lack of long term monitoring efforts, it remains unknown if these individuals will develop as mature plants capable of reproduction. Thus, the Service is unable to determine if the natural populations are actually stable or improving.

In the case of reintroduced material, a rapid assessment conducted by the Service on individuals planted since 1998 at Laguna Cartagena NWR, identified several size classes, which suggests some recruitment (USFWS 2014a). However, a thorough assessment of the entire population at Laguna Cartagena is needed to determine if natural recruitment is actually occurring. Also, other reintroduced individuals have been planted in private and public lands, which are not suitable natural habitats for the species (e.g. pasturelands and urban areas). Hence, we do not consider these plantings self-sustaining and the chances for these populations to be expanding are very limited. Therefore, we believe that the factors mentioned above are a threat to the species.

Hurricanes and Climate change

Disturbances such as hurricanes may affect small relic populations of *Cóbana negra*. These populations are very important as they may harbor an important genetic stock of the species. *Cóbana negra* may be further threatened by climate change, which is predicted to increase the frequency and strength of tropical storms and can cause severe droughts (Hopkinson et al. 2008). Even if *Cóbana negra* resists adverse effects of

hurricanes, the cumulative effects of severe storms, soil erosion and increased sediment runoff may compromise the establishment of seedlings along drainages, which usually provide suitable habitat for the species. Habitat modification may result in irreversible damage to the species' natural habitat, decreasing the number of individuals in already small populations. However, the current frequency of severe hurricanes is low, therefore, the Service considers severe tropical storms as a low and non-imminent threat to the species.

Human-induced fires

Caribbean ecosystems are vulnerable to natural and anthropogenic events. Native plants and endemic species with limited distribution are particularly susceptible to human-induced fires. Restoring native plant communities is challenging where invasive plants have altered fire regimes and ecosystem properties (Brooks et al. 2004). In Puerto Rico, the native plant community of subtropical dry forests is not fire-adapted; hence, it has been affected by human induced fires (Wolfe 2008). These fires may lead to destruction of the native vegetation seed bank, and usually favor conditions for the establishment of exotic plant species (e.g., *Leucaena leucocephala* and *Megathyrsus maximus*). Moreover, exotic plants increase direct competition for resources and limit native plant species recruitment in highly degraded areas (Wolfe 2008). The possibility of severe droughts triggered by climate change may contribute to an increase in the number and frequency of fires on Puerto Rico. These cumulative factors may reduce the number of individuals and further reduce populations of Cóbana negra. The Service is aware of natural populations of Cóbana negra being directly affected by human induced fires and the associated habitat modification in the area of Sierra Bermeja (USFWS 2014b). Moreover, areas managed for conservation, and where the species have been widely planted, have been recently affected by fires (i.e., Cabo Rojo NWR and Laguna Cartagena NWR). Nonetheless, we consider the threat of human-induced fires to be low and non-imminent because their effect is local and they do not threaten all populations of Cóbana negra at once.

Genetic variation

Cóbana negra occurs in small natural populations with a limited geographic distribution. These factors along with habitat fragmentation, and the fact that planted individuals come from propagated material from the same seed source, may result in the erosion of genetic variation of the species (Honnay and Jacquemyn 2007). Such genetic erosion also may limit the species' ability to respond to environmental changes (Booy et al. 2000). As previously mentioned under the section about new genetic information, Cóbana negra may be facing a population bottleneck due to a severe reduction in population size in the recent past. Based on the above information, we consider the low genetic variation as a high, but non-imminent threat to the species.

3. Synthesis

Stahlia monosperma or Cóbana negra is a federally-listed threatened species that belongs to a monotypic genus of the family Fabaceae, endemic to Puerto Rico and Dominican

Republic. According to the information gathered for this 5-year review, the status of the species is improving. At present, we have knowledge of more naturally occurring populations than previously reported when the species was listed, and the number of individuals in the wild has also increased.

Currently, there are nine natural known populations located sparsely around Cabo Rojo, Lajas, Guayanilla, Río Grande and Vieques Island. Introduced individuals may be found at least 18 municipalities around the island of Puerto Rico and in three areas in the Dominican Republic (Macao, Higüey, and San Pedro de Macoris).

The recovery criteria establish that delisting of *Cóbana negra* could be considered when: (1) self-sustaining new populations (following the appropriate ecological and genetic studies to determine self-sustainability) are established within protected areas, and (2) specimens or populations found on privately-owned lands are placed under protective status. Criteria 1 has been initiated with the introduction of individuals in protected areas. Criteria 2 has been partially met as most natural individuals (80%) are in areas managed for conservation by governmental and non-governmental organizations.

Based on the information gathered for this review, we believe that *Cóbana negra* is still threatened by habitat modification and natural factors such as lack of genetic variation, and natural recruitment, along with other factors such as hurricanes, landslides, and introduction of exotic species.

III. RESULTS

A. Recommended Classification:

 X No, no change is needed.

B. New Recovery Priority Number: 8c

Cóbana negra remains subject to a moderate degree of habitat destruction mainly due to tourism and residential development, and human-induced fires. Nonetheless, the species' recovery potential continues to be high because management needs have been documented and the introduction of individuals in protected areas has high probability of success. The species is in conflict with development growth (expansion may be limited or may be completely disrupted), consequently the conflict category 'c' has been added to the recovery priority number.

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

- The Service, in cooperation with PRDNER and academia, needs to determine how many individuals constitute a self-sustaining population. After this work, the recovery plan should be revised to establish objective, measurable delisting criteria.

- Genetic studies should be conducted to determine the genetic variation of planted individuals.
- Efforts to protect privately-owned populations should be started. Areas like Punta Melones, near Villa Taina, Laguna Joyuda and Sierra Bermeja are susceptible to development. Hence, working with the private landowners to conserve these natural areas is essential. Private-lands initiatives such as Partners for Fish and Wildlife and Coastal Programs are needed to further protect the areas where *Cóbana negra* is known to occur naturally.
- The Service should continue the efforts to promote the collection of seed material from natural populations and not from plantations. This actions help to increase the genetic variation of *Cóbana negra*.
- Conduct periodic surveys of introduced populations to assess the success of planting efforts and determine if recovery actions are effective.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Stahlia monosperma* (Cóbana negra)

Current Classification: Threatened

Recommendation resulting from the 5-Year Review:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change is needed

Review Conducted By: José G. Martínez, Caribbean Ecological Services Field Office, Boquerón, Puerto Rico

FIELD OFFICE APPROVAL

Approve *Paulin Pi* Date Oct 8, 2014

Lead Field Supervisor, U.S. Fish and Wildlife Service

for

REGIONAL OFFICE APPROVAL:

Approve *Aaron L. Valde* Date 10-29-14

Lead Regional Director, U.S. Fish and Wildlife Service

Appendix A. Summary of peer review for the 5-year review of *Stahlia monosperma* (Cóbana negra)

A. Peer Review Method: We sent the draft 5 year review of *Stahlia monosperma* to knowledgeable individuals and requested their peer review to the document, particularly any additional information on the status and the current threats of the species. Only two peer reviewers responded the request.

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B. Summary of Peer Review Comments/Report: Peer reviewer responses were supportive of the information and assessment presented in this review. Mike Barandarian provided us information with historic information of one adult individual of Cóbana negra located north-east of La Chiva lagoon on the east tract of Vieques NWR (CH2MHILL U.S. Navy).

C. Response to Peer Review: The Service was in agreement with the comments received from peer reviewers. Comments were evaluated and incorporated accordingly into the 5-year review.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Stahlia monosperma*
(Cóbana negra)

Addendum 1. Summary of new information obtained since the 2014 Five-Year Review.

I. GENERAL INFORMATION

On June 20, 2019, the U.S. Fish and Wildlife Service (Service) published a notice in the Federal Register (84 FR 28850) announcing the 5-year status review of the *Stahlia monosperma* (Cóbana negra). The notice requested new information and comments from species experts and biologists familiar with Cóbana negra concerning its biology and status. No comments were received from the public during the comment period. This Addendum includes the information we have gathered on Cóbana negra since the 2014 5-year status review for the species.

This addendum summarizes information that the Service has gathered since the previous 5-year status review for Cóbana negra was approved on October 29, 2014. The sources of information used for this review include unpublished reports from Cooperative Agreements under the Service's Partners for Fish and Wildlife (PFW) Program, and data gathered through the Cooperative Recovery Initiative (CRI) project conducted collaboratively by the Caribbean Ecological Services Field Office (CESFO), the Caribbean Islands National Wildlife Refuge Complex (CINWRC), and Envirosurvey, Inc.

B. Reviewers

Lead Region: Carrie Straight, Atlanta Regional Office. (404) 679-7226.

C. Background

1. Federal Register Notice citation announcing initiation of this review: June 20, 2019; 84 FR 28850.

2. Species status: This metric is no longer included as part of a 5-year status review.

3. Recovery Achieved This metric is no longer included as part of a 5-year status review.

6. Review History:

The previous 5-year status review recommended that Cóbana negra is still threatened by habitat modification and natural factors such as lack of genetic variation, and natural recruitment, along with other factors such as hurricanes, landslides, and introduction of exotic species.

7. Species' Recovery Priority Number at start of review (48 FR 43098): 8c. The 2014 5-year status review recommended a change to the Recovery Priority Number (RPN) to 8c.

Cóbana negra was recognized as a species with a moderate degree of threat and high recovery potential and adding the “c” indicating that the species is in conflict with development.

II. Review Analysis

C. Updated information and Current Species Status

1. Biology and Habitat

Distribution and abundance:

At the time the 2014 5-year status review was completed, about nine natural populations consisting of 191 naturally-produced individuals and approximately 2,256 planted individuals, were known to occur throughout Puerto Rico in both public and private lands (USFWS 2014). In addition, Cóbana negra was documented in the localities of Macao, Higüey, and San Pedro de Macoris in the Dominican Republic (Mejia et al. 1997). Presently, we have no information on the current status of the species in Dominican Republic.

Since the previous status review of Cóbana negra, the Service has gathered information regarding the status of natural populations, propagation, and planting efforts of the species in Puerto Rico. These efforts are the result of a combination of initiatives and programs implemented by the Service and other partners aiming at establishing self-sustainable populations of this species on lands managed for conservation and private lands with conservation agreements with the Service.

In February 2014, CESFO and CINWRC received funding from the Service’s CRI for the implementation of priority recovery actions for federally listed plant species in southwest Puerto Rico, including Cóbana negra. This project has been implemented throughout a Cooperative Agreement with Envirosurvey, Inc.

Most of the new information presented below include natural population assessments, propagation, and planting efforts that have been implemented as part of this agreement.

Assessments of Natural Populations

In the 2014 5-year status review, we reported a total 191 Cóbana negra individuals known from nine natural populations, but the information at that time was not from comprehensive surveys and did not differentiate individuals by age structure (i.e., adults, saplings, and seedlings). Since that time, we have gathered more accurate information on the status of five of the nine known natural populations of Cóbana negra in Puerto Rico, including number of individuals per age classes. These five populations include three in the municipality of Cabo Rojo, one in the municipality of Lajas, and one in the municipality of Guayanilla; see Table 1). In addition, here we report two individuals of Cóbana negra located at the former Naval Station Roosevelt Roads (NSRR) in the municipality of Ceiba in eastern Puerto Rico (Vicente *et al.* 1989, Naval Facilities

Engineering Command Atlantic (NAECA) 2006). These two individuals were not reported in the 2014 5-year status review, and unfortunately at the time of this review we have no additional information and the current status of those trees is unknown. The location of both trees is within undevelopable areas designated for conservation at the former NSRR (NAECA 2006).

Currently, there is no up-to-date information on the status of the natural Cóbana negra populations from Vieques, NSRR, Laguna Joyuda in the municipality of Cabo Rojo, and Punta Picúa in the municipality of Río Grande, but we included their 2014 information in Table 1 below along with the current data of other populations.

Below we present a description of each of the 5 natural populations surveyed between 2014 and 2020 (Table 2 in the 2014 5-year review, Table 1 for 2020 data, below).

Boquerón Country Club (Cabo Rojo)

In the 2014 5-year status review, we reported that this population consisted of about 17 adult trees found along a creek in the middle of a residential area known as Boquerón Country Club (USFWS 2014a). In July 2016, staff from Envirosurvey, Inc. found a total of 38 adults, 71 saplings, and 9 seedlings (Table 1). In addition, they documented that all saplings and seedlings were growing under parental trees, which suggests a lack of a disperser (Envirosurvey, Inc. 2020). This higher number of individuals is the result of a comprehensive survey, as the numbers reported in the 2014 5-year status review were the result of a rapid assessment of the population while checking for the implementation of the conservation measures recommended by the Service during the construction of the project (Monseguer-Rivera 2020, pres. comm.). In addition to the low probability of expansion of this population due to the lack of a disperser (other than gravity), impacts to the population have been documented as result of activities from the residential complex that surrounds the population. For example, an analysis of 2020 aerial images from this area shows that the vegetation along the drainage where the Cóbana negra trees are found was cleared probably as a measure to prevent flooding (Cruz-Burgos 2020, pers. obs.). Such action probably impacted the seedlings and saplings under parental trees affecting the likelihood of natural recruitment of the population.

Punta Melones (Cabo Rojo)

In the 2014 5-year status review we reported 8 individuals in the area of Punta Melones growing sparsely (USFWS 2014a). This area is composed of different types of habitats, including coastal shrub vegetation, mangrove wetlands, salt flats, and hills with native dry forest vegetation. In August 2016, during a comprehensive survey, staff from Envirosurvey, Inc. documented a total of 96 Cóbana negra individuals: 7 adults, 75 saplings, and 10 seedlings in this area (Table 1). Adult individuals are found scattered on the edge of marginal habitat near the shore, on the edges of the salt flats, and close to dirt roads, while saplings were found under the parental tree (Envirosurvey, Inc. 2020). Such marginal habitat does not provide suitable habitat for the recruitment of the species as individuals are susceptible, to deforestation, human or cattle trampling, competition with exotic plant species, and the probably high salinity of the soil also affects seedlings development (J.G. Martinez 2020, pers. obs.). In fact, Service biologists have been

monitoring this population at least during the past 10 years and have noticed that seedlings and saplings are not likely reaching adulthood due to threats indicated above (Monsegur-Rivera 2020, pers. comm.).

Sierra Bermeja (Cabo Rojo-Lajas)

The Service reported five *Cóbana negra* individuals from Sierra Bermeja in the 2014 5-year status review. Currently, only three adult individuals of the species have been documented at this site, all three isolated from each other: one at a private property southwest of Sierra Bermeja, one at another private property known Finca Lozada, and a third at El Conuco, a property managed for conservation by PLN (Figure 1; Table 1) (Envirosurvey, Inc. 2020). In August 2016, staff from Envirosurvey, Inc. visited the private property southwest of Sierra Bermeja where the largest *Cóbana negra* tree that we have on record is located. They found 90 saplings of the species, but all were found under the canopy of the parental tree, and cattle were observed resting under the shade of that tree (Envirosurvey, Inc. 2020), which result in trampling of seedlings and saplings. . In June 2019, Envirosurvey, Inc. documented one adult *Cóbana negra* tree at Finca Lozada, a private property located west of the Laguna Cartagena National Wildlife Refuge (LCNWR). Recently, we have learned that this locality has more individuals in other areas (C. Pacheco 2020, pers. comm.), but unfortunately this information was unknown at the time Envirosurvey, Inc. conducted the survey. In addition, in December 2019, staff from PLN found another individual of *Cóbana negra* with two saplings and no presence of seedlings at El Conuco (Morales-Pérez 2020, pers. comm.).

Punta Guaniquilla Natural Reserve (PGNR) (Cabo Rojo)

In the 2014 5 year status we mentioned that the Punta Guaniquilla and Villa Taina populations had 5 individuals each, but we later determined both locations were the same, located within the Punta Guaniquilla Natural Reserve (PGNR), a land managed for conservation by the non-government organization Para La Naturaleza (PLN) (Envirosurvey 2020; Figure 2). In July 2018, staff from PLN and Envirosurvey, Inc. conducted a rapid assessment of the *Cóbana negra* in the PGNR. They found 6 adults scattered among mangroves, shrubs, and pasturelands, and documented 200 saplings growing predominantly under the adult trees (Table 1; Envirosurvey 2020; Arocho 2020, pers. comm.). Also, they reported that the trees had many broken branches, probably as a result of Hurricane María, but the population seemed to be recovering as evidenced by the presence of tall saplings extending beyond the canopy.

Punta Ventana (Guayanilla)

In the 2014 5-year review we reported that the *Cóbana negra* population in Punta Ventana is the largest known natural population, with approximately 97 individuals of different age classes. Punta Ventana is located in private land and the area where the species is found is under conservation status (Guarnaccia 2005). All individuals grow in a brackish, seasonally flooded wetland in association with mangroves. In May 2018, Service biologist J. G. Martínez, along with staff from Envirosurvey, Inc. visited the area to assess this *Cóbana negra* population after Hurricane María. Results from the assessment accounted for 47 adults and 504 saplings (Table 1; Envirosurvey, Inc. 2020).

Some of the adult trees had fallen and had exposed roots, probably due to the effects of the Hurricane María, but were still alive at the time of the survey.

Table 1. Cóbana negra known natural populations monitored between 2014 and 2019 in Puerto Rico (Envirosurvey, Inc. 2020). * = populations located in protected areas or areas managed for conservation. ** = populations located in private lands with no conservation status. (NWR= National Wildlife Refuge, PLN = Para La Naturaleza).

Population	Locality	Status	Adults	Saplings	Seedlings
Guayanilla	Punta Ventana*	Stable	47	504	0
Cabo Rojo	Punta Guaniquilla (PLN)*	Stable	6	200	0
Cabo Rojo - Lajas (Sierra Bermeja) ^a	El Conuco (PLN)*	Stable	1	2	0
	Big tree **	Stable	1	90	0
	Finca Lozada**	Stable	1	0	0
Cabo Rojo	Punta Melones**	Stable	7	75	10
Cabo Rojo	Boquerón Country Club**	Stable	38	71	9
Ceiba	Roosevelt Roads Naval Station*	unknown	2	0	0
Vieques	Vieques NWR*	unknown	40	0	0
Río Grande	Punta Picúa*	unknown	11	0	0
Cabo Rojo	Laguna Joyuda*	unknown	3	0	0
Total			157	942	19

^aThe population of Sierra Bermeja includes three localities: El Conuco, Big tree, and Finca Lozada.

Based on the information gathered since the 2014 five year status review, we have updated information on five of the nine natural populations (i.e., (i.e., Guayanilla (Punta Ventana), Cabo Rojo- Lajas (Sierra Bermeja^a), Cabo Rojo (Punta Guaniquilla), Cabo Rojo (Punta Melones) Cabo Rojo (Boquerón Country Club)), which indicates that 73% (816 individuals) of the Cóbana negra individuals occur in lands managed for conservation, and the remaining 27% (302 individuals) occur in private lands with conservation status (Table 1). Moreover, the largest number of saplings (704) also occur in those properties managed for conservation (i.e., Punta Ventana and PGNR). However, most of the saplings are located just below parental trees, and very few individuals were documented outside of the adult tree canopy, particularly in PGNR (Envirosurvey, Inc. 2020). This information suggests the reduced seed dispersal capability of the species, and is likely the cause of the observed reduced survival of seedlings and samplings due to natural thinning resulting from competition for resources such water, nutrients and sunlight (Monsegur-Rivera 1999-2020, pers. obs.). The overall abundance of the Cóbana negra individuals in all nine natural populations (not including planted individuals) is 1,118 individuals, corresponding to 157 (14%) adults, 942 (84%) saplings, and 19 (2%) seedlings (Table 1). Based on these numbers, it seems the recruitment of Cóbana negra in natural populations is low, as most saplings are not reaching the adult stage because

adults only make up 14% of the populations. Thus, the lack of natural seed dispersal out from the influence of the parental tree may continue to limit the species' survival, and the natural expansion of its populations.

Currently, the status of natural populations of Vieques, NSRR, Laguna Joyuda, and Punta Picúa is unknown. Overall, combining the information of the natural populations from this review with that reported in the 2014 5-year status review, about 110 (70%) of the 157 adult individuals of natural populations are located in Federal, State or private lands managed for conservation. The remaining 30% occurs in privately owned lands and are subject to different threats. Moreover, the high number of saplings in some of these protected natural populations suggests they are self-sustainable.

Assessments of Introduced/Reintroduced Populations

Propagation efforts

Between 2015 and 2018, staff from Envirosurvey, Inc. collected 2,107 Cóbana negra seeds from different populations in the municipalities of Cabo Rojo, Lajas, and Guayanilla as part of the CRI project (Envirosurvey, Inc.2020). A total of 1,097 (52%) of those seeds germinated and were propagated. Envirosurvey, Inc. (2020) documented that the germination process is faster when the seeds were cleaned by removing the exocarp (fleshy outer cover) and directly placing the embryo just slightly above the propagation medium on the germination bank. In addition, they mentioned that the viability of the Cóbana negra seeds is higher at the early state of collection. They observed that the germination time is 5 to 7 days when planted right after collection, compared to 7 to 14 days when seeds are dried first for two to three days (Envirosurvey, Inc. 2020).

As of the most recent information received by PLN, in 2018 and 2019 their propagation efforts have resulted in a total of 1,711, and 1,438 Cóbana negra individuals, respectively (PLN 2018, PLN 2019). Cóbana negra is one of the several endemic and native species propagated under their Habitat Program (previously known as Tree plus Tree Program), which aims for the Island's ecological recovery, particularly after the impacts of hurricanes Irma and María. In addition, the non-government organization Protectores de Cuencas, Inc. (PDC) reported they have 3,210 Cóbana negra individuals whose seeds were collected from trees planted along the edge of State road 116 in Guánica, and 173 individuals that the Service propagated from seeds collected at Punta Ventana population (Envirosurvey, Inc. 2020). Those 173 individuals were propagated as part of the CRI project and were transferred to PDC for planting at the Guánica Commonwealth Forest because that habitat is contiguous to Punta Ventana. The 3,210 individuals will be planted in the future on different restoration projects within lands managed for conservation in coordination with the Service and Puerto Rico Department of Natural and Environmental Resources (PRDNER) (Cruz-Quiñones 2020, pers. comm.). In addition, 250 individuals are still in Vieques National Wildlife Refuge nursery to be planted in the future (E. Bermúdez 2020, pers. comm.).

Planted populations

Since the 2014 5-year status review, the Service continued implementing planting efforts, resulting in an increase in the number of Cóbana negra populations and individuals throughout public and private lands in Puerto Rico (Figure 2). These efforts are the result of a combination of programs and initiatives (e.g., CRI, PFW, Joint Chiefs Initiative) implemented by the Service and other partners to establish self-sustaining populations on lands managed for conservation. Over the past recent years, more than 1,000 individuals of Cóbana negra have been planted in selected areas where suitable habitat conditions are present to maximize their establishment (e.g., planted near natural drainages with gentle slope to minimize the risk of landslides, presence of firebreaks in selected properties, fencing, and irrigation systems) (Envirosurvey, Inc. 2020). Additionally, some of the Cóbana negra planting sites are close to natural populations, which promote ecological corridors and thus, increase cross-pollination between planted individuals and individuals from natural populations. These planting sites were identified within suitable habitat for the species, and it is expected that these planting efforts would increase genetic diversity and increase resiliency of these populations.

Between 2016 and 2020, a total of 1,531 Cóbana negra individuals have been introduced in both public and private lands managed for conservation (874 individuals), and private lands with PFW Cooperative Agreements (657 individuals) (Figure 1, Table 2). Overall, about 77% (1,186 individuals) of those were still alive at the time of this review. Presently, the Service and partners continue working together on the implementation of recovery actions for this species. Details about planted populations on public and private lands are found below.

Planted populations on public lands:

Cabo Rojo National Wildlife Refuge (CRNWR)

The efforts to establish new populations of Cóbana negra within CRNWR (Figure 1) began after the 1980s, but the majority of plantings were affected by severe fires and droughts, where most of the individuals did not survive (J. Padilla 2020, pers. comm.). In 2016, a volunteer student working at the CRNWR conducted a rapid assessment to evaluate the status of the 448 Cóbana negra planted in this refuge (Weaver and Schwagerl 2008). She found more than 20 adult Cóbana negra trees in a drainage near an abandoned landing strip and two adults near the tree nursery, areas where previous fires had not caused impacts (L. Rivera-Rodríguez 2020, pers. comm.).

From June 2017 to January 2020, Service biologists and staff from Envirosurvey, Inc. conducted several planting events of Cóbana negra at the CRNWR. A total of 91 trees were planted from June 2017 to September 2018. In August 2019, staff from Envirosurvey, Inc. assessed the site and found 42 (46%) of the 91 Cóbana negra trees were still alive (Envirosurvey, Inc. 2020). In addition, 15 individuals were planted from October to January 2020. All trees were planted along natural drainages (Table 2) within areas less likely to be affected by human-induced fires. Planted individuals came from different seed sources of natural populations found in Cabo Rojo and Sierra Bermeja.

Overall, they planted a total of 106 Cóbana negra trees at the CRNWR with a survival of 58% as of February 2020 (Arocho 2020, pers. comm.).

Laguna Cartagena National Wildlife Refuge (LCNWR)

The LCNWR, in collaboration with the non-government organization PDC is working on the restoration of an area that was burned in 2015 near the southern boundary of Cartagena Lagoon at the LCNWR (Figure 1). Between April and May 2017, we provided PDC with a total of 184 Cóbana negra individuals to be planted in the restoration area. These individuals were propagated from different seed sources of natural populations found in Cabo Rojo and Sierra Bermeja. After Hurricane María (September 2017), staff from Envirosurvey, Inc. conducted a rapid assessment of those trees and found that 164 individuals (89%) were still alive. On September 2019, Envirosurvey, Inc. revisited the reforestation project and found 110 live trees and 10 dead, for a 54% survival; the remaining individuals could not be found and were presumed dead (Table 2; Envirosurvey, Inc. 2020). The specific cause of mortality of these trees was not identified.

From 2016 to 2019, Services biologist J.G. Martínez, along with staff from Envirosurvey, Inc., surveyed individuals of Cóbana negra planted since 1998 in the northern boundary of the LCNWR. A total 178 adults, 2,265 saplings, and 165 seedlings were documented during those assessments. However, they documented that the majority of seedlings and saplings are located just below the parental tree (Envirosurvey, Inc. 2020), suggesting a limited dispersal and limited future survival because most of those individuals are apparently suppressed by parental trees and competition among them.

La Tinaja Tract

In 2017, Service biologists and staff from Envirosurvey, Inc. planted 30 individuals of Cóbana negra in La Tinaja Tract within the LCNWR (Figure 1; Table 2). These individuals were propagated from different seed sources of natural populations found in Cabo Rojo and Sierra Bermeja. After Hurricane María, staff from Envirosurvey, Inc. visited the planted site and found that only seven (23%) individuals had survived. In December 2019, two years after Hurricane María, staff from Envirosurvey, Inc. revisited the planting area and found that invasive plants (i.e., Guinea grass (*Megathyrsus maximus*) and *Leucaena* (*Leucaena leucocephala*)) had overgrown the planting site and did not find any of the Cóbana negra individuals (Envirosurvey, Inc. 2020). Thus, it is very likely that none of those planted individuals survived.

Ciénega las Cucharillas Natural Reserve (CLCNR)

In 2019, 75 individuals of Cóbana negra were planted through a PFW Cooperative Agreement between the Service, El Corredor del Yaguazo, Inc., and Caras of the Americas (Caras con Causa) at CLCNR in the municipality of Cataño (Figure 1; Table 2). These planting efforts seek to establish new populations of Cóbana negra in northern Puerto Rico, and to enhance the habitat of the CLCNR with different tree species (Caras of the America 2020). All of these individuals were propagated by staff from El Corredor del Yaguazo, Inc., and the seed source was a Cóbana negra tree planted about

10 years ago at the CLCNR. As of the date of this review, all planted individuals were still alive.

Para La Naturaleza Habitat Program

In 2012, a total of 22 individuals of Cóbana negra were planted at Hacienda La Esperanza Natural Reserve (HLENR) (Figure 2; Table 3). This property is managed for conservation by PLN. This planting was not reported in the 2014 5-year status review because we did not have the information. Currently, all Cóbana negra trees are still alive and in good condition, and staff from PLN have documented flowers and fruits in past years (Morales-Pérez 2020, pers. comm.). Additionally, in 2019 staff from PLN planted 67 individuals of Cóbana negra in the coastal forest within HLENR (Table 3). All of these individuals were propagated by PLN and the seed source is from a Cóbana negra tree planted long time ago in the parking lot of the Department of Agriculture at the University of Puerto Rico, Mayagüez Campus (Morales-Pérez 2020, pers. comm.)

From October to December 2018, staff of Envirosurvey, Inc., in collaboration with PLN, planted 150 individuals of Cóbana negra at the PGNR (Figure 1). In August 2019, staff from Envirosurvey, Inc. returned to assess that population and found 105 (70%) trees alive (Table 2). In 2019, staff of PLN planted an additional 50 Cóbana negra individuals in that same area (PLN 2019).

Following Hurricane María in 2017, PLN engaged in reforestation efforts in both public and private lands managed for conservation throughout Puerto Rico. Through their Habitat Program, they planted approximately 188 Cóbana negra trees in different PLN natural protected areas in 7 municipalities (i.e., Barranquitas, Fajardo, Florida, Humacao, Manatí, Naguabo, and Vieques) (Table 3; PLN 2018, PLN 2019).

Protectores de Cuencas (PDC)

From 2018 to 2020, PDC established a restoration project in La Jungla, located within Guánica Commonwealth Forest. PDC planted a total 279 Cóbana negra individuals in that restoration area (PDC 2020). These individuals were propagated from seed sources of trees found in State road PR-116 in the municipality of Lajas. Recently, staff from PDC conducted a rapid assessment of those trees and found that all individuals were still alive, and some individuals measured approximately 5 ft tall (Cruz-Quiñones 2020, pers. comm.).

Planted populations on private lands:

Cooperative Recovery Initiative (CRI)

In 2017, the Service established additional agreements through the CRI project with owners of land south of Sierra Bermeja (Figure 1). From 2017 to 2020, we delivered Cóbana negra trees and other native species to those landowners for planting in natural drainages and other suitable habitats within their properties. In July 2019, staff from Envirosurvey, Inc. visited Property 1 and found that 37 Cóbana negra of the 75 planted (49%) were alive (Envirosurvey, Inc. 2020, Table 2). In July 2019, staff from Envirosurvey, Inc. conducted a rapid assessment at Property 2 and found that none of the

75 Cóbana negra planted in that property survived. Unfortunately, this landowner ceased irrigation a couple of months after the trees were planted as understood they were adapted to such dry environment (Envirosurvey Inc. 2020), and the lack of water stressed the trees causing their dead. On December 2019, Envirosurvey, Inc. assessed the Cóbana negra trees planted at Bayahonda Farm and found 40 (65%) alive of the 61 planted (Table 2; Envirosurvey, Inc. 2020). In January 2020, 76 Cóbana negra were planted within another private farm (Property 5), located in La Pitahaya, Cabo Rojo (Table 2; Envirosurvey, Inc. 2020). In February 2020, a site visit confirmed that all Cóbana negra trees in this property were still alive (J.G. Martínez 2020, pers. obs). All of these individuals were propagated as part of CRI project, and the seed source were natural populations of Cóbana negra.

Partners for Fish and Wildlife Cooperative Agreements (PWF)

As part of the recovery efforts for listed species, the Service has been working with landowners on the implementation of habitat restoration and enhancement practices, which have included the planting of Cóbana negra. In 2015, Service biologists visited the Montalvo farm in Cabo Rojo, where more than 20 Cóbana negra trees had been planted through a PFW Agreement, and found that most of the individuals were still alive and were producing fruits (Cruz-Burgos 2015, pers. obs.). In 2016, Service biologists assessed the suitability of habitat at a creek and drainage areas for additional planting of Cóbana negra in this property. After the evaluation, the Service established a new PFW Cooperative Agreement with the landowner for planting an additional 100 Cóbana negra individuals. One year after planted, all individuals were alive and in good condition (J. G. Martínez 2017, pers. obs.).

In 2019, the Service established three PFW Cooperative Agreements in collaboration with PDC, and provided a total of 100 individuals of Cóbana negra to be planted on three farms in southwest Puerto Rico: Tai South, Semidei, and Juanita Farm, with 25, 25, 50 individuals, respectively, as part of a project aiming to enhance habitat for the yellow-shouldered blackbird (Table 2). As of the date of this review, all Cóbana negra trees were still alive in these farms. All of these individuals were propagated by PDC from seeds collected from Cóbana negra trees planted along State road PR-116 in the municipality of Lajas.

Joint Chiefs Landscape Restoration Partnership

In 2017, after hurricanes Irma and María struck Puerto Rico, the Natural Resources Conservation Service, the U.S. Forest Service, and the U.S. Fish and Wildlife Service partnered to develop the Joint Chiefs Landscape Restoration Partnership. The main goals of this initiative are to establish biological corridors and restoring ecosystem functionality post-hurricane in the central mountain range of western Puerto Rico (Figure 1). Through the Joint Chiefs project, we provided a total of 170 individuals of Cóbana negra to be planted on three farms: Rancho AA, KeFruit, and Toro Farm, with 65, 49 and 56 individuals, respectively (Table 2). As of the date of this review, all Cóbana negra trees in these farms were still alive. All of these individuals were propagated by PDC from seeds collected from Cóbana negra trees planted along State road PR-116 in the municipality of Lajas.

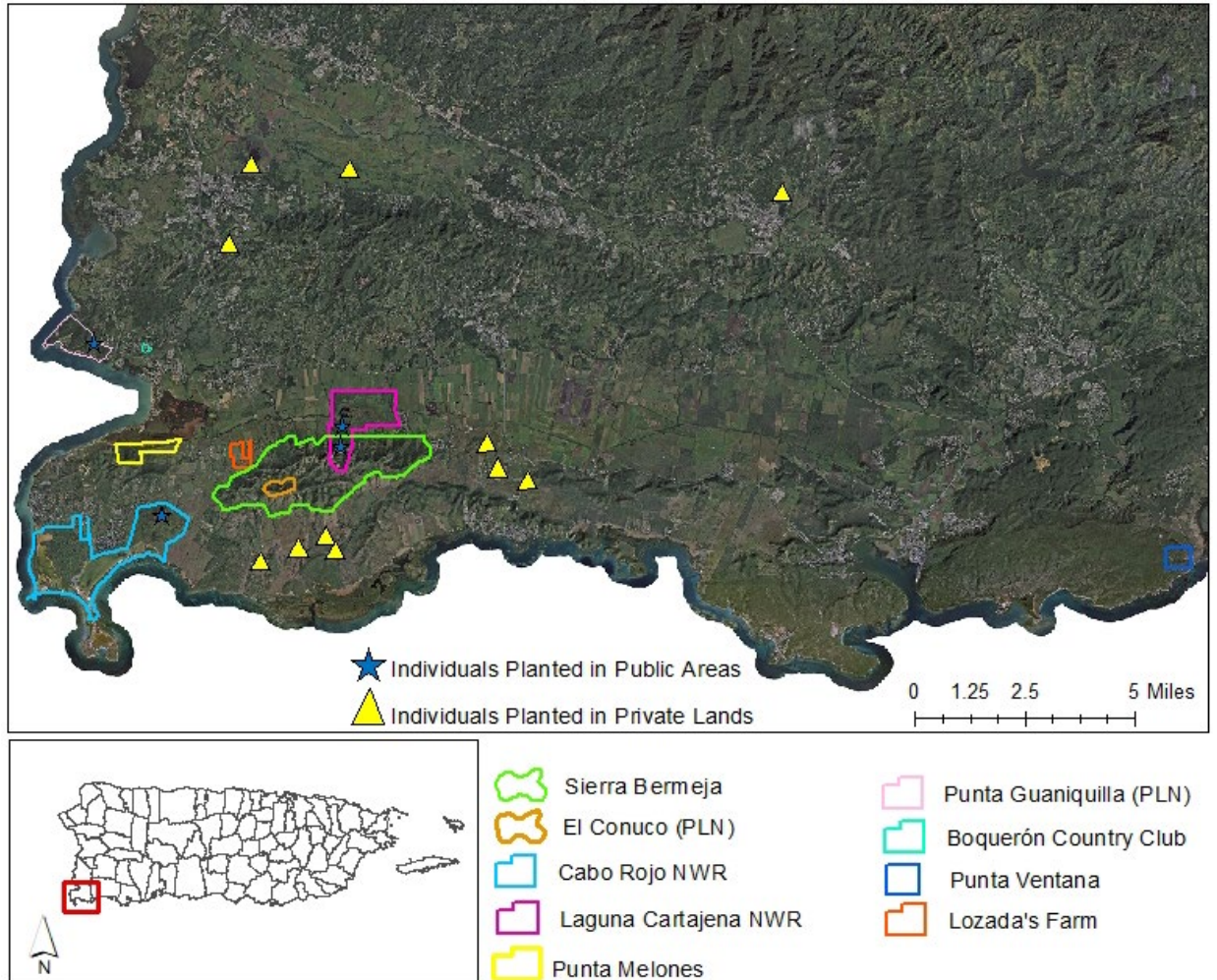


Figure 1. Public and private lands where Cóbana negra occurs in southwest Puerto Rico (Envirosurvey, Inc. 2020). (NWR = National Wildlife Refuge, PLN=Para La Naturaleza). Blue stars are the Cóbana negra trees planted in public lands and yellow triangles are the Cóbana negra trees planted in private lands from 2016 to 2020.

Table 2: Planted Cóbana negra trees between 2016 and 2020 through U.S. Fish and Wildlife Service’s initiatives (NWR = National Wildlife Refuge, NR= Natural Reserve. * = populations located in protected areas or areas managed for conservation. ** = populations located in private lands.

Population	Locality	Number of planted individuals	Number of individuals found alive	Percent of Survival	Year planted	Source
Cabo Rojo	Cabo Rojo NWR*	106	57	58	June 2017 to Jan 2020	Envirosurvey, Inc. 2020
Lajas ^a	Laguna Cartagena NWR*	184	100	54	2017	Envirosurvey, Inc. 2020
	La Tinaja Tract*	30	0	0	2017	Envirosurvey, Inc. 2020
Cataño	Cienega las Cucharillas NR*	75	75	100	2019	Caras of the Americas 2020
Guánica	La Jungla*	279	279	100	2019	Protectores de Cuenca, Inc. 2020
Cabo Rojo	Punta Guaniquilla NR (PLN)*	200	155	77	2018	Envirosurvey, Inc. 2020. PLN 2019
Cabo Rojo	Montalvo Farm**	100	100	100	2016	PFW-FY16-AC01198
Cabo Rojo (Pitahaya) ^b	Property 1**	75	37	49	2018	Envirosurvey, Inc. 2020
	Property 2**	75	0	0	2018	Envirosurvey, Inc. 2020
	Bayahonda Farm**	61	40	65	2018	Envirosurvey, Inc. 2020
	Property 5**	76	73	96	2020	Envirosurvey, Inc. 2020
Lajas ^c	Tai South Farm**	50	50	100	2019	PFW-YSBL-03-2019
	Semidei Farm**	25	25	100	2019	PFW-YSBL-02-2019
	Juanita Farm**	25	25	100	2019	PFW-YSBL-04-2019
Sabana Grande	Rancho AA**	65	65	100	2018	PFW-JCLRP-04-2018

Cabo Rojo	KeFruit Farm**	49	49	100	2019	PFW-JCLRP-05-2019
Cabo Rojo	Toro Farm**	56	56	100	2020	PFW-JCLRP-08-2019

Total individuals 1,531 1,186 77%

^aLaguna Cartagena NWR and La Tinaja Tract constitute one population

^bProperties 1, 2 and 5, and Bayahonda Farm constitute one population

^cTai Farm, Semidei Farm, and Juanita Farm constitute are one population

Table 3: Number of Cóbana negra trees planted by Para La Naturaleza (PLN) (NR= Natural Reserve, NPA= Natural Protected Area)

Population	Locality	Number of planted individuals	Year planted	Source
Manatí	Hacienda La Esperanza NR	22	2012	Morales-Pérez 2020 pers. comm.
	Hacienda La Esperanza NR	67	2019	Morales-Pérez 2020 pers. comm.
Barranquitas	Finca Don Felix NAP	5	2018	PLN 2018
Humacao	Pterocarpus Forests NPA	30	2018	PLN 2018
Fajardo	Cabezas de San Juan NR	15	2018	PLN 2018
Vieques	Cerro el Buey NAP	12	2018	PLN 2018
		22	2019	PLN 2019
Naguabo	Santa Aguila NPA	11	2019	PLN 2019
Florida	Río Encantado NAP	4	2019	PLN 2019
Total individuals		188		

As shown in Table 3, a total of 188 Cóbana negra additional individuals have been introduced in lands managed for conservation by Para La Naturaleza (Figure 2). The Service and PLN will work together in cooperative monitoring, and reporting efforts are needed to determine overall success of these and future introduction efforts.

In the 2014 5-year review, we reported that 2,256 *Cóbana negra* individuals were planted throughout Puerto Rico in both public and private lands over the past decade (USFWS 2014a). However, many were planted in habitats that were not considered suitable for the recovery of the species (e.g., urban areas, pasturelands, and along roads). Unfortunately, many of the planted individuals reported in the 2014 5-year review have not been continuously monitored and their current status is unknown. In addition, we included in this review 6 individuals of *Cóbana negra* that were planted more than 15 years ago at the Culebra National Wildlife Refuge (CNWR) (Figure 2), which were not reported in the 2014 5-year status review, but that at the time of this review, all are still alive (A. Román 2020, pers. comm.). Still, more than 970 *Cóbana negra* trees have been planted in the past in protected areas (e.g., Commonwealth Forests and NWRs; Table 4; Figure 2), which would be expected to contribute to the recovery of the species. However, no current information on the status of those individuals is available. Thus, monitoring and reporting efforts are necessary to determine the success of these planting efforts.

Table 4. *Cóbana negra* individuals planted in protected areas before of 2014 (USFWS 2014a) (CF = Commonwealth Forest, CR = Commonwealth Refuge, NWR= National Wildlife Refuge, IACWR= Iris Alameda Commonwealth Wildlife Refuge)

Population	Locality	Number of individuals
Santa Isabel	Finca Gabia	400
Juana Díaz	Toa Vaca Reservoir	200
Guánica	Guánica CF	15
Arecibo	Cambalache	50
Loíza	Piñones CF	10
Sabana Grande, Yauco	Susúa CF	20
Cabo Rojo	Boquerón CF	14
Cabo Rojo	Boquerón IACWR	5
Vega Alta	Vega CF	50
Culebra	Culebra NWR	6
Cabo Rojo	Cabo Rojo NWR	22
Lajas	Laguna Cartagena NWR	178
Total individuals		970

Table 5. Summary of natural and planted individuals (alive at the time of this review) by population and known threats to the species per site. * = populations located in protected areas or areas managed for conservation. ** = populations located in private lands. (NWR= National Wildlife Refuge, CF= Commonwealth Forest, CR= Commonwealth Reserve, NR= Natural Reserve, PNA= Natural Protected Area, IACWR= Iris Alameda Commonwealth Wildlife Refuge)

Population	Locality	Number of individuals	Threats			
			Development	Fires	Exotic plant species	Cattle
Guayanilla	Punta Ventana*	47		X	X	
Cabo Rojo	Punta Guaniquilla (PLN)*	161		X	X	X
Cabo Rojo - Lajas (Sierra Bermeja)	El Conuco (PLN)*	1		X	X	X
	Big tree **	1	X	X	X	X
	Finca Lozada**	1	X		X	X
Cabo Rojo	PuntaMelones**	7	X		X	X
Cabo Rojo	Boquerón Country Club**	38	X			
Vieques	Vieques NWR*	40		X	X	X
Ceiba	Naval Station Roosevelt Roads*	2		X	X	
Rio Grande	Punta Picúa*	11			X	
Cabo Rojo	Laguna Joyuda*	3			X	
Cabo Rojo	Cabo Rojo NWR* Old individuals	22		X	X	
	Cabo Rojo NWR* New individuals	57		X	X	
Lajas	Laguna Cartagena NWR* Old individuals	178		X	X	X
	Laguna Cartagena NWR* New individuals	100		X	X	X
Culebra	Culebra NWR*	6			X	
Guánica	La Jungla*	279		X	X	
Cataño	Cienega las Cucharillas NR*	75		X	X	
Cabo Rojo	Montalvo Farm**	100			X	

Cabo Rojo (Pitahaya) ^a	Property 1**	37		X	X	
	Bayahonda Farm**	40		X	X	
	Property 5**	73		X	X	
Lajas ^b	Tai South Farm**	50		X	X	
	Semidei Farm**	25		X	X	
	Juanita Farm**	25		X	X	
Sabana Grande	Rancho AA**	65			X	
Cabo Rojo	KeFruit Farm**	49			X	
Cabo Rojo	Toro Farm**	56			X	
Manatí	Hacienda La Esperanza NR (PLN)*	89		X	X	
Naguabo	Santa Aguila NPA (PLN)*	11		X	X	X
Vieques	Cerro el Buey NPA (PLN)*	34		X	X	X
Florida	Río Encantado NPA (PLN)*	4			X	X
Humacao	Pterocarpus Forests NPA (PLN)*	30		X	X	X
Barranquitas	Finca Don Felix NPA (PLN)*	5		X	X	
Fajardo	Cabezas de San Juan NR (PLN)*	15		X	X	
Santa Isabel	Finca Gabia*	400		X	X	
FJuana Díaz	Toa Vaca Reservoir*	200			X	
Guánica	Guánica CF*	15		X	X	
Arecibo	Cambalache*	50		X	X	
Loíza	Piñones CF*	10		X	X	
Sabana Grande, Yauco	Susúa CF*	20		X	X	
Cabo Rojo	Boquerón CF*	14		X	X	
Cabo Rojo	Boquerón IACWR*	5		X	X	
Vega Alta	Vega CF*	50			X	

Total individuals 2,501

^aProperties 1 and 5, and Bayahonda Farm constitute one population.

^bTai Farm, Semidei Farm, and Juanita Farm constitute are one population.

Based on the information presented above, the overall abundance of Cóbana negra has increased when compared to the information presented in the 2014 5-year status review. Throughout the years, additional planting efforts have been implemented to establish new

populations in protected and private land manage for conservation, thus increasing the distribution of the species throughout the Island (Figure 1 and Figure 2). Table 5 shows the combined planting efforts with multiple agencies and partners has increased the numbers of *Cóbana negra* individuals to approximately 2,500 distributed through 36 populations within 22 municipalities (Cabo Rojo, Guánica, Guayanilla, Lajas, Sabana Grande, Yauco, Juana Díaz, Santa Isabel, Naguabo, Arecibo, Vega Alta, Loíza, Manatí, Florida, Barranquitas, Cataño, Río Grande, Fajardo, Humacao, Ceiba, Culebra, and Vieques) (Table 5; Figure 2). Of those 36 populations, 27 are found within protected areas or areas managed for conservation, and 9 are in private land (Table 5). Additional monitoring efforts of all known individuals are needed to better assess the status of the species, particularly after the effects of hurricanes Irma and María, and to gather information about survival rates, recruitment, and threats. Also, information regarding the current status in Dominican Republic is needed.

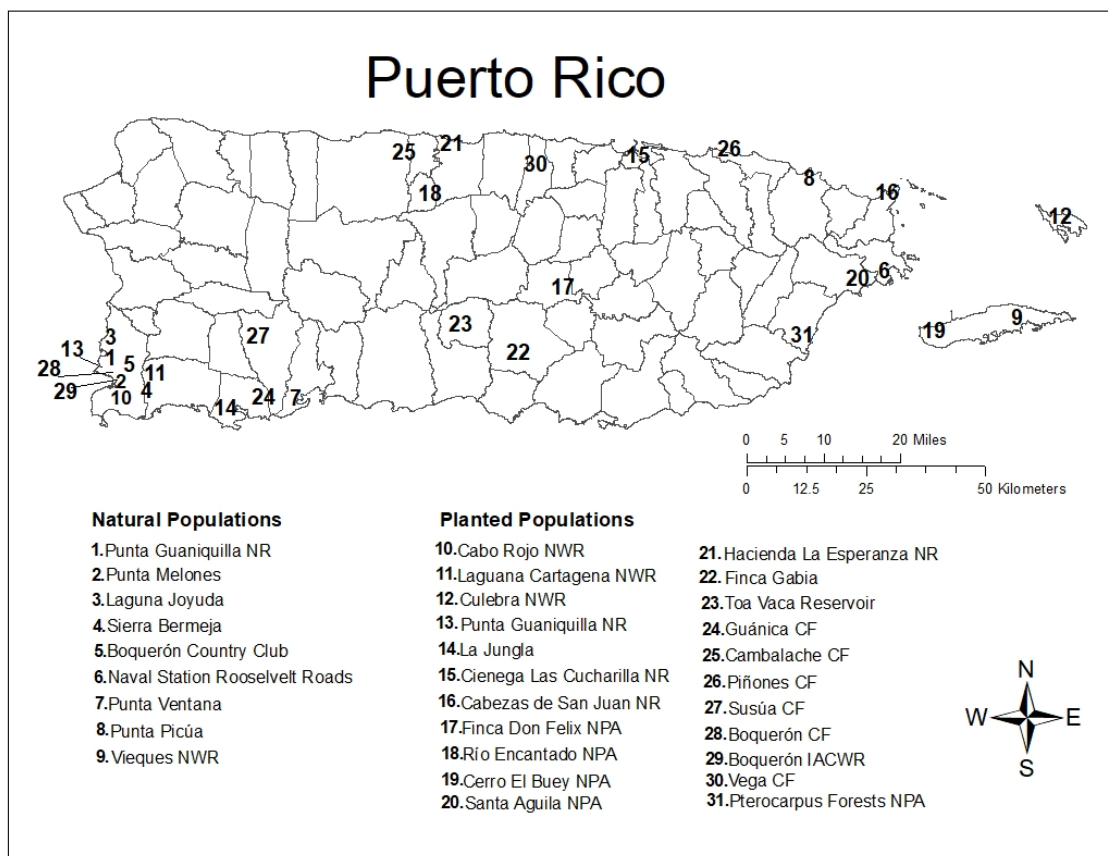


Figure 2. Natural and planted populations throughout Puerto Rico. (NWR= National Wildlife Refuge, CF= Commonwealth Forest, CR= Commonwealth Reserve, NR= Natural Reserve, NPA= Natural Protected Area, IACWR= Iris Alameda Commonwealth Wildlife Refuge)

Taxonomic classification or changes in nomenclature:

Cóbana negra is a legume species in the family Fabaceae within the Caesalpinia group, which contains over 200 species. Recently, Gagnon *et al.* (2016) conducted studies based

on single DNA sequence and morphology that provided the most comprehensive sampling and robust phylogeny of the Caesalpinia group. Gagnon *et al.* (2016) described that the genus *Libidibia*, also from the Fabaceae family and within the Caesalpinia group, shares many similarities with the monotypic *Stahlia* from the Caribbean. Given morphological similarities of both in their seed pods (similar shape and opening when mature), and the apparent lability of leaf division, they concluded that there is no justification for retaining *Stahlia* and moved it into *Libidibia* (Gagnon *et al.* 2016). The scientific community accepts *Libidibia* as the appropriate genus for the species. However, the Service will continue using the listed taxonomic classification of *Stahlia monosperma* until a formal revision of the species' genus can take place.

2. Threat Factor Analysis

(a) Present or threatened destruction, modification, or curtailment of its habitat or Range:

In the 2014 5-year status review, habitat destruction and modification associated with urban development was considered a factor affecting the continued existence of *Cóbana negra*. Presently, the five natural populations of *Cóbana negra* in Boquerón Country Club, Punta Melones, Punta Guaniquilla, Sierra Bermeja, and Punta Ventana are subject to habitat destruction or modification (Table 5). Currently, the Service has no information on habitat destruction and modification affecting the natural populations in Punta Picúa in Río Grande, NSRR in Ceiba, Laguna Joyuda in Cabo Rojo and Vieques Island.

Currently, although approximately 73% of the natural individuals of *Cóbana negra* are located in Federal, State or private lands managed for conservation, where threats from habitat modification have been reduced, cattle and horses (i.e., browsing, trampling), and fires still posing a threat to *Cóbana negra* due to direct impact and habitat modification (Lange *et al.* 2017). For example, fences in Sierra Bermeja have been intentionally broken to allow cattle and horses to forage within Refuge lands (Morales-Pérez 2013). There is information that cattle and horse's intrusion continues to be a problem within the boundaries of the LCNWR, particularly in La Tinaja Tract (Envirosurvey, Inc. 2020). In addition to browsing and trampling, cattle and horses cause habitat modification through soil erosion while walking and opening up spaces that facilitate the intrusion of exotic plant species that compete with *Cóbana negra* and serve as fuel for fires (e.g., Guinea grass). The Sierra Bermeja population have two locations with *Cóbana negra* in private lands, (i.e., Finca Lozada, and a big tree in a drainage on another property south of Sierra Bermeja). These individuals are in a habitat that remains under pressure of cattle grazing, trampling and bulldozing (Lange *et al.* 2017, Envirosurvey, Inc. 2020). Although we do not have current evidence that these individuals are being directly affected by these threats, seedlings and saplings can be impacted, for example by trampling and bulldozing for agricultural practices. To illustrate the ongoing threat of habitat destruction, 2016 Google Earth images from the southern slopes of Sierra Bermeja show the opening of new dirt roads in the proximity of known individuals of *Cóbana negra*, which could increase threats of trampling, land

conversion, and invasive species to Cóbana negra trees, hence reduce their reproduction and survival.

In 2015, the Puerto Rico Planning Board classified the Sierra Bermeja area as a District of Conservation Resource, which has specific restrictions on development activities in order to protect the natural resources of the area (PRPB 2015). Despite of this designation, cattle grazing, haying, and rural development in Sierra Bermeja are authorized. Private forested lands in this area also have been impacted through deforestation mainly for agricultural practices (i.e., cattle and horses grazing, and associated conversion of forested habitat to grasslands) and some urban development (i.e., construction of single houses, and roads) (Envirosurvey, Inc. 2016). In addition, observations from Service staff indicate that private landowners continue to affect the habitat through activities like cutting new access dirt roads on their properties (C. Pacheco and O. Monsegur-Rivera 2017, pers. obs.).

In the past, the Cóbana negra population at Punta Melones has been threatened by residential and urban development. Some developmental projects have been proposed (second homes and hotels), which could result in habitat modification and degradation. However, these projects have not been constructed. However, aerial images of this area evidenced has an increase of cattle, bike and ATV impacts in the last years. These impacts on the habitat likely results in direct and indirect impacts to individuals of Cóbana negra or at least reduce the species' expansion. In addition, dirt roads and trails provide corridors for the establishment of invasive species like exotic grasses (e.g., Guinea grass), which outcompete native vegetation and promote favorable conditions for human-induced fires.

In addition to lack of dispersion, the Cóbana negra population at Boquerón Country Club is impacted by activities related to the existing residential complex .. In the past, the Service recommended conservation measures to avoid impacts to this population, and since the construction of the urbanization began many years ago, homeowners followed those recommendations and the community protects this population (Envirosurvey, Inc. 2016). However, analysis of 2020 aerial images from this area show that the vegetation along the drainage where the Cóbana negra trees are found was cleared probably as a measure to prevent flooding (Cruz-Burgos 2020, pers. obs.). This action most likely impacted the seedlings and saplings documented by Envirosurvey, Inc. in 2016 (Envirosurvey Inc. 2020).

In the past, Cóbana negra individuals have been planted in private and public lands such as parks and along roads, which was not suitable habitats for the species because of their location. For example, in 2017 staff from Envirosurvey, Inc. observed that one Cóbana negra tree located along a road in Reparto Samán in Cabo Rojo, and two others located near the PRDNER office in Boquerón were cut. Theses adult trees were used as seed sources for propagation (R. Albarracín 2020, pers. comm.). Therefore, the Service has worked with partners during past recent years to focus the implementation of actions that lead to the recovery of the species. Our strategy aims at establishing self-sustainable

populations by planting individuals in areas where the species is protected from habitat destruction and modifications, and where it can persist into the future.

Based on this review, threats from habitat destruction and modification have been reduced, because the majority of populations occur in protected lands. However, there are some populations that are still threatened by this factor (e.g., Sierra Bermeja, Punta Melones, and Boquerón Country Club). The protection of these trees is important because they are relict of natural populations and are seed sources to maintain the genetic representation of the species.

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

In the past *Cóbana negra* was highly demanded for use as fence posts and furniture, which could have contributed to the reduction of population numbers in Puerto Rico and Dominican Republic (USFWS 2014a). Presently, we have no information indicating this factor continues to be a threat to the species. Therefore, we do not consider overutilization for commercial, recreational, scientific, or educational purposes as a threat to *Cóbana negra*.

(c) Disease or predation;

Predation of *Cóbana negra* seeds and individuals was documented in the 2014 5-year status review. However, no conclusive studies or reports indicated that these were a threat to the species then. Currently, no new information has been received nor published indicating otherwise. Therefore, we do not consider Factor C as a threat to *Cóbana negra*.

(d) Inadequacy of existing regulatory mechanisms:

In the 2014 5-year status review, we concluded that the inadequacy of existing regulatory mechanisms was not a threat to *Cóbana negra* (USFWS 2014a). Presently, 75% of the individuals are within Federal, State, or private lands managed for conservation. Although provisions of current Commonwealth laws and regulations protect *Cóbana negra* in both public and private lands, sometimes the enforcement of such legal mechanisms on private lands is challenging. For example, the *Cóbana negra* populations that occurs on private land can be subject to pressures like grazing and urban development (Lange *et al.* 2017). Furthermore, accidental damage (e.g., cutting, removing) of *Cóbana negra* individuals may occur due to lack of knowledge of the species by private landowners. Nonetheless, presently, we have no information or evidence that the inadequacy of existing regulatory mechanisms are threatening the species. Nevertheless, the Service continues working with partners and private landowners to protect and conserve *Cóbana negra* and its habitat.

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

In the 2014 5-year status review, *Cóbana negra* was considered threatened by natural or manmade factors (i.e., lack of natural recruitment, genetic variation, human-induced fires, invasive species, climate change and hurricanes). Although many populations are protected, those protections fail to prevent impacts to *Cóbana negra* related to each of the following natural or manmade factors. Recent information indicates that these threats are increasing or continue to apply to all populations.

Lack of Natural Recruitment

Based on the information obtained during this review, some natural and planted populations showed some evidence of recruitment. However, as mentioned in the past and confirmed in recent surveys, most saplings are under their parental tree, showing a lack seed dispersal (USFWS 2014a). Some observations over two years suggest that the fruits of *Cóbana negra* appear to be adapted for animal dispersal, as they are large, fragrant, and have an edible pulp (Densmore 1987, USFWS 1996). However, the possible dispersal agents of *Cóbana negra*, previously believed to be certain native mammalian species, are currently extinct (Densmore 1987, USFWS 1996). Another observation from Densmore suggested that water could disperse the seeds during the wet season, shown by placing fresh and dried fruits in water for five days and observing they all remained afloat the entire time (Densmore 1987). Currently, it is uncertain how long the seeds of *Cóbana negra* remain viable under natural conditions, but the best germination result in artificial propagation showed that vigorosity and viability of the seeds is higher in the early state of collection (Envirosurvey 2020). Another limiting factor that reduces the success of the dispersion of the *Cóbana negra* is that seed production (April-May) does not appear to be synchronized with the peak of the rainy season (August-September) in tropical dry forests. Thus, the seeds germinate under the parental tree before high rain events, or if the seeds are dispersed by run-off, the seed embryo have low germination rate (J.G. Martínez 2019, pers. obs.). In addition, observations of some individuals planted in moist life zones (e.g., HLENR) show the species flourishes and produces seeds between June and July (Morales-Pérez 2020). This could help the seed to have a greater probability of dispersing by run-off and germinate in the rainy season.

Recent monitoring of natural and planted individuals indicates that the seedlings produced by most individuals have not developed into trees that reach a reproductive size. For example, a comprehensive survey of *Cóbana negra* individuals planted approximately 20 years ago in the north section of the LCNWR did not report any evidence of new reproductive adults around the parental trees (J.G. Martínez 2019, pers. observation, Envirosurvey 2020). This finding suggests that individuals growing under parental trees are not reaching a reproductive size, and because there is a lack of natural seed dispersal, the populations have reduced natural expansion. The full recovery of the species is not possible without natural recruitment of seeds to mature ages.

Human-induced Fires

Human-induced fires continues to threaten *Cóbana negra* natural and planted populations. Habitat disturbance for agriculture and livestock practices, and vegetation clearing has promoted the establishment of exotic species like Guinea grass and *Leucaena* (Weaver and China 2003, Envirosurvey, Inc. 2020), resulting in favorable conditions for the occurrence of human-induced fires in the proximity of *Cóbana negra* populations (e.g., Sierra Bermeja, LCNWR). Human-induced fires may lead to destruction of the seed bank of native vegetation and promote the intrusion of more invasive grasses (e.g., Guinea grass), and it could alter microclimate, and nutrient cycling of the habitat that the species depend for establishment (Thaxton *et al.* 2012, Wolfe 2012).

In the past decade there have been fires more frequently in areas where natural and planted populations of *Cóbana negra* are present (e.g., PGNR, Sierra Bermeja, LCNWR, CRNWR), which have directly impacted the habitat of the species, individuals, and probably precluded the recruitment of its seedlings (USFWS 2014b, USFWS 2014c, Lange *et al.* 2017, Envirosurvey, Inc. 2020). Google Earth images from 2013 show that a fire at the PGNR impacted approximately 80 acres, and in 2015 staff of PLN reported other fire event that covered approximately 150 acres at this natural reserve (Rivera-Figueroa 2020, pers. comm.). Also, in 2015, a big fire affected approximately 200 acres south of LCNWR (J. Padilla 2020, pers. comm.). In 2019, another fire affected several acres in the southern slope of Sierra Bermeja and extended into El Conuco, directly affecting an undetermined number of various listed plant species (i.e., *Eugenia woodburyana*, *Vernonia protorii*, *Trichilia triacantha*, *Aristida chaseae* and *A. portoricensis*) (Envirosurvey 2020), and as per Google Earth images, reached very close to the big tree of *Cóbana negra* we mentioned above.

Such catastrophic events degrade that habitat (e.g., promote colonization of invasive plant species) and negatively affect the recruitment of the species. Currently, areas burned in both PGNR and LCNWR are being restored with native trees, including *Cóbana negra*, and the establishment and maintenance of firebreaks is expected to reduce fire risks. Although Federal and local agencies implement a fire prevention and management program during the dry season, it is not totally effective (J. Padilla 2020, pers. comm.). For example, hundreds of *Cóbana negra* trees have been planted within the CRNWR over the past 30 years and the majority have perished in fire events and droughts (J. Padilla 2020, pers. comm.). Therefore, adequate site selection (e.g., areas with low abundance of exotic grasses and less vulnerable to fires) is critical for the long-term viability of reintroduction sites.

Climate Change

The present climate change scenario may affect the forest plant community of dry forests via its impact on seedling growth and recruitment (Khalyani *et al.* 2016). As the influence of climate change on tropical forests becomes apparent, more studies are needed to understand how changes in climatic variables such as rainfall, temperature and drought are likely to affect *Cóbana negra*. For example, climate change can exacerbate the effects of stochastic events, such as droughts and human-induced fires. Seedlings are more susceptible to the effects of droughts and habitat modification associated to human-induced fires; therefore it can affect the recruitment and long-term viability of *Cóbana negra*. Another expected effect of climate change is that it will increase the intensity of hurricanes and tropical storms (IPCC 2012), which can affect the species by direct impact (i.e., uprooting). In addition, natural *Cóbana negra* populations located near the coast (i.e., Punta Melones, PGNR, Punta Ventana, Punta Picúa, and Vieques Island) are vulnerable to storm surges caused by hurricanes and to sea level rise due to its proximity to the sea. Also, these natural events reduce the tree canopy coverage, increasing the amount of sunlight reaching the ground, thus allowing the establishment of non-native plants (Lugo 2008) that compete with native flora, including *Cóbana negra*. Hurricane effects followed by extended period of drought may also result in changes in soil and microclimate conditions that can allow other plants (non-native grass, herbaceous or

woody vegetation) adapted to drier conditions to become established (Lugo 2000), also competing with *Cóbana negra*.

The islands of the Caribbean are more frequently impacted by hurricanes than other regions of the world (Wiley and Wunderle 1993). The most recent were Hurricanes Irma and María in 2017. In 2017, winds from Hurricane María uprooted or destroyed 67 % *Cóbana negra* individuals planted at La Tinaja Tract (Envirosurvey, Inc. 2020). Moreover, two years after the habitat disturbance caused by this hurricane, invasive plant species had overgrown the entire area, and no *Cóbana negra* were found alive (Envirosurvey, Inc. 2020). In addition, the Service and Envirosurvey documented that this hurricane also knocked down and uprooted *Cóbana negra* trees in the Punta Ventana population (Envirosurvey, Inc. 2020). Although the trees were alive at the time, their current survival is unknown. Of all known *Cóbana negra* populations, only a few have been visited since 2017. Thus, the overall impacts from Hurricanes Irma and María on this species is uncertain. In fact, we anticipate some impacts may have occurred to the *Cóbana negra* populations in eastern Puerto Rico (e.g., Río Grande, Ceiba, and Vieques), as this side of the Island received the greatest impacts from both hurricanes. Even though some of the natural populations are small, there are other natural and planted populations with large numbers of individuals. The combined efforts of multiple agencies and other partners in recent years has resulted in a wider distribution of the species throughout Puerto Rico (Figure 1). This strategy will help the species to persist into the future even if some populations are adversely affected by hurricanes.

Small and Isolated Populations

The currently known small natural populations of *Cóbana negra* appear to be relics of the species' former distribution, which is believed to have extended all along the coastal valleys of Puerto Rico and Dominican Republic. Unfortunately this species was described after the coastal valleys of Puerto Rico were deforested to give way to sugar cane plantations. Therefore, there is no account of the extent of the species or how it was impacted. Nonetheless, it is expected that the currently known populations have reduced genetic diversity and show problems associated to inbreeding depression as a result of past deforestation that also resulted in the isolation (lack of connection) of populations.

In addition, historical propagation efforts focused on collecting seeds from accessible natural populations or from planted individuals, most likely resulting in a reduction of the remaining genetic diversity of the species. Nonetheless, as part of ongoing efforts, the Service is working with partners to ensure that propagated material comes from different natural populations (i.e., Sierra Bermeja, Punta Melones, PGNR, and Punta Ventana) to enhance and increment the genetic variability in newly established populations. Also, we have been cautious not to plant individuals outside the range of the natural populations where the seeds were collected. For example, propagated material from the Punta Ventana population is being planted in the adjacent Guánica Commonwealth Forest.

Based on the above discussion, we believe that other natural and manmade factors such as lack of adult recruitment, low genetic diversity, invasive species, human-induced fire

and climate change, which could exacerbate hurricane development, continue to be threats for *Cóbana negra*.

Synthesis

Cóbana negra is a legume found throughout Puerto Rico and Dominican Republic. Although the scientific community accepts *Libidibia* as the appropriate genus for the species, the Service will continue using the listed taxonomic classification of *Stahlia monosperma* until a formal revision of the species' genus can take place.

Information gathered during this review resulted in a total of 1,118 *Cóbana negra* individuals (157 (14%) adults, 942 (84%) saplings, and 19 (2%) seedlings) documented in five of the nine currently known natural populations that were monitored between 2014 and 2020. Additional to the natural populations, numerous *Cóbana negra* individuals have been planted in both public and private lands managed for conservation through different conservation programs and initiatives over the past five years. These efforts aim at establishing self-sustainable populations of *Cóbana negra* in suitable habitats to ensure the recovery of the species. As of the time of this 5 year status review, approximately 2,500 *Cóbana negra* individuals had been planted since 2014 in different populations throughout Puerto Rico.

Although approximately 75% of the known populations of *Cóbana negra* occur within protected lands or areas managed for conservation, the species still threatened by habitat destruction and modification, and other natural or manmade factors. The 25% of populations occurring within private lands are subject to impacts from cattle and horses browsing and trampling, construction of dirt roads, and habitat modification resulting from human-induced fires. Probably one of the most important threats to the species is the lack of natural recruitment. *Cóbana negra* seems to have limited dispersal and most saplings are found growing under parental trees. It has been observed that most of these individuals do not reach a reproductive size probably due to interspecific competition, which affects the long term survival of *Cóbana negra*. Human-induced fires are also identified to threaten this species as habitat disturbance for agriculture and other practices promote the establishment of exotic species like Guinea grass, which serve as fuel for fires. During the past several years there have been fires more frequently in areas where natural and planted populations of *Cóbana negra* are present in southwest Puerto Rico, directly impacting the habitat and the species. Catastrophic events such droughts and hurricanes, which are predicted to increase due to climate change, can reduce seedlings and saplings survival. Reduction in rainfall and increase droughts can also increase the frequency and intensity of human-induced fires. The effects of the above mentioned threats on *Cóbana negra* area exacerbated by the low number and isolation of natural populations, and the low dispersal capability of the species. Therefore, there is a need to continue implementing recovery actions that help increase the number of individuals and populations of the species in areas that provide its long-term protection.

Based on the ongoing recovery actions and the overall stable status of natural populations, we believe that *Cóbana negra* is on its path to recovery. Numerous individuals are being planted, however, it will take time until those trees begin reproducing and recruiting new individuals into the populations. Also, there are some threats that cannot be controlled (i.e., climate change,

droughts, hurricanes), and others threats like human-induced fires and invasive species need to be addressed in order to achieve the full recovery of the species. In addition, efforts should continue to establish additional populations in suitable habitat, taking into account increasing the genetic variability of the species and expanding its range. Therefore, we believe that *Cóbana negra* still meets the definition of a threatened species.

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FY 2020 APPROVAL*

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approved _____ Date _____

In 2014, Southeast Region Field Supervisors have been delegated authority to approve 5-year reviews that do not recommend a status change.

Field Supervisor signature on this document reflects:

1. We have no new information received, no new public comments, and the original five factor analysis remains an accurate reflection of the species current status.
2. We have obtained a small amount of new information that we have summarized in Addendum 1, received no new public comments, and the original five factor analysis remains an accurate reflection of species current status.