

Palma de Manaca
(Calyptronoma rivalis)

5-Year Review:
Summary and Evaluation



Photo Credit: USFWS 2007

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

5-YEAR REVIEW
Palma de manaca (*Calyptromona rivalis*)

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 palma de manaca (*Calyptromona rivalis*). This notice requested new information concerning the biology and status of this plant species. A 60-day comment period was opened. No information on the palma de manaca was received from the public during the comment period.

A Service biologist prepared this 5-year review that summarizes the best available information on this plant. New information consists of publications on research projects conducted by species experts from 1993 to 2008. The 5-year review was also sent to six peer reviewers (see Appendix A). No comments were received from the peer reviewers.

B. Reviewers

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

Lead Field Office: Maritza Vargas, Caribbean Field Office, Boquerón, Puerto Rico. (787) 851-7297, extension 240.

C. Background

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

2. Species Status: 2008 Recovery Data Call: Improving. The species is present in three natural populations in the municipalities of San Sebastian, Quebradillas and Camuy. In addition, there are five introduced populations in various Commonwealth Forests.

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

4. Listing History

Original Listing

FR notice: 55 FR 4157

Date listed: February 6, 1990

Entity listed: Species

Classification: Threatened

5. Associated rulemakings: Not Applicable.

6. Review History: February 6, 1990 Final Rule (55 FR 4157), Palma de Manaca (*Calyptromona rivalis*) Recovery Plan [U.S. Fish and Wildlife Service (USFWS) 1992]

Palma de manaca is an arborescent palm that grows along stream banks in the northwestern karsts region of Puerto Rico. When the recovery plan was signed, about 275 individuals of palma de manaca were known from three naturally occurring populations (Quebrada Collazo in San Sebastian; along the Río Camuy area between the municipalities of Camuy and Hatillo; and the Río Guajataca gorge between the municipalities of Isabela and Quebradillas).

In addition, at the time of listing, palma de manaca had been planted in an area managed as a Boy Scout Camp adjacent to Guajataca Lake in the municipality of Quebradillas and in the Río Abajo Commonwealth Forest, which is managed by the Puerto Rico Department of Natural and Environmental Resources (DNER) in Utuado.

Every year the Service reviews the status of listed species and incorporates the information in the annual Recovery Data Call. In the 2007 and 2008 Recovery Data Call, we concluded that the status of the species was improving.

The Service conducted a five-year review for the palma de manaca in 1991(56 FR 56882). In this review, the status of many species was simultaneously evaluated with no in-depth assessment of the five factors or threats as they pertain to the individual species. The notice stated that the Service was seeking any 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 palma de manaca's listing classification was found to be appropriate.

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

8. Recovery Plan:

Name of plan: Palma de Manaca (*Calyptrotroma rivalis*) Recovery Plan.

Date issued: June 25, 1992.

II. Review Analysis

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

1. Is the species under review listed as a DPS? No.

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 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?** No. The species has an approved recovery plan. However, it establishes only non-measurable criteria to delist the species. It does not define the number of individuals needed for a sustainable population.
- 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. At the time of listing, the species was considered endemic to Puerto Rico but it is now also known from the Dominican Republic and Haiti (Hispaniola). Knowledge about its distribution and *ex-situ* individuals has expanded.
 - b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and there is no new information to consider regarding existing or new threat)?** 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. For threats-related recovery criteria, please note which of the 5 listing factors are addressed by that criterion. If any of the 5-listing factors are not relevant to this species, please note that here.**

The Plan specifies that palma de manaca could be considered for delisting when:

1. The known populations are placed under protective status; and
2. At least three new populations capable of self-perpetuation have been established within protective units, such as Conservation Trust property or Commonwealth Forests.

The plan specifies that these criteria must be considered minimum requirements, and should be expanded upon if the regenerative potential of natural and *ex situ* populations proves insufficient. The plan also states that if new populations are discovered, it might be preferable to place greater emphasis on protection, rather than propagation, to achieve a minimum number of plants (number not specified).

Criterion 1 has not been met. The three natural populations (Quebrada Collazo, Río Camuy, and Río Guajataca) located in private lands have not been placed in protective status.

Criterion 2 has been partially met. Various propagation efforts were conducted at various Commonwealth Forests of Puerto Rico. Currently, there are five introduced populations

on Commonwealth Forests: four in the Río Abajo Commonwealth Forest and one in the Guajataca Commonwealth Forest (DNER 2006, p.95; Victor Rodríguez, DNER, pers. comm., 2008; Omar Monsegur, USFWS, pers. comm., 2008). Two of the populations of Río Abajo Commonwealth Forest have been reported to fructify. However, there has been no documentation on any recruitment. In addition, in 2007, the Service introduced saplings of palma de manaca on El Tallonal farm (a private conservation area) under the Partner's for Fish and Wildlife Program.

C. Updated Information and Current Species Status

1. Biology and Habitat

a. Abundance, population trends, demographic features, or demographic trends:

Historically, palma de manaca was known from the northern karst region of Puerto Rico. When listed, 44 palma de manaca individuals persisted along the bank of Quebrada Collazo in San Sebastian; approximately 200 individuals were located along Río Camuy and about 10-15 individuals were located along the Río Guajataca (USFWS 1992, p.2).

Santiago-Valentín and Rojas-Vázquez (2000, p.1-14) surveyed the known populations to study aspects of the distribution, population structure, phenology, and threats. They found 554 individuals (Table 1) and about 1300 seedlings (Table 2). Only about 10 % of the total individuals were reproducing at the time of the survey. Quebrada Collazo had fewer individuals than the other two sites but had a higher percentage (27%) of reproducing individuals.

Table 1. Number of individuals reported (Santiago-Valentín and Rojas-Vázquez 2000, p. 1-4). Seedling not included in these numbers.

Locality Name	Reproducing	Not Reproducing	Total
Quebrada Collazo	35	97	132
Río Camuy	6	221	227
Río Guajataca	12	183	195
Total	53	501	554

Table 2. Number of Seedlings reported (Santiago-Valentín and Rojas-Vázquez 2000, p. 6-7).

Locality Name	Number of seedlings
Quebrada Collazo	<100
Río Camuy	>1000
Río Guajataca	About 200

The population structure of palma de manaca given by Santiago-Valentín and Rojas-Vázquez Report (2000, p.14) was based on dividing the growth stages of palma de manaca into four categories (roughly estimating age categories). Seedlings were not included in these categories (individuals with one leaf were considered seedlings).

- Class I - individuals with two or more leaves and less than a meter in length
- Class II - individuals with developed leaves higher than a meter in length and no visible stem.
- Class III - individual with fully developed fronds and a trunk less than 1.3 meters in height
- Class IV- individuals with trunks taller than 1.3 meters in height

Class I (the youngest plants) was the dominant category on all sites (Table 3). Based on their analysis, most individuals (86%) are young and non-reproductive (Classes I, II, and III) with only about 14% of the populations in Class IV - the Class expected to be reproducing. However, only 69% of individuals found in Class IV were reproducing at the time of the survey.

Table 3. Palma de manaca population structure (Santiago-Valentín and Rojas-Vázquez (2000, p. 14)

Locality Name	Class I	Class II	Class III	Class IV
Quebrada Collazo	64	24	6	38
Río Camuy	176	27	7	17
Río Guajataca	113	54	6	22
Total	353	105	19	77

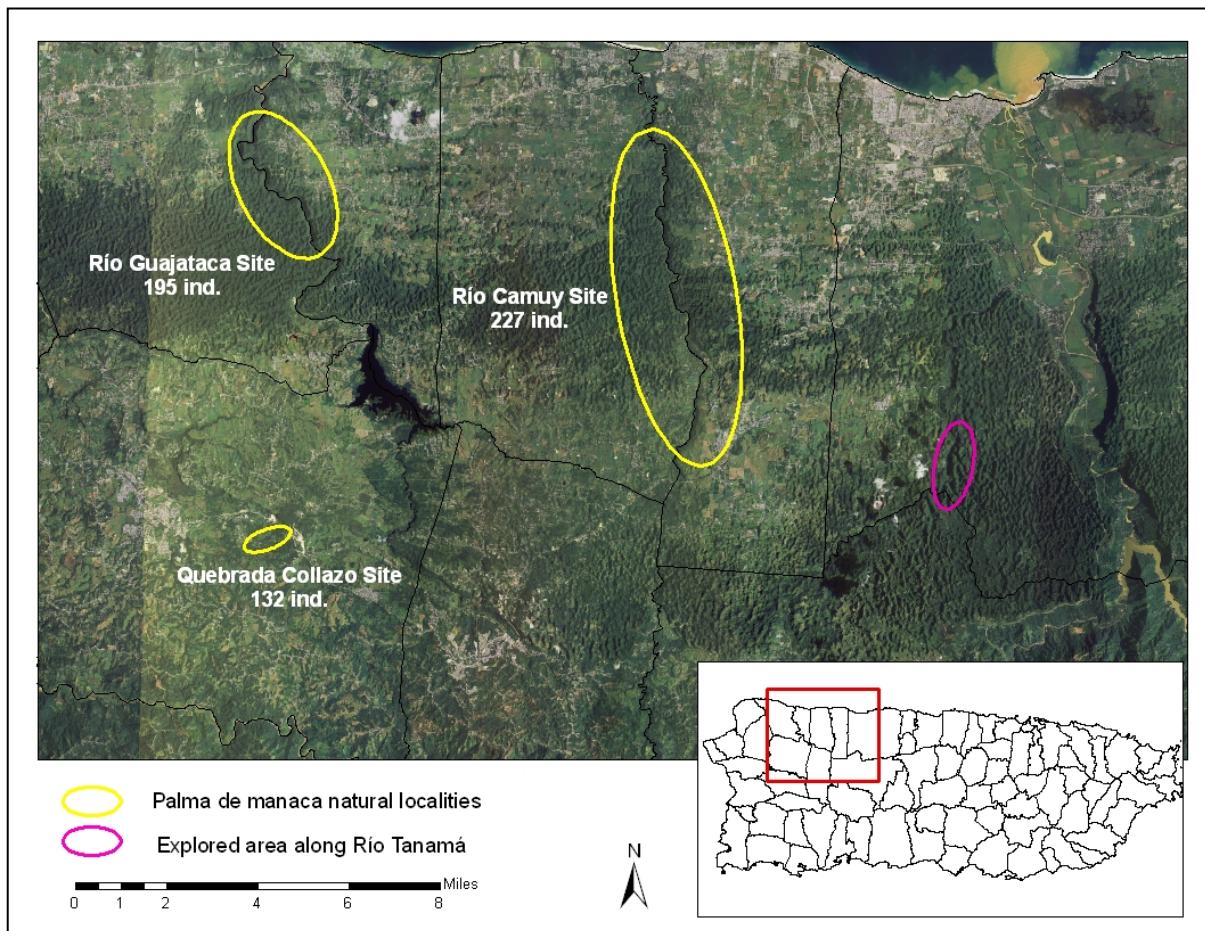
Santiago-Valentín and Rojas-Vázquez (2000, p. 4) surveyed for additional populations of the species in the northwestern karst region (Figure 2) where the ecology of the area was similar to the existing natural sites - mainly in Río Tanamá, between the municipality of Arecibo and Utuado. No additional plants/populations were found.

There has been an effort to introduce the species into other suitable areas. Four populations of about 50-100 individuals of palma de manaca were introduced in the Río Abajo Commonwealth Forest. Three of the populations are adults where two have been reported to produce viable seeds but there is no documentation on any recruitment (DNER 2006, p. 95; Victor Rodriguez, DNER, pers.comm. 2008). The fourth population of Río Abajo Commonwealth Forest was planted on October of last year (Omar Monsegur, USFWS, pers. comm. 2008). Another population of about 150 individuals was recently introduced to the Guajataca Commonwealth Forest. An undetermined number of individuals of palma de manaca have been planted sporadically in the Commonwealth Forests of Maricao and Guilarte.

DNER has an endangered species plant nursery where they propagate and maintain species to be introduced into protected areas. Palma de manaca is one of the numerous endangered species they are propagating and introducing to different Commonwealth

Forests. In addition, the DNER provide plants to the Service for planting on private lands that have wildlife cooperative extension agreements, conservation easements, or other conservation mechanisms. For example, in 2007, 50 individuals of palma de manaca were planted in El Tallonal farm (private land designated as a conservation area) in the municipality of Arecibo. During a recent site visit to the farm (June 2009), Service personnel observed the introduced palms growing successfully and reported a 100% survival rate (Silmarie Padrón, USFWS, pers. comm.,2009).

Figure 2. Palma de Manaca localities searched by Santiago-Valentín and Rojas-Vázquez (2000, p.1-4)



b. Genetics, genetic variation, or trends in genetic variation. There is no new information on genetics related to this plant.

c. Taxonomic classification or changes in nomenclature.

Kingdom:	Plantae
Division:	Magnoliophyta
Class:	Liliopsida
Order:	Arecales
Family:	Arecaceae
Genus:	<i>Calyptromona</i>
Species:	<i>C. rivalis</i> (O.F. Cook) L.H. Bailey 1938
Common name:	Palma de Manaca, Manac palm

Species synonyms (Zona 1995, p. 149): *Cocops rivalis* (O.F. Cook) 1901; *Calyptrogyne rivalis* (O.F. Cook) León 1944; *Calyptromona quisqueyana* (L.H. Bailey) 1938; and *Calyptrogyne quisqueyana* (L.H. Bailey) León 1994.

L.M. Underwood and R.F. Griggs first collected this species in 1901 in San Sebastian, Puerto Rico (USFWS 1992, p. 1). There is controversy in the placement of the genus *Calyptromona* within the family Arecaceae. Some scientists believe that this genus is monophyletic because of its morphological and anatomical characteristics and others believe it should be in the same group of *Calyptrogyne*.

Calyptromona is confined to the Greater Antilles. Palma de manaca (*Calyptromona rivalis*) has been described with the names *Cocops rivalis* and *Calyptrogyne rivalis*. A revision of the genus *Calyptromona* made by Zona (1995, p. 149; Santiago-Valentín and Rojas-Vázquez, 2000, p. 1; and Proctor 2005, p. 140) places *Calyptromona quisqueyana* and/or *Calyptrogyne quisqueyana* as a synonym of *Calyptromona rivalis*. Hence, this information extends the species range to Hispaniola (Dominican Republic and Haiti).

d. Spatial distribution, trends in spatial distribution, or historic range.

Historically, palma de manaca was thought to be endemic to Puerto Rico. However, Zona (1995, p. 149) recognized *Calyptromona quisqueyana* and *Calyptrogyne quisqueyana* as synonymous with *Calyptromona rivalis*, extending the species range to Hispaniola where the author states that it occurs throughout a wide area. Zona *et al.* (2007, p.303) states that this change in species distribution “has had a profound impact on the conservation status” of the species. This range expansion diminished the global threat to the species resulting in changes to the Red List of the International Union for Conservation of Nature (IUCN). The species was considered Vulnerable by the IUCN in 1988-96 but was dropped from the Red List in 2006 (Zona *et al.* 2007, Appendix 1, p. 1; and IUCN, 2007).

Calyptromona rivalis in Puerto Rico occurs in three natural localities: Quebrada Collazo, Río Camuy and Río Guajataca. In addition, DNER is propagating this threatened specie

and has introduced populations in the Río Abajo and Guajataca Commonwealth Forests. In addition, there are a number of individuals in the Guajataca Lake area near the Boy Scout camp in Quebradillas, in Maricao Commonwealth Forest between Maricao and San Germán and in Guilarte Commonwealth Forest in Adjuntas. The Service has also introduced this species to El Tallonal farm in Arecibo.

e. Habitat or ecosystem conditions.

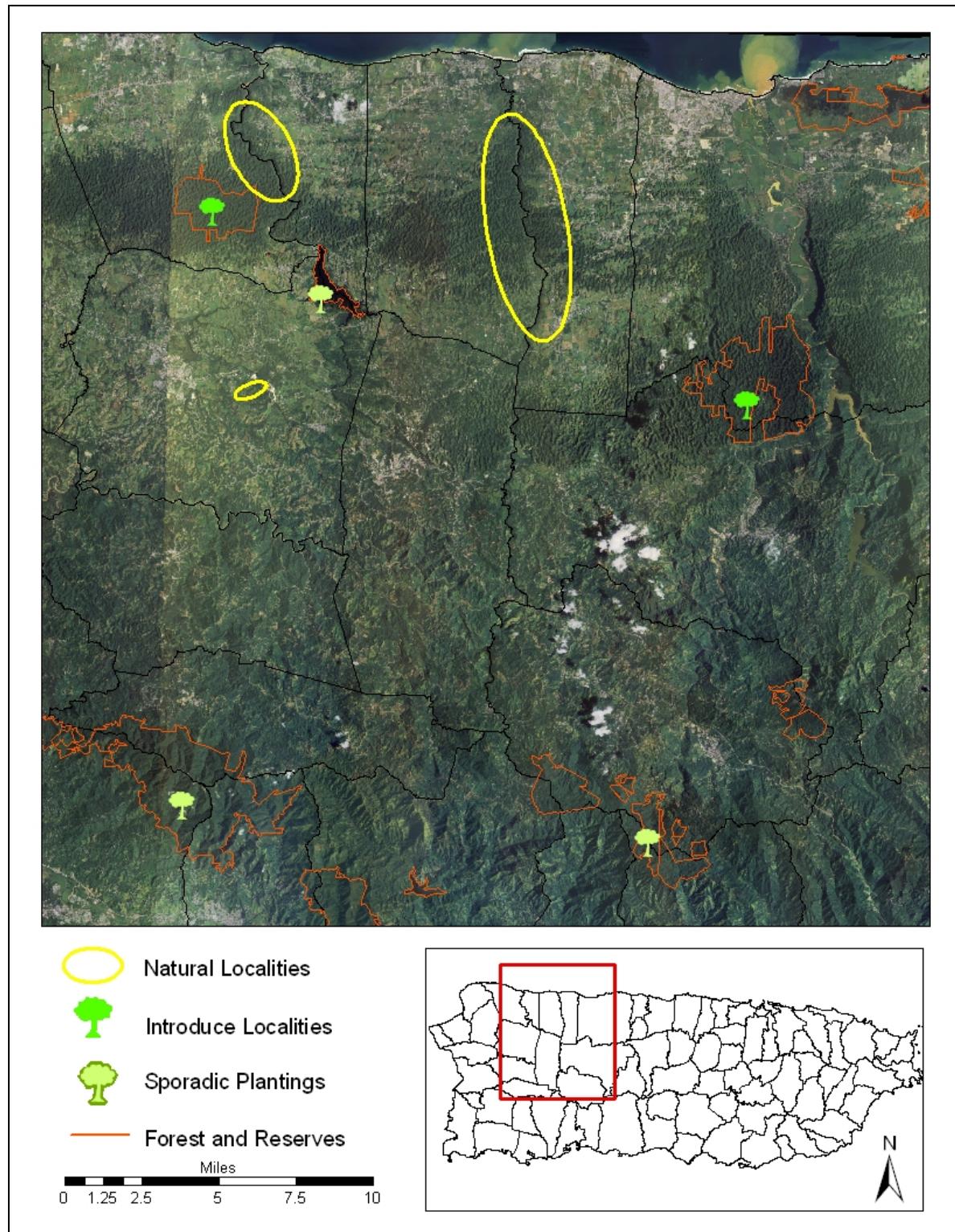
Palma de manaca is a riparian species and is found in the northwest limestone region of Puerto Rico. The natural populations of palma de manaca are located within the mature and young moist limestone evergreen and semideciduous forest, and the montane wet evergreen forest (Gould *et al.*, 2008, p. 37). Observations made by Santiago-Valentín and Rojas-Vázquez (2000, p. 8) identify that early stages of palma de manaca appear to need more moisture and shade to survive than mature palms which can tolerate more sun exposure.

We do not have any information on the species habitat or ecosystem condition in Hispaniola.

f. Other relevant information.

Research made on the phenology of palma de manaca by Santiago-Valentín and Rojas-Vázquez (2000, p. 7) indicate that the palm flowers mainly from November to April and fruiting occurs in the summer months. Santiago-Valentín and Rojas-Vázquez (2000, p. 8) state that the common honeybee (*Apis mellifera*) was the only insect they noted visiting the flowers of palma de manaca.

Figure 3. Currently known and introduced populations (general areas) of palma de manaca in Puerto Rico.



2. Five Factor Analysis

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

In the final rule, destruction of plants due to deforestation and associated flash flooding and habitat modification were identified as the most significant factors affecting the species. In addition, the final rule stated that road construction eliminated part of the Río Camuy population.

Santiago-Valentín and Rojas- Vázquez (2000, p. 9) consider habitat destruction and flash flooding to be the major threats to the species in the three privately owned areas. They observed land clearing for agriculture and pasture farming reaching the borders of the creek without erosion-control practices at the Quebrada Collazo site in San Sebastian. These authors also mentioned that habitat modification related to land clearing can exacerbate the effects of flash flooding on the species at the Quebrada Collazo area. Additionally, they observed conversion of agricultural lands to residential development in this same area. This could be indicative of the increase in land use in rural areas where the species could disappear by clearing the surrounding area altering the natural habitat of the species. Information gathered by Santiago-Valentín and Rojas-Vázquez (2000, p. 8) indicate that early stages of this species need more moisture and shade to be established, hence, if the area surrounding the natural populations are cleared the populations may not recruit or establish more individuals. Santiago-Valentín and Rojas also reported erosion resulting from deforestation and believe that is a major threat to the species in the Río Camuy site. They observed two mature palms that had been knocked down by another tree because of a landslide after heavy rains in which the area was eroded by deforestation activities. In addition, they reported that the site near Río Guajataca is threatened by a proposed tourist and housing development project.

Based on the information from our files, during the last four years, we have received numerous projects in the northern karst region of Puerto Rico. For example, we have provided technical assistance to the Puerto Rico Highway Authority for the expansion of the Highway PR-22 from Hatillo to Aguadilla to minimize possible adverse effects to the Puerto Rican boa (*Epicrates inornatus*) and several plant species. The currently proposed route is located north of the existing populations of palma de manaca, and adverse effects are not anticipated on this species. However, if the proposed route is moved southward, this proposed highway may affect the species. The aerial photographs of the area show that urban development is expanding between the Guajataca Gorge and the Rio Camuy area.

The population located in San Sebastian is close to rural housing projects and Road PR-111. Increasing rural development creates a need for roads to be expanded and additional deforestation to take place. Land clearing activities adjacent to rivers and creeks make the populations susceptible to flash flooding (e.g. uproot of palms, mortality of seedlings and juveniles caused by bigger trees). Thus, the expansion of the current residential areas and the possible expansion of the existing roads may affect the population. The aerial photograph of the San Sebastian site shows development encroachment for housing in the

area. Based on the above, the modification of habitat for housing development and infrastructure continues to be a threat to the species. The Service has not found information on the status of the species and current threats on Hispaniola.

(b) Overutilization for commercial, recreational, scientific or educational purposes;
At the time of listing, overutilization for commercial, recreational, scientific or educational purposes was not considered a threat to the species. At present time, the Service is not aware of overutilization of this species for commercial, recreational, scientific, or educational purposes in Puerto Rico.

(c) Disease or predation;

At the time of listing, disease or predation was not considered a threat to the species. At present time, the Service is not aware of any disease or predation that may threaten the species.

(d) Inadequacy of existing regulatory mechanisms; and

When the final rule was published, palma de manaca was not on the Commonwealth of Puerto Rico's list of protected species. Regulations have since been enacted that protect the species. In 1999, the Commonwealth of Puerto Rico approved the Law # 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. The Puerto Rico Department of Natural and Environmental Resources approved in 2004 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). Palma de manaca (*Calyptrotroma rivalis*) is designated as "endangered" by the DNER. Regulation 6766 under Article 2.06 prohibits collecting, cutting, removing, among other activities, listed plant individuals within the jurisdiction of Puerto Rico.

Based on the presence of Federal and Commonwealth laws and regulations protecting the palma de manaca, and the absence of evidence supporting lack of enforcement of regulations to protect this species, we believe that inadequacy of existing regulatory mechanisms should no longer be considered a threat to this species.

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

The final rule indicated that the natural populations are known to inhabit areas that are susceptible to flash flooding and that germination may occur readily however the establishment of seedlings is often impossible due to the frequency of such occurrences.

At the present time, we do not have information on how this species disperses naturally. The majority of saplings and seedlings are found very close to parent trees. It is unclear if this species has a vertebrate (bird/bat) fruit disperser or if seeds are dispersed by flooding.

At the present time, the Service is not aware of any natural or manmade factors that may threaten the species.

3. Synthesis

At the time of listing, palma de manaca was believed to be endemic to Puerto Rico and the species abundance was estimated at about 275 individuals. Currently, there are an estimated 554 individuals in three naturally occurring populations (Quebrada Collazo, Río Camy and Río Guajataca). In addition the species has been introduced in five additional areas: the Río Abajo Commonwealth Forest (about 400 individuals in four different localities), 150 individuals in the Guajataca Commonwealth Forest, 50 individuals in El Tallonal in Arecibo. The species has also been planted sporadically in other public areas like Maricao and Guilarte Commonwealth Forests. Two of the four populations planted in the Rio Abajo Commonwealth Forest have been reported to fructify, however, there has been no documentation on any recruitment. The viable seeds produced in the Río Abajo Commonwealth Forest are used in the propagation program developed and implemented by DNER (Victor Rodriguez, DNER, pers. comm. 2008).

The natural populations of palma de manaca are located within the mature and young moist limestone evergreen and semideciduous forest, and the montane wet evergreen forest in the northern karst area in Puerto Rico where they are typically found growing in association with ravines and creeks. Seedlings and saplings appear to need more moisture and shade to survive than mature palms, which can tolerate more sun exposure.

A recent revision of the genus *Calyptrotroma* joined a synonymous species widely spread on the island of Hispaniola, considerably expanding the range of the species. The Service does not have additional information regarding palma de manaca in Hispaniola. Additional information is needed to determine the overall status of the species throughout its entire range. However, in Puerto Rico, the natural populations are located in privately owned lands threatened by modification of habitat for housing development and infrastructure. Additionally, bad management practices upstream; for example, land movement (clearing) activities without erosion control measures adjacent to rivers and creeks can exacerbate the effects of flash flooding on the species.

The recovery criteria establish that delisting of the species could be considered when the natural populations are placed under protective status, and at least three new populations capable of self-perpetuating are established in protected areas. Based on the information gathered for this review, criterion one has not been met and criterion two has been partially met.

Based on the analysis of the 5-listing factors, we believe that the species continues to be threatened by habitat modification for residential development and possible expansion of roads and or highways.

III. RESULTS

A. Recommended Classification:

X No, no change is needed.

Although the species is no longer considered endemic to Puerto Rico (the species also occurs in the Hispaniola), up-to-date information on the species status and threats in Hispaniola is not currently available. However, the species status in Puerto Rico is currently threatened by Factor A.

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

- Update the recovery plan to revise and better define objective measurable criteria for this palm.
- Determine how many individuals constitute a self-sustainable population, in cooperation with DNER and the academia.
- Implement private-lands initiatives to further protect the stream and rivers where palma de manaca are known (Quebrada Collazo, Río Camuy and Río Guajataca).
- Foster a working partnership with regulatory agencies to address and minimize potential adverse effects of development projects on the species and its habitat.
- Continue the propagation efforts of palma de manaca with DNER, Puerto Rico Conservation Trust, and the University of Puerto Rico. Current efforts should be carefully evaluated to ensure that these efforts are more effective, consistent with the biological and ecological limiting factors of the species, and to ensure establishment of viable populations in protected areas.
- Undertake efforts to obtain information on the status and threats to the species in Hispaniola.
- Conduct periodic surveys of introduced populations to assess the success of planting efforts (e.g., fructifying, recruiting, age classes, reproductive stages).

REFERENCES

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Santiago-Valentín, E. and G. Rojas-Vázquez. 2000. Research on five threatened and endangered plant species of Puerto Rico: *Calyptrotroma rivalis*, *Daphnopsis helleriana*, *Schefflera arenaria*, *Stahlia monosperma*, and *Zanthoxylum thomasianum*. Final Report. 96 pp.

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U.S. FISH AND WILDLIFE SERVICE
5 YEAR REVIEW of *Calyptronoma rivularis* (No common name)

Current Classification Threatened

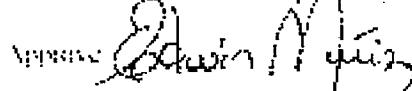
Recommendation resulting from the 5-Year Review

No change is needed

Review Conducted By: Mitzia Vargas, Caribbean Field Office, Río Piedras, Puerto Rico

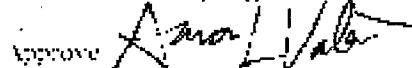
FIELD OFFICE APPROVAL:

Edwin E. Muñiz, Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve  Date Sept 4, 2009

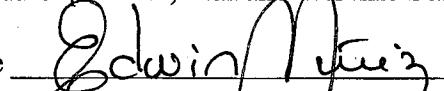
REGIONAL OFFICE APPROVAL:

Petra J. Vargas
Cynthia Dohner, Acting Regional Director, Fish and Wildlife Service

Approve  Date 9/18/09

FY 2016 APPROVAL*

Lead Field Supervisor, Fish and Wildlife Service

Approve  Date 5/24/2016

*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 the species current status.

Appendix A

Summary of peer review for the 5-year review of Palma de manaca (*Calyptromona rivalis*)

The document was reviewed internally by Marelisa Rivera, Carlos A. Díaz and Edwin E. Muñiz. They mostly provided editorial comments. Once the comments were added to the document, it was sent to six outside peer reviewers (see below). The outside peer reviewers were chosen based on their qualifications and knowledge of the species. We indicated our interest in all comments the reviewers may have about palma de manaca, specifically in any additional information on the status and the current threats of the species.

The due date of the peer review comments was on June 22, 2009. No comments were received during the comment period.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Calyptonomia rivalis* (Palma de manaca)

Addendum 1. Summary of new information obtained since the 2011 5 Year Review.

Updated information

Between 2009 and 2014 a cooperative agreement among the Service, the Puerto Rico Department of Natural and Environmental Resources (PRDNER), and Envirosurvey, Inc. was in place to plan and implement activities to restore and enhance habitat for Palma de manaca, and to protect existing populations in at least three privately owned riparian and upland areas. The site-specific conservation measures were implemented in accordance with the Recovery Plan for the species. For example, actions that promoted or supported obtaining the protection of privately owned sites, monitoring of known natural populations, document habitat requirements for the species, assurance of site protection after introduction of plants, and selection of appropriate sites for habitat enhancement and introduction of individuals propagated in nurseries.

A total of four cooperative agreements with private landowners were signed during the five years of this partnership. All agreements were signed for a term of at least 10 years. Two of the four agreements were within the existing known natural populations, and the other two were signed for lands that harbor suitable habitat for Palma de manaca and are within its range, but did not have the species present. In addition, communication with other private landowners within the range of the known natural populations was made; however, we could not formalize agreements with them. Nonetheless, these landowners authorized access to their properties to conduct surveys and monitor the natural populations within their properties.

Tables 1 and 2 present the number of Palma de manaca individuals in the natural populations that were monitored as part of these efforts. This information also presents a broad notion of the structure (life stages) of the populations. Out of the three currently known natural populations, only one (Camuy-Hatillo) showed a diverse population structure (all stages of development were observed; O. Monsegur, Service, 2013; PRDNER, unpubl. data 2013).

The assessments/surveys included: marking adult and reproductive individuals (Table 2), accounting juveniles and seedlings stages to determine population structure, georeferencing locations, describing vegetation composition of the area (see next section), and identifying threats. Specific management actions implemented to safeguard the natural populations and introduced individuals included livestock exclusion through fencing, signage (i.e., advise of prohibitions of harming the species, and area under conservation signage), habitat enhancement practices (e.g., enhance natural population with more individuals of Palma de manaca and native flora, clean up solid waste/scrap from sites), riparian buffers, and seedling propagation and planting in ex-situ areas. The most recent rapid status assessment of the Palma de manaca in lands with agreements was conducted by Service and Envirosurvey, Inc. biologists in January 2016. More than 90% of planted individuals of Palma de manaca were growing very well and with no evident threats (M. Vargas, Service, 2016, pers. obs.).

As mentioned in the 2009 5-year review of Palma de manaca, the PRDNER has a propagation initiative in which they use the material they collect to enhance ex-situ populations and to propagate new populations on suitable sites within Commonwealth Forests (PRDNER, unpubl. data 2013). The PRDNER Cambalache Tree Nursery provided 173 individuals of Plama de manaca that were planted in October 2012 at Río Abajo Commonwealth Forest by biologist of the Service, PRDNER and Envirosurvey Inc. (DRNA 2012). These 173 individuals were not planted within the properties under agreements because we did not know the genetic origin of the material. However, as part of the efforts to recover the species, the current propagation of seedlings has been done taking into account the origin of the material to avoid cross breeding the natural populations (to safeguard the natural populations). The seeds and saplings used to enhance the populations of Palma de manaca (in the agreements) were from the same population or watershed. The Service and PRDNER agreed to collect no more than 20% of the available seeds at the moment of the collection to safeguard the natural regeneration of the population, and at the same time, germinate material to enhance the natural populations and introduce new populations within the range of the species (DRNA 2012).

Vegetation composition surrounding natural populations

Some of the vegetation observed in the San Sebastian area included: *Roystonea borinquena*, *Guarea guidonea*, *Margaritaria nobilis*, *Andira inermis*, *Dendropanax arboreus*, *Cecropia schreberiana*, *Touinia striata*, *Alchornea latifolia*, *Petitia domingensis*, *Altocarpus altilis*, *Cecropia schreberiana*, *Spathodea campanulata*, *Szygium jambos*, *Nectandra sp.*, *Ocotea leucoxylon*, *Schefflera morototoni*, *Spondias mombin*, *Bambusa vulgaris*, *Citrus aurantium*, *Citharexylum caudatum*, and other native and exotic species (PRDNER, unpubl. data 2013).

In the Hatillo-Camuy area the dominant tree is *Spathodea campanulata*, with other abundant species like: *Guarea guidonea*, *Erythrina poeppigiana*, *Ardisia obovata*, *Szygium jambos*, *Roystonea borinquena*, *Casearia silvestris* (PRDNER, unpubl. data 2013). The understory is dominated by the shrubs *Parathesis crenulata* and *Piper hispidum* and in the border of river and open areas the dominant species is *Odontonema cuspidatum* and *Thelypteris grandis* (PRDNER, unpubl. data 2013).

Abundance of natural populations

Three sites with natural populations of Palma de manaca have been documented and monitored since the last 5 year status review for this species (Tables 1-3 present the information for these sites):

1. San Sebastian - Quebrada Collazo
2. Hatillo-Camuy - Río Camuy (Bayaney)
3. Guajataca - Guajataca Gorge

Table 1. Total number of individuals observed in natural populations including all categories (adult, sub-adult, juvenile and seedling).

Location	Palma de manaca individuals	Source
Camuy-Hatillo	1,620	DRNA (2012 and 2013)
Guajataca	165	DRNA (2013)
San Sebastian	3,125	DRNA (2012)
Total	4,910	

Note: The currently known sites might not be the same areas observed by Santiago-Valentin and Rojas (2000)

Table 2. Total number of tagged adults and surrounding juvenile and seedling individuals.

Location	Adults	Juveniles and Seedlings	Source
Camuy-Hatillo	180	691*	DRNA (2013); O. Monsegur, Service, unpubl. data (2013)
Guajataca	19	432	DRNA (2013); O. Monsegur, Service, unpubl. data (2013)
San Sebastian	100	2544	DRNA (2013); O. Monsegur, Service, unpubl. data (2013)
Total	297	3667*	

*Juveniles and seedlings were underestimated

Table 3. Total number of Palma de manaca individuals planted within private lands as part of the agreements.

Agreements	Location	Planted individuals of Palma de manaca		745
		Within natural populations	In new areas	
1	San Sebastian	210		
2	San Sebastian	165		
3	San Sebastian		120	
4	Isabela		250	
Total		375	370	745

Synthesis

Agreements with two private landowners placed an important natural population of Palma de manaca under protection for at least 10 years in the municipality of San Sebastián. In addition, these recovery efforts allowed to enhance the natural populations as well as to introduce individuals of Palma de Manaca in new areas with suitable habitat in the northern karst of Puerto Rico.

Since the previous 5-year status review for Palma de manaca, the Service, PRDNER and Envirosurvey, Inc. conducted a status assessment of the known natural populations providing information about the current status of the species. Only one of the natural populations (Camuy-Hatillo) showed a diverse structure with a composition of seedling, juvenile, and adults individuals, while the other two populations (San Sebastian and Guajataca Gorge) were composed mostly of adults and seedlings, but with minimal or no in-between stages in the population.

The efforts conducted since the last revision of the status of the species in 2009, partially meet Criterion 1 (i.e., place known populations under protective status) of the recovery criteria established for Palma de manaca since a natural population within a private land was placed under a protective status for at least for 10 years. Criterion 2 (i.e., establish at least three new populations capable of self-perpetuation within protective units) continues to be partially met. Between 2009 and 2014, a 5th planting of Palma de manaca was conducted at the Río Abajo Commonwealth Forest, in addition to the new two sites with suitable habitat the species was introduced under agreements in San Sebastian and Isabela. However, it is premature to determine if these efforts will result in the establishment of self-sustainable populations of Palma de manaca.

In summary, the overall status assessment of Palma de manaca conducted between 2009 and 2014 suggests the continued improvement of the status of the species. As part of this review, the Service assessed the five factor analysis, and we continue to believe that Plama de manaca is threatened by the present or threatened destruction, modification or curtailment of its habitat (Factor A) because the species continues to be threatened by possible expansion of roads and or highways and the expansion of development within the private lands (e.g. expand back yards that curtail the habitat or work done within the surrounding riverine system modifying the habitat to cause erosion or sedimentation). In addition, there are no buffers to protect the species in areas that are still used for agriculture and/or cattle grazing. Land clearing for these purposes makes the Palma de manaca populations susceptible to flash flooding and erosion surrounding its habitat. Despite the moderate degree of threat, its recovery potential remains high. Therefore, the status of Palma de manaca should remain as threatened and the Recovery Priority Number remains 8.

Recommendations for future actions

- Continue monitoring natural populations to evaluate the success of the actions conducted under agreements with private landowners.

- Continue collecting data on habitat and information on marked adult individuals on the natural populations not currently under protection.
- Continue searching and reaching out to private landowners to protect natural populations in their properties.

Literature cited

Puerto Rico Department of Natural and Environmental Resources. 2014. Acuerdos cooperativos para promover y facilitar la recuperación de la palma manaca (*Calyptromona rivalis*) en Puerto Rico. Informe final 2009-2014. Diciembre 2014. 19pp.

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[PRDNER] Puerto Rico Department of Natural and Environmental Resources. 2013. Recovery of Several Listed Plants Throughout Propagation Program. ES-1-29-Study 21. Final Report. March 20, 2013. 33pp.

U. S. Fish and Wildlfie Service. 2013. Status and Management of Palma Manaca (*Calyptromona rivalis*) on Private Lands: Challenges and Concerns of a Threatened Plant Species. Powerpoint Presentation by Omar A. Monsegur. November 19, 2013.

Photos of recovery actions implemented between 2009 and 2014:



Service, PRDNER, and Envirosurvey, Inc. biologists transplanting seedlings to enhance a natural population in the municipality of San Sebastian as part of the Agreement # 1.



Partners marking the sites for planting Palma de manaca seedlings in a private land in the municipality of San Sebastian as part of the Agreement # 1 (April 2012).



Palma de manaca juveniles after 4 years (January 2016; Agreement # 1)



Partners marking the sites for planting Palma de manaca seedlings in a private land in the municipality of San Sebastián as part of the Agreement # 2 (June 2013).



Planted Palma de manaca juveniles as part of the Agreement #2 (July 2013)



Planted Palma de manaca juveniles after approximately 2.5 years (January 2016, Agreement #2)



Certification of Palma de manaca planting in the municipality of San Sebastian as part of the Agreement #3 (March 2014)



Planted Palma de manaca juveniles after 2 years (Jan 2016; Agreement #3)



First visit to evaluate potential area for Palma de manaca new introduction site in the municipality of Isabela. (February 2014; Agreement #4)



Planted individuals of Palma de manaca after 1.5 years (January 2016; Agreement #4)