

Chupacallos
(*Pleodendron macranthum*)
and
Uvillo (*Eugenia haematocarpa*)

5-Year Review:
Summary and Evaluation

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



Flower of Chupacallos and fruits of Uvillo.
Photos by Omar Monsegur (USFWS)

5-YEAR REVIEW
Chupacallos / *Pleodendron macranthum*
&
Uvillo / *Eugenia haematocarpa*

I. GENERAL INFORMATION

- A. Methodology used to complete the review:** On April 9, 2010, the U.S. Fish and Wildlife Service (USFWS) published a notice in the *Federal Register* (75 FR 18232) announcing the 5-year review for Chupacallos (*Pleodendron macranthum*) and Uvillo (*Eugenia haematocarpa*), and requested new information concerning the biology and status of the species. Since these species share almost the same range, habitat, and threats, both species were included into a single document. A 60-day comment period was opened; however, no information was received from the public during the comment period.

This 5-year review was prepared by a USFWS recovery biologist and summarizes the information that the USFWS has gathered in the Chupacallos and Uvillo files since the plants were listed on November 25, 1994. The sources of information used for this review included the original listing rule for the species, the recovery plan for Chupacallos and Uvillo, and information provided by the University of Puerto Rico, Mayagüez Campus (UPRM), the Puerto Rico Department of Natural and Environmental Resources (PRDNER), the Puerto Rico Conservation Trust (PRCT), and the U.S. Forest Service (USFS). In 2011, USFS, under an agreement with USFWS, led an interagency effort that included the USFS, USFWS, and PRDNER to survey and evaluate the status of known populations of Uvillo located at El Yunque National Forest. Under the agreement, the USFS also compiled all available information and provided the new information to the USFWS regarding the status and threats to the species populations.

Additionally, USFWS and UPRM signed a cooperative agreement to gather and summarize new information on Chupacallos. Under this agreement, botanists from UPRM, Dr. Duane A. Kolterman and Dr. Jesús D. Chinaea, conducted literature research on the species, consulted with other specialists, and examined herbarium data from the University of Puerto Rico at Mayagüez (MAPR), Río Piedras Botanical Garden (UPR), University of Puerto Rico at Río Piedras (UPRRP), Department of Natural and Environmental Resources of Puerto Rico (SJ), New York Botanical Garden (NY), U.S. National Herbarium (US), and the University of Illinois (ILL). In addition, between March 25 and 27, 2011, USFWS biologist Omar Monsegur conducted a field trip to El Yunque National Forest along with Dr. Kolterman and Dr. Chinaea to search for known populations of Chupacallos. The lead USFWS biologist then completed the 5-year review by assessing the species and determining the appropriate status recommendation for these species.

B. Reviewers

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

Lead Field Office: Omar A. Monsegur, Caribbean Ecological Services
Field Office, Boquerón, Puerto Rico. (787) 851-7297, extension 217.

C. Background

1. Federal Register Notice citation announcing initiation of this review: April 9, 2010;
75 FR 18232.

2. Species Status:

In 2013, we believe the status of Chupacallos is uncertain and that the overall status of Uvillo is improving. Little monitoring has been conducted on the natural populations of Chupacallos. For this reason, we deemed the status of the species as uncertain. In the case of Uvillo, several new populations have been recorded and there is evidence of natural recruitment. Moreover, three of the new populations lie within areas managed for conservation.

3. Recovery Achieved: Uvillo: 2 (26-50%) of species recovery objectives achieved
Chupacallos: 1 (1-25%) of species recovery objectives achieved

4. Listing History

Original Listing

FR notice: 59 FR 60565

Date listed: November 25, 1994

Entity listed: species

Classification: endangered

5. Associated rulemakings: Not Applicable.

6. Review History:

Eugenia haematocarpa was first collected in 1939 from Barrio Maizales in the municipality of Naguabo by Leslie R. Holdridge, but was named in 1963, 24 years later, by Henri Alain Liogier (59 FR 60565). Further collections have been made from the El Verde area in the Luquillo Mountains and from a privately-owned property located adjacent to the Carite Commonwealth Forest in the municipality of Cayey (USFWS 1998). *Pleodendron macranthum* was discovered by the French botanist August Plee in 1822-1823, and was first described by Baillon under the genus *Cinnamodendron* (59 FR 60565).

The final listing rule (59 FR 60565) and the Recovery Plan for *Pleodendron macranthum* and *Eugenia haematocarpa* (hereafter the “Plan”), approved on September 11, 1998 (USFWS 1998), are the most comprehensive analyses of the status of both species and are used as the baseline references documents for this 5-year review. In November 25, 1994, the USFWS reviewed the best available scientific and commercial information, analyzed the five listing

factors and their application to these species, and listed *Pleodendron macranthum* and *Eugenia haematocarpa* as endangered (59 FR 60565). The USFWS identified Factor A (present or threatened destruction, modification, or curtailment of its habitat or range), Factor D (the inadequacy of existing regulatory mechanisms), and Factor E (other natural or manmade factors affecting its continued existence) as the main threats for the two species. Examples of these threats included clearing of vegetation, forest management practices, the plants' limited distribution, and hurricanes. The 1998 recovery plan included the description of the two species and information about their distribution, habitat characteristics, reproductive biology, and conservation. Thus, the information included in the plan will not be repeated in this review.

Every year the USFWS reviews the status of listed species and update species information in the Recovery Data Call (RDC). The last RDC for Chupacallos and Uvillo was completed in 2013. Recovery Data Call: 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, and 2013.

7. Species' Recovery Priority Number at start of review (48 FR 43098): 8.

At the time of listing, Chupacallos and Uvillo were recognized as species with a moderate degree of threat and a high recovery potential.

8. Recovery Plan:

Name of plan: Recovery Plan for *Pleodendron macranthum* and *Eugenia haematocarpa*
Date issued: September 11, 1998

II. REVIEW ANALYSIS

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

1. Is the species under review listed as a DPS?

The Endangered Species Act (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 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 have an approved recovery plan establishing downlisting and ultimately delisting as the recovery objectives. The plan's downlisting criteria are in part measurable. We did not have enough information to define one of the criteria at the time of the plan's development.

2. Adequacy of recovery criteria

a. Do the recovery criteria reflect the best available and 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 and abundance. Knowledge about the spatial distribution and habitat requirements for both species has increased.

b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?

All listing factors that were considered threats at the time of listing are addressed in recovery criteria.

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 two species will be considered for downlisting when the following criteria are met:

1. An agreement between the USFWS and the USFS concerning the protection of Chupacallos and Uvillo within the Caribbean National Forest property has been prepared and implemented.
2. An agreement between the USFWS and the PRDNER concerning the protection of these two species in Commonwealth Forests, specifically Río Abajo, for Chupacallos, has been prepared and implemented.
3. New populations (the number of which will be determined by appropriate scientific studies) capable of self-perpetuation have been established within protected areas.

Criterion 1 has been partially initiated. There is no formal agreement between the USFS and USFWS for the implementation of a management plan to protect Chupacallos and Uvillo. Nonetheless, under Section 7 of the Endangered Species Act (ESA), Federal agencies are mandated to carry out programs for the conservation of endangered species. Under the ESA, it must be ensured that any action authorized, funded, or carried out by a Federal agency is not likely to jeopardize the continued existence of an endangered species. The USFS and USFWS have developed a good communication relationship, and USFS always consults with USFWS to avoid and minimize impacts to listed species and their habitat at El Yunque National Forest. Further coordination is needed for the long term monitoring of natural populations and propagation of Chupacallos and Uvillo.

Criterion 2 has been partially met. The Río Abajo Commonwealth Forest has an approved management plan that recognizes the presence of Chupacallos within the forest. Furthermore, PRDNER has listed Chupacallos as endangered, and as part of their list of critical elements. Species on the list of critical elements receive special consideration when evaluating development actions within suitable habitat. However, there is no formal agreement in place between USFWS and the PRDNER to protect Chupacallos populations within the Río Abajo Commonwealth Forest. Further coordination is needed

for the long term monitoring of natural populations and the propagation of Chupacallos. Because the species is not monitored on the forest, adverse impacts to the populations could be occurring due to forest management practices (e.g., opening of new trails and research projects).

Criterion 3 has been initiated. Several natural populations of Uvillo have been reported since the species was listed in 1994. The Puerto Rico Conservation Trust (PRCT) has conducted an exhaustive evaluation of two recently discovered population in the municipality of Cayey in two properties known as Las Robledas, and Sotomayor del Toro and have consulted with the USFWS about adequate management practices for these populations. USFWS biologists visited the population at Las Robledas and it seems to be healthy and may set the standards to establish further viable populations within these areas (Las Robledas and Sotomayor del Toro) and other Commonwealth protected areas. Furthermore, a germination experiment with Uvillo is being conducted by the PRCT in their greenhouse at Río Piedras, which is expected to improve our knowledge on the propagation of this species.

Despite the lack of available information about the natural populations of Chupacallos, this species was successfully propagated by Dr. Eugenio Santiago (professor at UPRRP). The material produced in this effort has been used to establish a new experimental population of Chupacallos in an area adjacent to the aviary of the Puerto Rican parrot at El Yunque National Forest. However, more information on the reproductive biology and ecology of this species is needed in order to establish what constitute a viable population. Thus, further research and monitoring of planted individuals of Chupacallos is needed.

C. Updated Information and Current Species Status

1. Biology and Habitat

a. Species' abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g. age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends

Pleodendron macranthum (Chupacallos) is a small to medium size aromatic evergreen tree that was known from 11 individuals within El Yunque National Forest and about 10 individuals within the Río Abajo Commonwealth Forest at the time of listing. The populations at El Yunque National Forest consisted of 9 trees at the Jimenez Ward and two separated trees at Mameyes II Ward in Río Grande. However, none of these populations was located during the latest surveys conducted by MAPR personnel in March 2011. Since two of the historical localities were represented by a single individual, it is likely they have been extirpated due to stochastic events such as hurricanes (See factor E). A site with three planted individuals at El Portal Visitor Center, also at El Yunque National Forest, was recorded during the assessment conducted by botanists of the University of Puerto Rico (Table 1). The individuals at El Portal Visitor Center are managed by USFS for outreach and future seed production. The ten individuals from the Río Abajo Commonwealth Forest are found in two separate populations (specific number of

individuals per population not specified). The current status of these natural populations is unknown as they have not been recently visited and their exact locations are unknown.

Since there is no long term monitoring of the natural populations and some of the historical populations seem to be lost or extirpated, we cannot make inferences about the status or demography of Chupacallos. The USFWS suspects that further populations of the species may occur within the El Yunque National Forest and probably in some remnants of native forest in the Río Abajo Commonwealth Forest. However, similar to the historically known natural populations, these may be comprised of few individuals with little or no natural recruitment and might also be threatened by stochastic events such as hurricanes and landslides.

Overall, the majority of the known individuals of Chupacallos are planted trees. There are 97 known individuals in the wild, and 70 percent have been planted (Table 1). Of the 21 naturally-occurring individuals, none have been observed during the last decade.

Table 1. Status of the known Chupacallos populations in Puerto Rico.

Site Name	Municipality	Number of individuals	Source of Information / Reference
*El Portal, El Yunque N. F.	Río Grande	3	Luis Rivera, USFS, pers. comm., 2011
*Iguaca Aviary, El Yunque N. F.	Río Grande	22	Jesus Rios, USFWS, 2012
*Las Perdices, Río Abajo Commonwealth Forest	Arecibo	5	Jesus Rios, USFWS, 2012
*Río Piedras Botanical Garden	San Juan	6	Eugenio Santiago, UPRRP, 2011
Jiménez, El Yunque N. F. (Jimenez)	Río Grande	9	USFWS, Recovery Plan, 1998
Mameyes II A, El Yunque N. F.	Río Grande	1	USFWS, Recovery Plan, 1998
Mameyes II B, El Yunque N. F.	Río Grande	1	USFWS, Recovery Plan, 1998
Río Abajo Commonwealth Forest (two populations)	Uttao/Arecibo	10	USFWS, Recovery Plan, 1998
*Guavate, Carite Commonwealth Forest	Cayey	30	PRDNER, Forest Service Bureau 2011.
*Río Abajo Commonwealth Forest (Las Cruces)	Arecibo	10	Omar Monsegur, USFWS, 2012
Total number of individuals		97 (70% are planted individuals)	

The asterisk (*) represent experimental populations and planted individuals. See comments under section f “other relevant information”

Eugenia haematocarpa (Uvillo) is a small evergreen tree reaching 6 meters (20 feet) tall that was originally known from the Sierra de Luquillo (El Yunque National Forest) and from the Sierra de Cayey. At the time of listing in 1998 the species was known to have about 134 individuals: approximately 119 individuals in six populations at El Yunque National Forest, and one population of about 15 individuals in a private property adjacent to the Carite Commonwealth Forest. The number of individuals per populations at El Yunque National Forest was not specified in the listing rule or the Recovery Plan. During the latest surveys conducted in 2011, USFS personnel visited an Uvillo population located at Río Gurabo and reported 12 individuals. They also visited a population on road PR 186, km. 12.3, and found 27 individuals (Luis Rivera 2011, USFS pers. comm.). Other historical Uvillo populations known from El Yunque National Forest were not evaluated by USFS personnel during 2011.

The status of the original population of 15 Uvillo at the private property adjacent to the Carite Commonwealth Forest is unknown. The species has been reported from four additional locations in the Sierra de Cayey area. Two of the new populations were located within the Sierra de Cayey by Pascarella (2000). The first population reported by Pascarella consisted of several individuals (number not specified) with evidence of natural recruitment (small juvenile plants). The second population had five individuals with recent evidence of flower and fruit production, but without evidence of natural recruitment.

The other two new locations of Uvillo are from the properties known as Finca Las Robledas and Sotomayor del Toro, also within the Sierra de Cayey and managed by the PRCT (E. Santiago 2011, UPRRP). Eugenio Santiago (UPRRP) indicated these populations are comprised of approximately 150 individuals in Las Robledas and at least six individuals in Sotomayor del Toro. Based on an evaluation by USFWS biologists, Las Robledas population seems to be healthy and shows evidence of natural recruitment despite the apparent lack of natural dispersion mechanisms, except for gravity (seeds dispersion occurs only downhill). The population seems to be improving and it is expected to continue expanding and slowly colonizing adjacent secondary growth forest.

However, it is important to mention that the core of the population lies along a ridge that is the boundary between the PRCT property and other private lands, and some clusters of individuals (amount not determined) lie within properties that are not managed by the PRCT (see Factor A). Based on the discovery of these new populations, the overall status of Uvillo populations along the Sierra de Cayey appears to be improving, and there is a high probability that further populations may occur within the Carite Commonwealth Forest and surrounding areas.

The range of Uvillo has expanded and now extends to the northwestern corner of Puerto Rico. A new locality was reported in 2011 at the municipality of Isabela by Marcos Caraballo and Dr. Eugenio Santiago (UPRRP). This site comprises a single reproductive individual with no evidence of natural recruitment. The species was also located in two locations within the boundaries of the Guajataca Commonwealth Forest (José Román 2012, PRDNER pers. comm.). One population contained at least 30 individuals of different size classes with natural recruitment evident. Uvillo also occurs in a different location within the Guajataca Commonwealth Forest, with one individual found (José Román 2012, PRDNER pers. comm.).

Despite the lack of long term monitoring of the status of *Uvillo* at El Yunque National Forest and the original population in the Sierra de Cayey, the overall status of the species seem to be improving as six new populations have been reported and the number of known individuals has doubled to about 247 plants (Table 2). Three of these populations show evidence of natural recruitment. However, further long term monitoring is needed to determine the status of these populations.

Table 2. Status of the known populations of *Uvillo* populations in Puerto Rico.

Site Name	Municipality	Number of individuals	Source of Information / Reference
Cordillera Jaicoa	Isabela	1	Marcos Caraballo and Eugenio Santiago, 2011 UPRRP.
Guajataca Commonwealth Forest 1	Isabela	30	José Roman 2012, PRDNER pers. comm.
Las Robledas (PRCT)	Cayey	150	Eugenio Santiago, 2012 UPRRP.
Sotomayor del Toro (PRTC)	Caguas	6	Eugenio Santiago, 2012 UPRRP.
Río Grande (El Verde), El Yunque N. F.	Rio Grande	27	Luis Rivera, USFS, pers. comm., 2011
Río Gurabo, El Yunque N. F.	Las Piedras	12	Luis Rivera, USFS, pers. comm., 2011
Carite/Muñoz Rivera	Guayama	Several	Pascarella 2000
Carite	Guayama	5	Pascarella 2000
Guajataca Commonwealth Forest 2	Isabela	1	José Román 2012, PRDNER pers. comm.
Cayey Hist. Site	Cayey	15	USFWS, Recovery Plan, 1998
Total number of individuals		At least 247	

- Only two of the six populations reported in the Recovery Plan were assessed in 2011 by USFS at El Yunque National Forest.

b. Genetics, genetic variation, or trends in genetic variation (e.g. loss of genetic variation, genetic drift, inbreeding, etc.)

There is no new information on genetics, genetic variation, or trends in genetic variation of Chupacallos or *Uvillo*.

c. Taxonomic classification or changes in nomenclature.

There are no recent taxonomic or nomenclatural changes for *P. macranthum*, which was originally described as *Cinnamodendron macranthum*. Its closest relative, *P. ekmanii*, is a very rare tree from Haiti (Little et al., 1974) whose present status is unknown. The other member of the Canellaceae family in Puerto Rico is *Canella winterana*, a dry forest species.

There is no new information about taxonomic reclassification or changes in the nomenclature for *E. haematocarpa*.

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

The natural distribution of Chupacallos remains limited to the Luquillo Mountains in El Yunque National Forest and to the Río Abajo Commonwealth Forest (Figure 1.). Few individuals were planted within the Carite Commonwealth Forest by PRDNER personnel. However, although the Carite area harbors suitable habitat for Chupacallos, this forest has never been considered part of the natural range of the species.

Uvillo was originally reported from the Luquillo Mountains and from a single locality within the Sierra de Cayey (Figure 1.). The range within the Cayey region has expanded to include four additional localities, as new populations have been discovered in this area. Therefore, we expect that further populations may occur within this area, including within the boundaries of the Carite Commonwealth Forest. Furthermore, during the last decade, at least three new populations have been reported in the municipality of Isabela, extending its distribution now to the northwestern corner of Puerto Rico.

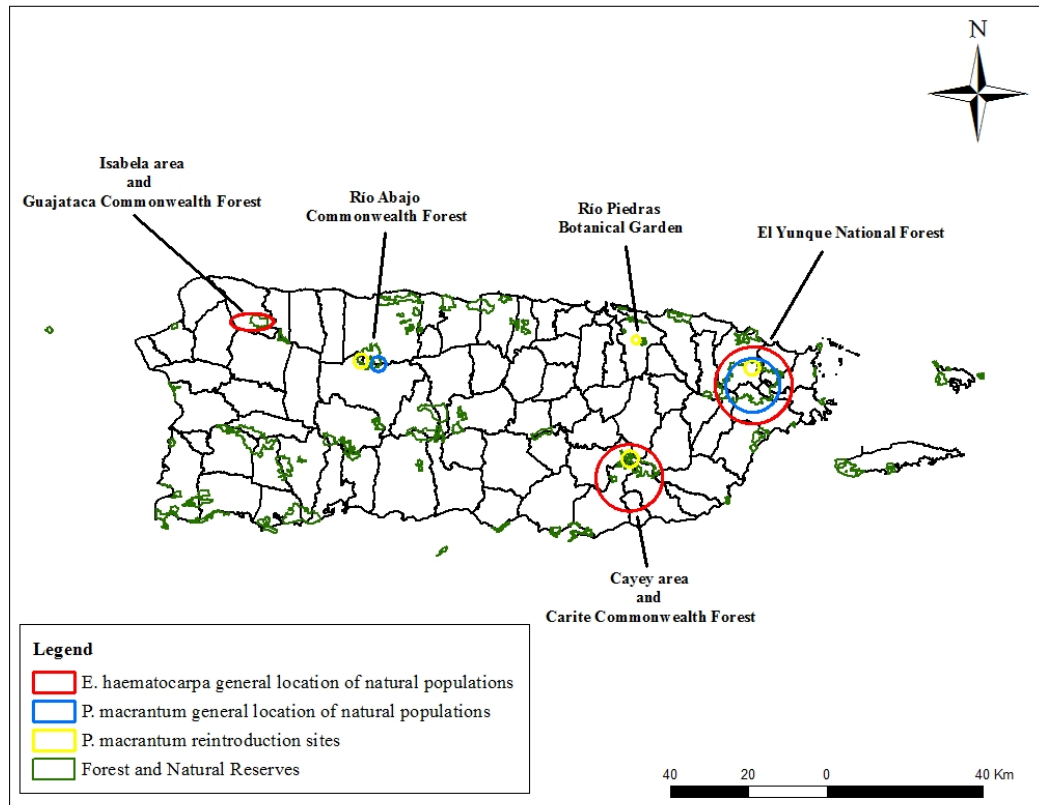


Figure 1. Map showing the general distribution of Chupacallos (blue) and Uvillo (red). The yellow circles indicate reintroduced populations of Chupacallos. Note that there are no reintroduction efforts for Uvillo.

e. New information addressing habitat or ecosystem condition (e.g. amount, distribution, and suitability of the habitat or ecosystem)

Chupacallos is endemic to the northeastern and north central, regions of Puerto Rico and may be found in the northwestern region. The species occurs primarily within the subtropical wet forest life zone, probably extending into the lower montane wet forest zone (Ewel and Whitmore 1973). These life zones were once extensively deforested for agriculture and charcoal production, and are currently undergoing forest regeneration. Areas in which agricultural activities have been abandoned and forest regeneration has occurred may harbor undetected populations of Chupacallos or provide possible sites for the establishment of new populations. The majority of known populations of Chupacallos occur within protected forests, although it is a cryptic species that may be difficult to identify in the wild, unless it is flowering or fruiting.

Uvillo occurs primarily within the subtropical moist forest and the subtropical wet forest life zones (Ewel and Whitmore 1973), which also were extensively deforested for agriculture and charcoal production. New information indicates that the range of Uvillo now extends to the northwestern corner of Puerto Rico and that it also grows in moist limestone forest. The northern karst region of Puerto Rico harbors several protected areas (i.e., Río Abajo, Guajataca, and Cambalache Commonwealth Forests) that include mature secondary forest and remnants of native forest that may include suitable habitat and undetected populations of Uvillo. Areas in which agricultural practices have been abandoned and forest regeneration has occurred may provide possible sites for the establishment of new populations of Uvillo.

f. Other relevant information.

Little is known about the reproductive biology and propagation of Uvillo or Chupacallos. The PRDNER (2011) established a protocol for the planting of Chupacallos in the Carite Commonwealth Forest, outside the species' historical range (i.e., *ex situ* conservation). The project included the propagation and planting of 20 to 30 individuals of Chupacallos, followed by a routine monitoring schedule. The monitoring efforts were interrupted by lack of personnel, and the present status of the planted individuals remains unknown, as they have not been visited recently. The material planted at the Carite Commonwealth Forest was donated by Mr. Pedro Juan Rivera Lugo, although the source of the seed material was not specified (PRDNER 2011).

Further surveys were conducted by Dr. Eugenio Santiago (UPRP 2011), who in 2002 collected and germinated seeds of Chupacallos from El Verde (within El Yunque National Forest). Santiago (2011) reported that the seeds maintained viability for only a short time. He observed flowering three years after those trees were planted, but no fruit or seed production was documented. In 2006, seven juvenile individuals of Chupacallos from the propagated material were planted in three different sites within the University of Puerto Rico Botanical Garden (i.e., *ex situ* conservation). By 2011 all but one of these

individuals remained alive (Santiago 2011). In 2011, the USFWS received 35 individuals of Chupacallos from Dr. Santiago for conservation purposes.

Twenty-two individuals were planted in 2011 within the boundaries of the El Yunque National Forest in an area adjacent to the Iguaca Aviary, which is managed by the USFWS (Monsegur 2011). After a year of being planted, all individuals remained alive and were actively flowering (Omar Monsegur, USFWS, pers. obs. 2012.). Ten additional individuals that had been provided by Dr. Santiago were planted on October 2012 at the Río Abajo Commonwealth Forest. It is expected that the material planted at El Yunque National Forest and the Río Abajo Commonwealth Forest will set fruits as one individual from the same batch maintained for outreach at the USFWS Nursery in the Cabo Rojo National Wildlife Refuge is already fruiting (Omar Monsegur, USFWS, pers. obs. 2012.).

For Uvillo, despite the discovery of new populations, few propagation efforts have been conducted with this species. Material from Las Robledas is being germinated at the nursery of the PRCT at Río Piedras. Nonetheless, a recent site visit to Las Robledas indicates plants flower vigorously and flowers are frequently visited by honeybees (*Apis mellifera*) (Omar Monsegur, USFWS, pers. obs. 2012.). Aside from the above, there is no more information on the biology or reproductive ecology of Uvillo.

2. Five Factor Analysis (threats, conservation measure, and regulatory mechanisms)-

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

Forest management and deforestation for urban development.

At the time of listing, forest management practices such as the establishment and maintenance of plantations, selective cutting, trails maintenance, and shelter construction were identified as threats to both Chupacallos and Uvillo. Based on the available information, the core of the known populations of Chupacallos and Uvillo occurs within the boundaries of Federal, State, or other protected areas. Within these areas, there is no direct evidence of populations or individuals being affected by forest management practices. Therefore, USFWS no longer considers forest management practices a threat to Chupacallos or Uvillo.

However, the largest known population of Uvillo lies within Las Robledas along a ridge that marks the boundary of several private properties and some clusters of individuals lie within neighboring properties that are not managed by the PRCT. Boundary management practices (clearing and fencing) may affect individuals along these areas. Similarly, land clearing for agricultural purposes and urban development may affect the small populations of Uvillo within private properties at the Sierra de Cayey, including the private properties adjacent to Las Robledas.

Undetected populations of Chupacallos and Uvillo might be affected by deforestation for urban development on the periphery of El Yunque National Forest. In the northern Karst

region, suitable habitat for these species may be affected by rock quarries, particularly in the Quebradillas and Isabela area.

The present or threatened destruction, modification, or curtailment of the species habitat or range remains a threat to Chupacallos and Uvillo. However, since the majority of the known populations lie within properties managed for conservation and there is no direct evidence of populations being affected by habitat destruction or modification, we consider this threat to be low in magnitude and non-imminent.

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

Overutilization for commercial, recreational, scientific, or educational purposes was not identified as a threat to the two species in the final listing rule. Although both species are attractive and might have some cultivation potential, we have no evidence that Chupacallos and Uvillo are currently threatened by this factor. Therefore, the overutilization for commercial, recreational, or educational purposes is not a current threat to either species.

(c) Disease or predation:

Disease or predation were not identified as a threat to these species at the time of listing. Based on the best available information, disease or predation are not a current threat to either species.

(d) Inadequacy of existing regulatory mechanisms:

The Carite, Río Abajo and Guajataca Commonwealth Forests are protected by Law No.133 (12 L.P.R.A. sec. 191) 1975, as amended, known as *Ley de Bosques de Puerto Rico* (Puerto Rico's Forest Law), as amended in 2000. Section 8 (A) of Law No. 133, prohibits cutting, killing, destroying, uprooting, extracting, or in any way hurting any tree or vegetation within a Commonwealth forest without authorization of the Secretary of the PRDNER. These forests are also designated Critical Wildlife Areas (CWAs) by the Commonwealth of Puerto Rico. The CWA designation constitutes a special recognition by the Commonwealth with the purpose of providing information to Commonwealth and Federal agencies about the conservation needs of these areas and assisting permitting agencies in precluding negative impacts as a result of permit approvals or endorsements (PRDNER 2005).

The Commonwealth of Puerto Rico also approved Law No. 241 in 1999, known as *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 as the property of Puerto Rico all wildlife species within its jurisdiction, regulate permits, hunting activities, and exotic species, among other activities. This law also has provisions to protect habitat for all wildlife species, including plants. In 2004, the PRDNER approved Regulation 6766, *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). Article 2.06 of this regulation prohibits collecting, cutting, and removing, among other activities, listed plant individuals within the jurisdiction of Puerto Rico. Uvillo was listed under Regulation 6766 as endangered, whereas Chupacallos was listed in the regulation as critically endangered.

In the case of the populations occurring within the El Yunque National Forest, these are protected under the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended. Section 7 of the Endangered Species Act requires Federal agencies to insure that any action authorized, funded or carried out by them is not likely to jeopardize the continued existence of listed species or modify their critical habitat. Plant collection within the boundaries of the forest is regulated and requires a research permit, as well as a permit from the PRDNER.

Suitable habitat may extend to private properties. The enforcement of laws and regulations on these private 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 on private property. Therefore, based on the presence of Commonwealth and Federal laws and regulations protecting these species, the inadequacy of existing regulatory mechanisms is no longer be a threat to either of these species.

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

Hurricanes, Landslides and Climate Change. Due to the low number of populations and individuals, hurricanes were identified as a threat to Chupacallos and Uvillo on the final rule. As an endemic to the Caribbean, these tree species should be well adapted to tropical storm disturbance. However, the low number of populations and individuals pose a threat to these species by making them more susceptible to stochastic events such as hurricanes. It is not clearly evident the extent of the damage to the populations of these species by Hurricane Hugo, which devastated El Yunque National Forest in 1989, or by Hurricane Georges, in 1998. The heavy rains associated with tropical storms and hurricanes in the mountains of Puerto Rico often lead to landslides, which are part of the forest dynamics in Puerto Rico. However, the frequency of landslides is expected to increase, as landslides are triggered by severe rain events or droughts, whose frequency and severity is expected to increase as a result of climate change (Hopkinson et al. 2008). Given the steep slopes on which these species usually grow (associated to remnants of forest that were not cleared due the inaccessibility of the area), massive landslides may extirpate entire populations. This is particularly true for Chupacallos, which is represented by small populations with almost no natural recruitment. Therefore, a landslide can extirpate an entire population of Chupacallos, and it may also be a threat to some of the small populations of Uvillo at El Yunque National Forest and the Carite Commonwealth Forest.

Climate change is predicted to increase the frequency and strength of tropical storms and can cause severe droughts (Hopkinson et al. 2008). Vulnerability to climate change impacts is a function of sensitivity to those changes, exposure to those changes, and the adaptive capacity of the species (Glick et al. 2011). Shifts of vegetation communities are expected as temperatures and moisture regimes are altered by climate change. Under this scenario populations of Chupacallos and Uvillo may be displaced or outcompeted by native or exotic species with wider environmental plasticity. Climate change may also compromise natural recruitment by affecting the survival of seedlings.

Despite the low number of populations and individuals (particularly for Chupacallos), at this time the USFWS considers hurricanes, landslides and climate change a moderate and non-imminent threat to both species. Climate change is occurring gradually and the frequency of severe hurricanes is low.

Genetic Variation. Along with a decreasing population size, negative impacts of habitat fragmentation may result in erosion of genetic variation through the loss of alleles by random genetic drift (Honnay and Jacquemyn 2007), and may also limit the ability of a species to respond to a changing environment (Booy et al. 2000). Given the extremely small population size and low number of known natural populations of Chupacallos, it is likely that their genetic variability is low. As previously indicated, all reported populations consist of less than 10 individuals, and in some cases they are represented by a single individual.

Despite the reports of new populations of Uvillo, this species may be affected by genetic depression due to the low number of individuals in some populations, as it is evident that the species was severely affected by former habitat fragmentation due primarily to extensive deforestation for agriculture. However, the wide distribution and geographical isolation of the species, from the eastern to the northwestern side of the Island (i.e., El Yunque National Forest, Sierra de Cayey, and Guajataca Commonwealth Forest), with different environmental conditions, suggests that the species may show high inter-population genetic variability. In order to safeguard the remaining genetic diversity, the origin and survival of reintroduced individuals needs to be monitored as well as their development into mature individuals. The protection and monitoring of known adult individuals should be considered a high priority for the conservation of Chupacallos and Uvillo.

Based on the above, we consider the lack of genetic variation is a high and imminent threat to Chupacallos, and a low and non-imminent threat for Uvillo.

Lack of Natural Recruitment. Lack of natural recruitment represents one of the major threats to Chupacallos (Luis Rivera 2011, USFS, pers. comm.). Despite evidence of flower and fruit production and good germination under nursery conditions, it is evident that previously known populations were not recruiting; seedling and sapling stages were missing. Nonetheless, all the reintroduced individuals of Chupacallos at El Yunque National Forest are flowering. However, no fruit production has been documented (Jesus Rios, USFWS, pers. comm. 2012). A single fruit was documented on an individual

maintained for outreach purposes at the USFWS greenhouse at Boquerón National Wildlife Refuge (Omar Monsegur, USFWS, pers. obs. 2012.). No flower or fruits have been documented on individuals planted at the Río Abajo Commonwealth Forest (Omar Monsegur, USFWS, pers. obs. 2012.).

Without natural recruitment or successful augmentation from captive propagated individuals, populations (natural and reintroduced) of Chupacallos are likely to become extirpated as older individuals naturally die. Despite future efforts to enhance natural populations by planting seedlings and saplings, it is unknown if planted individuals will develop into mature plants capable of reproducing. Therefore, we consider the lack of natural recruitment a high and imminent threat to Chupacallos.

Based on the distribution, abundance, and observations on flower and fruit production of Uvillo, it does not appear to be affected by lack of natural recruitment. The majority of known populations of this species are producing flowers and fruits, and natural recruitment is evident in the wild. However, further monitoring is needed to determine what constitutes a viable population and if the species dispersing seeds successfully.

Overall, hurricanes, landslides, climate change, genetic variation, and lack of natural recruitment are threats to Chupacallos. Due to the small number of populations, these threats are high in magnitude and imminent for this species. For Uvillo, USFWS considers the threats by hurricanes, landslides, climate change, genetic variation, and lack of natural recruitment as low and non-imminent.

3. Synthesis

Chupacallos and Uvillo are federally listed as endangered. Based on the available information, Chupacallos is known from about 22 individuals in 5 natural populations and 75 individuals planted in six localities. The main reintroduction efforts have been conducted within the Río Abajo Commonwealth Forest and the El Yunque National Forest. The status of the reintroduction effort at the Carite Commonwealth Forest by PRDNER is unknown as the individuals have not been recently monitored. Uvillo is currently known from approximately 247 individuals in nine natural populations. No information is available about reintroduction or population enhancement efforts being conducted for Uvillo.

Early population assessments for both species date back to the early 1990's, prior to the time when the two species were listed. However, little to no monitoring has been conducted in recent years on the natural populations that occurred within the El Yunque National Forest or the Sierra de Cayey area. Therefore, we believe that during the last decade the overall status of these species was uncertain.

Information gathered as part of surveys for this review validate the uncertain status for the natural Chupacallos populations and highlight the need for more exhaustive surveys of the habitat within El Yunque National Forest and the Río Abajo Commonwealth Forest in order to identify new populations of the species. Moreover, it is essential to

revisit previously known natural populations to determine their status. Overall, Chupacallos seems to be seriously threatened by lack of natural recruitment.

The case of Uvillo is noteworthy, as the distribution of the species has expanded to the northwestern corner of Puerto Rico (i.e., Quebradillas and Isabela). One of the recently reported populations lies within the Guajataca Commonwealth Forest and shows evidence of natural recruitment. Furthermore, four new localities have been reported in the Sierra de Cayey area, one comprised by over one hundred individuals and with clear evidence of natural recruitment. The number of known individuals has doubled since the time of listing. The evidence of abundant fruit production and the occurrence of populations within at least four natural areas managed for conservation highlight the recovery potential of the species as well as the need to revise the species' recovery plan. Further research on the reproductive biology of the species and long term monitoring of natural populations are needed to establish measurable criteria to delist the species. Based on our threats analysis, this endangered plant remains threatened by habitat modification at rights of way, vegetation clearing and development pressures on private inholdings. Therefore, Uvillo still meets the definition of an endangered species.

IV. RECOMMENDATIONS FOR FUTURE ACTION

1. Studies should be conducted on both species' phenology and reproductive biology to address other limiting factors affecting these species (e.g., lack of pollinators or seed dispersers).
2. All known populations should be marked and monitored on a regular basis, and additional visits should be made after hurricanes or other major disturbances to determine any possible adverse effects on the populations.
3. The previous *ex situ* conservation efforts (individuals reintroduced to the wild) should be monitored and further similar efforts should be undertaken to enhance the status of both species.
4. The USFS and USFWS should develop a comprehensive survey program to inventory areas with potential habitat. This program should include training to field biologists of both agencies so these personnel is able to recognize listed species on the field.
6. The populations that are actively producing seeds need to be identified and monitored to collect seed material for recovery purposes. A protocol to collect seed material should be developed and implemented to avoid altering the natural recruitment of the species. Enhancement of natural populations should be considered particularly for Chupacallos. The development of adequate propagation techniques is essential for the recovery of these species.

7. The recovery plan should be revised to establish measurable downlisting and delisting criteria, including how many individuals constitute a self-sustainable population and how many populations would be needed to delist these species.
8. Studies should be conducted to determine the patterns of genetic variation within and among populations in order to develop a plan to preserve the species genetic variability.

V. REFERENCES:

- Axelrod, F.S. 2011. A systematic vademecum to the vascular plants of Puerto Rico. BRIT Press, Fort Worth, TX. 428 pp.
- Booy G., R.J.J. Hendriks, M.J.M. Smulders, J.M. Van Groenendael, and B. Vosman. 2000. Genetic Diversity and the Survival of Populations. *Plant Biol.* 2 (2000) 379–395
- Caraballo M. and E. Santiago. 2011. Report on the rare plants of the Cordillera Jaicoa, in the municipalities of Isabela and Moca, Puerto Rico. University of Puerto Rico, Rio Piedras. 17pp.
- Ventosa-Febles E. A., M. Camacho, J.L. Chabert Llompart, J. Sustache Sustache and D. Dávila Casanova. 2005. Puerto Rico Critical Wildlife Areas. Commonwealth of Puerto Rico. Department of Natural and Environmental Resources. 392 pp.
- Ewel, J.J. and J.L. Whitmore. 1973. The ecological life zones of Puerto Rico and the U.S. Virgin Islands. Forest Service Research Paper ITF-8, USDA. 72 pp.
- Glick P., H. Chmura, and B. A. Stein. 2011. Moving the conservation goalpost: A review of climate change adaptation literature. National Wildlife Federation. 25 pp.
- Honnay, O. and H. Jacquemyn. 2007. Susceptibility of Common and Rare Plant Species to the Genetic Consequences of Habitat Fragmentation. *Conservation Biology* Volume 21, No. 3, 823–831.
- Hopkinson, C.H., A.E. Lugo, M. Alber, A.P. Covich and S.J. Vam Bloem. 2008. Forecasting effects of sea-level rise and windstorms on coastal and inland ecosystems. *Front Ecol Environ* 6(5): 255–263.
- Lioger, H. A. and L. F. Martorell. 2000. Flora of Puerto and the adjacent islands: A systematic synopsis 2nd edition. Editorial de la Universidad de Puerto Rico, Río Piedras. 382 pp.
- Lioger, H.A. 1994. Descriptive flora of Puerto Rico and adjacent islands.

- Spermatophyta. Volume III. Cyrillaceae to Myrtaceae. Editorial de la Universidad de Puerto Rico, Río Piedras. PR. 461 pp.
- Little, E.L., Jr., R.O. Woodbury, and F.H. Wadsworth. 1974. Trees of Puerto Rico and the Virgin Islands. Second volume. Agriculture Handbook No. 449. USDA Forest Service, Washington, DC. 1,024 pp.
- Monsegur, O.A. 2011. Report on the reintroduction of *Pleodendron macranthum* (chupacallos) in El Yunque National Forest. U.S. Fish and Wildlife Service, Caribbean Ecological Services Field Office, Boquerón, PR. 11 pp.
- Pascarella J.B. 2000. A New Record for the Rare and Endangered Tree *Eugenia haematocarpa* Alain (Myrtaceae) in The Sierra de Cayey Mountains, Puerto Rico. Caribbean Journal of Science 36(1-2):146.
- PRDNER. 2011. Informe de progreso del Acuerdo (No. 401817J167) con el Servicio de Pesca y Vida Silvestre de EE.UU. Informe de trabajos realizados 2007-2010. Departamento de Recursos Naturales y Ambientales, Negociado de Servicio Forestal, Sección de Investigación y Monitoria Forestal. 75 pp.
- Rios J. 2012. Personal observation. US Fish and Wildlife Service, Puerto Rican Parrot Project, Río Grande. Puerto Rico
- Rivera L. 2011. Personal communication. USDA Forest Service, Río Grande, Puerto Rico.
- Roman J. 2012. Personal communication. Puerto Rico DNER. Guajataca Commonwealth Forest Management Officer.
- Santiago, E. 2011. Propagation of listed plant species of Puerto Rico. Final report submitted to the U.S. Fish and Wildlife Service. Grant Agreement No. 1448-40181-00-G-192. 40 pp.
- U.S. Fish and Wildlife Service. 1998. Recovery plan for *Pleodendron macranthum* and *Eugenia haematocarpa*. Atlanta, GA. 19 pp.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Pleodendron macranthum* and *Eugenia haematocarpa*

Current Classification: Endangered

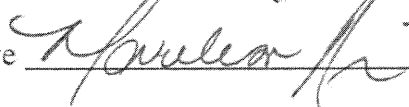
Recommendation resulting from the 5-Year Review:

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

Review Conducted By: Omar A. Monsegur, Caribbean Ecological Services Field Office,
Boquerón, Puerto Rico.

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve 

Date 3/19/2014

REGIONAL OFFICE APPROVAL:

for
Lead Regional Director, Fish and Wildlife Service

Approve 

Date 6-29-14