Eugenia woodburyana
(no common name)

Photo by: Carlos Pacheco, USFWS, 2012

5-Year Review:
Summary and Evaluation

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

5-YEAR REVIEW
***Eugenia woodburyana*/ (no common name)**

I. GENERAL INFORMATION

A. Methodology used to complete the review: On September 21, 2007, the U.S. Fish and Wildlife Service (hereafter the Service) published a notice in the *Federal Register* (72 FR 54061) announcing the 5-year review of the plant *Eugenia woodburyana* and requesting new information concerning the biology and status of this species. A 60-day comment period was opened, but no comments were received from the public.

This 5-year review was prepared by the Service's species recovery lead, and summarizes the information that has been gathered on *Eugenia woodburyana* since the plant was listed on September 9, 1994 (59 FR 46715). The sources of information used for this review include the original listing rule for the species, the recovery plan for the species, peer-reviewed literature, personal communications with qualified biologist and experts on the species, information provided by the Puerto Rico Department of Natural and Environmental Resources (PRDNER), unpublished reports from field visits and recovery activities conducted by Service biologists; and data gathered through the Cooperative Recovery Initiative (CRI) project conducted collaboratively by the Caribbean Ecological Services Field Office, the Caribbean National Wildlife Refuge System, and Envirosurvey, Inc.

We did not seek additional peer review in this 5-year review since Service biologists Carlos Pacheco and Omar Monsegur, and the interviewed local botanist José Sustache (PRDNER) are considered the leading experts on this plant and other similar plants that share habitat with *Eugenia woodburyana*. No part of the review was contracted to an outside party.

B. Reviewers:

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

Lead Field Office: Carlos Pacheco, Ecological Services, Caribbean Field Office, Boquerón, Puerto Rico. (787) 851-7297, extension 229.

C. Background

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

2. Species Status: 2016: *Improving*. When the Service approved the species' recovery plan in 1998, approximately 150 individuals were estimated in three localities. At that time, *Eugenia woodburyana* was known from the Laguna

Cartagena National Wildlife Refuge (LCNWR) in the mountain range of Sierra Bermeja, the Guánica Commonwealth Forest (GCF) and the Cabo Rojo National Wildlife Refuge (CRNWR); all these localities fall in the southwest region of Puerto Rico (Figure 1). Since 1998, additional adult individuals of *Eugenia woodburyana* have been discovered within the Sierra Bermeja area and the GCF; and new species' localities have been found in the municipalities of Yauco, Peñuelas, and Salinas. The locality in Salinas expands the natural range of the species along the southern region of Puerto Rico. Additionally, the species has been successfully propagated under tree nursery conditions, producing over 714 individuals. A total of 333 of those individuals have been planted at nine sites in southwest Puerto Rico. At present, we estimate the *Eugenia woodburyana* population at over 2,597 individuals. Based on the new information, we believe that the abundance and distribution of *E. woodbururyana* has increased. Therefore, we consider the overall species status as improving.

3. Recovery Achieved for *Eugenia woodburyana*: 3 (51-75%) of species recovery objectives achieved.

4. Listing History

Original Listing
FR notice: 59 FR 46715
Date listed: September 9, 1994
Entity listed: species
Classification: endangered

5. Associated rulemakings: None.

6. Review History:

The final listing rule for the species and the recovery plan for *Mitracarpus maxwelliae, Mitracarpus polycladus,* and *Eugenia woodburyana* (hereafter the "recovery plan") approved in October 1998, are the most recent comprehensive analyses for the species, and they were used as the reference point documents for this 5-year review.

The small evergreen tree, *E. woodburyana,* (Family Myrtaceae), was first collected by Roy O. Woodbury in October 31, 1977 in the municipality of Guánica (Typus: UPR UPR 5108; Isotypi: New York Botanical Garden (NYBG) unpublished data, 2008), and described in 1980 by Alain Liogier (Liogier 1980). The species was found on dry thickets in limestone in the GCF (Liogier 1980; Breckon and Kolterman 1994). In 1981, Woodbury also collected *E. woodburyana* at an unidentified location in the Cabo Rojo National Wildlife Refuge (CRNWR; UPRM herbarium voucher 1981) and at Cerro Mariquita in Sierra Bermeja in 1984 (Santiago-Blay et al. 2003).

In 1994, the Service listed *E. woodburyana* as endangered using the best available scientific and commercial information at that time. In that process, we reviewed the threats to the species using the five listing factors analysis and 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 man-made factors affecting its continued existence) as the main threats to this species. At that time, only about 45 individuals of *E. woodburyana* were known from three locations in southwest Puerto Rico: Sierra Bermeja, CRNWR, and the GCF (Figure 1).

When the recovery plan was approved in 1998, the species' abundance in Puerto Rico was estimated at around 150 individuals (Service 1998). The recovery plan included an analysis of threats, a description of the species, its habitat characteristics, reproductive biology, and conservation needs. The information on the biology of the species is included in the recovery plan and will not be duplicated in this review.

Each year, the Service reviews and updates listed species information for inclusion in the required Recovery Report to Congress. Through 2013, we did a recovery data call that included status recommendations such as "Improving" for this plant. We continue to show that species status recommendation as part of our 5-year reviews. The most recent evaluation for this plant was completed in 2016.

Figure 1. Distribution of *Eugenia woodburyana* in Puerto Rico at the time the species recovery plan was approved (USFWS 1998).

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

8. Recovery Plan:

Name of plan: Recovery Plan for *Mitracarpus maxwelliae*, *Mitracarpus polycladus* and *Eugenia woodburyana*

Date issued: October 6, 1998

II. REVIEW ANALYSIS

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

The Endangered Species Act (ESA) defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. The definition limits listing DPSs to only vertebrate species of fish and wildlife. Because the species under review is a plant, the DPS policy is not applicable.

B. Recovery Criteria

1. Does the species have a final, approved recovery plan containing objective, measurable criteria? *Eugenia woodburyana* has an approved recovery plan establishing delisting as the recovery objective (Service 1998). However, when the recovery plan was developed, we did not have enough information to fully define the recovery criteria. Therefore, not all of the criteria to meet the recovery objective are measurable.

Recovery actions identified to help reverse the decline of this species include: 1) the protection of existing populations; 2) establishment of new populations at other appropriate protected sites; 3) the protection of the species' habitat; 4) conducting research on the life history of the species; 5) evaluating methods of propagation; 6) searching for reintroduction sites; and 7) enhancing existing populations by propagating and producing additional individuals.

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 recovery plan does not reflect the most up-to date information on the species' biology, distribution, abundance and habitat. When the recovery plan was written, we had little to no information on this plant. Knowledge on its biology, distribution and abundance has increased since the recovery plan was approved.

b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria? Yes. When the recovery plan was approved, the species was threatened by Factors A, D and E. The recovery criteria are relevant to addressing these threats to the species.

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 approved plan states that *E. woodburyana* could be considered for delisting when the following criteria are met:

1. A management plan that considers the protection and recovery of the species has been prepared and implemented for the Guánica Commonwealth Forest and for the Cabo Rojo and Laguna Cartagena National Wildlife Refuges.

2. Protection has been provided for those individuals known to occur on privately owned land.

3. New populations (the number of which should be determined following the appropriate studies) capable of self-perpetuation have been established within protected areas, such as other coastal areas in the Guánica Commonwealth Forest.

According to the recovery plan, these are minimum requirements and could be expanded upon if these criteria prove to be insufficient. Alternatively, if new populations of the species are discovered, it may be preferable to place greater emphasis on their protection and augmentation rather than on propagation to establish new populations to achieve the minimum number of populations and individuals necessary for recovery.

Criterion 1 has been met. Although, a management plan that explicitly considers the protection of *E. woodburyana* does not exist, the GCF is managed by PRDNER for the conservation of fish and wildlife resources, including federally listed species (DNER 1976). The PRDNER listed *E. woodburyana* as endangered and the species is also included in their list of critical elements (PRDNER 2004). Consequently, PRDNER scrutinizes all proposed actions in GCF that may adversely affect this and other listed species and their habitat in the forest. Additionally, an ESA Section 6 Cooperative Agreement between PRDNER and the Service has been in place since 1984 to establish and implement an endangered species program in the Commonwealth of Puerto Rico. *Eugenia woodburyana* is also protected within the Laguna Cartagena National Wildlife Refuge (LCNWR) and Cabo Rojo National Wildlife Refuge (CRNWR) under the National Wildlife Refuge Act of 2000 (50 CFR 27.51). In September 2011, the Service signed a Comprehensive Conservation Plan (CCP) for the LCNWR and the CRNWR that include measures for the protection and recovery of threatened and endangered species within these refuges (Service 2011a, b). Furthermore, the implementation of recovery actions is coordinated on a case-by-case basis with the LCNWR and the GCF managers.

Criterion 2 has been partially met. Since the species recovery plan was signed in 1998, at least six natural populations of *E. woodburyana* have been discovered in private lands. All listed species have protection under Commonwealth laws and regulations. Presently, the populations at Cerro El Conuco and Finca Maria Luisa in the municipality of Cabo Rojo and Lajas, respectively, occur in private properties managed for conservation by Para La Naturaleza (PLN, an Unit of the Puerto Rico Conservation Trust). The Service and PLN are developing a cooperative agreement to protect *E. woodburyana* in both properties and to implement recovery actions for its benefit. Nonetheless, populations of *E. woodburyana*, as well as its habitat have been affected in other privately owned lands by vegetation clearing for grazing, and

by rural and tourist development. Conservation Agreements (i.e., landowner agreements, conservation easements) with the private landowners, combined with education are needed to conserve and protect this species on private lands.

Criterion 3 has been partially met. This criterion states that new populations of *E. woodburyana* capable of self-perpetuation should be established within protected areas. The Service, PRDNER, Fundación Doña Inés, and the PLN have been successfully propagating *E. woodburyana* in their tree nursery facilities, producing over 714 individuals in the last 10 years. Over 333 of those individuals have been planted in protected areas (i.e., CRNWR, Susúa Commonwealth Forest (SCF), Cueva El Convento, and Gabia's Farm, among others (Table1). Some of the individuals planted in Gabia's Farm and CRNWR have been observed producing flowers and fruits (J. Casanova, PRDNER 2016, pers. comm.). Some of the fruits produced by these planted trees have been collected for reproduction in tree nurseries. In March 2014, the Caribbean Ecological Services Field Office (CESFO) and the LCNWR received funds from the Service's Cooperative Recovery Initiative (CRI) to implement recovery actions to improve the *E. woodburyana* populations in Sierra Bermeja in southwest Puerto Rico. Those recovery actions include propagation of at least 300 individuals of *E. woodburyana*, and the establishment of 3 additional populations on protected lands in Sierra Bermeja. At present, 160 of those 300 individuals have been planted in the LCNWR and over 140 seedlings are growing in containers at the CRNWR shade house for this purpose (R. Albarracín, Enviro Service Inc. pers. comm. 2016). Additionally, the PRDNER produced over 140 individuals of *E. woodburyana* in their nursery during 2014. At present, 55 of those individuals were planted in two public lands managed for conservation: 30 individuals were planted at Gabia Farm in Coamo, and 25 individuals were planted at the Toa Vaca Commonwealth Forest in Villalba. Additionally, PRDNER has at around 85 seedlings of *E. woodburyana* growing in their three nursery facilities for eventual introduction in their properties in near future (J. Casanova, PRDNER 2016, pers. comm.). The propagation and planting efforts of *E. woodburyana* should continue as suggested in the recovery plan. Once populations are established, long-term monitoring is needed to ensure that they are self-sustaining to fully meet the recovery criteria.

C. Updated Information and Current Species Status

1. Biology and Habitat

a. Species' abundance and population trends:

New information on *E. woodburyana* indicates that the overall species abundance has increased since it was listed in 1994. At the time of listing, the species' abundance was estimated at 45 individuals (59 FR 46715). When the recovery plan was approved, the abundance of *E. woodburyana* was estimated at around 150 plants (Service 1998). Since 1998, additional individuals of *E. woodburyana* have been found in the municipalities of Cabo Rojo, Lajas, Guánica, Guayanilla, Peñuelas,

Yauco, and Salinas. Additionally, the species has been successfully propagated under tree nursery conditions and planted in the wild. We have been able to detect new individuals of *E. woodburyana*, through the CRI project, and the population is now estimated at around 2,597 individuals in Puerto Rico (Table 1). It is important to highlight that this number includes both natural populations and planted individuals.

Guánica Commonwealth Forest

In 2006, Miguel Canals, former PRDNER Manager for the GCF, conducted a rapid assessment on the species estimating the population of *E. woodburyana* within the GCF at over 150 adult individuals (M. Canals, PRDNER, 2006, pers. comm.). On January 22, 2016, Service biologist Carlos Pacheco, with Ricardo Albarracín from EnviroSurvey Inc., conducted a rapid assessment of the species in the GCF. They visited two forested drainages where the species is known to occur: one at Dinamita trail and the other close to Cueva trail (Figure 7; C. Pacheco, Service, 2016, unpublished data). At Dinamita trail, they counted 95 individuals of *E. woodburyana* of different size classes: 29 seedlings, 39 saplings, 13 adult immature trees, and 14 adult mature trees. Here they found the biggest *E. woodburyana* tree recorded during the species' assessment. This tree is approximately 50 feet (15.2meters) tall and has a DBH of 7.6 inches (19.3cm) (C. Pacheco, Service, 2016, unpublished data).

At Cueva trail, they counted 41 individuals of *E. woodburyana*: 2 seedlings, 8 saplings, 26 adult immature trees, and 5 adult mature trees. The presence of different size classes in these two sites suggests that the species is improving because new adult individuals are likely to be recruited into these populations. It is important to highlight that the number of 136 individuals recorded during this assessment does not represent the entire population of *E. woodburyana* in the GCF. Although the other sites within the GCF where the species is known to occur were not visited this time, we consider the species as stable in the GCF because no changes in habitat or evidence of activities that may affect *E. woodburyana* individuals were observed (C. Pacheco, Service, 2016, pers. obs., Table 2). Hence, the estimate of 150 individuals of *E. woodburyana* provided by Canals described above (M. Canals, PRDNER, 2006, pers. comm.) is considered in this review as the most accurate information available on the overall status of the species in the GCF.

Sierra Bermeja

The abundance of *E. woodburyana* in Sierra Bermeja has been estimated at around 1,700 individuals (Table 1; Service 2016, unpublished data). Within Sierra Bermeja, the species is known to occur in four properties: LCNWR, Lozada Farm, Cerro El Conuco, and Finca Maria Luisa.

a. Laguna Cartagena National Wildlife Refuge – Tinaja Tract (LCNWR)

The LCNWR is managed by the Service for conservation. In 2012, Alcides Morales (biologist under contract with the Service), and José Martinez (Service biologist)

conducted an inventory of the species within the LCNWR Tinaja tract, estimating the *E. woodburyana* population at 1,079 individuals (808 adults and 271 saplings; Morales 2013). In 2016, Service biologist Carlos Pacheco visited the *E. woodburyana* population located in the LCNWR. Although the number of individuals were not estimated this time, he considered the species as stable because no changes in its habitat, or evidence of activities that may affect *E. woodburyana* individuals were observed (C. Pacheco, Service, 2016, pers. obs.).

b. Lozada Farm

In 2007, Service biologist Carlos Pacheco conducted a rapid assessment of *E. woodburyana* in Lozada Farm, a private site located immediately west of the LCNWR- Tinaja tract in Sierra Bermeja. At that time, the population was estimated at around 300 individuals (Service 2007, unpublished data). In 2016, the Service again visited this *E. woodburyana* population, and although the number of individuals was not estimated, we consider this population as stable because of the presence of adult trees, saplings, and seedlings. No changes in the habitat or evidence of activities that may affect *E. woodburyana* individuals were observed (C. Pacheco, Service, 2016, pers. obs.).

c. Cerro El Conuco and Finca María Luisa

In 2014, Service biologists Omar Monsegur and Iván Llerandi, and staff from PLN, discovered two populations of *E. woodburyana* in Sierra Bermeja: one at Cerro El Conuco, with approximately 41 individuals, and another at Finca María Luisa, with about 20 individuals (O. Monsegur and I. Llerandi, Service, 2014, unpublished data). Both farms are located close to LCNWR and are managed for conservation by PLN. Since August 2015, Ricardo Albarracín (EnviroSurvey, Inc.) has been conducting a population assessment of *E. woodburyana* at Finca María Luisa. As of 2017, he has found 281 individuals of the species: 89 adults, 138 immature adults, 7 saplings, and 47 seedlings. The surveys in this and other adjacent properties will continue during 2016 and 2017 and more individuals are expected to be found.

Almácigo Bajo, Municipality of Yauco

The *E. woodburyana* population at Almacigo Bajo Ward was first reported by José Sepúlveda, a biologist with the consulting firm CMA, Inc., in 2008 (Sepúlveda, CMA, pers. comm., 2008). However, his report did not provide information about the number of individuals in the population. In the same year, Service biologist C. Pacheco conducted a rapid assessment of this population and counted 194 individuals (Service 2008, unpublished data). C. Pacheco visited this population again in January 21, 2016. During this survey, C. Pacheco counted 557 individuals of *E. woodburyana* in a private land used for cattle grazing (Table 2, Figure2; Service 2016, unpublished data). He found 473 individuals of *E. woodburyana*: 172 seedlings, 196 saplings, 68 adult immature trees and 37 adult mature trees; all found in a small-forested drainage of approximately 1 acre (0.4 hectares) (Figure 6; Service 2016, unpublished data).

Another group of 84 individuals of *E. woodburyana* (39 seedlings, 30 saplings, 7 adult immature trees, and 8 adult mature trees) was discovered in a forested area located at the southern side of the hill where the original population is found (Figure 6; Service 2016, unpublished data). This is new information for the species in Almácigo Bajo Ward.

Encarnación Ward, Peñuelas

In 2004, Service biologist O. Monsegur, then a graduate student at the University of Puerto Rico, Mayagüez Campus, reported around 20 individuals of *E. woodburyana* in a forested drainage located at the Encarnación Ward in the municipality of Peñuelas (Monsegur, UPRM herbarium voucher 203, 2004). On October 4, 2011, Service biologists O. Monsegur and R. González visited this population again and found 10 adults, and one sapling (O. Monsegur, Service, 2010, unpublished data). They reported that areas that harbored *E. woodburyana* were bulldozed, and that an undetermined number of individuals were extirpated. José Salguero (PRDNER), then biologist at CSA, Inc., found another individual of *E. woodburyana* in the right-of-way for the proposed gas pipeline Gasoducto del Sur, close to a power line of the Puerto Rico Energy and Power Authority (PREPA) at Encarnación Ward in the municipality of Peñuelas (CSA 2008). In March 2016, Service biologists O. Monsegur and F. López, visited another forested drainage at Encarnación Ward and counted nine adult individuals of *E. woodburyana* (O. Monsegur, Service 2016, pers. comm.).

Based on the information above, we estimate the number of *E. woodburyana* individuals in Encarnación Ward at around 21 individuals. It is important to highlight that the area surveyed for the species does not correspond to the entire area where the species may occur. Therefore, the number of individuals in Encarnación Ward could be underestimated and may correspond to a portion of the species population in this site.

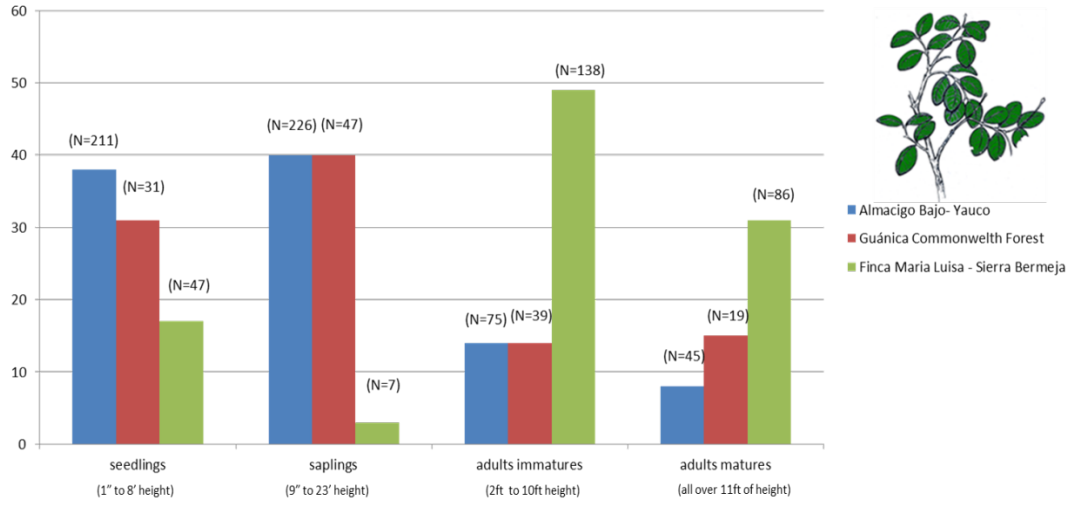


Figure 2. Population structure (percentage of seedlings, saplings, immature adults, and mature adults) of the *Eugenia woodburyana* populations surveyed in Almácigo

Bajo in Yauco, Guánica Commonwealth Forest, and Finca María Luisa in Sierra Bermeja (Service, 2016, unpublished data).

Table 2. Number of *Eugenia woodburyana* individuals (seedlings, saplings, immature adults, and mature adults) at Almácigo Bajo in Yauco and the Guánica Commonwealth Forest, populations surveyed during January 21-22, 2016 (Service, 2016, unpublished data)

Eugenia woodburyana:				
	Almacigo Bajo - Yauco	Guánica Commonwealth Forest	Finca Maria Luisa – Sierra Bermeja	Total:
Seedlings (1" to 8" height)	211	31	47	289
Saplings (9" to 23" of height)	226	47	7	280
Adults immature (2ft to 10ft of height)	75	39	138	252
Adults matures (all over 11ft of height)	45	19	86	150
Total:	557	136	278	**971**

Propagation and introduction of *Eugenia woodburyana*

Eugenia woodburyana is a species that is relatively easy to propagate under nursery conditions. Over the past 10 years, the Service has coordinated with local partners (i.e., PRDNER, PLN, University of Puerto Rico, among others) in the propagation of this species and its introduction into lands managed for conservation. To date, over 333 individuals of *E. woodburyana* have been planted, and successfully established in nine different sites in Puerto Rico (Table 1; Figure 3).

In 2008, the Service and PRDNER planted 46 saplings of *E. woodburyana* at the SCF (Service 2008, unpublished data). These individuals were seedlings from the *E. woodburyana* population located in Almácigo Bajo, Yauco. In 2016, Service biologist C. Pacheco conducted a rapid assessment of the individuals planted in the SCF and found that only 11 individuals had survived, but they appeared in good condition (C. Pacheco, Service 2016, per obs.).

In 2008, *E. woodburyana* was introduced in Gabia Farm, southern Puerto Rico. At that time, the Service and PRDNER planted seven individuals from the Sierra Bermeja population. Later, in 2015, PRDNER planted 30 new individuals from the same source to augment the species population at this site. Additionally, PRDNER

planted 25 individuals in the Toa Vaca Commonwealth Forest, another public land managed by PRDNER for conservation. Presently, some of the individuals planted in Gabia Farm and the Toa Vaca Commonwealth Forest are producing flowers and fruits, while others are not fully established (J. Casanova, PRDNER 2016, pers. comm.).

In 2010, the Service and PLN signed the Cooperative Agreement to plant 50 individuals of *E. woodburyana* in Cueva El Convento Natural Reserve, a private land managed by PLN for conservation. At present, 29 individuals of those 50 have survived and the PLN consider these individuals are doing well at the site (PLN 2015; J. Silva, PLN, 2014, pers. comm.).

Since 2014, Service biologists and Refuge staff have planted over 160 individuals of *E. woodburyana* within the CRNWR and LCNWR as part of the ongoing CRI project (Table 1). The *E. woodburyana* individuals have been planted close to forested drainages, but far from the water channel to avoid being affected during flood events. Presently, these individuals are growing well in both sites (C. Pacheco, Service, 2016, pers. obs).

Furthermore, *Eugenia woodburyana* has been planted in other sites such as Parque Doña Inées in Río Piedras, Río Piedras Botanical Garden, and Caguas Botanical Garden for educational purposes (Table 1). Currently, many of the individuals planted in these Botanical Gardens have been observed flowering and fruiting, but seedlings have not been documented because all produced seeds are collected for germination purposes (C. Pacheco, Service, 2016, pers. obs.).

Table 1. Number of individuals known per populations, population status, and status of the lands where the *Eugenia woodburyana* occurs in Puerto Rico. (Service, 2016, unpublished data).

Location	**Number of individuals (adults and saplings; seedlings excluded)**	**Population status**	**Status of lands (Private, Public or Federal)**	**Source of information**
Peñones de Melones-Boquerón, Cabo Rojo	19	Unknown	Private land proposed for urban development	Breckon (1996) UPRM Herbarium Voucher 4863
Encarnación Ward, Peñuelas	21	Stable (saplings observed)	Private land proposed for urban development	O. Monsegur, Service, 2016, pers. comm.
Almácigo Bajo, Yauco	346	Stable (seedlings and saplings observed)	Private land under agriculture	C. Pacheco, Service, 2016, unpubl. data.
Guánica Commonwealth Forest	200	Improving (seedlings observed)	Commonwealth land managed for conservation	C. Pacheco, Service, 2016, unpubl. data.
Lozada Farm, Sierra Bermeja	300	Stable (seedlings observed)	Private land use for cattle grazing	C. Pacheco, Service, 2016, unpubl. data

La Tinaja Farm (LCNWR), Sierra Bermeja	1079	Increasing (seedlings and saplings observed)	Federal land (LCNWR)	Morales-Pérez (2013)
	160*	Stable	Federal land (LCNWR)	R. Albarracín, Envirosurvey, Inc., 2016, unpubl. data.
Cerro El Conuco, Sierra Bermeja	41	Stable (seedlings observed)	Private land managed for conservation	O. Monsegur and I. Llerandi-Román, Service, 2014, unpubl. data.
Finca María Luisa, Sierra Bermeja	281	Stable (seedlings observed)	Private land managed for conservation	R. Albarracin, Envirosurvey, Inc., 2016, unpubl. data.
Camp Santiago, Salinas	1	Stable	Military base, Commonwealth land	P. Acevedo-Rodriguez, 2013, unpubl. data,
Cabo Rojo National Wildlife Refuge, Cabo Rojo	34*	Stable	Federal Land managed for conservation	O. Monsegur, Service, 2016, unpubl. data.
Gabia Farm, Coamo.	37*	Stable	Commonwealth land managed for conservation	J. Casanova, PRDNER, 2016, pers. comm.
Susúa Commonwealth Forest, Sabana Grande	11*	Improving	Commonwealth land managed for conservation	C. Pacheco, Service, 2016, unpubl. data.
Cueva El Convento Natural Reserve, Guayanilla	29*	Stable	Private land managed for conservation	PLN, 2015
Toa Vaca Commonwealth Forest, Villalba	25*	Stable	Commonwealth land managed for conservation	J. Casanova, PRDNER, 2016, pers. comm.
Arboretum Parque Doña Inés, San Juan	8*	Stable	Private Land managed as a Botanical Garden	C. Torres, Fundación Luis Muñoz Marin, 2016, unpubl. data.
Caguas Botanical Garden, Caguas	3*	Stable	Municipal land managed for conservation	M. Caraballo, UPR, 2008, pers. comm.
Río Piedras Botanical Garden, Río Piedras	2*	Stable	Commonwealth land managed for conservation	M. Caraballo, UPR. 2008, pers. comm.
Total:	**2,597**		**Private = 26% (N=687) Protected =74% (N=1,910)**	

* Planted individuals

Based on the information presented above, we believe that the overall abundance of *E. woodburyana* has increased throughout its range during the past 18 years. As well, we believe the population trend of the species is improving. Field observations from Service biologists and other partners indicate that at least seven natural populations

have seedlings, saplings, and adult individuals, which indicates recruitment, and that those populations may be self-sustaining (Service, 2016, unpublished data).

b. Genetic, genetic variation, or trends in genetic variation

No new information on genetics, genetic variation, or trends in genetic variation of *E. woodburyana* was found during this review.

c. Taxonomic classification or changes in nomenclature

There are no recent taxonomic or nomenclatural changes for the species. *Eugenia woodburyana* is the currently accepted name in the most recent checklist for the flora of Puerto Rico (Axelrod 2011) and the West Indies (Acevedo-Rodríguez and Strong 2012).

d. Species' spatial distribution, trends in spatial distribution, or historical range

It is believed that *E. woodburyana* is endemic to the southern portion of Puerto Rico since it has not been found naturally in other areas of the Island or in other islands in the Caribbean.

In 1998, *E. woodburyana* was only known from three localities in southwest Puerto Rico: Cerro Mariquita in Sierra Bermeja, GCF and the CRNWR. After reviewing the best available information on the species, we now believe that in 1998 *E. woodburyana* was more widely distributed than originally stated in the recovery plan. Dr. Frank Axelrod (University of Puerto Rico-Rio Piedras Campus) collected the species in 1994 from two sites at Peñones de Melones, Boquerón Ward, Cabo Rojo (Axelrod, New York Botanical Garden (NYBG) herbarium vouchers 843453 and 843457, 1994). Later, in 1996 Dr. Gary Breckon (University of Puerto Rico, Mayagüez Campus (UPRM), retired) collected the species from the same area, providing a description of the area and an estimation of the species' population (Breckon, UPRM herbarium voucher 4863, 1996; Table 1). On January 8, 1995, José A. Cedeño-Maldonado, a then graduate student at UPRM, found the species on a dry limestone hill at the Encarnación Ward in the municipality of Peñuelas (Cedeño-Maldonado and O'Relly 1996). We were not aware of these records when the recovery plan was approved; therefore, this information is considered as new for the purpose of this review.

Since 1998, new natural populations of *E. woodburyana* have been reported to occur in the southern region of Puerto Rico. In addition, new individuals have been found in areas where the species is known to occur.

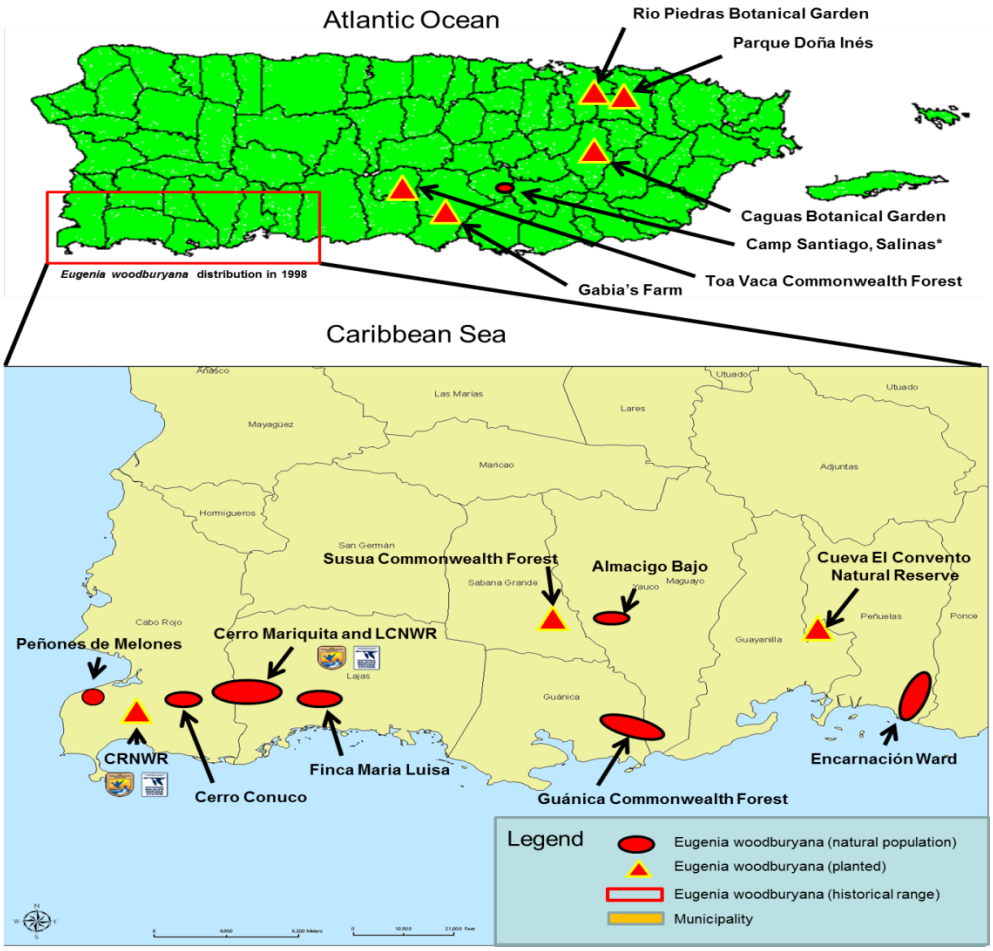
In 2008, *E. woodburyana* was reported to occur on private lands located west of Los Quiñones road in Almácigo Bajo Ward, municipality of Yauco (Sepúlveda, CMA, pers. comm., 2008). At this location, the species occurs in a natural drainage and at a forested area on a hill located northwest of the Puerto Rico Energy Power Authority

(PREPA)- Rio Loco Hydrological Power energy Plant facilities (Figure 6; Service 2016, unpublished data). In 2008, new individuals of *E. woodburyana* were found approximately 1.2 miles northeast of the individuals reported by Cedeño-Maldonado in 1996 at the Encarnación Ward, municipality of Peñuelas (CSA 2008). In 2016, another group of individuals of *E. woodburyana* were found by Service biologists at 0.59 mile (0.95 kilometer) north-west from the previous reported sites (Figure 7; Service 2016, unpublished data).

In the area of Sierra Bermeja, the species' distribution has expanded since the recovery plan was approved. At that time, *E. woodburyana* was known only from a discrete population located in the LCNWR- La Tinaja tract. Presently, the species is also known to occur in Finca María Luisa, Lozada Farm, and El Conuco. We consider the species either stable or improving at each of these sites (Table 1).

In 2013, Dr. Pedro Acevedo-Rodriguez, curator from the Smithsonian Botany Department, found an individual *E. woodburyana* in a forested hill located within the National Guard Training Area at Camp Santiago in the municipality of Salinas. This new record expands the natural range of the species from Cabo Rojo to Salinas in the southern region of Puerto Rico (Figure 3).

Since 2006, *E. woodburyana* were successfully planted at nine sites in Puerto Rico: six sites within the natural range for the species and three sites outside the natural range for educational purposes only (Table 1; Figure 3). At present, *E. woodburyana* has been planted at Gabia Farm in Coamo, SCF in Sabana Grande, Cueva El Convento Natural Reserve in Guayanilla, the CRNWR in Cabo Rojo, the LCNWR in Lajas and Toa Vaca Commonwealth Forest in Villalba. Moreover, individuals of *E. woodburyana* have been planted for educational purposes at the Caguas Botanical Garden in the municipality of Caguas, Parque Doña Ines in municipality of Trujillo Alto, and at the Río Piedras Botanical Garden in Río Piedras (Table 1, Figure 2).



**Eugenia woodburyana* was discovered in Camp Santiago in 2013.

Figure 3. Distribution of *Eugenia woodburyana* in Puerto Rico (Service, 2017, unpublished data).

e. Habitat or ecosystem conditions

At the time of listing, *E. woodburyana* was only known from forested drainages in the karst zone of the GCF, and from a forested drainage in Cerro Mariquita in Sierra Bermeja. Currently, the species is also found on exposed serpentine outcrops areas in Cerro Mariquita and in Almácigo Bajo. At the time that the recovery plan was approved, exposed serpentine outcrop habitat was not considered as suitable habitat for the species. Serpentine soils are typically very mineralized and granular, which can result in rapid drainage and periods of moisture deficiency (Cedeño-Maldonado and Breckon 1996). Based on the current information on *E. woodburyana*, the known distribution of the species has expanded, and our knowledge on habitat use for the species has increased.

The amount of protected habitat for *E. woodburyana* at the GCF has increased in the last 10 years. In 2003, the PRDNER acquired approximately 200 acres of dry forest to the north of the GCF, which were added to the forest (M. Canals, former GCF Manager, 2008, per.comm.). This parcel harbors suitable habitat for *E. woodburyana*,

but it has not been yet found there. However, the addition of these lands to a Commonwealth forest increases the conservation potential for the species because populations of *E. woodburyana* can be established in the area.

f. Other relevant information

Since the recovery plan was approved, knowledge about the phenology and germination of *E. woodburyana* has increased. This plant has been observed flowering in February, May, June, August, and October (Figure 3; C. Pacheco, Service, pers. obs.). In Sierra Bermeja, not all adult individuals flower at the same time and not all produce fruit. Flowers have been observed 3 to 5 days after rain events of more than 1 inch (25.4 mm) of precipitation in one day. Fruit are observed about three weeks later.

Figure 4. Photos of flowers (left) and fruit (right) of an *Eugenia woodburyana* in Sierra Bermeja, Puerto Rico (C. Pacheco, Service, 2010).

In 2002, Dr. Eugenio Santiago (UPR, Río Piedras) conducted a preliminary study on seed germination in a greenhouse and produced 77 *E. woodburyana* (Santiago et al. 2005). Since 2002, propagation efforts for the species have been conducted in the tree nursery facilities at the CRNWR, at PRDNER's tree nursery in Arecibo and Boquerón, and Parque Doña Inés in Trujillo Alto. Presently, about 714 individuals have been produced and over 333 of these have been planted.

In 2006, 19 individuals of *E. woodburyana* were planted within the CRNWR. In June 2008, the survival of those individuals was estimated at 63% (N=12). Two of these individuals were observed flowering and one had fruit (Service, 2008, unpublished data). In October 2007, 72 seedlings and saplings of *E. woodburyana* were rescued from an artificial trench that was going to be impacted by a water supply enhancement project of the Puerto Rico Aqueduct and Sewage Authority (PRASA) in Almácigo Bajo, Yauco. These individuals were planted in pots and transported to the green house of the SCF (Service, 2008, unpublished data). In June 2008, survival of these individuals was estimated at 94% (N=68) (Service, 2008, unpublished data). In July 2008, 44 of the 68 individuals were planted along a drainage close to the visitor center in the SCF. By 2015, 25 % (N=11) of those individuals had survived and considered stable (Pacheco, Service, 2016, per sobs.).

2. Five Factor Analysis

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

When *E. woodburyana* was listed in 1994, we identified habitat destruction and modification as one of the factors affecting the continued existence of the species. Presently, five of the eight natural populations are known to occur in privately-owned land subject to intensive pressure for agricultural, housing and tourist development.

The habitat for *E. woodburyana* on privately-owned lands in Sierra Bermeja has been largely modified or destroyed through deforestation for agricultural practices (i.e., grazing cattle and goats), tourist and rural development, and wildfires; thus eliminating the species throughout most of its former range (Service 1998). Presently, the Sierra Bermeja mountain range has been zoned by the Puerto Rico Planning Board as a District of Conservation of Resources 1 (CR1), the most restrictive category for development, precluding tourist and urban development and mining activities (PRJP-Regulation 4, 2009). Nonetheless, this classification allows agricultural (e.g., cattle grazing) and rural developments (i.e., one house in 25 acres of land). In 2006 and 2013, private landowners cut new roads to gain access to their properties at the peak of Cerro Mariquita and other properties along the Sierra Bermeja. This action affected an undetermined amount of habitat for the species (C. Pacheco, Service, 2014, pers. observation). Deforestation for agricultural practices and wildfire remain as threats to the species, and we believe some of these sources may have been responsible for the elimination of some individuals.

In 1996, the Service acquired la Tinaja Farm, a private land of 270 acres (109.3 hectares) located in the eastern section of Cerro Mariquita in Sierra Bermeja. Cerro Mariquita is the highest elevation point in the Sierra Bermeja mountain range, located between the municipalities of Cabo Rojo and Lajas (Service 2011). The Service incorporated this land into the LCNWR, protecting 67% of the known individuals of *E. woodburyana* in Cerro Mariquita (Table 1). The remaining 33% of the individuals in Cerro Mariquita occur in private lands subjected to cattle and goat grazing, and limited rural development (Service, 2016, unpublished data).

In the area of Peñones de Melones, Cabo Rojo, our field observations and aerial photo interpretation indicate that approximately 80% of the suitable habitat for the species has been impacted by residential and tourist development, and by agricultural practices such as livestock grazing (Figure 5; Service, 2008, unpublished data). These practices have resulted in habitat modification and degradation, soil erosion, and possible elimination of individuals. Only 20% of the area remains in secondary forest, but is under potential development pressure by two projects: Bahía de Campomar and Monte Carlo Resort – Boquerón Bay Villas. Both projects were proposed more than 10 years ago but have been delayed due to economic constraints. The Bahía de Campomar and Monte Carlo Resort – Boquerón Bay Villas projects

could affect approximately 510 acres of the remaining suitable habitat for *E. woodburyana*. In conclusion, we believe that the habitat for the species in Peñones de Melones has so severely impacted that that we consider *E. woodburyana* extirpated from this historical site.

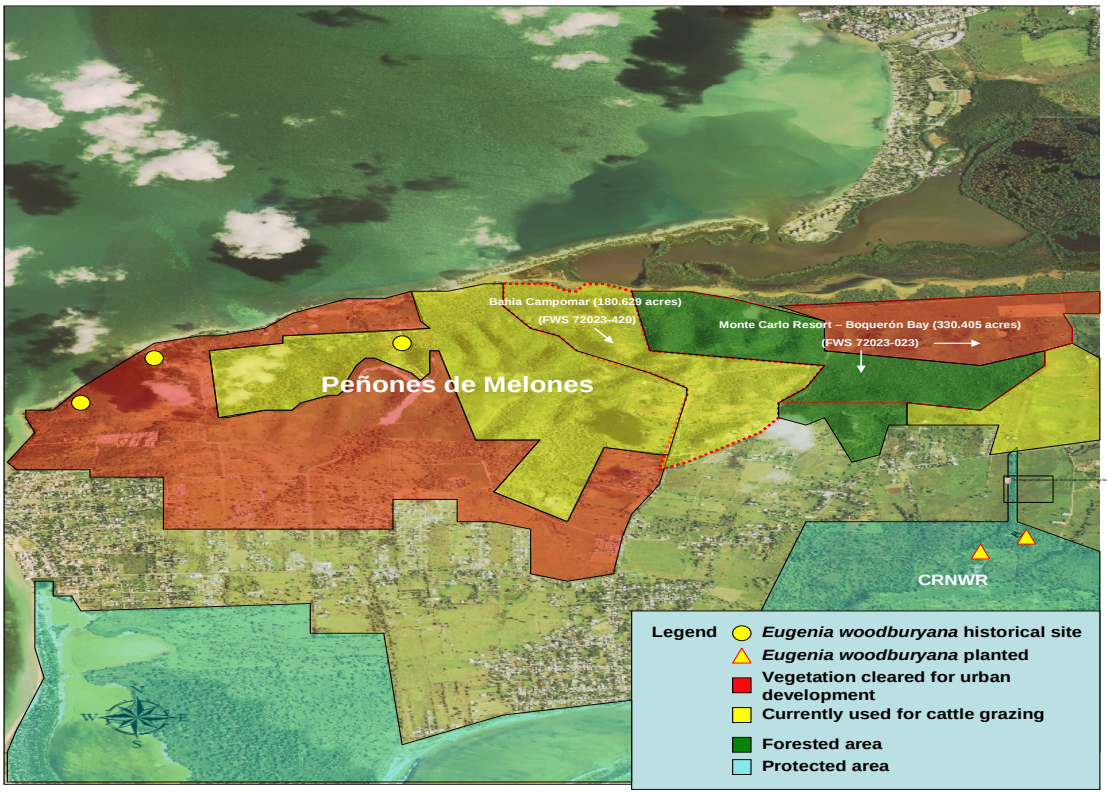


Figure 5. Current land use and habitat distribution of *Eugenia woodburyana* at Peñones de Melones,Boquerón Ward, municipality of Cabo Rojo. (Service, 2008, unpublished data).

The *Eugenia woodburyana* population at Almácigo Bajo is located in a small forested drainage located within a parcel of land currently used for cattle grazing, and adjacent to an abandoned quarry (Figure 6). According to our field observations, approximately 80% of the property was cleared of vegetation and the surrounding areas are under pressure of agricultural and urban development (C. Pacheco, Service, 2016, unpublished data). In this site, the species occurs in a natural drainage adjacent (less than 50 meters) to an abandoned quarry; therefore, we can expect that any new activity in the quarry could negatively affect this population. Additionally, José Sepulveda from CMA, Inc., found 72 seedlings and saplings of *E. woodburyana* in an artificial ditch located 45 meters downhill of this adult population. All these seedlings and saplings were transplanted to the SCF to avoid their impact by a project of the Puerto Rico Aqueduct and Sewage Authority (PRASA).

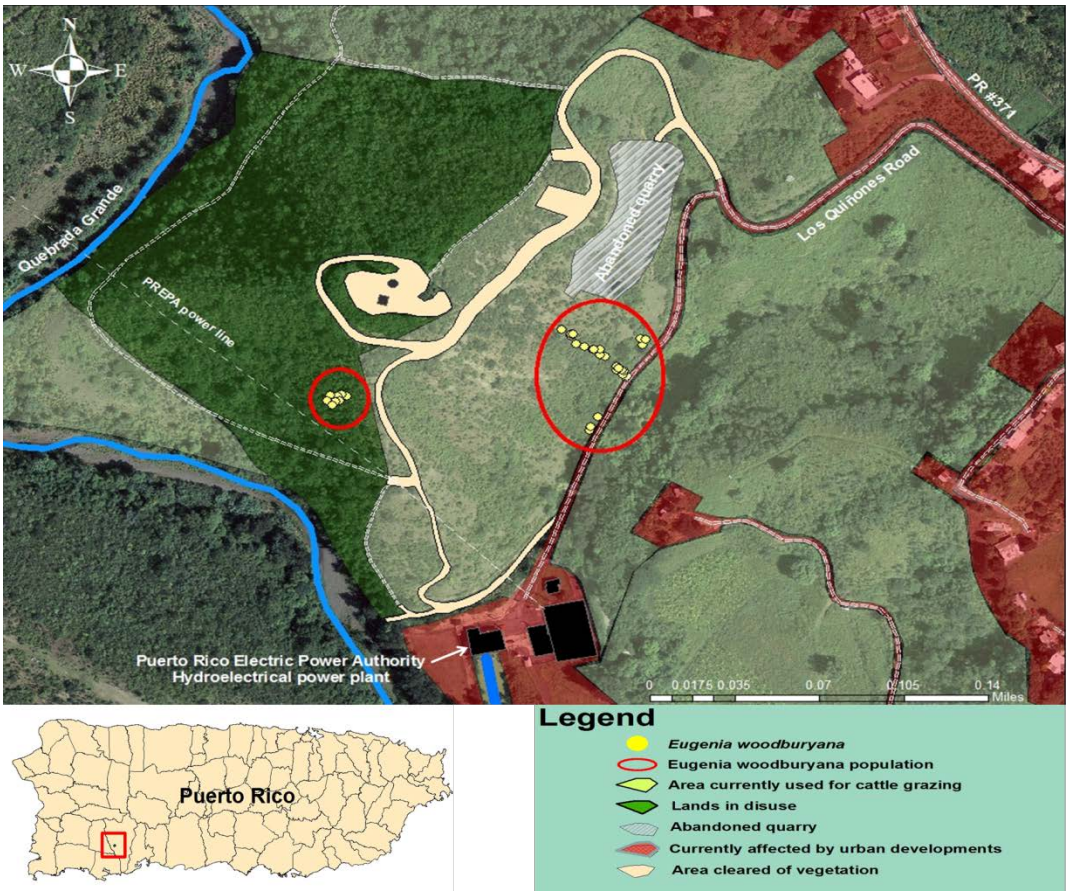


Figure 6. Current land use and location of the *Eugenia woodburyana* population at Almáigo Bajo in the Municipality of Yauco, Puerto Rico (Service, unpublished data. 2016).

The habitat of *E. woodburyana* has been reduced by urban development at the Encarnación Ward in the municipality of Peñuelas, (Monsegur 2004). Here the species is found in two forested drainages located to the north and close to road PR-2. Based on our field observations and aerial photo interpretation, urban development is expanding from the PR-2 to the north, threatening the suitable habitat for the species (Figure 7). In October 4, 2011, Service biologists Omar Monsegur and Rafael González visited the Encarnación Ward and found that areas that harbored *E. woodburyana* individuals were bulldozed and an undetermined number of individuals were extirpated. Currently, a residential development project called El Peñón de Ponce has been proposed for this area. This project will potentially affect approximately 81.2 acres (32.9 hectares) of *E. woodburyana* habitat. However, it is apparently on hold due to the economic situation of Puerto Rico. We believe this project will likely not be constructed in the near future.

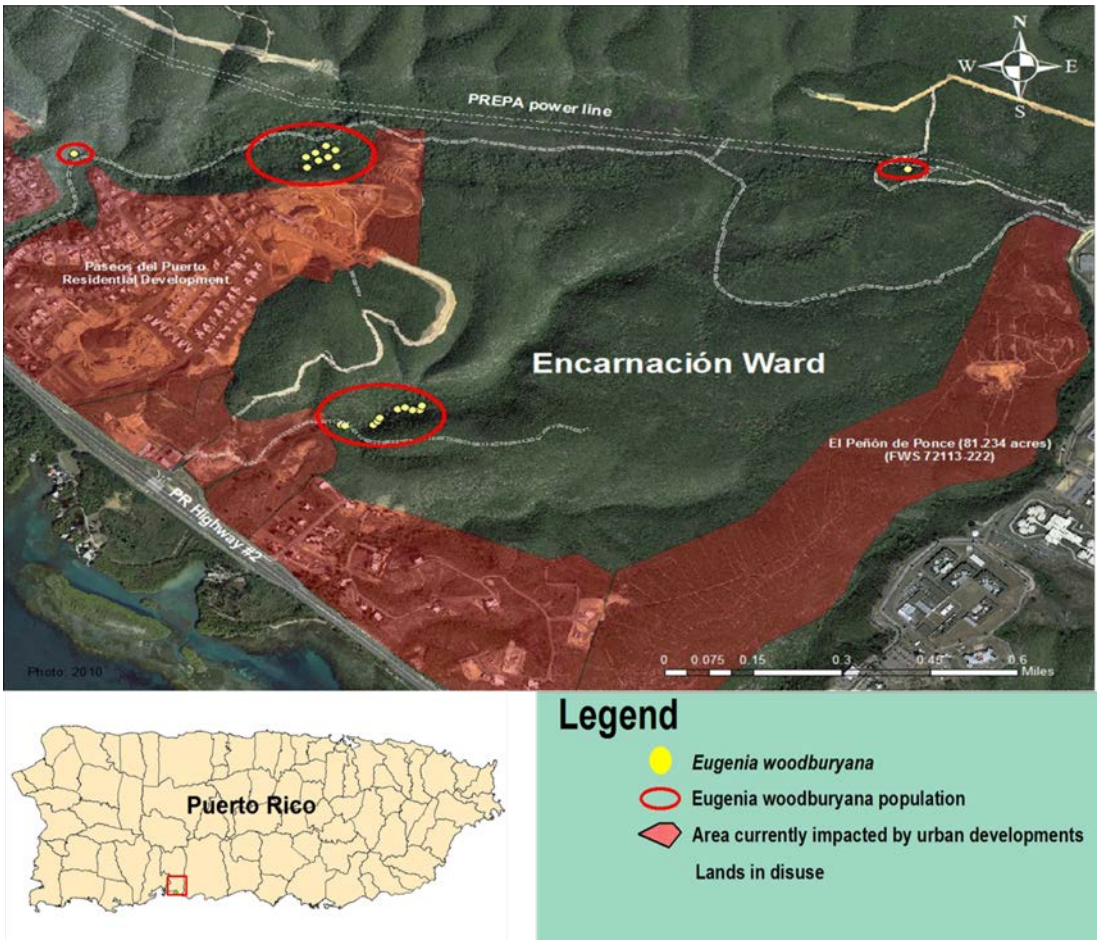


Figure 7. Current land uses and location of the *Eugenia woodburyana* population at the Encarnación Ward in the municipality of Peñuelas, Puerto Rico (Service, 2016, unpublished data).

Presently, 74 percent of the known individuals of *E. woodburyana* are located on Federal, State and private lands managed for conservation. The remaining 26 percent of the known individuals occur in privately owned lands threatened by agricultural, urban and tourist development. Therefore, we believe that present or threatened destruction, modification, or curtailment of its habitat or range is a threat to the species. However, we believe this threat is currently low in scope and non-imminent because development projects that pose major threats to the species have been delayed presumably due to economic constraints. Furthermore, the majority of known individuals occur in lands managed for conservation.

(b) Over-utilization for commercial, recreational, scientific or educational purposes;

This factor was not considered a threat to *E. woodburyana* in the final rule for listing the species. At present, we are not aware that over-utilization for commercial,

recreational, scientific or educational purposes constitutes a limiting factor for the species.

(c) Disease or predation;

This factor was not considered a threat to *E. woodburyana* in the final rule for listing the species. We do not have information indicating that disease or predation constitutes a threat to the species.

(d) Inadequacy of existing regulatory mechanisms.

When *E. woodburyana* was listed, the Service identified the inadequacy of existing regulatory mechanisms as one of the factors affecting the continued existence of the species. At that time, the species had no legal protection because it had not been included in the Commonwealth's list of protected species. Once *E. woodburyana* was federally listed, legal protection was immediately provided under the Endangered Species Act (Act), and by virtue of an existing Section 6 Cooperative Agreement with the Commonwealth of Puerto Rico. Listing assured the addition of *E. woodburyana* to the Commonwealth list as a protected species and to be designated as endangered.

Presently, *E. woodburyana* is legally protected under Commonwealth's Law No. 241-1999, or *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 activities. This law also has provisions to protect habitat for all wildlife species, including plants. In 2004, the PRDNER approved Regulation 6766 or *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 govern the management of threatened and endangered species in the Commonwealth of Puerto Rico). Article 2.06 of Regulation 6766 prohibits collecting, cutting, removing, among other activities, listed plant individuals within the jurisdiction of Puerto Rico (PRDNER 2004).

The GCF is protected by Law No. 133-1975 (12 L.P.R.A. sec 191), as amended, known as *Ley de Bosques de Puerto Rico* (Puerto Rico Forests' Law), as amended in 2002. Section 8 (A) of Law No. 133-1975 prohibits cutting, killing, destroying, uprooting, extracting, or in any way hurting any tree or vegetation within a Commonwealth forest without authorization of the PRDNER Secretary. The PRDNER also identified the GCF as a Critical Wildlife Area (CWA). 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 to assist permitting agencies in precluding negative impacts as a result of permit approvals or endorsements (PRDNER 2005).

As for the *E. woodburyana* populations found in LCNWR and CRNWR, these individuals are protected by the National Wildlife Refuges Act of 2000. All plants existing in the National Wildlife Refuge System are protected from collection (50 CFR 27.51). Additionally, the Comprehensive Conservation Plans (CCPs) for LCNWR and CRNWR include measures for the protection and recovery of threatened and endangered species, including *E. woodburyana*, within these Refuges (USFWS 2011a, b).

Although the protection of existing laws extends to populations of *E. woodburyana* in private lands, the enforcement of such laws and regulations on private lands continues to be a challenge. Accidental damage or extirpation of individuals of *E. woodburyana* has occurred due to lack of knowledge of the species by private landowners and law enforcement officers. However, at this time we are unaware of any damage occurring to *E. woodburyana* on private properties. Therefore, based on the presence of Commonwealth laws and regulations protecting this species, we no longer consider the inadequacy of existing regulatory mechanisms as a threat to *E. woodburyana*.

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

At the time of listing, the Service considered this Factor as a threat affecting the continued survival of *E. woodburyana*. One of the most important threats under this factor was the species' limited distribution (only three isolated populations known at that time) coupled with low number of individuals (only 45 individuals throughout the species range). Based on this information, the Service considered the risk of extinction of *E. woodburyana* very high. The new information about the distribution and abundance gathered during this review reflects that the species is more abundant and widely distributed than previously thought. Thus, we no longer consider limited distribution and low population numbers are threats to *E. woodburyana*. However, the areas where the species occurs are susceptible to other natural and manmade factors such as human induced fires, landslides, and sediment run off.

Human induced fires are a current threat for the species in Sierra Bermeja (LCNWR), Almácigo Bajo, Gabia Farm, Camp Santiago and CRNWR. These populations are found in the driest part of Puerto Rico, particularly close to private lands where fires could be ignited accidentally or deliberately. Fire is not a natural event in subtropical forests in Puerto Rico; thus, most species are not fire-adapted (Santiago-García et al. 2008). Human-induced fires may lead to destruction of the seed bank of native vegetation and may develop conditions favorable for the establishment of exotic plant species (e.g., guinea grass [*Megathyrsus maximus*]), which serve as fuel for fires (Thaxton et al. 2012). Although the PRDNER and the USFWS implement a fire-prevention and management program during the dry season, this program is not 100% effective. Presently, human induced fires have negatively affected habitat for the species in areas managed for conservation (C. Pacheco, Service, 2014, pers. obs.). Based on the distribution of *E. woodburyana* and the lack of information about

species resilience to fire, we consider this factor as low in magnitude and non-imminent.

Landslides and sediment run off may poses threat to *E. woodburyana* in Sierra Bermeja, GCF, Encarnación Ward and Almacigo Bajo Ward. At these locations, the adult mature individuals of *E. woodburyana* are mostly found on the steeper slopes and on deeper sides of the natural drainages. Furthermore, seedlings and saplings of *E. woodburyana* are often found growing on these drainages at these locations (O. Monsegur 2004; Service 2016, unpublished data). High rainfall associated with tropical storms and hurricanes (on occasion rainfall can exceed 24 in (2 ft) in a single storm event) can cause floods that in combination with steep topography and highly erosive substrate, may lead to mass wasting events (e.g., land, mud, and debris slides; Lugo 2000). A mass wasting event in the area where the species grows would not only destroy adult plants and their offspring, but also the seed bank and substrate. Landslides create gaps in the vegetation that would allow other plants (native or non-native, herbaceous or woody) to become established. In fact, in September 2009, three landslides resulting from heavy rains were observed adjacent to the area where *E. woodburyana* occurs in Sierra Bermeja (Service 2010). Due to the little information known about the species' ability to survive stochastic events such as landslides and heavy sediment run off, and to compete with other species; we believe that stochastic events such as those mentioned above may have adverse impacts on *E. woodburyana*, particularly on its natural populations in Sierra Bermeja, the GCF, Encarnación Ward and Almacigo Bojo Ward.

Change in climate can have a variety of direct and indirect impacts on species, and can exacerbate the effects of other threats. Rather than assessing "climate change" as a single threat in and of itself, we examine the potential consequences to species and their habitats that arise from changes in environmental conditions associated with various aspects of climate change. Vulnerability to climate change impacts is a function of sensitivity to those changes, exposure to those changes, and adaptive capacity (IPPC 2007; Glick et al. 2011).

An expected effect of climate change is the increase of hurricanes and tropical storms, followed by extended periods of drought (IPCC 2012). This climate change may alter (modify) the microclimate and the surrounding vegetation around the populations of the *E. woodburyana*. Hurricane effects followed by extended periods of drought may result in change in soil conditions and microclimate and allow other plants (native or non-native, herbaceous or woody) adapted to drier conditions to become established (Lugo 2000). Invasive species (e.g. *Megathyrsus maximus*) may spread and colonize the *E. woodburyana* habitat, and it could alter fire regimen, microclimate, and nutrient cycling of the habitat that the species depend.

It is difficult to predict the *E. woodburyana* recovery after natural and human catastrophic events such as landslides, human induced fires, and climate change due to the little information known on its natural recruitment capacity and the lack of knowledge on its survivorship to stochastics events. Therefore, we consider Factor E

as a threat to *E. woodburyana*. However, we believe the magnitude of these threats is low and not imminent because they do not occur frequently.

3. Synthesis

New information indicates that *E. woodburyana* is now more abundant and more widely distributed than what was thought when the species was listed in 1994 and when the recovery plan was published. At the time of listing, this species was known from three sites: CRNWR, Sierra Bermeja, and GCF. Currently, *E. woodburyana* is known to occur naturally in eight localities along the southern region of Puerto Rico: from the municipality of Cabo Rojo in south-west Puerto Rico eastward to the municipality of Salinas in the south. Additionally, the species was propagated under tree nursery conditions and has been planted at nine sites: CRNWR, LCNWR, Gabia Farm, Toa Vaca Commonwealth Forest, SCF, Cueva El Convento, Caguas Botanical Garden, Parque Doña Inés, and Río Piedras Botanical Garden. In 1998, the species abundance was estimated to be 45 individuals. Currently, approximately 2,597 individuals have been documented. After analyzing the new information about the distribution and abundance gathered during this review, we conclude the current status of *E. woodburyana* is improving.

According to the five factor analysis conducted for this review, *E. woodburyana* is currently threatened by Factor A (present or threatened destruction, modification, or curtailment of it habitat or range), and Factor E (other natural or manmade factors affecting its continued existence). At present, 1,910 of the known individuals occur in areas managed for conservation and 687 are found in privately owned lands, which may be subject to disturbance such as agriculture and development. According to information gathered for this review, agriculture and urban development may result in habitat modification and destruction, and possible destruction of individual plants. Human-induced fires and landslides may threaten the species. Nonetheless, we consider the level of these threats as low and non-imminent because about 74 percent of the known individuals of *E. woodburyana* are on protected land managed for conservation, and fire-prevention plans are implemented to reduce the incidence of fires on these lands. Additionally, the Service, through a CRI project, is working with partners and private landowner to implement activities for the recovery of the species at Sierra Bermeja.

The ESA defines an endangered species as any species, which is in danger of extinction throughout all or a significant portion of its range. However, based on the information gathered during this review, we believe that *E. woodburyana* does not meet the definition of endangered, rather the species meet the definition of threatened because some threats to the species still remain while others have been reduced or no longer occur. Further implementation of recovery actions is needed to bring the *E. woodburyana* to full recovery by reducing or removing threats to a point where the species is no longer likely to become endangered.

III. RESULTS

A. Recommended Classification:

__X__ Yes, downlisting to Threatened for *Eugenia Woodburyana*

New information gathered during this 5-year review shows an increase in the number of populations and individuals within the species' range. Currently, the abundance of the species is estimated at around of 2,597 individuals. Additionally, delisting criteria established in the Recovery Plan have been partially met. Additionally, our review of the best scientific and commercial information available indicates that some threats to the *Eugenia woodburyana* still remain while others have reduced or no longer occur. The 5-factor analysis shows that the degree of Factor A and Factor E are considered low, and Factor D is no longer considered a threat.

Therefore, based on our status review, threats analysis, and evaluation of conservation measures, we believes that the *Eugenia woodburyana* no longer meets the ESA definition of endangered and should be reclassified to threatened. The ESA defines a threatened species as any species, which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

B. New Recovery Priority Number: __14__

Based on the information gathered for this review, we believe that the new recovery priority number for *E. woodburyana* is 14, which indicates the species faces a low degree of threat, but has a high recovery potential.

C. If applicable, indicate the Listing and Reclassification Priority Number (48 FR 43098): __6__ for *Eugenia woodburyana*

We have determined that the degree of management impact on *E. woodburyana* is low; the petition status is an unpetitioned action. Therefore, we recommend the priority number for reclassification from Endangered to Threatened of 6.

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

- Develop measurable and objective criteria for the delisting of the species based on the new information available for the species.
- Publish a propose rule to reclassify the species to threatened.
- Continue conducting comprehensive surveys on the species within traditional (e.g., Cerro Mariquita in Sierra Bermeja, GCF, Encarnación Ward in Peñuelas, Camp Santiago in Salinas and Almácigo Bajo in Yauco), and non-traditional sites

(e.g., Sierra Bermeja mountain range and SCF) to determine relative abundance and distribution of the species in a wider range.

- Conduct surveys at Peñones de Melones to determine if the species is still present in that area.
- Promote Conservation Agreements with private landowners under the Service's Partners for Fish and Wildlife, and Coastal Programs to protect and enhance existing populations.
- Work closely with the PRDNER and landowners to ensure the protection of the species and its habitat in private lands.
- Continue with the propagation program to enhance the existing populations and establish new populations in protected areas in southwestern Puerto Rico.
- Continue implementing fire prevention practices in Sierra Bermeja, CRNWR and GCF during dry season.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW
Euginia woodburyana (non common name)

Current Classification Endangered

Recommendation resulting from the 5-Year Review

X Downlist to Threatened for *Eugenia woodburyana*

Appropriate Listing/Reclassification Priority Number 6

Review Conducted By Carlos Pacheco, Service biologist, Endangered Species Program, Caribbean Ecological Service Field Office, Boquerón, Puerto Rico.

FIELD OFFICE APPROVAL:

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

Approve _____ Date 12/8/16

REGIONAL OFFICE APPROVAL:

Lead Regional Director, Fish and Wildlife Service

Approve _____ Date 5/9/17