Myrcia paganii

5-Year Review:
Summary and Evaluation

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

Images of specimens from the University of Puerto Rico, Mayagüez Campus Department of Biology Herbarium

5-YEAR REVIEW
Myrcia paganii

I. GENERAL INFORMATION

A. Methodology used to complete the review:

On April 9, 2010, the U.S. Fish and Wildlife Service (Service) published a notice in the *Federal Register* (75 FR 18232) announcing the 5-year review for *Myrcia paganii*, and requested new information concerning the biology and status of the species. A 60-day comment period was opened; however, no information was received from the public during that period.

Then, the Service signed a cooperative agreement with the University of Puerto Rico, Mayagüez campus (UPRM), to gather and summarize available information on *M. paganii*. Botanists from the UPRM, Drs. Duane A. Kolterman and Jesús D. Chinea, reviewed available literature, consulted with specialists, and examined herbarium data, including specimens from the herbarium of the UPRM (MAPR), Río Piedras Botanical Garden (UPR), University of Puerto Rico at Río Piedras (UPRRP), Puerto Rico Department of Natural and Environmental Resources (PRDNER), New York Botanical Garden (NY), U.S. National Herbarium (U.S.), and University of Illinois (ILL), and prepared a report.

A Service biologist completed this 5-year review using the information provided by UPRM and that gathered by the Service since *M. paganii* was listed on September 29, 1997, including the original listing rule and the recovery plan for the species. A compendium on the rare plants of the northern karst of Puerto Rico was also used as reference for this review (Trejo-Torres et al. 2011). We did not seek additional peer review on this 5 year review since Drs. Kolterman and Chinea, and Service biologist Omar Monsegur are leading experts on *M. paganii*. This review includes the best available information on the species.

B. Reviewers

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

Lead Field Office: José A. Cruz-Burgos, Caribbean Ecological Services Field Office, Boquerón, Puerto Rico. (787) 851-7297, extension 218.

C. Background

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

2. Species Status: We consider the status of *M. paganii* as uncertain because no monitoring has been recently conducted to determine the status of its natural populations.

3. Recovery Achieved 1 (1 = 0-25 % of species' recovery objectives achieved).

4. Listing History

Original Listing
FR notice: 59 FR 8138
Date listed: February 18, 1994
Entity listed: Species
Classification: Endangered

5. Associated rulemakings: Not Applicable.

6. Review History:

The February 18, 1994, Final Rule (59 FR 8138), and the *Myrcia paganii* and *Auerodendron pauciflorum* Recovery Plan, approved and signed on September 29, 1997 (USFWS 1997), are the most comprehensive analyses of the status of *M. paganii*, and were used as the referenced point documents for this 5-year review.

Each year the Service reviews and updates listed species information to benefit the required Recovery Report to Congress. Through 2013, we did a recovery data call that included showing status recommendations like "Uncertain" for this plant. We continue to show that species status recommendation in 5-year reviews. The most recent evaluation for *M. paganii* was completed in 2015.

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

8. Recovery Plan:
Name of plan: *Myrcia paganii* and *Auerodendron pauciflorum* Recovery Plan.
Date issued: September 29, 1997.

II. REVIEW ANALYSIS

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

The Act defines species to include any distinct population segment of any species of vertebrate wildlife. This definition limits listings as distinct population segments (DPS) only to vertebrate species of fish and wildlife. Because the DPS policy is not applicable to plants, 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?

Yes. The species has an approved recovery plan (USFWS 1997), which establishes delisting as the recovery objective for *M. paganii*. However, the plan does not contain measurable recovery criteria for delisting. The plan neither defines the number of individuals needed for a self-perpetuating population.

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. A few new populations have been documented since the plan was written.

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

Yes.

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

The recovery plan specifies that *M. paganii* could be considered for delisting when:

1. Populations on privately owned land area placed under protective status.

2. New populations (the number of which should be determined following the appropriate studies) of the species, capable of self-perpetuation, have been established within protected areas such as the Guajataca Commonwealth Forest, the Cambalache Commonwealth Forest, or the Río Abajo Commonwealth Forest.

Criterion 1 has been partially met. Some of the new records of *M. paganii* are on private properties managed for conservation (i.e., El Tallonal and Mata de Plátano in the municipality of Arecibo). However, we do not know how many individuals are elsewhere in unprotected land.

Criterion 2 has not been initiated. The species has not been observed in reproductive status; hence, fruits have not been described. However, Trejo-Torres et al. (2011) reported seedlings in the Guajataca Commonwealth Forest, although the number was not specified. Propagation techniques for the species have not been developed.

These are minimum requirements and could be expanded upon if the regenerative or propagative potential of natural and ex situ populations proves to be insufficient when developed. Alternatively, if new populations of the species are discovered, it may be preferable to place greater emphasis on protection, rather than on propagation, in order to achieve the minimum number of plants necessary for recovery.

C. Updated Information and Current Species Status

1. Biology and Habitat

Myrcia paganii is a rare evergreen tree of the Myrtaceae family, endemic to Puerto Rico, which grows up to 20 m (65.6 ft) in height (Little et al. 1974, Liogier 1994). It is currently known only from few locations within the limestone hill region of northwestern Puerto Rico, where it grows at elevations of 150 to 250 m (492-820 ft) on steep hills and top of hills (USFWS 1997, Axelrod 2011, Trejo-Torres et al. 2011).

a. Species' abundance, population trends (e.g. increasing, decreasing, stable), demographic features, or demographic trends

Myrcia paganii was originally described from a sterile specimen collected by Sintenis in the 1880s (Little et al. 1974), and appears to occur primarily on limestone substrates. By the time the species was listed, only eight individuals in three locations were known: six individuals in a population south of the municipality of Arecibo, and two isolated individuals in the municipality of Quebradillas (USFWS 1997). In 2003, J.C. Trejo-Torres (Centro de Investigación Científica de Yucatán, México) searched for the individuals to the south of Arecibo, but did not find any (Trejo-Torres et al. 2011).

Based on the BRAHMS database (Kolterman and Chinea 2013) and herbarium collections deposited at UPR herbarium in Río Piedras, *M. paganii* has been recorded in the municipalities of Isabela, Quebradillas, Camuy, Utuado, and Arecibo. According to Trejo-Torres et al. (2011), in 2001 Pedro Acevedo (U.S. National Herbarium, Smithsonian National Museum of Natural History) and Danilo Chinea (UPRM) found a population of 10 individuals in the Biáfara sector in Arecibo. In 2005, during a flora and fauna study for the Senderos de Miraflores project in the Biáfara sector, Ruiz-Lebrón and Puente-Rolón also reported two populations of *M. paganii* comprised of 12-20 individuals (Departamento de la Vivienda de Puerto Rico 2009).

In work conducted during 2002-2006, Trejo-Torres et al. (2011) found a total of 103 individuals of *M. paganii*. Ninety four of these individuals were found in four different areas within the northern karst region of Puerto Rico: Guajataca Commonwealth Forest (50 individuals, some were seedlings, number not specified), the private natural reserves of Mata de Plátano and El Tallonal (22 individuals), Biáfara sector, Arecibo (18 individuals; same population found by Acevedo and Chinea in 2001), and Piedra Gorda Ward, Plazuela sector in Camuy (4 individuals) (Figure 1). Nine other individuals were found in 2006 by M. Caraballo (UPRRP) in the Toro Negro Commonwealth Forest (Trejo-Torres et al. 2011; Figure 1).

In addition, J. Sustache (PRDNER, pers comm. 2015) provided information to the Service regarding the location of *M. paganii* in Quebradillas (1 sterile individual found at one of the proposed routes for highway PR-22), and El Tallonal (19 individuals, including adults and juveniles). According to J. Sustache, he does not have the specific location of the individuals at El Tallonal, thus we are not certain these are the same individuals reported by Trejo-Torres et al. (2011). Despite the observation of Trejo-Torres et al. (2011) of the occurrence of some recruitment, the limited information about the status of these populations is not enough to determine population trends or demographic features. In fact, Trejo-Torres et al. (2011) described the species as extremely rare.

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

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

c. Taxonomic classification or changes in nomenclature.

No recent taxonomic or nomenclatural changes are known for the species. *Myrcia paganii* is the accepted name in the recent checklists for Puerto Rico (Axelrod 2011) and the West Indies (Acevedo-Rodríguez and Strong 2012). However, Trejo-Torres et al. (2011) stated that the inclusion of *M. paganii* within the *Myrcia* genus is not certain. They suggested that *M. paganii* might belong to the genus *Psidium* as suggested by the only flower of this species that has been found. Trejo-Torres et al. (2011) did not provide further supporting evidence on this regard. We do not believe that current existing information supports a change in taxonomy at this time. Nonetheless, we are aware of the information and will work with experts on this plant to get a better understanding and reach a consensus regarding its taxonomic classification.

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

Myrcia paganii was known to be endemic to the northwestern Karst region (subtropical moist forest; Ewel and Whitmore 1973) of Puerto Rico. Further populations of *M. paganii* have been recently documented within the private natural reserves of El Tallonal and Mata de Plátano in the municipality of Arecibo (Trejo-Torres et al. 2011). The core known population within the northern karst region of Puerto Rico highlights the importance of the karst habitat for the species. However, it is noteworthy the recent record of the species within the Toro Negro Commonwealth Forest (subtropical wet forest; Ewel and Whitmore 1973). This represents the first record of the species occurring on volcanic derived soils.

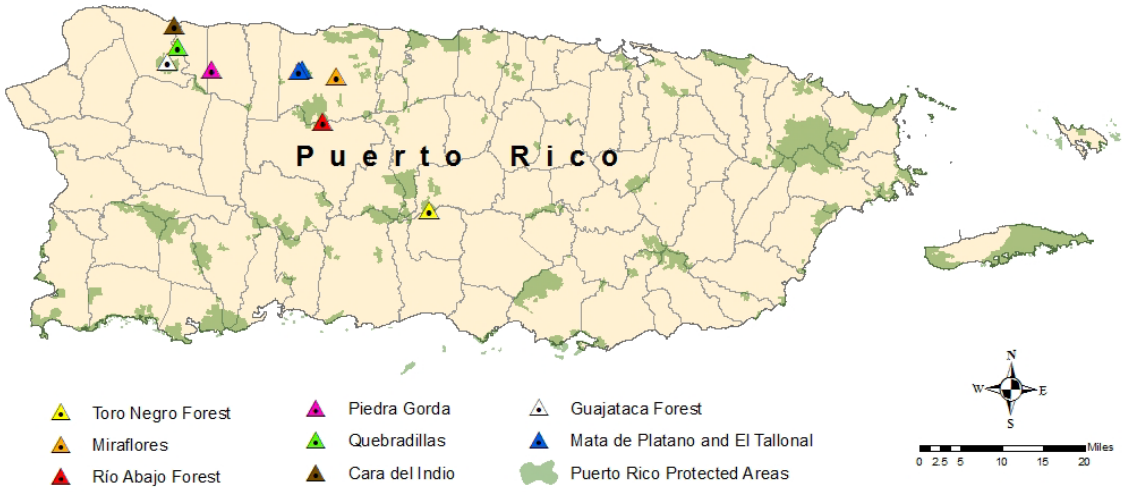

Figure 1. Reported populations of *Myrcia paganii* in Puerto Rico.

e. New information addressing habitat or ecosystem condition

Most forested areas within the subtropical moist forest life zone, where *M. paganii* primarily occurs, were extensively deforested for agriculture and charcoal production during the 19th and early 20th Centuries. The northwestern karst region of Puerto Rico appears to be the most important area for the species as it harbors several protected areas (i.e., Río Abajo, Guajataca, and Cambalache Commonwealth Forests) containing mature secondary forest and remnants of native forest that may provide suitable habitat and probably undetected populations of *M. paganii*. Similarly, areas in which agricultural practices have been abandoned and forest regeneration has occurred may provide habitat for the establishment of new populations of *M. paganii*.

However, new information indicates that the range of the species now extends to the subtropical wet forest in volcanic derived soils of the central mountain range of Puerto Rico (i.e., Toro Negro Commonwealth Forest; Trejo-Torres et al. 2011). This evidence suggests that undisturbed forest remnants within the central mountain region of Puerto Rico may also harbor undetected populations of *M. paganii*.

f. Other relevant information.

Liogier (1994) described the flowers and fruits of *M. paganii* as unknown. Trejo-Torres et al. (2011) indicated that the only reproductive structure of this species that has been found is a flower that was missing its petals and stambres. So far little is known about the reproductive biology of the species and there is no information related to attempts of propagation or studies related to the species phenology. Moreover, all the examined herbarium specimens and images were sterile material.

2. Five Factor Analysis

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

In the final rule, the Service identified habitat destruction and modification as a factor affecting *M. paganii*. Certainly, those individuals occurring in protected areas are not expected to be affected by habitat destruction or modification. However, individuals on privately-owned lands are a concern to the Service as modification of habitat can occur at any given time. During the last decade, the Service has reviewed various projects in the northern karst region of Puerto Rico, where *M. paganii* is known to occur.

At present, the Service is working with the Puerto Rico Highway and Transportation Authority (PRHTA) on a consultation under section 7 of the Endangered Species Act (ESA) for highway PR-22 in northern Puerto Rico. This highway will run through the municipalities of Isabela and Quebradillas, and one of the proposed alignments could affect *M. paganii* populations and habitat at *La Cara del Indio* area in Isabela. This project represents the main current threat to the species. Therefore, the Service, PRHTA, and the Puerto Rico Department of Natural and Environmental Resources (PRDNER) are working together to develop alternatives and conservation measures to avoid possible adverse effects from this project on *M. paganii*.

Senderos de Miraflores is another project proposed in an area near the historical *M. paganii* populations in the Biáfara sector in Arecibo. The Environmental Impacts Statement for this project highlights the presence of *M. paganii* within the boundaries of the property. Between 2006 and 2009 the Service provided comments and recommendations to avoid impacting the species. However, as of today this project has not been constructed.

Based on the above information, we believe that the present or threatened destruction, modification, or curtailment of the species' habitat or range is a low and non-imminent threat to *M. paganii*.

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

Many Myrtaceae are attractive small trees, thus *M. paganii* might have some cultivation potential. However, based on the available information, we have no evidence that this species is used for such purposes. Furthermore, there is no evidence that it has been affected by overutilization for scientific or educational purposes. Therefore, we do not consider this factor as a threat to the species.

(c) Disease or predation:

Disease or predation was not identified as threat to *M. paganii* at the time of listing. Based on the best available information, we do not consider this factor to be a current threat to the species.

(d) Inadequacy of existing regulatory mechanisms:

Following listing, *M. paganii* acquired protection under the Endangered Species Act of 1973, as amended. In 1999 the Commonwealth of Puerto Rico approved Law No. 241-1999, also 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 Puerto Rico Department of Natural and Environmental Resources (PRDNER) approved the Reglamento 6766 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). *Myrcia paganii* was included in the list of protected species of this regulation and designated as endangered. Article 2.06 of Regulation 6766 prohibits collecting, cutting, removing, among other activities, listed plant individuals within the jurisdiction of Puerto Rico.

Nonetheless, suitable habitat for *M. paganii* extends to private properties. The enforcement of laws and regulations on 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 to *M. paganii* on private properties. Therefore, based on the presence of Commonwealth and Federal laws and regulations protecting this species, we do not consider the inadequacy of existing regulatory mechanisms as a threat to *M. paganii*.

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

Hurricanes. As a species endemic to the Greater Antilles, *M. paganii* should be adapted to tropical storms disturbance. However, the low number of populations and individuals pose a threat to the species by making it susceptible to stochastic events such as hurricanes.

Climate Change. Vulnerability to climate change impacts is a function of sensitivity and exposure to those changes, and the adaptive capacity of the species (Glick et al. 2011). Under this scenario, the populations of *M. paganii* may be displaced or outcompeted by native or exotic species with wider environmental plasticity. Climate change may also compromise natural recruitment by affecting seed germination and/or the survival of seedlings. Nonetheless, at present there is no information regarding the competitive abilities of *M. paganii* nor its seed germination capability and survival.

Despite the low number of populations and individuals of *M. paganii*, at this time the Service considers hurricanes and climate change as a moderate and non-imminent threats

to the species. Climate change is occurring gradually and the frequency of severe hurricanes in Puerto Rico is low.

Genetic Variation. Given the very small numbers of individuals reported in wild populations of *M. paganii*, it is highly likely that its genetic variability is very low. This would result in a loss of alleles by random genetic drift (Honnay and Jacquemyn 2007), which would limit the species' ability to respond to a changing environment (Booy et al. 2000). Also, there may be genetic differences among populations. Until studies of the species' genetic variation are conducted, efforts should focus on preservation and/or propagation of multiple individuals from all wild populations. Based on the above, we consider the lack of genetic variation as a likely threat to the species.

Phenology and Breeding system. The reproductive biology of *M. paganii* is unknown, and we believe that the small and isolated populations may be affected by lack of natural recruitment. Many Myrtaceae flower sporadically and for very short periods of time. If the species is self-incompatible (not able to self-pollinate), its sexual reproduction would be severely limited. Thus, we consider the reproductive biology of the species and the small size of populations as threats to the species.

Overall, hurricanes, climate change, genetic variation, phenology, and breeding system are threats to *M. paganii*. Due to the small number and size of populations, the Service considers the cumulative effects of these threats as high in magnitude and imminent.

3. Synthesis

Myrcia paganii was listed as endangered on February 1994. The species was known to occur only in the northern karst of region of Puerto Rico, where eight individuals in three locations had been detected at the time it was listed: six individuals in a population south of the municipality of Arecibo, and two isolated individuals in the municipality of Quebradillas. The BRAHMS database from the University of Puerto Rico, Mayagüez Campus, includes a total of eight specimens collected in the municipalities of Isabela, Quebradillas, and Arecibo. The species has been also detected in the municipalities of Camuy and Utuado. More recent specific locations includes the private natural reserves of El Tallonal and Mata de Plátano in Arecibo, Biáfara sector, also in Arecibo, and Piedra Gorda Ward, Plazuela sector in Camuy. Also, *M. paganii* was documented in the Toro Negro Commonwealth Forest. This finding represents an expansion of the know range of the species to the subtropical wet forest in volcanic derived soils. Despite more individuals have been located since the species was listed, no monitoring has been conducted. Hence, population and demographic trends and features, and phenology are unknown for the species.

Threats to *M. paganii* include habitat modification, particularly in private lands due to urban development, and road constructions. However this threat is considered low and non-imminent. Natural factors such as hurricanes, climate change, genetic variation, phenology, and breeding system are also considered threats to *M. paganii*. Despite additional populations of *M. paganii* have been reported, these threats are exacerbated by

the low number of known individuals and the limited distribution of the species. Therefore, we believe that *M. paganii* remains in danger of extinction and should continue to be protected as an endangered species.

IV. RECOMMENDATIONS FOR FUTURE ACTION

1. The recovery of *M. paganii* should focus on the protection of known populations and their habitat.

2. Conduct studies to determine the current status of wild populations. Additional visits should be made after hurricanes or other major disturbances.

3. Conduct studies on the species' phenology and reproductive biology, including its breeding system.

4. Conduct studies to determine the genetic variation in order to develop a plan to preserve the species' germplasm.

5. Currently known populations should be enhanced using seeds if available or vegetative propagation (e.g., air layering, tissue culture, etc.) if necessary. Ideally, the species' patterns of genetic variation should be known first.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Myrcia paganii*

Current Classification: Endangered

Recommendation resulting from the 5-Year Review

____ **Downlist to Threatened**
____ **Uplist to Endangered**
____ **Delist**
_X_ **No change is needed**

Review Conducted By: José A. Cruz-Burgos, Caribbean Ecological Services Field Office, Boquerón, Puerto Rico

FIELD OFFICE APPROVAL:

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

Approve Edwin Muñiz Date 9/16/2015

REGIONAL OFFICE APPROVAL:

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

Approve Lis Ellis Date 6/16/16