U.S. FISH AND WILDLIFE SERVICE SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

Scientific Name:

Solanum conocarpum

Common Name:

Marron bacora

Lead region:

Region 4 (Southeast Region)

Information current as of:

05/12/2016

Status/Action

___ Funding provided for a proposed rule. Assessment not updated.

___ Species Assessment - determined species did not meet the definition of the endangered or threatened under the Act and, therefore, was not elevated to the Candidate status.

___ New Candidate

_X_ Continuing Candidate

___ Candidate Removal

- ___ Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status
- ___ Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species
- ___ Range is no longer a U.S. territory
- ___ Taxon mistakenly included in past notice of review

___ Taxon does not meet the definition of "species"

___ Taxon believed to be extinct

___ Conservation efforts have removed or reduced threats

___ More abundant than believed, diminished threats, or threats eliminated.

___ Insufficient information exists on taxonomy, or biological vulnerability and threats, to support listing

Petition Information

___ Non-Petitioned

_X_ Petitioned - Date petition received:

90-Day Positive:10/16/1998

12 Month Positive:02/22/2011

Did the Petition request a reclassification? **No**

For Petitioned Candidate species:

Is the listing warranted(if yes, see summary threats below) **Yes**

To Date, has publication of the proposal to list been precluded by other higher priority listing? **Yes**

Explanation of why precluded:

We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions (including candidate species with lower LPNs). During the past 12 months, the majority our entire national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements; meeting statutory deadlines for petition findings or listing determinations; emergency listing evaluations and determinations; and essential litigation-related administrative and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of Progress on Revising the Lists, in the current CNOR which can be viewed on our Internet website (http://endangered.fws.gov/).

Historical States/Territories/Countries of Occurrence:

- **States/US Territories**: Virgin Islands
- **US Counties**:County information not available
- **Countries**:Country information not available

Current States/Counties/Territories/Countries of Occurrence:

- **States/US Territories**: Virgin Islands
- **US Counties**: St. John, VI
- **Countries**:Country information not available

Land Ownership:

Solanum conocarpum is known from eight localities in St. John Island, USVI. Six of these populations are found within the U.S. National Park Service (NPS) boundaries, and two in private lands (Friis Bay and Sabbat Point).

Lead Region Contact:

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Biological Information

Species Description:

Solanum conocarpum is a dry-forest shrub of the Solanaceae or tomato family, which may attain 3 m (9.8 ft) height. Its leaves are oblong-elliptic or oblanceolate (broader at the distal third than the middle), ranging from 3.5-7 cm (0.62-1.5 in) wide. The leaves are coriaceous (leathery texture) and glabrous (no hairs), and have a conspicuous yellowish mid-vein. The flowers are usually paired in nearly sessile (not stalked) lateral or terminal cymes (flat-topped flower cluster). The corolla consists of five separate petals that are light violet, greenish at the base, and about 2 cm (0.78 in) wide. The fruit, a berry, is ovoid-conical (teardrop shaped), 2-3 cm (0.78-1.2 in) long, and turns from green with white striations to golden yellow when ripe (Acevedo-Rodríguez 1996).

Taxonomy:

Solanum conocarpum belongs to the Solanaceae family. The genus Solanum includes about 1,200 species mostly of herbs and shrubs with a worldwide distribution (Liogier and Martorell 1995).

Liogier and Martorell (1982) recognized about 24 species of Solanum from the Puerto Rican platform, and 10 species occurring within the island of St. John (Acevedo-Rodríguez 1996).

Habitat/Life History:

Acevedo-Rodríguez (1996) described the habitat of *S. conocarpum* as a dry, deciduous forest. The species also has been reported to occur on dry, poor soils (Ray and Stanford 2005). It can be locally abundant in exposed topography on sites disturbed by erosion (depositional zones at the toe of the slopes), areas that have received moderate grazing, and around ridgelines as an understory component in diverse woodland communities (Carper and Ray 2008). A habitat suitability model suggests that the vast majority of *S. conocarpum* habitat is found in the lower elevation coastal scrub forest (Vilella and Palumbo 2010).

Little is known about the natural history, reproductive biology, and effects of herbivory on *S. conocarpum* (Ray and Stanford 2003). It has been suggested that this species might be functionally dioecious (requiring male and female flowers from different plants to outcross). However, P. Acevedo-Rodríguez (pers comm., 2002) documented flowers and fruits in a solitary wild plant he discovered in the White Cliff area (Reef Bay general area). He further suggested that *S. conocarpum* may have less reproductive fitness due to selfing (self-pollination). Later, Ray and Stanford (2005) conducted some pollination studies in a controlled environment, which indicate that the species might be an obligate outcrosser with complete self-incompatibility (plant has both male and female parts, but it needs to outcross with other individuals to produce fruits due to self-incompatibility). These studies were conducted because prior to 2003 a lack of natural recruitment was observed in the wild (Ray and Stanford 2003, J. Saliva, USFWS, pers obs., 2004, O. Monsegur, USFWS, pers obs., 2010, Vilella and Palumbo 2010). Anderson et al. (2015) confirmed the hermaphroditic and dioecious biology of *S. conocarpum*. They found that crossing of pollen to the stigma of other male flowers or transferred to the stigma of the same flower produced negative results, and thus, confirmed the auto self-incompatibility of the species. Another evidence of the self-incompatibility of the species is the absence of fruits on wild and greenhouse plants bearing male flowers (Anderson et al., 2015). An outstanding finding from this research is the 1:1 sex ratio of the species and the longer time required to reach reproductive maturity on female plants. The latest highlights the rarity of the species as only half (based on the 1:1 ratio) of the wild individuals are able to produce fruits and viable seeds, and shows the importance of introducing an adequate number of plants into the wild.

DNA sampling of the majority of *S. conocarpum* populations suggests that most populations have been long isolated (Ray and Stanford 2005). Additionally, genetic work performed by Dr. A. Stanford at the University of the Virgin Islands has shown low heterozygosity (a measure of the allele frequency or genetic diversity) (G. Ray, pers comm., 2010). Further, when compared with its close relative *S. polyganum*, it appears to show a significant reduction in genetic diversity (G. Ray, pers comm., 2010).

Historical Range/Distribution:

Solanum conocarpum was originally known from a type specimen collected by L.C. Richard at Coral Bay, St. John, USVI, in 1787 (Acevedo-Rodríguez 1996). No population estimates are available from Richard's discovery, nor are there any known population estimates prior to 1992. However, the species was presumed to be near extinction, as two mature plants were believed to be the only specimens left in the wild, one in NPS land, and the other in private land (B. Kojis and R. Boulon, pers comm., 1996, Vilella and Palumbo 2010). The species was rediscovered in 1992 by P. Acevedo-Rodríguez on the island of St. John (Ray and Stanford 2003).

After 1992, six additional populations of Solanum conocarpum were identified and reported to occur on dry, poor soils (Ray and Stanford 2005). Acevedo-Rodríguez (1996) referenced the possibility of the species being present on St. Thomas, and mentioned a collection of a sterile specimen from Virgin Gorda (British Virgin Islands; BVI). Pedro Acevedo-Rodríguez (pers comm., 2002) believes that the specimen from Virgin Gorda belongs to a different species, Cestrum laurifolium. Omar Monsegur, USFWS, conducted a site visit to the John Folly population in 2010 and identified several C. laurifolium adjacent to individuals of S. conocarpum. Both plants (C. laurifolium and S. conocarpum) look very similar and may be easily confused to one another (O. Monsegur, pers comm., 2010).

Current Range Distribution:

Solanum conocarpum is currently known from eight localities in the island of St. John, USVI. Two locations are found in the north side of the Island (Base Hill and Brown Bay Trail), and six towards the southeast side (Nanny Point, Friis Bay, Reef Bay, John Folly, Sabbat Point, and Europa Ridge). All of the eight known localities of S. conocarpum are wild populations each ranging from 1 to 144 individuals. The majority of individuals are found within the NPS boundaries, leaving only two populations on private lands (Friis Bay and Sabbat Point).

The largest population of S. conocarpum is located at Nanny Point. Due to potential urban and tourism development at Nanny Point, most of the natural population has been transferred to NPS lands. The owners of the private properties that harbor the Nanny Point natural population agreed to protect an additional area corresponding to Parcel 30-3 by donating it to the NPS (Carper and Selengut 2003, Ray and Carper 2009). Thus, the entire Nanny Point population now lies within a protected area. Populations located on Base Hill, Brown Bay Trail, Europa Ridge, and Reef Bay, lie within NPS lands.

Population Estimates/Status:

No population estimates of S. conocarpum are available prior to 1992. The species was presumed to be near extinction, as two mature plants were believed to be the only specimens left in the wild (B. Kojis and R. Boulon, pers comm., 1996, Vilella and Palumbo 2010). The known wild populations

of currently occur in eight localities in the island of St. John, and range from 1 to 144 individuals.

The original natural population of S. conocarpum located at Nanny Point consisted of 184 individuals. About 40 of these plants were located within a 30-ft access corridor to a private property and were transplanted to an adjacent location within the same population in the national park (property donated by Mike Carper to the NPS) to avoid potential impacts from development (M. Carper, pers comm., 2010). During a site visit to Nanny Point in May 2010 it was observed that approximately 90 percent of the transplanted material was dead or stressed due to lack of water (O. Monsegur, USFWS, unpubl. data, 2010). Death was also observed in the non- transplanted individuals (144), apparently resulting from competition with edge vegetation (vines and exotic grasses). Thus, the current number of natural individuals at Nanny Point is estimated at 144 individuals. Combined deaths (transplanted and competition) of plants has resulted in an overall population decline of about 25 percent.

A Nanny Point landowner has promoted and implemented an active propagation program of S. conocarpum through germination and cloning of adult individuals to enhance the Nanny Point and other natural populations (i.e., Brown Bay Trail and John Folly; Ray and Carper 2009). The aim of this program is to safeguard the genetic diversity of the species and to enhance the existing populations (Ray and Carper 2009, M. Carper, pers comm., 2010). Transplanting efforts of seedlings and cuttings (clones) seem to be successful (O. Monsegur, USFWS, unpubl. data, 2010). Ray and Stanford (2005) reported a 95 percent seedling survival rate after a reintroduction at Reef Bay. Further planting efforts conducted at Brown Bay Trail, John Folly, and Nanny Point showed a 97 percent survival rate after 2 months (Ray and Carper 2009).

The second largest natural population of S. conocarpum is located at Friis Bay and consists of 33 individuals (Ray and Stanford 2005). The natural populations found in Base Hill, Brown Bay Trail, Europa Ridge, and Sabbat Point consist of one individual each, whereas that in Reef Bay consists of six individuals. Though more recently, the population at Reef bay has been reported as extirpated (G. Ray, pers comm., 2010), but no official confirmation of the extirpation has been made. The current status of introduced seedlings at Reef Bay, which initially experienced high rates of survival, is also unknown. The individual in Brown Bay is located on the edge of the Brown Bay Trail, and shows evidence of damage due to trail maintenance. A new population was recently recorded in John Folly Bay adjacent to Road 107, just along the boundaries of the NPS (M. Carper, pers comm., 2010). This population is comprised by approximately 11 adult individuals and shows signs of human disturbance (O. Monsegur, USFWS, unpubl. data, 2010).

Ray and Stanford (2003) developed an implementation plan to conduct shade-house propagation of S. conocarpum, using both seedlings and cuttings for reintroduction within the NPS land in St. John. Plants responded well in shade-house conditions, where seed germination and survivorship have been very successful, almost 100 percent and 95 percent, respectively. On the other hand,

the survival rate for the cutting technique (cutting a piece of a plant and inducing root growth) is less than 10 percent under nursery conditions (Ray and Carper 2009). However, as observed during a site visit, the transplanting of seedlings and cuttings to the wild seems to be successful (O. Monsegur, USFWS, unpubl. data, 2010). Approximately 240 seedlings and propagules have been planted around several wild individuals to enhance and augment natural populations of S. conocarpum, providing new genetic inflow to several wild populations, especially those consisting of one individual.

Several efforts have been conducted to propagate S. conocarpum in the last decade. B. Kojis and R. Boulon (pers comm. 1996) reported that a local horticulturist, E. Gibney, was able to propagate the species by cuttings and reproduced it sexually by dusting the flowers. Later on, Ray and Stanford (2005) reported that E. Gibney successfully reproduced S. conocarpum and distributed specimens to various places in the Virgin Islands. Pedro Acevedo-Rodríguez (pers comm. 2002) reported planted individuals (cultivars) on the Campus of the University of Virgin Islands in St. Thomas that are sexually reproducing. He also reported a few individuals in the St. George Botanical Garden in St. Croix, in the island of Tortola, at Cannel Bay Hotel in St. John, and in the Botanical Gardens of New York, Dominican Republic, and Puerto Rico.

Distinct Population Segment(DPS):

N/A

Threats

A. The present or threatened destruction, modification, or curtailment of its habitat or range:

Only two of the currently known S. conocarpum populations remain on private lands (Friis Bay and Sabbat Point). However, suitable habitat for the species still exists in private lands that have not been surveyed. All other known populations are located within the NPS lands. The populations that occur in private lands as well as the ones bordering the NPS are subject to intense pressure from urban development (Vilella and Palumbo 2010). The upper slopes and drainage areas that surround the largest population of S. conocarpum (Nanny Point) are privately-owned. These private lands are planned for housing development and have been divided for smaller housing lots that are currently advertised for sale (Carper and Selengut 2003, Ray and Carper 2009). The same situation is observed at the Johns Folly drainage (O. Monsegur, USFWS, pers obs., 2010), where small housing developments may threaten undetected populations. In addition, habitat suitability models conducted by Vilella and Palumbo (2010) indicate that a good portion of the high-quality (39 percent) and moderate quality (38 percent) habitat for S. conocarpum is located within private lands subject to urban development. The relative abundance of the species at some sites (i.e., Nanny Point and Friis Bay) suggests that the species was more common, and that it was an important component of the vegetation of the dry forest of St. John. Even though the majority of known

populations lie within federally protected areas, the likely destruction or modification of the high-quality habitat within St. John may result in the extirpation of undetected populations and the irreversible damage to areas with suitable habitat for the reintroduction of the species.

Based on the above information, we consider the present or threatened destruction, modification, or curtailment of the species' habitat or range as low-to-moderate, there are no imminent threats to populations of S. conocarpum. However, a large part of the suitable habitat for the species in private lands is under pressure from development, which could result in the extirpation of unknown populations and we consider that as a potential threat.

B. Overutilization for commercial, recreational, scientific, or educational purposes:

The current available information on the species does not suggest that over-utilization for commercial, recreational, scientific, or educational purposes have contributed to a decline of S. conocarpum. In recent years this species has been propagated from seeds and cuttings obtained from wild populations. However, collection for these purposes is not considered to affect survival of individuals or negatively affect the status of the species. In fact, this practice has significantly enhanced the existing populations, and continues to safeguard the genetic diversity of the species (Ray and Stanford 2005, Ray and Carper 2009). This is the only known use of the species, and it is strictly for scientific purposes. Therefore, we do not have any evidence that suggests overutilization as a threat to S. conocarpum.

C. Disease or predation:

It has been hypothesized that hermit crabs act as predators of the fruits and seeds of S. conocarpum (Ray 2005). These crabs have been observed feeding on the fruit where shrub densities are high (Carper and Ray 2008, Ray 2005). Fruit and seed production in the Nanny Point and Johns Folly populations has been reported as ample and copious (Ray 2005; M. Carper, pers comm., 2010). While hermit crabs may consume fallen fruit in large quantities (Ray 2005), it is not known at this time if fruit consumption prevents seed germination (e.g., potentially crushing seed embryos as the crabs feed), or if this consumption is in any way responsible for the lack of seedling recruitment in the wild. Another observation of S. conocarpum predation was reported by Vilella and Palumbo (2010), and was presumed to be by insects feeding on the leaves of the species. This observation concurs with the reports by Ray and Stanford (2005) indicating bite marks of an herbivore insect on S. conocarpum leaves. Nevertheless, there is no clear evidence indicating that seed or plant predation is adversely affecting the status of the species. Based on the above, we do not consider disease or predation as a current threat to the species.

D. The inadequacy of existing regulatory mechanisms:

The Territory of the USVI currently considers S. conocarpum to be endangered under the Virgin Islands Indigenous and Endangered Species Act (V.I. Code, Title 12, Chapter 2), and has amended an existing regulation (Bill No. 18-0403) to provide for protection of endangered and

threatened wildlife and plants by prohibiting the take, injury, or possession of indigenous plants. However, Rothenberger et al. (2008) mentioned that the lack of management and enforcement capacity continues to be a significant challenge for the USVI, since enforcement agencies are chronically understaffed and territorial resource management offices experience significant staff turnover. Nonetheless, we do not consider the inadequacy of Territorial regulatory mechanisms to be a threat, because at this time we have not identified any adverse effect to the populations or the species related to collection or take.

The National Park Service, under its Organic Act, is responsible for managing the national parks to conserve the scenery and the natural and historic objects and the wildlife (16 U.S.C. § 1). The National Parks Omnibus Management Act of 1998 requires the NPS to inventory and monitor its natural resources (16 U.S.C. § 5934). The NPS has implemented its resource management responsibilities through its Management Policies, Section 4.4, which states that “it will maintain as parts of the natural ecosystems of parks all plants and animals native to park ecosystems.” Pursuant to these authorities, NPS in USVI does not allow cutting of vegetation and all natural resource activities must be permitted by the park (Boulon, pers comm., 2010). Section 207 of the Omnibus Management Act of 1998 allows NPS to withhold the nature and specific location information for endangered, threatened, or rare species from the public unless disclosure would not create an unreasonable risk of harm to the species (16 U.S.C. § 5937).

These regulatory mechanisms allow NPS to prevent collection or take of this species on its property. Furthermore, as *S. conocarpum* is protected within NPS lands, we do not consider development outside NPS boundaries to be a threat to populations inside the NPS land.

E. Other natural or manmade factors affecting its continued existence:

Human-induced fires:

Native plant species may be vulnerable to human-induced fires. Fire is not a natural component of subtropical dry forest in Puerto Rico and the Virgin Islands; thus, most species found in this type of forest are not fire adapted (Monsegur 2009). Solanum conocarpum is associated with lower elevation dry forests. This habitat may be susceptible to forest fires, particularly on private lands, where fire could be accidentally ignited. Furthermore, regenerating forests, such as the ones prevalent in St. John, are prone to wildfires that promote a decrease in the stature of the vegetation and allow for the development of persistent shrubland dominated by introduced tree species and grasses (Wiley and Vilella 1998). Studies conducted within the Guánica Commonwealth Forest in southern Puerto Rico, indicate that some exotic tree species can remain as a dominant canopy species for at least 80 years (Wolfe 2009). Given the growth habit of S. conocarpum, it is unlikely that mature individuals would survive a fire even of moderate intensity (Vilella and Palumbo 2010), and therefore, the species might be outcompeted by exotics. However, during a site visit to St. John to evaluate the threats to the species, no substantial evidence that fires posed an imminent threat was found (O. Monsegur, USFWS, pers obs., 2010). The only site that is vulnerable to fires is the John Folly site due to its proximity to a road and the accumulation of trash left by people that live in the area (O. Monsegur, USFWS, pers obs., 2010). In addition, the NPS has a fire prevention

plan that includes the protection of native species, including S. conocarpum. Therefore, we conclude that this species is not currently threatened by human-induced fires.

Hurricanes and Climate Change:

In the Caribbean, native plant species, particularly endemics with limited distribution, may be vulnerable to natural events such as hurricanes. In fact, successional responses to hurricanes can influence the structure and composition of plant communities in the Caribbean islands (Van Bloem et al. 2005). In natural conditions it is likely that S. conocarpum is well-adapted to these atmospheric events. However, the cumulative effects of severe tropical storms and increased sediment runoff may jeopardize the establishment of seedlings along drainage areas usually associated with suitable habitat for S. conocarpum (Ray 2005; O. Monsegur, USFWS, pers obs., 2010). Due to the low number of adult individuals and the problems associated to the natural recruitment of the species, severe tropical storms may have an adverse impact on the species. However, based on the available information, we consider hurricanes as a low and non-imminent threat to the species.

Solanum conocarpum may be further threatened by climate change, which is predicted to increase the frequency and strength of tropical storms and cause severe droughts (Hopkinson et al. 2008). The cumulative effect of coastal erosion due to severe hurricanes, plus the habitat modification for urban and tourist development can further diminish the availability of suitable habitat for S. conocarpum, and therefore, limit population expansion and colonization of new areas. In addition, the possibility of severe droughts may contribute to an increase in the quantity and frequency of fires. These cumulative factors may reduce the number of individuals and further reduce populations. We consider the threat of climate change to be moderate and non-imminent since climate change occurs gradually and the level of the effects of climate change in the future are uncertain. We do not anticipate any changes that would appreciably reduce this threat in the foreseeable future.

Lack of natural recruitment:

Lack of natural recruitment represents one of the major threats to S. conocarpum. An example is the structure of the populations of Nanny Point and John Folly, which are predominantly comprised by old individuals. This is also true for the Brown Bay Trail individual. Seedling and sapling stages are missing in these populations, and old individuals are dying due to competition with other species such as vines. Without natural recruitment or successful augmentation from captive propagated individuals, these populations are likely to become extirpated as older individuals die. Efforts have been conducted to enhance the natural populations by planting seedlings and saplings. However, it is unknown if planted individuals will develop as mature plants capable of reproduction. Flowering or fruit production of individuals planted in the wild has not been reported to date. Additionally, the structure of the existing wild population indicates that they are mostly represented by old individuals (O. Monsegur, USFWS, pers obs., 2010). Hermit crab consumption of fruit is currently the only factor suspected for the lack of natural recruitment. However, as both species co-evolved in the same habitat, this consumption is unlikely to explain the complete lack of

recruitment. Plant sterility is not a viable theory for the lack of recruitment, as germination under greenhouse conditions is highly successful, with almost 100-percent germination (Ray and Stanford 2005). Although the cause for unsuccessful recruitment of S. conocarpum is unknown, it is not the only species within the Solanaceae family facing this threat. Matabuey (Goetzea elegans) is an example of another species endemic to the Caribbean that shows a conspicuous flowering with showy fruits, but faces problems with its dispersal and recruitment. Similar to S. conocarpum, matabuey shows outstanding germination under greenhouse conditions. Based on the above, we consider lack of natural recruitment as a high and imminent threat to the species.

Reproductive biology:

The nature of the relationships between S. conocarpum and different pollinators and seed dispersers that have interacted with the species over its evolutionary history, is an important factor to consider. Controlled pollination studies concluded that this species is an obligate outcrosser (reproduction requires pollen from another plant) with complete self-incompatibility (Anderson et al. 2015; Ray and Stanford 2005). Anderson et al. 2015 reported a 1:1 sex ratio for the species and a longer time to reach reproductive maturity on female plants. Highlighting the rarity of the species as only half (based on the 1:1 ratio) of the wild individuals are able to produce fruits and viable seeds. As plant populations become reduced and spatially segregated, important life-history needs provided by pollinators and seed dispersers may be compromised (Kearns and Inouye 1997). It is possible that natural fruit dispersers of S. conocarpum had targeted other food sources as the populations of this shrub became increasingly patchy, as a result of deforestation and introduction of exotic plant species. The absence of a fruit disperser may also indicate that the disperser of the species is extinct or that the populations are too small to attract the disperser (Roman 2006). The loss of potential breeding partners, reduction or loss of pollinators, and the loss of seed dispersers are examples of negative impacts due to habitat fragmentation (Kearns and Inouye 1997, Murren 2002). As an obligate outcrosser, S. conocarpum encounters another challenge in that isolated and relic individuals may no longer reproduce unless enhancement and artificial propagation projects are conducted. Based on the previous discussion, we consider the absence of natural dispersal to be a high and imminent threat.

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). Habitat fragmentation may also limit the ability of a species to respond to a changing environment (Booy et al. 2000). Research conducted on S. conocarpum shows a reduction in its genetic diversity (Ray and Stanford 2005). The population with the greatest genetic diversity is the one located at Nanny Point, which also has the largest number of individuals. In addition to attempts to safeguard the genetic diversity of the species, the survival of reintroduced individuals needs to be monitored as well as their development into mature individuals capable of contributing to the natural recruitment of the species. Consequently, the protection and monitoring

of known adult individuals should be considered as a high priority for the conservation of the species. Based on the above, we consider the lack of genetic variation as a moderate, but imminent threat to the species.

Nonnative species:

Exotic mammal browsers are found throughout the range of S. conocarpum in St. John Island. These include feral goats (Capra aegagrus hircus), pigs (Sus scrofa), Key deer (Odocoileus virginianus clavium), and donkeys (Equus asinus) (Vilella and Palumbo 2010; O. Monsegur, USFWS, pers obs., 2010). Feral donkeys, pigs, deer, and goats could directly and indirectly affect S. conocarpum populations by uprooting and eating seedlings, destabilizing slopes, and dispersing exotic plant species, thus preventing or reducing the sustainability of its populations. However, the extent of such threats to the species is “speculative” (NPS 2003) and “imprecise” (NPS 2004). There is no available information on the role these exotic species play as a limiting factor to S. conocarpum population dynamics in general, including recruitment (Schemske et al. 1994). Nonetheless, the NPS is implementing plans to control the populations of nonnative feral hogs, goats, and sheep within its territory (NPS 2003, 2004).

Feral hogs populations within NPS land are low, and control efforts have been targeted to problem areas such as Reef Bay Valley (NPS 2008). However, hogs continue to be a problem at the Reef Bay area as they uproot the vegetation searching for food and water (O. Monsegur, USFWS, unpubl. data, 2010). The Service conducted a field assessment that confirmed the presence of exotic mammal species within S. conocarpum habitat, highlighting the abundance of the Key deer and herds of feral goats (O. Monsegur, USFWS, unpubl. data, 2010). Observations by Monsegur (2010) coincide with reports of high abundance of Key deer within the range of S. conocarpum by Ray and Stanford (2005), and with reports from the NPS that describe deer populations as increasing (NPS 2008). Despite the reports of the intrusion of free-roaming ungulates within S. conocarpum natural populations (Ray and Stanford 2005), there is a lack of information regarding the specific adverse effects of these exotic animals on the species. However, it is expected that these exotic mammals are modifying the structure of the vegetation, and therefore, the environmental conditions in these areas. This may imply changes on microhabitat conditions that are necessary for seed germination and seedling recruitment of S. conocarpum. Apparently, the distribution of this species is more correlated with abiotic or environmental factors than with habitat structure and composition, as it shows little fidelity to any particular suite of community associations (Ray and Stanford 2005).

At present, there is no clear evidence that donkeys, deer, pigs, or goats constitute a specific threat to S. conocarpum by feeding on young, adult, wild or reintroduced individuals, and fruits of the species. However, the impacts of introduced herbivores include modifying the structure of the vegetation and the environmental conditions in which S. conocarpum evolved, and that are required for its natural recruitment. Based on the above information, we consider the effects of ungulates as a moderate, but imminent threat to the species.

In summary, we consider that S. conocarpum is threatened by the lack of natural recruitment,

absence of dispersers, fragmented distribution, lack of genetic variation, climate change, and habitat destruction or modification by exotic mammal species. These threats are evidenced by the reduced number of individuals, low number of populations, and lack of connectivity between populations, any or all of which may result in an increased risk of genetic drift. Thus, overall we consider threats under this factor to be high in magnitude and imminent.

Conservation Measures Planned or Implemented :

• E. Gibney, horticulturist, propagated S. conocarpum by cuttings and reproduced them sexually by dusting the flowers (B. Kojis and R. Boulon, pers comm., 1996). He then distributed S. conocarpum specimens to various places in the Virgin Islands (Ray and Stanford 2005).
• A Nanny Point landowner implemented a propagation program of S. conocarpum through germination and cloning of adult individuals to enhance natural populations of the species in Brown Bay Trail and Johns Folly (Ray and Carper 2009).
• Reintroduction of S. conocarpum seedlings has been conducted at Reef Bay with 95 percent survival rate (Stanford 2005).
• Ray and Stanford (2003) developed an implementation plan to conduct shade-house propagation of S. conocarpum using both seedlings and cuttings for reintroduction within the NPS land in St. John.
• Solanum conocarpum individuals located in a private property at Nanny Point were transplanted to a location within the NPS land to avoid impacts from development. In addition, the owners of the private properties that harbor the Nanny Point natural populations of S. conocarpum agreed to protect an additional area by donating the land to the NPS.
• The Territory of the U.S. Virgin Islands currently considers S. conocarpum as endangered under the Virgin Islands Indigenous and Endangered Species Act (V.I. Code, Title 12, Chapter 2), and has amended an existing regulation (Bill No. 18-0403) to provide for protection of endangered and threatened wildlife and plants by prohibiting the take, injury, or possession of indigenous plants.
• As of February 22, 2011, S. conocarpum was warranted to be listed under the Endangered Species Act of 1973, as soon as funds become available we will develop a proposed listing rule.
• There are about 400 plants of S. conocarpum in the Puerto Rico Conservation Trust (PRCT) shade house at Río Piedras Botanical Garden. These plants were propagated from seed material collected by Pedro Acevedo (U.S. National Herbarium, Washington, DC) from individuals planted at the University of the Virgin Islands in St. Thomas.

Summary of Threats :

This candidate assessment identifies threats to S. conocarpum attributable to Factors A and E. Of the currently known eight populations, two are located on private lands, and six are located in the NPS territory. Habitat modification may result in irreversible damage to the species' natural habitat, decreasing the number of individuals of already small populations. In addition, the current sale of private housing lots adjacent to currently known populations suggests future urban developments that could lead to the extirpation of unknown populations (see Factor A).

Solanum conocarpum is also threatened by the lack of natural recruitment, absence of dispersers,

fragmented distribution, lack of genetic variation, drought and habitat destruction or modification by exotic mammal species. These threats are evidenced by the predominance of old individuals in the populations, reduced number of individuals, low number of populations, and lack of connectivity between populations, any or all of which may result in an increased risk of genetic drift. Furthermore, four of the currently known localities consist of a single individual, which may not be sustainable, as the species has been identified as an obligate outcrosser. One natural population has been reported as extirpated, the largest population has suffered a reduction of approximately 25 percent of the natural individuals, and low genetic variability has been reported for the species. In addition, the abundance of feral animals may modify the structure of vegetation and may change the conditions necessary for seed germination or seedling recruitment (see Factor E).

For species that are being removed from candidate status:

_____ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions(PECE)?

Recommended Conservation Measures :

• Surveys should continue to update status and distribution of the species, including in St. Thomas and the British Virgin Islands. Surveys should consider the habitat suitability model prepared by Vilella and Palumbo (2010).
• Threats to S. conocarpum as well as the magnitude or the imminence of such threats should be monitored on an annual basis.
• Attempts to safeguard the genetic diversity of the species, the survival of reintroduced individuals, as well as their development into mature individuals need to continue.
• Due to lack of natural recruitment, protection and monitoring of known adult individuals should be considered a high priority for the conservation of the species.
• Efforts to protect S. conocarpum populations on privately-owned lands should be initiated.
• Public education and outreach programs regarding the status of S. conocarpum should be reinforced.

Priority Table

Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	**2**
		Subspecies/Population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/Population	6
Moderate to Low	Imminent	Monotype genus	7
		Species	8
		Subspecies/Population	9
	Non-Imminent	Monotype genus	10
		Species	11
		Subspecies/Population	12

Rationale for Change in Listing Priority Number:

N/A

Magnitude:

Solanum conocarpum faces low-to-moderate threats from the present or threatened destruction, modification, or curtailment of its habitat or range, lack of genetic variation, hurricanes, and climate change. However, threats from lack of natural recruitment, existing small populations, lack of age structure (most existing individuals are old), apparent absence of dispersers, and fragmented distribution, outweigh the low-to-moderate threats. Therefore, we deem the magnitude of the threats to be high.

Imminence :

Many of the threats to S. conocarpum are imminent. The species is currently facing lack of natural recruitment, apparent absence of dispersers, fragmented distribution, lack of genetic variation, and potential habitat modification by exotic mammal species. Also, existing populations of S. conocarpum are comprised mostly by old individuals. These threats are evidenced by small existing populations, reduced populations, and lack of connectivity among populations, any or all of which may result in an increased risk of genetic drift. Based on the above, we believe the threats to the species are largely imminent.

__Yes__ Have you promptly reviewed all of the information received regarding the species for the purpose of determination whether emergency listing is needed?

Emergency Listing Review

__No__ Is Emergency Listing Warranted?

Description of Monitoring:

Vilella and Palumbo (2010) conducted a survey of S. conocarpum in St. John and developed a habitat suitability model for the species. The Nanny Point population has been monitored for a long time by a local botanist. Nanny Point also is the site of a population enhancement project. On March 2016 Service staff joined the staff from the NPS and the Virgin Islands DPNR to conduct a site visit to the S. conocarpum populations, and discuss about conservation actions.

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:

Virgin Islands

Indicate which State(s) did not provide any information or comment:

none

State Coordination:

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Approval/Concurrence:

Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:  06/07/2016
Date

Concur:  11/14/2016
Date

Did not concur: _____ _____
Date

Director's Remarks: