

TECHNICAL/AGENCY DRAFT RECOVERY PLAN
for
CATESBAEA MELANOCARPA

Prepared by

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EXECUTIVE SUMMARY

Current Status: *Catesbaea melanocarpa* (no common name), an endangered plant species, is a small spiny shrub of the family Rubiaceae. It is extremely rare and is known from Puerto Rico, St. Croix in the U.S. Virgin Islands, Barbuda, Antigua, and Guadeloupe. In the U.S. Caribbean, this species is currently known from only one individual in Cabo Rojo, Puerto Rico and approximately 100 individuals at one location in St. Croix. All known individuals in Puerto Rico and St. Croix occur on privately-owned lands. The species is also found on the islands of Barbuda, Antigua, and Guadeloupe. However, little is known of their status on these islands.

Habitat Requirements and Limiting Factors: *Catesbaea melanocarpa* occurs in the subtropical dry forest life zone, the driest life zone in Puerto Rico and the U.S. Virgin Islands (Ewel and Whitmore 1973). The vegetation in this zone forms a nearly continuous single-layered canopy, with little ground cover, and it is deciduous on most soils. The leaves of dry forest species are succulent or coriaceous (leathery), and species with spines and thorns are common. Tree heights usually do not exceed 49 feet (15 meters) and crowns are typically broad, spreading and flattened. This life zone receives a mean annual rainfall ranging from 24 to 40 inches (60 to 100 centimeters). *Catesbaea melanocarpa* is threatened by the limited number of individuals and distribution, habitat destruction or modification for residential and tourist development, fire, and catastrophic natural events such as hurricanes. Because the species is extremely rare, the risk of extinction is high.

Recovery Goal: The interim goal of this recovery plan is to protect and enhance existing populations to the point that downlisting to threatened status is warranted.

Recovery Criteria: Limited information on the current number of individuals throughout the species' range and the limited knowledge on biology, habitat requirements, and genetic information preclude us from thoroughly addressing the threats to and limiting factors of this species and developing specific recovery criteria. Therefore, to achieve our interim recovery goal, we would need (1) to protect and enhance habitat known to support extant populations through landowner conservation agreements or easements; (2) enhancement of existing populations; (3) establishment of new self-sustaining populations within known range of the species; and (4) research on key biological and genetic issues, including effective propagation techniques, necessary to define recovery criteria.

The following are interim priority tasks that would lead us to obtain information essential for the development of more objective, measurable criteria that would need to be met before considering the downlisting of the species (reclassification from endangered to threatened). Delisting recovery criteria cannot be set at this time because critical biological, ecological, and genetic information is lacking to establish the number of populations that will ensure self-sustaining populations throughout the species' range.

1. Identify and implement short term and long term mechanisms to protect known populations from current and future threats or limiting factors.
2. Conduct surveys of *Catesbaea melanocarpa* in all known locations throughout the species' range and update data on the number of individuals in these locations.
3. Collect propagation material and develop techniques for the propagation and re-introduction of the species to enhance existing populations and establish new self-sustaining populations in protected areas.
4. Conduct biological, ecological, and genetic studies to understand species dynamics or fluctuations, biological and ecological requirements, and to determine the number of self-sustaining populations needed to recover the species.

Recovery Actions Needed:

1. Protect known populations from current and future threats and/or limiting factors through landowner agreements and other conservation mechanisms.
2. Determine the distribution and population status of *Catesbaea melanocarpa* throughout its range.
3. Evaluate techniques and develop a plant propagation program for *Catesbaea melanocarpa* to enhance existing populations and to establish new self-sustaining populations.
4. Establish new populations by selecting appropriate sites for population introduction or enhancement of historic sites using propagated material.
5. Conduct additional scientific research on *Catesbaea melanocarpa*.
6. Facilitate the recovery of *Catesbaea melanocarpa* through public awareness and education.
7. Refine recovery criteria.

Total Estimated Cost of Recovery: \$412,000

Year	Action 1	Action 2	Action 3	Action 4	Action 5	Action 6	Action 7	Total
2005	14	35	15	15	43	7	0	129
2006	19	58	10	10	13	5	0	115
2007	24	52	5	10	13	7	0	111
2008	5	20	0	0	0	0	0	25
2009	5	20	0	0	0	2	5	32
Total	67	185	30	35	69	21	5	412

(** Dollar amounts listed above in thousands of dollars)

Date of Recovery: Downlisting should be initiated by 2015, if interim recovery criteria are met.

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PART I. INTRODUCTION

Background

The Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (ESA), establishes policies and procedures for identifying, listing, and protecting species of wildlife and plants that are endangered or threatened with extinction. The ESA defines an “endangered species” as “any species which is danger of extinction throughout all or a significant portion of its range.” A “threatened species” is defined as “any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.”

The Secretary of the Interior is responsible for administering the ESA’s provisions as they apply to this species. Day-to-day management authority for endangered and threatened species under the Department’s jurisdiction has been delegated to the U.S. Fish and Wildlife Service (Service). To help identify and guide species recovery needs, section 4(f) of the ESA directs the Secretary of the Interior to develop and implement recovery plans for listed species or populations. Such plans are to include: (1) a description of site-specific management actions necessary to conserve the species or population; (2) objective measurable criteria which, when met, will allow the species to be removed from the list of threatened and endangered species; and (3) estimates of the time and funding required to achieve the plan’s goals and intermediate steps. Section 4 of the ESA, and regulations promulgated to implement its listing provisions (50 CFR Part 424), also set forth the procedures for reclassifying and delisting species on the Federal list of threatened and endangered species. A species can be delisted if the Secretary of the Interior determines that the species no longer meets the endangered and threatened status, based upon the following five factors listed in section 4(a)(1) of the ESA:

1. the present or threatened destruction, modification, or curtailment of its habitat or range;
2. overutilization for commercial, recreational, scientific, or educational purposes;
3. disease or predation;
4. the inadequacy of existing regulatory mechanisms; and
5. other natural or manmade factors affecting its continued existence.

Further, a species may be delisted, according to 50 CFR Part 424.11(d), if the best scientific and commercial data available substantiate that the species or population is neither endangered nor threatened for one of the following reasons: (1) extinction; (2) recovery; or (3) original data for classification of the species were in error.

Listing Status

Catesbaea melanocarpa (no common name) was listed as endangered on March 17, 1999, pursuant to the ESA (64 FR 13116-13120). The Service determined that designation of critical habitat was not prudent for this species because of the risks of vandalism and illegal collection should the exact location of individuals be made public.

Description

Catesbaea melanocarpa is a branching shrub that may reach approximately 9.8 feet (ft) (3.0 meters (m)) in height. Spines are borne at every internode (space between nodes) and are from 0.39 to 0.78 inches (in) (1.00 to 2.00 centimeters (cm)) long. Leaves are small, from 0.19 to 1.0 in (5.00 to 25.00 millimeters (mm)) long, and 0.07 to 0.58 in (2.00 to 15.00 mm) wide, often opposite. The flowers are white, solitary or paired, and almost lacking a stalk in the axils (angle formed by a leaf or branch with the stem). The petals are united in the form of a funnel and measure from 0.31 to 0.39 in (8.00 to 10.00 mm) long. The fruit is black, spherical, and 0.19 to 0.23 in (5.00 to 6.00 mm) in diameter. The two-celled fruit contains five to seven seeds in each cell (Proctor 1991).

Catesbaea melanocarpa superficially resembles *Randia aculeata* (box-briar or tintillo), but differs in its more slender spines, many opposite leaves, overlapping petals, and in having non-adhesive black fruits with much smaller seeds (Proctor 1991).

Taxonomic Status

Catesbaea melanocarpa, of the family Rubiaceae, belongs to a genus that consists of ten or more species of spiny shrubs confined to the Antilles, but some may extend into the Bahamas and the Florida Keys. In Puerto Rico, two species are known: *C. melanocarpa* and *C. parviflora*. These two species are differentiated by the color and size of the fruits: black and larger (0.19 to 0.23 in (5.00 to 6.00 mm) in diameter) in the former and white and smaller (0.07 to 0.15 in (2.00 to 4.00 mm) in diameter) in the latter (Breckon and Kolterman 1993). Some authors have noted that *C. melanocarpa* may be a synonym or variant of *C. parviflora* and have recommended further review (Howard 1989, Proctor 1991). To date, this review has not been initiated.

Distribution and Population Trends

Catesbaea melanocarpa is known from Puerto Rico, St. Croix in the U.S. Virgin Islands (USVI), Barbuda, Antigua, and Guadeloupe (Proctor 1991) (Figure 1). The German collector Hienrich Rudolph Wulschlaegel first discovered it in the mid-nineteenth century in the British island of Antigua. It was found in St. Croix, USVI, in about 1881 by the Danish collector Baron H. F. A. von Eggers and in Guánica, Puerto Rico, by the German collector Paul Sintenis in 1886 (Proctor 1991). Although duplicate specimens

are maintained at other herbariums, the original collections were in the herbarium at Berlin-Dahlem and were destroyed by the bombing during World War II.

Historic Distribution of *Catesbaea melanocarpa*

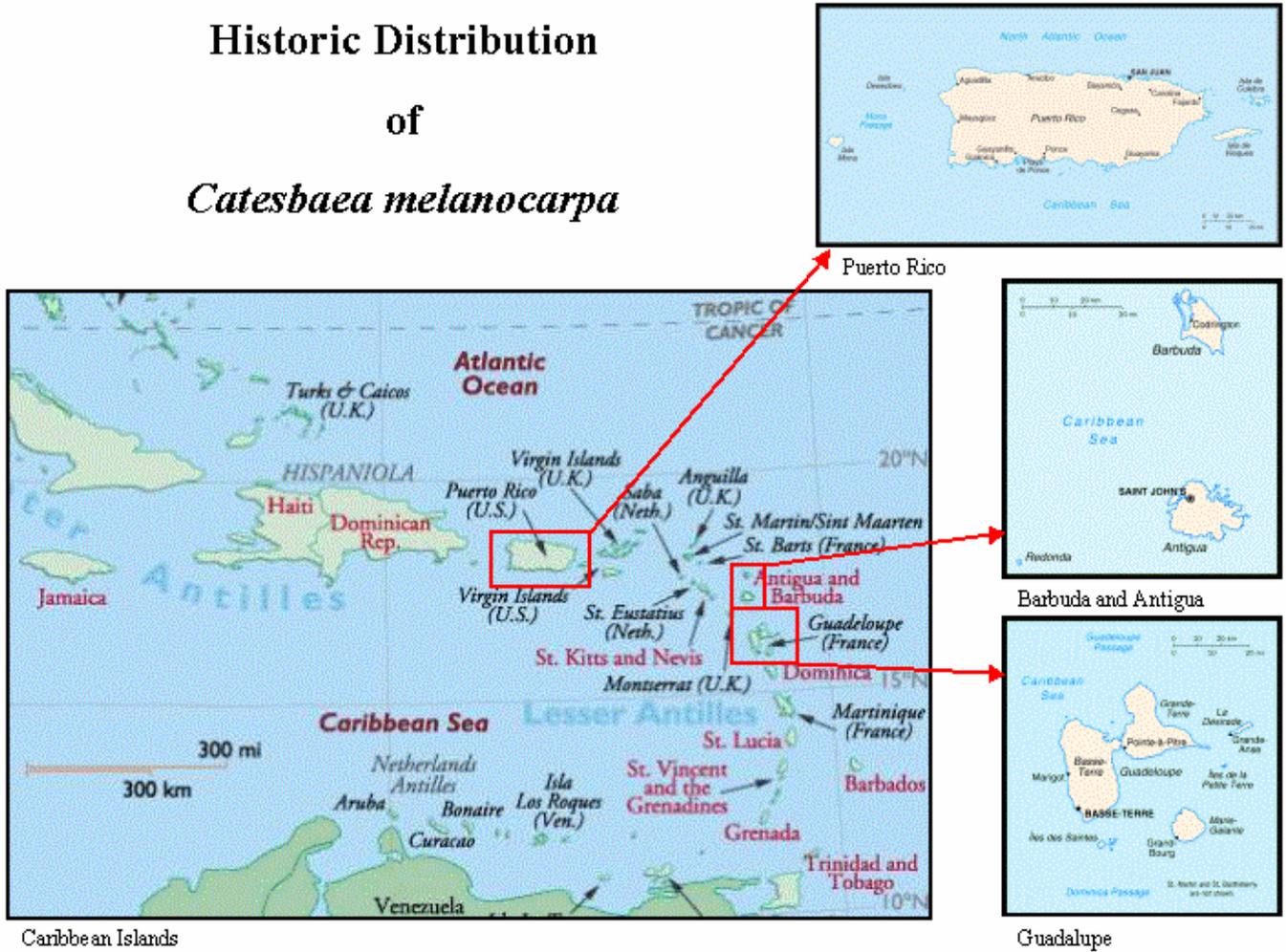


Figure 1. Historic distribution of *Catesbaea melanocarpa*.

Rudy G. O'Reilly (Proctor 1991) rediscovered the St. Croix population in 1988 (Figure 2). In Puerto Rico, the Guánica population has not been reported since 1886, but an individual was reported in Peñones de Melones in Cabo Rojo in 1995 (Figure 3). Little is known about this species' status and current distribution on the islands of Barbuda, Antigua, and Guadeloupe (Center for Plant Conservation 1992). One specimen, apparently originating from the Susúa Commonwealth Forest, was collected in 1974 and is located in the herbarium in San Juan, Puerto Rico. However, this specimen is sterile and in poor condition. Its identification cannot be confirmed because mature fruits are necessary to distinguish between *C. melanocarpa* and *C. parviflora*.

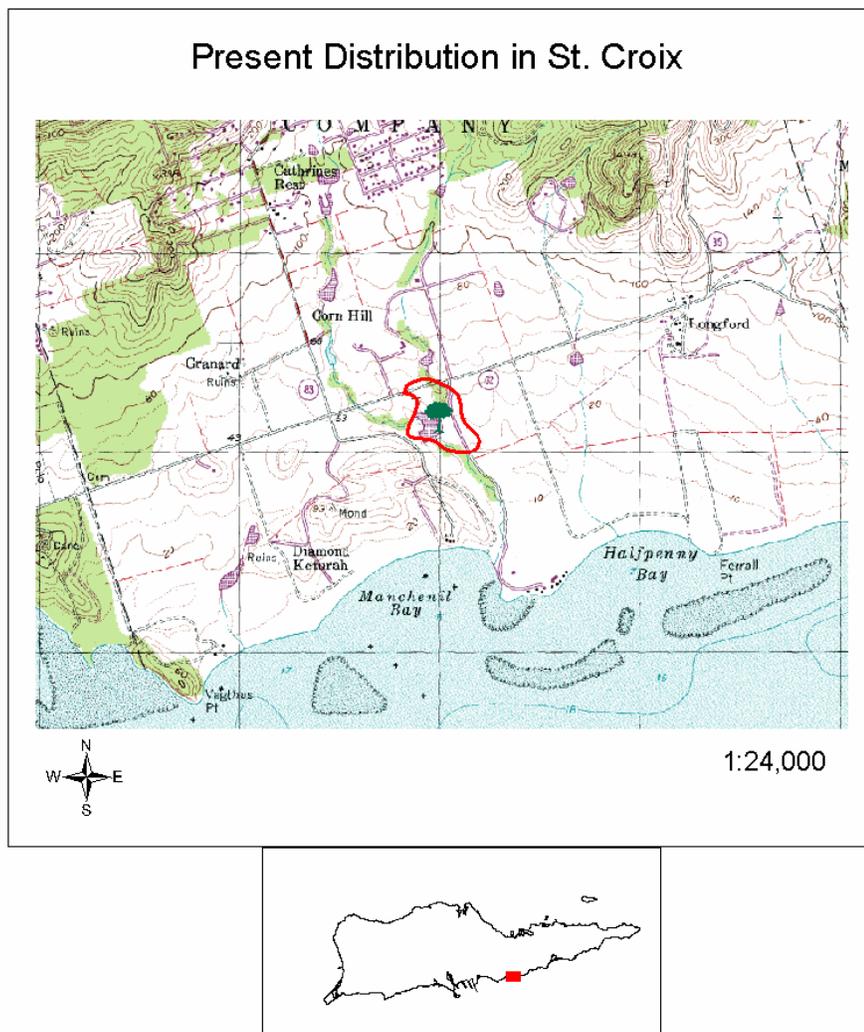


Figure 2. Present distribution of *Catesbaea melanocarpa* in St. Croix.

evaluation of the area in 1995. However, when Mr. Foote (one of the authors of this plan) visited the site with Dr. Axelrod in 2002, they could not find the species. No population estimates are available for the islands of Barbuda, Antigua, and Guadeloupe.

Habitat Description

Catesbaea melanocarpa occurs in the subtropical dry forest life zone. The subtropical dry forest is the driest life zone of Puerto Rico and the USVI. Ewel and Whitmore (1973) described the vegetation in this zone as deciduous on most soils with tree species dropping leaves during the dry season. The vegetation usually consists of a nearly continuous single-layered canopy, with little ground cover. The leaves of dry forest species are succulent or coriaceous (leathery), and species with spines and thorns are common. Tree heights usually do not exceed 49 ft (15 m) and crowns are typically broad, spreading and flattened. This life zone receives a mean annual rainfall ranging from 24 to 40 in (60 to 100 cm). Successional vegetation includes grasses, and the accumulated organic debris serves as fuel for human-induced fires.

In Puerto Rico, subtropical dry forest covers about 14 percent of the island area. Extensive areas of the life zone lie over limestone, including the area from which *Catesbaea melanocarpa* is known.

Between 1980 and 1993, average precipitation in the Cabo Rojo area was 34.76 in (88.30 cm), ranging from a low of 22.64 in (57.50 cm) in 1991 to a high of 44.48 in (113.00 cm) in 1981. The drier period extends from December through March and the wetter period includes May and September through November. Mean maximum monthly temperature during this same period was 84.2 F (29.0 C), and the mean minimum monthly temperature was 67.74 F (19.30 C). Soils in the area belong to the Americus-Guayabo-Sosa association, which are described as well-drained to excessively drained, level to sloping, with sandy soils (Soil Conservation Service 1965).

In Cabo Rojo, *Catesbaea melanocarpa* is known from the Peñones de Melones area. On August 27, 2002, Service biologist Kenneth Foote visited this location with Dr. Frank Axelrod from the University of Puerto Rico, Mr. Joseph Schwagerl from the Cabo Rojo National Wildlife Refuge, and Mr. Manny Montalvo. Based on their observations, the main part of the drainage (where *Catesbaea melanocarpa* was previously observed) has experienced continuous disturbance from periodic land clearing and road construction. The area was covered with secondary vegetation with species characteristic of disturbed habitat, such as *Acacia farnesiana* (aroma), *Leucaena leucocephala* (tan-tan or zarcilla), and *Prosopis juliflora* (mesquite). This type of disturbance may result in adverse effects to *C. melanocarpa*. Although the species was not found, Service biologists concluded that the species may be present, but the conditions of the habitat were not suitable to appropriately locate and identify the species.

The Peñones de Melones area also supports habitat for the endangered Puerto Rican nightjar (*Caprimulgus noctitherus*) and the endangered plants *Stahlia monosperma*

(Cóbana negra) and *Eugenia woodburyana* (no common name).

The area containing *Catesbaea melanocarpa* in St. Croix is located on a dry coastal plain of the island. Vegetation in the area has been described as savannah (an ecosystem dominated by grasses with scattered trees or clusters of trees). Savannah type vegetation on St. Croix is maintained by either grazing or fire and may have been a deciduous forest in the past. Associated species include the introduced *Panicum maximum* (guinea grass), *Crescentia cujete* (calabash tree), *Acacia tortuosa* (acacia), *Leucaena leucocephala* (tantal), *Randia aculeata* (box-briar or tintillo), *Psidium guajava* (guava), and *Cordia alba* (white manjack). The site is estimated to be approximately 50 acres (ac) (20 hectares (ha)) and it is an agricultural track subject to intense but periodic grazing.

Soils in this St. Croix area have been described as belonging to the Cornhill series, which consists of near level, moderately drained soils that are deep over clayey sediments. The Cornhill gravelly clay loam is found on terraces and alluvial fans in the southern part of St. Croix. The average annual precipitation in the area ranges from 30.00 to 54.68 in (76.20 to 138.90 cm) (Soil Conservation Service 1970).

Life History/Ecology

Biological and ecological information on *Catesbaea melanocarpa* is very scarce. In July of 1992, Breckon and Kolterman (1993) measured stem height and basal diameter for the 24 individuals known from St. Croix. Stem height ranged from 0.36 to 9.91 ft (0.11 to 3.02 m) and averaged 2.59 ft (0.79 m). Basal stem diameter ranged from 0.16 to 2.20 in (0.40 to 5.60 cm). The stem of the largest individual split into two at a height of 7.87 in (20.00 cm), and above that point, the two stems had diameters of 1.14 and 1.22 in (2.90 and 3.10 cm). Eleven of the 24 living individuals had green fruit and one had mature fruit. The reproductive condition of the plants was observed for several weeks after, and during this time all reproductive stages were observed on the majority of plants. In December 1992, the reproduction was checked, and while no flowers were observed, many adults (greater than 1.64 ft (0.50 m) in height) were in fruit (Breckon and Kolterman 1993).

Only a few seed germination and propagation experiments have been conducted (Breckon and Kolterman 1993). In August 1988, seeds and plants were collected from the St. Croix location. Most of the transplanted seedlings have survived and two have produced flowers and fruits. Of 57 seeds collected in December of 1990, 92 percent germinated but only five of the seedlings survived. In 1993, two fruits were collected. Ten seeds were obtained from these two fruits, but none germinated. Two plants previously germinated from St. Croix seeds were donated to the Guánica Commonwealth Forest. These plants died before being planted.

Reasons for Listing/Current Threats

Catesbaea melanocarpa is considered rare on Antigua (Center for Plant Conservation

1992). In Puerto Rico, the single individual is located on privately-owned land, which is currently proposed for a high density residential/tourist development. In St. Croix, the population is also on privately-owned land. This population is subject to impacts from intense grazing activities as well as pressure for a golf course development.

The risk of extinction is high because so few individuals of *Catesbaea melanocarpa* are known to occur in limited areas. Catastrophic natural events, such as hurricanes, may dramatically affect forest species composition and structure, felling large trees and creating numerous canopy gaps. Breckon and Kolterman (1993) documented the loss of individuals in St. Croix following the passing of Hurricane Hugo in 1989. Deforestation for residential and tourist development may pose imminent threats to the survival of the species. Fire may also be a threat to the known population on the island of St. Croix. Fire is not a natural component of subtropical dry forest in Puerto Rico and Virgin Islands. Species found in this type of forest are not fire adapted. The St. Croix location is a mixed pasture area adjacent to an existing road. Human-induced fires may affect the survival of these individuals.

Conservation Measures

Conservation measures provided to federally listed species include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing encourages and results in conservation actions by Federal, state, and private groups and individuals. The ESA provides for possible land acquisition in cooperation with the states and requires that recovery actions be carried out for all listed species. Section 7(a) of the ESA requires Federal agencies to evaluate their actions with respect to any species that is listed as federally endangered or threatened. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with the Service.

Following the listing of this species as endangered by the Service, the Puerto Rico Department of Natural and Environmental Resources and the U.S. Virgin Islands Department of Planning and Natural Resources also began protecting this species through their local laws and regulations. These agencies, as well as the Service, consider this species when reviewing development projects within the known range of the species or within their potential habitat.

The Service also has signed Cooperative Agreements with both Commonwealth and Territorial governments under section 6 of the ESA to support vigorous endangered species programs for all federally listed species within their jurisdictional areas.

PART II. RECOVERY

Recovery Strategy

To address the threats to *Catesbaea melanocarpa*, given the limited amount of biological and ecological information on the species at this time, the following approach to recovery is recommended. Intensive surveys of the species should be conducted throughout present and historic range to determine presence/absence and to update information regarding the number of individuals in all locations. Biological, ecological, and genetic studies should be conducted to better understand population dynamics or fluctuations, biological and ecological requirements, and number of self-sustaining populations (wild, naturally reproducing population large enough to maintain sufficient genetic variability and to adapt and respond to natural habitat changes) necessary to protect and enhance the species throughout its range. Techniques for the propagation and re-introduction of *Catesbaea melanocarpa* should be developed and implemented to enhance existing populations and establish new self-sustaining populations in protected areas.

Present and future activities resulting in habitat destruction or modification of existing locations, such as intensive agricultural practices, land clearing associated with proposed residential/tourism development projects and associated facilities, improvement of roads, and installation of infrastructure utilities, should be evaluated by the appropriate government agencies and parties responsible for the recovery of *Catesbaea melanocarpa*. Long term protection strategies, such as the establishment of conservation easements, designation of conservation areas, habitat restoration projects, and land acquisition, should be explored as appropriate mechanisms to minimize habitat loss or degradation.

The effects of natural and human-induced disturbances, such as hurricanes and fires, should be evaluated. Habitat disturbance and fires may promote the establishment of exotic/invasive fire resistant vegetation species that may alter components of the habitat that may be required by *Catesbaea melanocarpa*. Land management mechanisms to reduce adverse impacts related to these limiting factors should be identified and implemented.

The importance of protecting and enhancing rare plant species, such as *Catesbaea melanocarpa*, should be incorporated into public education and outreach programs. These programs need to include stakeholders interested in the impacts of recovery activities on their actions, as well as parties interested in the recovery of the species, such as landowners, government agencies, legislators, consultants for development projects, the academic and scientific community, and the general public. These programs should balance the needs of the target audiences and the species and include the development and distribution of information (e.g., species reports, audiovisual presentations, meetings, media sources) on the recovery needs of the species.

Recovery Goal / Objective

The interim goal of this recovery plan is to protect and enhance existing populations and associated habitat of *Catesbaea melanocarpa* in the near term to the point that downlisting to threatened status is warranted.

Recovery Criteria

Limited information on the current number of individuals throughout the species' range and the limited knowledge on biology, habitat requirements and genetic information, preclude us from thoroughly addressing the threats to and limiting factors of this species and developing specific recovery criteria. Therefore, to achieve our interim recovery goal, we would need to protect and enhance habitat known to support extant populations through landowner conservation agreements or easements, enhancement of existing populations, establishment of new self-sustaining populations within known range of the species, and research on key biological and genetic issues, including effective propagation techniques, necessary to define recovery criteria.

The following are interim priority tasks that would lead us to obtain information essential for the development of more objective, measurable criteria that would need to be met before considering the downlisting of the species (reclassification from endangered to threatened). Delisting recovery criteria cannot be set at this time because critical biological, ecological, and genetic information is lacking to establish the number of populations that will ensure self-sustaining populations throughout the species' range.

1. Identify and implement short term and long term mechanisms to protect known populations from current and future threats or limiting factors.
2. Conduct surveys of *Catesbaea melanocarpa* in all known locations throughout the species range and update number of individuals in these locations.
3. Collect propagation materials and develop techniques for the propagation and re-introduction of the species to enhance existing populations and establish new self-sustaining populations in protected areas.
4. Conduct biological, ecological, and genetic studies to understand species dynamics or fluctuations, biological and ecological requirements, and to determine the number of self-sustaining populations needed to recover the species.

Table 1. Relationship of Recovery Criteria and Actions to Treat and Listing Factors for *Catesbaea melanocarpa*.

LISTING FACTOR	THREAT	RECOVERY CRITERIA	RECOVERY ACTIONS
A	Habitat Destruction and Modification	1, 2, 4	111 develop landowner agreement in St. Croix, 112 develop landowner agreement in Peñones de Melones, 113 enforce existing regulations, 12 monitor status, 21 conduct surveys, 22 collect biological data and characterize habitat, 23 identify potential habitat and search for new populations, 24 protect new populations, 31 assess methods for propagation, 32 develop a propagation program, 41 characterize potential recovery sites, 42 select sites for new recovery populations, 43 ensure site protection, 44 introduce and monitor, 51 define habitat requirements, 61 identify target audiences and locations for outreach, 621 develop and distribute educational materials, 622 educate legislators.
B	Overutilization or collection	N/A	N/A
C	Disease or Predation	1, 3, 4	12 monitor status, 21 conduct surveys, 22 collect biological data and characterize habitat, 31 assess methods for propagation, 32 develop a propagation program, 43 ensure site protection, 44 introduce and monitor, 51 define habitat requirements, 521 assess periodicity of flowering, 522 assess seed production and dispersal, 523 evaluate seed viability and germination, 524 evaluate requirements for establishment and growth, 525 determine genetic structure.
D	Inadequacy of Regulatory Mechanisms	1	111 develop landowner agreement in St. Croix, 112 develop landowner agreement in Peñones de Melones, 24 protect new populations, 42 select sites for new recovery populations, 43 ensure site protection, 61 identify target audiences and locations for outreach, 621 develop and distribute educational materials, 622 educate legislators.
E	Low Numbers and Limited Distribution	1, 2, 3, 4	12 monitor status, 21 conduct surveys, 22 collect biological data and characterize habitat, 23 identify potential habitat and search for new populations, 24 protect new populations, 31 assess methods for propagation, 32 develop a propagation program, 41 characterize potential recovery sites, 42 select sites for new recovery populations, 43 ensure site protection, 44 introduce and monitor, 51 define habitat requirements, 521 assess periodicity of flowering, 522 assess seed production and dispersal, 523 evaluate seed viability and germination, 524 evaluate requirements for establishment and growth, 525 determine genetic structure, 71 determine number of individuals and self-sustaining populations, 72 determine additional actions to achieve recovery.
E	Other Natural or Manmade Factors	1, 2, 3, 4	12 monitor status, 21 conduct surveys, 24 protect new populations, 43 ensure site protection, 44 introduce and monitor, 51 define habitat requirements, 521 assess periodicity of flowering, 522 assess seed production and dispersal, 61 identify target audiences and locations for outreach, 621 develop and distribute educational materials, 622 educate legislators.

Listing Factors:

- A. The Present or Threatened Destruction, Modification, or Curtailment of a Species Habitat or Range
- B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes
- C. Disease or Predation
- D. The Inadequacy of Existing Regulatory Mechanisms
- E. Other Natural or Manmade Factors Affecting its Continued Existence

Recovery Criteria (Interim Priority Tasks):

- 1. Identify and implement short term and long term mechanisms to protect known populations from current and future threats or limiting factors.
- 2. Conduct surveys of *Catesbaea melanocarpa* in all known locations throughout the species range and update number of individuals in these locations.
- 3. Collect propagation materials and develop techniques for the propagation and re-introduction of the species to enhance existing populations and establish new self-sustaining populations in protected areas.
- 4. Conduct biological, ecological, and genetic studies to understand species dynamics or fluctuations, biological and ecological requirements, and to determine the number of self-sustaining populations needed to recover species.

Recovery Actions - General (see plan for details)

- 1. Protect known populations from current and future threats and/or limiting factors through landowner agreements and other conservation mechanisms.
- 2. Determine the distribution and population status of *Catesbaea melanocarpa* throughout its range.
- 3. Evaluate techniques and develop a plant propagation program for *Catesbaea melanocarpa* to enhance existing populations and to establish new self sustaining populations.
- 4. Establish new populations by selecting appropriate sites for population introduction or enhancement of historic sites using propagated material.
- 5. Conduct additional scientific research on *Catesbaea melanocarpa*.
- 6. Facilitate the recovery of *Catesbaea melanocarpa* through public awareness and education.
- 7. Refine recovery criteria.

Recovery Program

Recovery Actions Stepdown Outline and Narrative

1. Protect known populations from current and future threats and/or limiting factors through landowner agreements and other conservation mechanisms.

Catesbaea melanocarpa is currently known from only two localities in the U.S. Caribbean of approximately 100 individuals. Both are on privately owned lands that are currently impacted by land clearing and intensive grazing activities and are under development pressure, primarily for residential and tourism development. Resource and other government agencies and land owners need to protect these two sites and the individual plants to secure the survival and recovery of this species in the U.S. Caribbean and ensure effective propagation and re-introduction efforts.

11. Develop and implement short-term and long-term mechanisms to protect habitat and individual plants from known locations. Preventing loss of individuals and further degradation habitat of the two known locations of *Catesbaea melanocarpa* in St. Croix and Peñones de Melones is essential for the survival of the species in U.S. Caribbean.

111. Develop landowner agreements to provide protection of *Catesbaea melanocarpa* in St. Croix. The St. Croix population is located in an approximately 50-ac (20-ha) privately-owned lot under intense grazing activities and subject to development pressure for a golf course. Private land-owner incentive programs for wildlife protection and habitat enhancement are available within the Service and the U.S. Department of Agriculture (e.g., Partners for Fish and Wildlife, Landowner Incentive Program, Wildlife Habitat Incentive Program (USDA-NRCS), Forest Land Enhancement Program (USDA-Forest Service), Conservation Reserve Program (USDA-Farm Service Agency), and Forest Stewardship Program (USDA-Forest Service)). The need for protection of this species should be conveyed to the land owners leading to the development of a conservation agreement. Additional protection and other long-term mechanisms should be explored in coordination with the U.S. Virgin Islands Department of Planning and Natural Resources (VIDPNR).

112. Develop landowner agreements to provide protection of *Catesbaea melanocarpa* in Peñones de Melones, Cabo Rojo, Puerto Rico. The site is located in forested hills and drainages surrounded by important wildlife habitats. The area also supports habitat for the endangered Puerto Rican nightjar (*Caprimulgus noctitherus*) and the endangered plants *Stahlia monosperma* (Cóbana negra) and *Eugenia woodburyana* (no common name). The area is adjacent to the Boquerón Wildlife Refuge and to important wetland and coastal ecosystems. Conservation measures, such as a Habitat Conservation Plan under section 10 (a)(1)(B), Safe Harbor

Agreements, or the establishment of conservation easements, should be implemented. Future land acquisition should be evaluated as an option for protection of this area.

113. Enforce existing Federal, Commonwealth, and Territorial endangered species regulations. Federal, Commonwealth, and Territorial laws and regulations should be appropriately enforced to prevent illegal collection and habitat destruction of *Catesbaea melanocarpa* on private land in both Puerto Rico and St. Croix. The Puerto Rico Department of Natural and Environmental Resources (PRDNER) Regulation to Govern the Management of Threatened and Endangered Species of 2003 provides for criminal penalties for the illegal take of listed plant species on public land. In addition, development projects that occur in these areas are often funded through local or Federal agencies or require local permits. Section 7 of the ESA would apply where Federal lands or federally funded or permitted projects are involved.

12. Monitor status of known populations and individuals. Individual specimens and populations of *Catesbaea melanocarpa* should be monitored on a long-term basis, along with the recruitment of new individuals into the populations, at both the Cabo Rojo and St. Croix sites. Individual plants should be measured and specific locations of individuals identified using a Global Positioning System (GPS) device, as opposed to marking each individual with tape, paint, or metal tag. Marking individuals may make them susceptible to illegal collection and/or vandalism. Basic field observations, which will contribute to the information available on population dynamics (including phenology, seed production, seed dispersal, recruitment success, site changes, and growth), should be conducted on an annual basis.

2. Determine the distribution and population status of *Catesbaea melanocarpa* throughout its range. The individual reported in Cabo Rojo has not been observed since 1995. No updated information is available from Barbuda, Antigua, and Guadalupe. Furthermore, no documentation of intensive surveys of this species in Guánica Commonwealth Forest is available in the literature. Intensive surveys for this species are needed in both historically and currently known locations to gather information on distribution, abundance, and habitat characteristics of these locations. Future management decisions and the establishment of recovery priorities depend on obtaining additional information concerning the distribution and abundance of this species.

21. Conduct surveys within known and historic range of the species. The historic range of *Catesbaea melanocarpa* includes Guánica Commonwealth Forest in Puerto Rico, and the islands of Bermuda, Antigua, and Guadalupe. The last report from Guánica Commonwealth Forest is from 1886. No recent information is available regarding the status and distribution of *Catesbaea melanocarpa* in the West Indies.

There is the possibility that *Catesbaea melanocarpa* may be present in the Susúa Commonwealth Forest in Puerto Rico since there is a collection record, although not confirmed, from 1974. Surveys should be conducted in all these localities to identify the presence of the species and the number of individuals remaining in these areas.

22. **Collect biological data and characterize habitat.** Basic field data, such as phenology information, seed production, seed dispersal, recruitment success, habitat characteristics, and possible threats, should be taken from these localities. If propagative materials are available, appropriate collection and propagation efforts should be conducted in coordination with the responsible agencies and organizations.
23. **Identify potential habitat for the species and search for new populations.** Based on a characterization of known habitat types where *Catesbaea melanocarpa* is known to occur, potential population sites should be identified and searched. If new populations are discovered, appropriate collection and propagation efforts should be conducted in coordination with the responsible agencies and organizations.
24. **Protect new populations.** If new populations are discovered, protection mechanisms for these locations and individuals should be developed and implemented.

3. **Evaluate techniques and develop a plant propagation program for *Catesbaea melanocarpa* to enhance existing populations and to establish new self-sustaining populations.** *Catesbaea melanocarpa* has limited distribution and low number of individuals. Propagation efforts are essential to enhance existing populations and establish new self-sustaining population in protected areas. The best available scientific information will be used to determine the most effective propagation techniques. A plant propagation program with the Commonwealth, Territories, West Indies Island governments, universities, and local nurseries should be established and implemented.

31. **Assess methods for propagation.** Based on the availability of propagative material, economic and logistical considerations, results from research, and successful propagation methods used in similar species, determine the most feasible method of propagation and re-introduction of *Catesbaea melanocarpa* to historical or suitable new sites. Sexual versus asexual reproduction should be evaluated as a potential propagation method.
32. **Develop a propagation program and determine the appropriate propagation facilities.** A propagation program should be developed in coordination with governmental and non-governmental organizations

(NGO) in Puerto Rico and St. Croix. Appropriate sites will be determined by the following: (1) adequate facility infrastructure and security; (2) previous experience with propagation of endangered plants; (3) obtain appropriate permits from regulatory agencies; and (4) willingness to participate in the program. St. George Botanical Garden in St. Croix, Puerto Rico Botanical Garden, Puerto Rico Department of Natural and Environmental Resources, University of Puerto Rico, and Puerto Rico Conservation Trust are some of the possible facilities

4. Establish new populations by selecting appropriate sites for population introduction or enhancement of historic sites using propagated material. Areas for the establishment of new populations of *Catesbaea melanocarpa* should be selected and new populations established. Habitat requirements must be considered to ensure the success and relevance of transplanting propagated material.

- 41. Characterize potential recovery sites to determine their suitability for the species.** Identify potential sites for the establishment of new self-sustaining populations of *Catesbaea melanocarpa* in protected areas. These areas may include: the Sandy Point National Wildlife Refuge (NWR) in St. Croix, the Cabo Rojo NWR in Cabo Rojo, and the Guánica Commonwealth Forest. Other possible sites will be identified once the distribution and habitat characterization studies are conducted.
- 42. Select sites for establishment of new recovery populations.** Using information from Task 41, potential sites should be inventoried for the introduction and establishment of new populations of *Catesbaea melanocarpa*. Consideration should be given to the introduction of this species in areas of the Guánica Commonwealth Forest, the Sandy Point NWR, and the Cabo Rojo NWR because these areas are located within the range of the species, support very similar habitat, and are protected by Federal and Commonwealth agencies.
- 43. Ensure site protection.** Steps should be taken (e.g., conservation easements and agreements) to protect proposed sites to re-introduce or introduce the species in areas that are not already protected. Resource agencies will develop management plans for new sites.
- 44. Introduce and monitor plants.** Survival and success of introduced plants should be monitored on a quarterly basis for at least one year and then once every other year.

5. Conduct additional scientific research on *Catesbaea melanocarpa*. Studies should focus on those aspects of life history that may be critical to the recovery of the species.

51. **Define habitat requirements.** Information available from existing studies should be evaluated to more clearly define habitat requirements such as preferred soil type, associate plant species, presence or lack of vegetative canopy, etc.
52. **Study reproductive biology and ecology of *Catesbaea melanocarpa*.** Effective management and recovery of this species depends upon obtaining this information. Studies will be conducted to determine periodicity of flowering, seed production and dispersal, and the genetic structure of the species.
 521. **Assess periodicity of flowering.** Studies to determine the frequency, timing, and abundance of flowering; pollination mechanisms; and the physical and biological factors controlling these events should be continued.
 522. **Assess seed production and dispersal.** Conduct studies to identify the agents of seed predation and/or dispersal.
 523. **Evaluate seed viability and germination requirements.** Conduct studies to determine the environmental conditions required for germination. Studies will be conducted at known population sites and also within a controlled environment, such as a laboratory, plant nursery, or botanical garden, to determine the optimal environmental conditions needed to successfully propagate the species
 524. **Evaluate requirements for establishment and growth.** Field and laboratory experiments should focus on this critical stage to determine the factors that affect establishment and survival.
 525. **Determine genetic structure of the species.** Study intra-population genetic diversity of the species using appropriate scientific techniques.

6. Facilitate the recovery of *Catesbaea melanocarpa* through public awareness and education. Compliance with regulation and management plans depends on public support that specifically focuses on the conservation of species and their habitats. The recovery of *Catesbaea melanocarpa*, as well as all of the U.S. Caribbean threatened and endangered species, needs comprehensive and integrative public awareness and education programs. Public support, in turn, depends on an informed public who understands species conservation issues and the reasons for necessary regulatory and management actions. The information provided to the public should be clear, consistent, concise, and readily available. The program developed for *Catesbaea melanocarpa* should be multi-species and directed to dry forest conservation.

61. **Identify target audiences and key locations for outreach.** The success of a public awareness/education program is based on the proper identification of target audiences and key locations. Target audiences may include, but are not limited to private landowners, government agencies, environmental planners, development consultants, schoolchildren, recreational users, and educators.
 62. **Develop, evaluate, and implement an outreach and educational plan for *Catesbaea melanocarpa*.** A multi-species landscape oriented outreach and educational plan will be developed for *Catesbaea melanocarpa* and other dry forest species, targeting audiences and communities identified in Task 61. The theme of the program will emphasize *Catesbaea melanocarpa* habitat conservation.
 621. **Develop and distribute educational materials to target audiences.** A wide variety of materials may be designed and distributed for outreach and/or educational posters and brochures. The type of material produced, along with its content, will vary according to the identified target audience.
 622. **Educate Federal, Commonwealth, and Territorial legislators about *Catesbaea melanocarpa* conservation and protection.** Legislators can enact regulations that may protect, or conversely result in harm, to *Catesbaea melanocarpa* and its habitat. Therefore, legislators should be provided with briefing packages (e.g., species status report, general species information, management issues, and concerns for the species) on an annual basis. This should enable legislators to make better informed legislative actions as they pertain to the species.
7. **Refine recovery criteria.** As additional information on the biology, ecology, propagation, and management of *Catesbaea melanocarpa* is accumulated, it will be necessary to better define recovery criteria.
71. **Determine number of individuals and self-sustaining populations necessary to ensure species survival and recovery.** Environmental and reproductive studies, together with the relative success of population protection measures, will allow for more precise and realistic recovery criteria to be established.
 72. **Determine what additional actions, if any, are necessary to achieve recovery criteria.** Any action(s) not included in this recovery plan that are recognized during the recovery process as being necessary or important for the conservation and/or recovery of this species should be

incorporated into the plan.

Implementation Schedule

Recovery plans are intended to assist the U.S. Fish and Wildlife Service and potential Federal, state, and private partners in planning and implementing actions to recover and/or protect endangered and threatened species. The Implementation Schedule that follows lists the actions and estimated costs for the recovery program for *Catesbaea melanocarpa*. It is a guide for meeting recovery goals outlined in this plan. Parties with authority, responsibility, or expressed interest to implement a specific recovery action are identified in the Implementation Schedule. The listing of a party in the Implementation Schedule does not require, nor imply a requirement, that the identified party has agreed to implement the action(s) or to secure funding for implementing the action(s). However, parties willing to participate may benefit by being able to show in their own budgets that their funding request is for a recovery action identified in an approved recovery plan and is therefore considered a necessary action for the overall coordinated effort to recover *Catesbaea melanocarpa*. Also, section 7(a)(1) of the ESA directs all Federal agencies to utilize their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of threatened and endangered species.

Recovery Action Priorities

Priorities in column 1 of the following Implementation Schedule are assigned as follows:

- Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
- Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.
- Priority 3 - All other actions necessary to provide for full recovery of the species.

List of Abbreviations

- PRDNER - Puerto Rico Department of Natural and Environmental Resources
- VIDPNR - Virgin Islands Department of Planning and Natural Resources
- ES - Fish and Wildlife Service, Ecological Services Division
- NWR - Fish and Wildlife Service, National Wildlife Refuge Division
- BOTGAR - Botanical Gardens
- UNIV - Universities
- NGO - Non-Governmental Organization
- LAND - Landowner
- GOV - Other governmental agency

IMPLEMENTATION SCHEDULE

Task Priority	Task Description	Task Number	Task Duration	Responsible Organization		Cost Estimates (\$000)					Comments
				FWS	Other	FY 05	FY 06	FY 07	FY 08	FY 09	
1	Develop landowner agreements to provide for protection of <i>Catesbaea melanocarpa</i> in St. Croix.	111	3 years	R4, ES	VIDPNR, LAND, GOV	7	7	7			
1	Develop landowner agreement to provide for the protection of <i>Catesbaea melanocarpa</i> in Peñones de Melones, Cabo Rojo, Puerto Rico.	112	3 years	R4, ES	PRDNER, LAND, GOV	7	7	7			
1	Enforce existing Commonwealth, Territorial, and Federal endangered species regulations.	113	Cont.	R4, ES	PRDNER, VIDPNR, GOV						No cost anticipated.
1	Monitor status of known populations and individuals.	12	5 years	R4, ES, NWR	PRDNER, VIDPNR, UNIV, NGO	5	5	5	5	5	
1	Conduct surveys within known and historic range of the species.	21	5 years	R4, ES, NWR	PRDNER, VIDPNR, UNIV, NGO	10	10	10	5	5	
1	Collect biological data and characterize habitat.	22	5 years	R4, ES, NWR	PRDNER, VIDPNR, UNIV, NGO	15	15	15	10	10	
1	Identify potential habitat for the species and search for new populations.	23	5 years	R4, ES, NWR	PRDNER, VIDPNR, UNIV, NGO	10	10	10	5	5	

Task Priority	Task Description	Task Number	Task Duration	Responsible Organizations		Cost Estimates (\$000)					Comments
				FWS	Other	FY 05	FY 06	FY 07	FY 08	FY 09	
1	Protect new populations.	24	Cont.	R4, ES	PRDNER, VIDPNR	15	15	10			
1	Assess methods for propagation.	31	2 years	R4, ES, NWR	PRDNER, VIDPNR, UNIV, GOV, BOTGAR	5	5				
1	Develop a propagation program and determine the appropriate propagation facilities.	32	3 years	R4, ES, NWR	PRDNER, VIDPNR, UNIV, GOV, NGO, BOTGAR	5	5	5			
2	Characterize potential recovery sites to determine their suitability for the species.	41	3 years	R4, ES, NWR	PRDNER, VIDPNR, UNIV, GOV	5	5	5			
2	Select sites for establishment of new recovery populations.	42	1 year	R4, ES, NWR	PRDNER, VIDPNR, UNIV, GOV, BOTGAR						No cost anticipated.
2	Ensure site protection.	43	Cont.	R4, ES, NWR	PRDNER, VIDPNR, GOV, LAND						No cost anticipated.
2	Introduce and monitor plants.	44	3 years	R4, ES, NWR	PRDNER, VIDPNR, GOV, LAND	10	5	5			

Task Priority	Task Description	Task Number	Task Duration	Responsible Organizations		Cost Estimates (\$000)					Comments
				FWS	Other	FY 05	FY 06	FY 07	FY 08	FY 09	
2	Define habitat requirements.	51	3 years	R4, ES	PRDNER, VIDPNR, UNIV, BOTGAR	2	2	1			
2	Assess periodicity of flowering.	521	3 years	R4, ES	PRDNER, VIDPNR, GOV, LAND	4	4	4			
2	Assess seed production and dispersal.	522	3 years	R4, ES	PRDNER, VIDPNR, UNIV, BOTGAR	4	4	4			
2	Evaluate seed viability and germination requirements.	523	3 years	R4, ES,	PRDNER, VIDPNR, UNIV, BOTGAR	4	3	3			
2	Evaluate requirements for establishment and growth.	524	3 years	R4, ES	PRDNER, VIDPNR, UNIV, BOTGAR	4	3	3			
2	Determine genetic structure of the species.	525	3 years	R4, ES	PRDNER, VIDPNR, UNIV, BOTGAR	10	5	5			
Task Priority	Task Description	Task Number	Task Duration	Responsible Organizations		Cost Estimates (\$000)					Comments

						FY 05	FY 06	FY 07	FY 08	FY 09	
3	Identify target audiences and key locations for outreach.	61	Cont.	R4, ES	PRDNER, VIDPNR, UNIV						No cost anticipated.
3	Develop and distribute educational materials to target audiences.	621	Cont.	R4, ES	PRDNER, VIDPNR, UNIV	5	5	5			
3	Educate Federal, Commonwealth, and Territorial legislators about <i>Catesbaea melanocarpa</i> conservation and protection.	622	Cont.	R4, ES	PRDNER, VIDPNR, UNIV, NGO	2		2		2	.
3	Determine number of individuals and self-sustaining populations necessary to ensure species survival and recovery.	71	Cont.	R4, ES, NWR	PRDNER, VIDPNR, UNIV, NGO					2	.
3	Determine what additional actions, if any, are necessary to achieve recovery criteria.	72	Cont.	R4, ES	PRDNER, VIDPNR, UNIV, NGO					3	.

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