



# United States Department of the Interior



## FISH & WILDLIFE SERVICE

### Boqueron Field Office

Carr. 301, KM 5.1, Bo. Corozo

P.O. Box 491

Boqueron, PR 00622

AUG 23 2011

In Reply Refer To:  
FWS/R4/CESFO/72LP012

Col. Alfred A. Pantano, Jr.  
District Commander  
Jacksonville District Corps of Engineers  
701 San Marco Boulevard.  
Jacksonville, FL 32207-0019

RE: Biological Opinion  
Vía Verde Project, Puerto Rico  
SAJ 2010-02881 (IP-EWG)

Dear Col. Pantano:

This document is the biological opinion of the U.S. Fish and Wildlife Service's (Service) based on our review of the proposed Vía Verde Project and its effects on the Puerto Rican boa (*Epicrates inornatus*), Puerto Rican broad-winged hawk (*Buteo platypterus brunnescens*), and Puerto Rican sharp-shinned hawk (*Accipiter striatus venator*) in accordance to section 7 of the Endangered Species Act (Act) of 1973, as amended (16 United States Code [U.S.C.] 1531 et seq.); in response to your request of July 11, 2011 for formal consultation. In your letter, you also determined that the project may adversely affect the Puerto Rican boa, Puerto Rican broad-winged hawk and Puerto Rican sharp-shinned hawk, but would not likely adversely affect four (4) animal species [Puerto Rican parrot (*Amazona vittata vittata*), Puerto Rican nightjar (*Caprimulgus noctitherus*), Puerto Rican crested toad (*Peltophryne lemur*), and coquí llanero (*Eleutherodactylus juanariveroi*)]; and 27 plant species [*Aurodendron pauciflorum*, *Banara vanderbiltii*, *Buxus vahlii*, *Calyptrionoma rivalis*, *Catesbaea melanocarpa*, *Chamaecrista glandulosa* var. *mirabilis*, *Cordia bellonis*, *Cordia rupicola*, *Cornutia obovata*, *Cyathea dryopteroides*, *Daphnopsis helleriana*, *Eugenia woodburyana*, *Goetzea elegans*, *Juglans jamaicensis*, *Myrcia paganii*, *Ottoschulzia rhodoxylon*, *Pleodendron macranthum*, *Polystichum calderonense*, *Schoepfia arenaria*, *Solanum drymophilum*, *Stahlia monosperma*, *Tectaria estremerana*, *Thelypteris inabonensis*, *Thelypteris verecunda*, *Thelypteris yaucoensis*, *Thichilia triacantha*, and *Zanthoylum thomasianum*].

The Service concurred in writing on July 15, 2011.

This biological opinion is based on information provided in the July 11, 2011 Biological Assessment, the project alignment and construction right-of-way (ROW) dated July 2, 2011; the modifications to the project alignment and construction ROW submitted on July 27, 2011; and information discussed during meetings and site visits. In addition, we have reviewed and incorporated information from the species final listing rules, recovery plans, and 5-year reviews, office files, published literature, field investigations, and other sources of information. A complete administrative record of this consultation is on file in the Caribbean Ecological Services Field Office (CESFO), Boquerón, Puerto Rico.

### **Consultation History**

- June 8, 2010 Puerto Rico Electric Power Authority (PREPA) presented the proposed Via Verde gas pipeline project during a meeting at CESFO.
- June 28, 2010 PREPA's consultants (Asesores Ambientales y Educativos, Inc.) (Consultants) met with CESFO staff to discuss U.S. Army Corp of Engineers (USACE) permit application for the Vía Verde project.
- June 30, 2010 The Service provided comments via email to the Consultants regarding the Vía Verde project, identifying suitable habitat for federally listed plants in the dry limestone hills from Guayanilla to Ponce (8 species), central mountains (5 species), moist limestone within the Rio Abajo / PR 10 area (9 species), northern karst region (10 species), and 2 species from the northern wetlands and white sands. We did not recommend the establishment of transects to survey listed plants; but instead, recommended systematic plant surveys conducted by qualified and experienced personnel.
- October 18, 2010 The Service reviewed the Joint Permit Application (JPA) and the Biological Evaluation (BE). After reviewing the information, we concluded that the methodology utilized for the flora and fauna inventories was not appropriate to determine presence/absence of federally-listed species. The surveys conducted did not cover the entire project area and were not appropriately conducted. We expressed concerns regarding the use of transects to search for listed plants since federally-listed plant species show limited abundance and patchy distribution and may be missed if systematic surveys are not conducted. In conclusion, the Service determined that the BE failed to appropriately design survey methodologies to maximize detection of federally-listed plants, it did not include site-specific habitat characterization, and it did not include appropriate survey methods to collect data on listed flora and fauna. Therefore, we concluded that the determination of effects for listed species was not supported by the best information. The Service recommended a Biological Assessment (BA) be prepared for the project and that appropriate site-specific surveys be designed and conducted.

October 26, 2010 CESFO staff met with project consultants to discuss Service's comments provided on October 18, 2010 and the need to develop site-specific surveys for listed species. At that meeting, the project consultants agreed to develop a work plan to address Service's concerns regarding federally-listed species, survey schedules and qualification of staff to conduct such surveys.

November 5, 2010 PREPA submitted a work plan to address concerns regarding federally-listed species to the Service.

November 10, 2010 The Service reviewed the work plan and provided comments to PREPA. We agreed with the approach of characterizing the suitable habitat for endangered raptors (broad-winged hawk and sharp-shinned hawk) in a GIS layer utilizing expert's opinion, maps of previously known breeding areas or home ranges, data from previous studies and published references. However, we insisted on the need to conduct appropriate surveys for the species. PREPA proposed to survey for listed plants at intervals of 100 meters (m) within suitable habitat. The Service insisted that interval sampling and transects were not appropriate methods to search for listed plants within the project area, and recommended that the areas that harbor suitable habitat for listed species be entirely and systematically screened using personnel trained to recognize sterile specimens of listed plants. We recommended a working meeting between CESFO staff and Consultants to delineate survey areas and joint site visits to determine suitability of the sampling approach for each area. For the Puerto Rican crested toad, we recommended that, before surveys were initiated, survey areas should be discussed and delineated between CESFO staff and contracted personnel by the Applicant. We also recommended intensive surveys for the endangered Puerto Rican nightjar during its breeding season, to determine amount of suitable habitat to be affected by the proposed project and the number of singing males to be affected by the project. Regarding the Puerto Rican boa, we recommended that the amount of suitable boa habitat potentially affected by the project be appropriately delineated and quantified. Once the boa areas were delineated, we recommended that alternatives be explored to avoid these areas and conservation measures be implemented to minimize possible adverse effects on listed species and their habitats. The implementation of search and rescue protocols may affect the Puerto Rican boa and its behavior. Although we recognized that protocols to search and rescue boas may be needed to minimize the possibility of taking individuals during the construction phase, we recommended the implementation of such protocols as a last resort and only after impacts to this species had been minimized by relocating the route outside of suitable boa habitat.

- November 18, 2010 CESFO staff met with Consultants to discuss comments provided on November 10, 2010. Further discussions regarding protocols to survey listed raptors occurred during meetings and conference calls in December 2010.
- December 8, 2010 CESFO staff met with Consultants to discuss appropriate protocols for survey listed raptors and plants.
- December 13, 2010 CESFO staff visited proposed project route in the Peñuelas area to identify areas that must be surveyed extensively for listed plants.
- December 15, 2010 The Service provided comments to USACE regarding the Public Notice (PN) for the proposed project. We concurred with the preliminary may affect determination for listed species and requested a complete initiation package to initiate consultation under Section 7(a)(2).
- December 20, 2010 CESFO staff visited proposed route in the Peñuelas area to keep identify suitable habitat to be extensively surveyed for listed plants.
- December 21, 2010 Consultants submitted the work plan for raptor surveys along the project route. We requested additional information on December 29, 2010.
- December 30, 2010 Consultants submitted additional information regarding species surveys to the Service.
- January 4, 2011 CESFO staff and Consultants conducted a site visit to review the proposed observation points for the raptors surveys. The Service recommended two additional survey areas to be included in the proposed surveys.
- January 7, 2011 Consultants agreed to add these two additional survey areas.
- January 12, 2011 The Service provided comments to Consultants regarding survey protocols, maps for the endangered raptors, and plant surveys. We recommended six additional observation points and provided a map with the locations of the suggested observation points for the surveys. We recommended that observation points by geographic location be surveyed simultaneously. This approach is very similar to the method used by the Puerto Rico Department of Natural and Environmental Resources (DNER) and the Service for other bird surveys such as the Puerto Rican parrot. We recommended that survey points near the Río Abajo Commonwealth Forest be surveyed for presence of the Puerto Rican parrot. We also provided comments regarding plant surveys since PREPA failed to provide a survey schedule for plants and the written methodology for plant surveys. In the communication, we provided habitat characteristics of the areas visited on December 13 and

December 20, 2010. The Service identified and provided coordinates of specific areas that needed comprehensive surveys.

January 23, 2011

Consultants submitted for the Service evaluation, a project proposal to conduct surveys for the Puerto Rican nightjar along the project route.

January 27, 2011

The Service provided comments to the Consultants regarding both raptor and nightjar survey protocols, and expressed concerns regarding potential nightjar habitat impacts; since the area to be affected by the project ROW has been identified by experts on this species as the best habitat for the nightjar in the Guayanilla-Peñuelas area. We recommended that the project route be modified to avoid habitat destruction and fragmentation of this important habitat for nightjars. In addition, we requested the methodology for plant surveys.

January 31, 2011

PREPA submitted a protocol for the search of federally-listed plants along the proposed project route.

February 1, 2011

CESFO staff participated in the USACE Interagency Meeting for the Via Verde project.

February 7, 2011

The Service provided technical assistance and recommendations on the plant survey protocol to PREPA. We provided comments regarding the use of parallel transects to survey target areas for threatened and endangered plant species and recommended additional personnel. The Service expressed concerns regarding the potential for impacts to limestone hills (“mogotes”) and the presence of endangered species within “mogotes”. We recommended that the applicant assess the entire “mogote” area, including the base of the hills along the alignment as target areas to be surveyed as well as the access roads and staging areas. The Service commented that during sites visits to the Peñuelas area it was noted that some habitat assessment was conducted outside the center line of the project. We recommended that all parallel transects be marked using a GPS and be submitted as a GIS layer in the final report. This GIS layer would be overlaid over the ROW of the project, which would allow us to evaluate if the surveyed sites were within the area to be impacted, and if further evaluations were needed. Plant experts and surveyors would be provided with the latest pipeline alignment so that they could evaluate the actual project footprint. The Service continued recommending surveying the Adjuntas area. We expressed interest in conducting site visits to evaluate the habitat for endangered species and provide technical assistance to PREPA. We recommended that PREPA

provide a detailed schedule to allow CESFO staff to joint project consultants in the field.

- February 7, 2011 CESFO staff met with USACE, the applicant, and Consultants to discuss nightjar surveys.
- February 11, 2011 CESFO staff met with Consultant to discuss nightjar survey methodology.
- February 14, 2011 Consultants submitted proposed transects for the Puerto Rican nightjar presence/absence study.
- February 16, 2011 The Service provided comments regarding the nightjar study transects and requested a field work schedule. We highlighted the importance of the nightjar habitat to be affected by the project and recommended that the project route be modified to avoid fragmentation of this important habitat.
- March 1, 2011 Consultants provided the Service with additional information regarding plant surveys.
- March 2, 2011 CESFO staff participated in the USACE Interagency Meeting for the Via Verde project.
- March 9, 2011 CESFO staff met with Consultants regarding plant surveys.
- March 12, 2011 Consultants submitted via email reports regarding studies conducted for the Puerto Rican parrot, Puerto Rican nightjar, Puerto Rican crested toad, coquí llanero, and endangered raptors.
- March 24, 2011 Consultants submitted the project alignment to the Service.
- March 25, 2011 USACE submitted the alignment changes to the Service.
- April 20, 2011 USACE submitted the Biological Assessment for the Via Verde project to the Service.
- April 20, 2011 USACE sent the Essential Fish Habitat Evaluation provided by PREPA's consultant, via e-mail.
- April 28, 2011 CESFO and USACE staff conducted a joint visit to the EcoEléctrica LNG facilities in Guayanilla to discuss the operation of the facility.
- May 5, 2011 Consultants submitted via email a map showing distribution of the Puerto Rican parrot within the Rio Abajo Commonwealth Forest.

May 10, 2011 CESFO staff met with the USACE to discuss the BA.

May 11, 2011 CESFO staff participated in the USACE Interagency Meeting for the Via Verde project.

May 16, 2011 CESFO staff met with the USACE, the applicant and project consultants to address Service's concerns regarding possible adverse effects to listed species.

May 17, 2011 Consultant provided geographic coordinates of the endangered plant palo de rosa (*Ottoschulzia rhodoxylon*) within the project area, via e-mail.

May 18, 2011 DNER provided the Service information regarding a leatherback sea turtle nesting activity on the Levittown beach area via e-mail.

May 18, 2011 CESFO staff and Consultants conducted a site visit to Peñuelas, Alternative Route #1.

May 19, 2011 CESFO staff participated in a conference call with the USACE and Consultant to discuss preliminary results of the site visits conducted to project areas.

May 20, 2011 The Service sent a letter providing technical assistance on the BA and EFH documents submitted by PREPA. The Service letter included recommendations to the BA and three enclosures: 1) Technical assistance from the Service for the review of the biological assessment for the Via Verde project, 2) Technical assistance from the Service regarding aquatic resources impacts of the proposed Via Verde project, and 3) Other concerns.

May 23, 2011 CESFO staff, DNER, PREPA and Consultants conducted a site visit to assess areas adjacent to the road PR 10 area in Utuado.

May 25, 2011 CESFO staff and Consultants conducted a site visit to Peñuelas to assess Alternative Route #2.

May 25, 2011 CESFO staff, PREPA, USACE and Consultants conducted a site visit to the Levittown project site to assess project alignment and measures to avoid impacts to sea turtles.

May 26, 2011 CESFO staff and Consultants conducted a site visit to the Manatí, Vega Baja areas to assess alternative routes.

May 27, 2011 The Service submitted a follow-up letter to the USACE regarding the Antillean manatee (*Trichechus manatus manatus*).

June 6, 2011 CESFO staff and Consultants conducted a site visit to Peñuelas to assess Alternative Route #3.

June 6, 2011 Consultant submitted the Service meeting notes taken at meeting on June 2, 2011.

June 8, 2011 CESFO staff participated on the USACE Interagency Meeting for the Vía Verde project.

June 10, 2011 The Service provided the USACE a short list of plant species to be evaluated in the project BA.

June 14, 2011 CESFO staff and Consultants conducted a site visit to the Cerrote area in Adjuntas to assess the alternative route.

June 15, 2011 Consultants submitted shape-files of the project alignment and additional survey information to the Service for review.

June 15, 2011 CESFO staff reviewed information submitted and provided a response to the project consultants.

June 21, 2011 Consultants submitted a quantitative analysis of nightjar habitat to be affected in Peñuelas.

June 23, 2011 CESFO and USACE staff discussed, via telephone, pending issues regarding listed species for the development of the BA for the project.

June 24, 2011 CESFO staff met with USACE staff regarding listed species and pending issues for the development of the BA.

June 26, 2011 Consultants submitted shape-files showing a revised project alignment in the Vega Baja area.

June 29, 2011 CESFO staff met with USACE staff to discuss the Consultants' project shape-files, pending issues for the development of the BA and possible conservation measures for listed plants and other listed species.

July 1<sup>st</sup>, 2011 CESFO staff submitted to the USACE possible conservation measures for plants, as discussed during the meeting on June 29, 2011.

July 11, 2011 The Service submitted a Biological Assessment for the Via Verde project and requested initiation of formal consultation under Section 7(a)(2) for the Puerto Rican boa, Puerto Rican broad-winged hawk and Puerto Rican sharp-shinned hawk. USACE also determined that the project was not likely to adversely affect four (4) animal species [the Puerto Rican parrot (*Amazona vittata vittata*), Puerto Rican nightjar

(*Caprimulgus noctitherus*), Puerto Rican crested toad (*Peltophryne lemur*), coquí llanero (*Eleutherodactylus juanariveroi*)]; and 27 plant species [*Auerodendron pauciflorum*, *Banara vanderbiltii*, *Buxus vahlii*, *Calyptronoma rivalis*, *Catesbaea melanocarpa*, *Chamaecrista glandulosa* var. *mirabilis*, *Cordia bellonis*, *Cordia rupicola*, *Cornutia obovata*, *Cyathea dryopteroides*, *Daphnopsis helleriana*, *Eugenia woodburyana*, *Goetzea elegans*, *Juglans jamaicensis*, *Myrcia paganii*, *Ottoschulzia rhodoxylon*, *Pleodendron macranthum*, *Polystichum calderonense*, *Schoepfia arenaria*, *Solanum drymophilum*, *Stahlia monosperma*, *Tectaria estremerana*, *Thelypteris inabonensis*, *Thelypteris verecunda*, *Thelypteris yaucoensis*, *Thichilia triacantha*, and *Zanthoylum thomasianum*].

- July 12, 2011 USACOE staff submitted via e-mail the project alignment shape-files.
- July 13, 2011 CESFO staff participated in the USACE Interagency Meeting for the Via Verde Project.
- July 15, 2011 The Service concurred with USACE effect determinations via letter.
- July 27, 2011 USACE submitted revised GIS shape-files of the project route.

**FWS Log No:** 72LP-012  
**Applicant:** Puerto Rico Electric and Power Authority (PREPA)  
**Action Agency:** U.S. Army Corps of Engineers  
**Applicant No:** SAJ 2010-02881 (IP-EWG)  
**Date Started:** July 15, 2011  
**Project Title:** Via Verde Project  
**Ecosystem:** U.S. Caribbean  
**Municipality:** Peñuelas Adjuntas, Utuado, Arecibo, Barceloneta, Manatí, Vega Alta, Vega Baja, Dorado, Toa Baja, Cataño, Bayamón, and Guaynabo.  
**State:** Puerto Rico

Table 1. Species and critical habitat evaluated for effects and those where “no effect (NE)” was determined or the Service has concurred with a “not likely to adversely affected (NLAA)” determination.

<b>SPECIES or CRITICAL HABITAT</b>	<b>PRESENT IN ACTION AREA</b>	<b>PRESENT IN ACTION AREA BUT “NO EFFECT” or “NOT LIKELY TO BE ADVERSELY AFFECTED”</b>
Puerto Rican parrot	X	NLAA
Puerto Rican nightjar	X	NLAA
Puerto Rican crested toad	X	NLAA
Coquí llanero (Petitioned Species)	X	NLAA
Auerodendron pauciflorum	X	NLAA
Banara vanderbiltii	X	NLAA
Buxus vahlii	X	NLAA
Calyptrionoma rivalis	X	NLAA
Catesbaea melanocarpa	X	NLAA
Chamaecrista glandulosa var. mirabilis	X	NLAA
Cordia bellonis	X	NLAA
Cordia rupicola	X	NLAA
Cornutia obovata	X	NLAA
Cyathea dryopteroides	X	NLAA
Daphnopsis helleriana	X	NLAA
Eugenia woodburyana	X	NLAA
Goetzea elegans	X	NLAA
Juglans jamaicensis	X	NLAA
Myrcia paganii	X	NLAA
Ottoschulzia rhodoxylon	X	NLAA
Pleodendron macranthum	X	NLAA
Polystichum calderonense	X	NLAA
Schoepfia arenaria	X	NLAA
Solanum drymophilum	X	NLAA
Stahlia monosperma	X	NLAA
Tectaria estremerana	X	NLAA
Thelypteris inabonensis	X	NLAA
Thelypteris verecunda	X	NLAA
Thelypteris yaucoensis	X	NLAA
Thichilia triacantha	X	NLAA
Zanthoxylum thomasianum	X	NLAA
Yellow-shouldered blackbird	X	NE
Green sea turtle	X	NE
Leatherback sea turtle	X	NE
Hawksbill sea turtle	X	NE
Mitracarpus maxwelliae	X	NE
Mitracarpus polycladus	X	NE
Puerto Rican Plain Pigeon	X	NE
Antillean manatee	X	NE
Brown pelican (delisted)	X	NE

The species above are either “not affected” or “not likely to be adversely affected” by this action and have no designated critical habitat; hence, will not be discussed further in this biological opinion. The Applicant proposed conservation measures for the Puerto Rican nightjar, Puerto Rican crested toad, coquí llanero and listed and candidate plant species that are discussed in the Project Conservation Measures section of this Biological Opinion (BO).

## **BIOLOGICAL OPINION**

### **DESCRIPTION OF THE PROPOSED ACTION**

The Via Verde project consists of the construction of a buried 24-inch (in) diameter steel natural gas (NG) pipeline from the EcoEléctrica LNG Terminal in Peñuelas, north to the Cambalache Termoeléctrica electric power plant in Arecibo, then east to the Palo Seco and San Juan power plants. The approximately 92 mile (mi) pipeline will pass through the municipalities of Peñuelas Adjuntas, Utuado, Arecibo, Barceloneta, Manatí, Vega Alta, Vega Baja, Dorado, Toa Baja, Cataño, Bayamón, and Guaynabo.

Installation of the approximately 92 mi pipeline will generally require an initial construction right-of-way (ROW) approximately 100 feet (ft) wide in uplands and a maintained post-construction ROW of 50 ft. The total project area encompasses approximately 1,114 acres (ac) (92 mi X 100 ft ROW); approximately 369 ac or less of which are Waters of the United States. The actual construction corridor within the ROW will vary from 60 ft in some sensitive upland habitats to the maximum of 100 ft. In wetland areas, the construction corridor will be reduced to limit the amount of temporary impacts (i.e. wetland habitat = max. 60 ft wide) and there will be no maintained post-construction ROW. The pipeline will traverse 235 water bodies (rivers, wetlands, canals). The project will temporarily impact approximately 369 ac or less of jurisdictional wetlands and aquatic resources (Waters of the U.S.).

### **Action Area**

Service regulations define “action area” as “all areas affected directly or indirectly by the federal action and not merely the immediate area involved in the action,” (50 C.F.R. § 402.02.). Accordingly, this BO addresses all areas potentially affected by the action with suitable habitat for the Puerto Rican boa, Puerto Rican broad-winged hawk and Puerto Rican sharp-shinned hawk.

For the purpose of this BO, the action area is defined as the project ROW along the 92 mi project route. In addition, the action area includes construction areas, storage areas, access roads and land to be acquired to compensate for adverse effects to wildlife.

Figure 1. Action area for the Via Verde Project.



**Legend**

— Via Verde 7-20-2011  
Municipalities

0 3.75 7.5 15 22.5 30 Kilometers



**Project Conservation Measures**

The Applicant has incorporated conservation measures into the project description to avoid, minimize and compensate for the effects of the proposed project to the Puerto Rican boa, Puerto Rican broad-winged hawk, and the Puerto Rican sharp-shinned hawk. The following information identifies the proposed measures:

Puerto Rican boa:

Conservation measures proposed by the Applicant for the Puerto Rican boa include educating project staff, pre-construction studies, and relocation of individuals to protected areas. The proposed conservation measures are as follow:

1. All construction personnel will be required to attend instructive meetings related to the Puerto Rican boa. Information to be presented at these meetings will include a description of the snake, protection measures which must be undertaken to insure their survival, penalties for harassing boas, and the relocation and capture procedures described below.
2. During the clearing and construction of the right-of-way, two field biologists will carry out daily surveys for presence of the Puerto Rican boa in each construction area

before starting work. Heavy equipment will be checked to see if any boa occupied it overnight. Observations are to be carried out daily and any changes to the work plan shall be considered when planning for examinations. The search shall take place from 5: 00 a.m. to 7: 30 a.m. any day that heavy equipment is used, and whenever heavy machinery that has not been in use for 24 hours or longer is operated.

3. In the event that the presence of any individual of Puerto Rican boa is detected, the protocol below will be followed to capture the specimen for relocation. If construction staff discovers a snake in the workspace, all machinery 50 ft around the snake shall cease operation and the resident engineer shall be notified. An authorized project biologist will capture the snake for relocation in accordance with the protocol mentioned above. Construction activities may continue once the snake has been removed.

4. Any captured snake will be relocated to the Guajataca or Río Abajo Commonwealth forests, or other public lands in an area with habitat similar to the capture area.

5. Boa monitoring reports will be prepared monthly, summarizing the results of surveys, the capture of any boas, and relocation activities. Reports are to be forwarded to the Service and the DNER as per permit conditions.

#### Protocol for Capture and Relocation of the Puerto Rico Boa

Resident project biologists are responsible for implementing these procedures in the event a Puerto Rican boa is found within the limits of the established ROW during construction. At least one resident biologist will be present in the project during all working hours. The following steps will be taken in the event a snake is found:

1. Workers and equipment up to 50 ft away from the boa will stop all work.
2. A person will observe the snake while another alerts the project engineer or the biologist.
3. The project biologist will capture the snake with a snake rod or other appropriate instrument, not inflicting any damage to the snake. The snake will be placed in a bag or box in a cool, dark place until it is transported to the relocation site.
4. All captured Puerto Rican boas will be released in the forests of Guajataca or Río Abajo Commonwealth forests, or any other public land with habitat similar to the area where the snake was captured. All other species of snakes will be released outside the limits of the existing construction ROW or future construction sites at the end of the work day.
5. The project biologist releasing the snake will be responsible for writing an incident report. This report shall contain the following information:
  - a. Exact location of the snake when observed and the circumstances of the observation.

- b. Size, length, weight, body condition (e.g., emaciated, healthy, sick), and sex of the specimen.
- c. The order and the procedures followed after the observation time.
- d. Personnel involved in every step of the procedure.
- e. The perceived condition of the snake at the time of observation and the snake's condition when captured and removed.
- f. Species of snake, if known.
- g. The time and location where the snake is released.
- h. Any photographs taken of the snake.
- i. In the event a dead snake is discovered inside the construction ROW, the carcass will be placed in a sealed plastic bag with ice or frozen until a positive identification can be made. If the snake is identified as a Puerto Rican boa, the body must remain frozen and the Service and the DNER will be notified for additional instructions.
- j. The report shall be signed by the project biologist and included in the monthly report submitted to the Service and DNER.

Puerto Rican broad-winged hawk:

Based on the information discussed in the BA, the Applicant proposed several options to minimize possible adverse effects of the project on the Puerto Rican broad-winged hawk, including rerouting certain pipeline segments to avoid direct impacts or other techniques to reduce impacts to this species. Available information on spot mapping and raptor surveys (Hengstenberg and Vilella 2004) indicates that broad-winged hawks were frequently observed outside the Rio Abajo Commonwealth forest boundaries. Three areas of particular importance to broad-winged hawks on the periphery of Rio Abajo Commonwealth Forest in the northeast, northwest, and south-central portions of the reserve have been documented by Vilella and Hengstenberg (2006). Broad-winged hawk pairs were observed engaged in courtship and territory display behaviors in privately owned lands during studies in 2001 and 2002. These private lands comprised about 1,712 ac (693 ha) of mostly closed-canopy forest, and should be considered high priority areas for protection or acquisition. Protection of broad-winged hawk habitat within private lands surrounding Río Abajo Forest could entail cooperation between government agencies, public entities, and landowners. PREPA proposed to compensate for unavoidable impacts to broad-winged hawk habitat by acquiring up to 100 acres of suitable hawk habitat presently held in private ownership. Based on the information in the BA, an area immediately west of the Rio Abajo Commonwealth Forest has been recommended by DNER. After acquisition, this land would be turned over to DNER in perpetuity for management. Figure 2 illustrates the preliminary proposed location for acquisition. Additional mitigation proposed by the Applicant involves planting of 3 trees for every tree removed. Trees could be planted within the cleared ROW, except in the 50 ft no root zone maintenance area.

Figure 2. Proposed area for acquisition for the Via Verde Project, USACE (2011).



The Applicant proposed that construction activity will be restricted to the non-breeding season (July to December) in Focal Areas 1 and 2 as identified in the BA. This will minimize impacts to nesting birds and to their courtship aerial flights. During construction, specialized biologists familiar with the sharp-shinned hawk and broad-winged hawk will conduct surveys ahead of the construction crews to identify the presence/absence of species and any nesting trees (Identification of a nesting site will necessitate coordination with the Service). If nesting trees are identified, the pipeline alignment and associated clearing activities can be adjusted to avoid impacts to those trees.

#### Puerto Rican sharp-shinned hawk:

Based on the information discussed in the BA, the Applicant proposed several options to minimize impacts of the project on the Puerto Rican sharp-shinned hawk, which include re-routing certain pipeline segments to avoid direct impacts or other techniques to reduce impacts to this species. PREPA proposed to compensate for unavoidable impacts to sharp-shinned hawk habitat by acquiring up to 50 acres of suitable hawk habitat presently held in private ownership. In addition, the proposed mitigation consists of planting 3 trees for every tree removed within the construction corridor. Trees will be planted in the cleared ROW, except in the 50 ft maintenance area. The Applicant proposed that construction activity will be restricted to the non-breeding season (July to December) in Focal Areas 1 and 2 as identified in the BA. This will minimize impacts to nesting birds and to their courtship aerial flights. During construction, specialized biologists familiar with the sharp-shinned hawk and broad-winged hawk will conduct surveys ahead of the construction crews to identify the presence/absence of species and any nesting trees (Identification of a nesting site will necessitate coordination with the Service). If nesting trees are identified, the pipeline alignment and associated clearing activities will be adjusted to avoid impacts to those trees.

These conservation measures are consistent with recovery actions 1.2, 11 and 24 of the recovery plans for the Puerto Rican boa, the Puerto Rican sharp-shinned, and the Puerto Rican broad-winged hawks, respectively:

1.2. Survey Puerto Rico for location of unknown populations of the Puerto Rican boa.

11. Conduct surveys within the known range of the species and determine population trends. Surveys should be conducted in the six public forests and adjacent lands where the species are known in order to update information on the present distribution and relative abundance of the Puerto Rican broad-winged hawk and the Puerto Rican sharp-shinned hawk. The last surveys were conducted in 1992, and Guilarte Commonwealth Forest was not surveyed. The Caribbean National Forest, which is the largest forest from where the species are known, was only surveyed for 2 days. Periodic censuses of extant populations should continue on a regular basis, at least once every 2 years, to determine relative abundance and population trends of the species. To reduce potential errors in population estimates, a standard census protocol should be adopted by all agencies involved in the recovery of the species. This will improve the understanding and manipulation of field data reports and will allow for population analysis.

24. Obtain protective status for habitat on privately-owned lands. Privately-owned habitat should be protected through land acquisition, establishment of conservation easements, development of Habitat Conservation Plans, and implementation of private land incentive programs and landowner agreements with the DNER, U.S. Department of Agriculture, and the Service.

As described in the Consultation History section, the Corps determined that the proposed project may affect, but is not likely to adversely affect 31 species, including three federally-listed animals, one petitioned animal species, 26 federally-listed plants and one candidate plant species. The Service concurred with the Corps determination based on changes to the proposed project alignment and width of the construction ROW as presented in the GIS shape-files provided in July 2011, and the implementation of the following conservation measures:

### **Puerto Rican nightjar**

In order to avoid impacts to nightjars during construction, the Applicant proposed the following conservation measures:

1. Commencement of any clearing of vegetation required for construction, within or adjacent to mature dry forest where nightjars are abundant, will occur outside of the nightjar breeding season (January to early July). However, in emergency situations, if vegetation needs to be cleared during the nesting season, experienced and qualified biologists will survey the area proposed for clearing for nightjar nests prior to any clearing activity being undertaken. In the event that nests are found, the nests will be avoided by reducing or relocating the ROW, or by delaying the activity until the nightjars fledge their young.

2. Construction protocol and an educational program will be implemented to ensure that all construction activities minimize any potential and avoidable impacts during the construction phase. An on-site biologist will be available during construction activities to ensure compliance with the protocol.

3. Specific construction techniques must be used to reduce the temporal loss of habitat for the nightjar. In areas used for temporary construction access, the vegetation would be "run over" by equipment rather than clearing the vegetation.

4. Habitat restoration, conservation, among others, will be proposed to compensate for habitat loss. One of the most crucial issues facing Puerto Rico today is the need to set aside privately owned lands and the continued need to purchase additional lands deemed critical habitats for the large number of endangered, threatened, and rare species on both federal and commonwealth lists. Therefore, a preliminary proposal is for land acquisition of approximately 290 acres (based on calculation of 1.9 acres multiplied by 14:1 plus 38 acres multiplied by 7:1) of such habitat areas to further mitigate unavoidable impacts to nightjar habitat from the project.

On July 15, 2011, the Service recommended the following measures to be incorporated into the permit conditions.

1. Proposed route Alternative #2 (June 6, 2011) shall be used to minimize impacts to nightjar habitat.
2. Although the BA established that 1.9 acres of prime nightjar habitat and 38 acres of low quality nightjar habitat would be impacted, our review of the shape files indicates that about 8 acres of prime nightjar habitat would be affected. Therefore, the Corps and the Service will continue working with the Applicant on the land acquisition plan for the nightjar.

#### **Puerto Rican crested toad**

The Puerto Rican crested toad or "sapo concho" is very difficult to detect due to their small size and secretive habits. However, due to the potential for occurrence of this species in the project corridor ROW, the Applicant proposed the implementation of the following conservation measures:

1. During the initial establishment and clearing of the construction ROW, two biologists will conduct daily monitoring before work begins to detect the presence of the crested toad in every area of construction with the potential for harboring the species.
2. These monitoring activities will be carried out daily; concurrent with the monitoring required for the Puerto Rican boa and will be focused on cover areas (cracks in rocks and tree species) that are typically used by these species.

3. All monitoring events will be incorporated into and will be carried out in coordination with the work plan of the contractor; daily changes to these work plans shall be considered in conducting monitoring events.
4. Monitoring events will be carried out between 5:00 a.m. and 7:30 a.m. on days when major equipment will be operated within the construction ROW.
5. When a crested toad is detected, established capture and relocation protocols (similar to those identified for the boa) shall be implemented. Data regarding all individuals identified within the ROW, captured and/or relocated, will be incorporated into the daily environmental monitoring logs.
6. All collections, relocations, and data transmissions will be coordinated with the appropriate local, Commonwealth, and Federal regulatory agencies.
7. The construction ROW corridor will be reduced to 70 ft from 100 ft in potential habitat for this species.

### **Coquí Llanero**

Conservation measures for the coquí llanero will involve conducting surveys for the species prior to any construction activities in each area considered to have potential habitat for the species. A local qualified biologist will be on staff to conduct these surveys. During surveys, detected individuals of the coquí llanero will be relocated into a nearby undisturbed suitable habitat.

The coquí llanero is a Commonwealth listed species and coordination of conservation measures has been in process with the DNER. A draft letter summarizing the avoidance protocol was delivered in April 2011. A final letter will be submitted to DNER upon approval of the proposed methods.

1. During the initial establishment and clearing of the construction ROW, two biologists will conduct daily sampling to detect the species in the construction area before work begins.
2. These monitoring activities will be carried out daily, concurrent with the monitoring required for the Puerto Rican boa.
3. All monitoring events will be incorporated into and will be carried out in coordination with the work plan of the contractor; daily changes to these work plans shall be considered in planning the work.
4. Monitoring events will be carried out between 5:00 a.m. and 7:30 a.m. on days when major equipment will be operated within the construction ROW.
5. When a species is detected, established capture and relocation protocols (similar to those identified for the boa) will be implemented. Data regarding all species identified

within the ROW, captured and/or relocated, will be incorporated into the daily environmental monitoring logs.

6. All collections, relocations and data transmissions will be coordinated with the appropriate local, state, and federal regulatory agencies.

On July 15, 2011, the Service recommended the following measures to be incorporated into the permit conditions.

1. Any proposed efforts to collect and re-locate individuals should be carefully evaluated with species experts and alternatives shall be developed to avoid possible effects to the species.
2. Conservation alternatives developed for this species shall be closely coordinated with species experts to ensure the protection of the species.

### **Conservation Measures for Listed and Candidate Plant Species:**

#### Construction ROW

The construction ROW is typically 100 ft wide within which the construction contractor will be permitted to stage materials or drive vehicles, and in non-wetland areas, be allowed to clear the land.

1. Reduction of the construction ROW width from 100 ft to a total of 60 ft will be shown on the final project drawings on steep slopes and narrow ridges.
2. The accompanying GIS shape file "Listed Plants Reduced Footprint" show additional areas where the ROW width will be to 60 ft.

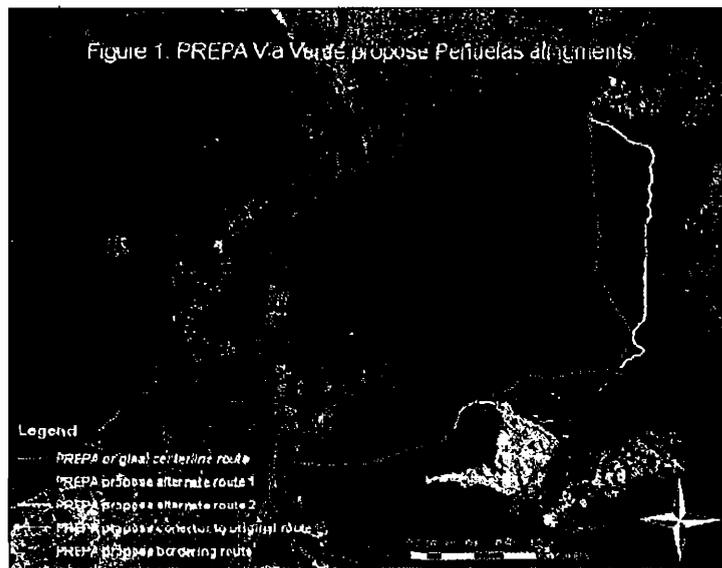
#### Advance Construction Survey

Relatively undisturbed areas will be surveyed prior to starting vegetation removal.

1. In the Peñuelas region, the "relatively undisturbed area" is the eastern extent of the east-west alignment (Orange line in the Figure 3). In other regions the "relatively undisturbed area" will be extent of alignment excluding that in active agriculture, alongside highways, or wetlands. Exact definition of these areas can be refined during consultation;
2. The boundary of the construction ROW shall be clearly flagged in advance of the survey;
3. The appropriate methodology will be used (not transects) to survey the entire ROW for listed plants;
4. A qualified botanist with expertise and experience identifying the species expected in the area will perform the surveys.
5. At least 60 days before the first survey, the Applicant/permittee will provide the name of candidate botanists, their credentials and academic records to demonstrate their expertise to recognize the species;

6. At least 30 days before the first survey (and updates thereafter), the Applicant/permittee will provide a detailed schedule of the surveys to the USACE/Service and a point of contact from whom they can obtain the “meet me” location to provide the opportunity to participate in any of the surveys;
7. After the survey, if no individuals of the species are found, the applicant/permittee shall submit the survey results to the USACE/ Service not less than 30 days before the scheduled start of land-clearing activities to provide opportunity for USACE/ Service to review and visit the area;
8. If listed plants are found, procedures at 5.1.30.4 of the BA (Section titled If Species Identified) will be implemented.

Figure 3. Via Verde Project alignment in Peñuelas, Puerto Rico (Figure 1 of the BA (2011)).



### Concurrent Construction Survey

The entire alignment ROW will be surveyed prior to and during land-clearing activities.

1. The boundary of the construction ROW shall be clearly flagged in advance of the survey;
2. The appropriate methodology will be used survey the construction ROW prior to land clearing;
3. During land clearing activities, a botanist will be on site to ensure that adjacent areas with suitable habitat are not affected and conservation measures are appropriately implemented;
4. A qualified botanist with expertise and experience in identifying the species expected in the area will be present.
5. At least 60 days before the botanist begins work on-site, the Applicant/permittee will provide the name of candidate botanists, their credentials and academic records to demonstrate their expertise to recognize the species;

6. At least 30 days before the first survey, the Applicant/permittee will provide a projected schedule of the surveys to the USACE/ Service and updates thereafter adjusting for the pace of construction and a point of contact from whom they can obtain the “meet me” location to provide opportunity to accompany any of the surveys;
7. After the survey, if no individuals of the species are found, the applicant/permittee shall submit a monthly summary of the surveys to the USACE / Service;
8. If listed plants are found, procedures at 5.1.30.4 of the BA (Section titled If Species Identified) will be implemented.

#### If Species are Identified

If an individual of a listed species is identified during surveys discussed in previous sections, the botanist shall contact the Service to confirm the identity of the species.

1. If a detection occurs during construction, ongoing activity within 50 meters will cease and no new activity will commence until after (1) the Service confirms the species was mis-identified or (2) USACE/Service approves resumption of work after revisions of the project to avoid and protect the species;
2. After the Service confirms the species identification, a comprehensive species survey of the habitat will be carried out within the area “including outside of the ROW” to determine if the detected individuals are part of a larger viable population.
  - a. No impacts to the habitat will occur until the applicant conducts the survey and USACE/Service approves resumption of work after revisions of the project to avoid and protect the species;
  - b. The appropriate survey data (site map, transect waypoints, etc) shall be submitted to the USACE/Service to be evaluated;
3. The presence of the species should be documented thru digital photography and if possible, a sample should be collected to be deposited at the herbariums of the University of Puerto Rico (MAPR or UPRRP). The botanist should be trained in collecting herbarium specimens and should collect the minimum field data “number of adults, number of seedlings, evidence of flowers or fruits, GPS readings, etc”. The collection of herbarium samples should not compromise an individual or a population.
4. The Applicant/permittee will submit a proposal to modify the project to re-align the construction ROW to avoid the individual(s);
  - a. Upon preliminary approval by USACE/Service, the Applicant will survey the re-alignment for listed species as well as other issues relevant to the permit (e.g., historic or cultural resources);
  - b. The area where the population is present shall be acquired and protected in perpetuity;
  - c. Due to possible direct / indirect impacts (changes in microhabitat conditions, sedimentation of drainage areas, loss of seed bank, intrusion of exotics, ect.) that may result in the net loss of the habitat necessary for the natural recruitment of the species, the Applicant/permittee will implement a propagation program as described at section 5.1.30.5 of the BA titled Propagation Program.
  - d. The permittee/Applicant can propose that the USACE/Service review justifications why the project cannot be re-aligned completely to avoid direct impact to one or more individual(s) of the species. If the USACE/Service accepts such justifications, the applicant will either:

1. Submit for consideration a plan for transplanting affected individuals. The plan must meet the restrictions listed in section 5.1.30.6 of the BA titled Transplanting Program; or,
  2. Submit a Biological Assessment to the USACE/Service for initiation of formal consultation under Section 7 of the Endangered Species Act for the proposed impact.
- e. No work on neither original nor proposed alignment will occur until USACE/Service approves resumption of work after revisions of the project to avoid and protect the species.

### Propagation Program

The following are measures that will be included in the development and implementation of an appropriate propagation program for the species when required by section 5.1.29.4 of the BA titled If Species Identified.

1. Propagation should be conducted by qualified personnel with expertise in the propagation of rare plants (e.g., UPR Río Piedras, UPR Mayaguez, Puerto Rico Conservation Trust) and utilizing information where propagation was successful (e.g., by Mr. Eugenio Santiago from the UPRRP for *Trichilia triacantha* and *Ottoschulzia rhodoxylon*, Mr. José “Rene” Roman of Guajataca Forest for *Buxus vahlii*, Mr. Eugenio Santiago from the UPRRP for *Eugenia woodburyana*, and KEW Botanical Garden at England for *Cordia rupicola*).
2. At the time of this writing propagation techniques have not been developed for fern species such as *Polystichum calderonense*, *Tectaria estremerana* and *Cyathea dryopteroides*, however the Applicant/permittee will investigate and consult with the Service on any new developments.
3. Collection of seed material should follow the appropriate standards to avoid impacts to the natural recruitment of a natural viable population. The collection of seed and seedling from wild population should not compromise the natural recruitment. The Service recommends that no more than 20% of the available seed material be collected.
4. Propagation should consider the genetic diversity of the species. The source of the plant material should be tracked to avoid outbreeding depression. Seed material for propagation should be collected from populations within Puerto Rico.
5. The minimum number of individuals to be established per populations will be based on that observed to be the minimum for a self sustainable population or based on the Service’s current efforts to establish self-sustaining populations.
6. The minimum number of populations to be established will be in accordance with the Recovery Plan of the species.
7. All planted individuals should be marked with an aluminum numbered tag and properly geo-referenced to track their status over the long term.
8. The area selected for the establishment of the populations must be in accordance with the recovery plan of the species.
9. Planted individuals should be watered and monitored as needed to guaranty the survival of the individuals in the field. Maintenance should include the control of exotic plants species and if necessary, the enhancement of the area with the appropriate native vegetation.

10. After the first year of establishment, all populations should be monitored periodically until individuals establish as part of a viable population. Monthly reports on the status of planted individuals should be submitted to the Service during the first year of the establishment, and subsequently on a yearly basis for the first five years.

### Transplanting Program

The Applicant/permittee can propose a transplanting plan if all the following conditions are met :

1. The USACE/Service accepts submission of a transplanting plan (as specified in section 5.1.29.4 of the BA titled If Species Identified);
2. The species is one of the following: *Ottoschulzia rhodoxylon*; *Trichilia triacantha*; *Buxus vahlii*; *Eugenia woodburyana*; *Cordia rupicola*; *Cordia bellonis*; *Daphnopsis helleriana*; *Solanum drymophilum*; *Pleodendron macranthum*; *Banara vanderbiltii*; *Myrcia paganii*; *Auerodendron pauciflorum*; and *Zanthoxylum thomasianum*;
3. The following species are not eligible for transplanting: *Catesbaea melanocarpa*, *Juglans jamaicensis*, *Polystichum calderonense*, and *Cyathea dryopteroides*. These are excluded because of very low number of total known population and/or have very restricted distribution and/or have low or no potential for transplantation success;
4. The number of individuals to be transplanted comprises 10% or less of the population, including seedlings found adjacent to the construction ROW;
5. Transplanted individuals will be transferred to the botanical Garden at Río Piedras and later planted within a protected area within the range of the species;
6. The area to establish the transplanted individuals will be enhanced by planting additional individuals in the future to make sure that it constitutes a viable population.
7. Since discovery/presence of the species in the ROW indicates the project may impact areas essential for recovery of the species, the Applicant/permittee will protect suitable habitat. The total amount of habitat to be protected will be proportional (1:1) to the amount of prime (undisturbed) suitable habitat to be affected plus the amount of suitable but degraded habitat that harbors the conditions necessary for the establishment of the species to be affected. The first priority is adding protection of the transplant receiving area if is not already protected. Second priority is protection of known populations not currently protected, e.g., placing a conservation easement on the *Buxus vahlii* population in Rincón and transferring it to the DNER. The third is protecting further suitable habitat in the region of the discovered individual(s).

### Earthwork on steep topography

Due to the steep topography of some areas, cut and fill activities are anticipated. This construction method will be limited to the minimum necessary and fill material will not be deposited down slope on undisturbed forest habitat. Fill material will be removed from the areas and not deposited down slope. If fill material is deposited down slope, it may affect further habitat outside the ROW. The purpose of this action is to minimize the possibility that fill material reaches areas that were not appropriately surveyed and to minimize the possibility of affecting listed plants populations "seedlings and seed bank". The areas identified to deposit fill material will be appropriately surveyed to ensure that additional impacts to listed species are avoided.

## Restoration of cleared area

Cleared areas that are not part of permanent ROW will be restored to the previous conditions of the area.

1. Prior to initiation of land clearing operations, the Applicant/permittee will submit to the USACE/CESFO a detailed plan for the restoration for each of the major regions. The outline for the detailed plan for the Peñuelas region follows.
2. Restoration in Peñuelas.
  - a. Habitat quality in the Guánica Commonwealth Forest can be used as a standard to reforest the affected areas within Peñuelas.
  - b. Restoration can be based on species and tree density from Murphy and Lugo (1986): Structure and Biomass of a subtropical dry forest in Puerto Rico.
    1. Plant at least a minimum 2,000 trees per acre.
    2. Include the more common species for the Guánica Forest as reported in Murphy and Lugo (1986).
    3. No exotic tree species must be used.
    4. The survival of each planted tree must be guaranteed for a period of at least five years.
    5. Watering should be provided as necessary to guarantee the survival of the planted trees.
    6. In the case of the alignment that harbors habitat but shows some evidence of recent disturbance, (e.g., north-south yellow line in the Figure 4), use Cobana negra (*Stahlia monosperma*), for reforestation purposes.

## Reporting

The Applicant/permittee will submit monthly report on implementation of the conservation measures, including summarizing the information gathered during surveys and construction phases of the project. The content of the reports and the format of the data should be coordinated with the USACE/Service prior the start of the project.

## **STATUS OF THE SPECIES/CRITICAL HABITAT**

### **Species/critical habitat description**

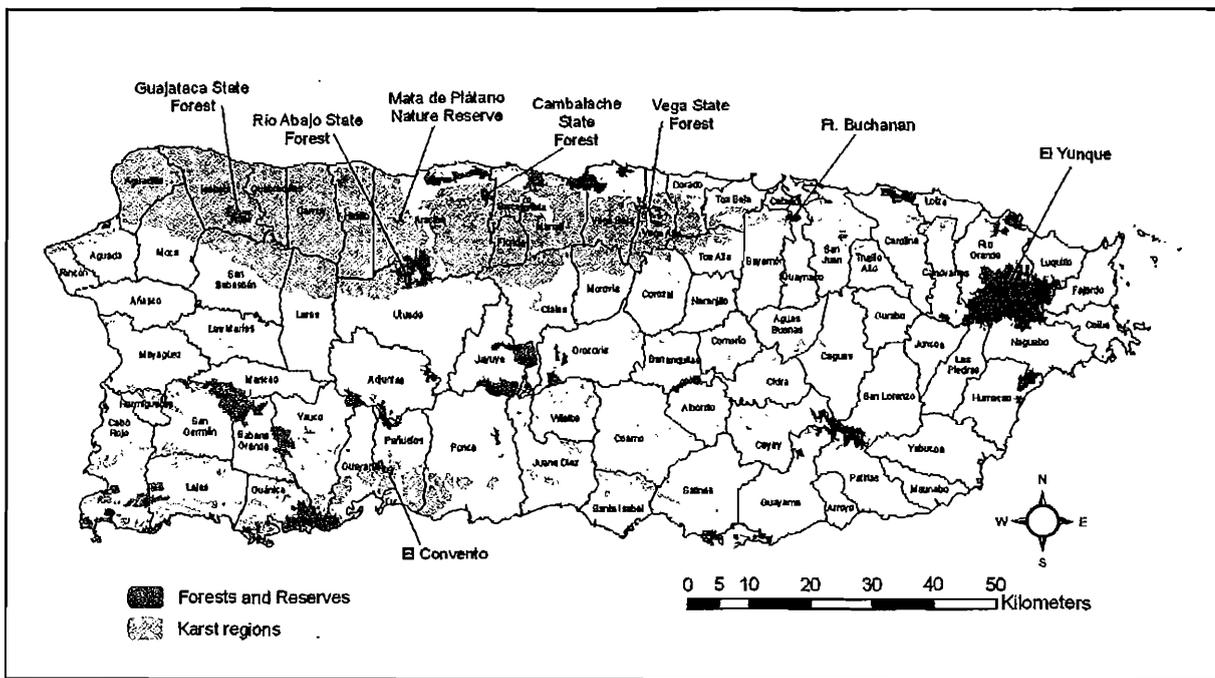
#### **Puerto Rican boa**

The Puerto Rican boa is the largest native snake species within the Puerto Rico Island Shelf. This species is endemic to the island of Puerto Rico. It may grow to a length of approximately 6 to 7 ft (1.8 to 2 m), although there are claims of larger snakes. The color patterns of the Puerto Rican boa may vary somewhat, but are generally dark colored. Rivero (1998) describes the Puerto Rican boa color as varied from tan to very dark brown, some having cross bars or spots along its body. Occasionally, a young individual may be of a yellowish or reddish color. The PR boa is not poisonous and kills its prey by asphyxiation (Rivero 1998). This species seems to employ active and ambush foraging modes and has been documented to prey on rats,

mice, bats, lizards, domestic fowl chicks, common ground doves, and invertebrates (Wiley 2003).

The altitudinal distribution of the Puerto Rican boa ranges from sea level to 3,445 ft (1,050 m) (Henderson and Powell 2009). Wiley (2003) collected two dead specimens on the road at higher elevations, 1,476 ft (450 m), in the Sierra de Luquillo. Puerto Rican Boas seems to be distributed throughout the island, but are more abundant in the karst areas of the north, between Aguadilla (northwest) towards the east to Bayamón, and considerably less abundant in the dry region of the south (Rivero 1998). Its distribution includes the northern karst region of Puerto Rico, the periphery of coastal plains and the mountain regions (Sierra de Luquillo, Sierra de Cayey, and the Central Mountain Chain). Additional sightings have been reported from the dry limestone region in the southern part of the island including Cabo Rojo, Guánica, Guayama, Ponce, Guayanilla, Salinas and Lajas.

Figure 4. Municipalities, forests, natural reserves, and karst regions within the island of Puerto Rico.



The Service has additional information from species experts, site visits and personal communications about Puerto Rican boa occurrence. For example, we know this species has been sighted in numerous caves within the karst areas of the island. We also have reports of Puerto Rican boas from several Commonwealth and private forests such as the Río Abajo Forest, Guajataca Forest, Cambalache Forest, Vega Forest, Mata de Plátano Nature Reserve, and, El Convento. The Puerto Rican boa may occupy wet montane forest to dry forest environment and also lowland forest, mangrove forest, wet limestone karst, offshore cays,

remnant coastal rainforest, pastureland with patches of exotic trees, Tabonuco and Palo Colorado forest types, plantations, and second-growth forests (from Gould *et al.* 2008).

The Puerto Rico Gap Analysis Project (GAP) developed an occurrence map and predicted distribution map for the Puerto Rican boa (Gould *et al.* 2008). They described the Puerto Rican boa as widespread in its distribution, but uncommon. For their analysis, a species record of occurrence may be confirmed when associated to a credible observation, including the location, observation date, and observer's name. Species probable records of occurrence are based on published range maps, location descriptions, or expert opinion. A species predicted records of occurrence is based on confirmed occurrence of habitat and expert opinion that the species is likely to occur. Species habitat models were linked to specific mapped land cover units or other information for which they have reliable spatial information. The PR boa predicted habitat includes 46.3% [1,023,952.81 ac] 414,379 ha] of the island, of which 9% occurs in protected areas. This does not exclude Puerto Rican boa occurrence outside of the predicted habitat. In fact, GAP illustrates the entire island of Puerto Rico as having a probable occurrence of boas based on a strong likelihood (Gould *et al.* 2008). The Puerto Rican boa predicted habitat model includes the following land cover types: moist and wet forest, woodland, shrubland, mangrove, *Pterocarpus*, mature dry forest and dry forest near water bodies, at or below 3280.84 ft (1,000 m) in elevation.

The Final Rule to include the Puerto Rican boa in the U.S. Endangered Native Fish and Wildlife was published on October 13, 1970. The Recovery Plan developed for this species was approved and signed on March 27, 1986 (USFWS 1986). The Service conducted a 5-year review for the boa in 1991(56 FR 56882). In this review, the status of many species was simultaneously evaluated with no in-depth assessment of the five factors or threats as they pertain to the individual species. The notice stated that the Service was seeking any new or additional information reflecting the necessity of a change in the status of the species under review. A draft species specific PR boa 5-year review document is currently being evaluated. No critical habitat has been designated for this species.

### **Puerto Rican broad-winged hawk**

The Puerto Rican broad-winged hawk is a small hawk with dark chocolate-brown upperparts, heavily streaked rufous breast, and a broadly banded black and white tail. Adult male and female are similar in appearance, but the female is slightly larger. This species occurs in Elfin Woodland, Sierra Palm, Caimitillo-granadillo, and tabonuco forest types of the Río Abajo Commonwealth Forest, Carite Commonwealth Forest, and El Yunque National Forest as well as within hardwood plantations, shade coffee plantations, and mature secondary forests. The Puerto Rican broad-winged hawk population is estimated at about 125 individuals island-wide (USFWS 2010). The Puerto Rican broad-winged hawk was listed as an endangered species on September 9, 1994. No critical habitat has been designated for this species. The Puerto Rican broad-winged hawk 5-year review, approved and signed on October 28, 2010 (USFWS 2010), is the most recent comprehensive analysis of the species status.

## **Puerto Rican sharp-shinned hawk**

The Puerto Rican sharp-shinned hawk, also known as *falcón de sierra* and *gavilán de sierra* (Delannoy-Juliá 2009), was first discovered in the Maricao Commonwealth Forest, and now it is known from the northern karst and six forests in Puerto Rico: Maricao Commonwealth Forest, Toro Negro Commonwealth Forest, Guilarte Commonwealth Forest, Carite Commonwealth Forest, Rio Abajo Forest, and El Yunque National Forest. The Puerto Rican sharp-shinned hawk is a small hawk with dark slate-gray upperparts and heavily barred rufous underparts. Adult male and female are similar in appearance, but the female is larger. Immature birds are brown above and heavily streaked below. In flight, the short, rounded wings and long, narrow tail are characteristic (Raffaele 1989).

The Puerto Rican sharp-shinned hawk was listed as an endangered species on September 9, 1994. No critical habitat has been designated for this species. The Puerto Rican broad-winged hawk and Puerto Rican sharp-shinned hawk recovery plan was approved and signed on September 28, 1997 (USFWS 1997). A draft 5-year review document for the species is currently being evaluated.

### **Life history**

#### **Puerto Rican boa**

According to Tolson (1994) the Puerto Rican boa reproduces every two years. Wiley (2003) found females in reproductive condition in late April through mid-August and non-reproductive females from February to April and in November. Puente-Rolón and Bird-Picó (2004) noted non-reproductive time from November to February and reproductive period from March to October. The Puerto Rican boa does not lay eggs as it is ovoviviparous, where the embryos develop inside eggs retained within the female until ready to hatch alive. Longevity record in captivity is of a wild caught adult male Puerto Rican boa living to 23 years and 11 months (A. Wisnieski *in* Slavens and Slavens 2003).

Tolson and Henderson (1993) report litter sizes of 12-32 neonates for the Puerto Rican boa, while Wiley (2003) reports from 13 to 30 embryos for each gravid female observed (average brood size of 21.8). Gestation is reported to last from 152-193 days (Henderson and Powell 2009) and is dependent on temperature. Gravid females will frequently bask to increase body temperature (Tolson and Henderson 1993, Tolson 1994). Gravid females have been reported in June and July (Reagan 1984) and extreme dates of gravid females have been reported from late April through mid August (Wiley 2003).

Courtship and mating of the Puerto Rican boa is seasonal. Several authors have suggested that mating mostly occurs at the beginning of the wet season (late April through May) and that females give birth during the later part of the wet season on August through October (Reagan 1984, Tolson and Henderson 1993). Tolson (1992) explains that neonate *Epicrates* are usually born during August and September when hatchling *Anolis* populations are substantial and rainfall is abundant. Huff (1978) reported that increased humidity and precipitation enhanced courtship in the Puerto Rican boa. This is consistent with Puerto Rico's annual rainfall

patterns with the first peaks during the spring and summer (Colón 2009). The onset of spring rains could serve as an important cue for courtship and reproduction (Tolson 1992).

Puente-Rolón and Bird-Picó (2004) utilized radiotelemetry to determine the home range, activity, and movement patterns of the Puerto Rican boa in the Mata de Plátano Natural Reserve in Arecibo. Home range area varied from 0.03 to 4.54 ac (0.012 ha to 1.84 ha) and did not differ significantly between sexes. No sexual differences in home range size were found during their study, although a tendency for females to have a larger home range was observed (Table 2). Males were more active during the reproductive period than during the non-reproductive period and males tended to be more active than females during the reproductive period, but not significantly different. The following table summarizes some of Puente-Rolón and Bird-Picó (2004) additional findings.

Table 2. Puerto Rican Boa home range in the Mata de Plátano Natural Reserve, Arecibo 2004.

Sex	Mean home range	Mean distance traveled per day	Area used during non-reproductive period (November-February)	Area used during reproductive period (March-October)	Mean time (days) spent at the same location
Male	7,890 m <sup>2</sup> (1.95 ac)	83 m (272 ft)	1,322 m <sup>2</sup> (0.33 ac)	18,500 m <sup>2</sup> (4.57 ac)	37.4
Female	5,000 m <sup>2</sup> (1.24 ac)	99 m (324.8 ft)	22,119 m <sup>2</sup> (5.47 ac)	16,940 m <sup>2</sup> (4.19 ac)	47

Wunderle *et al.* (2004) also conducted studies on the Puerto Rican boa spatial ecology with radiotelemetry in a subtropical wet forest (Luquillo Experimental Forest [LEF], currently El Yunque National Forest) of eastern Puerto Rico from October 1996 to July 2001. Monitored boas moved an average of 42.3 ft (12.9 m) daily between fixes (fix= relocation with telemetry). No significant differences in daily movement per fix were found between males [mean 50 ft (15.2 m)] and females [34.5 ft (10.5 m)]. Sexes did not differ in annual home range sizes [mean 21 ac (8.5 ha)].

Wunderle *et al.* (2004) also provided detailed information on immobility in addition to daily and monthly movements of boas. According to their findings, boas moved an average of 86.6 ft (26.4 m) daily per move. Boas located by telemetry were immobile much of the time as evident in a mean of 10.2 consecutive days without movement between fixes. In general, movement of boas during a fix was observed significantly more often at night than during daylight hours. Mean daily movement per month varied significantly among months.

Sex differences in mean daily movement per month were significant with greater values for males than females (Wunderle *et al.* 2004). A significant interaction between sex and month was detected, with males showing a bimodal peak in monthly movement during April and June in contrast to females in which movement peaked in July. This suggest that males actively

search for females during their peak (corresponds to the mating period) and females peak movement during July partly represents increased foraging to sustain embryo growth as well as a shift to environments appropriate for gestation and parturition (Wunderle *et al.* 2004). In addition, fidelity to a specific site was usually low, as boas only revisited a small percentage of the sites in the home range during the approximately one year that each boa was studied. Although seasonal patterns of boa movements in the LEF may be most attributable to reproductive behavior, the overall patterns of movement likely reflect foraging behavior (Wunderle *et al.* 2004).

Comparison of results from Wunderle *et al.* (2004) and Puente-Rolón and Bird-Picó (2004) indicates that snakes foraging in productive food patches are expected to have smaller home ranges than those in less productive patches. It is likely that the substantial differences in home range size between the two sites (LEF vs. Culebrones Cave) resulted from differences in prey abundance and dispersion. Culebrones Cave (Mata de Plátano Nature Reserve), represents a highly productive habitat where food is concentrated in a particular area and is available to the snakes, whereas prey in the LEF are likely more widely dispersed and occur in lower densities. In areas where food resources are more dispersed or in lower densities the Puerto Rican boa needs larger home ranges (Puente-Rolón and Bird-Picó 2004).

Wunderle *et al.* (2004) also observed that broadleaf trees in which boas were located by radiotelemetry differed from randomly selected broadleaf trees in a number of traits. For example, trees with boas differed from random trees by having larger diameter trunks; being taller; having more crown contact with neighboring crowns; being closer to other broadleaf trees; being surrounded by a higher density of understory vegetation; and having a lower percentage canopy cover than random trees. It was vine cover, however, that especially characterized trees used by boas, as these trees had more vines (both attached and unattached to the trunk), the nearest free vines were closer to the trunk and had larger diameters than vines on randomly selected trees.

Ríos-López and Aide (2007) studied herpetofaunal dynamics during secondary succession. Within a reforested karst valley, arboreal species increased with increased woody vegetation cover, and predatory species increasing with increased prey density. Species richness increased rapidly from three to eleven species in 13 months, with predatory species like the Puerto Rican boa colonizing the reforested valley by the end of the study. In contrast, in the deforested karst valley, which is under natural secondary succession, herpetofaunal richness did not increase during the same period and only included two amphibian species. The authors explain that abundance and persistence of early succession species within the planted vegetation provided colonization opportunities for late succession species (Puerto Rican boa) to prey upon them. The Puerto Rican boa was found foraging in the planted trees, suggesting that that it may represent a late succession species of the herpetofauna in the reforested valley (Ríos-López and Aide 2007).

### **Puerto Rican broad-winged hawk**

The Puerto Rican broad-winged hawk is found in mature forests within the subtropical moist, subtropical wet, and rain forest life zones (Ewel and Whitmore 1973). It shows a clumped

spatial pattern within the forests, associated with certain types of habitats such as Tabonucopalo colorado forest types, Tabonuco and Caimitillo-granadillo forest types at El Yunque National Forest and Carite Commonwealth Forest (Delannoy 1997). At the Río Abajo Commonwealth Forest, the species inhabits the limestone hillsides, sinkholes, and valleys between haystack hills or “mogotes” (Delannoy 1997).

Hengstenberg and Vilella (2004) found that the vast majority (97%) of Puerto Rican broad-winged hawk movements and home ranges at the Río Abajo Commonwealth Forest were confined to the boundaries of the forest. Adult birds used private lands less than 1% of the time, whereas juveniles used private lands 6% of the time, suggesting that adults are able to secure the most suitable tracts of continuous, closed canopy forest while juvenile birds used areas on the periphery of the forest. Hengstenberg and Vilella (2004) suggested that adult Puerto Rican broad-winged hawks at Río Abajo Forest maintain relatively exclusive territories; with overlap limited to the outside borders of their respective home ranges. Areas shared by radio-marked Puerto Rican broad-winged hawks were usually limestone hill ridges that bounded the exterior of their territories (Hengstenberg and Vilella 2004).

At the Río Abajo Forest, Puerto Rican broad-winged hawks feed primarily on rats, lizards, and small birds (Hengstenberg and Vilella 2005). Predation by red-tailed hawks (*Buteo jamaicensis*) on juvenile Puerto Rican broad-winged hawks has been reported at the Río Abajo Commonwealth Forest, where both species are sympatric (Hengstenberg and Vilella 2004). The intensity of the antagonistic response of Puerto Rican broad-winged hawks to the presence of red-tailed hawks intruding into their territories (Hengstenberg and Vilella 2004) suggests that predation and/or competition plays an important role in Puerto Rican broad-winged hawk nest-site selection, nest attendance, and juvenile survival. Parasitism by the warble fly is not currently considered a threat to the Puerto Rican broad-winged hawk because it has not been reported in populations of this species.

### **Puerto Rican sharp-shinned hawk**

This species dwell in elfin woodland, sierra palm, caimitillo-granadillo, and tabonuco forest types (Ewel and Whitmore 1973; Delannoy 1997) of the Maricao Commonwealth Forest, Carite Commonwealth Forest, Guilarte Commonwealth Forest, and El Yunque National Forest. The species was thought to be absent from the karst and secondary growth forest (Delannoy 1997), until biologists detected the species in the north karst area (Llerandi and Hengstenberg personal communication and report). It shows a clumped distribution within their range, most evident in Maricao and Carite Commonwealth forests, and less so in Toro Negro Commonwealth Forest (Delannoy 1997). The distribution pattern of this species has not been determined in El Yunque National Forest and Río Abajo Commonwealth Forest.

Reproductive strategy reported by Delannoy (1997) supports earlier reports that epigamic and territorial activities of Puerto Rican sharp-shinned hawks are associated with certain montane habitats within the subtropical wet forest and subtropical montane forest life zones. The continued re-occupancy pattern of these habitats was seen in Maricao, Toro Negro, Carite, and El Yunque forests (Delannoy 1997). These habitats appear to provide adequate requisites for nesting and foraging, while the absence of Puerto Rican sharp-shinned hawks from other

montane habitats may indicate that some important requirement is missing (Delannoy 1997). At least in the Maricao Commonwealth Forest, nest-site habitat fidelity has been related to a pattern of nest-site selection dependent on structural features of the vegetation (Cruz and Delannoy 1986).

Mortality of Puerto Rican sharp-shinned hawk attributed to warble fly parasitism is high in some forests. The parasitic larvae of the botfly (*Philornis pici* and *P. obscura*) can debilitate, affect the growth and development, cause permanent damage to tissues and organs, and it can kill the host (Cruz and Delannoy 1986; Delannoy and Cruz 1991). The rate of infestation may vary between years and among forests; but very few Puerto Rican sharp-shinned hawk nestlings survive once they are parasitized (Cruz and Delannoy 1986). Mortality of Puerto Rican sharp-shinned hawk nestlings was higher in parasitized than unparasitized nestlings in the Maricao Commonwealth Forest; suggesting that *Philornis* ectoparasitism had an additive effect in overall mortality (Delannoy and Cruz 1986; Delannoy and Cruz 1991). Historically, botfly ectoparasitism has inflicted significant sharp-shinned hawk nestling losses to the El Yunque National Forest population; therefore, it is potentially a serious threat to the Puerto Rican sharp-shinned hawk population at El Yunque National Forest (Delannoy 1997).

## **Population dynamics**

### **Puerto Rican boa**

The population size or abundance of the Puerto Rican boa is not currently known. Various attempts have been carried out by researchers to determine the Puerto Rican boa population status. However these investigations have either been conducted on specific areas, are based on boa counts and not actual estimates, or their results are mostly based on anecdotic reports. According to Reagan (1984), this species is probably less abundant than it was in Pre-Columbian times, when Puerto Rico was more heavily forested. More recent reports indicate that the PR boa is not as rare as previously thought (Moreno 1991, Bird-Picó 1994, Wunderle *et al.* 2004). Much of the boa's apparent rarity may be related to the observer's difficulties in visually detecting this cryptic and secretive species within its forest habitat (Wunderle *et al.* 2004, Joglar 2005). Nevertheless, some argue that its apparent abundance may be an artifact of increased encroachment into the boa's ever reducing habitats (Moreno 1991, Bird-Picó 1994, Puente and Vega 2005).

In 1991, the proposed Costa Isabela development project, within the Isabela and Quebradillas municipalities, conducted a study to determine the status of the Puerto Rican boa within their proposed project areas (Lebrón Associates 1992). During the months of June, July and August, they positively identified 45 Puerto Rican boas distributed along the projects property. They concluded that there is an abundant population of Puerto Rican boas and that they are widely distributed within the study area.

From July 1992 to December 1994, Bird-Picó (1994) conducted a status survey of the Puerto Rican boa to determine its presence mostly in the northern part of Puerto Rico. In his report, he did not provide a population estimate. The report makes reference to a questionnaire based survey by Rivero and Seguí (1992), of which 32 out of the total 76 towns for the island

responded. Of those less than 10% reported the boa as abundant, more than 25% reported the boa absent from their localities, another 25% reported the boa as rare, and the other 37.5% reported that the snakes were occasionally seen. Bird-Picó (1994) emphasized that people interviewed had a tendency to exaggerate the species abundance.

Bird-Picó (1994) was able to document a maximum of 24 snakes during one night at Culebrones Cave (Mata de Plátano Nature Reserve) in Arecibo, Puerto Rico. It is common to see boas at this particular cave and it is where Puente-Rolón and Bird-Picó (2004) captured nine snakes for their tracking study. Puente-Rolón and Bird-Picó (2004) stated that Culebrones Cave represents a highly productive habitat, where food is concentrated in a particular area and is available to the snakes, thus explaining the boa's common occurrence at this site. Rodríguez-Durán (1996) also observed boas at Culebrones Cave ranging from 2 to 21 boas on a given night.

Wunderle *et al.* (2004) conducted a radiotelemetry study at the El Yunque National Forest. Besides monitoring twenty-four snakes for their tracking study, Wunderle *et al.* (2004) tagged with transponders (pit-tags) a total of 70 Puerto Rican boas. Boas were found incidentally during daylight and evening hours while walking or driving to sites with telemetrically monitored boas. Nevertheless, no population estimate was calculated. According to Wunderle *et al.* (2004), much of the boa's apparent rarity is related to the observer's difficulties in visually detecting this cryptic species within the forest. While conducting their study, they failed to visually detect telemetry-tracked boas during an average of 85 percent of their fixes (= telemetric relocations). They indicated that, given this detection difficulty in forests, it is likely that the boa is more abundant than generally perceived.

The only published density estimate for the Puerto Rican boa is from Ríos-López and Aide (2007). They surveyed herpetofauna within five different types of habitats (deforested valley, reforested valley, old valley, karst hilltop, karst hillside) along a 164 ft (50 m) transect for each site in the Toa Baja municipality (Fig. 1). Ríos-López and Aide (2007) estimated a mean monthly density of 5.6 boas per hectare (5.6 boas per 2.47 acres) for the reforested valley, the old valley and the karst hilltop. They did not encounter boas in either the deforested valley or at the karst hillside habitats.

Although island wide population estimates are not available, it is clear that the Puerto Rican boa is distributed throughout the island (it has been reported in more than 50 percent of the municipalities of Puerto Rico) and it is likely that the Puerto Rican boa is more abundant than generally perceived.

### **Puerto Rican broad-winged hawk**

Puerto Rican broad-winged hawk density and population estimates varied considerably among forests, being highest at the Río Abajo Commonwealth Forest and lowest in El Yunque National Forest (Delannoy 1997). New information on the abundance and demographic features of the population of Puerto Rican broad-winged hawks at the Río Abajo Commonwealth Forest indicates an abundance of approximately 52.2 individuals in the forest; high pair fidelity; a nest survival rate of 0.67 across breeding seasons; and an average annual

productivity of 1.1 young per nest (Hengstenberg and Vilella 2004). The Service does not have information on the species abundance, population trends, demographic features or demographic trends for the El Yunque National Forest and Carite Commonwealth Forest.

Hengstenberg and Vilella (2004) reported an average annual home range of 262 ac (106 ha) and a breeding home range size of 204 ac (82.55 ha) for the Puerto Rican broad-winged hawk at Río Abajo Commonwealth Forest. Delannoy and Tossas (2002) indicated that reforestation and regeneration of degraded forest lands has added important nest sites for broad-winged hawks in the Río Abajo Commonwealth Forest, which has allowed this species to thrive within this forest despite changing land uses and habitat modification. Hengstenberg and Vilella (2004) found that, within this forest, Puerto Rican broad-winged hawk nests are located in timber producing plantations and secondary forests, primarily *Callophylum calaba* (palo de María). Hengstenberg and Vilella (2004) described the nest sites of Puerto Rican broad-winged hawks at Río Abajo Forest as occurring in mature closed-canopy overstory stands sheltering a midstory, with dense understory, in close proximity to a limestone rock wall, and on southwest-facing slopes (sheltered from the easterly trade winds). Closed canopy forests may be the major structural characteristic describing the suitability of Puerto Rican broad-winged hawk habitat (Hengstenberg and Vilella 2004). Other habitat associations (*e.g.*, pasture, regenerating forests) may lack a closed canopy, but may advantageously offer areas to locate prey for Puerto Rican broad-winged hawks (Hengstenberg and Vilella 2004). Hengstenberg and Vilella (2004) found that adult and juvenile Puerto Rican broad-winged hawks at Río Abajo Forest did not use habitats within the forest in proportion to their availability. Tossas (1995), Delannoy and Tossas (2000), and Hengstenberg and Vilella (2004) suggested that the Puerto Rican broad-winged hawk has reduced space requirements compared to their temperate counterparts, which may be a function of higher prey abundance and interspecific competition in a tropical habitat.

Hengstenberg and Vilella (2005) cited abandoned shade-grown coffee plantations as part of the secondary forest used by the Puerto Rican broad-winged hawk. They also indicated that the hawks readily used plantation trees such as palo de maría and Honduras mahogany (*Swietenia macrophylla*) with thick understory vegetation (Hengstenberg and Vilella 2005). Hengstenberg and Vilella (2005) suggested that Puerto Rican broad-winged hawks do not limit their activities to the Río Abajo Commonwealth Forest, and that their fate in the surrounding private lands may be uncertain. They suggested that DNER forest managers should work proactively with the surrounding landowners to promote land-use practices to conserve and to enhance existing forest cover. Additionally, Hengstenberg and Vilella (2005) believe that the future patterns of land use around the forest boundary directly and indirectly may affect the ability of the Río Abajo Commonwealth Forest to function as an effective conservation unit for the broad-winged hawk. They also recommended that DNER encourage surrounding private landowners to engage in agro forestry practices using fast-growing plantation species, and that programs for private lands that promote maintenance and enhancement of forest cover (*e.g.*, Service's Partners for Fish and Wildlife Program) be brought to the attention of the landowners adjoining Río Abajo Commonwealth Forest (Hengstenberg and Vilella 2005). The Partners for Fish and Wildlife Program promotes agricultural land use practices that promote habitat diversity and enhance habitat for listed species and migratory birds, particularly shade-grown coffee plantations.

## **Puerto Rican sharp-shinned hawk**

The Puerto Rican sharp-shinned hawk population is estimated at about 150 individuals island-wide; much lower than earlier estimates (Delannoy 1997). The apparent overall decline of this species has resulted primarily from major declines in the two eastern populations. Puerto Rican sharp-shinned hawk density and population estimates decreased consistently from the west (Maricao Commonwealth Forest) to the east (El Yunque National Forest) (Delannoy 1997). Counts yielded more individuals; higher average density; higher maximum density; and higher population estimates in Maricao than Toro Negro, Carite, and El Yunque forests (Delannoy 1997). Counts in El Yunque National Forest yielded the lowest values overall; being so much lower than earlier estimates that Delannoy (1997) believes that they give rise to serious concern as to the viability of the sharp-shinned hawk population in El Yunque National Forest. The El Yunque and Carite populations experienced a 93% and 59% decline respectively over a 7-year period (Delannoy 1997). Count declines in Toro Negro and Maricao Commonwealth forests were much more moderate in magnitude, and may not have reflected real population declines. According to Delannoy (1997), causes for the decline of the eastern populations may be complex, and may have resulted in part from the impact of Hurricane Hugo in 1998, particularly in El Yunque National Forest. However, Service biologists working in El Yunque forest have indicated that the decline in Puerto Rican sharp-shinned hawk sightings in the forest was already well advanced before the hurricane (Delannoy 1997). Although Puerto Rican sharp-shinned hawks have historically shared the same nesting areas as the Puerto Rican parrot in El Yunque, by 1989 (prior to Hurricane Hugo), they were no longer being seen from parrot lookouts covering any of these areas (Delannoy 1997). The estimated home range size of the Puerto Rican sharp-shinned hawk is 369.4 ac (149.5 ha), where they forage for small birds (the size of tanagers or smaller).

## **Status and Distribution**

### **Puerto Rican boa**

The Puerto Rican boa was apparently abundant in the island during the early years of the Puerto Rico colonization. Boa populations presumably declined in both size and distribution during a period of intense deforestation in Puerto Rico in the late 1800s. In addition, herpetological expeditions to the island in the early 1900s failed to collect Puerto Rican boa specimens (USFWS 1986). This decline and apparent rarity prompted the Federal government to include the Puerto Rican boa in the Endangered Species list in 1970.

The Puerto Rican boa appears to be widely distributed throughout Puerto Rico and utilizes a variety of habitats ranging from mature forest to plantations and disturbed areas. Various authors concurred that this species is most often found in the northern limestone karst region of Puerto Rico. The Recovery Plan for the Puerto Rican boa (USFWS 1986) mentions the following threats to the species: direct human impacts for medicinal oil extraction and intentional killings for prejudice against snakes, habitat destruction, and mongoose predation. Besides the mongoose, house cats may also represent a predation threat.

The greatest threats to the Puerto Rican boa are caused by humans (Rivero 1998, Joglar 2005). Joglar (2005) explains how Puerto Rican boas are still being killed to extract its oil because of beliefs that it serves medicinal purposes. In addition, some people still think that boa's are venomous and/or dangerous and would thus harass or injure the snake. Some Puerto Rican boas are also reported to be kept as pets and still others are commonly killed by cars while trying to cross roads. Joglar *et al.* (2007) discusses how habitat loss and landscape fragmentation have become another concern in the conservation of the Puerto Rican boa. The authors explain that habitat destruction is increasing, and may disrupt natural population dispersal and gene flow. Habitat disturbance occurs within the karst region and its surroundings, currently transforming the karst landscape by removing "mogotes", filling sinkholes and caves, filling wetlands, and generally paving over surfaces to facilitate very intense uses of the land (Lugo *et al.* 2001).

Although the species has an approved final Recovery Plan (USFWS 1986), it does not contain measurable criteria and should be reviewed. The objective of the Recovery Plan was to attain population levels at which the species could be delisted. The Recovery Plan recommends conducting a comprehensive status survey and ecological studies of the species before determining specific recovery actions. At present time, the population of the Puerto Rican boa is considered stable.

#### **Puerto Rican broad-winged hawk**

Status surveys conducted in 1991 and 1992 indicated that the Puerto Rican broad-winged hawk has experienced recent population declines. The Puerto Rican broad-winged hawk experienced a local population decline of approximately 50 percent in the El Yunque National Forest (from 50 individuals in 1984 to 22 individuals in 1992; Delannoy 1992).

Destruction and modification of forested habitats in Puerto Rico appear to be the most significant factors affecting the numbers and distribution of Puerto Rican broad-winged hawks and are among the most important threats to the species. Patchy distribution of the species may have resulted from the fragmentation of forested habitats. During the first half of the 20th century, forested areas were drastically reduced for intensive agricultural uses. In the last half of this century early secondary forests have developed in areas that are no longer under intensive cultivation and these secondary forests connect patches of more mature forests that were previously isolated. Timber harvest without considering the vegetation structural features needed by both species and inappropriate management practices in public forests could result in negative effects on the Puerto Rican broad-winged hawks, reducing the number of individuals and/or diminishing habitat quality. For species already limited in their abundance and distribution, these activities can reduce effective population size, causing detriment to the species.

Road construction in several forests has resulted in substantial habitat alteration and fragmentation. In the Rio Abajo Commonwealth Forest, the construction of highway P.R. 10 from Arecibo to Ponce, which has been under way for several years, affected the Puerto Rican broad-winged hawk population. The construction of this highway eliminated approximately 509 ac (205.9 ha) of the Puerto Rican broad-winged hawk's habitat or one nest (USFWS

1995). In addition to the substantial habitat alteration and fragmentation produced by the construction of the highway, this road provides a source of human disturbance, reducing habitat suitability for species with a strong need for isolation, and could increase illegal shooting and the introduction of exotic fauna.

Construction of recreation facilities has been proposed for the western and northern sides of the El Yunque National Forest, areas where the Puerto Rican broad-winged hawks occur. Such recreation facilities could potentially eliminate habitat or bring human activities too close to preferred nesting areas. Raptors are particularly sensitive to disturbance near their nesting territories. In the Carite Commonwealth Forest, increasing pressure for new recreation facilities has been identified (Delannoy 1992).

Increased pressure for new right-of-way access to farms through the Carite Commonwealth Forest land and the establishment of new communication facilities could also destroy prime habitat or bring human activities too close to Puerto Rican broad-winged hawks. Delannoy (1992) documented that destruction of substantial caimitillo granadillo habitat occurred in the ROW access through the road commonly known as "Camino El Seis" in the north-central part of this forest. This author also reported the establishment of new communication facilities along an access road through sector Farallón in the northwestern part of the forest where the highest broad-winged hawk densities have been reported.

The extensive devastation from hurricanes may be particularly detrimental to species with small population sizes and long generation times, such as the broad-winged hawk. Additionally, there may also be a long-term reduction in effective population size if the hawks prove to require habitat characteristics not presently available in the storm-damaged forest. Decline of the Puerto Rican broad-winged hawks has been attributed to possible direct and indirect effects of Hurricane Hugo in 1989 by Delannoy (1992). Dr. Wunderle (International Institute of Tropical Forestry, personal communication 1997), however, believes that it is unlikely that these hawk species were strongly affected by the hurricane unless their nest sites were reduced or eliminated. Nevertheless, he believes that the latter suggestion is unlikely given the patchy nature of the storm damage in the forests.

The Puerto Rican broad-winged hawk has an approved multi-species recovery plan (USFWS1997). The plan established the following interim downlisting criteria for the Puerto Rican broad-winged hawk.

1. Maintain a Puerto Rican broad-winged hawk breeding population of 60 pairs (20 breeding pairs in El Yunque National Forest, Carite Commonwealth Forest, and Río Abajo Commonwealth Forest, respectively).
2. Reach an island-wide Puerto Rican broad-winged hawk population of 200 individuals (60 individuals in Río Abajo and Carite Commonwealth forests, and 80 individuals in El Yunque National Forest).
3. Gather additional documentation on population trends (*i.e.*, conduct surveys, search for new populations, obtain population biology information, identify mortality factors

and threats) and adequate support habitat for the species (*i.e.*, characterize currently used habitat, identify additional habitat, determine spatial and temporal use of habitat).

### **Puerto Rican sharp-shinned hawk**

The destruction and modification of forested habitats in Puerto Rico may be among the most significant factors affecting the numbers and distribution of the Puerto Rican sharp-shinned hawk and are among the most important threats to the species. The patchy distribution of the Puerto Rican hawk may have resulted from the fragmentation of forested habitats. During the first half of the 20th century, forested areas were drastically reduced for intensive agricultural uses. In the last half of this century, areas that are not longer under intensive cultivation have developed into secondary forest that connect patches of previously isolated mature forests. Timber harvest without considering the natural vegetation structural features needed by the species, and inappropriate management practices in public forests could result in negative effects on the species, reducing the number of individuals and/or diminishing habitat quality. For a species already limited in its abundance and distribution, these activities can reduce effective population size resulting in detriment to the species.

Status surveys conducted in 1991 and 1992 indicated that the Puerto Rican sharp-shinned hawk has experienced recent population declines. The Puerto Rican sharp-shinned hawk experienced a 40 percent population decline in a period of 7 years (from about 250 individuals in 1985 to 150 in 1992). Locally, the Puerto Rican sharp-shinned hawk population experienced a 60 percent decline in the Carite Commonwealth Forest and a 93 percent decline in the El Yunque National Forest.

Road construction in several forests has resulted in substantial habitat alteration and fragmentation. Road construction and/or road repair have been proposed and/or conducted in the Caribbean National Forest, Rio Abajo Commonwealth Forest, and Maricao Commonwealth Forest.

Construction of recreation facilities has been proposed for the western and northern sides of the El Yunque National Forest, areas where the species occurs. Such recreation facilities could potentially eliminate habitat or bring human activities too close to preferred nesting areas. Raptors are particularly sensitive to disturbance near their nesting territories. In the Carite Commonwealth Forest, increasing pressure for new recreation facilities has been identified (Delannoy 1992). In the Maricao Commonwealth Forest, Cruz and Delannoy (1986) found that nest failures related to direct human harassment ranked third in importance. Five nesting areas in the Maricao Commonwealth Forest are within or less than 100 meters from the camping and picnic areas. Some of the traditional nesting areas for the Puerto Rican sharp-shinned hawk in the Toro Negro Commonwealth Forest lie near recreation facilities (Cruz and Delannoy 1986). Increased pressure for recreation from a growing human population could bring about frequent and regular human disturbance near nest sites.

In the Maricao Commonwealth Forest, PREPA has a power substation located in the lower montane wet forest life zone, the center of Puerto Rican sharp-shinned hawk nesting habitat. Many kilometers of aerial power lines run through forest lands. The access road for the

substation is located adjacent to Puerto Rican sharp shinned hawk habitat in the subtropical wet forest life zone (Delannoy 1992). The construction of this access road resulted in the destruction of approximately 6.4 ac (2.6 ha) of Puerto Rican sharp-shinned hawk habitat (Delannoy 1992). The construction of new or the enlargement of the existing, communication infrastructure could potentially eliminate important Puerto Rican sharp-shinned hawk habitat.

One of the most important factors affecting this species is the low numbers and limited distribution. Extant populations of the Puerto Rican sharp-shinned hawk are restricted to only five in montane forests. Significant adverse effects to this species or its habitat could drive it to extinction.

The extensive devastation from hurricanes may be particularly detrimental to a species with small population sizes and long generation times, such as Puerto Rican sharp-shinned hawk. Additionally, there may also be a long-term reduction in effective population size if this species proves to require habitat characteristics not presently available in the storm-damaged forest.

Decline of the Puerto Rican sharp-shinned hawk has been attributed to possible direct and indirect effects of Hurricane Hugo in 1989 by Delannoy (1992). However, Wunderle (International Institute of Tropical Forestry, personal communication 1997) believes that it is unlikely that this hawk species was strongly affected by the hurricane unless its nest sites were reduced or eliminated. Nevertheless, he believes that the latter suggestion is unlikely given the patchy nature of the storm damage in the forests. Wunderle (International Institute of Tropical Forestry, personal communication, 1997) also mentioned that the 60 percent decline of Puerto Rican sharp-shinned hawks in the Carite Commonwealth Forest after Hurricane Hugo seems like an unexpectedly high value given that the hurricane damage to habitat in that forest was very light, and limited to some of the highest ridges. He also mentioned, that in the few cases where raptor populations were quantified both before and after hurricanes, no significant declines were detected.

The mortality of Puerto Rican sharp-shinned hawk nestlings due to parasitism by the warble fly *Philornis* sp. has been documented. Studies conducted in Maricao Commonwealth Forest attributed 61 percent of nestling mortality to *Philornis* parasitism (Cruz and Delannoy 1986).

The lack of comprehensive management plans for the Commonwealth Forests could be considered a serious threat to this species. In absence of such plans, policy makers and managers lack basic information on which to base decisions related to the best use and management of forest resources.

The Puerto Rican sharp-shinned hawk has an approved multi-species recovery plan (USFWS1997). The plan established the following interim downlisting criteria for the Puerto Rican sharp-shinned hawk:

- 1.. Maintain a breeding population of Puerto Rican sharp-shinned hawk of not less than 250 pairs in five forests, for a minimum of seven years. In each forest, breeding

densities should be restored to the higher levels known in 1983 and 1985 as in Delannoy (1992).

2. Gather additional documentation on population trends (*i.e.*, conduct surveys, search for new populations, obtain population biology information, identify mortality factors and threats), and adequately support habitat for Puerto Rican sharp-shinned hawk (*i.e.*, characterize currently used habitat, identify additional habitat, determine spatial and temporal use of habitat).

Table 3. Biological opinions within the Puerto Rico geographic area that have been issued for adverse impacts to the Puerto Rican boa and Puerto Rican broad-winged hawk. Previous biological opinions for the Puerto Rican sharp-shinned hawk have not been signed in Puerto Rico.

PREVIOUS OPINIONS (mm/yr)	SPECIES	NUMBER OF INDIVIDUALS AFFECTED	AMOUNT OF HABITAT PREVIOUSLY AFFECTED
04/1995	Puerto Rican boa	All individuals	179.4 ac
04/1995	PR broad-winged hawk	One Nest	502.60 ac
12/1995	Puerto Rican boa	All individuals	.35 ac
06/1996	Puerto Rican boa	All individuals	2.123 ac
03/1999	Puerto Rican boa	All individuals	83 ac
10/1999	Puerto Rican boa	All individuals	4.38 ac
02/2000	Puerto Rican boa	All individuals	10 ac
03/2000	Puerto Rican Boa	All individuals	3 ac
09/2000	Puerto Rican Boa	All individuals	50 ac
<b>TOTAL</b>			<b>1,131.86 ac</b>

### Analysis of the species/critical habitat likely to be affected

#### Puerto Rican boa

The construction of the proposed project may affect the Puerto Rican boa and its habitat. According to the Puerto Rico GAP predicted habitat model (Gould *et al.* 2008), the Puerto Rican boa habitat includes 46.3% [1,023,952.81 ac (414,379 ha)] of the island, of which 9% occurs in protected areas. By using the Puerto Rican boa GAP predicted habitat model and the latest Vía Verde GIS shape-file (submitted in July 2011), approximately 330 ac (133.55 ha) of Puerto Rican boa habitat would be impacted by the proposed project construction ROW. Based on our analysis of the GIS shape-files, this represents approximately 33% of the calculated 1,000 ac (404.69 ha) to be directly impacted by the proposed project ROW. Based on habitat prediction models, the amount of Puerto Rican boa habitat to be affected by the proposed project is significantly low taking into consideration the range of the species

throughout the island, and the plasticity of the species for utilizing different habitat types. As part of the project, conservation measures were proposed by the Applicant and include educating project staff, pre-construction studies, and relocation of individuals to protected areas. The Service does not recommend the relocation of individuals to remote locations because of possible detrimental effects to individuals. Therefore, the Service developed a Protocol for the Puerto Rican boa to be integrated by the Applicant into the project plans (Appendix 1).

### **Puerto Rican broad-winged hawk**

The Puerto Rican broad-winged hawk is present in the action area and, thus, it may be adversely affected by the proposed action. The project could destroy approximately 104 ac (42 ha) of occupied Puerto Rican sharp-shinned hawk habitat. According to the Puerto Rico GAP (Gould *et al.* 2008), the Puerto Rican broad-winged hawk predicted habitat includes 465,672.56 ac (188,451 ha). However, this area may not be completely occupied by the species. The amount of occupied predicted habitat by the Puerto Rican broad-winged hawk is unknown. Based on the information currently available to us, at least two individual broad-winged hawks are known to inhabit the areas to be affected by the proposed project. Therefore, at least two occupied home ranges could be affected. Based on the home range of this species (i.e., 262 ac; Hengstenberg and Vilella 2004), this project may affect the future use of at least 524 ac of occupied broad-winged hawk home range habitat. As part of project conservation measures the Applicant proposed to limit construction activities to the non-breeding season, and to identify and monitor broad-winged hawk nesting sites during the 2011 and 2012 breeding seasons.

### **Puerto Rican sharp-shinned hawk**

The Puerto Rican sharp-shinned hawk is present in the action area and, thus, it would be adversely affected by the proposed action. The project could destroy approximately 189 ac (76.5 ha) of occupied sharp-shinned hawk habitat. According to the GAP predicted habitat model (Gould *et al.* 2008), the Puerto Rican sharp-shinned hawk predicted habitat includes 209,023.97 ac (84,589 ha). However, this area may not be completely occupied by the species. The amount of occupied predicted habitat by the Puerto Rican sharp-shinned hawk is unknown. Based on the information currently available to us, at least 4 individual sharp-shinned hawks are known to inhabit the areas to be affected by the proposed project. Therefore, at least four occupied home ranges will be at risk. Based on the home range of the species (i.e., 369.4ac; Delannoy 1997), this project could affect the future use of 1,476 acres of occupied sharp-shinned hawk home range habitat. Conservation measures proposed by the applicant include the restriction of construction activities to the non-breeding season, and identifying and monitoring sharp-shinned hawk nesting sites during the 2011 and 2012 breeding seasons.

## **ENVIRONMENTAL BASELINE**

The Via Verde project consists of the construction and operation of a 92-mile natural gas pipeline running south to north to operate three power plants in northern Puerto Rico. Based

on the information provided by PREPA, the project corridor would affect four of the six life zones identified in Puerto Rico: the Subtropical Dry Forest, Subtropical Wet Forest, Lower Montane Rain Forest, and Subtropical Moist Forest (Ewel and Whitmore 1973). Location data and approximate relative coverage of each zone within the project corridor are included in Table 4.

Table 4. Project life zones within action area.

Project Life Zones				
Zone Type	Location, MM	Length, miles	Total Area, acres	% Project Area
Subtropical Dry Forest	0 – 5.25	5.25	63.5	5.8
Subtropical Wet Forest	12.25 – 13.5, 15 - 25	11.25	147.5	13.5
Lower Montane Rain Forest	13.5 – 15.0	1.5	10.6	1.0
Subtropical Moist Forest	5.25 – 12.25, 25 – 92	72.3	872.5	79.7

The project corridor includes and exhibits a variety of land uses; including forest lands, wetlands, creeks, rivers, cattle grazing of varied intensities, sugar cane plantations, shade and sun grown coffee plantations, pineapple plantations, and rice fields.

The proposed corridor would traverse private property and natural reserves or Commonwealth Forests. The following table provides descriptions and locations, when available, for Commonwealth forests and reserves by municipality (Table 5).

The proposed project will traverse thirteen municipalities in Puerto Rico including: Peñuelas Adjuntas, Utuado, Arecibo, Barceloneta, Manatí, Vega Alta, Vega Baja, Dorado, Toa Baja, Cataño, Bayamón, and Guaynabo.

Table 5. Parks and reserves within the action area.

PARKS AND RESERVES SUMMARY			
Municipality	Mile Marker	Map Number	Park/Reserve Name
Peñuelas, Adjuntas	13.75 to 16.3	1	
Utuado	22.35 to 55	2	
Utuado, Arecibo	29.1 to 30.05	3	Bosque Estatal de Río Abajo
Arecibo	31.1 to 32.5	4	Bosque Estatal de Río Abajo
Arecibo	45.4 to 45.7	5	Reserva Cano Tiburones
Arecibo	47.2 to 48.7	6	Reserva Cano Tiburones
Arecibo	49.0 to 49.7	7	Reserva Cano Tiburones
Barceloneta	53.2 to 54.2	8	Reserva Natural Hacienda la Esperanza
Vega Baja, Vega Alta	70.6 to 71.5	9	Bosque Estatal de Vega
Vega Alta	72.4 to 73.6	10	
Dorado, Toa Baja	80.4 to 81.8	11	

**Notes:**  
Mile Marker - Via Verde Pipeline, begin Peñuelas MM 0.0 to end Guaynabo MM 92  
Map Number - BCPeabody Critical Habitats and Wildlife Elements August 27, 2010

## Peñuelas:

Peñuelas is located within the Subtropical Dry Forest and the Subtropical Moist Forest life zones (Ewel and Whitmore, 1973). Within the municipality of Peñuelas, the proposed Via Verde project corridor will run from mile 0 to approximately mile 14.5. Within this municipality, the proposed project corridor passes through several land cover areas, including industrial/developed land areas and native shrubby vegetation in several stages of succession. The proposed project corridor does not pass through any reserves or protected areas. Endemic and endangered plant species included are: *Ottoschulzia rhodoxylon*, *Buxus vahlii*, *Trichilia triacantha*, *Eugenia woodburyana*, *Catesbaea melanocarpa*, *Juglans jamaicensis*, *Polystichum calderonense*, *Cyathea dryopteroides*, and *Cordia rupicola*. This area harbors habitat for the Puerto Rican boa and Puerto Rican nightjar.

## Adjuntas:

The municipality of Adjuntas is located in three ecological life zones: Subtropical Wet Forest, Subtropical Moist Forest, and Subtropical Lower Montane Wet Forest (Ewel and Whitmore 1973). Within the municipality of Adjuntas, the proposed Via Verde project corridor will run from approximately mile marker 14.5 to mile marker 21.7. Within this municipality, the proposed project corridor does not pass through any reserves or protected areas. Endemic and endangered plant species included are: *Juglans jamaicensis*, *Polystichum calderoense*, and *Cyathea dryopteroides*. This area harbors habitat for the Puerto Rican boa, Puerto Rican sharp-shinned hawk and Puerto Rican broad-winged hawk.

## Utuado:

In the municipality of Utuado, in the barrios of Río Abajo, Río Arriba, and Hato Viejo, the pipeline corridor will run 400 m to the south and east of the Río Abajo Commonwealth Forest from Mile Marker (MM) 28.4 to MM 35.

This forest and its associated wetlands have a great diversity of wildlife and varied vegetation. Within the forest, one hundred and seventy-five tree species were identified in past fauna studies; forty-seven of which are considered threatened or endangered. As a result of past deforestation that occurred in Puerto Rico during the 1930's, the Government of Puerto Rico began, and currently maintains, programs for tree planting in Commonwealth forests. Some representative species of the native vegetation found in the forest are: algarrobo, almácigo, hairy camasey, canelilla, white capá, ceboruquillo, male cedar, kapok, cojoba, heart, Cork, rubial Hawthorn, guano, guara, higuierillo, jobo, magician, coyor and tabaiba palm. Several research projects involving multiple endangered species that inhabit the forest are currently being conducted. Endemic and endangered plant species include the following: *Solanum dryophilum*, *Ottoschulzia rhodoxylon*, *Daphnopsis hellerana*, *Pleodendron macranthum*, *Tectaria estremerana*, and *Cordia bellonis*.

In the Río Abajo barrio, approximately 1,050 m from the project corridor (KM 29.6), the endangered plant species, chupacallos (*Pleodendron macranthum*) was found during other flora studies. The species was not identified in the corridor during the PREPA flora study conducted by Coll Environmental or the Threatened and Endangered Plant Survey.

The proposed project corridor follows, and will be co-located within, an existing transportation right-of-way for about 2.3 mi (KM 30.5 - 31 and 25.2 - 27) within the municipality of Utuado.

This area harbors habitat for the Puerto Rican boa, Puerto Rican sharp-shinned hawk and Puerto Rican broad-winged hawk. In addition, the Río Abajo forest supports the second wild population of the Puerto Rican parrot.

#### Arecibo:

The municipality of Arecibo has several protected areas. These include the Río Abajo Commonwealth Forest, Cambalache Commonwealth Forest and the Caño Tiburones Natural Reserve. These have been designated as protected areas by the DNER.

At the border with the municipality of Utuado, the pipeline corridor will pass through the eastern boundary of the Río Abajo Commonwealth Forest in two locations for a total distance of approximately 3.5 miles. The project corridor will additionally pass through approximately 1.54 miles of the Caño Tiburones. Endemic and endangered plant species include the following: *Solanum drymophilum*, *Ottoschulzia rhodoxylon*, *Daphnopsis hellerana*, *Pleodendron macranthum*, *Tectaria estremezana*, and *Cordia bellonis*. This area harbors habitat for the Puerto Rican boa, Puerto Rican sharp-shinned hawk and Puerto Rican broad-winged hawk. In addition, the Río Abajo forest supports the second wild population of the Puerto Rican parrot.

#### Barceloneta:

A part of the Caño Tiburones Natural Reserve lies in this municipality, approximately 543 meters north of the project corridor right-of-way, at MM 51.0 to 51.30. This reserve is the largest herbaceous marsh on the Island, and the second largest in the Caribbean. This coastal wetland plays an important role in quantity and quality of storm water treatment. Flora found in the project corridor varied throughout the municipality. The land cover within the project right-of-way corridor ranges from farmlands (pineapple and other minor fruits) and fallow uncultivated areas to herbaceous wetlands and open freshwater wetlands with floating aquatics. This area harbors habitat for the Puerto Rican boa.

#### Manatí:

The project corridor will pass through approximately 1.1 mi of the Hacienda La Esperanza Nature Reserve in the municipality of Manatí. The importance of this reserve lies mainly in its diversity of terrestrial and marine natural resources. It is classified as an important area for wildlife that uses the area for foraging and reproduction. There is a dense, structurally complex natural forest located within the “mogotes” (haystack hills) area in the southeast of the municipality. The vegetation consists of a secondary forest composed mostly of invasive species: secondary spiny forest composed mostly of tintillo (*Randia aculeata*), an area of invasive herbaceous vegetation with new growth mostly exotic in origin, bamboo forest, tall herbaceous species (brava cane), and other exotic species that grow on the edge of the Manatí River. Portions of this system are brackish water due to past flood control. These areas are populated by tidal marsh species. Salt flats, mostly devoid of vegetation due to high salinity (irregularly inundated by extreme high tides), and fringed by red, white, black, and buttonwood mangroves are also an important vegetative community in this system. The forest along the route in Manatí lies within the mogotes (haystacks) to the southeast of the municipality. The

rest of the route crosses mostly herbaceous areas associated with the Rio Grande de Manatí floodplain. The endangered tree species palo de rosa is known to occur within this natural reserve.

The remainder of this segment of the project corridor (from Mile Marker 54.75 mile to Mile Marker 63.45) includes vegetation consisting of weeds and shrubs commonly found on the northern coast of Puerto Rico. Endemic and endangered plant species include the following: *Ottoschulzia rhodoxylon*, *Buxus vahlii*, *Banara vanderbiltii*, *Daphnopsis helleriana*, *Solanum drymophilum*, *Myrcia paganii*, *Schoepfia arenaria*, *Tectaria estremerana*, *Auerodendron pauciflorum*, *Zanthoxylum thomasianum*, and *Cordia bellonis*. This area harbors habitat for the Puerto Rican boa, Puerto Rican sharp-shinned hawk, Puerto Rican crested toad and Puerto Rican broad-winged hawk.

#### Vega Baja and Vega Alta:

The Vega Commonwealth Forest includes six areas that are distributed between the municipalities of Vega Alta and Vega Baja. Vega Alta and Vega Baja have been considered as one region since all parts of the corridor pass through this forest. This forest is found within the construction right-of-way for both municipalities.

These areas are classified as moist subtropical forest. Forest flora is represented by seventy-two species of trees. Endemic and endangered plant species include the following: *Ottoschulzia rhodoxylon*, *Buxus vahlii*, *Banara vanderbiltii*, *Daphnopsis helleriana*, *Solanum drymophilum*, *Myrcia paganii*, *Schoepfia arenaria*, *Tectaria estremerana*, *Auerodendron pauciflorum*, *Zanthoxylum thomasianum*, and *Cordia bellonis*. This area harbors habitat for the Puerto Rican boa, Puerto Rican sharp-shinned hawk, Puerto Rican crested toad and Puerto Rican broad-winged hawk.

#### Dorado:

In Dorado, most of the route goes through herbaceous areas and the highway PR-22 right of way. This area is located within the range of the Puerto Rican boa.

#### Toa Baja:

None of the federally listed species known to exist within the municipality of Toa Baja were found in the project corridor. In contrast, Toa Baja is home of the coquí llanero (*Eleutherodactylus juanariveroi*) a proposed species for listing as endangered. This area is located within the range of the Puerto Rican boa.

#### Cataño:

Cataño has several environmentally sensitive areas of high natural value that need protection. These areas include: La Esperanza Park, the Laguna Secreta, remnant wetlands from channelization of the Bayamón River, and the historic mouth of the Bayamón River. Remnants of wetlands can also be found along the project construction right-of-way at the Hondo River. The vegetation associated with these estuarine wetlands includes black mangrove (*Avicennia germinans*) and white mangrove (*Laguncularia racemosa*). The Laguna Secreta is located 100 m north of the project ROW. This area is dominated by cattail marsh with several remnants of marshy areas occupied by black mangrove. This area is located within the range of the Puerto Rican boa.

Bayamón:

Six endangered species occur in Bayamon, four of which are endangered plant species. The four endangered plant species include: *Banara vanderbiltii*, *Buxus vahlii*, *Daphnopsis hellerana*, and *Ottoschulzia rhodoxylon*. The only listed terrestrial faunal species identified is the Puerto Rican Boa.

Guaynabo:

The municipality of Guaynabo harbors six endangered species, five of which are endangered animals: the paloma sabanera (*Patagioenas inornata wetmorei*), Puerto Rican boa and the Antillean manatee (*Trichechus manatus manatus*). The single plant species identified is the palo de rosa tree.

### **Status of the species within the action area**

#### **Puerto Rican boa**

The pipeline route will pass through active and abandoned agricultural lands, residential and urban areas, coastal, karst and mountain forests, wetlands and rivers, among others. As previously discussed, the project corridor will traverse four life zones (i.e., subtropical dry forest, lowland subtropical moist forest, subtropical wet forest, and lower montane subtropical wet forest). According to the Via Verde Natural Gas Pipeline BA (2011), the majority of the project (79.7%) falls within the lowland subtropical moist forest life zone. All of these life zones are considered within PR boa habitat. Thus, the PR boa is considered a species with a high potential for occurrence within the proposed pipeline corridor (Coll Rivera Environmental 2010).

Based on our analysis of the project's GIS shape-files, the area to be affected by construction comprises approximately 1,000 ac (404.69 ha) of which approximately 330 ac (133.55 ha) lie within the boa habitat model predicted by the PR GAP. Nevertheless, this does not exclude PR boa occurrence outside of the predicted habitat. The PR boa predicted habitat model is the best scientific information available to assess impacts to the boa and its habitat within large scale projects such as the Via Verde gas pipeline. Despite the difficulty of actively finding PR boas in the wild, the species was incidentally sighted on several occasions during field evaluations of the pipeline corridor. According to Coll Rivera Environmental (2010), two individuals were encountered during the flora and fauna study. Vega-Castillo (2010) also found the PR boa within the Manatí area of the proposed pipeline corridor. The Service also found PR boas, one during the site visit to the Manatí area, and another during the site visit to the Arecibo PR-10 area.

#### **Puerto Rican broad-winged hawk**

Based on our analysis of the GIS shape-files of the project ROW, the Puerto Rican broad-winged hawk can occur through about 19 mi of the project. Approximately 104 ac of hawk habitat would be destroyed by the proposed action. According to Tetra Tech report (2011), one adult broad-winged hawk was observed south of highway PR-10 just west of the project area.

The broad-winged hawk was sighted flying and vocalizing in the transition zone between the karst forests of the Rio Abajo Forest and the central mountains of Utuado in close proximity to or within the project area (Action Area). It was observed along a slope north of the Rio Grande de Arecibo River and south of the Rio Abajo Forest. The Service also found a broad-winged hawk during a site visit to Pellejas River in Utuado. The hawk flew and vocalized over the area.

### **Puerto Rican sharp-shinned hawk**

The Puerto Rican sharp-shinned hawk can occur thorough about 33 mi of the project. Based on the project GIS shape-files, approximately 189 ac of hawk habitat would be directly impacted by the project construction. According to Tetra Tech's report (2011), four sharp-shinned hawks were observed during surveys in the proposed project area. Two of the four sharp-shinned hawks occurred in the karst region, while the other two occurred in higher altitudes in the central volcanic mountain region.

### **Factors affecting the species environment within the action area**

The action area is influenced by various activities and features, including agriculture, industry, recreational, roads, and commercial. The action area lies within a variety of public and private land uses; including forest lands, wetlands, creeks, rivers, cattle grazing in varied intensities, sugar cane plantations, shade and sun grown coffee plantations, pineapple plantations, rice fields, and fallow agricultural lands.

Over 68% of the action area will go through rural areas. Based on the Puerto Rico Gap Analysis Project urban and rural land use layer, the project would lie in approximately 861 ac of rural land, 272 ac of rural densely populated areas and 589 ac of rural sparsely populated areas. In addition, the project corridor will affect 128 ac of urban areas and 50 ac of developed areas. Furthermore, the project corridor will traverse four of the six life zones identified in Puerto Rico: subtropical dry forest, lowland subtropical moist forest, subtropical wet forest and lower montane subtropical wet forest. According to the Via Verde Natural Gas Pipeline BA (2011), the majority of the project (79.7%) falls within the lowland subtropical moist forest life zone.

## **EFFECTS OF THE ACTION**

### **Factors to be considered**

#### **Puerto Rican boa**

The proposed action would destroy approximately 330 ac (133.55 ha) of the PR boa predicted habitat. The construction activity may result in the death of adult and juvenile boas that are not detected and relocated during the project construction. Although a construction period of approximately one year has been previously mentioned, the actual construction period has not been determined or specified by PREPA. After construction, a 50 ft wide permanent

disturbance area will remain along the pipeline route. Based on the available information, one might expect to find a higher potential of occurrence of PR boas along and around the karst areas that occur within the proposed pipeline route. The applicant has proposed conservation measures that include educating project staff, pre-construction studies, searching efforts and relocation of individuals to protected areas.

### **Analyses for effects of the action**

#### *Beneficial effects*

No beneficial effects have been identified or are expected to occur.

#### *Direct effects*

The proposed pipeline project will impact approximately 330 ac (133.55 ha) of PR boa predicted habitat and construction activities have the potential to adversely affect adult and juvenile boas. Direct effects on the Puerto Rican boa may result in harassment, harm and mortality. A permanent disturbance area will remain along the pipeline route. Conservation measures have been proposed in order to avoid and/or minimize adverse effects to Puerto Rican boa individuals.

#### *Indirect effects*

Once the project is completed, a permanent 50 ft wide ROW will remain along the project route. This corridor will be maintained clear of deep rooting trees and other vegetation to avoid possible damage to the pipeline. The corridor will also serve to access the pipeline valves for inspection and maintenance if needed. Puerto Rican boa may still be encountered within this area and responsible parties should apply recommended measures to avoid further impacts to the species. In addition, habitat destruction within the pipeline route may promote invasive species colonization and further degrade boa habitat. Mammal exotic or feral species may increase mortality of Puerto Rican boas through predation. Puerto Rican boas may be displaced by the project actions. Those individuals may be forced to overlap their home ranges with other boas, resulting in competition for resources such as foraging, mating, and breeding habitat, which ultimately would increase their mortality rate and reduce fitness. The probability of mortality through predation may also increase as individuals modify their movement patterns to colonize new territories.

In addition, the permanent 50 ft wide ROW along the pipeline route may serve as an access for motorized all-terrain vehicles (ATV's), and other passive alternatives like mountain bikes and horseback riding. These activities may also result in additional effects to the Puerto Rican Boa. The presence of the pipeline ROW will result in traffic in an area previously not open to the public and may result in the accumulation of trash, the possibility of fires, illegal cutting of vegetation, illegal hunting, and the increased presence of introduced invasive species and predators such as rats, mongooses, and feral dogs and cats. The existence of the road may result in an increased use of the forested areas by visitors, possibly resulting in disturbance to nesting areas of the Puerto Rican Boa.

### Interrelated and interdependent effects

Three valves connections on the project plans have been identified with the names of Barceloneta, Aguirre, and Bayamón. Two of these valves are located in wetland areas. These valves may lead to new pipelines and developments, and may affect habitat of Puerto Rican boa. At present time, the proposed routes of these three additional pipelines have not been identified. Additional new valves connections to the gas pipeline may adversely impact trust resources.

### **Species' response to a proposed action**

The PR boa is considered a species with a high potential of occurrence within the proposed pipeline corridor (Coll Rivera Environmental 2010). Based on the available information for the species, one might expect to find a higher potential of occurrence of boas along and around the karst areas within the proposed pipeline route. Ríos-López and Aide (2007) estimated a mean monthly density of 5.6 boas per 2.47 ac for the reforested and old valley, and the karst hilltop areas within their study site. Although, this estimate may provide a rough idea of how many boas one may encounter in similar areas, it may not be extrapolated to the whole karst region. The area where Ríos-López and Aide (2007) conducted their study is a small somewhat isolated karst fragment surrounded by urban and commercial development, an herbaceous wetland, and primary and secondary roads. Karst and other types of forest where boas occur are dynamic and the occurrence and abundance of this species within such habitats also depends on other factors (e.g., forest complexity and composition, abundance and availability of prey, climate). After construction, PR boas may still occur within the permanent impact area. Because of the proximity of the pipeline to PR boa suitable habitat, the species may still be crossing along the route or simply basking within the area.

### Number of individuals in action area -

Within the action area the number of Puerto Rican boas is not currently known.

### Sensitivity to change- needed

Although the Puerto Rican boa utilizes a wide range of habitats, the species may be adversely affected by habitat loss and degradation related to the proposed actions.

### **Puerto Rican broad-winged hawk**

The proposed action will destroy approximately 104 ac (42.08 ha) of Puerto Rican broad-winged hawk habitat, resulting in habitat loss for the species. It is unknown if this entire habitat is currently occupied. However, the project may result in adverse effect to two Puerto Rican broad-winged hawk home ranges in Utuado. The Puerto Rican broad-winged hawk is found in mature forests, and alteration of this habitat may result in abandonment of those areas. Deforestation and edge effects created by this project may result in permanent loss of Puerto Rican broad-winged hawk home range area. After construction, a permanent 50 ft wide corridor will remain along the project route. In addition, habitat fragmentation could adversely

affect the Puerto Rican broad-winged hawk habitat or alteration in the use of those home ranges in the future. Some of the effects of habitat fragmentation are: increased disturbance by humans, habitat net loss, adverse effect to nesting site; breeding habitat, roosting habitat, and sheltering habitat. The Puerto Rican broad winged hawks need a lot of space to sustain a viable population (Delannoy 2011).

### **Analyses for effects of the action**

#### *Beneficial effects*

No beneficial effects have been identified or are expected to occur.

#### *Direct effects*

The proposed pipeline project will impact approximately 104 ac (42.08 ha) of Puerto Rican broad-winged hawk habitat, and construction activities have the potential to adversely affect the home range and feeding areas of adult and juvenile hawks. Direct effects on the Puerto Rican broad-winged hawk would include harassment and harm caused by disturbance, noise and deforestation during the construction phase of the project. A permanent disturbance area of 50 ft will remain along the pipeline route after the project is completed. Conservation measures have been proposed in order to avoid and/or minimize adverse effects to Puerto Rican broad-winged hawk individuals.

#### *Indirect effects*

Once the project is completed, a permanent 50 ft wide ROW will remain along the pipeline route. This corridor will be maintained clear of deep rooting trees and other vegetation to avoid possible damage to the pipeline. This edge effect may result in displacements of broad-winged hawks home ranges and intrusion of predators such as the red-tailed hawk, which may result in a reduction of the survival rate of broad-winged hawks. The corridor will also serve to access the pipeline valves for inspection and maintenance. External people and adjacent land owners may access this corridor causing disturbance and possibly affecting the species during breeding. In addition, habitat destruction within the pipeline route may promote colonization by invasive species which previously did not have access to these forest areas. Plant invasive species colonize disturbed habitats outcompeting native plant species, which would degrade Puerto Rican broad-winged hawk habitat by changing the forest species composition and structure. Puerto Rican broad-winged hawk may be displaced by the project actions. Those individuals may be forced to overlap their home ranges with other hawks, resulting in competition for resources such as food, mates, and breeding habitat, which ultimately would increase their mortality rate and reduce fitness. The probability of mortality through predation may also increase as individuals modify their movement patterns to colonize new territories.

In addition, the permanent 50 ft wide ROW along the pipeline route may serve as an access for motorized all-terrain vehicles (ATV's), and other passive alternatives like mountain bikes and horseback riding. These activities may also result in additional effects to broad-winged hawks. The presence of the pipeline ROW will result in traffic in an area previously not open to the public and may result in the accumulation of trash, the possibility of fires, illegal cutting of vegetation, illegal hunting, and the increased presence of introduced invasive species and

predators such as rats, mongooses, and feral dogs and cats. The existence of the road may result in an increased use of the forested areas by visitors, possibly resulting in disturbance to nesting areas of the broad-winged hawks.

### Interrelated and interdependent effects

Three valve connections on the project plans have been identified with the names of Barceloneta, Aguirre, and Bayamon. Two of these valves are located in wetland areas. These valves may lead to new pipelines and developments, and may affect endangered species. However, the proposed routes of these three additional pipelines have not been identified. Additional new valve connections to the gas pipeline may adversely affect habitat of the Puerto Rican broad-winged hawk.

### **Species' response to a proposed action**

#### Number of individuals in action area

Population estimates for the species in the action area are unknown. However, Tetra Tech (2011) found one Puerto Rican broad-winged hawk in the proposed project area during a short assessment survey. The Service also found a broad-winged hawk during a site visit to the Pellejas River in Utuado. Based on information currently available we believe that home range of the hawk may be adversely affected.

#### Sensitive to change

The Puerto Rican broad-winged hawk is only found in mature forests within the subtropical moist, subtropical wet, and rain forests (USFWS 1997). It is expected that broad-winged hawks move from the areas as habitat destruction advances. The capability of these hawks to reestablish another territory is unknown, no previous studies on relocation of this species have been conducted

### **Puerto Rican sharp-shinned hawk**

The proposed action will destroy approximately 189 ac (76.5 ha) of Puerto Rican sharp-shinned hawk habitat, resulting in habitat loss for the species. It is unknown if all this habitat is currently occupied. However, the project may result in the loss of 4 sharp-shinned hawk home ranges. The Puerto Rican sharp-shinned hawk is found in mature forests, and alteration of his habitat may result in abandonment of those areas. Deforestation and edge effects created by this project may result in permanent loss of Puerto Rican sharp-shinned hawk home range area. After construction, a permanent 50 ft wide corridor will remain along the route, creating habitat fragmentation which could adversely affect the Puerto Rican sharp-shinned hawk habitat or alter the use of those home ranges in the future. Some of the effects of habitat fragmentation are: increased disturbance by humans, habitat net loss, adverse effect to nesting sites; breeding habitat, roosting habitat, and sheltering habitat. The Puerto Rican sharp-shinned hawks need a lot of space to sustain a viable population (Delannoy 2011).

## **Analyses for effects of the action**

### *Beneficial effects*

No beneficial effects have been identified or are expected to occur.

### *Direct effects*

The proposed pipeline project will impact approximately 189 acres of Puerto Rican sharp-shinned hawk habitat and construction activities have the potential to adversely affect the home range and feeding areas of adult and juvenile hawks. Direct effects on the Puerto Rican sharp-shinned hawk would include harassment and harm caused by disturbance, noise and deforestation during the construction phase of the project. Conservation measures have been proposed in order to avoid and/or minimize adverse effects to Puerto Rican sharp-shinned hawk individuals.

### *Indirect effects*

Once the project is completed, a permanent disturbance area to Puerto Rican sharp-shinned hawk habitat will remain along the 50 ft wide ROW along the pipeline route. This corridor will be maintained clear of deep rooting trees and other vegetation to avoid possible damage to the pipeline. This edge effect may result in displacements of sharp-shinned hawk home ranges and intrusion of predators such as the red-tailed hawk, which may result in a reduction of the survival rate of the sharp-shinned hawk. The corridor will also serve to access the pipeline for inspection and maintenance. External people and adjacent land owners may access this corridor causing disturbance particularly during the breeding season. In addition, habitat destruction within the pipeline route may promote invasive species colonization which previously did not have access to these forest areas. Plant invasive species colonize disturbed habitats outcompeting native plant species, which would degrade the Puerto Rican sharp-shinned hawk habitat by changing the forest species composition and structure. The ROW may serve as a corridor to invasive species, which previously did not have access to these forest areas.

In addition, the permanent 50 ft wide ROW along the pipeline route may serve as an access for motorized all-terrain vehicles (ATV's), and other passive alternatives like mountain bikes and horseback riding. These activities may also result in additional effects to Puerto Rican sharp-shinned hawks. The presence of the pipeline ROW will result in traffic in an area previously not open to the public and may result in the accumulation of trash, the possibility of fires, illegal cutting of vegetation, illegal hunting, and the increased presence of introduced invasive species and predators such as rats, mongooses, and feral dogs and cats. The existence of the road may result in an increased use of the forested areas by visitors, possibly resulting in disturbance to nesting areas of the Puerto Rican sharp-shinned hawk.

### *Interrelated and interdependent actions*

Three valve connections on the project plans have been identified with the names of Barceloneta, Aguirre, and Bayamon. Two of these valves are located in wetland areas. These valves may lead to new pipelines and developments, and may affect habitat of the Puerto Rican

sharp-shinned hawk. However, the proposed routes of these three additional pipelines have not been identified. Additional new valves connections to the gas pipeline may adversely impact trust resources.

### **Species' response to a proposed action**

#### *Number of individuals in action area*

Population estimates for the Puerto Rican sharp-shinned hawks in the action area are unknown. Tetra Tech (2011) reported four sharp-shinned hawks within the proposed project area. Therefore, it might be expected that at least four Puerto Rican sharp-shinned hawks could be impacted by the proposed project. However, the number of hawks affected may be greater because during the breeding season the species spend considerable amounts of time motionless and quiet (Delannoy 2011).

#### *Sensitivity to change*

Delannoy (1997) found that the Puerto Rican sharp-shinned hawks are only associated with certain montane habitat. It is expected that sharp-shinned hawks move from the areas as habitat destruction advances. The capability of these hawks to reestablish another territory is unknown, no previous studies on relocation of this species has been conducted in Puerto Rico.

### **CUMULATIVE EFFECTS**

Cumulative effects include the effects of future Commonwealth, local or private actions that are reasonably certain to occur in or near the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed project action are not considered in this section because those actions require separate consultation pursuant to Section 7 of the Act.

The Service may anticipate new actions near the proposed project. There are three proposed pipeline connection valves along the pipeline route. Possible future pipeline expansion may be expected, but has not been proposed, evaluated or impacts assessed. Nevertheless, any future expansion of the pipeline may add impacts of incidental take on the species.

In addition, new development may occur on forested private land, areas which are considered to be habitat for both endangered animal and plant species. The karst and surrounding forests are under heavy pressure from development that could further destroy essential Puerto Rican boa, Puerto Rican broad-winged hawk and Puerto Rican sharp-shinned hawk habitat.

### **CONCLUSION**

After reviewing the current status of the Puerto Rican boa, Puerto Rican broad-winged hawk, and Puerto Rican sharp-shinned hawk; the range of the species; the effects of the proposed Via Verde gas pipeline and the cumulative effects; it is the Service's biological opinion that the Via Verde gas pipeline project, as proposed, is not likely to jeopardize the continued existence of

any of these species because: 1) conservation measures will be implemented during construction to minimize possible direct effects, and 2) the amount of habitat to be affected is small relative to the overall distribution of the species. The proposed construction of the Via Verde project would result in the destruction of about 330 ac of Puerto Rican boa habitat, 104 ac of Puerto Rican broad-winged hawk habitat, and 189.0 ac of Puerto Rican sharp-shinned hawk habitat. These impacts are small if compared to the habitat predicted from models, which suggest that in Puerto Rico there are about 1 million acres of Puerto Rican boa habitat, 465,672 ac of Puerto Rican broad-winged hawk and about 209,023 ac of sharp-shinned hawk habitat. The GAP predicted habitat models are based on habitat suitability for the species and does not imply that habitat is currently occupied. Thus, the number of individuals to be affected by the project within the suitable habitat cannot be determined with the information available. In addition, in terms of the Puerto Rican boa, direct impacts from the proposed construction will not affect the most highly productive habitat for this species (i.e., karst caves). No critical habitat has been designated for these species; therefore, none will be affected.

## **INCIDENTAL TAKE STATEMENT**

Section 9 of the Act and Federal regulation under section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the USACE so that they become binding conditions of any grant or permit issued to PREPA, as appropriate, for the exemption in section 7(o)(2) to apply. The USACE has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions, or (2) fails to require PREPA to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the USACE must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR '402.14(I)(3)]

**AMOUNT OR EXTENT OF TAKE ANTICIPATED**

The Service is unable to identify the numbers of Puerto Rican boas that may be taken as a result of the construction and operation of the Via Verde gas pipeline project because of the biology of the species and its widespread distribution. Based on the best information available, the Service anticipates that approximately 330 ac of Puerto Rican boa habitat and an unknown number of boas that are not detected and relocated during surveys may be taken as a result of the proposed project. Because information on density of boas at the project ROW is not available, a number of impacted individuals cannot be identified at this time. The incidental take is expected to be in form of harassment, harm, and mortality (as stated above). The proposed project will use heavy and specialized construction machinery within and around the project footprint. A permanent impact footprint will remain as a result of the proposed project. Significant habitat modification or degradation may result in death or injury to the Puerto Rican boa as well as disturbance and/or avoidance of behavioral patterns such as breeding, feeding or sheltering.

The Service is unable to identify the numbers of Puerto Rican broad-winged hawks and Puerto Rican sharp-shinned hawk that may be taken as a result of the construction and operation of the Via Verde gas pipeline project because of the biology of the two species. Based on the information currently available, the Service anticipates that approximately 104 ac of suitable Puerto Rican broad-winged hawk habitat and 189 ac of suitable Puerto Rican sharp-shinned hawk habitat may be taken as a result of the proposed action. The GAP predicted habitat models are based on habitat suitability for the species and does not imply that habitat is currently occupied. Thus, the number of individual hawks to be affected by the project within the suitable habitat cannot be determined with the information available. Based on the individual hawks observed within the action area during surveys, two home ranges of the Puerto Rican broad-winged hawk and four home ranges of the Puerto Rican sharp-shinned hawk may be partially or completely taken by the project. The Service expects to find a higher potential of occurrence of Puerto Rican sharp-shinned hawks and Puerto Rican broad-winged hawks along and around the karst areas that occur within the proposed pipeline route. The incidental take is expected to be in form of harm and harassment. Direct mortality is not anticipated since construction activities will be conducted outside of the breeding seasons. Once the project is constructed, a permanent 50 ft wide ROW will remain without forested vegetation. Significant habitat modification or degradation may result in disturbance and/or avoidance of behavioral patterns such as breeding, feeding or sheltering.

Table 6. The estimated number of individuals and amount of critical habitat affected for the proposed project, based on the best available commercial and scientific information.

SPECIES	INDIVIDUALS / HABITAT	TAKE TYPE	CH DESTROYED
Puerto Rican boa	Unknown / 330 acres	Harm, Harass, and Mortality	N/A
Puerto Rican broad-winged hawk	Unknown / 104 acres	Harm and Harass	N/A
Puerto Rican sharp-shinned hawk	Unknown / 189 acres	Harm and Harass	N/A

## **EFFECT OF THE TAKE**

In the accompanying biological opinion, the Service determined that this level of expected take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

## **REASONABLE AND PRUDENT MEASURES**

The Service believes the following reasonable and prudent measures are necessary and minimize impacts of incidental take of the Puerto Rican boa, Puerto Rican broad-winged hawk and Puerto Rican sharp-shinned hawk. These measures are in addition to those presented as part of the project description.

1. The USACE must ensure that their permit to PREPA includes a special condition to ensure full implementation of the Conservation Measures previously described in this BO.
2. The USACE must ensure that the proposed project is constructed and operated as designed, planned, and documented in the BA, GIS shape-files submitted in July 2011, all supporting information provided by PREPA, and this BO.
3. The USACE must ensure that PREPA monitors (specified in the terms and conditions) the level of Puerto Rican boa, Puerto Rican broad-winged hawk and Puerto Rican sharp-shinned hawk take associated with the proposed project and the implementation of on-the ground measures to minimize effects of the anticipated take.
4. The USACE must ensure that PREPA implements measures to minimize or eliminate impacts from construction and operation. Further impacts to all the areas outside of the proposed action footprint shall be avoided at all costs.
5. PREPA has proposed habitat loss compensation as a conservation measure for the project. In order to implement this conservation measure, PREPA shall develop a systematic land protection plan. The Service will review and optimize this plan for the recovery of the Puerto Rican boa, Puerto Rican broad-winged hawk and Puerto Rican sharp-shinned hawk.

## **TERMS AND CONDITIONS**

In order to be exempt from the prohibitions of section 9 of the Act, the Corps and PREPA must comply with the following terms and conditions, which carry out the reasonable and prudent measures described above, and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary and are described according to the timing of the construction activity.

- A. Prior to any construction or habitat modification activity:

1. PREPA shall clearly mark in the field boundaries of all construction areas.
2. Personnel associated with habitat modification and construction operations shall be oriented on the Puerto Rican boa biology, ecology, habitat, and conservation. This orientation shall be given by a qualified biologist who has work or research experience with the Puerto Rican boa.
3. PREPA shall provide the USACE and the Service a detailed schedule of the Puerto Rican boa search efforts along the project route and coordinate with the Service the qualifications and experience of contracted personnel for such surveys.
4. Puerto Rican boa surveys shall start at least 30 days before project construction starts, two qualified and experienced field biologists shall conduct intensive Puerto Rican boa surveys at previously marked construction ROW within the species habitat. In order to maximize the possibility of finding boas, these surveys should take place during nocturnal hours after sunset until midnight and ideally within the periods of highest peaks of activity for the species (March through May and August through October). Although one may still find boas outside of these hours and months, the likelihood of finding the species is greatly reduced. Surveyors will focus particularly on crevices in the ground and exposed rock and trees that could be used by the species. Surveyors shall have previous experience searching and handling boas and shall have the required permits from DNER to handle boas. Surveys will be scheduled according to the contractors work plan; daily changes in these work plans will be taken into account for planning site inspections.
5. If Puerto Rican boas are found, the protocol in Appendix 1 for capture and relocation of boas shall be implemented (Appendix I). It is important to record the information indicated in the protocol. Monthly reports shall be prepared and submitted to the CESFO summarizing survey results and capture and relocation activities for boas.
6. Contractors shall develop a management and protection plan for the Puerto Rican boa and its habitat adjacent to the pipeline permanent ROW, establishing the site-specific actions to be taken by the Contractor and PREPA to prevent and/or minimize direct, indirect and cumulative impacts of the operation and maintenance of the permanent pipeline corridor on the species.
7. Sixty days before project starts, PREPA shall provide the Service with site specific plans, methods and the list of qualified personnel to conduct Puerto Rican broad-winged hawk and Puerto Rican sharp-shinned hawk along the project route.
8. Surveys shall be conducted during the 2012 and 2013 breeding seasons (subsequent surveys shall be conducted if construction continues) to locate possible nesting sites within the two Focal areas identified in the Hengstenberg surveys. Emphasis shall be given to occupied territories. Continuous monitoring of these areas shall be conducted to determine the reuse of these areas and to document the potential for nesting.

Nesting sites shall be determined using the four criteria mentioned by Delannoy (1995). Breeding season begins in January-February with the courtship display flights. The monitoring of breeding activity will be conducted with an intensity of no less than three times a week. Intensive monitoring during the first three stages of the breeding season (courtship, selection of nest tree and nest building) are essential to avoid impacts to nests. Lookouts appropriately located, trained personnel and intensive monitoring are needed. Once the nest is constructed by the hawks, when egg deposition begins will be determined by qualified personnel. Monitoring of activity patterns will be conducted to determine natural abandonment or predation. The hatching date will be recorded during the incubation period (no less than 28 days for the species), to estimate when chicks are ready to fly. It is known that when chicks are approximately 29-30 days old, begin venturing out of the nest. If the lookout is appropriately located, these chicks can be observed from the lookout. Spot mapping data collection will be used to monitoring hawks activity patterns to determine possible impacts related to construction activities. Data shall be collected at least three times a week (from dawn to 2 p.m., the time when the hawks are more active).

9. At least thirty days before the projects starts, PREPA shall submit to the Service a systematic land protection plan in order to implement proposed conservation measures. The systematic land protection plan shall include detailed maps, time schedule of proposed activities and habitat quality criteria for the Service's review and approval.

**B. During the construction and habitat modification activities:**

1. Method of land clearing: PREPA shall scrape the vegetation at the surface, leaving the rootstalks intact, when clearing the ROW and or any other areas to allow forest vegetation to recover.
2. During construction daily surveys for the Puerto Rican boa shall continue.
3. Before any construction or habitat modification starts (recommend from 5 a.m. to 7:30 a.m), the qualified surveyor will search for boas within any construction materials, construction equipment and machinery where boa individuals might have entered during the previous night for shelter or thermoregulation. Surveyors shall also search within the boa habitat that will be impacted. An experienced biologist will evaluate the area to determine the amount of time required for the field inspection. If the area is large, the biologist will decide whether to commence field inspections the afternoon before any construction or habitat modification starts.
4. If boas are found during the habitat modification and construction activities, operation of any machinery within 50 feet of the boa shall stop. The qualified biologist will proceed to capture the boa according to the protocol in Appendix I and work may continue. The information indicated in the protocol shall be recorded. Monthly reports shall be prepared and submitted to the Service summarizing survey results, capture and relocation activities for boas.

5. In order to avoid mortality of the Puerto Rican broad-winged hawk and Puerto Rican sharp-shinned hawk within occupied habitat, all land clearing activities and construction activities within occupied habitat shall be conducted outside of the breeding seasons for the two species (December to July).

C. After the construction and habitat modification activities:

1. All temporarily impacted areas within boa habitat shall be enhanced via reforestation with native vegetation. Reforestation plans shall follow guidance provided in Ríos-López and Aide (2007). Reforestation efforts and maintenance shall continue for at least 5 years after project completion.
2. Puerto Rican boa survey efforts along the project's footprint and permanent impact area within boa habitat shall continue for at least 3-5 years in order to evaluate post-construction boa behavior and boa occurrence within the permanent impact area. Puerto Rican boas encountered during post-construction surveys or other activities may not need relocation, but will still be managed according to the protocol (Appendix I). Annual reports shall be prepared and submitted to the Service summarizing survey results, capture, and relocation activities (if necessary) for boas.
3. Once the pipeline is in operation, Puerto Rican broad-winged hawk and Puerto Rican sharp-shinned hawk nesting sites located adjacent to the ROW area shall be monitored for at least two breeding seasons to evaluate impacts of operation on the two species. An annual report will be submitted summarizing nesting activities for each of the two breeding seasons.
4. To reduce the possibility of shooting and nesting habitat vandalism, and to minimize indirect and cumulative impacts in the area adjacent to the ROW, actions shall be taken to increase surveillance and law enforcement in the area. These actions will include patrolling by rangers, the creation of educational materials to increase public awareness on protection of endangered wildlife species in the area, and placement of signs. The content of signs shall be coordinated with the CESFO.
5. Disturbed areas adjacent to the pipeline shall be revegetated with native vegetation to create a buffer zone between the permanent ROW and Puerto Rican boa, Puerto Rican broad-winged hawk and Puerto Rican sharp-shinned hawk habitat. The species density of plants to be utilized for the reforestation shall be coordinated with the CESFO.
6. A management and protection plan for the Puerto Rican boa, Puerto Rican broad-winged hawk, and Puerto Rican sharp-shinned hawk habitat adjacent to the pipeline ROW summarizing the actions to be taken by PREPA to prevent and/or minimize direct, indirect and cumulative impacts of the operation of the pipeline, shall be prepared and submitted to the CESFO.
7. After the project is constructed USACE shall continue submitting annual reports to CESFO, summarizing all measures implemented by PREPA for the permit period.

Upon locating a dead, injured, or sick individual of an endangered or threatened species, initial notification must be made to the Fish and Wildlife Service Law Enforcement Office at Guaynabo Puerto Rico (651 Federal Drive, Suite 372-12, Guaynabo, PR 00965 (telephone 787-749-4338). Additional notification must be made to the Fish and Wildlife Service Caribbean Ecological Services Field Office at Carr. 307, km 5.1 Boquerón, PR 00622 (telephone 787-851-7297). Care should be taken in handling sick or injured individuals, and in the preservation of specimens in the best possible state for later analysis of cause of death or injury.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impacts of incidental take that might otherwise result from the proposed action. The Service believes that no more than 330 ac of Puerto Rican boa habitat, 104 ac of Puerto Rican broad-winged hawk habitat, and 189 ac of Puerto Rican sharp-shinned hawk habitat will be incidentally taken. If, during the course of this action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The USACE must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

#### **COORDINATION OF INCIDENTAL TAKE STATEMENTS WITH OTHER LAWS, REGULATIONS, AND POLICIES**

While the incidental take statement provided in this consultation satisfies the requirements of the Act, it does not constitute an exemption from the prohibitions of take of listed migratory birds under the more restrictive provisions of the Migratory Bird Treaty Act.

The Fish and Wildlife Service will not refer the incidental take of any migratory bird or bald eagle for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. “ 703-712), or the Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. “ 668-668d), if such take is in compliance with the terms and conditions specified here.

#### **CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help carry out recovery plans, or to develop information.

We offer the following conservation recommendations for consideration:

A. PREPA may provide the following recovery actions for the Puerto Rican boa:

1. Implement a radio tracking component for Puerto Rican boas found during the proposed activities. A Puerto Rican boa radio tracking component would focus

on determining effects and behavior after relocation of individuals and further contribute to the continued existence of this species.

2. Provide funds for a quantitative and systematic effort to determine Puerto Rican boa population estimates, relative abundance and occupancy within island wide diverse habitats.
3. Contribute funds to purchase and protect in perpetuity land that provides Puerto Rican boa quality habitat, especially contiguous to privately or publicly protected areas.

**B. PREPA may provide the following recovery actions for the Puerto Rican broad-winged hawk and Puerto Rican sharp-shinned hawk:**

1. Provide funds for a quantitative and systematic effort to determine population estimates, relative abundance and occupancy within island wide diverse habitats.
2. Contribute funds to purchase and protect in perpetuity land that provides quality habitat, especially contiguous to privately or publicly protected areas.
3. Surveys should be conducted in the proposed compensation areas prior to acquisition to determine the presence/absence of the species and habitat use.
4. Proposed areas for compensation should be characterized prior to acquisition to determine if nesting and/or feeding habitat for the hawks is present in the areas.
5. Based on the above mentioned studies, if the areas proposed for acquisition do not appear to be adequate, the compensation should be reconsidered and other areas acquired. Ecological contiguity and continuity to the existing nesting habitat should also be used as criteria to determine final compensation areas.
6. A management and protection plan should be developed for the compensation areas in order to ensure the future availability of this habitat for the continued survival and recovery of the species.
7. Develop outreach materials in coordination with CESFO to raise awareness and promote protection of listed species among private landowners, permit applicants, and non-federal entities carrying out actions within Puerto Rican sharp-shinned hawk, and Puerto Rican broad-winged habitat. The karst and surrounding forests are under heavy pressure from development that could further destroy essential Puerto Rican boa, Puerto Rican broad-winged hawk and Puerto Rican sharp-shinned hawk habitat. Outreach activities would be invaluable in making residents and developers aware of these species and the need to protect their habitat as a whole. These efforts would also significantly contribute to the continued existence of the species.

**The Service recommends the following recovery actions for the Puerto Rican crested toad:**

1. Any proposed efforts to collect and re-locate individuals should be carefully evaluated with species experts and alternatives shall be developed to avoid possible effects to the species.
2. Conservation alternatives developed for this species shall be closely coordinated with species experts to ensure the protection of the species.

3. Daily monitoring should be conducted during hours of maximum activity for the species (8:00-10:00PM).
4. The CESFO does not recommend relocation of individuals because it would most likely result in loss of the toads.

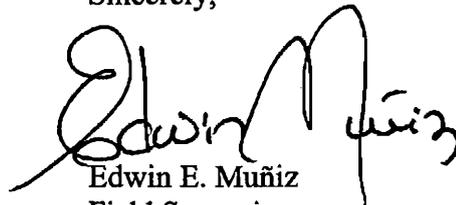
In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the conservation recommendations carried out.

### **REINITIATION NOTICE**

This concludes formal consultation on the action(s) outlined in the July 11, 2011 request. As written in 50 CFR ' 402.16, reinitiation of formal consultation is required where discretionary USACE involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the USACE action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the USACE action is later modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease until reinitiation.

If you have any questions about this biological opinion, please contact Marelisa Rivera, Deputy Field Supervisor at (787) 851-7297 extension 206.

Sincerely,



Edwin E. Muñiz  
Field Supervisor  
Caribbean Ecological Services Field Office

Cc: PREPA, San Juan

Enclosures: Appendix 1.

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## **APPENDIX I PUERTO RICAN BOA CAPTURE AND RELOCATION PROTOCOL**

This protocol is appended to the Via Verde gas pipeline project USFWS Biological Opinion (BO). As part of the terms and condition outlined in the BO for this project and in order to be exempt from the prohibitions of section 9 of the Act, the Corps and PREPA must comply with the terms and conditions (including this protocol), which carry out the RPMs described in the BO and must outline required reporting/monitoring requirements. This protocol is non-discretionary and shall be implemented for capture and relocation of all PR boa individuals found.

PREPA and its Contractor are responsible for the following procedures in the event a PR boa is found. Designated and alternate managers (may be one of the biologists) will be chosen for each working area and shift to ensure a responsible person is available on site during all working hours.

Once a PR boa is encountered, the following steps will be taken:

- a. Within 50 feet of the boa, any workers and associated construction or habitat modification machinery will stop work.
- b. One person will keep watch on the boa while another contacts the manager and/or biologists.
- c. Only the qualified biologists would be allowed to handle and capture the snake. If no biologists are present at the time the boa is found, then site manager must wait until one is available to retrieve the boa that same day.
- d. Depending on the location of the snake (on the ground, in a tree, in a hole or depression), the biologists may ask for assistance from other personnel to capture the boa. Location coordinates (GPS), date, time and description will be recorded.
- e. The biologist may capture the boa by hand or with the assistance of a snake hook, being careful not to injure the boa. The boa may immediately be put inside a cloth bag (e.g., pillow case, burlap sack) or secure box and closed as to not let the boa escape. Once captured the boa will be taken to a calm, quiet and cool place inside the project facilities to wait for further handling. It is recommended that when using a cloth bag, it may be placed inside a clearly identified cardboard, plastic or wooden box to help protect the boa from further stress or possible injury. By no means should the captured boa be left out in the sun or other inhospitable place.

- f. For all boas captured and/or recaptured, the biologist will take the following measurements and data:
  - Snout-vent length (SVL), tail length (TL) and weight
  - The sex of the boa only in the case were the biologist has had proper training and experience to achieve this (if not done correctly it may cause injury, infection and/or death to the boa)
- g. For all boas captured and previous to relocation, the biologist will implement a pit-tag or transponder into the snake. It is important that this technique requires training and experience in order not to cause further damage to the snake. If not done correctly it may cause injury, infection and/or death to the boa. This technology is necessary to individually identify each boa that may be captured and potentially recaptured after relocation. It will also provide invaluable information about the boa's biology and ecology if recaptured.
- h. Once the biologist has recorded the capture locality information, boa measurements, and boa has been properly pit-tagged, then relocation of the snake may proceed. Relocation site shall be within 1-1.5 km from the capture site and within the same type of habitat. It shall also be the farthest away from any previously developed area, in order to minimize future human boa interaction that may result in injury to the boa. If boa returns to capture site after relocation, then this relocation distance shall allow enough time for the boa to return after the project has been completed at the capture site. In addition, it will still be within same habitat and area that the captured boa normally uses, thus minimizing disorientation and negative relocation effects. If no relocation sites meet the previous characteristics, then relocation sites (outside of the captured boa's normal range) may be further evaluated and approved in coordination with the Service.
- i. Monthly and final reports shall be prepared and submitted to the Service and DNER summarizing survey results and capture and relocation activities for boas.

The following is an outline of the data that shall be recorded for all boas captured and relocated.

1. Name and contact information of the persons involved in searching the boas (surveyors).
2. Boa survey dates, sites, start and end times of survey.
3. Temperature and relative humidity at the beginning and end of the survey.
4. Number of boas found per hour per person and/or calculated survey effort.

It is important to record the following information once a boa is captured

1. Exact location (GPS coordinates) of boa occurrence.
2. Microhabitat (i.e., branch, rock, cavity, ground, exposed, hidden, etc.) and macro habitat (i.e., "mogote" top, hillside, foothill, valley, sinkhole) descriptions.

3. Photographs of the boa in its habitat.
4. General health description of the captured boa.
5. Notes on the behavior of the boa.
6. Snout-vent length (SVL), tail length (TL), weight and sex.
7. Pit-tag identification number.
8. Exact relocation (GPS coordinates) site.
9. Date and time of relocation.