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December 12, 2011

## VIA E-MAIL AND CERTIFIED MAIL

Honorable Ken Salazar  
Secretary of the Interior  
Office of the Secretary  
Department of Interior  
1849 C Street, N.W.  
Washington, DC 20240

**Re: Petition to Emergency List the Coquí Llanero (*Eleutherodactylus juanariveroi*) as Endangered under the Endangered Species Act, and to Designate Critical Habitat**

Mr. Salazar,

On behalf of petitioners Neftalí Ríos-López, Rafael L. Joglar, Ciudadanos del Karso, Federación Espeleológica de Puerto Rico, Janis Gonzalez, Héctor E. Quintero, Carlos A. Delannoy, Edgardo González, the Center for Biological Diversity, and the Sierra Club, we hereby formally petition U.S. Fish and Wildlife Service (FWS) to emergency list the Coquí Llanero (*Eleutherodactylus juanariveroi*) as endangered and to immediately designate Critical Habitat for the species under the Endangered Species Act, 16 U.S.C. § 1533.

This petition is filed under 5 U.S.C. § 553(e), 16 U.S.C. § 1533(b)(7), and 50 C.F.R. § 424.14 and § 424.20 (2010), giving interested persons the right to petition for issuance of a rule listing a species as endangered on an emergency basis to take effect immediately upon publication within the Federal Register.

As described throughout this petition, the Coquí Llanero has an extremely limited geographic range with its only known habitat under imminent threat. Therefore, an emergency listing of the Coquí Llanero is warranted to prevent a “significant risk to the well-being of [the] species.” 16 U.S.C. § 1533(b)(7). Petitioners also request that FWS concurrently designate Critical Habitat for the species concurrent with the emergency listing as necessary for the conservation of the species.

For the reasons discussed throughout the enclosed petition, we hereby request that the FWS exercise its emergency listing authority under the Endangered Species Act for the Coquí Llanero. If you would like to discuss the issues raised in this petition, please do not hesitate to contact us at (802) 831–1305 or via email at [p.parenteau@vermontlaw.edu](mailto:p.parenteau@vermontlaw.edu).

Very truly yours,



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Appendices to Petition**

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**Coquí Llanero**  
*Eleutherodactylus juanariveroi*

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**By Certified Mail**

**December 12, 2011**

**U.S. Fish and Wildlife Service  
United States Department of the Interior**

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## **Appendices**

1. Ríos-López, N. Letter dated Nov. 29, 2011 to Edwin Muñiz, U.S. Fish and Wildlife Service, regarding the Vía Verde Project.
2. Ríos-López, N. Letter dated Nov. 1, 2011 to Robert Barron, U.S. Army Corps of Engineers, regarding the Vía Verde Project.
3. Delimitation of the Watershed Tributary to the delimited Habitat of the Coquí Llanero, Sabana Seca, PR, prepared for Departamento de Recursos Naturales y Ambientales (July 2007).
4. U.S. Fish and Wildlife Service (USFWS). Letter dated July 15, 2011 to Mr. Robert Barron, U.S. Army Corps of Engineers, regarding Biological Assessment for the Vía Verde Project.
5. Ríos-López, N. & Thomas, R. (June 21, 2007). A new species of palustrine *Eleutherodactylus* (Anura: Leptodactylidae) from Puerto Rico, *Zootaxa* 1512, 51-64.



## INTRODUCTION

Neftalí Ríos-López, Rafael L. Joglar, Ciudadanos del Karso, Federación Espeleológica de Puerto Rico, Janis Gonzalez, Héctor E. Quintero, Carlos A. Delannoy, Edgardo González, the Center for Biological Diversity, and the Sierra Club hereby formally petition the United States Fish and Wildlife Service (FWS) to list the Coquí Llanero (*Eleutherodactylus juanariveroi*) as endangered pursuant to the Endangered Species Act (ESA), 16 U.S.C. § 1533, and to designate appropriate Critical Habitat under the ESA within a reasonable period of time following the listing.

The Coquí Llanero, endemic to Puerto Rico, is the smallest and only known herbaceous wetland tree frog specialist within the genus *Eleutherodactylus*. This obligate marsh dweller, discovered in 2005 and known to inhabit a single freshwater herbaceous wetland-karst ecosystem in Toa Baja Puerto Rico, is under extreme threat of extinction due to habitat destruction and modification throughout its entire range. As described in this petition, extreme threat of extinction to the Coquí Llanero is remarkably imminent due to impending construction of the Vía Verde natural gas pipeline project (Vía Verde Project) on lands and waters adjoining the only known wetland habitat for the Coquí Llanero on the planet. Construction of the Vía Verde Project constitutes an “emergency posing a significant risk to the well-being” of the Coquí Llanero. 16 U.S.C. § 1533(b)(7) (2006). Accordingly, petitioners request an immediate determination to list the species as endangered under the emergency listing provisions of the

ESA and request corresponding emergency critical habitat designation. Furthermore, petitioners formally request revision of the proposed critical habitat designation for the Coquí Llanero as essential to provide for the necessary conservation of the species. 50 C.F.R. § 424.14(c) (2010).

This petition is filed under 5 U.S.C. § 553(e), 16 U.S.C. § 1533(b)(7), and 50 C.F.R. § 424.14 and § 424.20 (2010), giving interested persons the right to petition for issuance of a rule listing a species as endangered on an emergency basis to take effect immediately upon publication within the Federal Register.

## **BACKGROUND**

The Coquí Llanero was first collected by Neftalí Ríos-López and J.P. Richard Thomas in 2005 from a single freshwater, herbaceous wetland in Toa Baja, Puerto Rico. On May 22, 2007, the Caribbean Primate Research Center petitioned FWS to list the Coquí Llanero as endangered under the ESA and to designate critical habitat concurrently with such listing. On July 8, 2009, FWS announced its 90-day finding on a petition to list the Coquí Llanero under the Endangered Species Act, determining that the petition to list the species contained substantial scientific and commercial information indicating listing may be warranted (74 Fed. Reg. 32510). On October 12, 2011, pursuant to a settlement agreement between the Center for Biological Diversity and Department of Interior, FWS proposed to list the Coquí Llanero as endangered under the ESA. (76 Fed. Reg. 63420). Concurrently with this finding, FWS proposed to designate 615 acres of public and private land in Toa Baja, Puerto Rico as critical habitat for the species (*Id.*).

By October 2012, within one year of this 12-month finding, FWS is required to promulgate a final rule to list the Coquí Llanero as endangered throughout its range and to designate corresponding critical habitat in Toa Baja, Puerto Rico. 16 U.S.C. § 1533(b)(6)(A) (2006). FWS made its determination to list the Coquí Llanero based on the finding that the

continued existence of the species is threatened by “urban development and associated activities, changes in hydrology, surface and ground water pollution, use of herbicides, invasion of nonnative species, predation, climate change, brush fires, competition, and inadequate regulatory mechanisms” (74 Fed. Reg. at 63428). FWS found that these operative threats were “exacerbated” because the only known and “extremely localized” population of Coquí Llanero exists on lands directly threatened by destruction and modification (76 Fed. Reg. at 63425). Therefore, due to remote isolation of the species within a single unique wetland complex, FWS recognized the importance of listing the Coquí Llanero throughout its entire range (*Id.*).

However, despite FWS’s proposal to list the species as endangered by October 2012, an *immediate emergency listing* of the Coquí Llanero is required due to numerous threats posed by the Puerto Rico Electric Power Authority’s (PREPA) imminent plans for construction of a liquefied natural gas pipeline project, known as Vía Verde, directly adjacent to the Coquí Llanero’s only known wetland habitat. The proposed Vía Verde Project will traverse at least 92 miles across the island of Puerto Rico, crossing countless ecological zones, impacting approximately 235 rivers and wetlands, covering 369 acres of jurisdictional waters of the United States. Construction of the Vía Verde Project will consist of a 150-foot right-of-way during construction and a 50-foot maintenance right-of-way throughout the life of the pipeline. Construction plans for the Vía Verde Project include use of open trenching throughout wetlands, terracing of hills and slopes, Horizontal Directional Drilling under rivers and streams, diversion and dewatering of stream channels and drains, placement of riprap along streams, installation of culverts, clearing of natural vegetation, excavation of fill material, replacement of backfill into trenches, and installation of construction platforms and access roads. Additionally, plans for

long-term right-of-way maintenance include use of herbicidal and mechanical clearing of vegetation throughout herbaceous wetlands.

The Vía Verde Project’s proposed right-of-way alignment through Toa Baja is a mere 1.4 miles from the only known Coquí Llanero wetland habitat in the world (76 Fed. Reg. at 63438). The proposed Vía Verde Project right-of-way alignment is planned to parallel an important stream interconnected to the Coquí Llanero’s sensitive 615-acre wetland habitat. Construction plans along this stream include the use of Horizontal Directional Drilling and open trenching, among other hydrologically damaging construction methods. Pre-construction studies have detected the presence of at least six Coquí Llanero individuals directly with the proposed right-of-way alignment along this important interconnected stream in Toa Baja (Vega-Castillo 2011). Despite detection of the Coquí Llanero squarely within the Vía Verde Project right-of-way, the project is moving forward rapidly without modifications and without a full accounting of the project’s effects on the species.

Approval of PREPA’s Vía Verde Project requires issuance of a Clean Water Act Section 404 Dredge and Fill Permit. The U.S. Army Corps of Engineers (Corps) is presently in the final stages of processing the Vía Verde Project 404 Permit application (Permit Application No. SAJ 2010-02881 (IP-EWG)). When issuing a 404 Permit, the ESA requires that the Corps insure that its actions are “not likely to jeopardize the continued existence of any endangered species . . . or result in the destruction or adverse modification of habitat of such species . . . determined . . . to be critical . . .” 16 U.S.C. § 1536(a)(2) (2006). When fulfilling this substantive duty, the ESA requires Section 7 consultation between FWS and the Corps for all listed species within the proposed project’s action area (Id.). However, for the Vía Verde Project, the Corps was merely required to “confer” informally with FWS on any action that is likely to jeopardize the continued

existence of a species that is *proposed* for listing, such as the Coquí Llanero was at the time of ESA consultation on the project. 16 U.S.C. § 1536(a)(4) (2006).

On July 15, 2011, FWS concurred with the Corps’s determination that the project “may affect, but is not likely to adversely affect” the Coquí Llanero, relying on a wholly incomplete and inadequate Biological Assessment submitted by PREPA for the Vía Verde Project (USFWS 2011c). Subsequently on August 23, 2011, FWS concluded its ESA Section 7 formal consultation with its issuance of a partially-complete Biological Opinion on *selected* listed species found within the Vía Verde Project’s action area. Other than a one paragraph description of mitigation measures for the Coquí Llanero in this Biological Opinion, FWS failed to consider the impacts of the project on the species (USFWS 2011b at 18). This ESA consultation cannot suffice to meet the requirements of Section 7, especially given the presence of the species within the project’s action area. Once the Coquí Llanero is subsequently listed by the statutory deadline of October 2012, the ESA will require more stringent Section 7 formal consultation for impacts of federal permitting actions on the species. However, considering the extremely fast-track nature of the Vía Verde Project, it is very likely that the project will be fully constructed prior to the Coquí Llanero receiving any mandated ESA protections.

On November 30, 2011, the Corps issued a draft Environmental Assessment (EA), Statement of Findings, and a Finding of No Significant Impact for the Vía Verde Project (USACE 2011). In issuing its draft EA, the Corps relied on FWS’s concurrence that the Vía Verde Project may affect but is not likely to adversely affect a multitude of listed species, including the Coquí Llanero (*Id.* at 100). In justifying its Finding of No Significant Impact, the Corps claims that the project’s impacts to the Coquí Llanero wetland habitat are “expected to be

temporary” (*Id.*). However, FWS never fully assessed the Corps’s conclusion of temporary impacts to the Coquí Llanero’s habitat through the ESA Section 7 formal consultation process.

In its 12-month finding proposing to list the Coquí Llanero as endangered, FWS states that the following federal agency actions must require ESA Section 7 consultation once the species is subsequently listed (76 Fed. Reg. at 63429):

1. Actions that would significantly alter the structure and function of the wetland
2. Actions that would significantly alter the vegetative structure in and around the wetland
3. Actions that may alter the natural flow of water
4. Actions that would significantly degrade water quality

As described throughout this petition, the imminent federal approval of the Vía Verde Project presents an action that would otherwise require ESA Section 7 consultation if the species were presently listed. Specifically, the project will significantly alter the structure and function of the wetland, significantly alter the vegetative structure in and around the wetland, alter the natural flow of water, and significantly degrade water quality.

Due to the Coquí Llanero’s presently unprotected legal status, FWS conducted no formal Section 7 consultation for the species and produced no Biological Opinion addressing effects of the Vía Verde Project on the species and its habitat. Therefore, the Corps and FWS failed to insure that the proposed Vía Verde Project construction would not jeopardize the continued existence of the Coquí Llanero, as required for all major federal permitting actions. 16 U.S.C. §1536(a)(2) (2006). Furthermore, the Coquí Llanero has not received any of the ESA Section 9 protections and prohibitions against any unanticipated “take” of the species that will be associated with construction of the Vía Verde Project. 16 U.S.C. § 1538(a) (2006). Such unanticipated take of the species is a particular threat to the well-being of such a minuscule and elusive species recently discovered squarely within the project’s action area.

Because the Coquí Llanero has not been afforded the protections of formal ESA Section 7 consultation and because the proposed Vía Verde Project poses a significant risk to the well-being of the Coquí Llanero and its habitat, an emergency listing of the species is warranted. As described throughout in this petition, the proposed construction of the Vía Verde Project and failure to conduct ESA Section 7 formal consultation for the Coquí Llanero presents a “significant risk to the well-being of [the] species.” 16 U.S.C. § 1533(b)(7) (2006).

#### **EMERGENCY LISTING IS WARRANTED BASED ON THE BEST AVAILABLE SCIENTIFIC EVIDENCE**

The ESA empowers and requires the Secretary to act immediately to list a species whenever “any emergency pos[es] a significant risk to the well-being of any species of fish or wildlife or plants.” 16 U.S.C. § 1533(b)(7). An emergency listing would remain in effect for 240 days while the FWS complies with its ordinary rulemaking procedures under the ESA. Such an emergency listing would also require Section 7 consultation between FWS and the Corps regarding the effect of the proposed Vía Verde Project on the Coquí Llanero, protection essential to prevent jeopardy to the species’ continued existence and adverse modification of its critical habitat in the face of a significant federal permitting action. 16 U.S.C. § 1536(a)(2) (2006).

An emergency posing a significant risk to the well-being of the Coquí Llanero exists, thereby triggering the duty to immediately list the Coquí Llanero. For reasons discussed below, construction of the Vía Verde Project through wetlands and streams adjacent to the Coquí Llanero’s only known wetland habitat will lead to exacerbation of (1) the present or threatened destruction, modification, or curtailment of the Coquí Llanero’s habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) risk to the species from disease or predation; and (4) other natural or manmade factors affecting the species’ continued existence. 16 U.S.C. § 1533(a)(1) (2006). Furthermore, the existing regulatory

measures applied to the Coquí Llanero have been inadequate to prevent furtherance of these operative threats to the species (Id.).

For the protections of the ESA to be effective, the Coquí Llanero must be listed now while there is still time to consider the impacts of the Vía Verde Project before it is fully authorized. The possibility is real that, by the time of formal listing of the Coquí Llanero in October 2012 or even later, the Vía Verde Project will already be under construction, thereby resulting irreversible harm to the population and its only known habitat.

Therefore, petitioners request that FWS (1) immediately list the Coquí Llanero as endangered under its emergency listing authority; (2) immediately designate critical habitat for the Coquí Llanero under its emergency listing authority; and (3) commence the mandated ESA Section 7 consultation procedures.

## **PETITIONERS**

Neftalí Ríos-López, Ph.D., Ecologist and Herpetologist at the University of Puerto Rico–Humacao Campus, discovered the Coquí Llanero in 2005 while conducting studies of the freshwater, herbaceous wetland located on the closed U.S. Naval Security Group Activity Sabana Seca property in Toa Baja, Puerto Rico. He currently conducts field studies on the Coquí Llanero within the species' only known habitat. Petitioners Rafael L. Joglar, Ph.D., Janis Gonzalez, Ph.D., Héctor E. Quintero, Ph.D., Carlos A. Delannoy, Ph.D., and Edgardo González are distinguished biologists, ecologists, and herpetologists at various universities and organizations throughout Puerto Rico.

Ciudadanos del Karso is a nongovernmental nonprofit organization, consisting of 30 active leaders, incorporated in 1994 under the laws of the Commonwealth of Puerto Rico. It is dedicated to the protection and conservation of natural resources in the karst of Puerto Rico. Its

mission is to protect and conserve the natural systems of Puerto Rico, especially the karst of Puerto Rico, and to encourage and develop actions that illustrate how the social organization and nature can and should be supported.

Federación Espeleológica de Puerto Rico is a non-profit organization founded in 1996 and consisting of approximately 70 members. Its mission is to coordinate and combine efforts between the various caving organizations in Puerto Rico in the study of the speleology and the Karst, its preservation and protection, as well as in other areas of common interest. Main objectives of the organization include: coordinating the development of caving in Puerto Rico; providing a forum for discussion of situations, social problems and issues of common interest related to caving, cave rescue, conservation and protection of speleological resources and any resources, natural or historical related.

The Center for Biological Diversity is a national, nonprofit organization whose mission is to protect and restore endangered species and wild places through science, policy, education, advocacy, and environmental law. The Center has over 320,000 members and on-line activists, some of whom reside and recreate in Puerto Rico.

The Sierra Club is a national, nonprofit organization dedicated to protecting and restoring the quality of the natural and human environment. The mission of the Sierra Club is: To explore, enjoy, and protect the wild places of the earth; To practice and promote the responsible use of the earth's ecosystems and resources; To educate and enlist humanity to protect and restore the quality of the natural and human environment; and to use all lawful means to carry out these objectives. Sierra Club has approximately 1.3 million members as well as sixty-three Chapters and twenty-seven Field Offices throughout the United States, including a Chapter in Puerto Rico.

## **PART I: CURRENT STATUS OF THE COQUÍ LLANERO**

### **TAXONOMY**

The Coquí Llanero (*Eleutherodactylus juanariveroi*) belongs to the Order Anura, Family Eleutherodactylidae (formerly in Leptodactylidae), and Genus *Eleutherodactylus*. It was first collected by Neftalí Ríos-López and J.P. Richard Thomas in 2005 and described as a new species of the genus *Eleutherodactylus* in 2007 (Ríos-López and Thomas 2007). Although the Coquí Llanero is similar to the tree frog species *Eleutherodactylus gryllus*, differences in morphological ratios, body coloration, call frequency and structure, DNA, and habitat requirements indicate that it is a well differentiated species (Id.). The Coquí Llanero is the only known freshwater herbaceous wetland specialist within the taxonomic genus *Eleutherodactylus* in Puerto Rico and throughout the Caribbean (Id.).

### **DESCRIPTION OF THE SPECIES**

The Coquí Llanero is a tree frog endemic to the island of Puerto Rico. It is the smallest Puerto Rican frog within the genus *Eleutherodactylus*, with a mean snout-vent length of 14.7 millimeters in males and 15.8 millimeters in females (76 Fed. Reg. 63420, citing Ríos-López and Thomas 2007). The species is insectivorous (Id.). It possesses extensive dorsal skin glandularity, minute vomerine teeth, a distinctive carpal element, a unique high-pitched call, and a palustrine habitat (Ríos-López and Thomas 2007). Male Coquí Llaneros have an external single subgular vocal sac, absent in females (Id.). Finger webs and toe webs are absent, with nearly T-shaped terminal phalanges (Id.). It has prominent nasal passages with a connecting ridge behind the snout tip, giving the tip a somewhat squared appearance (Id.). The species is yellow to yellowish brown with a light, longitudinal, reversed comma mark on each side and a broadly bifurcated mid-dorsal zone (Id.).

## **REPRODUCTION AND LIFE HISTORY OF THE COQUÍ LLANERO**

### ***Reproduction***

The Coquí Llanero reproduces only on the herbaceous obligate wetland plant *Sagittaria lancifolia* (Ríos-López and Thomas 2007). *S. lancifolia* is found throughout the northern coastal plain of Puerto Rico, particularly within palustrine wetlands located in Toa Baja (Id.). Egg clutches are found on *S. lancifolia* leaf axils or leaf surfaces (Id.). The Coquí Llanero has the lowest reproductive output of any Coquí species in Puerto Rico—averaging merely three eggs per clutch (Id.). Egg clutches are found on *S. lancifolia* surfaces between 1.3 feet and 3.9 feet above the water level (Id.). Eggs develop directly into terrestrial amphibians without an intermediate tadpole or aquatic larvae phase (76 Fed. Reg. at 63433). Parental care has not been observed in the field (Id. at 63421). Thus, *S. lancifolia* vegetation provides the only protection that the offspring might receive (Id.).

The Coquí Llanero uses the herbaceous vegetation in the wetland, especially the ferns, as calling areas for advertising its presence to other Coquí Llanero species and for purposes of attracting mates (Ríos-López and Thomas 2007). The species' communication call consists of a series of short high-pitched notes with call duration varying from 4 to 21 seconds (76 Fed. Reg. 63420, citing Ríos-López and Thomas 2007). The advertisement call has the highest frequency among all Puerto Rican *Eleutherodactylus*, between 7.38 and 8.28 kilohertz (Id.). The calling activity starts at approximately 4:30 p.m. and decreases significantly before midnight (Id.).

### ***Life history***

The life history of the Coquí Llanero remains largely unstudied since its discovery in 2005 (76 Fed. Reg. at 63433). Therefore, not much is known about the species' juvenile development, sexual maturity, reproduction, number of offspring, and mortality rates. While

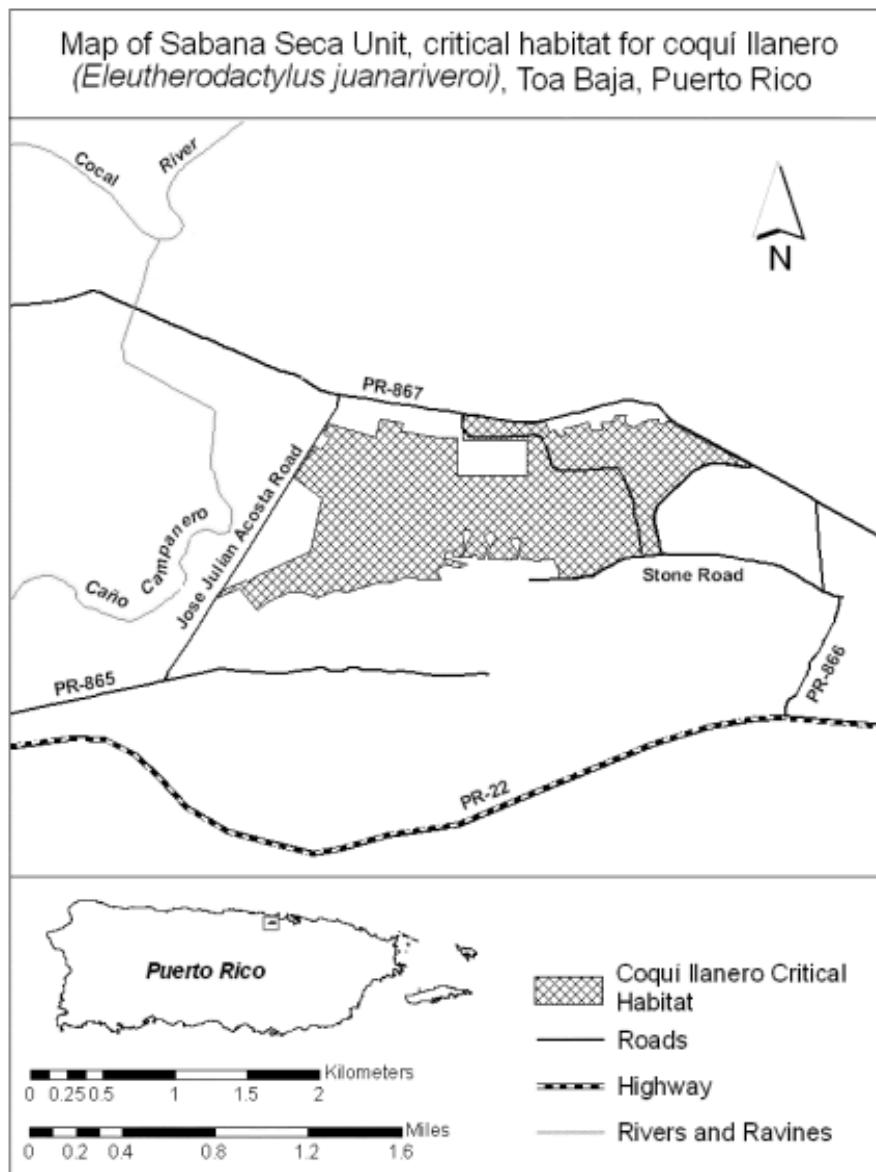
little is known about the life history of the Coquí Llanero, it is known that the species requires a specific palustrine herbaceous wetland and a very specialized wetland vegetation composition in order to carry out its life history (*Id.* at 63432).

## HABITAT REQUIREMENTS

### *Habitat Range*

The Coquí Llanero is an obligate marsh dweller (76 Fed. Reg. at 63421). The Coquí Llanero is only known to exist within the subtropical moist forest life zone of Puerto Rico, particularly within a single palustrine herbaceous wetland at 17 meters in elevation (Ríos-López and Thomas 2007). This particular palustrine wetland is seasonally flooded with fresh water (*Id.*). Palustrine wetlands are non-tidal wetlands with a salinity concentration due to ocean-derived salts of less than 0.5% parts per thousand (76 Fed. Reg. at 63421). The soil of this particular wetland consists of swamp and organic marsh deposits, herbaceous vegetation, and vines and grasses (Ríos-López and Thomas 2007). Herbaceous vegetation in this habitat includes the toothed midsorus fern (*Blechnum serrulatum*), willdenow's maiden fern (*Thelypteris interrupta*), bulltongue arrowhead (*Sagittaria lancifolia*), flatsedges (*Cyperus* sp.), and spike rushes (*Eleocharis* sp.) (*Id.*). Within this wetland, the majority of Coquí Llanero individuals have been found while perching and calling on herbaceous vegetation, mainly on ferns (*Id.*).

At present time, the Coquí Llanero is known to occur on a total of 615 acres of wetland habitat located in Toa Baja, in an area known as the Sabana Seca Unit (76 Fed. Reg. at 63422) (see Figure 1 for a map of this location, proposed for Critical Habitat designation). This 615 acre area is presently owned or managed by three entities—the U.S. Department of Defense, the University of Puerto Rico, and the Puerto Rico Land Authority (*Id.*). Due to ownership by governmental entities, this wetland habitat has experienced little disturbance over time (*Id.*).



**Figure 1:** Proposed Critical Habitat for the Coquí Llanero  
Source: 76 Fed. Reg. 63420 (Oct. 12, 2011).

The presently limited range of the Coquí Llanero suggests that this population is a remnant of a once more widely-distributed herbaceous wetland specialist whose habitat was decimated by modern land uses (*Id.*, citing Ríos-López and Thomas 2007). Moreover, Ríos-López and Thomas indicate that few or no remaining wetlands with a plant composition similar to the Sabana Seca Unit exist in Puerto Rico (*Id.*).

Multiple surveys conducted within additional potential wetlands habitat for the Coquí Llanero have yielded no further known populations of the species (76 Fed. Reg. at 63422). Therefore, FWS estimates that the 615 acre palustrine herbaceous wetland located at Sabana Seca constitutes the entire known habitat of the Coquí Llanero (Id.) However, a recent study conducted by Vega-Castillo (2011), conducted along the proposed Vía Verde Project route, presents the first known detection of the Coquí Llanero outside of the Sabana Seca Unit. Diurnal and nocturnal surveys detected the presence of at least six individuals of the Coquí Llanero vocalizing in a tributary of the Río Cocal, in an area of grassy vegetation along the sides of the water channel approximately 1.7 miles northwest from the Sabana Seca Unit (see Figure 2).



**Figure 2:** Location of Coquí Llanero outside of proposed Critical Habitat designation. The blue dot represents the locality of observed Coquí Llanero calls, approximately 1.7 miles northwest of the proposed Critical Habitat designation.

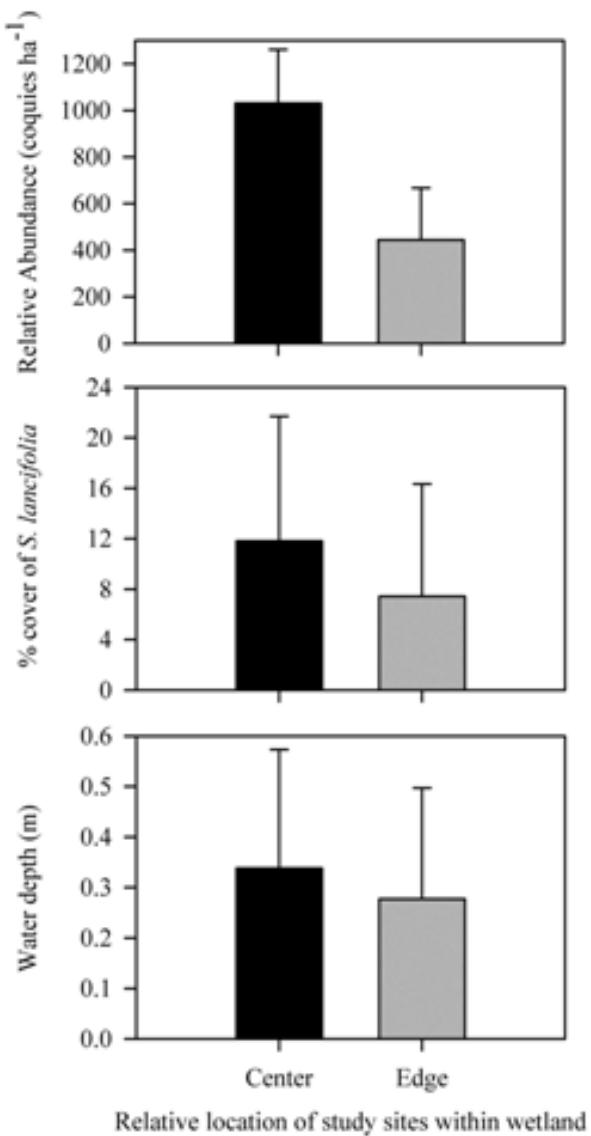
Source: Vega-Castillo, 2011.

Ríos-López believes that the detection of Coquí Llanero presence outside of the Sabana Seca Unit “suggests the ecological functionally of the Coquí Llanero’s Critical Habitat natural drainage outlet and associated canals and Río Cocal as important natural corridors for population migration and species’ persistence in Toa Baja” (Ríos-López 2011a). While FWS biologists conducted several surveys of this area to confirm the study’s findings, these surveys failed to detect the presence of the Coquí Llanero in this area (76 Fed. Reg. at 63422). This is not surprising given the pronounced difficulty of finding such an elusive species. However, based on the “highly degraded” nature of the Río Cocal tributary, FWS summarily dismissed this area as part of the total habitat occupied by the Coquí Llanero (*Id.*).

### ***Species Distribution***

The Coquí Llanero is not evenly distributed throughout the Sabana Seca Unit wetland habitat. In fact, its distribution within the palustrine wetland habitat is highly correlated with the presence of a single plant species, *S. lancifolia*. Recent data from Ríos-López (2011) illustrates the species’ specialized ecological requirement and close dependency on *S. lancifolia* within the palustrine wetland (see Figure 3). This data shows that small differences in *S. lancifolia* cover, along with water depth, present large differences in Coquí Llanero abundance (Ríos-López 2011b). A slight increase in vegetation cover thus results in a significantly higher number of Coquí Llanero individuals found per plant (*Id.*). Ríos-López also notes that the presence and distribution of *S. lancifolia* is highly dependent on specific hydrology conditions, in particular *S. lancifolia* requires undisturbed, high water depths of at least 0.3 meters (*Id.*). As observed from this data, the relative abundance of Coquí Llanero individuals increases twofold in deep water areas as compared to the shallower, drier conditions of the wetland (see Figure 3).

Preliminary studies by Ríos-López (2009) on the reproductive biology of Coquí Llanero suggest that wetland areas subjected to prolonged dry periods (generally located towards the edges of wetland) are characterized by less native ferns and arrowheads that the species requires for reproduction and survival (76 Fed. Reg. at 63424). Additionally, these drier areas also maintain a disproportionate abundance of Coquí Llanero egg clutch predators, such as native and exotic mollusks and insects, thereby limiting the number of Coquí Llanero individuals distributed in these drier regions of the wetland (Id.).



**Figure 3:** Relative abundance and interdependence of Coquí Llanero individuals in relation to water depth and *S. lancifolia* cover  
Source: Ríos-López, 2011b.

### **Breeding Habitat**

Breeding preference of the Coquí Llanero is limited to a single plant species, *S. lancifolia*, an obligate wetland species indicator (76 Fed. Reg. at 63426). A study of the Coquí Llanero's only known wetland habitat in Toa Baja indicates that *S. lancifolia* consists of 7.4 percent of the wetland's entire vegetative cover (Id., citing Ríos-López 2009). Furthermore, current unpublished research by Ríos-López suggests that Coquí Llanero reproduction on *S. lancifolia* may not occur randomly and is limited to plants located in permanently flooded wetland areas of little disturbance away from the wetland's edges (Id.). Thereby, small differences in *S. lancifolia* cover and water depth translate into large differences in availability of breeding habitat for the Coquí Llanero (Ríos-López 2011a).



**Figure 4:** Coquí Llanero egg clutches on *S. lancifolia*  
Source: Ríos-López, 2011b.

## **POPULATION**

In its 12-month finding, FWS states that no current population estimates are available for the species (76 Fed. Reg. at 63422). However, recent unpublished studies from herpetologist Ríos-López suggest that the estimated mean population size of the Coquí Llanero is approximately  $473.3 \pm 186.8$  individuals per hectare, or 192 frogs per acre (Ríos-López 2011b). Despite extensive survey efforts throughout potential species' habitat made by several researchers, the Coquí Llanero has only been observed in this single locality throughout all of Puerto Rico (76 Fed. Reg. at 63428). Subsequent to discovery of the species in 2005, additional on-the-ground surveys based on preferred species habitat characteristics have revealed "no additional populations" of the Coquí Llanero (Id. at 63423).

## **PART II: EMERGENCY LISTING IS WARRANTED UNDER THE STATUTORY CRITERIA**

Pursuant to the ESA, FWS must consider the following five listing factors when making an emergency listing determination: (1) the present or threatened destruction, modification, or curtailment of habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; and (5) other natural or manmade factors affecting its continued existence. 16 U.S.C. § 1533(a)(1) (2006). The Coquí Llanero's exposure to these five factors will cause actual, operative, and emergency threats to the species contributing to the risk of its extinction; therefore, emergency listing is warranted.

For reasons discussed below, construction of the Vía Verde Project will lead to an emergency exacerbation of the following listing factors: (1) the present or threatened destruction, modification, or curtailment of the Coquí Llanero's habitat or range; (2) overutilization of the species for commercial, recreational, scientific, or educational purposes; (3) risk to the species

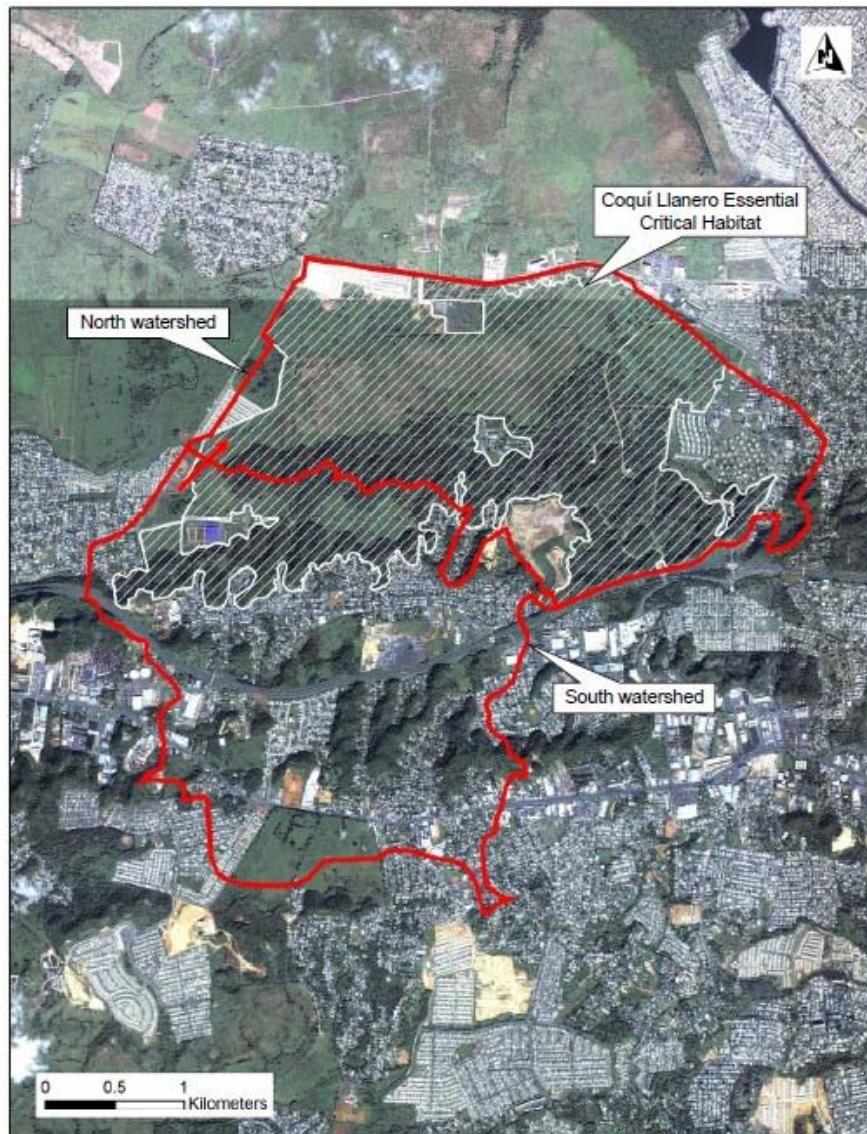
from disease or predation; (4) inadequacy of existing regulatory mechanisms to protect the species in the face of the proposed federal project; and (5) other natural or manmade factors affecting the species' continued existence.

#### ***1. Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range***

FWS acknowledges that the Coquí Llanero inhibits such “highly specialized ecological requirements” within a *single wetland ecosystem*, and that as such, any effect to this specialized ecosystem will threaten the species existence and well-being (76 Fed. Reg. at 63426). The Coquí Llanero’s unique wetland habitat is maintained by a specific water quantity and depth, channel slope, and sediment input to the system through periodic flooding events (76 Fed. Reg. at 63432). In its 12-month finding, FWS states that “[c]hanges in one or more of these parameters can result in changes in the wetland function and vegetation composition, with serious effects to the Coquí Llanero.” (*Id.*). As evidenced throughout this petition, the proposed Vía Verde Project construction will result in destruction, modification, and curtailment of the Coquí Llanero’s unique and fragile wetland ecosystem through irreversible alteration of the habitat’s hydrology. The serious effects of the Vía Verde Project on the wetland function, hydrology, and vegetation composition will result in significant risk to the well-being of the Coquí Llanero, thus warranting an immediate emergency listing of the species.

The topography of the Coquí Llanero’s wetland habitat at Sabana Seca has an east to west inclination with surface and groundwater flowing from the limestone hills in the south watershed discharging into the wetland, flowing north by northwest to Caño Campanero, then north to the Río Cocal, and into the Atlantic Ocean (see Figure 5) (76 Fed. Reg. at 63432). The Vía Verde Project’s proposed right-of-way alignment through Toa Baja is a mere 1.4 miles from the only known Coquí Llanero wetland habitat in the world, paralleling and intersecting the Río

Cocal, an important stream interconnected to, and draining from, the Coquí Llanero's sensitive wetland habitat (see Figure 6).



**Figure 5:** Watersheds Contributing to  
Coquí Llanero Wetland Habitat  
Source: Gregory L. Morris Engineering, 2007.

The Río Cocal is responsible for the maintenance of the wetland's hydrology and preservation of its unique vegetation, which consists mainly of obligate, fresh-water plant species like *Sagittaria lancifolia* (Ríos-López 2011a). Construction plans along this river include the use

of Horizontal Directional Drilling, open trenching, and “dam and pump” during construction. Herpetologist Ríos-López believes that such construction methodology in the Río Cocal will result in acceleration of drainage of the Coquí Llanero’s wetland habitat and the canals interconnected with the Río Cocal (Ríos-López 2011a). Furthermore, depletion of the wetland habitat may be accelerated due to the narrow, shallow, and fragile nature of the wetland’s only natural drainage passage (see Figure 6) (Ríos-López 2011a). This natural drainage point, located on the western edge of the wetland, maintains adequate seasonal hydrology and water flow in and out of the wetland, and is a “dynamic responsible for the maintenance of its vegetation characteristics and population size of the Coquí Llanero” (Ríos-López 2011b). This important hydrological connection to the Seca Sabana wetland is under “imminent threat of destruction” from the proposed dam and pump construction techniques of the Vía Verde Project (*Id.*).



**Figure 6:** Coquí Llanero Proposed Critical Habitat Designation with Interlaid Project Alignment.  
The red dot signifies the wetland’s only natural drainage outlet.

Source: Ríos-López, 2011b.

Interference with the natural hydrology of the Coquí Llanero's wetlands habitat is evident within at least three locations along the proposed Vía Verde Project alignment—two proposed Horizontal Directional Drilling locations along the Río Cocal and the use of trenching, damming, and pumping along the Caño Campanero (see Figure 7) (Ríos-López 2011a). The proposed Vía Verde Project construction activities at these locations will also occur below water table, one to two meters below surface level (Id.). The construction activities associated with the Vía Verde Project will alter the Coquí Llanero's fragile wetland ecosystem by lowering the water table, impacting natural inflows and outflows of water in the system, affecting rates of aquifer recharge, and reducing groundwater contact to the wetland surface. Moreover, Vía Verde Project construction through wetlands is scheduled to occur exclusively during the dry season, further exacerbating the effects of wetland draining and aquifer recharge alteration (USACE 2011 at 57).



**Figure 7:** Hydrologic Connection between HDD Drill Points on Río Cocal, Proposed Open Trenching, and Coquí Llanero Habitat. The red dot indicates the same water outlet as in Figure 6. Source: Ríos-López, 2011b.

Further impacting this fragile wetland ecosystem, proposed construction plans include a 60-feet right-of-way permanently cleared of vegetation along the Vía Verde Project route along the Río Cocal and the river's important buffer zone (Id.). Removal of riparian vegetation in drainage channels and connected streams "may facilitate drainage and drying of the wetland and accelerate colonization of invasive, herbaceous vegetation," thereby prolonging drier conditions along the edges of the wetland (76 Fed. Reg. at 63424). Drier conditions within the wetland will result in an irreversible physical curtailment of the Coquí Llanero's sensitive wetland habitat.

The Coquí Llanero is an obligate wetland dweller known to exist only within the Sabana Seca wetland complex. As a result of Vía Verde Project construction methods during Puerto Rico's dry season, draining the only known wetland habitat of an obligate wetland dweller will undoubtedly result in curtailment of habitat and a significant risk to the well-being of the species. Moreover, overall reduction in the wetland's recharge and water depth will result in irreversible change of wetland vegetation characteristics, thereby significantly destroying, modifying, and curtailing the Coquí Llanero's only known habitat (Ríos-López, 2011b). In fact, FWS acknowledges that draining and filling the wetland inhabited by the Coquí Llanero will leave "little or no suitable habitat for coquí llanero to carry out its life-history processes" (76 Fed. Reg. at 63423). Because the Coquí Llanero's existence relies on the highly specialized ecological requirements found within a *single wetland ecosystem*, the hydrological damage caused by construction of the Vía Verde Project to this ecosystem will lead to destruction and curtailment of the species' only known habitat. Thereby, an immediate emergency listing is warranted and necessary to prevent significant and imminent risks to the well-being of the species.

## ***2. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes***

While the Coquí Llanero is not a commercially valuable species sought for recreational, educational, or commercial purposes, it has been sought for scientific utilization. In its 12-month finding, FWS notes that species individuals and egg specimens have been collected for scientific purposes upon first discovery in 2005 (76 Fed. Reg. at 63425). Additionally, increased visitation for educational, research, or recreational purposes may have significant impacts on the unique wetlands vegetation composition (*Id.* at 63428). These impacts are thought to be minimal due to current access restrictions to the Sabana Seca wetland for permitted scientific research personnel only (*Id.* at 63425). However, if access to this wetland becomes unrestricted in the future as a result of Vía Verde Project right-of-way land acquisition, the Coquí Llanero may become subject to overutilization for commercial, recreational, scientific, or educational purposes.

Construction and clearing activities in the Vía Verde Project right-of-way and development of associated access roads and mainline valve stations will cause this once highly secured military area and the Sabana Seca wetland to become more accessible and well-known to the general public. This increased accessibility poses a significant risk to the well-being of the Coquí Llanero due to the increased likelihood of human visitation for educational, research, and recreational purposes.

## ***3. Disease or Predation***

Construction of the Vía Verde Project will cause physical alteration and draining of the Coquí Llanero's 615-acre wetland habitat hydrology, resulting in drier habitat conditions. These drier conditions increase the threat of disease and predation on the Coquí Llanero. In its 12-month finding, FWS determined that, based on the best scientific and commercial information available, predation is a threat to the continued existence of the Coquí Llanero (76 Fed. Reg. at

63425). Drier areas of the wetland maintain a disproportionate abundance of Coquí Llanero egg clutch predators, such as native and exotic mollusks and insects (Id. at 63424). Egg predation, coupled with the fact that the Coquí Llanero maintains the lowest reproductive output of any coquí species in Puerto Rico, makes it exceptionally vulnerable to the threat of predation (Id.). Additional information presented by Ríos-López (see above Figure 3) suggests that flooded wetland conditions provide more native vegetative cover, thereby limiting predation pressures on the Coquí Llanero. An abundance of *S. lancifolia* and deeper water conditions found at the wetland’s center are conditions required for copious Coquí Llanero egg clutch production (Id.).

FWS notes that predation of the Coquí Llanero is predominantly enhanced at the dryer edges of the wetland, and “could be exacerbated by the destruction, modification, or curtailment of the species’ habitat” (Id.). As noted in Factor 1 above, construction of the Vía Verde Project presents significant “destruction, modification, or curtailment of the species’ habitat” through alteration of drainage patterns and an anticipated decrease of water depth throughout the Coquí Llanero’s wetland habitat. This emergency situation is exactly the circumstance that FWS warns will further increase the threat of disease and predation to the species. Such an extremely localized and specialized species population is particularly susceptible to the increased threat of predation from native and exotic invertebrates as well as increased susceptibility to diseases such as the pathogenic chytrid fungus *Batrachochytrium dendrobatidis*.

Due to the extremely isolated nature of the only known Coquí Llanero reproducing population, and because of the imminent threat of increased predation and disease posed to the species from construction of the Vía Verde Project, emergency protection is warranted under the Endangered Species Act.

#### **4. Inadequacy of Existing Regulatory Mechanisms**

Although the Coquí Llanero is currently listed as endangered in the Commonwealth of Puerto Rico by the Department of Natural and Environmental Resources (DNER), this designation is not adequate to address the existing, imminent, and future threats to the species. In fact, FWS affirms in its 12-month finding determination that, due to the “uncertainty of the level of protection the existing laws will provide,” the inadequacy of existing regulatory mechanisms presents an operative threat to the Coquí Llanero remedied only by federal listing (76 Fed. Reg. at 63426). The urgent threat posed to the species resulting from imminent construction of the Vía Verde Project, correlated with the lack of adequate regulatory protections for the Coquí Llanero during development of construction methodology and project alignment, presents a significant risk to the well-being of the species. Therefore, emergency listing of the species is warranted prior to commencement of the project’s construction.

In particular, during ESA Section 7 consultation and development of a Biological Assessment for the proposed Vía Verde Project, the DNER listing failed to insure no jeopardy to the Coquí Llanero nor prevent the threat of adverse modification to its critical habitat. One example of the inadequacy of a DNER listing occurred upon discovery of six individuals of the species within the Vía Verde Project proposed right-of-way. Had the species been federally listed under the ESA it is likely that greater care would have been taken in surveying the *entire project action area* to identify the presence of additional individuals and habitat. Instead, the Biological Assessment merely utilized study transects to identify species’ presence and locations. FWS would never approve such inadequate species detection survey methodology for federally listed species, especially when detected within the project’s action area.

With federal protection in place, the discovery of a species within a project’s action area would surely result in more exacting formal Section 7 consultation and better safeguards for the species. Instead of the more rigorous protections afforded when a federally listed species is found directly within a project’s action area, FWS and the Corps are merely requiring PREPA to relocate the species if found during the course of Vía Verde Project construction (USFWS 2011b). A relocation approach has never before been utilized for the Coquí Llanero and is likely to result in failure given the species’ dependence on a single plant species within a single wetland complex. Relocation of the Coquí Llanero was fully adopted in the draft EA, signaling that the Corps and FWS intend to implement no further protections for the species beyond this untested and dangerous relocation protocol (USACE 2011 at 58). This relocation approach surely would not be allowed under the more protective federal listing regime and formal Section 7 consultation.

Additionally, the informal Section 7 consultation process conducted between the Corps and FWS for the Coquí Llanero failed to take into consideration many indirect and cumulative impacts from the proposed Vía Verde Project on the species and its fragile habitat. The Biological Assessment for the project failed to analyze the project’s impacts on the wetland classification PEM1H6 (palustrine, emergent, persistent, permanently flooded, oligohaline), the largest part of the Coquí Llanero’s Critical Habitat and connected to waters of the Río Cocal (Ríos-López 2011a). Moreover, the Corps also failed to consider the Vía Verde Project’s hydrological effects on the unique obligate plant composition upon which the Coquí Llanero depends for its survival. In its draft EA, the Corps admits that the Vía Verde Project “is impacting palustrine herbaceous wetlands” located one mile from the proposed Coquí Llanero

critical habitat (USACE 2011 at 82). However, the Corps dismisses such effects as “temporary” and “minimal” without fully consulting the expertise and experience of FWS (*Id.*).

Regrettably, until the Coquí Llanero is conclusively listed as endangered in October 2012, the more stringent ESA Section 7 formal consultation and subsequent issuance of a Biological Opinion for federal actions that “may affect” the species are not required. In fact FWS admits that the following federal agency actions must require ESA Section 7 consultation once the Coquí Llanero is subsequently listed: (1) actions that would significantly alter the structure and function of the wetland; (2) actions that would significantly alter the vegetative structure in and around the wetland; (3) actions that may alter the natural flow of water; and (4) actions that would significantly degrade water quality (76 Fed. Reg. at 63429). As described throughout this petition, forthcoming construction of the Vía Verde Project will vastly alter and degrade the species’ fragile wetland habitat in a manner implicating the need for ESA section 7 consultation and protections.

In past emergency listings, such as with the Miami Blue Butterfly, FWS has determined that the risk to a proposed species from an imminent federally permitted project warrants use of its emergency listing powers. FWS notes that, “[w]ith emergency listing, we can also influence Federal actions that may potentially impact the subspecies . . .” (76 Fed. Reg. at 49563). Heightened Federal protection through use of an emergency listing is particularly warranted for extremely sensitive and isolated species such as the Coquí Llanero, especially in the face of imminent Federal actions likely to jeopardize the continued existence of the species. Unless the Coquí Llanero is immediately listed, the Vía Verde project will move forward as planned and without adequate regulatory protections to protect the species from significant risks to its well-being

## **5. Other Natural or Manmade Factors Affecting the Coquí Llanero's Continued Existence**

In its 12-month finding, FWS summarized various natural and manmade factors affecting the Coquí Llanero's continued existence (76 Fed. Reg. at 63428). These factors included leachate contamination of the watershed from a nearby landfill, the use of herbicides within the watershed, increasing threats from accidental and deliberate brush wildfires, increased species competition, and environmental effects on the species habitat resulting from climate change (Id.) (see Figure 8 for overlay of these factors with proposed Coquí Llanero critical habitat designation). FWS determined that the effect on the species from each of these factors is further exacerbated by the particularly specialized ecological requirements of the Coquí Llanero (Id.). Therefore, FWS concluded that all of these factors present potential threats to the continued existence of the species (Id.).



**Figure 8: Additional Manmade Factors (Wildfires and Toxic Spills) within Toa Baja**  
Source: Ríos-López, 2011b.

As described throughout this petition, construction of the Vía Verde Project presents significant destruction or modification of the Sabana Seca wetland, thereby intensifying the effect of all manmade or natural factors on the Coquí Llanero. In particular, the Vía Verde Project will: (i) intensify leachate pollution from a nearby landfill; (ii) lead to increased use of herbicides within the watershed; (iii) lead to increased threats from wildfires; (iv) increase species competition within the wetland; and (v) increase the effects of climate change on the hydrology of the habitat. Construction of the Vía Verde Project will increase the likelihood and severity of these manmade and natural factors, placing the species and its entire known habitat under extreme threat. The synergistic effect of these additional factors on a species with such a limited and highly specialized habitat range creates an urgent situation warranting listing of the species under emergency provisions.

### **i. Water and Soil Pollution**

Leachate from the Toa Baja Municipal Landfill, located on the limestone hills to the south of the Sabana Seca wetland, is a factor threatening the Coquí Llanero (76 Fed. Reg. at 63426). The landfill is located on top of a limestone hill 0.5 miles upstream from the only known Coquí Llanero habitat (*Id.* at 63424). Contaminants from this landfill flow to the north at or near the ground surface, through a series of channels and small valleys, eventually reaching the Coquí Llanero wetland habitat (see Figure 9) (*Id.* at 63426). Leachate from this landfill contains arsenic, cyanide, sodium, lead, and chromium, among other elements (*Id.*). Such contaminants are of particular concern due to the ability for bioaccumulation of toxins throughout the food web and due to the likelihood of absorption of chemicals through the skin of sensitive amphibian species (*Id.*). These contaminants could directly affect the Coquí Llanero

development, cause morphological abnormalities, and increase the species' likelihood of predation and disease (*Id.*).



**Figure 9:** Directional Flow of Landfill Leachate toward Coquí Llanero wetland habitat  
Source: Gregory L. Morris Engineering, 2007.

Presently, no analysis has been conducted regarding the effects of Horizontal Directional Drilling, trenching, and canal and stream diversions associated with construction of the Vía Verde Project on overall watershed drainage patterns. Therefore, no analysis has been conducted regarding the Vía Verde Project's effects on drainage from this landfill. The Vía Verde Project draft EA and Biological Assessment fail to address overall alteration of the limestone hill hydrology surrounding this landfill and how this alteration will affect surface water flow into and out of the Toa Baja Municipal Landfill. However, as discussed in this petition, the hydrologic connection located on the western edge of the Sabana Seca wetland maintains adequate water flow in and out of the wetland. Downward withdrawal of water from this point may lead to

increased pull of leachate contamination from the landfill and into the Coquí Llanero’s only known wetland habitat.

## ii. Use of Herbicides

Use of herbicides in urban housing areas surrounding the Coquí Llanero’s wetland habitat run off into the Seca Sabana wetland, threatening the species through direct contamination and bioaccumulation (76 Fed. Reg. at 63427). Herbicide contamination leads to developmental abnormalities (such as limb malformations) in the Coquí Llanero (76 Fed. Reg. at 63426). In its 12-month finding, FWS found that this factor is a potential threat to the species (*Id.*). Moreover, FWS notes that the threat of herbicide contamination of water and soil could be “particularly harmful during drought conditions when water flows are low and pollutants are more concentrated” (76 Fed. Reg. at 63433).

The addition of increased herbicides into the Coquí Llanero’s already stressed wetland environment poses yet another supplementary risk to the well-being of the species. The Vía Verde Project plans allow for use of herbicides to maintain the right-of-way over the lifetime of the pipeline. Construction and maintenance plans for the project currently provide for herbicide spraying to control plant growth in herbaceous wetlands along the right-of-way, access roads, and valve mainline stations. Direct herbicide application for pipeline maintenance and construction has not been analyzed by FWS with respect to the Coquí Llanero’s wetland habitat, especially not with respect to the lifetime of the project. Moreover, the inevitable wetland draining resulting from the Vía Verde Project construction activities further compounds the threat of increased contaminant concentration during times of low water flow. Use of herbicides for the Vía Verde Project presents an additional factor threatening the species, thereby warranting listing of the species under emergency provisions.

### **iii. Increased Species Competition**

Because the Coquí Llanero is more specialized than other coquí species, it is more readily out-competed within the Sabana Seca wetland. Increasing threats to the Coquí Llanero from competitive pressure is a particularly destructive factor to such an extremely localized and specialized species population. This competition is enhanced when water levels are low. In fact, in this habitat the more common coquí species “rarely invade more permanently flooded areas of the wetland, suggesting a synergism between hydrology alteration and competition that may result in magnified, negative biological interactions against the Coquí Llanero” (76 Fed. Reg. at 63427, citing Ríos-López 2009).

Construction of the Vía Verde Project will cause physical alteration and draining of the Coquí Llanero’s 615-acre wetland habitat, thereby increasing drained wetland surface area and decreasing the availability of obligate *S. lancifolia* required for Coquí Llanero reproduction. Information presented by Ríos-López (see above Figure 3) suggests that flooded wetland conditions provide more native vegetative cover, thereby limiting competitive pressures on the Coquí Llanero (76 Fed. Reg. at 63425). As discussed in throughout this petition, a reduction of available Coquí Llanero habitat is an inevitable consequence of the draining and hydrological alteration resulting from construction of the Vía Verde Project. The emergency threat posed to the species resulting from alteration of its wetland hydrology through construction of the Vía Verde Project therefore presents a significant risk to the well-being of the Coquí Llanero warranting emergency listing of the species.

### **iv. Wildfires**

In its 12-month notice, FWS identified brush fires, both accidental and deliberate, as a current threat to the Coquí Llanero (76 Fed. Reg. at 63427). Moreover, increased development

surrounding the Sabana Seca wetland habitat facilitates exposure of the wetland to this increasing threat (*Id.*). Compounding this problem and creating the potential for a negative feedback loop, FWS notes that increased wildfires could exacerbate the entrance of invasive plants such as the southern cattail, thereby changing the underlying vegetative composition of the wetland towards drier plant habitat specialists (*Id.*). In fact, wetland areas subjected to prolonged dry periods are characterized by “greater vegetation cover of grasses” more susceptible to fire (76 Fed. Reg. at 63424). An increase in dry surface area and growth of grasses and cattails will undoubtedly lead to an increase of the wetland’s overall vulnerability to the threat of fire. FWS notes that impacts from wildfire on this particular wetland-type locality may adversely impact the Coquí Llanero to an extent similar to wildlife impacts observed on the closely related coquí species, *Eleutherodactylus jasperi*, now believed by FWS to be extinct (*Id.* at 63427).

As discussed throughout this petition, construction of the Vía Verde Project will cause physical alteration and draining of the Coquí Llanero’s 615-acre wetland habitat. Moreover, construction is planned for the dry season, presenting increased risk of wetland drying. Draining of this wetland will lead to increased dry habitat surface area throughout the wetland complex and an increase of dry vegetative growth more susceptible to the spread of fire. Therefore, the increased risk of wildfire on the Coquí Llanero due to physical alteration and draining of its wetland from the Vía Verde Project’s construction presents a significant risk to the well-being of the species warranting an emergency listing.

#### **v. Increased Effects of Climate Change**

Maintenance of the palustrine herbaceous wetland habitat of the Coquí Llanero requires that ocean-derived salts need to be less than 0.5% parts per thousand salinity (76 Fed. Reg. at 63434). Coquí Llanero habitat may be within the reach of sea level fluctuations and presumable

salinization of its ground waters in the event of a worst case scenario of a one meter sea level rise (Ríos-López 2011b). Such encroaching salinity may be compounded by overall alterations to the underlying watershed of the Sabana Seca wetland due to channelization, trenching, and drilling activities proposed for the Vía Verde Project. All direct and indirect threats from climate change on the Coquí Llanero (changes to habitat availability, changes to predator-prey relationship, increase of disease and disease vectors, climatological and precipitation changes) will only be compounded by the extremely specialized and localized nature of this species and the imminent threat to the species posed by external development and the proposed Vía Verde Project. This compounded threat to the Coquí Llanero’s only known wetland habitat presents an additional threat warranting an emergency listing of endangered under the Endangered Species Act.

### **PART III: PETITION FOR REVISION OF PROPOSED DESIGNATED CRITICAL HABITAT FOR THE COQUÍ LLANERO**

FWS has defined the occupied critical habitat for the Coquí Llanero as “palustrine emergent persistent wetland with an herbaceous vegetation compensation dominated by perennial plants like ferns, *Sagittaria lancifolia*, flatsedges, spike rushes, vines, and grasses occupied by the coqui llanero at the time of listing” (76 Fed. Reg. at 63434). However, the current boundaries of the critical habitat designation do not fully account for the areas occupied by the Coquí Llanero, as evidenced by detection of the species along the Río Cocal (see Figure 2) (Vega-Castillo 2011). The recent study conducted by Vega-Castillo (2011) along the proposed Vía Verde Project route presents the first known detection of the Coquí Llanero outside of the Sabana Seca Unit. Herpetologist Ríos-López believes that the detection of Coquí Llanero presence outside of the Sabana Seca Unit “suggests the ecological functionally of the Coquí Llanero’s Critical Habitat natural drainage outlet and associated canals and Río Cocal as important natural corridors for population migration and species’ persistence in Toa Baja” (Ríos-

López 2011a). This discovery provides evidence that suitable habitat for this newly discovered and elusive species may be present outside of FWS's proposed critical habitat boundary.

In making its determination of designation of critical habitat for the Coquí Llanero, FWS admits that the best scientific and commercial data available is "limited" when identifying specific areas for designation (76 Fed. Reg. at 63432). FWS further admits that "little is known of the specific habitat requirements of the Coquí Llanero other than it requires a palustrine herbaceous wetland and a specific vegetative composition" (*Id.*). Due to the large unknowns surrounding Coquí Llanero habitat occupation, FWS should seriously take into consideration the discovery of Coquí Llanero individuals outside of its currently proposed designation.

Moreover, FWS may designate critical habitat outside the geographic area currently occupied by the species at the time of listing, upon a determination that such areas are essential for the conservation of the species. 16 U.S.C. § 1532(5)(A)(ii) (2006). The evidence presented above in this petition establishes the necessity of maintaining undisturbed hydrology of the Coquí Llanero's only known wetland habitat. It is essential for the conservation of the species that this hydrology is maintained throughout the Karst region and within all interconnected streams and canals. The importance of the Karst region located south of the palustrine wetland on the water supply of the Coquí Llanero's habitat led to inclusion of this area into the Puerto Rico DNER designated Essential Critical Natural Habitat in 2007 (76 Fed. Reg. at 63433).

Therefore, due to the known importance of this habitat as essential for the species, petitioners ask FWS to revise its determination of critical habitat to include such important watershed areas outside of the present geographic occupation of the species. Furthermore, petitioners request that FWS designate critical habitat to account for discovery of the Coquí Llanero within channels and streams interrelated with the Seca Sabana wetland.

## CONCLUSION

For the foregoing reasons, petitioners respectfully urge the U.S. Fish and Wildlife Service to use its emergency authority to list the Coquí Llanero as an endangered species throughout its range and to immediately designate a revised critical habitat determination for the Coquí Llanero under its emergency listing authority.

Respectfully submitted,



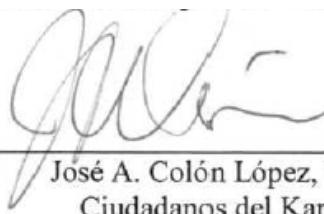
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Neftalí Ríos-López, Ph.D.



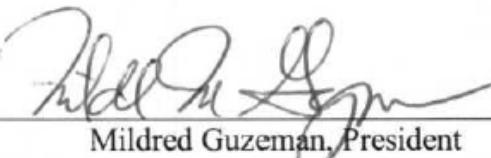
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Rafael L. Joglar, Ph.D.



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José A. Colón López, Vice  
Ciudadanos del Karso



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Mildred Guzman, President  
Federación Espeleológica de Puerto Rico



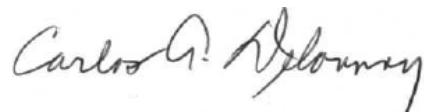
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Janis Gonzalez, Ph.D.



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Héctor E. Quintero M.S., Ph.D.



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Carlos A. Delannoy, Ph.D.



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Edgardo González



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Jacki Lopez  
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Sierra Club, Puerto Rico Chapter



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Patrick A. Parenteau, Senior Counsel  
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*For Petitioners*

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## **Appendix 1**

Neftalí Ríos-López, Ph.D.  
Ecologist and Herpetologist  
University of Puerto Rico–Humacao Campus

November 29, 2011

Edwin Muñiz  
Field Supervisor  
Caribbean Ecological Services  
Boquerón Field Office  
Fish & Wildlife Service  
Department of the Interior  
P.O. Box 491  
Boquerón, Puerto Rico 00622-0491

Dear Mr. Muñiz:

I present for your consideration my comments on the U.S. Fish and Wildlife Service's (FWS) '12-Month Petition Finding—Proposed Listing of Coquí Llanero as Endangered, and Designation of Critical Habitat for Coquí Llanero'. In addition, I also present for your consideration my formal petition to the FWS to exercise its authority pursuant to section 4(b)(7) of the Endangered Species Act of 1973, as amended (ESA), to EMERGENCY LIST the Coquí Llanero (*Eleutherodactylus juanariveroi*) as endangered. Due to the species' severely limited geographic range, small population size (information provided herein), and several imminent threats to the ecosystem it depends on for reproduction and survival, I request the FWS to make all protective measures afforded by the ESA available to the Coquí Llanero immediately. In support of this request, I provided herein detail information on current threats not considered in the FWS 12-month finding on a petition to list the Coquí Llanero (*Eleutherodactylus juanariveroi*) as endangered under the ESA and to designate critical habitat<sup>1</sup>. However, I provided additional scientific information that warrants my request for increasing the area designated Critical Habitat in FWS *FINDING*<sup>2</sup>.

**I. Ecological Specialization the Coquí Llanero, *Eleutherodactylus juanariveroi*, of Imminent Threats to the Species and to its Wetland-Karst Ecosystem**

**A. Estimated Population Size and Ecological Specialization**

I am providing here unpublished data on estimates of population size for the Coquí Llanero along with a percent of it in relation to the rest of the species in

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<sup>1</sup> 12-Month Petition Finding, Proposed Listing of Coquí Llanero as Endangered, Designation of Critical Habitat for Coquí Llanero, 76 Fed. Reg. 63420 (50 CFR Part 17; proposed October 12, 2011).

<sup>2</sup> In support of my arguments and throughout this document I include in italics and font size 10 cited portions of your 12-month finding, *FINDING*, and of other sources of information.

the wetland. In this way, a seemingly large number at first sight is in fact a very small one compared to the abundance of its fellow species in the wetland (the Llanero is the rarest of all in terms of abundance). The estimated mean population size of the Coquí Llanero obtained among 5, 90m<sup>2</sup>-census transects, is approximately  $473.3 \pm 186.8$  individuals per hectare (or 192 frogs per acre) for a 19.9% of total *Eleutherodactylus* species in its wetland. The most abundant species in the wetland is the Grass Coquí, *E. brittoni* ( $717.0 \pm 270.0$  individuals per hectare for a 30.2%), followed by the Common Coquí, *E. coqui* ( $640.0 \pm 168.2$  individuals per hectare for a 27.0%), and the Whistling Coquí, *E. cochranae* ( $542.2 \pm 272.2$  individuals per hectare for a 22.9%). In several instances, however, I have clarified how these estimates may be misleading to the uninitiated, as organisms are not distributed evenly throughout the landscape. Considering this caveat, I contrast estimates of mean population size of the Coquí Llanero obtained from two areas within the wetland that differ in water depth and vegetation cover: the inner, center portion of the wetland and the outer, edge portion of the wetland (Figure 1).

Figure 1 illustrates the species' specialized ecological requirement and close dependency on only one plant species (*Sagittaria lancifolia*) in its wetland-karst ecosystem, which in turn depends on specific hydrology conditions that are highly threatened by human activities. Notice how small differences in *S. lancifolia* cover and water depth translate into large differences in Coquí Llanero's abundance: greater abundance of Coquí Llanero is observed in areas with greater cover of *S. lancifolia*.

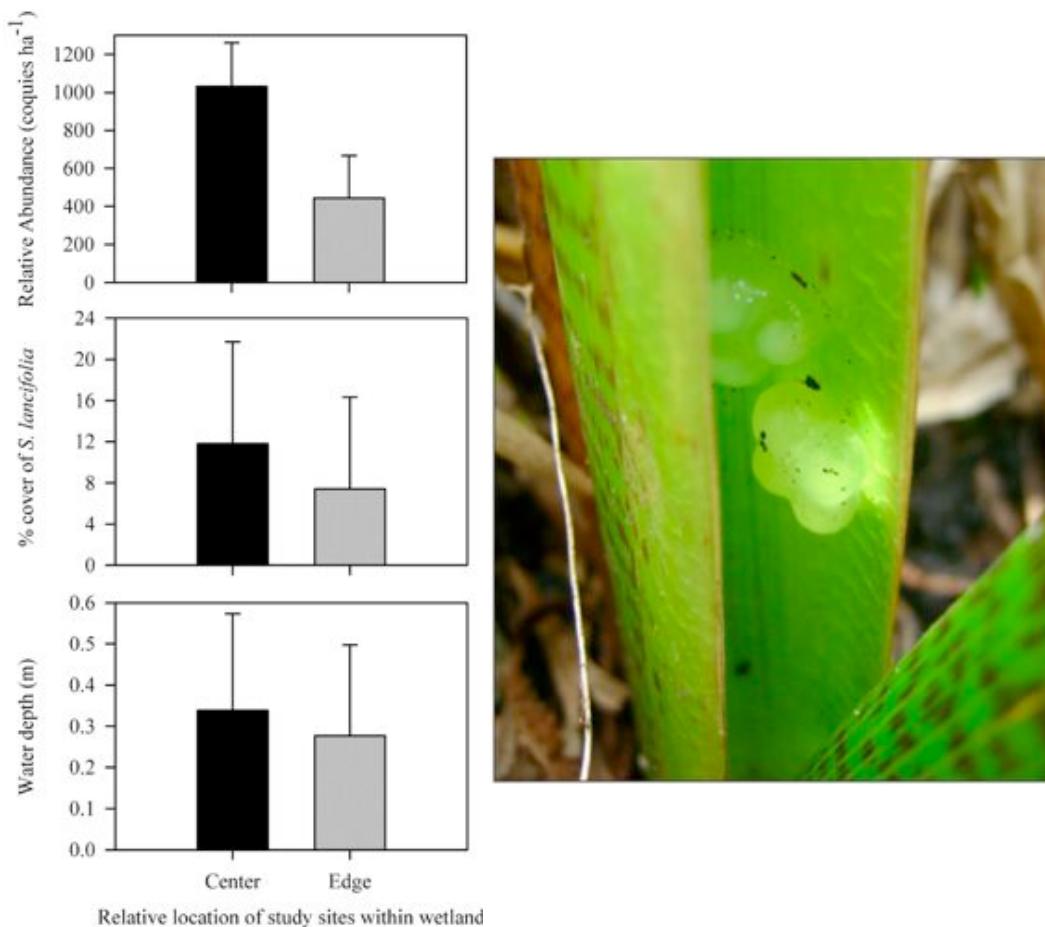


Figure 1. On the left (previous page 2), data on relative abundance of the Coquí Llanero, percent cover of *Sagittaria lancifolia*, and water depth collected during four monthly censuses between 2005 and 2006 from each of two locations within the Coquí Llanero's wetland. In this figure, Edge represents the undisturbed, long-term study site from which the estimated population size of 473 individuals per hectare came from. Center represents the disturbed study site, which locates towards the inner portion of the wetland. On the right, large estimates of population size in areas with greater vegetation cover are associated with each plant being used for breeding and as retreat sites by several animals so a slight increase in vegetation cover translate into several times the number of animals frequently found per plant (shown are two egg clutches of similar development time, presumably deposited by different mates). In addition, the fact that *S. lancifolia* has not been found in numbers along nearby areas in Toa Baja (personal observation) suggests that this is a plant adapted to flooded conditions in relatively undisturbed (or minutely disturbed), freshwater wetlands.

#### *B. Imminent Threats to the Coquí Llanero's wetland-karst ecosystem.*

Two pertinent citations are required herein.

First:

*“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.)”* (Action Area, page 11 in the FWS’ Biological Opinion of July 15, 2011, on the proposed activities by PREPA’s Vía Verde Natural Gas Pipeline Project).

Second, the FWS defines Critical Habitat as (citation obtained from U.S. Fish & Wildlife Service Endangered Species Program, 703/358 2105, <http://endangered.fws.gov>):

*“...a term defined and used in the Act. It is a specific geographic area(s) that is essential for the conservation of a threatened or endangered species and that may require special management and protection. Critical habitat may include an area that is not currently occupied by the species but that will be needed for its recovery.”*

Along with these, I should emphasize that the ESA does provide for designation of "unoccupied habitat" that is "essential to the conservation of the species" (16 USC 1532 [5]). In addition, Section 4 of the ESA (16 U.S.C. 1533), and its implementing regulations at 50 CFR part 424, set forth the procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. Specifically, under section 4(a)(1) of the ESA, the FWS may determine a species to be endangered or threatened due to one or more of the following five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. The FWS specifies that listing actions may be warranted

based on any of the above threat factors, singly or in combination. In previous communications, I have provided the FWS with much information on each and every of these five factors but herein I provide additional information on factors (A), (D), and (E).

Accordingly, the FWS has selected the following area as Critical Habitat for the Coquí Llanero, which *is the area currently occupied by the species* but precludes areas not currently occupied by the species but that are highly needed for its survival. Most of such occupied **and** essential unoccupied areas, however, are in imminent threat of destruction by human activities from private and public sectors at the Municipality, State, and Federal governmental levels (factors A and E) as shown herein. Current designations of the species as Critically Endangered Species and Critical Essential Natural Habitat made in July 2007 by the Department of Natural and Environmental Resources of the Commonwealth of Puerto Rico (DNER), although adequately made based on scientific data and analysis, have proved inefficient for implementing adequate regulatory mechanisms by the DNER (factor D). Relevant to FWS proposed habitat designation, however, I will show that the effective conservation unit for the Coquí Llanero must be at the watershed level as adopted by the DNER and not at the species' current occupancy level adopted by FWS in its *FINDING*. In addition, I will show areas that must be included as Critical Habitat by FWS that most importantly support my requirement for EMERGENCY LISTING of the Coquí Llanero as endangered.



Figure 2 (previous page 4). Proposed designated Critical Habitat (reticulate portion) in FWS' *FINDING*. Note the Caño Campanero to the west, which connects with waters of the Cocal River to the north. Both water bodies are interconnected with waters from the designated Critical Habitat but such connection is not shown in this figure. Figure 3 (below) shows this connection clearly: this is the main natural connection of water that drains waters from the Coquí Llanero's ecosystem into it.



In Figure 3, this connection (from red filled circle in the middle of the picture to the west along the southern margin of the Barrio Ingenio and up to Caño Campanero) is of vital importance for the Coquí Llanero's Critical Habitat. It maintains adequate seasonal hydrology and water flow in and out of the wetland, a hydrology dynamic responsible for the maintenance of its vegetation characteristics and population size of the Coquí Llanero (see Figure 1). This connection is in imminent threat of destruction by PREPA's Vía Verde Natural Gas Pipeline Project under consideration for granting construction permit by U.S. Army Corp of Engineering (USACE).

**PREPA's Vía Verde Natural Gas Pipeline Project: major threat to the Coqui Llanero and its Wetland Ecosystem (State Government Level).**

In a previous letter to USACE and FWS (Ríos-López, 2011), I provided evidence in support of how the "Vía Verde" projected route in Toa Baja-Dorado

wetland directly affects the Cocal River, the only natural connection to waters of the Coquí Llanero's Critical Habitat, in at least four different segments of the river. The following picture (Figure 4) illustrates the instances in which proposed construction activities will directly affect the hydrology of the Coquí Llanero's Critical Habitat in Toa Baja, northern Puerto Rico.



Figure 4. Red arrow and red dot highlights the natural drainage outlets of waters of the Coquí Llanero's Critical Habitat as in Figure 3. Direct interference of water flow is evident from at least three instances along the action area of PREPA's project (four instances by including an additional trench that will cross between the first and second canal to the north, from left to right of this Figure). Water pumping from construction activities during the dryer months of the year and continued maintenance of ROW (see PREPA's Biological Assessment [BA], chapter 6—"Impactos", submitted to FWS) will dramatically affect how waters from the wetland interact with waters of the larger Caño Campanero and Cocal River: it is expected that increased drainage flow rate from the wetland will occur along with irreversible change of its vegetation characteristics (see Figure 5, next page).



Figure 5. A picture taken at the westernmost outlet of the only natural drainage of the Coquí Llanero's Critical Habitat (red filled circle in previous figures) shows how narrow, shallow, and fragile this drainage outlet is.

In Figure 5, I am at the middle of the outlet with the easternmost side of the wetland in the background (picture taken at 4:00pm on October 12, 2011, from the edge of José Julián Acosta Road to the west). The red vertical line beside me is approximately 1.7m in height, which is my body height. The red arrow at the right of the picture indicates the precise location in which the Coquí Llanero was heard calling when the picture was taken. The red oval at the left of the picture illustrate “management practices” performed by Toa Baja Municipality (Municipal Government Level) as flood-control measures all along the east-to-west margins of this canal, the connecting Caño Campanero (to the west), and along selected northern portions of the Cocal River.

According to BA submitted to FWS, the Coquí Llanero has been found within PREPA’s Project Right-Of-Way (ROW) along the Cocal River, which suggests the ecological functionality of the Coquí Llanero’s Critical Habitat natural drainage outlet and associated canals and Cocal River as important natural corridors for population migration and species’ persistence in Toa Baja.<sup>3</sup> This connection outlet and associated areas to the west must be included in FWS designated Critical Habitat as recommended also by the Toa Baja’s land-use plan, “Plan de Ordenamiento Territorial” (TB-POT). This plan was adopted in 2008 by

<sup>3</sup> Puerto Rico Electric Power Authority, Via Verde Natural Gas Pipeline Project Biological Assessment (April 2011, modified July 2011) [hereinafter Final Biological Assessment] Appendix 3, Search of the Puerto Rican Crested Toad and Coquí Llanero in areas proposed for the construction of Via Verde, page 81.

Puerto Rico Environmental Quality Board (“Junta de Calidad Ambiental de Puerto Rico”), which include this outlet and nearby areas as Especially Protected Rustic Soils (translated freely from “Suelos Rústicos Especialmente Protegido”, see next).

Residential/Industrial Development Projects: major threats to the Coquí Llanero and its Wetland Ecosystem (Municipal Government Level)

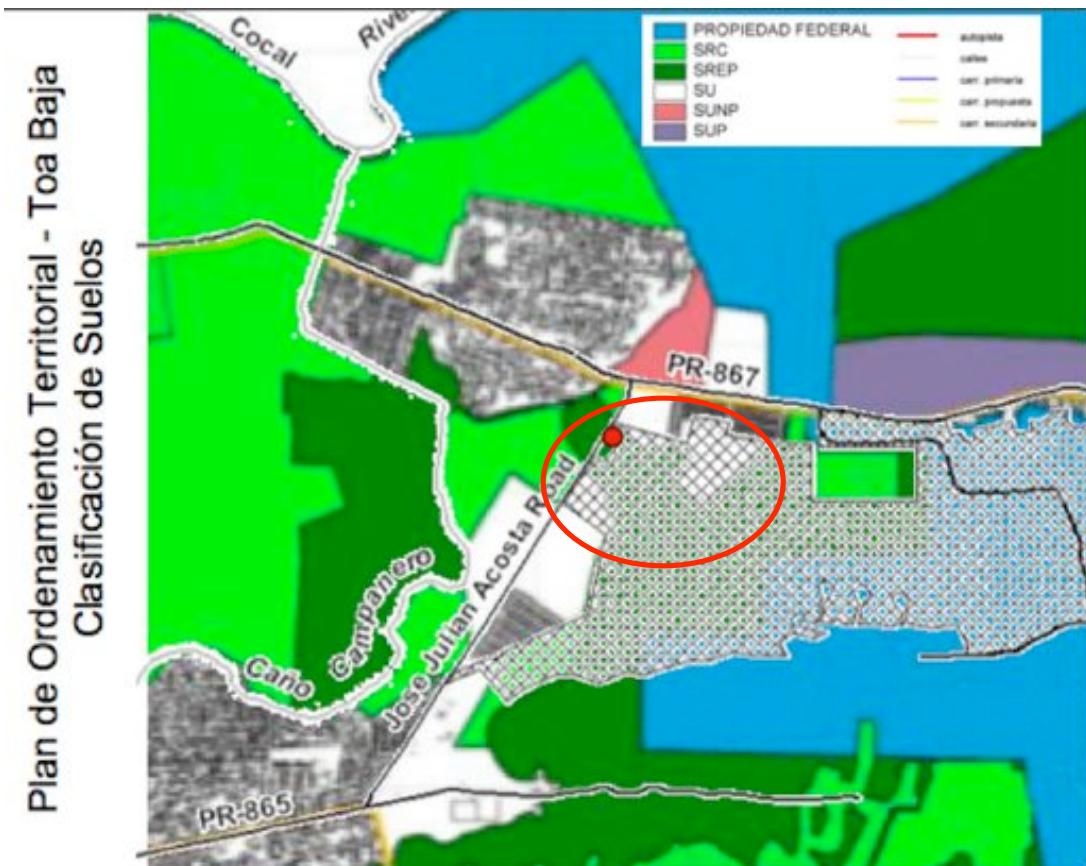


Figure 6. This figure comes from the Toa Baja's land-use plan or “Plan de Ordenamiento Territorial” (TB-POT), which classifies soils into six categories, from urban to especially protected rustic soils (TB-POT, see Table 6: Proposed Classifications of Soils, section 2.5–2.5.4). Each classification includes a suit of recommended uses from high-density urban/industrial development projects to protected soils with minimum or no proposed development other than recreation and conservation. Red filled dot highlights the Coquí Llanero’s Critical Habitat outlet canal as previously noted. In this figure, particular attention must be paid to areas of darker green coloration—Especially Protected Rustic Soils (SREP in Spanish, see section 2.5.4 of the TB-POT), light green coloration—Common Rustic Soils (SRC in Spanish), and white—Urban Soils (SU in Spanish). Especially Protected Rustic Soils include the wetland’s outlet, riverbank, and the western part of the Caño Campanero, which should facilitate administrative collaboration with Toa Baja Municipality for the expansion of the designated Coquí Llanero’s Critical Habitat by the FWS. However, note the extent of white

areas within the designated Critical Habitat by FWS—at east, south, and northern sides of the Critical Habitat water outlet (red filled circle)—, which are highlighted within a red oval and represent areas classified by the TB-POT as urban soils or areas proposed for urban development projects that will choke the Coquí Llanero's wetland hydrology.

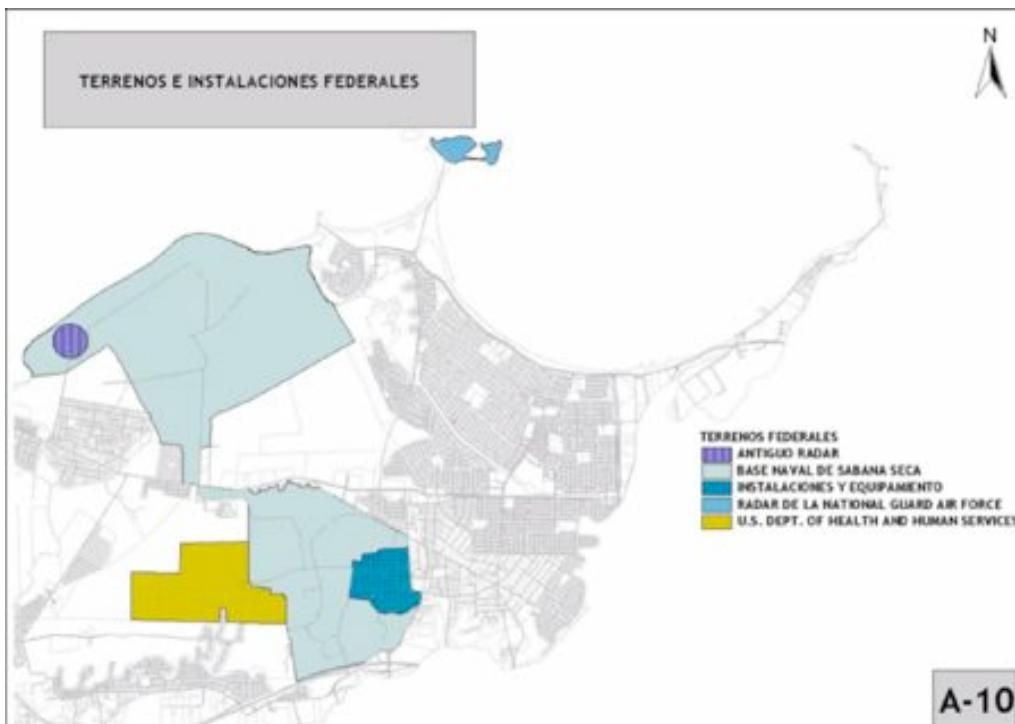


Figure 7. U.S. Federal Government Lands and Facilities in Toa Baja, comes from TB-POT as well. Note that areas classified as urban in TB-POT for which future urban/industrial development projects are planned (western/northern side from yellow area) are all in State-owned lands regardless the designation as Critical Habitat by the DNER. This evidence contrast with public comments made by Toa Baja's Mayor Aníbal Vega Borges in which he has favored conservation efforts for the Coquí Llanero but he is reluctant to accept designation of critical habitat from DNER and as currently proposed by FWS as well. His ambiguous statements provide further evidence in favor of factor (D), the inadequacy of existing regulatory mechanisms, as his Municipality is in large part responsible for contaminating waters of this wetland as well (Morris 2007; see below).

Evidence in favor of factor (D) has also been revealed as the DNER and the Environmental Quality Board of Puerto Rico (“Junta de Calidad Ambiental”) has not acted upon these proposed activities and the TB-POT was approved by the Board in 2008. Additional evidence for factor (D) comes from the fact that the DNER has not acted upon a private motorized go-kart and motocross speed and racetrack. In 2007, the DNER publicly communicated its intentions to enforced mitigation actions for alleged landfill of the wetland for building the racetrack (let

alone contaminated water runoff with oils and fuel to the wetland from the track after each rain).

Further evidence for factor (D) comes from the fact that I sent comments related with PREPA's proposal for dumping marine sediments to Toa Baja's landfill from the agency's dredging activities proposal in Palo Seco's Station Facility submitted to the Environmental Quality Board in 2006 and the U.S. COE ("Aviso Ambiental, Intención de Emitir Certificado de Calidad de Agua, COE Núm. SAJ-1995-5870 [IP-CGR], Solicitud de Permiso Conjunta JPA-647: Ríos-López, 2006). PREPA's proposal included draining sediments in an unspecified nearby location and once dry, these sediments are to be deposited in Toa Baja's landfill (note that the extension of operations of this landfill provided by the Environmental Protection Agency—approximately 80 acres into the "Hoyo de Minga" location—could well be related to PREPA's proposal and the FWS said recently in a local newspaper that it was unaware of this action by the EPA).

Water evaporates, but salts remain within sediments and once deposited, salts are moved to ground waters and along water runoff after rains into the Coquí Llanero's Critical Habitat (Figure 8). The Board rejected my request to participate in public hearings but solicited my comments in written format. The Board finally considered my comments irrelevant and to date there has been little or no public note or information related with this project. Evidently, factor (D) stands alone at State Government level as well.



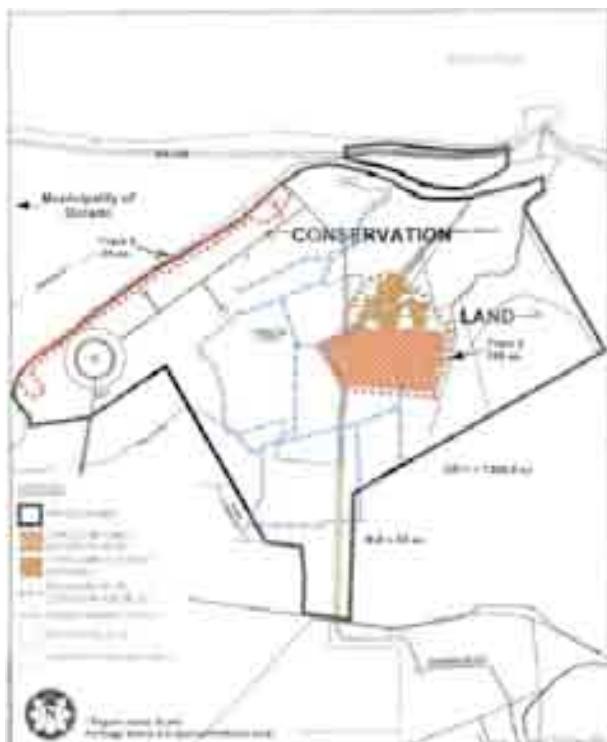
Figure 8. Toa Baja's landfill leachate flow pattern (taken from Gregory L. Morris Engineering, Delimitation of the Watershed Tributary to the Delimited Habitat of the Coqui Llanero, Sabana Seca, PR. July 6, 2007).

**U.S. Naval Security Group Activity in Sabana Seca, Sabana Seca Land Management L.L.C., and Toa Baja Landfill: major threats to the Coquí Llanero and its Wetland Ecosystem (Federal Government Level)**

The FWS decided not to designate as critical habitat karst areas associated with the Coquí Llanero's wetland to the south because these areas are already under several conservation agreements and under protection by state government. I argue that this statement is erroneous and current information provides additional evidence for factor (D), inadequacy of existing regulatory mechanisms. For example, in June 2006 the U.S. Naval Security Group Activity in Sabana Seca (USNSGASS) produced its Environmental Assessment for Transfer/Disposal of the Former NSGA Sabana Seca Property. The preferred action related with the transfer/disposal of its lands is presented herein (Executive Summary, page ES-1):

**EXECUTIVE SUMMARY**

The Department of the Navy has prepared this Environmental Assessment (EA) pursuant to the National Environmental Policy Act (NEPA), the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508), and the Chief of Naval Operations Instruction (OPNAVINST) 5090.1B. This EA evaluates the potential impacts of the proposed transfer/disposal of the former Naval Security Group Activity (NSGA) Sabana Seca, Puerto Rico property to a private entity, Sabana Seca Partners, LLC, that is associated with Navy Public Private Venture (PPV) partnerships for military family housing. The private entity, Sabana Seca Partners, LLC, would market and dispose of the former Navy property and use the proceeds of the sale may generate as funding for the Navy PPV partnerships to manage and/or develop adequate military family housing areas at other United States (U.S.) Navy or Marine Corps installations. Those housing areas under consideration include locations at Naval Station Great Lakes, Illinois, and Marine Corps installations to be determined. Because the potential impacts resulting from the Navy PPV partnerships providing/managing military family housing at those respective bases are site specific, NEPA documentation for those housing areas is being developed independently of this action, which is the transfer/disposal of the former NSGA Sabana Seca property. This EA focuses on the transfer/disposal of the former NSGA Sabana Seca property and the potential indirect impacts of its re-use.



The U.S. NSGASS specifies that "in the event Sabana Seca Partners, LLC receives NSGA Sabana Seca, three parcels of land containing sensitive natural and cultural resources totaling approximately 285 acres would then be transferred to the Puerto Rico Conservation Trust to ensure protection of those parcels in perpetuity (pages ES-2, ES-3, ES-4, ES-5). Two of these three parcels, however, will be impacted directly and permanently by PREPA's Vía Verde Natural Gas Pipeline Project (Tract 3 in Figure 9, left).

Figure 9 (previous page 11). USNSGASS conservation parcel areas to be transferred to PRCT, which are located along PREPA's proposed project. One of these parcels (not shown) is located in the karst region adjacent to the Coquí Llanero's designated critical habitat (see next Figure 10).

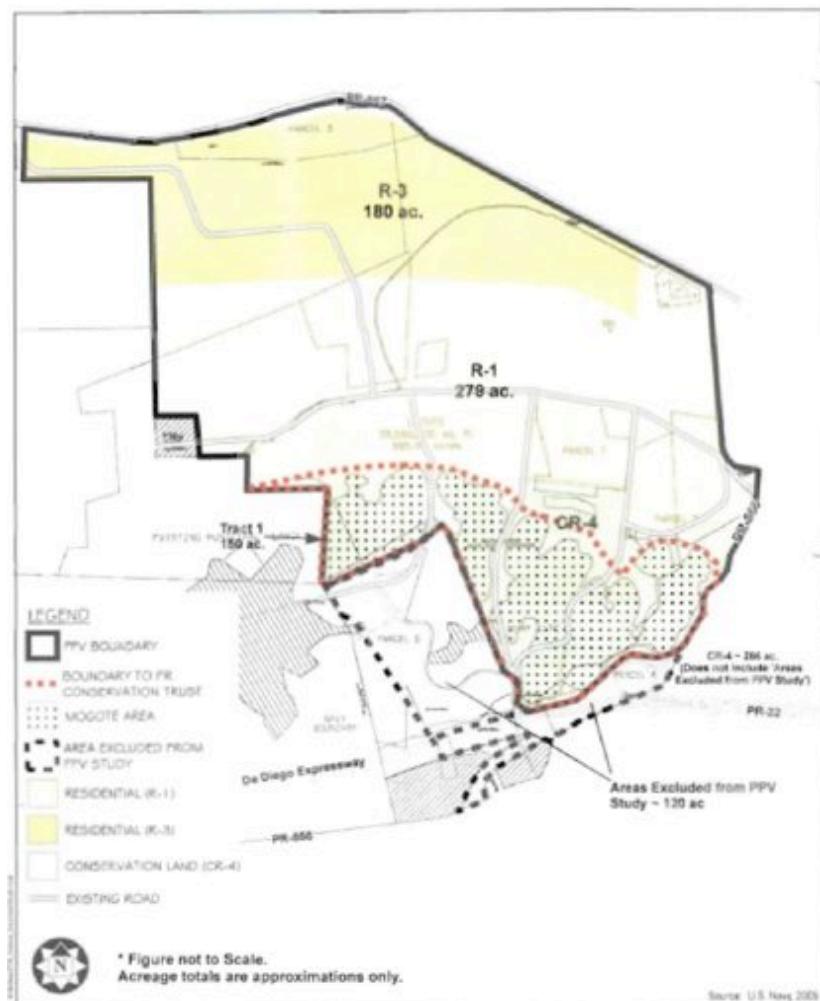
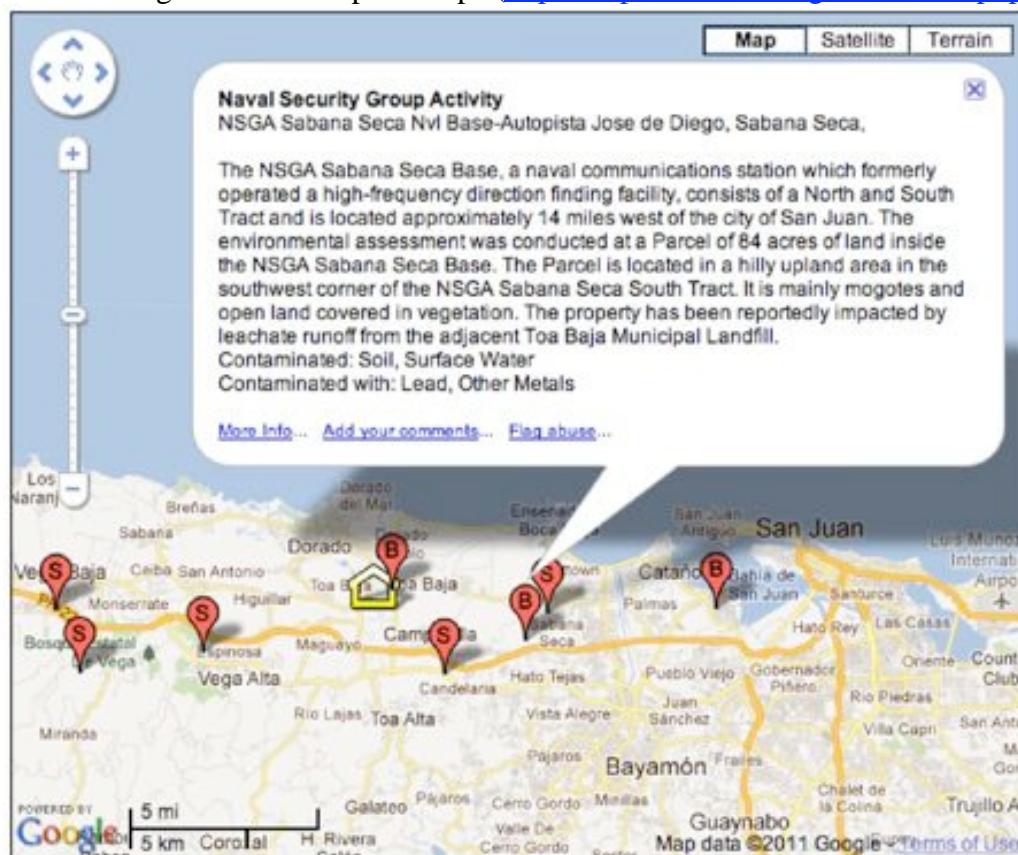


Figure 10. USNSGASS conservation parcel areas to be transferred to PRCT. Part of this parcel is within lands presumably contaminated by leachate from Toa Baja's landfill.

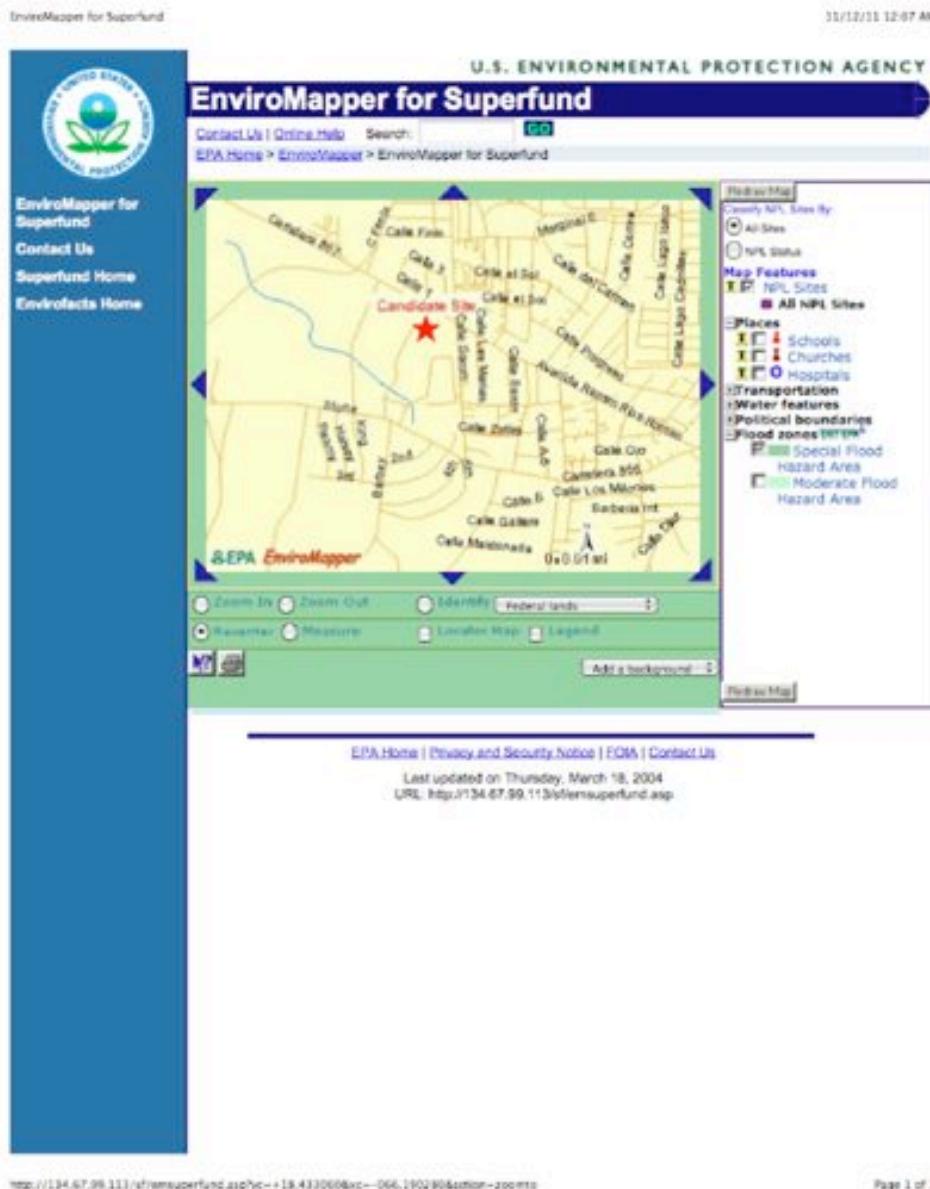
Again, in its *FINDING*, and from personal communications, the FWS argue against including associated karst areas from the southern portion of the Coquí Llanero's Critical Habitat because these areas are already protected by conservation agreements between the USNSGASS, the Puerto Rico Conservation Trust, and the Puerto Rico Commonwealth Government. However, information on the possible contamination of these federal lands due to continuous leachate from Toa Baja's landfill may have discouraged the PRCT from accepting the USNSGASS transfer of these lands. Likewise, the DNER has declined USNSGASS offer, and its third option, the University of Puerto Rico is in its way

towards declining the offer (Dr. Janis González, Executive Director of the Caribbean Research Primate Center, University of Puerto Rico-Medical Sciences Campus; personal communication). The possible reason for these pre-agreement withdrawals, although complex, is understandable as in its EA, the USNSGA stated “*...the future re-use of the property could have indirect adverse effects on the environment...that are beyond the control on the NAVY*” (page ES-3). The USNSGASS continues on page ES-5 “*The Toa Baja landfill located directly west of the South Tract has been a concern for the NAVY, as landfill leachate and stormwater runoff collects on the NSGA Sabana Seca Property in an area designated as Installation Restoration (IR) Site 7, the Leachate Ponding Area. Recognizing the landfill as the source and based on the fact that no maximum contaminant levels (MCLs) in the groundwater were exceeded, the United States Environmental Protection Agency (USEPA) notified the NAVY in February 1997 that no further action in the Leachate Ponding Area was necessary*”. Interestingly, EPA’s notification date is as 1997 while the USNSGASS’ EA is as 2006. ). Other documents, however, revealed important and related information: “*The Leachate Ponding Area will be addressed by the Municipality of Toa Baja, the party responsible for the contamination*”, and “*The Municipality of Toa Baja is interested in purchasing the Leachate Ponding Area*” (Naval Security Group Activity Puerto Rico, EPA ID#: PR4170027383, EPA REGION 2, Congressional District(s): 01, Toa Baja, Village of Sabana Seca, NPL LISTING HISTORY, Proposed Date: 6/24/1988, Final Date: 10/4/1989, Deletion Date: 10/7/1998).

The next picture, however, was downloaded on November 12, 2011 from SaferBuilding™ Toxic Trespass Maps (<http://maps.saferbuilding.com/index.php>).



The next picture was also downloaded on November 12, 2011, from EPA's site although its information was last updated on Thursday, March 18, 2004 (URL: <http://134.67.99.113/sf/emsuperfund.asp>). The red star in this picture represents the exact location of the only Superfund site in the South Tract of the USNSGASS and that does not include the Leachate Ponding Area as a contaminated/Superfund site by the EPA.



Even though this information may seemed outdated, a more recent article in a local newspaper interviewed Michael Nanney, development manager of Forest City Military Communities, the Public Private Venture in charge of the sale of Sabana Seca Navy Base in Toa Baja, which revealed that: "The cost of not developing the 350 acres could represent having the contaminated areas inside the base uncleared, including **two** superfund sites..." (Caribbean Business, 2007).

Mr. Nanney continued “...Sabana Seca Land Management is committed to achieving a sustainable development of Sabana Seca using only 15% of the entire parcel. Some 80% of the land is slated for conservation, including 141 acres of *mogotes*, 35 acres of *riverine* from El Cocal creek and 100 acres of *wetland forest*”, the areas affected by PREPA’s project under USACE permit granting consideration and by the Toa Baja landfill. As for the Toa Baja landfill, the EPA has issued an extension for the operation of the Toa Baja landfill, presumably until 2014, at the expense of approximately 80 acres in a location named “Hoyo de Minga” in the same locality.

Consequently, and unfortunately, the instances so far presented herein provided only additional support to factor (D), inadequacy of existing regulatory mechanisms, all against conservation measures of the Coquí Llanero to be adopted by the FWS. Levels of failure have reached Municipal government (Toa Baja Municipality), State agencies (Puerto Rico Environmental Quality Board, Department of Natural and Environmental Resources), and Federal government (U.S. Environmental Protection Agency, and presumably U.S. Army Corp of Engineering). In the meantime, Toa Baja Municipality is not taking actions towards mitigating effects of its landfill on the Coquí Llanero’s wetland nor it cannot make efforts towards acquiring the Leachate Ponding Area, as it is known that it has the highest budget deficit among all Puerto Rican municipalities as by 2011. Interestingly enough, the *FINDING* highlighted all these concerns related with the Toa Baja Municipal landfill as a major threat to the Coquí Llanero “by potentially altering the hydrology of its wetland habitat and by contaminating the wetland with the landfill run-off”, which further supports my request for emergency listing of the Coquí Llanero as endangered.

Request for Emergency Listing and to Expand the Area Designated Critical Habitat on the base of the best Scientific Information and Analysis: the need for an ecosystem-oriented conservation state of mind

In the *FINDING*, the FWS has mentioned climate change as one source of threats for the Coquí Llanero. Climate change, however, is a generic factor that encloses a very wide range of environmental variables for which we do not have a clear idea on their influence to the species and its wetland ecosystem, which agrees FWS’ *FINDING*. The need for further and detailed clarification on what constitute climate change as a threat to the Coquí Llanero needs to be made by FWS, as to link climate change and threats due to spread of nonnative, invasive species, fires, and precipitation levels. To illustrate, for example, several scientists have evoked climate change as a proxy for pathogenic infection by the chytrid fungus in amphibians. This infection is frequently associated with warming of highland areas resulting in drastic population declines of amphibians. However, several individuals of the Coquí Llanero have been sampled for this fungus and it was not found among all frogs inspected in its wetland type locality (Burrowes et al., 2008).

Other instances associated with climate change were not discussed in the article (Burrowes et al., 2008) nor in the *FINDING*. For example, sea level rise and drop has occurred in nearby areas towards the coast as geological evidence suggests, but still the Coquí Llanero has survived in its geographic location since ancient times (definitively, the species originated several tens of thousands yrs). I could mention that its habitat may be within the reach of sea level fluctuations and presumable salinization of its ground waters in the event of a worse case scenario of >1-m sea level rise. Yet, this is beyond current estimates of 0.26–0.59m sea level rise for the next 100-yr estimate according to IPCC's [2007] Synthesis Report, Table 3.1, p. 45). Freshwater springs from the adjacent karst belt area to the southern part of the Coquí Llanero's wetland, however, supply freshwater to the species type locality continuously and should minimize the potential for salinization of its surface water (in fact, Pepsi Bottling Company uses 255,500,000 gallons of water a year, mainly due to its Aquafina<sup>TM</sup> production; Pepsi gets its water for bottling from both the Toa Baja Municipality and from on-site wells [Chi et al., 2005]). If the karst belt in Barrio Candelaria neighborhood is good for selling bottling water in such a large quantity it should be equally good for conservation efforts for the Coquí Llanero and for its wetland-karst ecosystem as the amount of in-site ground water withdrawn annually may represent a considerable portion of the total annual rainfall for the region. Consequently, chances are habitat disturbances and alterations by human activities in, and near its habitat—instead of uncertain, climate change related events—represent the main, most significant source of imminent threats to the Llanero's survival unless emergency listing occurs immediately as requested. The following figure below, Figure 11, clearly illustrate this fact and provides further support for my petition for Emergency Listing of the Coquí Llanero.

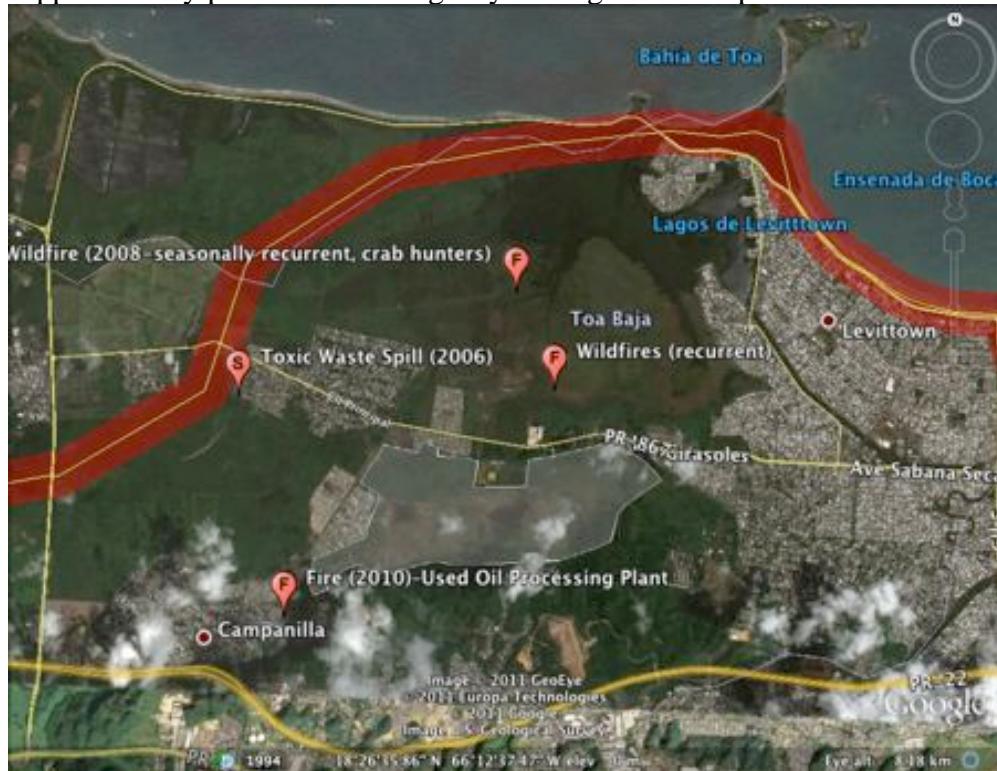


Figure 11 (previous page 16). Recent major disturbances of anthropogenic origin with the potential for wiping out proposed designated Critical Habitat in a single event (see Appendix for related documentation) along with proposed PREPA's Via Verde route (red band). Wildfires are intentional fires, rather than natural fires, induced by local crab hunters as fires temporarily clear vegetation cover revealing crab holes in the ground. With this ancient practice, common along the northern costal wetlands, crab hunting is greatly facilitated, but such a fire can clear more than 40 acres, going east to west, in a single event (personal observation). Other disturbances include dumping of waste waters and toxic wastes.

I must emphasize that most major sources of threats are of high intensity and magnitude and with long lasting (irreversible) effects on the Coquí Llanero like PREPA's project, urban projects planned within the wetland, and leachate from landfill. Other "minor" sources of threats, however, are equally adverse: water runoff from streets, laundry machines, car washing, homemade mechanics, and go-karting among others, all from the Coquí Llanero's neighbors. These activities are major venues for bioaccumulation of toxics by predator-prey interactions in local food web dynamic. So far, the only area currently protected from similar activities from humans is the southern karst belt adjacent to the Coquí Llanero's critical habitat, which provides and maintains water quality and quantity to the wetland. This protection, however, occurs not because current regulation exists but because these areas are federally owned and protected by military police from the USNSGA before 2005, and stately owned by the Caribbean Primate Center with its private, armed guards. Although this protection has partly vanished in the federal owned lands, as recent unfortunate events revealed, the conservation of the karst belt should be adopted by FWS by its inclusion, along with all riparian connections to Caño Campanero and Cocal River by the wetland's natural outlet to the west, to areas proposed as Critical Habitat for the Coquí Llanero. Only then, adequate and effective regulatory mechanisms may be developed based on FWS current actions supporting DNER past designations (see Figure 12, next page).

Evidently, the conservation unit needed for fulfilling the FWS' Vision and Mission effectively must be the wetland-karst watershed unit, which includes "*...a specific geographic area(s) that is essential for the conservation of a threatened or endangered species and that may require special management and protection. Critical habitat may include an area that is not currently occupied by the species but that will be needed for its recovery.*"



Figure 12 (left) represents a suitable reference point for FWS reassessment of its designated Critical Habitat as it includes all areas essential for the conservation of the Coqui Llanero and its wetland-karst ecosystem unit.

In this figure, available essential areas needed for the conservation of the Coqui Llanero in Toa Baja are highlighted in light green (DNER, 2007). The vast majority of water contribution to the Coqui Llanero's wetland, however, comes from the Northern Watershed (see next Figure 13) as illustrated by G. L. Morris Engineering (2007).



Figure 13. Watersheds contributing to the Coqui Llanero's critical habitat (from Morris, 2007).

An extract of Morris (2007) is pertinent here (from page 5, Conclusions):

*"1. Runoff from the North Watershed drains into a wetland area where the species is known to reproduce. While there are some canals that have historically drained this area, over much of the area these canals are in disuse and have filled with sediment. As a result, stormwater runoff from this area may be dispersed over a wide area within the wetland during a rainfall event. The North Watershed, and a particularly on the Naval Station site, has been of low density. An increase in land use intensity may be*

*expected to significantly affect water quality and flooding hydroperiod. This area also receives landfill leachate.*

*2. The South Watershed has intense land use and probably generates significant amounts of contaminants. However, this effect on the species habitat may actually be more limited than in the North Watershed because this runoff generally tends to pass through canals and along distinctive drainage paths, instead of spreading out across a large wetland area.*

*3. There are actively maintained artificial drainage channels that runs and help drain wetland areas in the North Watershed. We do not know how water levels and wetland drainage may influence the habitat for this species.”*

As for the third conclusion above from Morris (2007), we now know that current maintenance practices will change hydroperiodicity, which changes vegetation characteristics, which reduces population size of the Coquí Llanero. Thus, including all wetland's natural outlets that connect waters from Caño Campanero and Cocal River with those from the designated Critical Habitat, along with the karst belt to the south of this Critical Habitat, is of prime importance.

Likewise, I have provided supporting evidence for factors (A) the present or threatened destruction, modification, or curtailment of its habitat or range; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting its continued existence, that support my request to FWS for an EMERGENCY LISTING of the Coquí Llanero as endangered. I strongly believe the conservation of the Coquí Llanero, as intended by the ESA as amended and by the FWS FINDING, is only to be achieved as these petitions (Emergency List and increasing designated Critical Habitat) are adopted immediately by FWS. Only then, venues for development of effective management practices and regulatory mechanisms can be worked out adequately for the benefit of the Coquí Llanero and for the ecosystem for which it depends on for reproduction and survival.

Sincerely,

Neftalí Ríos-López, Ph.D.  
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Carr. 175, Apt. 22101  
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- Ríos-López, N. 2011. Letter dated Nov. 1, 2011 to Robert Barron, U.S. Army Corps of Engineers, regarding the Vía Verde Project.

## **Appendix 2**

Tuesday, November 1, 2011

Mr. Robert Barron  
Project Manager - Regulatory Division  
U.S. Army Corps of Engineers  
Jacksonville District Office  
701 San Marco Boulevard  
Jacksonville, FL 32207-8174

Dear Mr. Barron:

I present for your consideration additional scientific information and comments related to the U.S. Fish and Wildlife Service (FWS) Biological Opinion (BO) regarding the Puerto Rico Electric Power Authority's (PREPA) permit application for construction of the "Vía Verde" natural gas pipeline project in Puerto Rico and its effects on the Coquí Llanero and its Critical Habitat given that the FWS announced its intention to list the Coquí Llanero as "endangered" under the Endangered Species Act and proposed to designate approximately 615 acres within the municipality of Toa Baja, Puerto Rico, as "critical habitat"<sup>1</sup>. Specifically, I will address new concerns that emerged after rereading the BO, which is based on information allegedly gathered from a broad range of sources ("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", BO-page 2)<sup>2</sup>.

Most importantly, however, I call your attention on how the proposed natural gas pipeline, hereafter "Vía Verde", will affect the hydrology and environmental conditions of the Coquí Llanero's Critical Habitat if the U.S. Corps of Engineering issues PREPA's construction permit. The possibility exists, however, that by the time the listing of the Coquí Llanero by FWS is finalized, the pipeline could be under construction resulting in the only known population and habitat of an endangered species to be threatened by a pending federal action.

Consequently, the new data represent a significant change in circumstances that underscores the need for a new public notice and preparation of draft Environmental Impact Statement (EIS), in most part due to the inevitability of a final listing of the Coquí Llanero. Evidence that justifies part of my requests is presented below.

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<sup>1</sup> 12-Month Petition Finding, Proposed Listing of Coquí Llanero as Endangered, Designation of Critical Habitat for Coquí Llanero, 76 Fed. Reg. 63420 (proposed October 12, 2011).

<sup>2</sup> In support of my arguments and throughout this document I include in italics and font size 10 cited portions of your BO and of other sources of information.

## I. The Puerto Rican Lowland Coquí or ‘Coquí Llanero’, *Eleutherodactylus juanariveroi*.

On page 1 of the BO, the FWS states that the U.S. Army Corps of Engineering (USACE) “determined that the project (“Vía Verde”) may adversely affect the...coquí llanero (*Eleutherodactylus juanariveroi*)...” (from letter dated July 11, 2001, requesting formal consultation to U.S. FWS), but the FWS continues on page 8 of this BO with “USACE also determined that the project was not likely to adversely affect..., coquí llanero (*Eleutherodactylus juanariveroi*)”, (information reconfirmed in Table 1, page 10 of the BO).

I contend that valuable information influencing conservation efforts of the Coquí Llanero and its Critical Habitat has been omitted by FWS in its BO. For example, the U.S. FWS indicates in its BO (page 18) that, “*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.*”

However, circumstances have changed since FWS BO (pages 40 to 45) stated that “*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.*” As the FWS announced its intention to list the Coquí Llanero as “endangered” under the Endangered Species Act, it is known that “*Once a species is listed by the Secretary as threatened or endangered, various statutory protections apply. For example, section 7 of the ESA requires all federal agencies to ‘insure’ that their actions neither ‘jeopardize the continued existence’ of any listed species nor ‘result in the destruction or adverse modification’ of a species’ critical habitat*” (Case No. 10-CV-00230-PLF). FWS has also proposed to designate approximately 615 acres within the municipality of Toa Baja, Puerto Rico, as “Critical Habitat”, which require me to emphasize that “*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.)*” (Action Area, page 11 in the FWS’ BO). In Toa Baja, action area impacted by PREPA’s proposed project affects directly and permanently the Coquí Llanero’s proposed Critical Habitat as discussed below.

## II. Wetlands and Waters of the United States of America.

The FWS BO pointed out that 1/3 of the project area encompasses Waters of the United States (BO, page 11) “*The project will temporarily impact approximately 369 acres or less of jurisdictional wetlands and aquatic resources (Water of the United States)*”.

Recent documents submitted to USACE, however, shows a most revealing finding in which the Service points out a major source of uncertainty and new information about “Vía Verde” project: the inclusion of 20 connection valves along the gas pipeline proposed route. This finding revealed PREPA’s intention not to document the real extent of actions related with development, construction, and habitat-species destruction by a larger and hidden project within “Vía Verde” natural gas pipeline project. This project, if approved by USACE, will certainly affect much more than 369 acres of wetlands, a large underestimate of the amount of wetland area and Water of the U.S. to be affected by the proposed actions for the “Vía Verde” project. A follow up letter submitted by FWS to USACE clearly points out this manipulative action by PREPA’s and violation of consultation procedure by USACE to FWS (extract cited):

*“1) Recent documents on the Corps’ website indicate that there will be 14 main line valves (ML V) along the project route. We should note that while these valves were mentioned in the EIS they were never identified in project drawings, nor were the permanent wetland impacts identified in the Corps Public Notice dated November 19, 2010 which stated that all wetland impacts would be temporary.*

*2) The applicant has recently provided details on the 6 valves impacting wetlands.*

*The Service requests that the Corps provide details on all of the 14 proposed valves to our office as soon as possible. We recommend that any new or additional information regarding the any of the project’s impacts be forwarded to the reviewing agencies as per the existing 404 MOA. The 6 ML Vs that will impact wetlands have an estimated acreage of 1. 68 ac of permanent impacts. This includes the access roads and construction pad but may not include the indirect impacts associated with solid fills in wetlands such as alteration to hydrology.*

*The illustrations downloaded from the Corps website do not show culverts or other similar structures to allow water to flow under the road fills. We believe that the applicant’s estimated 1.68 acres of wetland impacts needs to be recalculated to include possible indirect impacts associated with these structures. There is no indication that the applicant followed minimization guidelines by locating the valve pads closer to existing roads, placing culverts in the access roads etc. thereby minimizing the impacts to wetlands.”<sup>3</sup>*

This finding expands on previous concerns pointed out by FWS in its BO: “*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*”. The FWS continues, “*anticipates new actions near the proposed project*”; “*...actions that are reasonably certain to occur in or near the action area considered in this biological opinion*”; “*possible future pipeline expansion may be expected,...may add impacts of incidental take on the species*”; “*new development may occur on forested private land, areas which are considered to be habitat for both endangered animal and plant species*” (Cumulative Effects, page 52 in FWS BO).

Consequently, the 20 valves are directly related with current “Vía Verde” project making the FWS BO dangerously incomplete, as it cannot assess the magnitude and extent of wetland areas affected permanently.

In a previous letter to USACE and FWS, I provided evidence in support of how the “Vía Verde” projected route in Toa Baja-Dorado wetland directly affects the Río Cocal, the only natural connection to waters of the Coquí Llanero’s Critical Habitat, in at least in four different segments of the river. The following pictures (Figure 1) illustrate the instances in which proposed construction activities will directly affect the hydrology of the Coquí Llanero’s Critical Habitat in Toa Baja, northern Puerto Rico.

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<sup>3</sup> Letter from U.S. FWS to USACE (FWS/R4/CESFO/72LP-012; October 2011).

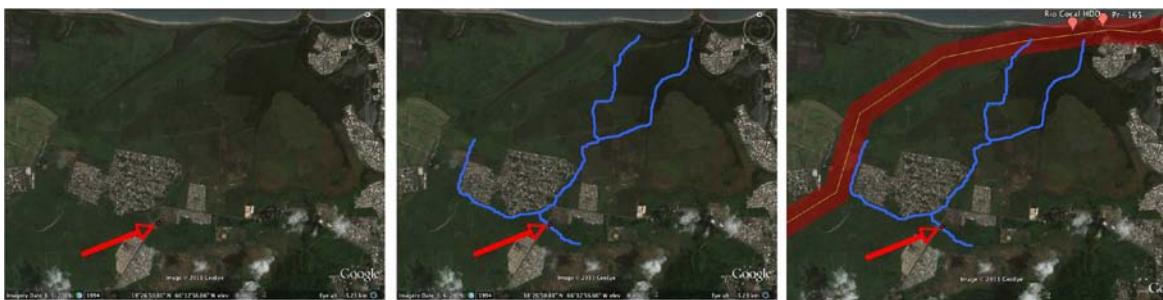


Figure 1. Red arrow in left pane highlights the natural drainage outlet of waters of the Coquí Llanero’s Critical Habitat. Picture in middle pane highlights three canals—the largest and widest on the left—where waters of Coquí Llanero’s wetland drain naturally. In this picture, the waters from the larger left canal merge with waters of the even larger Caño Campanero (canal not shown), which increases evidently drainage flow rate of waters from smaller canal of the Coquí Llanero’s wetland (see next picture below). Picture in right pane highlights alignment of proposed PREPA’s gas pipeline as in August 2011. In this picture, the thin yellow line represents the pipeline while the red bands at each side of the yellow line represent ROW and buffer area, at scale, proposed by PREPA (HDD locations in the Río Cocal are also shown). Direct interference of Coquí Llanero’s Critical Habitat water flow is evident from at least three instances along the action area (four instances by including an additional trench that will cross between the first and second canal to the north, from left to right of this picture; NOTE: according to Chapters 5 and 6 in the BA submitted to U.S. FWS, several sections of the Río Cocal, an estuarine forested area, several creeks, and at least eight section of palustrine herbaceous wetland are directly impacted by proposed activities in Toa Baja region).

It should be emphasize that the Río Cocal is responsible for the maintenance of the wetland’s hydrology and preservation of its unique vegetation, which consists mainly of obligate, fresh-water plant species like *Sagittaria lancifolia* (bulbtongue arrowhead). This is the only plant species used as breeding and retreat site by the Coquí Llanero. I have included herein additional unpublished data in figure format (Figure 2) to show the interdependence among water depth, vegetation cover, and Coquí Llanero’s abundance. The figure highlights explicitly how small differences in *S. lancifolia* cover and water depth translate into large differences in Coquí Llanero’s abundance (hence the Coquí Llanero’s specialized ecological requirements): greater abundance of Coquí Llanero is observed in areas with greater cover of *S. lancifolia*. The data are from censuses made in two locations within the wetland, one of them with data collected only for four months (this study area was abandoned due to habitat disturbances by PR State Police helicopter, which hovered over me on two occasions, flattening most vegetation that recovered >four months later!). I only show data on Coquí Llanero’s relative abundance in the disturbed and undisturbed locations for the same four months of censuses for comparative purposes. Data included Coquí Llanero’s relative abundance, percent cover of *Sagittaria lancifolia* (bulbtongue arrowhead), and water depth in meters.

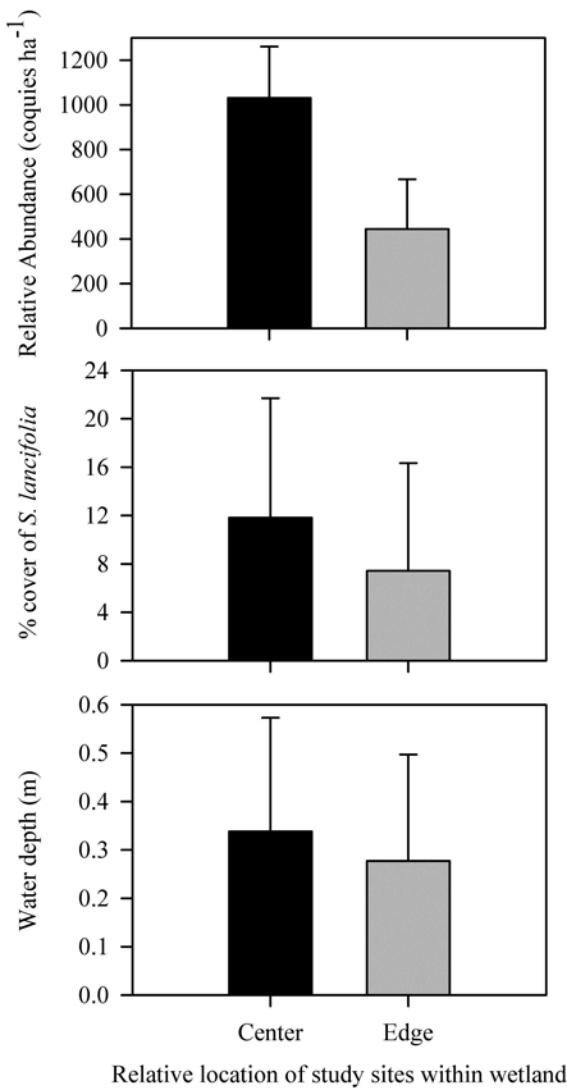


Figure 2 (on the left): Data on relative abundance of the Coquí Llanero, percent cover of *Sagittaria lancifolia*, and water depth collected during four monthly occasions between 2005 and 2006 from two locations within the Coquí Llanero’s wetland. In this figure, Edge represents the undisturbed study site, which locates towards the wetland’s edge relative to its center, while Center represents the disturbed study site (see text above), which locates towards the center portion of the wetland.

The Department of Natural and Environmental Resources of the Commonwealth of Puerto Rico (DNER) provided the FWS with documents of hydrological studies for DNER’s designation of the Coquí Llanero’s habitat as Essential Natural Critical Habitat. These documents include essential data of the species and of its ecosystem resource requirements for management and conservation purposes (consulted by FWS as mentioned in its BO). Major threats are recognized in these documents, but I include herein additional threats that expand evidence provided in my previous

letter to USACE and FWS on how PREPA’s proposed activities will affect the Coquí Llanero and the wetland it depends on for reproduction and survival.

For example, the BA submitted to FWS indicates that construction activities will also occur below water table (one to two meters below surface level: see Chapter 6 “Impactos” in the BA). In my previous letter to USACE and FWS, I also mentioned that according to the BA, construction in wetlands and mangrove areas would occur during the dry season (when rainfall is minimal!). Construction methodology included techniques like horizontal direct drilling (HDD) and open trench activities that includes “dam and pump” during construction, thus leading us conclude that wetland drainage of the Coquí Llanero’s Critical Habitat will be accelerated and magnified along canals connecting the Río Cocal. I included below a picture (Figure 3, next page) taken at the westernmost outlet of the only natural drainage of the Coquí Llanero’s Critical Habitat to show how narrow, shallow, and fragile this drainage passage is. Location of this picture is indicated by red arrow in Figure 1 above.



Figure 3. Here I am at the middle of the outlet with the easternmost side of the wetland in the background (picture taken at 4:00pm on October 12, 2011, from the edge of José Julián Acosta Road (to the west). The red vertical line beside me is approximately 1.7m in height, which is my body height. The red arrow at the right of the picture indicates the precise location in which the Coquí Llanero was heard calling when the picture was taken. The red oval at the left of the picture illustrate “management practices” performed by Toa Baja Municipality as flood-control measures all along the east-to-west margins of this canal, the connecting Caño Campanero (to the west), and along selected northern portions of the Río Cocal. According to BA submitted to FWS, the Coquí Llanero has been found within the Project Right-Of-Way (ROW) on six separate instances in the Río Cocal, which suggests the ecological functionality of the Coquí Llanero’s Critical Habitat natural drainage outlet and associated canals and Río Cocal as important natural corridors for population migration and species’ persistence in Toa Baja.<sup>4</sup>

I have shown in Figure 2 (previous page) the close interdependence of hydrological conditions and cover of critical vegetation for the abundance of the Coquí Llanero. I must emphasize that PREPA’s BA nor the U.S. FWS BO included/analyzed wetland classification PEM1H6 (palustrine, emergent, persistent, permanently flooded, oligohaline). This Wetland Type is the largest part of the Coquí Llanero’s Critical Habitat and connects its waters with waters of the Río Cocal thru PEM1C type (and as shown herein). PREPA’s construction activities, if are to be approved by USACE, include one to two meters dredging actions (Chapter 6 “Impactos” in the BA), a 60-feet ROW permanently cleared of vegetation in the Río Cocal, and related buffer area (see Figure 1). Information provided herein (and in my previous letter to USFWS and

<sup>4</sup> Puerto Rico Electric Power Authority, Via Verde Natural Gas Pipeline Project Biological Assessment (April 2011, modified July 2011) [hereinafter Final Biological Assessment] Appendix 3, Search of the Puerto Rican Crested Toad and Coquí Llanero in areas proposed for the construction of Via Verde, page 81.

USACE) requires the inclusion of this Coquí Llanero’s wetland type as action area to be affected by PREPA’s proposed activities (see Action Area, page 11 in FWS BO). Moreover, the clearing, widening, and “dam and pump” construction activities for “Vía Verde” will unequivocally increase the Coquí Llanero’s Critical Habitat wetland drainage resulting in permanent changes in vegetation, spread of invasive species, and possible threats from fires as grasses replaces native non-grass vegetation.

In summary, a profound and significant change of circumstances related with the Federal Register’s (50 CFR Part 17 issued on October 11, 2011) 12-Month Petition Finding—Proposed Listing of Coquí Llanero as Endangered and Designation of Critical Habitat for Coquí Llanero, and new data and evidence, not considered in initial PREPA’s proposal referenced in FWS BO, has occurred. Consequently, I request the REINITIATION OF FORMAL CONSULTATION of PREPA’s PROJECT “Vía Verde”, but also A NEW PUBLIC NOTICE BY THE USACE, and PREPARATION OF DRAFT ENVIRONMENTAL IMPACT STATEMENT.

Sincerely,

Neftalí Ríos-López, Ph.D.  
Cond. Vista Serena 920  
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San Juan, PR 00926-9266

Copy:

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Ms. Cindy Dohner  
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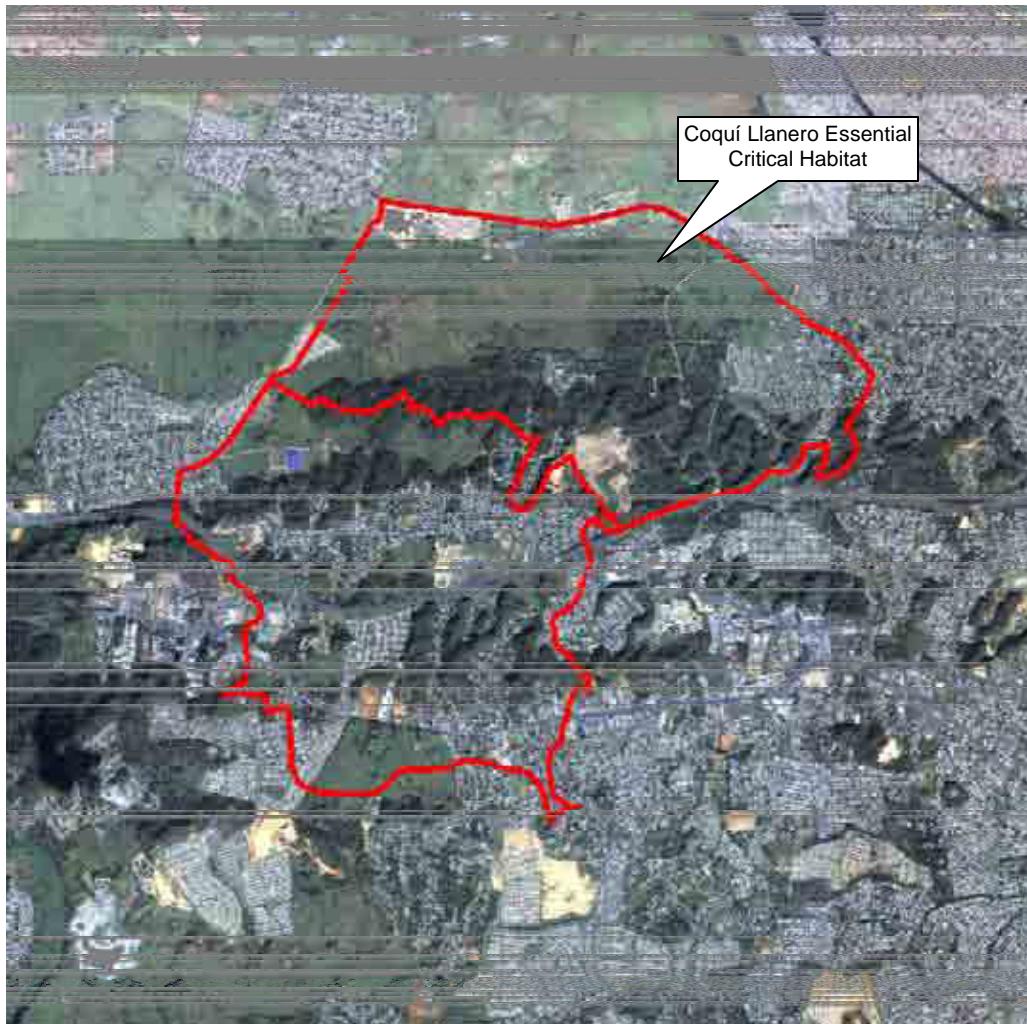
Mr. Kenneth L. Salazar  
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Col. Alfred A. Pantano  
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Jacksonville, FL 32207-8174

Major General Merdith W.B. Temple  
Acting Commanding General  
Headquarters, US Army Corps of Engineers  
441 G. Street, NW  
Washington, DC 20314-1000

## **Appendix 3**

# **Delimitation of the Watershed Tributary to the delimited Habitat of the Coquí Llanero, Sabana Seca, PR**



**July, 2007**

**PREPARED FOR:**



**PREPARED BY:**



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# Gregory L. Morris Engineering

## Delimitation of the Watershed Tributary to the Delimited Habitat of the Coquí Llanero

Sabana Seca, PR

July 6, 2007

### **1. INTRODUCTION**

#### **1.1. Scope and Purpose**

In 2005 new Coquí species was identified in a wetland adjacent to the former Sabana Seca Naval Communication Station in Toa Baja. An area of Essential Critical Habitat was delimited that includes the wetland and adjacent areas. This report describes the limits of the watershed which is tributary to the identified Essential Critical Habitat area of the Coquí Llanero (*Eleutherodactylus juanriveroi*) as delimited by the Department of Natural and Environmental Resources (DNER).

#### **1.2. Report Limitations**

The report presents surface water drainage patterns only; it does not discuss groundwater flow patterns.

#### **1.3. Authorization**

Preparation of this report has been performed through contract with the Water Plan Office (*Oficina Plan de Agua*) of the Department of Natural and Environmental Resources.

## **2. STUDY AREA DESCRIPTION**

The identified Essential Critical Habitat of the Coqui Llanero consists of wetlands in which the species has been observed plus adjacent undeveloped upland areas. This habitat includes floodplain areas inundated by Río de la Plata, limestone hills (mogotes), and blanket sands which comprise the valleys between the mogotes. The species has been identified and is known to reproduce in the wetland area.

The Essential Critical Habitat area as delimited by DNER is presented in **Figure 1**. It includes two principal types of habitat.

- Wetlands on the Río de la Plata floodplain (474 cuerdas), an area where the species is known to reproduce, generally occupies the northwestern portion of the Essential Critical Habitat area; and
- Additional areas (1,195 cuerdas) which also include some wetlands, relatively level upland areas, and steep limestone haystack hills (mogotes).

Elevations in the area range from 1 to 125 meters above sea level. Rio La Plata is the principal source of flooding in the area and its channel is located approximately 5 km east of the western limit of the identified habitat.

The habitat area has also been outlined on a recent aerial photo, as shown in **Figure 2**. To the west this habitat is circumscribed by a recent housing development, which tends to separate the habitat area from the remaining portion of the Río de la Plata floodplain

### **3. WATERSHED LIMITS**

Watershed limits have been determined based on USGS topographic mapping, aerial photography and site visits on June 12 and June 20, 2007.

Being an area of karst topography plus river floodplain, stormwater drainage patterns within the study area are influenced by several factors.

- Wetland areas within the Essential Critical Habitat area may be affected by overflow from Río de la Plata. The FEMA map for the area (**Figure 3**) indicates that wetlands in the northwestern area of the Essential Critical Habitat may be inundated by the 100-year flood from Río de la Plata.
- Surface drainage patterns from specific storms are affected by the capacity of sinkholes, which may vary over time.
- Drainage canals dug many decades ago for agricultural purposes have modified drainage conditions. These canals accelerate and concentrate runoff but have not modified the watershed boundaries.
- The Toa Baja landfill operation has modified the drainage pattern within its boundaries, and drainage patterns from the landfill can change over time as a result of earth movement. The specific drainage pattern within the landfill area has not been delimited in this study. However, it is known that leachate from the landfill does flow north to enter the Essential Critical Habitat area, as observed during the field inspection on June 20.

The delimitation prepared here shows the entire area which can potentially contribute runoff that enters the Essential Critical Habitat during severe rainstorms, based on surface topography.

From the standpoint of delimiting watersheds, the Essential Critical Habitat will be subdivided into two-areas based on runoff and flow patterns anticipated during rains not sufficient to cause flooding by Río de La Plata.

1. The **NORTH WATERSHED** is delimited in **Figure 4** and **Figure 5**. It receives runoff from the following directions: (1) from the south it may receive both surface and shallow sub-surface runoff from the mogotes; (2) from the east it receives runoff from the developed portion of the naval communications station; (3) from the north it receives runoff from the adjacent small community along highway PR-867, the highway, and small businesses including the go-kart racing track; and (4) from the west it receives runoff

from a portion of the exiting urban developments bordering the Brisas de Campanera urbanization (**Figure 7A**). This area also receives all runoff from the South Watershed via the drainage canal depicted in **Figure 4** and **Figure 5**, and which runs along the east side of the Brisas de Campanera development. A photograph of the channel which conveys runoff into the North Watershed area of the Essential Critical Habitat area is shown in **Figure 7B**. See **Figure 7C** for photos location.

Field inspection on June 20, 2007 determined that this watershed receives leachate from the Toa Baja Municipal Landfill, via drainage along the perimeter fence road on the Naval Station site. The area where this drainage was observed is shown in **Figure 6**. This problem is known to regulatory agencies but we did not investigate the status of any remedial actions.

2. The **SOUTH WATERSHED** receives runoff from limestone topography and drains through a dug canal and into the North Watershed. It is delimited in **Figure 4** and **Figure 5**.

During smaller rainfall events, the drainage within this watershed will discharge primarily to sinkholes and runoff will not be generated from the entire watershed area. However, during extreme rainfall and flooding events the watershed which may contribute runoff to this area is very large and is delimited in **Figure 4** and **Figure 5**. Personal of our office have observed that surface runoff from the south side of PR-22 entered the Critical Habitat area as a result of rains that occurred during the week of October 10, 2005.

#### **4. CONCLUSIONS**

1. Runoff from the North Watershed drains into a wetland area where the species is known to reproduce. While there are some canals that have historically drained this area, over much of the area these canals are in disuse and have filled with sediment. As a result, stormwater runoff from this area may be dispersed over a wide area within the wetland during a rainfall event. The North Watershed, and particularly on the Naval Station site, has been of low density. An increase in land use intensity may be expected to significantly affect water quality and flooding hydroperiod. This area also receives landfill leachate.
2. The South Watershed has intense land use and probably generates significant amounts of contaminants. However, this effect on the species habitat may actually be more limited than in the North Watershed because this runoff generally tends to pass through canals and along distinctive drainage paths, instead of spreading out across a large wetland area.
3. There are actively maintained artificial drainage channels that run and help drain wetland areas in the North Watershed. We do not know how water levels and wetland drainage may influence the habitat for this species.

## **5. RECOMMENDATIONS**

1. North Watershed Management. Because runoff from the North Watershed drains directly to the wetland areas where the species is known to reproduce, and because this runoff may become dispersed within this wetland, water quality controls are particularly important in this watershed. Strict development controls are recommended within the North Watershed, focusing on “green” stormwater management strategies. These controls should focus on techniques such as the following:

- Route all runoff through detention structures designed to maximize contaminant capture.
- Maximize green area and minimize impervious surfaces.
- Utilize vegetation buffers and maintain runoff dispersed (rather than concentrated) is so far as possible.

Other strategies may also useful. It is recommended that the Department establish “green” guidelines for storm water management in environmental sensitive areas, and that said guidelines be applied within the Northern Watershed.

Landfill leachate is a strong contaminant that enters the North Watershed. There is also a significant amount of eroded soil from the landfill that enters the wetlands, draining north through the monkey farm area. An aggressive management program should be implemented to address both sources of contaminants.

A vegetative buffer zone is recommended around all wetland areas within the Essential Critical Habitat area. This buffer should be established based on hydrologic units related to wetland limits and surface drainage features, such as canals. The objective is to maximize the potential for vegetative cleaning of runoff. As such, these buffers should be established in coordination with the “green” stormwater guidelines.

2. South Watershed Management. Outside of the Essential Critical Habitat area, the South Watershed is much more developed than the North Watershed. This area contains industrial activities, two major highways (PR-2 and PR-22), and extensive areas of urban development. There is not a large amount of land area that is available for new development, and much of the residential area has been developed in an informal manner, lacking even basic stormwater drainage infrastructure such as pipes.

"Green" stormwater management guidelines should be applied within the South Watershed area to the extent practical. However, the combination of existing known flooding problems within this area plus the existing high density of existing development will require that each situation be considered on a case-by-case basis to seek opportunities for water quality enhancement.

Inasmuch as runoff in the South Watershed tends to flow along defined channels, erosion and the transport of eroded material along these channels is a potentially significant issue.

3. All Watersheds. Community education should be undertaken in the urbanizations adjacent to the Essential Critical Habitat area. A key element of this education should focus on avoiding the discharge of contaminants (detergents, oil, etc) onto streets which drains into the wetland.

# **FIGURES**

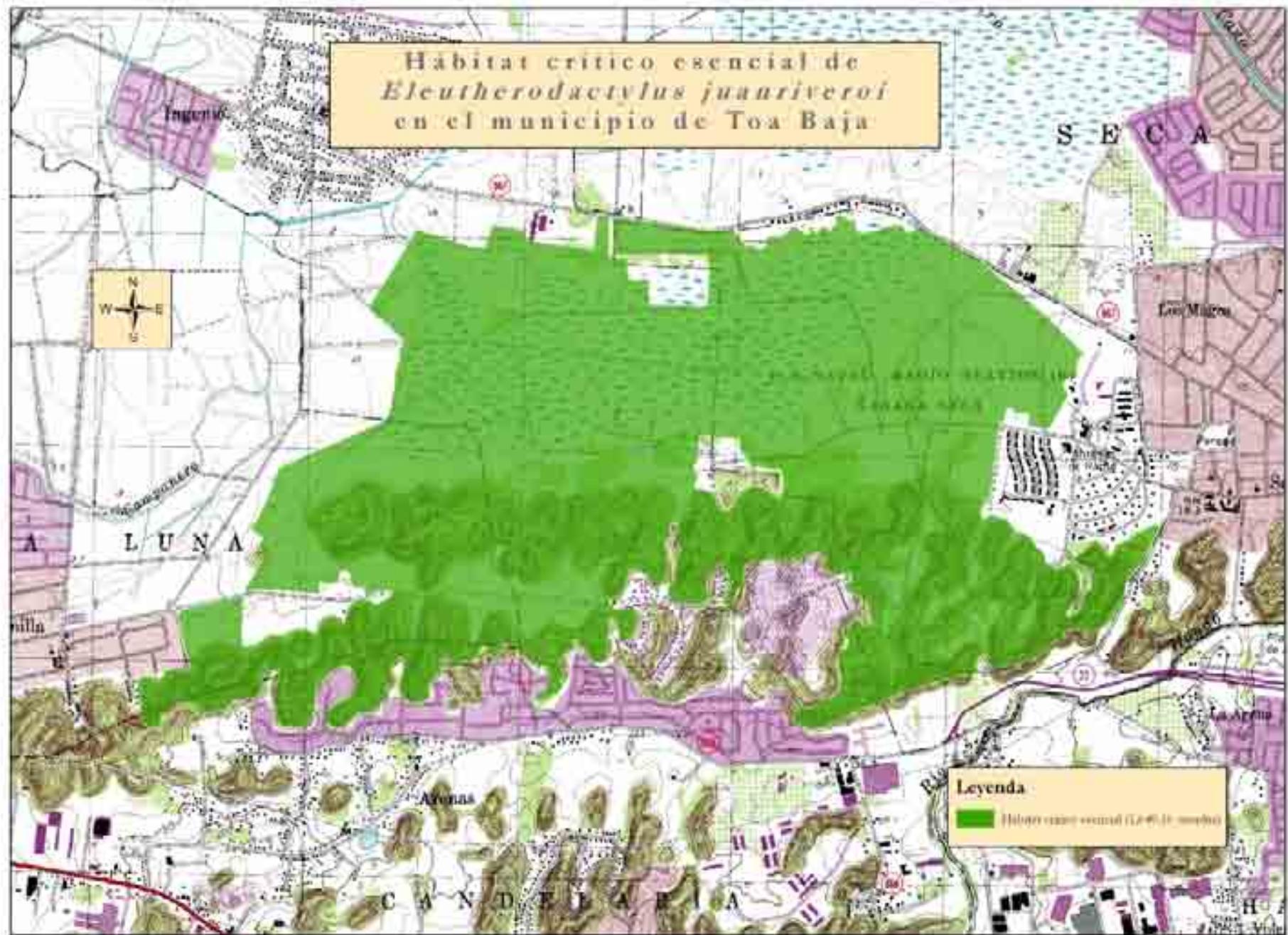


Figure 1: Habitat for Coquí Llanero (*Eleutherodactylus juanriveroi*) in Toa Baja as identified by DNER.



Figure 2: Coquí Llanero habitat on aerial photo as identified by DNER.

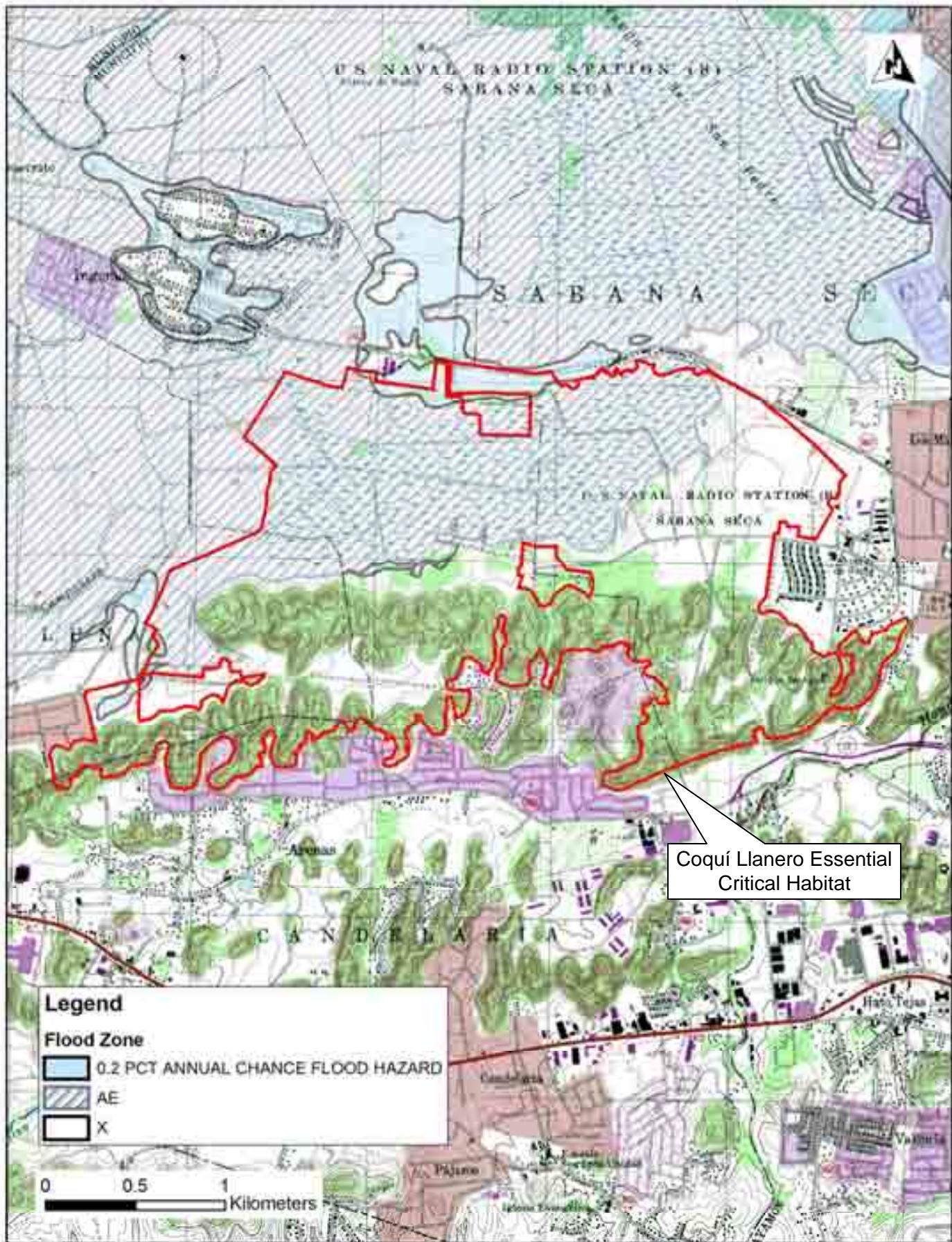


Figure 3: FEMA map showing Coqui Llanero Essential Habitat.

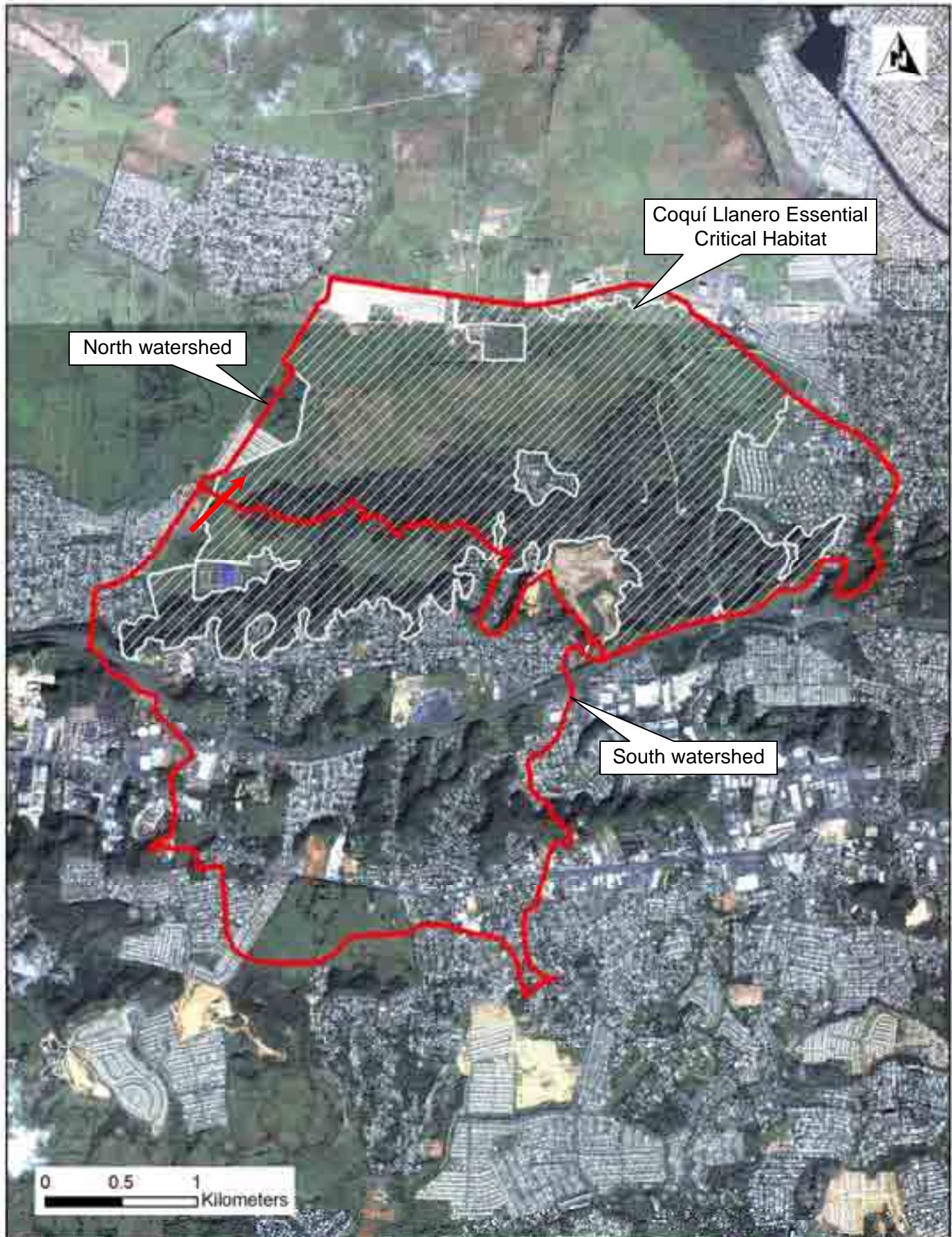


Figure 4: Watersheds contributing to the Coquí Llanero habitat.

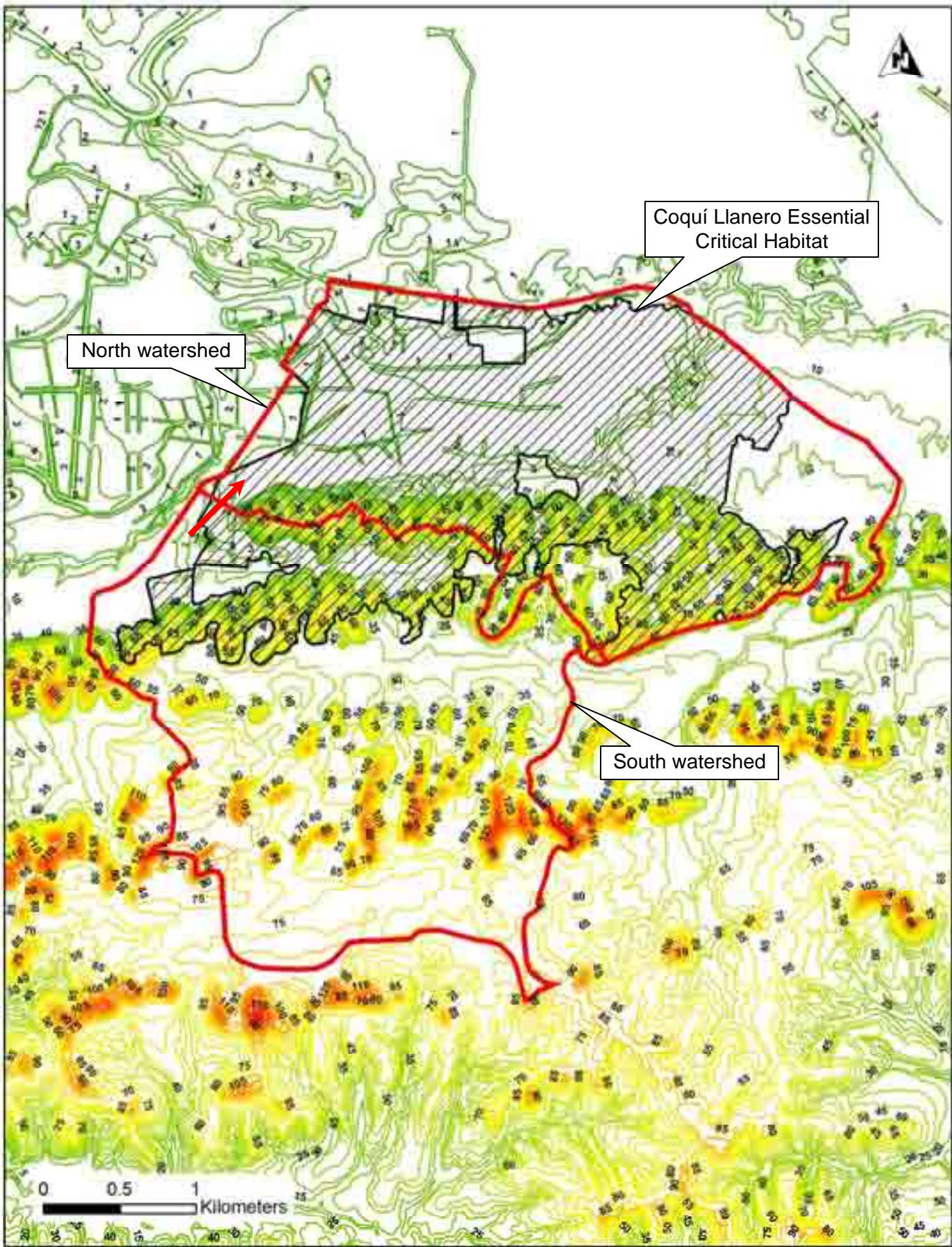


Figure 5: Topographic features of the watershed contributing to the Coqui Llanero habitat.



Figure 6: Toa Baja landfill leachate flow patterns.



Figure 7(A): Urb. Brisas de Campanero, surface drainage into Essential Critical Habitat wetland.

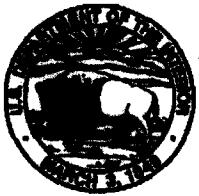


Figure 7(B): Drainage channel which conveys flow from South watershed into North watershed (location of arrow in Figures 4 and 5).



Figure 7(C): Location map for photos.

## **Appendix 4**



# 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

JUL 16 2011

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

Mr. Bob Barron  
Regulatory Program Manager  
Jacksonville District Corps of Engineers  
701 San Marco Boulevard  
Jacksonville, Florida 32207-0019

Re: Biological Assessment dated July 11, 2011,  
Via Verde Project, SAJ 2010-02881 (IP-EWG)

Dear Mr. Barron:

This letter acknowledges the U.S. Fish and Wildlife Service's July 11, 2011 receipt of your letter requesting initiation of formal section 7 consultation under the Endangered Species Act (ESA). We also acknowledge receiving a Biological Assessment (BA) dated July 11, 2011, and the draft shapefile reduced footprint work area dated July 02, 2011. The consultation concerns the possible effects of the proposed Via Verde Project on the Puerto Rican Boa (*Epicrates inornatus*), Puerto Rican sharp-shinned hawk (*Accipiter striatus venator*), and the Puerto Rican broad-winged hawk (*Buteo platypterus brumescens*).

The Service concurs with your determination that the proposed project may affect, is likely to adversely affect these three species. Section 7 allows the Service up to 90 calendar days to conclude formal consultation with your agency and an additional 45 calendar days to prepare our biological opinion (unless we mutually agree to an extension). Nevertheless, since the Service and the Corps have been closely coordinating efforts to minimize possible adverse effects to federally-listed species previous to initiation of consultation, we anticipate being able to complete a biological opinion in less time than 135 days.

In addition, based on information found in the BA, the Corps has made an initial determination that the proposed Via Verde project may affect, but is not likely to adversely affect (MANLAA) four (4) animal species [Puerto Rican parrot (*Amazona vittata vittata*), Puerto Rican nightjar (*Caprimulgus noctitherus*), Puerto Rican crested toad (*Peltophryne lemur*), coqui llanero (*Eleutherodactylus juanariveroi*)] and 27 plant species [*Aurodendron pauciflorum*, *Banara venderbiltii*, *Buxus vahlii*, *Calyptromoma rivalis*, *Catesbeia 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 Zanthoxylum thomasianum].*

Based on our evaluation of the information discussed in the BA and that available in our files, we concur with the effects determination for the above-referenced species. The following information summarizes the basis for our concurrence.

1. Puerto Rican parrot: The Puerto Rican parrot has been successfully released in the Rio Abajo Commonwealth Forest. Based on the information discussed during the meeting on May 16, 2011, site visit conducted on May 23, 2011 and information in the BA, the proposed project alignment and construction right-of-way (ROW) in the Utuado-Arecibo area follows the existing PR10 ROW and no suitable habitat for the species within the Rio Abajo Commonwealth Forest would be adversely affected.
2. Puerto Rican nightjar: In order to minimize possible adverse effects to nightjar habitat, the Applicant identified and evaluated alternate routes in the Pefiuelas area. The proposed route (Alternative #2 – June 6, 2011) significantly reduced the direct effects to prime nightjar habitat to be affected by the project in Pefiuelas. Sections of the route were re-aligned to previously disturbed areas, areas with low quality habitat for the species, and the construction ROW was reduced from 100 ft to 60 ft in this area. 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. However, we believe that the project re-alignment resulted on a significant reduction of effects since the original alignment would affect about 34 acres of prime nightjar habitat. In addition, the BA's Section 5.2.9.6 proposes additional measures to further minimize possible effects to the species during construction and ensure that no direct effects to individual nightjars are anticipated. To further minimize effects and to foster nightjar conservation and recovery the Applicant has a preliminary proposal to acquire approximately 290 acres of nightjar habitat.
3. Puerto Rican crested toad: The Applicant developed a model identifying suitable habitat for the Puerto Rican crested toad and possible breeding sites both in the northern and southern karst regions of Puerto Rico. The Applicant re-aligned the proposed project route to avoid potential effects to potential breeding sites for the species and reduced the construction ROW from 100 ft to 60 ft in the northern karst and to 70 ft within the areas identified by the model as species' potential habitat. The BA's Section 5.2.3.6 establishes that before construction activities start, daily surveys will be conducted by two biologists and on-site measures will be implemented to ensure no adverse effects on the species during construction.

4. Coqui llanero: Although the species is not currently listed under the ESA, the Applicant developed measures to minimize possible adverse effects on the species. These measures have been developed in coordination with the Puerto Rico Department of Natural and Environmental Resources which is the current agency with jurisdiction on the species. The species is currently protected by the Commonwealth Wildlife Law. As we mentioned in our letter dated May 20, 2011, we recommend that proposed efforts to collect and re-locate individuals should be carefully evaluated with species experts and alternatives developed to avoid possible effects to the species. We continue recommending that conservation alternatives developed for this species are closely coordinated with species experts to ensure the protection of the species.
5. 27 Plant Species: Although no federally-listed plants have been identified within the transects conducted within the project alignment and construction ROW, suitable habitat for federally-listed plants would be affected by the project. To address possible effects to listed plants, the Applicant modified the project alignment in Pefiuelas (Alternative Alignment 2- June 6, 2011), Adjuntas (Cerro Area), Arecibo (PR10), Manati (Manati East and Manati West) and Vega Baja (Vega Baja 1 and Vega Baja 2) to minimize possible adverse effects to forested habitat and reduced the construction ROW from 100 ft to 60 ft on steep slopes and narrow ridges (GIS shape file titled "Listed Plants Reduced Footprint"). In addition, the Corps developed proposed permit conditions under Section 5.1.30 of the BA to protect listed plants in the event they are found during intensive surveys to be conducted before project starts. We consider the proposed permit conditions appropriate to avoid or minimize possible adverse effects to listed plants, if present within the project alignment and construction ROW.

In our meeting on July 13, 2011, the Corps indicated that the proposed conservation measures for the species determined to be MANLAA would be included as special conditions in a permit, if the project is authorized. The Corps requested technical assistance from the Service on that matter to ensure that permit conditions are appropriately written. The Service is willing to provide further assistance and would like to review draft permit conditions. At the time the permit conditions are drafted, please provide us with the draft conditions for such review. Nevertheless, we would like to provide the following guidance regarding the Puerto Rican nightjar and Puerto Rican crested toad:

1. Vegetation clearing activities within nightjar habitat must be avoided from January to August to eliminate any possibility of take of individuals.
2. Proposed habitat restoration for nightjar mentioned in Section 5.2.9.6 of the BA should be designed following the guidance provided to the Corps on July 1, 2011 for habitat restoration, species and tree density from Murphy and Lugo (1986): Structure and Biomass of a subtropical dry forest in Puerto Rico.
3. The proposed acquisition for the nightjar habitat should be conducted within the area identified as Mitigation Area for the Gasoducto del Sur which is located north-west to the proposed project alignment and purchase efforts should be conducted by the Applicant before land clearing activities within nightjar habitat start.

4. The BA establishes that monitoring events for the Puerto Rican crested toad will be carried out between 0500 and 0730 AM. This would be appropriate only during periods of reproductive events when the toads would be travelling to and/or calling at potential breeding ponds. During periods of no reproduction and/or when breeding ponds are dry, the species, if present, will move outside of the breeding ponds and into the surrounding forest where it will find shelter and food. The crested toad is difficult to detect outside of breeding events and/or during drier periods of no precipitation. Therefore, we recommend the monitoring activities be conducted from 2000 to 2400 nocturnal periods when they would be more active during wetter periods.
5. The Puerto Rican crested toad is very difficult to detect due to their small size, secretive habitats, cryptic coloration, and particular behaviors. In order to maximize species detection at the monitoring sites, the Service further recommends the use of automated recording systems during the rainy season, before construction starts and during construction. If individuals of the Puerto Rican crested toad are found, we do not recommend relocating the specimens. The BA establishes that capture and relocation protocols for the crested toad would be similar to those identified for the PR boa. This approach is not appropriate because these two species do not have the same ecological and physiological requirements. The Service is willing to work with the Corps and the Applicant's consultant to develop appropriate protocols to capture crested toads during construction, if species is found.

In our meeting on July 13, 2011, we also learned that the project alignment for the proposed pipeline has changed, and that there is potential for other changes to occur as result of on-going consultation with other agencies. As we mentioned during the meeting on July 13, 2011, we need to emphasize that this concurrence with the Corps determination of may affect, but is not likely to adversely affect is based on the information submitted to us on July 11, 2011, and the project alignment submitted on July 12, 2011. Therefore, should project plans change, or if additional information on the distribution of listed species becomes available, this determination may require reconsideration.

If you have any questions, please call Marelisa Rivera, Deputy Field Supervisor, Caribbean Ecological Services Field Office at 787-851-7297 extension 206.

Sincerely yours,



Edwin E. Muñiz  
Field Supervisor

## **Appendix 5**

## A new species of palustrine *Eleutherodactylus* (Anura: Leptodactylidae) from Puerto Rico

NEFTALÍ RIOS-LÓPEZ<sup>1</sup> & RICHARD THOMAS<sup>2</sup>

Department of Biology, University of Puerto Rico, Río Piedras, Puerto Rico 00931, USA.

E-mail: <sup>1</sup>neftalirios@yahoo.com, <sup>2</sup>jprthomas32@yahoo.com

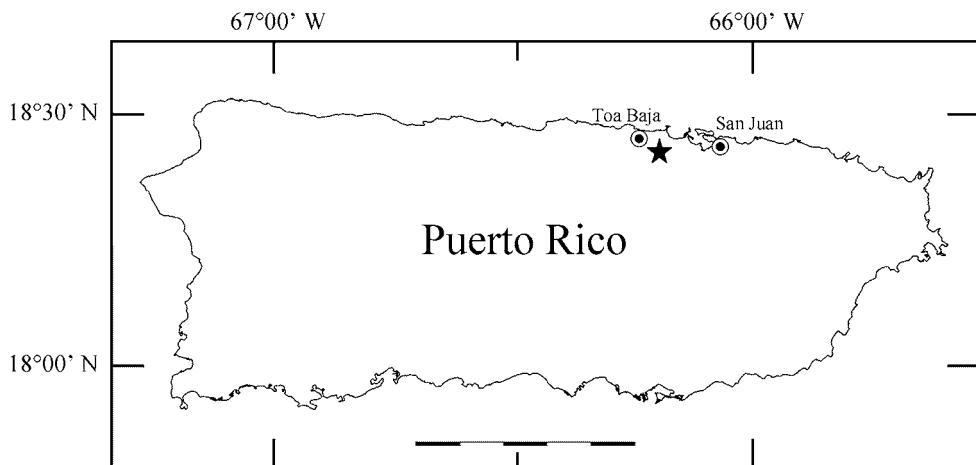
### Abstract

We describe adult morphology, advertisement call, and natural history diagnostic of a new species of *Eleutherodactylus* from a fresh water (palustrine) herbaceous wetland of northern coastal Puerto Rico. The new species is apparently the smallest Puerto Rican *Eleutherodactylus* and is morphologically most similar to *E. gryllus*, which inhabits high-elevation humid forests and cloud forests. Although both species have well-developed glands throughout the body, morphological ratios, body coloration, frequency of calls, call structure, and habitat association indicate that it is a well-differentiated species. The new species and *E. gryllus* may have diverged from an ancestral wetland-dwelling species.

**Key words:** coastal ecosystems, Coqui Llanero, freshwater, herbaceous, karst, NMDS

### Introduction

THE anuran genus *Eleutherodactylus* (Duméril & Bibron) represents the most species-rich genus of vertebrates with more than 600 recognized species in Central, South America, and the West Indies (Frost, 2002; Frost *et al.*, 2006). Although herpetology in Puerto Rico began formally in 1820 (Thomas & Joglar, 1996), it was not until 1863 that the first *Eleutherodactylus*, *E. antillensis* (Reinhardt & Lutken), was described. By 1976, the addition of *E. jasperi* (Drewry & Jones), the first New World anuran reported to be ovoviparous (Drewry & Jones, 1976), comprised 15 *Eleutherodactylus* on the main island of Puerto Rico. The native anuran fauna of Puerto Rico has been nomenclaturally stable for 30 years and no additional species has been described since. Most of these descriptions were based, however, on studies in forest remnants in mid-high elevation areas, while herpetological studies in lowland wetlands were virtually nonexistent. The vast majority of these lowland wetlands were heavily altered mostly for agriculture since 1500's and for urban development since the 1930's, which may partly suggest that these areas were considered of little herpetological interest. On the other hand, ~94% of forested areas were cleared from 1930 to 1950 during the peak of agriculture activity (Birdsey & Weaver, 1987; López del Mar *et al.*, 2001; Lugo, 2004). Consequently, several ecologically specialized *Eleutherodactylus* like *E. jasperi* and two more Puerto Rican *Eleutherodactylus* from forested and high elevation areas are now presumably extinct (Joglar, 1998), mostly due to habitat destruction. Then, it was with great surprise that one of us (NRL) discovered a small, unknown *Eleutherodactylus* in a palustrine herbaceous habitat on the northern coastal plain, not far west from the capital city of San Juan (Fig. 1).



**FIGURE 1.** Map of Puerto Rico showing type locality (star) of *Eleutherodactylus juanariveroi* along with the capital city of San Juan and the Toa Baja municipality. Scale bar 50 km.

## Material and methods

Specimens were collected, fixed in 10% formalin, and transferred to 70% ethanol for storage. Two specimens of the new species and two of *Eleutherodactylus gryllus* (Schmidt) were cleared and stained following Dingerkus and Uhler (1977) and Rosa-Molinar *et al.* (1999) for cartilage and osteological data. The following measurements were taken, to the nearest 0.01 mm, using a digital slide-caliper: Snout-vent length (SVL), Femur length (FL), Tibio-fibula length (TiL), and Tarsal length (TL, from the tibio-tarsal articulation to the inner base of metatarsal tubercle). The following measurements were also taken, but to the nearest 0.001 mm using a digimatic micrometer: HW (head width, at the angle of jaws), HL (head length, from the rear of mandible to tip of snout), UEW (maximum upper eyelid width), IOD (inter orbital distance, that is, the shortest distance between the upper eyelids), TYW (tympanum width, maximum horizontal width), IN (inter-narial distance or distance between internal border of nostrils), EL (eye length or orbital length, which is the horizontal distance between orbital borders of eye), EN (distance from nostril to anterior orbital border of eye), FD<sub>III</sub> (disk width on finger III), TD<sub>IV</sub> (disk width on toe IV), and FDB<sub>III</sub> (width of finger III at the base of disk; FDB<sub>III</sub> was taken by measuring tracings made using a camera lucid attached to a dissecting microscope). Angular measurements were taken with a vernier protractor on camera lucid tracings of the relevant structures. Sex was determined by examining gonads. At first glance, several morphological and acoustic affinities of the new species with *E. gryllus* lead to focus our comparison to the small Puerto Rican *Eleutherodactylus* showing affinities with *E. eneidae* [Rivero] and *E. locustus* [Schmidt] and/or those small-bodied species that occur in the same type locality (*E. brittoni* [Schmidt] and *E. cochranae* [Grant]). We used Non-metric Multidimensional Scaling (NMDS) to compare body proportions of the new species with those of *E. brittoni*, *E. cochranae*, *E. eneidae*, *E. gryllus*, and *E. locustus*. NMDS was selected, because most of the morphological variables are correlated and do not conform to the normality assumptions required by parametric multivariate analyses (e.g., PCA, CCA; McCune & Grace, 2002). The NMDS was performed using PC-ORD 4 software package (McCune & Mefford, 1999). The data matrix consisted of 97 rows that represented one individual from each species and columns represented 91 relative body proportions. The NMDS analysis resulted in groups of individuals, in ordination space, representing every taxon characterized by the combination of morphological variables. The spatial arrangement of these groups allowed detecting those species that showed a greater morphological affinity with the new species. Indicator Species Analysis (Legendre & Legendre, 1998) was then used to detect those morphological variables/ratios that could be useful in distinguishing

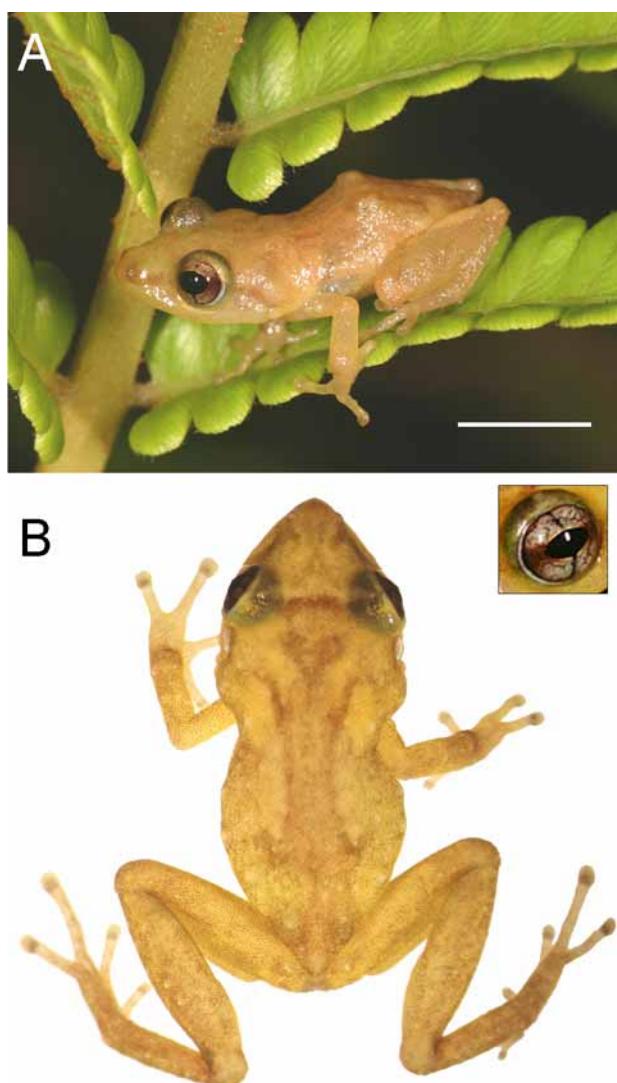
ing the new species from the most similar species. The main diagnostic attributes of the new species are qualitative characters not included in the multivariate matrix with morphological data.

We recorded calls in the field using a Sony stereo microphone (Model ECM-719) and a Sony cassette recorder (Model WM-D6C). Call parameters were analyzed using Adobe® Audition™ 1.5 software package (© Adobe Systems Incorporated) and Raven 1.0 software package (© Cornell Lab of Ornithology). The analyses were performed using Butterworth filter, which allows for the specification of the width of the transition band. A narrow 20 Hz transition band was selected for all analyses.

***Eleutherodactylus juanariveroi*, n. sp.**

(Fig. 2; Table 1)

**Holotype:** KU 306997, an adult female collected at Sabana Seca, Toa Baja Municipality (Fig. 2), in a seasonally flooded herbaceous wetland in the vicinity of the US Naval Security Group Activity Sabana Seca (USNS-GASS) and the Caribbean Primate Research Center, Puerto Rico ( $18^{\circ}26.127'N$ ,  $66^{\circ}12.092'W$ ), 10–20 m elevation, by N. Rios and R. Thomas on 2 August 2005.



**FIGURE 2.** Live *Eleutherodactylus juanariveroi* (female) on a willdenow's maiden fern (*Thelypteris interrupta*) from the type locality (A) (specimen number unavailable). Scale bar 5 mm. Dorsal view of *E. juanariveroi* showing reversed comma pattern (B) (KU 306997, holotype). Pupil shape with '+' pattern (insert, specimen number unavailable).

*Paratypes*: 45 (26 females, 18 males, 1 juvenile). Females (KU 306998–99, USNMS 563626–28, UPRRP 6340–2, UPRRP 6343, UPRRP 6348–9, UPRRP 6351–4, UPRRP 6356–7, UPRRP 6359, UPRRP 6360–2, UPRRP 6365, UPRRP 6367–9, and RT 14535 [Richard Thomas, private collection]), males (KU 307000–02, USNM 563623–25, UPRRP 6344–7, UPRRP 6350, UPRRP 6355, UPRRP 6358, UPRRP 6363–4, UPRRP 6366, UPRRP 6370, and RT 14501), juvenile (UPRRP 6371), all from the vicinity of the USNSGASS, the Caribbean Primate Research Center, and the public lands in the Toa Baja Municipality, 18°26.049'N, 66°12.209'W, 18°26.127'N, 66°12.092'W, N. Rios and R. Thomas, 30 July 2005, 2 August 2005, 3 August 2005, and 23 August 2005.

**Diagnosis.** A member of the West Indian subgenus *Eleutherodactylus*, *auriculatus* section, *martinicensis* series (sensu Hedges, 1989) having extensive dorsal skin glandularity (Fig. 3), minute vomerine teeth, a distinctive carpal element (see description), a unique high-pitched call, and a palustrine habitat. Males have an external single subgular vocal sac, absent in females; nuptial pads absent. Pupil horizontally elliptical with two thin, sharp vertical slits, black colored below and above the mid portion of pupil, resulting in a '+', sometimes only the inferior slit is clearly visible resulting in a 'T' (Fig. 2). The digital disks are small and spatulate as opposed to widening abruptly from the base of the pad. The terminal phalanges are nearly T-shaped, clearly visible in finger III and Toe IV, but only with minute lateral projections of the terminal phalanges; rest of phalanges knobbed clearly visible in finger I of holotype (KU 306997), although terminal transverse groove across the tip of the digital pad visible in external view. Large carpal element (fused carpals 2+3) with pronounced ventral spine and emargination (the equivalent structure in *E. gryllus* being more solid and rounded with a minute spine). Eyelid tubercles absent; dorso-lateral folds absent. Ulnar tubercles absent; thenar tubercle elevated, elliptical, about the same size as pad in finger I; subarticular tubercles rounded; few minute supernumerary tubercles on proximal segments of fingers; a few minute centrally grouped supernumerary palmar tubercles; fingers lacking lateral fringes; relative length of fingers 1=2<4<3; disk of fingers small, spatulate not widening abruptly (Fig. 4A). Heel tubercles few, small, rounded, elevated; tarsal fold and lateral fringes of the toes absent; metatarsal tubercle rounded; subarticular tubercles rounded and slightly larger than palmar; supernumerary plantar tubercles present on proximal segments of toes; sole with a few minute irregularly scattered plantar tubercles; relative lengths of toes 1<2<3=5<4 (Fig. 4B). Finger webs and toe webs absent.

The closest relative of *E. juanariveroi* is *E. gryllus* with which it agrees in size and proportions (Fig. 3, Tables 1 and 2), skin glandularity and fundamental call note. However, *E. juanariveroi* is smaller than *E. gryllus* (SVL in mm: males, 14.7 females 15.8 vs. *E. gryllus* males 15.7 and females 16.4) (Table 1 and 2). The nares are prominent, and a ridge connects them behind the snout tip, giving it a somewhat squared-off appearance (Fig. 3A). On the other hand, the nares are less prominent in *E. gryllus*; the loreal surface is steeper on the average (65–79°) in *E. juanariveroi* compared with *E. gryllus* (51–67°); the loreal surface has a mid-indentation, which is not so pronounced in *E. gryllus*. The vomerine teeth are minute (2–3 teeth in UPRRP 6358) or absent (UPRRP 6341); the vomerine teeth of *E. gryllus* are small, but always visible (2–3 teeth in UPRRP 6373 and UPRRP 6374). The large carpal element (fused 2+3) is sculptured and emarginated ventrally, much more so than in *E. gryllus*. Glands in *E. juanariveroi* are clearly discernible on both external and internal examination (KU 306998) while glands in *E. gryllus* can only be verified by examining the inner surface of the skin (UPRRP 6372); glands are heavier and more extensive over the posterior angle of the head (supra-axillary gland, parotoid glands sensu Lynch [1971]), body (flanks-lumbar-inguinal) and hind leg (dorsal side of thighs, tibiae, and tarsi) in *E. juanariveroi* than in *E. gryllus* (Fig. 3B); gular glands prominent and more extensive in females of *E. juanariveroi* than in *E. gryllus* (Fig. 5A); the hyoid plate is narrower in *E. juanariveroi* than in *E. gryllus* (Fig. 5b); left lobe of liver short and rounded, significantly smaller than right lobe compared with *E. gryllus* (Fig. 5C); the ventral skin is unpigmented or with a very light stippling of melanophores and is smooth to weakly areolate in *E. juanariveroi* (pigmented, slightly glandular, and with more prominent areolae in *E. gryllus*). The relationship between tympanum width and inter-narial distance and

between tibio-fibula length and tarsal length are significantly smaller than in *E. gryllus* (see beyond, *Multivariate comparison of morphological ratios*, for a detailed explanation on how we identified diagnostic morphological ratios and assessed the statistical significance).

**TABLE 1.** Range of measured characters (in mm) followed by mean and standard deviation in parentheses. For abbreviations, see Materials and methods.

	<i>Eleutherodactylus juanariveroi</i>		<i>Eleutherodactylus gryllus</i>	
	Males (N = 18)	Females (N = 27)	Males (N = 11)	Females (N = 10)
SVL	12.9–16.0 (14.66 ± 0.74)	12.1–17.3 (15.76 ± 1.21)	14.0–17.0 (15.65 ± 0.89)	14.1–17.9 (16.41 ± 1.18)
HW	5.1–6.1 (5.61 ± 0.23)	4.7–6.5 (5.98 ± 0.39)	5.4–6.5 (6.07 ± 0.33)	5.7–7.1 (6.39 ± 0.44)
HL	5.6–6.4 (5.95 ± 0.22)	5.4–7.8 (6.33 ± 0.48)	5.8–9.3 (6.83 ± 0.88)	6.3–7.4 (7.03 ± 0.41)
UEW	0.9–1.4 (1.21 ± 0.11)	1.0–1.7 (1.27 ± 0.14)	1.1–1.7 (1.38 ± 0.17)	1.2–1.5 (1.38 ± 0.10)
IOD	1.7–2.0 (1.82 ± 0.08)	1.4–2.3 (1.97 ± 0.18)	1.7–2.2 (2.00 ± 0.20)	1.8–2.4 (2.17 ± 0.21)
TYW	0.6–1.0 (0.81 ± 0.09)	0.5–1.2 (0.95 ± 0.14)	0.8–1.1 (1.00 ± 0.09)	0.8–1.3 (1.09 ± 0.13)
IN	1.3–1.5 (1.43 ± 0.08)	1.2–1.7 (1.51 ± 0.10)	1.3–1.7 (1.51 ± 0.12)	1.4–1.7 (1.60 ± 0.10)
EL	2.1–2.6 (2.27 ± 0.14)	2.0–2.8 (2.36 ± 0.19)	2.3–3.0 (2.60 ± 0.25)	2.3–3.0 (2.73 ± 0.24)
EN	1.3–1.7 (1.52 ± 0.09)	1.4–2.2 (1.70 ± 0.15)	1.6–2.1 (1.78 ± 0.15)	1.7–2.1 (1.93 ± 0.12)
FD <sub>III</sub>	0.6–0.7 (0.67 ± 0.05)	0.5–0.9 (0.73 ± 0.08)	0.6–1.0 (0.76 ± 0.11)	0.6–0.9 (0.77 ± 0.08)
FDB <sub>III</sub>	0.4–0.5 (0.44 ± 0.04)	0.4–0.6 (0.45 ± 0.04)	0.4–0.5 (0.44 ± 0.04)	0.4–0.5 (0.43 ± 0.03)
TD <sub>IV</sub>	0.5–0.8 (0.67 ± 0.07)	0.5–0.9 (0.74 ± 0.09)	0.6–1.0 (0.78 ± 0.12)	0.6–0.9 (0.77 ± 0.10)
FL	5.7–7.3 (6.59 ± 0.42)	5.4–7.5 (6.99 ± 0.46)	6.4–7.6 (7.00 ± 0.44)	6.5–8.9 (7.71 ± 0.63)
TiL	5.9–7.2 (6.45 ± 0.33)	5.5–7.6 (6.99 ± 0.51)	6.6–8.7 (7.26 ± 0.60)	6.7–8.6 (7.70 ± 0.56)
TaL	3.5–4.0 (3.84 ± 0.14)	3.3–4.6 (4.10 ± 0.28)	3.9–5.5 (4.48 ± 0.46)	3.9–5.1 (4.71 ± 0.35)

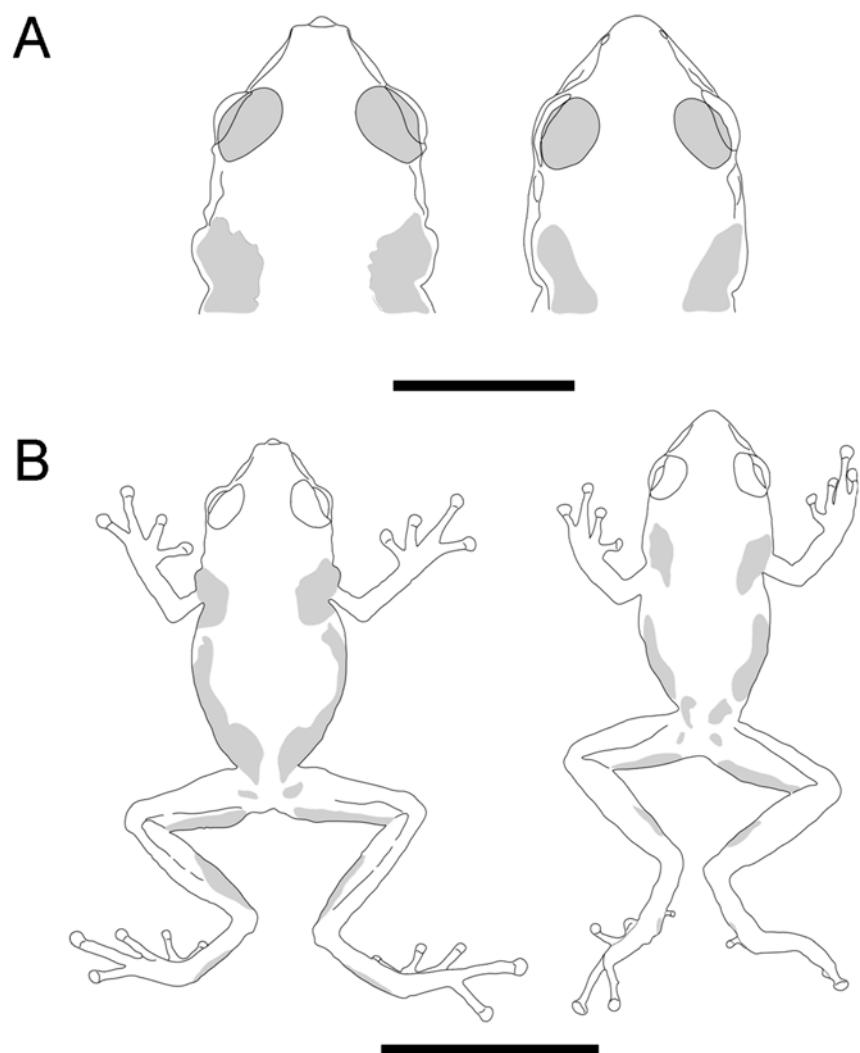
**TABLE 2.** Body proportions (mean ± SD) of *Eleutherodactylus juanariveroi* and *Eleutherodactylus gryllus* that showed significant differences at  $\alpha = 0.05$  and  $\alpha = 0.10$ . Significant variables (TYW/IN and TiL/TaL) were extracted from NMDS multivariate analysis. Data for males and females were analyzed separately; Mann-Whitney U-Test.

	Males				Females			
	<i>E. juanariveroi</i> (N = 18)	<i>E. gryllus</i> (N = 10)	Z	P	<i>E. juanariveroi</i> (N = 27)	<i>E. gryllus</i> (N = 9)	Z	P
TYW/IN	0.56 ± 0.06	0.66 ± 0.07	3.03	<0.01	0.63 ± 0.07	0.68 ± 0.06	1.60	0.11
TiL/TaL	1.68 ± 0.06	1.64 ± 0.09	1.66	0.09	1.70 ± 0.06	1.65 ± 0.07	1.34	0.18

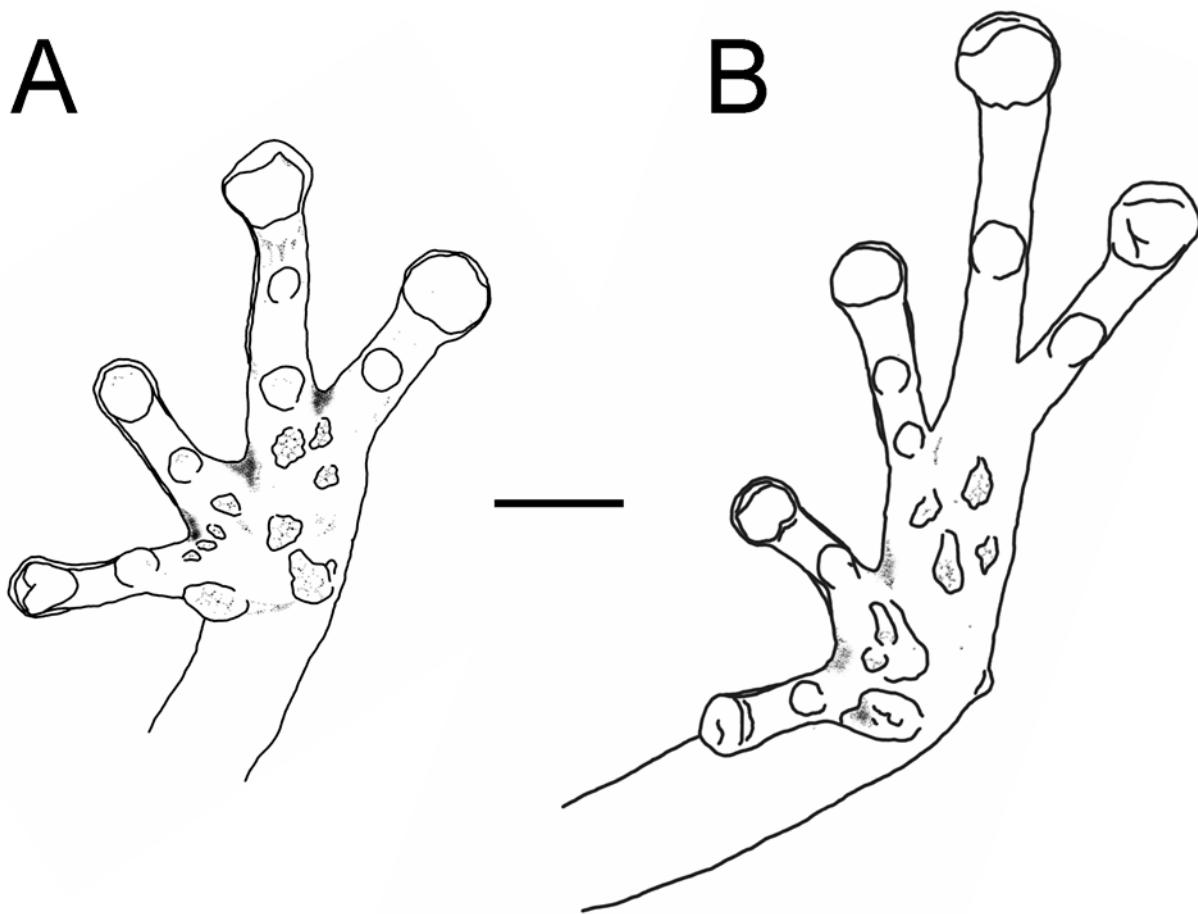
The dorsal coloration of *Eleutherodactylus juanariveroi* in life is yellow to yellowish brown (Fig. 2B) with a light, longitudinal, reversed comma mark on each side, lateral to the dorsal pigmented zone, with the head of the comma lying over the supra-axillary (parotoid) gland; the dorsal pigmented zone itself bifurcates, each branch being broad and fading, usually defining part of the cephalic triangle and not forming the sharp, well-defined “tines” of *E. gryllus*; the pattern is generally non-contrasting, versus a strongly contrasting dorsal pattern in *E. gryllus* that may include reversed parenthesis marks and occasionally a bold yellow mid-dorsal stripe (Fig. 2B; Joglar, 1998, Figs. 4.11–4.12; Rivero, 1998, Pl. XXV). *Eleutherodactylus juanariveroi* can be distinguished from other Puerto Rican species by an overall yellowish, non-contrasting coloration with a reversed comma pattern and a broadly bifurcated mid-dorsal zone (Figs. 2B and 6).

The marks that we call inverted commas in *E. juanariveroi* may be homologues of the inverted parenthesis marks of *E. gryllus*, but they could also be a modification of the entire lateral zone (Fig. 6). However, these

inverted commas may be a modification of the basic pattern elements of related species. Thus, in order to describe the color pattern of *E. juanariveroi* we relate it to the patterns of the other small Puerto Rican species (*E. cochranae*, *E. eneidae*, *E. gryllus*, and *E. locustus*) by identifying similar pattern elements (Fig. 6): (1) a dark mid-dorsal zone extending from roughly the sacral region to the head, usually narrowing gradually along the trunk and expanding again near the head, thus having curved indentations on either side, (2) a pair of light, narrow reversed parenthesis marks that closely follow the indentation in the mid-dorsal zone, (3) a bifurcation of the mid-dorsal zone near the head, producing two dark, diverging extensions that approach the postero-medial edge of each eyelid (in *E. juanariveroi*, these are pale and broad), (4) a median head triangle, an apex of which projects caudad, fitting between the diverging extensions of the divided mid-dorsal zone, with the other two angles at each eye and side extending between the eyes (another pattern element that occurs in some of these species is a light midline stripe, but it is an occasional variant and is not found in *E. juanariveroi*). These pattern elements have been variously modified by adding or lessening of pigment in the different species (and are variable within species), but reversed parentheses are frequent. A further modification occurs when pigment bridges form between the lower parts of the “tines” of the fork to the caudad apex of the cephalic triangle, which results in a dark scapular ‘W’ (Fig. 6).



**FIGURE 3.** Comparative morphology of holotype of *E. juanariveroi* (left, KU 306997) and *E. gryllus* (right, UPRRP 6372): canthus rostralis in dorsal view, scale bar 5 mm (A), distribution and shape of glands in dorsal view, scale bar 10 mm (B).



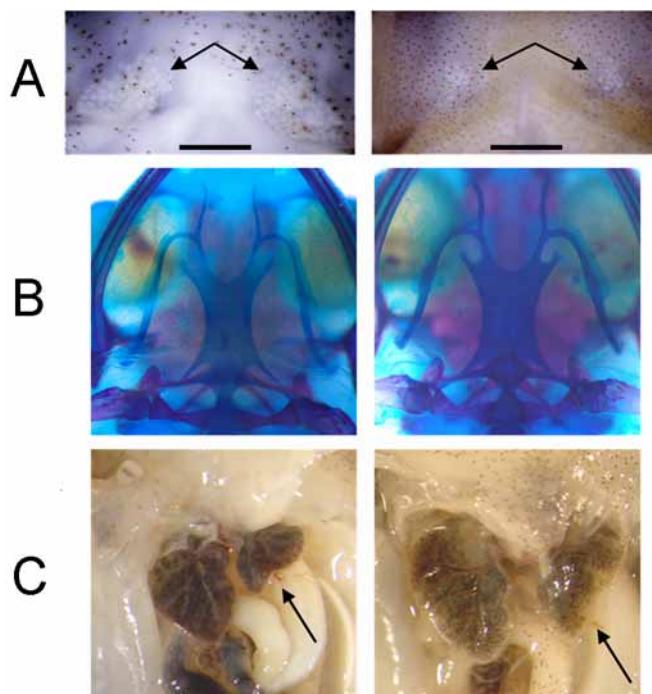
**FIGURE 4.** Holotype of *Eleutherodactylus juanariveroi*, KU 306997. Palmar view of hand (A) and plantar view of foot (B). Scale bar 1 mm.

On some individuals of these related small species, particularly *E. locustus*, the scapular ‘W’ and the light reversed parentheses may be the only pattern readily seen. Some of the components occur in frog species we have not mentioned; for example, *E. hedricki* (Rivero) and *E. eneidae* may have the reversed parentheses. In *E. juanariveroi* the pattern is much reduced in contrast; the reversed parenthesis marks are very wide; and the median dark zone is relatively light and the anterior branches broad; a well-developed scapular ‘W’ is not found. The result is a pair of light, longitudinal marks that curve laterally onto each side of the occiput, terminating with the large posterior head glands (Figs. 2B and 6). Interior to these marks on many specimens is another pair of diverging, light longitudinal marks (the altered median dorsal zone and branches). Some individuals show only the light heads of the commas, the rest of the pattern being obscure; this results in a pattern of two ocelli over the area of the scapula on the back of the head (Fig. 6), representing the most divergent pattern among this group of small frogs.

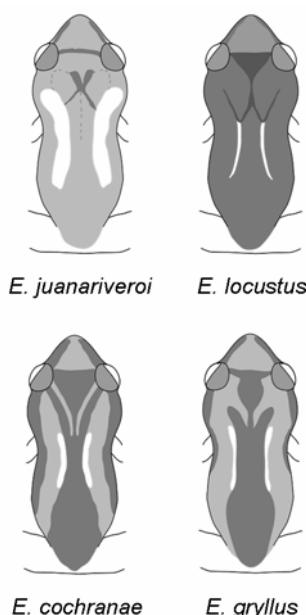
A light-brown inter-orbital band that extends to the tip of the snout is present in 16.3% of the *E. juanariveroi* (clearly defined in KU 306999) and absent or rare in *E. gryllus* (some specimens are so faded that it is difficult to discern the pattern). The legs of *E. juanariveroi* do not have any cross bands; those of *E. gryllus* have 1–2 hazy bands on the thigh and two on the shank. Although its call is related to that of *E. gryllus*, it is distinctive in its patterning and higher pitch (see *Advertisement call* for a detailed explanation on call parameters).

A Puerto Rican *Eleutherodactylus* that may has morphological affinities with *E. juanariveroi* and *E. gryllus* is *E. jasperi*. *Eleutherodactylus jasperi* also has two pairs of lateral sub-dermal glands well developed on flanks and posterior surfaces of thighs (Drewry and Jones, 1976). However, although *E. jasperi* has a yellow to yellow-brown body coloration in life, it differs dramatically from *E. juanariveroi* and *E. gryllus* in repro-

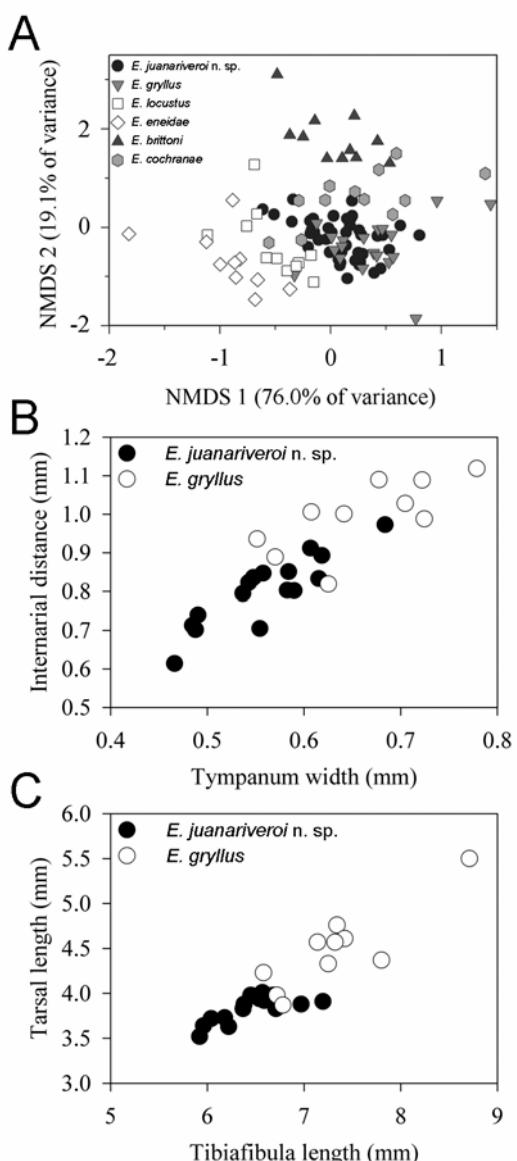
duction (*E. jasperi* is ovoviparous, the other species are oviparous), body size (19–20 mm in *E. jasperi*, 14–15 mm in *E. juanariveroi*, 15–16 mm in *E. gryllus*), acoustics (frequency of calls: 5 kHz in *E. jasperi*, ~7 kHz in *E. gryllus*, ~8 in *E. juanariveroi*), habits (*E. jasperi* is an obligate bromeliad-dwelling in somewhat xeric conditions in highlands, *E. juanariveroi* is an obligate herbaceous-dwelling in palustrine lowland wetland [N. Rios, in prep.], *E. gryllus* is arboreal in highland wetland conditions), and geographic distribution. Additionally, *E. jasperi* lacks prevomerine teeth while *E. juanariveroi* and *E. gryllus* have them.



**FIGURE 5.** Comparative morphology of *E. juanariveroi* (left, holotype, KU 306997) and *E. gryllus* (right, UPRRP 6374): glands in gular region (arrows), scale bar 1 mm (A), cleared-stained hyale apparatus (UPRRP 6341 and UPRRP 6374) (B), and relative liver size and shape of liver (*E. juanariveroi* UPRRP 6358 and *E. gryllus* UPRRP 6373) with arrows highlighting small-sized left lobe of liver (C).



**FIGURE 6.** Comparison of dorsal color pattern of *E. juanariveroi* with related species showing reversed comma pattern and basic similar coloration elements.



**FIGURE 7.** Ordination scores of NMDS axis II plotted against axis I (A) and comparative morphometry of males of *Eleutherodactylus juanariveroi* and *E. gryllus*: IN plotted against TYW (B); TaL plotted against TiL (C).

**Measurements (in mm) and description of the holotype.** Adult female; SVL 16.7; head width 6.1; head length 6.7; upper eye lid width 1.1; inter-ocular distance 2.1; tympanum width 1.0; inter-narial distance 1.5; eye length 2.3; eye-tympanum distance 0.3; eye-naris distance 1.7; fingertip (III) width 0.8; toe tip (IV) width 0.9; femur length 7.5; tibia-fibula length 7.2; tarsal length 4.2. Inter-orbital band absent; gular glands prominent; supra-axillary gland (parotoid), body glands (flanks-lumbar-inguinal), and hind limb glands (dorsal side of thighs, tibiae, and tarsi) clearly visible; well-expressed pale reversed comma heads and a pale dorsal zone bifurcation occur in dorsum. Mature eggs undetected externally. Dorsal coloration in life yellow to light brown; light brown in preservative.

**Variation.** SVL of adult males 12.9–16.0 mm (mean = 14.66, n = 18), of adult females 12.1–17.3 mm (mean = 15.76, n = 27), and juvenile (SVL 5.82 mm) of moderate habitus, typical of scansorial species of *Eleutherodactylus* (Table 1); head around 40% of SVL; snout tip pointed in dorsal view, sides forming an angle of about 72°; nares distinctly protuberant, canthus rostralis not distinct, lores sloping, slightly indented; eyes prominent, EL into HW around 2.7; tympanic membrane present and tympanic annulus distinct but with

roughly the dorso-posterior third of the rim obscured by supra-tympanic fold, fitting tightly between the ventro-posterior edge of the orbit and the angulus oris, TYW into HW around 6; 2–3 minute vomerine teeth barely visible on weakly defined patches postero-medial to choanae (of two cleared and stained specimens UPRRP 6358, a male, with 3 tiny vomerine teeth on one patch, 2 or 3 in the other patch, teeth absent in UPRRP 6341, a female); tongue rounded posteriorly with a weak notch; there are well-developed glands on the following regions (Fig. 3): (1) supra-axillary (parotoid), extending ventrally to glenoid region, (2) flanks to sacral region, (3) posterior surfaces of thighs, shank, tarsi and (4) postero-lateral parts of the gula (sexually dimorphic: present in 96.3% in females, which also have larger glands, compared with 23.5% in males). Digital disks moderate, fitting within the tympanum; hyoid plate narrow (Fig. 5B); medial element of anterior process of the hyale long and straight; hyale without free flanges; antero-lateral process angled anteriorly; postero-lateral process long and thin; thyrohyal process narrow. Venter nearly smooth with weak, rounded areolations and with a sparse stippling of melanophores; testes pigmented. Measurements (range, mean, and standard deviation) of the type series are given in Table 1 along with measurements of *E. gryllus* for comparative purposes.

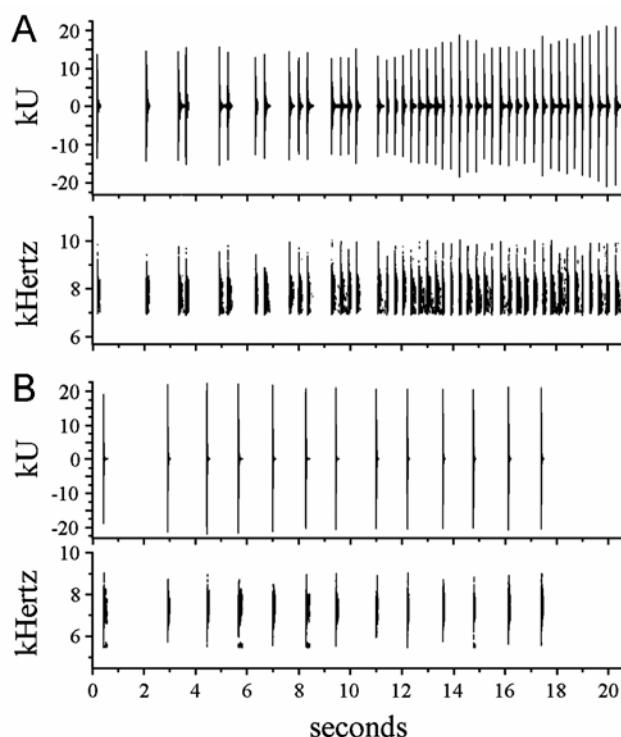
The limbs are irregularly pigmented with varied intensities of pigment but without a distinct patterning; the post-femoral surfaces of some specimens are darker; the digit tips of manus and pes are darkly pigmented. In some individuals of *E. juanariveroi*, a horizontally elliptical pupil, and a thin, dark vertical slit below the mid portion of pupil result in a ‘T’ (Fig. 2A) similar to the condition in *E. gryllus*, *E. eneidae*, and *E. locustus*. In other individuals of *E. juanariveroi* the pupil resembles that in *E. cochranae*, which has thin, vertical slits below and above pupil resulting in a ‘+’. Pupil shape in *E. juanariveroi*, however, differs from *E. brittoni*, which lacks vertical slits.

**Multivariate comparison of morphological ratios.** Non-metric Multidimensional Scaling (NMDS) of morphological ratios of adult specimens extracted two axes that explained 95.1% of the variance in ordination space (final stress = 11.3 and instability = 0.052 after 500 iterations, orthogonality = 94.8%) (Fig. 7A). A Multi-Response Permutation Procedure (MRPP, a non-parametric analysis used to test the hypothesis of six species in the data matrix) revealed six groups that had similar within-group homogeneity ( $A = 0.27$ ,  $p < 0.0001$ ), which corroborates the hypothesis of six nomenclaturally and taxonomically stable species in the data matrix. However, the overlap between *E. juanariveroi* and *E. gryllus* in ordination space suggests a strong affinity in morphological ratios between species. An Indicator Species Analysis (ISA) (Legendre & Legendre, 1998) that could be helpful in distinguishing *E. juanariveroi* from other species resulted in four potential diagnostic morphological ratios (morphological ratio and Indicator Value from Monte Carlo tests with 10,000 permutations): SVL:HW, 17.1 ( $p = 0.067$ ); TYD:IND, 18.9 ( $p = 0.004$ ); TYD:EN, 18.2 ( $p = 0.028$ ); TiL:TaL, 17.1 ( $p = 0.054$ ). In ordination space, only TYD:IN and TiL:TaL differed significantly between males of *E. juanariveroi* and the most similar *E. gryllus* (Table 2), which justified the use of these two morphological ratios to distinguish *E. juanariveroi* from *E. gryllus* (Figs. 7B and 7C).

**Distribution and natural history.** *Eleutherodactylus juanariveroi* is known only from the type locality (Fig. 1), which lies within the subtropical moist forest life zone (Ewel & Whitmore, 1973). This locality consists of a palustrine herbaceous wetland at 17 m elevation. The wetland is seasonally flooded with fresh water; the soil consist of swamp and marsh organic deposits from Pleistocene and/or recent origin (Briggs & Akers, 1965). Herbaceous vegetation in this habitat consists of the toothed midsorus fern (*Blechnum serrulatum*), willdenow's maiden fern (*Thelypteris interrupta*), bulltongue arrowhead (*Sagittaria lancifolia*), flatsedges (*Cyperus* sp.), spike rushes (*Eleocharis* sp.), and vines and grasses. The habitat at the type locality occupies approximately 180 ha; we were unable to find the frog at other wetland sites in the northern coastal plain. All specimens were collected between 1900–2200 h while perching, sitting, or calling on herbaceous vegetation, mainly on ferns, between 0.4 m and 1.2 m above water level. Calling sites for males were 0.6 to 1.2 m above the ground. Egg clutches comprised 1–5 eggs and were found on leaf axils (21 egg clutches) or leaf surfaces (3 egg clutches) of only *S. lancifolia* (N. Rios, unpubl. data). Like *E. gryllus*, the calling activity of *E. juanariveroi* was observed at night.

*nariveroi* started at approximately 1630 h and decreased significantly before midnight. The single locality from which *E. juanariveroi* is known is adjacent to the coast at 17 m elevation, while *E. gryllus* is only known from between 305 m to 1189 m elevation (Joglar, 1998), although we have not recently found *E. gryllus* below 600 m elevation. This species is mostly arboreal, calling from branches and bromeliads, which contrasts with *E. juanariveroi*.

**Advertisement call.** The call consists of a series of short high-pitched notes (Fig. 8A). At 26 C, call duration varies from 4–21 sec ( $10.9 \pm 6.2$  sec,  $n = 6$ ). Call structure consists of one to three one-note series, followed by one or more series of two notes each, one (or more) series of three-four notes each, and a series that varies from 5–30 notes at the end of the call. Notes per call was 8–45 ( $23.0 \pm 13.4$  notes,  $n = 6$ ) (Fig. 8A). Frequency was 6.03–9.02 kHz; the dominant frequency was 7.38–8.28 kHz ( $7.69 \pm 0.18$  kHz,  $n = 92$ ) (Fig. 8A). Note duration was 15–31 ms ( $24.1 \pm 3.1$  ms,  $n = 92$ ). Note repetition rate varies between consecutive notes within a series of two or more notes ( $341 \pm 22$  ms,  $n = 58$ ) and between the final note of a series and the note in the following series ( $819 \pm 99$  ms,  $n = 30$ ) (Fig. 8A). The advertisement call of *E. juanariveroi* differs from that of *E. gryllus* in notes per call (range 5–29,  $15.3 \pm 10.0$  notes,  $n = 4$ ) (Fig. 8B), dominant frequency (range 6.31–7.79 kHz,  $7.44 \pm 0.28$  kHz,  $n = 61$ ) (Fig. 8B), note duration (range 21–32,  $26.8 \pm 2.4$  ms,  $n = 61$ ), and note repetition rate (consecutive notes within a series  $1.23 \pm 0.13$  sec,  $n = 53$ ; between the first note of the call and the note in the following series in the call  $1.97 \pm 0.67$  sec,  $n = 4$ ) (Fig. 8B). Among sympatric *Eleutherodactylus*, the call of *E. juanariveroi* has the highest frequency and the greatest structural complexity compared with *E. brittoni*, *E. cochranae*, and *E. coqui* (Thomas), but probably among all Puerto Rican *Eleutherodactylus* as well (for comparison see Drewry & Rand, 1983 and Narins, 1995).



**FIGURE 8.** The advertisement calls of *Eleutherodactylus juanariveroi* (A) and *E. gryllus* (B). Oscillogram (relative amplitude in kU vs. time) and audiospectrogram (sonogram: frequency in kHz vs. time).

**Etymology.** The specific name honors Juan A. Rivero, distinguished Puerto Rican herpetologist and naturalist.

## Discussion

Among the West Indian *Eleutherodactylus*, *E. juanariveroi* is most similar to *E. gryllus* based on (1) its small size, (2) morphological ratios in multivariate analyses, and (3) gland distribution. Although it is premature to conclude that this similarity is a reflection of phenetic or phylogenetic relationship, DNA sequencing data suggests that *E. juanariveroi* belongs to the Puerto Rican species radiation of *Eleutherodactylus* (S. B. Hedges, pers. comm.). Hedges (1989) included *E. gryllus* in the genus *Eleutherodactylus*, subgenus *Eleutherodactylus*, *auriculatus* section, *martinicensis* series, based on liver shape, testis coloration, and protein data. *Eleutherodactylus juanariveroi* and *E. gryllus* share liver shape and testis coloration, which justifies the inclusion of *E. juanariveroi* in the *auriculatus* section, most likely as a sister species of *E. gryllus* under Hedges (1989) classification.

*Eleutherodactylus juanariveroi* appears to be an obligate marsh-dweller (N. Rios, unpubl. data) and is thus nearly unique among its West Indian congeners; the only other species known to have a similar habitat requirement is *E. caribe* (Hedges & Thomas) of Haiti (Hedges & Thomas, 1992). We have noted that *E. juanariveroi* is the smallest of the Puerto Rican frogs; however, it is not much smaller than *E. unicolor* (Stejneger), a fossorial species of high elevations, in which the largest recorded size is 17.3 mm SVL (identical to the largest female of *E. juanariveroi*); *E. unicolor* has a rounded body and much shorter legs, however, and the average SVL for both sexes is also larger (males 15.0 mm, females 16.1 mm; Jolgar, 1998). A partial consequence of small size is a high-pitched call; *E. juanariveroi* has a dominant frequency between 7.38 and 8.28 kHz, which is among the highest pitched call of frogs calling in the sonic range of humans (Estrada & Hedges, 1996). It is now known that *Amolops tormotus* (Wu) of China communicates in the ultrasonic range (Feng *et al.*, 2006).

### Land-use history and conservation

The discovery of a Puerto Rican *Eleutherodactylus* with such an apparently restricted and small range may be a surprise to the uninitiated, but it may reflect a remnant population of a once wide-distributed herbaceous wetland specialist whose habitat was decimated during the Puerto Rican land-use history. For example, the vast majority of coastal wetlands in Puerto Rico were drained and destroyed for agriculture and cattle ranching since the settlement by the Spaniards in the early 1500's (Picó, 1990). During the mid 1900's, however, many agriculture lands were abandoned due to a shift in the Puerto Rican economy, from agriculture to industry (Grau *et al.*, 2003). As a result, most of these lands were destroyed and invaded by grasses and other herbaceous vegetation or converted for urban development, dramatically reducing these wetlands' cover area (Lugo & Brown, 1988). Not surprisingly, the type locality of *E. juanariveroi* has many plant species that have been recorded from sites now destroyed for urban development (F. Axelrod, pers. comm.).

Aerial photographs from 1937 show, however, that a significant portion of the type locality in the north-eastern side was largely protected from agriculture and/or wetland drainage. This portion of the type locality was occupied by the USNSGASS since late 1940's for military purposes after World War II. Since then, access to people has been much restricted, and this portion has not been developed. This contrasts with the land-use history of the rest of the wetlands in eastern and western Puerto Rico and that were transformed dramatically through drainage and landfill for local socio-economic reasons (Lugo & Brown, 1988; Pico, 1990). Thus, the type locality of *E. juanariveroi* has experienced little disturbances partly due to restricted access of local people by the USNSGASS and the limited development of military installations in this wetland. The restricted access to this wetland site, and the fact that few herpetological studies have been conducted in Puerto Rican fresh water wetlands, may have contributed to the late discovery of *E. juanariveroi* more than 30 years since the discovery of the last *Eleutherodactylus* from mainland Puerto Rico.

Unfortunately, *E. jasperi*, the last discovered species, has not been found since 1981 (R. Thomas, pers. obs.). Its historic habitat has been dramatically fragmented for agriculture and urban development and

destroyed by fires. This species has possibly become extinct before effective conservation actions were taken to protect its habitat (Joglar & Burrowes, 1996). Similarly, recent surveys conducted in nearby wetlands failed to locate populations of *E. juanariveroi* (N. Rios, unpubl. data) and apparently, there are few or no wetlands with plant composition similar to that in the type locality. This suggests that the type locality could represent a relict palustrine herbaceous wetland now rare in Puerto Rico. Also, the high-pitched call of *E. juanariveroi* is, to a human perceiver, overwhelmed by the loud and lower chorus of *E. coqui*, *E. brittoni*, *E. cochranae*, and *Leptodactylus albilabris* (Günther) at the type locality, which makes its detection more difficult. The type locality, however, is now threatened by private and governmental housing, industrial, and recreational projects that are spreading rapidly through the region after the USNSGASS has ceased operations in 2005. These immediate threats on the ecological integrity of this wetland and on the survival of this species require prompt conservation efforts.

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## Appendix 1. Specimens examined

- Eleutherodactylus brittoni*: Puerto Rico: Utuado-Arecibo: Bosque Estatal de Río Abajo, <464 m, RT 554; Toa Baja: Sabana Seca, 17 m, RT 14524, 14528, 14531–32; RT 3835, 3998–99, 8454, 8773–74 [no data].
- Eleutherodactylus cochranae*: Puerto Rico: Isla Vieques: east of Ensenada Sombe, <5 m, RT 9306–9308, 9310; Guayama-Santa Isabel: Bosque Estatal de Aguirre, <10 m, RT 10909–11; Toa Baja: Sabana Seca, RT 14525, 14529, 14551; RT 7154, 8735 [no data].
- Eleutherodactylus eneidae*: Puerto Rico: Rio Grande: El Yunque, La Mina Recreation Area, ~670 m, RT 145–148; Jayuya: Toro Negro Forest, 8.8 km [by road] E La Pica, 1182 m, RT 2220–21, 2223–24; RT 3845, 3847, 6461 [no data].
- Eleutherodactylus gryllus*: Puerto Rico: Cayey: Bosque Estatal de Guavate, 8 km [by road] SE Las Cruces, ~630 m, RT 592; Rio Grande: El Yunque, 2 km [by road] E Pico del Este, UPRRP 6372–4, RT 14466–68; Rio Grande: El Yunque, trail to Pico del Este, ~650 m, UPRRP 20–21; La Mina Recreation Area, ~560 m, UPRRP 41; southern slopes Luquillo forest, ~758 m, UPRRP 2157–59, 2215–16; ~803 m, UPRRP 2275; El Yunque, University of Puerto Rico-Biology Station, ~636 m, UPRRP 2856, 2864; Maricao: near Jct. roads PR-105 and PR-128, UPRRP 3411; RT 3968, RT 8398 [no data].
- Eleutherodactylus juanariveroi*: Puerto Rico: Toa Baja: Sabana Seca, 17 m, KU 306997 (holotype), KU 306998–02; USNM 563623-8; UPRRP 6340–71; RT 14501, RT 14535.
- Eleutherodactylus locustus*: Puerto Rico: Rio Grande: El Yunque, La Mina Recreation Area, RT 138, RT 140, RT 142; Cayey: Bosque Estatal de Guavate, 8 km [by road] SE Las Cruces, ~630 m, RT 574, RT 576, RT 578, RT 581, RT 590; Rio Grande: El Yunque, 2 km [by road] E Pico del Este, RT 14558–60.