

**Recovery Implementation Strategy**  
**Coquí llanero (*Eleutherodactylus juanariveroi*)**



**Photo by: C. Pacheco, USFWS**

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This Recovery Implementation Strategy describes the activities to implement the recovery actions in the Draft Recovery Plan for the coquí llanero (*Eleutherodactylus juanariveroi*) (Service 2017). The strategy provides the expanded narrative and the implementation schedule for the coquí llanero recovery activities. The implementation schedule estimates the cost for implementing recovery activities. Additionally, this strategy document restates the criteria for determining when the coquí llanero should be considered for delisting. A Species Biological Report, which provides information on the species' biology and status and a brief discussion of factors limiting its populations, is available at <http://www.fws.gov/caribbean/es>. The Recovery Implementation Strategy and Species Biological Report are finalized separately from the Recovery Plan and will be updated on a routine basis.

## **Recovery Strategy**

The recovery strategy for the coquí llanero includes protection and management of occupied habitat and suitable unoccupied habitat for potential future introductions, and addresses immediate threats that led to its listing. In order to meet the recovery goal of delisting, we must increase the number of coquí llanero populations. This strategy seeks to safeguard the only existing coquí llanero population in case the species does not withstand or recover from a stochastic or catastrophic event. In addition, because of stressors like the reduced geographic distribution, limited dispersal capabilities, and its specialized breeding requirements, the species is likely to have reduced adaptive capabilities in the future. This recovery strategy would increase the species' representation, resiliency and redundancy to sustain populations in the wild over time. The Service will work closely with partners (e.g., local governments, universities, NGOs, among others) to reduce threats to the only known coquí llanero population, increase understanding of its biology, identify new areas suitable for introductions to establish new populations within the likely historic range, protect the currently occupied habitat, and educate the public about this species and the importance of its conservation. The species should be delisted as a result of the successful implementation of recovery actions delineated in this plan.

## **Recovery Objectives**

The ultimate recovery goal is to remove (delist) the coquí llanero from the Federal List of Endangered and Threatened Wildlife (50 CFR 17.11) by ensuring the long-term viability of the species in the wild. Criteria will be reevaluated as new information becomes available.

## **Criteria to Delist the Species**

1. Three viable coquí llanero populations demonstrate stable or increasing population trends (addresses Factor A and E).
2. Habitat for three viable coquí llanero populations are protected in perpetuity through a conservation mechanism (e.g., land acquisition, conservation easements) (addresses Factor A)
3. Threats and causes of decline have been reduced or eliminated to a degree that the coquí llanero does not need protection under the ESA (addresses Factor A and E).

## Recovery Actions Narrative with Stepped-down Activities

1. **Protect and manage existing wild coquí llanero population and its habitat by implementing habitat management practices and other conservation techniques** (addresses Factor A and E threats). Management should focus on maintaining, enhancing, and restoring essential components of the palustrine wetland habitat currently supporting the coquí llanero frogs.

The protection and management of coquí llanero population and its habitat should be implemented by property owners to enhance habitat features on occupied habitat.

- 1.1 Protect coquí llanero existing habitat. Measures such as land acquisition, establishment of conservation easements, and habitat restoration programs (e.g., USFWS Coastal Program) will be vital to protect and enhance existing coquí llanero habitat.
  - 1.1.1 Work with the Commonwealth of Puerto Rico to develop and implement a habitat management plan that supports the recovery of the coquí llanero. The plan will include specifics on restoration and enhancement practices to maintain the vegetation composition of the palustrine wetland, eliminate or reduce undesirable plant species (e.g., dense stands of cattail), and a fire prevention plan. Also, incorporate other management and restoration actions that result from further research.
- 1.2 Transfer public lands for conservation. Transferring public lands adjacent to the coquí llanero's currently occupied habitat to natural resources management entities through long term leases or actual acquisition, would prevent the immediate or future development of these lands, and further protect and increase resilience of currently occupied habitat and the species.
- 1.3 Work with landowners to protect and manage private lands. Buffer zones should be established around conservation areas to lessen the effect of human activity near the critical habitat and maintain suitable hydrology. Habitat acquisition, conservation easements, habitat conservation plans, and economic incentives are some of the means to establish buffer zones.
- 1.4 Evaluate land-use plans to minimize threats on the species. Municipal land-use plans within the area of distribution of the coquí llanero in the municipality of Toa Baja must be carefully evaluated to ensure they address potential threats to the species and its habitat, particularly urban expansion.
- 1.5 Delineate the watershed of the occupied wetland. Gather information on the different sources of water entering the palustrine wetland (e.g., underground water, surface water, etc.). This would help refine the watershed on which the wetland depends upon and help develop conservation measures for the watershed and water quality.

- 1.6 Identify, minimize, and mitigate contaminants that may potentially affect the coquí llanero and its habitat. Watershed use and land use plans should identify potential contaminant sources, including point and non-point sources and provide strategies for minimizing or mitigating potential impacts of contaminants. Priority should be given to the Toa Baja Municipal Landfill and other potential sources of contaminants such as the race track adjacent to the critical habitat.
  - 1.7 Identify, minimize, and mitigate fire prone areas that may help propagate fires within the designated critical habitat and adjacent areas. The early identification and the rapid response to fires adjacent and within the habitat of the coquí llanero will minimize direct impacts to the species and its habitat (e.g., encroachment, fragmentation, and change in vegetation).
  - 1.8 Utilize existing regulations to promote the recovery of the coquí llanero. The use of regulations will minimize adverse effects of actions that may affect the coquí llanero and its habitat. Working with Federal partners through the ESA-Section 7 consultation, and expanding other existing programs will further help the recovery of the coquí llanero.
  - 1.9 Minimize impact of development. The designated critical habitat and adjacent areas should be protected from impacts of development. The location of the known coquí llanero population and potential adverse effects of projects needs to be considered when planning development or other projects with no Federal nexus. These actions must be proactively addressed through technical assistance and local regulatory mechanisms.
- 2. Monitor status and trends of the only known coquí llanero population and its habitat** (addresses Factor A, C and E). Specific data will provide information on the status of the species and the magnitude of the threats that are impacting the species and or its habitat.
- 2.1 Monitor existing population. Data are needed to assess the status of the species and the effectiveness of the management efforts. Long-term comprehensive surveys should be developed to document population fluctuations, representation, and overall health of the species and its habitat. Information from the known population will also serve as baseline data for the potential introduction of the species in other sites.
    - 2.1.1 Conduct surveys within the only known area where the species occurs (i.e., critical habitat). A standard survey methodology should be implemented in order to properly estimate population density and abundance. A long-term survey program should be implemented in order to allow assessment of population fluctuations over time. Climatic variables such as temperature and precipitation, and habitat variables such as vegetation cover should also be monitored. Survey methods should minimize disturbance to the species and its habitat.

- 2.2 Characterize the genetic structure of the coquí llanero population. Preserving the genetic variability of the population is vital for the recovery of the species and can influence the course of management of the species.
  - 2.3 Assess the potential to conduct a Population Viability Analysis (PVA). As new biological and ecological information becomes available, a PVA model may be developed to help guide the recovery strategy, criteria, and actions for the species. The PVA may help provide information regarding carrying capacity, minimum number of individuals to sustain a viable population, amount of habitat needed for a viable population, and help inform future management decisions.
- 3. Develop a habitat suitability model to predict spatial dynamic of the species and to guide future introductions within the likely historic range** (addresses Factor E). An inclusive GIS habitat model should be developed to identify suitable habitat for the species outside of the designated critical habitat and to predict the potential impact of anthropogenic and natural threats. The model would guide future introductions plans and help evaluate the possible future land use scenarios and their impact on the habitat of the coquí llanero.
- 3.1 Develop habitat suitability model. Model should include, but not be limited to, the following parameters: ecological features (e.g., palustrine herbaceous wetland, availability of *Sagittaria lancifolia* and perennial plants like ferns), critical habitat Principle Constituent Elements, land cover and climate change, among others.
  - 3.2 Based on the model, identify areas that may be potential habitat for the coquí llanero.
  - 3.3 Identify in what areas the species has already been searched for and not found. This information should also be included into the GIS framework.
  - 3.4 Select at least five suitable areas from the habitat model to assess their potential as future introduction sites. Priority should be given to Commonwealth and other protected lands. The selected sites must be ranked according to their habitat suitability potential.
- 4. Determine the suitability of other palustrine wetlands within the likely historic range of species to inform and implement an introduction plan** (addresses Factor E). Given the coquí llanero is currently known only from one location, there is a need to establish new populations within the species historic range. Determining the historic range will be the first step. Additionally, habitat features essential for the species' highly specialized ecological requirements must be assessed in potential new areas for the introduction of the species.
- 4.1 Determine the historical range. Assess the habitat requirements of coquí llanero, conduct a comprehensive literature review, and consult with experts
  - 4.2 Assess what is the most appropriate introduction method, either through a captive breeding program, translocation (assisted migration), or both.

4.3 Establish new populations. At least two self-sustainable coquí llanero populations must be established or discovered to maximize the species' recovery potential and to increase its resilience, representation and redundancy over time.

4.3.1 Post-introduction monitoring. Implement and evaluate the introduction program. The populations must be carefully monitored over time to ensure their survival and to assess the success of these efforts.

**5. Facilitate recovery of coquí llanero through public awareness and education** (addresses Factor A, C, and E). Compliance with regulatory mechanisms and support of management actions for the coquí llanero, including both population and habitat protection elements, depends on broad public support. That support, in turn, depends on an informed public who understands the coquí llanero conservation issues and the reasons for regulatory and management actions. The information provided to the public must be clear, consistent, concise, and readily available to promote the recovery of the coquí llanero.

5.1 Develop fact sheets and other communication tools in partnership with our recovery partners to disseminate information to the public on the importance of the conservation of this endangered species and its habitat. Include information on the importance of wetland and landscape conservation. Information available for the public should be updated accordingly.

5.2 Institute and maintain proactive public outreach. The success of a public awareness and education program is directly related to the proper identification of target audiences. Target audiences may include, but are not limited to, private landowners, government agencies, environmental planners, consultants for development projects, and educators. Prudent use of the media (e.g., newspapers, magazines, radio, and television) and the use of social networks (e.g., Facebook and Flickr, among others) is an effective means of educating the public.

5.3 Involve the local communities in coquí llanero recovery projects, when feasible. Contact local experts in herpetology, hydrology, botany and climate change and invite them to participate in recovery activities. Expand relationships with local environmental friends groups and non-governmental organizations.

## REFERENCES CITED

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## IMPLEMENTATION SCHEDULE

Recovery schedules are intended to assist the Service and other stakeholders in planning and implementing actions and activities to recover and/or protect endangered and threatened species. The following Implementation Schedule indicates activity numbers; activity descriptions; activity duration; potential stakeholders and responsible agencies; and estimated costs. It is a guide for planning and meeting the objectives discussed in this strategy. The Implementation Schedule outlines recovery activities, and their estimated costs to reach the goal of delisting the species. It should be noted that these are minimum estimates of the costs associated with recovery of the coquí llanero. **Actual expenditures by agencies and other partners is contingent upon appropriations and other budgetary constraints.**

While the ESA assigns a strong leadership role to the Service for the recovery of listed species, it also recognizes the importance of other Federal agencies, States, and other stakeholders in the recovery process. The “Responsible Agency” column of the Implementation Schedule identifies partners who can make significant contributions to specific recovery tasks. The identification of agencies and other stakeholders within the Implementation Schedule does not constitute any additional legal responsibilities beyond existing authorities (e.g., ESA, CWA, etc.).

### Key to acronyms used in the Implementation Schedule

ES	U.S. Fish and Wildlife Service, Ecological Services
USFWS	U.S. Fish and Wildlife Service
NAVY	US Department of Defense-Navy
DNER	Puerto Rico Department of Natural and Environmental Resources
UNIV	Universities
MUN	Municipality

## IMPLEMENTATION SCHEDULE

Activity	Activity Description	Duration	Responsible Party		Cost Estimate in Thousands of Dollars
			USFWS	Other	
1.1	Protect coquí llanero existing habitat	5 years	ES	DNER, NAVY	150
1.1.1	Work with the Commonwealth of PR to develop and implement a habitat management plan that supports the recovery of the coquí llanero.	2 years	ES	DNER	40
1.2	Transfer public lands for conservation	3years		DNER, NAVY	90
1.3	Work with landowners to protect and manage private lands	5 years	ES	DNER	125
1.4	Evaluate land-use plans to minimize threats on the species	1 year	ES		Internal
1.5	Delineate the watershed of the occupied wetland	2 years		UNIV	40
1.6	Identify, minimize, and mitigate contaminants that may potentially affect the coquí llanero and its habitat	Continual	ES	DNER, UNIV	20
1.7	Identify, minimize, and mitigate fire prone areas	Continual	ES	DNER, MUN	15
1.8	Utilize existing regulations to promote the recovery of the coquí llanero	Continual	ES	DNER	Internal
1.9	Minimize impact of development	Continual	ES	DNER	Internal
2.1	Monitor existing population	Continual		UNIV	25
2.1.1	Conduct surveys within the only known area the species occurs	Continual	ES	UNIV	25

2.2	Characterize the genetic structure of the coquí llanero population	2 years		UNIV	30
2.3	Assess the potential to conduct a Population Viability Analysis	1 year	ES		20
3.1	Habitat Suitability Model	2 years		UNIV	50
3.2	Identify areas that may be potential habitat for the coquí llanero	1 years	ES		20
3.3	Identify in what areas the species has already been searched for and not found.	2 year	ES	UNIV	20
3.4	Select at least five suitable areas from the habitat model to assess their potential as future introduction sites	2 years	ES	DNER	20
4.1	Determine the historical range	2 years	ES	UNIV	30
4.2	Assess what is the most appropriate introduction method	4 years	ES	DNER, UNIV	90
4.3	Establish new populations	4 years	ES	DNER	80
4.3.1	Post introduction monitoring	Continual	ES	DNER, UNIV	15
5.1	Develop fact sheets and other communication tools in partnership with our recovery partners to disseminate information to the public on the importance of the conservation of this endangered species and its habitat	Continual	ES	DNER,UNIV	10
5.2	Institute and maintain proactive public outreach	Continual	ES		5
5.3	Involve the local community in coquí llanero recovery projects when feasible	Continual	ES		5

## APPENDIX 1

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