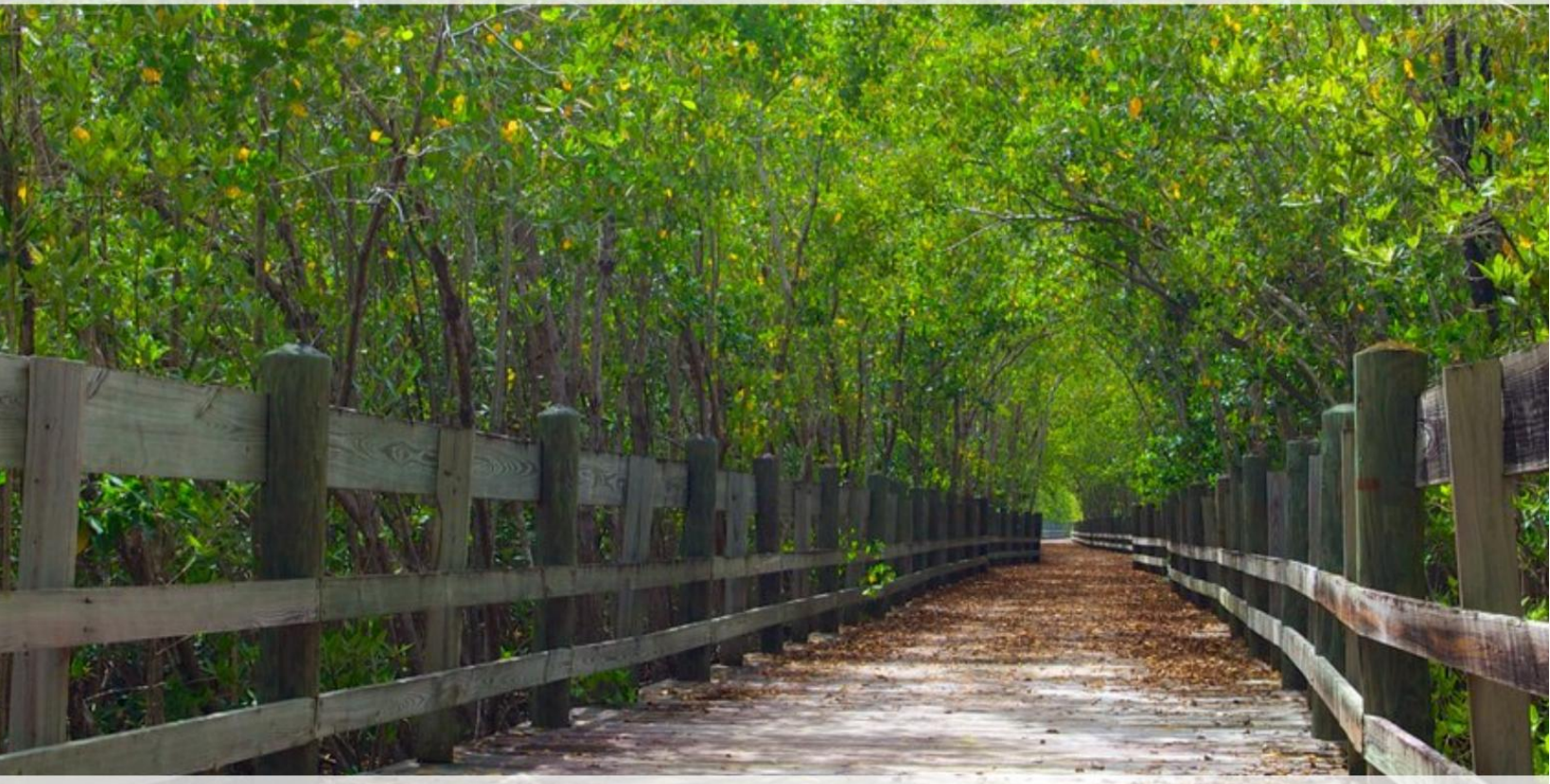
Puerto Rico State Wildlife Action Plan:
Ten Year Review



Puerto Rico Department of Natural and Environmental Resources

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EXECUTIVE SUMMARY

Twenty years ago, the first comprehensive strategy for conserving our wildlife resources, then known as the Comprehensive Wildlife Conservation Strategy (CWCS, 2005), began leading our local conservation initiatives. The strategy, whose title was updated to the Puerto Rico State Wildlife Action Plan (PRSWAP, 2015) was initially perceived as a requirement for receiving funds from the US Fish and Wildlife Service's State Wildlife Grants Program, but rapidly evolved into "a real" guide and a handbook for prioritizing and implementing projects, particularly those associated to the island's non-game species and their associated habitats.

Today, we can report that great progress has been made toward the following expected results and the predicted benefits outlined in the original Comprehensive Wildlife Conservation Strategy from 2005 and the updated Puerto Rico Wildlife Action Plan from 2015.

- Identifying and addressing the greatest conservation needs of Puerto Rico's fish and wildlife.
- Prioritizing efforts on species with the greatest conservation needs.
- Allowing the DNER to work in partnerships to conserve, enhance, and protect Puerto Rico's diverse, but not necessarily rare or at-risk, fish and wildlife species.
- Improving the DNER's ability to address present and future challenges and opportunities for Puerto Rico's fish and wildlife populations.
- Integrating monitoring and management actions for game and non-game species.

Careful analysis is not required to realize that the past two decades have only served to identify and partially attend to the needs of Puerto Rico's fish and wildlife resources. This task is ongoing and never-ending due to the instability of our environmental and socio-economic realms. Besides the intrinsic and monumental

challenges of the aforementioned assignments, Puerto Rico receives limited federal funding allocations, further restricting the DNER's potential achievements. Notwithstanding, the following actions have been completed, reflecting the usefulness of having an up-to-date State Wildlife Action Plan:

- A new chapter highlights the legal and regulatory framework guiding wildlife conservation in Puerto Rico, with flexibility to incorporate future state and federal legislation.
- The list of *Species of Greatest Conservation Need* has been updated to include newly identified species. At the same time, some from the 2015 SWAP were removed to keep the list focused, evidence-based, and aligned with current priorities.
- A new chapter addresses the local and global classification and opportunities for international collaboration, emphasizing the international classification of the *Species of Greatest Conservation Need.*
- Stressors and threats were expanded using updated data, with hydromodifications, large-scale agriculture, and droughts identified as new concerns. A dedicated section now uses FEMA tools to map and better assess these risks.
- A new framework supports systematic analysis of threats, enabling future mapping, prioritization, and decision-making.
- Conservation strategies have been broadened and organized around identified strategic axes.
- Habitats of Greatest Conservation Need were expanded with new data, and updated maps provided by the Southeast Conservation Adaptation Strategy help refine habitat identification.
- The Critical Wildlife Areas resource has been refreshed with a 2025 draft update, replacing a document nearly 20 years old.
- The PRSWAP now adopts a more analytical approach, explicitly comparing the 2015 plan with the current version.

In conclusion, the milestones reached in the conservation of Puerto Rico's wildlife resources during the past two decades have generated mixed emotions; we are being challenged by the numerous tasks the island currently faces and daunted by those to come. Ecological pressures, combined with the island's current economic situation, have exacerbated the already complex scenario we faced when work on the original action plan began back in 2005.

SUMMARY OF CHANGES

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CHAPTER 1
INTRODUCTION

I. Background

The Caribbean is considered a global biodiversity hotspot (Cincotta and Engelman 2000; Helmer et al. 2002; Myers et al. 2000). The islands commonly known as the Greater Antilles occupy the larger area within the Caribbean Region, with Puerto Rico being the smallest (8,892 km^2 or 3,425 $miles^2$) and most eastward (18º 15'North/66º 30' West) (Cruz and Boswell 1997). Paradoxically, the majority (80%) of the documented species extinctions have occurred on islands (Island Conservation, 2014). The combination of a high extinction rate with high indices of biodiversity and endemism makes implementing conservation initiatives and allocating funding toward these ecosystems a necessary and important priority.

Unsustainable exploitation of resources (Myers 1989), habitat loss, and invasive species (Walker and Steffen 1997) have been identified as the main culprits for species extinctions on islands. Moreover, insular species exhibit greater extinction rates and are more susceptible to environmental stress than their mainland counterparts (Vitousek 1988; Vitousek et al. 1995). This increased vulnerability has been linked to low population numbers, reduced genetic diversity, constrained geographical range (Adsersen 1995; Vitousek 1988), and limited migratory capabilities (Ives and Foufopoulus 2003).

Puerto Rico is an archipelago composed of several islands and cays, the majority of which are managed as protected areas under local and federal designations, and only a few are privately owned. A complex topography, soils, and climate produce distinct life zones (Ewel and Whitmore 1973) and several vegetation

associations, ranging from high-elevation elfin forests to coastal alluvial swamps. Likewise, the marine environment is diverse, ranging from the deepest depths in the world (the Puerto Rican Trench) to shallow ecosystems dominated by coral reefs and seagrass prairies.

Habitats in Puerto Rico have been degraded over the past three to four centuries as the growing human population has increased use of the island's natural and environmental resources, significantly transforming the landscape. Population growth led to a dramatic shift in the local economy, transitioning from an agriculture-based economy (circa 1930-1950) to an industrial one (López et al. 2001). These changes resulted in major deforestation during the first half of the past century. The abandonment of agricultural lands sparked a remarkable forest recovery, with forest cover on the island increasing from approximately 6% to 34% (Birdsey and Weaver 1987). However, the island's growing population has affected forest recovery, as many abandoned agricultural lands have been replaced by rapid urbanization (López et al. 2001).

Since the publication of the 2015 PRSWAP, the island has experienced a series of compounding natural and public health disasters, each with far-reaching implications for its economy, society, and environment. These include Hurricanes Irma and Maria in 2017, the earthquakes in the southern region from 2019 to 2020, the global COVID-19 pandemic that began in 2020, and Hurricane Fiona in 2022. In response, the federal government allocated emergency relief and recovery funding, which temporarily stimulated economic activity (Marxuach, 2021). However, the non-recurring nature of these funds introduces significant fiscal uncertainty, complicating long-term economic planning and sustainable development efforts.

Puerto Rico has approximately 5,847 native wildlife species. Of these, 51 are reptiles (Rivero 1998), 18 are amphibians (Rivero 1998), 5,573 are insects (Torres and Medina-Gaud 1998), 190 are birds (Raffaele 1989), and 15 are

mammals. Most of these are considered non-game and are poorly known by the government and the general public. Unless recognized as threatened or endangered (T/E), non-game species lack the public constituency and awareness needed to support basic research and management. As a result, the population status and distribution of most non-game, non-listed species are unknown, limiting the implementation of actions and management strategies.

In Puerto Rico, management priorities for wildlife and fisheries resources have been sharply delineated by the conditions established by the four primary sources of federal funds that support the majority of our management efforts. These are the Sport Fish and Wildlife Restoration Programs, the Endangered Species Program, and the State Wildlife Grants Program. User fees and taxes paid by hunters and anglers have financed management and restoration efforts for several decades; however, these funds are primarily used to conserve game species and are insufficient to address the needs of other species. In fact, the total amount allocated to endangered, threatened, and species of greatest conservation need identified as Data Deficient (García et al. 2005) has been around $750,000 per year. Consequently, conservation goals and initiatives can only be achieved by collaborating with other conservation entities, particularly the US Fish and Wildlife Service, National Resources Conservation Services, and NGOs such as The Nature Conservancy (International) and Para La Naturaleza (local). Such partnerships are instrumental in achieving the shared goal of conserving wildlife and their habitats.

II. Federal Funding and Legislation Requirements

Federal funding for wildlife has primarily focused on game species and those that are threatened or endangered. To address the needs of declining non-game species, Congress established the Wildlife Conservation and Restoration Program in 2001 and the State Wildlife Grants (SWG) program in 2002. These programs assist states and territories in protecting all types of wildlife and their habitats. In

Puerto Rico, the DNER manages these funds to protect native species and ecosystems, with SWG funding supporting various conservation efforts.

Since its inception in 2002, Puerto Rico has, on average, received just over $282,000 from the SWG. The yearly allocation to Puerto Rico is half the minimum amount a U.S. state receives but twice what other territories receive. This funding enables Puerto Rico to prioritize safeguarding and securing healthy populations of diverse wildlife and their habitats.

To qualify for federal aid programs, such as the SWG, Congress requires each state and territory to develop a Comprehensive Wildlife Conservation Strategy, now commonly referred to as the State Wildlife Action Plan. This legislative requirement requires these plans to be revised and updated at least every 10 years to ensure their relevance and effectiveness. The original CWCS was developed in 2005, followed by an updated SWAP in 2015, which was designed to fulfill federal requirements. As part of the ongoing commitment to conservation, the latest iteration, SWAP 2025, has been developed to meet the necessary criteria for accessing federal funding and support for wildlife conservation efforts.

III. Objective

The State Wildlife Action Plan represents a comprehensive, statewide approach for conserving Puerto Rico's wildlife and natural areas for future generations. The objectives of this document include: (1) Identify the current status of the species and their habitats, (2) Identify and update conservation priorities for these species and their habitats, and (3) establish a regular monitoring process aimed at updating the previous two objectives.

IV. Expected Results and Benefits

The Puerto Rico State Wildlife Action Plan will:

- Identify and address the greatest conservation needs of Puerto Rico's fish and wildlife resources.
- Prioritize efforts on species with the greatest conservation needs.
- Allow the DNER to work in partnership to conserve, enhance, and protect Puerto Rico's diverse, but not necessarily rare or at-risk, fish and wildlife species.
- Enhance the DNER's capacity to address current and future conservation challenges and opportunities.
- Integrate monitoring and management of game and non-game species.

V. Approach

DNER revised the PRSWAP in 2015, utilizing both internal and external resources. However, stakeholders, the Academia, local and federal agencies, and the general public have been able to participate in the review process for the priority list of Species of the Greatest Conservation Need (SGCN). DNER referred to existing Wildlife Action Plans from other states and the Guiding Principles for States to Consider in Developing Comprehensive Wildlife Conservation Plans for the State Wildlife Grants and the Sport Fish and Wildlife Restoration Programs. A draft version of the new PR SWAP was posted on the DNER's website for 30 days to allow broad public review.

The Puerto Rico State Wildlife Action Plan addresses the following required elements:

Element 1: Inventory

Information on the distribution and abundance of wildlife species, including low and

declining populations, as the State Fish and Wildlife Agency deems appropriate, is indicative of the diversity and health of the State's wildlife.

Element 2: Condition

Description of the locations and relative condition of key habitats and community types essential to the conservation of species identified in Element 1.

Element 3: Threats

Descriptions of problems that may adversely affect species identified in Element 1 or their habitats, and priority research and survey efforts needed to identify factors that may assist in the restoration and improved conservation of these species and habitats.

Element 4: Actions

Descriptions of conservation actions proposed to conserve the identified species and habitats, and priorities for implementing such actions.

Element 5: Monitoring

Proposed plans for monitoring species identified in Element 1 and their habitats, for monitoring the effectiveness of the conservation actions proposed in Element 4, and for adapting these conservation actions to respond appropriately to new information or changing conditions.

Element 6: Review

Descriptions of procedures to review the PRWAP at intervals not exceeding ten years.

Element 7: Coordination

Plans for coordinating the development, implementation, review, and revision of the PRWAP with federal, state, and local agencies.

Element 8: Public Participation

Involvement of the general public in the development of the conservation strategy and resulting actions.

The first version of PRSWAP, known as the CWCS (2005), the updated PRSWAP (2015), the updated Fisheries and Wildlife Resources Strategic Plan (DNER 2004), the Puerto Rico Critical Wildlife Areas (Ventosa-Febles et al. 2005a; DNER 2025), the Puerto Rico Waterfowl Focus Areas (Ventosa-Febles et al. 2005b), and the Puerto Rico Terrestrial Gap Analysis (2007), and Aquatic Gap Analysis (2011) were used to update and inform this plan. These documents provide detailed information on wildlife species and their habitats and are recommended references for further detail.

VI. Conclusion

The original Comprehensive Wildlife Conservation Strategy (2005) and the updated State Wildlife Action Plan (2015) considered the broad range of Puerto Rico's wildlife, with an appropriate emphasis placed on species and habitats with the greatest conservation needs, particularly those considered Data Deficient. Two decades after the initial conservation strategy was introduced, Puerto Rico has embarked on a journey to protect and preserve its natural resources. Despite the strides made since 2015, the island has faced formidable challenges, particularly from the devastating impacts of the 2017 hurricane season.

Nonetheless, this latest version of the Puerto Rico SWAP is expected to serve as a roadmap for the next ten years. It is designed to provide an up-to-date inventory of the island's flora and fauna, key habitats, threats, and other relevant information impacting conservation efforts. The goal is for this document to promote a more resilient and supportive environment for Puerto Rico's wildlife and plant life.

CHAPTER 2
LEGAL AND REGULATORY FRAMEWORK FOR WILDLIFE CONSERVATION EFFORTS IN PUERTO RICO

I. Purpose of the Legal and Regulatory Framework

The 2025 PRSWAP's Legal and Regulatory Framework establishes the statutory foundations and institutional mandates that authorize, guide, and constrain wildlife management and biodiversity protection on the Island. It identifies key federal, state, and local laws relevant to the plan and acknowledges evolving legal trends related to ecological pressures, environmental justice, and integrated governance.

The framework serves four purposes:

1. **Legal Alignment**: To ensure that the goals, strategies, and conservation actions proposed in the PRSWAP fully comply with applicable laws, regulations, and executive orders at all levels of government.
2. **Institutional Clarity**: To delineate the authority and responsibilities of the Department of Natural and Environmental Resources and its partners across public agencies, municipalities, and civil society.
3. **Governance Transparency**: To inform the public and decision-makers about the legal tools available to protect wildlife and habitats, and to promote accountability in enforcement and implementation.
4. **Strategic Opportunity**: To identify legal precedents, policy gaps, and institutional innovations that can be leveraged to strengthen the efficacy and long-term sustainability of wildlife conservation in Puerto Rico.

Given that legal frameworks are subject to ongoing evolution, this section also addresses anticipated legal and policy shifts necessary for implementing a 21st-

century conservation strategy that addresses the intersecting challenges of habitat loss, climate risk, food insecurity, and social inequity. In this context, biodiversity is recognized as a matter of public interest in Puerto Rico, requiring deliberate and sustained legal stewardship.

II. Federal Legal Foundations

Puerto Rico's SWAP is developed under the authority and guidance of the U.S. Fish and Wildlife Service. It aligns with the framework established by the State and Tribal Wildlife Grants (STWG) Program. As a territory of the United States, Puerto Rico participates in federal conservation programs and is subject to national environmental statutes, many of which have been adapted and applied within the archipelago's distinct legal and geographic context.

The following are the most relevant federal legal instruments that shape the PRSWAP's priorities, obligations, and opportunities. These laws provide the framework for protecting species, conserving habitats, facilitating interagency coordination, and accessing federal funding.

State and Tribal Wildlife Grants Program

Authorized by Congress in 2000, the STWG Program is the principal federal funding mechanism supporting the development and implementation of SWAPs. Through this program, Puerto Rico is eligible for annual federal allocations, contingent upon submitting an approved SWAP and complying with federal guidelines. The program requires that each state or territory:

- Develop a comprehensive wildlife conservation strategy.
- Address the eight essential elements defined by USFWS.
- Submit updates on a ten-year cycle.
- Demonstrate broad-based participation in the planning process.

- Prioritize Species of Greatest Conservation Need and their habitats.

Key Federal Environmental Laws

The statutes in Table 1 establish the legal framework for wildlife conservation at the federal level and apply directly to Puerto Rico:

Table 1. Key federal environmental laws that apply to Puerto Rico

Law	Information	Effects
Endangered Species Act (ESA) of 1973	Puerto Rico is home to numerous species listed under the ESA, including the Puerto Rican parrot (Amazona vittata) and coquí llanero (Eleutherodactylus juanariveroi), making this statute central to the PRSWAP.	•Provides for the listing and recovery of threatened and endangered species. •Prohibits the "take" of listed species and mandates federal agency consultation. •Requires designation and protection of critical habitat. •Supports habitat conservation plans (HCPs) and cooperative agreements.
Clean Water Act (CWA) - Section 401 & 404	This law is especially relevant to Puerto Rico's wetland habitats, karst landscapes, and coastal marshes, where water quality and habitat integrity are directly linked.	•Regulates the discharge of pollutants into waters of the U.S. •Section 404 authorizes the U.S. Army Corps of Engineers to issue permits for the discharge of dredged or fill material in wetlands and streams. •Section 401 requires state/territorial certification of water quality for federally permitted activities.
Coastal Zone Management Act (CZMA)	Puerto Rico's Coastal Zone Management Program, led by the DNER, serves as the territorial implementation of the CZMA and plays a vital role in conserving coastal and marine habitats included in the PRSWAP.	•Encourages states and territories to develop and implement coastal zone management plans. •Provides funding and technical assistance for integrated coastal resource management. •Requires consistency between federal actions and state/territorial plans.
National Environmental Policy Act (NEPA)	NEPA assessments often intersect with PRSWAP priorities when federal projects (e.g., energy, transportation, infrastructure) may impact wildlife or habitat.	•Requires federal agencies to assess the environmental impacts of major actions. •Establishes processes for Environmental Assessments (EAs) and Environmental Impact Statements (EISs); •Mandates public participation and interagency coordination.
Infrastructure Investment and Jobs Act (IIJA) & Inflation Reduction Act (IRA)	The PRSWAP aligns with IIJA and IRA objectives, particularly its focus on habitat connectivity, blue-green infrastructure, and coastal resilience.	•Authorize funding for resilience, ecosystem restoration, and natural infrastructure projects. •Encourage nature-based solutions and climate adaptation strategies. •Provide competitive grant opportunities to territories and local agencies.

Federal Trust Responsibilities and Cross-Border Coordination

Though Puerto Rico does not have federally recognized tribal governments, it shares migratory, marine, and ecological connections with the continental U.S., the

Caribbean, and Latin America. The federal Migratory Bird Treaty Act, Marine Mammal Protection Act, and international agreements (e.g., CITES) remain applicable, and their integration into PRSWAP supports cross-boundary species management.

Case Example – Federal Law in Action

The designation of critical habitat for the coquí llanero (Eleutherodactylus juanariveroi) under the Endangered Species Act demonstrates the effective use of federal legal tools within Puerto Rico's unique ecological and jurisdictional setting. This native amphibian, restricted to a single freshwater wetland in Toa Baja, was listed as endangered in 2012 due to its extreme habitat specialization and vulnerability to urban encroachment and hydrological alteration. In 2022, the U.S. Fish and Wildlife Service, in collaboration with the Puerto Rico DNER, completed a recovery plan and designated critical habitat under ESA authority, representing one of the few such initiatives in Puerto Rico that combines federal habitat protections with territorial land-use restrictions.

This case shows how federal-territorial cooperation can do more than just identify legal protections on paper; it can put them into action through joint management, habitat monitoring, and regulatory consistency. The coquí llanero recovery plan includes goals for hydrologic restoration, protocols for landowner involvement, and site-specific permitting guidelines, all of which can be replicated for other Species of Greatest Conservation Need. Moving forward, similar approaches should be actively pursued, especially for narrowly distributed endemic species and habitats facing immediate development threats or climate challenges.

Federal-State Partnership Principles

The PRSWAP is developed in close coordination with the USFWS and complies with all federal grant assurances, transparency standards, and performance metrics. This partnership is foundational to ensuring continuity in conservation investments and maximizing Puerto Rico's access to future federal funding opportunities.

III. Commonwealth of Puerto Rico – Core Environmental Legislation

The Commonwealth of Puerto Rico has established a robust legal framework to protect its wildlife and natural resources. Over the past four decades, a series of environmental statutes have been enacted that collectively authorize the DNER to conserve native and migratory species, manage habitat areas, regulate development, and promote the sustainable use of ecological systems.

Table 2 presents the core legislative instruments and regulatory tools at the commonwealth level that define the scope of DNER's conservation mandate and directly intersect with the goals of this SWAP.

Table 2. Key Commonwealth environmental laws

Law / Regulation	Description	Effects
Law No. 241-1999 – New Wildlife Law of Puerto Rico	Commonly referred to as the Wildlife Law, this statute is the cornerstone of Puerto Rico's legal regime for wildlife protection. The law recognizes the intrinsic value of wildlife and provides a broad mandate for both in-situ conservation and sustainable management.	•Declares all wildlife species within Puerto Rico as public trust resources held by the Commonwealth. •Establishes protections for native, endemic, migratory, and exotic species. •Authorizes DNER to regulate hunting, possession, collection, and commerce of wildlife. •Requires permits for any activity that could affect wildlife or their habitats. •Supports the development of species management plans and interagency agreements.
Regulation No. 6766 (2004) – Management of Vulnerable and Endangered Species	This regulation is a vital legal tool for species of greatest conservation need (SGCN), complementing protections afforded under the federal Endangered Species Act.	•Establishes the official list of endangered and threatened species under Puerto Rico jurisdiction. •Prohibits the collection, harm, or disturbance of any species on the list or their habitat. •Enables the designation of Critical Habitat Areas. •Provides DNER with authority to adopt species-specific recovery plans and habitat restoration protocols.
Law No. 133-1975 – Puerto Rico Forest Law (as amended)	Puerto Rico's public forest system plays a central role in biodiversity conservation and climate adaptation, providing core habitat for numerous SGCN. This law provides the legal basis for the designation and protection of public forests in Puerto Rico.	•Establishes forest conservation as a matter of public interest and ecological necessity. •Authorizes DNER to manage, restore, and expand state forests. •Designates all public forests as Critical Wildlife Areas (CWAs) with additional legal protections. •Prohibits deforestation and unauthorized activities within these lands.

Law / Regulation	Description	Effects
Law No. 150-1988 – Puerto Rico Natural Patrimony Program Act	This law creates a mechanism for the designation and legal protection of ecologically significant areas across diverse landscapes. It protects many of Puerto Rico's most biologically valuable habitats, including mangroves, coral reefs, coastal forests, and bioluminescent bays.	•Enables the formal designation of Natural Reserves and Marine Reserves. •Promotes the preservation of ecosystems, landscapes, and species of scientific or cultural value. •Authorizes co-management agreements with nonprofit organizations and academic institutions.
Law No. 416-2004 – Environmental Public Policy Act	This statute is Puerto Rico's analogue to the U.S. National Environmental Policy Act (NEPA). Law 416 is particularly important for the PRSWAP as it ensures that conservation priorities are integrated into infrastructure, land development, and permitting decisions.	•Declares it public policy to conserve the natural environment and ensure sustainable development. •Requires Environmental Impact Assessments (EIAs) and Statements (EISs) for projects with significant ecological effects. •Ensures public participation in environmental review processes. •Grants standing to citizens to file legal challenges in defense of environmental rights.

Regulation 6766 and Law 150-1988 are recommended for modernization. The Monitoring and Adaptation Chapter outlines proposed updates to Regulation 6766, including automatic triggers for habitat designation based on mapping outputs for Species of Greatest Conservation Need. These updates may be integrated into the PRSWAP reporting cycles.

Coastal and Marine Resource Management

Since over 70% of Puerto Rico's population lives in coastal municipalities, this body of law balances biodiversity conservation with community resilience and sustainable use. Multiple instruments govern Puerto Rico's coastal and marine areas.

- **Puerto Rico Coastal Zone Management Program (CZMP)**, developed under the federal CZMA.
- **Regulation 8853 (2016)** – Establishes rules for the use and management of the maritime-terrestrial zone, mangroves, and reefs.
- **Puerto Rico Sea Grant Act** – Supports research, education, and capacity-building in marine and coastal ecosystems.

Integration with Planning and Permitting Laws

While not always framed as environmental law, Puerto Rico's land use and permitting statutes play a pivotal role in habitat fragmentation, species protection, and conservation outcomes. The PRSWAP promotes integrating biodiversity data and ecological sensitivity analysis into land classification, rezoning, and development approval processes. Relevant statutes and instruments include:

- Law No. 75-1975 – Puerto Rico Planning Board Act
- Puerto Rico Land Use Plan (PUT 2015)
- Joint Regulation on Permits and Land Use (Reglamento Conjunto 2023)
- Zoning Map Resolutions and Sectoral Plans

IV. Cross-Sectoral Legal Instruments (Integrated Conservation Enablers)

Conservation outcomes are inherently linked to broader systems of governance. Wildlife habitat and species viability in Puerto Rico are influenced by decisions made in sectors often considered external to environmental law, such as agriculture, transportation, disaster management, energy, and food distribution. The following Table 3 identifies and contextualizes the legal instruments across sectors that either support or constrain biodiversity conservation efforts, emphasizing opportunities for strategic integration.

Table 3. Cross-sectoral legal instruments

Legal Instruments	Description	Key Instruments	Strategic Conservation Implications
Land Use Planning and Zoning	Puerto Rico's land use legal framework shapes patterns of development, conservation, and degradation across ecosystems. Although not explicitly designed for wildlife protection, land use laws determine the extent to which habitat fragmentation, urban sprawl, and infrastructure encroachment can be mitigated.	•Puerto Rico Land Use Plan (PUT 2015): The official territorial spatial planning document, classifying land by conservation value, development potential, and hazard exposure. •Joint Permitting and Land Use Regulation (Reglamento Conjunto 2023): Regulates land use, construction permits, and environmental impact review. •Law No. 75-1975 (Puerto Rico Planning Board Act): Empowers the Planning Board to adopt regulations and issue planning certifications.	•The PRSWAP recommends increased coordination between DNER and the Planning Board to incorporate ecological sensitivity maps into zoning revisions and permit evaluations. •Supports the creation of biodiversity overlay zones in ecologically sensitive or species-rich areas.
Agriculture, Food Security, and Agroecology	Agricultural land use and rural development can either degrade wildlife habitat or contribute to biodiversity-friendly landscapes. Puerto Rico's legal framework for food production and distribution is increasingly intersecting with conservation goals, particularly as the island seeks to build food sovereignty and climate-resilient farming systems.	•Law No. 550-2004 (Puerto Rico Food Security Act): Declares food security a matter of public interest and establishes mechanisms for local food system development. •Agroecological Promotion Bill (under consideration): Seeks to formalize agroecological practices as public policy and provide technical and legal support to smallholder farmers. •NAP to SNAP Transition Policy (2023–present): A federal commitment to expanding Puerto Rico's participation in the Supplemental Nutrition Assistance Program (SNAP), with implications for rural livelihoods and food access.	•The PRSWAP supports incentives for landowners and cooperatives that integrate wildlife-friendly practices such as agroforestry, native hedgerows, and pollinator gardens. •Promotes habitat restoration in abandoned or underutilized agricultural parcels using conservation easements or stewardship agreements.
Climate Change Adaptation and Disaster Resilience	Ecological pressures are already altering species distributions, disrupting ecological processes, and increasing the vulnerability of critical habitats. Puerto Rico's legal framework is increasingly addressing these risks through climate adaptation, coastal zone management, and risk-reduction strategies.	•Puerto Rico Climate Change Council (PRCCC) policy framework •Law No. 1-2012 (Puerto Rico Emergency Management and Disaster Law): Establishes protocols for risk identification, mitigation, and post-disaster recovery. •FEMA's Hazard Mitigation Planning Requirements •Infrastructure Investment and Jobs Act (IIJA) and Inflation Reduction Act (IRA): Provide funding for resilience projects, nature-based solutions, and conservation-focused infrastructure.	•Supports designation of ecological refugia and resilience corridors in climate-vulnerable zones. •Recommends legal recognition of ecosystem services (e.g., mangroves and forests as flood mitigation infrastructure) in municipal mitigation plans and CIP evaluations.

Legal Instruments	Description	Key Instruments	Strategic Conservation Implications
Coastal and Marine Governance	Puerto Rico's marine ecosystems are among its most biologically rich and economically vital. Yet legal fragmentation and insufficient enforcement have long hindered marine conservation efforts.	•Puerto Rico Coastal Zone Management Program (CZMP): Implements the federal Coastal Zone Management Act in the territory. •Regulation 8853 (2016): Establishes standards for uses of maritime-terrestrial zones, mangroves, and coral reefs. •Law No. 147-1999 (Marine Resources Management Law): Enables DNER to regulate fishing, aquaculture, and marine resource extraction. •Law No. 307-2004 (Beaches and Coastal Access Law): Guarantees public access to beaches and coastal areas.	•PRSWAP supports the expansion and formal recognition of marine corridors and reef sanctuaries. •Recommends harmonization of coastal zone permitting with biodiversity impact assessments and cumulative effects analysis.
Natural Infrastructure and Public Works Integration	Traditional infrastructure development, such as roads, drainage systems, and energy projects, can create barriers to species movement and degrade habitat quality. However, legal frameworks increasingly support the concept of natural infrastructure as an alternative or complement to conventional gray infrastructure.	•IIJA and IRA Resilience and Restoration Programs •Safe Streets and Roads for All (SS4A): Federal funding program encouraging wildlife crossings, greenways, and non-motorized mobility infrastructure. •Puerto Rico Public-Private Partnership Law (Law No. 29-2009): Offers opportunities for biodiversity-inclusive public infrastructure design.	•PRSWAP promotes legal definitions and planning criteria for "ecological infrastructure", such as riparian buffers, wetlands, and urban forests, as functional components of public safety and infrastructure resilience.

V. Institutional Roles and Legal Mandates

Puerto Rico's environmental governance structure relies on a constellation of public agencies, municipal governments, and civil society partners. While the DNER holds primary legal authority for wildlife protection, many critical decisions affecting biodiversity, such as land use, coastal development, and disaster response, fall under the jurisdiction of other entities.

The following outlines the legal mandates, operational roles, and coordination pathways of the key institutions responsible for enacting the laws and policies described in the previous sections.

Department of Natural and Environmental Resources

Established by Law No. 23-1972 and redefined by Law No. 171-2018, DNER is the lead agency responsible for managing Puerto Rico's natural resources and enforcing all related environmental and wildlife laws. Relevant units under DNER include the Wildlife Bureau, the Ranger Corps, the Bureau of Protected Areas and Forests, and the Coastal Management Program. Its core functions include:

- Implementation of Law No. 241-1999 (Wildlife Law), Law No. 133-1975 (Forest Law), Law No. 150-1988 (Natural Patrimony), and Regulation No. 6766.
- Designation and management of Critical Wildlife Areas, natural reserves, and marine protected areas.
- Issuance and enforcement of permits related to species collection, habitat use, hunting, and environmental impact.
- Coordination with federal agencies, especially the USFWS, NOAA, and EPA.

Table 4. Other Commonwealth institutions of interest

Institutions	Mandate	Conservation Relevance
Puerto Rico Planning Board	Under Law No. 75-1975, the Planning Board oversees spatial planning, zoning, and the evaluation of territorial land-use policies.	•Develops and oversees the Puerto Rico Land Use Plan (PUT). •Approves sectoral and special planning areas that may impact habitat quality or species corridors. •Coordinates with DNER on land classifications and rezoning requests that affect protected areas or SGCN habitats.
Permit Management Office (OGPe)	Established under the Permits Process Reform Law (Law No. 161-2009), OGPe is responsible for issuing construction and land use permits across Puerto Rico.	•Reviews projects subject to Regulation 8853 (maritime-terrestrial zone) and Law No. 416 (Environmental Public Policy Act). •Interfaces with DNER through interagency consultations. •Critical in assessing cumulative ecological impacts of development.
Municipal Governments	Under the Autonomous Municipalities Act (Law No. 81-1991), municipalities are responsible for managing local land use, environmental education, waste management, and, increasingly, green infrastructure.	•Local ordinances may designate protected areas or implement urban forest programs. •Some municipalities have adopted co-management agreements with DNER for the stewardship of community forests and coastal areas. •Municipal planning offices participate in hazard mitigation planning and zoning map revisions with implications for biodiversity corridors.

Table 5. Federal institutions of interest

Federal Institutions	Relevance
U.S. Fish and Wildlife Service (USFWS)	•Administers ESA-listed species and critical habitat designations. •Provides technical and financial support for PRSWAP implementation.
U.S. Environmental Protection Agency (EPA)	•Oversees water quality standards, Clean Water Act compliance, and environmental justice metrics.
National Oceanic and Atmospheric Administration (NOAA)	•Manages marine species, coral reefs, and supports the Puerto Rico Coastal Zone Management Program.
Federal Emergency Management Agency (FEMA)	•Coordinates hazard mitigation and resilience investments affecting ecological systems.

Academia and Civil Society

While not legal authorities, academic institutions and nonprofit organizations play a critical role in co-producing science, educating the public, and implementing place-based conservation initiatives. Their collaboration with government entities is often facilitated through legal instruments such as Memorandum of Understanding (MOUs), Co-Management Agreements under Law No. 150-1988,

and Citizen Science Frameworks (non-binding but increasingly used in adaptive monitoring).

Governance Mechanisms for Co-Implementation]

Effective conservation benefits from governance platforms that facilitate shared implementation. One approach is to establish a Conservation Law and Policy Roundtable that convenes regularly to discuss emerging issues. Regional implementation consortia may be explored, potentially co-led by DNER in collaboration with key municipalities, to enhance coordination across jurisdictions. Additionally, progress dashboards could be developed to provide transparent updates that incorporate partner data. These mechanisms may be supported through formal agreements and publicly available memoranda of understanding, when applicable.

Governance Gaps and Institutional Challenges

Several challenges persist despite the broad authority granted to the DNER and its partners. Underfunding and staff shortages across agencies reduce enforcement capacity, while legal overlaps create ambiguity in permitting processes, especially in coastal and urban areas. Additionally, inadequate data-sharing mechanisms between agencies hinder effective coordination.

To address these issues, the PRSWAP supports formalizing interagency protocols and developing integrated permitting platforms that incorporate biodiversity criteria into early-stage project review.

VI. Enforcement and Access to Justice

Puerto Rico's environmental and wildlife laws grant the DNER substantial authority, but enforcement capacity and public access to legal remedies remain key areas for improvement.

The following outlines the formal enforcement mechanisms available to the Commonwealth, identifies the role of civil society in monitoring and challenging violations, and proposes pathways to strengthen the rule of law in biodiversity conservation.

DNER Enforcement Authority and Ranger Corps

The principal enforcement body within the DNER is the *Cuerpo de Vigilantes*, or Ranger Corps, empowered by Law No. 1-2000 and its subsequent amendments. They are responsible for investigating and intervening in cases of illegal hunting, poaching, habitat destruction, and trafficking of protected species; patrolling natural reserves, state forests, and maritime-terrestrial zones; and supporting compliance with permits, protected area regulations, and critical habitat designations. However, the Corps faces chronic underfunding, personnel shortages, limited presence in remote high-biodiversity areas, and gaps in technological resources such as drones, GPS tracking, and real-time data systems.

The PRSWAP recommends strengthening investment in ranger training, recruitment, and deployment; establishing co-enforcement mechanisms with municipal police or citizen rangers in community-managed areas; and incorporating community-based monitoring programs to complement formal enforcement efforts.

Permit Compliance and Environmental Oversight

The DNER, the OGPe, and the Environmental Quality Board (JCA) share responsibility for enforcing permit conditions and mitigation measures, particularly those related to wildlife impacts. Their enforcement tools include stop-work orders, fines, project suspensions for noncompliance, and environmental impact review processes under Law No. 416-2004, the Environmental Public Policy Act. They also coordinate with federal agencies, such as the EPA and the U.S. Army Corps of Engineers (USACE), in cases involving Clean Water Act and NEPA violations.

However, enforcement efforts are often reactive rather than preventive, and biodiversity data is limitedly integrated into site inspections and permit reviews. To strengthen enforcement, the PRSWAP recommends embedding biodiversity monitoring clauses into permits for activities that affect SGCN habitats and developing protocols to assess cumulative impacts during the permitting phase.

Citizen Participation and Legal Standing

Puerto Rico's environmental law provides avenues for citizen oversight and legal intervention, particularly through Law No. 416 and Supreme Court decisions that recognize legal standing in environmental cases. Legal mechanisms available to the public include filing comments during environmental reviews, accessing administrative appeals for project approvals and permits, seeking judicial review of agency decisions (especially where protected species or habitats are at risk), and using legal tools such as the writ of injunction and mandamus to compel agency action. Notable precedents include "Ciudadanos del Karso v. U.S. Army Corps of Engineers", which challenged inadequate public notice; the Northeast Ecological Corridor cases, which led to permanent habitat protections; and recent lawsuits from 2023 to 2024 over renewable energy siting, where community groups opposed utility-scale solar projects on ecologically sensitive and agricultural lands.

In support of these efforts, the PRSWAP advocates for expanding environmental legal literacy programs, formally recognizing community-based conservation initiatives with co-management status, and incorporating community-generated reports and data into enforcement decision-making.

Role of the Judiciary and Prosecutorial System

The Puerto Rican judiciary plays a pivotal role in interpreting and enforcing environmental law. Although specialized environmental courts have not yet been established in the territory, general courts have adjudicated significant biodiversity and habitat protection cases.

To enhance judicial capacity in this area, the PRSWAP recommends exploring the feasibility of establishing a specialized environmental docket or tribunal, providing targeted training for prosecutors and judges on ecological evidence, habitat thresholds, and species-specific impacts, and, where applicable, strengthening collaboration with the Office of the Environmental Public Prosecutor.

Strengthening Legal Pathways for Equitable Justice

Environmental justice requires not only equal access to natural resources but also equal protection under the law. Historically marginalized communities, such as those in coastal informal settlements or adjacent to industrial zones, often experience higher rates of biodiversity loss and receive fewer enforcement protections.

In response, the PRSWAP emphasizes the need to prioritize enforcement in areas of both ecological and social vulnerability, ensure that conservation restrictions are accompanied by investments in community benefits and local capacity, and promote participatory mechanisms for monitoring, oversight, and equitable benefit-sharing.

VII. Legal Precedents and Judicial Decisions

Statutes, regulations, and judicial decisions influence Puerto Rico's environmental legal framework. Court rulings have interpreted existing laws, clarified regulatory responsibilities, and, at times, established new norms for how public agencies and private entities must engage with wildlife and natural resources.

While most SWAPs do not explicitly incorporate case law, including it marks an intentional evolution in Puerto Rico's approach, linking legal history with conservation strategy and highlighting the role of judicial oversight in enforcing biodiversity protections.

Judicial decisions play a crucial role in shaping environmental governance by interpreting the scope of agency authority and citizen rights, clarifying the limits and obligations established by environmental statutes, and exposing recurring failures or ambiguities in policy implementation. In cases where legislation is vague or contested, court rulings often serve as de facto environmental policy. Understanding these decisions is particularly important in Puerto Rico, where conservation conflicts frequently arise regarding land use, economic development, and public participation.

The DNER could create a living case law repository to document decisions related to habitat law, public participation, and environmental equity. If established, this repository should be updated annually and utilized during permitting reviews.

Table 6. Summary of relevant cases

Case Name	Legal Issue	Outcome / Precedent	Relevance to PRSWAP
Citizens of the Karst v. U.S. Army Corps of Engineers (2016)	Challenge to the issuance of a Clean Water Act §404 permit without adequate public notice	Court deferred to agency discretion but emphasized procedural consistency	Reinforces the importance of transparency and community consultation in habitat-impacting permits
Northeast Ecological Corridor (2000–2013)	A series of lawsuits to prevent large-scale development in critical coastal habitats	Led to the legislative designation of the area as a nature reserve	Demonstrates the power of community litigation and sustained legal advocacy to secure permanent protections
Vía Verde Natural Gas Pipeline (2009–2012)	Lawsuits over the proposed pipeline's environmental impacts, particularly in the karst region	Permit was withdrawn; project halted	Illustrates the role of legal pressure in redirecting major infrastructure projects away from sensitive habitats
RCRA Enforcement – Moca Landfill (2024)	EPA legal action under the Resource Conservation and Recovery Act (RCRA) to improve landfill operations	Settlement resulted in a mandated composting program and closure upgrades	Shows the utility of federal enforcement in reducing ecological risk in karst and aquifer zones
Climate Liability Case – PR Municipalities v. Oil Companies (2023–present)	Suit alleging fossil fuel companies' role in exacerbating climate impacts in Puerto Rico	The federal court allowed antitrust and racketeering claims to proceed	Opens precedent for legal framing of ecosystem and community harm from ecological pressures
Illegal Construction in Cueva Las Golondrinas (2023)	The court ordered the demolition of unauthorized structures in a coastal protected area	Restoration mandated; site protected	Reinforces the enforceability of maritime-terrestrial zone laws and public access protections
Renewable Energy Siting Lawsuits (2023–2024)	Legal challenges to utility-scale solar projects sited in ecologically sensitive or agricultural zones	Cases are ongoing; courts have issued injunctions and remand orders	Highlights the need for integrated land-use screening and conservation-compatible energy planning

These cases illuminate several trends in environmental jurisprudence. First, procedural integrity, ensuring community participation and agency transparency, is not optional but an enforceable legal standard. Second, courts increasingly recognize habitat integrity as a legitimate legal interest, with ecological degradation sufficient to warrant judicial intervention. Third, climate justice is emerging as a valid legal argument to protect natural systems and vulnerable communities. Finally, the judiciary serves a vital oversight function, helping to check administrative inaction and guard against regulatory capture in environmental decision-making.

The PRSWAP encourages the strategic use of legal precedent as both a proactive planning tool and a defensive strategy. This includes aligning permit review procedures with judicial rulings on procedural deficiencies, such as inadequate public notice or failure to conduct cumulative impact analyses, and using litigation outcomes to inform policy feedback loops and identify recurring risks or regulatory gaps. Additionally, incorporating legal risk assessments into conservation priority setting is crucial, particularly in contested landscapes such as coastal and agricultural zones. To support these efforts, the PRSWAP also advocates for strengthening legal literacy among conservation organizations, municipal governments, and DNER field staff.

VIII. Gaps, Challenges, and Strategic Legal Opportunities

While Puerto Rico's legal framework for wildlife conservation is among the most comprehensive in the Caribbean, it faces critical gaps in implementation, coordination, scope, and responsiveness to 21st-century ecological realities. The SWAP presents an opportunity to identify these gaps and propose legal and regulatory reforms that will strengthen long-term conservation outcomes.

Table 7. Lists of identified gaps, challenges, and strategic legal opportunities

Legal and Policy Gaps	
Incomplete Coverage of Species and Habitats	•Regulation No. 6766 (Endangered Species) has not been consistently updated to reflect current scientific assessments. •Critical habitat designations are underutilized and unevenly enforced. •Freshwater species and invertebrates remain legally under-protected.
Marine and Coastal Ecosystem Vulnerability	•Marine corridors, coral reefs, and seagrass beds lack formal legal recognition as protected ecological systems. •Enforcement within the maritime-terrestrial zone remains fragmented and inconsistent.
Weak Integration in Land Use Law	•Zoning codes and land classification instruments fail to systematically incorporate biodiversity data or ecological sensitivity analysis. •Habitat fragmentation is legally invisible in many permitting processes.
Absence of Legal Recognition for Ecological Infrastructure	•Wetlands, riparian buffers, and urban green spaces are not defined in law as infrastructure with functional value. •Nature-based solutions are not consistently prioritized in capital investment planning or mitigation requirements.
Implementation and Enforcement Challenges	
Limited Enforcement Capacity	•DNER's Ranger Corps is under-resourced relative to the scale of its enforcement mandate. •Many infractions go uninvestigated, particularly in rural and coastal zones.
Institutional Fragmentation	•Coordination among DNER, Planning Board, OGPe, municipalities, and federal partners lacks formalized protocols or integrated permitting systems. •Jurisdictional overlaps create legal ambiguity in critical areas (e.g., karst aquifers, coastal dunes).
Access and Equity in Legal Processes	•Low-income communities often lack the resources to participate meaningfully in permitting reviews or litigation. •Legal tools such as conservation easements or co-management agreements remain underused and inaccessible to grassroots stakeholders.
Strategic Legal Opportunities	
Legislative Modernization	•Update Regulation No. 6766 to reflect new SGCN assessments and allow proactive habitat protection. •Enact legislation recognizing and funding ecological infrastructure and biodiversity corridors. •Expand the legal toolkit for DNER and municipalities to engage in adaptive land stewardship.
Integrated Land Use and Biodiversity Planning	•Require biodiversity and habitat impact screening for all major land use changes. •Create a unified spatial platform (GIS-based) shared among agencies for decision-making.
Legal Innovation in Climate Resilience	•Recognize forests, reefs, wetlands, and karst systems as climate-critical ecosystems in hazard mitigation law. •Expand legal pathways for climate-just relocation and managed retreat in ecologically sensitive areas.
Community Legal Empowerment	•Institutionalize co-management agreements through simplified procedures and model templates. •Provide technical and legal assistance to communities seeking conservation easements or local ordinance protections.
Judicial and Procedural Reforms	•Explore the establishment of an environmental court docket or technical review panel within the judiciary. •Embed cumulative effects analysis, not just single-project impacts, into environmental review statutes.

To facilitate effective follow-up, the DNER could establish a Gap Resolution Tracker that corresponds with this table. Each item should be classified by the required action (such as regulatory reform, interagency protocol, or judicial ruling), the lead actor responsible, and indicators of progress. This tool should be published alongside mid-term updates.

Alignment with Federal and Global Trends

Puerto Rico's conservation law should align with and leverage major federal and international frameworks, including the Infrastructure Investment and Jobs Act, the Inflation Reduction Act for green infrastructure funding, the Post-2020 Global Biodiversity Framework, and the UN Decade on Ecosystem Restoration. Aligning with these initiatives enhances the legitimacy of local efforts and positions Puerto Rico as a regional leader in biodiversity governance.

IX. Recommendations for Legal Modernization and Policy Reform

To achieve durable, just, and science-informed conservation outcomes, the PRSWAP must be supported by a legal architecture that is adaptive, enforceable, and aligned with ecological and social realities. The following Table 8 outlines recommended legal and policy reforms across five strategic categories: statutory updates, regulatory reforms, integration with planning and development systems, innovation in governance models, and alignment with equity and climate imperatives.

Table 8. Recommended legal and policy reforms

Update and Expand Wildlife and Habitat Protection Laws	
Revise and modernize Regulation No. 6766	•Update the list of endangered, threatened, and vulnerable species using the most recent SGCN data. •Establish clear procedures for critical habitat designation and management. •Ensure consistent alignment with federal ESA protections and ecological risk assessments.
Create enabling legislation for biodiversity corridors	•Formally recognize ecological connectivity as a planning and conservation priority. •Provide DNER with tools to designate and manage habitat corridors at multiple scales (terrestrial, freshwater, and marine).
Legally recognize nature-based solutions and ecological infrastructure	•Amend planning and infrastructure laws to treat forests, reefs, wetlands, and urban green spaces as infrastructure with public safety, health, and economic value.
Strengthen Regulatory Integration in Permitting and Land Use	
Incorporate biodiversity screening into all major land use changes	•Require ecological sensitivity analysis during rezoning, subdivision approval, and large-scale development permitting. •Integrate SGCN data layers into the Permit Management Office's digital platforms.
Mandate cumulative impact analysis in environmental review processes	•Ensure that environmental assessments under Law No. 416 (Environmental Public Policy Act) account for spatial and temporal accumulation of habitat loss.
Develop interagency coordination protocols	•Create formal agreements between DNER, the Planning Board, OGPe, and municipalities for shared ecological data and coordinated permitting processes.
Expand Access to Legal Tools for Community-Based Conservation	
Simplify and promote co-management agreements	•Develop model agreements and guidance for NGOs, academic partners, and community groups to co-steward public lands and marine areas.
Support the legal use of conservation easements and servitudes	•Build technical and legal support systems to facilitate their use by farmers, land cooperatives, and community trusts.
Recognize community monitoring and citizen science in regulatory compliance	•Create pathways for data submitted by local groups to be used in permit compliance, enforcement, and adaptive management.
Reform Enforcement Structures and Judicial Access	
Expand the operational and legal capacity of DNER's Ranger Corps	•Codify funding mechanisms and minimum staffing thresholds. •Provide rangers with updated training in ecological enforcement, GIS tools, and citizen engagement.
Institutionalize an environmental court docket or tribunal	•Assign judges with environmental expertise to review natural resource and permitting disputes. •Create expedited procedures for habitat-impacting violations.

Guarantee environmental legal standing	•Protect and promote the rights of individuals and communities to challenge permits and agency inaction, especially in ecologically vulnerable or underserved areas.
Align with Equity, Resilience, and Climate Justice Goals	
Apply environmental justice criteria in conservation spending	•Prioritize investment in areas historically burdened by environmental degradation or lack of access to green infrastructure.
Recognize climate-critical ecosystems in mitigation and adaptation planning	•Designate mangroves, cloud forests, coral reefs, and karst aquifers as strategic climate adaptation infrastructure in Puerto Rico's Hazard Mitigation Plan and CIP process.
Create a Puerto Rico Wildlife Conservation Trust Fund	
Establish a dedicated, legally protected funding mechanism	•Funded through mitigation offsets, voluntary contributions, fines, and federal matching programs. •Support long-term monitoring, restoration, education, and community-based implementation of PRSWAP actions.

By 2027, DNER could launch a pilot project in one ecological corridor to test co-governance between agency, municipal, and civil society actors. This project would apply relevant legal instruments (Law 150-1988 and Law 133-1975) and develop a replicable protocol.

These legal modernization recommendations are designed to build resilience across institutions, ecosystems, and communities. They reflect a shift from fragmented conservation interventions to a whole-of-government and whole-of-society approach, ensuring that wildlife conservation is legally embedded in Puerto Rico's development trajectory.

CHAPTER 3
SPECIES OF GREATEST CONSERVATION NEED

The New Wildlife Law of Puerto Rico (Law No. 241 of August 15, 1999) and its Regulations (Regulation No. 6765, for the Conservation and Management of Wildlife, Exotic Species and Hunting in the Commonwealth of Puerto Rico, and Regulation No. 6766, to Govern the Threatened and Endangered Species of the Commonwealth of Puerto Rico), are the legal framework empowering DNER to protect Puerto Rico's wildlife resources (DRNA 2004). Selected statutes related to wildlife and forest resources protection in Puerto Rico are listed in Table 9.

Table 9. List of selected statutes.

Statues	Name	Objective
Constitution of the Commonwealth of Puerto Rico, adopted in 1952	Constitution	It establishes as a public policy "the most efficient conservation of natural resources, as well as the best development and use of these for the benefit of the community."
Commonwealth Law No. 23 of 1972, as amended	Organic Law of the Department of Natural Resources	It creates DNER and assigns to it, among several things, the responsibility of establishing programs for the conservation of the PR's natural resources, including forests.
Commonwealth Law No. 133 of 1975, as amended	Puerto Rico Forests Act	It establishes the public policy of the Commonwealth to protect, expand, and conserve the Commonwealth's forest resources. It creates the Commonwealth Forest Service.
Planning Board Regulation No. 25	Planting, Cutting, and Foresting Regulations for Puerto Rico	It requires a DNER permit for cutting and grooming trees on public or private land in Puerto Rico.
Commonwealth Law No. 144 of 1976, as amended	Law for the extraction and excavation of Earth's crust components	It prohibits the issuance of permits for the extraction and excavation of Earth's crust components from natural resources "reserves" (including Commonwealth Forests).
Commonwealth Law No. 136 of 1976 (also known as the "Water Act")	Act for the Conservation, Development, and Use of the Water Resources of Puerto Rico	It assigns to DNER the faculty to plan and rule the use, conservation, and development of water resources in the Commonwealth, including subterranean water.

Statues	Name	Objective
Commonwealth Law No.29 of 1976	Department of Natural and Environmental Resources Rangers Corp Act	It creates DNER Rangers Corp to enforce all the Commonwealth statutes available for the protection of all natural resources (forests included).
Commonwealth Law No. 241 of 1999	New Wildlife Law of Puerto Rico	It authorizes the DNER Secretary to rule all activities related to the wildlife well-being, including its habitats (forests included).
Commonwealth Law No. 182 of 2014	Model Forest Act	To recognize the ecological value of the area, by establishing an umbrella effect on ecosystems and associated diversity of these areas, and the role of citizens in landscape conservation by declaring the Model Forest of Puerto Rico as a priority area for planning and a geographic sustainable development platform to promote criteria for management and conservation.

Species of conservation priorities were initially listed in Regulation No. 6766 (Table 10). This regulation presented an updated list of species with their respective levels of endangerment. This 2025 PRSWAP includes an updated and improved list of species of greatest conservation need (SGCN) using recently available sources of information (e.g., Núñez-García and Hunter 2000, among others; Table 10) and builds upon the 2015 PRSWAP. Some of these species will be recommended for listing under Regulation No. 6766.

The information presented is limited to the species' common and scientific names and priority classification evolution from 2005 to 2025, following the established format of the 2015 PRSWAP. The DNER adapted the following five categories from the International Union for the Conservation of Nature (IUCN) Red List (1994) to classify priority species (Figure 1). See Appendix I for detailed category definitions.

1. Critically Endangered (CR): A critically endangered species faces an extremely high risk of extinction in the wild in the immediate future.
2. Endangered (EN): A species is considered endangered when it is not CR but faces a very high risk of extinction in the wild in the near future.
3. Vulnerable (VU): A species is considered vulnerable when it is not CR or

EN but faces a high risk of extinction in the wild in the foreseeable future.

4. Low Risk (LR): A species is considered low risk when, after an evaluation, it does not satisfy any of the previous categories (CR, EN, or VU) and it is not Data Deficient.
5. Data Deficient (DD): A species falls under this category when there is insufficient information for a direct or indirect assessment of its risk of extinction based on distribution and/or population status. Some aspects of the ecology of a species in this category may be well studied, and its biology might be well known. However, appropriate data about its abundance and distribution may be lacking. Therefore, Data Deficient is not a threat category.

Table 10. Number of species by taxon included in Regulation No. 6766 as SGCN.

Taxon	CR	RN	VU	DD	LR	Total
Amphibians	3	1	4	1	0	**9**
Birds	7	5	5	9	1	**27**
Reptiles	3	6	3	5	0	**17**
Marine Mammals	0	1	1	0	0	**2**
Terrestrial Mammals	0	0	3	2	1	**6**
Freshwater Fish	-	-	-	-	-	**0**
Marine Fish	2	1	1	0	0	**4**
Terrestrial Invertebrates	-	-	-	-	-	**0**
Fresh Water Invertebrates	2	0	1	8	8	**19**
Marine Invertebrates	-	-	-	-	-	**0**
Plants	30	15	3	0	0	**48**
Total	**47**	**29**	**21**	**25**	**10**	**132**

Strategic Role of SGCN in Conservation Planning

In addition to classification, each SGCN acts as a node in a broader ecological and governance framework. The distribution and threat profiles of these species highlight spatial and thematic patterns that are essential for developing place-based strategies. For example:

- The **Puerto Rican Sharp-shinned Hawk** indicates canopy health and upland forest integrity.
- The **Antillean Manatee** embodies estuarine resilience and is emblematic of coastal communities.
- The **Coquí Llanero** highlights conservation needs in karst regions, aligning with habitat-specific management.

These cases illustrate how SGCN can serve as entry points for designing habitat-based corridors, climate adaptation strategies, and stakeholder-led monitoring programs.

Species and Actions for Prioritization

Conservation actions and funding are prioritized based on the taxon's level of endangerment. Critically endangered species are given the highest conservation priority, followed by endangered, vulnerable, and low-risk species (Figure 1). Data-Deficient (DD) species are significant because they may fall into any of the previous categories after further evaluation. Interestingly, many DD species are considered non-game.

However, DNER remains highly concerned about DD species, which make up most of the SGCN list (Table 11). The main challenge in implementing more comprehensive conservation efforts and gathering information on non-game species is limited funding and a shortage of personnel to determine basic population data and threats. Therefore, DNER aims to promote and support research on this group. While academia and some NGOs have made partial progress in addressing this knowledge gap, more collaborative efforts are needed to fully understand Puerto Rico's SGCN.

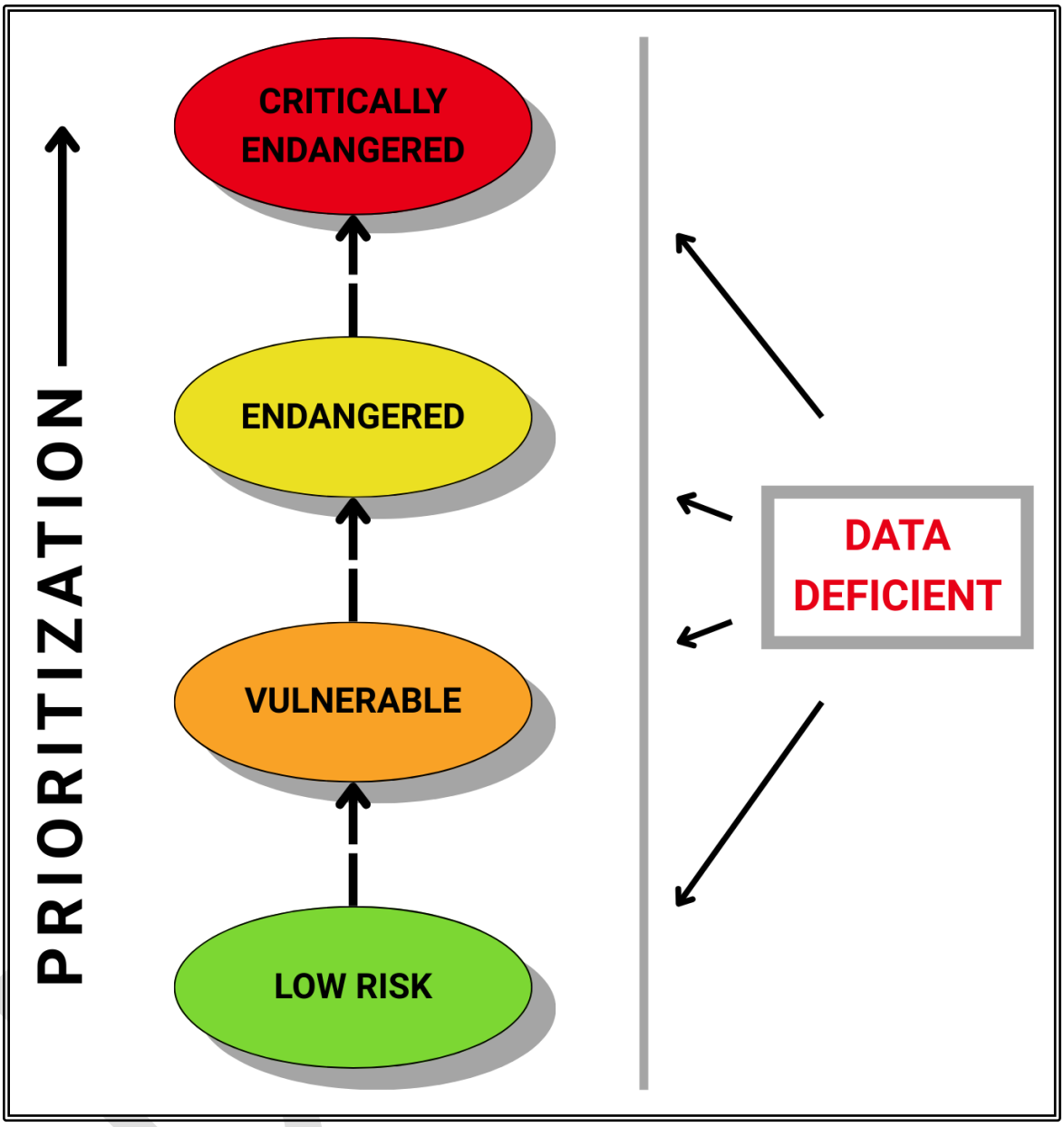


Figure 1. Scheme of species and actions of conservation prioritization.

Table 11. Number of species included in the 2025 PRSWAP as SGCN.

Taxon	CR	EN	VU	DD	LR	Total
Amphibians	2	0	4	6	0	**12**
Birds	6	8	14	30	4	**62**
Reptiles	1	6	4	13	0	**24**
Marine Mammals	0	1	1	18	0	**20**
Terrestrial Mammals	0	1	5	4	3	**13**
Freshwater Fish	0	0	0	3	6	**9**
Saltwater Fish	1	6	22	54	25	**108**
Invertebrates	3	2	9	22	7	**43**
Plants	31	23	5	0	1	**60**
Total	**44**	**47**	**64**	**150**	**46**	**351**

The following list provides information about Species of Greatest Conservation Need in Puerto Rico. It highlights where conservation resources should be directed to protect the territory's wildlife. For more detailed definitions, please refer to Appendix I. Species that are not included in this list are not covered by this State Wildlife Action Plan.

Status and Protection of Species of Greatest Conservation Need

Common Name	Scientific Name	Category		
		2005	2015	2025
Marine Mammals				
Humpback Whale	*Megaptera novaeangliae*	VU	EN	VU
West Indian Manatee	*Trichechus manatus*	EN	EN	EN
Common Bottlenose Dolphin	*Tursiops truncatus*	DD	DD	DD
Atlantic spotted dolphin	*Stenella frontalis*	-	DD	DD
Pygmy killer whale	*Feresa attenuata*	-	-	DD
Short Finned Pilot Whale	*Globicephala macrorhynchus*	-	-	DD
Risso's Dolphin	*Grampus griseus*	-	-	DD
Pigmy sperm whale	*Kogia breviceps*	-	-	DD
Dwarf sperm whale	*Kogia sima*	-	-	DD
Fraser's dolphin	*Lagenodelphis hosei*	-	-	DD
Blainville's beaked whale	*Mesoplodon densirostris*	-	-	DD
Gervai's beaked whale	*Mesoplodon europaeus*	-	-	DD
Killer whale	*Orcinus orca*	-	-	DD
Melon headed whale	*Peponocephala electra*	-	-	DD
Sperm whale	*Physeter macrocephalus*	-	-	DD
False killer whale	*Pseudorca crassidens*	-	-	DD
Striped dolphin	*Stenella coeruloalba*	-	-	DD
Spinner dolphin	*Stenella longirostris*	-	-	DD
Rough toothed dolphin	*Steno bredanensis*	-	-	DD
Cuvier's beaked whale	*Ziphius cavirostris*	-	-	DD
Terrestrial Mammals				
Jamaican Fruit Bat	*Artibeus jamaicensis*	DD	DD	LR
Antillean Fruit-eating Bat	*Brachyphylla cavernarum*	DD	DD	DD

Common Name	Scientific Name	Category		
		2005	2015	2025
Big Brown Bat	*Eptesicus fuscus*	DD	DD	DD
Brown Flower Bat	*Erophylla bombifrons*	VU	VU	VU
Little Red Bat	*Lasiurus minor*	DD	EN	EN
Velvety Free-Tailed Bat	*Molossus molossus*	DD	LR	LR
Greater Antillean Long Tongued Bat	*Monophyllus redmani*	DD	VU	DD
Antillean Ghost-faced Bat	*Mormoops blainvillei*	DD	VU	VU
Greater Bulldog Bat, Fisherman Bat	*Noctilio leporinus*	DD	DD	DD
Puerto Rican Common Mustached Bat	*Pteronotus portoricensis*	DD	VU	VU
Sooty Mustached Bat	*Pteronotus quadridens*	DD	VU	VU
Red Fruit Bat	*Stenoderma rufum*	VU	VU	VU
Brazilian Free Tailed Bat	*Tadarida brasiliensis*	LR	LR	LR
Birds				
Puerto Rican Sharp-shinned Hawk	*Accipiter striatus venator*	CR	CR	CR
Yellow-shouldered Blackbird	*Agelaius xanthomus*	EN	EN	EN
Puerto Rican Parrot	*Amazona vittata vittata*	CR	CR	CR
Grasshopper Sparrow	*Ammodramus savannarum*	DD	VU	DD
Snowy Plover	*Anarhynchus nivosus*	CR	CR	CR
Wilson's Plover	*Anarhynchus wilsonia*	CR	VU	VU
White-cheeked Pintail	*Anas bahamensis*	VU	VU	VU
Brown Noddy	*Anous stolidus*	DD	DD	DD
Puerto Rican Nightjar	*Antrostomus noctitherus*	EN	EN	EN
Limpkin	*Aramus guarauna*	CR	DD	DD
Broad-winged Hawk	*Buteo platypterus brunnescens*	CR	CR	CR
Piping plover	*Charadrius melodus*	CR	DD	DD
Yellow-billed Cuckoo	*Coccyzus americanus*	DD	DD	DD

Common Name	Scientific Name	Category		
		2005	2015	2025
Puerto Rican Lizard-Cuckoo	*Coccyzus vieilloti*	DD	LR	DD
Black Swift	*Cypseloides niger*	DD	VU	DD
West Indian Whistling-Duck	*Dendrocygna arborea*	CR	CR	CR
Caribbean Coot	*Fulica americana*	VU	VU	VU
Key West Quail-Dove	*Geotrygon chrysia*	DD	DD	DD
Ruddy Quail-Dove	*Geotrygon montana*	DD	DD	DD
Bridled Quail-Dove	*Geotrygon mystacea*	DD	DD	DD
American Oystercatcher	*Haematopus palliatus*	LR	VU	VU
Yellow-breasted Crake	*Hapalocrex flaviventer*	DD	VU	DD
Puerto Rican Oriole	*Icterus portoricensis*	DD	DD	VU
Least Bittern	*Ixobrychus exilis*	DD	DD	DD
Puerto Rican Woodpecker	*Melanerpes portoricensis*	DD	LR	LR
Puerto Rican Bullfinch	*Melopyrrha portoricensis*	DD	LR	LR
Puerto Rican Tanager	*Nesospingus speculiferus*	DD	DD	DD
Masked Duck	*Nomonyx dominicus*	EN	EN	EN
Ruddy Duck	*Oxyura jamaicensis*	VU	VU	VU
Puerto Rican plain Pigeon	*Patagioenas inornata wetmorei*	EN	EN	CR
White-crowned Pigeon	*Patagioenas leucocephala*	DD	VU	VU
Brown Pelican	*Pelecanus occidentalis*	EN	EN	EN
Cave Swallow	*Petrochelidon fulva*	DD	DD	DD
Red-billed Tropicbird	*Phaethon aethereus*	DD	EN	EN
White-tailed Tropicbird	*Phaethon lepturus*	DD	EN	EN
Pied-billed Grebe	*Podilymbus podiceps*	DD	DD	DD
Audubon’s Shearwater	*Puffinus iherminieri*	CR	VU	VU
Adelaide’s Warbler	*Setophaga adelaidae*	DD	LR	LR
Elfin-Woods warbler	*Setophaga angelae*	VU	EN	EN

Common Name	Scientific Name	Category		
		2005	2015	2025
Prairie Warbler	*Setophaga discolor*	DD	DD	DD
Yellow warbler	*Setophaga petechia*	VU	VU	VU
Puerto Rican Spindalis	*Spindalis portoricensis*	DD	LR	LR
Least Tern	*Sterna antillarum, now Sternula antilllarum*	DD	VU	VU
Caribbean Roseate Tern	*Sterna dougallii*	VU	VU	VU
Least Grebe	*Tachybaptus dominicus*	DD	DD	DD
Black-whiskered Vireo	*Vireo altiloquus*	DD	DD	DD
Puerto Rican Vireo	*Vireo latimeri*	VU	VU	VU
Canada Warbler	*Cardellina canadensis*	-	DD	DD
Bicknell's Thrush	*Catharus bicknelli*	-	DD	DD
Antillean Nighthawk	*Chordeiles gundlachii*	-	DD	DD
White Ibis	*Eudocimus albus*	-	VU	VU
Magnificent Frigatebird	*Fregata magnificens*	-	VU	VU
Worm-eating Warbler	*Helmitheros vermivorum*	-	DD	DD
Swainson's Warbler	*Limnothlypis swainsonii*	-	DD	DD
Glossy Ibis	*Plegadis falcinellus*	-	DD	DD
American Golden Plover	*Pluvialis dominica*	-	DD	DD
Caribbean Martin	*Progne dominicensis*	-	DD	DD
Prothonotary Warbler	*Protonotaria citrea*	-	DD	DD
Bay-breasted Warbler	*Setophaga castanea*	-	DD	DD
Golden-winged Warbler	*Vermivora chrysoptera*	-	DD	DD
Blue-winged Warbler	*Vermivora cyanoptera*	-	DD	DD
Black capped petrel	*Pterodroma hasitata*	-	-	EN
Reptiles				
Cook's Anole	*Anolis cooki*	DD	EN	EN

Common Name	Scientific Name	Category		
		2005	2015	2025
Puerto Rican Twig Anole, Pygmy Anole	*Anolis occultus*	DD	DD	DD
Ponce Anole	*Anolis poncensis*	VU	VU	VU
Grant's Blindsnake	*Antillotyphlops granti*	DD	DD	DD
Puerto Rican Coastal Blindsnake	*Antillotyphlops hypomethes*	DD	DD	DD
Puerto Rican White-tailed Blindsnake	*Antillotyphlops platycephalus*	DD	DD	DD
Green Sea Turtle	*Chelonia mydas*	EN	EN	EN
Virgin Island Tree Boa	*Chilabothrus granti*	CR	CR	CR
Puerto Rican Boa	*Chilabothrus inornatus*	VU	VU	VU
Mona Island Boa	*Chilabothrus monensis*	EN	VU	EN
Mona Island Iguana	*Cyclura stejnegeri*	EN	EN	EN
Leatherback Sea Turtle	*Dermochelys coriacea*	EN	EN	EN
Hawksbill Sea Turtle	*Eretmochelys imbricata*	EN	EN	EN
Puerto Rican Blue-tailed Ameiva	*Pholidoscelis wetmorei*	DD	DD	DD
Pandura’s Gecko	*Sphaerodactylus gaigeae*	DD	DD	DD
Desecheo Island Gecko	*Sphaerodactylus levinsi*	DD	DD	DD
Puerto Rican Skink	*Spondylurus nitidus*	VU	VU	VU
Puerto Rican Slider	*Trachemys stejnegeri*	DD	DD	DD
Puerto Rican Brown-bellied Blindsnake	*Typhlops rostellatus*	DD	DD	DD
Puerto Rican Giant Anole	*Anolis cuvieri*	-	DD	DD
Puerto Rican Galliwasp	*Diploglossus pleei*	-	DD	DD
Mona skink	*Spondylurus monae*	-	-	DD
Monito skink	*Spondylurus monitae*	-	-	DD
Culebra Island Skink	*Spondylurus culebrae*	-	-	VU
Amphibians				
Grass Coqui	*Eleutherodactylus brittoni*	DD	DD	DD

Common Name	Scientific Name	Category		
		2005	2015	2025
Cave Coqui	*Eleutherodactylus cooki*	VU	VU	VU
Cricket Coqui	*Eleutherodactylus gryllus*	DD	DD	DD
Hedrick's Coqui	*Eleutherodactylus hedricki*	DD	DD	DD
Plain Coqui	*Eleutherodactylus juanariveroi*	CR	CR	CR
Warty Coqui	*Eleutherodactylus locustus*	VU	VU	VU
Mona Island Coqui	*Eleutherodactylus monensis*	DD	DD	DD
Puerto Rican Mountain Coqui/Forest Coqui	*Eleutherodactylus portoricensis*	VU	VU	VU
Richmond's Coqui	*Eleutherodactylus richmondi*	VU	VU	VU
Burrowing Coqui	*Eleutherodactylus unicolor*	DD	DD	DD
Wrinkled Frog	*Eleutherodactylus wightmanae*	DD	DD	DD
Puerto Rican Crested Toad	*Peltophryne lemur*	CR	CR + EN	CR
Freshwater Fishes				
American Eel	*Anguilla rostrata*	DD	LR	LR
River Goby	*Awaous banana*	DD	LR	LR
Mountain Mullet	*Dajaus monticola*	DD	LR	LR
Fat Sleeper Snook	*Dormitator maculatus*	DD	DD	DD
Bigmouth Sleeper	*Gobiomorus dormitor*	DD	LR	LR
Short-tail River Pipefish Short-tailed pipefish	*Microphis brachyurus*	DD	DD	DD
Burro grunt	*Rhonciscus crocro*	DD	DD	DD
Spotted Algae Eating Gobby	*Sicydium punctatum*	DD	LR	LR
Sirajo Goby	*Sicydium plumieri*	-	LR	LR
Saltwater Fishes				
Nurse Shark	*Ginglymostoma cirratum*	VU	VU	VU
Lined seahorse	*Hippocampus erectus*	VU	VU	VU
Longsnout seahorse	*Hippocampus reidi*	VU	VU	VU

Common Name	Scientific Name	Category		
		2005	2015	2025
Nassau Grouper	*Epinephelus striatus*	EN	EN	EN
Mexican Snook to Largescale fat snook	*Centropomus mexicanus*	DD	DD	DD
Tarpon Snook	*Centropomus pectinatus*	DD	DD	DD
Tarpon	*Megalops atlanticus*	DD	DD	DD
Yellow Goatfish	*Mulloidichthys martinicus*	DD	DD	DD
Spotted Goatfish	*Pseudupeneus maculatus*	DD	DD	DD
Goliath Grouper	*Epinephelus itajara*	CR	CR	CR
Spotted Eagle Ray	*Aetobatus narinari*	-	DD	DD
Bonefish	*Albula vulpes*	-	DD	DD
Jolthead Porgy	*Calamus bajonado*	-	DD	DD
Blue Runner	*Caranx crysos*	-	DD	DD
Crevalle Jack	*Caranx hippos*	-	DD	DD
Horse Eye Jack	*Caranx latus*	-	DD	DD
Caribbean Reef Shark	*Carcharhinus perezii*	-	DD	DD
Common Snook	*Centropomus undecimalis*	-	DD	DD
Coney	*Cephalopholis fulva*	-	DD	DD
Barred Grunt	*Conodon nobilis*	-	DD	DD
Rock Hind	*Epinephelus adscensionis*	-	DD	DD
Tiger Shark	*Galeocerdo cuvier*	-	DD	DD
Black Grunt	*Haemulon bonariense*	-	DD	LR
Smallmouth Grunt	*Haemulon chrysargyreum*	-	DD	LR
White Grunt	*Haemulon plumierii*	-	DD	DD
Hogfish	*Lachnolaimus maximus*	-	DD	DD
Mutton snapper	*Lutjanus analis*	-	DD	DD
Cubera Snapper	*Lutjanus cyanopterus*	-	DD	DD
Gray Snapper	*Lutjanus griseus*	-	DD	DD

Common Name	Scientific Name	Category		
		2005	2015	2025
Dog Snapper	*Lutjanus jocu*	-	DD	DD
Caribbean Red Snapper	*Lutjanus purpureus*	-	EN	EN
Lane Snapper	*Lutjanus synagris*	-	DD	DD
Silk Snapper	*Lutjanus vivanus*	-	DD	DD
Black Grouper	*Mycteroperca bonaci*	-	EN	EN
Lemon Shark	*Negaprion brevirostris*	-	DD	DD
Reef Croaker	*Odontoscion dentex*	-	DD	DD
Smalltooth Sawfish	*Pristis pectinata*	-	EN	EN
Vermillion Snapper	*Rhomboplites aurorubens*	-	DD	DD
Princess Parrotfish	*Scarus taeniopterus*	-	DD	DD
Queen Parrotfish	*Scarus vetula*	-	DD	DD
Greater Amberjack	*Seriola dumerili*	-	DD	DD
Redtail Parrotfish	*Sparisoma chrysopterum*	-	DD	DD
Stoplight Parrotfish	*Sparisoma viride*	-	DD	DD
Scalloped hammerhead shark	*Sphyrna lewini*	-	EN	EN
Permit	*Trachinotus falcatus*	-	DD	DD
Palometa	*Trachinotus goodei*	-	DD	DD
Cutlass fish	*Trichiurus lepturus*	-	DD	DD
Doctorfish	*Acanthurus chirurgus*	-	-	LR
Blue Tang	*Acanthurus coeruleus*	-	-	LR
Northern Ocean Surgeonfish	*Acanthurus tractus*	-	-	LR
Blue Chromis	*Azurina cyanea*	-	-	LR
Brown Chromis	*Azurina multilineata*	-	-	LR
Gray Triggerfish	*Balistes capriscus*	-	-	VU
Silky shark	*Carcharhinus falciformis*	-	-	DD
Bull shark	*Carcharhinus leucas*	-	-	DD

Common Name	Scientific Name	Category		
		2005	2015	2025
Backtip shark	*Carcharhinus limbatus*	-	-	DD
Oceanic whitetip shark	*Carcharhinus longimanus*	-	-	DD
Dusky shark	*Carcharhinus obscurus*	-	-	DD
Sandbar shark	*Carcharhinus plumbeus*	-	-	DD
Gulper shark	*Centrophorus granulosus*	-	-	DD
Cherubfish	*Centropyge argi*	-	-	LR
Basking shark	*Cetorhinus maximus*	-	-	DD
Foureye Butterflyfish	*Chaetodon capistratus*	-	-	LR
Spotfin Butterflyfish	*Chaetodon ocellatus*	-	-	LR
Reef Butterflyfish	*Chaetodon sedentarius*	-	-	LR
Banded Butterflyfish	*Chaetodon striatus*	-	-	LR
Purple Chromis/Reeffish	*Chromis scotti*	-	-	LR
Barfin Goby / Barfin-Sand Goby	*Coryphopterus alloides*	-	-	VU
Pallid Goby / Pallid-Sand Goby	*Coryphopterus eidolon*	-	-	VU
Glass Goby / Glass-Sand Goby	*Coryphopterus hyalinus*	-	-	VU
Peppermint Goby	*Coryphopterus lipernes*	-	-	VU
Masked Goby / Masked-Sand Goby	*Coryphopterus personatus*	-	-	VU
Bartail Goby / Bartail-Sand Goby	*Coryphopterus thrix*	-	-	VU
Sand Goby	*Coryphopterus tortugae*	-	-	VU
Venezuela Goby	*Coryphopterus venezuelae*	-	-	VU
Broadstripe Goby	*Elacatinus prochilos*	-	-	VU
Red Grouper	*Epinephelus morio*	-	-	DD
Yellowcheek Basslet	*Gramma linki*	-	-	LR
Fairy Basslet / Royal Gramma	*Gramma loreto*	-	-	LR
Blackcap Basslet	*Gramma melacara*	-	-	LR
Blue Angelfish	*Holacanthus bermudensis*	-	-	VU

Common Name	Scientific Name	Category		
		2005	2015	2025
Queen Angelfish	*Holacanthus ciliaris*	-	-	VU
Rock Beauty	*Holacanthus tricolor*	-	-	LR
Yellowedge Grouper	*Hyporthodus flavolimbatus*	-	-	LR
Snowy Grouper	*Hyporthodus niveatus*	-	-	LR
Shortfin Mako	*Isurus paucus*	-	-	VU
White Marlin	*Kajikia albida*	-	-	VU
Candy Basslet	*Liopropoma carmabi*	-	-	LR
Cave Basslet	*Liopropoma mowbrayi*	-	-	LR
Peppermint Basslet	*Liopropoma rubre*	-	-	LR
Cubera Snapper	*Lutjanus cyanopterus*	-	-	VU
Blue Marlin	*Makaira nigricans*	-	-	VU
Giant manta ray	*Mobula birostris*	-	-	DD
Ocean Sunfish / Mola Mola	*Mola mola*	-	-	VU
Dusky Smooth-hound	*Mustelus canis*	-	-	DD
Yellowmouth Grouper	*Mycteroperca interstitiali*	-	-	VU
Gray Angelfish	*Pomacanthus arcuatus*	-	-	LR
French Angelfish	*Pomacanthus paru*	-	-	LR
Blue shark	*Prionace glauca*	-	-	DD
Longsnout Butterflyfish	*Prognathodes aculeatus*	-	-	LR
Whale shark	*Rhincodon typus*	-	-	DD
Midnight Parrotfish	*Scarus coelestinus*	-	-	DD
Blue Parrotfish	*Scarus coeruleus*	-	-	DD
Rainbow Parrotfish	*Scarus guacamaia*	-	-	DD
Great Hammerhead	*Sphyrna mokarran*	-	-	DD
Smooth Hammerhead	*Sphyrna zygaena*	-	-	DD
Bigeye Tuna	*Thunnus obesus*	-	-	VU

Common Name	Scientific Name	Category		
		2005	2015	2025
Bluefin Tuna	*Thunnus thynnus*	-	-	EN
Invertebrates				
Fresh Water Cave Shrimp	*Alloweckellia gurnee*	CR	CR	CR
Mangrove Tree Crab	*Aratus pisonii*	DD	DD	DD
Puerto Rican Harlequin Butterfly	*Atlantea tulita*	CR	CR	CR
Magnificent Feather Duster	*Bispirina brunnea*	DD	DD	DD
Blue Land Crab	*Cardisoma guanhumi*	LR	LR	LR
West Indian Topshell	*Cittarium pica*	DD	VU	VU
Puerto Rican Freshwater Crab	*Epilobocera sinuatifrons*	LR	DD	DD
Blackback Land crab	*Gecarcinus lateralis*	DD	DD	DD
Land Crab	*Gecarcinus ruricola*	LR	LR	DD
Mangrove Root Crab	*Goniopsis cruentata*	LR	LR	LR
Cinnamon River Shrimp	*Macrobrachium acanthurus*	DD	DD	DD
Bigclaw River Shrimp	*Macrobrachium carcinus*	LR	VU	LR
Big-Claw River Shrimp	*Macrobrachium crenulatum*	LR	DD	DD
Cascade River Prawn	*Macrobrachium heterochirus*	DD	LR	LR
Octopus	*Octopus spp*	DD	DD	DD
Smoothtail Spiny Lobster	*Panulirus laevicauda*	VU	DD	DD
Magnificent Feather Duster	*Sabellastarte magnifica*	DD	DD	DD
Mona’s Cave Shrimp	*Typhlatya monae*	CR	CR	CR
Thin-Fingered Fiddler Crab	*Uca leptodactyla*	DD	DD	DD
Greater Fiddler Crab	*Uca major*	DD	DD	LR
Mangrove Fiddler Crab	*Uca thayeri*	DD	DD	DD
Hairback Fiddler Crab	*Uca vocator*	DD	DD	DD
Swamp Ghost Crab	*Ucides cordatus*	LR	LR	LR

Common Name	Scientific Name	Category		
		2005	2015	2025
Staghorn Coral	*Acropora cervicornis*	-	VU	VU
Elkhorn Coral	*Acropora palmata*	-	VU	VU
West Indian Sea Cucumber	*Actinopyga agassizii*	-	DD	DD
Vieques Sweat Bee	*Agapostemon viequesensis*	-	DD	DD
Lamarck's sheet coral	*Agaricia lamarcki*	-	EN	EN
Queen conch	*Aliger gigas*	-	LR	VU
Furry Sea Cucumber	*Astichopus multifidus*	-	DD	DD
Cuckoo Bee	*Brachymelecta tibialis*	-	DD	DD
Small Carpenter Bee	*Ceratina guarnacciana*	-	DD	LR
Sharp-Tailed Bee	*Coelioxys spinosus*	-	DD	DD
Pillar Coral	*Dendrogyra cylindrus*	-	VU	EN
Long Spined Sea Urchin	*Diadema antillarum*	-	DD	DD
Three-Rowed Sea Cucumber	*Isostichopus badionotus*	-	VU	VU
Caribbean Longarm Shrimp	*Macrobrachium faustinum*	-	DD	DD
Long-Horned Bee	*Melissodes trifasciatus*	-	DD	DD
Rough Cactus Coral	*Mycetophyllia ferox*	-	VU	VU
Krug's Nomad Bee	*Nomada krugii*	-	DD	DD
Lobed Star Coral	*Orbicella annularis*	-	VU	VU
Mountainous Star Coral	*Orbicella faveolata*	-	VU	VU
Boulder Star Coral	*Orbicella franksi*	-	VU	VU
Plants				
Elfin Tree Fern	*Alsophila dryopteroides*	-	EN	EN
Cordillera Maiden Fern	*Amauropelta inabonensis*	-	CR	CR
Chase's threeawn	*Aristida chaseae*	-	EN	EN
Pelos del Diablo	*Aristida portoricensis*	-	EN	EN

Common Name	Scientific Name	Category		
		2005	2015	2025
Turtlefat	*Auerodendron pauciflorum*	-	CR	CR
Palo de Ramón	*Banara vanderbiltii*	-	CR	CR
Thicketwood	*Bonellia pauciflora*	-	CR	CR
Vahl’s Boxwood	*Buxus vahlii*	-	EN	EN
Capa Rosa	*Callicarpa ampla*	-	CR	CR
Puerto Rico Mountainbay	*Calyptranthes acevedoi*	-	EN	EN
Palma Manaca	*Calyptronoma rivalis*	-	EN	EN
Tropical Lilythorn	*Catesbaea melanocarpa*	-	CR	CR
Jamaican broom	*Chamaecrista glandulosa var. mirabilis*	-	CR	CR
Limestone Thoroughwort	*Chromolaena borinquensis*	-	EN	EN
Palo de Nigua	*Cornutia obovata*	-	CR	CR
Puerto Rico Helmet Orchid	*Cranichis ricartii*	-	CR	CR
Calabash tree	*Crescentia portoricensis*	-	CR	CR
Heller's cieneguillo	*Daphnopsis helleriana*	-	EN	EN
Serpent Tongue Fern	*Elaphoglossum serpens*	-	CR	CR
Fajardo's Big Guava	*Eugenia fajardensis*	-	CR	CR
Luquillo Mountain stopper	*Eugenia haematocarpa*	-	EN	EN
Woodbury's stopper	*Eugenia woodburyana*	-	EN	VU
Puerto Rican Gaussia Palm	*Gaussia attenuata*	-	EN	EN
Yerba Maricao de Cueva	*Gesneria pauciflora*	-	VU	VU
Beautiful goetzea	*Goetzea elegans*	-	EN	EN
Barrio Charcas Maiden Fern	*Goniopteris verecunda*	-	CR	CR
Puerto Rico Maiden Fern	*Goniopteris yaucoensis*	-	CR	CR
Island Brittleleaf	*Gonocalyx concolor*	-	CR	CR
Higo Chumbo	*Harrisia portoricensis*	-	EN	EN
Cook’s Holly	*Ilex cookii*	-	CR	CR

Common Name	Scientific Name	Category		
		2005	2015	2025
Sintenis' holly	*Ilex obcordata*	-	EN	EN
West Indian Walnut	*Juglans jamaicensis*	-	CR	CR
Luquillo Mountain Babyboot Orchid	*Lepanthes eltoroensis*	-	VU	LR
Proctor's ironweed	*Lepidaploa proctorii*	-	CR	CR
Culebra shrub cacti	*Leptocereus grantianus*	-	CR	CR
Cobana Negra.	*Libidibia monosperma*	-	CR	CR
Proctor's Staggerbush	*Lyonia truncata var. proctorii*	-	CR	CR
Maxwell's Girdlepod	*Mitracarpus maxwelliae*	-	EN	EN
Cana Gorda Girdlepod	*Mitracarpus polycladus*	-	EN	VU
Las Cuevas Mountainbay	*Myrcia estremerae*	-	EN	EN
Palo de Rosa	*Ottoschulzia rhodoxylon*	-	CR	VU
Wheeler's peperomia	*Peperomia wheeleri*	-	EN	EN
Ausú	*Pimenta paganii*	-	CR	CR
Chupacallos	*Pleodendron macranthum*	-	CR	CR
Monte Guilarte Holly Fern	*Polystichum calderonense*	-	CR	CR
Florida Cherry Palm	*Pseudophoenix sargentii*	-	EN	EN
Woodbury's Netvine	*Ruehhsia woodburyana*	-	EN	EN
Puerto Rican Hat Palm	*Sabal causiarum*	-	EN	EN
Araña	*Schoepfia arenaria*	-	EN	EN
Erubia	*Solanum ensifolium*	-	EN	EN
Quina	*Stenostomum sintenisii*	-	EN	CR
Palo de Jazmín	*Styrax portoricensis*	-	CR	CR
Puerto Rico Halberd Fern	*Tectaria x estremerana*	-	CR	CR
Palo Colorado	*Ternstroemia luquillensis*	-	CR	CR
El Yunque Colorado	*Ternstroemia subsessilis*	-	CR	CR
Bariaco	*Trichilia triacantha*	-	CR	CR

Common Name	Scientific Name	Category		
		2005	2015	2025
Serpentine Manjack	*Varronia bellonis*	-	EN	EN
Puerto Rico Manjack	*Varronia rupicola*	-	VU	VU
Spiny Logwood	*Xylosma pachyphylla*	-	CR	CR
St. Thomas prickly ash	*Zanthoxylum thomasianum*	-	EN	EN

Analysis of Changes from PRSWAP 2015 to 2025

This version of the PRSWAP uses an analytical approach to examine changes in conservation status between 2015 and 2025. It provides a summary of the changes over the past decade for the SGCN, the general species listed in Table 12, and specific taxa in Table 13. It shows how conservation projects and initiatives have helped maintain or improve species populations. It also highlights cases where species status has declined, identifying areas that may require future conservation efforts. The best way to measure the success of conservation strategies is whether a species' classification improves, indicating a move away from being critically endangered. Additionally, an unchanged classification can also be positive, as it may mean the species has remained stable enough over the decade not to worsen its status.

According to the current SWAP assessment, most species previously classified in the 2015 PRSWAP have kept their conservation status. A total of 12 species had their classifications changed during this update. Among these, six species, mostly from the Plants taxon, showed improvements in their conservation status, reflecting successful conservation efforts or improved understanding of their populations. The remaining six species experienced declines in status, suggesting potential conservation challenges or population declines.

Regarding species classified as data deficient in the 2015 SWAP, the majority remained in this category in this update, highlighting ongoing uncertainties about their population sizes and trends. Only six species have had the DD status updated to a regular classification.

Additionally, the 2025 SWAP has expanded the species list by adding 81 new species, mostly in the Saltwater Fishes and Marine Mammals taxa. However, the assessment also led to the removal of multiple species due to extinction, hybrid status, recovery, or other delisting means.

Table 12. Conservation status change for all SGCN from 2015 to 2025

Species With a Classification in 2015	
Improving	6
Worsening	6
Unchanged	138
Species With Data Deficiency in 2015	
Updated from DD	6
Changed to DD	6
Unchanged from DD	108
New Species Added in 2025	
New classification	81

Table 13. Conservation status change per SGCN taxon from 2015 to 2025

Amphibians	
Worsening	1
Unchanged	5
Unchanged from DD	6
Birds	
Worsening	1
Unchanged	29
Updated from DD	1
Changed to DD	4
Unchanged from DD	26
New classification	1
Freshwater Fishes	
Unchanged	6
Unchanged from DD	3

Invertebrates	
Improving	1
Worsening	2
Unchanged	16
Updated from DD	2
Changed to DD	1
Unchanged from DD	21
Marine Mammals	
Improving	1
Unchanged	1
Unchanged from DD	2
New classification	16
Plants	
Improving	4
Worsening	1
Unchanged	55
Reptiles	
Worsening	1
Unchanged	9
Unchanged from DD	11
New classification	3
Saltwater Fishes	
Unchanged	9
Updated from DD	2
Unchanged from DD	36
New classification	61

Terrestrial Mammals	
Unchanged	3
Unchanged from DD	3
Removed or missing current status	7

Valuing Species Beyond Science

Conservation efforts can be more effective when they align with public interests. Many SGCN have cultural, symbolic, or educational significance:

- The Puerto Rican Parrot serves as a symbol of resilience and recovery.
- The Leatherback Sea Turtle is recognized as an important figure in marine conservation and ecotourism.
- The Puerto Rico harlequin butterfly, though less known, exemplifies the beauty and fragility of Puerto Rican biodiversity.

By acknowledging these values, the PRSWAP has the potential to improve public engagement, strengthen support for policies, and foster interdisciplinary partnerships among educators, artists, local governments, and youth leaders.

CHAPTER 4
INTERNATIONAL CONSIDERATION OF THE SPECIES OF GREATEST CONSERVATION NEED

Puerto Rico occupies a unique biogeographic position at the intersection of the Caribbean and Atlantic regions. This location heightens its ecological significance as a link between continental and insular ecosystems. It also serves as a vital route for migratory species, supports endemic biodiversity, and facilitates ecological shifts in response to ecological pressures.

Among the Puerto Rican SGCN identified in the 2025 PRSWAP, nearly three-quarters are classified as critically endangered, endangered, or vulnerable. Although these species may require targeted conservation measures within the archipelago to support population stability or growth, their conservation status may differ globally.

While local conservation efforts in Puerto Rico are important, considering each species' global status helps assess whether it is at risk of extinction or has been extirpated (locally disappeared). This distinction can help prioritize conservation strategies: species at risk of extinction may require immediate intervention, while extirpated species may be candidates for reintroduction if viable populations exist elsewhere.

Understanding how local SGCN align or diverge from global conservation assessments offers not only technical insights but also creates an opportunity for Puerto Rico to demonstrate leadership in advancing the goals of international initiatives such as the *Post-2020 Global Biodiversity Framework, the Convention on Biological Diversity*, and the *UN Decade on Ecosystem Restoration*. The

PRSWAP thus functions not only as a local compliance tool but also as a mechanism that supports global biodiversity objectives through concrete action.

The information presented includes the species listed in the SGCN, along with their local classifications based on the IUCN Red List, and their global status as reported on the IUCN website (https://www.iucnredlist.org/). Of the 351 species reported, 51 lack classification on the IUCN website, mostly plant and invertebrate species.

Four determinations were created for the international comparison:

- Data Deficient in one or both sources – No comparison can be conducted given data deficiency in the sources.
- Lower global threat category – At the global level, the species is considered less vulnerable than the local assessment.
- Higher global threat category – At the global level, the species is considered more vulnerable than the local assessment.
- Consistent threat category – Both local and global levels are the same.

Table 14. Comparison of local and global conservation status

Determination	Amount
Data Deficient in one or both sources	135
Lower global threat category	59
Higher global threat category	27
Consistent threat category	79

The following Table 15 is a detailed list of the SGCN and their local and global conservation status and comparison:

Table 15. Detailed comparison of local and global conservation categories

Common Name	Scientific Name	2025 PR Status	IUCN Status	Comparison
Grass Coqui	*Eleutherodactylus brittoni*	DD	LR	Data is deficient in one or both sources
Cave Coqui	*Eleutherodactylus cooki*	VU	EN	Higher global threat category
Cricket Coqui	*Eleutherodactylus gryllus*	DD	CR	Data is deficient in one or both sources
Hedrick's Coqui	*Eleutherodactylus hedricki*	DD	EN	Data is deficient in one or both sources
Plain Coqui	*Eleutherodactylus juanariveroi*	CR	CR	Consistent threat category
Warty Coqui	*Eleutherodactylus locustus*	VU	EN	Higher global threat category
Mona Island Coqui	*Eleutherodactylus monensis*	DD	VU	Data is deficient in one or both sources
Puerto Rican Mountain Coqui/Forest Coqui	*Eleutherodactylus portoricensis*	VU	EN	Higher global threat category
Richmond's Coqui	*Eleutherodactylus richmondi*	VU	EN	Higher global threat category
Burrowing Coqui	*Eleutherodactylus unicolor*	DD	CR	Data is deficient in one or both sources
Wrinkled Frog	*Eleutherodactylus wightmanae*	DD	EN	Data is deficient in one or both sources
Puerto Rican Crested Toad	*Peltophryne lemur*	CR	EN	Lower global threat category
Puerto Rican Sharp-shinned Hawk	*Accipiter striatus venator*	CR	EN	Lower global threat category
Yellow-shouldered Blackbird	*Agelaius xanthomus*	EN	EN	Consistent threat category
Puerto Rican Parrot	*Amazona vittata vittata*	CR	CR	Consistent threat category
Grasshopper Sparrow	*Ammodramus savannarum*	DD	LR	Data is deficient in one or both sources
Snowy Plover	*Anarhynchus nivosus*	CR	LR	Lower global threat category
Wilson's Plover	*Anarhynchus wilsonia*	VU	LR	Lower global threat category
White-cheeked Pintail	*Anas bahamensis*	VU	LR	Lower global threat category
Brown Noddy	*Anous stolidus*	DD	LR	Data is deficient in one or both sources
Puerto Rican Nightjar	*Antrostomus noctitherus*	EN	VU	Lower global threat category
Limpkin	*Aramus guarauna*	DD	LR	Data is deficient in one or both sources
Broad-winged Hawk	*Buteo platypterus brunnescens*	CR	EN	Lower global threat category
Canada Warbler	*Cardellina canadensis*	DD	LR	Data is deficient in one or both sources

Common Name	Scientific Name	2025 PR Status	IUCN Status	Comparison
Bicknell's Thrush	*Catharus bicknelli*	DD	VU	Data is deficient in one or both sources
Piping plover	*Charadrius melodus*	DD	LR	Data is deficient in one or both sources
Antillean Nighthawk	*Chordeiles gundlachii*	DD	LR	Data is deficient in one or both sources
Yellow-billed Cuckoo	*Coccyzus americanus*	DD	LR	Data is deficient in one or both sources
Puerto Rican Lizard-Cuckoo	*Coccyzus vieilloti*	DD	LR	Data is deficient in one or both sources
Black Swift	*Cypseloides niger*	DD	VU	Data is deficient in one or both sources
West Indian Whistling-Duck	*Dendrocygna arborea*	CR	LR	Lower global threat category
White Ibis	*Eudocimus albus*	VU	LR	Lower global threat category
Magnificent Frigatebird	*Fregata magnificens*	VU	LR	Lower global threat category
Caribbean Coot	*Fulica americana*	VU	LR	Lower global threat category
Key West Quail-Dove	*Geotrygon chrysia*	DD	LR	Data is deficient in one or both sources
Ruddy Quail-Dove	*Geotrygon montana*	DD	LR	Data is deficient in one or both sources
Bridled Quail-Dove	*Geotrygon mystacea*	DD	LR	Data is deficient in one or both sources
American Oystercatcher	*Haematopus palliatus*	VU	LR	Lower global threat category
Yellow-breasted Crake	*Hapalocrex flaviventer*	DD	LR	Data is deficient in one or both sources
Worm-eating Warbler	*Helmitheros vermivorum*	DD	LR	Data is deficient in one or both sources
Puerto Rican Oriole	*Icterus portoricensis*	VU	LR	Lower global threat category
Least Bittern	*Ixobrychus exilis*	DD	LR	Data is deficient in one or both sources
Swainson's Warbler	*Limnothlypis swainsonii*	DD	LR	Data is deficient in one or both sources
Puerto Rican Woodpecker	*Melanerpes portoricensis*	LR	LR	Consistent threat category
Puerto Rican Bullfinch	*Melopyrrha portoricensis*	LR	VU	Higher global threat category
Puerto Rican Tanager	*Nesospingus speculiferus*	DD	VU	Data is deficient in one or both sources
Masked Duck	*Nomonyx dominicus*	EN	LR	Lower global threat category
Ruddy Duck	*Oxyura jamaicensis*	VU	LR	Lower global threat category
Puerto Rican plain Pigeon	*Patagioenas inornata wetmorei*	CR	LR	Lower global threat category
White-crowned Pigeon	*Patagioenas leucocephala*	VU	LR	Lower global threat category

Common Name	Scientific Name	2025 PR Status	IUCN Status	Comparison
Brown Pelican	*Pelecanus occidentalis*	EN	LR	Lower global threat category
Cave Swallow	*Petrochelidon fulva*	DD	LR	Data is deficient in one or both sources
Red-billed Tropicbird	*Phaethon aethereus*	EN	LR	Lower global threat category
White-tailed Tropicbird	*Phaethon lepturus*	EN	LR	Lower global threat category
Glossy Ibis	*Plegadis falcinellus*	DD	LR	Data is deficient in one or both sources
American Golden Plover	*Pluvialis dominica*	DD	LR	Data is deficient in one or both sources
Pied-billed Grebe	*Podilymbus podiceps*	DD	LR	Data is deficient in one or both sources
Caribbean Martin	*Progne dominicensis*	DD	LR	Data is deficient in one or both sources
Prothonotary Warbler	*Protonotaria citrea*	DD	LR	Data is deficient in one or both sources
Black capped petrel	*Pterodroma hasitata*	EN	EN	Consistent threat category
Audubon's Shearwater	*Puffinus iherminieri*	VU	LR	Lower global threat category
Adelaide's Warbler	*Setophaga adelaidae*	LR	LR	Consistent threat category
Elfin-Woods warbler	*Setophaga angelae*	EN	EN	Consistent threat category
Bay-breasted Warbler	*Setophaga castanea*	DD	LR	Data is deficient in one or both sources
Prairie Warbler	*Setophaga discolor*	DD	LR	Data is deficient in one or both sources
Yellow warbler	*Setophaga petechia*	VU	LR	Lower global threat category
Puerto Rican Spindalis	*Spindalis portoricensis*	LR	LR	Consistent threat category
Least Tern	*Sterna antillarum, now Sternula antillarum*	VU	LR	Lower global threat category
Caribbean Roseate Tern	*Sterna dougallii*	VU	LR	Lower global threat category
Least Grebe	*Tachybaptus dominicus*	DD	LR	Data is deficient in one or both sources
Golden-winged Warbler	*Vermivora chrysoptera*	DD	LR	Data is deficient in one or both sources
Blue-winged Warbler	*Vermivora cyanoptera*	DD	LR	Data is deficient in one or both sources
Black-whiskered Vireo	*Vireo altiloquus*	DD	LR	Data is deficient in one or both sources
Puerto Rican Vireo	*Vireo latimeri*	VU	LR	Lower global threat category
Cook's Anole	*Anolis cooki*	EN	EN	Consistent threat category
Puerto Rican Twig Anole, Pygmy Anole	*Anolis occultus*	DD	LR	Data is deficient in one or both sources

Common Name	Scientific Name	2025 PR Status	IUCN Status	Comparison
Ponce Anole	*Anolis poncensis*	VU	LR	Lower global threat category
Grant's Blindsnake	*Antillotyphlops granti*	DD	EN	Data deficient in one or both sources
Puerto Rican Coastal Blindsnake	*Antillotyphlops hypomethes*	DD	LR	Data deficient in one or both sources
Puerto Rican White-tailed Blindsnake	*Antillotyphlops platycephalus*	DD	LR	Data deficient in one or both sources
Green Sea Turtle	*Chelonia mydas*	EN	EN	Consistent threat category
Virgin Island Tree Boa	*Chilabothrus granti*	CR	EN	Lower global threat category
Puerto Rican Boa	*Chilabothrus inornatus*	VU	LR	Lower global threat category
Mona Island Boa	*Chilabothrus monensis*	EN	LR	Lower global threat category
Mona Island Iguana	*Cyclura stejnegeri*	EN	CR	Higher global threat category
Leatherback Sea Turtle	*Dermochelys coriacea*	EN	VU	Lower global threat category
Hawksbill Sea Turtle	*Eretmochelys imbricata*	EN	CR	Higher global threat category
Puerto Rican Blue-tailed Ameiva	*Pholidoscelis wetmorei*	DD	VU	Data deficient in one or both sources
Pandura's Gecko	*Sphaerodactylus gaigeae*	DD	LR	Data deficient in one or both sources
Desecheo Island Gecko	*Sphaerodactylus levinsi*	DD	LR	Data deficient in one or both sources
Puerto Rican Skink	*Spondylurus nitidus*	VU	EN	Higher global threat category
Puerto Rican Slider	*Trachemys stejnegeri*	DD	LR	Data deficient in one or both sources
Puerto Rican Brown-bellied Blindsnake	*Typhlops rostellatus*	DD	LR	Data deficient in one or both sources
Puerto Rican Giant Anole	*Anolis cuvieri*	DD	LR	Data deficient in one or both sources
Puerto Rican Galliwasp	*Diploglossus pleei*	DD	LR	Data is isdeficient in one or both sources
Mona skink	*Spondylurus monae*	DD	CR	Data is deficient in one or both sources
Monito skink	*Spondylurus monitae*	DD	CR	Data is deficient in one or both sources
Culebra Island Skink	*Spondylurus culebrae*	VU	CR	Higher global threat category
Humpback Whale	*Megaptera novaeangliae*	VU	LR	Lower global threat category
West Indian Manatee	*Trichechus manatus*	EN	VU	Lower global threat category
Common Bottlenose Dolphin	*Tursiops truncatus*	DD	LR	Data is deficient in one or both sources
Atlantic spotted dolphin	*Stenella frontalis*	DD	LR	Data is deficient in one or both sources

Common Name	Scientific Name	2025 PR Status	IUCN Status	Comparison
Pygmy killer whale	*Feresa attenuata*	DD	LR	Data deficient in one or both sources
Short Finned Pilot Whale	*Globicephala macrorhynchus*	DD	LR	Data deficient in one or both sources
Risso's Dolphin	*Grampus griseus*	DD	LR	Data deficient in one or both sources
Pigmy sperm whale	*Kogia breviceps*	DD	LR	Data deficient in one or both sources
Dwarf sperm whale	*Kogia sima*	DD	LR	Data deficient in one or both sources
Fraser's dolphin	*Lagenodelphis hosei*	DD	LR	Data deficient in one or both sources
Blainville's beaked whale	*Mesoplodon densirostris*	DD	LR	Data deficient in one or both sources
Gervai's beaked whale	*Mesoplodon europaeus*	DD	LR	Data deficient in one or both sources
Killer whale	*Orcinus orca*	DD	LR	Data deficient in one or both sources
Melon headed whale	*Peponocephala electra*	DD		Incomplete classification data
Sperm whale	*Physeter macrocephalus*	DD	VU	Data deficient in one or both sources
False killer whale	*Pseudorca crassidens*	DD	LR	Data deficient in one or both sources
Striped dolphin	*Stenella coeruloalba*	DD	LR	Data deficient in one or both sources
Spinner dolphin	*Stenella longirostris*	DD	LR	Data deficient in one or both sources
Rough toothed dolphin	*Steno bredanensis*	DD	LR	Data deficient in one or both sources
Cuvier's beaked whale	*Ziphius cavirostris*	DD	LR	Data deficient in one or both sources
Jamaican Fruit Bat	*Artibeus jamaicensis*	LR	LR	Consistent threat category
Antillean Fruit-eating Bat	*Brachyphylla cavernarum*	DD	LR	Data is deficient in one or both sources
Big Brown Bat	*Eptesicus fuscus*	DD	LR	Data is deficient in one or both sources
Brown Flower Bat	*Erophylla bombifrons*	VU	LR	Lower global threat category
Little Red Bat	*Lasiurus minor*	EN	VU	Lower global threat category
Velvety Free-Tailed Bat	*Molossus molossus*	LR	LR	Consistent threat category
Greater Antillean Long Tongued Bat	*Monophyllus redmani*	DD	LR	Data is deficient in one or both sources
Antillean Ghost-faced Bat	*Mormoops blainvillei*	VU	LR	Lower global threat category
Greater Bulldog Bat, Fisherman Bat	*Noctilio leporinus*	DD	LR	Data is deficient in one or both sources
Puerto Rican Common Mustached Bat	*Pteronotus portoricensis*	VU		Incomplete classification data

Common Name	Scientific Name	2025 PR Status	IUCN Status	Comparison
Sooty Mustached Bat	*Pteronotus quadridens*	VU	LR	Lower global threat category
Red Fruit Bat	*Stenoderma rufum*	VU	LR	Lower global threat category
Brazilian Free Tailed Bat	*Tadarida brasiliensis*	LR	LR	Consistent threat category
American Eel	*Anguilla rostrata*	LR	EN	Higher global threat category
River Goby	*Awaous banana*	LR	LR	Consistent threat category
Mountain Mullet	*Dajaus monticola*	LR	LR	Consistent threat category
Fat Sleeper Snook	*Dormitator maculatus*	DD	LR	Data deficient in one or both sources
Bigmouth Sleeper	*Gobiomorus dormitor*	LR	LR	Consistent threat category
Short-tail River Pipefish Short-tailed pipefish	*Microphis brachyurus*	DD	LR	Data deficient in one or both sources
Burro grunt	*Rhonciscus crocro*	DD	DD	Data deficient in one or both sources
Spotted Algae Eating Gobby	*Sicydium punctatum*	LR	LR	Consistent threat category
Sirajo Goby	*Sicydium plumieri*	LR	DD	Data deficient in one or both sources
Nurse Shark	*Ginglymostoma cirratum*	VU	VU	Consistent threat category
Lined seahorse	*Hippocampus erectus*	VU	VU	Consistent threat category
Longsnout seahorse	*Hippocampus reidi*	VU	LR	Lower global threat category
Nassau Grouper	*Epinephelus striatus*	EN	CR	Higher global threat category
Mexican Snook to Largescale fat snook	*Centropomus mexicanus*	DD	LR	Data is deficient in one or both sources
Tarpon Snook	*Centropomus pectinatus*	DD	LR	Data deficient in one or both sources
Tarpon	*Megalops atlanticus*	DD	VU	Data is deficient in one or both sources
Yellow Goatfish	*Mulloidichthys martinicus*	DD	LR	Data deficient in one or both sources
Spotted Goatfish	*Pseudupeneus maculatus*	DD	LR	Data is deficient in one or both sources
Goliath Grouper	*Epinephelus itajara*	CR	VU	Lower global threat category
Spotted Eagle Ray	*Aetobatus narinari*	DD	EN	Data is deficient in one or both sources
Bonefish	*Albula vulpes*	DD	LR	Data deficient in one or both sources
Jolthead Porgy	*Calamus bajonado*	DD	LR	Data is deficient in one or both sources
Blue Runner	*Caranx crysos*	DD	LR	Data is deficient in one or both sources

Common Name	Scientific Name	2025 PR Status	IUCN Status	Comparison
Crevalle Jack	*Caranx hippos*	DD	LR	Data is deficient in one or both sources
Horse Eye Jack	*Caranx latus*	DD	LR	Data is deficient in one or both sources
Caribbean Reef Shark	*Carcharhinus perezii*	DD	EN	Data is deficient in one or both sources
Common Snook	*Centropomus undecimalis*	DD	LR	Data is deficient in one or both sources
Coney	*Cephalopholis fulva*	DD	LR	Data is deficient in one or both sources
Barred Grunt	*Conodon nobilis*	DD	LR	Data is deficient in one or both sources
Rock Hind	*Epinephelus adscensionis*	DD	LR	Data is deficient in one or both sources
Tiger Shark	*Galeocerdo cuvier*	DD	LR	Data is deficient in one or both sources
Black Grunt	*Haemulon bonariense*	LR	LR	Consistent threat category
Smallmouth Grunt	*Haemulon chrysargyreum*	LR	LR	Consistent threat category
White Grunt	*Haemulon plumierii*	DD	LR	Data is deficient in one or both sources
Hogfish	*Lachnolaimus maximus*	DD	VU	Data is deficient in one or both sources
Mutton snapper	*Lutjanus analis*	DD	LR	Data is deficient in one or both sources
Cubera Snapper	*Lutjanus cyanopterus*	DD	LR	Data is deficient in one or both sources
Gray Snapper	*Lutjanus griseus*	DD	LR	Data is deficient in one or both sources
Dog Snapper	*Lutjanus jocu*	DD	DD	Data is deficient in one or both sources
Caribbean Red Snapper	*Lutjanus purpureus*	EN		Incomplete classification data
Lane Snapper	*Lutjanus synagris*	DD	LR	Data is deficient in one or both sources
Silk Snapper	*Lutjanus vivanus*	DD	LR	Data is deficient in one or both sources
Black Grouper	*Mycteroperca bonaci*	EN	LR	Lower global threat category
Lemon Shark	*Negaprion brevirostris*	DD	VU	Data is deficient in one or both sources
Reef Croaker	*Odontoscion dentex*	DD	LR	Data is deficient in one or both sources
Smalltooth Sawfish	*Pristis pectinata*	EN	CR	Higher global threat category
Vermillion Snapper	*Rhomboplites aurorubens*	DD	VU	Data is deficient in one or both sources
Princess Parrotfish	*Scarus taeniopterus*	DD	LR	Data deficient in one or both sources
Queen Parrotfish	*Scarus vetula*	DD	LR	Data is deficient in one or both sources

Common Name	Scientific Name	2025 PR Status	IUCN Status	Comparison
Greater Amberjack	*Seriola dumerili*	DD	LR	Data is deficient in one or both sources
Redtail Parrotfish	*Sparisoma chrysopterum*	DD	LR	Data is deficient in one or both sources
Stoplight Parrotfish	*Sparisoma viride*	DD	LR	Data is deficient in one or both sources
Scalloped hammerhead shark	*Sphyrna lewini*	EN	CR	Higher global threat category
Permit	*Trachinotus falcatus*	DD	LR	Data is deficient in one or both sources
Palometa	*Trachinotus goodei*	DD	LR	Data is deficient in one or both sources
Cutlass fish	*Trichiurus lepturus*	DD	LR	Data is deficient in one or both sources
Doctorfish	*Acanthurus chirurgus*	LR	LR	Consistent threat category
Blue Tang	*Acanthurus coeruleus*	LR	LR	Consistent threat category
Northern Ocean Surgeonfish	*Acanthurus tractus*	LR	LR	Consistent threat category
Blue Chromis	*Azurina cyanea*	LR	LR	Consistent threat category
Brown Chromis	*Azurina multilineata*	LR	LR	Consistent threat category
Gray Triggerfish	*Balistes capriscus*	VU	LR	Lower global threat category
Silky shark	*Carcharhinus falciformis*	DD	VU	Data is deficient in one or both sources
Bull shark	*Carcharhinus leucas*	DD	VU	Data is deficient in one or both sources
Backtip shark	*Carcharhinus limbatus*	DD	VU	Data is deficient in one or both sources
Oceanic whitetip shark	*Carcharhinus longimanus*	DD	CR	Data is deficient in one or both sources
Dusky shark	*Carcharhinus obscurus*	DD	EN	Data is deficient in one or both sources
Sandbar shark	*Carcharhinus plumbeus*	DD	EN	Data is deficient in one or both sources
Gulper shark	*Centrophorus granulosus*	DD	EN	Data is deficient in one or both sources
Cherubfish	*Centropyge argi*	LR	LR	Consistent threat category
Basking shark	*Cetorhinus maximus*	DD	EN	Data is deficient in one or both sources
Foureye Butterflyfish	*Chaetodon capistratus*	LR	LR	Consistent threat category
Spotfin Butterflyfish	*Chaetodon ocellatus*	LR	LR	Consistent threat category
Reef Butterflyfish	*Chaetodon sedentarius*	LR	LR	Consistent threat category
Banded Butterflyfish	*Chaetodon striatus*	LR	LR	Consistent threat category

Common Name	Scientific Name	2025 PR Status	IUCN Status	Comparison
Purple Chromis/Reeffish	*Chromis scotti*	LR	LR	Consistent threat category
Barfin Goby / Barfin-Sand Goby	*Coryphopterus alloides*	VU	VU	Consistent threat category
Pallid Goby / Pallid-Sand Goby	*Coryphopterus eidolon*	VU	VU	Consistent threat category
Glass Goby / Glass-Sand Goby	*Coryphopterus hyalinus*	VU	VU	Consistent threat category
Peppermint Goby	*Coryphopterus lipernes*	VU	VU	Consistent threat category
Masked Goby / Masked-Sand Goby	*Coryphopterus personatus*	VU	VU	Consistent threat category
Bartail Goby / Bartail-Sand Goby	*Coryphopterus thrix*	VU	VU	Consistent threat category
Sand Goby	*Coryphopterus tortugae*	VU	VU	Consistent threat category
Venezuela Goby	*Coryphopterus venezuelae*	VU	VU	Consistent threat category
Broadstripe Goby	*Elacatinus prochilos*	VU	VU	Consistent threat category
Red Grouper	*Epinephelus morio*	DD	VU	Data is deficient in one or both sources
Yellowcheek Basslet	*Gramma linki*	LR	LR	Consistent threat category
Fairy Basslet / Royal Gramma	*Gramma loreto*	LR	LR	Consistent threat category
Blackcap Basslet	*Gramma melacara*	LR	LR	Consistent threat category
Blue Angelfish	*Holacanthus bermudensis*	VU	LR	Lower global threat category
Queen Angelfish	*Holacanthus ciliaris*	VU	LR	Lower global threat category
Rock Beauty	*Holacanthus tricolor*	LR	LR	Consistent threat category
Yellowedge Grouper	*Hyporthodus flavolimbatus*	LR	VU	Higher global threat category
Snowy Grouper	*Hyporthodus niveatus*	LR	VU	Higher global threat category
Shortfin Mako	*Isurus paucus*	VU	EN	Higher global threat category
White Marlin	*Kajikia albida*	VU	LR	Lower global threat category
Candy Basslet	*Liopropoma carmabi*	LR	LR	Consistent threat category
Cave Basslet	*Liopropoma mowbrayi*	LR	LR	Consistent threat category
Peppermint Basslet	*Liopropoma rubre*	LR	LR	Consistent threat category
Cubera Snapper	*Lutjanus cyanopterus*	VU	LR	Lower global threat category
Blue Marlin	*Makaira nigricans*	VU	VU	Consistent threat category

Common Name	Scientific Name	2025 PR Status	IUCN Status	Comparison
Giant manta ray	*Mobula birostris*	DD	EN	Data is deficient in one or both sources
Ocean Sunfish / Mola Mola	*Mola mola*	VU	VU	Consistent threat category
Dusky Smooth hound	*Mustelus canis*	DD	LR	Data is deficient in one or both sources
Yellowmouth Grouper	*Mycteroperca interstitiali*	VU	VU	Consistent threat category
Gray Angelfish	*Pomacanthus arcuatus*	LR	LR	Consistent threat category
French Angelfish	*Pomacanthus paru*	LR	LR	Consistent threat category
Blue shark	*Prionace glauca*	DD	LR	Data is deficient in one or both sources
Longsnout Butterflyfish	*Prognathodes aculeatus*	LR	LR	Consistent threat category
Whale shark	*Rhincodon typus*	DD	EN	Data is deficient in one or both sources
Midnight Parrotfish	*Scarus coelestinus*	DD	DD	Data is deficient in one or both sources
Blue Parrotfish	*Scarus coeruleus*	DD	LR	Data is deficient in one or both sources
Rainbow Parrotfish	*Scarus guacamaia*	DD	LR	Data is deficient in one or both sources
Great Hammerhead	*Sphyrna mokarran*	DD	CR	Data is deficient in one or both sources
Smooth Hammerhead	*Sphyrna zygaena*	DD	VU	Data is deficient in one or both sources
Bigeye Tuna	*Thunnus obesus*	VU	VU	Consistent threat category
Bluefin Tuna	*Thunnus thynnus*	EN	LR	Lower global threat category
Fresh Water Cave Shrimp	*Alloweckellia gurnee*	CR		Incomplete classification data
Mangrove Tree Crab	*Aratus pisonii*	DD		Incomplete classification data
Puerto Rican Harlequin Butterfly	*Atlantea tulita*	CR		Incomplete classification data
Magnificent Feather Duster	*Bispirina brunnea*	DD		Incomplete classification data
Blue Land Crab	*Cardisoma guanhumi*	LR		Incomplete classification data
West Indian Topshell	*Cittarium pica*	VU		Incomplete classification data
Puerto Rican Freshwater Crab	*Epilobocera sinuatifrons*	DD	LR	Data is deficient in one or both sources
Blackback Land crab	*Gecarcinus lateralis*	DD		Incomplete classification data
Land Crab	*Gecarcinus ruricola*	DD		Incomplete classification data
Mangrove Root Crab	*Goniopsis cruentata*	LR		Incomplete classification data

Common Name	Scientific Name	2025 PR Status	IUCN Status	Comparison
Cinnamon River Shrimp	*Macrobrachium acanthurus*	DD	LR	Data is deficient in one or both sources
Bigclaw River Shrimp	*Macrobrachium carcinus*	LR	LR	Consistent threat category
Big-Claw River Shrimp	*Macrobrachium crenulatum*	DD	LR	Data is deficient in one or both sources
Cascade River Prawn	*Macrobrachium heterochirus*	LR	LR	Consistent threat category
Octopus	*Octopus spp*	DD		Incomplete classification data
Smoothtail Spiny Lobster	*Panulirus laevicauda*	DD	DD	Data is deficient in one or both sources
Magnificent Feather Duster	*Sabellastarte magnifica*	DD		Incomplete classification data
Mona's Cave Shrimp	*Typhlatya monae*	CR	LR	Lower global threat category
Thin-Fingered Fiddler Crab	*Uca leptodactyla*	DD		Incomplete classification data
Greater Fiddler Crab	*Uca major*	LR		Incomplete classification data
Mangrove Fiddler Crab	*Uca thayeri*	DD		Incomplete classification data
Hairback Fiddler Crab	*Uca vocator*	DD		Incomplete classification data
Swamp Ghost Crab	*Ucides cordatus*	LR		Incomplete classification data
Staghorn Coral	*Acropora cervicornis*	VU	CR	Higher global threat category
Elkhorn Coral	*Acropora palmata*	VU	CR	Higher global threat category
West Indian Sea Cucumber	*Actinopyga agassizii*	DD	LR	Data is deficient in one or both sources
Vieques Sweat Bee	*Agapostemon viequesensis*	DD		Incomplete classification data
Lamarck's sheet coral	*Agaricia lamarcki*	EN	CR	Higher global threat category
Queen conch	*Aliger gigas*	VU	CR	Higher global threat category
Furry Sea Cucumber	*Astichopus multifidus*	DD	LR	Data is deficient in one or both sources
Cuckoo Bee	*Brachymelecta tibialis*	DD		Incomplete classification data
Small Carpenter Bee	*Ceratina guarnacciana*	LR		Incomplete classification data
Sharp-Tailed Bee	*Coelioxys spinosus*	DD		Incomplete classification data
Pillar Coral	*Dendrogyra cylindrus*	EN	CR	Higher global threat category
Long Spined Sea Urchin	*Diadema antillarum*	DD		Incomplete classification data
Three-Rowed Sea Cucumber	*Isostichopus badionotus*	VU	LR	Lower global threat category

Common Name	Scientific Name	2025 PR Status	IUCN Status	Comparison
Caribbean Longarm Shrimp	*Macrobrachium faustinum*	DD	LR	Data is deficient in one or both sources
Long-Horned Bee	*Melissodes trifasciatus*	DD		Incomplete classification data
Rough Cactus Coral	*Mycetophyllia ferox*	VU	CR	Higher global threat category
Krug's Nomad Bee	*Nomada krugii*	DD		Incomplete classification data
Lobed Star Coral	*Orbicella annularis*	VU	EN	Higher global threat category
Mountainous Star Coral	*Orbicella faveolata*	VU	EN	Higher global threat category
Boulder Star Coral	*Orbicella franksi*	VU	LR	Lower global threat category
Elfin Tree Fern	*Alsophila dryopteroides*	EN		Incomplete classification data
Cordillera Maiden Fern	*Amauropelta inabonensis*	CR		Incomplete classification data
Chase's threeawn	*Aristida chaseae*	EN		Incomplete classification data
Pelos del Diablo	*Aristida portoricensis*	EN		Incomplete classification data
Turtlefat	*Auerodendron pauciflorum*	CR	CR	Consistent threat category
Palo de Ramón	*Banara vanderbiltii*	CR	CR	Consistent threat category
Thicketwood	*Bonellia pauciflora*	CR		Incomplete classification data
Vahl’s Boxwood	*Buxus vahlii*	EN	EN	Consistent threat category
Capa Rosa	*Callicarpa ampla*	CR	CR	Consistent threat category
Puerto Rico Mountainbay	*Calyptranthes acevedoi*	EN		Incomplete classification data
Palma Manaca	*Calyptronoma rivalis*	EN	LR	Lower global threat category
Tropical Lilythorn	*Catesbaea melanocarpa*	CR		Incomplete classification data
Jamaican broom	*Chamaecrista glandulosa var. mirabilis*	CR		Incomplete classification data
Limestone Thoroughwort	*Chromolaena borinquensis*	EN		Incomplete classification data
Palo de Nigua	*Cornutia obovata*	CR	CR	Consistent threat category
Puerto Rico Helmet Orchid	*Cranichis ricartii*	CR		Incomplete classification data
Calabash tree	*Crescentia portoricensis*	CR	CR	Consistent threat category
Heller's cieneguillo	*Daphnopsis helleriana*	EN	EN	Consistent threat category
Serpent Tongue Fern	*Elaphoglossum serpens*	CR		Incomplete classification data

Common Name	Scientific Name	2025 PR Status	IUCN Status	Comparison
Fajardo's Big Guava	*Eugenia fajardensis*	CR		Incomplete classification data
Luquillo Mountain stopper	*Eugenia haematocarpa*	EN	EN	Consistent threat category
Woodbury's stopper	*Eugenia woodburyana*	VU	VU	Consistent threat category
Puerto Rican Gaussia Palm	*Gaussia attenuata*	EN	VU	Lower global threat category
Yerba Maricao de Cueva	*Gesneria pauciflora*	VU		Incomplete classification data
Beautiful goetzea	*Goetzea elegans*	EN	EN	Consistent threat category
Barrio Charcas Maiden Fern	*Goniopteris verecunda*	CR		Incomplete classification data
Puerto Rico Maiden Fern	*Goniopteris yaucoensis*	CR		Incomplete classification data
Island Brittleleaf	*Gonocalyx concolor*	CR		Incomplete classification data
Higo Chumbo	*Harrisia portoricensis*	EN		Incomplete classification data
Cook’s Holly	*Ilex cookii*	CR	CR	Consistent threat category
Sintenis' holly	*Ilex obcordata*	EN	LR	Lower global threat category
West Indian Walnut	*Juglans jamaicensis*	CR	VU	Lower global threat category
Luquillo Mountain Babyboot Orchid	*Lepanthes eltoroensis*	LR		Incomplete classification data
Proctor's ironweed	*Lepidaploa proctorii*	CR		Incomplete classification data
Culebra shrub cacti	*Leptocereus grantianus*	CR	CR	Consistent threat category
Cobana Negra.	*Libidibia monosperma*	CR	EN	Lower global threat category
Proctor's Staggerbush	*Lyonia truncata var. proctorii*	CR	LR	Lower global threat category
Maxwell's Girdlepod	*Mitracarpus maxwelliae*	EN		Incomplete classification data
Cana Gorda Girdlepod	*Mitracarpus polycladus*	VU	EN	Higher global threat category
Las Cuevas Mountainbay	*Myrcia estremerae*	EN		Incomplete classification data
Palo de Rosa	*Ottoschulzia rhodoxylon*	VU		Incomplete classification data
Wheeler's peperomia	*Peperomia wheeleri*	EN	EN	Consistent threat category
Ausú	*Pimenta paganii*	CR	CR	Consistent threat category
Chupacallos	*Pleodendron macranthum*	CR	CR	Consistent threat category
Monte Guilarte Holly Fern	*Polystichum calderonense*	CR		Incomplete classification data

Common Name	Scientific Name	2025 PR Status	IUCN Status	Comparison
Florida Cherry Palm	*Pseudophoenix sargentii*	EN	VU	Lower global threat category
Woodbury's Netvine	*Ruehhsia woodburyana*	EN		Incomplete classification data
Puerto Rican Hat Palm	*Sabal causiarum*	EN	VU	Lower global threat category
Araña	*Schoepfia arenaria*	EN	EN	Consistent threat category
Erubia	*Solanum ensifolium*	EN	CR	Higher global threat category
Quina	*Stenostomum sintenisii*	CR	VU	Lower global threat category
Palo de Jazmín	*Styrax portoricensis*	CR	CR	Consistent threat category
Puerto Rico Halberd Fern	*Tectaria x estremerana*	CR		Incomplete classification data
Palo Colorado	*Ternstroemia luquillensis*	CR	CR	Consistent threat category
El Yunque Colorado	*Ternstroemia subsessilis*	CR	CR	Consistent threat category
Bariaco	*Trichilia triacantha*	CR	EN	Lower global threat category
Serpentine Manjack	*Varronia bellonis*	EN	EN	Consistent threat category
Puerto Rico Manjack	*Varronia rupicola*	VU	EN	Higher global threat category
Spiny Logwood	*Xylosma pachyphylla*	CR	CR	Consistent threat category
St. Thomas prickly-ash	*Zanthoxylum thomasianum*	EN	EN	Consistent threat category

Strategic International Alignment and Opportunities

The comparative analysis of conservation statuses across local and global scales creates a foundation for aligning Puerto Rico's wildlife conservation agenda with international strategies and funding priorities. The following strategic linkages are recommended:

1. Advance PRSWAP Actions as Contributions to Global Commitments - Puerto Rico can position its habitat restoration and species recovery efforts as contributions to the Global Biodiversity Framework, particularly Target 1 (area-based conservation), Target 4 (species recovery), Target 6 (ecosystem connectivity), and Target 8 (climate resilience). Progress can be reported in partnership with regional multilateral environmental agreements.
2. Pursue International Research and Conservation Partnerships - SGCN with transboundary habitats or migratory patterns offer opportunities for collaborative monitoring with Caribbean and Latin American partners. Data-sharing with the IUCN SSC (Species Survival Commission) and BirdLife International, as well as co-management with regional academic institutions and NGOs, will strengthen these efforts.
3. Leverage Funding Mechanisms - Species with *higher global threat categories* can justify access to biodiversity funds such as the GEF Small Grants Program or the Critical Ecosystem Partnership Fund. Puerto Rico can also lead regional initiatives under the Caribbean Challenge Initiative or UNEP Caribbean Environment Programme, while developing project pipelines eligible for climate-focused funds like the *Green Climate Fund* or *Adaptation Fund*.
4. Communicate Public and Cultural Value Internationally - The conservation of iconic species, such as the Puerto Rican parrot, coquíes, and manatee, should be framed as both ecological and cultural heritage. Bilingual outreach and education materials can foster greater regional awareness and solidarity in conservation.

Relevant Metrics for International Determination of SGCN

As shown in Table 15, some species found in Puerto Rico have a lower conservation status locally yet are more abundant in other parts of the world. Effective international considerations necessitate coordinated assessments, timely data exchange, aligned policy responses, and joint conservation actions when species cross borders or are impacted by global threats. Success metrics should therefore capture how well jurisdictions harmonize threat evaluations, share and use data, establish formal collaboration, and translate international cooperation into measurable improvements in species status.

Table. Strategies and monitoring metrics to track the conservation efforts relating to international considerations of SGCN.

Topic	Strategies	Monitoring Metrics
Alignment of Classification	-Routine cross-referencing of local lists with international databases -Develop criteria to reconcile conflicting statuses	-Number/Classifications of locally designated SGCN that match international red lists -Reduction in discrepancies between local and global threat statuses
Collaboration and Partnerships	-Engage in bilateral/multilateral conservation agreements -Leverage international funding -Promote cooperative management in shared habitats	-Number of formal agreements or memoranda of understanding with international conservation bodies -Participation in multinational conservation initiatives or recovery plans -Joint projects funded or implemented across borders
Data-Sharing and Knowledge Exchange	-Build centralized databases accessible to both local and international partners -Develop open-access data-sharing agreements	-Establishment of standardized data protocols compatible with international systems -Number of species population datasets submitted to or accessed from international databases
Conservation Outcomes	-Implement coordinated monitoring programs -Launch joint habitat restoration initiatives	-Population trends of shared priority species at regional or global scales -Successful reintroductions, habitat protections, or range expansions achieved through cooperation

CHAPTER 5
HABITAT REQUIREMENTS AND INFORMATION NEEDS FOR PRIORITY SPECIES

Most of the information related to the species included on the SGCN list was compiled as part of the revision conducted between 2002 and 2003 of Regulations No. 6765 and 6766. The Bureau of Fisheries and Wildlife staff produced a first draft of this list, which was later revised by the scientific community, the general public, and interested non-governmental organizations. The final product was a comprehensive accomplishment, broader and updated than the USFWS list of threatened and endangered (T/E) species for Puerto Rico.

Research is necessary to understand the natural history of priority species, including their habitat requirements, demographics, activity patterns, and home ranges, in order to develop effective conservation and management plans. DNER has been gathering biological/habitat information and monitoring game species that are currently hunted (e.g., Scaly-naped Pigeon *Patagioenas squamosa*) or have the potential to be hunted (e.g., White-crowned Pigeon *Patagioenas leucocephala*) or are listed as T/E species in Puerto Rico. However, the long-term conservation of Puerto Rico's biological diversity would benefit from a comprehensive, spatially-based database of its wildlife and associated habitats. Several approaches are currently ongoing or completed within DNER or through interagency collaboration.

Forest composition, structure, and function

The Holdridge life zone model is used to facilitate comparisons of ecological information worldwide (Holdridge, L.R., 1967). Life zones are broad bioclimatic units of land that can be further subdivided into associations based on the

combination of soils, vegetation, and microclimates within them. Six Subtropical Holdridge Life Zones are present in Puerto Rico (Figure 2) (Ewell and Whitmore 1973). At 62%, the Subtropical moist forest life zone contains the most land in mainland Puerto Rico. (Brandeis et. al. 2007). The Lower montane wet forest and Lower montane rain forest zones combined account for only slightly more than 1% of land cover. The land area in the dry forest zone is approximately 14%, while the combined wet forest and rain forest zones account for around 23% of the land cover.

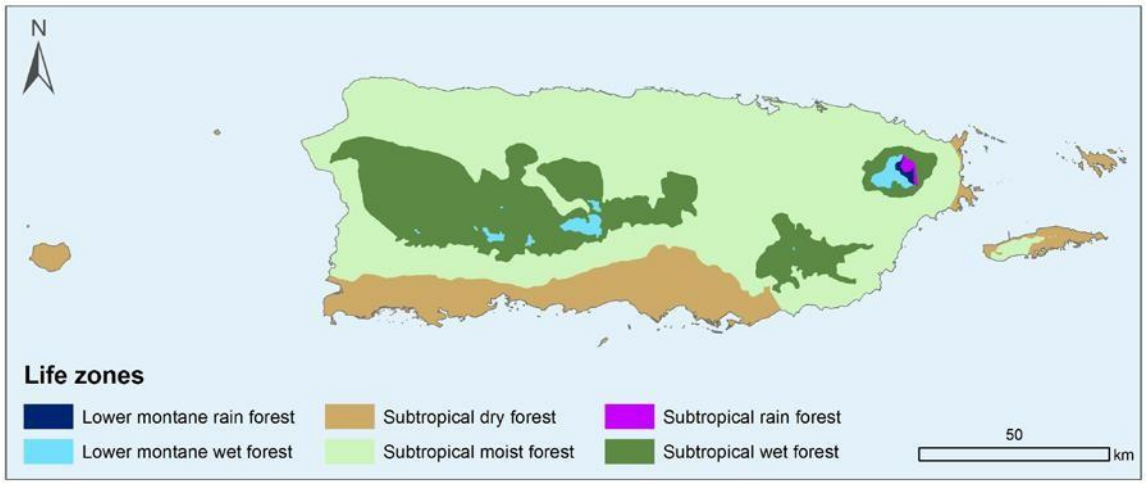


Figure 2. Land distribution among mainland P.R.'s Subtropical Forest life zones (Brandeis 2007).

Figure 3 depicts the proportion of each life zone in forest cover as of 2003 (Brandeis et al. 2007). The Lower Montane Wet and Rain Forest group has the highest percentage of forest cover, but, as indicated in Figure 3 below, it has the second-smallest land area, slightly larger than that of mangroves. The moist and dry forest zones together account for over two-thirds of Puerto Rico's land area, but each has less than 50% forest cover. Information on forest cover in each subtropical life zone has not been updated since 2003, so changes may have occurred since then.

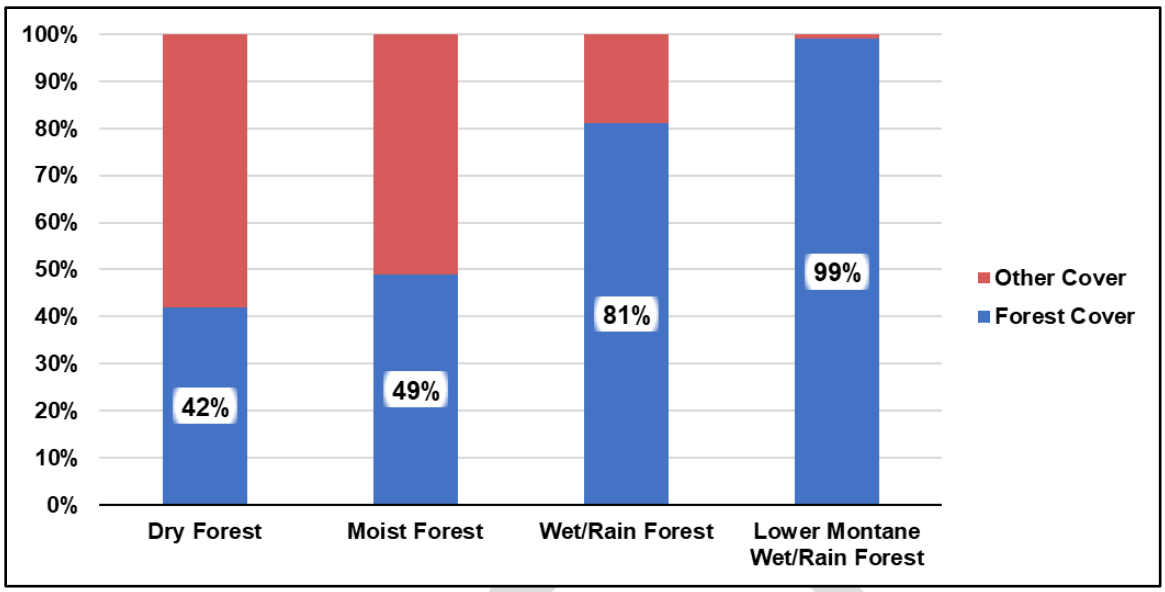


Figure 3. Percent forest cover within each subtropical life zones group in mainland P.R. in 2003 (Brandeis et al. 2007).

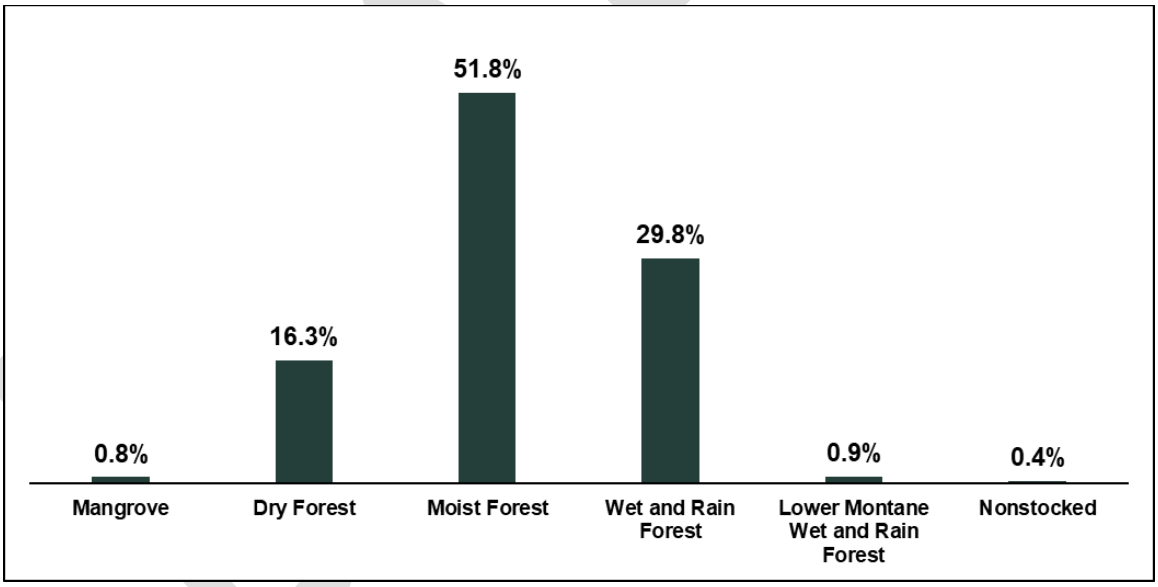


Figure 4. Percent of each subtropical life zone group in P.R. (Forest Inventory Assessment 2025 estimates).

An estimated 68% of Puerto Rico is comprised of young secondary forest, 12% is mature forest, and land reverting to forest accounts for 18% of the total forest cover. Subtropical moist forest had the most land in the reversion category. The lower montane group had no reverting forest; the wet and rain forest had 30.4%; and the dry forest had 12.5% reverting forest.

Size class information is collected on stands with at least 10% live-tree stocking. Figure 4 provides information for all islands. Trees in the seedling stage have a diameter at breast height (d.b.h.) <5", small trees have a d.b.h. of 5-8", medium trees have a d.b.h. of 8 to 20", and large trees have a d.b.h. > 20". Slow growth is common in stressful environments, so a given species growing at high elevations, on barren land, or in drought-prone areas does not accumulate girth as rapidly as the same species in more hospitable environments.

Small-diameter stands cover the largest area of forests in Puerto Rico. However, during the 2004-2014 period, the forest area characterized by stands dominated by small-diameter trees showed a decreasing trend (Marcano-Vega, 2017). The 2014 Forest Inventory Assessment (FIA) reported slight forest maturation, with increases in medium- and large-diameter tree stands and declines in small-diameter stands, along with higher total net volume and aboveground biomass, indicating more mature secondary forests before the 2014–2016 droughts and Hurricanes Irma and María.

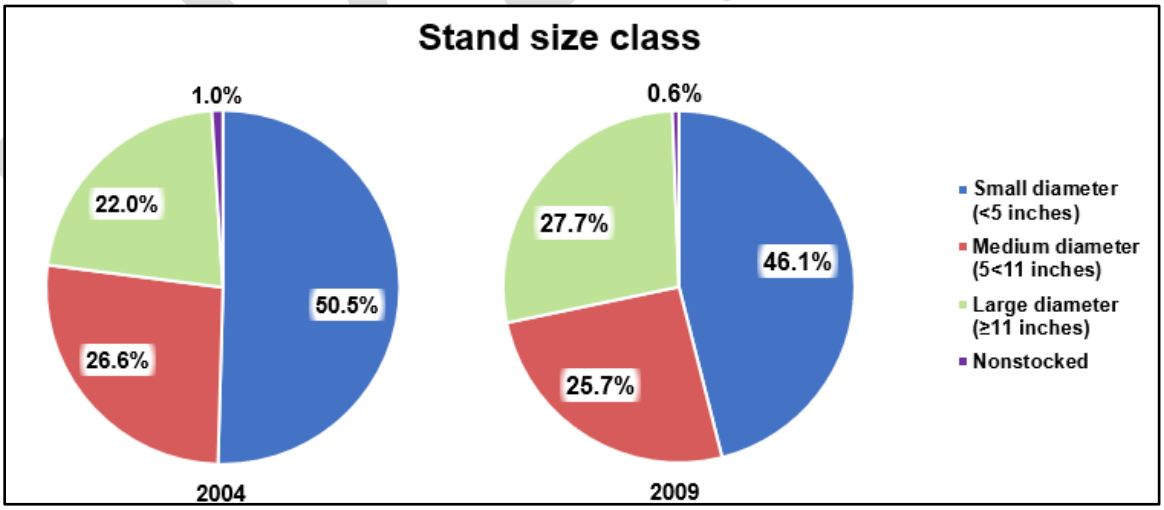


Figure 5. Percentage of stand-size class distribution, Puerto Rico, 2004 and 2009 (Brandeis and Turner 2013).

The recent FIA indicates that forest maturation is advancing across Puerto Rico. While small-diameter tree stands still make up the largest forest area, recent data show a steady increase in medium-diameter tree stands, narrowing the gap

between these two categories.

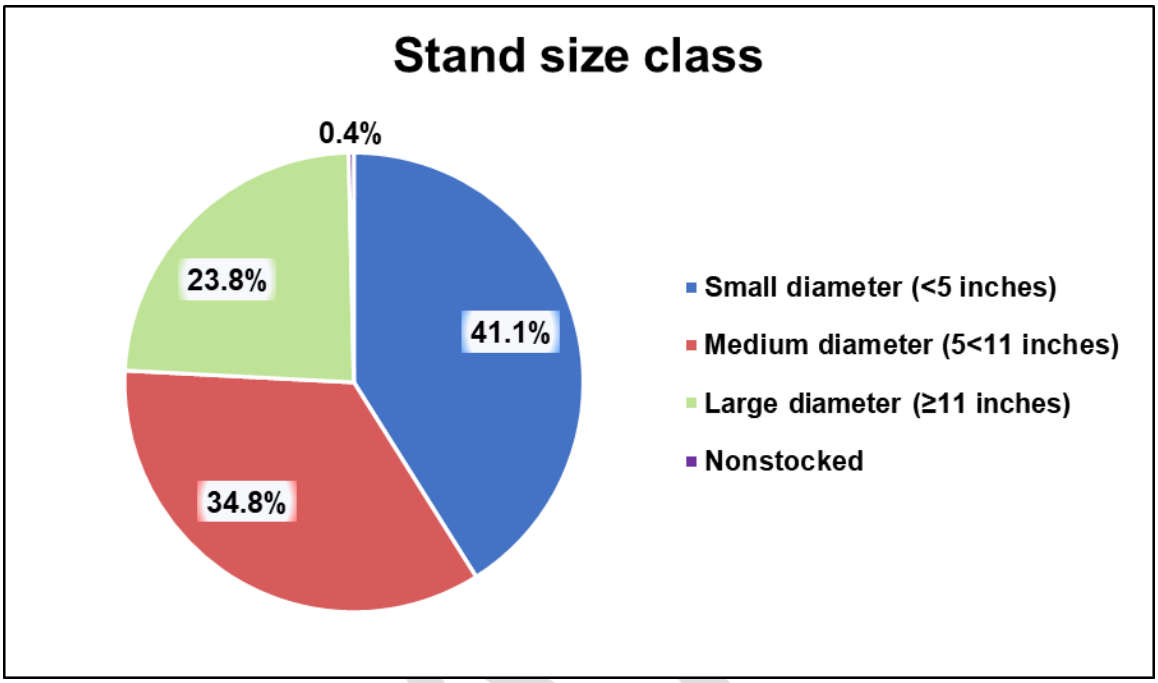


Figure 6. Percentage of stand-size class distribution, Puerto Rico (Forest Inventory Assessment 2025 estimates).

Plant species composition, dominance, and their significance in today's regenerating forests differ from those of forests that existed before the island was deforested (Lugo and Helmer 2004). There are 349 species, both native and introduced, living in Puerto Rico's forests. The introduced African tulip tree (*Spathodea campanulata*) is the most abundant tree species on the island. Native species like guaraguao (*Guarea guidonia*), moca (*Andira inermis*), and yagrumo (*Cecropia schreberiana*) follow in abundance.

The mix of native and non-native naturalized species is creating novel plant and animal communities. Many of today's forests are far from maturity, so definitive successional pathways and the ultimate composition and structure of future forests are conjecture. We are gathering evidence that these novel forests provide public benefits. They support wildlife, mitigate species extinctions, and provide ecosystem services such as soil stabilization, temperature regulation, nutrient transformation, and water and carbon cycling (Lugo 2004). For example, the

African tulip tree is a pioneer species that colonizes abandoned lands and facilitates the establishment of native tree species under its canopy (Lugo and Helmer 2004; Brandeis 2006).

There is no field inventory of forest vegetation communities in Puerto Rico; however, some general taxonomic principles inform remote sensing inventories, as in the work of Kennaway and Helmer (2007), summarized in Table 17.

Table 16. Satellite image mapping zones in P.R. and associated vegetation formations (Kennaway and Helmer 2007).

Satellite image mapping zone [1, 2]	Woody vegetation formations[2]
Dry forest-Alluvial	Lowland dry semi-deciduous forest or woodland/shrubland Tidally and semi-permanently flooded evergreen sclerophyllous forest
Dry forest[3]-Volcanic, Sedimentary, Limestone	Lowland dry semi-deciduous forest or woodland/shrubland Lowland dry mixed evergreen drought-deciduous shrubland with succulents
Dry and moist forests –Serpentine	Lowland dry and moist, mixed seasonal evergreen sclerophyllous forest with succulents
Moist forest-Alluvial	Lowland moist evergreen hemi-sclerophyllous shrubland Lowland moist seasonal evergreen forest or forest/shrub Lowland moist coconut palm forest Seasonally flooded evergreen forest Tidally and semi-permanently flooded evergreen sclerophyllous forest
Moist forest-Volcanic and Sedimentary	Lowland moist seasonal evergreen forest or forest shrub Lowland moist semi-deciduous forest[4]
Moist forest with rainfall<1500 mm yr-1 Northern Limestone [5]	Lowland moist semi-deciduous forest or forest/shrub
Moist forest with rainfall>1500 mm yr- 1-Northern Limestone5	Lowland moist and wet, seasonal evergreen and semi-deciduous forest, and forest/shrub
Wet and lower montane wet forest-Serpentine	Submontane and lower montane wet evergreen sclerophylous forest or forest/shrub[6]
Wet and rain forest, lower montane wet and rain forest-Volcanic, Sedimentary, and Alluvial	Submontane wet evergreen forest Active sun/shade coffee, submontane/lower montane wet evergreen forest/shrub, other agriculture Submontane/lower montane wet evergreen forest/shrub, active/abandoned shade coffee Lower montane wet evergreen forest[7] -tall cloud forest Lower montane wet evergreen forest[7]-palm and elfin cloud forest Lower montane wet evergreen forest-elfin cloud forest

[1] Aggregated from Geoclimatic Zones in Figueroa Colón (1996), which overlay Holdridge life zone (Ewel and Whitmore, 1973) onto generalized geology (Krushensky, unpubl.). Volcanic refers to intrusive/plutonic and extrusive/volcanoclastic geology.

[2] Forest are subtropical sensu Holdridge (1967) and broadleaf unless otherwise indicated; lowland refers to forests from 0 to 400 m elevation. Both forest/shrub and woodland/shrubland refer to stands with a)25-60% covers of trees with distinct canopies and an under story of shrubs, seedlings, or saplings, or b) dense shrubs, seedlings or saplings, as indicated by a matrix of woody vegetation or a smooth canopy.

[3] The Dry Volcanic/Sedimentary/Limestone Zone included southern limestone areas in the drier part of the moist forest zone.

[4] Coastal areas in southeastern Puerto Rico

[5] Northern Limestone refers to limestone areas north of the Central Cordillera with well-developed karst topography and areas at the Cordillera's southern edge.

[6] Includes forest in the rain forest zone sensu Holdridge (1967).

[7] Includes forest in the lower montane rain forest zone sensu Holdridge (1967).

Table 18 presents the multifunctional roles of habitats in supporting biodiversity and facilitating human adaptation to ecological pressures, highlighting their significance for landscape-level conservation.

Table 17. Ecosystem services provided by key habitat types in Puerto Rico

Habitat Type	Key SGCN Supported	Ecosystem Services	Climate Risk Mitigated
Mangroves	Yellow-shouldered Blackbird, coastal fish nurseries	Coastal erosion control, nursery habitat	Storm surge, flooding
Wet Forests	Puerto Rican Parrot, Coquí Llanero	Water regulation, carbon storage	Drought, landslides
Dry Forests	Mona Island Boa, endemic pollinators	Soil stabilization, drought buffering	Wildfires, erosion
Karst Systems	Cave-dwelling bats, blind fishes	Aquifer recharge, habitat refuge	Water scarcity

Puerto Rico Gap Analysis

The Puerto Rico Gap Analysis (PR-GAP) was a spatially based project designed to provide comprehensive information on species and habitats. Gap analysis was developed as a proactive coarse-filter approach to protect biodiversity (Scott et al. 1987 and 1993). The PR-GAP provided an overview of the island's biological diversity, serving as a benchmark for landscape conservation approaches and as a tool for resource managers to establish conservation priorities (e.g., land acquisition). This project was a joint effort among the DNER, the U.S. Forest Service International Institute of Tropical Forestry (IITF), the North Carolina Cooperative Fish and Wildlife Research Unit (NCSU), and the U.S. Geological Survey Biological Resources Division.

The Gap Analysis sought to identify "gaps" (i.e., vegetation types or species not adequately represented in areas managed for long-term maintenance of natural systems) that may be filled through changes in land management practices. Gap

researchers use terrestrial vertebrates and vegetation alliances as indicators of, or surrogates for, biodiversity (Austin and Margules 1986; Scott et al. 1993, National Gap Analysis Program 1994; Csuti and Kiester 1996; Noss and Cooperrider 1994; Jennings 1996). Digital maps containing these elements of diversity were overlaid in a GIS with maps of areas managed for biodiversity and land ownership to identify those areas that are underrepresented in the existing network.

a. **Land Cover** – IITF, in coordination with DNER, developed a semi-automated process to create a Landsat-7 ETM+ image mosaic based on 2001-2003 satellite imagery that is 97.5% cloud and cloud-shadow-free (Martinuzzi et al. 2003a). Initial classification includes mapping the extent of four classes of urban cover in Puerto Rico (Martinuzzi et al. 2003b). Urban cover comprises nearly 15% of Puerto Rico's land surface, and the urban forest and low- and high-intensity urban land cover classes are important for both our habitat modeling and for understanding the dynamics of land cover change and threats to habitat sustainability and biodiversity. Vegetation descriptions have been compiled from the plant community and later organized into a hierarchical structure along gradients of climate, substrate, and topographic position (Gould et al. 2003a). The analysis includes an updated map of Puerto Rico's physiography (Gould et al. 2003b) and an analysis and map of Puerto Rico's landforms (slope position) (Martinuzzi et al. 2003c) (Figure 8).

   According to the NOAA's Coastal Change Analysis Program (CCAP, 2017), current land cover estimates in Puerto Rico consists of 59% forest land, 13% developed land, 10% agricultural land, 9% scrub land, 4% palustrine wetland, 3% grassland, and 1% estuarine wetlands, water and submerged lands, and barren lands (Figure 7).

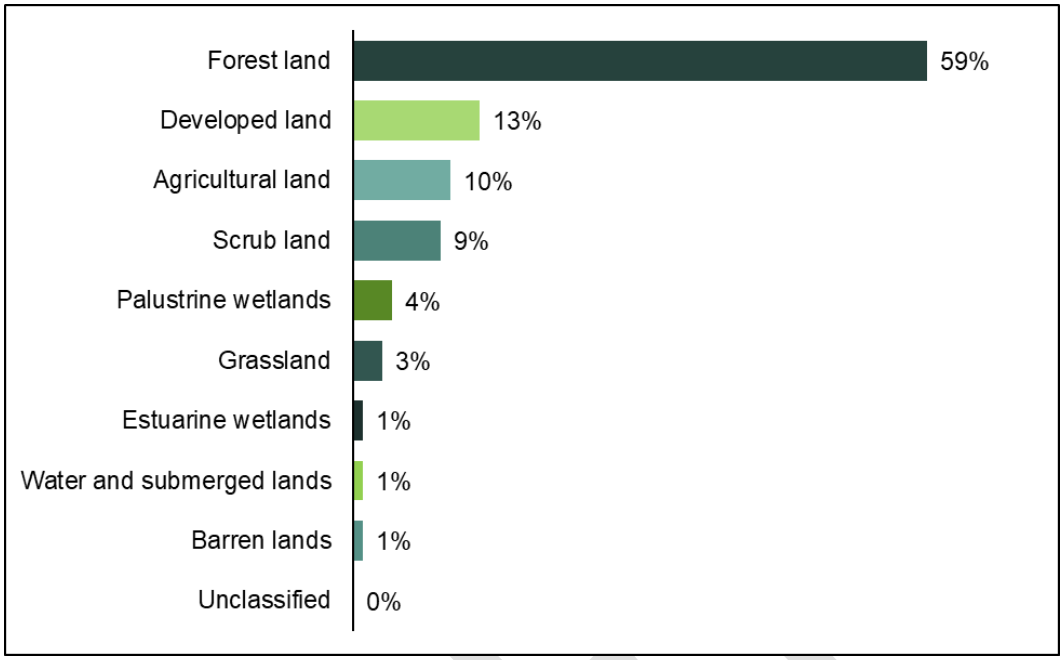


Figure 7. Land cover in Puerto Rico. (Office for Coastal Management, 2021).

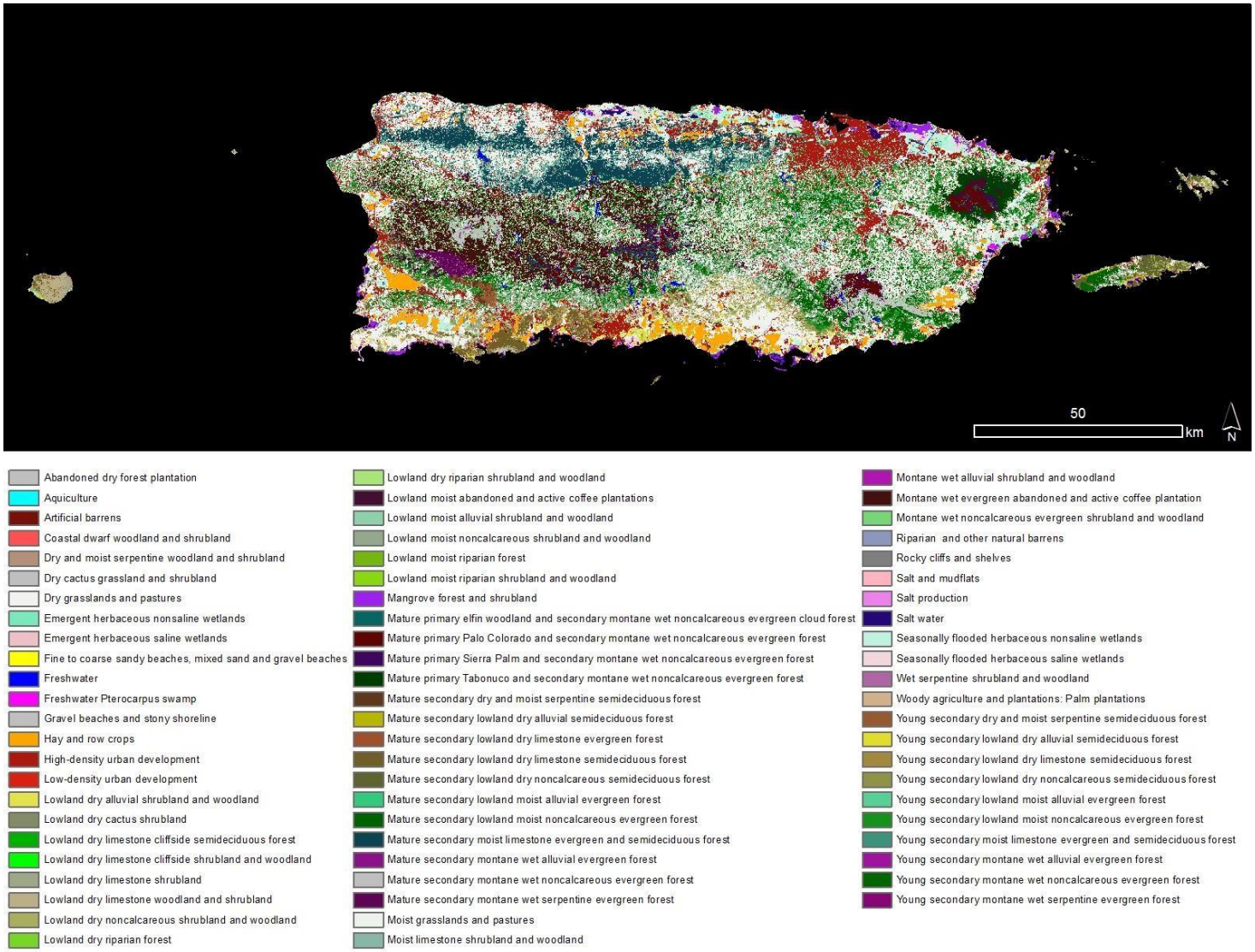


Figure 8. Puerto Rico Land Cover 2015. Data obtained from DNER.

b. Animal Modeling – The original list of 437 vertebrate species has gone through expert review, and now the list consists of 426 vertebrate species known to occur across Puerto Rico or its offshore islands. A large proportion of Puerto Rico's vertebrate fauna is composed of species dependent upon aquatic and/or coastal-marine habitats. Therefore, DNER is developing a relational database model, recognizing that aquatic and marine species are important components of the landscape and have strong potential for gap analysis after the completion of the terrestrial and marine Gap analyses. A subset of 168 species was for inclusion in the terrestrial component of the gap analysis. This list contains those species considered endemic, resident, breeding migrants, and species of conservation concern that have become established through human introductions (e.g., Small Indian Mongoose *Herpestes javanicus*) or range expansion (e.g., Hispaniolan Parrot *Amazona ventralis*). The PR-GAP adopted a modification of the U.S. Forest Service's Forest Inventory and Analysis hexagon grid of the Caribbean as the minimum mapping unit for creating species' geographic range maps. The smaller hexagon size (24 km^2) was considered a valid scale for representing species distribution, given the challenge of representing Puerto Rico's diverse and heterogeneous landscape. The Puerto Rico Ornithological Society assisted in developing field survey methods for a Breeding Bird Atlas of Puerto Rico and in incorporating PR-GAP data, maps, and analyses into the Atlas. Peer revisions of species geographic range maps are currently in progress (Figure 9).

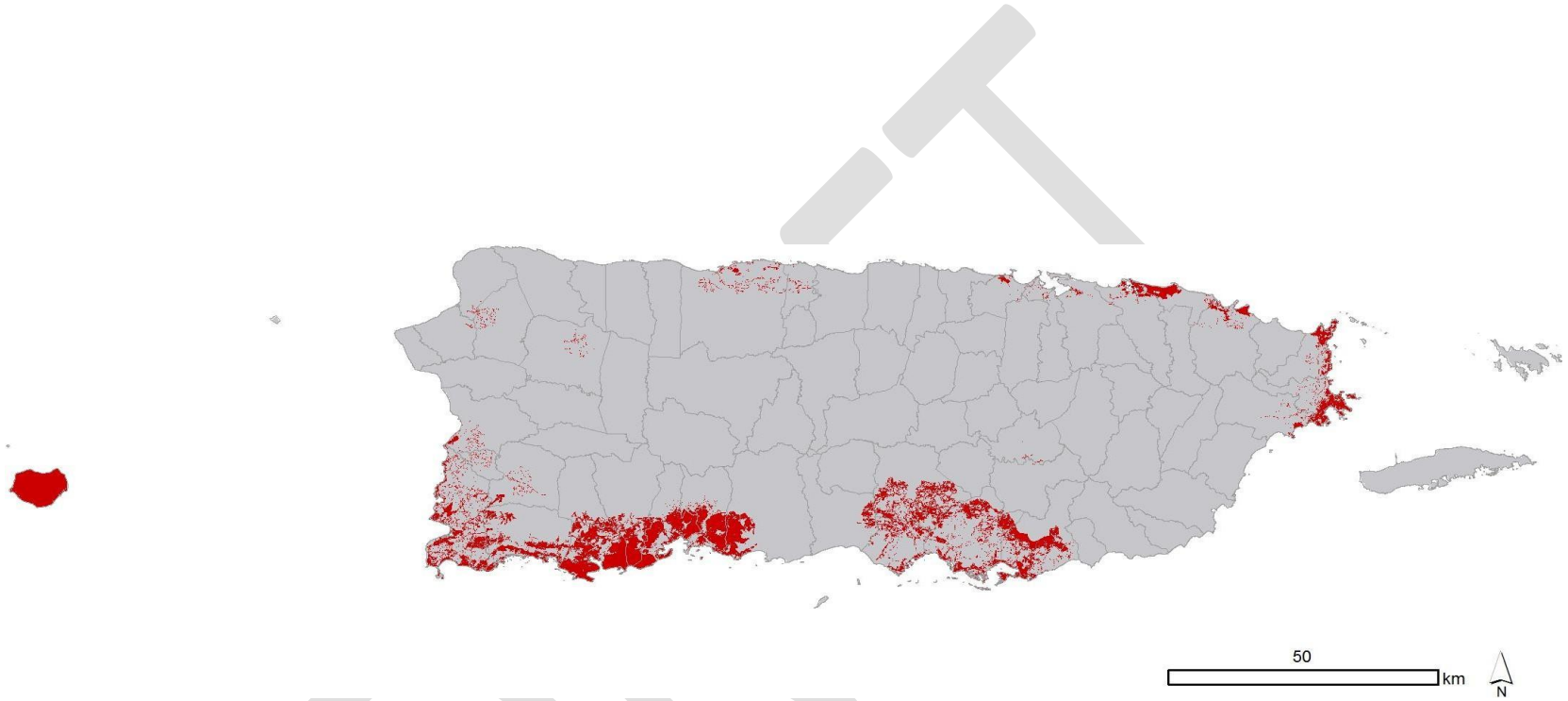


Figure 9. Example of a geographic range map for the endangered Yellow-shouldered Blackbird (Agelaius xanthomus). Data from DNER 2015.

c. **Land Stewardship Mapping** – DNER is currently establishing an interagency collaborative effort to update an existing, but incomplete, land stewardship layer of Puerto Rico. To date, we have identified 21 public land managers (Figure 10). Land management areas will be identified by contacting land managers to determine management policies, classifying land parcels into the management strategies used in the Gap program, and developing a land management geospatial database to facilitate the final GAP analyses.

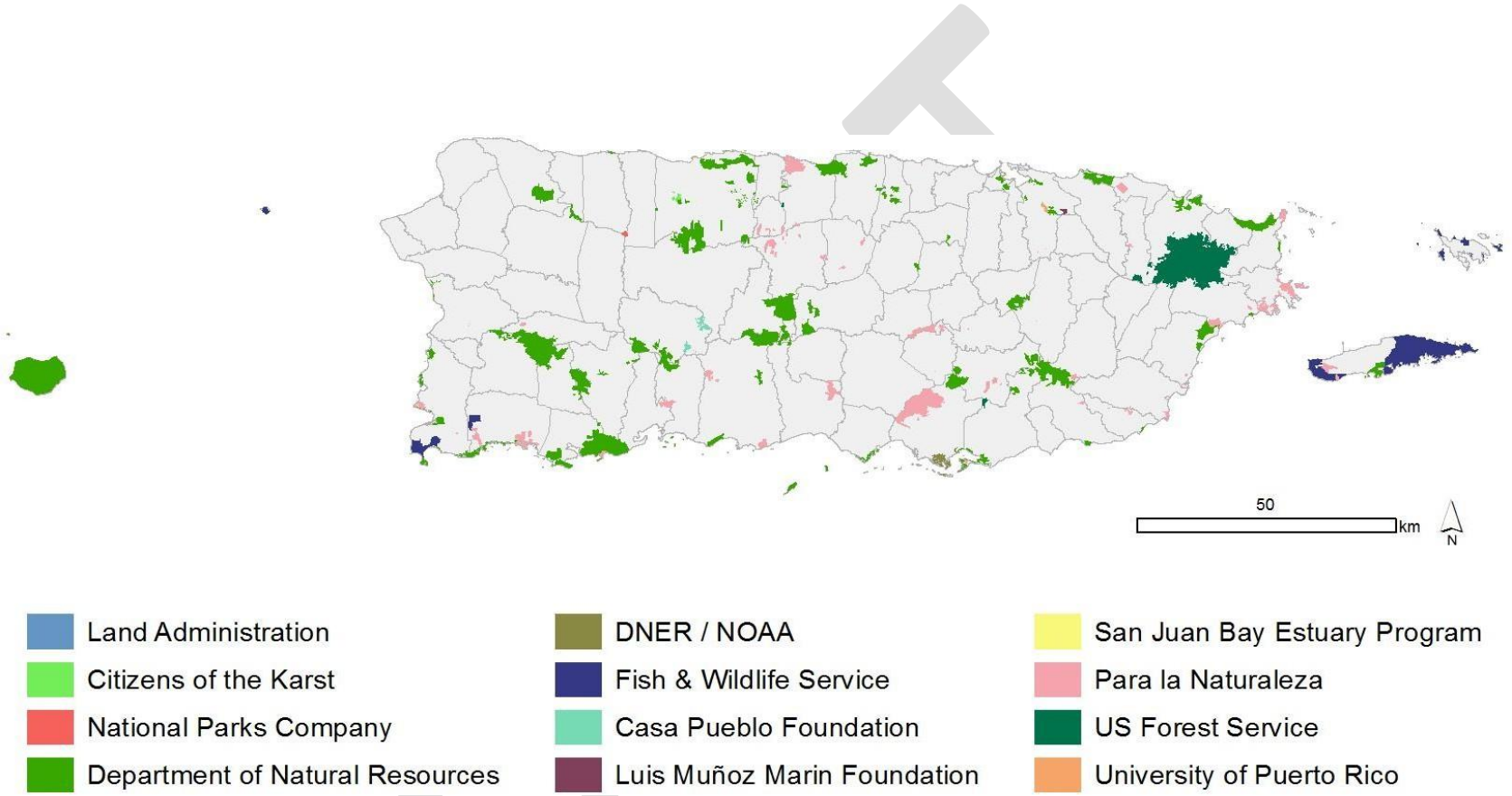


Figure 10. Puerto Rico Land Stewardship 2015. Data obtained from DNER.

2016 Revision of the New Wildlife Law (Law 241 of 1999).

The revision of this law was completed in August 2016. The revised law included a revised list of Species of Greater Conservation Need with updated statuses and, in some cases, designations of Critical Natural Habitat (see Figure 11).

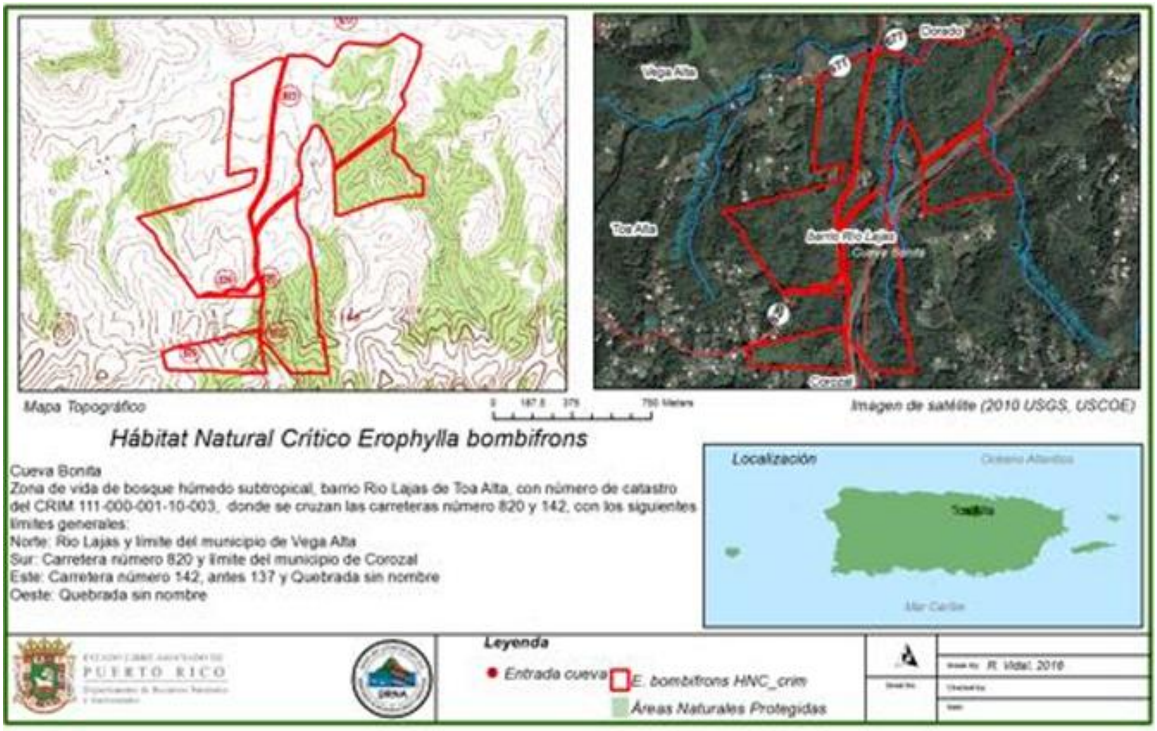


Figure 11. Critical Natural Habitat for the vulnerable Brown Flower Bat (Erophylla bombifrons).

DNER Natural Heritage Program

DNER's Natural Heritage Program (NHP) maintains a conservation data center of species of concern or critical elements (Figure 12). This information is available to other DNER divisions, partners, and the general public. The conservation data center employs a full-time manager who maintains updated species distribution maps and provides technical assistance using the database. Relevant data is primarily obtained from other DNER units, federal institutions, and academia.

Critical elements are not limited to federally or locally listed species, according to the NHP. Species important to Puerto Rican heritage and culture, such as the Common Coquí (*Eleutherodactylus coqui*), and other endemics (e.g., the Mona Island Gecko *Sphaerodactylus monensis*), although abundant, are considered critical elements for this unit.

Besides ecological importance, many species and habitats hold strong cultural significance and are widely recognized by the public. The NHP understands the value of including these aspects in conservation stories. Highlighting iconic species such as the Coquí, the Puerto Rican Parrot, or the Arlequín Butterfly encourages public stewardship and builds support across sectors for biodiversity objectives.

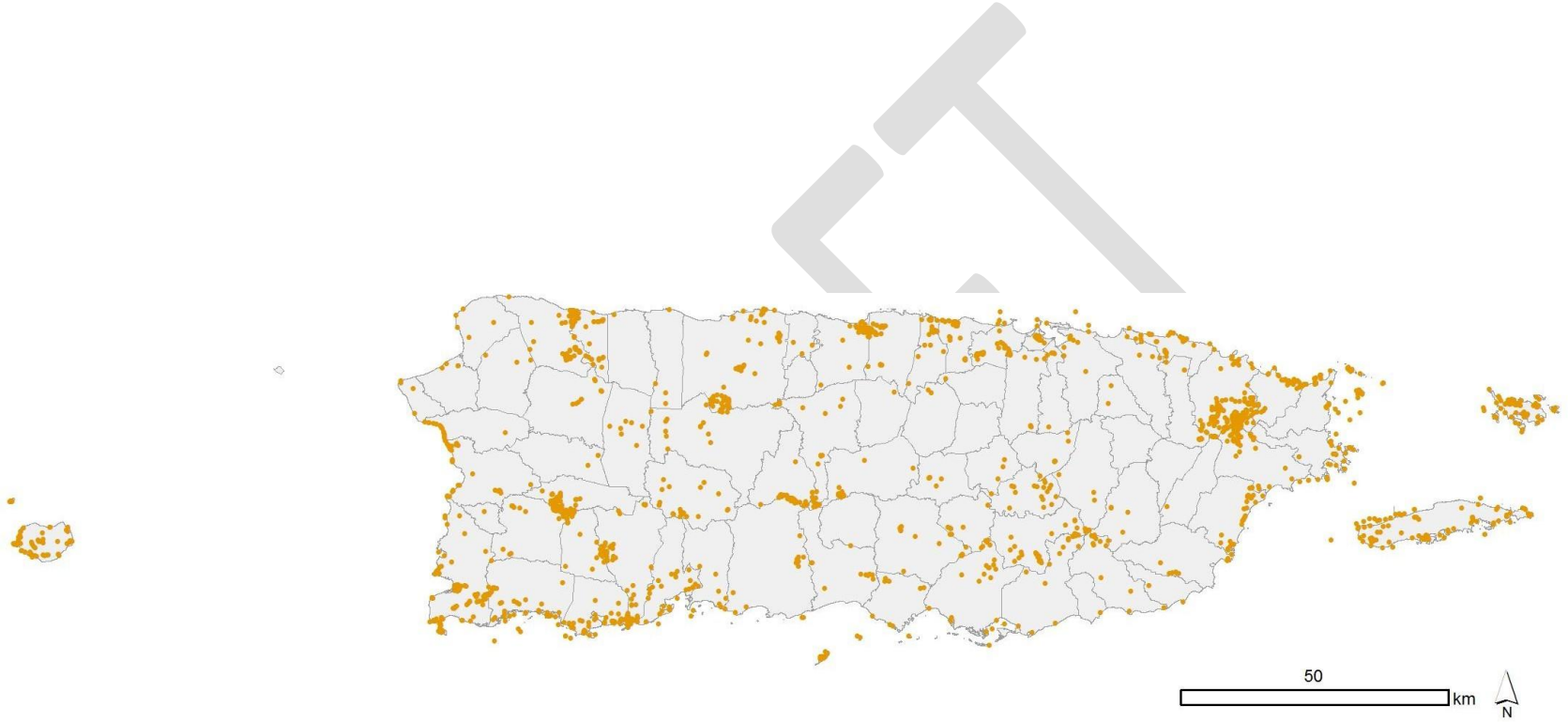


Figure 12. Distribution of Critical Elements in the Natural Heritage Program. Data from DNER 2015.

CHAPTER 6
IDENTIFYING STRESSORS/THREATS TO PUERTO RICO'S WILDLIFE

The Caribbean region is one of the world's biodiversity hotspots (Myers et al. 2000). Historically, Puerto Rico's landscape has undergone widespread deforestation. In fact, by the 1930s, only 6-15% of the island's surface area was covered by forest. Forest conversion had profound effects on the resident avifauna, our largest group of terrestrial vertebrates. It is believed that forest destruction precipitated the extinction of the Culebra Island race of the Puerto Rican Parrot (*Amazona vittata gracilipes*), and the extirpation of the White- necked Crow (*Corvus leucognaphalus*) (Raffaele 1983; Snyder et al. 1987). The distribution of presently endangered species, such as the Broad-winged Hawk (Buteo platypterus brunnescens), the Sharp-shinned Hawk (Accipiter striatus venator), and the Puerto Rican Nightjar (Caprimulgus noctitherus), has been restricted by habitat destruction (Raffaele 1983). The distribution of other more common forest-dependent species, such as the Puerto Rican Tanager (Nesospingus speculiferus), has also been limited by accelerated forest conversion. Nevertheless, the species-habitat relationships for many species are not as straightforward; hence, more integrated approaches to conservation are necessary.

Many members of island bird communities are ecological generalists and opportunistic species (Ricklefs and Cox, 1978; Abbot, 1980; Terborgh, 1980; Blondel, 1985). These attributes can lead to unsuspected ecological resiliency in many instances (Lugo 1988). Indeed, it has been postulated that these traits may have ameliorated extinction rates of resident avifauna in Puerto Rico during the 20th century (e.g., Brash 1987). In addition, some agricultural activities, such as the cultivation of shade coffee in the mountains, may have served as surrogate

refugia for some of the more plastic flora and fauna.

By the latter part of the 20th century, forested acreage in Puerto Rico had increased to approximately 35% (Birdsey and Weaver 1982). This encouraging trend was driven primarily by a socio-economic transition from an agrarian to an industrialized society. Although gains in forested habitats must have benefited many elements of the island's biodiversity, the reality is that Puerto Rico's growing human population is reversing this trend through urbanization (López et al. 2001). The human population of Puerto Rico increased more than three and a half times from 1899 to 1992, resulting in a corresponding increase in the number of settlements (Cruz-Báez and Boswell 1997). In 2010, the island's population was estimated at 3.7 million people with a density of 1,112 persons per square mile (U.S. Census Bureau 2010). A significant part of urban expansion on the island has resulted from suburbanization, the outward physical expansion of urban areas into rural areas (Cruz-Báez and Boswell 1997). By 2020, the population had decreased to approximately 3.3 million people, with a density of around 959 persons per square mile (U.S. Census Bureau, 2020); however, the loss of forested habitats for Puerto Rico's wildlife remains an issue due to a range of other hazards.

The following pages highlight the main stressors and threats to Puerto Rico's wildlife. They provide descriptions of these issues, including how the stressors and threats have changed over the years and how they are expected to behave in the future.

Development and forest fragmentation

Humans depend on natural systems for survival. The primary impact of development is that built-up areas displace forests and other vegetation with inert materials that do not provide the environmental, economic, and social benefits discussed in the sections above (Martinuzzi et al., 2007). More than 10% of Puerto Rico is composed of urban/built-up areas distributed throughout the island, but which tend to concentrate in coastal plains and valleys and follow transportation routes to the very interior of the island. In Puerto Rico, one-quarter of the rich, agriculturally suitable soils have been developed.

Forest cover remained relatively constant between the 1980 and 1990 inventories and then increased dramatically between the 1990 and 2004 inventories. In 1980, the forest cover was 31.3%, and by 2004, it had increased to 52.8% (Marcano-Vega, 2017). A 21.5% increase is substantial, even after a portion of this increase is attributed to changes in inventory methods and definitions. Forestland is defined in the 2013 inventory as any area that is at least ten percent (10%) stocked by forest trees of any size and is not currently developed for a non-forest use. This is, intentionally, a more comprehensive definition of 'forest' than was used previously. It is intended to capture forests developing on old farm fields and pastures. Forest covered 77.1% of Vieques and 91.1% of Culebra (Marcano-Vega, 2017). The spatial distribution of forest cover is shown in Figure 13.

From 2004 to 2014, Puerto Rico's forest cover stayed fairly stable, partly due to a surge in coastal construction during the 1990s and 2000s, while forests in the central mountains recovered. After 2006, the economic downturn and population decline led to a decline in construction activity, reducing pressure on forest resources. However, as construction activity increases again, protecting forests is becoming more important.

In 2019, total forested land on mainland Puerto Rico decreased, with forest cover

dropping from 54.8% in 2014 to 51.8% in 2019 (Marcano-Vega, 2023). The island of Culebra also experienced a reduction in forest cover during this period, while Vieques saw an increase. However, it is important to note that the overall forest cover on both islands has remained relatively stable since 2004.

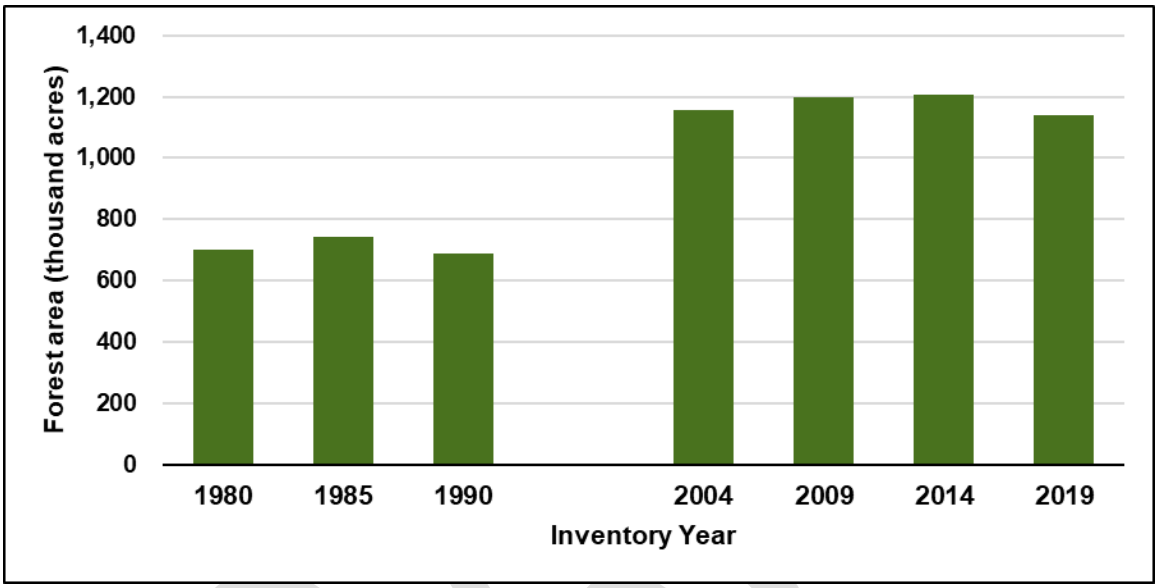


Figure 13. Forest area of mainland Puerto Rico as measured by forest inventories in 1980, 1985, 1990, 2004, 2009, 2014, and 2019. (Brandeis, T. J. and J. A. Turner. 2013; Marcano-Vega, 2017; Marcano-Vega, 2023.).

Forest fragmentation and the loss of forested wetlands, especially in coastal areas, remain critical concerns. Over nearly forty years, vacant land on the outskirts of urban areas has been developed more rapidly than population growth, leading to excess housing and urban sprawl. As a result, by 2010, 14.4% of Puerto Rico was developed, up from 9.9% before 1977. If this urbanization trend continues, the Puerto Rico Land Use Plan estimates that an additional 7,283.5 hectares of mostly forested land will be developed by 2025.

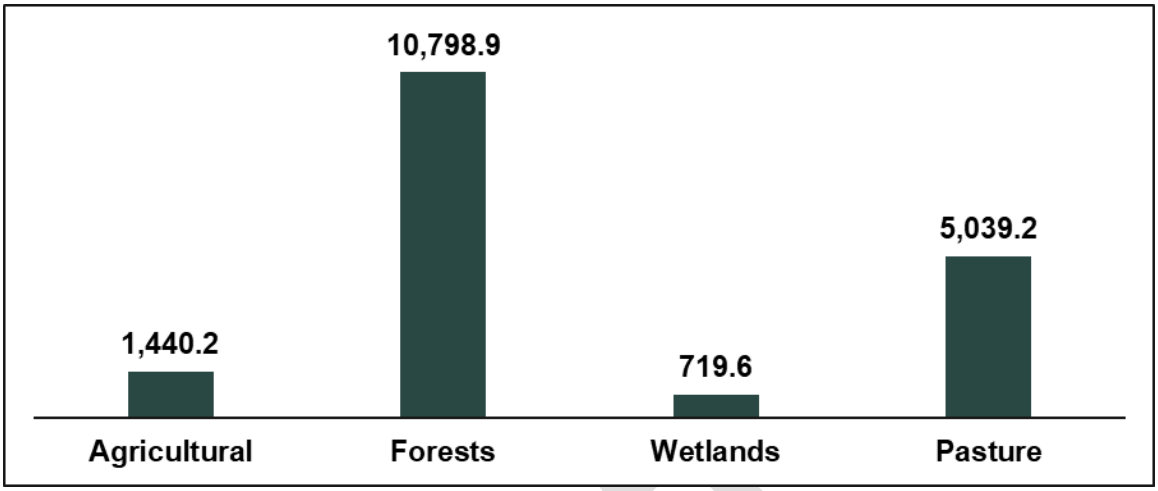


Figure 14. Habitats to be impacted according to projected land uses in the PRLUP (in acres). (Puerto Rico Planning Board, 2015).

Forest fragmentation can involve a simultaneous decrease in average patch size, an increase in average patch spacing, and an increase in edge effects and habitat degradation. As a general rule, large fragments have more wildlife species and can sustain larger wildlife populations than small fragments. As fragmentation increases, species populations may become isolated, and migration of individuals and populations between areas of suitable habitat becomes more difficult.

This intense growth pattern in land use has impacted a significant number of geographic zones associated with the recharge areas of the main aquifers in Puerto Rico and has direct consequences of soil erosion and sedimentation of water bodies and reservoirs (DRNA 2008-a). Likewise, it affects the quality of the resource and contributes to the deterioration of the environmental conditions necessary to sustain the aquatic biodiversity.

Site location consultations, an indicator of development pressure in Puerto Rico, provided by the Puerto Rico Planning Board from 2015 to 2021, show that site location consultations are spread throughout the island, especially in watersheds of reservoirs that are vital for water supply, such as the Río Grande de Arecibo Watershed, La Plata Watershed, and the Río Grande de Loíza Watershed.
The increase in population densities on rural land puts pressure on young forests

and open spaces on the urban fringe (Martinuzzi et al., 2007). Many of the lands where site consultations and new development inquiries are requested are classified as common rural land. This land-use zoning designation is the most permissive classification in the Municipal Territorial Plans. An additional overlay of this zoning with the wildland-urban interface areas reveals that a significant portion of the island's open space is under development pressure or has not yet been designated for a specific land use. These areas shall be considered priorities, particularly those portions overlapping Forest priority areas (high, medium, or low), according to the Southern Forest Land Assessment.

Wildfires

Managing wildfires is a crucial global and local issue, given the complex interactions among people, fire, and wildlands. While studies have shown that fire affects ecosystem structure and functioning, uncertainties remain about its specific effects on ecosystem services due to feedback loops involving multiple factors, such as land cover, invasive species, and ecological pressures (Gould et al., 2008).

Understanding the ecological and social consequences of wildfires in Puerto Rican natural ecosystems is crucial and essential for planning effective conservation and management actions. Fire prevention efforts need to reach private forest owners and others, as the majority of fires in Puerto Rico are set by people (Gould et al., 2008). Research and monitoring of fires in our region have not been a high priority. Most fires and the highest fire potential occur in the dry forest zones. Ecological pressures, extended droughts, and human-induced landscape fragmentation have the potential to significantly expand fire-prone areas into moist and wet tropical forests, as well as into non-forested landscapes traditionally considered fire-free (Gould 2008). The Caribbean Fire Ecology and Management Symposium, held in San Juan, Puerto Rico, in 2007, sent a clear message that in the New World Tropics, human activities and fire are intricately linked; at the same time, forest

fragmentation increases the likelihood of fire.

According to Puerto Rico Firefighters Bureau (PRFB) statistics, 7,358 forest fires were reported across Puerto Rico between 2022 and 2024. The peak number of fires occurred in 2023, with a total of 3,155. As seen in Table 15, the PRFB regions with the highest numbers of fires during these years were Ponce, Aguadilla, and Mayagüez. The high occurrence of wildland fires in Puerto Rico underscores the need for targeted educational and outreach efforts to raise public awareness. Along with active management and a landscape conservation approach, these efforts could help reduce the frequency of fires and other threats to forest ecosystems.

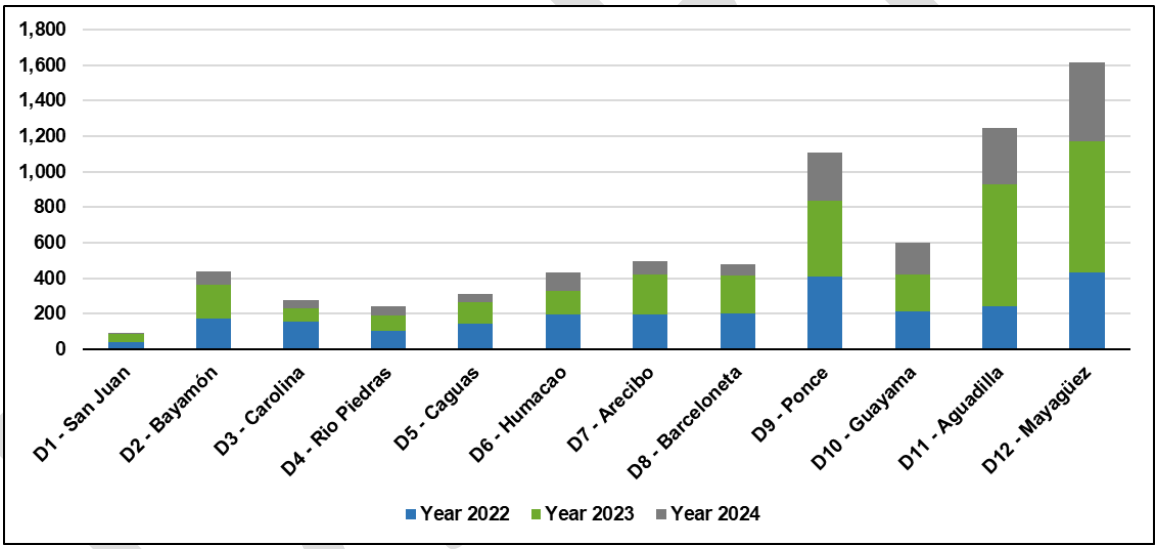


Figure 15. Annual forest fire statistics by PRFB district (PRFB Annual Statistics for 2022, 2023, and 2024)

Over the past decade, protected natural areas have experienced wildfires, though most occur outside them (Figure 16). This suggests that conservation efforts to prevent fires within NPAs have been successful, yet fires still pose a risk to less protected habitats. Recent data indicate that most fires within NPAs are concentrated in the island's northern part, which warrants attention.

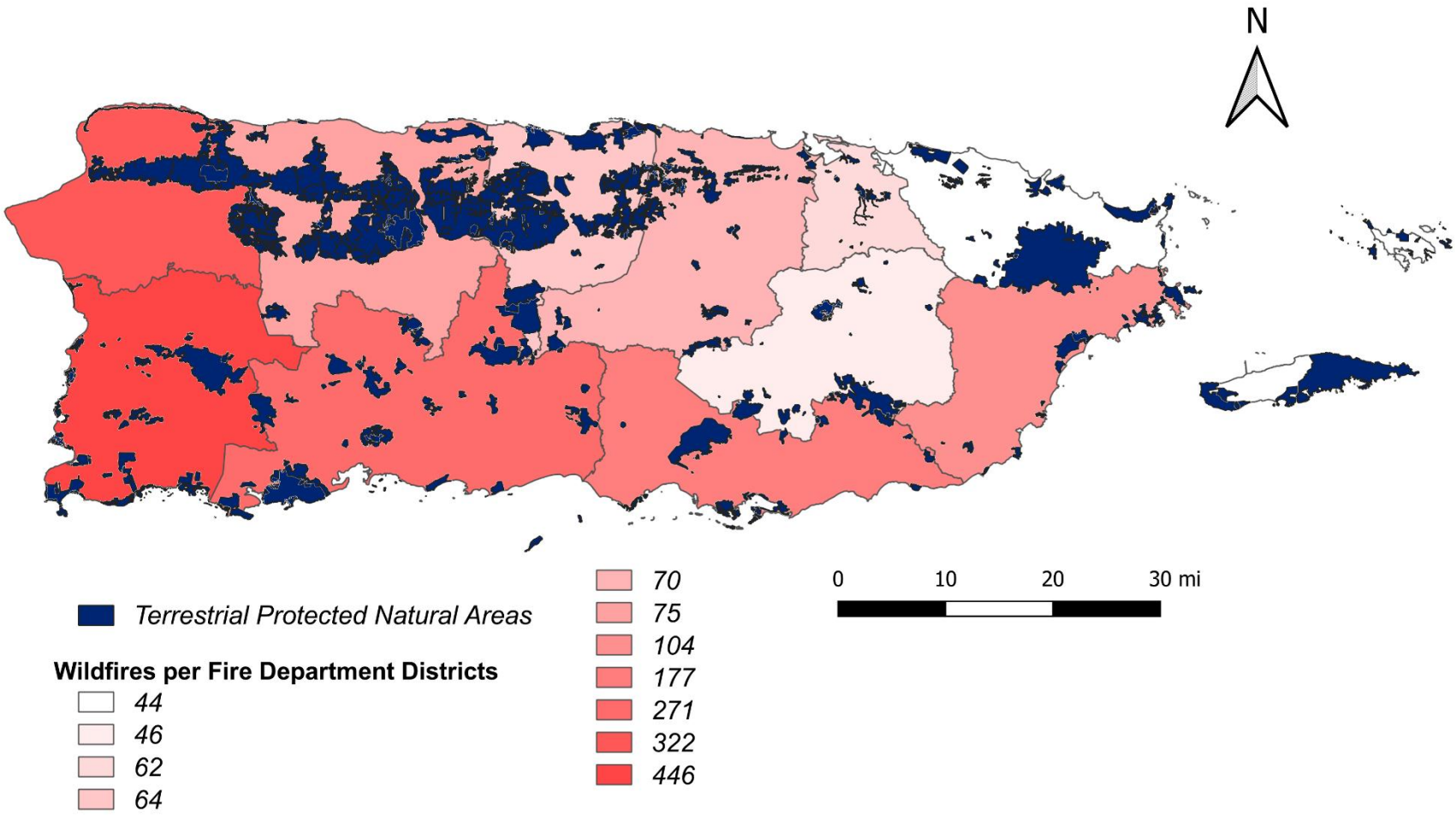


Figure 16. Wildfire Occurrence and the Terrestrial Protected Natural Areas of Puerto Rico (Fire Department of Puerto Rico, 2025)

Hurricanes

Islands in the northern Caribbean are highly susceptible to extreme weather-related disasters (Bowden et al., 2020). Tropical forests are influenced by natural disturbances that vary in strength and frequency (Hartshorn, 1978; Lugo, 2000). The hurricane cycle in the Atlantic has shaped Puerto Rico's forests for approximately 10 million years, with an average of 0.45 hurricanes making landfall on the island each year (Joglar, 2005). Hurricanes are just one of several natural disturbances that affect the dynamics, structure, and function of forest ecosystems (Borman & Likens, 1979; Pickett & White, 1985). These atmospheric events cause significant and recurring disturbances within Puerto Rico's ecosystems, leading to additional natural disasters such as floods and landslides.

Known effects of hurricanes on Caribbean forests include: defoliation, tree mortality, felling of trees by uprooting and snapping, variation of food supplies for animal populations and direct damage to a proportion of their individuals, modifying microclimate, modifying seeds and seedling bank dynamics (Tanner et al. 1991); varies based on environmental gradients, topographic location, stand characteristics, tree size, and species characteristics such as wood density (Tanner et al 1991; Basnet et al 1992). Hurricanes are a significant factor controlling species composition and important aspects of ecosystem dynamics in our region (Tanner et al., 1991; Lugo, 2000; Flynn et al., 2010). Their effects have been theorized as a major determinant of the distribution patterns of tree species in tropical forests, affecting their pathways (Basnet et al., 1992). In urban areas, a strategy is to establish green infrastructure to mitigate the potential for wind damage, flooding, and mass wasting (Lugo 2000). Decades are required for both urban and natural systems to recover from the passage of a single category 4 or 5 hurricane. Hurricanes Maria in 2017 and Fiona in 2022 passed through Puerto Rico's natural, forested regions, with varying effects.

They removed foliage or caused tree mortality over hundreds of acres of forested

land on subtropical wet or moist, lower montane wet, and rainforest life zones. Urban forest resources were not exempt as trees fell onto power lines, houses, vehicles, and roads. Habitat loss and fragmentation have increased the threat that stochastic events, such as hurricanes and tropical storms, pose to plants and animals on the island (e.g., Wiley and Wunderle 1993). For example, half the population of the Puerto Rican Parrot (*Amazona vittata*) (ca. 35 individuals) disappeared when Hurricane Hugo (ca. 35 individuals) struck the island in 1989 (Wiley and Vilella 1998). In fact, about half of the wild parrot population disappeared when Hurricane Hugo struck the Luquillo forest in 1989 (Vilella and García 1995).

According to the 4th National Climate Assessment, climate models project an increase in the frequency of strong hurricanes (Categories 4 and 5) in the Atlantic Basin, including the Caribbean (Gould et al, 2018). It is crucial to develop long-term, comprehensive, and coordinated strategies to conserve, protect, and enhance Puerto Rico's forests, safeguarding them and boosting their resilience to future natural disturbances. These strategies may include:

1) developing and implementing strategies at the watershed scale to promote a comprehensive management approach and reduce the impact on forest ecosystems.
2) establishing public and private collaborations to restore the function and structure of rural protected forests, ecological corridors, private forested lands, agroforestry, and urban forests.
3) applying green infrastructure in urban areas to mitigate floods and wind damage.
4) managing hurricane-induced debris, such as high-quality wood gathered during the vegetation waste removal process, to support and boost the local wood product industry; and
5) using structural approaches to stabilize soils and slopes and protect these areas during future storms.

In recent years, Hurricane Maria has been one of the most destructive natural events to Puerto Rico's ecosystems. Research comparing data on tree damage in the same forest in Puerto Rico after Hurricanes Hugo (1989, category 3), Georges (1998, category 3), and María (2017, category 4) found that María killed twice as many trees as Hugo and broke 2- to 12 times more stems than the other two storms for all but two species (Uriarte et al., 2019, p.2). With Hurricane Irma, which did not make landfall but still affected the archipelago, they reduced about a quarter of the biomass in Puerto Rico's trees (Krajick, 2020; Hall et al., 2020). The study concluded that storm-related rainfall, including its effect on soil water storage capacity, caused more damage to the forest than maximum wind speeds (Hall et al., 2020).

Forest damage across the island also contributed to a loss of ecosystem services, including reductions in species diversity, habitat for animal species, water quality, and stormwater runoff control, as well as land stabilization, mitigation of the urban heat island effect, recreation, and economic opportunities.

Ecological Pressures

Ecological pressures refer to any significant change in climate measures lasting for an extended period, including major changes in temperature, precipitation, or wind patterns, among others, that occur over several decades or longer (EPA 2015). The recent and ongoing rise in average global surface temperatures, commonly referred to as global warming, is leading to changes in climate patterns. Global warming, primarily caused by increasing concentrations of greenhouse gases in the atmosphere, is only one aspect of ecological pressures (EPA, 2015). However, the effects of anthropogenic ecological pressures have the potential to devastate many areas of the world, including islands with substantial portions of their coastal plain composed of lowlands close to current sea level. The predicted intensity of change and the time frame over which change will occur depend on the model; however, most of these models agree that ecological pressures will

affect forests along the coastlines. The expected changes, presented so far by the United Nations Environmental Program (UNEP 2008), include:

- deteriorating coastal conditions, such as beach erosion and coral bleaching, affecting fisheries and touristic coastal scenarios;
- floods, storm surge, erosion, and other coastal hazards, exacerbated by sea-level rise, threatening fundamental infrastructure, settlements, and facilities that support the livelihood of island communities;
- reduction in freshwater resources to the point where they cannot meet demand during drought periods;
- increased invasion by non-native species as a result of higher temperatures, particularly on middle and high latitude islands;
- economic losses from reduced agricultural yields (shortening of the growing seasons and droughts)
- loss of mangrove forests and coral reefs as a consequence of sea level rise;
- coral bleaching and acidification of the ocean;
- damage to terrestrial forests caused by extreme events;
- reduction of the size of freshwater aquifers or lenses and general water resource availability due to decreased rainfall and saltwater intrusion;
- inundation of coastal settlements and arable land on the coast;
- reduction in tourism due to increased frequency and extremely severe weather;
- hurricanes and tropical storm winds could reach more than 170 miles per hour, with the ability to devastate entire landscapes (Reilly 1991).

Anthropogenic ecological pressures are among the most critical issues facing biodiversity and natural resource management globally today. Land and ocean surface temperatures have warmed; the spatial and temporal patterns of precipitation have changed, sea levels have risen, and more intense storms are expected. These pressures, particularly warmer regional temperatures, have impacted the timing of reproduction in animals and plants, the migration patterns

of animals, the duration of growing seasons, species distributions and population sizes, and the frequency of pest and disease outbreaks. Ecological pressures are projected to affect all aspects of biodiversity; however, these projected changes must also consider the impacts of past, present, and future human activities. The effects of ecological pressures, including rising sea levels, increasing mean atmospheric and sea surface temperatures, and changes in rainfall and weather patterns, are likely to be particularly severe for the ecological systems of the Caribbean islands and small island states (Puerto Rico Climate Change Council, 2013).

Ecological pressures are already impacting various aspects of Puerto Rico's society, economy, and natural ecosystems, and these effects are expected to intensify. Not all of these changes will be gradual. When certain tipping points are crossed, impacts can increase dramatically. Past climate is no longer a reliable guide to the future. This impacts planning for public and private infrastructure, tourism, industry, water resources, energy, and all other social and economic systems.

Observed precipitation trends across the Caribbean remain unclear, as indicated by the existing literature. An analysis for the PRCCC shows that since 1948, the Caribbean Basin has experienced decreasing precipitation (-0.01 to -0.05 mm/day/year), with a more pronounced drying trend in the Eastern Caribbean. There has been no observed trend in annual or seasonal rainfall for Puerto Rico from 1925 to 2020 (Puerto Rico Climate Change Council, 2022). Recent droughts are more closely linked to unusually low precipitation during the wet season rather than the dry season. Both global and local climate models project reduced rainfall for Puerto Rico in the future, especially with ongoing greenhouse gas emissions. By mid-century, average rainfall is expected to decline year-round, though there is low confidence about where the largest reductions will occur on the island.

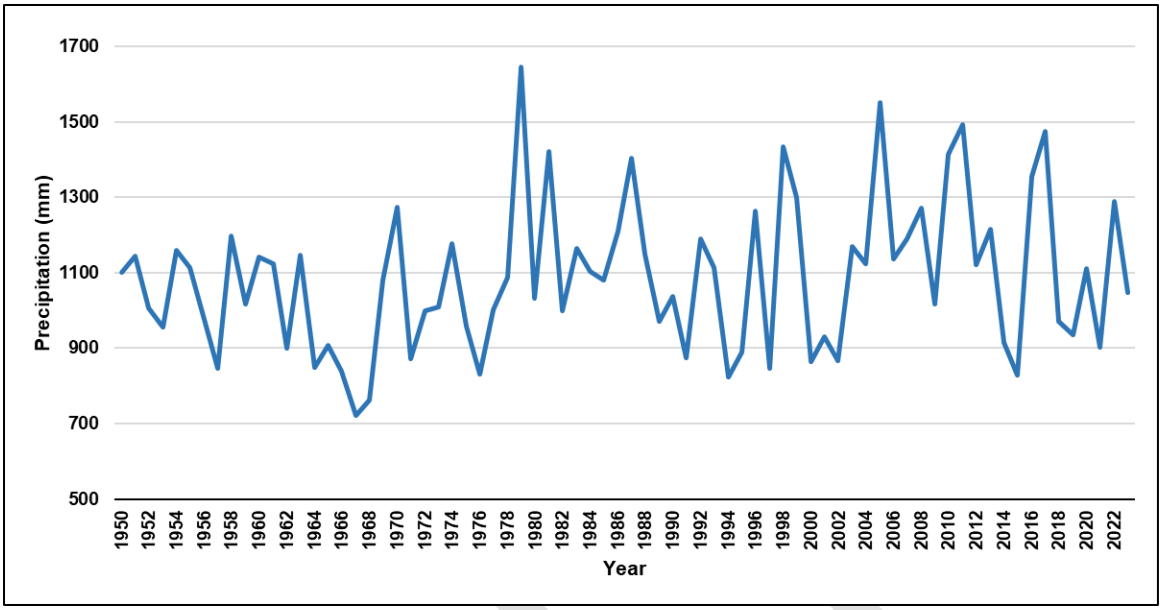


Figure 17. Observed Annual Precipitation of Puerto Rico for 1950-2023 (World Bank Group)

According to the 4th National Climate Assessment (4th NCA), expected decreases in rainfall will likely change the distribution of ecological life zones, with dry zones increasing and wetter zones shrinking or disappearing (Gould et al., 2018). As temperatures continue to rise, montane species are moving upslope and may reach their upper elevational limits. Model simulations indicate a strong drying trend across all Caribbean islands, especially in Puerto Rico, where some life zones could see a 25% reduction in annual rainfall. These projections suggest that by 2050, temperature will rise significantly and precipitation will decrease across all life zones in Puerto Rico (Bowden et al., 2020).

Vulnerable life zones, such as the unique rainforest habitats in the Luquillo Mountains, could be impacted. These mountains have experienced effects from human activities due to urban growth over the past decades (Gould, Martinuzzi, and Parés, 2012; López-Marrero and Hermansen-Báez, 2010). In addition to land-use changes, ecological pressures also threaten the cloud forest ecosystem in the Luquillo Mountains (Beusekom-Van, González, and Scholl, 2017).

The expected sea level rise is another factor that will significantly affect certain

forests in Puerto Rico, particularly in the coastal zone. A rise in sea level of just one foot could have a detrimental effect on coastal forests, including mangrove systems and other coastal swamps characterized by lower salinity intrusion, such as bloodwood swamps (*Pterocarpus officinalis*) and pond apple swamps (*Annona glabra*). These coastal forests serve as nurseries for fish, habitats for other wildlife, and sediment filters for runoff.

According to NASA's Goddard Space Flight Center, global sea levels have risen by approximately 10.2 centimeters (0.34 feet) since 1993. Data from the Lajas and San Juan tide gauges show that relative sea level has increased by about 2 mm per year since the mid-20th century. Although there has been a gradual increase, recent data from 2010 onward reveal a faster rate of sea level rise. Estimates from the PRCCC suggest that by 2050, sea levels could rise between 0.19 meters (0.62 feet) under low-emission scenarios and 0.83 meters (2.72 feet) in extreme cases. A study found that areas currently covered by other saltwater and freshwater wetlands would likely be replaced by mangroves and estuarine water, with salt marshes experiencing the greatest relative loss among wetland types (Yu et al., 2019). A 1-meter rise in sea level would promote the expansion of mangroves as salt marshes and freshwater wetlands diminish. In contrast, a 2-meter rise would significantly reduce the distribution of all vegetated wetlands, mostly replacing them with estuarine water. Sea level rise could trigger a domino effect if FEMA flood zones cause development to shift into Puerto Rico's central volcanic and karstic zones.

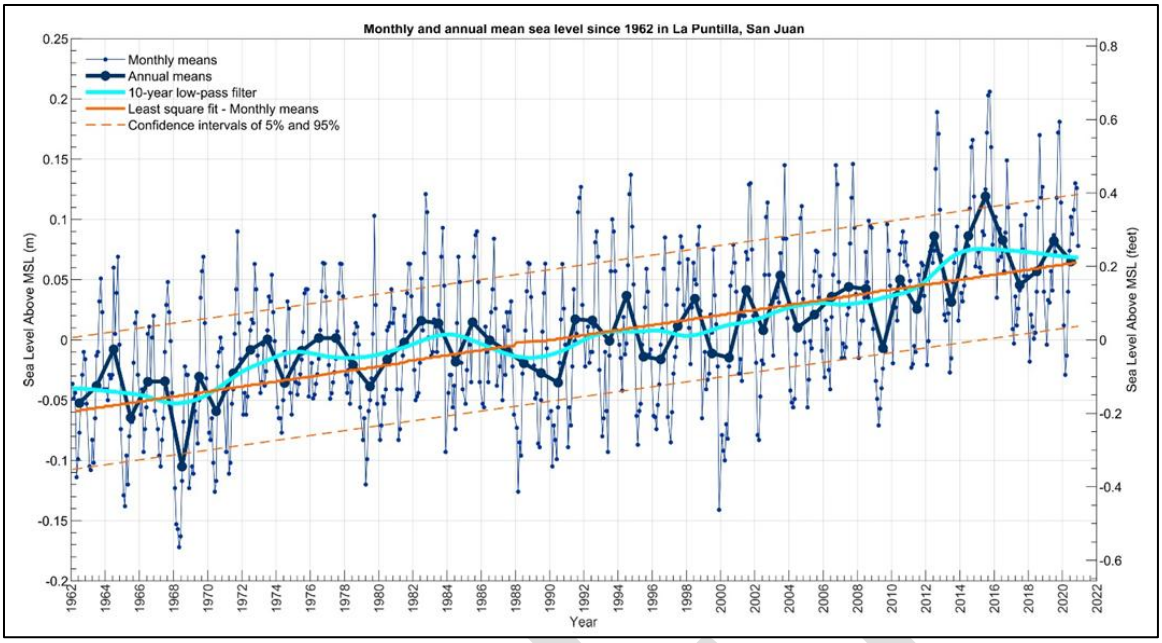


Figure 18. Sea level since 1962 in La Puntilla, San Juan (PRCCC, 2022)

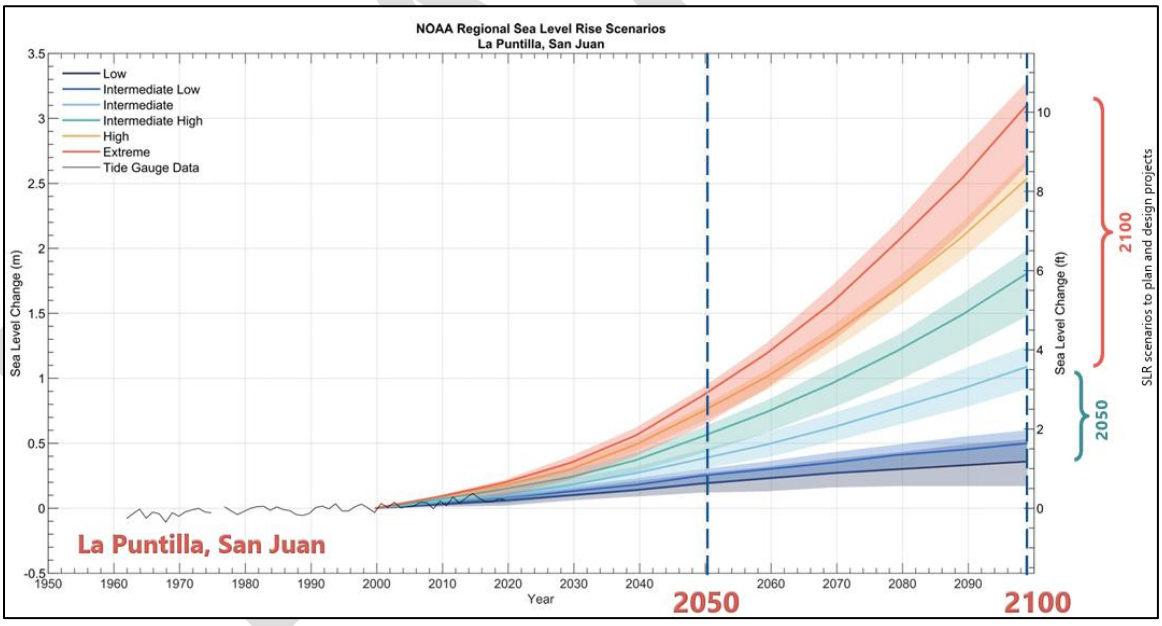


Figure 19. Future sea level rise projections for Puntilla, San Juan (PRCCC, 2022)

Ecological pressures are likely to exacerbate many of the existing threats to forest ecosystems. Climatic warming and drying, and the increase in invasive species will make forests more vulnerable to wildfires. Evidence of this is already evident in Puerto Rico, where wildfires are increasing in frequency and occurring in areas where such fires have never been recorded (Robbins et al. 2009).

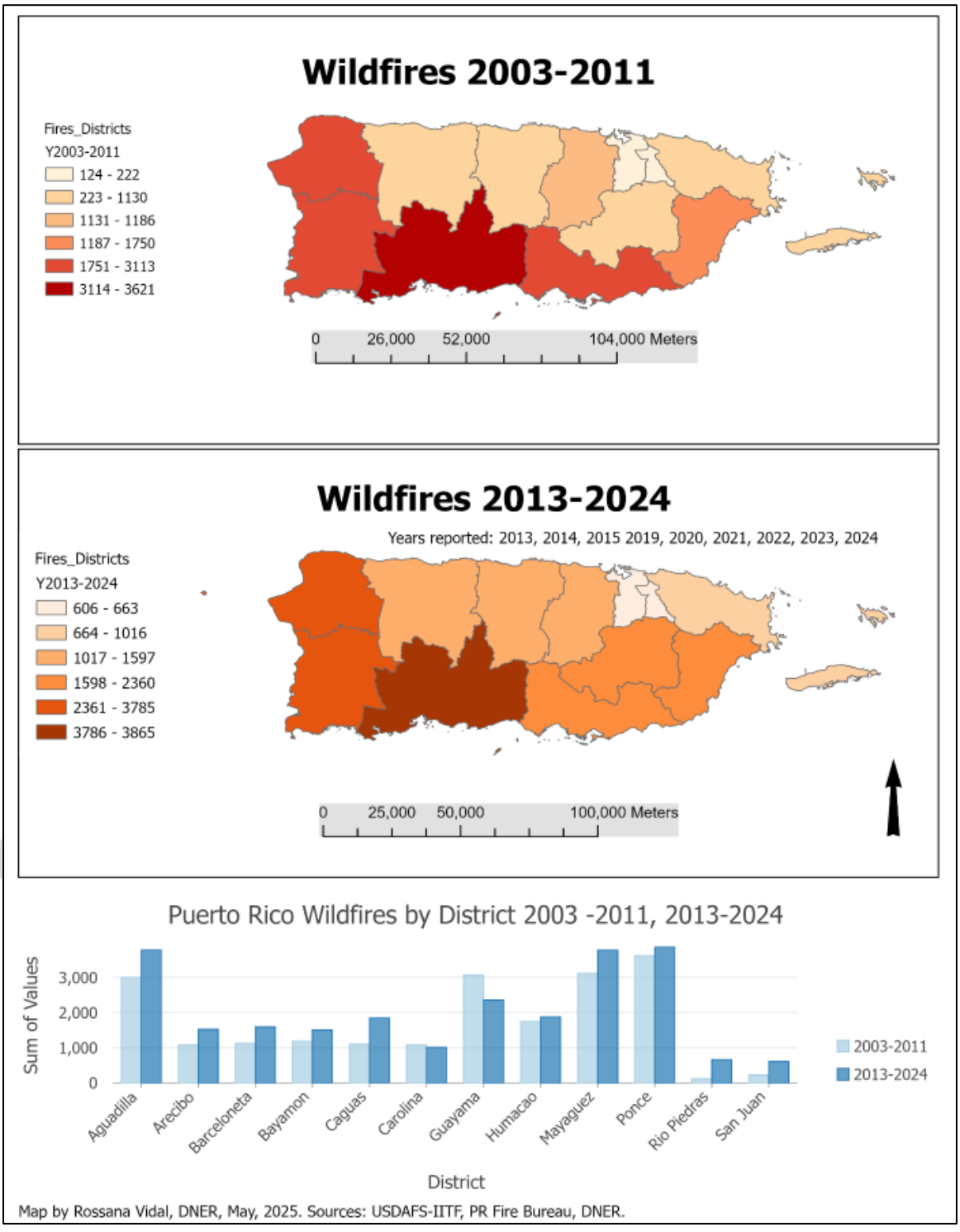


Figure 20. Wildfire occurrence in Puerto Rico by District (Puerto Rico Critical Wildlife Areas, 2025)

The main effect of ecological pressures on Puerto Rico's ecosystems and species

will be synergistic, as already stressed systems will be exposed to additional stressors that push them beyond their limits of existence, resulting in widespread habitat loss, unfavorable changes in structure and function, or diminished services to Puerto Rico's society. Some ecosystems and species will acclimate to changing environmental conditions better than others (PRCCC, 2013).

While some species may potentially migrate to more favorable conditions in Puerto Rico (e.g., Colorado trees, swamp cyrilla), species already reaching the upper limits of their range may not be so fortunate and could be diminished or lost from Puerto Rico altogether due to the lack of suitable environmental conditions (e.g., dolphinfish, yellowfin tuna). Others may be unable to relocate and become globally extinct, such as the Coquí Duende, the Cricket Coqui, and the forest-dwelling Puerto Rican Upland Sphaero. On the other hand, new species or community assemblages in Puerto Rico could benefit society by providing new ecosystem services (PRCCC, 2013).

The World Bank has identified Puerto Rico among nations in Latin America and the Caribbean with higher carbon dioxide emissions per person than the world average. Climatic warming is mainly caused by increasing CO2 emissions in our atmosphere. Forests store carbon dioxide; therefore, decreases in forest cover increase the amount of carbon dioxide in other parts of the cycle.

In 2022, Puerto Rico emitted 12.6 million metric tons of CO2, ranking 99th out of 206 countries for total emissions (European Commission, 2025; IEA, 2023; United Nations, 2024). However, in terms of per capita emissions, Puerto Rico ranks 80th among those countries. Within the Caribbean, Central, and South American regions, Puerto Rico is eighth out of 42 countries or territories for per capita CO2 emissions. Looking at historical emissions, Puerto Rico has made notable progress since 1977, reducing total emissions by over 72%. The most recent major decline in CO2 emissions occurred between 2006 and 2012, and levels have remained fairly stable through 2022.

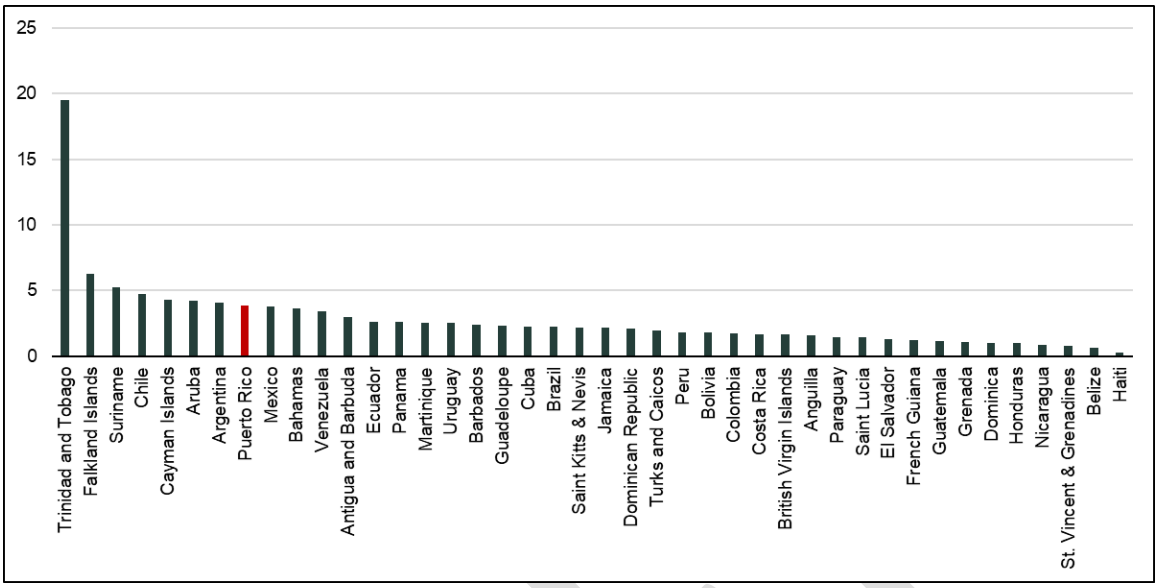


Figure 21. Caribbean, Central, and South American Nations/Territories Fossil CO2 Emissions Per Capita. (European Commission, 2025; IEA, 2023; United Nations, 2024).

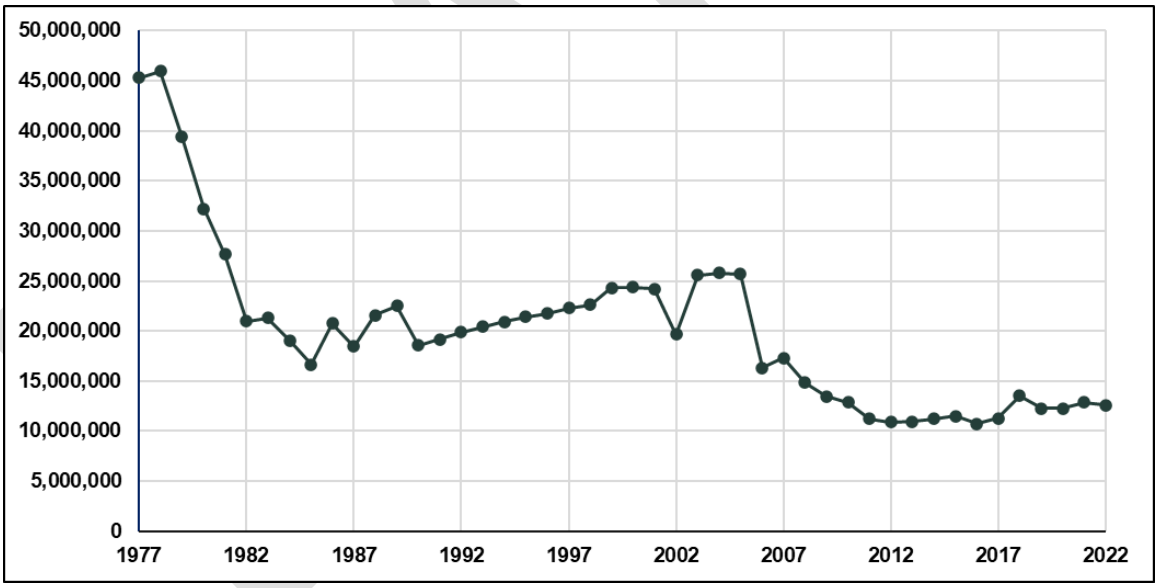


Figure 22. Puerto Rico Fossil CO2 Emissions (tons). (European Commission, 2025; IEA, 2023).

Ecological pressures require a monitoring mechanism or protocol to categorize management applications and set priorities that can focus on adapting to the process. Given the importance of forests in sequestering carbon, expanding forest cover is a logical response to ecological pressures. Carbon credit trading is one-

way private landowners may participate and prosper while contributing to mitigation efforts. At present, there is no active carbon market on the island.

The DNER, through the CZMP, serves as the coordinator of the Puerto Rico Climate Change Council (PRCCC). The PRCCC was established in 2010 to conduct assessments and develop adaptation strategies for the current and potential impacts of ecological pressures and sea level rise on coastal communities, infrastructure, ecosystems, habitats, and populations of coastal and marine species. Over 180 PRCCC members from partner organizations, as well as researchers from Federal and Commonwealth agencies, universities, independent researchers and investigators, non- governmental and community-based organizations contributed and continue investigating, evaluating, assessing, and contributing to develop and catalog the best scientific, technical, and communities' knowledge to support decision making at the public and private sectors and each member of our population. PRCCC's first comprehensive assessment was completed through four working groups: Geophysics and Chemistry, Scientific Knowledge, Ecology and Biodiversity, Economy and Society, and Communicating Climate Change and Coastal Hazards. The report titled Puerto Rico's State of the Climate Report 2010-2013 – Assessing Puerto Rico's Social-Ecological Vulnerabilities in a Changing Climate integrates assessments for different climate and ocean conditions. It delineated a course of action to address the effects and impacts as well as to develop adaptation strategies and build resilience for coastal communities, critical infrastructure, and biodiversity.

Before 2010 and immediately after the Intergovernmental Panel on Climate Change (IPCC) issued its 4th Assessment Report in 2007, the Government of Puerto Rico established a high-level Commission to address ecological pressures mitigation and adaptation in Puerto Rico (Executive Order 2008-09). Although the Commission discussed and recommended public policies, no specific vulnerability-impact assessments or adaptation strategies were devised or implemented in Puerto Rico. Before 2008, most climate variability and change impacts on

biodiversity and society were assessed, and adaptation strategies were recommended by scientists and resource managers from Academia, Federal, and Commonwealth agencies. Researchers in amphibian ecology, marine science, and coastal hazards have conducted notable work.

In 2010, the PRCCC met for the first time and committed to develop a comprehensive report on the potential effects and impacts of ecological pressures based on publications and direct participation of the most knowledgeable researchers and practitioners in the field, collecting the best available science and scientific knowledge, coming to agreement on key drivers of ecosystem changes and ways Puerto Rico's ecology and biodiversity may be affected and impacted, as well as identifying research gaps, information needs, and adaptation strategies.

The adaptive capacity of Puerto Rico's flora and fauna, and therefore the current status and threats to each system, is intrinsically related to each ecological system's vulnerabilities. The following climate conditions were assessed: Air and Sea Surface Temperatures, Precipitation, Extreme Events (e.g., downpours, droughts), Sea Level Rise, Tropical Storms and Hurricanes, and Ocean Acidification. The PRCCC report presents the results of the vulnerability assessments conducted on sub-tropical forests, coral reefs, seagrasses, beaches, amphibians and reptiles, fish, and marine mammals, among others.

The PRCCC Ecology and Biodiversity working group assessed the impacts of changing climate conditions on Puerto Rico's biodiversity. The United Nations Convention on Biological Diversity defines Biodiversity as the variability among living organisms from all sources, including, among others, terrestrial, marine, and other aquatic ecosystems, as well as the ecological complexes of which they are part. This includes diversity within species, between species, and of ecosystems. Biodiversity is highly stressed worldwide. Human activities globally and in Puerto Rico have caused and are likely to continue causing losses in ecosystems and habitats, potentially inducing species losses. The introduction of non-native

species, disease, pests, and speciation by hybridization may be a signature of the Anthropocene. Claims that Conservation is losing the battle to protect biodiversity in the Era of Man, also known as the Anthropocene, have been highly controversial, and so is the position that changes induced by humans may bring increased animal and plant diversity and distribution as they respond to warming temperatures, which are signs of the recognition of ecological pressure's impacts on global biodiversity.

The loss of biodiversity directly impacts society, as we also lose ecosystem services, such as clean water, air pollution abatement, CO2 sequestration, natural protection against storm surges, floods, and hurricanes, landslide prevention, erosion control, sedimentation control, and recreation and tourism opportunities, among others.

The PRCCC report on Ecology and Biodiversity examined the effects and impacts of changing climate and ocean conditions on beach ecosystems, wetlands, coastal lagoons, sea birds, shore birds, forests, woodlands, amphibians, reptiles, coral reefs, submerged aquatic vegetation and seagrasses, coastal and pelagic fishes, bioluminescent bays, marine mammals, as well as intersecting issues. Vulnerability assessments were conducted through literature review, expert meetings, PRCCC summits, and the Working Group’s workshops.

The PRCCC released its latest update on the Puerto Rico State of the Climate in 2022, covering the period from 2014 to 2021. This report maintains the same working groups as the initial State of the Climate: Geophysical and Chemical Scientific Knowledge, Ecology and Biodiversity, and Society and Economy. Additionally, a new working group has been added to focus on Communications and Outreach. This group was created to emphasize the importance of informing citizens about the science of ecological pressures.

The PRCCC members continue to collaborate and exchange information through

the pr-cc-listserv@googlegroups.com, workshops, and annual summit meetings. The PRCZMP, as the Executive Secretariat of the PRCCC, has initiated the update of "The State of Puerto Rico's Climate," aiming to publish it in 2018. The PRCZMP has also completed the Puerto Rico Guide to Climate.

Change Adaptation (in print) and is currently conducting pilot Ecosystem-based adaptation plans at 5 of the 44 coastal municipalities of Puerto Rico. These plans are envisioned to build resiliency in those communities using a triple bottom line approach: economic, social, and environmental. Focused on stakeholders, the process will be conducted in four steps in each community: (1) Community Resiliency Report Cards, (2) Engage with stakeholders to develop master plan scenarios for the community, (3) Scenario Stress Testing, and (4) Reach consensus on master plan.

The Convention on Biological Diversity calls for action to combat ecological pressures and their impacts, recognizing that they threaten human well-being and development in all countries, and the Millennium Ecosystem Assessment identifies them as one of five global drivers of biodiversity loss. Ecological pressures are already forcing biodiversity to adapt through changes in habitat, altered life cycles, and the development of new physical traits. These pressures are also projected to reduce economic growth and the livelihood assets of vulnerable individuals, particularly those who depend on biodiversity and ecosystem services for access to food, water, and shelter. It will impact these basic needs for all people. Further, ecological pressures will increase populations' vulnerability to perturbations such as drought, flooding, and disease. While biodiversity plays a major role in mitigating and adapting to ecological pressures by contributing to long-term carbon sequestration and reducing the impacts of extreme events such as droughts and floods, it is also highly vulnerable to these pressures.

The DNER continues to lead biodiversity conservation efforts through its Fisheries and Wildlife Bureau and promotes adaptation and building resilience through its

Coastal Management Division. Current island-wide collaborations occur through the Caribbean Landscape Conservation Cooperative and the PRCCC, among others.

Invasive species

Biological invasions are considered a major threat to biodiversity conservation (Mack et al., 2000; Levine et al., 2003; D'Antonio et al., 2004). At a global scale, plants are among the most widespread invasive organisms as they are frequently introduced for agriculture, agroforestry, and ornamental purposes (Daehler 2003; D'Antonio et al. 2004; Pysˇek et al. 2012).

In 1999, Executive Order No. 13112 was signed by President Bill Clinton to prevent the introduction of invasive plant and animal species, provide resources for their control, and diminish their main economic and ecological impact. Under this Executive Order, federal agencies could not authorize, provide funding for, or take any action considered capable of causing or promoting the introduction or dispersion of invasive species into the United States of America (USA), unless all reasonable measures to diminish risks are first considered. This Order applies to Puerto Rico and requires action by several federal or Commonwealth agencies.

The following terms are commonly used when discussing exotic organisms and invasive species:

- Native – Organisms found within what is considered their natural range.
- Endemic – Similar to native, but usually refers to a more specific geographic range.
- Exotic – Exotic species are organisms taken from their natural range and transported to a new area. This only pertains to organisms moved by humans, such as in cargo ships or planes. It does not include natural migrations, such as those of birds or fish, which involve long-distance travel.

- Naturalized – An organism that can reproduce unassisted in its new habitat is considered naturalized.
- Invasive – An organism that grows or spreads aggressively in its new environment and causes environmental and/or economic harm.

Islands have long been considered to be particularly vulnerable to biotic invasions. Usual predictions about the number of invasive plant species per island group are based on factors such as area, isolation, habitat diversity, and human development. Comprehensive data set to date on the global distribution of invasive plant species in natural areas of oceanic islands has shown that island area, latitude, isolation from continents, number of present nonnative species with known invasion history, and native species richness do not seem to be retained as significant factors in the multivariate models (Kueffer et al., 2009).

The 1,032 species of alien plants reported for Puerto Rico and the Virgin Islands (PRVI) represent approximately one-third of the total plant diversity on these islands. This proportion is relatively high compared to other Greater Antilles islands (Rojas-Sandoval and Acevedo-Rodríguez, 2014). For instance, alien plant species account for approximately 12% of the total plant diversity in Cuba, 18.4% in Hispaniola, and 21.4% in Jamaica (Acevedo-Rodríguez and Strong, 2012; González et al., 2012). These differences are even more noteworthy in PRVI as they are the smallest landmass within the Greater Antilles. In general, the origin and quantity of alien plants in PRVI can be explained by historical and ecological factors (but not exclusively). First, the historic role of Puerto Rico as a port of call on European-American trade routes during colonization (between the 1500s and 1890s; Dietz, 1986) facilitated the introduction of numerous alien species, mostly from continental America but also from Africa, Asia, and Europe. Second, the extensive rates of human-mediated disturbance to which natural ecosystems in PRVI have been subjected (Rojas-Sandoval and Acevedo-Rodríguez, 2014).

The alien flora in PRVI is diverse, encompassing a wide range of taxonomic

groups. Poaceae and Fabaceae are the families with the highest numbers of naturalized and invasive species, a fact that is not surprising, as these two families are among the most diverse plant families in the world and in other Caribbean floras (Acevedo-Rodríguez and Strong, 2012).

Another example of an invasive species is the introduction of domestic cats (*Felis catus*). This has resulted in detrimental effects, including extinctions, on native prey populations (Ebenhard, 1988). In Puerto Rico, several exotic species have already been established, whose adverse effects on native fauna have been documented (Camacho-Rodríguez et al., 1999; García et al., 2001, 2002).

Nonetheless, there are many other introduced species (e.g., Lionfish [*Pterois* spp.] [Green iguana [*Iguana iguana*], Australian Red Claw crawfish [*Cherax quadricarinatus*], Yellow-crowned parrot [*Amazona amazonica*], feral pigs [*Sus scrofa*] and goats [*Capra hircus*] on Mona Island, White-tailed deer [*Odocoileus virginianus*] on Culebra Island, and Bottlebrush trees [*Melaleuca quinquenervia*]) that potentially affect the native flora and fauna of Puerto Rico. Exotic bird species may serve as vectors of diseases that could negatively affect native fauna, especially those classified as vulnerable or endangered (Camacho-Rodríguez et al., 1999). The green iguana has been reported to negatively affect many farms, including crop loss and infrastructure damage, according to farmers (De Jesús Villanueva et al., 2022). The small Indian mongoose (*Herpestes auropunctatus*) accounts for over 70% of rabies cases in Puerto Rico (The Wildlife Society, 2017). While extensive research has been done on invasive species, the impact of many others has not been fully quantified.

Due to the potential establishment of exotic animals imported as pets, DNER regulates all introductions and breeding of wildlife species through Regulation No. 6765. This document presents several lists that establish the following criteria:

1. Low-risk species that can be imported without a permit.

2. Established exotic species that can be captured for exportation.
3. Exotic species that can be bred with or without authorization.

Predatory and competitive impacts of biological invasions are well documented, as is the success of invading exotics in escaping their natural enemies rather than through novel interactions with their new neighbors (Callaway and Aschehoug, 2000; Jenkings and Pimm, 2003). Plant diversity patterns, plant community structure, and forest regeneration patterns have been interpreted as strongly affected in the Luquillo Mountains of Puerto Rico due to the introduction of an invasive tropical tree species to the Island over 180 years ago (Brown et al., 2006). In contrast, perspectives and paradigms based on such data appear threatened by new concepts and observations. Searches through ecological literature found that facilitative interactions between invasive and native species occur in a wide range of habitats, and can have cascading effects across trophic levels, for example, restructuring communities and leading to evolutionary changes; recent evidence suggests that several mechanisms that exemplify how exotic species can facilitate native species (Rodriguez, 2006), having important implications for management, eradication and restoration. The change in species composition that occurs due to invasiveness may not be perceived as a chaotic process; instead, it is a directed process responding to fundamental changes in the planet's conditions (Lugo 2004).

Pests and diseases

The Agricultural Extension Service of the University of Puerto Rico in Mayagüez has compiled a list of native and non-native insect species that, at certain life-cycle stages, adversely affect particular organs of native or naturalized tree or shrub species in forested or urban forest ecosystems (Martorell 1945; Almodovar 2008). Table 19 lists the species considered pests in Puerto Rico forests and their host woody plants.

Table 18. Native and non-native insect species in P.R. that are considered harmful to local tree or shrub species.

Insect scientific name	Insect common name	Tree or shrub species affected, present in Puerto Rico
Apate monacha	The apate borer	Bixa orellana; Bucida buceras; Casuarina equisitefolia; Delonix regia; Inga vera; Eugenia jambos; Linocieradomingensis; Melia azedarach; Persea americana; Picramniapentandra; Salix chilensis
Aspidotus destructor	The coconut scale	Cocos nucifera; Annona glabra/Barringtonia speciosa; Grevillearobusta; Mammea americana; Perseaamericana; Phoenix dactylifera; Psidium guajava; Terminalia catappa
Chlorida festiva	The mango borer	Albizzia lebbeck; Casuarinaequisetifolia; Mangifera indica; Stahliamonosperma
Chrysomphalus aonidum	The Florida red scale	No information available
Diapprepes abbreviatus	Sugarcane weewil	Albizzia lebbeck; Andira jamaicensis; Byrsonima spicata; Cedrela mejicana; Cedrela odorata; Ceiba pentandra; Chrysophyllum cainito; Coccolobauvifera; Cordia alliodora; Delonix regia; Ficus stahlii; Guaicaumofficinale; Inga vera; Lagerstromiaspeciosa; Melicocca bijugata; Thespessia grandiflora; Perseaamericana; Psidium guajava; Swietenia macrophylla; Swieteniamahogani; Tamarindusindica; Terminalia catappa

Insect scientific name	Insect common name	Tree or shrub species affected, present in Puerto Rico
Eulepte concordalis	The oak leafweeber	Tabebuia argentea; Tabebuiaheterophylla; Tabebuia lucida;Tabebuia rigida; Tabebuiaschumaniana; Crescentia cujete; Spathodea campanulata
Exophthalmus roseipes	The green bug	Andira inermis; Chrysobalanus icaco; Coccoloba uvifera; Conocarpuserectus; Dalbergia ecastophyllum; Elaodendrumxylocarpum; Hymanea courbaril; Ingavera; Inga laurina; Terminalia catappa
Homaledra sabalella	The palm leaf-webber	Cocos nucifera; Prestoea montana
Iceria motserratensis	No official common name	Byrsonima spicata; Callophyllum calaba; Casearia sylvestris; Casuarina equisitefolia; Chrysophyllum argenteum; Cocos nucifera; Ficus nítida; Inga vera; Inga laurina; Mammea americana; Psidium guajava; Samanea saman
Megalopyge krugii	Flannel moth	Andira inermis; Byrsonima spicata; Cocos nucifera; Delonix regia; Erythrina glauca; Ficus laevigata; Guaiacum officinale; Guarea trichiloides; Guazuma ulmifolia; Inga vera; Inga laurina; Nectandra sintenisii; Ormosia krugii; Psidium guajaba; Rhizophora mangle; Sciacassia siamea; Spondias purpurea; Terminalia catappa; Triplaris caracasana
Nasutitermes costalis	Common termite	Albizzia lebbeck; Albizzia procera; Andira inermis; Artocarpus communis; Bucida buceras; Bursera simarouba; Callophyllum calaba; Canagium odorata; Capparis portoricensis; Casuarina equisetifolia; Cecropia peltata; Cedrelaodorata; Ceiba pentandra; Coccoloba uvifera; Cocos nucifera; Colubrina arborescens; Crescentia cujete; Delonix regia; Eucalyptus robusta; Ficus elástica; Inga vera; Petitia domingensis; Prestoea montana; Roystonea borinquena; Swietenia mahogani; Terminalia catappa
Oiketicus kirbyi	Bagworm	Casuarina equisetifolia; Casearia sylvestris; Ceiba pentandra; Chrysophyllum cainito; Cordia alliodora; Cupania americana; Guazuma ulmifolia; Thespesia populnea; Ochroma pyramidale; Petitia domingensis; Persea americana; Pisonea aculeata; Randia portoricensis; Terminallia catappa; Thuja orientalis; Tabebuia spp.
Pachylia ficus	The ficus sphinx	Ficus nitida; Castilla elastica

Insect scientific name	Insect common name	Tree or shrub species affected, present in Puerto Rico
Pectynophora gossypiella	The pink bollworm	Thespesia grandiflora; Thespesia populnea
Phyllophaga portoricensis	May beetle	Coccoloba uvifeera; Schefflera morototoni; Lagerstromia speciosa; Bucida buceras; Cordia alliodora; Cordia sebestena; Grevillea robusta; Sterculia apétala; Sterculia foetida; Swietenia mahogani; Swietenia macrophylla; Terminalia catappa
Pseudalcapasis pentagona	West indian peach scale	Calatropis procera; Clibadium erosum; Erythrina poeppigiana; Fraxinus sp.; Gleditsia triacanthos; Mammea americana; Mangifera indica; Thespessia grandiflora; Hibiscus tiliaceum; Salix chilensis; Trema lamarkiana; Trema micrantha
Pseudococcus adonidum	Mealybug	Barringtonia speciosa; Callophyllum calaba; Erythrina glauca; Hibiscus tiliaceus
Psychonoctua personalys	Mangrove stem-borer	Eugenia jambos; Laguncularia racemosa; Rhizophora mangle
Saissetia oleae	Black scale	Andira inermis; Annona muricata; Cedrela mejicana; Cordia alliadora; Cordia sulfata; Crescentia cujete; Erythrina berteroana; Erythrina glauca; Erythrina poeppigiana;Ficus laevigata; Ficus nitida; Gleditsia triacanthos; Guarea trichiloides; Guazuma ulmifolia; Isandrina emarginata; Eugenia jambos; Lagerstromia speciosa; Manilkara bidentata; Thespesia grandiflora; Ocotea portoricensis; Petitia domingensis; Psidium guajava; Sciacia siamea; Sideroxylon foetidissimum;Spathodea campanulata; Spondias dulcis; Sterculia apétala; Swietenia mahogani; Tamarindus indicus; Tectona grandis; Terminalia catappa; Trema lamarckiana; Trema micrantha; Zanthoxylum flavum
Selenothrips rubrocinctus	Cacao thrips	Anacardium ; occidentale; Bixa Orellana; Chrysobalanus icaco; Coccoloba laurifolia; Mangifera indica; Psidium guajava; Spondias bombim; Terminalia catappa; Zanthoxylum monophyllum
Sericocerina krugii	Sea grape wasp	Coccoloba uvifera; other Coccolobba spp; Triplaris surinamensis
Xyloborus affinis	Ambrosia beetle	Albizzia lebeck; Cocos nucifera; Inga vera; Inga laurina

Major threats and stressors currently affect Puerto Rico's wildlife (Table 20). Most are well known, such as urban development, but others are more subtle, like the installation of power lines.

Table 19. Other threat categories and classes used for PRSWAP.

Threat Category	Threat Class
Habitat Conversion: Intentional conversion of natural habitat that is detrimental to wildlife use and survival by causing loss or degradation of wildlife habitat and available forage.	Housing and urban development
	Agricultural practices
	Recreational areas
	Intentional fires
	Illegal dumping areas
	Wetland filling
Invasive Species: Introduction and/or spread of unwanted exotic and native organisms into ecosystems that increases wildlife predation, competition, and reduced fitness or causes loss of wildlife habitat.	Invasive Plants
	Invasive animals and plants
	Pathogens
Transportation and Infrastructure: Development of corridors/passages that increase wildlife mortality and fragmentation of wildlife habitat.	Roads
	Pier and harbor
	Power lines, aqueducts, gas ducts
	Wind power plants
Abiotic Resources Use: Extraction or use of rocks, minerals, and water that causes direct or indirect negative impacts to wildlife habitats.	Land cover removal for construction material (e.g., sand, limestone, other rocks)
	Water use
	Drilling (wells)
Consumptive Use of Biological Resources: Harvest or use of plant and animal populations in a manner that negatively impacts wildlife distributions and fitness, or the ecosystem.	Forest and woodland management
	Grazing
	Collection
	Illegal hunting and fishing practices

Threat Category	Threat Class
Non-consumptive Resources Use: Activities that have an incidental, but negative impact on wildlife and their habitats.	Motor-powered recreation
	Non-motorized recreation
Pollution: Introduction and spread of unwanted matter and energy into ecosystems from point and non-point sources that cause increased mortality of wildlife and degradation of their habitats and available foraging opportunities.	Solid waste
	Waste or residual materials
	Chemicals and toxins
	Eutrophicants substances
	Noise pollution

Hydromodifications

Coastal forests have been affected by hydromodification, which has changed vegetation cover and species composition. Evidence of these changes has been documented at the Efrain Archilla Nature Reserve in Humacao, where the Río Antón Ruiz flood control project modified a nearby mangrove forest near the Boca Prieta channel and Pterocarpus officinalis trees adjacent to the mangroves (DNER, 2009). A team also studied mortality and recruitment in a freshwater swamp dominated by Pterocarpus officinalis, considering landscape saltwater intrusion and drought (Yu et al., 2019). They found that saltwater intrusion and drought increased tree mortality from 2003 to 2015 compared to 1994 to 2003. Saltwater intrusion had a greater negative impact on tree recruitment than on mortality in this Pterocarpus forest. Essentially, coastal wetlands are facing risks to their existence at current sites due to rising sea levels, limited coastal land, and altered hydrological systems.

As part of Hurricane Maria's recovery efforts, several flood control projects, including channelization of water bodies and levee construction, have been proposed across Puerto Rico. These projects could potentially harm coastal wetlands, which are already stressed by various natural and human-made factors.

Conventional Large-Scale Agricultural Practices

Conventional and mechanized agricultural production can threaten forests, causing fragmentation and clearing, especially in coastal areas. Also, large-scale farming often uses large amounts of chemical fertilizers and pesticides, which harm wildlife and water supplies, further stressing forest ecosystems.

In Puerto Rico, shade-grown coffee was largely replaced by intensive full-sun methods, which greatly increased the crop's vulnerability to storm damage and ecological pressures, such as rising annual average temperatures (Fain et al., 2017).

Additionally, new questions have emerged about how much and where to expand food production (Gould et al. 2017 as cited in Castro-Prieto, 2019). This conflict was clear in 2013 when around 950.3 acres of wetlands were cleared or filled for an agricultural project in Guánica (El Nuevo Día, 2013). It was estimated that 45.8 acres of secondary forest were cleared (El Vocero, 2013).

Drought

The most severe drought in recent years in Puerto Rico occurred between 2013 and 2016. Atypically dry conditions were observed since the end of November 2013, especially in Puerto Rico's southern region (DNER, 2016a). During the spring and summer of 2014, drought conditions affected the central part of the island and municipalities along the north-central and west coasts. In 2015, conditions worsened in the eastern half of the island, while municipalities along the north-central and west coasts experienced a significant increase in rainfall. By January 2016, extreme drought conditions were observed in the southern region, affecting 59% of the island. In October 2016, drought persisted in 12.7% of the territory. Impacts on State Forests included changes in bird behavior, especially in Toro Negro State Forest. In the Jobos Bay National Estuarine Research Reserve

(JBNERR), water shortage caused stress and death among vegetation, particularly in the mangrove forests (DNER, 2016a).

Since 2015, drought conditions in Puerto Rico have worsened. DNER used the U.S. Drought Monitor's Drought Severity and Coverage Index (DSCI) to assess this trend. The DSCI is calculated by assigning a weighted score to each of the five drought categories in the Drought Monitor: D0 (Abnormally Dry), D1 (Moderate Drought), D2 (Severe Drought), D3 (Extreme Drought), and D4 (Exceptional Drought). The index is derived by summing the weighted scores for each category's coverage, producing a value from 0 to 500. Zero means no drought, while 500 indicates the entire area faces exceptional drought, making it easy to compare drought conditions across different times or regions.

The index indicates the following:

- Puerto Rico has never experienced a D4 category drought in the analyzed timeframe.
- The only occurrence of a D3 category drought took place from the week of July 7, 2015, to the week of February 16, 2016. During this period, the highest DSCI was recorded at 220, which occurred during the two weeks from August 11 to August 24, 2015.
- Before 2015, the DSCI rarely exceeded 100 and peaked at 138 in the week of July 18, 2000. Since 2015, the index has consistently surpassed 100 and has occasionally reached over 150. D1 and D2 category droughts have also become more common.

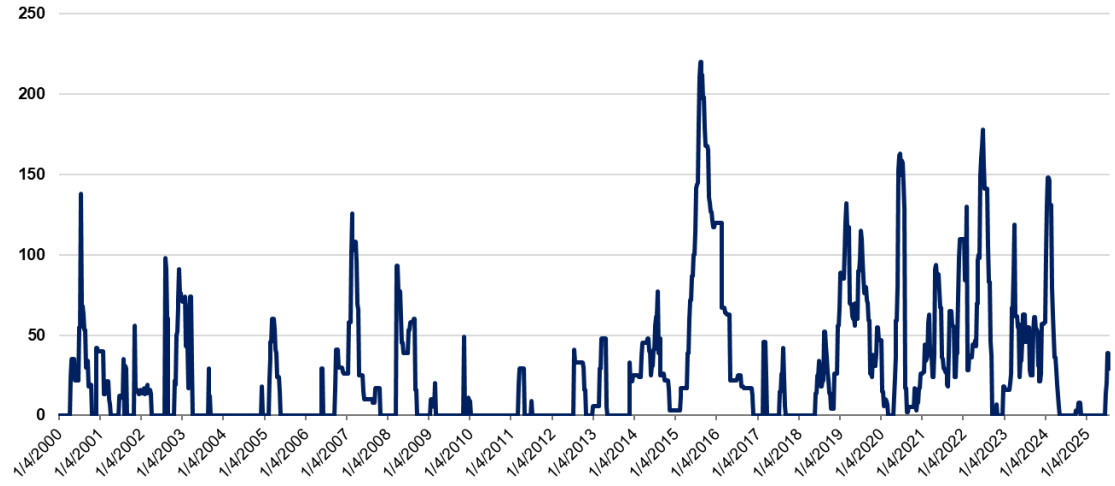


Figure 23. Puerto Rico's Drought Severity and Coverage Index for all weeks from January 2000 to July 2025 (U.S. Drought Monitor, 2025)

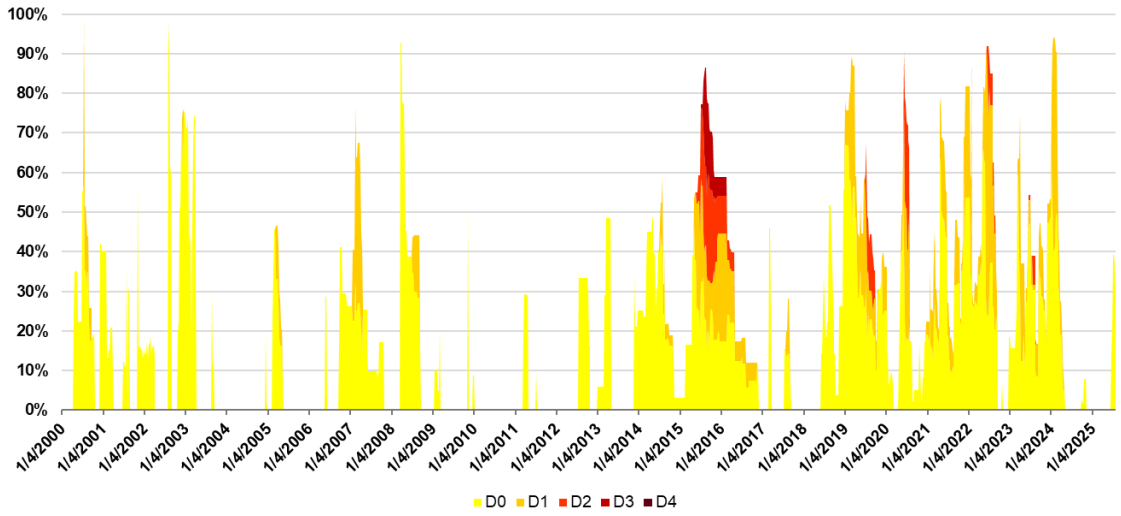


Figure 24. Puerto Rico's Drought Monitor Category Percent Area for all weeks from January 2000 to July 2025 (U.S. Drought Monitor, 2025)

At the regional level, the southern and southeastern municipalities are the most impacted by drought events. Over the past 25 years, the average DSCI shows that the municipality of Salinas has experienced the most consistent periods of drought. Since 2000, Salinas has recorded 615 weeks (about 11.8 years) of abnormal dryness or drought conditions. When considering only these weeks, Salinas has had an average DSCI of 141 and a maximum DSCI of 394. Additionally, neighboring municipalities have occasionally registered DSCIs reaching 400.

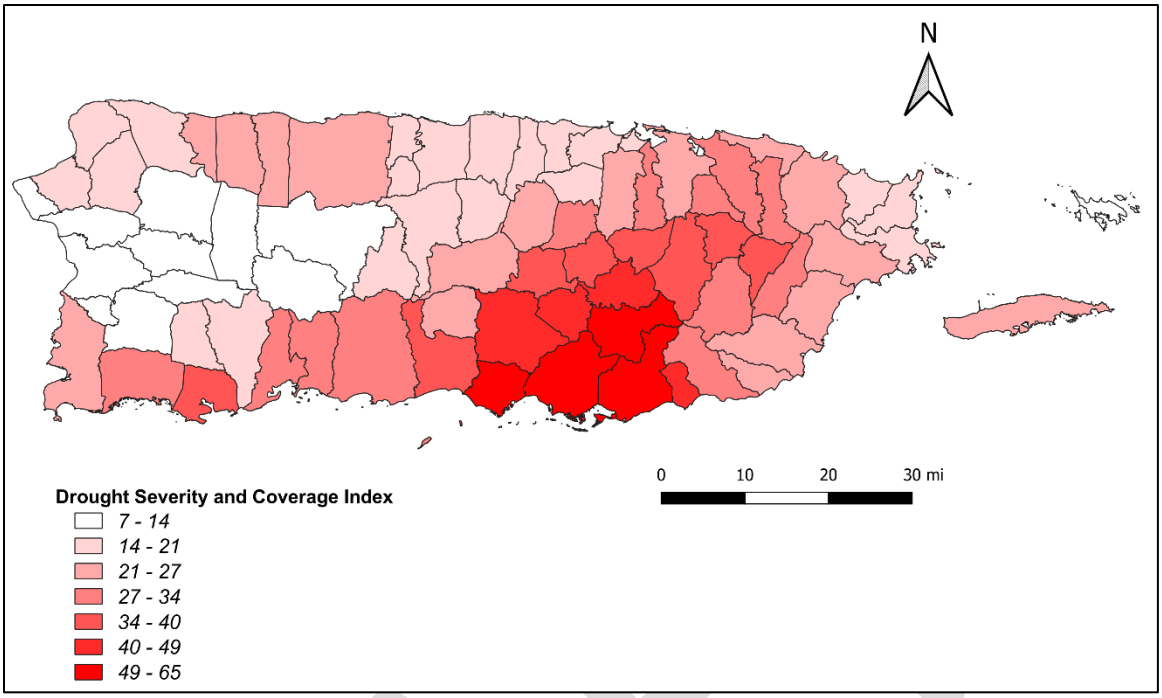


Figure 25. Average Drought Severity and Coverage Index for all weeks from January 2000 to July 2025 (U.S. Drought Monitor, 2025)

Droughts are another factor affecting forests that will worsen with ecological pressures. Although many forest species in Puerto Rico can tolerate drought, hotter, more prolonged droughts could reduce their tolerance, leading to long-term effects such as changes in plant communities and species loss (Crausbay et al., 2018). In estuaries, the compound effects of ecological pressures, urbanization, and competing uses of surface and groundwater may alter the dominant wetland plants that provide the primary structure of estuaries. This has been documented in the South Coast Aquifer, where the availability of water required to sustain the mangrove forests on the southeast coasts of Puerto Rico, especially in the JBNERR and the Aguirre Forest, has been compromised. This has led to the death of the mature black mangrove forest (DNER, 2016d).

Mapping of Stressors and Threats to Wildlife and Habitats

To visualize stressors and threats, DNER analyzed data compiled by the Federal Emergency Management Agency (FEMA) for its 2023 National Risk Index (NRI). The NRI is a dataset that shows communities at risk from various hazards. While many of the natural hazards in the NRI are absent in Puerto Rico, several are common or have a high likelihood of affecting the islands. These hazards include coastal and riverine flooding, earthquakes, hurricanes, landslides, strong winds, and tsunamis.

Although FEMA's NRI is not specifically designed for ecological risk analysis, its estimates of hazard exposure and potential losses can act as a useful proxy for evaluating environmental disturbance. Going forward, by combining these risk indicators with habitat maps or species distribution data, it might be possible to pinpoint areas where natural hazards worsen existing threats to wildlife and their habitats.

The following maps present the ranking of expected annual losses (average financial impact from natural hazards each year) alongside historic loss rankings (actual past damages):

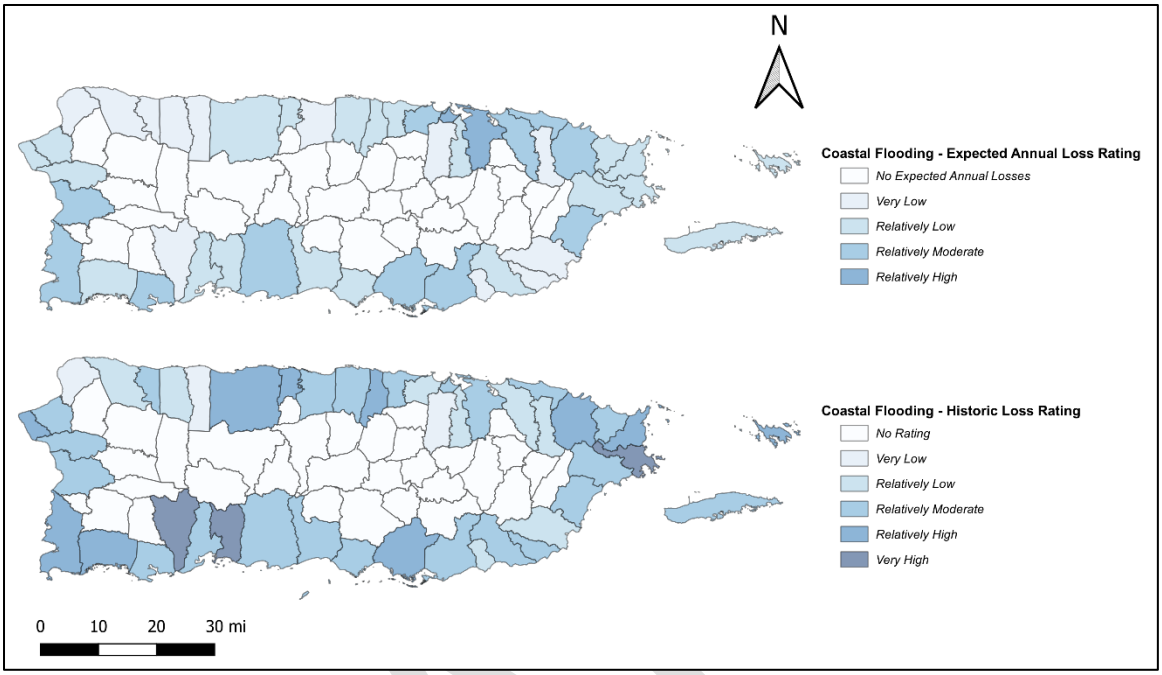


Figure 26. FEMA National Risk Index 2023 – Coastal Flooding Expected Annual and Historic Loss Ratings

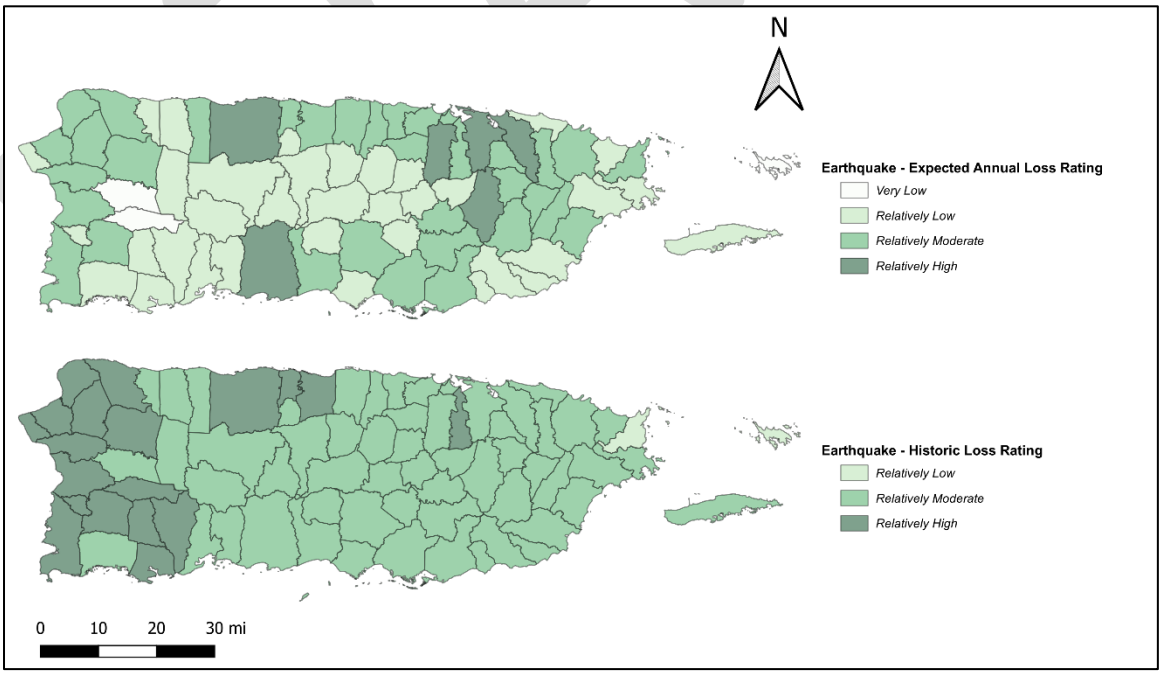


Figure 27. FEMA National Risk Index 2023 – Earthquake Expected Annual and Historic Loss Rating

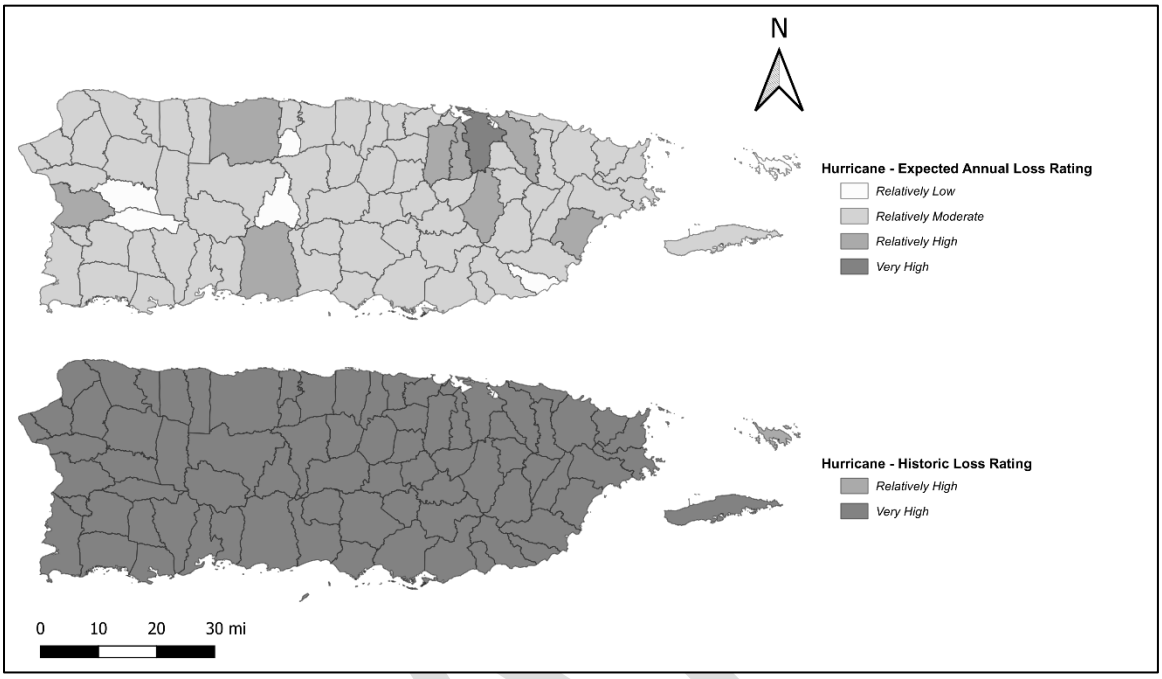


Figure 28. FEMA National Risk Index 2023 – Hurricane Expected Annual and Historic Loss Rating

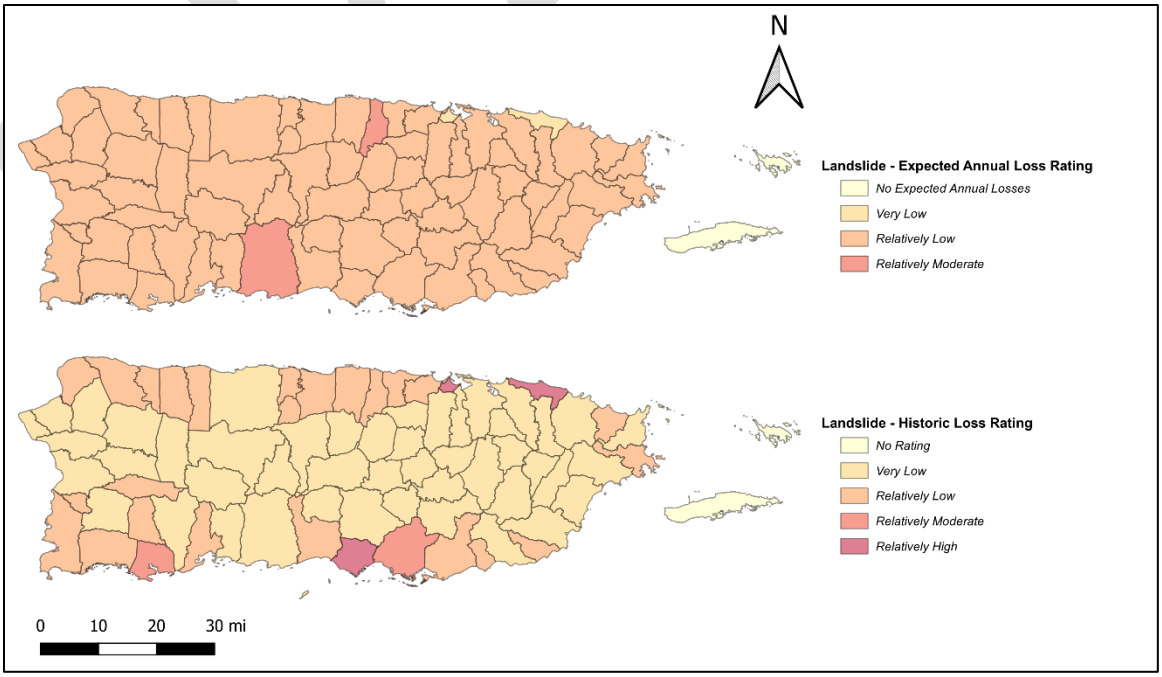


Figure 29. FEMA National Risk Index 2023 – Landslide Expected Annual and Historic Loss Rating

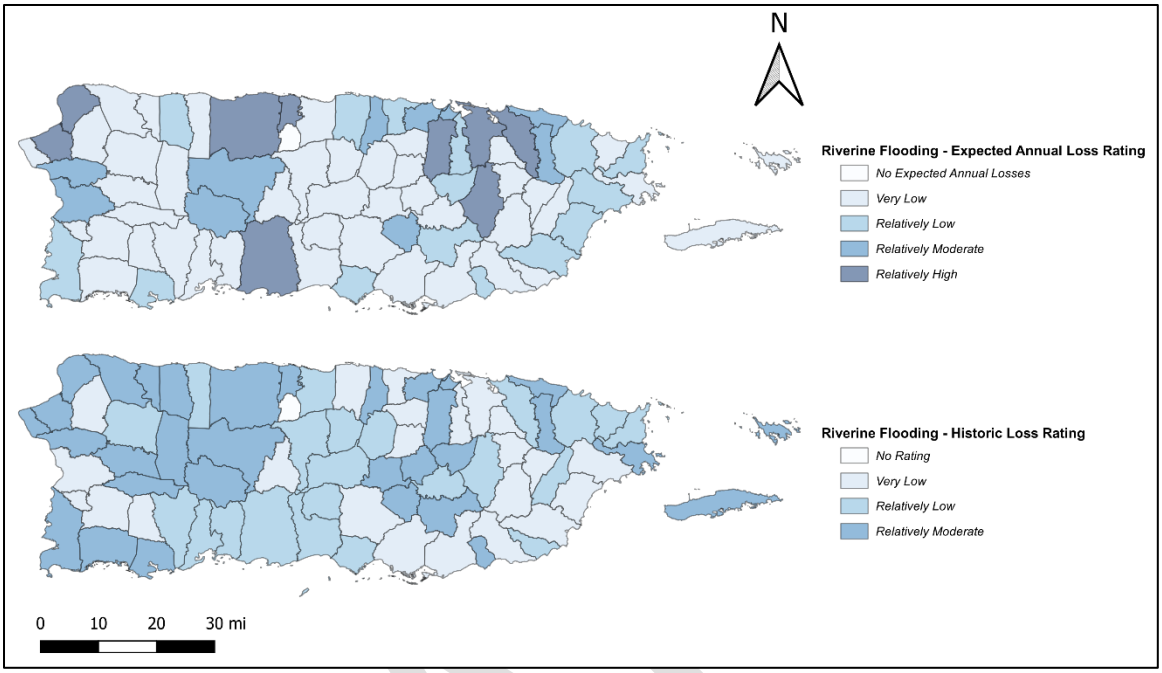


Figure 30. FEMA National Risk Index 2023 – Riverine Flooding Expected Annual and Historic Loss Rating

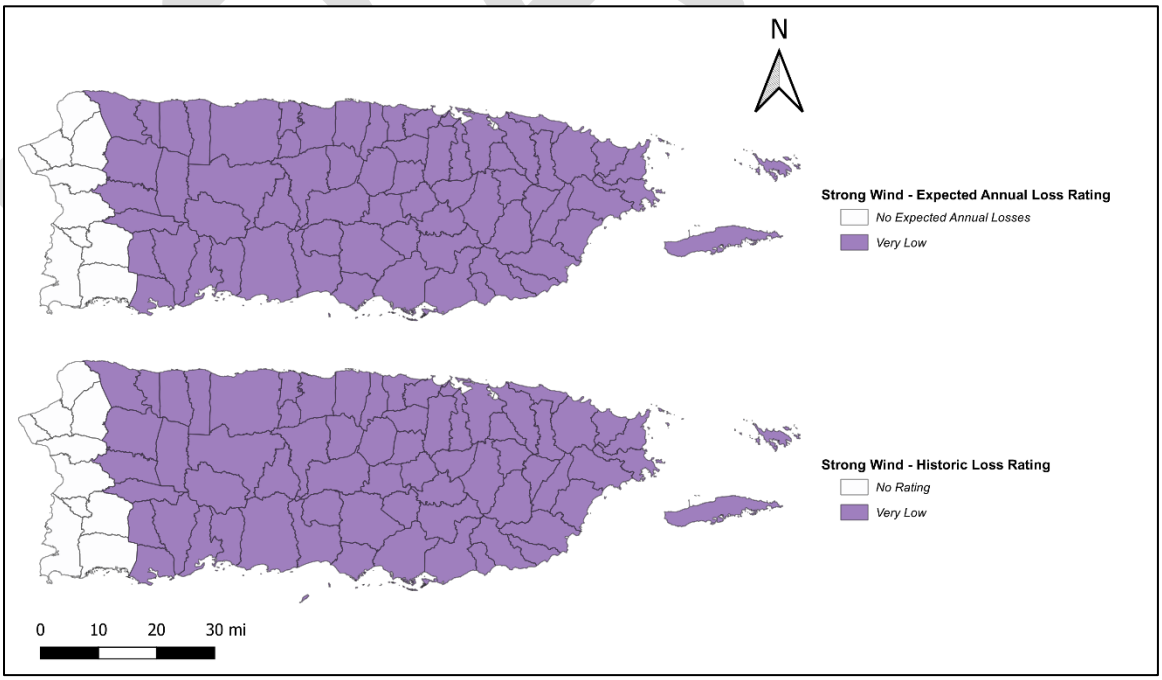


Figure 31. FEMA National Risk Index 2023 – Strong Wind Expected Annual and Historic Loss Rating

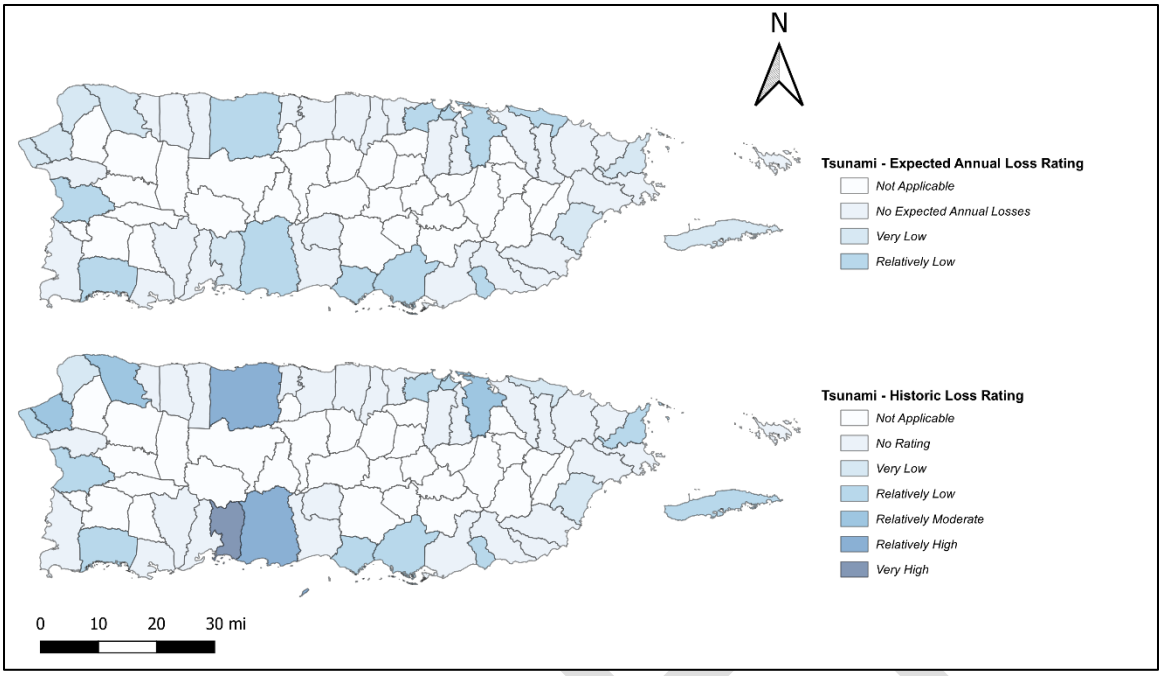


Figure 32. FEMA National Risk Index 2023 – Tsunami Expected Annual and Historic Loss Rating

Framework for Analysis of Threats

Understanding the spatial, ecological, and socioeconomic interactions of stressors can offer valuable insights for wildlife conservation. While earlier sections highlighted individual threats, this part outlines potential methods for mapping, analyzing, and prioritizing threats across Puerto Rico. The techniques described, such as risk matrices, socioecological overlays, and compound hazard assessments, provide a framework for consideration rather than strict steps.

Threat–Species–Habitat Risk Matrices

Risk matrices can be used to link specific stressors, such as wildfire, urban development, or drought, with affected Species of Greatest Conservation Need and the critical habitats where impacts are observed or expected. These matrices may assign qualitative or quantitative risk levels (high, medium, or low) based on factors such as habitat fragmentation, a species's sensitivity and recovery ability, and the significance of a habitat for different lifecycle stages, such as breeding or

feeding. This tool aims to help identify where threats align and to highlight areas that could benefit from cross-sectoral conservation efforts.

Prioritizing Threats by Impact and Urgency

Building on existing classifications, threats can be ranked by evaluating the severity of their ecological impacts, how quickly they may develop, the degree to which they can be reversed through natural regeneration or restoration, and the opportunities for policy interventions. These criteria can help create a Threat Prioritization Matrix that assists decision-makers in allocating conservation resources more efficiently, implementing early-warning systems in vulnerable landscapes, and collaborating more closely with municipalities under greater socioeconomic pressure. For instance, fire risk in dry forests near informal housing might be prioritized higher due to its rapid spread, structural vulnerabilities, and limited institutional capacity.

Socioeconomic Layer Integration

Threat mapping can also be improved by including socioeconomic factors such as land tenure patterns, land-use conflicts, urbanization trends, zoning flexibility in areas like rustic land, agricultural expansion, pesticide use, drainage modifications, and economic pressures that drive habitat conversion. Adding this data helps identify situations where social and economic conditions worsen ecological vulnerability. Examples include low-income coastal neighborhoods facing higher exposure to threats, protected areas impacted by unregulated tourism, or communities experiencing food insecurity that may turn to deforestation for subsistence farming.

Visualizing Compounding and Synergistic Threats

Single-stressor analyses often overlook the cascading and cumulative effects of environmental pressures, which can be especially evident on an island. For example, hurricanes can damage forests, increasing fuel loads that heighten the risk of wildfires; sea-level rise combined with hydromodification can turn freshwater wetlands saline, threatening endemic amphibians; and unchecked urban sprawl with weak enforcement can lead to floodplain occupation, putting both wildlife and communities at greater risk. Multi-hazard overlays could therefore integrate FEMA's National Risk Index for natural disasters, data on forest loss and fragmentation, information on infrastructure vulnerabilities such as transmission lines and roads, and records of historical stressor interactions following Hurricanes María and Fiona. This systems-based approach may reveal areas with both low ecological resilience and high human exposure, guiding strategies to protect wildlife while also enhancing community safety.

CHAPTER 7
CONSERVATION STRATEGIES FOR THE PRSWAP

This chapter serves as the operational core of the SWAP, highlighting the pathways through which conservation priorities will be pursued over the next decade. The strategies are based on the principles of ecological integrity, climate resilience, environmental justice, and participatory governance. They also acknowledge that conservation depends on the involvement of communities, municipalities, NGOs, academic institutions, and private landowners working together across different scales. The strategic axis outlined herein will provide justifications, objectives, actions, tools, implementation examples, and evaluation metrics.

This chapter distinguishes different levels of detail within the planning framework:

- **Objectives** are broad, measurable outcomes to achieve, such as reducing habitat loss, improving water quality, or increasing species resilience to ecological pressures.
- **Strategies** outline the main methods to achieve those objectives, such as restoring ecological corridors, enhancing coastal defenses, or strengthening community stewardship.
- **Courses of Action (COAs)** are specific options for implementing a strategy, such as conservation easements, public land acquisition, or zoning reforms to improve connectivity.
- **Actions** are specific, operational steps with clear responsibilities, resources, and timelines, such as signing conservation easements on identified parcels, adopting lighting ordinances for turtle nesting beaches, or updating municipal zoning maps to include ecological overlays.

This hierarchy offers a roadmap to help decision-makers transition from broad objectives to concrete steps. For instance, the goal of reducing habitat fragmentation translates into the strategy of enhancing ecological corridors. A COA under this strategy might involve promoting voluntary conservation easements, while a specific action could be formalizing twenty easements in corridors identified by the Puerto Rico GAP Analysis within five years.

Strategic Axes for Conservation

The following strategies are organized into seven strategic axes, each serving as a pathway to safeguard biodiversity while also enhancing Puerto Rico's resilience, quality of life, and capacity for sustainable development. These axes were developed by integrating multiple inputs: the ecological needs of Species of Greatest Conservation Need; the threats and stressors identified in Chapter 6; the spatial priorities revealed through habitat and land-use analyses; the legal and institutional frameworks discussed in Chapter 2; and the lessons learned from decades of programs and community initiatives across the island.

The seven axes are interconnected and form a unified web of strategies: habitat protection and connectivity (Axis 1) are inseparable from the restoration of degraded ecosystems (Axis 3), climate adaptation (Axis 2), and species-specific measures (Axis 4). Similarly, community stewardship (Axis 5), institutional strengthening (Axis 6), and sustainable financing (Axis 7) provide the enabling environment that allows ecological strategies to succeed over time. Taken together, the strategic axes would constitute a national conservation agenda.

Each axis contains:

- **A brief justification** linking back to the threats, gaps, and opportunities identified in earlier chapters.

- **Specific objectives** that define what must be achieved within the next decade.
- **Key programs and tools** presented in concise tables, acknowledging the broad range of instruments available in Puerto Rico.
- **Courses of Action (COAs)** that outline alternative pathways for implementation.
- **Examples of concrete actions** to illustrate how strategies can take shape on the ground.
- **Implementation details and nuances** that recognize enabling conditions, institutional roles, and local challenges.
- **Metrics and evaluation tools** that connect each axis directly to the monitoring framework in Chapter 9.

Each strategic axis includes actions classified by timeframe: immediate (1–2 years), medium-term (3–6 years), and long-term (7+ years). Geographic priorities include corridors, watersheds, coastal zones, and urban green spaces identified in Chapters 5 and 6. Integrating these priorities ensures that conservation efforts are both targeted and scalable.

Implementation will need active involvement from DNER, federal partners, municipalities, NGOs, academic institutions, and communities. Conservation strategies must also align with existing tools, such as the Puerto Rico Land Use Plan, municipal land-use plans, and FEMA hazard mitigation plans. Regional efforts such as the Southeast Conservation Adaptation Strategy provide additional opportunities for alignment and funding.

Each strategy includes preliminary indicators, which will be elaborated on in Chapter 9. These indicators will evaluate progress in ecological outcomes (such as species recovery and habitat restoration), institutional capacity (including data integration and staffing), and community engagement (like co-management agreements and citizen science participation).

Strategic Axis 1: Habitat Protection and Ecological Connectivity

Habitat loss and fragmentation are among the most urgent threats to Puerto Rico's biodiversity. This axis seeks to secure ecological connectivity by expanding protected areas, collaboratively managing private lands, and integrating biodiversity overlays into land-use planning.

The Puerto Rico GAP Analysis Project provides a foundation by identifying conservation gaps and critical corridors where Species of Greatest Conservation Need lack sufficient protection. These results support the enhancement of the Natural Heritage Program, updating of critical habitat maps, and designation of Critical Wildlife Areas (CWAs) as tools for spatial prioritization.

Table 20: Strategic Axis 1 key programs and tools supporting habitat protection

Programs / Instruments	Purpose / Relevance to Puerto Rico	Lead Agency / Partners	Notes / Local Data
Puerto Rico GAP Analysis	Identifies conservation gaps and corridors for SGCN	USFS / DNER / Conservation Trust	116 protected areas identified by 2011, many without updated management plans
Natural Heritage Program (Law 150)	Habitat acquisition, critical habitat prioritization, and natural areas database	DNER	$2M initial funding, includes ecological land-use management
Critical Wildlife Areas (CWA)	Designation and management of priority wildlife areas	DNER	Updated 2025 version includes 87 CWAs
Puerto Rico Land Use Plan (PRLUP)	Classifies urban, rustic, and specially protected lands	Planning Board / DNER	60% of PR is classified as specially protected rustic land
Hydrological Resources	Protect watersheds and reservoir headwaters	DNER / Planning Board	Includes Cordillera Central, Karst, Sierra de Luqillo, etc.
Forest Legacy Program	Protects private forest areas via purchase or easements	USFS / DNER	Puerto Rico competes nationally for funds (25% match required)

Courses of Action Under Strategic Axis 1

- Expanding the system of nature reserves and community-managed protected areas through acquisitions supported by the Forest Legacy Program.
- Establishing voluntary conservation easements on private lands, facilitated by the Conservation Trust of Puerto Rico and USDA programs.
- Integrating biodiversity corridors into municipal land-use plans and the island-wide Puerto Rico Land Use Plan (PRLUP).

Potential Concrete Actions Under Strategic Axis 1

- Formalize at least 5,000 hectares of conservation easements in identified corridors within five years.
- Designate three new priority areas under the Natural Heritage Program in regions with high ecological vulnerability.
- Integrate updated ecological connectivity maps into municipal zoning tools and regulatory reviews.
- Establish hydrological reserves and watershed protections by explicitly including the designation of Hydrological Protection Areas (surface, groundwater, or combined) as essential tools to secure water supply reservoirs and safeguard aquatic habitats.

Implementation Details and Nuances for Strategic Axis 1

Implementing habitat protection and connectivity strategies requires close coordination between the DNER, the Planning Board, municipalities, NGOs, and private landowners. Key nuances include navigating land tenure complexities, balancing conservation priorities with competing land-use pressures, and ensuring compliance with zoning and permitting frameworks. Partnerships with the Conservation Trust of Puerto Rico, local land trusts, and USDA programs are

critical to sustain voluntary conservation easements and forest stewardship. Hydrological reserves will require cross-sector agreements, since they involve both biodiversity and water security. Implementation must also be adaptive, incorporating updated ecological corridor maps, aligning with municipal land-use plans, and building community support to avoid perceptions of imposed restrictions.

Metrics and Evaluation Tools for Strategic Axis 1

Evaluation of habitat protection and connectivity should monitor both spatial coverage and functional outcomes. Key indicators include hectares of land under legal protection (e.g., reserves, easements); the number of designated Critical Wildlife Areas formally managed; kilometers of ecological corridors incorporated into land-use plans; and the number or extent of hydrological reserves established. Tools include GIS overlays of protected areas, land-cover change monitoring, conservation easement registries, and periodic assessments of corridor functionality using GAP and biodiversity occurrence data.

Strategic Axis 2: Climate Adaptation and Ecosystem Resilience

Ecological pressures intensify existing stresses on species and habitats, with effects ranging from stronger hurricanes to sea-level rise, longer droughts, and changes in species ranges. This axis aims to enhance the adaptive capacity of ecosystems and communities by using nature-based solutions to lower vulnerabilities for both wildlife and people.

Existing programs already establish a solid base. The USFWS Coastal Program and the NOAA Coral Reef and Mangrove Restoration Initiatives have backed vital restoration projects. These efforts are enhanced by FEMA hazard mitigation planning and municipal climate adaptation strategies.

Table 21: Strategic Axis 2 key programs and tools supporting climate adaptation

Programs / Instruments	Purpose / Relevance to Puerto Rico	Lead Agency / Partners	Notes / Local Data
USFWS Coastal Program	Provides technical and financial support for habitat restoration in coastal ecosystems	USFWS / DNER / NGOs	Focuses on high-priority coastal habitats
NOAA Coral Reef and Mangrove Restoration	Restores natural barriers, enhances resilience to storms and erosion	NOAA / NGOs / Municipalities	Coral reefs insurance pilots in the Caribbean are models for PR
FEMA Hazard Mitigation Plans	Integrates ecosystem services into disaster planning	FEMA / Municipalities	Several municipalities updating plans post-Maria
Urban Forest Inventories & Hazard Mitigation	Track urban forest conditions, mitigate tree hazard post-hurricanes	USFS / DNER / Municipalities	Originally linked to fire/hurricane resilience
Tree City USA / Urban Forestry Programs	Promote sustainable management of urban forests	USFS / Municipalities / NGOs	Helps urban heat and storm impacts

Courses of Action Under Strategic Axis 2

- Identifying and protecting climate refugia (areas that are more resistant to temperature and precipitation changes).
- Restoring mangroves, coral reefs, dunes, and wetlands as natural buffers against flooding and storm surges.
- Incorporating ecosystem-based adaptation into hazard mitigation and municipal climate adaptation plans.
- Connecting urban forestry programs to climate resilience goals.

Potential Concrete Actions Under Strategic Axis 2

- Complete restoration of at least 1,000 hectares of mangroves and coastal wetlands within ten years.
- Integrate ecosystem-based adaptation measures into at least ten municipal hazard mitigation plans.
- Establish pilot projects that utilize coral reef insurance and other innovative financial mechanisms to support post-storm recovery.
- Expand participation in Tree City USA and related programs to include at least five municipalities.
- Establish coral reef insurance pilots in at least two coastal municipalities.

Implementation Details and Nuances for Strategic Axis 2

Implementing climate adaptation measures will require coordinated efforts across multiple governance levels. DNER and NOAA provide technical leadership for mangrove and coral reef restoration, while FEMA hazard mitigation frameworks help municipalities incorporate ecosystem-based adaptation into their official plans. A key nuance is that adaptation projects must be designed for long-term sustainability, understanding that restoring reefs, mangroves, and dunes needs ongoing monitoring and maintenance rather than one-time efforts. Collaboration

with municipal planning offices is essential, especially for urban forestry and stormwater management projects that reduce heat-island effects and storm damage. Another nuance involves financing. Reef insurance pilots and other innovative mechanisms will only succeed if supported by clear governance agreements and strict enforcement of land-use policies in vulnerable coastal areas.

Metrics and Evaluation Tools for Strategic Axis 2

Progress in climate adaptation should be assessed using both ecological and socio-economic indicators. Recommended metrics include hectares of mangroves, wetlands, and reefs restored; the number of municipalities adopting ecosystem-based adaptation measures in hazard mitigation plans; the number of reef insurance or climate financing pilots implemented; and the extent of urban canopy cover in storm-prone cities. Evaluation methods include remote sensing for coastal habitat extent, ecosystem service valuation models (e.g., avoided flood damage estimates), FEMA hazard plan audits, and field-based monitoring of species and shoreline stabilization.

Strategic Axis 3: Restoration of Degraded Ecosystems

Historical deforestation, unsustainable farming, urban growth, and pollution have degraded many of Puerto Rico's ecosystems. Restoring ecological structure and function is crucial for biodiversity recovery and human well-being.

Key programs like the Forest Stewardship Program (FSP), NRCS, and USACE wetland rehabilitation projects, and invasive species management efforts (Forest Health Management, Lionfish Control Program) offer essential tools to reverse degradation.

Table 22: Strategic Axis 3 key programs and tools supporting ecosystem restoration

Programs / Instruments	Purpose / Relevance to Puerto Rico	Lead Agency / Partners	Notes / Local Data
Reforestation & Riparian Restoration	Restores native vegetation, reduces erosion, and improves habitat connectivity	DNER / NGOs / Municipalities	Priority for watersheds upstream of reservoirs
Wetland Rehabilitation	Enhances water quality and habitat recovery in degraded wetlands	NRCS / USACE / DNER	Includes San Juan Bay Estuary projects
Forest Health Monitoring & Management	Detects and responds to pests, pathogens, and invasive plants	USFS / DNER / UPR Forest Health Clinic	Provides early detection & rapid response
State Fires Assistance & Volunteer Fire Assistance	Improves fire suppression, prevention, and wildfire preparedness	USFS / PR Fire Service / Municipalities	Supports Community Wildfire Protection Plans
Invasive Species Program (Lionfish, Exotic Plants)	Controls invasive species to restore ecosystem balance	DNER / NGOs / Estuary Programs	Community-based campaigns active
Landscape Scale Restoration Program	Funds collaborative restoration at the watershed/landscape level	USFS / DNER	Addresses erosion, invasive control, and wildfire risk

Courses of Action Under Strategic Axis 3

- Implementing reforestation initiatives in riparian corridors and degraded slopes.
- Restoring wetlands and river systems to enhance water quality and habitat conditions.
- Developing and expanding early detection and rapid response programs for pests, pathogens, and invasive species.
- Strengthening community wildfire prevention and suppression capacity.

Potential Concrete Actions Under Strategic Axis 3

- Restoring 500 kilometers of riparian buffers in priority watersheds by 2030.
- Removing invasive plant species in at least 10 designated Critical Wildlife Areas.
- Supporting community-led invasive species removal campaigns, such as lionfish control in coastal waters.
- Incorporate the State Fire Assistance and Volunteer Fire Assistance Programs as key tools for reducing wildfire risk in forest-urban interfaces.
- Include actions such as “developing a Fire Danger Rating System” and “Community Wildfire Protection Plans.”
- Explicitly add Forest Health Monitoring programs (early detection, Integrated Pest Management, inventories of urban/community trees).
- Acknowledge partnerships with the UPR Extension Service Forest Health Clinic.
- Establish at least five Community Wildfire Protection Plans in high-risk forest-urban interface areas.
- Train 200 local responders and volunteers in wildfire suppression techniques by 2028.

Implementation Details and Nuances for Strategic Axis 3

Restoration in Puerto Rico requires careful sequencing and strong interagency collaboration. DNER, USFS, NRCS, and USACE play central roles, but municipalities and community groups are often the first responders in degraded landscapes. A key nuance is that reforestation, wetland rehabilitation, and invasive species control all need multi-year maintenance to succeed. Fire prevention is especially challenging in the wildland–urban interface, where community engagement and municipal emergency services must align with federal fire assistance programs.

Forest health initiatives must also connect with early detection systems and swift diagnostic capabilities through organizations like the UPR Forest Health Clinic. Adaptive silviculture techniques, such as planting climate-resilient native species and employing bioengineering to prevent erosion, will be crucial to ensure restored areas remain viable under future climate scenarios.

Metrics and Evaluation Tools for Strategic Axis 3

Evaluation of restoration efforts should monitor both ecological recovery and risk reduction. Indicators include kilometers of riparian corridors restored; hectares of wetlands and estuaries rehabilitated; number of Community Wildfire Protection Plans developed and implemented; frequency of pest and pathogen detection and response; and the extent of invasive species removal in priority habitats. Tools include GIS land-cover change analysis, aerial and drone imagery, community-based invasive species monitoring, and standardized wildfire risk assessments.

Restoration success should also be evaluated using ecosystem service proxies, such as reduced sediment loads in reservoirs or increased infiltration rates in restored catchments.

Strategic Axis 4: Species-Specific Conservation Measures

While most conservation efforts benefit multiple species, some taxa need targeted actions. This axis supports species-specific recovery planning, captive breeding, reintroduction, and habitat management tailored to their individual needs.

Programs such as captive breeding for endangered amphibians, the Marine Mammal Rescue Program, and disease monitoring for bat populations demonstrate the importance of targeted responses.

Table 23: Strategic Axis 4 key programs and tools supporting species-specific measures

Programs / Instruments	Purpose / Relevance to Puerto Rico	Lead Agency / Partners	Notes / Local Data
SGCN Recovery Planning & Critical Site Protection	Develop/update species recovery plans; protect nesting, roosting, breeding, and foraging sites	DNER / USFWS / NGOs / Academia	Applies to amphibians, reptiles (incl. sea turtles), bats, raptors, seabirds/shorebirds
Marine Mammal Stranding & Response Network	Responds to strandings; necropsy & health database; mitigation of vessel strikes/entanglement	DNER / NOAA partners / NGOs / Universities	Strengthens rapid response, public reporting, and prevention outreach
Waterfowl Focus Areas (ACJV) & Shorebird Network	Prioritize lagoons, wetlands, reservoirs, and coastal flats used by migratory birds	ACJV / DNER / Municipalities / NGOs	Links PR to hemispheric flyway conservation and habitat management
Captive Breeding / Head-starting & Reintroduction	Ex-situ conservation for critically imperiled taxa; genetic management	DNER / USFWS / Zoos / Universities	Applicable to threatened amphibians and select birds
Disease Surveillance (bats, corals, amphibians)	Monitor & respond to WNS in bats, SCTLD in corals, chytrid in amphibians	DNER / Academia / Federal partners	Early detection & rapid response; biosecurity protocols
Nesting Beach & Colony Management	Seasonal closures, lighting management, predator control, stewardship	DNER / Municipalities / NGOs / Communities	Applies to sea turtles, terns, pelicans, and other colonial nesters

Courses of Action Under Strategic Axis 4

- Updating and implementing recovery plans for priority SGCN, with clear critical-site maps and threat-reduction targets.
- Establishing seasonal protection and stewardship for nesting beaches (lighting management, access controls) and seabird/shorebird colonies (setbacks, buffers, predator management).
- Expanding ex-situ programs (captive breeding/head-starting) and structured reintroduction where habitat is suitable.
- Strengthening the marine mammal stranding network, vessel-speed management in hotspots, and gear/bycatch mitigation with fishing sectors.
- Implementing health and disease surveillance (bats, amphibians, corals), with early-warning indicators and response protocols.
- Deepening participation in migratory bird partnerships (e.g., ACJV focus areas; shorebird networks) to align habitat work with species needs.

Potential Concrete Actions Under Strategic Axis 4

- Expand captive breeding and reintroduction of endangered coquí species.
- Enhance nest protection for leatherback turtles and other coastal birds.
- Implement long-term monitoring of White-nose Syndrome in bat populations.
- Conduct annual bat roost monitoring and lab screening for WNS; publish an island-wide health bulletin.
- Recognize these efforts as critical for migratory birds, linking Puerto Rico to broader hemispheric conservation efforts.
- Highlight that waterfowl and shorebirds rely on specific lagoons, wetlands, and artificial ponds that need targeted protection.
- Designate and manage seasonal buffer zones around active seabird colonies and key shorebird roosts, with signage and volunteer wardens.

- Formalize lighting ordinances and retrofit priorities on key sea-turtle nesting beaches; establish night-patrol stewardship with local groups.
- Increase rapid response and necropsy capacity for marine mammals; promote targeted boater-speed advisories in collision hotspots.
- Initiate a head-starting or captive assurance program for an extremely endangered amphibian, combined with habitat restoration and disease hygiene.
- Coordinate water-level management and disturbance-free periods in Waterfowl Focus Areas with peak migration and breeding seasons.

Implementation Details and Nuances for Strategic Axis 4

Species-focused conservation needs tailored strategies that vary widely across different taxa. For instance, managing seabird colonies might involve seasonal closures and predator control, while marine mammal conservation relies on rapid-response stranding networks and on enforcing vessel speed limits. Key complexities include the necessity for cross-jurisdictional coordination, as many species migrate throughout the broader Caribbean, and the need to align local efforts with federal recovery plans. Collaborations with NGOs, universities, and international groups like the Atlantic Coast Joint Venture (ACJV) are crucial for leveraging expertise and data. Implementation also requires balancing species protection with community use of coastal areas and fisheries, making sure conservation measures are socially acceptable and rooted in local stewardship. Biosecurity and disease surveillance add additional layers of complexity, demanding ongoing funding, laboratory capacity, and clear protocols for early response.

Metrics and Evaluation Tools for Strategic Axis 4

Monitoring species-specific measures should integrate demographic, habitat, and threat-reduction indicators. Recommended metrics include: population trends of

key species (for example, annual counts of sea turtle nests, seabird colony sizes, bat roost occupancy); number of active recovery plans updated and implemented; response times and results of marine mammal strandings; hectares of managed Waterfowl Focus Areas; and incidence rates of major diseases (chytrid in amphibians, White-nose Syndrome in bats, SCTLD in corals). Tools include standardized survey methods, acoustic and camera-trap monitoring, satellite telemetry for migratory species, necropsy and laboratory diagnostics, and citizen-science platforms such as eBird for migratory bird populations.

Strategic Axis 5: Community-Based Conservation and Stewardship

Conservation in Puerto Rico is becoming more community-driven, with local groups taking the lead in restoration, monitoring, and environmental education. This approach highlights co-management, citizen science, and participatory conservation as key pillars for sustained success.

Existing programs such as the Forest Stewardship Program, voluntary conservation easements, and citizen science networks for birds, corals, and turtles already show the potential of community leadership.

Table 24: Strategic Axis 5 key programs and tools supporting community stewardship

Programs / Instruments	Purpose / Relevance to Puerto Rico	Lead Agency / Partners	Notes / Local Data
Forest Stewardship Program (FSP)	Technical assistance & management plans for private/communal lands	USFS / DNER / NGOs	Aligns landowner goals with soil, water, and wildlife conservation
Voluntary Conservation Easements	Long-term protection of private lands via deed restrictions	Conservation Trust / DNER / Land Trust	Critical for corridors and riparian buffers
Urban & Community Forestry (incl. Tree City USA, Municipal Tree Boards)	Build local capacity for canopy cover, hazard tree mitigation, and urban heat reduction	USFS / Municipalities / NGOs	Bridges equity, health, and biodiversity; supports post-storm resilience
Citizen Science Networks (birds, turtles, corals, bats)	Island-wide monitoring & public engagement	NGOs / Academia / DNER	Standardized protocols feed PRSWAP indicators
Co-management Agreements for Reserves	Shared governance & on-site stewardship	DNER / Community orgs / Municipality	Formal MOUs clarify roles, access, and maintenance
Interpretive Training & Demonstration Projects	Environmental education, native plant nurseries, and site interpretation	DNER / Estuary Program / NGOs / Schools	Builds place-based skills and volunteer pipelines
School-based Biodiversity Programs	Curriculum integration, field labs, campus habitat restoration	Dept of Education / DNER / Universities	Creates long-term cultural support for conservation
Shade-Grown Coffee & Community Agroforestry	Biodiversity-positive livelihoods in working landscapes	DNER / USDA / Co-ops / NGOs	Habitat value for birds & pollinators; connects to incentives (Axis 7)

Courses of Action Under Strategic Axis 5

- Expanding co-management agreements between communities and DNER.
- Supporting citizen science initiatives to monitor biodiversity and ecosystem health.
- Integrating biodiversity education into formal and informal curricula at all levels.
- Formalize co-management frameworks between DNER and qualified community organizations for priority sites.
- Launch a national citizen science portal with standardized methods (birds, sea turtles, bats, corals) and open data feeds to the PRSWAP monitoring system.
- Scale Urban & Community Forestry: create or strengthen municipal Tree Boards, adopt canopy targets, and implement hazard-tree protocols.
- Fund community nurseries, interpretive training, and school “living labs” to supply native plants and education programs.
- Support community agroforestry (e.g., shade-grown coffee corridors) that deliver habitat, erosion control, and household income.

Potential Concrete Actions Under Strategic Axis 5

- Sign 10+ co-management agreements for reserves and CWAs, each with annual work plans and volunteer programs.
- Deploy an island-wide citizen science platform by 2027; train 500 volunteers; publish annual biodiversity status reports.
- Establish Tree Boards in 25 municipalities, adopt 10-year canopy and urban heat reduction targets, and implement post-storm hazard tree protocols.
- Create 12 community native plant nurseries producing at least 100,000 native seedlings per year for riparian and coastal restoration.
- Integrate biodiversity modules into public school science curricula; set up 20 school living-lab sites (pollinator gardens, rain gardens, mini-arboreta).

- Convert 500 hectares to shade-grown coffee/agroforestry in priority watersheds with technical assistance and purchase commitments (linked to Axis 7 incentives).

Implementation Details and Nuances for Strategic Axis 5

Implementing community-based conservation requires strong local ownership and institutional support. While DNER and USFS offer technical guidance, real success relies on municipalities, schools, NGOs, cooperatives, and grassroots organizations. A nuance here is that communities differ in capacity. Some have established conservation groups, while others need training, initial resources, or long-term support. Building trust is essential; conservation agreements should be co-designed, transparent, and respectful of cultural and economic realities. Urban and Community Forestry programs demonstrate the importance of connecting conservation to everyday life in cities, while shade-grown coffee and agroforestry highlight how biodiversity-friendly practices can support livelihoods. Another nuance is ensuring that citizen science data are standardized and validated so they can be effectively integrated into official monitoring systems.

Metrics and Evaluation Tools for Strategic Axis 5

Evaluation of stewardship efforts should measure both ecological outcomes and social engagement. Indicators include: the number of co-management agreements signed and actively maintained; participation rates in citizen science programs; hectares of private or community lands under Forest Stewardship or conservation easements; the number of municipalities with active Tree Boards and canopy targets; and hectares converted to shade-grown coffee or community agroforestry. Tools include conservation easement registries, citizen science platforms (eBird, iNaturalist, community turtle patrols), surveys of community engagement, and urban tree inventory data. Education outcomes can be tracked through the number

of schools integrating biodiversity modules and the number of students involved in field projects.

Strategic Axis 6: Strengthening Institutions, Policies, and Data Systems

Effective conservation relies on strong governance, consistent policies, and accessible ecological data. This axis addresses institutional capacity, legal frameworks, and inter-agency coordination.

The Natural Heritage Program (established under Law 150 of 1988) plays a key role in habitat acquisition and managing biodiversity data. Related programs include developing centralized GIS platforms, SECAS regional datasets, and municipal land-use plans.

Table 25: Strategic Axis 6 key programs and tools supporting institutional capacity

Programs / Instruments	Purpose / Relevance to Puerto Rico	Lead Agency / Partners	Notes / Local Data
Natural Heritage Program (Law 150)	Administers habitat acquisition, maintains natural areas database, and sets criteria for conservation	DNER	$2M initial funding; manages critical habitat portfolio
Good Neighbor Authority	Authorizes cooperative agreements with USFS for restoration & protective services	USFS / DNER	Allows PR to leverage USFS capacity on state & private lands
Integrated GIS & Biodiversity Databases	Centralize ecological, land-use, and species occurrence data	DNER / USFWS / SECAS / Academia	Requires modernization, interoperability, and open access
Urban Tree Inventories & Hazard Tree Data	Maintain updated records to inform urban forestry and climate adaptation	DNER / Municipalities / USFS	Supports storm preparedness and canopy management
Interagency Wildlife Coordination	Protocols for prevention, suppression, and recovery	DNER / PR Fire Service / Municipalities / USFS	Includes community wildlife protection planning
Forest Health Advisory Committees & Monitoring Programs	Early detection and response for pests, pathogens, and invasive species	USFS / DNER / UPR	Coordinates diagnostics and public education

Courses of Action Under Strategic Axis 6

- Modernize the Natural Heritage Program by ensuring sustainable funding, updating data systems, and integrating with SWAP monitoring.
- Build a centralized biodiversity observatory with GIS layers, species databases, and open-data policies accessible to stakeholders and communities.
- Formalize interagency coordination protocols for wildfire suppression, forest health monitoring, and invasive species response.
- Incorporate urban forestry data into municipal planning and hazard mitigation systems.
- Strengthen institutional capacity through staff training, technical exchanges, and cross-sector partnerships.
- Provide training for technical staff and improve interagency coordination protocols.

Potential Concrete Actions Under Strategic Axis 6

- Develop and launch a Puerto Rico Biodiversity Observatory by 2028, linking DNER, SECAS, and academic databases.
- Establish an interagency working group (DNER, PR Fire Service, municipalities, USFS) with annual wildfire preparedness exercises.
- Update and maintain urban tree inventories in at least 20 municipalities by 2030, integrating them into hazard mitigation and climate adaptation plans.
- Convene a Forest Health Advisory Committee with UPR, NGOs, and DNER to produce annual status reports on pests, pathogens, and invasive species.
- Revise and expand habitat acquisition criteria under the Natural Heritage Program, incorporating climate adaptation and connectivity priorities.

Implementation Details and Nuances for Strategic Axis 6

Strengthening institutions in Puerto Rico requires political commitment, sustainable funding, and trust among agencies. Success depends on revitalizing the Natural Heritage Program as the main source for habitat data, acquisition, and prioritization. A nuance is that, despite opportunities provided by federal frameworks such as the Good Neighbor Authority and SECAS, Puerto Rico's conservation agencies face ongoing underfunding and staff turnover, which threaten continuity. Data integration is another issue: biodiversity and land-use data are scattered across multiple agencies, universities, and NGOs, but remain disconnected. Coordinating wildfire response, forest health monitoring, and invasive species control also calls for formal protocols and shared budgets across sectors. Overall, implementation will be most effective when paired with regulatory reforms, such as zoning, permitting, and acquisition standards, as well as capacity-building for staff and municipalities. Making data systems accessible to the public will also boost transparency and accountability.

Metrics and Evaluation Tools for Strategic Axis 6

Indicators for institutional and data capacity should monitor both structural improvements and functional outputs. Suggested metrics include: the number of staff positions added or retained in key conservation units; annual budget allocations dedicated to the Natural Heritage Program; the number of functional interagency protocols (e.g., wildfire, forest health, invasive species) formally adopted; the percentage of biodiversity datasets integrated into a centralized GIS platform; and the number of municipalities using ecological overlays in zoning decisions. Evaluation tools include annual institutional performance audits, open-data dashboards, staff training records, and monitoring of decision-making processes (e.g., environmental review timelines).

Strategic Axis 7: Sustainable Financing and Economic Incentives

Long-term conservation in Puerto Rico cannot depend only on short-term grants or sporadic appropriations. Stable, diverse, and innovative funding is needed to ensure continuity, scalability, and the integration of biodiversity into economic decision-making. This axis emphasizes building trust funds, leveraging federal and philanthropic programs, creating incentive structures for private landowners, and testing market-based mechanisms that reward conservation-compatible production.

Puerto Rico has a range of existing tools, from USDA incentive programs that fund restoration on private lands to the Auxiliary Forest Program (Law 133), which provides tax benefits to landowners maintaining forest cover. Programs promoting shade-grown coffee and agroforestry also show how biodiversity-friendly practices can align with livelihoods and cultural traditions. Meanwhile, new instruments such as biodiversity credits, green bonds, or reef insurance are needed to secure conservation funding at a larger scale.

Table 26: Strategic Axis 7 key programs and tools supporting sustainable financing

Programs / Instruments	Purpose / Relevance to Puerto Rico	Lead Agency / Partners	Notes / Local Data
Environmental Quality Incentives Program (EQIP)	Financial/technical support for habitat restoration and sustainable land management	USDA / NRCS	Widely used in PR for erosion control, habitat projects
Conservation Stewardship Program (CSP)	Rewards landowners for long-term conservation outcomes	USDA / NRCS	Supports sustainable agriculture with ecological co-benefits
Conservation Reserve Program (CRP) & Regional Conservation Partnership Program (RCPP)	Retires sensitive lands; builds partnerships for large-scale conservation	USDA / NRCS / NGOs / DNER	Underutilized in PR but high potential in floodplains & watersheds

Programs / Instruments	Purpose / Relevance to Puerto Rico	Lead Agency / Partners	Notes / Local Data
Agricultural Conservation Easement Program (ACEP) & Healthy Forest Reserve Program (HFRP)	Protects wetlands/forest through easements and incentives	USDA / NRCS / Land Trusts	Aligns with corridors and watershed protection
Auxiliary Forest Program (Law 133 of 1975)	Grants tax exemptions to landowners preserving forest cover	DNER / Treasury Dept.	>40,000 ha enrolled; underfunded but still active
Puerto Rico Wildlife Conservation Trust Fund (proposed)	Dedicated fund for wildlife conservation, independent of annual budgets	DNER / NGOs / Philanthropy	Would provide long-term stability
Shade-Grown Coffee * Agroforestry Incentives	Integrates biodiversity conservation with agricultural livelihoods	USDA / DNER / Co-ops / NGOs	Habitat for birds & pollinators; cultural heritage
Green Bonds / Biodiversity Credits (emerging)	Market-based financing linked to conservation performance	DNER / Private Sector / International Partners	Pilot-ready in coral reefs, mangroves, and watersheds

Courses of Action Under Strategic Axis 7

- Establishing the Puerto Rico Wildlife Conservation Trust Fund with dedicated revenue streams.
- Expanding enrollment in the Auxiliary Forest Program and updating its criteria to include connectivity and climate adaptation.
- Increasing landowner participation in USDA conservation incentive programs, especially CSP and ACEP.
- Developing pilot biodiversity credit schemes, green bonds, and reef insurance mechanisms with private-sector and philanthropic partners.
- Supporting agroforestry and shade-grown coffee as dual strategies for conservation and rural livelihoods.

Potential Concrete Actions Under Strategic Axis 7

- Launch the Puerto Rico Wildlife Conservation Trust Fund by 2027 with an initial capitalization of $20 million.
- Increase enrollment in the Auxiliary Forest Program by 25% over the next decade, prioritizing corridors and watersheds.
- Double the number of active USDA conservation contracts with Puerto Rican landowners by 2030.
- Pilot at least two biodiversity credit or green bond mechanisms tied to watershed or reef restoration projects.
- Support the conversion of 500 hectares to shade-grown coffee and mixed agroforestry systems, with linked purchase commitments to ensure market viability.

Implementation Details and Nuances for Strategic Axis 7

Implementing sustainable financing strategies in Puerto Rico requires balancing innovation with institutional reliability. Establishing the Puerto Rico Wildlife Conservation Trust Fund will require legislative support, seed funding from government and philanthropy, and long-term revenue sources such as environmental fees or earmarked taxes. A nuance is that, despite the availability of USDA incentive programs (EQIP, CSP, ACEP, etc.), participation in Puerto Rico has historically been limited by administrative barriers, inadequate outreach, and complex land tenure issues; therefore, tailored outreach and technical assistance are essential. Likewise, the Auxiliary Forest Program needs modernization not only to increase enrollment but also to align eligibility with connectivity and climate-adaptation priorities. Newer tools, such as reef insurance, biodiversity credits, and green bonds, will require pilot testing and clear regulatory frameworks to establish credibility. Implementation should also focus on linking incentives to community livelihoods, such as shade-grown coffee, so that conservation finance delivers meaningful social benefits.

Metrics and Evaluation Tools for Strategic Axis 7

Evaluation of financing strategies should evaluate both resource mobilization and ecological leverage. Indicators include total capital secured for the Wildlife Conservation Trust Fund; number and value of active USDA conservation contracts in Puerto Rico; hectares enrolled in the Auxiliary Forest Program; number of hectares under agroforestry or shade-grown coffee supported by incentives; and number of new financing instruments (e.g., reef insurance pilots, biodiversity credits) launched. Tools include annual fund audits, program participation databases, geospatial analysis of land under incentive programs, and socio-economic surveys of participating landowners.

Additional metrics should measure financial sustainability and program durability, including the percentage of conservation funding that is recurring, landowner and property turnover rates, and the average length of time landowners or properties remain enrolled in conservation programs. Ecological return on investment should also be assessed by linking dollars spent to measurable outcomes, such as habitat restored or species protected.

Program Catalog: Conservation Tools and Incentives Available in Puerto Rico

The conservation strategies presented in this chapter utilize a variety of existing programs, initiatives, and tools at the federal, state, local, and community levels. Many of these programs provide technical assistance, financial incentives, regulatory authority, or collaborative platforms. While specific programs are mentioned throughout this chapter as examples, this section compiles them into a program catalog for easy reference.

The following catalog aims to complement the strategic framework of the seven conservation axes by serving as a technical resource. By gathering these tools in one place, the catalog helps stakeholders connect strategic objectives with the practical resources needed to implement them. It includes detailed descriptions of conservation programs in Puerto Rico from prior versions of the Conservation Strategies Chapter, updating and expanding the information as appropriate.

The catalog is organized into seven conservation axes: habitat, climate, restoration, species, community, institutions, and financing. This structure allows readers to efficiently locate programs relevant to their work.

Puerto Rico Gap Analysis

Strategic Axis 1: Habitat Protection and Ecological Connectivity

Land protection is an important conservation tool today. The Puerto Rico Gap Analysis Project conducted an inventory of protected areas and an evaluation of the degree of their management for conservation purposes, utilizing information from federal and state agencies, the Conservation Trust of Puerto Rico, and the Puerto Rico Planning Board. (Gould et al., 2008). The project initially identified 90 stewardship areas, 77 of which have some form of conservation management. In the 2011 publication, the number of protected areas increased to 116. Among the stewardship areas, 57% are managed by commonwealth agencies, 28% by federal agencies, and 15% by non-governmental agencies. Another key finding was that management plans for many areas either do not exist or have not been updated to provide direction for today's conditions (e.g., reduced timber production, focus on forest restoration, and increased development pressures).

By 2018, the number of terrestrial protected areas had increased to 177 (PACAT, 2018). This includes approximately 361,084 acres of protected land, with the largest being the Karst Conservation Zone, which spans 159,048 acres. Commonwealth agencies managed about 53% of these areas, with five areas co-managed alongside federal and non-governmental organizations. Non-governmental organizations played a key role in conservation, managing 44% of areas, with four areas also co-managed with Commonwealth agencies. Conversely, federal agencies have scaled back their involvement since 2011, now managing only 6% of the protected areas, including one area co-managed with a commonwealth agency.

In the same year, 27 marine protected areas were established, totaling approximately 894,218 acres. The largest of these is the marine reserve around the islands of Mona and Monito, which extends over 373,795 acres. The DNER

manages all of these areas, with one being co-managed alongside the San Juan Bay Estuary Program.

The most important metric for protected areas in Puerto Rico is the designation of additional protected lands and waters, which supports conservation efforts. From the original Gap Analysis Project to the 2018 assessments, the amount of protected land has increased by 126%. Once areas are designated as protected, other conservation metrics can be tracked. For example, the San Juan Bay Estuary Program reports various metrics on its website, including acres restored, trash collected, volunteer participation, and trees or vegetation planted. The DNER should implement relevant metrics that they can monitor or collaborate with federal or non-governmental organizations to track effectively.

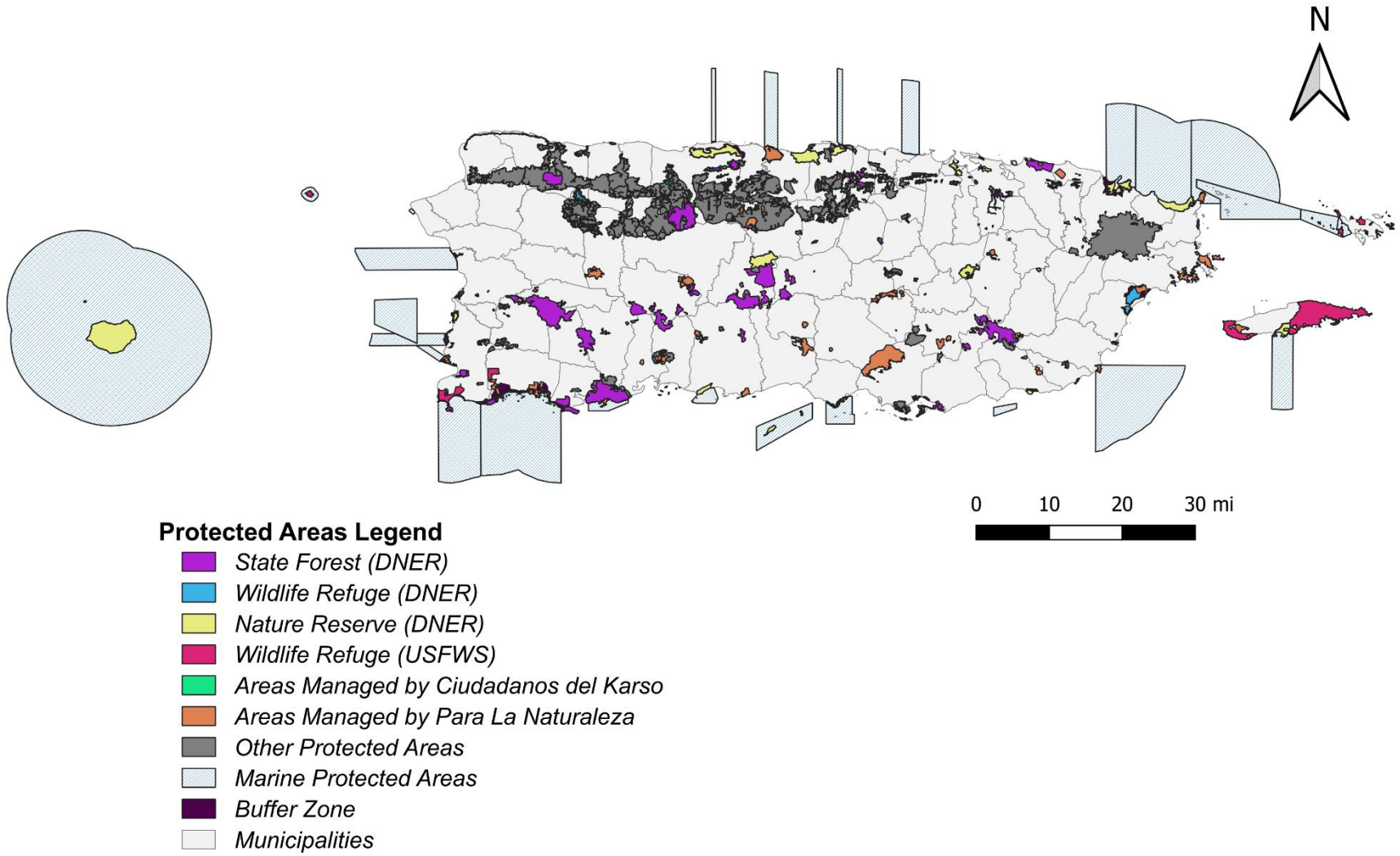


Figure 33. Location of land currently protected by Federal or Commonwealth designation, or proclamation, or as private reserves of non-government organizations (PACAT, 2018).

The Sportfish Gap Analysis Project

Strategic Axis 4: Species-Specific Conservation Measures

The Sportfish Gap Analysis Project aimed to develop a comprehensive set of databases on Puerto Rico's freshwater and marine recreational fisheries resources to assess the conservation status of species and habitats. The Sportfish Gap Project consisted of four components: habitat description and mapping; protected areas and conservation priorities; species distributions and conservation status; and analyses of gaps in species conservation and protection. The Project provided information on the stewardship of marine and terrestrial protected areas, natural history accounts of species, bibliographic information, species occurrences, and habitat characterization. The species included in the report are those identified by DNER staff as a priority for recreational fisheries.

For the habitat mapping component, an extensive geospatial database was compiled, incorporating all available habitat-related information and modifying or developing new data to integrate geospatial information and develop predicted habitat models for the species. For the marine component, in addition to the existing layers of information, new layers, such as slope and rugosity, were developed using bathymetry. Eleven new layers were developed for the freshwater component of the project, integrating hydrographic and landscape features for species distribution modeling purposes.

A comprehensive database documenting terrestrial and marine protected areas in Puerto Rico was developed to support protected areas and conservation priorities. This geospatial layer was used to analyze conservation "gaps."

During the species distribution and conservation status component, 29,571 records for 66 marine species were obtained. Occurrence maps were created for each species, and a comprehensive report was compiled for ten species. For the

freshwater/brackish/marine species, 582 occurrence records were obtained, and eight occurrence maps were completed.

This type of gap analysis project has not been performed in over ten years. Since then, many environmental conditions in Puerto Rico have changed, suggesting that the databases of fishery resources developed during the previous gap project may now be outdated. Therefore, before developing any new conservation strategies, it is crucial to conduct and approve a new analysis within the next ten years, prior to the 2035 SWAP revision. Success metrics for this new analysis would include:

- Completeness of species distribution and habitat mapping.
- Percentage of sportfish species with updated population assessments and habitat evaluations.
- Number of priority gaps identified in species or habitat coverage.
- Integration of findings into fisheries management plans.

Development of a Strong Private Lands Program

Strategic Axis 1: Habitat Protection and Ecological Connectivity

Strategic Axis 5: Community-Based Conservation and Stewardship

Strategic Axis 7: Sustainable Financing and Economic Incentives

Over the last twenty years, it has become increasingly evident that private landowners play a critical role in conserving fish and wildlife resources, particularly listed species. The US Forest Service has many programs that provide technical and financial assistance to non-industrial private landowners and communities (Table 28). The DNER's Forestry Bureau is the primary state administrator for most USFS Cooperative programs, with one exception; the Puerto Rico Fire Service is designated as the primary agency responsible for implementing the State Fire Assistance and Volunteer Fire Assistance Program.

Table 27. USDA Forest Service Cooperative Programs available in P.R.

Program	Purpose
Forest Stewardship	-Provides technical assistance, through State forestry agency partners, to nonindustrial private forest owners to encourage and enable active long-term forest management. A primary focus of the Program is the development of comprehensive, multi-resource management plans that provide landowners with the information they need to manage their forests for A variety of products and services. -Promotes the conservation of soil, water, flora, and fauna through the protection and effective management of private forest land. -Promotes greater participation of owners in the programs. -Develops projects that are aimed at improving water quality through the protection and conservation of watersheds and forest areas.

Program	Purpose
Urban and Community Forestry	-Provides technical and financial assistance to communities, public and private entities, and municipalities on the management of urban forest resources to promote a sustainable ecosystem. -The program has an Advisory Council composed of representatives of various sectors of society, whose primary function is to advise the director of the DNERFSB in the process of implementing the program. -Provide technical and financial assistance to communities, public and private entities, and municipalities on the management of urban forest resources to promote a sustainable ecosystem.
Forest Legacy	-Promotes the protection of forest areas through the purchase of private land with forest values that are under threat to be converted to non-forest uses and have features that warrant preservation and enrich our natural areas. This goal can be achieved through the purchase of land or conservation easements. Puerto Rico competes with other states for funding of this program, which should provide a 25% match from the state.
Community Forest Open Space Conservation	-The purpose of the CFP is to competitively award grants to enable local governments, Indian Tribes, and nonprofit organizations to establish community forests by acquiring and protecting private forest lands that will provide continuing and accessible community benefits. Community benefits provided by community forests established through this program include, but are not limited to: economic benefits through sustainable forest management; environmental benefits such as clean water and wildlife habitat; benefits from forest-based educational programs, including vocational education programs in forestry and serving as models to guide stewardship on private forest lands; and recreational benefits, including hunting and fishing. Public access to the community forests is required and intended to enhance public health and well-being.
Forest Health Management	-Works in partnerships to prevent, suppress, and slow the spread of native and nonnative forest insects, pathogens, and invasive plants affecting urban, rural, and wildland forests.
Forest Health Monitoring	-Monitors the forests of the United States to determine detrimental changes or improvements to forest health that occur over time.
State Fire Assistance	-Provides financial and technical support directly to the states to enhance firefighting capacity, support community-based hazard mitigation, and expand outreach and education to homeowners and communities concerning fire prevention. The program requires a 50-50 match by the state. The delivery system is through the State Forester.

Program	Purpose
Volunteer Fire Assistance	Provides financial, technical, and other assistance to rural communities with a population of less than 10,000, matched on a 50-50 basis either by the state or community. The State Foresters and their staff deliver this program. Some benefits include: • Available funding to renovate equipment obtained through the Federal Excess Personal Property Program • Improved fire protection capabilities and capacity in rural areas to protect lives and other rural investments • Improved effectiveness of fire protection in wildland-urban interface areas • Complements state and federal firefighting forces to optimize fire protection across ownerships • Complements the Rural Fire Assistance Program provided by the Bureau of Land Management
Good Neighbor Authority (FY 2014 Appropriations Act and the 2014 Farm Bill)	-These authorities encourage the USFS to enter into Good Neighbor Agreements with the States, the Commonwealth of Puerto Rico, and State Forestry Agencies to carry out authorized forest, rangeland, and watershed restoration and protective services when similar and complementary projects are being performed on adjacent State or private lands, and on and off National Forest System lands. (CFR 2015).
Landscape Scale Restoration	-A competitive grant program that promotes collaborative, science-based restoration of priority forest landscapes and furthers priorities identified in State Forest Action plans or equivalent restoration strategies. -Addresses large-scale issues such as wildfire risk reduction, watershed protection and restoration, and the spread of invasive species, insect infestation, and disease.

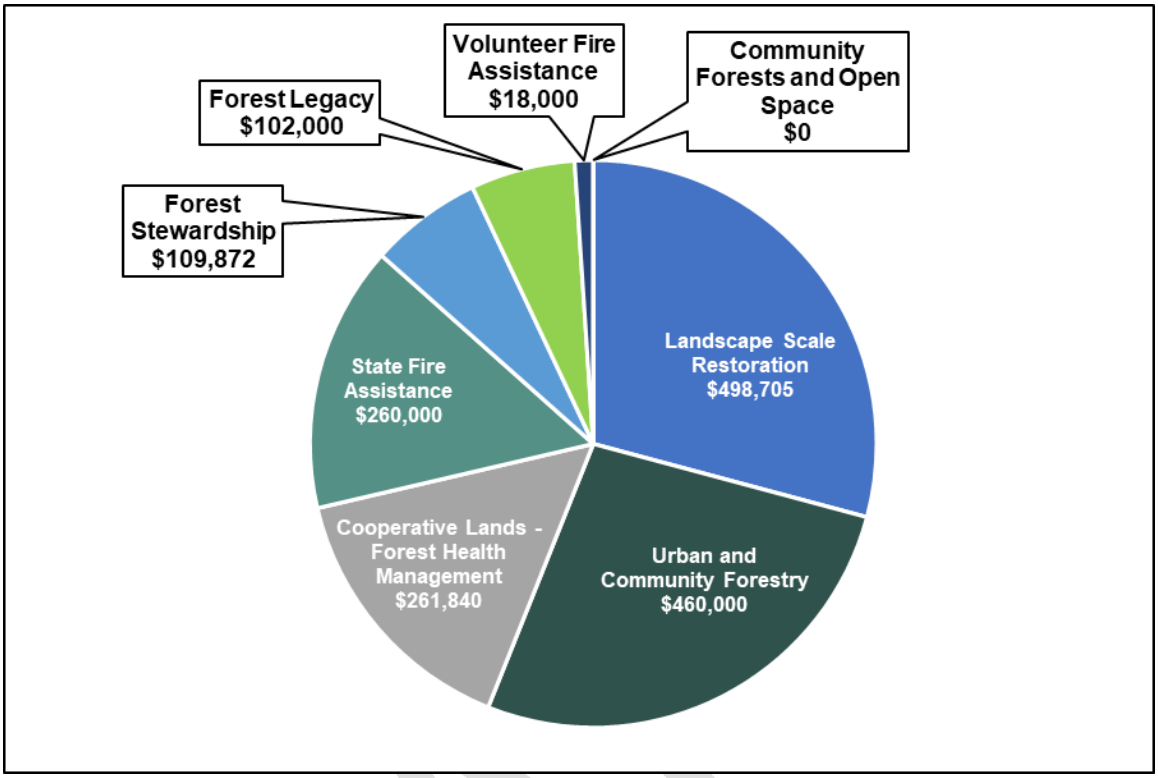


Figure 34. Investment in Puerto Rico's Cooperative Programs FY 2024 Final (Forest Service, 2025)

The U.S. Department of Agriculture and the U.S. Department of the Interior have technical and financial assistance programs that complement the Cooperative Programs described above. The cost incentive programs are the most commonly used to establish, restore, and manage forested lands (Table 29).

Table 28. USDA, NRCS, and the USFWS incentive programs available to non-industrial private landowners in P.R.

Environmental Quality Incentive Program (EQUIP)	-Provides a voluntary conservation program for farmers, ranchers, and owners of private, non-industrial forest land that promotes agricultural production, forest management, and environmental quality as compatible national goals. EQIP provides financial and technical assistance to help eligible producers install or implement conservation practices on eligible agricultural land.
Partners for Fish and Wildlife (PFW), and Coastal Program (CP)	-These programs provide financial and technical assistance for voluntary, on-the-ground habitat restoration and protection projects through locally based field coordinators. The programs recognize the need to balance residential, tourist, commercial, agricultural, and industrial needs with conservation of important habitats and species, and work closely with other Federal, Territorial, non-governmental organizations, and private partners to carry out restoration projects. The mission of these programs is to protect and recover Federal Trust Species (threatened and endangered species, migratory birds, and inter-jurisdictional fish species) by supporting the restoration of high-priority habitats and the recovery of important fish and wildlife species on private and public lands in Puerto Rico and the U.S. Virgin Islands.
Conservation Reserve Program (CRP)	-The Conservation Reserve Program (CRP) is a voluntary program for agricultural landowners. Through CRP, you can receive annual rental payments and cost-share assistance to establish long-term, resource-conserving covers on eligible farmland.
Conservation Stewardship Program (CSP)	-A voluntary conservation program that encourages producers to address resource concerns comprehensively by: • Undertaking additional conservation activities; and • Improving, maintaining, and managing existing conservation activities.
Regional Conservation Partnership Program (RCPP)	-Partners with agricultural producers, farmers, state or local governments, NGOs, and higher education institutions to stretch and multiply conservation investments and reach conservation goals on a regional or watershed scale by restoring or sustaining natural resources such as: • Clean and abundant water • Healthy, productive soils • Enhanced wildlife and pollinator habitat

Agricultural Conservation Easement Program (ACEP)	-Provides financial assistance to eligible partners for purchasing Agricultural Land Easements that protect the agricultural use and conservation values of eligible land. For working farms, the program helps farmers and ranchers keep their land in agriculture. It also provides technical and financial assistance to restore, protect, and enhance wetlands by purchasing a wetland reserve easement. Eligible partners include state and local governments, as well as NGOs, that have established farmland or grassland protection programs.
Healthy Forests Reserve Program (HFRP)	-Assists landowners, voluntarily, in restoring, enhancing, and protecting forestland resources on private lands through easements, 30-year contracts, and 10-year cost-share agreements.

Offering tax incentives is one strategy for land conservation. The Auxiliary Forest Program is authorized by Article 10 of Law 133, Forest Law of Puerto Rico. It enables the Secretary of the DNER to designate private forest land as State Auxiliary Forests Figure 36. Private forest landowners with five or more acres of continuous forest dedicated to conservation or the production of forest products. In return, landowners are exempt from taxes on the land and any income from forest products produced and sold in the market. As part of the program, each landowner must have a Forest Service Bureau-approved forest management plan. The Treasury Department assigns the tax exemption. This designation must be revised and renewed annually. In 2007, 2,938 hectares and 67 landowners were enrolled in the program; however, 110 landowners with 2,300 hectares, who had previously enrolled, had not reenrolled.

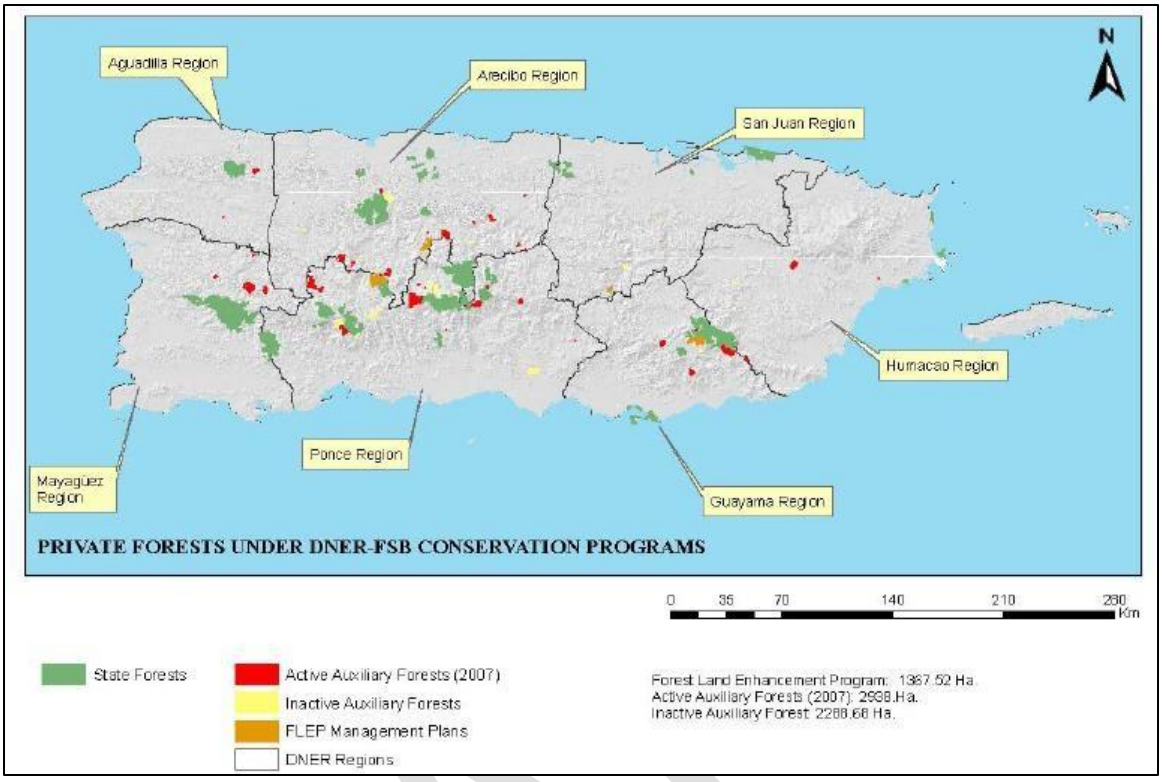


Figure 35. Location of private forests enrolled in DNER state auxiliary forest programs

Private conservation and management are necessary to preserve the ecological benefits of forests, as documented by the fact that as much as 82% of Puerto Rico's forested lands are held in private ownership (DNER 2000). An analysis conducted by the Forest Stewardship Program (FSP) documents 104 private landowners with management plans covering four thousand eight hundred thirty-three (4,833) acres distributed among five major river basins: the Rio La Plata, the Rio Grande de Arecibo, the Río Grande de Manatí, and the Rio Grande de Patillas Guamaní. Of this acreage, nearly 61% is forested, 3.7% is in agroforestry use, and 0.01% is in riparian ecosystems (Figure 37).

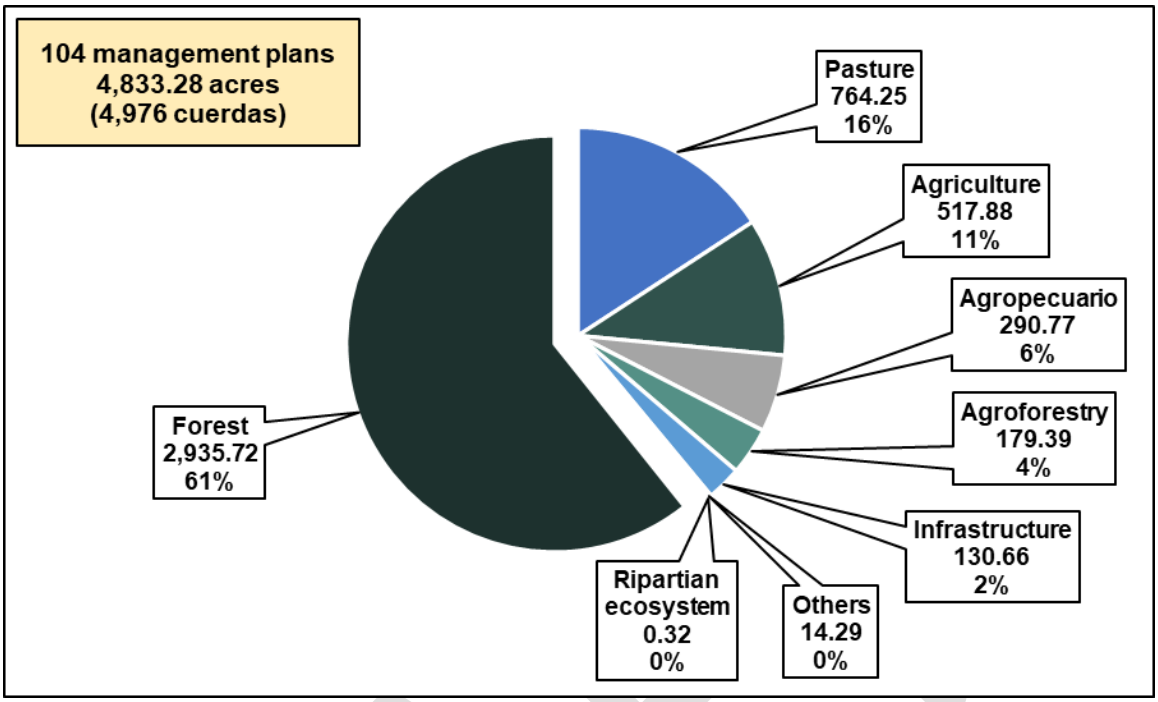


Figure 36. Land use on properties enrolled in the Forest Stewardship Program (DNER)

Strengthening of the Existing Natural Heritage Program

Strategic Axis 1: Habitat Protection and Ecological Connectivity

Strategic Axis 6: Strengthening Institutions, Policies, and Data Systems

Law 150 of 1988 formally vested authority for habitat acquisition in the National Heritage Division. The National Heritage Division was authorized to administer the NHP, which was funded with an initial appropriation of $2,000,000 under the 1988 enabling legislation, and given the mandate for:

- Establishing criteria for state government acquisition of natural habitats within Puerto Rico;
- Developing a priority list of critical habitats for acquisition, according to these criteria;
- Acquisition, transfer, and classification (e.g., Natural Reserve, Sanctuary, etc.) to state control of lands containing priority habitats;
- Developing and coordinating supplementary support, such as NGOs' funding, for habitat acquisition and management.

The NHP workplan includes land acquisition projects and other technical studies as priority activities. The latter includes developing an ecological land-use management plan, creating a natural areas database, assessing the feasibility of securing external funding, identifying natural areas within state-owned properties, and conducting land-titling analyses. The NHP also establishes actual boundaries within formally designated state-protected areas.

Identification of Waterfowl Focus Areas

Strategic Axis 4: Species-Specific Conservation Measures

Another conservation strategy is the identification of Puerto Rico's Waterfowl Focus Areas (PRWFA), as part of the Atlantic Coast Joint Venture (ACJV). The ACJV is a partnership focused on conserving habitat for native birds in the Atlantic Flyway of the United States, spanning from Maine south to Puerto Rico and the Virgin Islands. The joint venture is a partnership of 17 states and one commonwealth: Maine, New Hampshire, Vermont, New York, Massachusetts, Rhode Island, Connecticut, New Jersey, Pennsylvania, Delaware, Maryland, West Virginia, Virginia, North Carolina, South Carolina, Georgia, Florida, and Puerto Rico. With the addition of Puerto Rico in 2001, the joint venture boundary evolved to encompass the entire U.S. Atlantic Flyway.

The main purpose of the ACJV is to develop and maintain a strong scientific foundation for planning, implementing, and evaluating conservation actions and to work together to identify and conserve the key breeding, migration, and wintering habitats for priority bird species in the Atlantic Flyway. The joint venture was originally formed as a regional partnership focused on conserving waterfowl and wetlands under the North American Waterfowl Management Plan of 1986. The ACJV has since broadened its focus to the conservation of habitats for all birds consistent with major national and continental bird conservation plans and the North American Bird Conservation Initiative (ACJV, 2004).

Wetlands in Puerto Rico are threatened. As mentioned earlier, the island's economy has evolved from one based on agriculture to one sustained by urban development (i.e., construction) and industry. Nonetheless, human-made ponds initially constructed for irrigation purposes were left abandoned and became a new habitat for water birds. These artificial ponds were deep enough to benefit waterfowl species such as Ruddy Ducks and other diving species. Today, some of

these ponds, mainly those located in the south of the island, serve as critical habitat for the Ruddy Duck, a vulnerable species in Puerto Rico, as well as for many other migratory species. Protection of these ponds is imperative to save this species from local extinction.

The PRWFA was selected based on the presence of wetlands and lagoons that are optimal for the occurrence of migratory waterfowl and for the intense use of these habitats by birds. This includes optimum habitat for these species to feed and roost. Twenty primary areas were selected, including lagoons on the islands of Vieques and Culebra. The areas were also selected according to their importance as habitats that supported migratory, rare, and endangered waterfowl such as Black Ducks (*Anas rubripes*), Blue-winged Teals (*Anas discors*), Masked Ducks (*Nomonyx dominicus*), West Indian Whistling Ducks (*Dendrocygna arborea*), and White-cheeked Pintails (*Anas bahamensis*), among others. The study also included a list of other migratory, native, endemic, and exotic bird species reported in selected areas. Some of the references used were documents available at DNER, such as literature about important lagoons on the island (Negrón-González, 1986; Scott and Carbonell, 1986; Ortiz-Rosas and Quevedo-Bonilla, 1987), the status of the waterfowl (Chabert et al., 1984; Bonilla et al., 1992; NOAA et al., 2000), and the Critical Wildlife Areas documents (Raffaele and Duffield, 1979; Cardona and Rivera, 1988; Ventosa-Febles et al., 2005a).

The PRWFA document identifies and describes the main waterfowl areas DNER classifies in Puerto Rico (Figure 39 and Table 30; Ventosa-Febles et al., 2005b). DNER and other agencies that, through their ministerial duties, approve endorsements or permits, need to be aware that their actions do not jeopardize those sites recognized as Waterfowl Focus Areas.

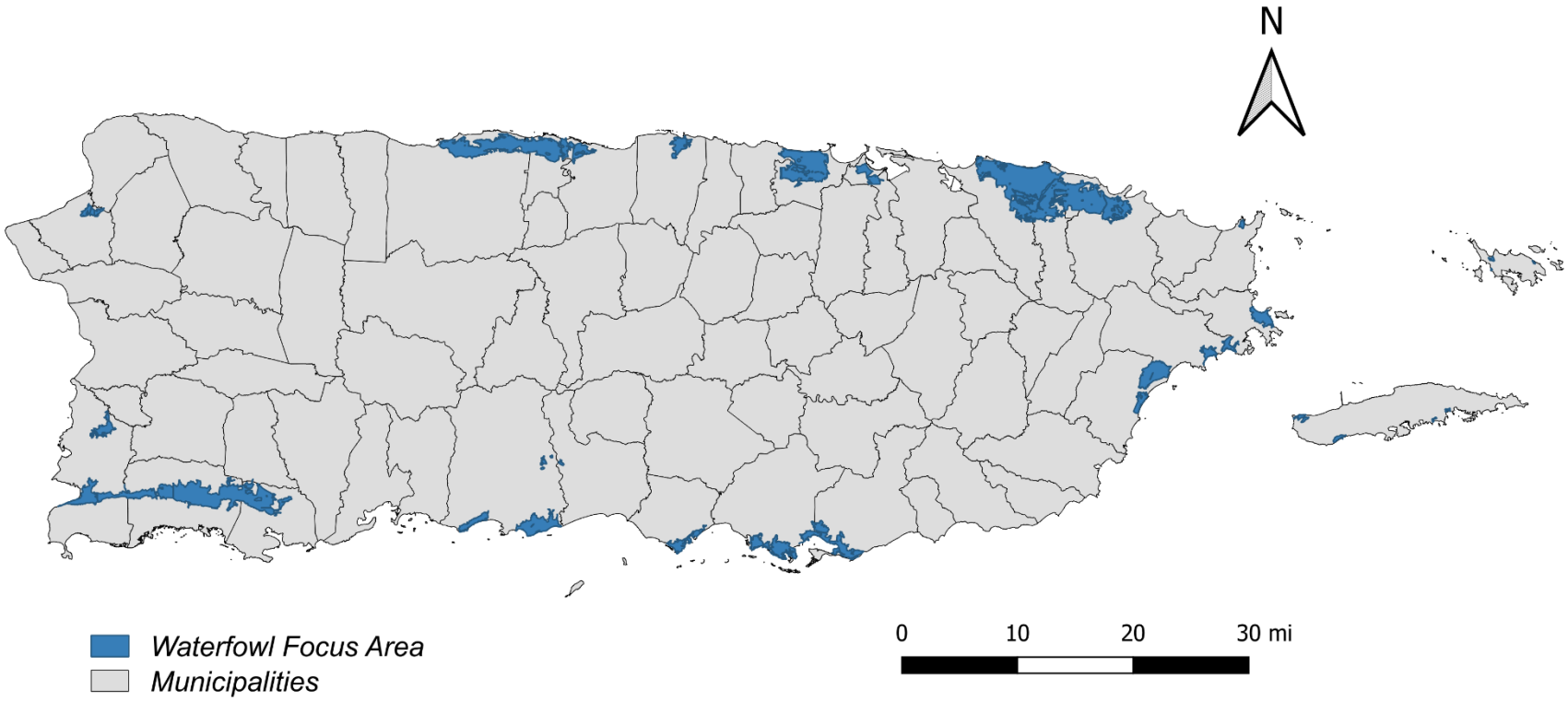


Figure 37. Puerto Rico Waterfowl Focus Areas (Ventosa-Febles et al. 2005b).

Table 29. Puerto Rico Waterfowl Focus Area, Sub-Focus Areas, and Municipalities

Focus Area	Sub-Focus Area	Municipality
Caño Tiburones	None	Arecibo and Barceloneta
Hacienda La Esperanza	None	Manatí
Cibuco Swamp	None	Vega Baja
El Mameyal	None	Dorado
Las Cucharillas Marsh	None	Cataño, Guaynabo, and Bayamón
Torrecillas Lagoon	Piñones and Torrecilla Alta	Loíza
Aguas Prietas	None	Fajardo
Ceiba Mangrove Forest and Lagoons	None	Ceiba
Culebra Island Lagoons	Flamenco Lagoon, Zoni Lagoon, and Cornelio Lagoon	Culebra Island
Vieques Island Lagoons	Kiani Lagoon Complex, Playa Grande Lagoon, Chiva Swamp, and Yanuel Lagoon	Vieques Island
Humacao Natural Reserve	None	Naguabo and Humacao
Punta Arenas, Mar Negro, Bahía de Jobos and Punta Pozuelo	None	Salinas and Guayama
Punta Petrona	None	Santa Isabel
El Tuque/Punta Cucharas/Salinas Lagoon	None	Ponce
La Esperanza/Cabuyón Mangrove	None	Ponce
Serrallés Lagoons Complex	None	Ponce
Cartagena Lagoon	None	Lajas
Boquerón Wildlife Refuge	None	Cabo Rojo
Cuevas Lagoon	None	Cabo Rojo
Cayures	None	Añasco

Identification of Critical Wildlife Areas

Strategic Axis 1: Habitat Protection and Ecological Connectivity

Another conservation strategy is the identification and description of Puerto Rico's Critical Wildlife Areas (CWA). The CWA fulfills one of the most fundamental responsibilities of DNER: to provide comprehensive information on important wildlife and habitat resources in Puerto Rico and its offshore islands. This wildlife and habitat information is used by local governments, state and federal agencies, private landowners, and consultants for land-use planning. This document seeks to protect critical wildlife habitats from degradation due to incompatible land uses. Wildlife species have varying capabilities to cope with human encroachment; therefore, careful planning is necessary to ensure that important wildlife habitats are not destroyed and that conflicts between wildlife and humans are minimized or eliminated.

The first version of the CWA was published thirty-six years ago, in 1989. To date, some of the original CWAs are degraded. Therefore, they were demoted or removed from the list. Others, which retain their wildlife value, were recommended for maintenance or upgrade, and their conservation was sought. Most Commonwealth forests, refuges, reserves, and other areas were included in the 2025 CWA document (Table 31; Figure 40). Each CWA was evaluated in relation to its faunal composition following the criteria used by Raffaele and Duffield (1979):

1. Is there one or more species unique to the locality and found nowhere else?
2. Is the site of particular importance for breeding, roosting, feeding, or some other behavior, even though the organism ranges elsewhere?
3. Is the site a center of abundance for game or endangered species?
4. Does the site have outstanding potential to be developed as (2) or (3) above?

Other categories for evaluating each CWA were the presence of species of limited distribution and/or game species. These categories are similar to those from Cardona and Rivera (1988):

1. Species considered endangered or threatened under the Federal Endangered Species Act of 1973, as amended.
2. Species considered endangered or threatened under the Regulation to Govern the Management of Threatened and Endangered Species in the Commonwealth of Puerto Rico (DRNA, 2004).
3. Species of importance for hunting, even though their hunting is prohibited, and do not belong to the above categories.
4. Aquatic, wading, and shorebirds, migratory or resident, which largely depend on coastal habitats up to about one kilometer inland.

The latest version of the Puerto Rico CWA (2025) has an updated format for the information presented. For each area, the following information is provided:

- Area Description
- Ownership/Protection
- Special Recognition
- Wildlife
- CWA Map

The municipality, boundaries, geographic location, and land cover (hectares) of each CWA were identified for each area description. Also, descriptions of the topography, life zones, and plant associations are provided for each area. The owner and/or administrator, and any actual or potential protection, were identified in the Ownership/Protection section. The Special Recognition segment mentioned whether the area was previously classified as a CWA or had any other recognition (e.g., Forest, Reserve, Important Bird Area, National Estuary, etc.). The area's present classification in terms of wildlife importance was included. The 1979 and

1988 documents were followed to classify areas of primary or secondary importance to wildlife.

Inventories available in the literature, forest or land managers' wildlife checklists, and censuses conducted by project personnel, other DNER researchers, or the Puerto Rico Ornithological Society Inc. were documented for the wildlife segment. Agricultural or domesticated species were not considered wildlife. Scientific and common names were obtained from the Integrated Taxonomic Information System (ITIS, 2005), the PR-GAP Terrestrial Vertebrates Species List (USFS, 2004), and NatureServe (2005). Wildlife considered in this document includes birds, reptiles, amphibians, mammals, fish, and invertebrates. Exotic species were also mentioned. Important plant species were also included.

The wildlife section in the document has been expanded. It counts the number of bird species recorded in 2005, followed by the count observed from 2015 to 2024. Additionally, the document compiles all species identified during the 2015-2024 period into a single list. Separately, it highlights the species present in 2005 but now absent in 2024, as well as those that emerged in 2024 and were not recorded in 2005.

The 2025 document has removed the specific CWA sections detailing threats and conservation recommendations. Instead, the document's summary of findings addresses general stressors and threats to the CWA environments. Individual reference sections have also been eliminated.

Unlike the 2005 CWA document, which included two types of maps for each area, the 2025 document features only one map per area. This map uses data from the DNER and the US-FWS (Figure 41). Multiple appendices also added additional non-specific maps and tables, such as bird density in CWAs (Figure 42).

Table 30. Puerto Rico Critical Wildlife Areas (2025) and their respective locality (Municipalities).

AREA	LOCALITY
CWA-1- Cucharilla's Mars	Cataño
CWA-2- Buchanan Haystack Hills and Fort Buchanan Pond	Bayamón
CWA-3- Torrecillas Swamp System-Piñones-Vacía Talega	Carolina-Loíza-Canóvanas
CWA-4- Barrio Borinquen, Trujillo Alto Lake, Bairoa Lake La 25, and Gurabo River Mouth	Trujillo Alto-Caguas-Gurabo
CWA-5- Baja Swamp and Herrera River Mouth	Río Grande
CWA-6- Ensenada Comezón	Río Grande
CWA-7- Río Mar, North of Road # 968	Río Grande
CWA-8- Luquillo Mountains	Luquillo
CWA-9- San Miguel, La Paulina and El Convento Natural Area	Luquillo-Fajardo
CWA-10- Laguna Grande, Laguna Aguas Prietas, and adjacent areas	Fajardo
CWA-11- Fajardo Coast Line	Fajardo
CWA-12- La Cordillera Natural Reserve	Fajardo
CWA-13- Flamenco Peninsula	Culebra
CWA-14- Flamenco Lagoon	Culebra
CWA-15- Cornelius Lagoon	Culebra
CWA-16- Resaca Mountain	Culebra
CWA-17- Resaca Beach	Culebra
CWA-18- Brava Beach	Culebra
CWA-19- Larga Beach and Zoní Lagoon	Culebra
CWA-20- Maillux Lagoon	Culebra
CWA-21- Puerto del Manglar	Culebra
CWA-22- Los Caños	Culebra
CWA-23- Cementerio Bay	Culebra
CWA-24- Culebra's Surrounding Islets	Culebra
CWA-25- Vieques west coast	Vieques
CWA-26- Ensenada Honda Mangrove	Vieques
CWA-27- Yanuel Lagoon	Vieques
CWA-28- Chiva Swamp	Vieques
CWA-29- Tapón Bay	Vieques
CWA-30- Ferro Bay, Mosquito Bay, and Sombe Bay	Vieques
CWA-31- East tip of Vieques and Conejo Cay	Vieques
CWA-32- Roosevelt Roads Naval Base	Ceiba
CWA-33- Ceiba State Forest	Fajardo, Ceiba and Naguabo

AREA	LOCALITY
CWA-34- Humacao Natural Reserve	Humacao
CWA-35- Pandura Mountain Range	Yabucoa-Maunabo
CWA-36- Palmas Pond	Arroyo
CWA-37- Carite State Forest	Cayey
CWA-38- Cerro El Gato and Associated Areas	Cayey
CWA-39- Cidra Lake	Cidra
CWA-40- Aguirre State Forest, Punta Pozuelo, Cayos Caribe, Cayos La Barca, and Mar Negro	Guayama and Salinas
CWA-41- Punta Arenas	Salinas
CWA-42- Salinas Training Area	Salinas
CWA-43- Punta Petrona Mangroves and Caracoles	Santa Isabel
CWA-44- Cabuyón Mangrove and Fríos Cays	Ponce
CWA-45- Caja de Muertos Complex	Santa Isabel, Juana Diaz and Ponce
CWA-46- Serrallés Lakes	Juana Díaz-Ponce
CWA-47- Toro Negro State Forest	Ciales-Jayuya-Ponce-Juana Diaz-Orocovis
CWA-48- Las Salinas Lagoon, El Tuque	Ponce
CWA-49- Monte Guilarte State Forest	Adjuntas-Guayanilla-Peñuelas-Yauco
CWA-50- Punta Verraco, Cerro Toro and Punta Ventana	Guayanilla
CWA-51- Guayanilla Hills	Guayanilla
CWA-52- Guánica Lagoon	Guánica
CWA-53- Guánica State Forest	Guánica
CWA-54- San Jacinto Salt Flats and Tamarind Lagoon	Guánica
CWA-55- Susúa State Forest and Adjacent Lands	Yauco-Sabana Grande
CWA-56- La Parguera Natural Reserve	Lajas
CWA-57- Cartagena Lagoon	Lajas
CWA-58- Boquerón State Forest	Cabo Rojo
CWA-59- Boquerón Wildlife Refuge	Cabo Rojo
CWA-60- Cabo Rojo Salt Flats and Adjacent Areas	Cabo Rojo
CWA-61- Punta Guaniquilla Natural Reserve	Cabo Rojo
CWA-62- Joyuda Lagoon Natural Reserve	Cabo Rojo
CWA-63- Cuevas Lagoon	Cabo Rojo
CWA-64- Sabanetas Swamp-Boquilla Channel	Mayagüez
CWA-65- Maricao State Forest	Maricao
CWA-66- Mona Island	Mona
CWA-67- Monito Island	Monito
CWA-68- Pozo Hondo Swamp	Añasco
CWA-69- Cayures Swamp	Aguada

AREA	LOCALITY
CWA-70- Desecheo Island	Desecheo
CWA-71- Barrio Coto	Isabela
CWA-72- Guajataca Cliffs	Isabela-Quebradillas-Camuy
CWA-73- Guajataca State Forest	Isabela
CWA-74- Guajataca Lake	Quebradillas
CWA-75- Barrio Cocos and Bellaca Creek	Quebradillas
CWA-76- Carrizales Mangroves	Hatillo
CWA-77- Tiburones Swamp and La Tembladera Pond	Arecibo
CWA-78- Cambalache State Forest	Arecibo
CWA-79- Río Abajo State Forest	Arecibo-Utuado
CWA-80- Hacienda La Esperanza Natural Reserve	Manatí
CWA-81- Tortuguero Lagoon, Cabo Caribe Swamp and Rica Lake	Vega Baja
CWA-82- Cibuco Swamp	Vega Baja
CWA-83- Vega State Forest	Vega Alta
CWA-84- Lakes and Forests of Dorado	Dorado
CWA-85- Mogotes Río Lajas y Nevárez	Toa Baja
CWA-86- El Mameyal	Dorado
CWA-87- San Pedro Swamp	Toa Baja

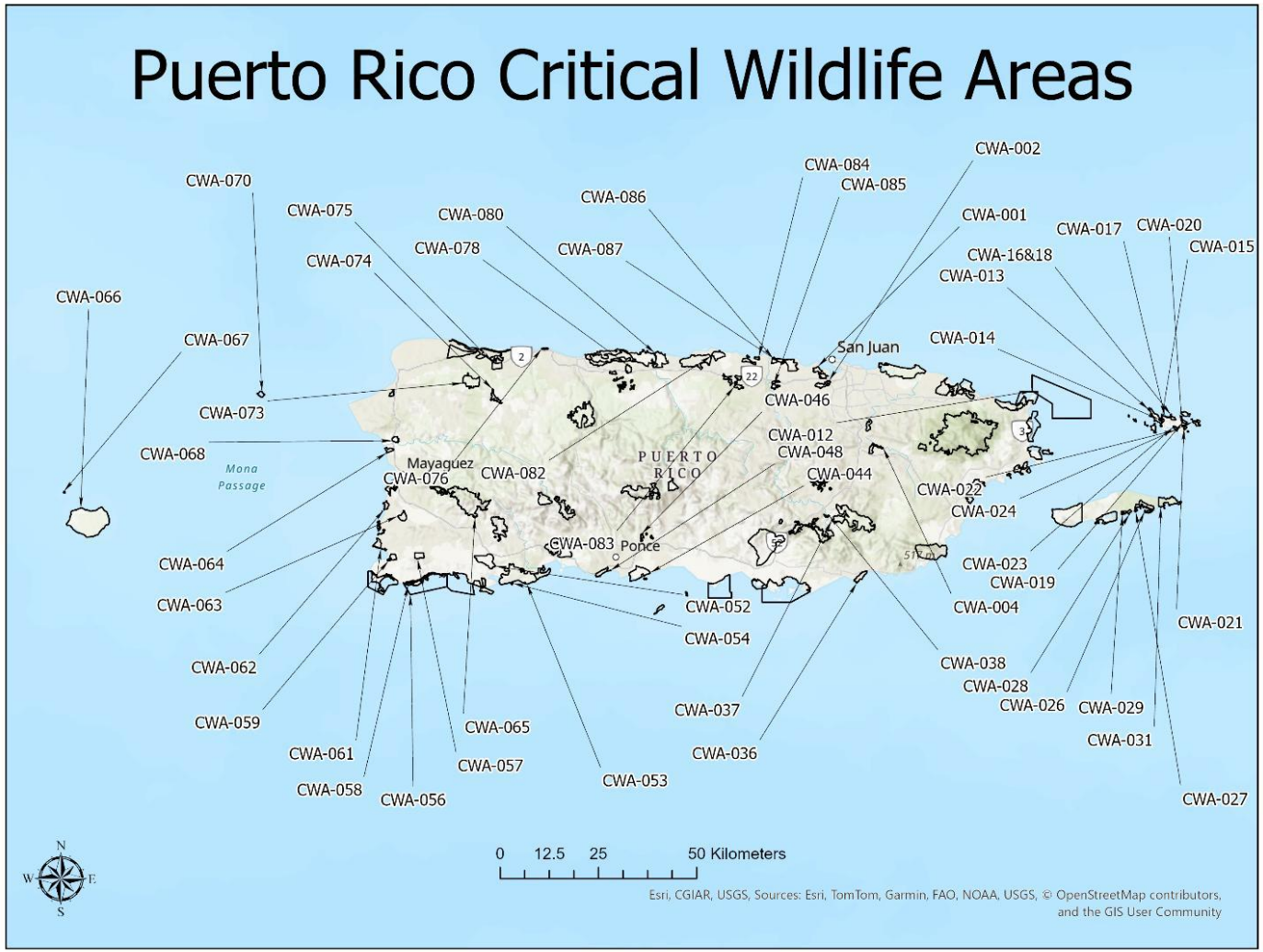


Figure 38. Puerto Rico Critical Wildlife Areas. From DNER 2025.

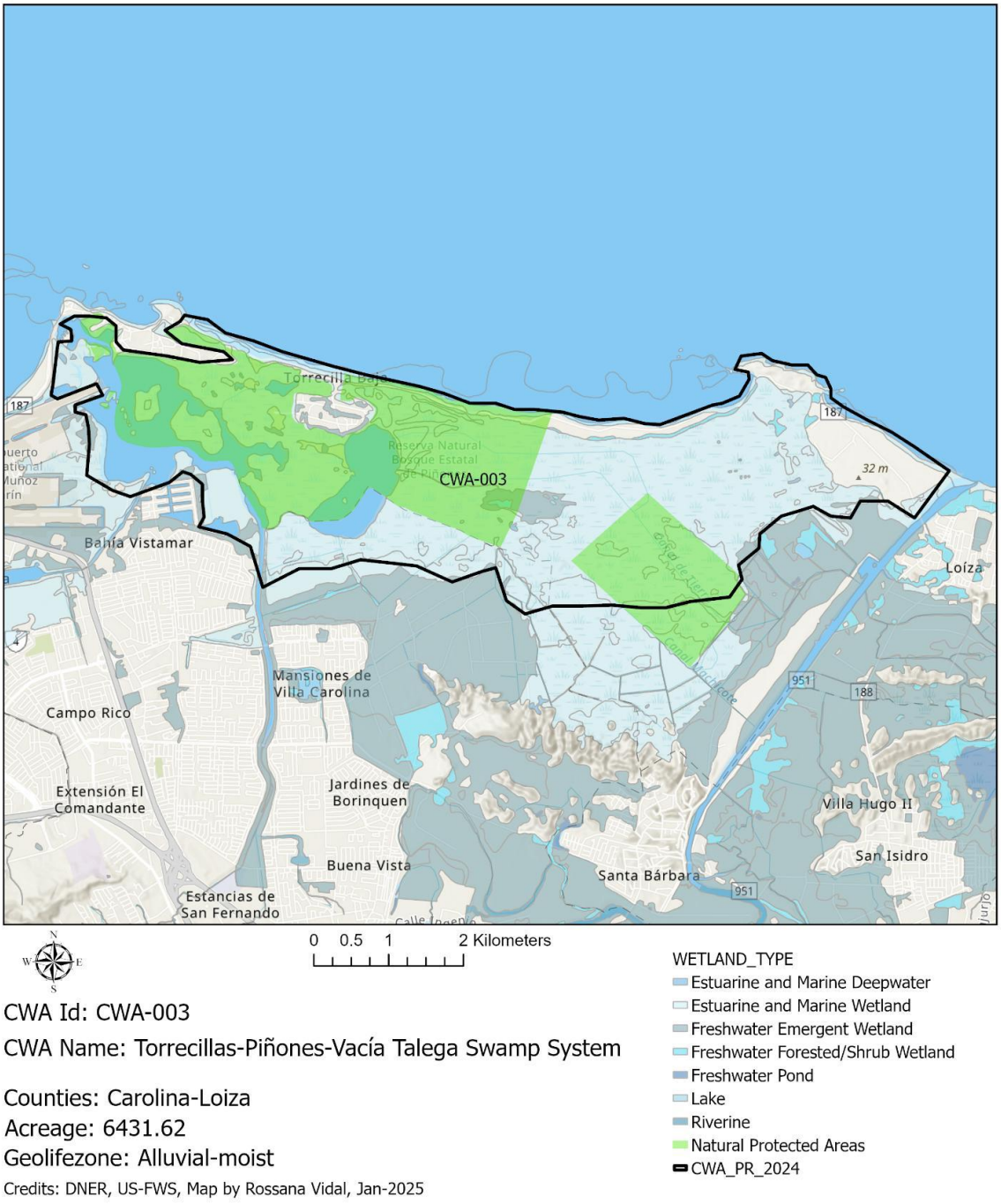
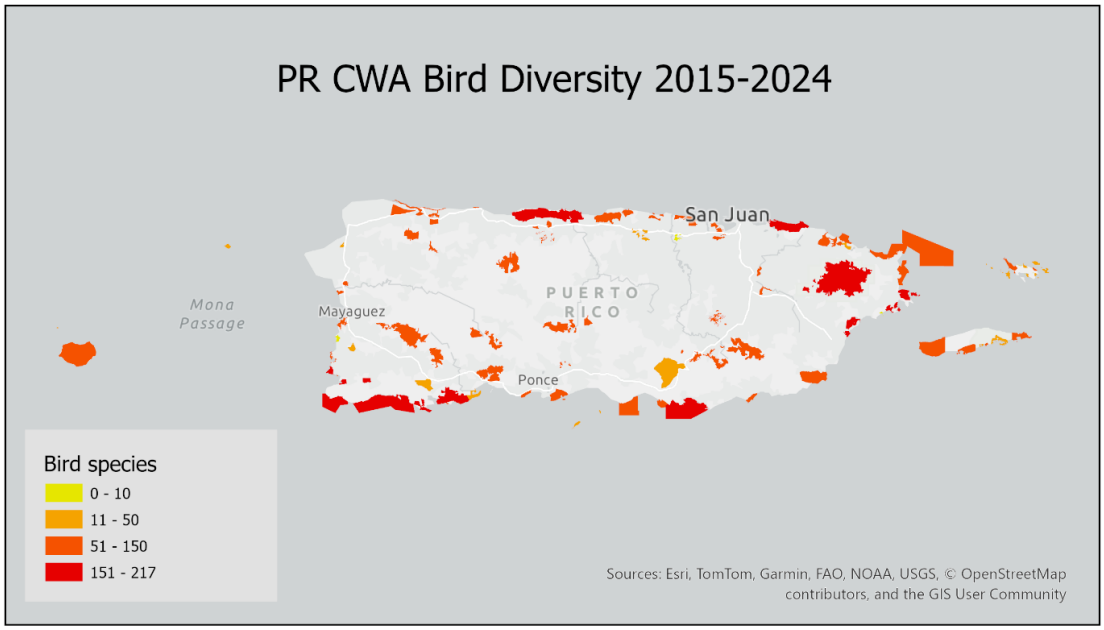
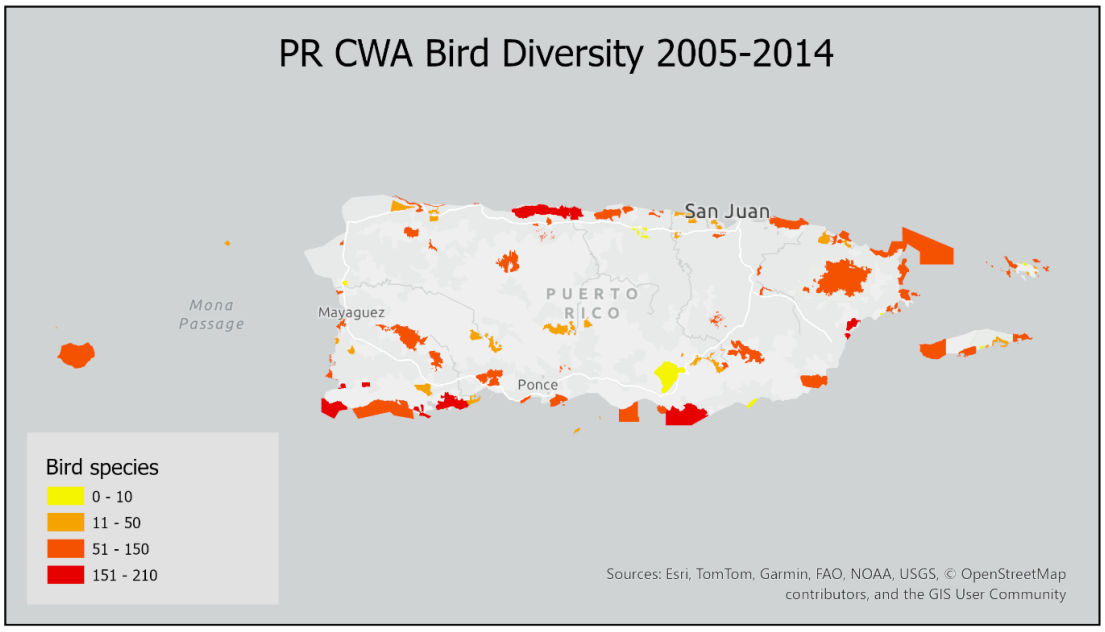


Figure 39. An example of a map included in the 2025 Critical Wildlife Areas document.





Data from DNER, eBird. Map by: Rossana Vidal, January 2025.

Figure 40. An example of a map included in the 2025 Critical Wildlife Areas document.

Comprehensive Land Use Plan

Strategic Axis 1: Habitat Protection and Ecological Connectivity

Strategic Axis 6: Strengthening Institutions, Policies, and Data Systems

Puerto Rico faces numerous challenges in sustainable land use planning. As a small island in the Caribbean, land is a scarce and highly valuable resource. Measuring 8,870 square kilometers with a population density of almost 367 inhabitants per square kilometer (in 2023, the U.S. Census' Puerto Rico Community Survey estimated the island's population at approximately 3.2 million), one of the highest population densities in the world and the eight highest in America, Puerto Rico is running out space and out of time (Center for Sustainable Development Studies, 2009).

According to the 2020 U.S. Census classifications, 43% of the island is urban and 57% is rural (U.S. Census Bureau, 2024). The majority of this population (92%) lives in urban areas (U.S. Census Bureau, 2023). This represents a significant shift from 1900 to 1930, when nearly 80% of the island's population was rural (U.S. Census Bureau, 1900-1930, 2000). Industrialization in Puerto Rico followed the United States' model of suburban growth in the 1940s and 50s, paving the way for accelerated urbanization of Puerto Rican society. Urban sprawl became one of its more evident consequences and one of the greatest threats to sustainability on the island (Center for Sustainable Development Studies, 2009).

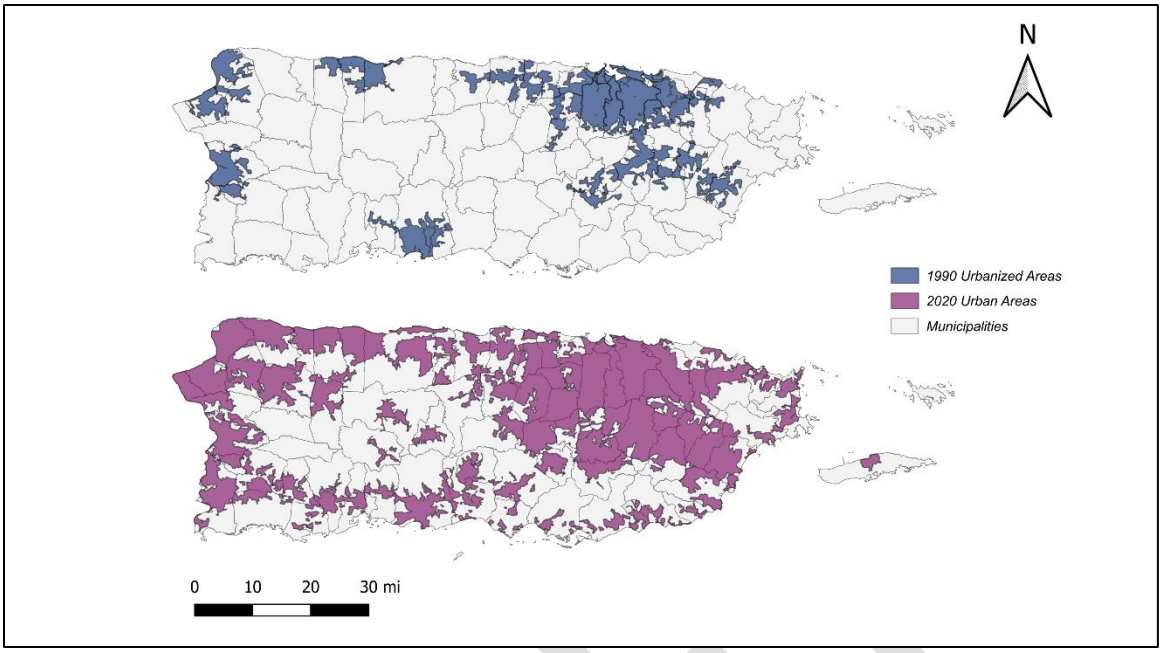


Figure 41. Puerto Rico 1990 Urbanized Areas and 2020 Urban Areas (U.S. Census Bureau)

The Puerto Rico Land Use Plan, a long-delayed master blueprint designed to guide all future development, zoning, and land conservation efforts on the island for the foreseeable future, was finished in January 2014.

The vision of what the plan should represent has also evolved. At one point, the plan was intended to classify every piece of land in Puerto Rico as either suitable for conservation or for development into residential, commercial, or industrial zones, and to determine whether the jurisdiction of such-and-such area fell to the state government or municipalities. The latter issue has previously been a main point of contention, as previous drafts of the plan frequently contradicted municipal land use plans, also known as “planes de ordenamiento territorial”, regarding the classification of certain lands. In many cases, decisions about the intended use of certain areas were also based on outdated information regarding flooding and ecological sensitivity, among other issues.

The Land Use Planning Law (Law No. 550 of October 3, 2004) mandated the creation of this office, the development of the PRLUP, the creation of an Advisory

Committee, and the creation of an Interagency Committee to develop the plan. On January 30th, 2014, the Puerto Rico Planning Board initiated the process and submitted the first draft of this Plan for public discussion, marking an unprecedented level of public participation on the island.

The goal of the 2014 PRLUP was to identify, evaluate, and classify land uses for Puerto Rico in order to:

1. Give a valuation to Puerto Rico, identifying the land according to its ecological, agricultural, and equity landscapes, rural or urban.
2. Improve coordination of planning and development efforts by state agencies, public corporations, and municipalities.
3. Encourage economic development and revitalization in municipalities, both urban and developable land, and rural settlements with the necessary infrastructure.
4. To preserve and promote at least 600,000 agricultural acres.
5. Prioritize planning the population increase for older adults and their needs, as well as the downward trend in the population.
6. Provide alternatives to accommodate housing needs and new developments, and engage without impacting agricultural soils, natural systems, watersheds, aquifers, heritage values, and landscapes.
7. Encourage citizens to dwell in secure areas and ensure that the necessary infrastructures are out of primary risk areas.
8. Establish guidelines and principles to be considered in local planning
9. To promote the equitable and sustainable development of Puerto Rico.
10. Take measures to adapt and mitigate ecological pressures.

Land Classification and Categories for the PRLUP:

1. Urban Land: Land consolidated by buildings and other structures, roads, water supply, electricity, and other infrastructure that serve it up. Most of

the social, administrative, and economic activities take place in these lands.

2. Urban Fringe Land: Land suitable for urbanization and development according to the expected population growth over a period of time:
    a. Programmed: Land served by infrastructure. This land will be developed first.
    b. Not Programmed: Land not served by infrastructure.
3. Rustic Land (Rural): Land that should be protected from urbanization:
    a. Common: Land that may accommodate growth in the long run.
    b. Specially Protected: Land for conservation, agricultural use, etc.

The PRLUP designated 13.3% of Puerto Rico's land as urban (294,213 acres) and 0.77% as developable land (16,973 acres), with 60.7% of this developable land being programmed (10,303 acres) and 39.3% non-programmed (6,669 acres). Additionally, it classified 20% of the land as common rustic land (442,206 acres) and 60.1% as specially protected rustic land (1,339,939 acres).

Specially protected rustic land refers to areas safeguarded because of their ecological, hydrological, aesthetic, and/or agricultural importance. However, these areas are mostly privately owned. The common rustic lands are also significant. Over the past few decades, most new development inquiries have been made in the “Common Rustic Land” (Martinuzzi et al., 2007).

Identifying areas of hydrological importance

Strategic Axis 2: Climate Adaptation and Ecosystem Resilience

Strategic Axis 3: Restoration of Degraded Ecosystems

The primary objective in this landscape is to maintain and/or restore sufficient forest cover to extend the lifespan of existing water supply reservoirs. The target zones are areas upstream of existing reservoirs (Figure 44) and Hydrological Reserves (Table 32). Management activity will focus on lands where reforestation or other forest management will improve sediment and erosion control. The DNER and the Office of the Land Use Plan of the Puerto Rico Planning Board conducted the analysis. It considered precipitation intensity, slope, soil types, aquifer recharge zones, and land use in preparing the base map. Alternatively, and much more expensive, responses to loss of reservoir capacity include new construction, hydraulic engineering, and the continuation of existing dredging operations (DNER, 2008a).

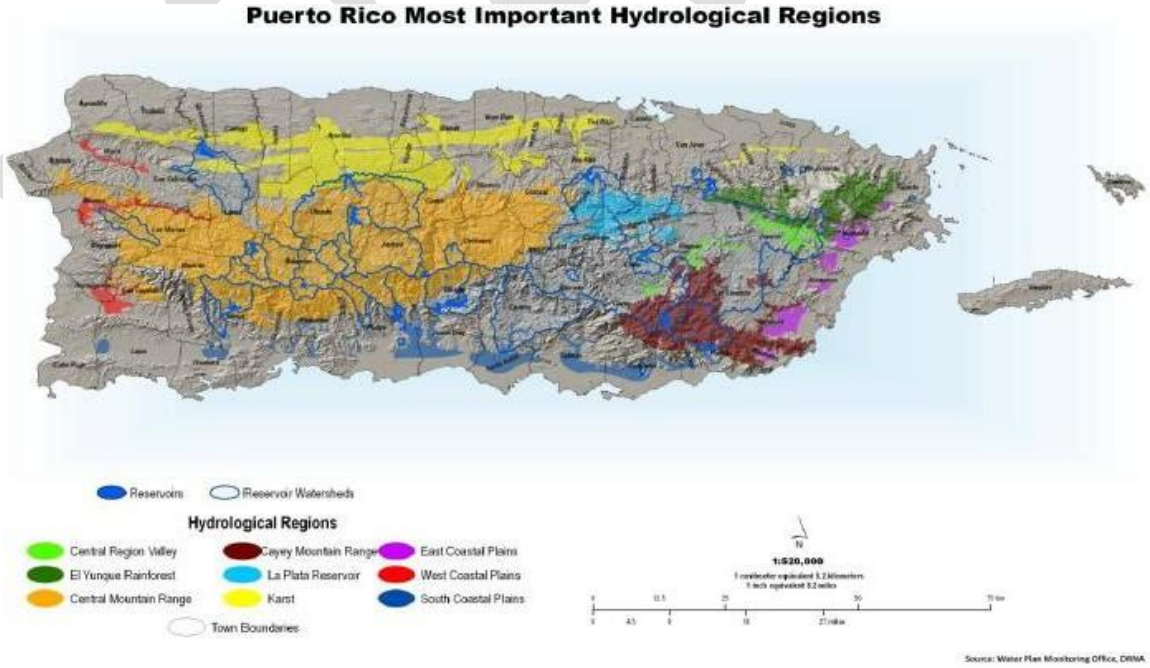


Figure 42. Hydrological regions in P.R. are recommended for water quality protection by DNER and P.R. Planning Board (DNER 2008a).

Table 31. Hydrological Reserves in P.R.

I - Surface Hydrological Protection Areas	II - Groundwater Hydrological Protection Areas	III - Combined Hydrological Protection Areas (surface and groundwater)
Cordillera Central Hydrological Reserve	Southern Coastal Plains Hydrological Reserve	Karst Hydrological Reserve
Sierra de Luquillo Hydrological Reserve	Eastern Coastal Plains Hydrological Reserve	Karst Hydrological Reserve
Sierra de Cayey Hydrological Reserve	Western Coastal Plains Hydrological Reserve	Karst Hydrological Reserve
La Plata Hydrological Reserve	Interior Plains Hydrological Reserve	Karst Hydrological Reserve

Conserving working forest landscapes

Strategic Axis 1: Habitat Protection and Ecological Connectivity

This goal encompasses the need to sustain the multiple values, uses, and services provided by Puerto Rico's forest cover. These benefits may be protected or enhanced by implementing more effective conservation practices. The main objectives under this goal are:

- Identifying and conserving high-priority forest ecosystems and landscapes in Puerto Rico currently under private control.
- Actively and sustainably managing private forested lands.

Table 33 presents the outputs, priority landscape, and strategies for promoting the forest landscape.

Table 32. Conserving Working Forest Landscapes (DNER 2010).

Outputs	Priority landscape	Strategies	Resources	Performance Measures
Recreation and Tourism	Public lands and surrounding private lands	-Continue land acquisition of key forested land by available mechanisms (USFS Forest Legacy Program) -Promote Conservation Easements on private forest land -Provide adequate conservation management to private forests through Forest Stewardship plans -Develop Forest and wildlife interpretation training	-USFS Forest Legacy Program -DNER PR Natural Heritage Program -DNER PR High Ecological Value Land Acquisition and Conservation Fund -USFS Forest Stewardship Program -NRCS Healthy Forest Reserve Program -USFWS State Wildlife Grant -PR Conservation Trust Land Acquisition Initiative	-High-priority forest ecosystems and landscapes are protected from conversion (acres – annual and cumulative). -Number of acres in forest areas being managed sustainably as defined by the current Forest Stewardship Management Plan. -Number of interpretation trainings offered to private landowners and community members.
Wood Products	Area around Toro Negro State Forest due to high risk of development	-Continue land acquisition of key forested land using available mechanisms (USFS Forest Legacy Program). -Promote conservation easements on private forest land. -Provide adequate conservation management to private forests through Forest Stewardship plans.	-USFS Forest Legacy Program. -DNER PR Natural Heritage Program. -DNER PR High Ecological Value Land Acquisition and Conservation Fund. -USFS Forest Stewardship Program. -NRCS Healthy Forest Reserve Program. -USFWS State Wildlife Grants Program. -PR Conservation Trust Land Acquisition Initiative. -PRIDCO PR Arts and Crafts Development Program.	-High-priority forest ecosystems and landscapes are protected from conversion (acres – annual and cumulative). -Number of acres in forest areas being managed sustainably as defined by the current Forest Stewardship Management Plan (cumulative), through a nationally consistent monitoring program.
Agroforestry products, Wood, fruit, medicinal products, craft products, shade-grown coffee	Rio Loco Watershed/Guánica Bay Watershed	-Develop management information on agroforestry practices suitable for the Río Loco Watershed at Guánica Bay Watershed. -Develop nursery quality standards (work with nursery growers to provide quality nursery stock).	-USFS Forest Stewardship Program. -NRCS Healthy Forest Reserve Program. -USFWS State Wildlife Grant.	-Number of educational fact sheets, talks, and training sessions offered to landowners and community members. -Number of nursery growers participating. -Number of nurseries producing high-quality nursery stock.

Outputs	Priority landscape	Strategies	Resources	Performance Measures
Control, forest, health, wood products, mulch, wildfire, green infrastructure, Recreation, safety, energy, conservation, air quality improvement	Urban Areas and Wildland Urban Interface	-Increase the capacity of communities to manage trees (e.g., promote municipal tree boards). -Increase tree canopy cover and condition. -Acquire community open space to protect key forested areas. -Hazard tree mitigation. -Increase use of native plant material (native tree propagation and use). -Develop educational programs and activities (e.g., demonstration forest projects). -Develop nursery quality standards. -Introduce agroforestry concepts. -Promote arboriculture in university curricula.	-USFS U&CF Community Cost-share Grants. -NGOs Education Programs. -Tree City USA. -PR Via Verde Program. -DNER Reforestation Programs. -USFS Community Forest and Open Space Conservation Program. -International Society of Arboriculture. -Municipalities. -Universities. -DNER. -PR U&CF Council. -UPR Extension Service - PR. -Association of Professional Arborists. -College of Architects and Landscape Architects. -PR Correctional and Rehabilitation Department.	-Number of cities protecting urban forests after working with U&CF to develop management plans and ordinances. -Number of cities and communities managing their urban forest. -Number of Municipal Tree Boards. -Number of cities participating in the Tree City USA Program. -Number of ISA Certified Arborists (private and public sector). -Number of communities participating in the Open Space Community Forest Program. -Number of nursery growers improving nursery protocols. -Number of nurseries producing high-quality nursery stock. -Number of demonstration projects using high-quality plant material and native species. -Number of arboriculture courses offered at the University of Puerto Rico in Mayaguez, College of Agriculture.

Protecting forests and wildlife

Strategic Axis 1: Habitat Protection and Ecological Connectivity

This goal aims to recognize the real threats to forested lands and their wildlife and to identify ways to mitigate or substantially reduce any harmful effects. Main threats with a strong capacity to affect present forest resources and wildlife on the island have been identified by the Puerto Rico Statewide Assessment of Forest Resources (DNER, 2011) and are presented in Table 34. These threats are followed by strategies recognized as highly valuable in support of the objectives of this goal.

Table 33. Threats and management strategies for P.R. forests and wildlife.

Threats / (risk map)	Resources affected / resource effects	Strategies	Resources	Performance Measures
Fire map showing fire occurrence information	Biodiversity, wildlife habitat and populations, water quality, esp. in Urban environments, recreation experiences, coastal resources	-Create a database to collect information on fire occurrences recording: (1) location, (2) type of vegetation, (3) number of acres affected, (4) resources used, and (5) resources needed. -Develop and implement a Fire Danger Rating System for the areas with high wildland fire occurrences. -Offer fire prevention education to the communities within the areas with high wildland fire occurrences. Increase efforts on the forest-urban interface. -Develop Community Wildfire Protection Plans and educational programs. -Wildland fire suppression. -Use prescribed burning as a resource to control fire occurrences in areas with high fire incidence. -Tree planting and resource restoration in areas affected by fires. -Acquire, maintain, and preposition essential equipment and supplies for wildland fire suppression. -Develop an effective communication tool between partners involved in the suppression of wildland fires.	-PR Fire Department Fire Prevention Program. -DNER Forest Service Bureau. -USFWS. -USFS. -USFS Cooperative Fire Program. -USFS Volunteer Fire Program.	-Number of acres treated to restore fire-adapted ecosystems that are (1) moved toward desired conditions and (2) maintained in desired conditions. -Total number of acres treated to reduce hazardous fuels on state and private lands through State Fire Assistance. -Percentage of at-risk communities reporting increased local suppression capacity as evidenced by: (1) the increasing number of trained and/or certified firefighters and crews, (2) upgraded or new fire suppression equipment obtained, or (3) formation of a new fire department or expansion of an existing department involved in wildland firefighting.

Threats / (risk map)	Resources affected / resource effects	Strategies	Resources	Performance Measures
Insect pests and disease	Loss and displacement of wildlife, decreased reproduction, stained wood, poor tree form, aesthetics, hazard trees, increased fire risk, fragmentation	-Establish a forest health monitoring program at the DNER Forest Service Bureau. -Encourage early detection and rapid response from forest managers. -Provide professional training to forest managers. -Promote public education about possible detrimental effects on forest floristic components. -Maintain adequate urban tree inventories and management practices. -Promote Integrated Pest Management.	-USFS Forest Health Monitoring Program. -UPR Extension Service Forest Health Clinic and Diagnostics Lab. -DNER Forest Health Program. -UPRP. -USFS.	-Number and percentage of forest acres restored and/or protected from (1) invasive and (2) native insects, diseases, and plants. -Percent of population living in communities developing or managing programs to plant, protect, and maintain their urban and community trees and forests.
Development, Urban Sprawl, Fragmentation (consultation map, urban sprawl map).	Decreased and fragmented forest cover decreases the quantity and quality of all forest-dependent values	-Protect large contiguous forest areas and corridors to ensure connectivity by: land acquisition, conservation easements, adequate land use zoning, and voluntary protection. -Encourage planting trees to increase canopy cover and create green corridors. -Promote proper land use planning and accurate zoning in forested areas. -Promote professional training about assessing forest cover and its benefits for agencies involved in determining present and future land use. -Increase program availability for the eastern side of the island by: (1) increasing outreach, (2) increasing water conservation, (3) enhancing forest diversity, and (4) enhancing all restored riparian habitats.	-USFS Forest Legacy Program. -USFS Forest Stewardship Program. -Professionals who evaluate zoning, planning, and permits. -Municipalities. -USFS Community Forest and Open Space Conservation Program. -USFS U&CF Program. -PR U&CF Council. -International Society of Arboriculture. -PR Association of Professional Arborists.	-Number of communities and percent of population served under an active urban forest management plan. -Percent of population living in communities developing or managing programs to plant, protect, and maintain their urban and community trees and forests. -Number of acquisitions completed that are instrumental for corridor protection. -Number of communities participating in the Community Forest Open Space Program.

Threats / (risk map)	Resources affected / resource effects	Strategies	Resources	Performance Measures
Hurricanes/storms (Island-wide)	Biodiversity, wildlife, urban forest, forest products, recreation experiences, coastal resources	-Urban forest inventory -Tree management Plan development -Hazard Tree mitigation -Tree selection	-USFS U&CF Program. -PR U&CF Council. -International Society of Arboriculture. -PR Association of Professional Arborists. -Tree City USA. -ITree (adapted to tropics). -FEMA Programs. -PR Conservation Trust.	-Number of communities and percent of population served under an active urban forest management plan. -Percent of population living in communities developing or managing programs to plant, protect, and maintain their urban and community trees and forests.
Ecological Pressures (sea level rise map)	Coastal forests and wildlife, salinization of freshwater swamps, increase in fires, more intense storms, salt water intrusion, biodiversity, forest products, decreased recreational experiences	-Corridors for tree migration -Increase carbon storage through increases in tree cover -Urban forest inventory -Tree Management plan development -Hazard tree mitigation -Tree selection	-USFS U&CF Program. -USFS Forest Stewardship Program. -USFS Forest Legacy Program. -USFS Community Forest and Open Space Conservation Program. -International Society of Arboriculture. -PR Association of Professional Arborists. -Tree City USA. -ITree (adapted to tropics). -PR Conservation Trust. -UPR Marine Science Department.	-Population of communities benefiting from S&PF activities designed to contribute to an improvement in air quality. -Population of communities benefiting from S&PF activities that result in energy conservation.
Flooding	Water quality, tree health, human safety, stream and bank erosion, and sediment	-Forested wetland protection -Riparian buffer installations -Maintain and increase forest cover in catchment and groundwater recharge areas -Urban tree inventory and hazard mitigation	- USFS U&CF Program -USFS Forest Stewardship Program -International Society of Arboriculture -PR Association of Professional Arborists -PR Conservation Trust	-Percent of population living in communities developing or managing programs to plant, protect, and maintain their Urban and community trees and forests to mitigate the effects of flooding events.
Drought (See fire, see ecological pressures)				

Threats / (risk map)	Resources affected / resource effects	Strategies	Resources	Performance Measures
Invasive plants	Biodiversity, wildlife, and the displacement of native species	-Professional and public education -Promote native and other suitable species -Early eradication -Law enforcement -Early detection.	-Nursery growers and buyers, -DNER -Puerto Rico Forest Health Advisory Committee -USFS Forest Health Program -San Juan Bay Estuary Program -Puerto Rico Conservation Trust -PR Department of Agriculture	-Number and percent of forest acres restored and/or protected from (1) invasive and (2) native insects, diseases, and plants (annual).
Invasive animals	WL habitat, egg predation, and rare pant seedling recruitment	-Law enforcement -Public education	-DNER -San Juan Bay Estuary Program -Puerto Rico Conservation Trust -Lionfish Control Program	-Number and percent of forest acres restored and/or protected from (1) invasive and (2) native insects, diseases, and plants (annual)

Enhancing benefits to the public associated with forests and wildlife.

Strategic Axis 5: Community-Based Conservation and Stewardship

There are several objectives under this goal that focus on maximizing the profitable social, environmental, and economic services that trees and forests provide to the community. Objectives include:

- protecting and enhancing water quality and quantity;
- improving air quality and conserving energy;
- assisting communities in planning for and reducing forest health risks;
- maintaining and enhancing the economic value and benefits of trees;
- protecting, conserving, and enhancing wildlife and fish habitat;
- connecting people to trees and forests, and engaging in environmental stewardship activities; and
- managing trees and forests to mitigate and adapt to global ecological pressures.

Strategies of great value for these goals are summarized in Table 35.

Table 34. Enhance public benefits associated with forests and wildlife (DNER 2010).

Benefits	Priority Area	Strategy	Resources	Performance Measures
Water Quality Benefits	-Riparian areas around rivers and reservoirs. -Aquifer Recharge areas -Upland Catchments	-Continue encouraging reforestation -Maintain and manage existing forest	-DNER reforestation program -USFS Forest Stewardship Program -NRCS Healthy Forest Reserve Program -USFWS State Wildlife Grant -NRCS Wildlife Habitat Incentive Program	-Acres and percent of priority watershed areas where S&PF activities are enhancing or protecting water quality and quantity.
Coastal Resources	-Through all PR Coastal Zone (1 km from the sea) -Existing forested wetlands (i.e., mangrove and or swamps, etc.), -Coastal upland remnants	-Continue encouraging reforestation -Maintain and manage existing forest	-COE Wetland Banking -USFS Forest Stewardship Program -NRCS Healthy Forest Reserve Program -USFWS State Wildlife Grant -NRCS Healthy Forest Reserve Program	-High-priority forest ecosystems and landscapes are protected from conversion (acres- annual and cumulative). -Number of acres in forested areas being managed sustainably as defined by the current Forest Stewardship Management Plan
Wildlife habitat	-Coastal upland forest remnants -Mature forest habitats -Corridors that link mature forest areas (i.e., riparian areas along streams, -Corridors required under Commonwealth Law Number 14 of 1999 -Threatened and Endangered Species habitat.	-Private forested land acquisition by several means, including the Forest Legacy Program -Encourage Conservation Easements -Promote voluntary private land conservation management. -Provision of proper management on public forested lands -Continue land acquisition programs to conserve mature forest -Promote and encourage agroforestry practices (Sun coffee plantations to shade-grown coffee) -Establish Maricao Commonwealth Forest and a 5-mile buffer (including Susúa Commonwealth Forest)	-Forest Legacy Program -DNER PR Natural Heritage Program -DNER PR High Ecological Value Land Acquisition and Conservation Fund -USFS Stewardship Program -NRCS WHIP, EQUIP -US F&WS Partners for WL -Federal and State agencies' management -NRCS Healthy Forest Reserve Program -NRCS Wildlife Habitat Incentive Program	-High-priority forest ecosystems and landscapes are protected from conversion (acres- annual and cumulative). -Number of acres in forest areas being managed sustainably as defined by the current Forest Stewardship Management Plan -Detectable increases in the frequency of priority critical species for WHIP. -Establishment of wild reproductive couples of Puerto Rican Parrot in Maricao Commonwealth Forest. -Increase of riparian forests under conservation practices. -Reduction of predator numbers on Maricao Commonwealth Forests and its 5-mile buffer zone. -Increase the number of ecological corridors created between public and private forested land.

Benefits	Priority Area	Strategy	Resources	Performance Measures
Plant biodiversity	Public forested lands	-Private forested land acquisition by several means, including the Forest Legacy Program -Promote voluntary private land conservation management.	-USFS Forest Legacy Program -USFS Community Forest and Open Space Conservation Program -Conservation Easement Commonwealth Law -DNER Puerto Rico Natural Heritage Program -DNER High Ecological Value Land Acquisition and Conservation Fund -NRCS Wildlife Habitat Incentive Program -NRCS Healthy Forest Reserve Program -USFS Forest Stewardship Program -USFWS State Wildlife Grant -NRCS Wildlife Habitat Incentive Program	-High-priority forest ecosystems and landscapes protected from conversion (acres- annual and cumulative). -Number of acres in forest areas being managed sustainably as defined by the current Forest Stewardship Management Plan.
Carbon Sequestration	Private forested land	-Retain forest cover -Manage for forest health and growth -Forest products benefit from incentivizing, protecting, and enhancing cover.	-USFS Stewardship Program -USFS Forest Legacy Program -USFS Community Forest and Open Space Conservation Program -Conservation Easement Commonwealth Law -Forest Legacy Program -NRCS Healthy Forest Reserve Program	-Population of communities benefiting from S&PF activities designed to contribute to an improvement in air quality. -Population of communities benefiting from S&PF activities that result in energy conservation.

Marine Mammals Rescue Program

Strategic Axis 4: Species-Specific Conservation Measures

The DNER established the Marine Mammal Rescue Program in 2007. The program leads and coordinates the actions of different governmental and non-governmental entities during emergencies involving marine mammals, including stranding events and necropsies. The program is also responsible for establishing agreements with stakeholders interested in marine mammal conservation, maintaining a mortality database, and implementing management actions to protect marine mammals and their habitats. These include deploying buoys to regulate vessel speeds, designing and implementing an outreach program, addressing emerging threats, overseeing compliance agreements between participating entities, evaluating and analyzing causes of death, and maintaining a sighting and population survey database.

As of 2024, according to DNER, the Rescue Program has handled 246 cases. Of these, 82 involved cetaceans, of which 19 were found alive. Unfortunately, many had to be euthanized due to illness, injuries from boat strikes, or interactions with debris. The most frequently stranded species in Puerto Rico is the manatee, with 185 cases reported. Only 20 of these were rescued alive and taken to rehabilitation, and just a few have been successfully released back into the wild.

Status Of Top Conservation Initiatives Started In 2015 And Continued In 2025 As Part of the PRSWAP

Since 2015, a series of conservation initiatives were established to address key threats to Species and Habitats of Greatest Conservation Need. Over the past decade, these initiatives have guided on-the-ground management actions, research efforts, interagency coordination, and community engagement activities across the island. The following table 35 summarizes the status of the principal initiatives initiated in 2015, highlighting their implementation progress and measurable outcomes.

Table 35. Top conservation initiatives started in 2015 and their status as of 2025.

Initiatives	Status
Work in coordination with the USFWS to re-establish or enhance river connectivity for the conservation of native freshwater species through the removal of dams or the installation of biological passages by 2025. Impact five (5) major rivers; one (1) every two years.	One river done, several culverts and dams under evaluation
Complete an assessment of at least 20% of the wildlife species classified as data deficient (DD) in this document by 2025.	Ongoing
Evaluate the rat eradication program associated with seabird populations of Monito Island by 2020. Compare pre (1973) and post (2015-16) eradication populations for the three (3) booby species (Brown, Red-footed, and Masked) found on Monito Island, located in the Mona Island Nature Reserve.	Close to concluding
Control invasive feral pigs on Mona Island and Puerto Rico.	Permitting and Planning
Eradicate feral (non-human) primates from Southwest Puerto Rico by 2020.	Unknown
Re-establish long-spined sea urchin (Diadema antillarum) populations on important coral reef habitats. Develop sea urchin farms in two important Marine Protected Areas, with at least two (2) new populations per site.	Two farms have been established
Coordinate the establishment of two Puerto Rican Parrot breeding populations with the USFWS and USFS as part of the Model Forest Conservation Initiative by 2025. Continue interagency efforts to reintroduce a new PRP population in the Maricao State Forest.	Completed
Strengthen the PRP population in the Río Abajo State Forest and adjacent lands.	Completed

Initiatives	Status
Establish a long-term annual monitoring program for endemic and native avian species, as well as neotropical species of Puerto Rico (2015-2025).	Ongoing
Complete a risk assessment analysis to identify, prioritize, and initiate proactive conservation measures for wildlife species threatened by rising sea levels. This includes: • Seabird nesting colonies • Reptile communities on low-profile cays	Not started
Efforts toward restoring the natural connectivity for some of the most important coastal lagoons in Puerto Rico: • Joyuda Lagoon (2020-2025) • Tortuguero Lagoon (2020-2025)	Planning stage
The creation or enhancement of biological corridors and habitat connectivity between important wildlife critical habitats, including: • Southwest Corridor (Guánica-Susúa-Maricao State Forests) • Southwest Corridor (Guánica-Susúa-Maricao State Forests) • Central Karst Corridor (Guajataca-Río Encantado-Río Abajo)	Ongoing

CHAPTER 8
HABITATS OF GREATEST CONSERVATION NEED

Terrestrial Habitats

General

Habitat loss is the major threat to wildlife in terrestrial ecosystems. The most important habitats for conservation have been identified by the Nature Conservancy's Ecoregional Plan for Puerto Rico and the DNER through the Natural Heritage Program and the Critical Wildlife Areas Initiative. The DNER completed an island-wide comprehensive habitat analysis for the PRSWAP. This task was the final result of the Puerto Rico GAP Analysis Program. This project developed a land cover/land use map of Puerto Rico's landscape and modeled animal species distributions. PR-GAP uses remote sensing and GIS technology, satellite imagery, aerial photography, and geoclimatic and topographic data to map the land cover units for the Island. Each land cover unit description includes information and references on the composition, structure, and ecology of the dominant plant communities of that unit.

Helmers et al. (2002) found that only 1.2% of lowland moist seasonal evergreen forests or forest/shrublands are protected. Some forest types are better protected, including 45-68% of cloud forests and 43-80% of sclerophyllous forests on serpentine substrates. Excluding riparian wetlands, about 20% to 63% of remaining forested or non-forested wetlands receive protection.

Caves

Puerto Rico has approximately 2,000 caves, which harbor a great array of species that are either totally dependent on or associated with the biotic and abiotic conditions in the habitats they provide. The formation of caves and caverns in Puerto Rico occurs mainly due to the weathering of limestone rock by underground water or water that filters through the rocky ceiling.

Recognizing the vital importance of preserving its distinctive geological features, Puerto Rico has taken measures to safeguard its extensive cave systems. Four decades ago, this dedication was reinforced with the passage of the "*Law for the Protection and Conservation of Caves, Caverns, or Sinkholes of Puerto Rico*." This law, updated through amendments in 2000 and 2007, provides a framework to protect not only the caves, caverns, and sinkholes themselves but also their natural formations, biodiversity, and archaeological significance.

The law bans actions like possessing, transporting, and selling natural materials from these environments to protect their integrity. The Secretary of Natural Resources is responsible for enforcing and managing this law's operations. To emphasize the importance of these protections, the law includes penalties for violations, showing the government's dedication to preserving Puerto Rico's natural heritage.

Urban Forest

Urban forests are forested ecosystems characterized by a high concentration of human influences (Dwyer et al., 2000). They capture significant levels of carbon and provide important economic benefits, including tourism, nursery production, food production, pharmaceutical research, and some wood and non-wood products (National Urban and Community Forestry Advisory Council, 2008).
The types of trees and plant associations in urban forests vary with regional and

local environmental conditions and human activities. Native, exotic, and naturalized plants and animals, ground cover, buildings, and human activities affect the character and values associated with an urban forest. Vegetation in urban environments is important for providing wildlife habitat and environmental services related to water, heat regulation, air quality, temperature regulation, and carbon sequestration. They provide oxygen, shade, food, and attributes important to human well-being. Recent studies reveal the psychological benefits of trees, helping people adjust to their societies. (Kuo and Sullivan 2001). Additionally, properties and neighborhoods with well-developed tree cover are appraised at a higher value.

Martinuzzi et al. (2007) estimated developed land, land use, and urban sprawl across the Puerto Rico landscape and explained important distinctions among urban land classification schemes (Table 36). Depending on the classification, between 11 and 43% of Puerto Rico could be called “urban.” They found that most urban areas are located on coastal plains, lower hills, and valleys, and that urban sprawl occurs at low elevations, over flat topography, and near roads and existing urbanized areas.

Table 36. Definitions of urban and related classifications and the percentage of land in each class in P.R. (Martinuzzi et al. 2007).

Classification	% in class	Definition
Urban/built-up cover or developed land	11%	Developed and non-vegetated surfaces that result from human activity (built structures, concrete, asphalt, buildings, barrens, roads, some of which occur in rural areas).
Urban use setting	16%	Includes development and undeveloped lands that are part of the urban landscape and excludes development that is part of a non-urban setting. (urban centers, exurban agglomerations, industrial areas, large isolated residential complexes, ports, airports, parklands, and urban forests).
Census Bureau Urban Area	50%	Census block with a population density of at least 1000 people/ mi2 (390 people/ km2) plus surrounding census blocks with at least 500 people/mi2 (195 people/km2).

Classification	% in class	Definition
Urban sprawl	40%	Low-density construction and areas with significant land consumption.

Source: Martinuzzi, S., W. Gould, and O. M. Ramos. 2007. Land development, land use, and urban sprawl in Puerto Rico: Integrating remote sensing and population census data. Landscape and Urban Planning 79: 288-297.

In 2019, the U.S. Department of Agriculture, in partnership with the University of Puerto Rico, released a new Urban Forestry Manual for Puerto Rico and the U.S. Virgin Islands (USDA, 2019). This manual provides information on the benefits of urban forests, the biology of various trees and plants, and relevant regulations and permits. It also discusses assessing and choosing species for specific urban areas and establishing and maintaining urban forests. The manual includes descriptions of species, design ideas, and principles of urbanism. Additionally, it offers guidance on preventing and responding to natural disasters and features a glossary of terms related to biology, forestry, urbanism, and other relevant subjects.

Strategies and Monitoring the Conservation of Terrestrial Habitats

To monitor the health of habitats, there needs to be clear, measurable indicators that reflect both ecological health and human impacts. The metrics used may vary by habitat type, but they typically focus on biodiversity, habitat quality, and risks to long-term survival. To collect the necessary data, significant resources from DNER would be required. Establishing collaborative agreements with universities, non-governmental organizations, or community groups could also help share the responsibility and ensure effective data collection.

The proposed monitoring metrics for Puerto Rico (Table 37) focus on general terrestrial habitats, including specific applications for cave systems and urban forests. To promote informed decision-making, these metrics should be made publicly available on the DNER website with greater ease of access. Although not comprehensive, they establish a baseline that can be expanded through stakeholder input or new metrics developed in partnership with DNER or via

publicly accessible private initiatives.

Table 37. Strategies and monitoring metrics to track the conservation of terrestrial habitats.

Habitat	Strategies	Monitoring Metrics
General Terrestrial	-Utilize satellite imagery and GIS technology to monitor land cover -Promote programs for controlling invasive species -Support practices for soil conservation	-Habitat extent and fragmentation -Presence and spread of invasive species -Soil health -Connectivity among habitat patches
Caves	-Establish and enforce regulations for cave protection -Implement pollution control measures for the groundwater recharge zone -Regularly map and monitor cave systems	-Water quality -Population of cave-dependent species -Disturbance levels -Structural integrity of cave systems
Urban Forest	-Expand urban tree-planting initiatives using native species -Include urban forests in climate resilience strategies	-Canopy cover and tree density -Proportion of native and non-native trees -Tree health, along with mortality rates -Distribution of urban green spaces

Freshwater Habitats

General

There are numerous rivers and streams on Puerto Rico's main island. There are reservoirs, but no freshwater inland lakes. 78% of Puerto Rico's water comes from surface sources, and 22% from groundwater. Fifty-five rivers discharge directly into the sea. Problems with freshwater ecosystems are a major environmental issue in Puerto Rico. Water pollution, siltation of reservoirs, and excessive freshwater withdrawals from rivers are associated with the Island's growing human population. Unauthorized wetland filling is also a substantial and continuing problem (U.S. Department of the Interior, 1994). Detailed descriptions of the freshwater communities in Puerto Rico are available (U.S. Army Corps of Engineers, 1978).

According to the PR-GAP, Puerto Rico has 34,000 ha (4%) of coastal wetlands, comprising 42% saline wetlands and 58% freshwater wetlands. Among the freshwater wetlands, 74% (25,100 ha) are dominated by herbaceous vegetation, and 92% (23,000 ha) are seasonally flooded. Of the herbaceous wetlands, 77% (19,300 ha) are non-saline, and 23% (58,000 ha) are saline. Forested coastal wetlands cover approximately 1% of the Commonwealth's territory, of which 6,700 ha are mangroves and 300 ha are bloodwood swamps, also known as Pterocarpus forests (Gould et al., 2008).

Rivers and Streams

Puerto Rico has about 1,200 rivers, streams, and creeks. None of the rivers is navigable by large vessels (Wiley and Vilella, 1998). Only twenty of these rivers have a permanent minimum water flow of at least 0.28 cubic meters per second and are relatively important to the island's fishery. Major river systems are the Río Grande de Loíza (64 km), Bayamón (41 km), La Plata (73 km), Arecibo (64 km),

Culebrinas (40 km), and Añasco (65 km). The profile of the streams changes radically from rapidly flowing in the steep mountains to slower and more winding courses across the narrow coastal plain, creating habitats for fish and other aquatic wildlife. Many fish migrate up or downstream to or from saltwater habitats (Wiley and Vilella, 1998). Some rivers are dammed principally for water uptake and thus have small lakes along their courses. The majority of the main rivers are either channelized or undergoing canalization, primarily for flood control. These constructions obstruct the natural movement of native fishes along rivers and, together with pollution, are the major threats to these aquatic systems.

To support conservation efforts, the Puerto Rican government passed the 2003 *"Ley para Establecer la Política Pública sobre la Prevención de Inundaciones, Conservación de Ríos y Quebradas y la Dedicación a Uso Público de Fajas Verdes en Puerto Rico."* Law #49-2003 defines "cleaning" as the removal of unnatural and obstructive materials from water bodies. Additionally, "conservation" refers to efforts to restore or stabilize eroded riverbanks and reduce erosion. The law stipulates that any cleaning or conservation activities must avoid altering the shape or flow of rivers and must not disrupt the natural sediment transport that nourishes coastal areas.

Under this law, DNER is responsible for monitoring, cleaning, and conserving beaches and rivers only when public safety, property, or ecologically sensitive areas are at risk, if deemed economically and environmentally effective, and when funding is available. Prior consultation with relevant municipalities is required for all actions. In contracts, the DNER is not obligated to clean or conserve private streams but can collaborate with municipalities or landowners if funded by the Legislature or municipalities. In emergencies or special merit cases, the DNER may use its funds for private waterways and seek reimbursement for future conservation. All projects must have a cost-benefit analysis that considers environmental impacts before approval.

Riparian forest

Riparian areas are the lands adjacent to a body of water, stream, river, marsh, or shoreline. These areas form the transition between the aquatic and the terrestrial environment. A riparian area may include several riparian ecosystems. Riparian ecosystems encompass the soil, surface structure (including woody debris, rocks, and depressions), and the associated plant and animal communities. Because of their position in the landscape, riparian areas interact with the flow of surface and groundwater from upland areas, playing a crucial role in filtering runoff, reducing excess nutrients and other pollutants, and providing critical ecological values such as shade, food, and structural habitat. Species abundance and richness tend to be greater in riparian ecosystems than in adjacent uplands (Odum, 1979). Although healthy riparian vegetation of any kind is desirable, forests provide the greatest benefits and the highest potential for achieving both water quality and living resource goals. As functional ecosystems, they have large energy, nutrient, and biotic interchanges with aquatic systems on one side and with upland terrestrial ecosystems on the other. Their linear nature and high edge-to-area ratios contribute to this functionality, which is why riparian areas are best evaluated and managed as parts of larger landscapes.

Streamside forests are important riparian areas. Under natural conditions, these forests would protect most of the rivers and streams in our land, but deforestation associated with agricultural and urban expansion has drastically reduced their extent. In agricultural areas, many floodplain forests have been reduced to isolated fragments that are no longer able to supply the river with essential woody debris or an adequate organic food supply for healthy fisheries. The linkage between streamside forests and the health of fish stocks may extend to ocean fisheries, where the natural process of delivering large quantities of wood from the watershed to the sea has been essentially severed (Maser and Sedell, 1994).

Riparian forests can help remove or ameliorate the effects of pollutants in runoff

and increase the biological diversity and productivity of aquatic communities by improving habitats and contributing to the organic food base. Riparian forests can also play a large role in buffering urban and agricultural development. When conserved and managed as buffers, riparian forests can significantly mitigate the impacts of land-use activities (Welsch, 1991). Studies have shown dramatic reductions of 30-98 percent in nutrients, sediments, pesticides, and other pollutants in surface and groundwater after passing through a riparian forest buffer (Lowrance et al., 1984).

Reservoirs

Puerto Rico has no natural inland bodies of fresh water (lakes). However, 20 reservoirs, ranging in size from 6 to 390 surface hectares, have been constructed as sources of potable water, irrigation, electrical power, and flood control (Figure 45). The associated reservoirs are the main surface water source in Puerto Rico (DNER, 2008a). During 2010, reservoirs provided 328.39 million gallons per day (mgd) of water for domestic use and over 15.73 mgd for agricultural purposes. Jointly, reservoirs account for 55% of the island's freshwater extraction. Therefore, preserving reservoir capacity is a crucial management objective.

Sedimentation has reduced reservoirs' capacity to store water and has lowered water quality for both human and wildlife use. High erosion and sedimentation rates result from steep slopes, heavy rains, and extensive land use in Puerto Rico (DNER, 2008a). There is significant variation in sedimentation rates among reservoirs. The ones with the most forested watersheds tend to have significantly lower sedimentation and runoff of non-point sources of pollution.

Most sediment is transported to reservoirs during extreme events, such as heavy rainfall or hurricanes, which can create long-term water supply issues. High sedimentation rates are observed in the north and east watersheds, where rainfall is high, and the watersheds are more developed (ASCE, 2019). Reservoirs whose

capacity has been reduced by more than 50% include Loco, Carraízo, Lucchetti, and Dos Bocas (ASCEPR, 2019). Given its current sedimentation rate, the lifespan of Dos Bocas is less than 35 years. This, along with Caonillas and four other reservoirs, is part of the North Coast Superaqueduct, which supplies over 50 mgd of drinking water to approximately 600,000 residents in the San Juan Metropolitan Area and northern municipalities (ASCEPR, 2019). A low lifespan is also reported for Loco, Carraízo, and Lucchetti, with fewer than 15, 45, and 50 years remaining, respectively (ASCEPR, 2019). The Lucchetti Reservoir in Yauco, which supplies drinking water to the Lajas irrigation system, is also affected by sedimentation issues (DNER, 2016-c). The United States Geological Survey (USGS) identifies this as a key watershed.

Figure 43. Distribution of reservoirs in P.R. From DNER 2015.

The larger native shrimp, gobies, and Mountain Mullet may enter some reservoirs from the rivers. Several game fish, including Peacock Bass, Largemouth Bass, and Channel Catfish, have been introduced into Puerto Rican reservoirs (Wiley and Vilella, 1998), representing the only important freshwater sport fish.

Artificial Freshwater Bodies

Ponds are important habitats in Puerto Rico, and almost all are artificial, primarily intended for irrigation, livestock, or aesthetic purposes. Most go dry at some point

during the year. Fish are stocked in some of these ponds for sport fishing and to control mosquitoes and weeds. Channels irrigating sugarcane fields are also important habitats for fish and aquatic invertebrates.

Lagoons

All of Puerto Rico's lagoons have shallow water, usually with mud bottoms, are weedy over large stretches, and if brackish or salty, are surrounded by mangrove forests (Figure 46). Cartagena Lagoon, one of Puerto Rico's most important wetland habitats (Danforth, 1926), has been severely degraded by nearby agricultural practices. The USFWS acquired this lagoon in 1989, and its restoration is proposed. Other important lagoons include Joyuda, San José, Torrecillas, Tortuguero, and Piñones.

The DNER, in collaboration with North Carolina State University and supported by the State Wildlife Grant, is developing a project to restore and manage coastal lagoons in Puerto Rico. This project aims to establish guidelines to enhance the productivity of invertebrates that serve as food for shorebirds and other birds in the natural ponds of Cabo Rojo and Guánica.

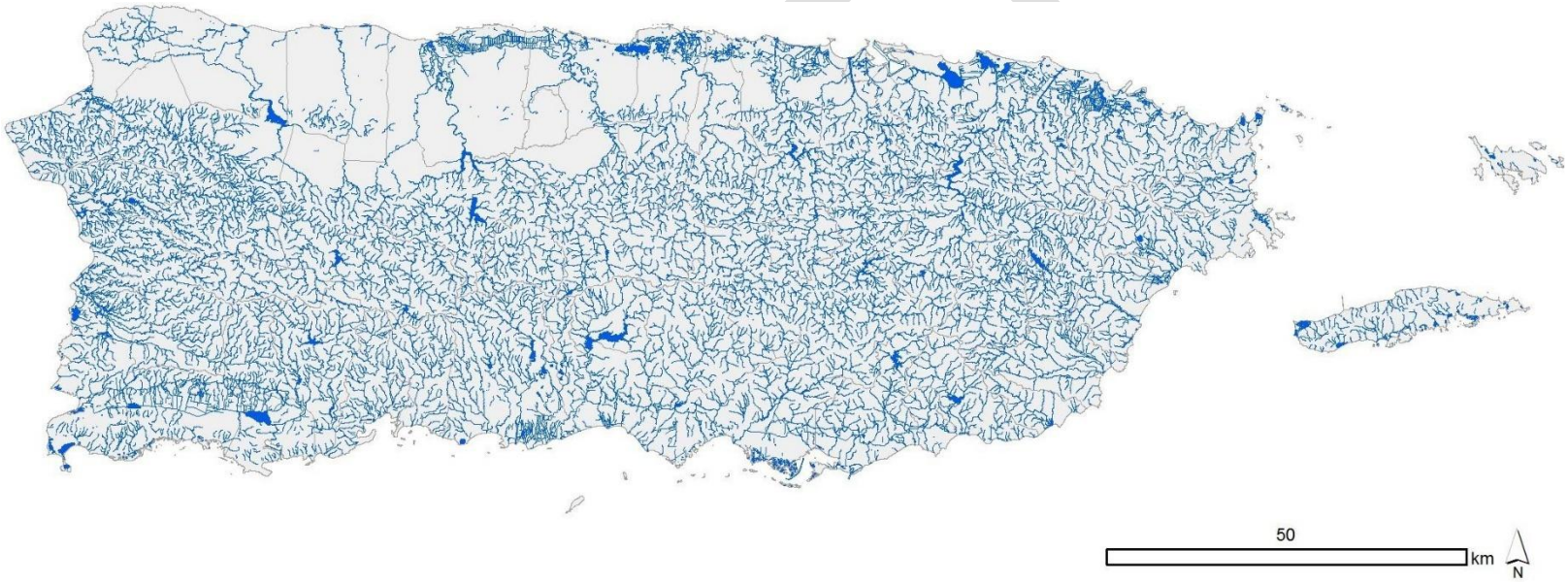


Figure 44. Puerto Rico Freshwater Habitats. From DNER 2015.

Mangrove forests

Mangroves are particularly important coastal forests due to the diverse range of functions and services they provide (Puerto Rico Coastal Zone Management Program, 2009). Mangroves are found along Puerto Rico's coast in wetlands subject to saltwater intrusion, providing numerous ecosystem services. They buffer coastlines against the onslaught of wind caused by weather events. They serve as wildlife refuges, fisheries, and nurseries for marine life, and they serve as sources and natural filters to purify water. These characteristics distinguish mangroves as coastal systems of high ecological and economic value. Between 70% and 90% of marine life with commercial or recreational value uses mangroves for at least part of their respective life cycles (DNER, 2003). Mangroves are also part of the habitat for native and migratory birds, including those listed as endangered species on the federal endangered species list.

Mangroves can be degraded or destroyed by activities such as drainage, dredging, filling, sedimentation, and oil spills. Human activities have significantly altered the mangrove forests in Puerto Rico. In the past 200 years, major periods of decline in mangrove areas occurred during agricultural development from 1800 to 1940 and during urban expansion in the 1960s and 1970s (Martinuzzi et al., 2009). Despite the massive destruction of these systems, mangrove coverage is increasing due to legal protections that began in 1972. Currently, landfilling, which affects hydrology, is the most significant threat to mangroves and adjacent lands.

Strategies and Monitoring the Conservation of Freshwater Habitats

Similar to terrestrial habitats, freshwater habitats need monitoring metrics to track conservation progress. Freshwater ecosystems are crucial not only for biodiversity but also for providing clean water, regulating floods, and supporting human livelihoods. These systems are sensitive to changes in water quality, flow patterns, and land use. Monitoring should focus on hydrological, chemical, and biological

indicators to evaluate the ecological health of water bodies and the condition of nearby habitats.

Table 38. Strategies and monitoring metrics to track the conservation of freshwater habitats.

Habitat	Strategies	Monitoring Metrics
Rivers and Streams	-Establish water quality monitoring networks -Employ biological indices for monitoring aquatic species -Restore riparian vegetation to stabilize streambanks	-Water quality -Flow variability and alterations -Carbon storage capacity
Riparian Forests	-Promote the planting of native riparian vegetation -Control invasive species in riparian corridors -Implement erosion control measures	-Vegetation cover and buffer zone width -Presence of invasive plant species -Rates of soil erosion and sediment deposition
Reservoirs and Artificial Bodies of Water	-Manage water storage to emulate ecological flow patterns -Monitor nutrient loading and manage runoff effectively -Align stocking practices with conservation objectives -Implement sediment dredging or prevention programs as needed	-Water level fluctuations and storage capacity -Algal blooms frequency -Fish stocking -Sedimentation rates
Lagoons	-Preserve natural water flow -Enforce pollution controls for surrounding land use -Safeguard bird nesting and feeding areas -Restore shore vegetation	-Salinity balance -Levels of nutrient concentration and pollution -Abundance of migratory and resident bird species -Shoreline integrity and vegetation coverage
Mangrove Forests	-Expand projects for the restoration and planting of mangroves -Monitor the hydrological conditions that support mangroves -Integrate mangroves into climate adaptation strategies -Protect mangrove areas from coastal development	-Extent and density of mangrove cover -Soil salinity -Carbon storage capacity -Vulnerability to coastal erosion and storm damage

Saltwater Habitats

Coral Reefs

Coral reefs and rock reef communities are highly productive marine ecosystems and are well-represented in Puerto Rico (Table 39). They provide habitat for a large number and variety of fish and invertebrates. Coral reefs protect coastlines from wave action. They are a primary source of carbonate sand. They promote the deposition of sand on beaches as well as the formation of seagrass beds and mangroves. They serve as buffers against coastal erosion.

Puerto Rico is surrounded by approximately 500,000 ha of easy-access coral reefs (reefs less than 20 meters deep) (CSOR, 2005). Some 228 species of corals have been identified in the territorial waters, including 117 *scleractinian* corals (rocky), 99 *antipatharia* corals (black or spiny), 13 *corallimorpharia* (fungi-type coral), three fire corals, and five hydrocorals (DNER, 2000). These coral reefs are formed mainly by three types of structures: fringing or marginal reefs (the most common), bank reefs, and barrier reefs.

Living coral reefs are present around Puerto Rico, but many are degraded, largely due to increased sediment and nutrient discharge resulting from anthropogenic modifications to the densely populated island. These modifications are associated with intensive land clearing, agricultural and industrial development that accompany a steady increase in the standard of living (Goenaga and Cintrón, 1979; Morelock et al., 1980, 1983, 1985; Rogers, 1990; Acevedo and Morelock, 1988; Clark and Wilcock, 2000; Larsen, 2000; Larsen and Santiago-Román, 2001; Torres and Morelock, 2002; Weil, 2004; Warne et al. 2005).

Coral degradation can also be caused by natural events, requiring an appropriate response to protect the reefs. After Hurricanes Irma and María impacted Puerto Rico in 2017, NOAA surveyed 153 coral sites, covering 414,354 m2 or 80,000

corals, as part of an assignment from FEMA. The assessment revealed that, overall, 11% of the corals were damaged, with some sites experiencing damage levels of up to 100%. The most severe impacts were observed on the northeastern, Culebra, Vieques, and northern coasts. Additionally, over 17,000 corals were rescued and triaged at 65 of the sites.

Table 39. Area of coastal wetland types (López 2007).

System	Definition	Hectares
Marine	Area exposed to sea waves and sea currents with a water salinity greater than 30-35 parts per thousand (e.g., coral reefs, seagrass beds).	23,642
Estuarine	Area affected by the tide with low-energy waves, where the water salinity is greater than 0.5 parts per million (e.g., saltpeter beds, mangroves, and coastal rivers).	31,947
Palustrine	Areas in freshwater that may be subject to the ebb and flow of tides. Persistent trees, shrubs, and herbaceous plants. Upright and entrenched, submerged and/or floating plants predominate in them. (e.g., swamps, marshes, wet meadows, shallow ponds).	31,555
Total		**87,144**

Puerto Rico's conservation efforts regarding coral reefs are exemplified through the Coral Reef Conservation and Management Program, established by Act 147-1999. The DNER, through this program, performs the following:

- Coordination of coral monitoring and research activities.
- Implementation and development of management strategies.
- Promotion of alliances to reduce threats, alongside promoting conservation of these ecosystems.

Strategies and Monitoring the Conservation of Saltwater Habitats

Since saltwater habitats are essential to marine biodiversity, fisheries, and coastal protection, effective monitoring requires metrics that assess ecosystem health across vast marine areas and in specialized environments, such as coral reefs.

Table 40. Strategies and monitoring metrics to track the conservation of saltwater habitats.

Habitat	Strategies	Monitoring Metrics
General Saltwater	-Establish marine water quality monitoring stations -Enforce sustainable fisheries management practices -Protect and restore seagrass meadows -Implement policies for marine debris clean-up and reduction -Develop projects to mitigate coastal erosion	-Water quality -Fish biomass and diversity -Seagrass cover and condition -Levels of plastic debris and other marine litter -Coastal erosion and shoreline change rates
Coral Reefs	-Establish and expand marine protected areas -Monitor coral health using standardized protocols -Implement tourism practices that are friendly to reefs -Reduce pollution from land that impacts reefs -Support projects for coral restoration and out planting.	-Coral cover percentage and diversity of species -Incidence of coral bleaching and disease prevalence -Reef fish diversity and abundance -Impacts from human activities

Initiatives to Identify Areas of Greatest Conservation Need

Natural Heritage Program

Fifty conservation priority areas (covering about 319,631 acres) have been identified by the NHP of the DNER (e.g., the northern karst region; Figure 47). The mechanisms used by the NHP to obtain its objectives are the following:

- Land acquisition through purchase, donation, lease, or public land title or management transfer.
- Agreements and Contracts.
- Funding, both recurring and non-recurring.
- Joint projects between the Puerto Rico Natural Heritage Program and Non-Governmental Organizations (NGOs).

Areas of greatest importance for protection of ecosystems and viable populations of native species are shown in Figure 48.

Figure 45. The northern karst region, an area of conservation priority identified by the DNER.

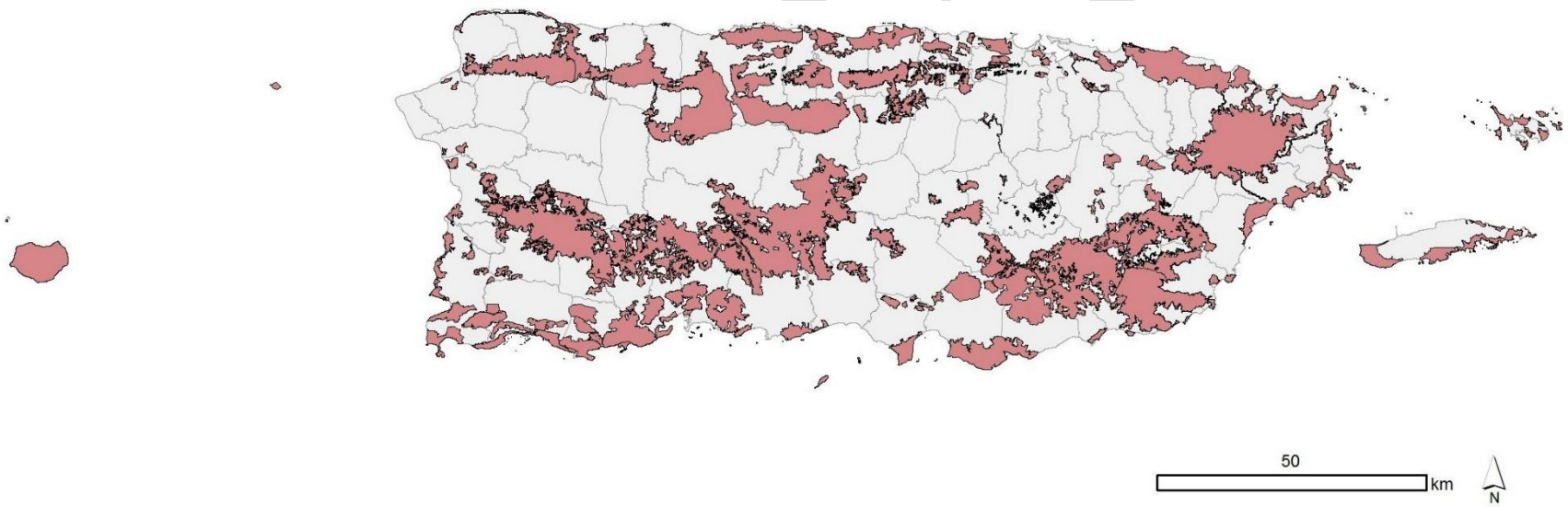


Figure 46. Areas of Conservation Priority identified by the Natural Heritage Program. DNER 2015

Critical Wildlife Areas

The third source of information used in lieu of a comprehensive statewide landscape analysis is the target species found in those zones classified as a CWA. The CWA effort identifies areas within Puerto Rico that are necessary to perpetuate the existence of species of special interest for DNER. The CWA identifies public lands as priorities for conservation, lands which DNER considers important wildlife habitat. Table 41 shows the target species found in each CWA. Below (Figure 49) is the Llanero Coqui (*Eleutherodactylus juanriveroi*), which was discovered in 2005 (northern Puerto Rico). Although DNER is currently working on designating critical habitat for this species, the USFWS has already completed this process.

Figure 47. Llanero Coqui (Eleutherodactylus juanriveroi).

Table 41. Data Deficient, Vulnerable, Endangered, or Critically Endangered species found in each CWA of P.R.

Area	Endangered and Vulnerable Species
Cucharilla's Marsh, Cataño	White-cheeked Pintail-*Anas bahamensis* Ruddy Duck-*Oxyura jamaicensis* Caribbean Coot-*Fulica caribaea* Yellow shouldered Blackbird-*Agelaius xanthomus* West Indian Whistling Duck-*Dendrocygna arborea* Masked Duck-*Nomonyx dominicus* Brown Pelican-*Pelecanus occidentalis* Fishing Bat-*Noctilio leporinus* Grasshopper Sparrow-*Ammondramus savannarum* Puerto Rican Oriole-*Icterus portoricensis* Puerto Rican vireo-*Vireo latimeri* Piping Plover-*Charadrius melodus*
Buchanan Haystack Hills and Fort Buchanan Pond, Bayamón	Ruddy Duck-*Oxyura jamaicensis* White-crowned Pigeon-*Patagioenas leucocephala* Puerto RicanOriole-*Icterus portoricensis* Adelaide's Warbler-*Setophaga adelaidae* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Puerto Rican Boa-*Chilobotrus inornatus* Puerto Rican Slider-*Trachemys stejnegeri*
Torrecillas Swamp System Piñones-Vacía Talega, Carolina-Loíza-Canóvanas	Brown Pelican-*Pelecanus occidentalis* Least Tern-*Sterna antillarum* West Indian Whistling Duck-*Dendrocygna arborea* Masked Duck-*Nomonyx dominicus* Caribbean Coot-*Fulica caribaea* White-crowned Pigeon-*Patagioenas leucocephala* Yellow Warble-*Setophaga petechia* Yellow shouldered Blackbird-*Agelaius xanthomus* Puerto Rican Oriole-*Icterus portoricensis* Puerto Rican Boa-Chilobotrus inornatus Leatherback Sea Turtle-*Dermochelys coriacea* Hawksbill Turtle-*Eretmochelys imbricata* West Indian Manatee-*Trichechus manatus* Juey Palancú-*Cardisoma guanhumi* Camarón Palaí-*Macrobrachium carcinus* Mangrove Crab-*Aratus pisoni* Cangrejo de Mangle-*Goniopsis cruentata*

Area	Endangered and Vulnerable Species
Bo. Borinquen, Trujillo Alto Lake, Bairoa Lake La 25 and Gurabo River Mouth, Trujillo Alto-Caguas-Gurabo	Caribbean Coot-*Fulica caribaea* Least Grebe-*Tachybaptus dominicus* Puerto Rican Plain Pigeon-*Patagioenas inornata* West Indian Whistling Duck-*Dendrocygna arborea* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieillot*
Baja Swamp and Herrera River Mouth, Río Grande	White-cheeked Pintail-*Anas bahamensis* West Indian Whistling Duck-*Dendrocygna arborea* Ruddy Duck-*Oxyura jamaicensis* Masked Duck-*Nomonyx dominicus* Juey Palancú-*Cardisoma guanhumi*
Ensenada Comezón, Río Grande	Brown Pelican-*Pelecanus occidentalis* Caribbean Coot-*Fulica caribaea* Piping Plover-*Charadrius melodus* White-crowned Pigeon-*Patagioenas leucocephala* Nassau Grouper-*Epinephelus striatus* Juey Palancú-*Cardisoma guanhumi* Mangrove Root Crab-*Goniopsis cruentata* Zambuco-*Ucides cordatus* Mangrove Crab-*Aratus pisoni*
Street # 968, Río Mar, Rio Grande	Puerto Rican Boa-*Chilobotrus inornatus* Virgin Island Tree Boa-*Chilobotrus granti* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti*
Luquillo Mountains, Luquillo	Sharp shinned Hawk-*Accipiter striatus* Broad-winged Hawk-*Buteo platypterus* Puerto Rican Parrot-*Amazona vittata* Puerto Rican vireo-*Vireo latimeri* Puerto Rican Oriole *Icterus portoricensis* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Elfin Woods Warbler *Setophaga angelae* Adelaide's Warbler-*Setophaga adelaidae* Puerto Rican Boa-*Chilobotrus inornatus* Puerto Rican Coqui-*Eleutherodactylus portoricensis* Ground Coqui-*Eleutherodactylus richmondi* Tree hole Coqui-*Eleutherodactylus hedricki* Mottled Coqui-*Eleutherodactylus eneidae* Web footed Coqui-*Eleutherodactylus karlschmidti* Free tailed Bat-*Tadarida brasiliensis* Cave Bat-*Brachyphylla cavernarum* Greater Antillean Long-tongued Bat-*Monophyllus redmani* Red fruit Bat-*Stenoderma rufum*

Area	Endangered and Vulnerable Species
San Miguel, La Paulina and El Convento Natural Area, Luquillo-Fajardo	West Indian Whistling Duck-*Dendrocygna arborea* Masked Duck-*Nomonyx dominicus* Ruddy Duck-*Oxyura jamaicensis* Puerto Rican Plain Pigeon-*Patagioenas inornata* White-crowned Pigeon-*Patagioenas leucocephala* Brown Pelican-*Pelecanus occidentalis* Least Grebe-*Tachybaptus dominicus* Adelaide's Warbler-*Setophaga adelaidae* Yellow Warble-*Setophaga petechia* Caribbean Coot-*Fulica caribaea* White-cheeked Pintail-*Anas bahamensis* Least Tern-*Sternulla antillarum* Snowy Plover-*Charadrius alexandrinus* Piping Plover-*Charadrius melodus* Roseate Tern-*Sterna dougalli* Grasshopper Sparrow-*Ammondramus savannarum* Puerto Rican Vireo-*Vireo latimeri* Puerto Rican Oriole-*Icterus portoricensis* Puerto Rican Boa-Chilobotrus inornatus Virgin Island Tree Boa-*Chilobotrus granti* Leatherback Sea Turtle-*Dermochelys coriacea* Hawksbill Turtle-*Eretmochelys imbricata* Puerto Rican Slider-*Trachemys stejnegeri* West Indian Manatee-*Trichechus manatus* *Schoepfia arenaria* Cobana Negra *Stahlia-monosperma* Beautiful Goetzea-*Goetzea elegans* Bloodwoodtree-*Pterocarpus officinalis*
Laguna Grande, Laguna Aguas Prietas and adjacent areas, Fajardo	West Indian Whistling Duck-*Dendrocygna arborea* Brown Pelican-*Pelecanus occidentalis* White-crowned Pigeon-*Patagioenas leucocephala* Caribbean Coot-*Fulica caribaea* Adelaide's Warbler-*Setophaga adelaidae* Yellow Warble-*Setophaga petechia* White-cheeked Pintail-*Anas bahamensis* Ruddy Duck-*Oxyura jamaicensis*

Area	Endangered and Vulnerable Species
Fajardo Coast Line, Fajardo	Green Sea Turtle-*Chelonia mydas* Leatherback Sea Turtle-*Dermochelys coriacea* Hawksbill Turtle-*Eretmochelys imbricata* White-cheeked Pintail-*Anas bahamensis* Brown Pelican-*Pelecanus occidentalis* Roseate Tern-*Sterna dougalli* White-crowned Pigeon-*Patagioenas leucocephala* Yellow shouldered Blackbird-*Agelaius xanthomus* Yellow Warble-*Setophaga petechia* West Indian Manatee-*Trichechus manatus*
La Cordillera Natural Reserve, Fajardo	Roseate Tern-*Sterna dougalli* Brown Pelican-*Pelecanus occidentalis* White-cheeked Pintail-*Anas bahamensis* Roseate Tern-*Sterna dougalli* Virgin Island Tree Boa-*Chilobotrus granti* Hawksbill Turtle-*Eretmochelys imbricata* Green Sea Turtle-*Chelonia mydas* Slippery-backed-*Spondylurus nitidus*
Flamenco Peninsula, Culebra Island	Slippery-backed-*Spondylurus culebrae* Roseate Tern-*Sterna dougalli*
Flamenco Lagoon, Culebra Island	White-cheeked Pintail-*Anas bahamensis* Ruddy Duck-*Oxyura jamaicensis* Caribbean Coot-*Fulica caribaea* Least Grebe-*Tachybaptus dominicus* White-crowned Pigeon-*Patagioenas leucocephala*
Cornelius Lagoon, Culebra Island	White-cheeked Pintail-*Anas bahamensis* Ruddy Duck-*Oxyura jamaicensis* Masked Duck-*Nomonyx dominicus* Brown Pelican-*Pelecanus occidentalis*
Resaca Mountain, Culebra Island	Culebra Iisland GiantAnole-*Anolis roosevelti*
Resaca Beach, Culebra Island	Leatherback Sea Turtle-*Dermochelys coriacea* Hawksbill Turtle-*Eretmochelys imbricata*
Brava Beach, Culebra Island	Leatherback Sea Turtle-*Dermochelys coriacea* Hawksbill Turtle-*Eretmochelys imbricata*
Larga Beach and Zoní Lagoon, Culebra Island	Leatherback Sea Turtle-*Dermochelys coriacea* Hawksbill Turtle-*Eretmochelys imbricate* Brown Pelican-*Pelecanus occidentalis* White-cheeked Pintail-*Anas bahamensis* Ruddy Duck-*Oxyura jamaicensis* Caribbean Coot-*Fulica caribaea*
Mailux Lagoon, Culebra Island	White-cheeked Pintail-*Anas bahamensis*

Area	Endangered and Vulnerable Species
Puerto del Manglar, Culebra Island	Brown Pelican-*Pelecanus occidentalis* White-crowned Pigeon-*Patagioenas leucocephala* Roseate Tern-*Sterna dougalli*
Los Caños, Culebra Island	White-crowned Pigeon-*Patagioenas leucocephala* White-cheeked Pintail-*Anas bahamensis*
Cementerio Bay, Culebra Island	White-crowned Pigeon-*Patagioenas leucocephala*
Culebra's Surrounding Cays, Culebra Island	Roseate Tern-*Sterna dougalli* Slippery-backed-*Spondylurus culebrae* Hawksbill Turtle-*Eretmochelys imbricata* Green Sea Turtle-*Chelonia mydas*
Vieques west coast, Vieques Island	White-crowned Pigeon-*Patagioenas leucocephala* White-cheeked Pintail-*Anas bahamensis* West Indian Whistling Duck-*Dendrocygna arborea* Leatherback Sea Turtle-*Dermochelys coriaceae* Hawksbill Turtle-*Eretmochelys imbricata* Adelaide's Warbler-*Setophaga adelaidae* Yellow Warble-*Setophaga petechia* Green Sea Turtle-*Chelonia mydas* Loggerhead Turtle-*Caretta caretta* West Indian Manatee-*Trichechus manatus* Cobana Negra-*Stahlia monosperma* Thoma's lidflower-*Calyptranthes thomasiana*
Kiani Lagoon, Vieques Island	White-cheeked Pintail-*Anas bahamensis* Ruddy Duck-*Oxyura jamaicensis* West Indian Whistling Duck-*Dendrocygna arborea* Adelaide's Warbler-Setophaga adelaidae Yellow Warble-*Setophaga petechia* White-crowned Pigeon-*Patagioenas leucocephala* Brown Pelican-*Pelecanus occidentalis*
Playa Grande Lagoon, Vieques Island	White-crowned Pigeon-*Patagioenas leucocephala* White-cheeked Pintail-*Anas bahamensis* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-*Setophaga adelaidae* Ruddy Duck-*Oxyura jamaicensis* Cobana Negra-*Stahlia monosperma* Beautiful Goetzea-*Goetzea elegans*
Ensenada Honda Mangrove, Vieques Island	West Indian Manatee-*Trichechus manatus* Cobana Negra-*Stahlia monosperma* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-*Setophaga adelaidae*

Area	Endangered and Vulnerable Species
Yanuel Lagoon, Vieques Island	Yellow Warble-*Setophaga petechia* White-crowned Pigeon-*Patagioenas leucocephala* White-cheeked Pintail-*Anas bahamensis* Cobana Negra-*Stahlia monosperma*
Chiva Swamp, Vieques Island	White-cheeked Pintail-*Anas bahamensis* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-*Setophaga adelaidae* Least Tern-*Sternulla antillarum*
Tapón Bay, Vieques Island	White-crowned Pigeon-*Patagioenas leucocephala* White-cheeked Pintail-*Anas bahamensis*
Ferro Bay, Mosquito Bay and Sombe Bay, Vieques Island	Key West Quail-Dove-*Geotrygon chrysie* Brown Pelican-*Pelecanus occidentalis* White-cheeked Pintail-*Anas bahamensis* West Indian Manatee-*Trichechus manatus* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-*Setophaga adelaidae*
East tip of Vieques and Conejo Cay, Vieques Island	White-cheeked Pintail-*Anas bahamensis* Roseate Tern-*Sterna dougalli* Brown Pelican-*Pelecanus occidentalis* Adelaide's Warbler-*Setophaga adelaidae* Hawksbill Turtle-*Eretmochelys imbricata* Leatherback Sea Turtle-*Dermochelys coriacea* Green Sea Turtle-*Chelonia mydas*
Roosevelt Roads Naval Base, Ceiba	West Indian Whistling Duck-*Dendrocygna arborea* Least Grebe-*Tachybaptus dominicus* White-cheeked Pintail-*Anas bahamensis* Brown Pelican-*Pelecanus occidentalis* Yellow shouldered Blackbird-*Agelaius xanthomus* Ruddy Duck-*Oxyura jamaicensis* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-*Setophaga adelaidae* White-crowned Pigeon-*Patagioenas leucocephala* Key West Quail-Dove-*Geotrygon chrysia* West Indian Manatee-*Trichechus manatus* Green Sea Turtle-*Chelonia mydas* Hawksbill Turtle-*Eretmochelys imbricata*
Ceiba State Forest, Fajardo, Ceiba and Naguabo	Brown Pelican-*Pelecanus occidentalis* Key West Quail-Dove-*Geotrygon chrysia* Bridled Quail-Dove-*Geotrygon mystacea* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-*Setophaga adelaidae* Yellow shouldered Blackbird-*Agelaius xanthomus*

Area	Endangered and Vulnerable Species
Humacao Natural Reserve, Humacao	Caribbean Coot-*Fulica caribaea* Least Tern-*Sternulla antillarum* Least Grebe-*Tachybaptus dominicus* Brown Pelican-*Pelecanus occidentalis* West Indian Whistling Duck-*Dendrocygna arborea* Masked Duck-*Nomonyx dominicus* Adelaide's Warbler-*Setophaga adelaidae* Ruddy Duck-*Oxyura jamaicensis* White-crowned Pigeon-*Patagioenas leucocephala* Leatherback Sea Turtle-*Dermochelys coriacea* Hawksbill Turtle-*Eretmochelys imbricate* Yellow-breasted crake-*Porzana flaviventer* Loggerhead Turtle-*Caretta caretta* Puerto Rican Slider-T*rachemys stejnegeri* Juey Palancú-*Cardisoma guanhumi* Mangrove root Crab-*Goniopsis cruentata* Cangrejo violinista-*Uca thayeri*
Pandura Mountain Range, Yabucoa-Maunabo	Brown Pelican-*Pelecanus occidentalis* White-crowned Pigeon-*Patagioenas leucocephala* Adelaide's Warbler-Setophaga adelaidae Puerto Rican plain Pigeon-*Patagioenas inornata* Puerto Rican Vireo-*Vireo latimeri* Puerto RicanOriole-*Icterus portoricensis* Puerto Rican demon-*Eleutherodactylus cooki*
Palmas Pond, Arroyo	Brown Pelican-*Pelecanus occidentalis* Ruddy Duck-*Oxyura jamaicensis* Masked Duck-*Nomonyx dominicus* Caribbean Coot-*Fulica caribaea* Least Tern-*Sternulla antillarum*

Area	Endangered and Vulnerable Species
Carite State Forest, Cayey	Elfin woods Warbler-*Setophaga angelae* Sharp shinned Hawk-*Accipiter striatus* Broad-winged Hawk-*Buteo platypterus* Key West Quail-Dove-*Geotrygon chrysia* Puerto Rican Vireo-*Vireo latimeri* Puerto RicanOriole-*Icterus portoricensis* Puerto Rican Boa-Chilobotrus inornatus Golden Coqui-*Eleutherodactylus jasperi* Puerto Rican Coqui-*Eleutherodactylus portoricensis* Ground Coqui-*Eleutherodactylus richmondi* Eneida's Coqui-*Eleutherodactylus eneidae* Warty Coqui-*Eleutherodactylus locustus* Tree hole Coqui-*Eleutherodactylus hedricki* Web footed Coqui-*Eleutherodactylus karlschmidti*
Cerro El Gato and Associated Areas, Cayey	Golden Coqui-*Eleutherodactylus jasperi*
39- Cidra Lake, Cidra	Puerto Rican plain Pigeon-*Patagioenas inornata*
Aguirre State Forest, Punta Pozuelo, Cayos Caribe & Mar Negro, Guayama-Salinas-Santa	Brown Pelican-*Pelecanus occidentalis* White-cheeked Pintail-*Anas bahamensis* Least Tern-*Sternulla antillarum* Roseate Tern-*Sterna dougalli* Least Grebe-*Tachybaptus dominicus* Puerto Rican-Oriole-*Icterus portoricensis* White-crowned Pigeon-*Patagioenas leucocephala* Puerto Rican plain Pigeon-*Patagioenas inornata* Puerto Rican Vireo-*Vireo latimeri* Grasshopper Sparrow-*Ammondramus savannarum* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-Setophaga adelaidae Leatherback Sea Turtle-*Dermochelys coriacea* Green Sea Turtle-*Chelonia mydas* Hawksbill Turtle-*Eretmochelys imbricata* Dryland grass Anole-*Anolis poncensis* West Indian Manatee-*Trichechus manatus* Fishing Bat-*Noctilio leporinus* Nassau grouper-*Epinephelus striatus* Jewfish-*Epinephelus itajitara*
Punta Arenas, Salinas	Brown Pelican-*Pelecanus occidentalis* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-*Setophaga adelaidae* White-cheeked Pintail-*Anas bahamensis*

Area	Endangered and Vulnerable Species
Salinas Training Area, Salinas	Dryland Grass Anole-*Anolis poncensis* Adelaide's Warbler-Setophaga adelaidae Key west Quail-Dove-*Geotrygon chrysia* Puerto Rican Oriole-*Icterus portoricensis* Erubia-*Solanum ensipholium*
Punta Petrona Mangroves and Caracoles Cay, Santa Isabel	Brown Pelican-*Pelecanus occidentalis* White-cheeked Pintail-*Anas bahamensis* Ruddy Duck-*Oxyura jamaicensis* Yellow Warble-*Setophaga petechia* Green Sea Turtle-*Chelonia mydas* West Indian Manatee-*Trichechus manatus*
Cabuyón Mangrove and Fríos Cays, Ponce	Brown Pelican-*Pelecanus occidentalis* Caribbean Coot-*Fulica caribaea* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-*Setophaga adelaidae* White-cheeked Pintail-*Anas bahamensis* Brown Pelican-*Pelecanus occidentalis* Snowy Plover-*Charadrius nivosus* White-crowned Pigeon-*Patagioenas leucocephala* Grasshopper Sparrow-*Ammondramus savannarum*
Caja de Muertos Complex, Ponce-Juana Díaz-Santa Isabel	Brown Pelican-*Pelecanus occidentalis* Least Tern-*Sternulla antillarum* White-tailed Tropicbird-*Phaeton aethereus* (nesting) Roseate Tern *Sterna dougalli* Yellow Warble-*Setophaga petechia* Green Sea Turtle-*Chelonia mydas* Hawksbill Turtle-*Eretmochelys imbricata* Grant's Blind Snake-*Typhlops granti* Cook's Anole-*Anolis cooki* Jueyita de Tierra-*Gecarcinus lateralis* Juey Morado-*Gecarcinus ruricola* Juey de Mangle-*Aratus pisonii*
Serrallés Lakes, Juana Díaz-Ponce	Ruddy Duck-*Oxyura jamaicensis* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Adelaide's Warbler-*Setophaga adelaidae* Caribbean Coot-*Fulica caribaea* Least Grebe-*Tachybaptus dominicus* Puerto Rican Oriole-*Icterus portoricensis* Brown Pelican-*Pelecanus occidentalis*

Area	Endangered and Vulnerable Species
Toro Negro and Tres Picachos State Forest, Ciales-Jayuya-Orocovis	Sharp-shinned Hawk-*Accipiter striatus* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Puerto Rican Vireo-*Vireo latimeri* Puerto Rican Oriole-*Icterus portoricensis* Cave Bat-*Brachyphylla cavernarum* Long-tongued Bat-*Monophyllus redmani* Red Fruit Bat-*Stenoderma rufum* Brown Flower Bat-*Erophylla sezekorni* Slippery-backed Mabuya-*Spondylurus nitidus* Buruquena-*Epilobocera sinuatifrons* Treehole Coqui-*Eleutherodactylus hedricki* Ground Coqui-*Eleutherodactylus richmondi* Eneida's Coqui-*Eleutherodactylus eneidae* Camarón Palaí-*Macrobrachium carcinus* Camarón-*Macrobrachium crenulatum* Camarón-*Macrobrachium faustinum* Camarón-*Macrobrachium heterochirus* Buruquena-*Epilobocera suinuatifrons*
Las Salinas Lagoon, El Tuque, Ponce	White-cheeked Pintail-*Anas bahamensis* Brown Pelican-*Pelecanus occidentalis* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-*Setophaga adelaidae* Least Tern *STernulla antillarum* Puerto Rican Vireo-*Vireo latimeri* Puerto RicanOriole-*Icterus portoricensis* Dryland Grass Anole-*Anolis poncensis*
Monte Guilarte State Forest, Adjuntas-Guayanilla, Peñuelas-Yauco	Sharp-shinned Hawk-*Accipiter striatus* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Puerto Rican Vireo-*Vireo latimeri* Key West Quail-Dove-*Geotrygon chrysia* Puerto Rican Oriole-*Icterus dominicensis* Red fruit Bat-*Stenoderma rufum* Cave Bat-*Brachyphylla cavernarum* Eneida's Coqui-*Eleutherodactylus eneidae* Puerto Rican Coqui-*Eleutherodactylus portoricensis* Puerto Rican Boa-*Chilobotrus inornatus* West Indian Walnut-*Juglans jamaicensis* Puerto Rican manac-*Calyptronoma rivalis*

Area	Endangered and Vulnerable Species
Punta Verraco, Cerro Toro and Punta Ventana, Guayanilla	Puerto Rican CrestedToad-*Peltophryne lemur* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-Setophaga adelaidae Brown Pelican-*Pelecanus occidentalis* Puerto Rican Nightjar-*Caprimulgus noctitherus* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Key West Quail-Dove-*Geotrygon chrysia* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-*Setophaga adelaidae*
Guayanilla Hills, Guayanilla	Puerto Rican Nightjar-*Caprimulgus noctitherus* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Bariaco-*Trichilia triacantha*
Guánica Lagoon, Guánica	Puerto Rican Nightjar-*Caprimulgus noctitherus* Yellow-breasted Crake-*Porzana flaviventer* West Indian Whistling Duck-*Dendrocygna arborea* White-cheeked Pintail-*Anas bahamensis* Ruddy Duck-*Oxyura jamaicensis*
Guánica State Forest, Guánica	Key West Quail-Dove-*Geotrygon chrysia* Puerto Rican Nightjar-*Caprimulgus noctitherus* White-crowned Pigeon-*Patagioenas leucocephala* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Puerto Rican Oriole-*Icterus dominicensis* Puerto Rican Vireo-*Vireo latimeri* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-*Setophaga adelaidae* Bridled Quail-Dove-*Geotrygon mystacea* Puerto Rican CrestedToad- *Peltophryne lemur* Slippery-backed-*Spondylurus nitidus* Grant's Blind Snake-*Typhlops granti* Juey Morado-*Gecarcinus ruricola* Camarón Troglobita de *Mona-Typhlatya monae* Bariaco-*Trichilia triacantha*
San Jacinto Salt Flats and Tamarindo Lagoon, Guánica	Puerto Rican Nightjar-*Caprimulgus noctitherus* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Brown Pelican-*Pelecanus occidentalis* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-*Setophaga adelaidae* White-cheeked Pintail-*Anas bahamensis* Roseate Tern-*Sterna dougallii*

Area	Endangered and Vulnerable Species
Susúa State Forest and Adjacent Lands	Yauco-Sabana Grande Key West Quail-Dove-*Geotrygon chrysia* Puerto Rican Nightjar-*Caprimulgus noctitherus* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Puerto Rican Vireo-*Vireo latimeri* Adelaide's Warbler-*Setophaga adelaidae* Puerto Rican Oriole-*Icterus dominicensis* Cobana Negra-*Stahlia monosperma* Pelos del Diablo-*Aristida portoricensis*
La Parguera Natural Reserve, Lajas	White-cheeked Pintail-*Anas bahamensis* Puerto Rican Nightjar-*Caprimulgus noctitherus* Yellow Warble-*Setophaga petechia* Yellow shouldered Blackbird-*Agelaius xanthomus* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Brown Pelican-*Pelecanus occidentalis* Adelaide's Warbler-*Setophaga adelaidae* Least Tern-*Sternulla antillarum* Puerto Rican Vireo-*Vireo latimeri* Hawksbill Turtle-*Eretmochelys imbricata* Green Sea Turtle-*Chelonia mydas* Leatherback Sea Turtle-*Dermochelys coriacea* West Indian Manatee-*Trichechus manatus*
Cartagena Lagoon, Lajas	Yellow shouldered Blackbird-*Agelaius xanthomus* Caribbean Coot-*Fulica caribaea* Least Grebe-*Tachybaptus dominicus* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-*Setophaga adelaidae* Ruddy Duck-*Oxyura jamaicensis* West Indian Whistling Duck-*Dendrocygna arborea* White-cheeked Pintail-*Anas bahamensis* Masked Duck-*Nomonyx dominicus* Broad-winged Hawk-*Buteo platypterus* Least Tern-*Sternulla antillarum* White-crowned Pigeon-*Patagioenas leucocephala* Key West Quail-Dove-*Geotrygon chrysia* Puerto Rican Oriole-*Icterus dominicensis* Puerto Rican Vireo-*Vireo latimeri* Yellow-breasted Crake-*Porzana flaviventer* Grasshopper Sparrow-*Ammondramus savannarum*

Area	Endangered and Vulnerable Species
Boquerón State Fores, Cabo Rojo	Yellow shouldered Blackbird-*Agelaius xanthomus* Brown Pelican-*Pelecanus occidentalis* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* West Indian Whistling Duck-*Dendrocygna arborea* White-cheeked Pintail-*Anas bahamensis* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-*Setophaga adelaidae* Ruddy Duck-*Oxyura jamaicensis* Caribbean Coot-*Fulica caribaea* Least Tern-*Sternulla antillarum* White-crowned Pigeon-*Patagioenas leucocephala* Puerto Rican Oriole-*Icterus dominicensis* Grasshopper Sparrow-*Ammondramus savannarum* Yellow-breasted Crake-*Porzana flaviventer* Piping Plover-*Charadrius melodus* West Indian Manatee-*Trichechus manatus* Cook’s Anole-*Anolis cooki* Free tailed Bat-*Tadarida brasiliensis* Bariaco-*Trichilia triacantha*
Boquerón Wildlife Refuge, Cabo Rojo	Least Grebe-*Tachybaptus dominicus* Brown Pelican-*Pelecanus occidentalis* West Indian Whistling Duck-*Dendrocygna arborea* White-cheeked Pintail-*Anas bahamensis* Masked Duck-*Nomonyx dominicus* Ruddy Duck-*Oxyura jamaicensis* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-Setophaga adelaidae Caribbean Coot-*Fulica caribaea* White-crowned Pigeon-*Patagioenas leucocephala* Puerto Rican Oriole-*Icterus dominicensis* Grasshopper Sparrow-*Ammondramus savannarum* Yellow shouldered Blackbird-*Agelaius xanthomus* Fishing Bat-*Noctilio leporinus* West Indian Manatee-*Trichechus manatus* Swamp Ghost Crab-*Ucides cordatus* Juey Palancú-*Cardisoma guanhumi* Mangrove Root Crab-*Goniopsis cruentata*

Area	Endangered and Vulnerable Species
Cabo Rojo Salt Flats and Adjacent Areas, Cabo Rojo	Snowy Plover-*Charadrius alexandrinus* Piping Plover-*Charadrius melodus* Yellow shouldered Blackbird-*Agelaius xanthomus* Least Tern-*Sternulla antillarum* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-*Setophaga adelaidae* White-cheeked Pintail-*Anas bahamensis* Roseate Tern-*Sterna dougalli* Green Sea Turtle-*Chelonia mydas* Hawksbill Turtle-*Eretmochelys imbricata* Leatherback Sea Turtle-*Dermochelys coriacea* Woodbury's stopper-*Eugenia woodburyana* Chase's threeawn-*Aristida chaseae* Cobana Negra-*Stahlia monosperma*
Punta Guaniquilla Natural Reserve, Cabo Rojo	Least Grebe-*Tachybaptus dominicus* Brown Pelican-*Pelecanus occidentalis* West Indian Whistling Duck-*Dendrocygna arborea* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-*Setophaga adelaidae* Ruddy Duck-*Oxyura jamaicensis* White-cheeked Pintail-*Anas bahamensis* Least Tern-*Sternulla antillarum* Cobana Negra-*Stahlia monosperma* Bariaco-*Trichilia triacantha*
Joyuda Lagoon Natural Reserve, Cabo Rojo	Ruddy Duck-*Oxyura jamaicensis* Yellow Warble-*Setophaga petechia* Puerto Rican Oriole-*Icterus dominicensis* Brown Pelican-*Pelecanus occidentalis*
Cuevas Lagoon, Cabo Rojo	White-cheeked Pintail-*Anas bahamensis* Ruddy Duck-*Oxyura jamaicensis* Masked Duck-*Nomonyx dominicus*

Area	Endangered and Vulnerable Species
Sabanetas Swamp-Boquilla Channel, Mayagüez	Leatherback Sea Turtle-*Dermochelys coriacea* Hawksbill Turtle-*Eretmochelys imbricata* West Indian Manatee-*Trichechus manatus* West Indian Whistling Duck-*Dendrocygna arborea* Caribbean Coot-*Fulica caribaea* Brown Pelican-*Pelecanus occidentalis* Least Tern-*Sternulla antillarum* Roseate Tern-*Sterna dougalli* Puerto Rican Oriole-*Icterus portoricensis* Swamp Ghost Crab-*Ucides cordatus* Mangrove root Crab-*Goniopsis cruentata* Juey de mangle-*Aratus pisonii*
Maricao State Forest, Maricao	Sharp-shinned Hawk-*Accipiter striatus* Broad-winged Hawk-*Buteo platypterus* White-crowned Pigeon-*Patagioenas leucocephala* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Puerto Rican Oriole-*Icterus portoricensis* Puerto Rican Vireo-*Vireo latimeri* Adelaide's Warbler-*Setophaga adelaidae* Elfin Woods Warbler *Aetophaga angelae* Puerto Rican Manac-*Calyptronoma rivalis* Higüero de Sierra-*Crescentia portoricensis* Orquid-*Cranichis ricartii* *Gesneria pauciflora* Palo de Rosa-*Ottoschulzia rhodoxylon*

Area	Endangered and Vulnerable Species
Mona Island	White tailed Tropicbird-*Phaeton aethereus* (nesting) Yellow shouldered Blackbird-*Agelaius xanthomus* White-crowned Pigeon-*Patagioenas leucocephala* West Indian Whistling Duck-*Dendrocygna arborea* Sharp shinned Hawk-*Accipiter striatus* Key west Quail-Dove-*Geotrygon chrysia* Higo Chumbo-*Harrisia portoricensis* Slippery-backed-*Spondylurus monae* Mona Island Ground Iguana-*Cyclura cornuta stejnegeri* Mona Blind Snake-*Typhlops monensis* Mona Boa-Chilobotrus monensis monensis Hawksbill Turtle-*Eretmochelys imbricata* Green Sea Turtle-*Chelonia mydas* Fishing Bat-*Noctilio leporinus* Humpback Whale-*Megaptera novaeangliae* Camarón Troglobita de Mona-*Typhlatya monae* Juey Morado-*Gecarcinus ruricola* Jueyita de Tierra-*Gecarcinus lateralis*
Monito Island	Yellow-shouldered Blackbird-*Agelaius xanthomus* Brown Pelican-*Pelecanus occidentalis* Slippery-backed-*Spondylurus monae* Monito's Gecko-*Sphaerodactylus micropithecus* Higo Chumbo-Harrisia portoricensis
Pozo Hondo Swamp, Añasco	West Indian Whistling Duck-*Dendrocygna arborea*
Cayures Swamp, Aguada	Masked Duck-*Nomonyx dominicus* West Indian Whistling Duck-*Dendrocygna arborea* Brown Pelican-*Pelecanus occidentalis* Caribbean Coot-*Fulica caribaea*
Desecheo Island	Brown Pelican-*Pelecanus occidentalis* White-crowned Pigeon-*Patagioenas leucocephala* Slippery-backed-*Spondylurus nitidus* Desecheo's Gecko-*Sphaerodactylus levinsi* Higo Chumbo-*Harrisia portoricensis*
Barrio Coto, Isabela	Puerto Rican Boa-*Chilobotrus inornatus* Beautiful Goetzea-*Goetzea elegans* Adelaide's Warbler-*Setophaga adelaidae* Puerto Rican CrestedToad-*Peltophryne lemur* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* *Auerodendron pauciflorum*
Guajataca Cliffs, Isabela-Quebradillas	White-tailed Tropicbird-*Phaeton aethereus* (nesting)
Camuy	Bridled Tern-*Onychoprion anaethetus* (nesting)

Area	Endangered and Vulnerable Species
Guajataca State Forest, Isabela	Key West Quail-Dove-*Geotrygon chrysia* White-crowned Pigeon-*Patagioenas leucocephala* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Bridled Quail-Dove-*Geotrygon mystacea* Sharp shinned Hawk-*Accipiter striatus* Adelaide's Warbler-*Setophaga adelaidae* Puerto Rican Oriole-*Icterus portoricensis* Puerto Rican Vireo-*Vireo latimeri* Puerto Rican Boa-*Chilobotrus inornatus* Grant's Blind snake-*Typhlops granti* Puerto Rican Crested Toad-*Peltophryne lemur* Long-tongued Bat-*Monophyllus redmani* Vahl's Boxwood-*Buxus vahlii* Palo de Rosa-*Ottoschulzia rhodoxylon* Ausú-*Myrcia paganii* Uvillo-*Eugenia haematocarpa* Spider-*Schoepfia arenaria* St. Thomas prickly-ash-*Zanthoxylum thomasianum* Beautiful Goetzea-*Goetzea elegans* Erubia-*Solanum drymophilum* *Daphnopsis helleriana* Palo de Nigua-*Cornutia obovata* Slippery-backed-*Spondylurus nitidus*
Guajataca Lake, Quebradillas	Key West Quail-Dove-*Geotrygon chrysia* Brown Pelican-*Pelecanus occidentalis* Broad-winged Hawk-*Buteo platypterus* White-crowned Pigeon-*Patagioenas leucocephala* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Ruddy Duck-*Oxyura jamaicensis* Adelaide's Warbler-Setophaga adelaidae Caribbean Coot-*Fulica caribaea* Puerto Rican Vireo-*Vireo latimeri* Puerto Rican Oriole-*Icterus portoricensis* Puerto Rican Boa-Chilobotrus inornatus Puerto Rican Slider-*Trachemys stejnegeri* Fishing Bat-*Noctilio leporinus*
Barrio Cocos and Bellaca Creek, Quebradillas	Puerto Rican CrestedToad-*Peltophryne lemur* Adelaide's Warbler-Setophaga adelaidae Beautiful Goetzea-*Goetzea elegans* Puerto Rican Boa-*Chilobotrus inornatus*

Area	Endangered and Vulnerable Species
Carrizales Mangroves, Hatillo	Least Grebe-*Tachybaptus dominicus* Brown Pelican-*Pelecanus occidentalis* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Grasshopper Sparrow-*Ammondramus savannarum* West Indian Whistling Duck-*Dendrocygna arborea* Puerto Rican Slider-*Trachemys stejnegeri*
Tiburones Swamp and La Tembladera Pond, Arecibo	Least Grebe-*Tachybaptus dominicus* Yellow-breasted Crake *Porzana flaviventer* Brown Pelican-*Pelecanus occidentalis* West Indian Whistling Duck-*Dendrocygna arborea* White-cheeked Pintail-*Anas bahamensis* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-*Setophaga adelaidae* Masked Duck-*Nomonyx dominicus* Ruddy Duck-*Oxyura jamaicensis* Caribbean Coot-*Fulica caribaea* Roseate Tern-*Sterna dougalli* Least Tern-*Sterna antillarum* White-crowned Pigeon-*Patagioenas leucocephala* Key West Quail-Dove-*Geotrygon chrysia* Puerto Rican Oriole-*Icterus portoricensis* Grasshopper Sparrow-*Ammondramus savannarum* Yellow shouldered Blackbird-*Agelaius xanthomus*
Cambalache Forest, Arecibo	Puerto Rican Boa-*Chilobotrus inornatus* Red fruit Bat-*Stenoderma rufum* Cave Bat-*Brachyphylla cavernarum* Beautiful Goetzea-*Goetzea elegans* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Adelaide's Warbler-*Setophaga adelaidae* Palo de Ramón-*Banara vanderbiltii* Palo de Rosa-*Ottoschulzia rhodoxylon* Puerto Rican Oriole-*Icterus portoricensis* Puerto Rican Vireo-*Vireo latimeri*
Río Abajo State Forest, Arecibo	Broad-winged Hawk-*Buteo platypterus* White-crowned Pigeon-*Patagioenas leucocephala* Adelaide's Warbler-*Setophaga adelaidae* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Puerto Rican Parrot *Amazona vitatta* Puerto Rican Vireo-*Vireo latimeri* Puerto Rican Oriole-*Icterus portoricensis* Puerto Rican Boa-*Chilobotrus inornatus*

Area	Endangered and Vulnerable Species
La Esperanza Natural Reserve, Manatí	Ruddy Duck-*Oxyura jamaicensis* White-cheeked Pintail-*Anas bahamensis* West Indian Whistling Duck-*Dendrocygna arborea* Brown Pelican-*Pelecanus occidentalis* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-*Setophaga adelaidae* Roseate Tern-*Sterna dougalli* Bridled Tern-*Sterna anaethetus* (nesting) Grasshopper Sparrow-*Ammondramus savannarum* White-crowned Pigeon-*Patagioenas leucocephala* Masked Duck-*Nomonyx dominicus* Caribbean Coot-*Fulica caribaea* Puerto Rican Oriole-*Icterus portoricensis* Puerto Rican vireo-*Vireo latimeri* Puerto Rican Slider-*Trachemys stejnegeri* Puerto Rican Boa-*Chilobotrus inornatus*
Tortuguero Lagoon, Cabo Caribe Swamp and Rica Lake, Vega Baja	Least Grebe-*Tachybaptus dominicus* Caribbean Coot-*Fulica caribaea* Brown Pelican-*Pelecanus occidentalis* Ruddy Duck-*Oxyura jamaicensis* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Yellow Warble-*Setophaga petechia* Adelaide's Warbler-*Setophaga adelaidae* Key West Quail-Dove-*Geotrygon chrysia* White-crowned Pigeon-*Patagioenas leucocephala* West Indian Whistling Duck-*Dendrocygna arborea* Bridled Quail-Dove-*Geotrygon mystacea* Yellow-breasted Crake-*Porzana flaviventer* Grasshopper Sparrow-*Ammondramus savannarum* Puerto Rican Boa-*Chilobotrus inornatus* Puerto Rican Senna-*Chamaecrista glandulosa var. mirabilis*

Area	Endangered and Vulnerable Species
Cibuco Swamp, Vega Baja	Brown Pelican-*Pelecanus occidentalis* Least Grebe-*Tachybaptus dominicus* White-crowned Pigeon-*Patagioenas leucocephala* West Indian Whistling Duck-*Dendrocygna arborea* Ruddy Duck-*Oxyura jamaicensis* White-cheeked Pintail-*Anas bahamensis* Roseate Tern-*Sterna dougalli* Yellow Warble-*Setophaga petechia* Puerto Rican Vireo-*Vireo latimeri* Grasshopper Sparrow-*Ammondramus savannarum* Long-tongued Bat-*Monophyllus redmani* Juey Palancú-*Cardisoma guanhumi* Mangrove Root Crab-*Goniopsis cruentata* Juey de Mangle-*Aratus pisonii* Swamp Ghost Crab-*Ucides cordatus* Juey Morado-*Gecarcinus ruricola*
Vega State Forest, Vega Alta	Key West Quail-Dove-*Geotrygon chrysia* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Adelaide's Warbler-*Setophaga adelaidae* Puerto Rican Vireo-*Vireo latimeri* Cobana Negra-*Stahlia monosperma*
Lakes and Forests of Dorado	White-crowned Pigeon-*Patagioenas leucocephala* Brown Pelican-*Pelecanus occidentalis* Caribbean Coot-*Fulica caribaea* Hawksbill Turtle-*Eretmochelys imbricata* Juey Palancú-*Cardisoma guanhumi* Bloodwood tree-*Pterocarpus officinalis*
Mogotes Río Lajas y Nevárez, Toa Baja	Key West Quail-Dove-*Geotrygon chrysia* Puerto Rican Lizard-Cuckoo-*Cocccyzus vieilloti* Puerto Rican Boa-*Chilobotrus inornatus* Slippery-backed-*Spondylurus monae* Palo de Ramón-*Banara vanderbiltii* *Daphnopsis helleriana*
El Mameyal, Toa Baja	West Indian Whistling Duck-*Dendrocygna arborea*
San Pedro Swamp, Toa Baja	West Indian Whistling Duck-*Dendrocygna arborea* White-crowned Pigeon-*Patagioenas leucocephala* Yellow Warble-*Setophaga petechia* Grasshopper Sparrow-*Ammondramus savannarum* Puerto Rican Boa-*Chilobotrus inornatus* Juey Palancú-*Cardisoma guanhumi* Green Sea Turtle-*Chelonia mydas* Loggerhead Turtle-*Caretta caretta*

Marine Protected Areas

Wetlands are natural areas defined by their hydrology, soil, and vegetation (Cowardin et al., 1979). Wetlands have important functions and economic, social, and scientific value. They help control floods, provide water, recharge aquifers, feed springs, modify the climate, improve water quality, maintain the salt balance needed for estuarine life, and stabilize and protect coasts. Economically, wetlands are highly productive, providing food, wood, energy, and recreational opportunities. They influence the quality and ecological status of associated water bodies and moderate peak stream flows during storm events. They are important nurseries for aquatic life.

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Inventories of wetlands in Puerto Rico mainly cover the coastal zone (Figure 50). In 2004, through a NOAA initiative, approximately 160,000 ha of benthic habitats in Puerto Rico's territorial waters were mapped. Approximately 87,578 ha of wetlands were inventoried. It is estimated that 25% of them are found within marine protected areas (Lopez, 2007). Marine protected areas can be natural reserves, marine reserves, coastal state forests, national estuarine research reserves, or seasonal fishing closures.

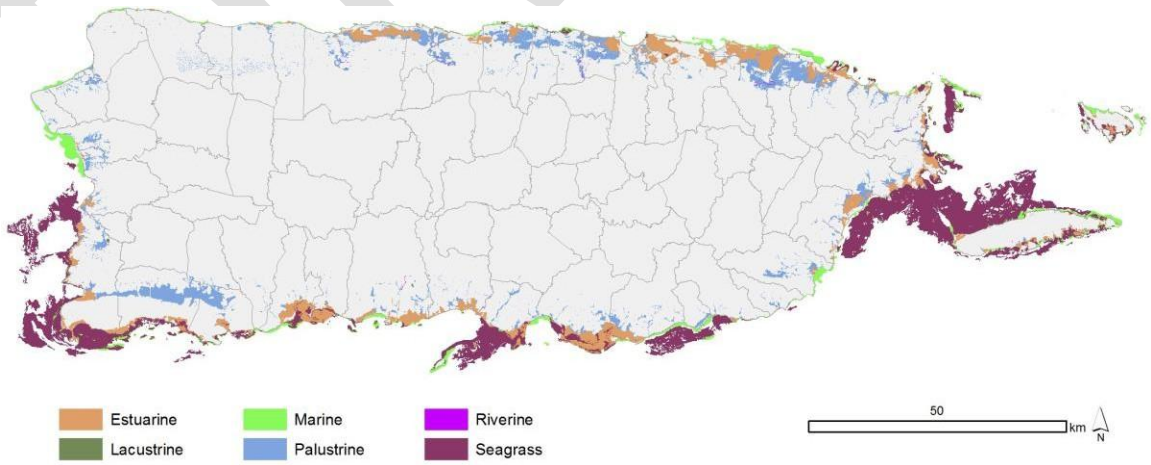

Figure 48. Inventory of Puerto Rico's Wetlands. From DNER 2015.

Puerto Rico Model Forest ("Bosque Modelo")

In 2014, the government approved the Puerto Rico Model Forest Law. With this law, Puerto Rico becomes the first country in the world to appoint a Model Forest through legislation. The Puerto Rico Model Forest, or "bosque modelo" in Spanish, covers about 390,000 acres of land in 32 municipalities (over 17% of the island). The Model Forest connects 26 natural areas (state forests, nature reserves, and refuges) that cover approximately 66,000 acres (17%) of the Model Forest's total area (Figure 52). The Model Forest area is an ecological corridor in western central Puerto Rico. The most comprehensive and collaborative management initiative in the history of Puerto Rico is being implemented across the remaining 83% of the Model Forest. This encompasses integrated management, high-ecological-value land uses, agriculture, and tourism initiatives.

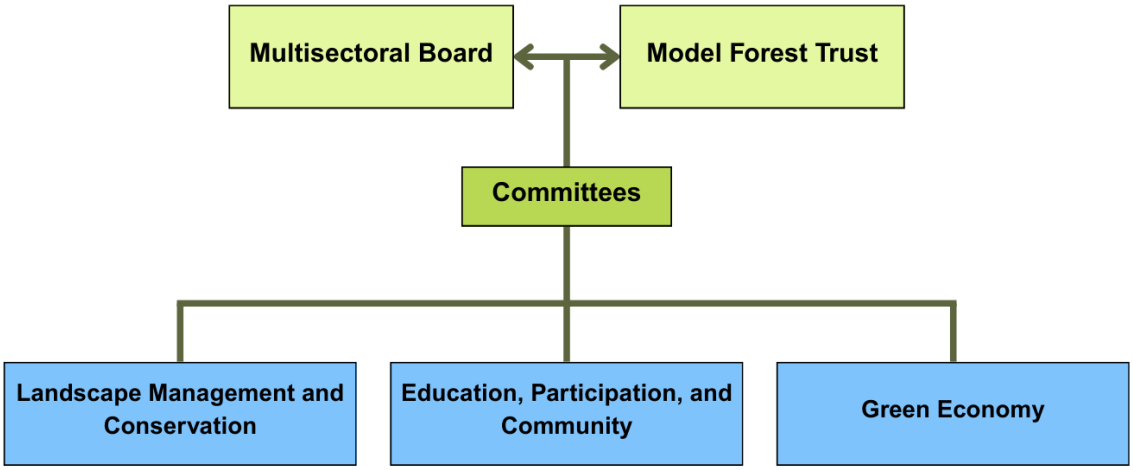

Figure 49. Model Forest Organization Chart

Given the fiscal and economic situation in Puerto Rico, the Model Forest initiative needs to identify the most effective and efficient ways of using public resources to promote conservation, sustainable development, and collaborative management. The future of Puerto Rico's natural resources lies in collaboration. Therefore, the Model Forest will encourage collaboration with volunteers and other entities to promote sustainable practices among landowners, farmers, retailers, and

municipalities within the agroforestry zone in west-central Puerto Rico.

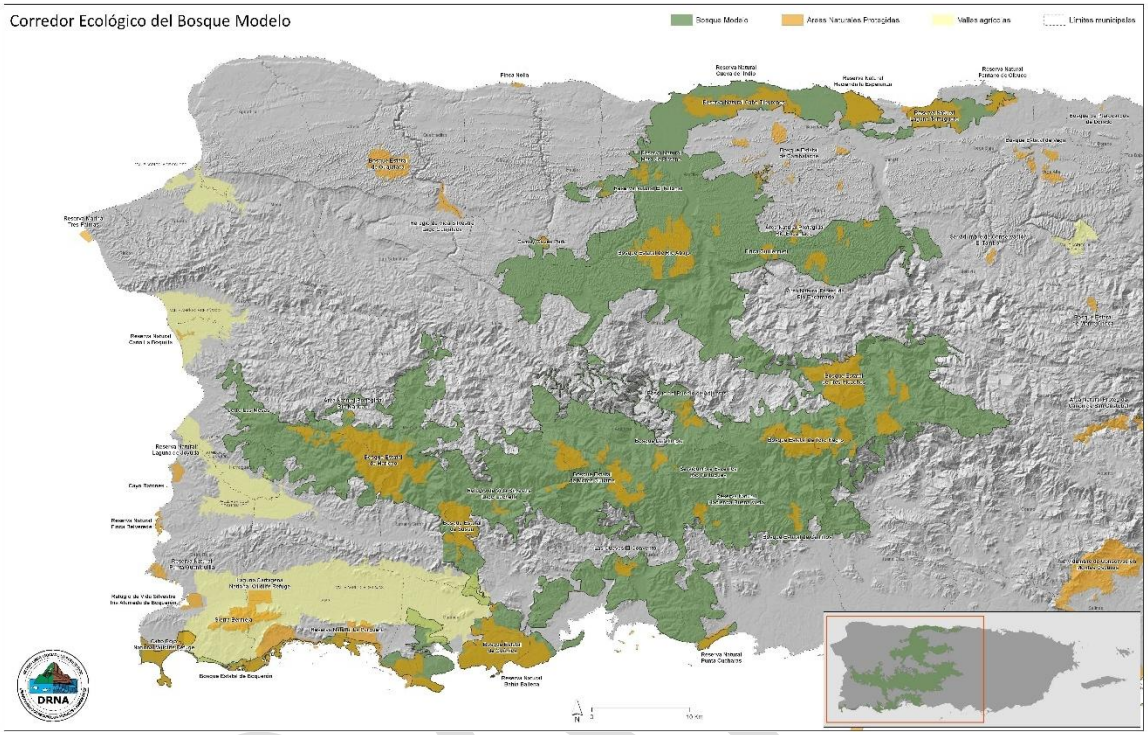

Figure 50. The Model Forest in West-Central P.R.

Southeast Conservation Blueprint

One of the main partners for analyzing habitats and their conservation needs is the Southeast Conservation Adaptation Strategy (SECAS) group. SECAS is a regional conservation effort that covers the Southeastern United States and the Caribbean, including Puerto Rico. The group's goal is to develop the Southeast Conservation Blueprint (SCB), a flexible spatial plan designed to create a connected network of land and water across the U.S. Southeast and the Caribbean. SECAS has produced various maps and datasets to pinpoint priority areas based on indicators of natural and cultural resources. For more details on the SCB and additional indicators not shown in this document, such as greenways and trails, and mangrove mitigation, visit the following website: https://secassoutheast.org/.

Because of its location in the Caribbean, Puerto Rico's network is mainly local and lacks connection to broader efforts in the U.S. Southeast. To fully understand the Caribbean network of land and water, studies involving other Caribbean countries will be needed.

Corridors and Hubs

An important aspect of species habitats is the idea of corridors and hubs. Corridors are large areas of undeveloped habitat that connect crucial core habitats or hubs (NCEL, 2021). These allow animals to move freely and complete their life cycles (USFWS, 2025). Puerto Rico has previously experimented with creating ecological corridors, such as the Northeast Ecological Corridor and the Marine Ecological Corridor. However, a comprehensive mapping of hubs and corridors for Puerto Rico has not yet been attempted.

The SCB found that approximately 323,102 acres of the analyzed area functioned as hubs, with the largest patch located in the mainland in the Yunque National Rainforest. Additionally, 559,542 acres of the area were identified as corridors.

Table 42. Puerto Rico Corridors and Hubs Analysis (SECAS 2025)

Indicator	Acres	Percent of Area
Hubs	323,102	11%
Corridor	559,542	19%
Not a hub or corridor	2,104,985	70%
Total Area	**2,987,629**	**100%**

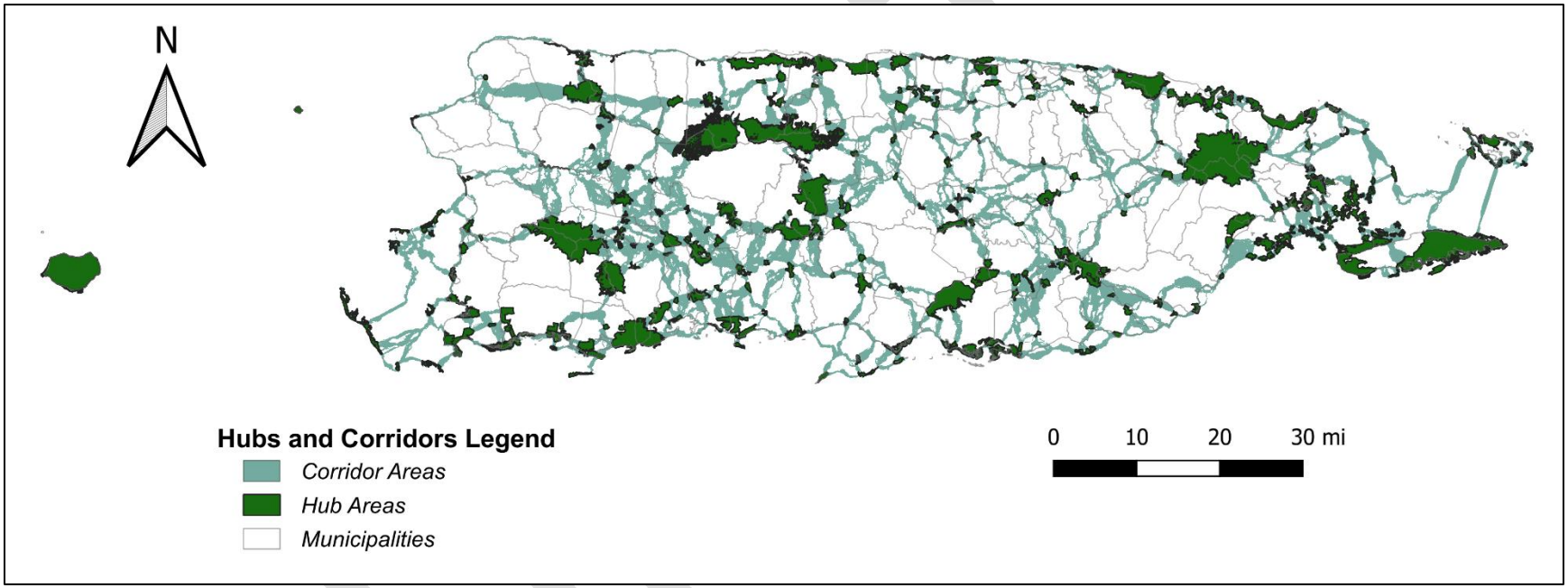

Figure 51. Puerto Rico Corridors and Hubs Map. From SECAS 2025.

Southeast Blueprint Priorities

One of the main products of the SECAS group is identifying priorities for a connected network of lands and waters. This analysis classified Puerto Rico into five priority categories, as defined by the SCB, along with the percentage of coverage for the analyzed acres.

- Highest priority - Areas where conservation efforts would have the biggest impact, based on a variety of natural and cultural resource indicators. This category covers approximately 10% of the Southeast Blueprint region.
- High priority - Areas where conservation efforts would have a big impact, based on a variety of natural and cultural resource indicators. This category covers about 15% of the Southeast Blueprint region.
- Medium priority - Areas where conservation efforts would have an above-average impact, based on a variety of natural and cultural resource indicators. This category covers roughly 20% of the Southeast Blueprint region.
- Priority connections - Corridors between priority areas that cover the shortest distance while passing through as many of the Blueprint priorities as possible. This category encompasses about 5% of the Southeast Blueprint region.
- Lower priority – Any areas not classified under the categories above.

The areas identified as highest priority for conservation efforts largely coincide with the critical core habitats mentioned earlier. Many of the high-priority areas are located on or near these core habitats, which also connect with the corridors discussed previously.

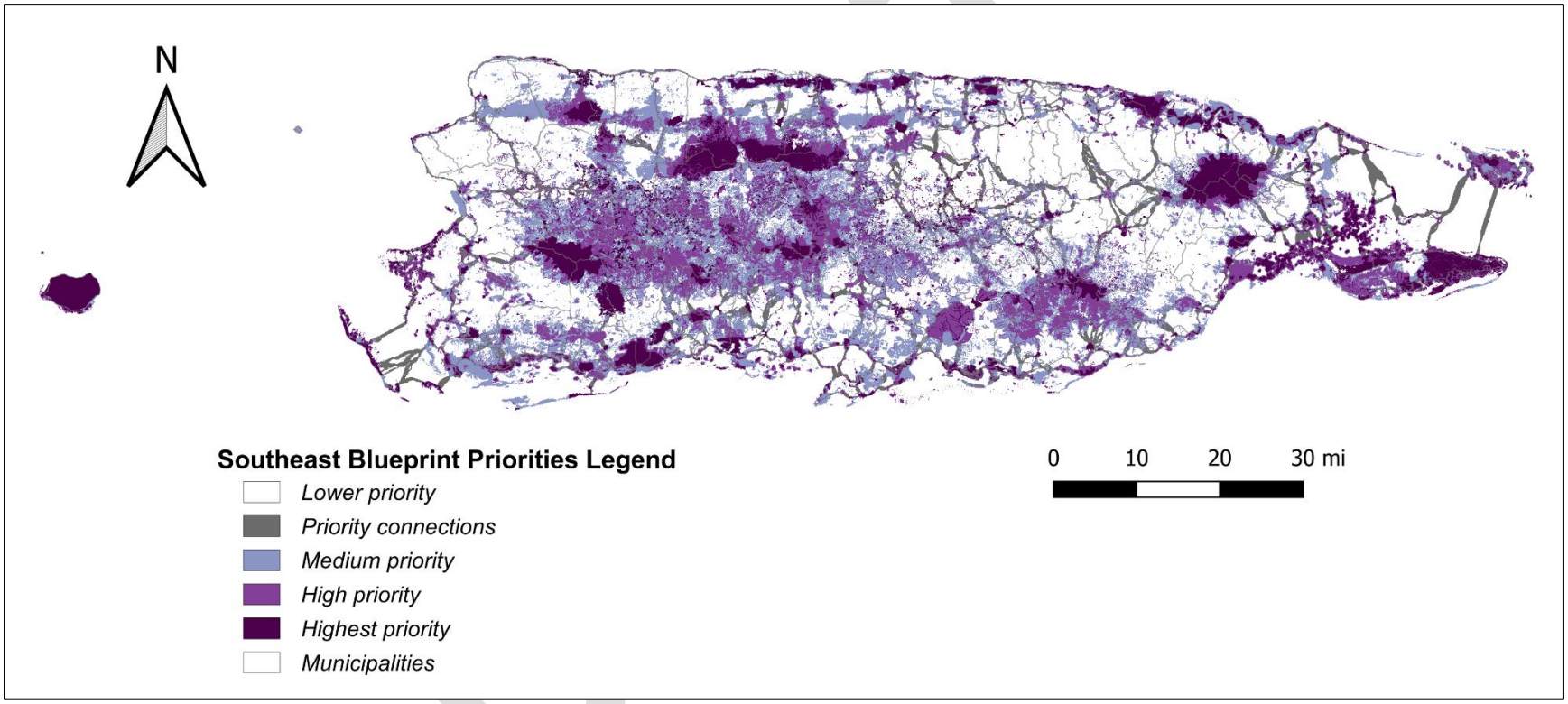

Figure 52. Puerto Rico Southeast Blueprint Priorities Map. From SECAS 2025.

Habitat Patch Size

Corridors and hub areas are not the only measures the SCB used to identify priority conservation areas. They also employed a set of indicators across terrestrial and aquatic environments to guide their analysis.

The SCB collected data on the size of unbroken natural habitat patches in Puerto Rico, which are areas not intersected by roads, urban development, or agriculture. These intact habitats are essential for supporting diverse wildlife, including reptiles, amphibians, birds, and large mammals. The SCB considers a habitat patch to be in good condition if it is 100 acres or larger.

A total of 2.2 million acres across the archipelago's islands were analyzed. Of this area, 62% exceeds the 100-acre threshold for patch size. According to SCB data, these patches are in good condition. The largest patch measured 634,032 acres, accounting for 29% of the analyzed land, and includes developed land or land used for agriculture.

Table 43. Puerto Rico Habitat Patch Size Analysis (SECAS 2025)

Indicator	Acres	Percent of Area
Very large patch (>10,000 acres)	419,737	19%
Large patch (>1,000-10,000 acres)	601,018	27%
Medium patch (>100-1,000 acres)	352,651	16%
Small patch (>10-100 acres)	132,856	6%
Very small patch (≤10 acres)	67,601	3%
Developed or agriculture	640,092	29%
Total Area	**2,213,955**	**100%**

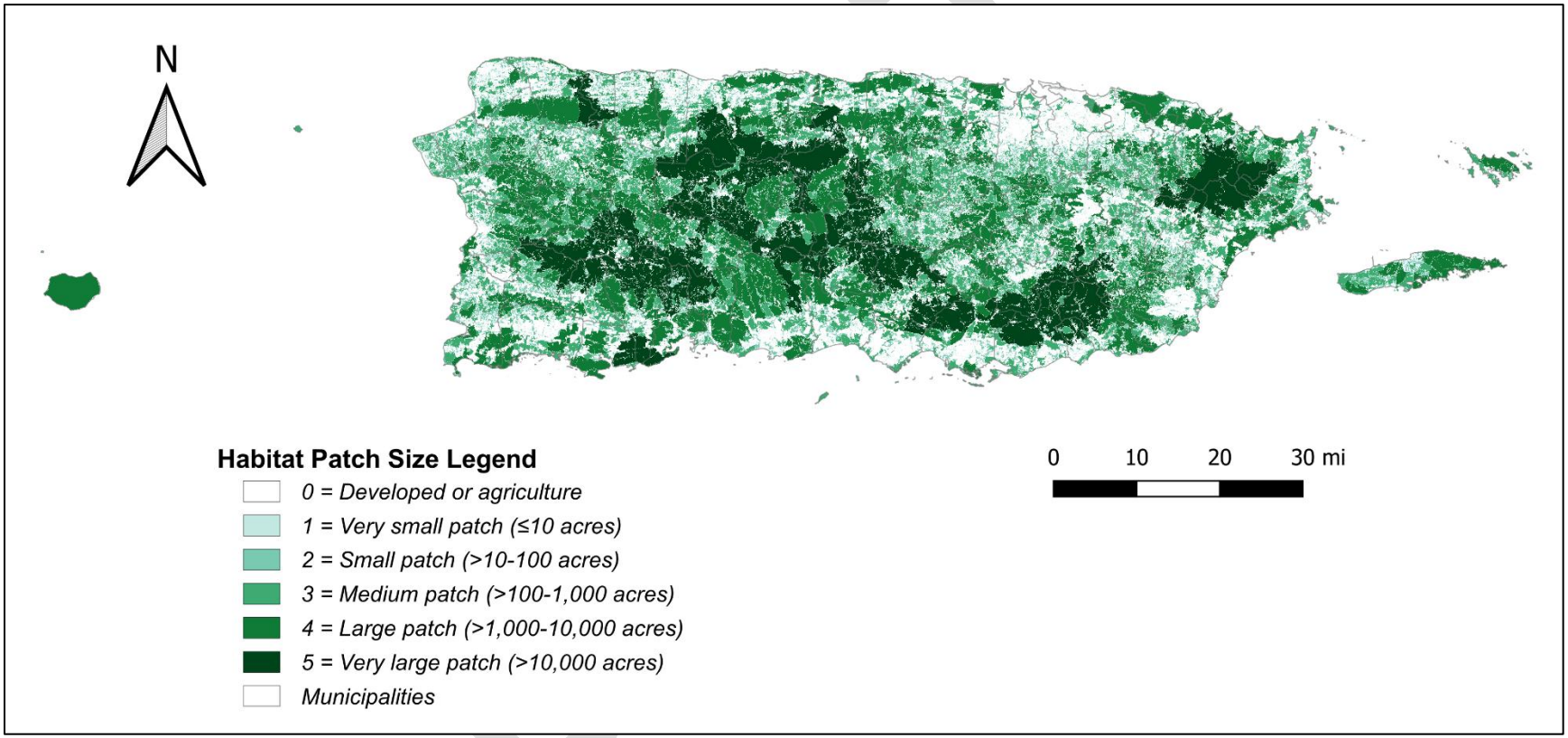

Figure 53. Puerto Rico Habitat Patch Size Map. From SECAS 2025.

Island Habitat

The SCB analysis developed an indicator of Puerto Rico's terrestrial island habitat in relation to invasive animals. This indicator assesses the significance of island habitats in the U.S. Caribbean for federally listed and other at-risk species by accounting for the presence of both endangered and invasive species. It notes that an island's isolation makes it ecologically unique and protects it from many mainland disturbances and predators, but it also increases its susceptibility to invasive species.

In the SCB analysis, approximately 96% of Puerto Rico's 2.2 million-acre land area was found to contain invasive species. Additionally, 31% of this land area hosts one or more imperiled species.

Table 44. Puerto Rico Terrestrial Island Habitat Analysis (SECAS 2025)

Indicator	Acres	Percent of Area
Island area with critical habitat for a threatened or endangered species	83,379	4%
Island area with no invasive animals and 2+ imperiled species	29	0%
Island area with no invasive animals and 1 imperiled species	33	0%
Island area with no invasive animals	2	0%
Island area with invasive animals and 2+ imperiled species	470,049	21%
Island area with invasive animals and 1 imperiled species	216,962	10%
Island area with invasive animals	1,443,502	65%
Total Area	**2,213,956**	**100%**

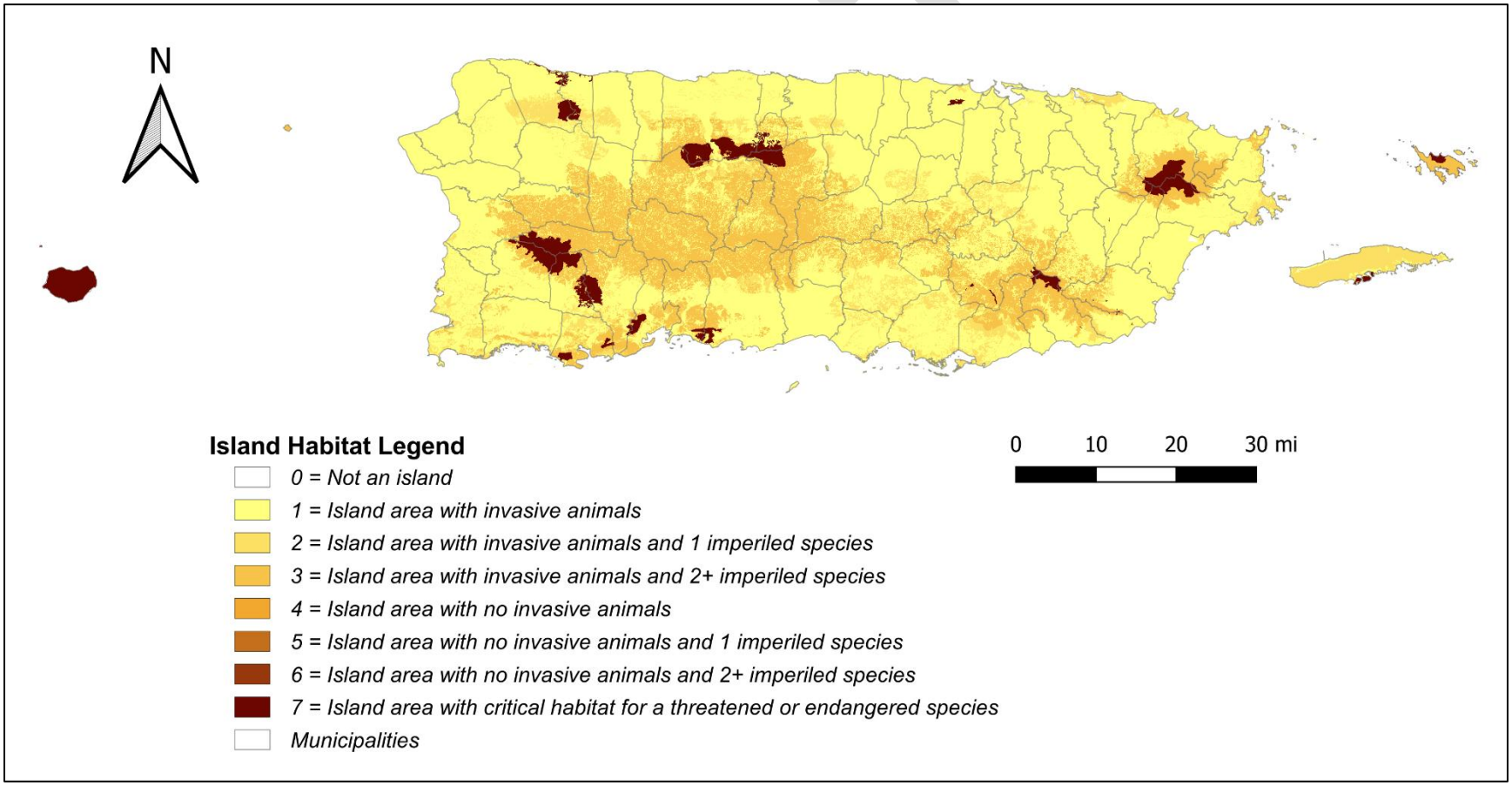

Figure 54. Puerto Rico Island Habitat Map. From SECAS 2025.

Karst Habitat

The SCB also considers Puerto Rico's natural karst regions in its analysis. This assessment identifies the nearly untouched karst landscapes in the U.S. Caribbean, which remain largely unaffected by human activities such as urban development and intensive farming. Karst landscapes form when water dissolves bedrock, such as limestone, creating features such as caves, sinkholes, and underground rivers. These areas hold ecological and cultural importance, as they are home to unique and endemic species, help refill freshwater aquifers, and often contain significant cultural and historical sites.

An ideal goal for habitat conservation is a karst area with minimal development. Puerto Rico has successfully maintained a largely natural karst habitat, with 92% of its total karst area still covered by natural land. Most of this karst is found in Puerto Rico's northern regions and municipalities, although small pockets are also present in the south and on Mona Island.

Table 45. Puerto Rico Karst Habitat Analysis (SECAS 2025)

Indicator	Acres	Percent of Area
Karst with natural land cover	214,320	92%
Karst with pasture, crops, or open space in a developed area	17,045	7%
Karst with developed land cover	1,612	1%
Total Area	**232,977**	**100%**

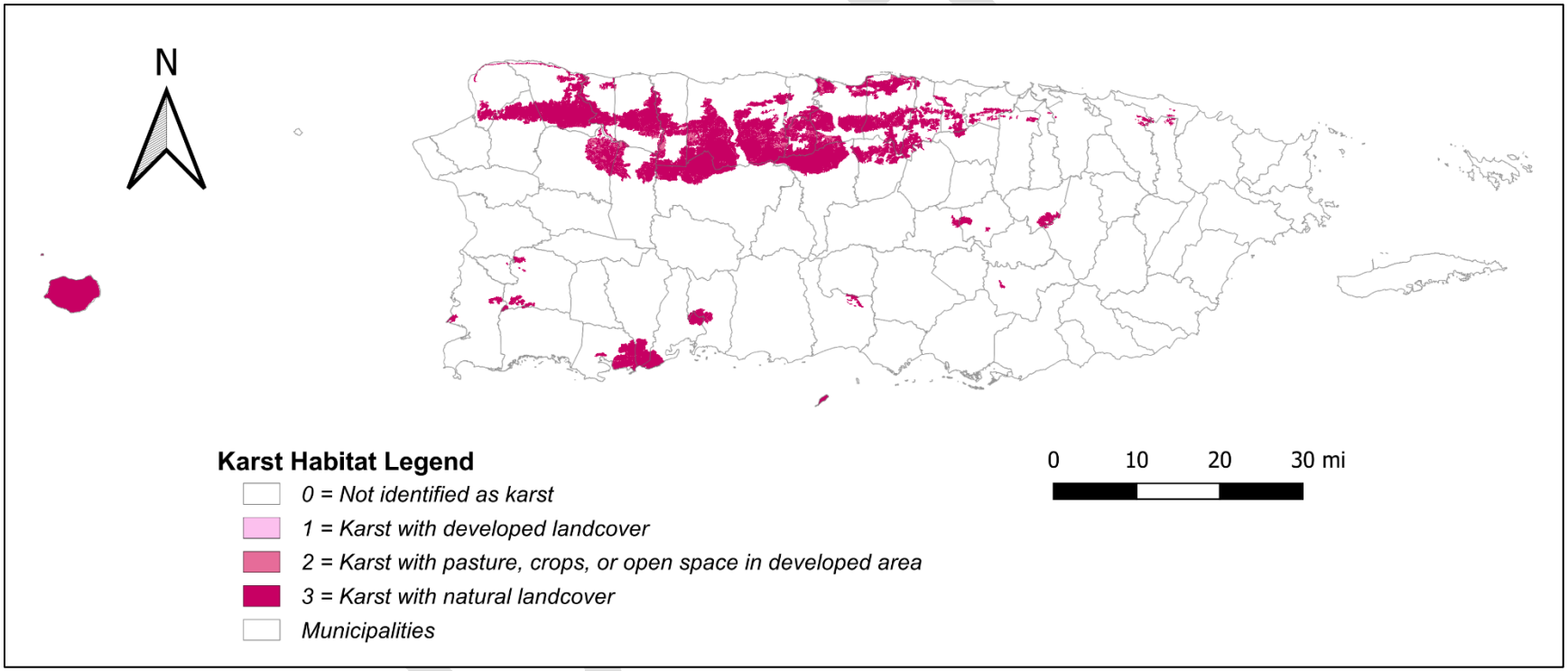

Figure 55. Puerto Rico Karst Habitat Map. From SECAS 2025.

Reforestation Potential

Given the threat of tree cover loss and potential forest fragmentation caused by increasing construction, identifying habitats suitable for reforestation can support the island's future development. The SCB has developed an indicator to highlight priority areas in the U.S. Caribbean for expanding tree cover, emphasizing how land use changes could benefit local drinking water supplies. Strategies include converting sun-grown coffee to shade-grown coffee, increasing tree canopy in existing shade-grown coffee areas, and reforesting open spaces in developed, pasture, and agricultural lands. The most critical areas are coffee plantations located within watersheds that supply reservoirs.

Most of Puerto Rico has low reforestation potential, with 92% of the land either naturally forested or developed. Excluding these areas, about 193,688 acres show at least a medium reforestation potential. Coastal regions and municipalities contain the most acres with medium potential. Conversely, the central mountain range has the highest reforestation potential, mainly due to coffee production.

Table 46. Puerto Rico Reforestation Potential Analysis (SECAS 2025)

Indicator	Acres	Percent of Area
Highest reforestation potential (coffee production in watershed with reservoir)	8,362	0%
Very high reforestation potential (other coffee production	18,167	1%
High reforestation potential (open space in developed area, pasture, or crops in watershed with reservoir)	9,756	0%
Medium reforestation potential (other open space in developed area, pasture, or crops	157,403	6%
Low reforestation potential (already natural or developed)	2,283,633	92%
Total Area	**2,477,321**	**100%**

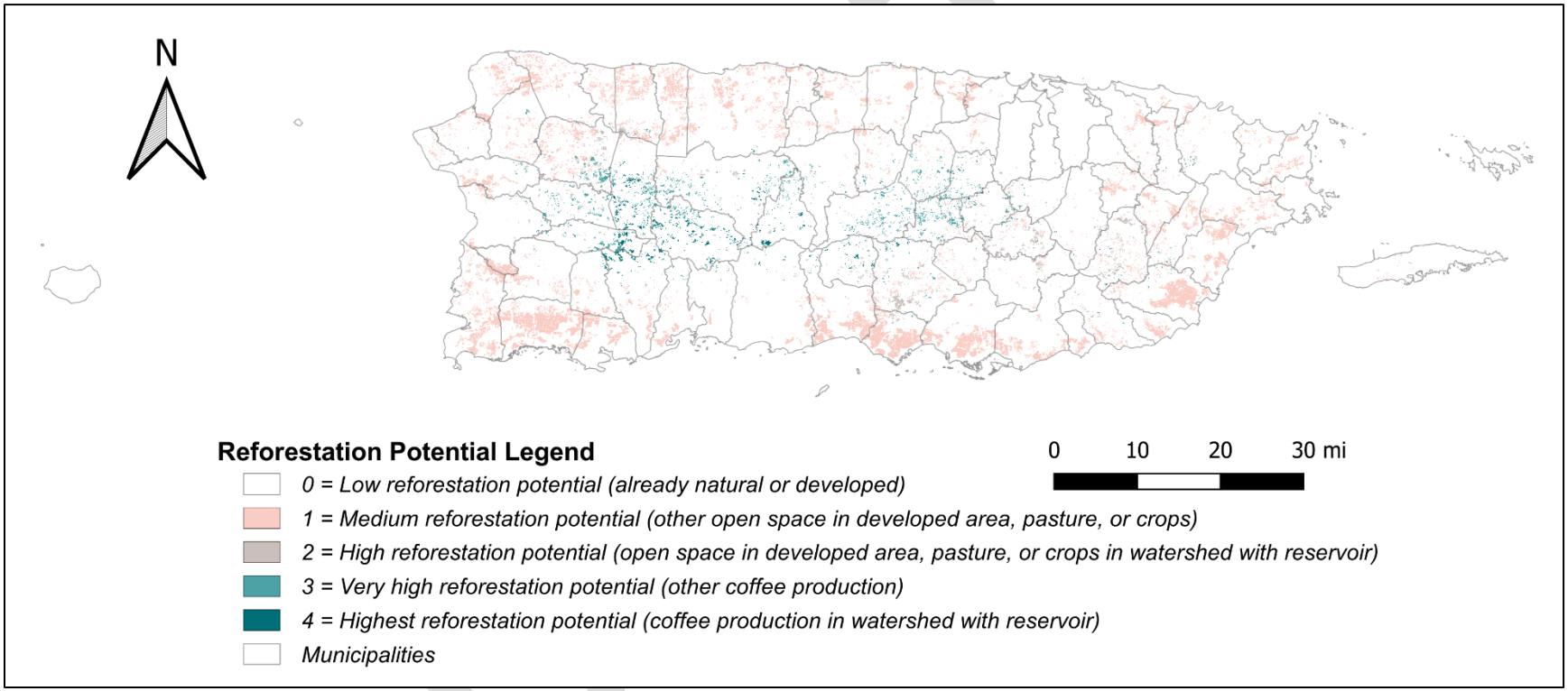

Figure 56. Puerto Rico Reforestation Potential Map. From SECAS 2025.

River Network Complexity

The SCB conducted analyses of both terrestrial and freshwater aquatic environments. One specific analysis examines the network complexity of rivers in Puerto Rico. This analysis evaluates the variety of stream size classes present within sections of a river network, especially between dams and waterfalls in the U.S. Caribbean. A higher diversity of connected stream types improves aquatic biodiversity, particularly in a changing climate, by enabling species to move between habitats and access climate refuges.

Table 47. Puerto Rico River Network Complexity Analysis (SECAS 2025)

Indicator: Number of connected stream size classes	Acres	Percent of Area
4 size classes	44,503	9%
3 size classes	148,701	31%
2 size classes	196,492	41%
1 size class	91,961	19%
Total Area	**481,657**	**100%**

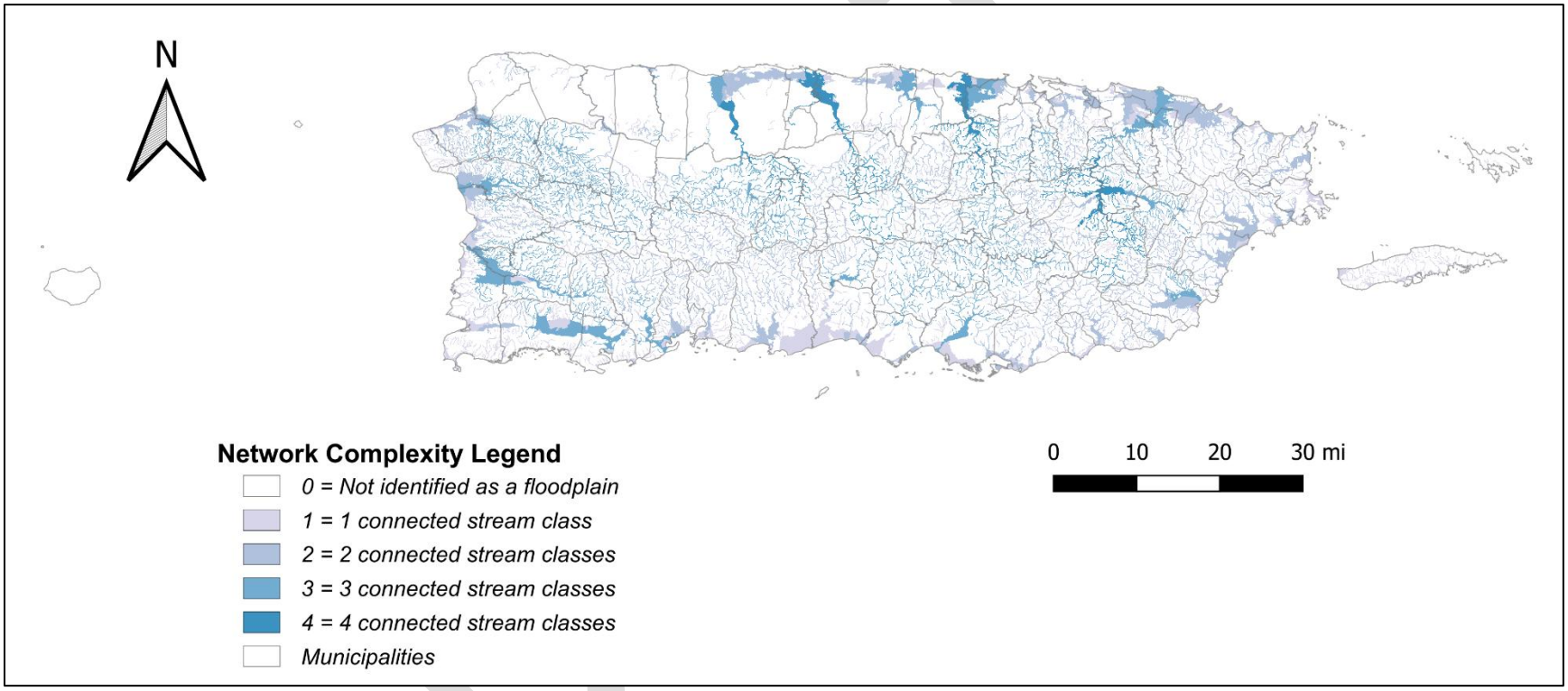

Figure 57. Puerto Rico River Network Complexity Map. From SECAS 2025.

Permeable Surfaces

This analysis measures the average percentage of land in each U.S. Caribbean catchment that is not covered by impervious surfaces, such as pavement or buildings. Impervious surfaces can degrade water quality and disrupt natural freshwater flow, affecting aquatic life and reducing ecosystem services, such as access to clean drinking water.

A surface with over 95% permeability is considered to be in good condition for this analysis. In Puerto Rico, data show that only about 41% of the surface meets the 95% or higher permeability standard. As a result, the remaining 59% may be experiencing a decline in water quality and support for aquatic species, or it may already be degraded. Urban areas in Puerto Rico mainly have surfaces with permeability of 70% or less.

Table 48. Puerto Rico River Permeable Surface Analysis (SECAS 2025)

Indicator: Percent of catchment or small island permeable	Acres	Percent of Area
>95% permeable (likely high-water quality and supporting most sensitive aquatic species)	899,665	41%
>90-95% permeable (likely declining water quality and supporting most aquatic species)	579,701	26%
>70-90% permeable (likely degraded water quality and not supporting many aquatic species)	563,966	26%
≤70% permeable (likely degraded instream flow, water quality, and aquatic species communities)	152,592	7%
Total Area	**2,195,924**	**100%**

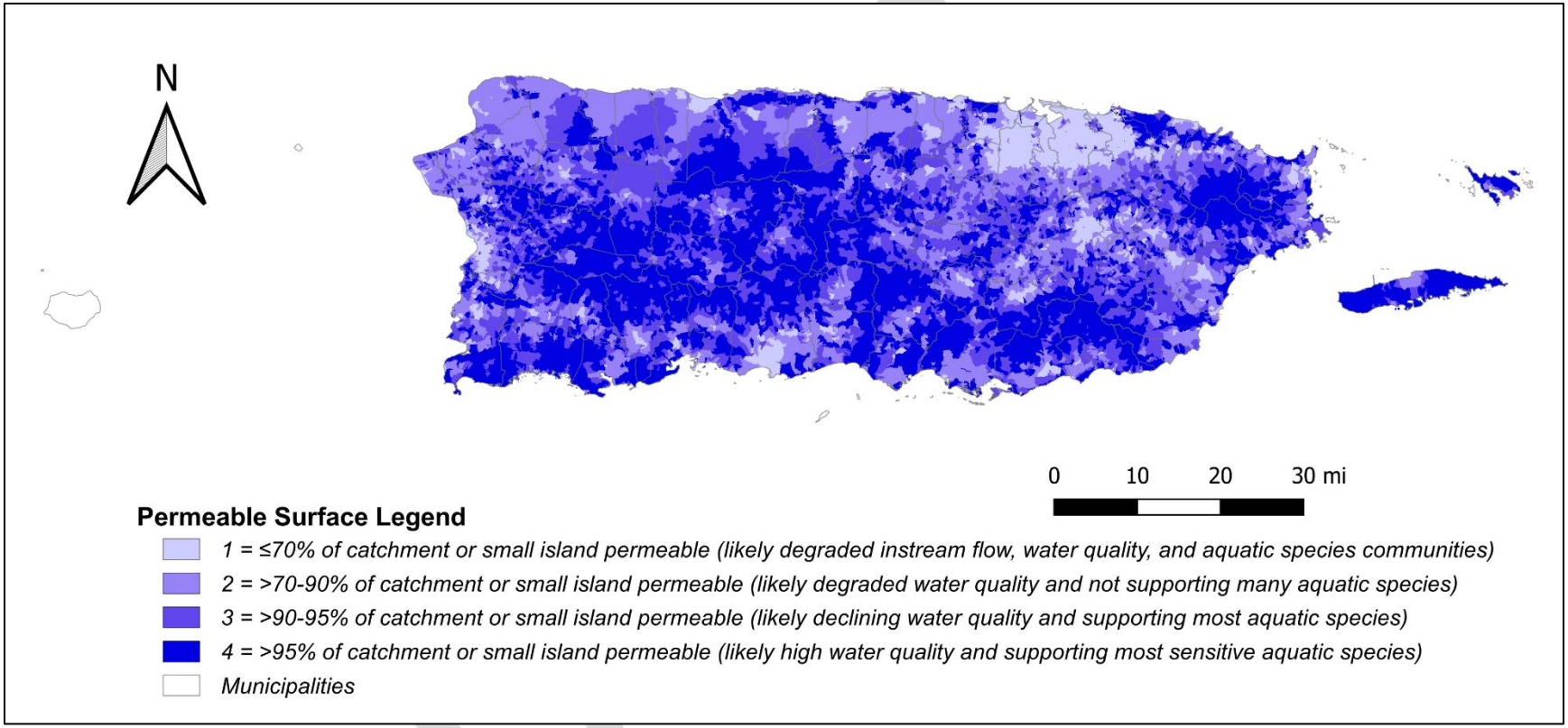

Figure 58. Puerto Rico Permeable Surface Map. From SECAS 2025.

Coastal and Marine Habitats

Puerto Rico's coastlines and surrounding marine environments host a variety of interconnected habitats that support both land and marine wildlife. Sandy beaches are vital nesting sites for Wilson's plovers, American oystercatchers, and sea turtles, including hawksbill, leatherback, green, and loggerhead species. These species are particularly vulnerable to development and rising sea levels because suitable habitat is limited.

In offshore and nearshore waters, ecosystems such as mangroves, seagrass beds, hardbottom areas, and coral reefs support high fish density and diversity. These habitats serve as vital nurseries, spawning grounds, and foraging areas for species like snook, tarpon, snapper, and bonefish. They also provide important ecosystem services: seagrasses improve water quality, store carbon, and stabilize sediments; coral reefs and mangroves defend shorelines against storms and erosion; and all these habitats contribute to the cultural and economic strength of coastal communities.

However, modifications to shorelines through the construction of hardened structures such as seawalls, groins, and riprap interfere with sediment flow, speed up erosion, prevent habitat migration inland, and harm conditions for birds, turtles, fish, and other species. Therefore, conserving Puerto Rico's natural coastlines and safeguarding the integrity of these interconnected habitats is essential to maintaining biodiversity, supporting fisheries, and ensuring the resilience of coastal ecosystems amid ecological pressures.

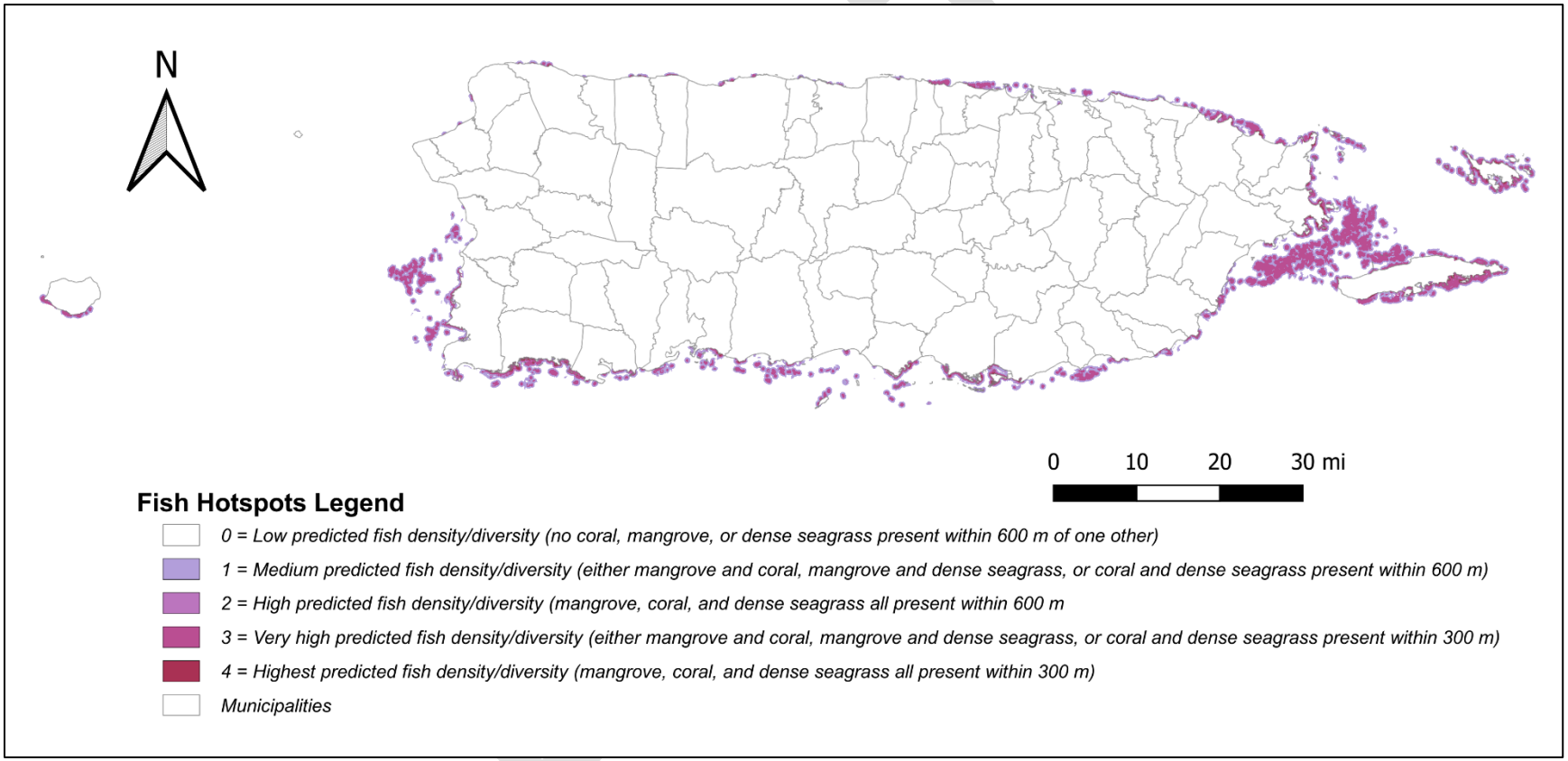

Figure 59. Puerto Rico Fish Hotspot Map. From SECAS 2025.

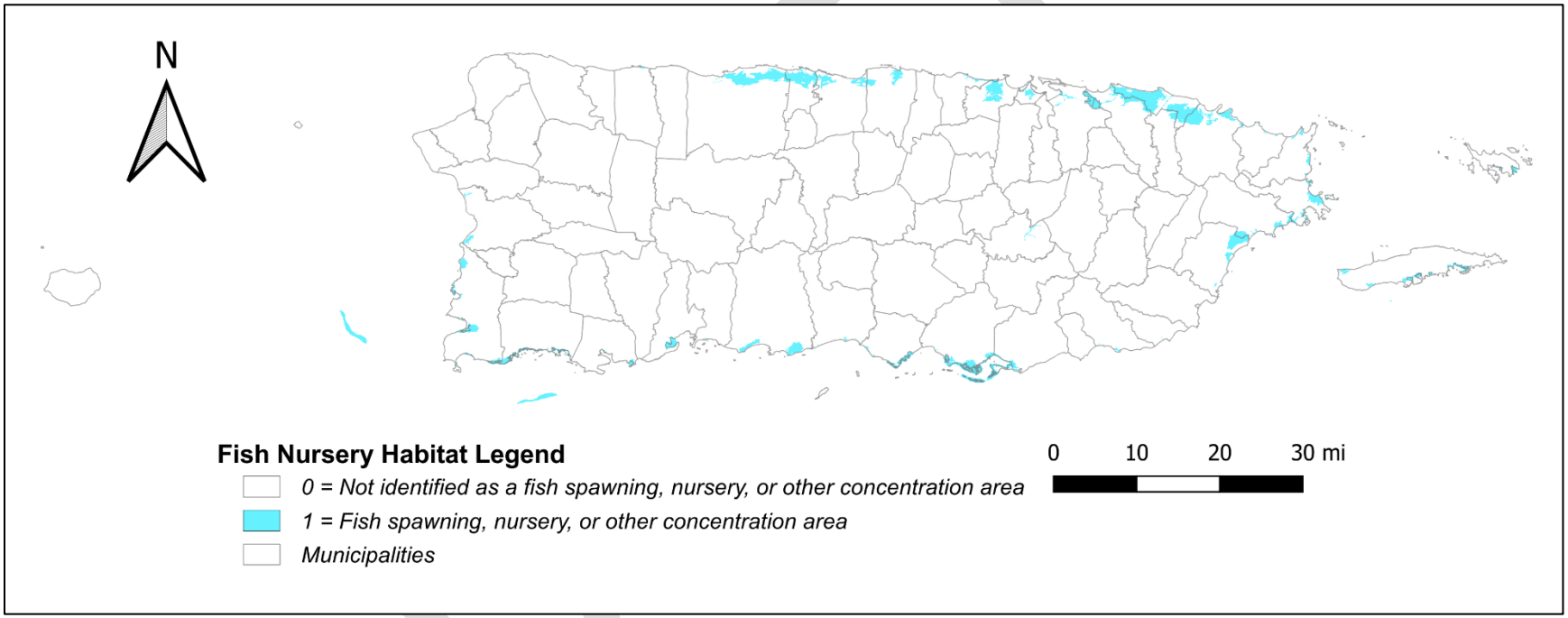

Figure 60. Puerto Rico Fish Nursery Map. From SECAS 2025.

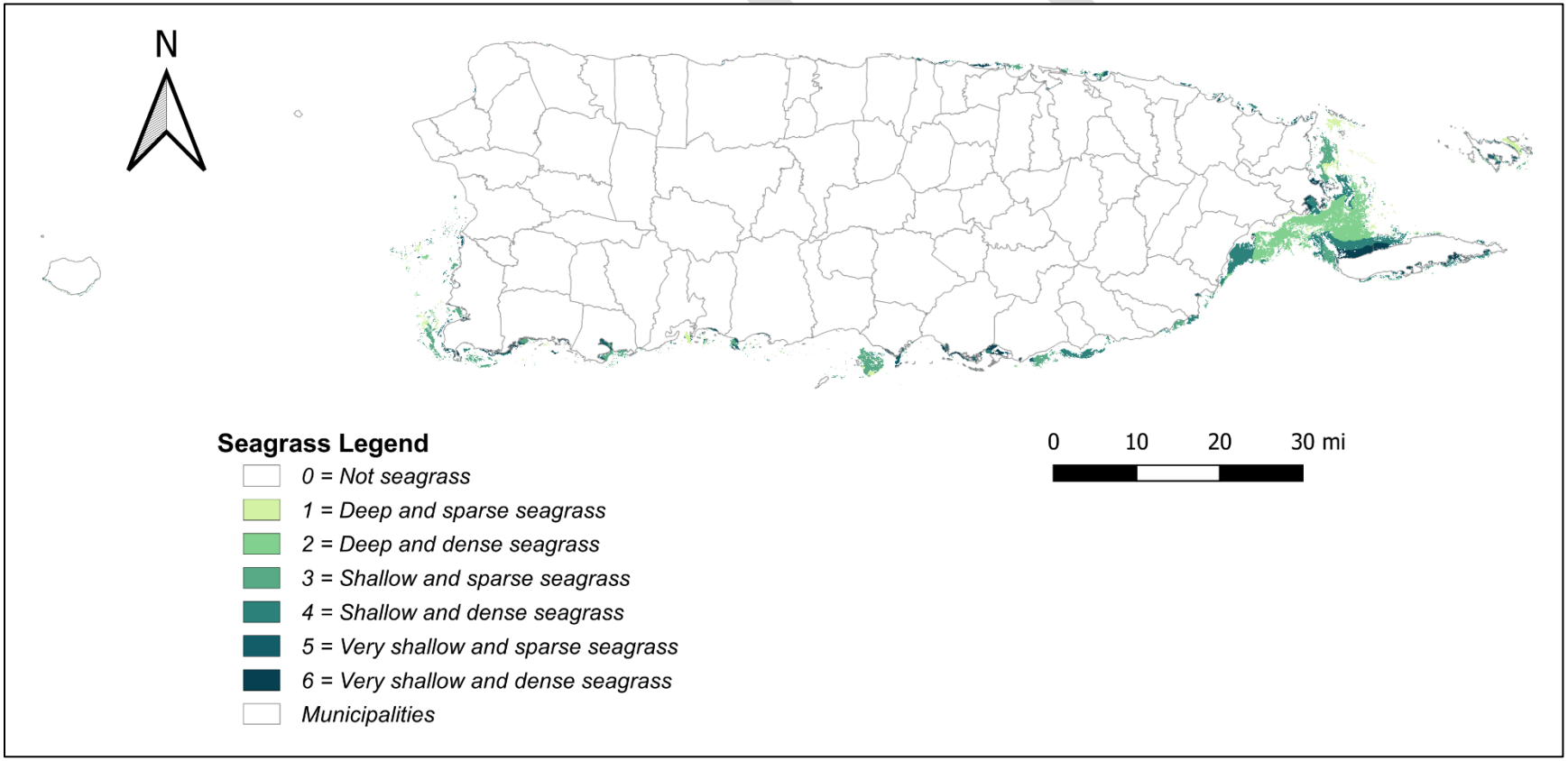

Figure 61. Puerto Rico Seagrass Map. From SECAS 2025.

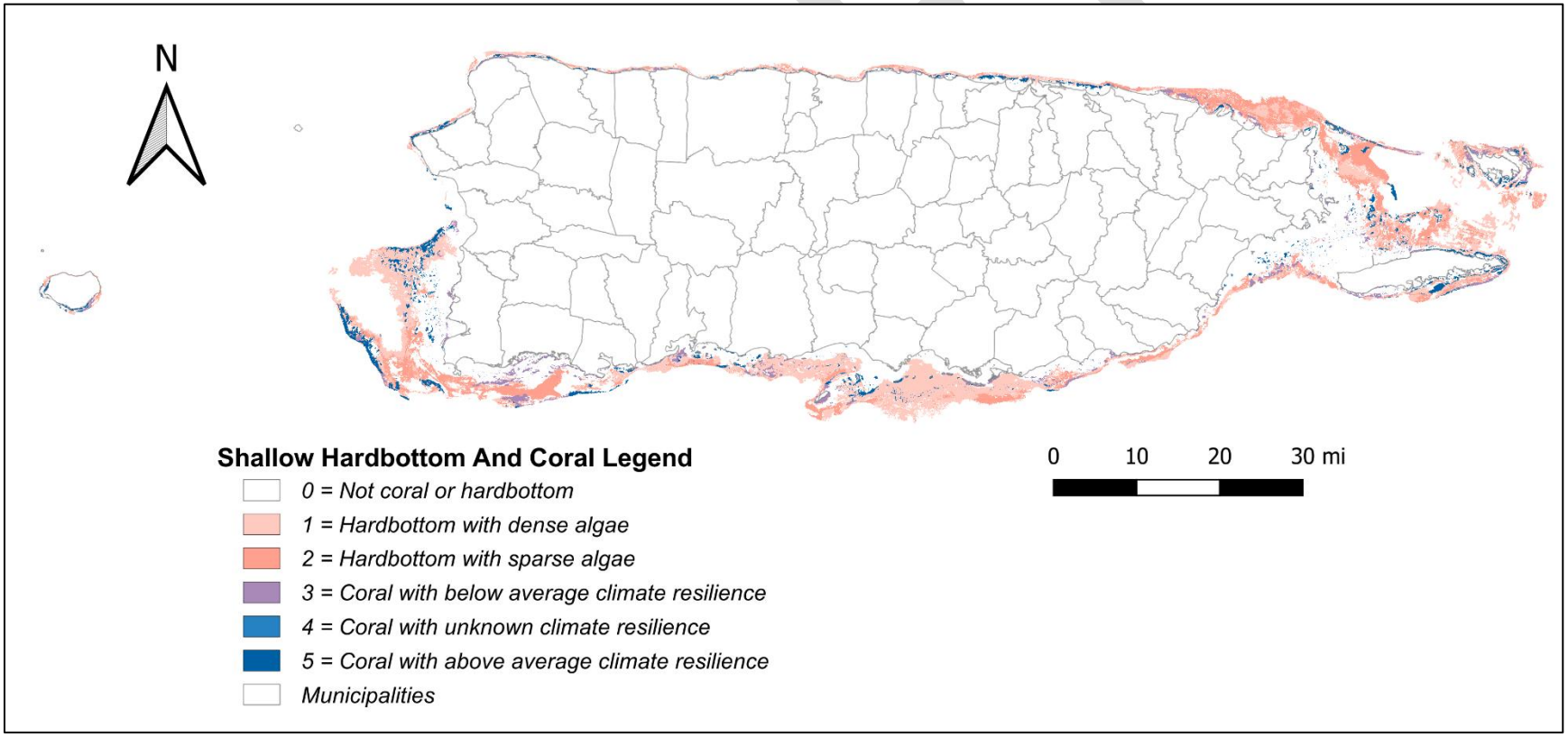
N
Shallow Hardbottom And Coral Legend
0 = Not coral or hardbottom
1 = Hardbottom with dense algae
2 = Hardbottom with sparse algae
3 = Coral with below average climate resilience
4 = Coral with unknown climate resilience
5 = Coral with above average climate resilience
Municipalities
0 10 20 30 mi

Figure 62. Puerto Rico Shallow Hardbottom and Coral Map. From SECAS 2025.

Other sources of information

Wildlife Conservation Areas, forest types, land cover, geographic shape, locations, and descriptions

Several studies were conducted to select and describe wildlife conservation areas and their habitats. These studies provided geographic information about priority conservation areas (Figure 65), critical wildlife areas (Figure 66), wildlife-protected areas (Figure 67), forest type, and land cover. Some priority conservation areas and critical wildlife areas are within the wildlife-protected areas managed and protected by DNER.

A map layer of wildlife conservation areas (Figure 68) was created by merging the geographic location of the priority conservation areas, critical wildlife areas, and wildlife protected areas (Figure 69). Then, the Puerto Rico mainland forest types and land cover layers were clipped from this map (Helmer et al. 2002). Figures 70 to 73 present the geographic shape and locations of each forest type and land cover described by Helmer et al. (2002) within the wildlife conservation areas. With information and analysis on our natural protected areas, DNER can focus conservation actions on the habitat types of interest.

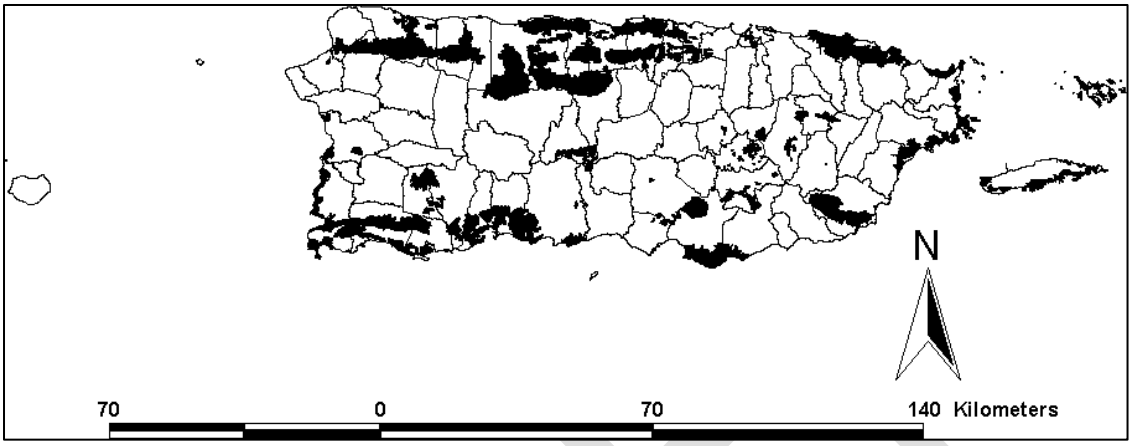

Figure 63. Marine and Terrestrial priority conservation areas.

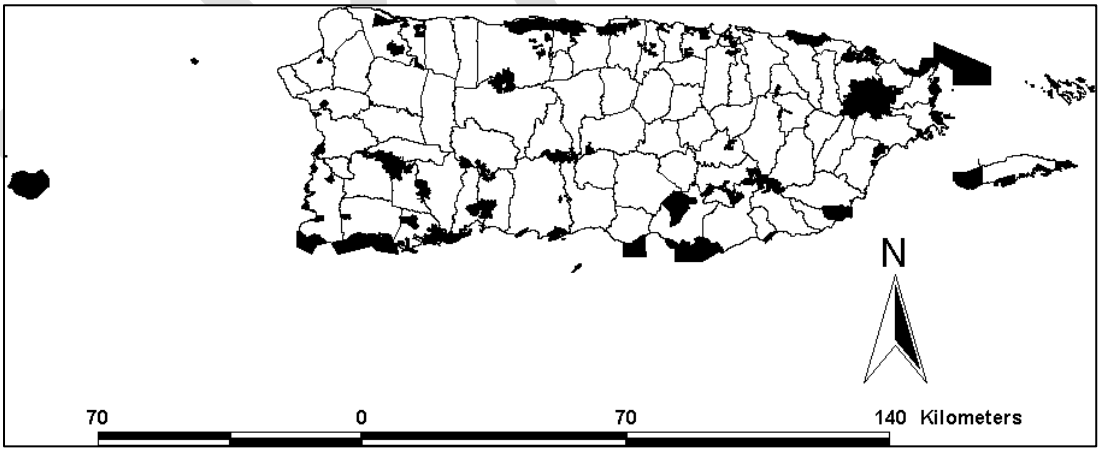

Figure 64. Critical Wildlife Areas and Waterfowl Focus Areas (marine and terrestrial).

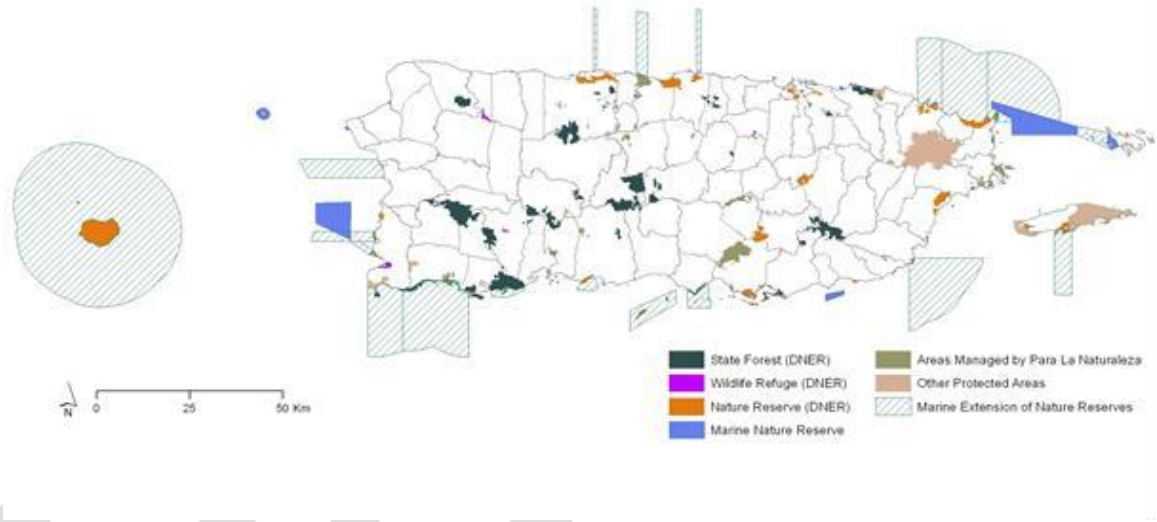

Figure 65. Marine and terrestrial wildlife protected areas.

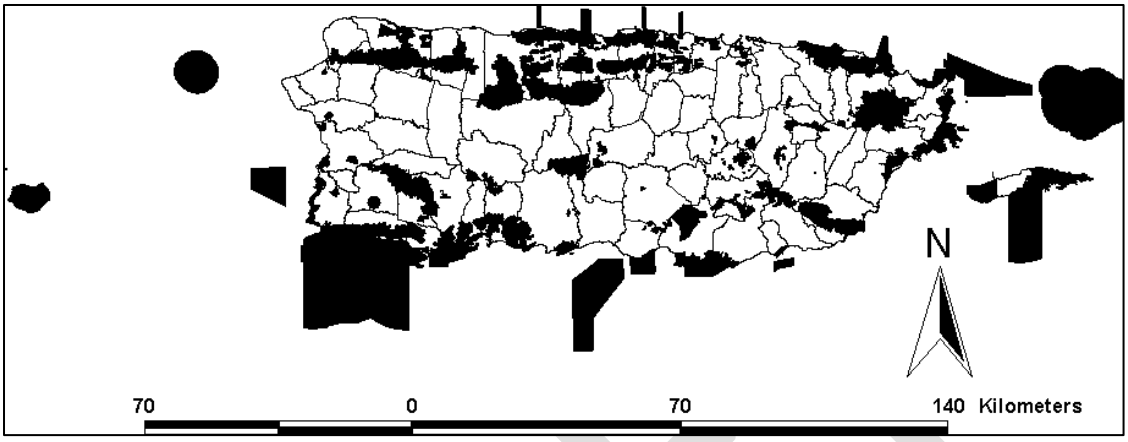

Figure 66. Marine and terrestrial wildlife conservation areas.

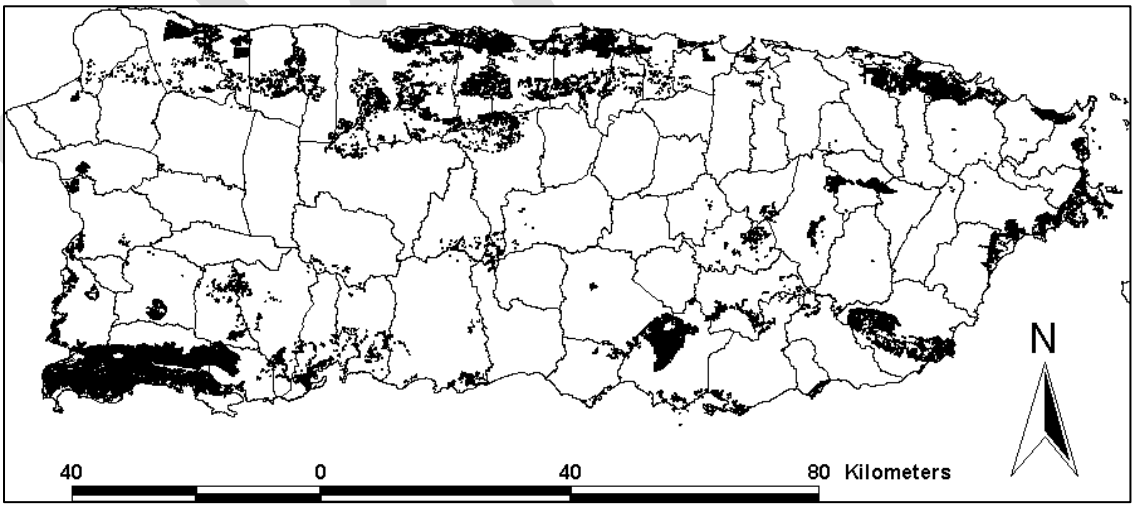

Figure 67. Agricultural land for conservation.

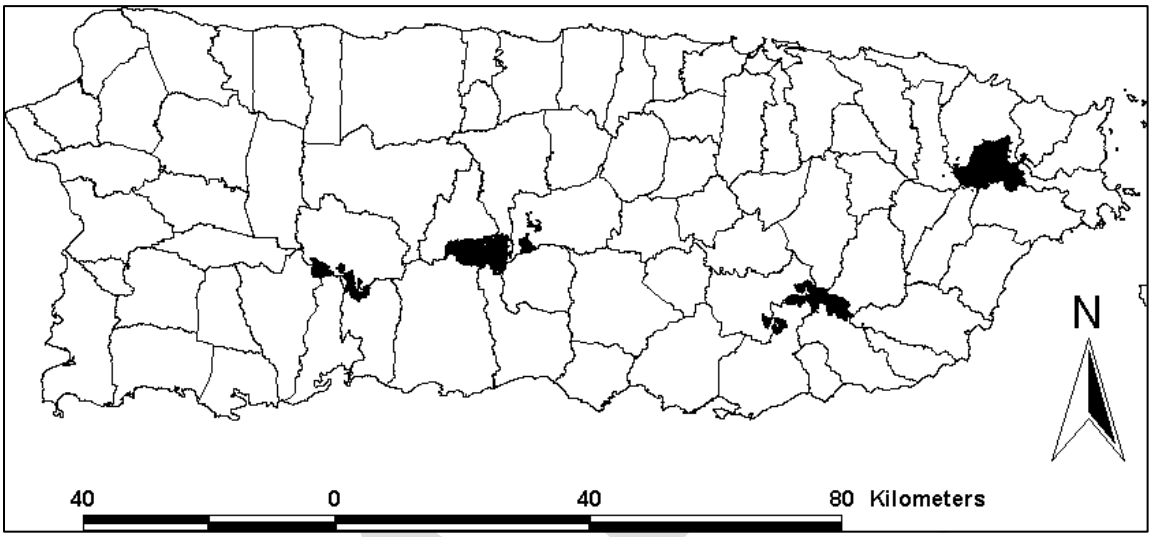

Figure 68. Lower montane wet evergreens forest for conservation.

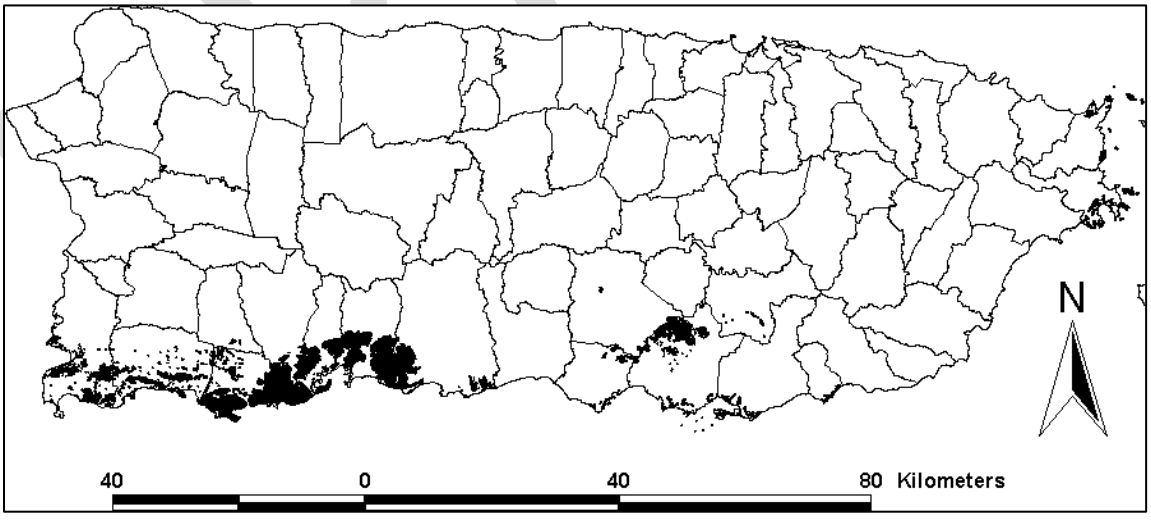

Figure 69. Lowland dry areas for conservation.

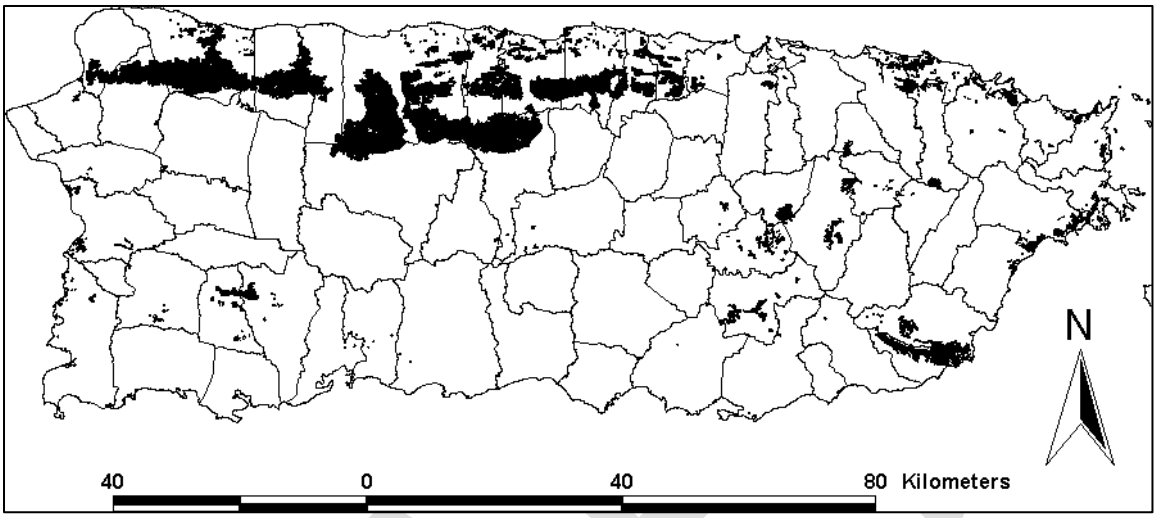

Figure 70. Lowland moist areas for conservation.

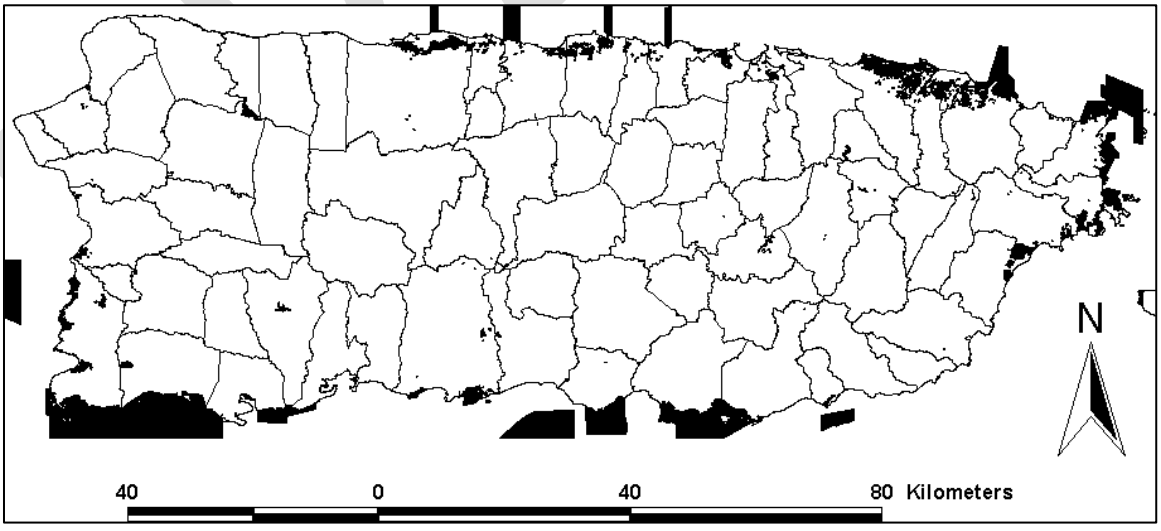

Figure 71. Wetlands, marine and terrestrial, for conservation.

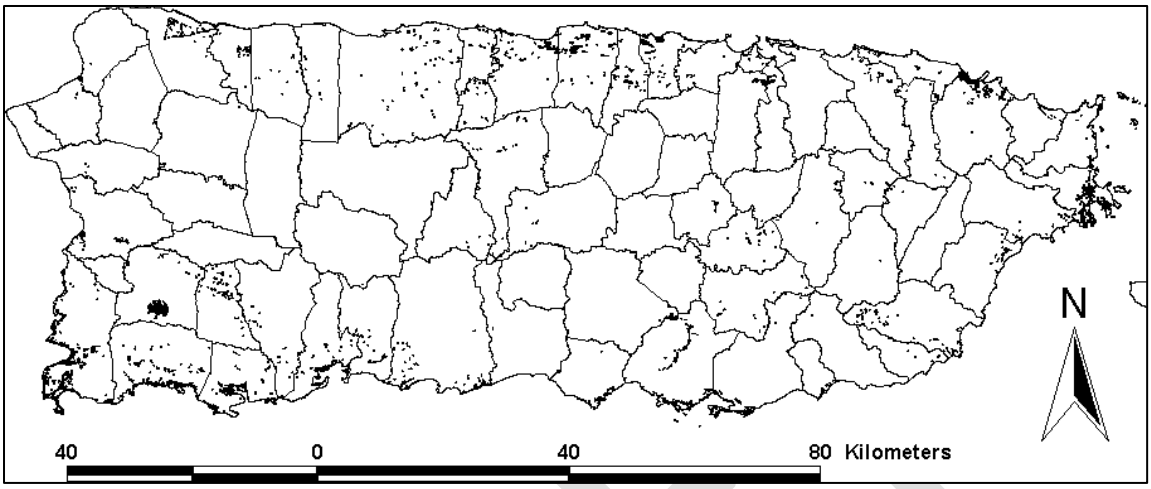

Figure 72. Deforested areas for conservation.

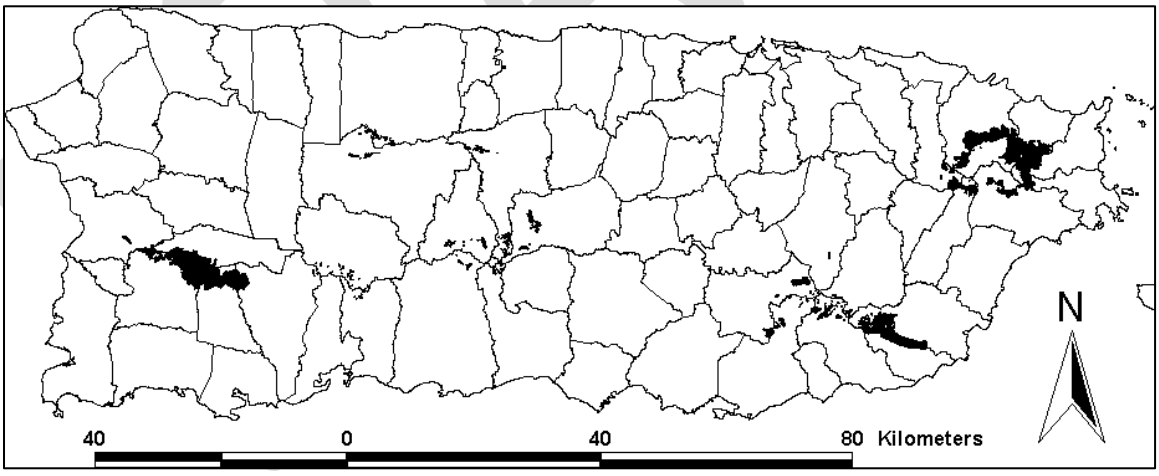

Figure 73. Submontane areas for conservation.

CHAPTER 9
MONITORING AND ADAPTATION OF CONSERVATION ACTIONS

Monitoring is an essential element for the success of the Puerto Rico State Wildlife Action Plan. Understanding ongoing activities and their effectiveness will allow DNER and its conservation partners to adapt to changing conditions and new knowledge. Our monitoring strategy is built on existing efforts by DNER and other entities to monitor individual wildlife populations and to identify, protect, and manage important habitats in Puerto Rico.

Monitoring the success of conservation actions, changes in land use, and habitat conditions will provide managers with information to design effective conservation actions and implement cost-effective methods. Results from monitoring and evaluation efforts can also be used to effectively communicate conservation achievements and garner support for programs among decision-makers, including legislators, funding organizations, non-profit organizations, and the general public.

Wildlife Permits

The New Wildlife Law of Puerto Rico stipulates that DNER will regulate all related wildlife activities. The Terrestrial Resources Division (TRD) of DNER is responsible for granting permits for scientific investigations, wildlife collections, and the importation and exportation of wildlife, as well as for education. One condition of each permit is the submission of a report on authorized activities. These reports provide updated information on the status of the studied species and inform DNER about programs conducted by non-governmental organizations or individuals to educate the public about the conservation of wildlife resources.

Regulation No. 6766 specifically mandates a five-year revision of the priority species list. It also dictates the preparation of recovery plans within 1 year for species listed as critically endangered, 2 years for endangered species, and 3 years for threatened species.

Game Species

The TRD has monitored game species populations for over 35 years through ground and aerial counts and harvest data. Game species in Puerto Rico include migratory waterfowl, columbids, feral goats, and pigs. However, non-game species such as native and resident waterfowl (e.g., White-cheeked pintail, West Indian whistling duck), and columbids (e.g., Puerto Rican Plain Pigeon) are also surveyed. These surveys are an important tool for the continued monitoring of these priority species.

Threatened and Endangered Species

Commonwealth and federal legislation mandate the monitoring of threatened and endangered species. The DNER allocates monitoring priorities according to the level of endangerment of the species. Nevertheless, limited funding and resources restrict the number of species that may be effectively monitored. To address inadequate resources, the DNER has established cooperative agreements with universities, federal agencies, non-governmental agencies, and, more recently, private landowners.

Habitat Conservation and Protection

Wildlife habitats are evaluated and characterized according to the categories established in Regulations No. 6765 and 6766. The DNER Secretary designates habitat for endangered and threatened species as Critical Habitat (CH) or Critical Essential Habitat (CEH). The CEH cannot be modified unless scientific data

support a change in designation. For instance, a CH may be modified only if the proposed action has a vital public interest and no other option exists. Any alteration to a CH will require mitigation in the form of habitat of at least a 3:1 ratio, with habitat of the same or higher ecological value.

The DNER-Terrestrial Resources Division evaluates the potential impact of development on our wildlife species and their habitats. Personnel from this Division provide technical guidance about proposed actions in accordance with regulations. The action will depend upon the habitat designation (Table 49).

Table 49. Wildlife habitat categories and actions proposed to deter habitat loss.

Habitat Category	Protection	Action
Critical Essential	Endangered/Threatened Species (only known locality)	No Modification
Critical	Endangered/Threatened Species (Natural or Historical distribution) (Reintroduction Potential)	Restricted Modification Requires a 3:1 or higher habitat compensation (mitigation)
Irreplaceable	All Wildlife	No Net Loss
Essential	All Wildlife	No Net Loss or in situ or adjacent 1:1 compensation
High Ecological Value	All Wildlife	'No Net Loss or in situ or adjacent 1:1 compensation
Ecological Value	All Wildlife	No Impact or in situ, adjacent, or off-site 1:1 compensation
High Potential	All Wildlife	Mitigation through habitat enhancement or land acquisition
Low Potential	All Wildlife	Mitigation through habitat enhancement and other actions that improve habitat conditions

Technical Assistance for Wildlife Conservation in Puerto Rico

The Terrestrial Resources Division is currently conducting a technical assistance project that provides landowners with up-to-date management information and techniques to sustain and enhance wildlife habitats on their properties. This project is also responsible for reviewing projects proposed by government and private entities that could impact wildlife resources and providing guidance on minimizing the negative impacts of such projects. The TRD and staff from other DNER units created a matrix to categorize proposed habitats for modification to facilitate decision-making. Habitat categories range from irreplaceable to those with low potential to be transformed into a higher category (see Table 49). This project focuses on the management and restoration of target habitats, including wetlands, shade coffee plantations, tropical hardwood forests, and riparian habitats. Monitoring is accomplished by recording the number of private landowners consulted, the number of actual restoration and/or management projects developed, and the number of acres and/or kilometers enhanced, restored, or protected.

Safe Harbor Agreements

The Safe Harbor Program is a conservation strategy that the DNER will implement to monitor and manage species of concern on private lands. This program will support recovery efforts of many federal and commonwealth trust species. With the development of multiple recovery projects for endangered species in Puerto Rico (e.g., establishing a second wild population of the Puerto Rican parrot in northern Puerto Rico), a robust private lands program is critical to the success of these initiatives. Monitoring will be achieved through regular visits to enrolled properties to ensure compliance with the agreement. The DNER, possibly with assistance from the USFWS, will monitor the protected species to determine the number of individuals occurring on enrolled lands.

Natural Heritage Program

The Natural Heritage Program is in charge of identifying lands for conservation throughout the Island. Once identified, the properties are prioritized for acquisition. This approach is another tool for conserving land to benefit wildlife species. This program also maintains a list of critical species, including both plants and animals. This list is regularly updated.

Para la Naturaleza ("For Nature" part of the Puerto Rico Conservation Trust)

The Puerto Rico Conservation Trust is a private, nonprofit organization that manages 14 reserves (~13,000 acres) across the island. This entity monitors habitats related to native habitat preservation and restoration. This organization also works to educate the public on the conservation of natural resources.

Ciudadanos del Carso ("Citizens of the Karst")

Ciudadanos del Carso is a private, non-profit organization whose mission is to acquire land, particularly in Puerto Rico's karst region, for protection and conservation. This organization monitors habitats to support the preservation and restoration of native habitats. Ciudadanos del Carso also educates the public on the conservation of natural resources and collaborates with other environmental organizations and government agencies on projects and studies related to karst conservation.

Joint Priority Landscapes

Joint Priority Landscapes are created when Federal and State agencies and non-governmental organizations independently establish complementary conservation priorities. It often makes sense to leverage these resources against each other. Joint Priority Landscapes can take many forms due to the variety of available

approaches (e.g., watersheds, ecological units, issue-centered). These efforts explicitly seek public engagement in a unified manner that respects the time and talent of community members.

Work on two joint priority landscapes will be in progress during this action plan's implementation period:

- The Guánica/Maricao joint priority landscape (Figure 76): This project is located in the southwestern corner of Puerto Rico. The Guánica/Maricao joint priority landscape will leverage the majority of federal, state, and independent conservation and management efforts. The NOAA Coastal Zone Management Program is working to protect the coral reef system. The Natural Resource Conservation Service is working with local farmers to improve water quality in the Rio Loco watershed and reduce soil erosion that affects streams and the reefs. Multiple wildlife and forestry agencies are collaborating with coffee growers to convert their plantations from sun coffee to shade coffee in order to benefit migratory birds and native wildlife. The EPA is considering a major estuary restoration effort. The US Forest Service and the DNER Forestry Bureau are working to promote the establishment of riparian buffer zones and agroforestry pilot programs in the area. The Fire Department and Guánica State Forest are developing strategies to manage wildlife fires. This landscape includes several important regional offices, including the Guánica State Forest (DNER), the Cabo Rojo Wildlife Refuge (USFWS), and the Maricao Critical Wildlife Area.

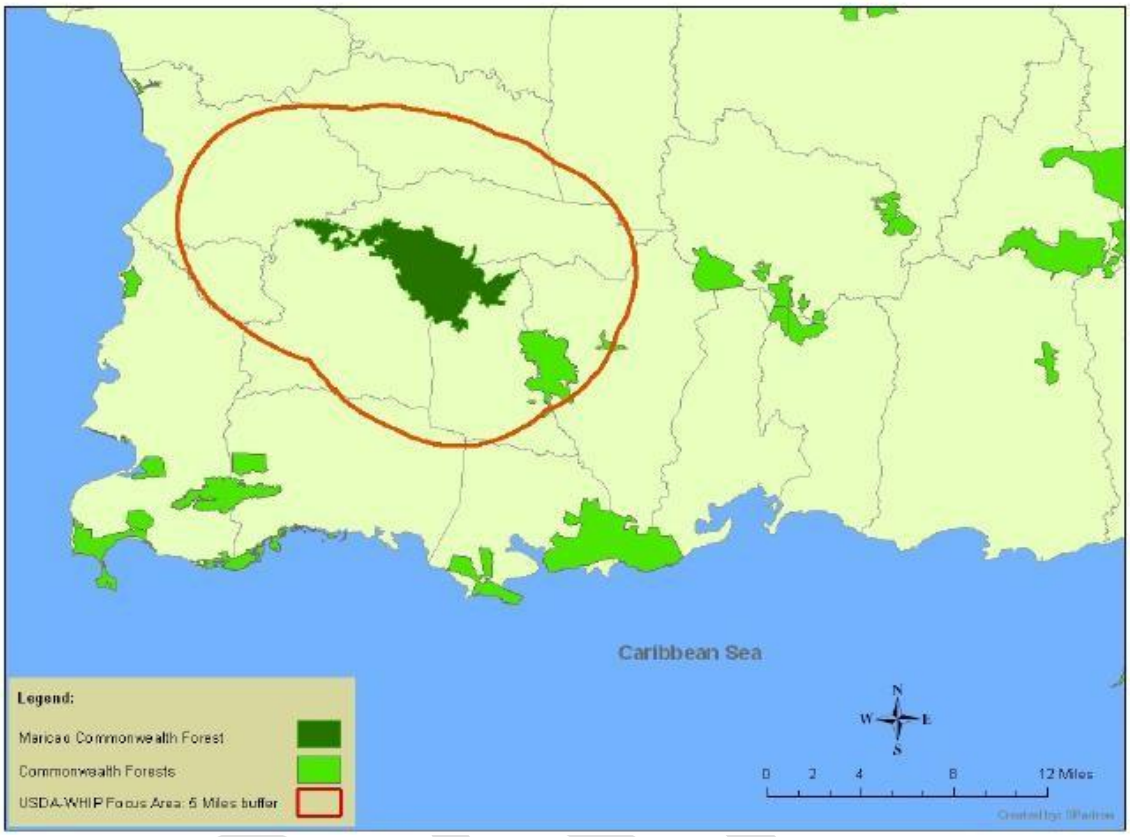

Figure 74. Overview of USDA-WHIP Focus Area, 5 miles around Maricao State Forest (From DNER 2011).

- The Humacao joint priority landscape: This area is located in the southeastern corner of Puerto Rico, in an area of urban sprawl. All the federal and state partners in the NRCS State Technical Committee have endorsed a collaborative effort in this area. The project would encourage collaboration among several local communities in conservation efforts. Efforts in the Humacao landscape will involve financial and technical assistance from federal agencies, as well as cost incentive programs. The DNER and the US Forest Service will be engaged through urban and community outreach programs, a forest stewardship program, a forest legacy program, and, eventually, a program to create new public spaces for Humacao communities. Federal and state fish and wildlife agencies will continue their conservation efforts focused on species and habitats listed as endangered or threatened.

Adaptive Management

The Puerto Rico State Wildlife Action Plan does not pretend to be a fixed set of conservation strategies and goals. The main objective of the plan is to establish DNER's priorities for the conservation of wildlife species and their habitat in Puerto Rico. Once conservation actions are implemented, evaluating their progress and measuring their effectiveness is important. Maintaining a loop between monitoring and management actions will help address the uncertainty arising from management and adapt to new conditions and developments. Continued feedback from collaborators (e.g., DNER staff, stakeholders, academia, and the general public) is essential to address information gaps related to specific conservation actions and to propose alternatives to improve project organization and fiscal responsibility. Conservation priorities and actions should be flexible to adapt to all situations.

Monitoring and conservation measures have been identified for many wildlife species in recovery or management plans. As previously mentioned, DNER conducts regular systematic surveys for some avian taxa. The Puerto Rican Ornithological Society conducts annual Audubon Christmas Bird Counts in southwestern and eastern Puerto Rico. However, most species require additional surveys, analysis, and conservation measures. For example, terrestrial invertebrates have not been adequately monitored, except for studies on specific species.

It is recognized that the monitoring phase will be time-consuming and resource intensive. Thus, limits will need to be set on the number of species and habitats monitored. However, through this program, the DNER will encourage participation by other parties (e.g., Universities, Conservation Organizations) by funding research projects that will provide information on the status of SGCN, particularly for data-deficient species and habitats.

The specific long-term success of the PRSWAP conservation actions will be evaluated through different approaches: new scientific knowledge about SGCN and their habitats, number of funded and completed projects of conservation priority, net increase in the acreage of key habitats conserved through acquisition, restoration, or mitigation as mandated by Law No. 241, an increase of partnerships and public involvement resulting in the protection of wildlife resources, a reduction or elimination of threats to SGCN and priority habitats, and a long-term reduction in the number of SGCN and threats.

Working Tools for Conservation Analysis

Conserving species or habitats requires not only clear objectives but also practical tools for their implementation. Strategies should be based on scientific research, incorporate collaborative governance, and include adaptable monitoring to effectively preserve biodiversity. Since no conservation strategy is flawless and circumstances can change, it is essential to strike a balance between conservation efforts, sustainable development, and the well-being of local communities.

Based on the information that has been acquired and incorporated into this SWAP, the following are recommended working tools for habitat conservation:

- **New maps and cartographic technology** – At the macro level, the latest advancements in cartography should be utilized to identify the crucial habitats in Puerto Rico that need conservation. While the DNER and its collaborators have undertaken initiatives to create and continuously update a variety of detailed maps, many of these maps are outdated and require revision. It is essential to expand the data obtained through newer cartographic technologies to gain a better understanding of local habitats. Additionally, these maps should be made publicly available and easily accessible to the community, as transparency is vital for the preservation,

restoration, and sustainable development of these critical conservation areas.

- **Collaborative agreements and shared governance** – DNER has staff and budget limitations that make it hard to create or use important tools for conservation that would help the island's environment. To tackle this issue, bringing together different groups to work together and making formal conservation agreements can improve overall conservation goals. These different groups will share the responsibility for conservation. This will help ensure that the choices made are more accepted. These collaborations will also help maintain conservation efforts, especially when the DNER lacks the resources to act effectively.

- **Effective evaluation of ecological indicator** – There is a need for practical evaluation tools that provide clear evidence to guide decisions. Either internally in the DNER or through collaborations, these evaluation tools must provide insights into the conditions of Puerto Rico's ecology in the form of conservation metrics. These metrics can involve habitat extent and condition, biodiversity and species health, connectivity and fragmentation, water and soil quality, and others. These also include evaluating how the previously mentioned collaborative agreements are developing, when new maps are expected to become available, and the effectiveness of public education and outreach efforts.

- **Development of an accessible database** – Other states and territories have established robust and easily accessible online databases that provide a wealth of information related to their SWAPs, species, and habitats. These databases include maps, details on species most in need of conservation, and other valuable data that people or organizations can access for personal, educational, or research purposes. They are centralized and updated regularly as new information becomes available.

Puerto Rico should create a centralized database to store and share information gathered for conservation purposes with the public. This can also include ecological indicator evaluations and the progress being made. Additionally, efforts should be made to develop visual representations that help the public understand the many aspects discussed in this document.

Portals of Information on the DNER Web Page

The official DNER website should be further developed to enhance the sharing of current research findings, monitoring data related to species and habitats of concern, and the selected ecological indicators and their progress. Actions should be taken to adopt best practices from other U.S. environmental departments, ensuring that a functional webpage is available before the 2035 SWAP revision. The following is the link to the DNERs web page: **https://www.drna.pr.gov/**

CHAPTER 10
REVISION TO THE PRSWAP 10 YEAR TIMELINE

The DNER will conduct internal evaluations and revisions of the PRSWAP every 2.5 years to adaptively address conservation priorities within the 10-year timeframe (Table 50). Changes in priorities will be based on changes in landscape and environmental conditions, wildlife and habitat responses to such changes, and implemented conservation actions. Performance reports for federally assisted projects and SWG projects, reports from wildlife permits granted by the agency, and in-house updates to the species priority list (mandated under Regulation No. 6766) will be used to document progress on activities related to the PRSWAP.

A detailed evaluation of the PRSWAP will be performed every five years to assess the status of conservation strategies and initiatives, SGCNs, and the stressors that significantly affect the island's wildlife and habitats. Input from partners and the general public will be requested during these evaluations. Previously identified partners and stakeholders will be asked to collaborate with DNER staff on the five-year review. This mid-term evaluation will allow corrections to the strategy within the anticipated 10-year timeframe.

Table 50. Planned Wildlife Action Plan 2025-2036 timeline.

FY 01	FY 02	FY 03-04	FY 05	FY 06-09	FY 10
July 1st, 2025 – March 31, 2026	April 1st, 2026 – June 30, 2027	July 1st, 2027 – June 30, 2029	July 1st, 2030 – June 30, 2031	July 1st, 2031 – June 30, 2036	July 1st, 2035 – June 30, 2036
↓	↓	↓	↓	↓	↓
PRSWAP Preparation	PRSWAP Completion and Implementation	PRSWAP Implementation	PRSWAP Mid-Term Evaluation	PRSWAP Implementation	PRSWAP Revision

CHAPTER 11

COORDINATION OF DEVELOPMENT, IMPLEMENTATION, REVIEW OF THE PLAN-STRATEGY WITH FEDERAL, STATE, AND LOCAL AGENCIES AND INVOLVEMENT OF THE GENERAL PUBLIC IN THE PRSWAP

History

The DNER officially began the PRSWAP revision in 2022, assembling an expert committee comprising DNER staff from the Fisheries and Wildlife Bureau and collaborating with external partners to revise and develop the new action plan. External resources included meetings with USFWS staff in Puerto Rico and information and feedback from researchers and academics.

Coordination

The Puerto Rico State Wildlife Action Plan was supported by a number of initiatives conducted before and after its development that provided valuable information through data collection, final reports, and other scientific publications. Regulation No. 6766 was of particular importance to this endeavor. This regulation includes the original SGCN list, along with each species' status and threats. For the current revision, an expert committee assembled in 2022 developed recommendations for the updated SGCN list presented in this document.

Other key initiatives included in this revision include publications such as the Puerto Rico Critical Wildlife Areas (2025), the Puerto Rico Gap Analysis Project (USDA 2008), the Puerto Rico Waterfowl Focus Areas (2005), and the Strategic Plan for Fisheries and Wildlife (PRDNER 1996). These documents have been subject to peer review by both private and public (State and Federal) agencies and organizations, providing valuable information and input. Thus, these entities provided indirect input in developing and revising the PRSWAP.

In 2010, the DNER created the “Puerto Rico Statewide Assessment and Strategies for Forest Resources”. This publication describes forest conditions on all ownerships in Puerto Rico; identifies forest-related benefits and services; identifies threats to forest resources; highlights issues and trends of concern related to Puerto Rico’s forests and delineates high-priority forest landscapes. It serves its three main goals: 1) Conserve forest landscapes; 2) Protect forests from harm; 3) Enhance benefits from trees and forests. This document was subsequently revised in 2016 and 2021 under the name Puerto Rico Forest Action Plan. The most recent publication was an important resource in the revision of the PRSWAP.

Agencies and Organizations that Provided Input:

Current and past agencies and organizations that have contributed to the accumulated information in the PRSWAP are as follows:

State Agencies

P.R. Department of Natural and Environmental Resources (several units)

Federal Agencies

U.S. Fish and Wildlife Services, Caribbean Ecological Services Field Office

U.S. Forest Service

Caribbean Landscape Conservation Cooperative

Non-profit Organizations

Effective Environmental Restoration, Inc.

Private Conservation Organizations:

Puerto Rico Conservation Trust

Puerto Rican Ornithological Society

Ciudadanos del Carso

Natural History Society of Puerto Rico

Academia:

University of Puerto Rico, Humacao Campus

Interamerican University of Puerto Rico

North Carolina State University

The draft of the Puerto Rico PRSWAP is currently posted on the DNER web page for revision. State and federal agencies, as well as other partners, were asked to review the document and submit their comments to incorporate these inputs into the final document. Partners are encouraged to integrate SGCN, habitat, and conservation actions identified in the PRSWAP into their future plans and programs, and are invited to collaborate with DNER on implementing these actions.

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APPENDIX I - CATEGORIES AND DEFINITIONS

Critically Endangered (CR): A taxon is Critically Endangered when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing an extremely high risk of extinction in the wild:

A. Reduction in population size based on any of the following:
    a. An observed, estimated, inferred, or suspected population size reduction of ≥90% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:
        i. direct observation
        ii. an index of abundance appropriate to the taxon
        iii. a decline in area of occupancy, extent of occurrence, and/or quality of habitat
        iv. actual or potential levels of exploitation
        v. the effects of introduced taxa, hybridization, pathogens, pollutants, competitors, or parasites.
    b. An observed, estimated, inferred or suspected population size reduction of ≥80% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.
    c. A population size reduction of ≥80%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.
    d. An observed, estimated, inferred, projected or suspected population size reduction of ≥80% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.
B. Geographic range in the form of either B1 (extent of occurrence), B2 (area of occupancy), OR both:
    a. Extent of occurrence estimated to be less than 100 km², and estimates indicating at least two of a-c:
        i. Severely fragmented or known to exist at only a single location.
        ii. Continuing decline, observed, inferred, or projected, in any of the following:
            1. extent of occurrence
            2. area of occupancy

3. area, extent, and/or quality of habitat
4. number of locations or subpopulations
5. number of mature individuals.

iii. Extreme fluctuations in any of the following:
1. extent of occurrence
2. area of occupancy
3. number of locations or subpopulations
4. number of mature individuals.

b. Area of occupancy estimated to be less than 10 km², and estimates indicating at least two of a-c:
i. Severely fragmented or known to exist at only a single location.
ii. Continuing decline, observed, inferred, or projected, in any of the following:
1. extent of occurrence
2. area of occupancy
3. area, extent, and/or quality of habitat
4. number of locations or subpopulations
5. number of mature individuals.

iii. Extreme fluctuations in any of the following:
1. extent of occurrence
2. area of occupancy
3. number of locations or subpopulations
4. number of mature individuals.

C. Population size estimated to number fewer than 250 mature individuals and either:
a. An estimated continuing decline of at least 25% within three years or one generation, whichever is longer, (up to a maximum of 100 years in the future) OR
b. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b):
i. Population structure in the form of one of the following:
1. no subpopulation estimated to contain more than 50 mature individuals, OR
2. at least 90% of mature individuals in one subpopulation.

ii. Extreme fluctuations in the number of mature individuals.

D. Population size estimated to number fewer than 50 mature individuals.

E. Quantitative analysis showing the probability of extinction in the wild is at least 50% within 10 years or three generations, whichever is the longer (up to a maximum of 100 years).

ENDANGERED (EN): A taxon is Endangered when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing a very high risk of extinction in the wild:

A. Reduction in population size based on any of the following:
    a. An observed, estimated, inferred, or suspected population size reduction of ≥70% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:
        i. direct observation
        ii. an index of abundance appropriate to the taxon
        iii. a decline in area of occupancy, extent of occurrence, and/or quality of habitat
        iv. actual or potential levels of exploitation
        v. the effects of introduced taxa, hybridization, pathogens, pollutants, competitors, or parasites.
    b. An observed, estimated, inferred or suspected population size reduction of ≥50% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.
    c. A population size reduction of ≥50%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.
    d. An observed, estimated, inferred, projected or suspected population size reduction of ≥50% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.
B. Geographic range in the form of either B1 (extent of occurrence), B2 (area of occupancy), OR both:
    a. Extent of occurrence estimated to be less than 5,000 km², and estimates indicating at least two of a-c:
        i. Severely fragmented or known to exist at no more than five locations.
        ii. Continuing decline, observed, inferred or projected, in any of the following:
            1. extent of occurrence
            2. area of occupancy
            3. area, extent, and/or quality of habitat
            4. number of locations or subpopulations
            5. number of mature individuals.

iii. Extreme fluctuations in any of the following:
1. extent of occurrence
2. area of occupancy
3. number of locations or subpopulations
4. number of mature individuals.

b. Area of occupancy estimated to be less than 500 km², and estimates indicating at least two of a-c:
i. Severely fragmented or known to exist at no more than five locations.
ii. Continuing decline, observed, inferred, or projected, in any of the following:
1. extent of occurrence
2. area of occupancy
3. area, extent, and/or quality of habitat
4. number of locations or subpopulations
5. number of mature individuals.
iii. Extreme fluctuations in any of the following:
1. extent of occurrence
2. area of occupancy
3. number of locations or subpopulations
4. number of mature individuals.

B. Population size estimated to number fewer than 2,500 mature individuals and either:
a. An estimated continuing decline of at least 20% within five years or two generations, whichever is longer, (up to a maximum of 100 years in the future) OR
b. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b):
i. Population structure in the form of one of the following:
1. no subpopulation estimated to contain more than 250 mature individuals, OR
2. at least 95% of mature individuals in one subpopulation.
ii. Extreme fluctuations in number of mature individuals.

C. Population size estimated to number fewer than 250 mature individuals.

D. Quantitative analysis showing the probability of extinction in the wild is at least 20% within 20 years or five generations, whichever is the longer (up to a maximum of 100 years).

VULNERABLE (VU): A taxon is Vulnerable when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing a high risk of extinction in the wild:

A. Reduction in population size based on any of the following:
    a. An observed, estimated, inferred, or suspected population size reduction of ≥50% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:
        i. direct observation
        ii. an index of abundance appropriate to the taxon
        iii. a decline in area of occupancy, extent of occurrence, and/or quality of habitat
        iv. actual or potential levels of exploitation
        v. the effects of introduced taxa, hybridization, pathogens, pollutants, competitors, or parasites.
    b. An observed, estimated, inferred or suspected population size reduction of ≥30% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.
    c. A population size reduction of ≥30%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.
    d. An observed, estimated, inferred, projected or suspected population size reduction of ≥30% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.
B. Geographic range in the form of either B1 (extent of occurrence), B2 (area of occupancy), OR both:
    a. Extent of occurrence estimated to be less than 20,000 km², and estimates indicating at least two of a-c:
        i. Severely fragmented or known to exist at no more than 10 locations.
        ii. Continuing decline, observed, inferred or projected, in any of the following:
            1. extent of occurrence
            2. area of occupancy
            3. area, extent, and/or quality of habitat
            4. number of locations or subpopulations
            5. number of mature individuals.

iii. Extreme fluctuations in any of the following:
1. extent of occurrence
2. area of occupancy
3. number of locations or subpopulations
4. number of mature individuals.

b. Area of occupancy estimated to be less than 2,000 km², and estimates indicating at least two of a-c:
i. Severely fragmented or known to exist at no more than 10 locations.
ii. Continuing decline, observed, inferred, or projected, in any of the following:
1. extent of occurrence
2. area of occupancy
3. area, extent, and/or quality of habitat
4. number of locations or subpopulations
5. number of mature individuals.
iii. Extreme fluctuations in any of the following:
1. extent of occurrence
2. area of occupancy
3. number of locations or subpopulations
4. number of mature individuals.

C. Population size estimated to number fewer than 10,000 mature individuals and either:
a. An estimated continuing decline of at least 10% within 10 years or three generations, whichever is longer, (up to a maximum of 100 years in the future) OR
b. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b):
i. Population structure in the form of one of the following:
1. no subpopulation estimated to contain more than 1000 mature individuals, OR
2. all mature individuals are in one subpopulation.
ii. Extreme fluctuations in number of mature individuals.

D. Population very small or restricted in the form of either of the following:
a. Population size estimated to number fewer than 1,000 mature individuals.
b. Population with a very restricted area of occupancy (typically less than 20 km²) or number of locations typically five or fewer such that it is prone to the effects of human activities or stochastic events within a very short time period in an uncertain future, and is thus capable of becoming Critically Endangered or even Extinct in a very short time period.

E. Quantitative analysis showing the probability of extinction in the wild is at least 10% within 100 years

Lower Risk (LR) - A species is at lower risk when, after an evaluation, it does not satisfy any of the categories of Critically Endangered, Endangered, or Vulnerable, and it is not Data Deficient. Species included in the category of lower risk can be divided into three sub-categories:

a. Conservation Dependent (dc) - Species that are the center of a continuous conservation program of taxonomic or habitat specificity, focused on a particular species, which would be classified into one of the previous categories if the program ends within a period of five years.
b. Almost Threatened (ca) - Species that cannot be classified as Conservation Dependent, but are close to being classified as Vulnerable.
c. Lower Concern (lc) - Species that cannot be classified as Conservation Dependent or Almost Threatened.

Data Deficient (DD) - A species belongs to the category of Data Deficient when the information is not adequate for a direct or indirect evaluation of risk of extinction, based on the distribution and/or condition of the population. A species in this category could be well studied, and its biology might be well known, but appropriate data about its abundance and distribution may be lacking. Therefore, data Deficient is not a threat or risk category. Including a species in this category indicates that more information is required, and it is recognized that future investigations could determine that a threatened classification can be appropriate. It is important to make a conscious use of all the data available. In many cases, caution is advised when selecting between Data Deficient and a threatened condition. If it is suspected that the distribution of a species is relatively restricted, and a considerable period of time has passed since the last time the species was registered, then the threatened condition could be well justified.

APPENDIX II - LIST OF ACRONYMS

ACJV – Atlantic Coast Joint Venture

CEH – Critical Essential Habitat

CH – Critical Habitat

CLCC – Caribbean Landscape Conservation Cooperative

CR – Critically Endangered

CWA – Clean Water Act

CWA – Critical Wildlife Areas

CWCS – Comprehensive Wildlife Conservation Strategy

CZMA – Coastal Zone Management Act

CZMP – Coastal Zone Management Program

DD – Data Deficient

DSCI – Drought Severity and Coverage Index

DNER – Department of Natural and Environmental Resources

EN – Endangered

EPA – U.S. Environmental Protection Agency

ESA – Endangered Species Act

FEMA – Federal Emergency Management Agency

FIA – Forest Inventory Assessment

FSP – Forest Stewardship Program

FY – Fiscal Year

IIJA – Infrastructure Investment and Jobs Act

IITF – International Institute of Tropical Forestry

IPCC – Intergovernmental Panel on Climate Change

IRA – Inflation Reduction Act

IT IS – Integrated Taxonomic Information System

IUCN – International Union for the Conservation of Nature

JBNERR – Jobos Bay National Estuarine Research Reserve

JCA – Environmental Quality Board

LR – Low Risk

MGD – Millions of Gallons per Day

NCSU – North Carolina Fish and Wildlife Research Unit

NEPA – National Environmental Policy Act

NGO – Non-Governmental Organization

NHP – Natural Heritage Program

NOAA – National Oceanic and Atmospheric Administration

OGPe – Permit Management Office

PFW – Partners for Fish and Wildlife

PRCCC – Puerto Rico Climate Change Council

PRCT – Puerto Rico Conservation Trust

PRFB – Puerto Rico Firefighters Bureau

PR-GAP – Puerto Rico Gap Analysis

PRLUP – Puerto Rico Land Use Plan

PRPP – Puerto Rico Plain Pidgeon

PRSWAP – Puerto Rico State Wildlife Action Plan

PRVI – Puerto Rico and the Virgin Islands

PRWFA – Puerto Rico Waterfowl Focus Areas

PUT – Puerto Rico Land Use Plan

SECAS – Southeast Conservation Adaptation Strategy

SCB – Southeast Conservation Blueprint

SGCN - Species of Greatest Conservation Need

STWG – State and Tribal Wildlife Grant

SWAP – State Wildlife Action Plan

SWG – State Wildlife Grant

T/E – Threatened or Endangered

TRD – Terrestrial Resources Division

USA – United States of America

USACE – U.S. Army Corps of Engineers

USFWS – U.S. Fish and Wildlife Service

USGS – United States Geological Survey

VU – Vulnerable

WCRP – Wildlife Conservation and Restoration Program

APPENDIX III - ROAD MAP

This roadmap is provided for those who are evaluating the Action Plan for the purpose of determining how well it meets the eight elements required by congress.

Element 1:

Information on the distribution and abundance of species of wildlife, including low and declining populations as the state deems appropriate, that are indicative of the diversity and health of the state's wildlife.

Sub-elements:

A. The Action Plan indicates sources of information (e.g., literature, data bases, agencies, individuals) on wildlife abundance and distribution consulted during the planning process.
B. The Action Plan includes information about both abundance and distribution for species in all major groups to the extent that data are available. There are plans for acquiring information about species for which adequate abundance and/or distribution information is unavailable.
C. The Action Plan identifies low and declining populations to the extent data are available.
D. All major groups of wildlife have been considered or an explanation is provided as to why they were not. The State may indicate whether these groups are to be included in a future Action Plan revision.
E. The Action Plan describes the process used to select the species in greatest need of conservation. The quantity of information in the Action Plan is determined by the State with input from its partners, based on what is available to the State.

Chapter	Sub-element addressed	Page(s)
Executive Summary	D	10-12
Introduction - Background	A, E	14-16
Introduction - Approach	B, D	18
Species of Greatest Conservation Need	A, B, C, D, E	43-68
Habitats of Greatest Conservation Need	B, D	223-294
Acknowledgments	A	9
Literature Cited	A	310-325

Element 2:

Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in Element 1.

Sub-elements:

A. The Action Plan provides a reasonable explanation for the level of detail provided; if insufficient, the Action Plan identifies the types of future actions that will be taken to obtain the information.
B. Key habitats and their relative conditions are described in enough detail such that the State can determine where (i.e., in which regions, watersheds, or landscapes within the State) and what conservation actions need to take place.

Chapter	Sub-element addressed	Page(s)
Executive Summary	A	10-12
Introduction	A, B	14-20
Habitat Requirements and Information Needs for Priority Species	A, B	87-104
Habitats of Greatest Conservation Needs	A, B	223-294

Element 3:

Descriptions of problems which may adversely affect species identified in Element 1 or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats:

Sub-elements:

A. The Action Plan indicates sources of information (e.g., literature, databases, agencies, or individuals) used to determine the problems or threats.
B. The threats/problems are described in sufficient detail to develop focused conservation actions.
C. The Action Plan considers threats/problems, regardless of their origins (local, State, regional, national and international), where relevant to the State's species and habitats.
D. If available information is insufficient to describe threats/problems, research and survey efforts are identified to obtain needed information.
E. The priority research and survey needs, and resulting products, are

described sufficiently to allow for the development of research and survey projects after the Action Plan is approved.

Chapter	Sub-element addressed	Page(s)
Introduction	A, C	14-20
Habitat Requirements and Information Needs for Priority Species	C, D	87-104
Identifying Stressor/Threats to Puerto Rico Wildlife	A, B, C, D, E	105-147
Acknowledgments	A	9
Literature Cited	A	310-325

Element 4:

Descriptions of conservation actions determined to be necessary to conserve the identified species and habitats and priorities for implementing such actions:

Sub-elements:

A. The Action Plan identifies how conservation actions address identified threats to species of greatest conservation need and their habitats.
B. The Action Plan describes conservation actions sufficiently to guide implementation of those actions through the development and execution of specific projects and programs.
C. The Action Plan links conservation actions to objectives and indicators that will facilitate monitoring and performance measurement of those conservation actions.
D. The Action Plan describes conservation actions (where relevant to the State's species and habitats) that could be addressed by Federal agencies or regional, national or international partners and shared with other States.
E. If available information is insufficient to describe needed conservation actions, the Action Plan identifies research or survey needs for obtaining information to develop specific conservation actions.
F. The Action Plan identifies the relative priority of conservation actions.

Chapter	Sub-element addressed	Page(s)
Executive Summary	C, D	10-12
Introduction	C, D	14-20
Habitat Requirements and Information Needs for Priority Species	A, B, C, D, E, F	87-104
Identifying Stressors/Threats to Puerto Rico Wildlife	A, B, C, D, E, F	105-147
Conservation Strategies for Puerto Rico Wildlife Action Plan	A, B, C, D, E, F	148-222

Element 5:

Proposed plans for monitoring species identified in Element 1 and their habitats, for monitoring the effectiveness of the conservation actions proposed in Element 4, and for adapting these conservation actions to respond appropriately to new information or changing conditions:

Sub-elements:

A. The Action Plan describes plans for monitoring species identified in Element 1, and their habitats.
B. The Action Plan describes how the outcomes of the conservation actions will be monitored.
C. If monitoring is not identified for a species or species group, the Action Plan explains why it is not appropriate, necessary or possible.
D. Monitoring is to be accomplished at one of several levels including individual species, guilds, or natural communities.
E. The monitoring utilizes or builds on existing monitoring and survey systems or explains how information will be obtained to determine the effectiveness of conservation actions.
F. The monitoring considers the appropriate geographic scale to evaluate the status of species or species groups and the effectiveness of conservation actions.
G. The Action Plan is adaptive in that it allows for evaluating conservation actions and implementing new actions accordingly.

Chapter	Sub-element addressed	Page(s)
Introduction	A, B, C, D, E, F, G	14-20
Executive Summary	A, B, C, D, E, F, G	10-12
Habitat Requirements and Information Needs for Priority Species	A, B	87-104
Monitoring and Adaptation of Conservation Actions	A, B, C, D, E, F, G	295-305

Element 6:

Descriptions of procedures to review the Action Plan at intervals not to exceed 10 years:

Sub-elements:

A. The State describes the process that will be used to review the Action Plan within the next ten years.

Chapter	Sub-element addressed	Page(s)
Executive Summary	A	10-12
Introduction	A	14-20
Revisions to the SWAP	A	306

Element 7:

Plans for coordinating, to the extent feasible, the development, implementation, review, and revision of the Action Plan with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the state or administer programs that significantly affect the conservation of identified species and habitats:

Sub-elements:

A. The State describes the extent of its coordination with and efforts to involve Federal, State and local agencies, and Indian Tribes in the development of its Action Plan.
B. The State describes its continued coordination with these agencies and tribes in the implementation, review and revision of its Action Plan.

Chapter	Sub-element addressed	Page(s)
Introduction	A, B	14-20
Revisions to the SWAP	A, B	304
Coordination of Development, Implementation, Review, and Revision	A, B	307-309

Element 8:

Provisions to ensure public participation in the development, revision, and implementation of projects and programs. Congress has affirmed that broad public participation is an essential element of this process:

Sub-elements:

A. The State describes the extent of its efforts to involve the public in the development of its Action Plan.
B. The State describes its continued public involvement in the implementation and revision of its Action Plan.

Chapter	Sub-element addressed	Page(s)
Introduction	A, B	14-20
Coordination of Development, Implementation, Review, and Revision	A, B	307-309

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U.S. FISH & WILDLIFE SERVICE

DEPARTMENT OF THE INTERIOR