



Assessment of Needs Forest Legacy Areas Draft

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ABSTRACT

To be included.

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ACRONYMS AND ABBREVIATIONS

ACJV	Atlantic Coast Joint Venture
ACS	American Community Survey
AON	Assessment of Need
APE-RC	Restricted Zone (classification in the Karst Special Planning Area)
ASCEPR	American Society of Civil Engineers Puerto Rico
CCAP	Coastal Change Analysis Program
CFAA	Cooperative Forestry Assistance Act
COR3	Central Office for Recovery, Reconstruction and Resiliency
CWA	Critical Wildlife Area
DNER	Department of Natural and Environmental Resources
DOC	Department of Commerce
DRD	Sport and Recreation Department
Exp.	Expansion
FIA	Forest Inventory Assessment
FLA	Forest Legacy Area
FLP	Forest Legacy Program
FWS	Fish and Wildlife Service
GIS	Geographic Information System
IBA	Important Bird Areas
IITF	International Institute of Tropical Forestry
LWCF	Land and Water Conservation Fund
m	Meters
NGO	Non-governmental organization
NHP	Natural Heritage Program
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NR	Nature Reserve
OCM	Office for Coastal Management
PCA	Priority Conservation Area
PLN	Para La Naturaleza
PNA	Protected Natural Area
PRAPEC	Plan and Regulations of the Karst Special Planning Area
PRGAP	Puerto Rico GAP Analysis
PRLUP	Puerto Rico Land Use Plan
PRPB	Puerto Rico Planning Board
PRSWAP	Puerto Rico State Wildlife Action Plan
PRWFA	Puerto Rico's Waterfowl Focus Areas

RTCA	Rivers, Trails and Conservation Assistance
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SFAP	State Forest Action plan
SFSCC	State Forest Stewardship Coordinating Committee
SGCN	Species of Greatest Conservation Need
SPA	Special Planning Areas
USFS	US Forest Service
USFWS	US Fish and Wildlife Service

2 INTRODUCTION

2.1 AUTHORITY AND PURPOSE OF THE FOREST LEGACY PROGRAM

The Forest Legacy Program (FLP) is authorized by an amendment to the Cooperative Forestry Assistance Act (CFAA) of 1978 (16 USC 2101 et seq.). The FLP was established in 1990 to:

- identify and protect environmentally important private forestlands¹ that are threatened by conversion to non-forest uses, and
- provide the opportunity for continuation of traditional forest uses², such as forest management activities and outdoor recreation.

The FLP is implemented by the US Forest Service (USFS) through State participation. In Puerto Rico, the Department of Natural and Environmental Resources (DNER) is the lead State agency responsible for overseeing FLP administration. Both agencies cooperate with municipalities, other Federal agencies, forest landowners, land trust organizations, and other partners to implement the FLP. The FLP is funded through the Land and Water Conservation Fund (LWCF).

By participating in the FLP, the DNER is eligible to receive grants for the acquisition of lands. These funds help pay for fee-simple land purchases that are then held by the DNER. To participate in the Program, the DNER must have an updated State Forest Action Plan (SFAP) that includes the required FLP elements.

2.2 THE ASSESSMENT OF NEEDS

To participate in the FLP, the DNER is required to assess the need to protect environmentally important private forestlands that are threatened by conversion to non-forest uses. This was a requirement since the creation of the FLP. In compliance with this requirement, in year 1997, Puerto Rico developed an Assessment of Need (AON) that was approved by the U.S. Secretary of Agriculture through the USFS.

¹ Environmentally important private forestlands include scenic, cultural, fish, wildlife, and recreational resources, riparian areas, and lands with other ecological values.

² Traditional forest uses, include timber management, and other recreational uses such as hunting, fishing, hiking, and similar recreational uses that are consistent with purposes of the FLP.

In 2008, an amendment to the CFAA required States and territories to develop a State Forest Action Plan to receive funds under the CFAA, including the FLP funds. The State Forest Action Plan should include the previous FLP requirements of the AON, which are now incorporated into such Plan. Puerto Rico is updating its 2016 SFAP and, once approved, this AON will be incorporated into the Puerto Rico SFAP.

This AON evaluates current forests, their uses, and the trends and forces causing conversion to non-forest uses and identifies eligibility criteria for FLAs. In this AON, geographic FLAs that were identified in the 1997 AON were assessed with the most recent scientific information and recommendations or modifications are made, as needed.

This revision of the AON was conducted in close coordination with the State Forest Stewardship Coordinating Committee (SFSCC), following the provisions of Section 19 of the CFAA. The SFSCC advises the DNER to help achieve FLP objectives, establish FLP goals and FLA eligibility requirements and selection criteria.

2.3 PUERTO RICO'S FOREST LEGACY PROGRAM BACKGROUND

The DNER is the Commonwealth's lead agency responsible for overseeing the FLP administration and holds lands and interests in lands acquired through the FLP. In Puerto Rico, the FLP is co-administered with the USFS-International Institute of Tropical Forestry (IITF).

Puerto Rico has been participating in the FLP since 1997, with the approval of the AON. The priorities for the FLP, as established in the 1997 AON, include:

- the protection and restoration of forested areas in watersheds developed as sources of public water supply.
- buffer zones of existing forest reserves.
- the conservation of forested areas in primary or close to primary conditions; and
- the conservation of biodiversity and unique features.

The 1997 AON identified eight FLAs, covering 857,248 acres (39%) of the island of Puerto Rico. These are:

- Guánica Legacy Area

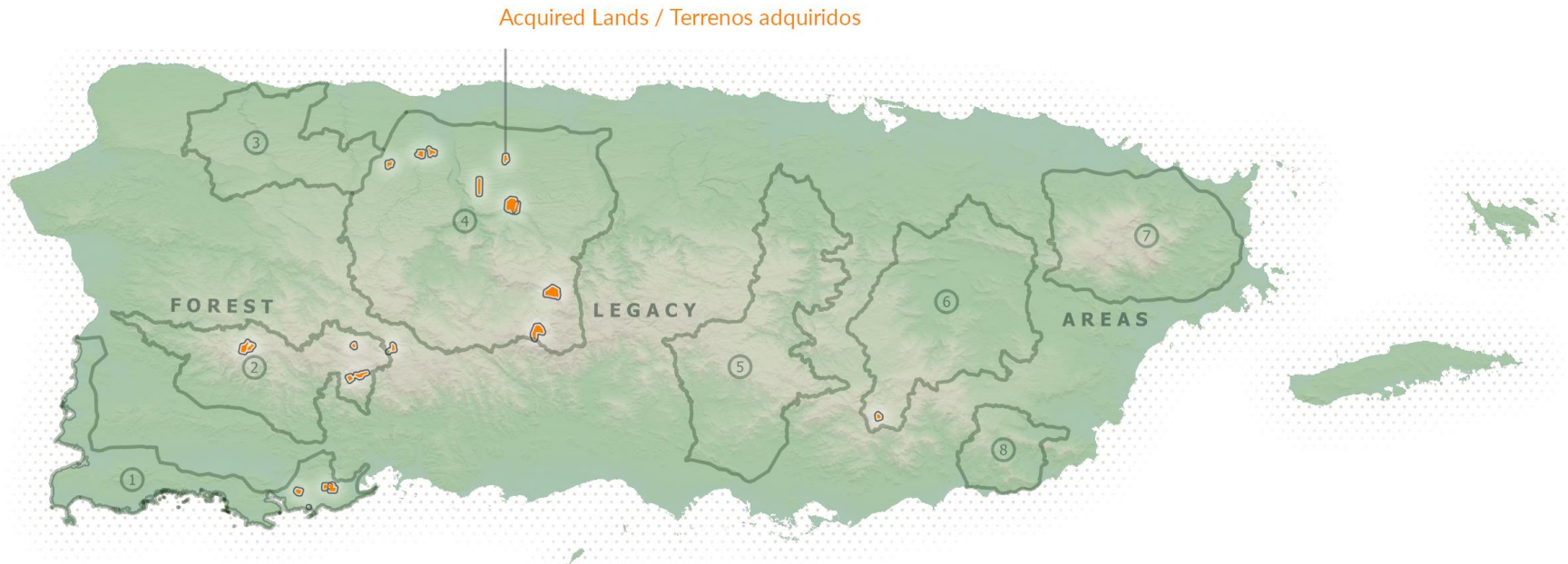
The goal for the Puerto Rico FLP is to protect environmentally important forest areas belonging to private owners that are threatened by conversion to non-forest uses and that respond to established program eligibility criteria.

DNER, 1997

- Maricao Legacy Area
- Quebradillas Legacy Area
- Caonillas-Dos Bocas Legacy Area
- La Plata-Coamo Legacy Area
- Río Grande de Loíza Legacy Area
- Maunabo Legacy Area
- El Yunque Legacy Area

Since its inception, 2,778 acres of forested lands in Puerto Rico have been acquired through the FLP. The following map and table present the number of lands acquired within each FLA.

Map 1. Forest Legacy Areas in Puerto Rico and acquired lands



Source: Forest Legacy Program, Department of Natural and Environmental Resources. Map prepared by Estudios Técnicos, Inc.

Table 1. Acreage of lands acquired in each FLA

	Forest Legacy Area	Acreage of FLA	Acquired lands by FLA (acres)
1	Guánica Legacy Area	70,611	300
2	Maricao Legacy Area	83,592	596
3	Quebradillas Legacy Area	67,580	0
4	Caonillas-Dos Bocas Legacy Area	243,665	1,825
5	La Plata-Coamo Legacy Area	131,350	0
6	Río Grande de Loíza Legacy Area	126,555	57
7	El Yunque Legacy Area	103,771	0
8	Maunabo Legacy Area	30,025	0

Source: Forest Legacy Program, Department of Natural and Environmental Resources. Area estimated by Estudios Técnicos, Inc.

2.4 GENERAL CONTEXT OF PUERTO RICO

Puerto Rico, the easternmost and smallest of the Greater Antilles, is located between 18°31' and 17°55' N latitude and 63°37' and 67°17' W longitude, between the Atlantic Ocean and the Caribbean Sea. It includes the main island of Puerto Rico, the two populated islands of Vieques and Culebra, as well as Mona, Monito and other small islands and cays. Puerto Rico is roughly rectangular in shape measuring approximately 100 miles or 161 kilometers east to west and 35 miles or 56 kilometers north to south. Puerto Rico's land surface is approximately 8,934 square kilometers (km²) or 3,449 square miles (mi²) (3,449mi²).

Map 2. Puerto Rico in the Caribbean



Source: Map prepared by Estudios Técnicos, Inc.

Puerto Rico has three geomorphological regions: the central mountainous interior (upland province), the karst region and the coastal plains. The central mountainous interior arises from tectonic activity during the island's evolution. This is the largest of the three geomorphological regions, covering approximately 53% of the island (Gould et al, 2008). The central mountain range, the Cordillera Central, extends almost the whole length of the island, the crest averaging more than 1,067 meters (3,500 feet) in elevation along its length, with the highest peak rising 1,338 meters (4,389 feet).

The karst region is mostly located north and south of the Central Mountain Range and covers about 27.5% of the island's surface. It is subdivided into the northern, southern, and dispersed limestone areas (Lugo et al., 2001). Nevertheless, the most significant limestone formations are found in the northern karst region. The karst region is formed by the deep deposition of limestone during submergence of the land over several millions

of years. These areas have been deeply dissected by dissolution and erosion and are characterized by river valley formations and distinctive karst formations, such as limestone hills (mogotes), caves, canyons, and sinkholes, among others.

The coastal plains were formed as a result of various factors, such as the mountains' erosion, and the accumulation of alluvium in the rivers' floodplains, among others (DNER, 2009). The coastal plains comprise about a third of the island's total area. Puerto Rico has 1,286 kilometers or 799 miles of coastline (DNER, 2009). There are diverse natural systems along the coasts, including cliffs, beaches, sand dunes, mangrove forests, and estuaries. Social and economic activities concentrate in these coastal areas (DNER, 2009).

A high proportion of the Puerto Rico landscape is very steeply sloped. Over 80% of the land is either hill or mountain land and 38% has a slope of 45° or more. The soils of Puerto Rico are exceptionally diverse in proportion to the size of the island, and closely reflect the rock formations from which they are derived.

Rainfall in Puerto Rico is determined by wind patterns that blow from the northeast and by the mountainous topography. The highest precipitation is registered in the Central Mountain Range, specifically in the Luquillo Range (*Sierra de Luquillo*), a spur from the Central Mountain Range located to the east (3,810 mm/year or 150 inches/year) (DNER, 2009). In contrast, in the southern coastal plains, the rainfall pattern is low with less than 1,016 mm (40 inches) a year (DNER, 2009). Rainfall patterns influence the distribution of vegetation, thus making the typical vegetation in the north to be of a humid subtropical forest while in the west, southwest and east the vegetation is representative of a subtropical dry forest.

Puerto Rico has 224 rivers, 553 named streams, and 39 reservoirs (DNER, 2016c). The largest river is the Río Grande de Loíza, draining an area of 767 square kilometers (296 square miles). There are only seven rivers on the island with drainage areas greater than 259 square kilometers (100 square miles), although more than 100 streams discharge into the ocean. The large number of drainage basins in the island results in a surface hydrology characterized by a multitude of small basins and catchments.

2.4.1 The people and its socioeconomic context

Puerto Rico has undergone a major transformation in the last two decades with a prolonged and deep contraction of the economy, a major loss of population, various natural disaster declarations³ and more recently the COVID-19 pandemic.

Puerto Rico has a population of 3,285,874 inhabitants according to the 2020 Census, and a population density of 952.7 inhabitants/square mile.⁴ Population concentrates in the coastal municipalities (DNER, 2019). The population has been decreasing during the past years for various reasons, including outward migration and a reduction in the number of births.

In Puerto Rico, the median age of the population increased during the past years, from 38.1 in 2014, to 41.7 years in 2019 (ACS, 2010-2014 and ACS 2015-2019, respectively).⁵ The elderly population is growing at a higher rate than other population segments as individuals of working age continue to migrate. Those of 65 years or more represented 16.0% in 2014, and 19.7% in 2019. In 2022, it is projected that the population of 65 years and older will be the largest population group in Puerto Rico.

Poverty has a very high prevalence in most of Puerto Rico. Approximately 44.1% of Puerto Rico's households live below the poverty level (ACS 2015-2019). Many of these are single-person households and/or elderly households. In addition, inequality has been increasing in Puerto Rico during the past years, leading the island to be the US jurisdiction with the highest economic inequality (Gini index US: 0.485; PR: 0.542).⁶

³https://www.fema.gov/disasters/disaster-declarations?field_dv2_state_territory_tribal_value=PR&field_year_value=All&field_dv2_declaration_type_value=All&field_dv2_incident_type_target_id_selective=All

⁴ U.S. Census Bureau. 2020 Census Apportionment Results. Table 2. RESIDENT POPULATION FOR THE 50 STATES, THE DISTRICT OF COLUMBIA, AND PUERTO RICO: 2020 CENSUS

⁵ The ACS was used as the detailed data for the 2020 Census is not available.

⁶ <https://www.census.gov/library/stories/2019/09/us-median-household-income-up-in-2018-from-2017.html>

3 PUERTO RICO FORESTS

3.1 ECOLOGICAL LIFE ZONES⁷

Puerto Rico forests are extremely diverse for a landmass the size of the island (Miller & Lugo, 2008). Puerto Rico forests are commonly described using the Holdridge life zone classification system. Six life zones have been described for Puerto Rico, which include: subtropical dry, lowland moist, subtropical wet, lower montane wet, subtropical rain, and lower montane rain forest zones (Gould et al, 2008). Table 2 presents the acres and the proportions of these life zones for each Legacy Area.

- **The subtropical dry forest** covers most of the Guánica Legacy Area (82.84%). It is also represented in La Plata-Coamo Legacy Area (27.32%) and, to a lesser extent, in the Maricao Legacy Area (0.79%). This is the driest of the six life zones in Puerto Rico, covering ample areas in the south region of the main island, the coasts of Fajardo and Ceiba, as well as the Vieques, Culebra, Mona, and Desecheo islands.

A variety of special adaptations of plants and animals can be observed in the dry forests. Historically this life zone, which is in coastal areas, has been preferred for human settlements and other activities, such as tourism and agriculture. Fires, introduced species, firewood collection and imperviousness of soils are some of the stressors in this life zone. According to Miller & Lugo (2008), the Guánica Forest is one of the premier examples of a Neotropical subtropical dry forest ecosystem in the Caribbean. This forest, although not structurally tall, is quite dense. There are many more bird species present in the Guánica Forest than in the montane rain forests, which provides an extraordinary opportunity for birdwatching and other outdoor recreation activities.

- **The subtropical moist forest** occupies the largest territorial extension in Puerto Rico. This life zone is represented, to a greater or lesser extent, in all the FLAs. Most of this zone has been deforested during different periods of time for conventional agricultural activities (e.g., sugarcane, pineapples, and tobacco) and urban developments. Today, pastures form one of the dominant landscapes uses in this zone. Apart from the regions of serpentine and limestone derived soils, most of this life zone remains in some form of non-forest use ((Miller & Lugo, 2008).

⁷ Most of this section was prepared based on the descriptions of Miller & Lugo, 2008.

The northern karst region contains Puerto Rico's largest continuous expanse of mature forest, known as the karst belt, which represents some of the least disturbed karst habitats remaining in the Caribbean (Lugo et al., 2001). Most of the karst belt (135,820 ha or 95%) is in the moist forest life zone (6,660 hectare are in the subtropical wet forest). Large portions of the karst belt are over 85% forested (Lugo et al., 2001).

The northern limestone region harbors more than 1,300 species of plants and animals, including federally and Commonwealth listed species, and Neotropical migratory birds (Miller & Lugo, 2008). There are four State Forests in the northern karst region: Cambalache, Bosque de Vega, Guajataca, and Río Abajo.

The rest of the moist forest, including the northern karst, experience considerable pressures related to the construction of roads and its accompanying accessibility for future development. In effect, the Río Abajo State Forest was fragmented with the construction of highway PR-10.

In this zone, in southwestern Puerto Rico, serpentine-derived soils result in an interesting plant association with unique vegetation, which contains several endemic species. This can be represented in the Susúa Commonwealth Forest. The serpentine-derived soils do not support any significant agriculture or commercial forestry (Miller & Lugo, 2008). Although mangroves can be found in this zone and in the subtropical dry forest zone, they appear to grow taller in this zone. This zone also houses remnants of alluvial swamp forest, represented by the *Pterocarpus* swamps. These remain near the municipality of Dorado, in Humacao and in La Boquilla, north of Mayagüez.

- **The subtropical wet forest** occupies much of the higher parts of Puerto Rico's mountains and exhibits distinguishing features including high species diversity (Miller & Lugo, 2008). This is a high rainfall life zone, encompassing areas with mean annual precipitation within the approximate range of 2,000 to 4,000 mm (78 to 156 inches) per year. Abundant moisture in this life zone is evident in the characteristics of the vegetation. Epiphytic ferns, bromeliads, and orchids are common, the forests are relatively rich in species and the growth rates of successional trees are rapid.

This zone is represented in the Maricao (53.68%), Caonillas-Dos Bocas (43.43%), El Yunque (29.51%), Río Grande-Loíza FLAs (21.07%) and, to a lesser extent, in the rest of the FLA's, except Guánica FLA.

Mature forest remnants in this life zone are found in the Carite State Forest, the Toro Negro State Forest and in El Yunque National Forest. Serpentine areas are also found in this zone; however, the vegetation is greener, denser, lusher and contains more epiphytes than the subtropical moist forest. The Maricao Commonwealth Forest is a representation of this association (Miller & Lugo, 2008).

Much of this zone is covered by successional vegetation, and particularly the western portion of the island is still covered by coffee plantations. Sugarcane was also grown but, grazing is the dominant practice. This zone provides an important source of runoff that supplies water to the drier coastal areas. From a planning perspective, land uses and forest manipulations in this zone may have important effects on downstream water yield and water quality (Miller & Lugo, 2008).

- **The subtropical rain forest** is the wettest of the subtropical life zones, occurring only on the windward faces of the Luquillo Mountains. It is represented in El Yunque FLA (3.41%), specifically inside El Yunque National Forest. This life zone is characterized by a superabundance of precipitation, with an annual total of 3,400 mm (130 inches) of runoff.

For the most part, the species here are the same as those found in the surrounding subtropical wet forest; although it is characterized by the abundance of epiphytes and the presence of sierra palms (Miller & Lugo, 2008). This zone is important for scientific, recreational and water and conservation purposes. For example, the Baño de Oro recreational area, much of which lies in this life zone, is a unique example of the mature vegetation of subtropical rain forest that receives long-term protection, while still being readily accessible.

- **The subtropical lower montane wet forest** occurs in both the eastern and central parts of the island and is represented in El Yunque FLA (10.65%) the Maricao (3.63%), Caonillas-Dos Bocas (3.41%) and, to a lesser extent, in the Río Grande de Loíza FLA (0.06%).

This forest is restricted to ridges and peaks above 750 meters (2,461 feet) and covers about two percent (2%) of the Luquillo Mountains. The Palo Colorado Forest, in El Yunque National Forest is an example of the zone's mature vegetation. These trees, especially the hollow trunks of the older individuals are the main nesting sites for the critically endangered Puerto Rican parrot. This zone is

important for its cloud forest⁸ also known as the elfin woodland or dwarf forest. The elfin forest is unique due to the high level of endemism⁹, and it depends on the continual cloud cover. This forest is highly susceptible to relatively small changes in cloud base height as this can have a drastic impact on the flora and fauna of the area, which lives in near constant cloud immersion (Morales, Walz & Bucher, 2018).

Human uses such as urbanization or conventional agriculture are not a direct threat to this life zone, due to the high rainfall (Miller & Lugo, 2008). However Waide and collaborators (2013) found that climate is changing in the Luquillo Mountains: precipitation is decreasing slowly, and annual maximum and minimum temperatures are increasing slowly (Waide et al., 2013). These climatic conditions may be affected by accelerating urbanization around the Luquillo Mountains.

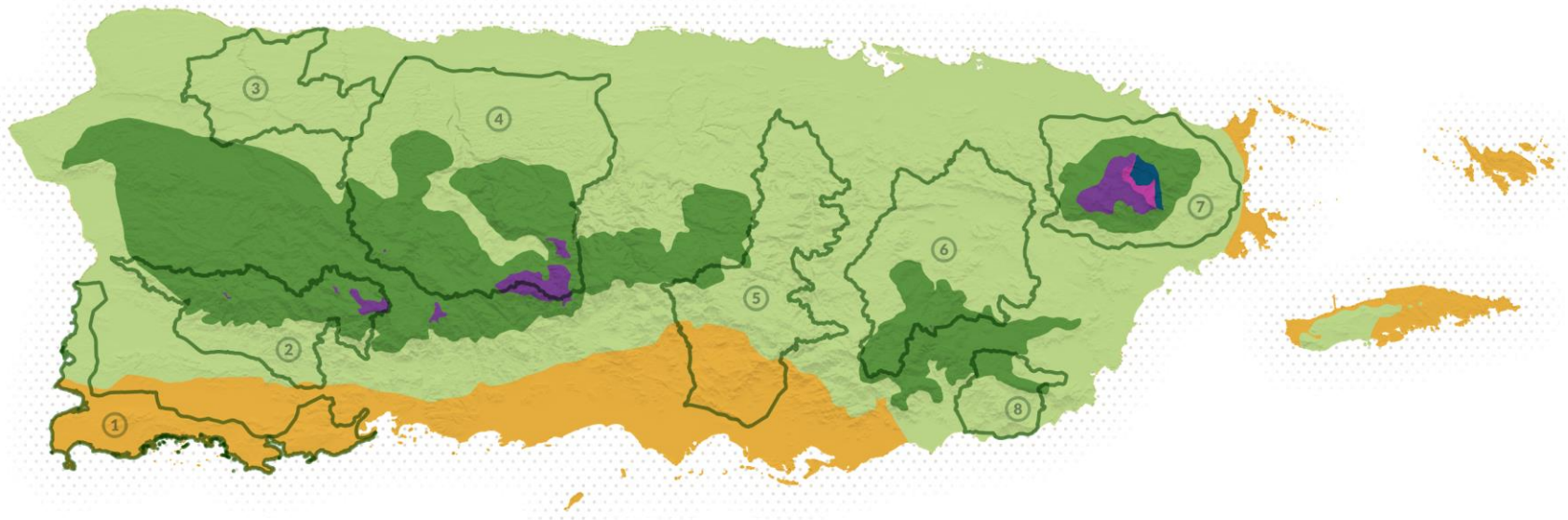
- **The subtropical lower montane rain forest** is found only in the Luquillo Mountains, inside El Yunque Legacy Area (2.76%). It is the smallest of the life zones in Puerto Rico, and it is subject to strong winds and extensive exposure to clouds. This life zone is almost covered by the elfin cloud forest. Although its vegetation is very similar to that of the lower montane wet forest life zone, previously described, it has a greater abundance of epiphytes, palms, and tree ferns (Miller & Lugo, 2008).

This unique life zone in Puerto Rico is highly susceptible to climatic variations as previously described for the subtropical lower montane wet forest.

⁸ The elfin, *sierra de palma*, and palo colorado forests are all cloud forests.

⁹ For example, The Elfin woods warbler (*Dendroica angelae*) is a bird species that is endemic to this association in Puerto Rico, which is also habitat for a rare species of tree frogs (Miller & Lugo, 2008).

Map 3. Ecological Life Zones and FLA



- | | | |
|---|--|--|
| Lower Montane Rain Forest/
Pluvial montano bajo subtropical | Subtropical Dry Forest/
Seco subtropical | Subtropical Rain Forest/
Pluvial subtropical |
| Lower Montane Wet Forest/
Muy húmedo montano bajo subtropical | Subtropical Moist Forest/
Húmedo subtropical | Subtropical Wet Forest/
Muy húmedo subtropical |

Source: The Ecological Life Zones of Puerto Rico, J.J. Ewel & J.L. Whitmore, 1973. Map prepared by Estudios Técnicos, Inc.

Table 2. Ecological Life Zones (Area in acres and percentage)

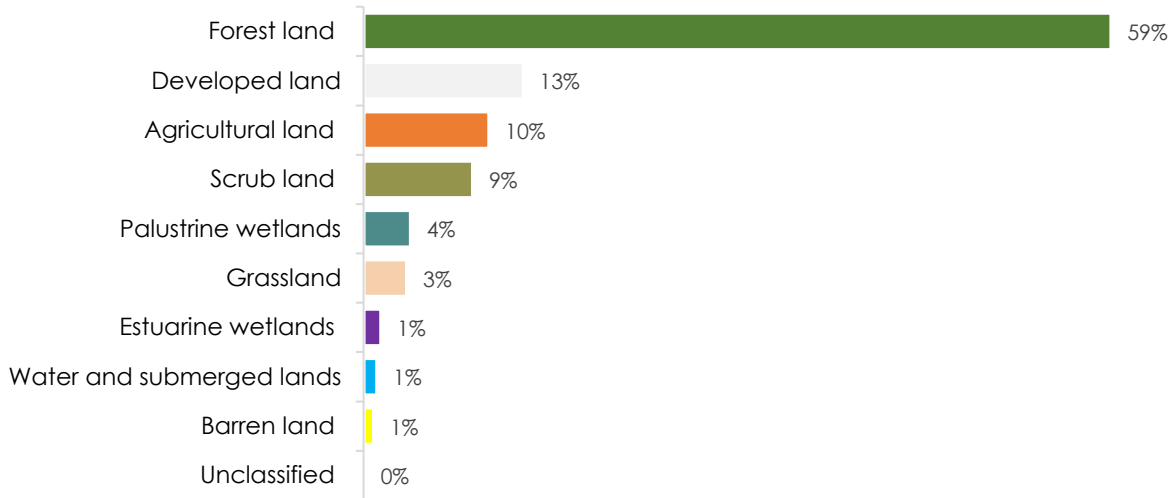
	Forest Legacy Area	Lower Montane Rain Forest	Lower Montane Wet Forest	Subtropical Dry Forest	Subtropical Moist Forest	Subtropical Rain Forest	Subtropical Wet Forest	Total
1	Guánica Legacy Area			58,178 82.84%	12,049 17.16%			70,227 100.0%
2	Maricao Legacy Area		3,030 3.63%	658 0.79%	35,034 41.91%	0.00%	44,870 53.68%	83,592 100.0%
3	Quebradillas Legacy Area				67,247 99.51%		333 0.49%	67,580 100.0%
4	Caonillas-Dos Bocas Legacy Area		8,302 3.41%		129,543 53.16%		105,820 43.43%	243,665 100.0%
5	La Plata-Coamo Legacy Area			35,886 27.32%	92,588 70.49%		2,875 2.19%	131,350 100.0%
6	Río Grande de Loíza Legacy Area		77 0.06%		99,812 78.87%		26,666 21.07%	126,555 100.0%
7	El Yunque Legacy Area	2,860 2.76%	11,050 10.65%		55,700 53.68%	3,535 3.41%	30,626 29.51%	103,771 100.0%
8	Maunabo Legacy Area				23,601 78.60%		6,424 21.40%	30,025 100.0%

Source: The Ecological Life Zones of Puerto Rico, J.J. Ewel & J.L. Whitmore, 1973. Estimates of acres and percentages prepared by Estudios Técnicos, Inc.

3.2 LAND COVER

Land cover 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, respectively, according to the NOAA's Coastal Change Analysis Program (CCAP, 2017).

Figure 1. Land cover in Puerto Rico

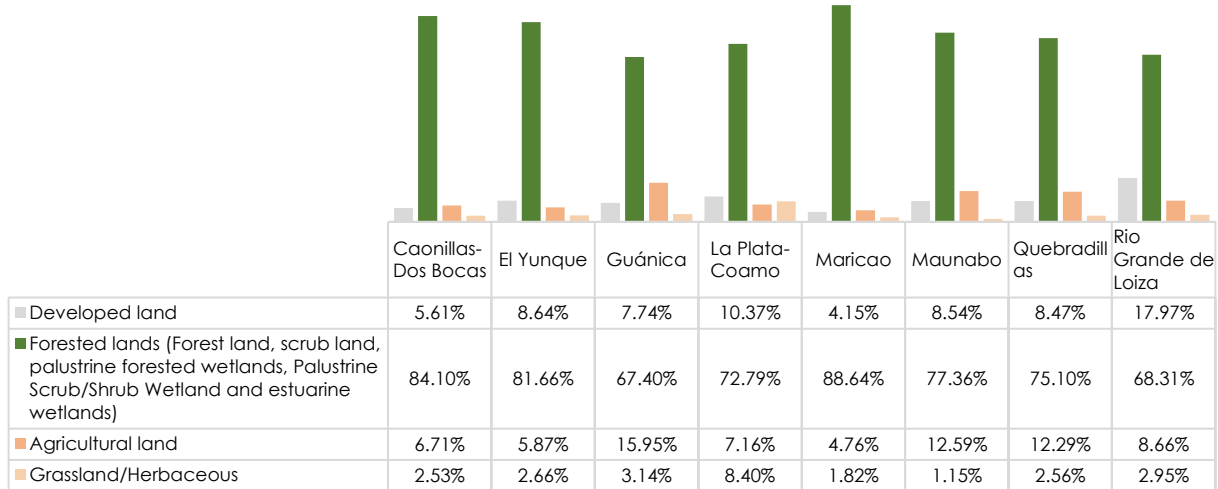


Source: Office for Coastal Management, 2021: C-CAP Land Cover, Puerto Rico, 2010. <https://www.fisheries.noaa.gov/inport/item/48301>. Estimates by Estudios Técnicos, Inc.

Forest land is fragmented by main roads in many areas, such as PR-2, PR-52, PR-1, PR-30 and PR-111, for example. Map 4 shows that the forest land cover occupies almost all the FLAs. However, in the Río Grande de Loíza FLA the developed land classification stands out, covering almost 18% of the FLA. Map 4 shows an extensive developed area that corresponds to the urbanization in the Caguas Valley and the PR-30 highway corridor in the Río Grande de Loíza FLA. For the past decades, this valley had the most significant urban expansion outside coastal municipalities (DNER, 2009; Municipality of Caguas, 2016).

Another land cover that stands out is the pasture-hay inside and north of the Guánica FLA, and in the north and south parts of the Quebradillas FLA. Some of the main land cover classes are represented in the following figure per FLA.

Figure 2. Land cover per FLA



Source: Office for Coastal Management, 2021: C-CAP Land Cover, Puerto Rico, 2010, <https://www.fisheries.noaa.gov/inport/item/48301>. Estimates by Estudios Técnicos, Inc

3.2.1 Forest cover

Forest land, scrub land, palustrine wetlands, and estuarine wetlands account for 73% of Puerto Rico's land cover.

- **Forest land**, which is the main cover (59%), is composed of mixed forest in areas dominated by trees generally 5 meters (16 feet) tall, and greater than 20% of total vegetation cover. In this class, neither deciduous nor evergreen species are greater than 75% of total tree cover. Forest land (mixed forest) is the primary land cover in all FLAs.
- **Scrub lands** (9%) contains areas dominated by shrubs less than 5 meters (16 feet) tall with shrub canopy typically greater than 20% of total vegetation. This class includes tree shrubs, young trees in an early successional stage, or trees stunted from environmental conditions.
- **Palustrine wetlands** include palustrine forested wetlands and palustrine scrub/shrub wetland.¹⁰ Both account for 4% of the island's forest cover. The palustrine forested wetlands include tidal and non-tidal wetlands dominated by woody vegetation greater than or equal to 5 meters (16 feet) in height. The

¹⁰ The Palustrine Emergent Wetland was not considered as part of the forest cover discussed in this section, but values are included in the following table.

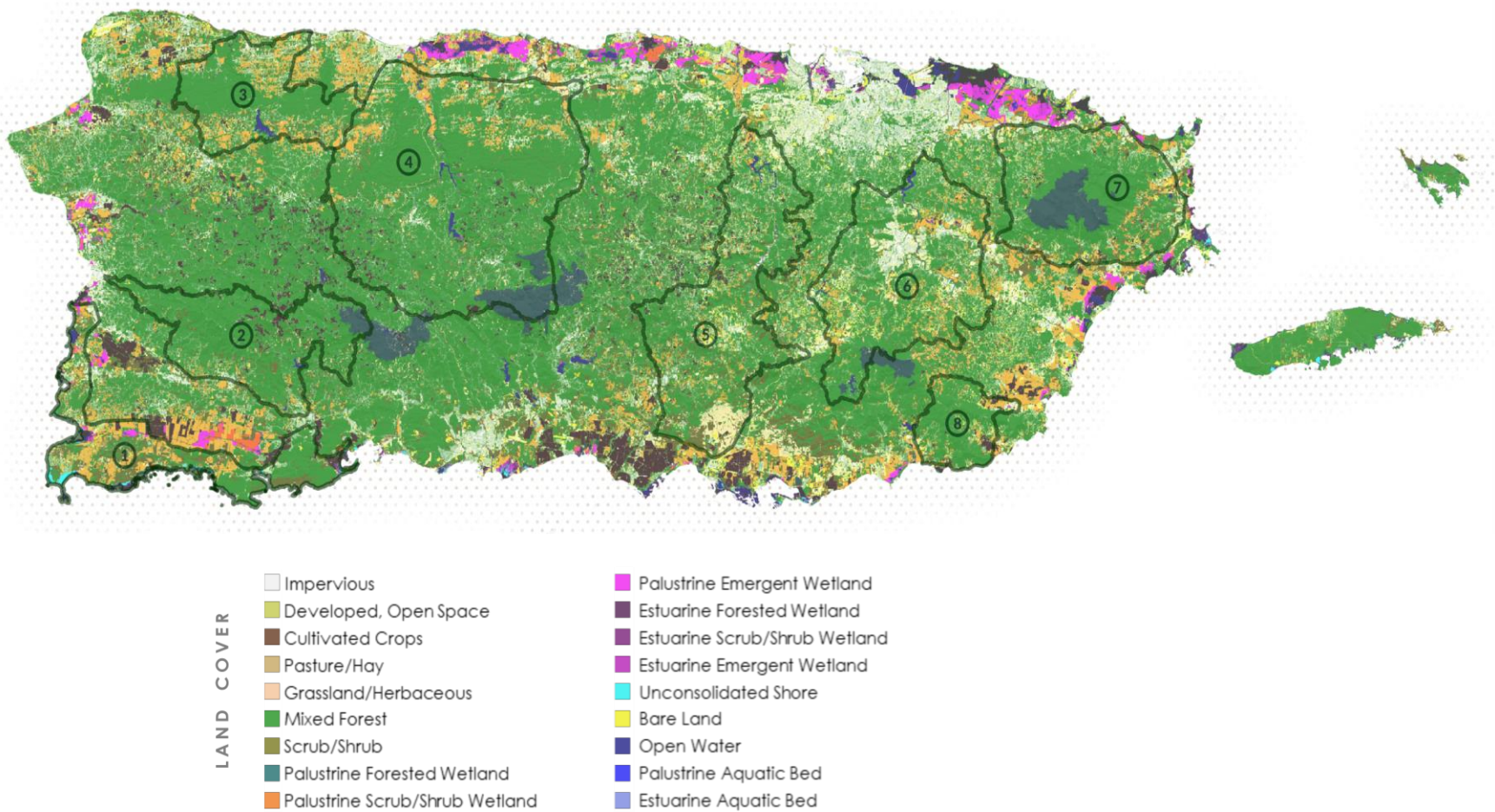
palustrine scrub/shrub wetland includes tidal and non-tidal wetlands dominated by woody vegetation less than 5 meters (16 feet) in height. Species present could be shrubs, young trees and shrubs or trees that are small or stunted due to environmental conditions.

A palustrine coastal wetland of particular interest in Puerto Rico is the blood wood forest (*Pterocarpus officinalis*). The largest of the remaining bloodwood forests in Puerto Rico is in the coast of Humacao, protected as a Nature Reserve. Other remnants are in Humacao, Dorado, Mayagüez, and much smaller stands in other areas of Puerto Rico. Other palustrine forested wetland types include the cloud forest, colorado forest, and palm forest on the high mountain slopes (USGS, 1996). Palustrine forested wetlands are found in El Yunque FLA and as a belt or corridor between the south of Caonillas-Dos Bocas and northeast of Maricao FLA.

- **Estuarine wetlands** represent 1% of the island's land cover. These are constituted by estuarine forested wetlands and estuarine scrub/schrub wetlands, each with total vegetation coverage greater than 20%. The estuarine forested wetlands include tidal wetlands dominated by woody vegetation greater than or equal to 5 meters (16 feet) in height, occurring in tidal areas with salinity equal to or greater than 0.5%. The estuarine scrub/schrub wetlands include tidal wetlands dominated by woody vegetation less than 5 meters (16 feet) in height, and wetlands in tidal areas with salinity equal to or greater than 0.5%.

The most extensive estuarine wetlands in Puerto Rico are the mangrove forests (forested or scrub-shrub wetlands) in which red, black, and white mangrove and buttonwood predominate (USFGS, 1996). The largest mangrove stand in Puerto Rico is in the municipality of Loíza, most protected under the Piñones State Forest-Nature Reserve. There are other important mangrove areas in the east, west and south coast. Mangrove forests along the southern coast are subject to drier climatic conditions, generally in association with salt flats (USGS, 1996).

Map 4. Land Cover in Puerto Rico and FLAs



Source: C-CAP Land Cover, Puerto Rico, Department of Commerce (DOC), NOAA, NOS, OCM. 2010. Map prepared by Estudios Técnicos, Inc.

Table 3. Land Cover Classes

Land Cover classes		Description	Area		
			Square miles (mi ²)	Square kilometers (km ²)	%
Developed land	2 Impervious	Anthropogenic features such as buildings, parking lots, and roads developed from concrete, asphalt or other construction material that does not allow infiltration from precipitation.	321	831	9.4%
	5 Developed, Open space	Contains areas with a mixture of some constructed materials, but mostly managed grasses or low-lying vegetation planted in developed areas for recreation, erosion control, or aesthetic purposes. These areas are maintained by human activity such as fertilization and irrigation, are distinguished by enhanced biomass productivity, and can be recognized through vegetative indices based on spectral characteristics. Constructed surfaces account for less than 20% of total land cover.	109	282	3.2%
Agricultural land	6 Cultivated crops	Contains intensively managed areas to produce annual crops. Crop vegetation accounts for more than 20% of total vegetation. This class also includes all land being actively tilled.	111	287	3.2%
	7 Pasture/Hay	Contains areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle and not tilled. Pasture / hay vegetation accounts for more than 20% of total vegetation.	226	585	6.6%
Grassland	8 Grassland	Contains areas dominated by graminoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling but can be utilized for grazing.	117	303	3.4%
Forest land	11 Mixed forest	Contains areas dominated by trees generally greater than 5 meters (16 feet) tall, and greater than 20% of total vegetation cover. <i>Both coniferous and broad-leaved evergreens are included in this category.</i>	2,008	5,201	58.6%
Scrub land	12 Scrub/shrub	Contains areas dominated by shrubs less than 5 meters (16 feet) tall with shrub canopy typically greater than 20% of total vegetation. This class includes tree shrubs, young trees in an early successional stage, or trees stunted from environmental conditions.	294	761	8.6%
Palustrine	13 Palustrine Forested	Includes tidal and non-tidal wetlands dominated by woody	79	205	2.3%

Land Cover classes		Description	Area		
			Square miles (mi ²)	Square kilometers (km ²)	%
wetlands		Wetland			
	14	Palustrine Scrub/Shrub Wetland	13	34	0.4%
	15	Palustrine Emergent Wetland	35	91	1.0%
Estuarine wetlands	16	Estuarine forested wetland	30	78	0.9%
	17	Estuarine scrub/schrub wetland	8	21	0.2%
	18	Estuarine emergent wetland	9	23	0.3%
Barren land	19	Unconsolidated shore	6	15	0.2%

Land Cover classes	Description	Area		
		Square miles (mi ²)	Square kilometers (km ²)	%
	conditions are favorable.			
20 Barren land	Contains areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earth material. Generally, vegetation accounts for less than 10% of total cover.	22	57	0.6%
21 Open water	Includes areas of open water, generally with less than 25% cover of vegetation or soil.	36	93	1.1%
22 Palustrine aquatic bed	Includes tidal and nontidal wetlands and deepwater habitats in which salinity due to ocean-derived salts is below 0.5% and which are dominated by plants that grow and form a continuous cover principally on or at the surface of the water. These include algal mats, detached floating mats, and rooted vascular plant assemblages. Total vegetation cover is greater than 80%.	0	0	0.0%
23 Estuarine aquatic bed	Includes tidal wetlands and deepwater habitats in which salinity due to ocean-derived salts is equal to or greater than 0.5% and which are dominated by plants that grow and form a continuous cover principally on or at the surface of the water. These include algal mats, kelp beds, and rooted vascular plant assemblages. Total vegetation cover is greater than 80%.	0	0	0.0%
Unclassified	Background	3	8	0.1%
	Unclassified			0.0%
Total		3,425		100.0%

Source: Office for Coastal Management, 2021: C-CAP Land Cover, Puerto Rico, 2010, <https://www.fisheries.noaa.gov/inport/item/48301>. Areas were estimated by Estudios Técnicos, Inc.

3.3 A BRIEF HISTORY OF PUERTO RICO'S FOREST COVER

In Puerto Rico, forest cover has varied greatly over the past centuries. At the end of the 15th century, forests were the dominant vegetation on the island. Of the total 890,000 hectares, about 850,000 ha (95%) were forest (Wadsworth, 1950 as cited in the AON, 2000). In subsequent centuries, the forest cover was gradually reduced by the increase in the use of wood by European settlers and by agricultural practices, which were mostly subsistence. In 1828 there were 587,000 ha in forest use and by 1899 it had been reduced to 182,000 ha (20% of the island) (Wadsworth, 1950).

The introduction of sun-grown coffee (*Coffea arabica*) cultivation in 1736, and other monocultures required the clearing of steeper slopes into the then heavily forested mountains. Production of coffee increased rapidly after 1755 and soon became an important product to be exported. By 1899 more than three quarters of Puerto Rico had been deforested, and forest cover reduced to 182,000 ha. Pasture accounted for about 490,000 ha and coffee production occupied 77,000 ha (Wadsworth, 1950).

Coastal forests have also been impacted by agriculture, especially sugar cane monoculture. This not only led to land clearing but also to hydromodifications that altered the vegetation cover and species composition. A significant decline in mangrove forests has been documented due to conventional agricultural activities (1800–1940) and later between the 1960s and 1970s due to urban expansion (Martinuzzi, Gould, Lugo & Medina, E. 2009). During the past decades, mangrove forests experienced an increase in area while palustrine forests, such as *Pterocarpus* forests, have been reduced and fragmented, leaving only a few remnants across the island (Martinuzzi, Gould, Lugo & Medina, E. 2009; Feagin, Toledo-Rodríguez, Colón-Rivera, Smeins, & Lopez, 2013).



In the early part of the 20th century, much of the *Pterocarpus* forests were eliminated to allow sugarcane production.

Zimmerman et al. 2007

Early in the 20th century, forests covered only about 20% of the island, but only one-third of forest land could yield wood products other than charcoal or fuelwood (Murphy, 1916 as cited in DNER, 2000). In that period, what was considered the most remote and marginally productive lands remained uncultivated. Additional pressure

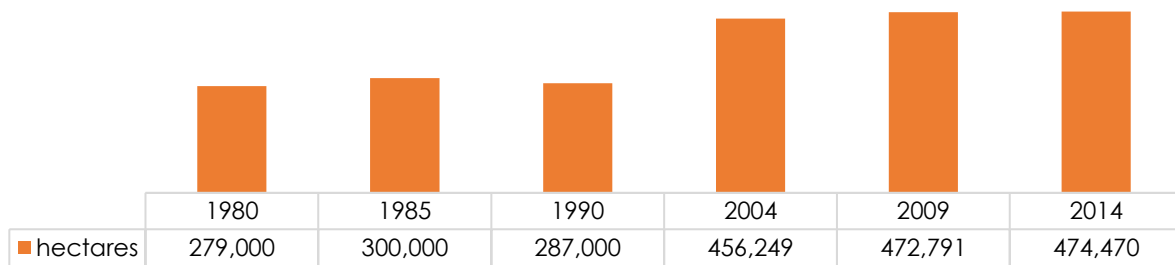
on land resources resulted from other reasons such as increasing population and expanding production of export crops. Fluctuating economic conditions was another factor, since people were forced to subsistence agriculture during periods of high unemployment, encroaching on the remaining lands in the interior (Birdsey and Weaver, 1982).

During the late 1940's the forest area declined to only 6% of the total land area of Puerto Rico. Cropland¹¹ and pasture each accounted for about 42%, with the remaining 10% in buildings, roads and wasteland (Koenig, 1953, as cited in Birdsey and Weaver, 1982). In that period, Puerto Rico became one of the most severely deforested and eroded regions in the world (Birdsey and Weaver, 1982).

In the mid-20th century, the island's industrialization efforts resulted in an exodus of population from the central mountains to the coastal plains. Most of the formerly cultivated lands were replaced by forests, urban/built-up, and pasture lands (Kennaway and Helmer, 2007).

Forest cover remained relatively constant between the 1980 and 1990 forest inventories, and then increased dramatically between the 1990 and 2004 inventories. In 1980, forest cover was 31.3%, and in 2004 was 52.8% (Marcano-Vega, 2017). The 2014 forest inventory assessment (FIA) documented a phase of forest cover steadiness in Puerto Rico since 2004. This inventory reported a forest area of 1,172,439 acres in 2014 (54.8%). Total forest cover on Vieques was estimated at 77.1% and Culebra 91.1% (Marcano-Vega, 2017).

Figure 3. Forest cover in Puerto Rico (2014 FIA)

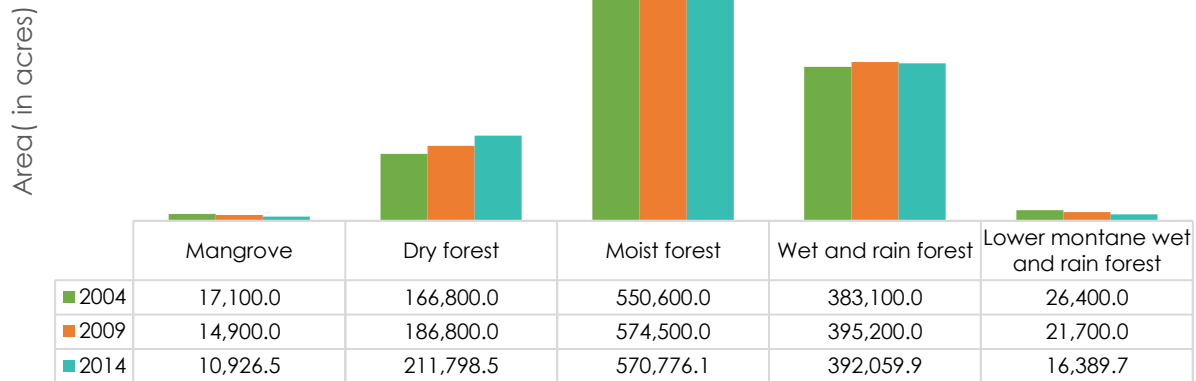


Source: Forest area of mainland Puerto Rico as measured by forest inventories in 1980, 1985, 1990, 2004, and 2009 (Brandeis and Turner 2013) as cited in DNER, 2016 and Marcano Vega, 2017.

¹¹ The category "cropland" included tree-covered coffee, some 8% of Puerto Rico then. (Wadsworth, as cited in DNER, 2000).

Even when forest cover steadiness is observed, there have been land use changes that included deforestation in some areas, while natural forest regeneration occurred in others (Marcano-Vega, 2017). For example, the 2014 FIA showed changes in the acreage of forest types that are representative of coastal forests. There is a minor increase in the dry forest area, but a reduction in the mangrove coverage.

Figure 4. Area of forest land/timberland per forest-type group/forest-types, Puerto Rico (2004, 2009 and 2014)



Source: Table 998.1—Area of forest land/timberland per forest-type group/forest-types, Puerto Rico (Mainland, Vieques, Culebra). Inventory years: 2003, 2009 and 2014.

The 2014 FIA found an increase in total net volume and total aboveground biomass in trees within dominant forest types, which is indicative of more mature stages of development within secondary forests (Marcano-Vega, 2017). However, this was collected prior to the occurrence of hurricanes Irma and María.

After the most recent FIA, Puerto Rico was impacted by two hurricanes in 2017, Irma and María, the latter being the worst natural disaster in Puerto Rico's recent history. Hurricane María, a category 4 hurricane on the Safir-Simpson scale, caused widespread disturbances across Puerto Rico. Rapid assessments made after the hurricane, demonstrated that 75% of significantly impacted wetlands were stressed mostly due to debris, tree defoliation, disease, damage, and changes in hydrology (COR3, 2018). It was estimated that between 23-31 million trees were killed or severely damaged (COR3, 2018).¹²



75% of wetlands that were significantly impacted by hurricane María were stressed mostly due to debris, tree defoliation, disease, damage, and changes in hydrology production.

COR3, 2018

A study published in 2019 by Uriarte, Thompson and Zimmerman compared data of tree damage collected in the same forest in Puerto Rico after three hurricanes: Hugo (1989, category 3), Georges (1998, category 3), and María (2017, category 4). The study concludes that "María killed twice as many trees as Hugo, and for all but two species, broke 2- to 12-fold more stems than the other two storms" (Uriarte, Thompson and Zimmerman, 2019).

Both hurricanes, Irma and María, reduced a quarter of the biomass contained in Puerto Rico's trees (Krajick, 2020; Hall et al 2020). The authors of the study concluded that storm-related rainfall, including soil water storage capacity, caused more forest damage than maximum wind speeds (Hall et al., 2020).

¹² "As of June 2018, approximately 25 assessments (of categories of assets, not individual sites) of damage to natural and cultural resources were completed for the recovery plan development process, and a few were still ongoing. The full effects of Hurricane María on natural resources will not be known for years to come" (COR3, 2018).

3.4 PROTECTED LANDS IN PUERTO RICO

Puerto Rico's land surface is approximately 8,934 square kilometers (km²) or 3,449 square miles (mi²) of which 16.1% is protected by the Commonwealth and federal governments, and local Non-Government Organizations (NGOs) (Castro-Prieto et al., 2019). There are 159 terrestrial protected areas in Puerto Rico, of which 90% are public and 10% are privately owned by NGOs¹³ or individuals (Castro-Prieto et al, 2019).

Commonwealth protected areas are Nature Reserves, state forests, wildlife refuges, natural corridors, and national parks, which are administered by the DNER. Federal protected natural areas include El Yunque National Forest and other lands owned by the USDA Forest Service (USFS), and five national wildlife refuges, administered by the US Fish and Wildlife Service (USFWS).

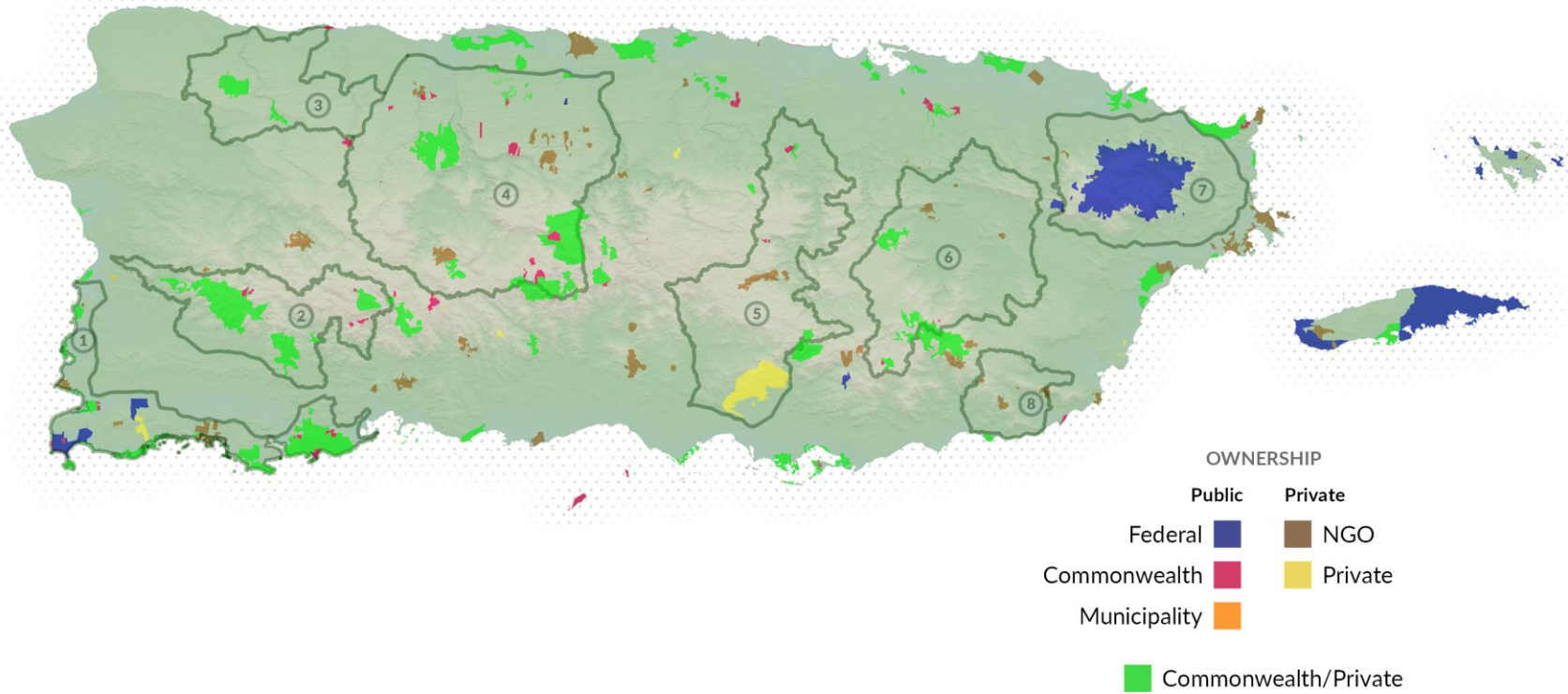
Not all protected lands are publicly owned. It is estimated that only 4% (357 square kilometers or 138 square miles) are owned by the DNER, USFS, USFWS, and private conservation NGOs (Castro-Prieto et al., 2019). The rest of the protected lands are either privately owned or are owned by public corporations such as the Puerto Rico Industrial Development Company, Lands Authority, the University of Puerto Rico, the Puerto Rico Electric Power Authority (PREPA), among other entities.

The following map shows the terrestrial protected areas in relation to the FLAs. The Guánica and El Yunque FLAs have almost a quarter of their territory protected. All the FLAs include protected natural areas, but many of these protected areas are located outside FLAs. These are mainly in coastal areas in the north and the east of the island. There is also a discontinuous corridor between the Río Grande de Loíza and Maunabo FLAs, comprised of the Carite State Forest and other protected areas. Overall, protected areas are scattered and fragmented not only in the FLA, but throughout the territory.



¹³ These NGO include: Para La Naturaleza, Casa Pueblo, Tropic Ventures, Ciudadanos del Karso and the Luis Muñoz Marín Foundation.

Map 5. Terrestrial Protected Natural Areas and FLA



Source: Protected Areas Conservation Action Team. 2018. Puerto Rico Protected Areas Database [version of December 2018]. GIS data. San Juan, PR. Map prepared by Estudios Técnicos, Inc.

Table 4. Protected areas in each FLA

	Forest Legacy Area	Area in square meters (m²)	Area in acres	Percentage	PNA in each FLA
1	Guánica	78,615,057	19,426	27.5 %	<ul style="list-style-type: none"> • Commonwealth: Boquerón State Forest, Guánica State Forest, Cabo Rojo Wildlife Refuge, Finca Belvedere Nature Reserve, La Parguera Nature Reserve, Laguna de Joyuda Nature Reserve, Five FLP acquisitions • Federal: Cabo Rojo National Wildlife Refuge, Laguna Cartagena National Wildlife Refuge • NGO: Punta Guaniquilla Nature Reserve, María Luisa Conservation Easement, and other PNA
2	Maricao	63,037,826	15,577	18.6 %	<ul style="list-style-type: none"> • Commonwealth: Maricao State Forest, Monte Guilarte State Forest, Susúa State Forest, Lago Lucchetti Wildlife Refuge and three FLP acquisitions
3	Quebradillas	12,445,993	3,075	4.6 %	<ul style="list-style-type: none"> • Commonwealth: Guajataca State Forest, Lago Guajataca Wildlife Refuge and Finca Nolla
4	Caonillas-Dos Bocas	98,993,014	24,462	10.0 %	<ul style="list-style-type: none"> • Commonwealth: Cambalache State Forest, Río Abajo State Forest, Toro Negro State Forest, Tres Picachos State Forest, Río Camuy Cave System National Park, nine FLP acquisitions, Río Cialitos Nature Reserve, Parque Ceremonial Indígena de Caguana • Federal: Manatí Research Area • NGO: Hacienda Pellejas PNA, Río Encantado PNA, Bosque del Pueblo de Adjuntas, El Tallonal, Finca G. Llinás & Co., Finca José Santiago, Mata de Plátano Field Station, Finca Ledesma Moulter Conservation Easement
5	La Plata-Coamo	41,357,226	10,220	7.8 %	<ul style="list-style-type: none"> • Commonwealth: Finca Vizcarrondo, La Plata Wildlife Refuge, Las Piedras del Collado Nature Reserve, Las Planadas – Yeyesa Nature Reserve • NGO: Cañón Las Bocas PNA, Cañón San Cristóbal PNA, Conservation Easement Centro Espíritu Santo, Conservation Easement Siembra Tres Vidas, Scenic Easement Montes Oscuros
6	Rio Grande de Loíza	20,579,996	5,085	4.0 %	<ul style="list-style-type: none"> • Commonwealth: Carite State Forest, Aguas Buenas Caves and Caverns System, Finca San Salvador Fase I, one FLP acquisition • NGO: Culebras PNA, Hacienda Lago PNA, Jorge Sotomayor del Toro PNA, Paraíso de Las Lunas PNA Quebrada Janer PNA, Río Bairoa PNA
7	El Yunque	113,913,872	28,149	27.1%	<ul style="list-style-type: none"> • Federal: El Yunque National Forest • NGO: La Pitahaya PNA, Shapiro PNA, Finca El Verde, Finca Guín Conservation Easement
8	Maunabo	3,066,072	758	2.5 %	<ul style="list-style-type: none"> • NGO: Marín Alto PNA, Río Jacoboa Sierra la Pandura
Total		432,009,057	06,751		

Source: Protected Areas Conservation Action Team. 2018. Puerto Rico Protected Areas Database [version of December 2018]. GIS data. San Juan, PR. Estimates prepared by Estudios Técnicos, Inc.

3.5 ADDITIONAL PLANNING MECHANISMS FOR LAND PROTECTION

Public and private lands in Puerto Rico are protected through other planning mechanisms in addition to the designation as a protected natural area. These are the Puerto Rico Land Use Plan (PRLUP) and the Karst Special Planning Area.

3.5.1 The Puerto Rico Land Use Plan

The PRLUP classifies the territory in three basic categories: urban, developable, and rustic land, from which other classifications are derived. The PRLUP classified 13.3% of the territory in Puerto Rico as urban land (294,213 acres), 0.77% as developable land (16,973 acres), of which 60.7% are programmed (10,303 acres) and 39.3% are non-programmed (6,669 acres). Likewise, it classified 20% as common rustic land (442,206 acres) and 60.1% as specially protected rustic land (1,339,939 acres)

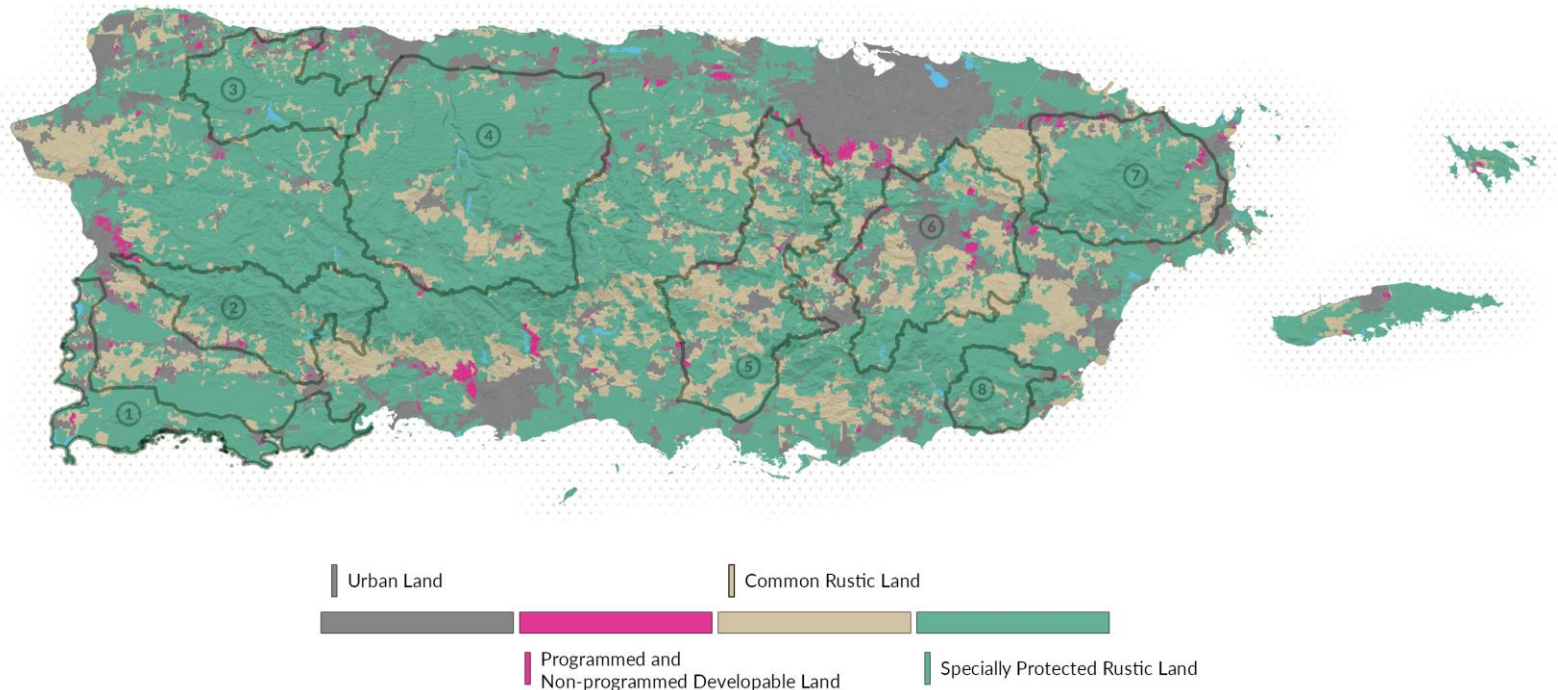
The land use classification most represented inside and outside the FLAs is the specially protected rustic land (67.4%). These are lands protected for their ecological, hydrological, aesthetic and/or agricultural values. However, these are mostly private lands. Therefore, strengthening their protection through acquisition continues to be necessary.

The common rustic lands are also of importance. For the past decades, most new development inquiries occurred in the "Common Rustic Land" (Martinuzzi et al 2007). This land use classification predominates in La Plata and Río Grande de Loíza FLAs.

The Río Grande de Loíza FLA draws attention as there is a wide extension of urban lands in its interior. Developable lands are scattered through the territory, mostly contiguous to urban lands. This land use classification is also found in the limits of some FLAs such as El Yunque and La Plata FLA.

The next map and table show the distribution of this classification throughout the forest legacy areas (FLAs).

Map 6. Land use classifications and Forest Legacy Areas



Source: Puerto Rico Planning Board, 2015. Puerto Rico Land Use Plan. Map prepared by Estudios Técnicos, Inc.

Table 5. Percentage of land use classifications per FLA

Forest Legacy Area	Urban lands	Developable lands	Rustic land	Specially protected rustic land
1 Guánica Legacy Area	9.0%	0.5%	11.3%	74.0%
2 Maricao Legacy Area	3.4%	0.6%	15.0%	77.6%
3 Quebradillas Legacy Area	5.7%	0.4%	13.7%	76.2%
4 Caonillas-Dos Bocas Legacy Area	4.2%	0.1%	10.8%	82.0%
5 La Plata-Coamo Legacy Area	9.1%	0.5%	38.2%	48.1%
6 Río Grande de Loíza Legacy Area	17.1%	1.2%	35.8%	38.4%
7 El Yunque Legacy Area	9.0%	1.0%	15.6%	70.4%
8 Maunabo Legacy Area	6.4%	0.0%	8.7%	82.3%
Total FLAs	7.9%	0.6%	19.9%	67.4%

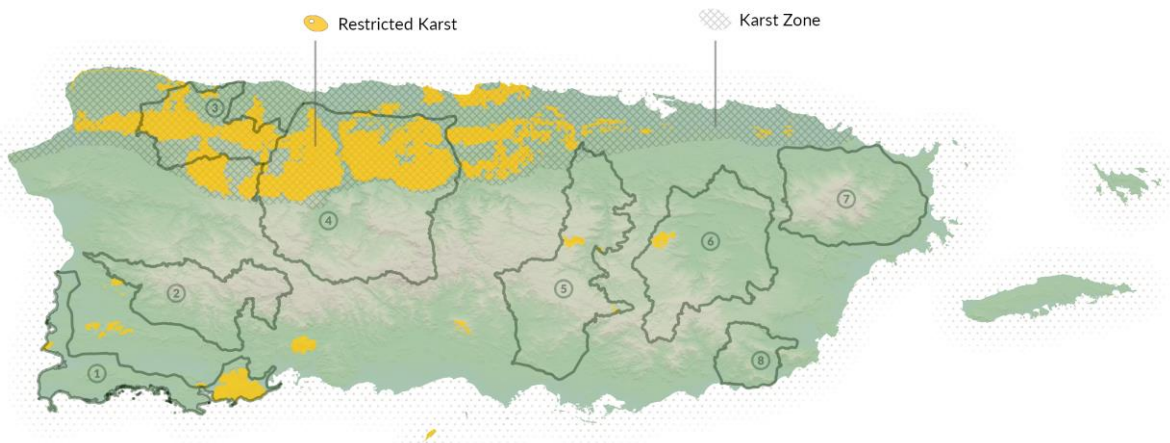
3.5.2 The Karst Special Planning Area

In June 2014, the Plan and Regulation for the Karst Special Planning Area (SPA) was approved.¹⁴ This SPA covers 236,138 acres where proper land use practices are promoted to protect forest and water resources in the region. This SPA includes the northern limestone region, which contains Puerto Rico's most extensive freshwater aquifer, largest continuous expanse of mature forest, and largest coastal wetland, estuary, and underground cave systems (Lugo et al., 2001).

The restricted karst is protected for its ecological, geological, and hydrological values, and covers public and private lands. It protects most of the karst belt and other disperse areas throughout Puerto Rico. The karst belt covers 142,544 ha or 65% of the northern limestone (Lugo et al., 2001). The karst belt is extremely diverse and unique due to its multiple landforms concentrated in a relatively small area. Karst forests contain the largest reported number of tree species per unit area in Puerto Rico (Lugo et al., 2001). The area provides habitat and refuge for many rare, threatened, endangered, and migratory species.

As shown in the following map, the restricted karst extends beyond the Quebradillas and the Caonillas-Dos Bocas FLAs. In the South coast it is inside the Guánica FLA and in disperse patches throughout the island.

Map 7. Karst Special Planning Area



Source: Puerto Rico Planning Board. Layers: Special Planning Area – Karst Restricted; Special Planning Area – Karst Zone. 2015. Map prepared by Estudios Técnicos, Inc.

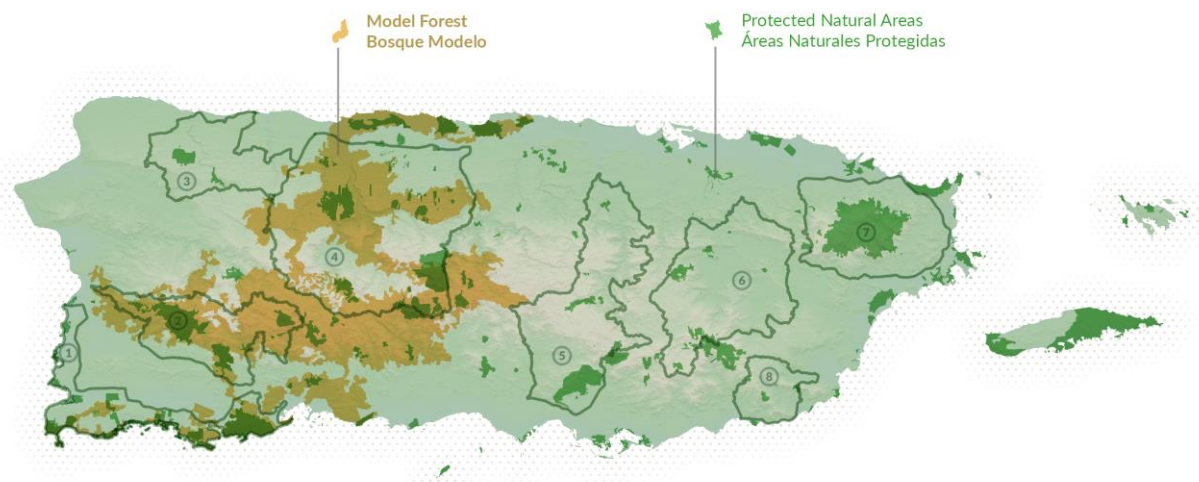
¹⁴ This plan and regulation were prepared by the DNER and the Puerto Rico Planning Board in compliance with the "Act for the Protection and Conservation of Puerto Rico's Karst Physiography (Law 292-1999)".

3.5.3 The Model Forest: a landscape approach to forest management

The Puerto Rico Model Forest was designated to protect and manage forested lands at a large scale by including the communities and economic activities within these lands (PRCWS, 2015). The Puerto Rico Model Forest is not a protected area but connects 26 protected natural areas. It covers 378,639 acres of public and private forested lands, across 17 municipalities, accounting for 17% of the Commonwealth's territory.

With the approval of the Puerto Rico Model Forest Act (Law No. 182 of 2014), these lands were identified as a priority for planning and sustainable development, and the role of citizens in landscape conservation was recognized. Voluntary conservation practices and the sustainable use of the landscape are to be promoted, such as sustainable tourism, education, and agriculture.

Map 8. Extension of the Puerto Rico Model Forest

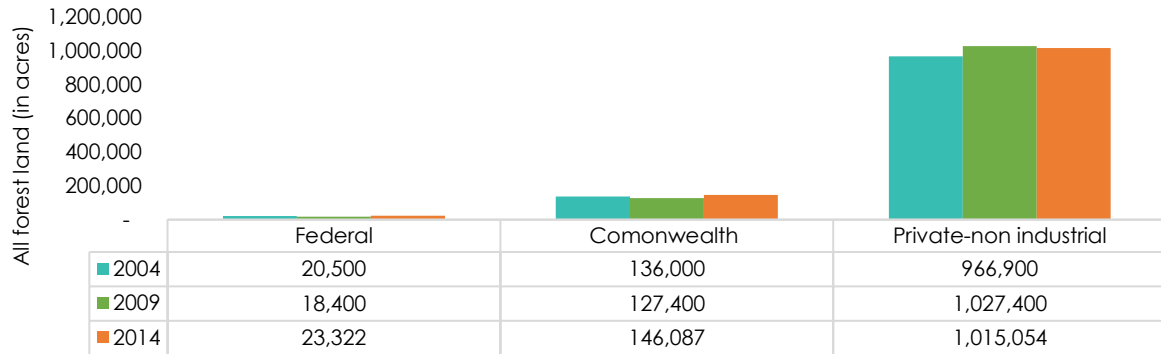


Source: Model Forest data taken from <https://gmtcorp.maps.arcgis.com/home/item.html?id=1ac2befc799a43d9b96f23165f6b61bd> Protected Areas Conservation Action Team. 2018. Puerto Rico Protected Areas Database [version of December 2018]. GIS data. San Juan, PR. Map prepared by Estudios Técnicos, Inc.

3.6 FOREST OWNERSHIP AND CONTROL

According to the 2014 FIA, most of the forested lands in Puerto Rico are under private ownership. Approximately 83% of forested lands in Puerto Rico, including Vieques and Culebra, are in private hands, the Commonwealth government has custody of about 13%, and federal agencies have custody of about 4% (Marcano-Vega, 2017).

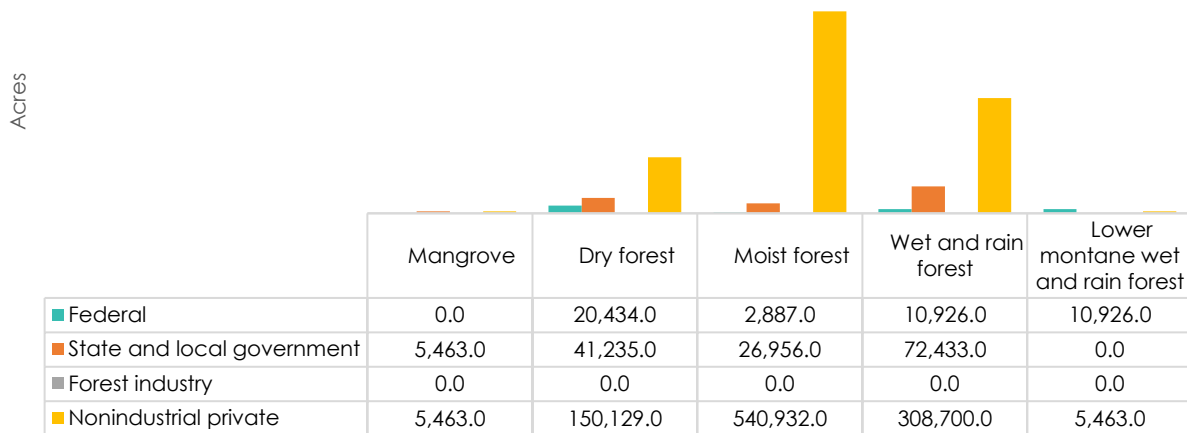
Figure 5. Area of forest land by ownership class and land status, Puerto Rico (Mainland, Vieques, Culebra), 2004, 2009 and 2014



Source: Table 2—Area of forest land by ownership class and land status. Forest Inventory years: 2003, 2009 and 2014. Marcano-Vega, Humfredo. (2017). Forests of Puerto Rico, 2014.

Marcano-Vega (2014) found that there are noticeable differences in the types of forest representativeness by tenure. For example, about 5% of the humid forest (10,909 ha out of a total of 230,985 forested ha) is managed by the Commonwealth through the DNER and other agencies. While 67% of the very humid / low montane rain forest area (4,422 ha of 6,633 ha forested) is owned by the federal government, as part of El Yunque National Forest.

Figure 6. Area of forest land by forest-type and ownership group, Puerto Rico, Vieques and Culebra, 2014



Source: Marcano-Vega, Humfredo. (2017). Forests of Puerto Rico, 2014.

4 RESOURCES AND BENEFITS

“Forest values and benefits” are defined in the FLP Guides (2017) as the “environmental, social, and economic purposes that benefit the public for which a tract is to be conserved in perpetuity by the FLP, such as scenic, cultural, recreation, historic, fish and wildlife habitat, rare and unique plant communities, water supply and quality, and production of timber and other forest products”.

Overall, Puerto Rico forests are a mix of native and non-native naturalized species, which together create novel plant and animal communities (DNER, 2015). These forests provide public benefits that include wildlife habitats, mitigate species extinctions, and provide ecosystem services such as soil stabilization, temperature regulation, nutrient transformation, and water and carbon cycling (Lugo, 2004 as cited in DNER, 2015).

4.1 FISH AND WILDLIFE HABITAT

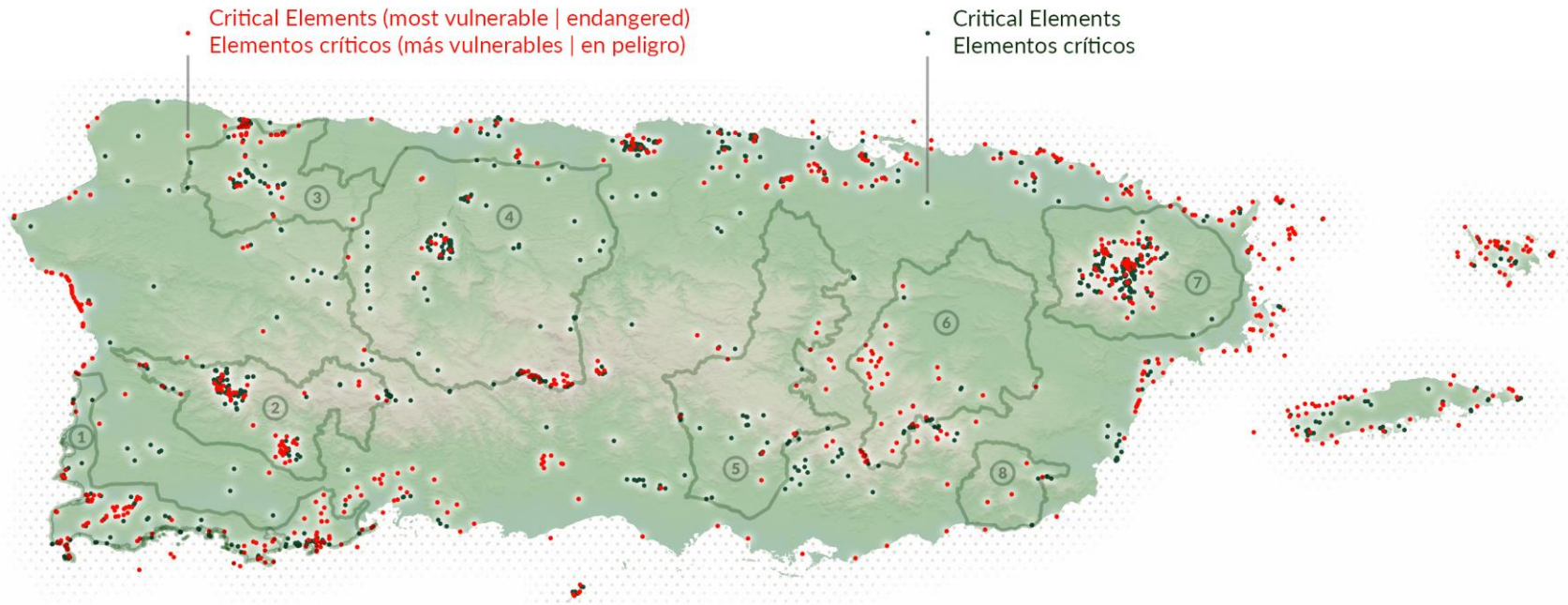
In Puerto Rico, over 3,100 plant species have been identified, of which 250 are endemic (Miller & Lugo, 2009). There are 436 species of fauna, of which 238 are birds, 57 reptiles, 27 mammals, and 24 amphibians (Gould, 2009).

The DNER identified 317 species of greatest conservation need subdivided into the following categories: 48 critically endangered (CR), 41 endangered (EN), 47 vulnerable (VU), 24 low risk (LR) and 156 data deficient (DD) (DNER, 2015).

The DNER maintains a database of species that are classified as critical elements either because of their vulnerability or because of their importance to Puerto Rican heritage and culture. The latter includes species that might be abundant, such as the common coquí (*Eleutherodactylus coqui*) or the ceiba tree (*Ceiba pentandra*), and other endemics, such as the Mona Island Gecko (*Sphaerodactylus monensis*) (DNER, 2015).

As shown in the next map, clusters of critical elements can be found inside the FLAs, especially in the Quebradillas FLA, Caonillas-Dos Bocas FLA, Guánica FLA, Río Grande de Loíza FLA and El Yunque FLA. Critical elements clusters can also be seen in coastal areas, outside FLAs boundaries.

Map 9. Critical Elements and FLA



Source: Department of Natural and Environmental Resources, Layer: Critical Elements 2008. Map prepared by Estudios Técnicos, Inc.

4.1.1 Designated terrestrial critical habitats

In Puerto Rico, there are seven critical habitats for terrestrial species designated either by Commonwealth or federal laws, and 19 proposed critical habitats. The habitat of five (5) species of greatest conservation need has been designated as "essential critical natural habitat", according to the DNER's Regulation No. 6766. At the federal level, "critical habitat" has been designated for seven (7) terrestrial species in Puerto Rico. The following table and map show designated and proposed terrestrial critical habitats in Puerto Rico, according to the Commonwealth and federal statutes.

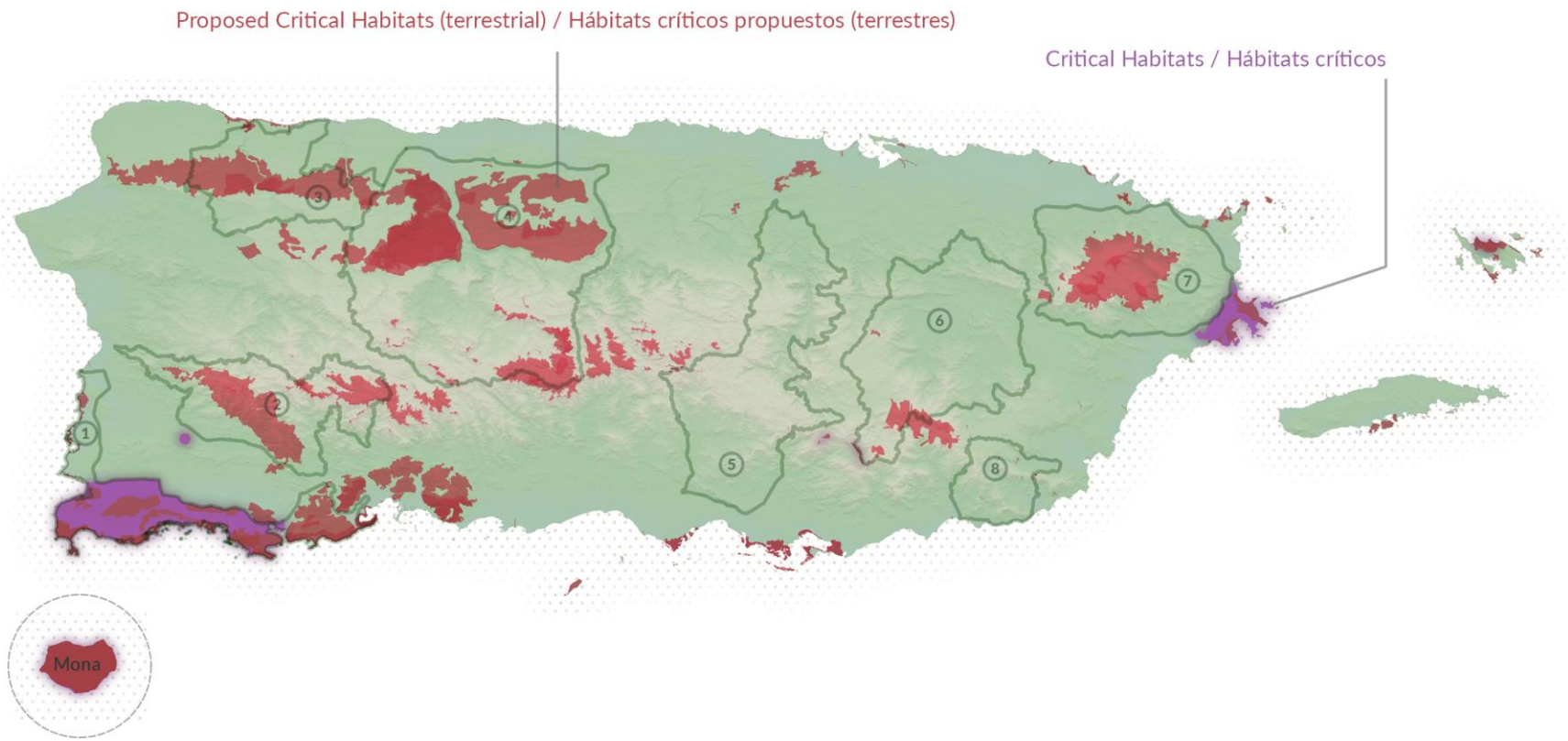
Table 6. Designated and proposed terrestrial critical habitats in Puerto Rico

	Species	Location	Commonwealth	Federal	Represented in FLA
Designated critical habitats					
1	<i>Eleutherodactylus jasperi</i> (Golden coqui)	Areas in Cayey	X	X	YES
2	<i>Anolis roosevelti</i> (Culebra Island Giant Anole)	Areas in Culebra Island	X	X	NO
3	<i>Cyclura cornuta stejnegeri</i> (Mona Ground Iguana)	Mona Island	X	X	NO
4	<i>Epicrates monensis</i> (Mona Boa)	Mona Island	X	X	NO
5	<i>Angelaius xanthomus</i> (Yellow Sholdered Blackbird)	Mona Island and areas in the municipalities of Cabo Rojo, Lajas, Guánica, San Germán and Ceiba.	X	X	YES
6	<i>Sphaerodactylus micropithecus</i> (Salamanquita de Monito)	Monito Island		X	NO
7	<i>Eleutherodactylus cooki</i> (Coquí guajón)	Areas in the municipalities of Humacao, Juncos, Las Piedras, Maunabo, Patillas, San Lorenzo and Yabucoa		X	YES
Proposed critical habitats					
1	<i>Adiantum vivesii</i> (Puerto Rico Maidenhair)	Quebradillas	X		YES
2	<i>Anolis cooki</i> (Cook's Anole)	Caja de Muertos Complex, Ponce, Salinas Guayama, Juana Díaz, Santa Isabel, Cabo Rojo	X		YES
3	<i>Antrostomus noctitherus</i> (Puerto Rican Nightjar)	Punta Verraco, Cerro Toro and Punta Ventana, Guayanilla, Guánica, Susúa State Forest and Adjacent Lands	X		YES
4	<i>Atlantea tulita</i> (Puerto Rican Harlequin Butterfly)	Areas in Isabela, Quebradillas and Camuy	X		YES
5	<i>Averodendron pauciflorum</i> (Turtlefat)	Areas in Isabela, North Karst Zone	X		YES

	Species	Location	Commonwealth	Federal	Represented in FLA
6	<i>Buteo platyperus</i> (Broad-winged Hawk)	Areas in Quebradillas, Arcibo, Luquillo, Cayey, Lajas, Maricao	X		YES
7	<i>Cyclura cornuta stejnegeri</i> (Mona Island Ground Iguana)	Mona Island	X		NO
8	<i>Chilabothrus monensis granti</i> (Mona Island Boa)	Areas in Luquillo, Fajardo, Culebra, Río Grande	X		NO
9	<i>Daphnopsis helleriana</i> (Heller's cieneguillo)	Areas in Quebradillas, Isabela, Toa Baja	X		YES
10	<i>Eleutherodactylus cooki</i> (Coquí Guajón)	Areas in Humacao, Juncos, Las Piedras, Maunabo, Patillas, San Lorenzo and Yabucoa	X		YES
11	<i>Eleutherodactylus juanriveroi</i> (Plain Coquí)	Areas in Toa Baja	X		NO
12	<i>Erophylla bombifrons</i> (Brown Flower Bat)	Toro Negro and Tres Picachos State Forest, Ciales, Jayuya, Orocovis	X		YES
13	<i>Gonocalyx concolor</i> (terrestrial shrub)	Areas in Cayey	X		YES
14	<i>Myrcia paganii</i> (Ausú)	Areas in Isabela, Arcibo	X		YES
15	<i>Peltophryne lemur</i> (Puerto Rican Crested Toad)	Areas in Isabela, Quebradillas, Guayanilla, Guánica	X		YES
16	<i>Tectaria estremerana</i> (Puerto Rico Halberd Fern)	Susúa State Forest and Adjacent Lands, Utuado, Arcibo, Ciales	X		YES
14	<i>Thelypteris inabonensis</i> (terrestrial fern)	Areas in Orocovis, Ponce	X		YES
17	<i>Thelypteris verecunda</i> (Barrio Charcas Maiden Fern)	Areas in San Sebastián, Quebradillas, 19Hatillo	X		YES
18	<i>Thelypteris yaucoensis</i> (Puerto Rico Maiden Fern)	Areas in Ciales and Yauco	X		YES
19	<i>Varronia rupicola</i> (Puerto Rico Manjack)	Areas in Guánica	X		YES

Source: Regulation 6766 and PR State Wildlife Action Plan, Department of Natural and Environmental Resources. FLA analysis by Estudios Técnicos, Inc.

Map 10. Designated and proposed critical habitats and FLA



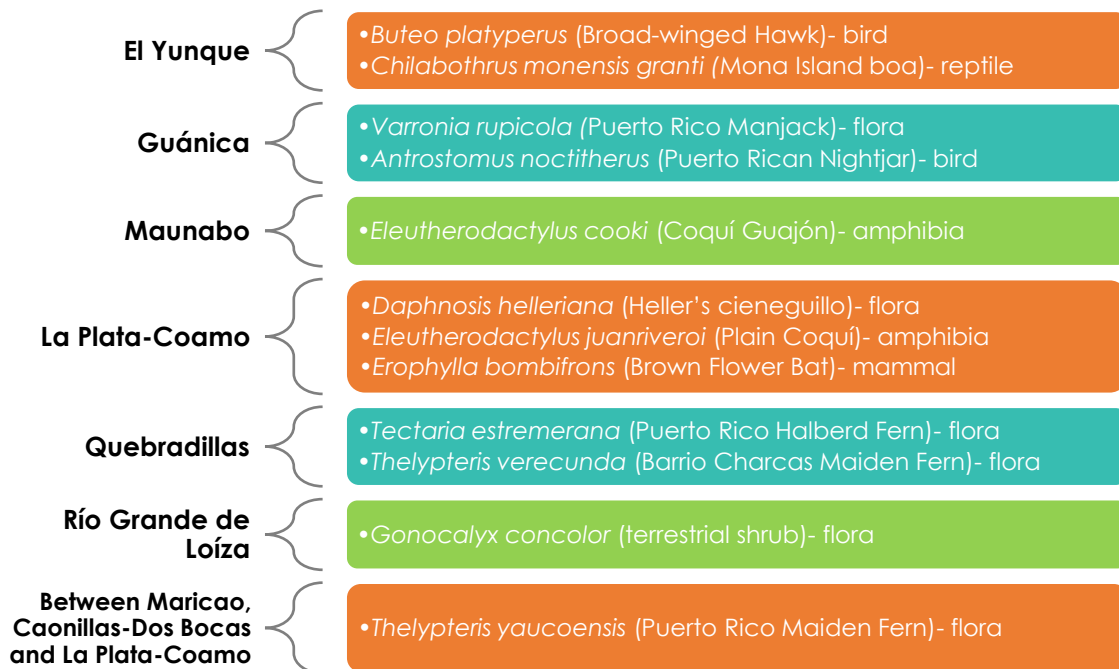
Source: Department of Natural and Environmental Resources. Layers: Rulebook 6766 proposed critical habitat sept 2016; Rulebook 6766 approved critical habitat 2004. Map prepared by Estudios Técnicos, Inc.

Table 7. Proposed and designated critical habitats in the FLAs

Forest Legacy Area	Proposed Critical Habitats	Area (Acres)	Designated	
			Critical Habitats	Area (Acres)
1 Guánica	<ul style="list-style-type: none"> • <i>Anolis cooki</i> (Cook's Anole) • <i>Antristomus noctitherus</i> (Puerto Rican Nightjar) • <i>Varronia Rupicola</i> (Puerto Rico Manjack) 	9,303 21,484 1,576	<i>Angelaius xanthomus</i> (Yellow Sholdered Blackbird)	42,258
2 Maricao	<ul style="list-style-type: none"> • <i>Antristomus noctitherus</i> (Puerto Rican Nightjar) • <i>Thelypteris yaucoensis</i> (Puerto Rico Maiden Fern) 	20,414 7,633		
3 Quebradillas	<ul style="list-style-type: none"> • <i>Adiantum vivesii</i> (Puerto Rico Maidenhair) • <i>Atlantea tulita</i> (Puerto Rican Harlequin Butterfly) • <i>Auerodendron pauciflorum</i> (Turtlefat) • <i>Daphnosis helleriana</i> (Heller's cieneguillo) • <i>Tectaria estremerana</i> (Puerto Rico Halberd Fern) • <i>Thelypteris verecunda</i> (Barrio Charcas Maiden Fern) 	587 136 222 3,863 23,975 1,309		
4 Caonillas-Dos Bocas	<ul style="list-style-type: none"> • <i>Buteo platyterus</i> (Broad-winged Hawk) • <i>Erophylla bombifrons</i> (Brown Flower Bat) • <i>Myrcia paganii</i> (Ausú) • <i>Peltophryne lemur</i> (Puerto Rican Crested Toad) • <i>Tectaria estremerana</i> (Puerto Rico Halberd Fern) • <i>Thelypteris inabonensis</i> (terrestrial fern) • <i>Thelypteris verecunda</i> (Barrio Charcas Maiden Fern) • <i>Thelypteris yaucoensis</i> (Puerto Rico Maiden Fern) 	23,480 31 732 18,727 74,695 723 51 12,603		
5 La Plata-Coamo	<ul style="list-style-type: none"> • <i>Thelypteris yaucoensis</i> (Puerto Rico Maiden Fern) 	105		
6 Rio Grande de Loíza	<ul style="list-style-type: none"> • <i>Buteo platyterus</i> (Broad-winged Hawk) • <i>Eleutherodactylus cooki</i> (Coquí Guajón) • <i>Erophylla bombifrons</i> (Brown Flower Bat) • <i>Gonocalyx concolor</i> (terrestrial shrub) • <i>Thelypteris yaucoensis</i> (Puerto Rico Maiden Fern) 	3,694 31 142 19 174	<i>Eleutherodactylus jasperi</i> (Golden coqui)	4
7 El Yunque	<ul style="list-style-type: none"> • <i>Buteo platyterus</i> (Broad-winged Hawk) • <i>Thelypteris yaucoensis</i> (Puerto Rico Maiden Fern) 	27,895 2,794	<i>Angelaius xanthomus</i> (Yellow Sholdered Blackbird)	30
8 Maunabo	<ul style="list-style-type: none"> • <i>Eleutherodactylus cooki</i> (Coquí Guajón) 	103		
Total		256,501		42,292

Source: Regulation 6766 and PR State Wildlife Action Plan, Department of Natural and Environmental Resources. FLA analysis by Estudios Técnicos, Inc.

As shown in the maps and tables above, proposed terrestrial critical habitats are located mainly within the north karst zone and in protected areas inside FLAs including the Quebradillas FLA, Caonillas-Dos Bocas FLA, El Yunque FLA, Maricao FLA and Río Grande FLA. Some terrestrial critical habitats are proposed outside the established FLAs. In this review, special attention is paid to these areas and the respective proposed terrestrial habitats located outside but close to the following FLAs:



On the other hand, there are several designated critical terrestrial habitats outside the FLAs, specifically the yellow shouldered blackbird to the east of El Yunque FLA and a patch in San Germán, southwest of Maricao FLA, as well as the golden coquí in the municipality of Cayey between the FLA of La Plata-Coamo and Río Grande Loíza.

4.1.2 Habitats of Greatest Conservation Need

The DNER identifies lands in Puerto Rico that are critical to wildlife and those that should have conservation priority. The Critical Wildlife Areas (CWAs) represent important compendiums of species and habitats of concern, emphasizing on endangered and/or endemic species occurrence, presence of critical habitat, and level of threat on habitats and species. These cover approximately 853.13 km² (9.58%) of lands in Puerto Rico (Castro et al., 2016).

The DNER defines these areas to protect critical wildlife habitat from degradation due to incompatible land uses (DNER, 2015). Map 11 depicts the CWA, the protected

natural areas and the FLAs. It shows that many of the CWAs are not within the protected area system, most of which correspond to the CWAs that are found on the coasts. The CWAs within the FLAs have some degree of protection such as forests, Nature Reserves, or refuges.

The DNER also identifies Priority Conservation Areas in Puerto Rico which include habitats for endangered species, wetlands, important areas for migratory species, ecologically important natural communities, and areas that have been identified to be declared as Nature Reserves.¹⁵ There are 97 priority conservation areas, covering approximately 31.7%¹⁶ of Puerto Rico, as shown in Map 12.

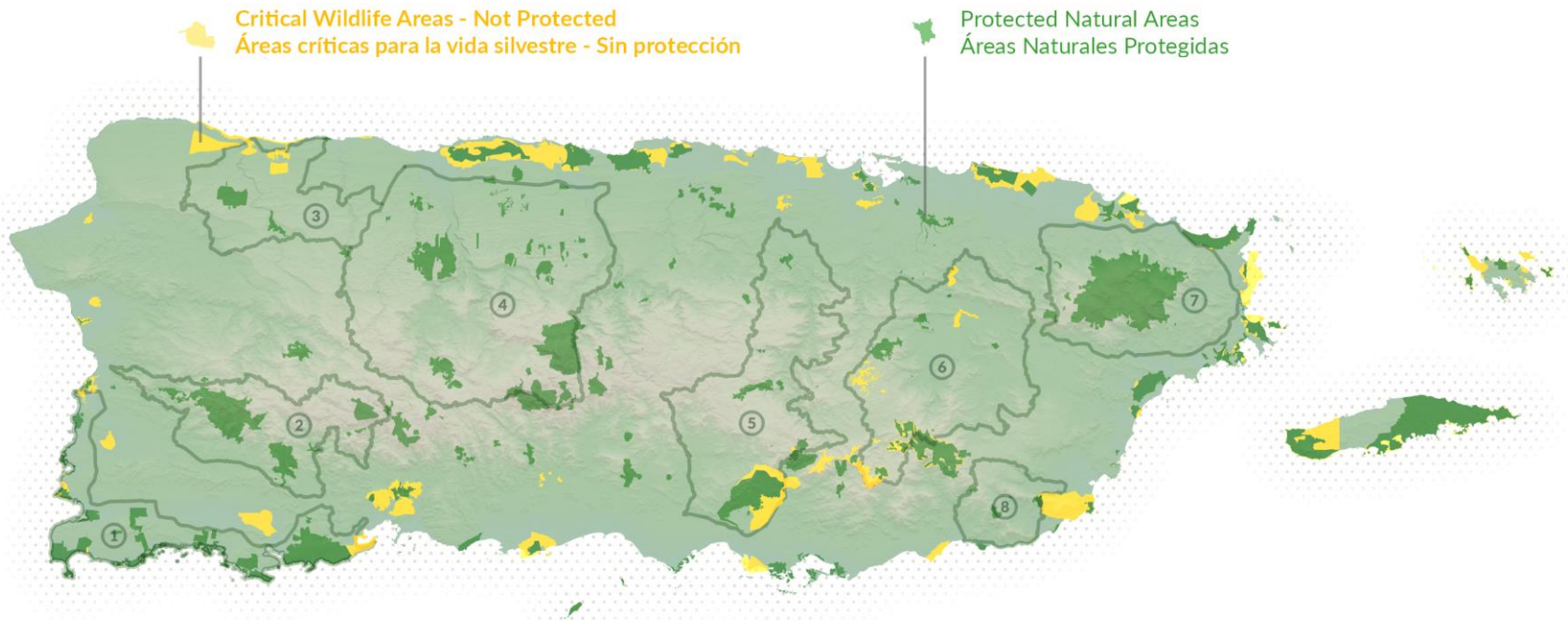
Map 13 depicts the system of protected natural areas, together with the CWAs and the Priority Conservation Areas. The Puerto Rico State Wildlife Action Plan (PRSWAP) identifies these as the wildlife conservation areas, which are the lands where the DNER should focus conservation actions and efforts according to the habitat types of interest (DNER, 2015).

Puerto Rico's forests are an important habitat for these species of flora and fauna. A portion of this wildlife is found on protected public lands, but a substantial amount of is found on private lands.

¹⁵ This is mandated by Law No. 150 of August 4, 1988, known as the "Natural Heritage Program Act" which directs the DNER to prepare an inventory of these Priority Conservation Areas.

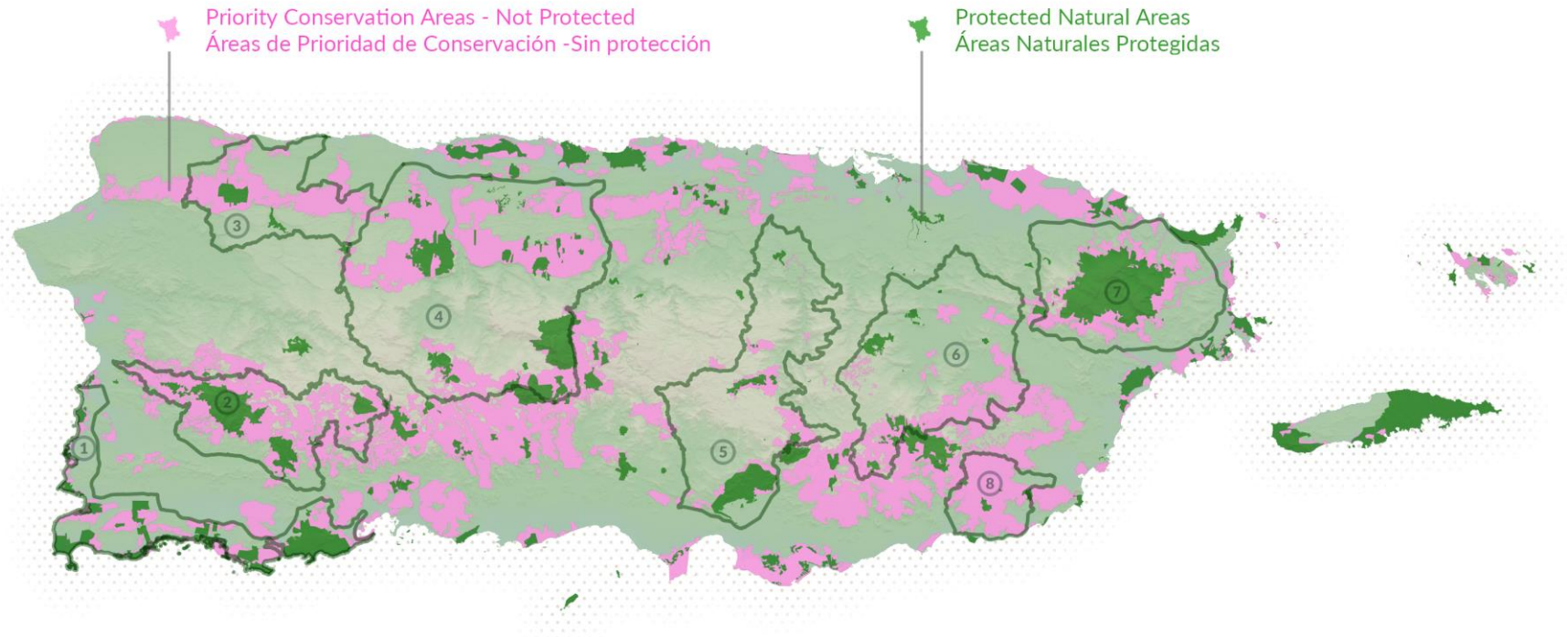
¹⁶ The Priority Conservation Areas cover approximately 717,170 *cuerdas* according to data provided by the Natural Heritage Program.

Map 11. Critical Wildlife Areas and FLA



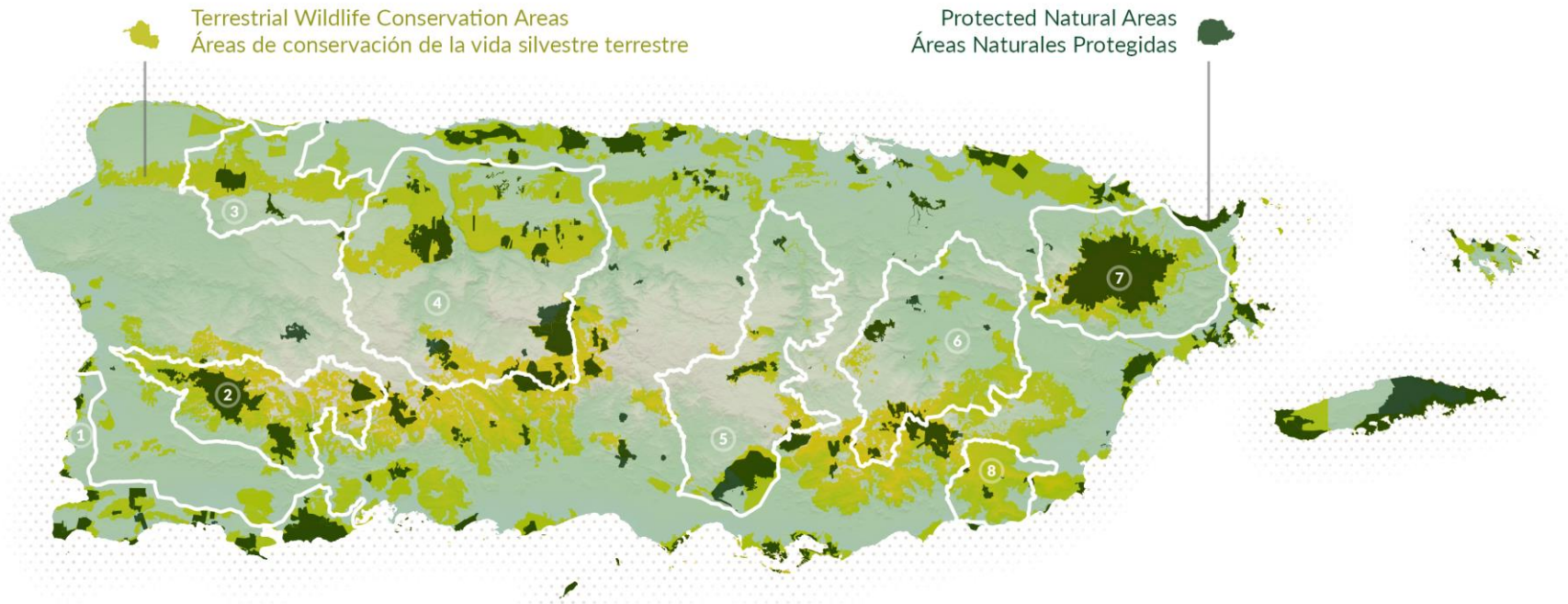
Source: Department of Natural and Environmental Resources, Critical Wildlife Areas; Protected Areas Conservation Action Team. 2018. Puerto Rico Protected Areas Database [version of December 2018]. GIS data. San Juan, PR. Map prepared by Estudios Técnicos, Inc.

Map 12. Priority Conservation Areas, Protected Natural Areas and FLA



Source: Department of Natural and Environmental Resources, Priority Conservation Areas; Protected Areas Conservation Action Team, 2018. Puerto Rico Protected Areas Database [version of December 2018]. GIS data. San Juan, PR Map prepared by Estudios Técnicos, Inc.

Map 13. Wildlife Conservation Areas (Priority Conservation Areas+CWA+PNA)



Source: Department of Natural and Environmental Resources, Terrestrial Wildlife Conservation Areas is composed of the following layers: Priority Conservation Areas DNER Heritage Program 2008 and CWA PR 2005; Protected Areas Conservation Action Team. 2018. Puerto Rico Protected Areas Database [version of December 2018]. GIS data. San Juan, PR Map prepared by Estudios Técnicos, Inc.

A spatial assessment of key biodiversity areas inside and outside the current network of protected areas in Puerto Rico estimated that 70% of the protected natural areas in Puerto Rico encompass high or very high landscape diversity associated with an expected high diversity of habitats and species, despite their relatively small size (Castro Prieto et al., 2016).

These researchers analyzed forest structure in protected areas to estimate forest quality as forests are the main habitat for most terrestrial species in Puerto Rico (Gould et al. 2007, as cited in Castro-Prieto 2016). Forests were classified according to their coverage and their relevance for planning purposes. Forests classified as core are the focus class for biodiversity conservation and are the least fragmented. These occupied 3,412.96 km² in Puerto Rico, of which 16% (543.74 km²) were in protected areas (Castro Prieto et al., 2016). This was the most abundant class in protected areas and accounted for 91.74% of the total protected forest area. Other abundant classes were edge (forests in the outer core area, where some species prefer to dwell in the foreground/background interface); and perforation (forests similar to edges, but correspond to the inner boundary of the core, these perforations inside core habitat are a sign of fragmentation).

Landscape diversity was also assessed based on the vegetation cover and ecological life zones according to the Holdridge classification scheme. Results indicate that it was varied among the protected areas, using both variables.¹⁷ However, almost all protected areas (90-95% of all protected natural areas assessed) have very low or low landscape diversity based solely on the Holdridge life zones classification scheme.

The regions with the highest species richness, or that are classified as critical or important wildlife areas are not well represented within the network of protected areas.

Almost all protected areas have very low or low landscape diversity based on the Holdridge life zones classification scheme.

Only 16% of the least fragmented forest cover in Puerto Rico is in protected areas.

Only a quarter of the areas with high or very high species richness are within protected natural areas

Castro-Prieto et al, 2016

¹⁷ Results ranged from 70 protected areas with a very high and high landscape diversity, 11 intermediate, and 14 with very low and low landscape diversity.

The study also found that the regions with the highest species richness, or that are classified as critical or important wildlife areas are not well represented within the network of protected areas (Castro Prieto et al., 2016).¹⁸ It is estimated that 38.98% of Puerto Rico has a very high to high species richness.¹⁹ Less than a quarter (23.74%) of this very high to high species richness is in protected natural areas.²⁰ The study found that unprotected regions with high species-richness, and that are classified as Critical Wildlife Areas (CWA) or Important Bird Areas (IBAs) occurred in lands adjacent to existing protected areas (Castro Prieto et al, 2016).

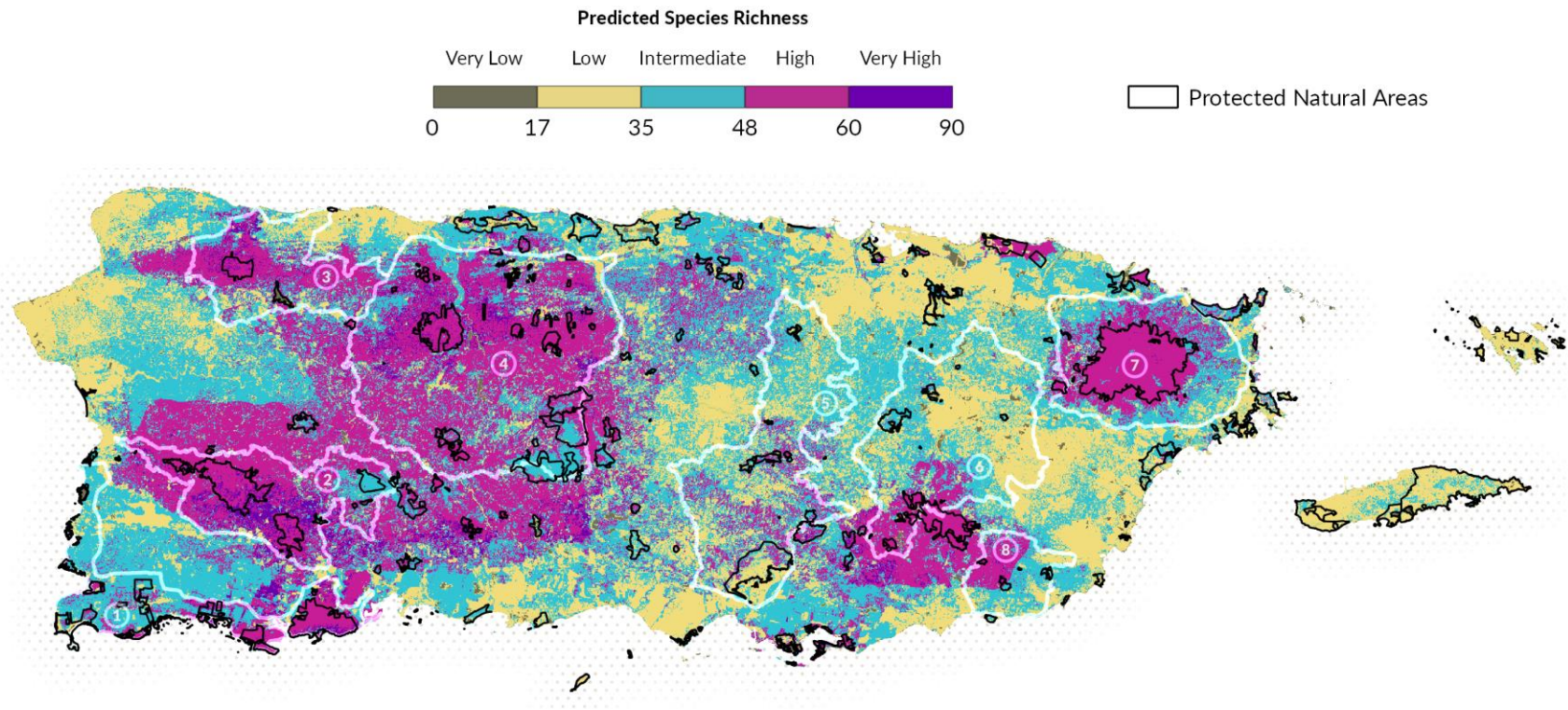
Map 14 shows a high and very high concentration of species richness in the western half of the island, inside and outside the FLAs; in El Yunque FLA and between the Río Grande de Loíza and Maunabo FLAs. It should be noted that the northern portions of the La Plata-Coamo and Río Grande de Loíza FLAs, show a low to intermediate concentration of species richness.

¹⁸ The researchers determined the proportion of high and very high species-richness areas, predicted habitats for threatened species under protection in Puerto Rico, and estimated the proportion of terrestrial critical wildlife areas (CWAs) and Important Bird Areas (IBAs) inside protected areas.

¹⁹ Very high species-richness regions in Puerto Rico occupied approximately 1,200 km², and high 2,270 km².

²⁰ It is estimated that 10.55% (126.55 km²) of the very high and 13.19% (299.34 km²) of the high species richness.

Map 14. Predicted species richness and FLA's



Source: Castro-Prieto, et al. 2016. Characterization of the network of protected areas in Puerto Rico. Map prepared by Estudios Técnicos, Inc.

4.2 AESTHETIC AND SCENIC VALUES

The diversity of forests in Puerto Rico, the topography, and the proximity of the ecosystems of the interior, the karst and the coast offer a unique scenic and aesthetic value. Taking advantage of the aesthetic and landscape values, various scenic routes have been designated or are proposed throughout the island. In addition, several viewpoints have been developed which are important for tourism and recreation in Puerto Rico.

In Puerto Rico, the Luis Muñoz Marín Panoramic Route is a 266 km long road that crosses the central mountain range along 21 municipalities and four state forests. It was established by Law No. 71-1965, as amended, and is included in the National Scenic Byways Inventory for its natural, scenic, historic, and cultural values. This panoramic route crosses or passes near five of the FLA (Maricao FLA, Caonillas-Dos Bocas FLA, La Plata-Coamo FLA, Río Grande Loiza FLA and Maunabo FLA).

More recently, the PR-957 and PR-186 roads in the municipality of Canóvanas, inside the El Yunque Legacy Area, were designated as scenic routes with the approval of the Law No. 54-2015, known as “Ruta Escénica Mirador de El Yunque”²¹. The Puerto Rico Highways and Transportation Authority, in coordination with municipalities and other Commonwealth agencies, identified 12 additional roads with the potential to be designated as scenic routes (DRD, 2020). These are presented in the following map.

²¹ The US Forest Service and the PRTC prepared a study for its designation as a National Scenic Byway.

Map 15. Aesthetic and Scenic Values in the FLA



Table 8. Proposed and designated scenic routes in Puerto Rico

Designated scenic routes		
1	Ruta Panorámica Luis Muñoz Marín	National Scenic Byways
2	Ruta Escénica Mirador de El Yunque	Law 54-2015
Scenic routes projected or proposed by the ACT or in coordination with municipalities and other agencies		
1	PR-187 (Loíza)	
2	PR-191 (Río Grande/El Yunque)	
3	PR-3 (Fajardo-Ceiba-Naguabo-Humacao)	
4	PR-139 (Ponce)	
5	PR-128 (Yauco)	
6	PR-333 (Guánica-Yauco)	
7	PR-111 (Aguadilla-Moca-San Sebastián-Lares-Utuado)	
8	PR-2 (Quebradillas)	
9	PR-10 (Arecibo-Utuado)	
10	PR-149 (Manatí-Ciales-Orocovis)	
11	PR-693 (Dorado-Vega Alta)	
12	PR-165 (Dorado-Toa Baja)	

Sources: Information provided by the Puerto Rico Highways and Transportation Authority, Office of Strategic Planning in February 2020.

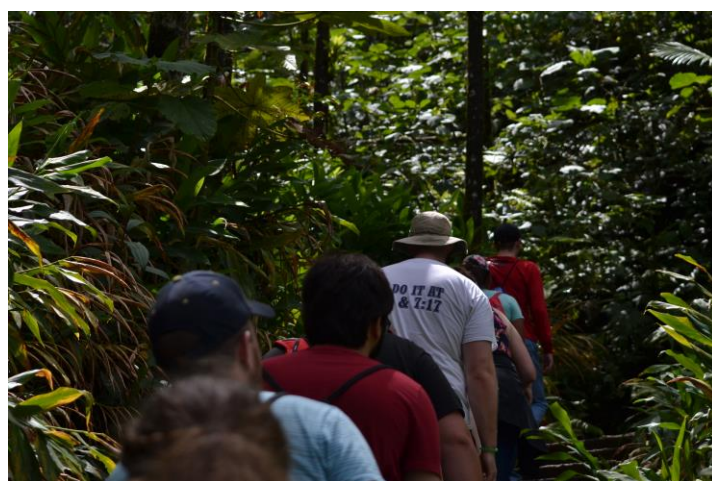
4.3 PUBLIC RECREATION OPPORTUNITIES

The climate, diversity and proximity of ecosystems in Puerto Rico allow outdoor recreational activities to be carried out throughout the year. Forested areas are widely used for hiking, camping, mountain bike (MBT), birdwatching, cave exploration/rappelling, among other activities. Approximately 87.2% of Puerto Rico's residents practice outdoor recreation activities such as hiking, biking, bird watching among other (DRD, 2020). In addition, Puerto Rico visitors reported engaging in over 20 different activities in the island, being the hiking/biking, camping, sightseeing, watching wildlife and beach going the most common activities (Leeworthy et al, 2018).

The DNER has recreational infrastructure in several of its protected areas. The natural areas under the USFWS, the USFS, and NGOs such as Para La Naturaleza and Casa Pueblo also provide recreational opportunities. In addition, during the past years, citizens, particularly organizations that group cyclists, have opened trails in forested public and private properties. These trails are not only used by MBT, but by hikers as well. This provides the opportunity for people to enter and enjoy forested areas, but proper management in natural areas and in areas important for wildlife is needed. In addition, social media has exposed many forested lands that are used for recreation and visitation has increased.

This reflects an increased demand of natural areas and forested lands for recreation, but also constitutes a liability issue for private landowners. This was one of the main outdoor recreation issues identified in the Puerto Rico's outdoor recreation plan (DRD, 2020). With the physical distancing measures associated with the COVID 19 Pandemic, there has been a substantial increase in the use/demand of open spaces for recreation.

Public recreation opportunities associated to forest resources in Puerto Rico are vast. One of the most important tourist attractions in Puerto Rico is El



There are rock formations of scattered throughout Puerto Rico of historical, cultural, spiritual, recreational and tourist importance.

Yunque National Forest. In reviewing its management plan, the USFS identified high visitation and pressure on this forest's resources. To address this situation, the development of a regional system of trails to connect with other protected areas of the northeast Puerto Rico is outlined as one of the objectives of the management plan.

Puerto Rico's karst region and coastal forests also provide a myriad of public recreation opportunities such as rock climbing, hiking, caving, nature observation, camping among other.

4.4 OUTSTANDING GEOLOGICAL FEATURES

Karst covers more than 27% of the island and is also present on the south coast, but more fragmented and not as extensive as on the north coast (Lugo et al., 2001). The landforms on the north coast limestone of Puerto Rico constitute one of the finest examples of tropical karst in the world, being the karst belt the area with the most spectacular surficial karst landforms (Lugo et al., 2001; Miller and Lugo, 2009).

The terrain appears as clusters of haystack hills that vary between 15 and 91 meters (50 and 300 feet) high, separated from one another by rounded depressions. The area is abundant in sinkholes, caves and caverns and rivers that appear, and disappear throughout the area. One of the largest underground



The karst belt is the northern limestone part, with the most spectacular surficial karst landforms (Lugo et al 2001).

Lugo et al 2001

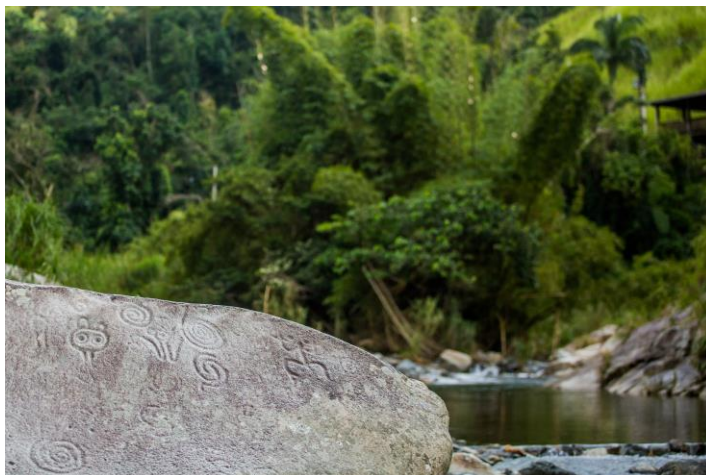
sections of river in the world is the Río Encantado, found in the karst region which runs 16 kilometers (9.6 miles) underground (Miller and Lugo, 2009).

The Río Grande de Arecibo cuts through the karst with a gorge 800 to 1,200m wide and nearly vertical walls as high as 200 m (Monroe 1976, as cited in Lugo et al 2001). Río Guajataca also has gorges with nearly vertical walls 150 m high (Lugo et al 2001). In the coastline, geological features include sea cliffs, and sand dunes.

The outstanding geological features in Puerto Rico also include the mountain ranges in the southeast coast of Puerto Rico, known as Sierra de Pandura and Guardarraya. Sierra Bermeja is another mountain range located in the Lajas Valley that has the oldest rocks in Puerto Rico and some of the oldest in the Caribbean region. This area has a high value for conservation due to its high biological diversity, its geological importance and relatively low urban development (Aukema, Carlo, Tossas & Anadón-Irizarry, 2006).

There are typical rock formations known as “guajonales”, which are cavities formed by granitic or sedimentary rocks. These are in the central- southeastern portion of the island.²²

There are also rock formations scattered throughout Puerto Rico that have historical, cultural, spiritual, recreational and tourist importance.



There are rock formations of scattered throughout Puerto Rico of historical, cultural, spiritual, recreational and tourist importance.

4.5 SOIL PRODUCTIVITY

Soil productivity is defined as areas suitable for forestry production, including timber, non-timber forest products, agroforestry, shade coffee, apiculture, livestock grazing, and agrotourism (Gould et al., 2017).

4.5.1 Forest products and timber management opportunities

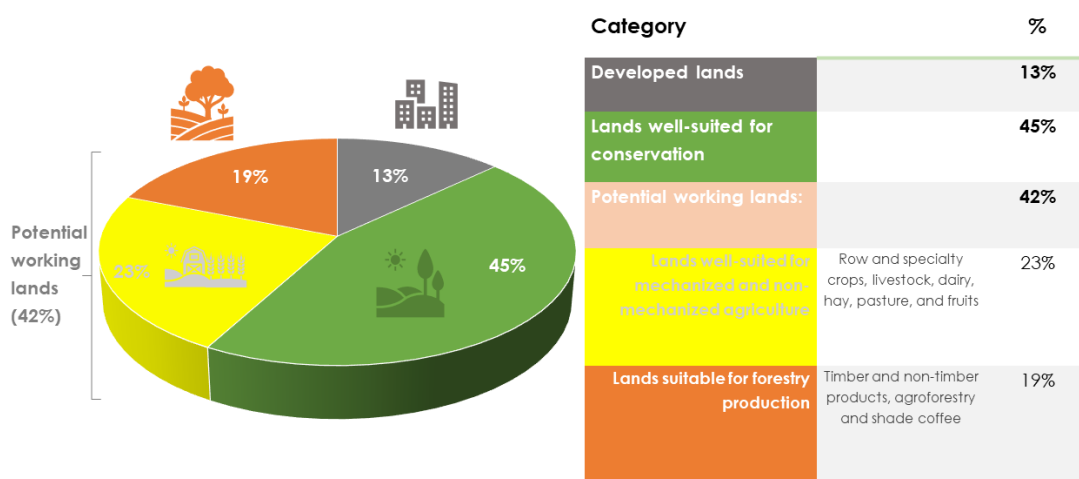
In 2017, Gould and collaborators classified 42% (933,777 acres) of lands in Puerto Rico as “potential working lands”, which include lands suited for mechanized and non-

²² Source: <https://www.fws.gov/southeast/pdf/fact-sheet/coqui-guajon-english.pdf>

mechanized agriculture and lands suitable for forestry production.²³ The study found that forest cover, biodiversity and ecosystem services can be maintained while increasing agricultural productivity on flatter lands and lower slopes, and integrating agroforestry, shade coffee, low impact timber harvest, and non-timber forest product uses on steeper slopes (Gould et al., 2017). The authors recognized the importance of keeping key watersheds and mountain slopes forested to increase sustainability and productivity on all working lands, and to include best practices, such as water and nutrient management, in all agricultural operations to improve productivity.

The next figure shows the potential land for conservation, agriculture and forestry in Puerto Rico as defined by Gould et al. (2017). **Error! Reference source not found.** shows the distribution of these categories across the island.

Figure 7. Land well-suited for conservation, agriculture, and forestry in Puerto Rico (Gould et al., 2017)



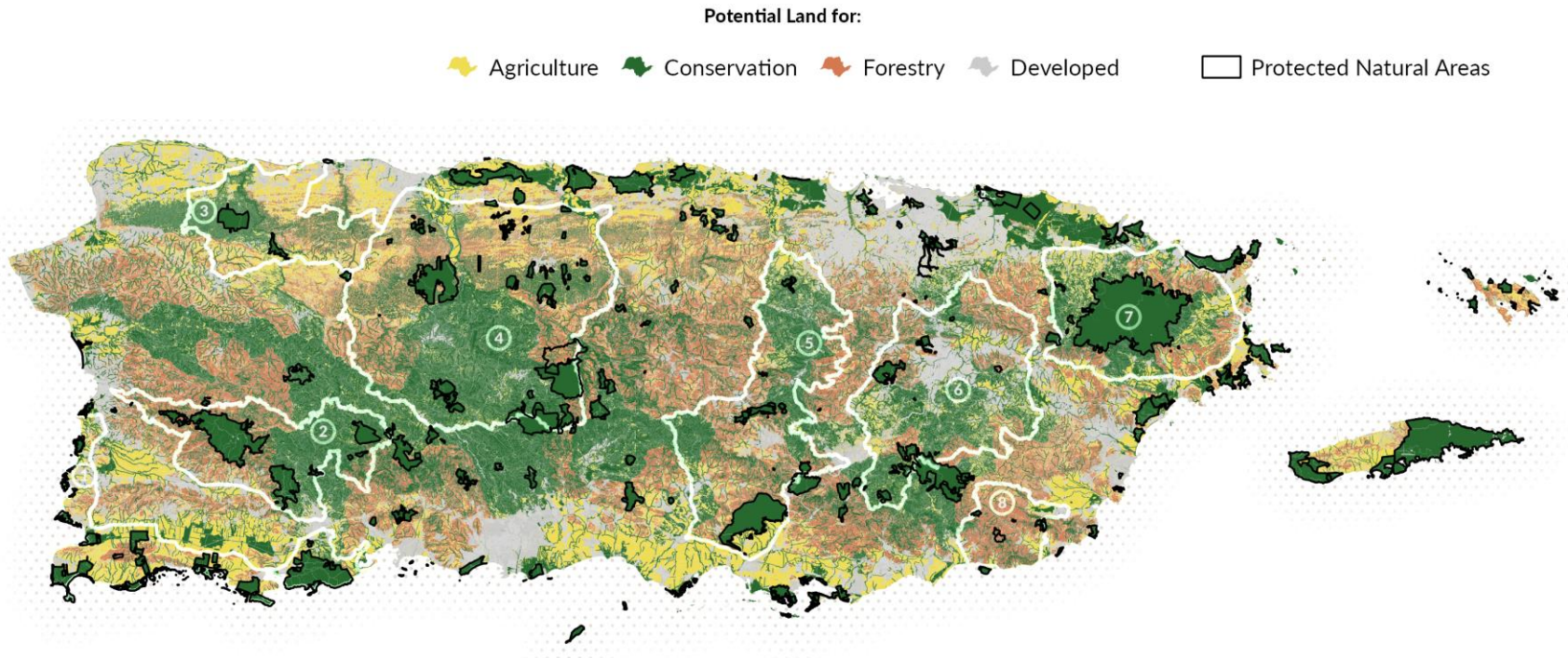
Source: Gould, et al., 2017. *Land Use, Conservation, Forestry, and Agriculture in Puerto Rico*.

Lands well suited for conservation, which occupy 45% of Puerto Rico, include protected areas, riparian buffers, lands surrounding reservoirs or sub watersheds, wetlands, beaches, and barrens such as salt and mudflats, slopes greater than 50% and water bodies (Gould et al., 2017). These are observed continuously in the central-west part of the island, inside and between the Maricao FLA and the Caonillas-Dos

²³ They did not include the following areas as areas suitable for timber production: protected areas, wetlands, developed land surface, natural barrens, riparian zone 50 m buffers, or watersheds that contain reservoirs because of their role in reducing sedimentation and protecting important water sources for the island.

Bocas FLA, and south of the latter. Also, between the Río Grande de Loíza and Maunabo FLA, extending west of the Quebradillas FLA and in the coastal areas. Lands that are suited for forestry are those where timber and non-timber products, agroforestry and shade coffee can be grown. These are observed in **Error! Reference source not found.** like a wide belt in the center of the island.

Map 16. Potential for conservation, agriculture, and forestry in the FLA (Gould et al., 2017)



Source: Gould, et al., 2017. Land Use, Conservation, Forestry, and Agriculture in Puerto Rico. Map prepared by Estudios Técnicos, Inc.

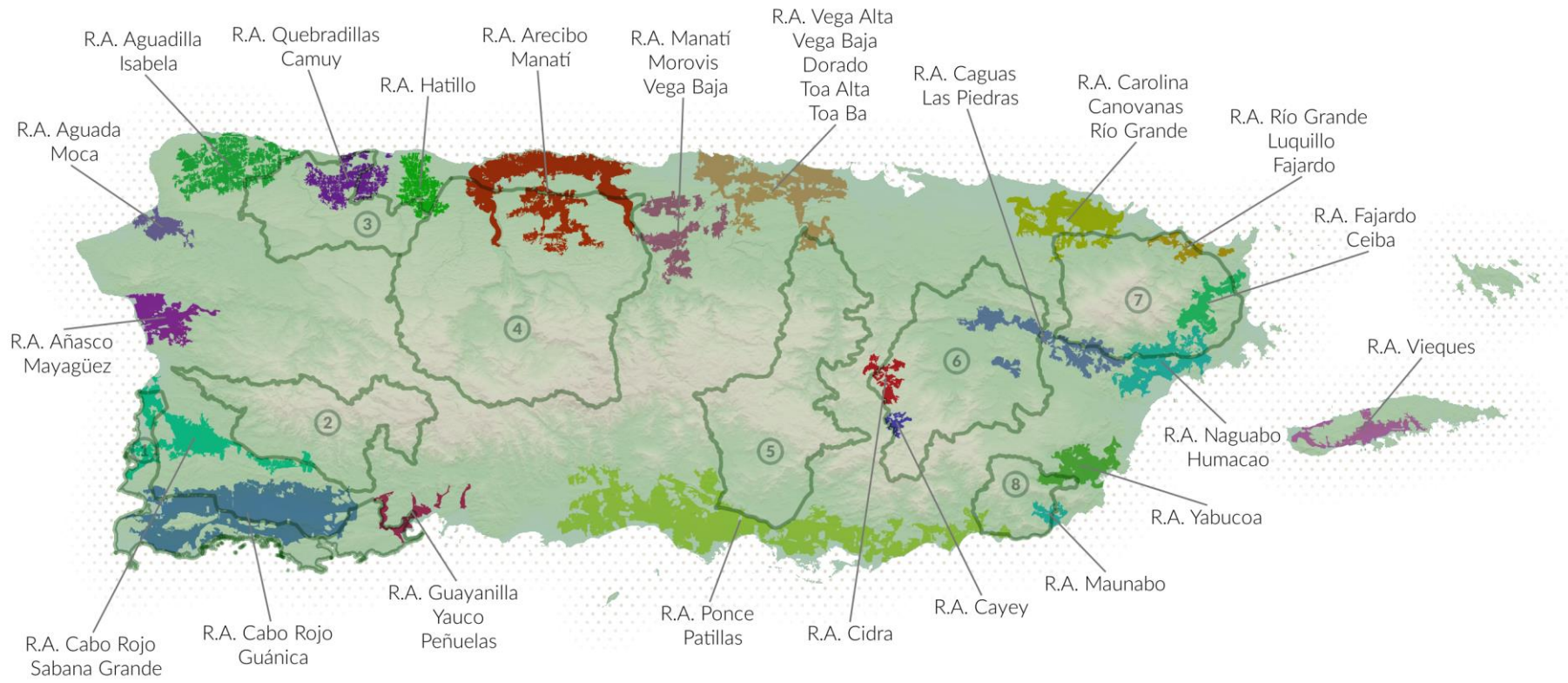
4.5.1.1 *Lands suited for agriculture*

Gould and collaborators (2017) identified lands suitable for mechanized and non-mechanized agriculture, based on slope, the presence of protected natural areas, wetlands and other conditions. These cover 23% of Puerto Rico, and include lands suitable for row and specialty crops, livestock, dairy, hay, pasture, and fruits (Gould et al., 2017). These are in the coastal plains and the interior valleys, with the largest patches located in the northwest (associated with the Quebradillas FLA) and south of the island (covering the Guánica FLA and the coastal plains to the east).

It is estimated that 27% of all lands in Puerto Rico (240,000 ha) are coastal and interior plains (Gould et al., 2017). Of these, 98,247 ha (11%) are developed, and 142,292 ha (16%) are designated as Agricultural Reserves. Agricultural Reserves are lands with a high agricultural capacity, that have been designated for agricultural production and where conflicting uses such as urbanization are not allowed. It was estimated that 30% of these agricultural reserves are either forested (16,072 ha or 11%), wetlands (21,774 ha or 15%), or protected natural areas (6,015 ha or 4%). After extracting lands with these characteristics within the agricultural reserves and other environmental conditions in the plains, they estimated that 14% of Puerto Rico (124,187 ha) -with slopes under 10%- was well-suited for mechanized agriculture.

As depicted in the following map, there are lands designated as Agricultural Reserves in all FLAs. Agricultural Reserves cover private and public lands. In these, sustainable agricultural practices such as agroforestry could be carried out. According to Marcano-Vega (2017), fruit trees within the secondary forests of Puerto Rico offer an opportunity for the promotion of agroforestry systems and guarantee ecosystem services. The FIA has been assessing four species of fruit trees and recently found that for example, the mango tree population figures as the fourth species of highest biomass in Puerto Rico with a total of 5.1 million stems in 2014 (Marcano-Vega, 2017).

Map 17. Agricultural Reserves in Puerto Rico



Source: Puerto Rico Planning Board, Puerto Rico Department of Agriculture. Map prepared by Estudios Técnicos, Inc.

4.5.1.2 Lands suitable for forestry production

Lands suitable for forestry production cover 19% of Puerto Rico. In these, timber and non-timber products, agroforestry²⁴, and shade coffee can be cultivated (Gould et al., 2017).

4.5.1.3 Timber

Gould and collaborators (2017) found that the municipalities with the greatest amount of land with forestry potential are Arecibo, Coamo, San Germán, and Corozal. These have steeper slopes where timber production may be integrated with agroforestry, shade coffee, non-timber forest product uses, or other forms of sustainable activity that maintain a high degree of forest cover.

The FIA estimated that there are 39.4 million cubic meters (1.39 thousand cubic feet) of commercial wood in the forests of Puerto Rico (including Culebra and Vieques). Most of this volume (83.3%) was found in private lands (Marcano-Vega, 2017). The assessment also found that most of the commercial quality wood of large diameter is in the interior of the moist and wet/pluvial forests. In addition, that the net volume of some wood species used to make furniture and crafts in Puerto Rico increased during the years 2004–2014. This was prior to hurricane María, which left millions of downed trees in Puerto Rico, much of which were high value tropical hardwood species. However, there is an increasing interest in developing wood products.

4.6 WATERSHED VALUES INCLUDING WATER-QUALITY PROTECTION

All rivers in Puerto Rico rise in the forested mountainous central area of Puerto Rico. The headwaters of these rivers supply most of the island's reservoirs, which provide water to meet domestic, industrial, and agricultural consumption. Aquifers are another important source of water in Puerto Rico. Their recharge depends to a greater or lesser extent on the water that infiltrates through the soil. All these provide the water that supports ecosystems functions and services, and for human consumption (industrial, commercial, and residential uses).

Forest cover is fundamental for the amount and quality of water of the rivers, reservoirs, and aquifers. Freshwater resources have been affected by deforestation

²⁴ According to Food and Agriculture Organization (FAO) "agroforestry is a collective name for land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land-management units as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence. In agroforestry systems there are both ecological and economical interactions between the different components". Retrieved from: <http://www.fao.org/forestry/agroforestry/80338/en/>

and land-use change. Sedimentation has decreased reservoirs' capacity to store water and has reduced water quality for human and wildlife consumption. It also increases water treatment costs. Most sediment is transported to reservoirs during extreme events, such as heavy rainfall or hurricanes, leading to a potential long-term water-supply problem. Jointly, reservoirs account for 55% of freshwater extraction on the island. Therefore, protection of reservoirs' capacity is an important DNER management objective (DNER, 2016c).

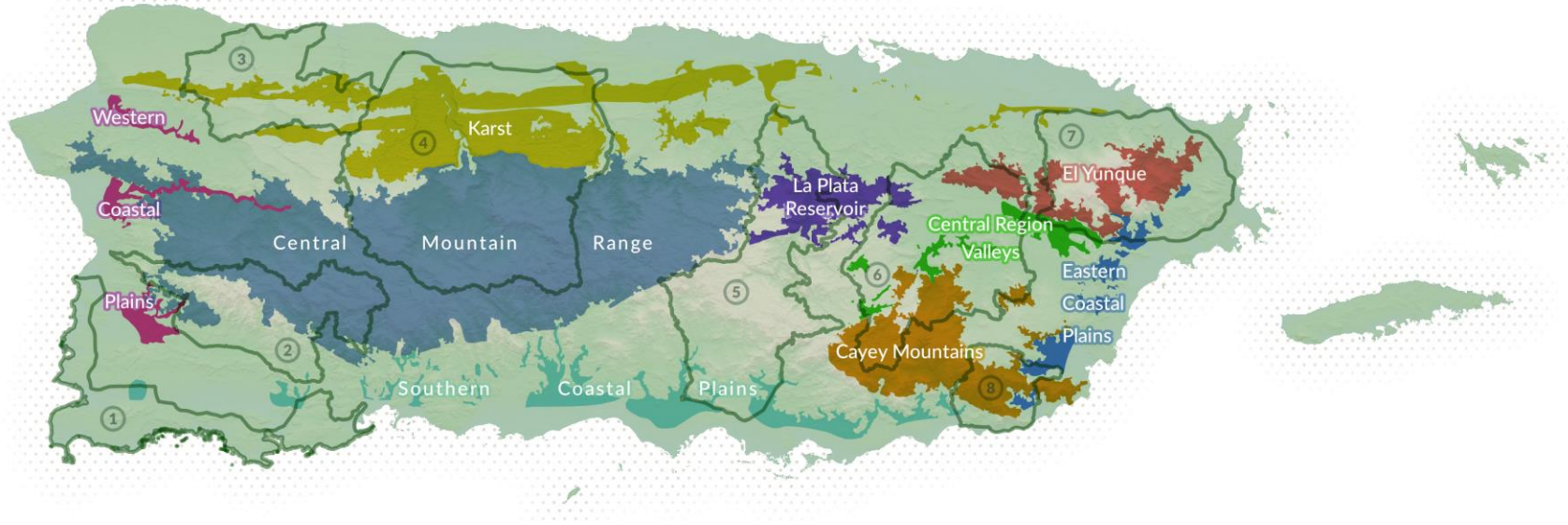
High sedimentation rates occur in the north and east watersheds where the rainfall is high, and the watersheds are more developed (ASCE, 2019). Reservoirs which's capacity has been reduced by more than 50% are the Loco, Carraízo, Lucchetti and Dos Bocas (ASCEPR, 2019). The Dos Bocas life expectancy is less than 35 years given its current sedimentation rate. This, along with Caonillas and four other reservoirs, are part of the North Coast Superaqueduct which supplies more than 50 mgd of drinking water to approximately 600,000 residents in the San Juan Metropolitan Area and municipalities in the northern region (ASCEPR, 2019). Low life expectancy is documented also for the Loco, Carraízo and Lucchetti, with fewer than 15, 45 and 50 years, respectively (ASCEPR, 2019). Lucchetti Reservoir in Yauco, which supplies drinking water and to the Lajas irrigation system, is affected by a sedimentation problem (DNER, 2016c). This is identified by the USGS as a principal basin.

Underground water quality and quantity also depend on the forest cover, precipitation, runoff, permeability of soils and sea level change. The most important groundwater resources in Puerto Rico are the north and south coast aquifers and the aquifers in the Caguas, Juncos and Cayey valley. The south coast aquifer is the main source of potable water for the municipalities of Salinas, Santa Isabel, Coamo, and Guánica (DNER, 2016c). It is also the freshwater source that sustains habitats in the Jobos Bay National Estuarine Reserve, the only in Puerto Rico and the Caribbean (DNER 2016d).

The headwaters of eight major rivers rise in El Yunque forest and provide water for domestic purposes and hydroelectric power for many communities in eastern Puerto Rico, including the Vieques and Culebra islands (Miller & Lugo, 2008; Waide et al, 2013).

The different regions in the following map show areas upstream of existing reservoirs and hydrological reserves identified by the DNER and the Office of the Land Use Plan of the Puerto Rico Planning Board (PRPB) in 2008. Its primary objective is to maintain and/or restore sufficient forest cover to extend the lifespan of existing water supply reservoirs (DNER, 2016c). All the FLAs have representation of the hydrological regions.

Map 18. Puerto Rico's most important hydrological regions



Source: DNER and P.R. Planning Board, 2008. Comprehensive Plan of Water Resources of Puerto Rico. Map prepared by Estudios Técnicos, Inc.

4.7 CLIMATE CHANGE MITIGATION

The most recent FIA reported that the biomass and total carbon dioxide accumulated in Puerto Rico's forests (including Vieques and Culebra forests) increased by 27.6% between 2004 and 2014 (Marcano-Vega, 2017). These increases in concentration were observed in the different types of forests.

Marcano-Vega (2017) estimated that the 23 Mg, carbon dioxide removed from the atmosphere and accumulated in Puerto Rico's forests mitigated the emissions of cars in Puerto Rico for eight (8) years, or the emissions of the barrels of oil consumed for three (3) and a half years.

Climate change is not only an overarching threat to America's forests, but also a source of new opportunities. Already, it is creating new markets for carbon storage and biomass energy that should be utilized (Tidwell, 2010). However, increases in the intensity and frequency of tropical cyclones may reduce the ability of tropical forests to sequester carbon (Hall, 2020).

Creating and managing protected areas is key for biodiversity conservation and as a climate change adaptation strategy (Carrasco et al., 2021). With changes in climate, species will disperse to maintain their habitat needs and will probably move to areas outside protected zones. As a result, researchers proposed three key land prioritization approaches for biodiversity persistence which include, among other, increasing connectivity between protected zones, and allowing species to move between them to escape adverse climate conditions (Carrasco et al., 2021).

5 THE PRESENT AND FUTURE THREATS OF CONVERSION OF FOREST AREAS TO NONFOREST USES IN PUERTO RICO

In Puerto Rico, the present and future threats of conversion of forest areas to non-forest uses include urban developments, especially in coastal forests, unsustainable agricultural practices, wildfires, natural disturbances such as hurricanes and climate change.

5.1 URBAN SPRAWL

The relative steadiness in forest cover documented by Marcano-Vega (2017) could be due, among other factors, to the fact that during the decades of 1990 and 2000 there was a substantial increase in the construction activity in the coastal areas of Puerto Rico, including the main island, Vieques and Culebra. As this occurred, the forest cover in the central mountains of the island continued to recover. In 2006, Puerto Rico began to experience an economic contraction, and a reduction in its population. Both factors have reduced construction activity in the coastal areas, and consequently the pressure on forest resources was reduced. However, a rebound in construction is being observed²⁵, which is why it is necessary to protect forest resources.

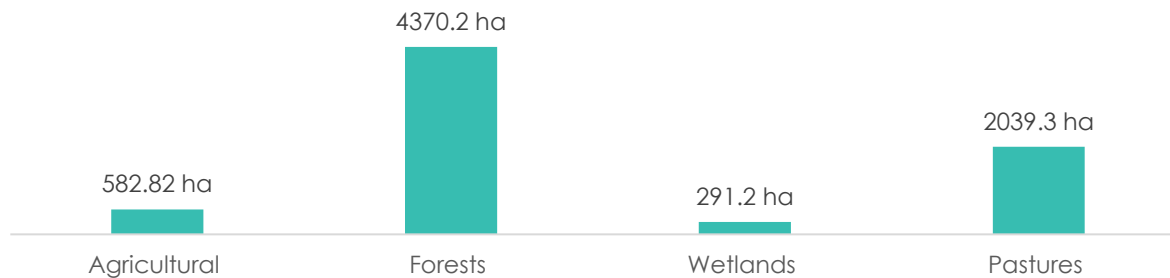
According to the PRLUP, for almost four decades, vacant lands on the periphery of the cities and metropolitan areas were urbanized at a rate higher than population growth, which resulted in an excess in the offer or housing inventory. Population in the urban centers declined, while urban expansion occurred in the peripheral areas. Based on the Land

²⁵ <https://www.elnuevodia.com/negocios/construccion/fotogalerias/se-reactiva-la-construccion-nueva-en-puerto-rico/>

Cover Map, the PRPB estimated that 14.4%²⁶ of Puerto Rico was developed in the decade of 2010. Approximately 9.9% of the island was developed before 1977, which indicated that it took almost 500 years to develop 105,221 ha (11.65%) and 33 years to develop 24,035 (or 2.66% of Puerto Rico).

If this trend of urbanization continues, despite the population reduction, the PRLUP estimated that an additional 7,283.5 ha will be urbanized by 2025, being the lands covered by forests the most impacted, as shown in the following graph.

Figure 8. Habitats to be impacted according to projected land uses in the PRLUP



Source: PRPB. 2015. Land Use Plan. Territorial Ordinance Guidelines.

The assessment made for the PRLUP concurs with the findings of Gould, Martinuzzi and Parés (2012) who identified a sharp decline in agriculture; the conversion of grassland, woodland, and shrubland to closed forest; and the urbanization of the landscape as the principal trend in land use and landcover patterns during the last decades in Eastern Puerto Rico. They found that in the last seven decades, the most noticeable change was the shift from a non-forested to a forested landscape and the intensification of the ring of urbanization surrounding El Yunque National Forest.

²⁶ 328,896 cuerdas

An important observation from this assessment was the loss of natural land cover in the coastal areas. As a result, researchers highlighted the need to protect the coastal hills and plains and the matrix of habitats that include the mangrove forests and river systems of the coastal area (Gould, Martinuzzi and Parés, 2012).

5.2 PUERTO RICO'S FISCAL SITUATION AND PROTECTED AREAS OWNED BY COMMONWEALTH AGENCIES AND PUBLIC CORPORATIONS

Recently, additional concerns have arisen, resulting from Puerto Rico's economic and fiscal situation as to how public lands will be governed (PROMESA 2016; Snow 2017 as cited in Castro Prieto, 2019). In 2016, the Congress enacted the Puerto Rico Oversight, Management and Economic Stability Act (PROMESA) to address the Puerto Rican fiscal situation. This law created the Financial Oversight and Management Board to oversee the fiscal and budgetary affairs, which include the restructure of Puerto Rico's public debt. This Board has powers over any Commonwealth instrumentality, including the DNER and could include selling, leasing, or disposing of lands administered by agencies or other public corporations (SNOW, 2016). This is important given that a substantial number of protected lands are privately owned or are owned by public corporations, as described in Sections 2.4-2.6.

5.3 TRADITIONAL AGRICULTURAL PRACTICES

Traditional and mechanized agricultural production may result in a threat, specially to coastal forests. New uncertainties have risen about how much and where to grow more food (Gould et al. 2017 as cited in Castro-Prieto, 2019).

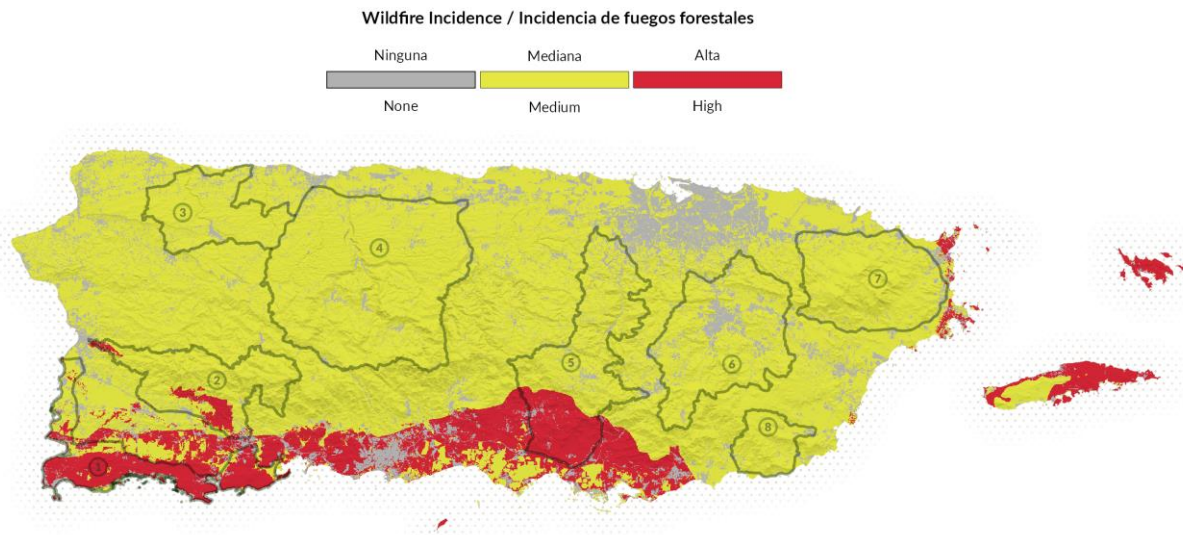
This conflict was evident in 2013 when approximately 978.6 ha²⁷ of wetlands were cleared or filled for an agricultural project in Guánica (El Nuevo Día, 2013). It was estimated that 47.2 ha of secondary forest were cleared (El Vocero, 2013). Large scale agricultural practices often use pesticides and other chemicals that affect wildlife and their habitats.

²⁷ 240 cuerdas

5.4 WILDFIRES

Most fires and the highest potential for fires occur in the dry forest zones. Climate change, extended drought, and human-induced landscape fragmentation have the potential to greatly expand fire-prone areas to moist and wet tropical forests and even non-forested landscapes traditionally 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 fires are intricately linked; at the same time, forest fragmentation will increase the likelihood of fires.

Map 19. Location of wildfire incidence areas in relation to FLA



Source: Department of Natural and Environmental Resources, 2015. Map prepared by Estudios Técnicos, Inc.

5.5 NATURAL DISTURBANCES AND CLIMATE CHANGE

Climate change poses a major threat to Puerto Rico's forest resources such as changes in biodiversity, carbon cycling, forest composition and structure, decreases in primary productivity, changes in ecosystems processes, and nutrient and water cycling (Waide et al., 2013; Gould et al., 2018). According to the 4th National Climate Assessment (4th NCA), projected decreases in rainfall will change the distribution of ecological life zones, as relative increases in dry life zones are estimated, and the shrinkage and disappearance of wetter life zones (Gould et al., 2018). As temperatures continue to increase, montane species are shifting their ranges upslope and may reach upper elevational limits (Gould et al., 2018).

Model simulations show a robust drying pattern for all Caribbean islands that is generally larger for Puerto Rico (25% annual rainfall reduction for some life zones). These project substantial increases in temperature and decreases in precipitation for all life zones within Puerto Rico by 2050 (Bowden et al., 2020).

Vulnerable life zones such as the unique rainforest habitats in the Luquillo Mountains could be affected, which during the past decades have been impacted by anthropogenic stressors resulting from urban expansion (Gould et al., 2018; Gould, Martinuzzi and Parés, 2012; López-Marrero, and Hermansen-Báez, 2010). In addition to land use changes, climate change represents a threat to the cloud forest ecosystem in the Luquillo Mountains (Beusekom- Van, González and Scholl, 2017).

Islands in the northern Caribbean are vulnerable to extreme weather-related disasters (Bowden et al., 2020). The hurricane cycle in the Atlantic has shaped Puerto Rico's forests for approximately 10 million years at a rate of 0.45 hurricanes hitting the island per year (Joglar, 2005). Atmospheric events like storms or hurricanes cause major recurrent ecosystem disturbances in Puerto Rico, from there, other natural disasters emerge like floods, landslides or severe periods of droughts.

As previously indicated, hurricanes Irma and María combined knocked down a quarter of the biomass contained in Puerto Rico's trees (Hall et al., 2020). Researchers found that an unsuspected key factor, more than wind, was massive rainfall and that future hurricanes stoked by warming climate may be even more destructive to forests than projected (Hall et al., 2020).

Climate change can also cause significant damage to forested wetlands due to sea level rise. In a three (3) feet sea level rise scenario, almost 60% of the estuarine wetlands dominated by shrubs and at least one third (30%) of the emerging estuarine wetlands, would be affected (DNER, 2019). In a six (6) feet sea level rise scenario, about a quarter of coastal palustrine and estuarine wetlands would be directly affected (DNER, 2019).

Droughts are another factor affecting forests that will worsen with climate change. Although many forest species in Puerto Rico can adjust to drought, hotter and longer droughts could affect their tolerance, causing long term effects, such as changes in plant communities and loss of species (Crausbay et al., 2018). In estuaries, the compound effects of climate change, urbanization and competing uses for the surface and underground waters may cause changes in 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 that is required to sustain the mangrove forests in the southeast coasts of Puerto Rico, especially in the Jobos Bay National Estuarine Research Reserve and the Aguirre Forest has been compromised. This has caused the death of the mature black mangrove forest (DNER, 2016d).

6 FLAS ELIGIBILITY CRITERIA

6.1 BACKGROUND

The purpose of the FLP is to protect **environmentally important forest** areas that are **threatened** to conversion to non-forest uses. According to the National FLP Implementation Guidelines (2017), the DNER is the Commonwealth designated entity that defines what constitutes threatened and environmentally important forest areas.

The DNER has identified and described environmentally important forest areas based on the following public values: timber and other forest commodities, scenic resources, public recreation opportunities, riparian areas, fish and wildlife habitat, known threatened and endangered species, known cultural resources, and other ecological values.

Threats to forest resources in Puerto Rico have been identified as: urban developments, Puerto Rico's fiscal situation, traditional agricultural practices, natural disturbances, and climate change.

6.2 FLP IMPLEMENTATION PRIORITIES

In the 1997 AON, the DNER identified the following priorities for FLP implementation:

- The protection and restoration of forested areas in watersheds developed as sources of public water supply,²⁸
- Buffer zones of existing forest reserves,
- Conservation of forested areas in primary or close to primary conditions, and
- Conservation of biodiversity and unique features.

²⁸ The forests, like the main reservoirs' watersheds, play an important role in the water supply system, as they allow the infiltration of water in the main aquifers.

In this 2021 AON revision, these priorities are following priorities are added, based on the analyses and the recommendations provided by

- Protection of coastal forests that are urban developments.
- Protection of the karst forests that provide economic benefits.
- Establish forested corridors.

Overall, the main change is towards a landscape-connectivity of forest systems is promoted to ecosystem values. Forested corridors are an connecting fragmented habitats into a more These are proposed for species of interest such as adequately protect ecosystem services and as a strategy.

Landscape connectivity will improve climate resilience not only for species but also for uncertainties of ecosystems' responses to climate facilitate species movement, as landscape species' migration capacity (Keeley et al., 2018a;

6.3 FLA ELIGIBILITY CRITERIA REVISION AND

In 1997, eight FLAs were selected using the priorities following eligibility criteria:

FLAs implementation priorities

- ✓ The protection and restoration of forested areas in watersheds as sources of public water supply,
- ✓ Buffer zones of existing forest reserves,
- ✓ Conservation of forested areas in primary or close to primary conditions,
- ✓ Conservation of biodiversity and unique features,
- ✓ Protection of coastal forests that are continually threatened for urban developments,
- ✓ Protection of the karst forests that provide multiple ecological and economic benefits,
- ✓ Establish forested corridors.

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maintained, and the literature review, spatial the SFSCC:

continually threatened for multiple ecological and

scale approach, where the maintain and enhance important means of unified whole (DNER, 2015). the Puerto Rican parrot, to climate change adaptation

change adaptation and communities. Despite the change, forested corridors fragmentation inhibits a Keeley et al., 2018b).

UPDATE

described above and the

1. Present a vegetal cover typical of forests
2. Are threatened by present or future conversion to non-forest uses
3. Contain one or more of the following important public values
 - a. Watershed values, including the protection of public water supply
 - b. Conservation of biodiversity and unique features
 - c. Aesthetic and scenic values
 - d. Existing or potential public recreation opportunities
 - e. Known cultural/historic areas
 - f. Fish and wildlife habitat
 - g. Known threatened and endangered species
 - h. In primary or close to primary forest conditions
 - i. Other ecological values
4. Promote the development of commercial timberland, and/or
5. Promote the preservation of the forest land base.

These criteria and their evaluation factors are described in Appendix 1, Table A- 1.

6.3.1 Recommendations provided by the SFSCC

In 2018, the DNER requested the SFSCC to revise these criteria and to provide recommendations on:

- Modifications to the criteria, and

- Modifications to FLAs. These include new areas, and/or expansions or additions to existing FLAs.

The SFSCC was requested, through a survey, to rate the 1997 criteria using a scale that went from one to seven (1-7), one (1) being “not a priority” and seven (7) “an essential priority”.²⁹ The SFSCC identified all criteria as an essential priority or a high priority. Essential priorities included: watershed values (water supply and quality); conservation of biodiversity and unique features (protection of species and habitats); and public recreation characteristics.

²⁹ Rating scale: 1-not a priority; 2-low priority; 3-somewhat priority; 4-neutral; 5-moderate priority; 6-high priority; 7-essential priority.

Table A- 2 in Appendix 1 shows the results of the survey and comments provided by the SFSCC.

The SFSCC was also asked to rate and provide recommendations on additional criteria that should be considered in the update of the AON. The SFSCC gave the highest priority to the establishment of buffer zones to protected natural areas and to establish ecological corridors to connect protected areas and green spaces.³⁰

The SFSCC also provided five specific recommendations that resulted in proposed modifications to the FLAs' boundaries. These are described below:

- **Inclusion of the karst region:** In 2014, the Plan and Regulations of the Karst Special Planning Area (PRAPEC, for its Spanish acronym) was approved. The SFSCC considered it necessary to include the karst region as part of the FLAs, as the original FLAs do not incorporate this area.
- **Expand the Quebradillas FLA to include the area known as “El Costillal”.** The area is known by the presence of abundant critical elements.
- **Include the area known as the corridor for the Puerto Rican parrot,** between the Río Abajo State Forest, the Maricao State Forest and the Guajataca State Forest. This is between the Caonillas-Dos Bocas, Maricao and Quebradillas FLAs.
- **Include an area in Jájome, Cayey,** where there are habitats of endangered species, and the critical habitat for the coquí dorado. This covers lands outside the boundaries of protected natural areas between Cayey and Coamo. The SFSCC recommended to unify the La Plata-Coamo FLA with the Río Grande de Loíza FLA.
- **Consider the Stewardship Program management plans** and include the areas with the highest concentration of active plans.

³⁰ The other criteria that were provided by the SFSCC and identified with high priority (score of 6) by the SFSCC were: (a) development of small and intermediate parks in urban areas that serve as habitats and with recreational uses; (b) restoration of habitats that were extensive (for example, freshwater swamps, riparian forests, and ausubo forests; (c) current ownership; and (d) soil productivity.

All the recommendations provided by the SFCC were approved by the DNER and incorporated in this 2021 AON.

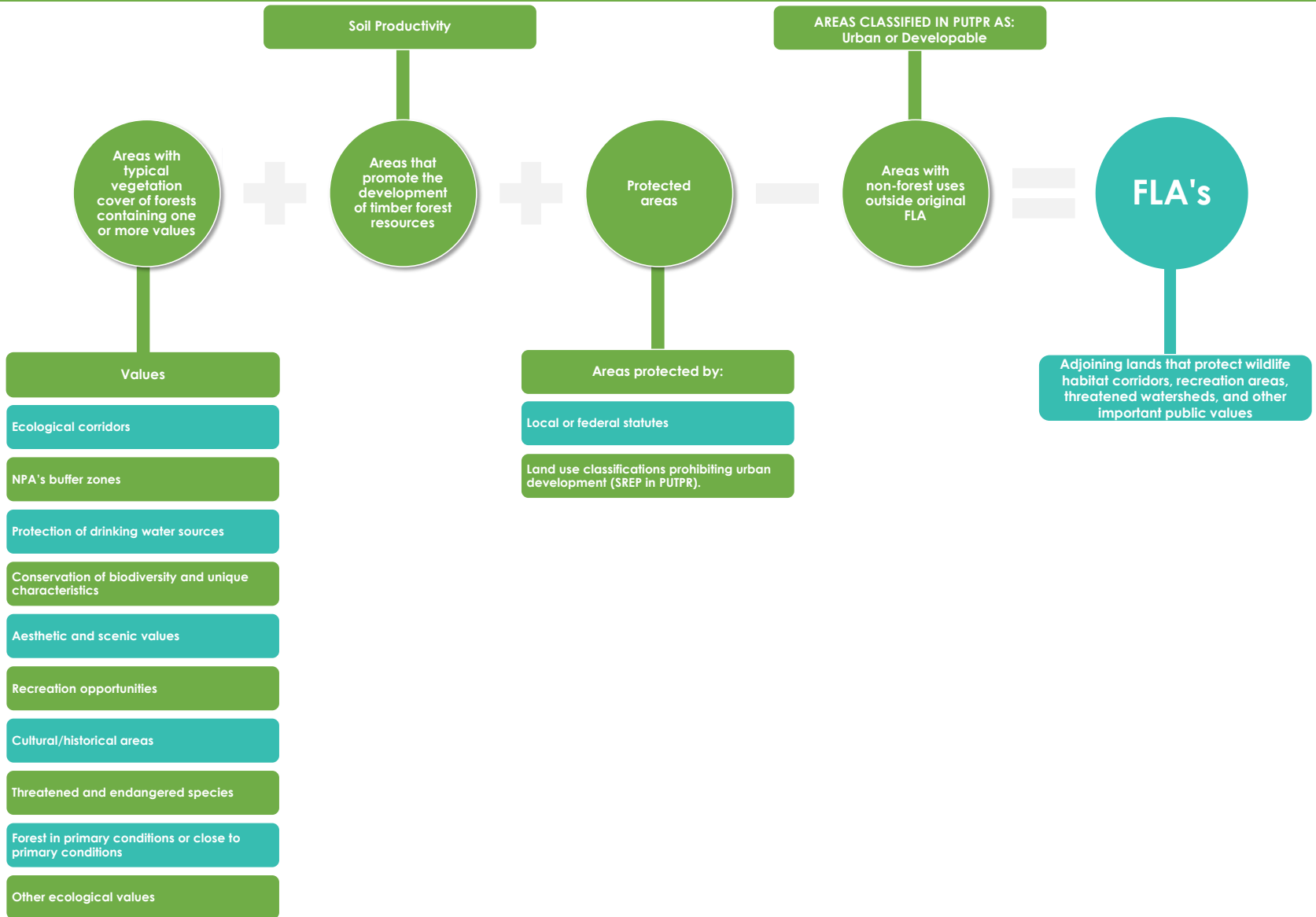
6.3.2 Summary of the analysis used to propose changes to the existing FLA

The recommendations provided by the SFSCC were used to carry out a geospatial analysis to refine/modify the FLAs' boundaries. In the 1997 AON, FLAs' boundaries were defined using existing roads. In this revision FLAs were expanded following the boundaries of the critical wildlife areas, priority conservation areas, protected natural areas, species richness, potential for forestry areas, and impervious lands (to avoid including developed areas to existing FLAs). This report presents the proposed general modification for each FLA, which will be refined with the public participation and the SFSCC's input.

For each FLA, a geospatial analysis was carried out with the most recent and available information. As the SFSCC recommendations were directed primarily to increase buffer zones in protected areas and biological corridors, special attention was paid to the boundaries of the original FLAs. The GIS layers used are detailed in Appendix 1, T

able A- 4.

Figure 9. Incorporation of the criteria and values into the analysis



7 MODIFICATIONS TO EXISTING FLAS

7.1 RECOMMENDATIONS OF MODIFICATIONS TO FLAS

The criteria for the selection or modifications to existing FLAs was conducted by the DNER, following the FLP Guidelines, in coordination with the SFSCC. The revised criteria and information recommended by the SFSCC, together with the main findings of the previous sections and a geospatial analysis, resulted in fifteen (15) changes to the original eight (8) FLAs. These modifications add 368,490 acres to the original 857,248 acres of FLAs, expanding these areas to a total of 1,225,738 acres.³¹

Overall, this revision does not recommend adding new FLAs nor eliminating existing FLAs. Rather, the analyses performed resulted in the expansion and connection of the existing FLAs. These expansions were primarily to protect corridors for endemic and endangered species and their critical habitats outside the original FLAs; to connect protected natural areas; to protect water resources and to protect unique forests or increase their representativeness, such as the dry life zone and the karst region. See Map 20 for the proposed changes.

7.2 PROPOSED EXPANSIONS TO THE EXISTING FLAS

In Puerto Rico, the coastal areas reveal high levels of habitat heterogeneity and biodiversity, but they are also subject to greater urban development pressures. In this revision, it is proposed to expand the Guánica FLA (Exp. 1A)³², the Quebradillas FLA (Exp. 3A in El Costillal), the Caonillas-Dos Bocas FLA (Exp. 4A), the La Plata-Coamo FLA (Exp. 5A), the El Yunque FLA (Exp. 7B) and the Maunabo FLA (Exp. 8A) up to the coast to give more protection to critical elements in these areas.

In addition, the proportion of regions with the highest species richness or that are classified as critical or important areas for wildlife, such as the karst forests, need a better representation within Puerto Rico's network of protected areas (Castro Prieto et al., 2016). As discussed previously, the north karst region, which provides multiple ecological and economic benefits, is continually threatened to be converted to non-forest uses. The urban development in the karst region also threatens the quality and availability of groundwater. In this revision, the areas classified as Restricted Zone in

³¹ The original FLAs represent 39% of the total area of Puerto Rico, and the proposed changes add 17%.

³² Exp. is used as an abbreviation for proposed expansions and the combination of numbers and letters (eg. 1A, 5C, 8A) are used to identify the expansions to the FLAs in the map.

the PRAPEC (APE-RC) were incorporated into the analysis. As a result, the Quebradillas FLA and La Plata-Coamo FLA will be expanded to include karst formations as the Cordillera de Jaicoa in Aguadilla (Exp. 3C) and Moca and the Mogote Nevarez in Toa Baja (Exp. 5A). The inclusion of the karst region is also important to achieve the purpose of sustaining the necessary water supply for the resilience and sustainability of Puerto Rico.

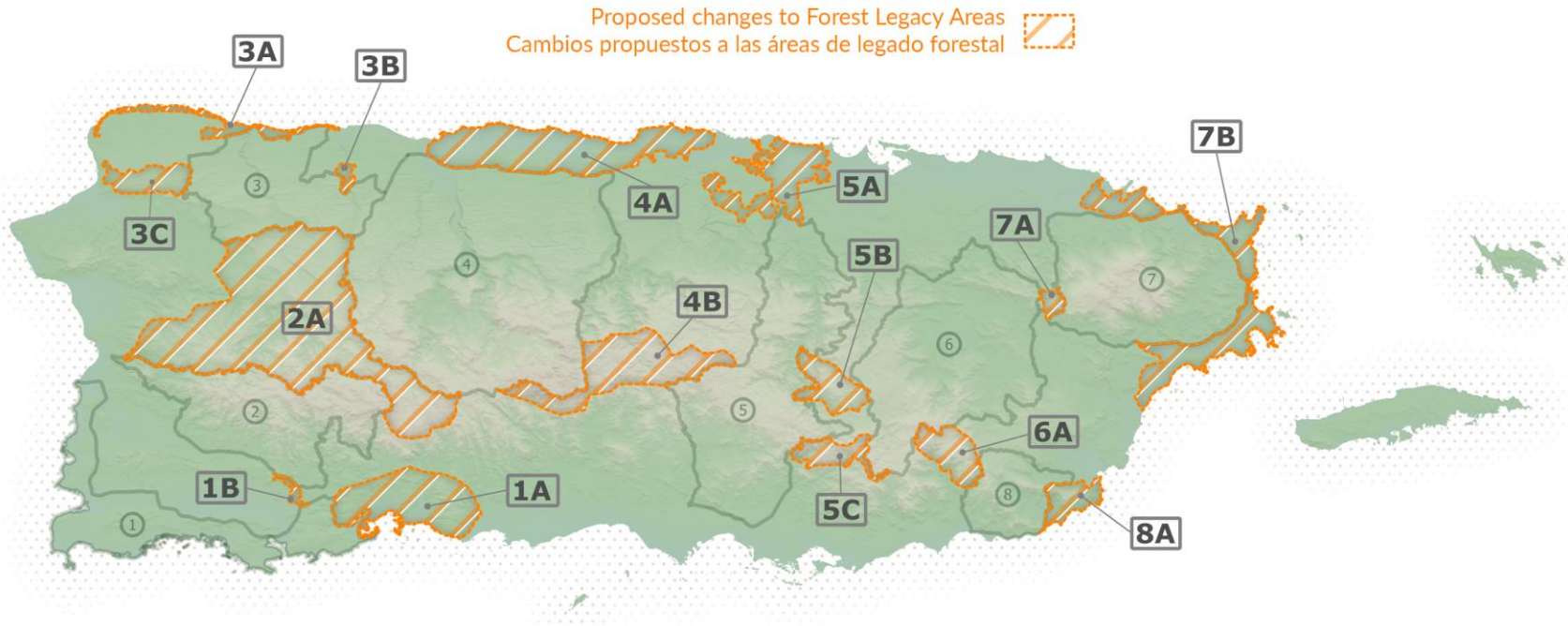
The expansions proposed for El Yunque FLA to the east (Exp. 7B), are aimed to increase representativeness of the dry forest life zone, and to protect coastal areas threatened to be converted to non-forest uses. This action will add protection to the cloud forest in El Yunque as it depends on the forest cover and climatic conditions of the surrounding lands, which have been under continuous development pressure. It also increases connectivity at a watershed level between El Yunque life zones towards the coast.

The expansions 2A, 4B, 5C, 6A and 7A integrate proposed critical habitats for endemic and endangered species and protect forest areas in important hydrological watersheds to preserve the quantity and quality of the main water reservoirs.

Another important need identified was to establish biological corridors for forest connectivity, as they are an important means of connecting fragmented habitats into a more unified whole (DNER, 2015). For example, the original FLAs show a discontinuous corridor between the Río Grande de Loíza FLA and the Maunabo FLA. These intermediate lands are part of the Carite State Forest and other protected areas. Another example are the lands between the Maricao FLA and the Caonillas-Dos Bocas FLA, where portions of the Monte Guilarte State Forest and La Olimpia Forest are outside the existing FLAs boundaries. The expansions 1B, 2A and 5C address this issue. Also, other forest corridors are proposed for species of interest such as the Puerto Rican parrot (Exp. 2A), as a climate change adaptation strategy, and to adequately protect ecosystem services.

The main changes proposed to the originals FLAs are presented in the next map and discussed in the following sections. For more details on this analysis, refer to Appendix 1 Table 7.

Map 20. Changes proposed to the FLAs



Source: Forest Legacy Program, Department of Natural and Environmental Resources. Map prepared by Estudios Técnicos, Inc.

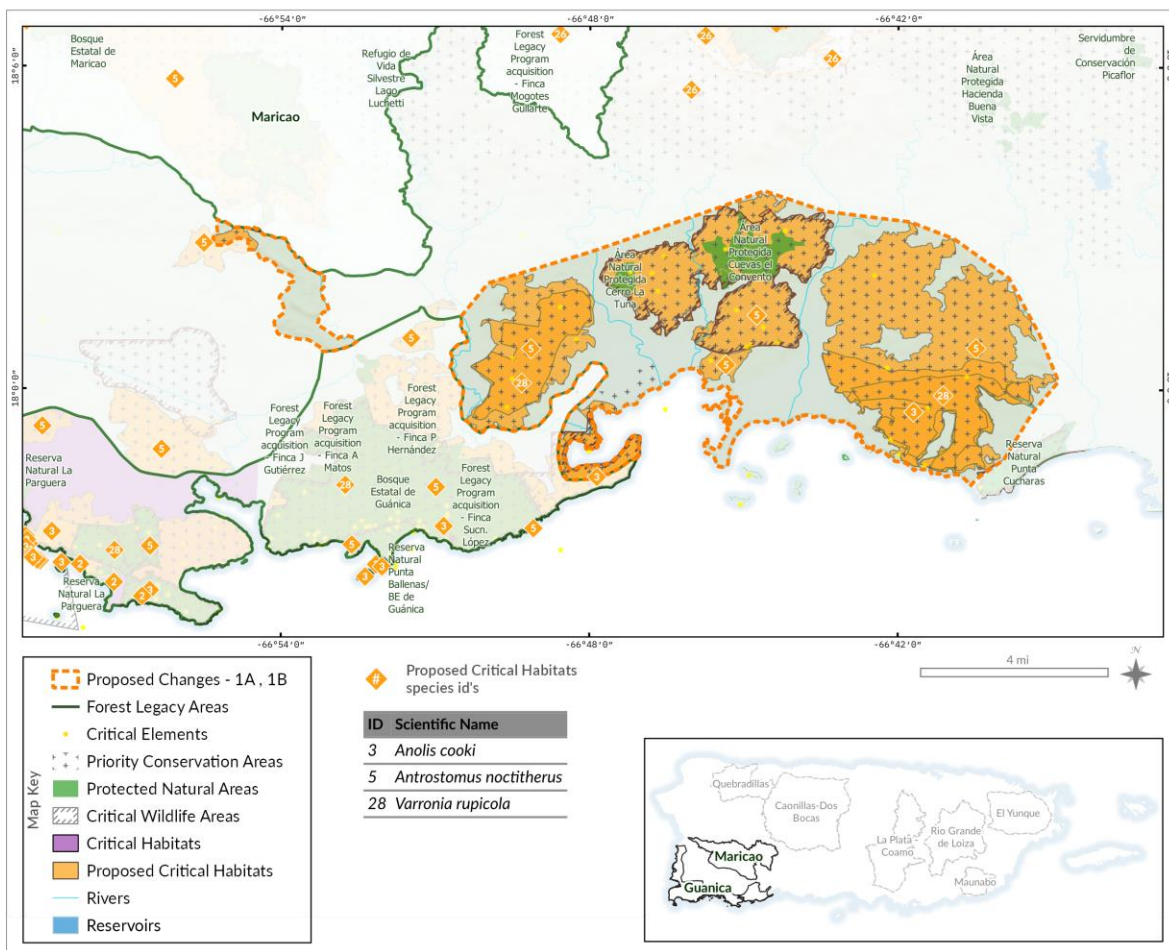
Table 9. Proposed modifications to existing FLAs

	Forest Legacy Area	Acreege of existing FLAs	Proposed expansions (acres)	Total area of FLA (acres)
1	Guánica Legacy Area	70,710	33,760	104, 470
2	Maricao Legacy Area	83,592	132,038	215,630
3	Quebradillas Legacy Area	67,580	18,412	85,992
4	Caonillas-Dos Bocas Legacy Area	243,665	80,494	324,160
5	La Plata-Coamo Legacy Area	131,350	43,040	174,390
6	Río Grande de Loíza Legacy Area	126,555	11,973	138,528
7	El Yunque Legacy Area	103,771	40,934	144,705
8	Maunabo Legacy Area	30,025	7,839	37,864
TOTAL		857, 248	368,490	1,225,738

7.2.1 Guánica FLA (Expansions 1A and 1B)

The Guánica FLA will be extended to the east 32,262 acres (Exp. 1A) to protect the critical habitat of the yellow-shouldered blackbird or mariquita (*Agelaius xanthomus*) and to the north 1,498 acres (Exp. 1B) to connect with the Maricao FLA through the Model Forest. In the Exp. 1A there are two proposed critical habitats under DNER's Regulation 6766: the Puerto Rican nightjar (*Antrostomus noctitherus*), and the Dry - forest lizard (*Anolis cooki*).

Map 21. Guánica FLA (Expansion 1A to the East and 1B to the North)



The Puerto Rican nightjar or guabairo is a critically endangered and endemic species. According to the USFWS, the high-quality habitat for this bird is found between the municipalities of Guánica, Sabana Grande, Yauco, Guayanilla, Peñuelas and

Ponce.^{33,34} These lands are also identified by the DNER as the Guabairo Priority Conservation Area (PCA) under the Natural Heritage Program. These are characterized by the presence of mature subtropical deciduous forests with adequate structural conditions in its understory, clear of opportunistic vines and with little human disturbance. Another DNER proposed critical habitat documented in the area is the Dry forest lizard's (*Anolis cooki*).

Other critical species documented in the proposed expansion is the Puerto Rico manjack (*Varronia rupicola*), a rare shrub in southwestern Puerto Rico, listed as threatened, that can be found at low elevations.

Three critical wildlife areas are found in this expansion: Guayanilla Hills; Las Salinas Lagoon/ El Tuque; and Punta Verraco, Cerro Toro and Punta Ventana. Other PCAs in this expansion are the Lluveras - Punta Verraco PCA and the Punta Cucharas PCA.

This expansion will increase the protection of the karstic forested lands in the southwest coast of Puerto Rico, that provide habitat to these species and will increase the representativeness of the dry forest life zone. According to the most recent FIA, human activities are the main disturbance in the dry forest (Marcano-Vega, 2017). In addition, the FIA includes Cueva el Convento PNA in Peñuelas, the Punta Cucharas Nature Reserve and the Cerro La Tuna PNA.

7.2.2 Maricao FLA (Expansion 2A)

This expansion will add 132,038 acres to the Maricao FLA (Exp. 2A). To the east, it will establish a corridor that connects this FLA with the Caonillas-Dos Bocas FLA. This connector includes the Monte Guilarte State Forest, La Olimpia Forest and the Foreman Conservation Easement. These lands include the habitat of the critically endangered fern, *Thelypteris yaucoensis*. This is an endemic species with only two known populations in Puerto Rico, in Yauco and Ciales. It also includes portions of the proposed critical habitats of the *Tectaria estremarana*, and the *Thelypteris verecunda*.

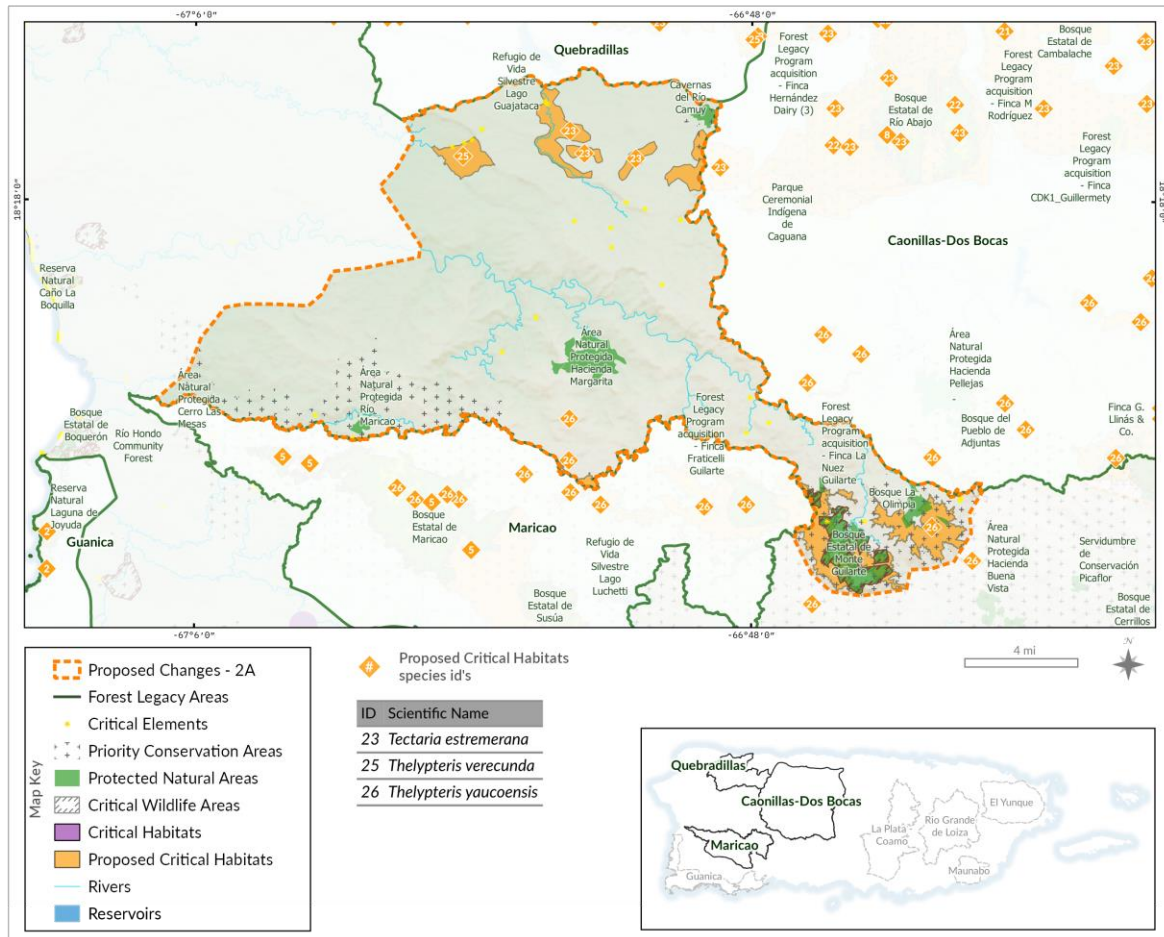
In addition, the Maricao FLA will be expanded to the north and east to connect with the Quebradillas FLA and to the Caonillas-Dos Bocas FLA. This new expansion will protect the corridor of the Puerto Rican parrot (*Amazona vittata*), between the Maricao, Guajataca and Río Abajo State Forests. This expansion also includes three

³³ <https://www.fws.gov/southeast/pdf/fact-sheet/puerto-rican-nightjar-english.pdf>

³⁴ At present, this FLA covers the municipalities of Guánica and Lajas.

PNA. Two of these, Hacienda Margarita and Río Maricao, are administered by Para La Naturaleza and the other, the Río Camuy Caverns National Park, is administered by the National Park Program under the DNER.

Map 22. Maricao FLA (Expansion 2A to the North)



These forest lands, part of the subtropical wet forest life zone, will protect portions of the restricted karst. There are also four PCA: Cerro Las Mesas, Cordillera Central, Carso Río Abajo and Carso Río Camuy. Furthermore, these additions will protect lands that are part of the Model Forest and will cover the municipalities with the highest number of management plans under the Forest Stewardship Program, which include Maricao, Yauco, San Germán and Las Marías.³⁵

³⁵ According to information provided by the Forest Stewardship coordinator.

This expansion cover lands with the potential for forestry, conservation, and agriculture, as identified by Gould et al. (2017). It will protect important hydrological regions in the western part of the island, and important agricultural and non-timber resources, such as the coffee farms, and the lands that are part of the Model Forest.

7.2.3 Quebradillas FLA (Expansions 3A, 3B and 3C)

The Quebradillas FLA will be expanded to the north (Exp. 3B), to the northwest (Exp. 3A) and to the west (Exp. 3C) to add 18,412 acres to the existing FLA. These expansions will protect lands with a high concentration of endemic and endangered species, important forest lands, and geological features.

The expansion 3A with 6,395 acres in the northwest, will protect the area known as El Costillal. It has various karstic formations covered by semi-evergreen forests, adjacent to the southern margin of the Quebrada La Sequía in Las Llanadas ward, Isabela. It is part of the PCA known as the Río Guajataca y sus Desfiladeros (Río Guajataca and its Gorges). These lands have a high diversity of flora and fauna with some critical species, including some endemic to Puerto Rico associated with karst and of singular rarity, such as the evergreen shrub *Auerodendron pauciflorum*, whose single population is in Isabela.

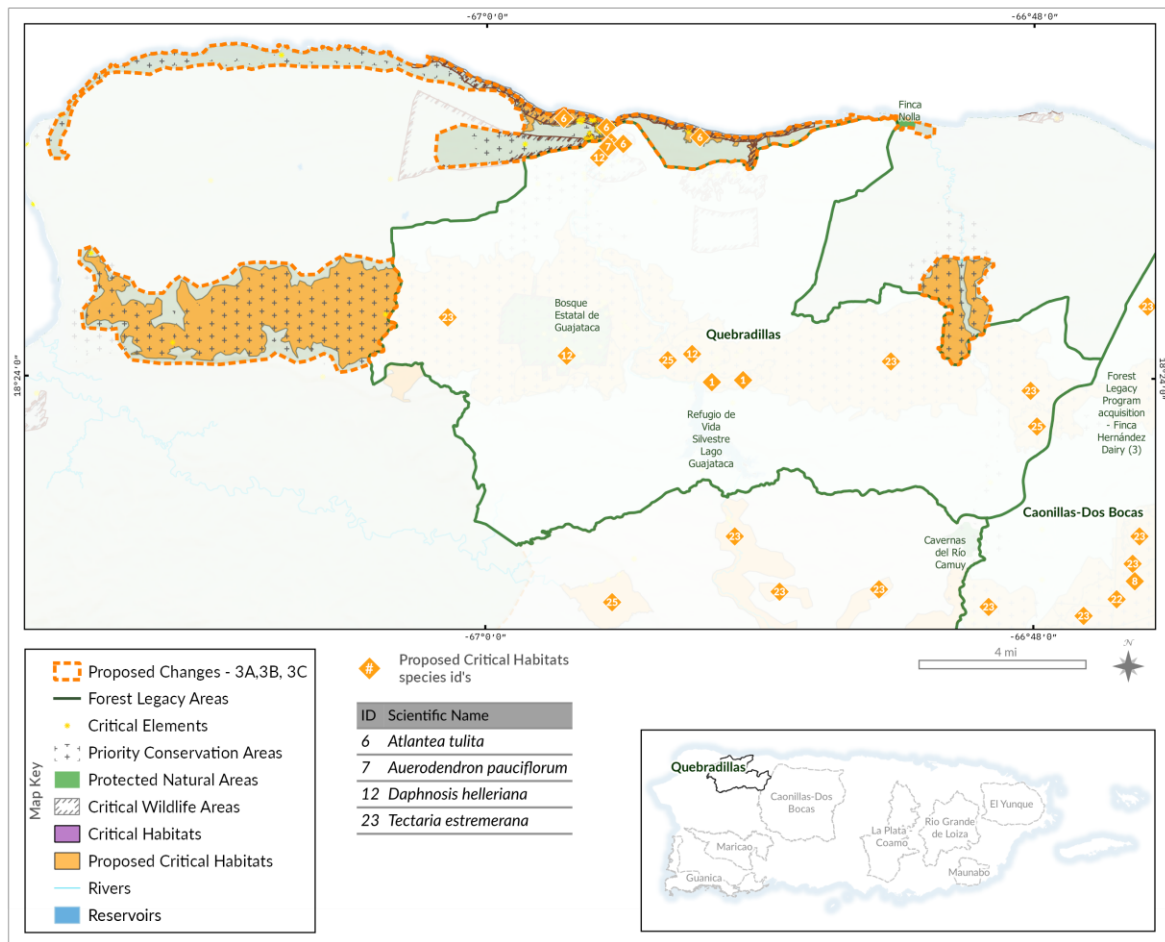
The *Daphnopsis helleriana* is another endemic and endangered species with limited distribution³⁶ that is present in these lands. Other endemic and endangered species include the palo de rosa (*Ottoschulzia rhodoxylon*), a tree known as matabuey (*Goetza elegans*), a rare species of fern (*Tectaria estremerana*), and the harlequin butterfly or mariposa arlequin (*Atlantea tulita*). The habitat of the latter was severely impacted by hurricane María. Up to 50% of the trees in each of the nine habitat survey sites had major damage, which likely decreased butterfly populations (Resetar et al., 2020). The area is also habitat to the Puerto Rican crested toad (*Bufo lemur*), identified as the Sapo Concho PCA by the DNER.

The other expansion of 1,708 acres to the north will protect the proposed critical habitat for the *Tectaria estremerana*. This area plays an important role in the conservation and protection of water resources, especially underground sources, as it is part of the restricted karst and the associated hydrological reserve. These are classified as specially protected rustic land with hydrological and ecological value, according to the Puerto Rico Land Use Plan.

³⁶ <https://www.fws.gov/southeast/pdf/fact-sheet/daphnopsis-hellerana-spanish.pdf>

The expansion of 9,769 acres to the west (Expansion 3C) will protect the Cordillera de Jaicoa, which is part of the restricted karst. These lands are within the Priority Conservation Area known as the Karso del Noroeste. This addition will also protect the proposed critical habitat for the *Tectaria estremarana* and other critical elements such as the *Buxus portorricensis*, a rare small tree whose known populations are in western Puerto Rico.

Map 23. Quebradillas FLA (Expansion 3a and 3B to the North, and 3C to the West)

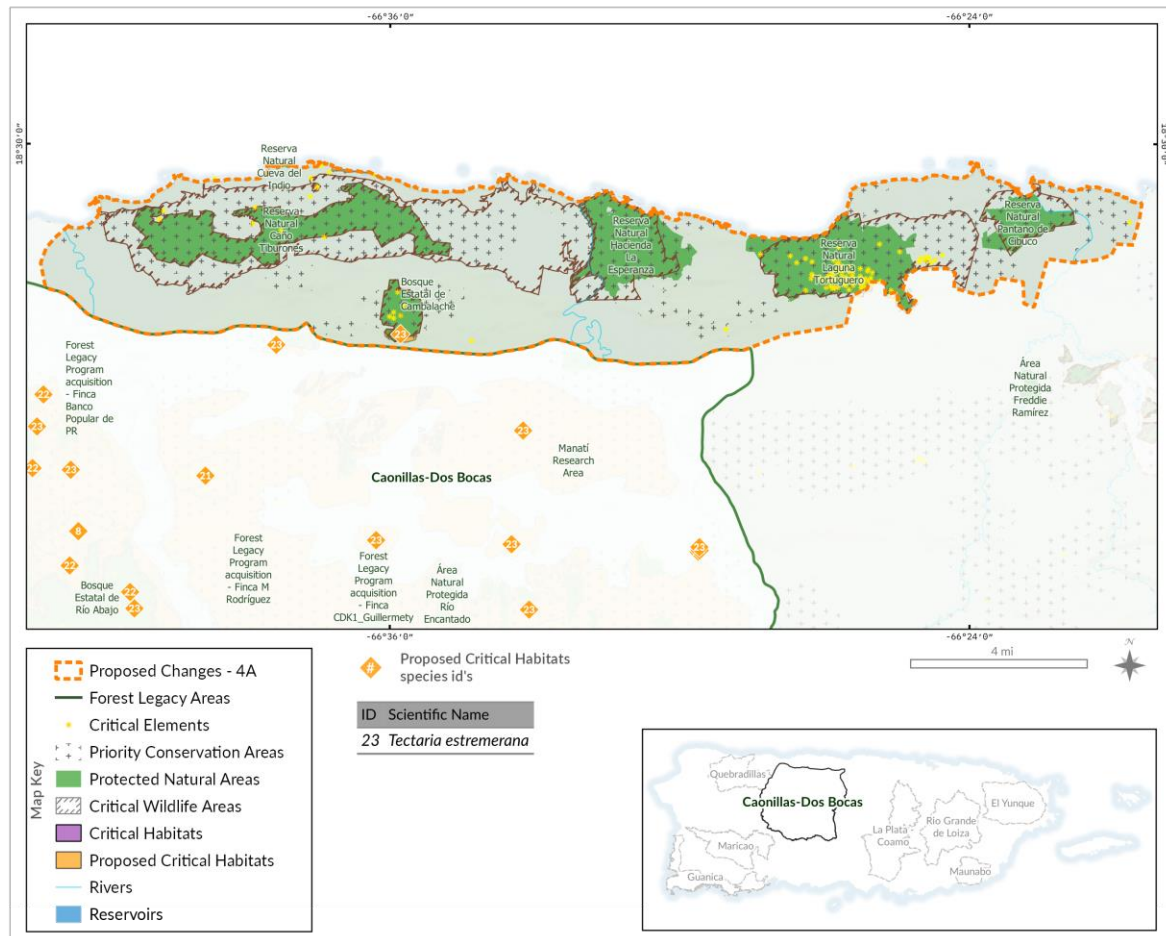


7.2.4 Caonillas-Dos Bocas FLA (Expansion 4A and 4B)

This FLA will be expanded 46,165 acres to the north (Exp. 4A), and 34,329 acres to the east-southeast (Exp. 4B) to connect with La Plata-Coamo FLA. The expansion to the

north (Exp. 4A) will connect this FLA with six PNA: Caño Tiburones Nature Reserve, Cueva del Indio Nature Reserve, Cambalache State Forest, Hacienda La Esperanza Nature Reserve, Laguna Tortuguero Nature Reserve and Pantano de Cibuco Nature Reserve. This expansion will also protect portions of the restricted karst in the Karso del Norte PCA.

Map 24. Caonillas-Dos Bocas FLA (Expansion 4A to the North)



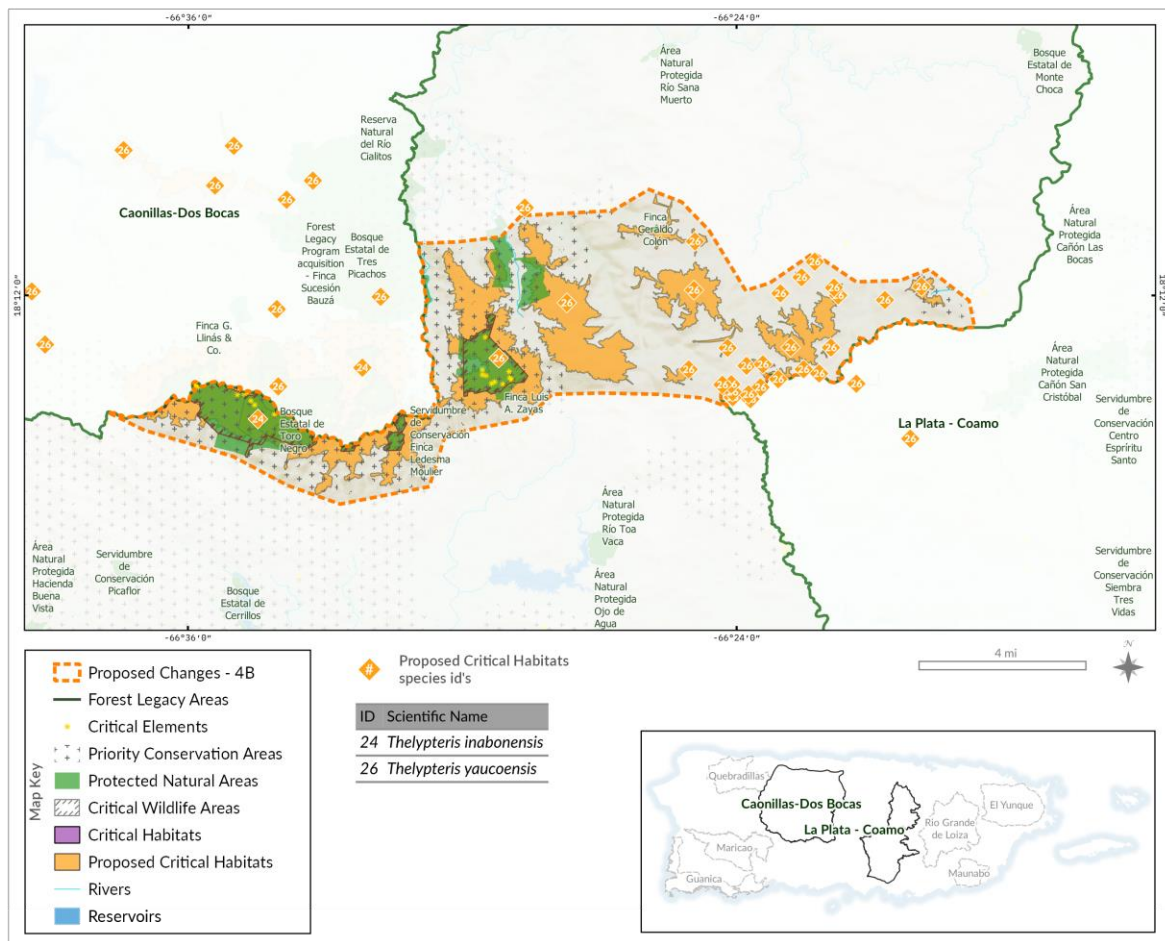
The Exp. 4B will protect the proposed critical habitat for two endemic and critically endangered species of ferns: the *Thelypteris inabonensis* and the *Thelypteris yaucoensis*. These lands also provide habitat for the endangered tree palo de ramón (*Banara vanderbilti*) and to two species of birds: the Puerto Rican sharp-shinned hawk or falcón de sierra (*Accipiter striatus venator*), and the Puerto Rican broad-winged hawk or guaraguao de bosque (*Buteo platypterus brunnescens*)³⁷. The Puerto Rican

³⁷ <https://www.fws.gov/southeast/pdf/fact-sheet/puerto-rican-broad-winged-hawk-spanish.pdf>

sharp-shinned hawk is threatened and is restricted to five isolated mountain forest areas on the island. This species experienced a population decline by an estimated 56% due to hurricane María, and 57% of the nest trees used by hawk pairs were destroyed (Resetar et al., 2020).

As a result, this expansion will provide a corridor for these and other species, connecting the Toro Negro State Forest, Tres Picachos State Forest, and two other PNA, known as Finca Geraldo Colón and Finca Luis A. Zayas. This expansion will also protect lands identified as PCAs: the Barranquitas PCA and the Cordillera Central PCA.

Map 25. Caonillas-Dos Bocas FLA (Expansion 4B to the East)



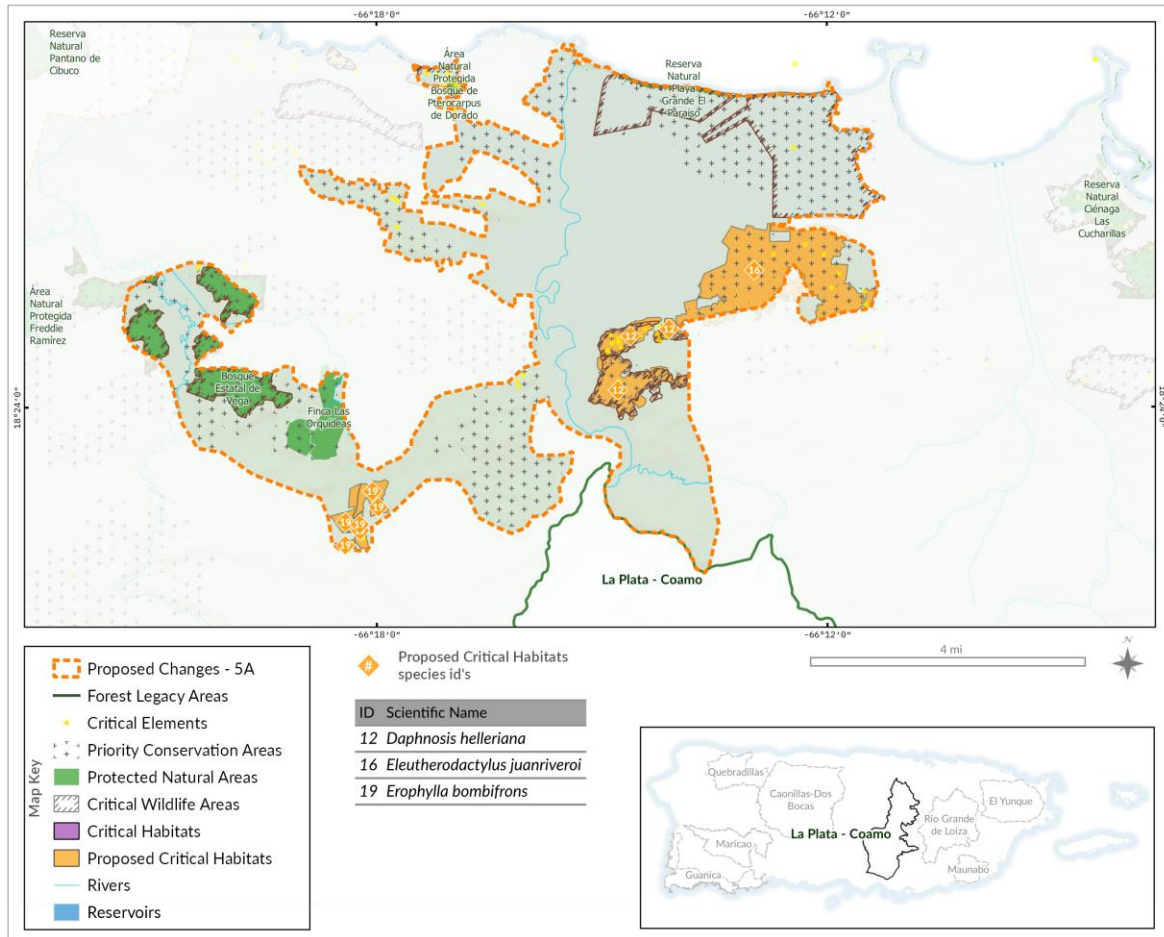
7.2.5 La Plata-Coamo FLA (Expansions 5A, 5B and 5C)

This revision proposes three expansions to this FLA, increasing its area by 43,041 acres. The north expansion (Exp. 5A) consists of 22,505 acres that will connect the FLA to various PCA like Mogotes de Río Lajas, Nevárez, Ciénaga San Pedro y Sector El Caracol, and Ciénaga Prieta. The Mogotes de Río Lajas and Nevarez PCA is constituted by a belt of interconnected limestone hills that are well preserved despite being surrounded by residential, commercial, and industrial developments and major highways. This PCA covers 4,600 acres of varied flora and fauna with various critical species, including some endemic species. This expansion will protect the proposed critical habitat for the endangered flowering plant *Daphnopsis helleriana* and the critically endangered coquí llanero (*Eleutherodactylus juanriveroi*).

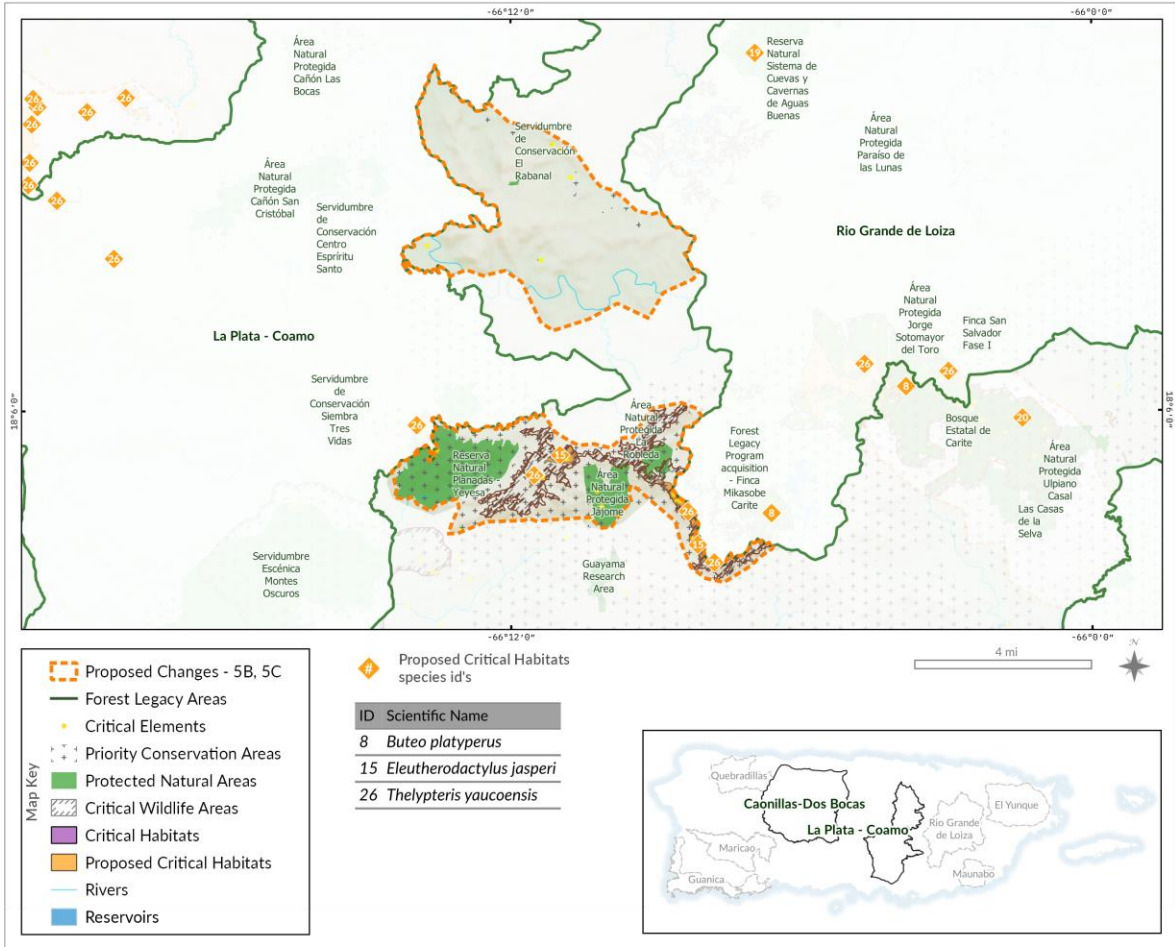
To the east, the area is expanded by 11,810 acres (Exp. 5B) to create a corridor that will connect to the Río Grande de Loíza FLA. This corridor will protect the "Habitat Paloma Sabanera" PCA. The Puerto Rican plain pigeon (*Patagioenas inornata wetmorei*) was severely impacted by hurricane María, as a decline of 88% was reported in the areas of most abundance of this species and 94% in islandwide surveys (Resetar et al., 2020). In addition, this corridor includes El Rabanal Conservation Easement.

South of this corridor, another connector of 8,726 acres (Exp. 5C) is proposed to protect two critical wildlife areas: Cerro El Gato and Associated Areas and the Carite State Forest. This corridor includes three PCAs: the Habitat Coquí Dorado PCA, the Piedras del Collado PCA and the Región Montañosa Carite State Forest PCA. These lands also include the designated critical habitat for the Golden Coquí or coquí dorado (*Eleutherodactylus jasperii*), which is presumed to be extinct. It also includes two proposed critical habitats under Regulation 6766 for the Puerto Rican broad-winged hawk (*Buteo platypterus brunnescens*) and the *Thelypteris yaucoensis*. These additions will also provide connectivity between various PNA such as La Yeyesa, La Robleda, Cerro El Gato, Jájome and Carite State Forest.

Map 26. La Plata-Coamo FLA (Expansion 5a to the North)



Map 27. La Plata-Coamo FLA (Expansions 5B and 5C to the East)

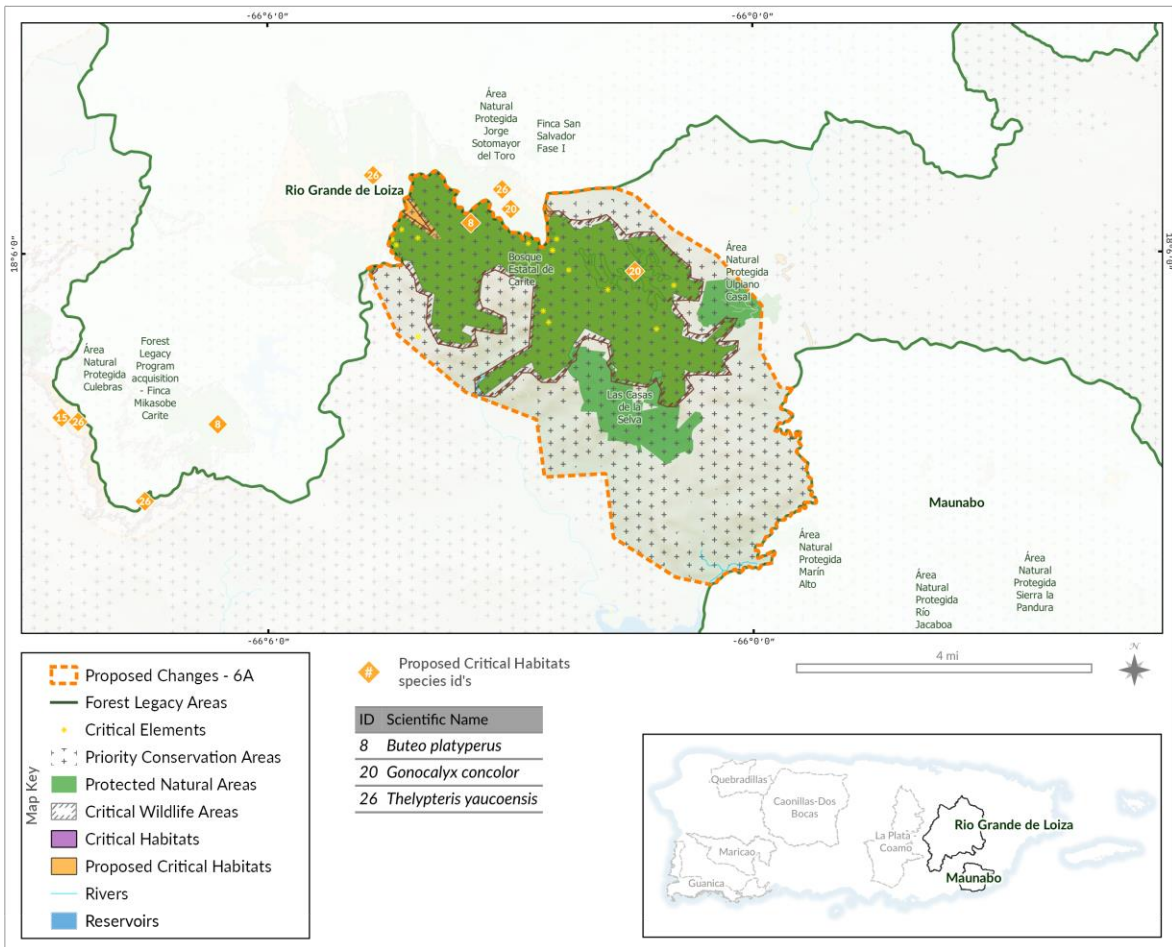


7.2.6 Río Grande de Loíza FLA (Expansion 6A)

This revision recommends one expansion to the southeast (Exp. 6A) that will add 11,973 acres to connect to the Maunabo FLA. These lands include the Carite State Forest CWA, the PCA for the Coquí Guajón, the Sierra de Pandura and Guardarraya PCA, and the Región Montañosa and Carite State Forest PCA. It includes Las Casas de la Selva, a PNA important for research and forestry, and the Ulpiano Casal and Marín Alto PNA.

In addition, the expansion will cover the proposed critical habitats under Regulation 6766 for the *Thelypteris yaucoensis* and the Island brittleleaf (*Gonocalyx concolor*), a rare vine that is found in the Sierra de Cayey.

Map 28. Río Grande Loíza FLA (Expansions 6A to the Southeast)

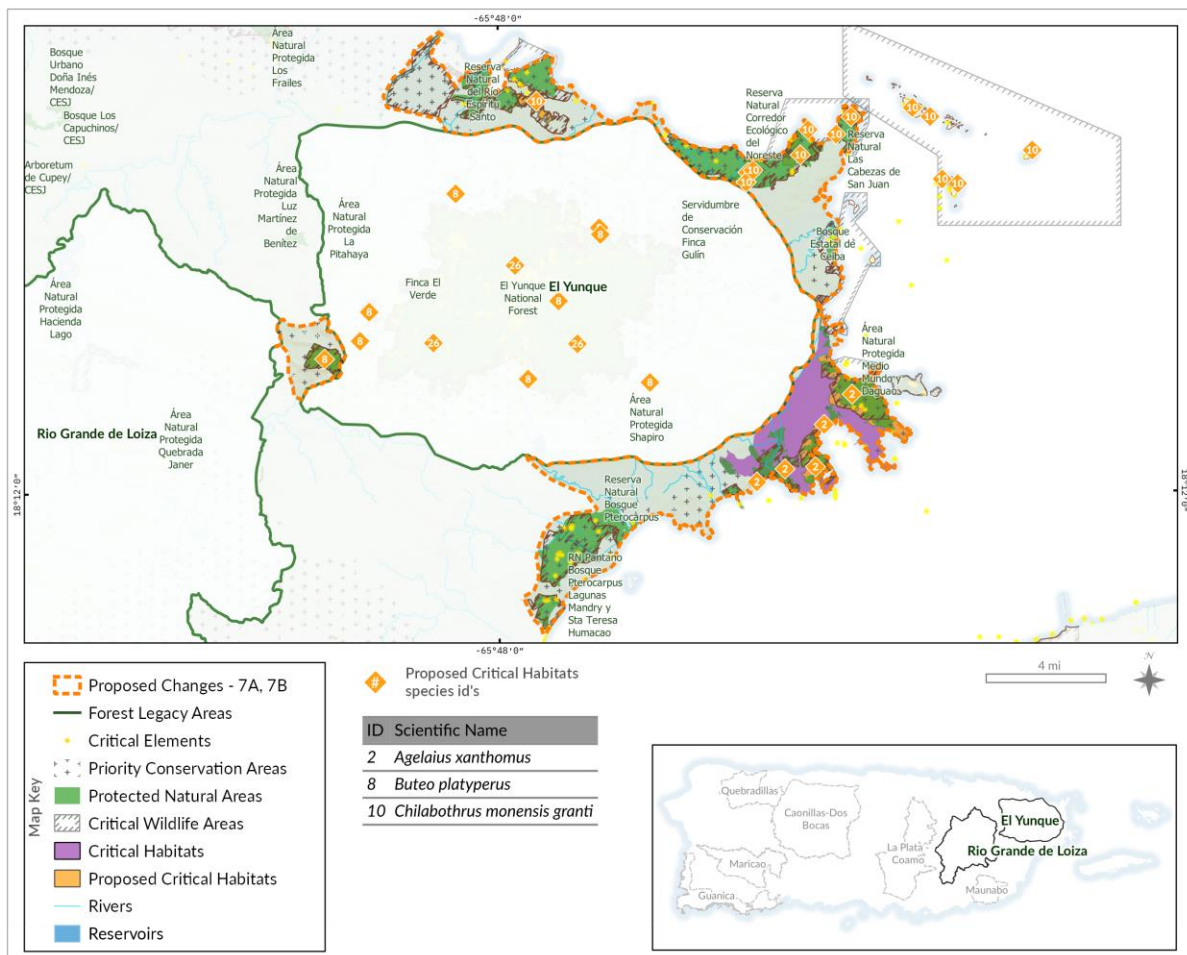


7.2.7 El Yunque FLA (Expansions 7A and 7B)

The expansions of El Yunque FLA consist of two sections: one of 2,445 acres to the southwest (Exp. 7A) to connect to the Río Grande de Loíza FLA, and other of 38,489 acres to the north, northeast and southeast (Exp. 7B) of the original FLA.

The expansion to the southwest includes the proposed critical habitat for the Puerto Rican broad-winged hawk (*Buteo platypterus brunnescens*). The extension 7B allows to maintain the representativeness of the forests of all the life zones present in Puerto Rico and adds some degree of protection against human threats. According to the most recent FIA, human activities are the main disturbance in the dry forest.

Map 29. El Yunque FLA (Expansion 7A and 7B to the East)



This expansion includes 11 CWA³⁸ and seven PCAs.³⁹ This FLA will be expanded to the north up to the Espíritu Santo Nature Reserve and will include the proposed critical habitat for the endangered Virgin Islands Tree Boa (*Chilabothrus monensis granti*). This expansion will also include the designated critical habitat of the yellow-shouldered blackbird (*Agelaius xanthomus*).

This addition will increase recreational opportunities in El Yunque National Forest and its surrounding communities, following the goals established in the Revised Land Management Plan, that aims to increase connectivity with communities through recreation (USFS, 2018).

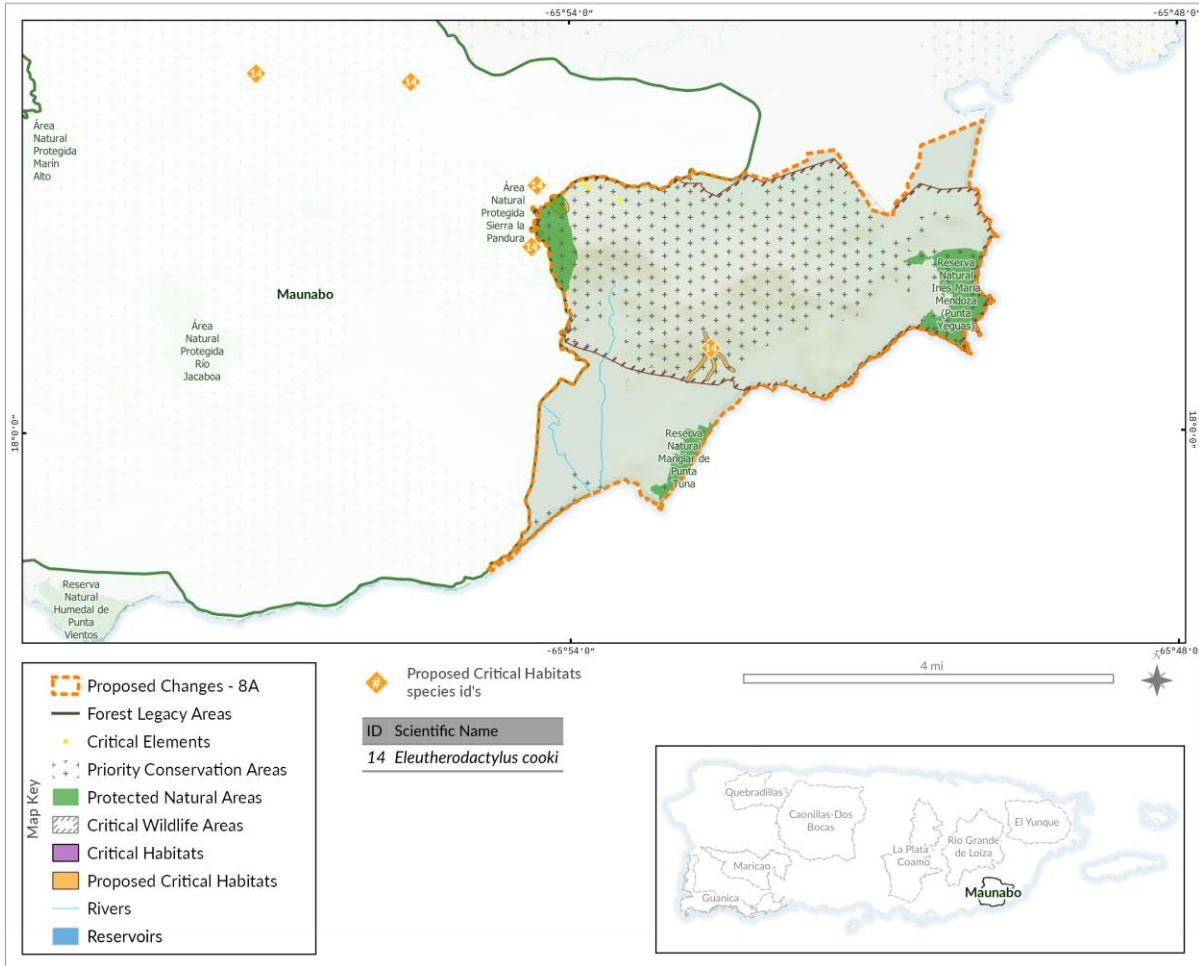
7.2.8 Maunabo FLA (Expansion 8A)

This revision recommends one expansion of the Maunabo FLA (Exp. 8A) that will add 7,839 acres to the existing FLA. This area expands the FLA to the southeast coast and includes all the Pandura Mountain Range CWA, and the Guajón- Sierra de Pandura y Guardarraya PCA. It connects with two coastal Nature Reserves that are also considered PCA: Punta Tuna and Punta Yeguas. This area also includes the proposed critical habitat for the Puerto Rican rock frog or coqui Guajón (*Eleutherodactylus cooki*).

³⁸ Laguna Grande, Laguna Aguas Prietas and adjacent areas, Baja Swamp and Herrera River Mouth, Ensenada Comezón and Espíritu Santo River Nature Reserve, Fajardo Coastline, Laguna Grande, Laguna Aguas Prietas and adjacent areas San Miguel, Las Paulinas and El Convento Natural Area, Former Roosevelt Roads Naval Base Mangroves, Ceiba State Forest and Humacao Nature Reserve.

³⁹ Cabezas de San Juan PCA, Corredor Ecológico del Noreste PCA, El Yunque PCA, Pilonos-Río Mameyes PCA, Playa de Fajardo - Cayo Algodones PCA, Pterocarpus Luquillo PCA and Lagunas de Humacao PCA.

Map 30. Maunabo FLA (Expansion 8A to the Southeast)



8 PUERTO RICO FOREST LEGACY AREAS

This section describes the resulting Puerto Rico's FLAs. For each FLA, the following descriptions are included following the FLA Guidelines:

- Location of each geographic area on a map and a written description of the proposed FLA boundary.
- Consistency with the eligibility criteria.
- Identification of important environmental values and how they will be protected and conserved.
- The conservation goals or objectives in each FLA.
- List of public benefits that will be derived from establishing each FLA, and
- Identification of the entities that may hold lands or interests in lands.

Finally, section 8 documents the public involvement process and analyzes the issues raised.

8.1 THE GUÁNICA LEGACY AREA

8.1.1 General Location

The Guánica Legacy Area is located on the southwestern part of Puerto Rico including the coastal areas of Cabo Rojo, Lajas, Guánica, Yauco, Guayanilla, Peñuelas and a small portion of Ponce. It extends from Laguna Joyuda in Mayagüez and Hormigueros on the north, the Cabo Rojo coast on the west, and Punta Cucharas in the southeast. The size of this Legacy Area is approximately 104,470 acres.

8.1.2 Summary of important environmental values

The Guánica Legacy Area contains, at least, 17 PNA, 13 PCA and 14 CWA. It includes one designated critical habitat and three proposed critical habitats. It also includes five FLA acquisitions. The area is representative of the dry forest life zone and has outstanding karst formations. This FLA covers lands that are part of the Model Forest. Specific values are detailed below.

Significant resource areas, of which most are PNA:

- Cerro La Tuna PNA
- Cordillera Sabana Alta PNA
- Cuevas el Convento PNA
- El Conuco PNA
- Boquerón State Forest- Nature Reserve
- Guánica State Forest-Nature Reserve
- Susúa State Forest (partially)
- Cabo Rojo National Wildlife Refuge
- Iris Alameda Wildlife Refuge
- Laguna Cartagena National Wildlife Refuge
- Finca Belvedere Nature Reserve
- La Parguera Nature Reserve
- Laguna Joyuda Nature Reserve
- Punta Ballenas Nature Reserve
- Punta Cucharas Nature Reserve
- Punta Guaniquilla Nature Reserve
- Conservation Easement: Finca María Luisa

Priority Conservation Areas (PCA)

- Bahía Montalva
- Bahía Ballena
- Caño Corazones (partially)

- Cordillera Central
- Estuario de la Bahía de Guánica
- Finca La Jungla
- Hábitat del Guabairo
- Humedales de la Parguera
- Joyudas- Laguna Cabo Rojo
- Laguna Cartagena
- Lluveras - Punta Verraco
- Punta Cucharas
- Sierra Bermeja

Critical Wildlife Areas (CWA):

- Boquerón State Forest
- Boquerón Wildlife Refuge
- Cabo Rojo Salt Flats and Adjacent Areas
- Cartagena Lagoon
- Guánica State Forest
- Guayanilla Hills
- Joyuda Lagoon Natural Reserve
- La Parguera Natural Reserve
- Las Salinas Lagoon / El Tuque
- Punta Guaniquilla Natural Reserve
- Punta Verraco, Cerro Toro and Punta Ventana
- San Jacinto Salt Flats
- Tamarindo Lagoon
- Susúa State Forest

Designated critical habitats:

- *Agelaius xanthomus*

Proposed critical habitats under DNER's Regulation 6766:

- *Anolis cooki*
- *Antrostomus noctitherus*
- *Varronia rupicola*

FLP Acquisitions:

- *Finca A. Matos*
- *Finca El Pitirre Inc. #16*
- *Finca J. Gutiérrez*
- *Finca P. Hernández*
- *Finca Sucesión López*

Representativeness of unique geological and forest resources:

- *Restricted Karst (PRAPEC)*
- *Dry forest life zone*

Other values

- The Model Forest
- The Guánica State Forest is also a Nature Reserve and an UNESCO's Biosphere Reserve.

8.1.3 Conservation and protection methods

Fee simple acquisition and/or conservation easements. Conservation easements for tracts should address:

- Development rights
- Management of land for traditional forest uses, recreational purposes and wildlife habitat and scenic resources.
- Incentives for private forest owners
- Public access
- Protection of rare and endangered species.

8.1.4 List of objectives

- Protect unique coastal forests
- Protect wildlife habitats, especially those of threatened and endangered species
- Protect landscape and scenic values
- Continue traditional forest uses
- Establish forest corridors as a climate change adaptation strategy

8.1.5 Public benefits to be derived

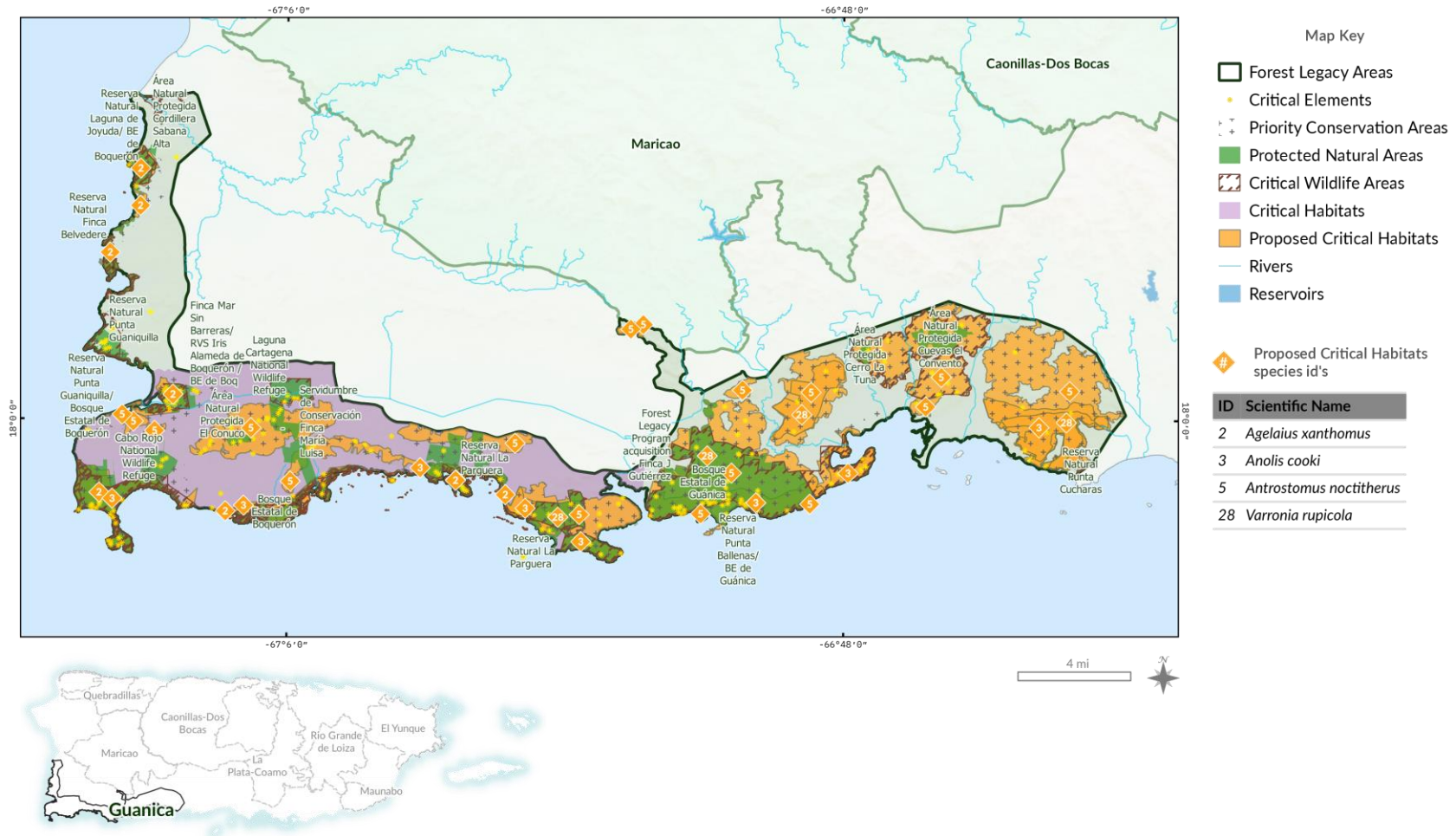
- Enhance and maintain biodiversity
- Reduce threats or pressures of forest conversion to other non-forest uses on the designated limits of the Guánica State Forest and the surrounding buffer zone

- Enhance and maintain natural elements for ecotourism activities
- Provide public access for recreation
- Provide traditional forest products
- Enhance livelihoods
- Reduce potential hazards to communities caused by wildland fires
- Increase resiliency for climate change and natural hazards

8.1.6 Entities that may be assigned administrative, monitoring, and/or management responsibilities.

- Commonwealth of Puerto Rico, Department of Natural and Environmental Resources, Bureau for the Management of Protected Natural Areas and Forests Services
- Local municipal governments
- Federal partners such the USFWS;
- NGO such as Para La Naturaleza, Fideicomiso del Bosque Modelo, Protectores de Cuenca, and other NGO and community-based organizations, including those with collaborative/management agreements with the PRDNER.

Map 31. Guánica Forest Legacy Area



8.2 THE MARICAO LEGACY AREA

8.2.1 General location

The Maricao Legacy Area is located on the southwestern portion of the Cordillera Central, extending west to the municipality of Mayagüez, east to Adjuntas and north to the municipalities of San Sebastián, Lares and Camuy, including also portions of the municipalities of San Germán, Sabana Grande, Maricao, Yauco, Guayanillas, Peñuelas, Utuado and Las Marías. The size of this Legacy Area is approximately 215,630 acres.

8.2.2 Summary of important environmental values

The Maricao Legacy Area contains at least nine PNA, six PCA and three CWA. It also includes four FLA acquisitions. It includes four proposed critical habitats and will protect forests that are part of the flight corridor of the Puerto Rican parrot. This FLA covers portions of the Restricted Karst and also includes lands that are part of the Model Forest. Specific values are detailed below.

Significant resource areas

- Hacienda Margarita PNA
- Río Maricao PNA
- Maricao State Forest
- Monte Guilarte State Forest
- Susúa State Forest
- La Olimpia Forest
- Río Camuy Caverns National Park
- Lago Luchetti Wildlife Refuge
- Foreman Conservation Easement

Priority Conservation Areas (PCA)

- Cerro Las Mesas
- Cordillera Central
- Hábitat del Guabairo
- Carso Río Abajo (partially)
- Carso Río Camuy (partially)
- Lago Luchetti Wildlife Refuge

Critical Wildlife Areas (CWA):

- Maricao State Forest
- Monte Guilarte State Forest

- Susúa State Forest

Proposed critical habitats:

- *Antrostomus noctitherus*
- *Tectaria estremerana*
- *Thelypteris verecunda*
- *Thelypteris yaucoensis*

FLP acquisitions

- Finca Busigó Maricao
- Finca Fraticelli Guilarte
- Finca La Nuez Guilarte
- Finca Mogotes Guilarte

Representativeness of unique geological and forest resources

- Subtropical wet forest life zone
- Restricted Karst (PRAPEC)

Other values

- Various municipalities with the highest number of management plans under the Forest Stewardship Program (Maricao, Yauco, San Germán and Las Marías).
- The Model Forest; potential lands for forestry, conservation, and agriculture (Gould et al, 2017).
- Important hydrological regions in the western part of the island.
- The corridor of the Puerto Rican parrot (*Amazona vittata*), between the State Forests of Maricao, Guajataca and Río Abajo.

8.2.3 Conservation and protection methods

Fee simple acquisition and/or conservation easements. Conservation easements should address:

- Development rights
- Management of land for traditional forest uses, recreational purposes and wildlife habitat and scenic resources
- Public access
- Protection of rare and endangered species
- Protection of public water supply

8.2.4 List of objectives

- Establish a buffer zone for the PNA
- Protect wildlife habitats, especially those of threatened and endangered species
- Protect landscape and scenic values
- Continue traditional forest uses
- Establish forest corridors as a climate change adaptation strategy

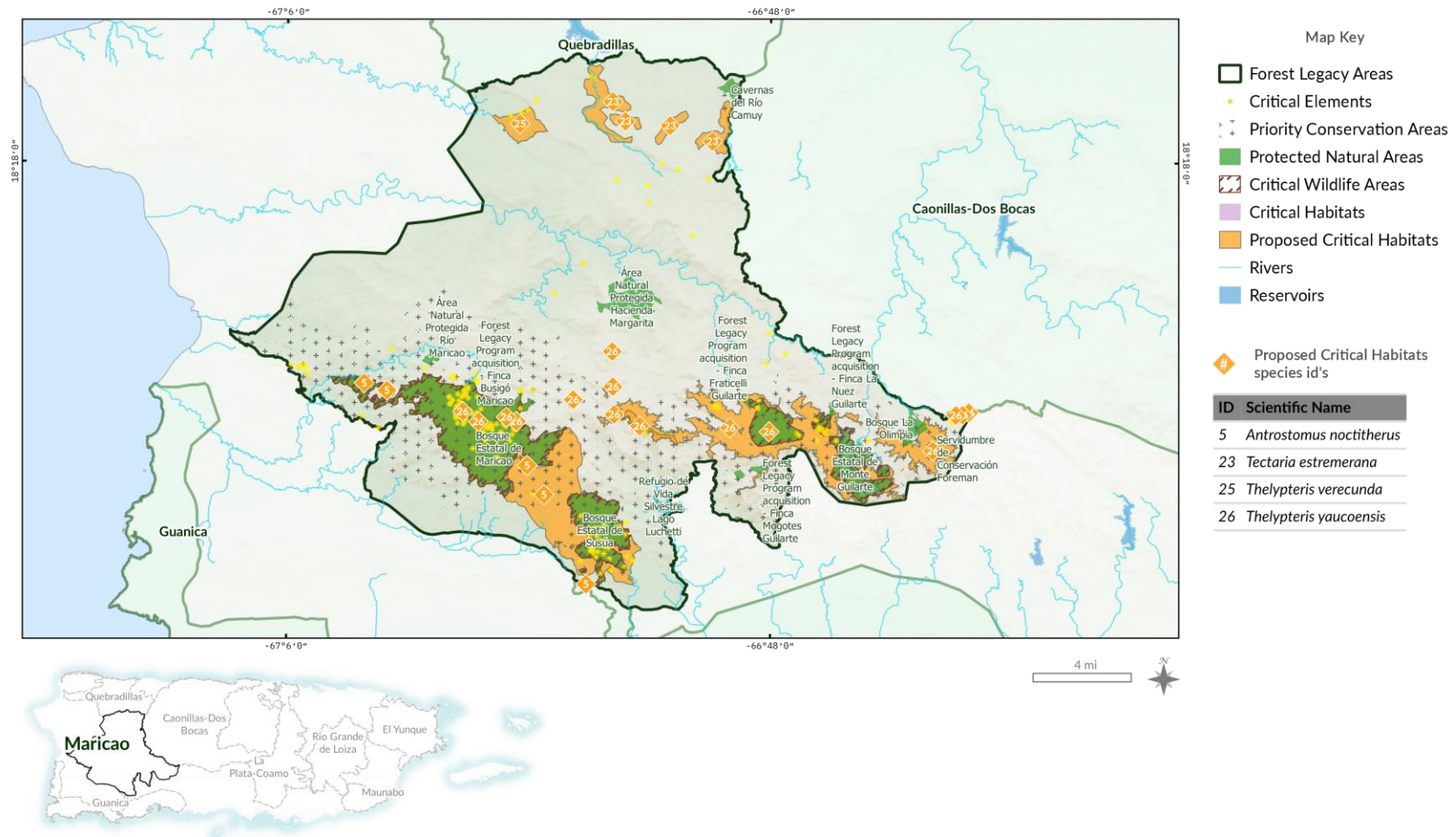
8.2.5 Public benefits to be derived

- Enhance and maintain biodiversity
- Allow for development of ecotourism activities
- Provide traditional forest products
- Provide public access for recreation
- Enhance livelihoods
- Reduce potential hazards to communities caused by wildland fires
- Increase resiliency for climate change and natural hazards

8.2.6 Entities that may be assigned administrative, monitoring, and/or management responsibilities

- Commonwealth of Puerto Rico, Department of Natural and Environmental Resources, Bureau for the Management of Protected Natural Areas and Forests Services
- Local municipal governments
- Partners such as Para La Naturaleza, Casa Pueblo, Fideicomiso del Bosque Modelo, Cofiesencia and other NGO and community-based organizations, including those with collaborative/management agreements with the PRDNER.

Map 32. Maricao Forest Legacy Area



8.3 THE QUEBRADILLAS LEGACY AREA

8.3.1 General Location

The Quebradillas Legacy Area is located on the northwestern portion of the karst region, extending west to the municipality of Aguadilla, east to the municipality of Hatillo, and portions of the municipalities of Isabela, Quebradillas, Camuy, San Sebastián and Moca. Also includes the coastal areas of Camuy, Quebradillas, Isabela and Aguadilla. The size of this Legacy Area is approximately 85,992 acres.

8.3.2 Summary of important environmental values

The Quebradillas Legacy Area contains three PNA, eight PCA and five CWA. It includes six proposed critical habitats. This FLA covers portions of the Restricted Karst and will protect outstanding karst features and coastal forests. This FLA will protect the sole source of drinking water and water for irrigation in the northeast portion of the island. Specific values are detailed below.

Significant resources areas:

- Guajataca State Forest
- Finca Nolla Nature Reserve
- Lago Guajataca Wildlife Refuge

Priority Conservation Areas (PCA):

- Bajura
- Hábitat Sapo Concho
- Humedales, Desfiladeros y Bosques Costeros Noroeste
- Carso Río Abajo
- Carso Río Camuy
- Quebrada Bellaca
- Lago Guajataca Wildlife Refuge
- Río Guajataca y sus Desfiladeros

Critical Wildlife Areas (CWA):

- Barrio Cocos and Quebrada Bellaca
- Barrio Coto
- Guajataca Cliffs
- Guajataca Lake
- Guajataca State Forest

Proposed critical habitat for listed species:

- *Adiantum vivesii*
- *Atlantea tulita*
- *Auerodendron pauciflorum*
- *Daphnopsis helleriana*
- *Tectaria estremarana*
- *Thelypteris verecunda*

Representativeness of unique geological and forest resources:

- Area known as El Costillal
- Cordillera de Jaicoa
- Karst formations such as cliffs, canyons, haystack hills among other

Other values

- Protection of underground water resources, as is part of the restricted karst and the associated hydrological reserve.
- Presence of a critical elements: *Buxus portoricensis*, a rare small tree with few locations in Puerto Rico, the flowering plant *Goetza elegans* or matabuey and *Ottoschulzia rhodoxylon* or palo de rosa.

8.3.3 Conservation and protection methods

Fee simple acquisition and/or conservation easements. Conservation easements should address:

- Development rights
- Management of land for traditional forest uses, recreational purposes and wildlife habitat and scenic resources
- Public access
- Protection of rare and endangered species
- Protection of public water supply

8.3.4 List of objectives

- Protect unique karst forests, including costal forests
- Protect wildlife habitats, especially those of threatened and endangered species
- Protect landscape and scenic values

- Continue traditional forest uses
- Establish forest corridors as a climate change adaptation strategy
- Protect surface and underground sources of water

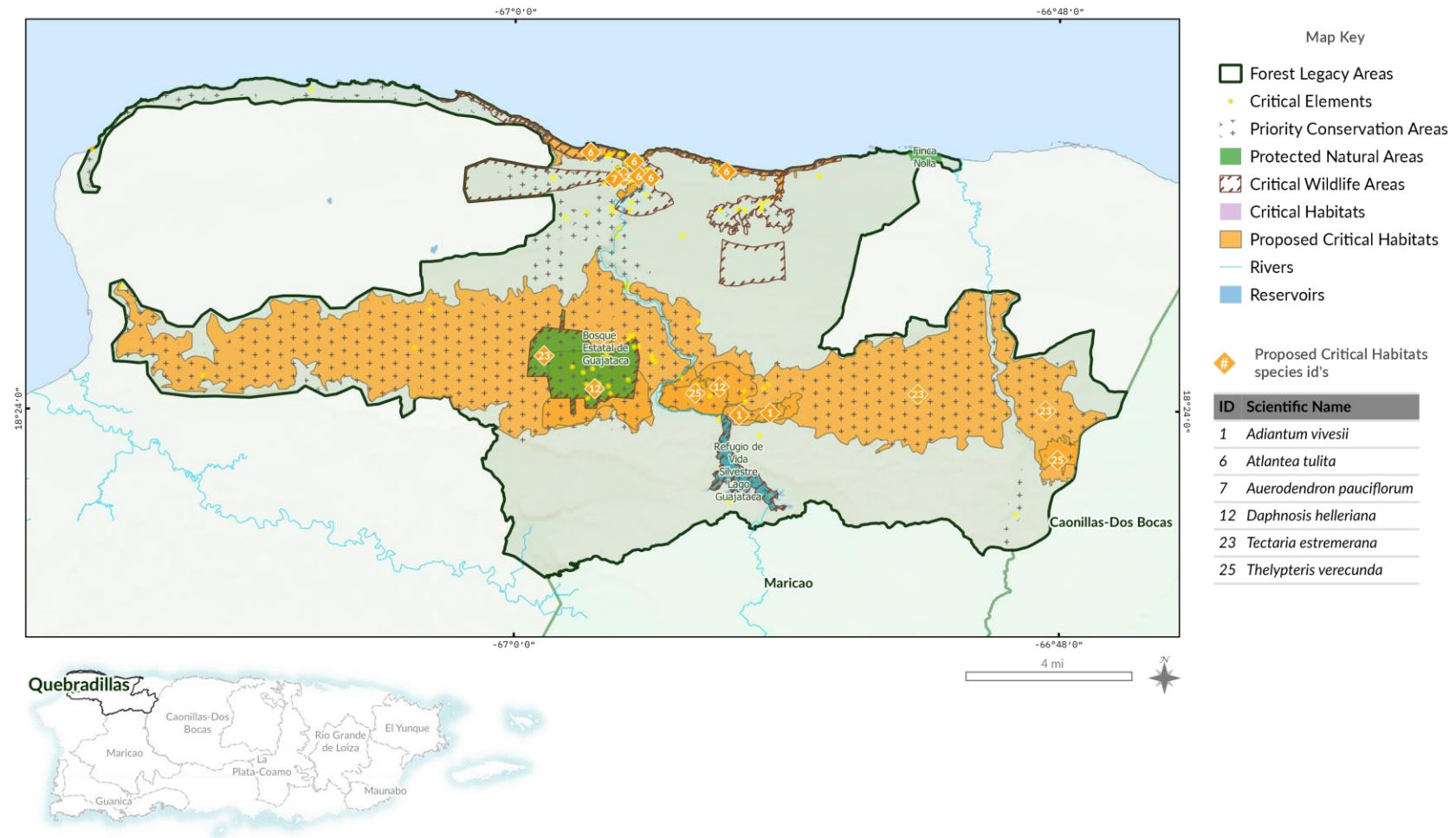
8.3.5 Public benefits to be derived

- Enhance and maintain biodiversity
- Allow for development of ecotourism activities
- Provide traditional forest products
- Provide public access for recreation
- Enhance livelihoods
- Increase resiliency for climate change and natural hazards
- Provide reliable sources of good water quality and quantity

8.3.6 Entities that may be assigned administrative, monitoring, and/or management responsibilities

- Commonwealth of Puerto Rico, Department of Natural and Environmental Resources, Bureau for the Management of Protected Natural Areas and Forests Services
- Local municipal governments,
- Partners such as Ciudadanos del Karso and other NGO and community-based organizations such as Conservación Costera Inc., Vida Marina-UPR Aguadilla among others, including those with collaborative/management agreements with the PRDNER.

Map 33. Quebradillas Forest Legacy Area



8.4 THE CAONILLAS-DOS BOCAS LEGACY AREA

8.4.1 General Location

The Caonillas-Dos Bocas Legacy Area is located on the northcentral region of the island. It includes portions of the karst limestone region and the Cordillera Central, extending West to the municipalities of Hatillo, Utuado and Adjuntas, and North to Arecibo, Barceloneta, Manatí, Vega Baja and a portion of Vega Alta. To the southeast, it extends to Orocovis and portions of Barranquitas, Villalba, Juana Díaz and Ponce. The size of this Legacy Area is approximately 324,160 acres.

8.4.2 Summary of important environmental values

The Caonillas-Dos Bocas Legacy Area contains at least 23 PNA, 13 PCA, 7 CWA and 9 FLP acquisitions. It includes eight proposed critical habitats. This FLA covers portions of the Restricted Karst and will protect outstanding karst features. It will also protect coastal forests and surface and underground water resources that serves industries, the municipalities in the FLA and in the San Juan Metropolitan Area. Specific values are detailed below.

Significant resources areas:

1. Hacienda Pellejas PNA
2. Río Encantado PNA
3. Bosque del Pueblo de Adjuntas
4. Cambalache State Forest
5. Río Abajo State Forest
6. Toro Negro State Forest
7. Tres Picachos State Forest
8. Río Camuy Caverns National Park
9. El Tallonal
10. Finca G. Llinás & Co.
11. Finca José Santiago
12. Finca Geraldo Colón
13. Finca Luis A. Zayas
14. Manatí Research Area
15. Caguana Indigenous Ceremonial Park
16. Caño Tiburones Nature Reserve
17. Cueva del Indio Nature Reserve
18. Río Cialitos Nature Reserve
19. Hacienda La Esperanza Nature Reserve

20. Laguna Tortuguero Nature Reserve
21. Mata de Plátano Field Station Nature Reserve
22. Pantano de Cibuco Nature Reserve
23. Conservation Easement Finca Ledesma Moulrier

Priority Conservation Areas (PCA):

1. Barranquitas
2. Caño Tiburones
3. Charca La Tembladera
4. Cordillera Central
5. Hacienda La Esperanza
6. Carso Arrozal-Biáfara
7. Carso del Norte
8. Carso Río Abajo
9. Carso Río Camuy
10. Laguna Puerto Nuevo
11. Laguna Tortuguero Cabo Caribe
12. Megareserva del Carso
13. Cueva del Indio Nature Reserve

Critical Wildlife Areas (CWA):

- Cambalache State Forest
- Cibuco Swamp
- Hacienda La Esperanza Nature Reserve
- Río Abajo State Forest
- Tiburones Swamp and La Tembladera Pond
- Toro Negro State Forest
- Tortuguero Lagoon, Cabo Caribe Swamp and Rica Lake

Proposed critical habitats under DNER's Regulation 6766:

- *Buteo platyperus*
- *Erophylla bombifrons*
- *Myrcia paganii*
- *Peltophryne lemur*
- *Tectaria estremerana*
- *Thelypteris inabonensis*

- *Thelypteris verecunda*
- *Thelypteris yaucoensis*

FLP acquisitions

- Finca Banco Popular de PR
- Finca CDK1 Guillermety
- Finca CDK2 Negrón
- Finca Gripiñas Toro Negro
- Finca Hernández Dairy
- Finca M Rodríguez
- Finca North Inv. & Prop. Inc.
- Finca San Andrés Dairy
- Finca Sucesión Bauzá

Representativeness of unique geological and forest resources:

- Karst belt
- Diversity of forest resources, including important wetlands

Other values

- Habitat for the endangered tree palo de ramón (*Banara vanderbilti*) and for the Puerto Rican sharp-shinned hawk or alcón de sierra (*Accipiter striatus venator*)
- Caonillas and Dos Bocas Lakes watersheds

8.4.3 Conservation and protection methods

Fee simple acquisition and/or conservation easements. Conservation easements for tracts should address:

- Development rights
- Management of land for traditional forest uses, recreational purposes and wildlife habitat and scenic resources
- Public access
- Protection of rare and endangered species
- Protection of public water supply

8.4.4 List of objectives

- Protect unique forests, including palustrine forested wetlands in the central Mountain range of Puerto Rico, karst forest and costal forests
- Protect wildlife habitats, especially those of threatened and endangered species

- Protect landscape and scenic values
- Continue traditional forest uses
- Establish forest corridors as a climate change adaptation strategy
- Protect surface and underground sources of water

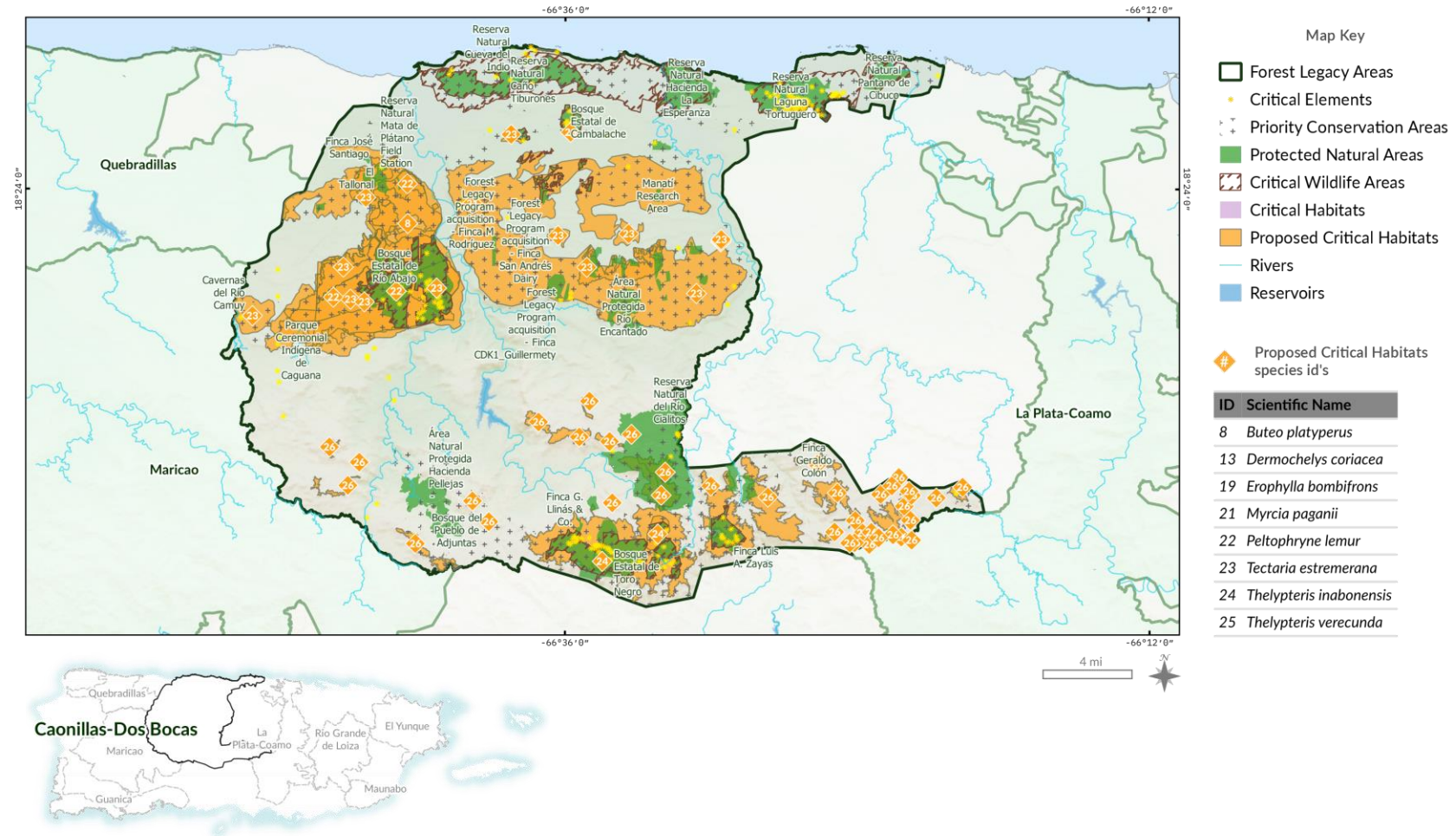
8.4.5 Public benefits to be derived

- Protect important water resources
- Protect coastal resources
- Enhance and maintain biodiversity
- Allow for development of ecotourism activities
- Provide traditional forest products
- Provide public access for recreation and increase outdoor recreation opportunities
- Enhance of livelihoods
- Increase resiliency for climate change and natural hazards

8.4.6 Entities that may be assigned administrative, monitoring, and/or management responsibilities

- Commonwealth of Puerto Rico, Department of Natural and Environmental Resources, Bureau for the Management of Protected Natural Areas and Forests Services
- Local municipal governments
- Partners such as Para La Naturaleza, Casa Pueblo and other NGO and community-based organizations, including those with collaborative/management agreements with the PRDNER.

Map 34. Caonillas-Dos Bocas Forest Legacy Area



8.5 THE LA PLATA-COAMO LEGACY AREA

8.5.1 General location

The La Plata-Coamo Legacy Area is located on the central and southern portion of the Cordillera Central, including a considerable portion of Río La Plata watershed. Its southern portion extends to the municipalities of Coamo, Santa Isabel and Salinas. To north, it extends to the coastal areas of Vega Alta, Dorado and Toa Baja. The size of this Legacy Area is approximately 174,390 acres.

8.5.2 Summary of important environmental values

The La Plata-Coamo Legacy Area includes at least 15 PNA, 19 PCA and 8 CWA. It includes one designated critical habitat, and five proposed critical habitats. The area includes La Plata River and its watershed, an important source of water for the San Juan metropolitan Area. Specific values are detailed below.

Protected Natural Areas:

- Bosque de *Pterocarpus* de Dorado PNA
- Cañón Las Bocas PNA
- Cañón San Cristóbal PNA
- Jájome PNA
- La Robleda PNA
- Carite State Forest
- De Vega State Forest
- Finca Las Orquídeas
- Finca Vizcarrondo
- Lago La Plata Wildlife Refuge
- Las Piedras del Collado Nature Reserve
- Planadas-Yeyesa Nature Reserve
- Playa Grande El Paraíso Nature Reserve
- Conservation Easements: Centro Espíritu Santo, El Rabanal, Siembra Tres Vidas
- Scenic Easement: Montes Oscuros

Priority Conservation Areas (PCA):

- Barranquitas
- Barrio Pasto (partially)
- Bosque Costero de Dorado
- Bosques de Ucar

- Cañón Las Bocas
- Cañón San Cristóbal
- Ciénaga San Pedro y Sector El Caracol
- Ciénaga Prieta
- Estuario Río La Plata
- Hábitat Paloma Sabanera
- Hábitat coqui Llanero
- Hábitat coquí Dorado
- Humedales Sur de Dorado
- Carso del Norte
- Mogotes Río Lajas & Nevárez
- Piedras Chiquitas
- Piedras del Collado
- Lago La Plata Wildlife Refuge
- Región Montañosa Carite State Forest

Critical Wildlife Areas (CWA):

- Carite State Forest
- Cerro El Gato and Associated Areas
- El Mameyal
- Lakes and Forests of Dorado
- Mogotes Río Lajas and Nevárez
- Salinas Training Area
- San Pedro Swamp
- Vega State Forest

Designated critical habitats:

- Golden Coqui (*Eleutherodactylus jasperii*), presumed to be extinct.

Proposed critical habitat for listed species:

- *Buteo platypterus*
- *Daphnosis helleriana*
- *Eleutherodactylus juanriveroi*
- *Erophylla bombifrons*
- *Thelypteris yaucoensis*

Representativeness of unique geological and forest resources:

- Karst features, diverse forest resources

Other values

- Watershed of Lake La Plata, one of the main providers of water supply to the San Juan Metropolitan Area

8.5.3 Conservation and protection methods

Fee simple acquisition and/or conservation easements. Conservation easements should address:

- Development rights
- Management of land for traditional forest uses, recreational purposes and wildlife habitat and scenic resources
- Public access
- Protection of rare and endangered species
- Protection of public water supply

8.5.4 List of objectives

- Protect wildlife habitats, especially those of threatened and endangered species
- Protect landscape and scenic values
- Continue traditional forest uses
- Establish forest corridors as a climate change adaptation strategy
- Protect surface and underground sources of water

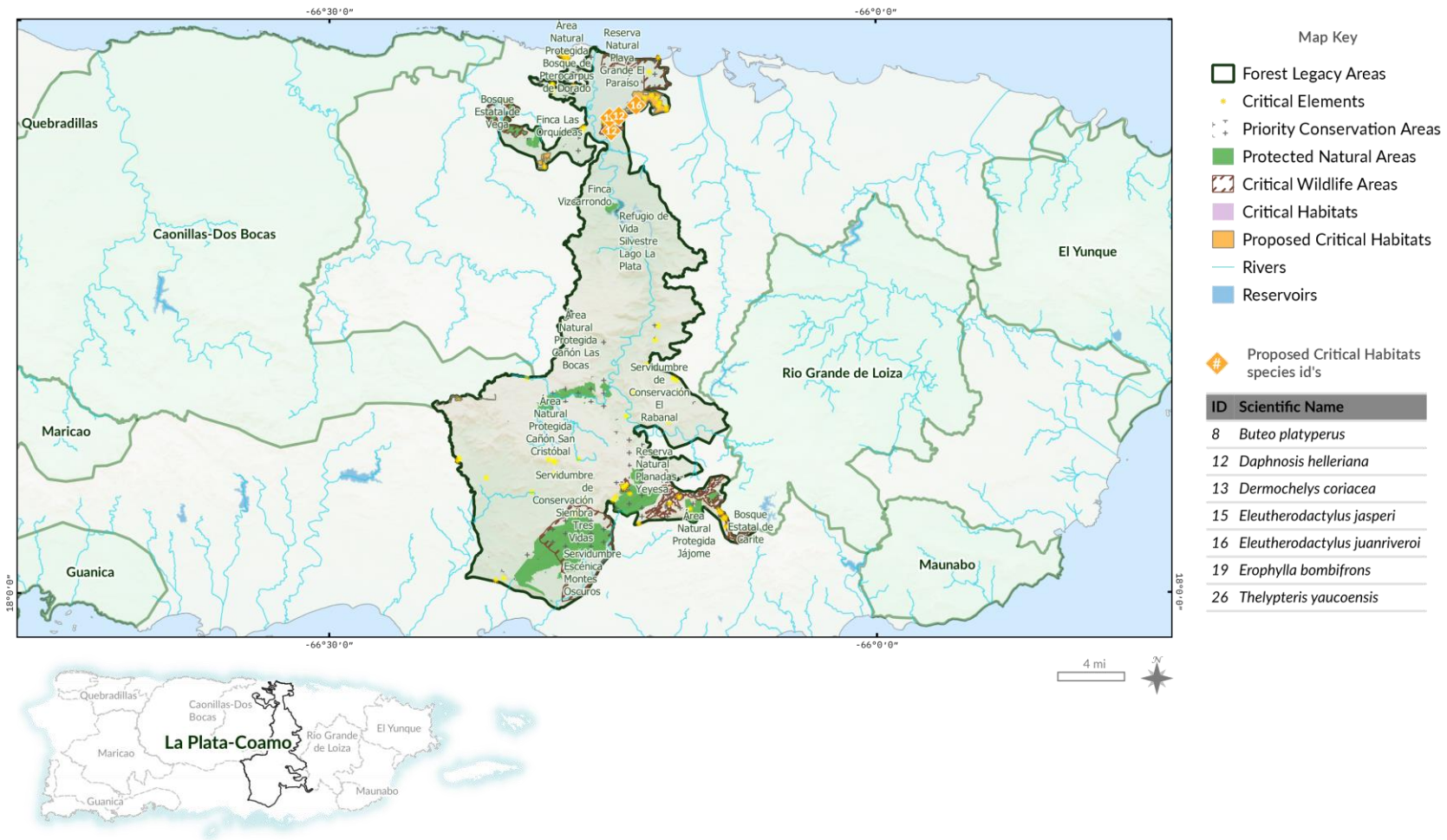
8.5.5 Public benefits to be derived

- Provide reliable sources of good water quality and quantity
- Enhance and maintain biodiversity
- Allow for development of ecotourism activities
- Provide traditional forest products
- Provide public access for recreation and increase outdoor recreation opportunities
- Enhance livelihoods
- Increase resiliency for climate change and natural hazards

8.5.6 Entities that may be assigned administrative, monitoring, and/or management responsibilities

- Commonwealth of Puerto Rico, Department of Natural and Environmental Resources, Bureau for the Management of Protected Natural Areas and Forests Services
- Local municipal governments
- Partners such as Para La Naturaleza, and other NGO and community-based organizations, including those with collaborative/management agreements with the PRDNER.

Map 35. La Plata-Coamo Forest Legacy Area



8.6 THE RÍO GRANDE DE LOÍZA LEGACY AREA

8.6.1 General Location

The Río Grande de Loíza Legacy Area is located on the central eastern portion of the Cordillera Central, extending west to the municipalities of Aguas Buenas and Cidra, east to Juncos, San Lorenzo and Las Piedras, and north to Guaynabo, San Juan, Trujillo Alto and Carolina. It also includes the municipalities of Caguas and Gurabo. The size of this Legacy Area is approximately 138,528 acres.

8.6.2 Summary of Important Environmental Values

The Río Grande de Loíza Legacy Area includes at least 12 PNA, 7 PCA, 4 CWA and one FLP acquisition. It includes five proposed critical habitats. This FLA will increase the protection of the Puerto Rican plain pigeon, which was severely affected by hurricane María. The area includes the Río Grande de Loíza River and its watershed, an important source of water for the San Juan Metropolitan Area. It will also protect the Caguas-Juncos Valley ground water resources. Specific values are detailed below.

Significant resource areas, of which most are PNA:

- Culebras PNA
- Hacienda Lago PNA
- Jorge Sotomayor del Toro PNA
- Marín Alto PNA
- Paraíso de las Lunas PNA
- Quebrada Janer PNA
- Río Bairoa PNA
- Ulpiano Casal PNA (partially)
- Carite State Forest
- Finca San Salvador Fase I
- Las Casas de la Selva
- Sistema de Cuevas y Cavernas de Aguas Buenas Nature Reserve

Priority Conservation Areas (PCA)

- Aguas Buenas Caves
- El Yunque
- Guajón
- Guajón- Sierras de Pandura y Guardarraya
- Hábitat Paloma Sabanera
- Hábitat Coqui Dorado

- Región Montañosa and Carite State Forest

Critical Wildlife Areas (CWA):

- Barrio Borinquen, Trujillo Alto Lake, Lake Bairoa La 25 and Gurabo River Mouth
- Carite State Forest
- Cerro El Gato and Associated Areas
- Cidra Lake

Designated critical habitats:

- Golden Coqui (*Eleutherodactylus jasperii*), presumed to be extinct.

Proposed critical habitats under DNER's Regulation 6766:

- *Buteo platyperus*
- *Eleutherodactylus cooki*
- *Erophylla bombifrons*
- *Gonocalyx concolor*
- *Thelypteris yaucoensis*

FLP Acquisitions:

- Finca Mikasobe Carite

Other values

- the upper watershed of the Carraízo Lake (Lake Loíza, the main water supply source of the San Juan Metropolitan Area)
- the immediate watershed of the Cidra Lake (another principal source of water for the San Juan Metropolitan Area)
- the Carite Lake (a water supply source for the southern portion of the island)

8.6.3 Conservation and protection methods

Fee simple acquisition and/or conservation easements. Conservation easements for tracts should address:

- Development rights
- Management of land for traditional forest uses, recreational purposes and wildlife habitat and scenic resources
- Public access
- Protection of rare and endangered species

- Protection of public water supply

8.6.4 List of objectives

- Protect wildlife habitats, especially those of threatened and endangered species
- Protect landscape and scenic values
- Continue and expand traditional forest uses
- Establish forest corridors as a climate change adaptation strategy
- Protect surface and underground sources of water

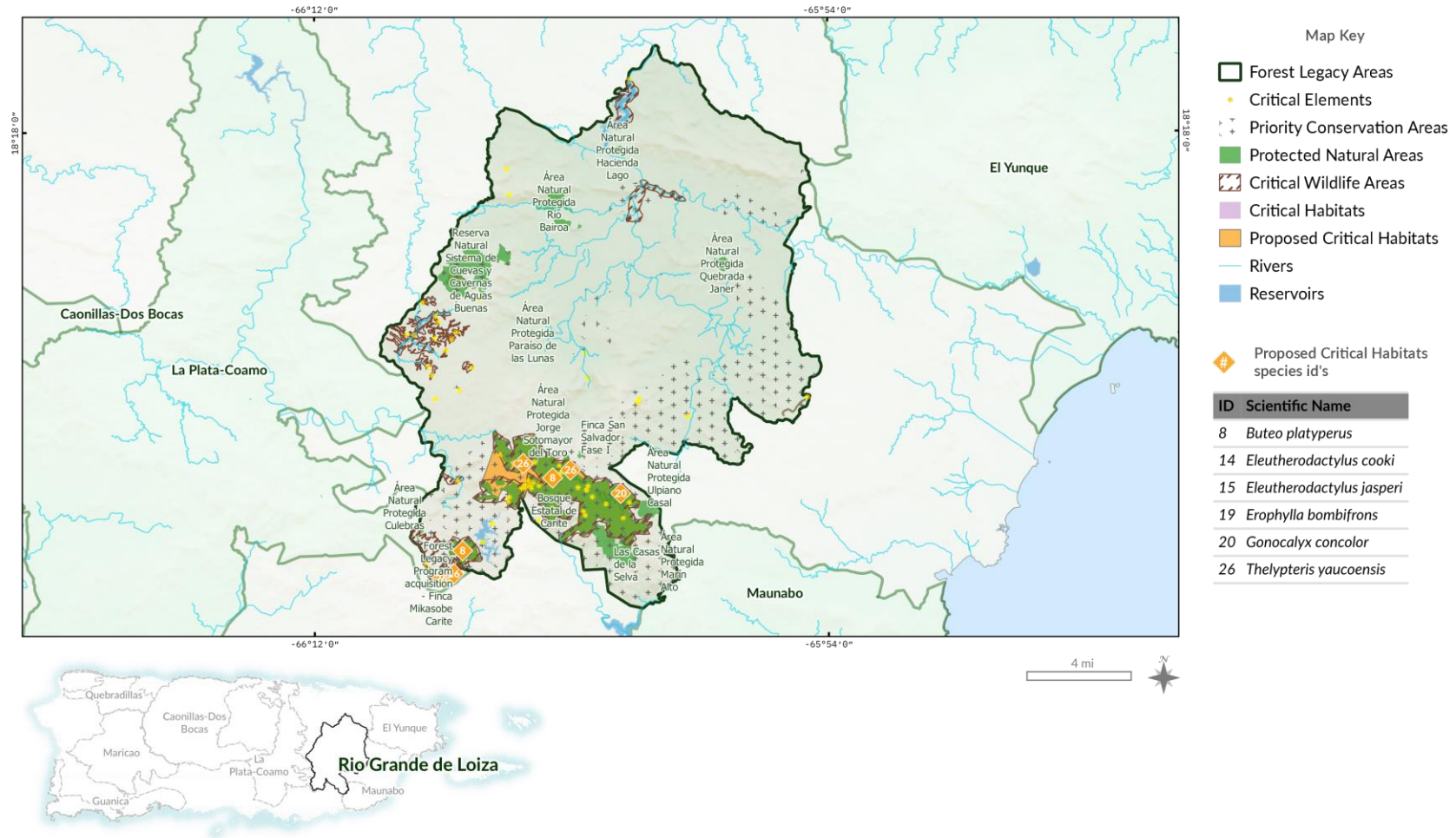
8.6.5 Public benefits to be derived

- Enhance and maintain biodiversity
- Allow for development of ecotourism activities
- Provide traditional forest products
- Provide public access for recreation and increase outdoor recreation opportunities
- Enhance livelihoods
- Increase resiliency for climate change and natural hazards

8.6.6 Entities that may be assigned administrative, monitoring, and/or management responsibilities

- Commonwealth of Puerto Rico, Department of Natural and Environmental Resources, Bureau for the Management of Protected Natural Areas and Forests Services
- Local municipal governments
- Partners such as Para La Naturaleza, Tropic Ventures, and other NGO and community-based organizations, including those with collaborative/management agreements with the PRDNER.

Map 36. Río Grande de Loíza Forest Legacy Area



8.7 THE EL YUNQUE LEGACY AREA

8.7.1 General location

El Yunque Legacy Area is located on the eastern portion of the island in the Sierra de Luquillo Mountains, including the buffer zone of the Caribbean National Forest and Biosphere Reserve. It extends to the northeast coastal area from the Río Espíritu Santo Nature Reserve in Río Grande, including the Northeast Ecological Corridor in Luquillo and Fajardo and the *Pterocarpus Forest* in Humacao. The size of this Legacy Area is approximately 144,705 acres.

8.7.2 Summary of important environmental values

El Yunque Legacy Area includes 14 PNA, 7 PCA and 11 CWA. It includes one designated critical habitat and four proposed critical habitats. This FLA will increase the protection of the Puerto Rican parrot and the cloud forests. This FLA will increase the protection of the sources of water for the eastern region of Puerto Rico, including Vieques and Culebra. It will protect all life zones present in Puerto Rico on a relatively small area. Specific values are detailed below.

Significant resource areas, of which most are PNA:

- La Pitahaya PNA
- Medio Mundo y Daguao PNA
- Shapiro PNA
- Ceiba State Forest
- El Yunque National Forest and Biosphere Reserve
- Finca El Verde
- Bosque Pterocarpus Nature Reserve
- Northeast Ecological Corridor Nature Reserve
- Río Espíritu Santo Nature Reserve
- Finca Seven Seas Nature Reserve
- Las Cabezas de San Juan Nature Reserve
- Pantano Bosque Pterocarpus Lagunas Mandry y Sta Teresa Humacao Nature Reserve
- Finca Gulín Conservation Easement

Priority Conservation Areas (PCA)

- Cabezas de San Juan
- Northeast Ecological Corridor

- El Yunque
- Lagunas de Humacao
- Pilonos-Río Mameyes
- Playa de Fajardo - Cayo Algodones
- *Pterocarpus* Luquillo

Critical Wildlife Areas (CWA):

- Baja Swamp and Herrera River Mouth
- Ceiba State Forest
- Ensenada Comezón and Espíritu Santo River Nature Reserve
- Fajardo Coastline
- Former Roosevelt Roads Naval Base Mangroves
- Humacao Nature Reserve
- Laguna Grande, Laguna Aguas Prietas and adjacent areas
- Luquillo Mountains
- Río Mar, Street #968
- San Miguel, Las Paulinas and El Convento Natural Area

Designated critical habitats:

- *Agelaius xanthomus*

Proposed critical habitats under DNER's Regulation 6766:

- *Agelaius xanthomus*
- *Buteo platypterus*
- *Chilabothrus monensis granti*
- *Thelypteris yaucoensis*

Representativeness of unique geological and forest resources:

- This FLA will have representativeness of all life zones that are present in Puerto Rico. In addition, it will have representativeness of the remnants of *Prerocarpus* forests stands.

8.7.3 Conservation and protection methods

Fee simple acquisition and/or conservation easements. Conservation easements for tracts should address:

- Development rights
- Management of land for traditional forest uses, recreational purposes and wildlife habitat and scenic resources
- Public access
- Protection of rare and endangered species
- Protection of public water supply

8.7.4 List of objectives

- Protect unique forests, including the cloud forest
- Protect wildlife habitats, especially those of threatened and endangered species
- Protect landscape and scenic values
- Continue and expand traditional forest uses
- Establish forest corridors as a climate change adaptation strategy
- Protect sources of water

8.7.5 Public benefits to be derived

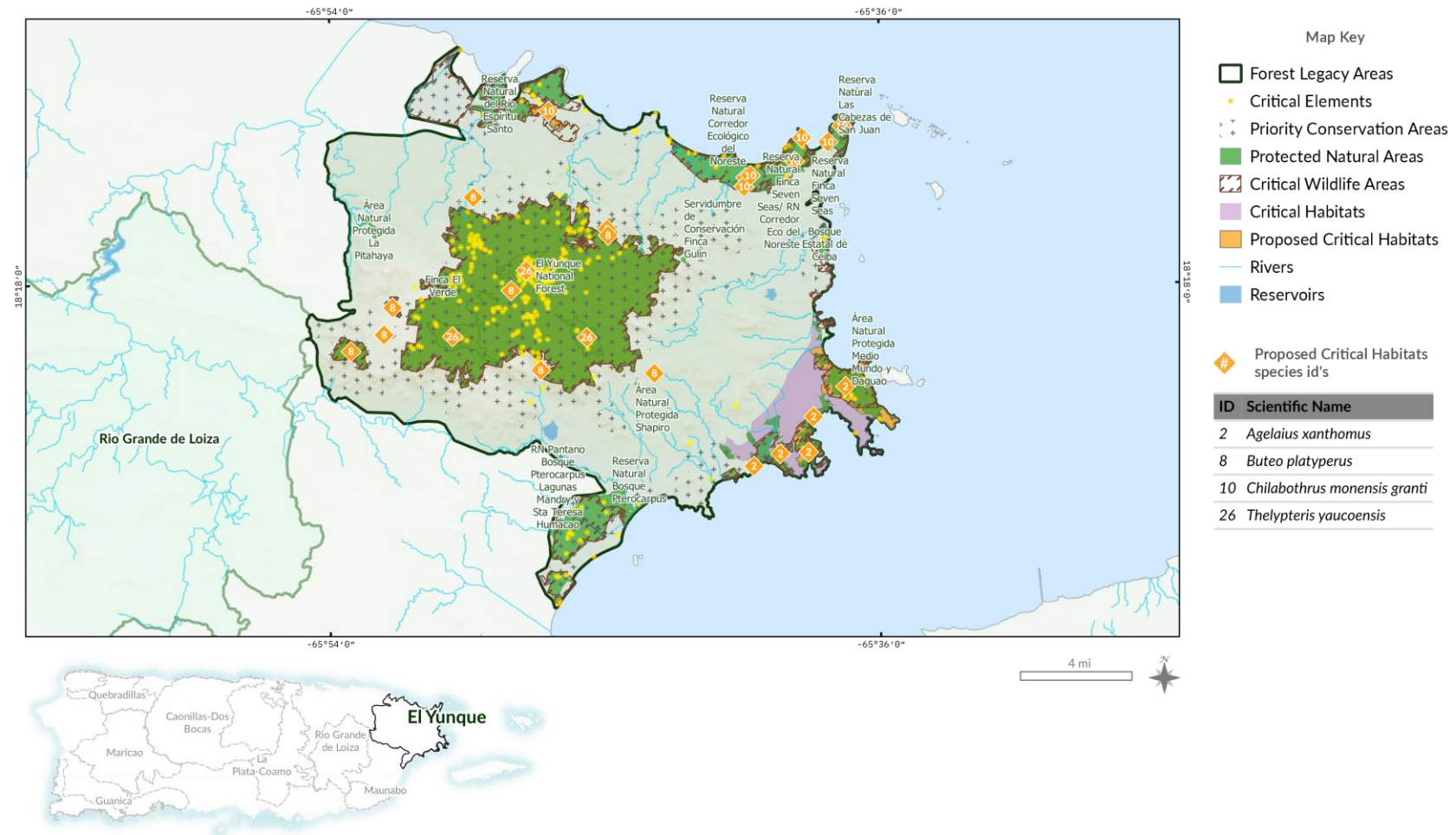
- Provide reliable sources of good water quality and quantity
- Enhance and maintain biodiversity
- Allow for development of ecotourism activities
- Provide traditional forest products
- Provide public access for recreation and increase outdoor recreation opportunities.
- Enhance livelihoods
- Increase resiliency for climate change and natural hazards

8.7.6 Entities that may be assigned administrative, monitoring, and/or management responsibilities

- Commonwealth of Puerto Rico, Department of Natural and Environmental Resources, Bureau for the Management of Protected Natural Areas and Forests Services
- Local municipal governments

- Federal partners such as El Yunque- USFS, Para La Naturaleza, Fundación Amigos De El Yunque and other NGO and community-based organizations, including those with collaborative/management agreements with the PRDNER.

Map 37. El Yunque Forest Legacy Area



8.8 THE MAUNABO LEGACY AREA

8.8.1 General Location

The Maunabo Legacy Area is located on the southeastern coast of the island, including Patillas and portions of the municipalities of Maunabo and Yabucoa. The size of this Legacy Area is approximately 37,864 acres.

8.8.2 Summary of important environmental values

The Maunabo Legacy Area includes 5 PNA, 5 PCA and 1 CWA. There is one proposed critical habitat. This FLA will increase protection of coastal forests, outstanding geological features and scenery. Specific values are detailed below.

Significant resource areas, of which most are PNA:

- Marín Alto PNA
- Río Jacoboa PNA
- Sierra La Pandura PNA
- Inés María Mendoza Nature Reserve (Punta Yeguas)
- Manglar de Punta Tuna Nature Reserve

Priority Conservation Areas (PCA)

- Guajón- Sierras de Pandura y Guardarraya
- Playa California
- Punta Tuna
- Punta Yeguas
- portion of Región Montañosa BE Carite

Critical Wildlife Areas (CWA):

- Sierra La Pandura

Proposed critical habitats under DNER's Regulation 6766:

- *Eleutherodactylus cooki*

Representativeness of unique geological and forest resources:

Unique geological features in this FLA include the rock formations known as "guajonales".

8.8.3 Conservation and protection methods

Fee simple acquisition and/or conservation easements. Conservation easements for tracts should address:

- Development rights
- Management of land for traditional forest uses, recreational purposes and wildlife habitat and scenic resources
- Public access
- Protection of rare and endangered species

8.8.4 List of objectives

- Protect wildlife habitats, especially those of threatened and endangered species
- Protect landscape and scenic values
- Continue and expand traditional forest uses
- Establish forest corridors as a climate change adaptation strategy

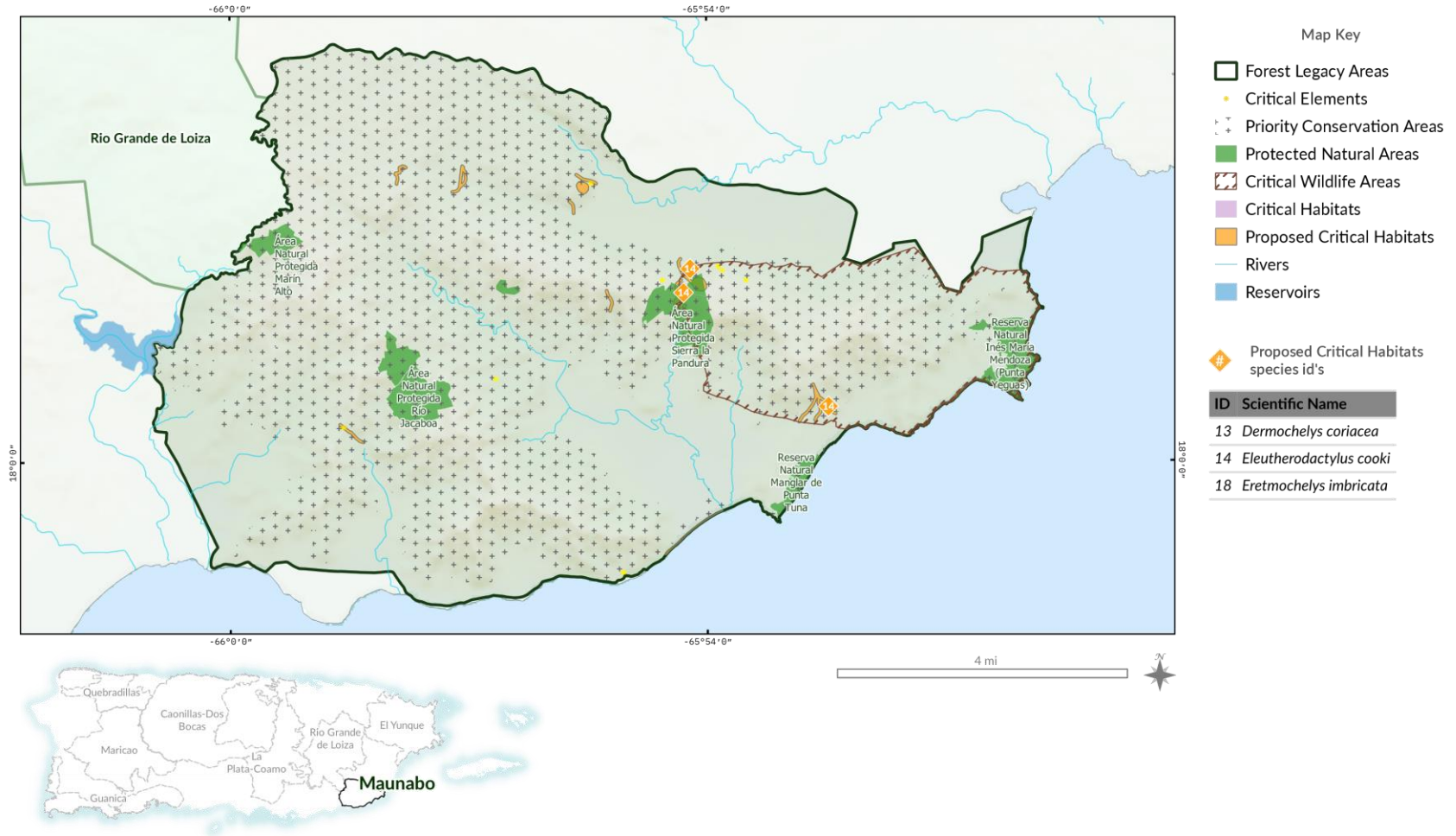
8.8.5 Public benefits to be derived

- Enhance and maintain biodiversity
- Allow for development of ecotourism activities
- Provide traditional forest products
- Provide public access for recreation and increase outdoor recreation opportunities.
- Enhance livelihoods
- Increase resiliency for climate change and natural hazards

8.8.6 Entities that may be assigned administrative, monitoring, and/or management responsibilities

- Commonwealth of Puerto Rico, Department of Natural and Environmental Resources, Bureau for the Management of Protected Natural Areas and Forests Services
- Local municipal governments
- Partners such as Para La Naturaleza, Comité Pro Desarrollo de Maunabo, and other NGO and community-based organizations, including those with collaborative/management agreements with the PRDNER.

Map 38. Maunabo Forest Legacy Area



9 PUBLIC PARTICIPATION

The preliminary recommendations of FLAs had been discussed and refined according to the commentaries of the SFSCC, the DNER and the public. Stakeholders (government agencies, NGOs and the general community) will be consulted in relation to the changes suggested as well as the SFSCC. This implies carrying out:

- A meeting with the SFSCC to present and discuss the proposed expansions will be held in July 14, 2021.
- The document will be available for public review on August 2021.

Comments provided will be integrated into a final AON, following the FLP Implementation Guidelines.

GLOSSARY

Agroforestry	Is an approach to land use that incorporates trees and shrubs into agricultural systems and allows for the production of trees, crops and/or livestock from the same piece of land (USDA, 2012).
Common Rustic Land (SRC, by its acronym in English)	Land use classification used for those lands not contemplated for urban or developable use in a territorial plan due, among others, to the fact that the lands classified as urban or developable are sufficient to accommodate the expected urban development (Municipal Code, 2020).
Conventional agriculture	Agriculture that typically focuses on a single crop (monoculture) and requires clearing the land, applying fertilizers and other chemicals to the soils and crops.
Developable land or urbanizable land (SUR, by its acronym in English)	These are the lands identifies as suitable for urbanization in a period of eight (8) years based on the need to accommodate the municipal urban expansion to meet the land use planning goals and objectives. This land classification includes the categories of programmed and non-programmed developable land (Municipal Code, 2020).
Environmentally important private forestlands	Include scenic, cultural, fish, wildlife, and recreational resources, riparian areas, and lands with other ecological values.
Forest values and benefits	The environmental, social, and economic purposes that benefit the public for which a tract is to be conserved in perpetuity by the FLP, such as scenic, cultural, recreation, historic, fish and wildlife habitat, rare and unique plant communities, water supply and quality, and production of timber and other forest products (FLP Guides, 2017).
Model Forest	It's a proposal that focuses on people with a common vision of sustainable development working together in the management of the goods and services provided by the forest or other ecosystem. Usually proposed in large territories where different uses, activities, and land values (as residential, commercial, industrial, agricultural and tourist) coexist in harmony, and where the forest ecosystem plays an important role (Model Forest, 2014).
Rustic Land (SR, by its acronym in English)	Lands that the territorial plan considers to be expressly protected from the urbanization process for reasons, among others, of their current or potential agricultural and livestock value; of its natural value; its current or potential recreational value; risks to public health or safety; or because they are not necessary to meet the expected urban growth in eight (8) years after the plan is approved. This land classification includes the categories of common rustic land and specially protected rustic land (Municipal Code, 2020).

Soil productivity	Areas suitable for forestry production, including timber, non-timber forest products, agroforestry, shade coffee, apiculture, livestock grazing, and agrotourism (Gould et al., 2017).
Specially Protected Rustic Land (SREP, by its acronym in English)	Land use classification used for lands that never should be used as urban land due to its special location, topography, aesthetic, archaeological or ecological values, unique natural resources or other attributes (Municipal Code, 2020).
Special Planning Area (APE, by its acronym in English)	Areas with important natural resources that require detailed planning due to current and future use conflicts. The DNER designates these areas, and the PRPB implements the designation (Puerto Rico Protected Natural Areas, Protected Areas Conservation Action Team. 2018).
Traditional forest uses	Include timber management, and other recreational uses such as hunting, fishing, hiking, and similar recreational uses that are consistent with purposes of the FLP.
Urban land (SU, by its acronym in English)	Lands that have infrastructure such as roads, water, electricity and other that are necessary for the development of the administrative, economic and social activities that are carried out on these lands (Municipal Code, 2020).

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The Institute for Regional Conservation
<https://www.regionalconservation.org/ircs/database/plants/>

APPENDIX A

Table A- 1 Criteria used in 2000 AON

Eligibility Criteria	Factors (defined by DNER in 2000 AON)
Present a vegetal cover typical of forests	This eligibility factor must be certified by the Forest Service Bureau. Areas not in vegetal cover typical of forests or with a lower percentage of forest cover can qualify if they belong to geographical areas not adequately represented (diversity) within existing conservation land stock, contain resources deemed unique by the FLP and/or constitute areas targeted for reforestation for water basin protection.
Threat by conversion to non-forest uses	These are lands which have characteristics that make them attractive to changes in use such that forest values are reasonably expected to be at risk. These threats can include, but are not limited to, currently development trends in the area, proximity to roads, short travel time to population centers, proposed housing, industrial, commercial, public or recreational development, encroaching housing development, improvement of roads, sewer line, and power line extensions, fragmentation of land ownership in smaller, less manageable parcels.
Environmentally important forest areas shall contain one or more important public values	
Watershed values, including the protection of public water supply:	<p>Area contributes to public or private water supply, including underground sources of water</p> <p>Area is important to erosion and sediment control in watersheds developed for public or private water supply</p> <p>Area contains major river/stream, water body, or contains and/or is the recharge area for major underground water resources</p> <p>Areas that maintain flood control by naturally collecting water runoff</p> <p>Areas that would be most adversely impacted by nonpoint source pollution, such as lands where riparian buffers have been removed</p>
Conservation of biodiversity and unique features:	<p>Areas that are representative of any one of the 18 geoclimatic regions currently underrepresented in the land conservation stock in Puerto Rico</p> <p>Areas with a unique or exceptional mix of ecological communities</p> <p>Area contains ecological communities that are dwindling</p> <p>Area has unique or exceptional geological/physiographic resources</p>
Aesthetic and scenic values:	<p>Area listed in DNER's inventory of aesthetic and scenic resources</p> <p>Area includes locally important panoramic views</p> <p>Area is situated along designated scenic road</p>
Existing or potential public recreation opportunities:	<p>Existing or potential recreational uses such as water-based recreation, trails, day use recreation such as hiking, picnics, horseback riding</p> <p>Existing or potential natural resource-based recreation such as camping and nature tours</p> <p>Areas critical for access to places of outstanding recreational opportunities or tourism resources</p> <p>Areas with existing or potential eco-touristic resources</p>
Known cultural/historic areas:	Areas that contain evidence of the earlier human occupation in Puerto Rico which comprises a unique and irreplaceable resource as do historic features, such as old coffee and tobacco plantation artifacts and structures,

Eligibility Criteria	Factors (defined by DNER in 2000 AON)
Fish and wildlife habitat:	<p>and vernacular landscapes.</p> <p>Preventing the fragmentation of forest tracts into smaller units is crucial objective to maintaining viable populations of particular wildlife species. Factors to be considered:</p> <ul style="list-style-type: none"> Area contains outstanding habitat for one or more species Area exhibits connective habitats, corridors, habitat linkages and areas that reduce biological isolation Area contains plant and animal species on federal or DNER list as endangered, rare or of special concern Area has unique, rare and/or important variety of vegetative cover types and size classes Areas of nesting, resting and feeding of migratory species Areas with significant wildlife population
Known threatened and endangered species:	<ul style="list-style-type: none"> Presence of endangered species habitat for federal, or DNER listed plant and/or animal species, or suitable habitat for such species that are documented on adjacent properties Rare natural habitats, communities or ecosystems and their buffers Unusually diverse or otherwise special biological community Forest lands necessary for the recovery or reintroduction of natural occurring species
Forest in primary or close to primary conditions: Other ecological values, such as: Promote the development of commercial timberland⁴⁰.	<ul style="list-style-type: none"> Areas that have over 10% of the forested parcel in primary or close to primary forest conditions Any area that exhibits additional or exceptional conditions that are important and add value to the quality of the Forest Legacy Areas Areas under a management plan for timberland development or recommended by a management plan for such uses, including those areas already participating of other local or state, public or private programs Potential areas for commercial timberland development and use Productive soils with significance to forestry Maintaining timbering activities
Promote the preservation of the forest land base in order to:	<ul style="list-style-type: none"> Protect and promote the creation of large blocks of protected forest land to yield greater ecological and watershed benefits Buffer or simplifying management of existing forested areas considered of high value Provide contiguous land to protect wildlife habitat corridors, recreation areas, threatened watersheds and other important public values

⁴⁰ According to USDA Forest Service report on forest area trends, Puerto Rico's Forest resource "is approaching a stage of recovery that could support sustained removals of useful timber products from selected areas" (2000 AON).

Table A- 2. Reponses of the SFSCC to the survey regarding the criteria used in 2000 AON (2018)

Criteria Title	Criteria Description	Rating	Comments on criteria
>75% forest cover	Present a vegetative cover typical of forests, according to the definition of the Puerto Rico Forest Act. This eligibility factor should be certified by the DNER Bureau for the Management of Protected Natural Areas and Forestry Services. Areas not in vegetal cover typical of forests or with a lower percentage of forest cover can qualify if they belong to geographical areas not adequately represented (diversity) within existing conservation land stock, contain resources deemed unique by the FLP and/or constitute areas targeted for reforestation for water basin protection. The FLP Implementation Guidelines (Part III, page 25) establishes the 75% of forestland as a minimum requirement for project's eligibility or a documented plan that includes sufficient landowner capacity to reforest to at least 75% of the property.	6	The criteria of 75% could be arbitrary for reasons of convenience, advantages and / or evaluative judgments that favor the most forested properties, but n. ot necessarily the most important factor. A lower % (example: 50% of forest cover), could be a property that compensates with other factors of ecological, cultural and landscape importance (pastures, wetlands, coastal, cultural, and agricultural or agroforestry units).
Threats	Be threatened by present or future conversion of forest areas to non-forest uses. These are lands which have characteristics that make them attractive to changes in use such that forest values are reasonably expected to be at risk. These threats can include, but are not limited to, currently development trends in the area, proximity to roads, short travel time to population centers, proposed housing, industrial, commercial, public or recreational development, encroaching housing development, improvement of roads, sewer line, and power line extensions, fragmentation of land ownership in smaller, less manageable parcels.	6	From the year 97 to the present there must have been somewhat complex changes to quantify, whenever necessary to do the analysis on database representing the evolution of all the components of changes involved (the threats themselves).
Watershed values ⁴¹	<p>Area contributes to public or private water supply, including underground sources of water</p> <p>Area is important to erosion and sediment control in watersheds developed for public or private water supply</p> <p>Area contains major river/stream, water body, or contains and/or is the recharge area for major underground water resources</p> <p>Areas that maintain flood control by naturally collecting water runoff</p> <p>Areas that would be most adversely impacted by nonpoint source</p>	7	It is possible that there may be consensus that this criterion is crucial and fundamental to the objectives of this program.

⁴¹ Including the protection of public water supply.

Criteria Title	Criteria Description	Rating	Comments on criteria
Conservation of biodiversity and unique features	pollution, such as lands where riparian buffers have been removed	7	
	Areas that are representative of any one of the 18 geoclimatic regions currently underrepresented in the land conservation stock in Puerto Rico		
	Areas with a unique or exceptional mix of ecological communities		
	Area contains ecological communities that are dwindling		
Aesthetic and scenic values	Area has unique or exceptional geological/physiographic resources	6	
	Area listed in DNER's inventory of aesthetic and scenic resources		
	Area includes locally important panoramic views		
Public recreation	Area is situated along designated scenic road	7	
	Existing or potential recreational uses such as water-based recreation, trails, day use recreation such as hiking, picnics, horseback riding		
	Existing or potential natural resource-based recreation such as camping and nature tours		
	Areas critical for access to places of outstanding recreational opportunities or tourism resources		
Historic and/or cultural resources	Areas with existing or potential eco-touristic resources	7	
	Areas that contain evidence of the earlier human occupation in Puerto Rico which comprises a unique and irreplaceable resource as do historic features, such as old coffee and tobacco plantation artifacts and structures, and vernacular landscapes.		
	Areas with significant wildlife population		
Fish & Wildlife Habitat	Area contains outstanding habitat for one or more species	7	
	Area exhibits connective habitats, corridors, habitat linkages and areas that reduce biological isolation		
	Area contains plant and animal species on federal or DNER list as endangered, rare or of special concern		
	Area has unique, rare and/or important variety of vegetative cover types and size classes		
	Areas of nesting, resting and feeding of migratory species		
	Areas with significant wildlife population		
Presence of endangered and endemic species	Presence of endangered species habitat for federal, or DNER listed plant and/or animal species, or suitable habitat for such species that are documented on adjacent properties	7	

Criteria Title	Criteria Description	Rating	Comments on criteria
Primary or close to primary forest conditions Promote the development of commercial timberland	Rare natural habitats, communities or ecosystems and their buffers	7	
	Unusually diverse or otherwise special biological community		
	Forest lands necessary for the recovery or reintroduction of natural occurring species		
	Areas that have over 10% of the forested parcel in primary or close to primary forest conditions		
	Areas under a management plan for timberland development or recommended by a management plan for such uses, including those areas already participating of other local or state, public or private programs		
Potential areas for commercial timberland development and use	6		
Productive soils with significance to forestry			

Table A- 3 Additional criteria recommended by the SFSCC to be included in the updated AON (2018)

Criteria Title	Criteria Description	Rating ⁴²	Comments on criteria
Protected areas boundaries	Better protection of the periphery of existing reserves to maintain the integrity of the natural protected area and maintain viable corridors and buffer zones	7	This criterion is in accordance with the recommendation to consider the aspect of biological corridors for forest interconnectivity.
Ecological corridors	Development of ecological corridors, including riparian corridors to connect existing reserves with green spaces	7	This criterion is in accordance with the recommendation to consider the aspect of biological corridors for forest interconnectivity.
Development of small and intermediate parks	Development of small and intermediate-sized parks and open spaces within urban areas that serve as habitats as well as recreational and educational resources for	6	

⁴² Rating scale: 1-not a priority; 2-low priority; 3-somewhat priority; 4-neutral; 5-moderate priority; 6-high priority; 7-essential priority.

Criteria Title	Criteria Description	Rating ⁴²	Comments on criteria
Restoration of formerly extensive habitats	communities		
	For example: freshwater swamps, riparian forests, and/or moist lowland <i>Manilkara bidentata</i> (Ausubo) forests	6	
Soil productivity ⁴³		6	
Current ownership	Current ownership patterns and size of tracts, and trends and projected future ownership patterns	6	This is a determining factor for the management and protection of ecosystems and forests, but at the same time highly controversial, given that in PR private properties are very fragmented, which makes the structural and functional connectivity of the ecosystem very vulnerable.
Limestone hills	Expand protected natural areas in this region	5	A possible recommendation towards that direction requires a more weighted analysis. To expand beyond what is already demarcated.
Coastal plains	Expand protected natural areas in this region	5	A possible recommendation towards that direction requires a more weighted analysis. To expand beyond what is already demarcated.
Central mountain range	Expand protected natural areas in this region	5	A possible recommendation towards that direction requires a more weighted analysis. To expand beyond what is already demarcated.
Geological features ⁴⁴		5	

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⁴³ Productive soils with significance to forestry was already included in the analysis. The definition used in this revision was the category "land well suited for forestry" identified by Gould et al. (2017). The authors defined these lands as "having slopes from 20 to 50 percent using the 10 m NED derived slope dataset". They did not include "protected areas, wetlands, developed land surface, natural barrens, riparian zone 50 m buffers, or watersheds that contain reservoirs" as areas suitable for timber production (Gould et al., 2017).

⁴⁴ The geological and geographical features (including areas as limestone hills, coastal plains, and central mountain range) are included in other criteria.

Table A- 4. Layers used for each value in the geospatial analysis.

Values	Geographic information layer	Source
Forest vegetation cover	C-CAP Land Cover	Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), Office for Coastal Management (OCM)
		C-CAP Land Cover, Puerto Rico (2010) Gould, et al.:
Soil Productivity	Lands well-suited for forestry	Land Use, Conservation, Forestry, and Agriculture in Puerto Rico (2017) Department of Natural and Environmental Resources and Puerto Rico Planning Board:
Protection of drinking water	Hydrological regions	Comprehensive Plan of Water Resources of Puerto Rico (2008) Department of Natural and Environmental Resources (Heritage Program):
Conservation of Biodiversity	Priority Conservation Area	Priority Conservation Areas Department of Natural and Environmental Resources:
	Critical Wildlife Areas	Critical Wildlife Areas Castro-Prieto, et al.:
	Species richness	Characterization of the network of protected areas in Puerto Rico (2016) Protected Areas Conservation Action Team:
Recreation Opportunities	Protected Natural Areas	Puerto Rico Protected Areas Database (version of December 2018) Department of Natural and Environmental Resources:
Threatened and endangered species	Designated and proposed critical habitats	Rulebook 6766 proposed critical habitat (sept 2016) Rulebook 6766 approved critical habitat (2004) Puerto Rico Planning Board:
	Land Classification	Puerto Rico Land Use Plan Puerto Rico Land Use Plan (2015)

Table A- 5 Updated criteria used in the revision of this AON

Criteria Title	New criteria	Criteria Description	Represented in the expansion of the FLA ⁴⁵
Ecological corridors	YES	Includes riparian corridors to connect green spaces	5-B
		Connect critical habitats to existing protected natural areas and green spaces	1A, 1B, 2A, 4A, 4B, 5A, 5B, 5C, 6A, 7A, 7B
		Maintain and promote viable corridors	1B, 2A, 3A, 3B, 4A, 4B, 5A, 5B, 5C, 6A, 7A, 7B
Protected areas boundaries	YES	Protection of the periphery of existing reserves to maintain the integrity of the natural protected area	2A, 4A, 4B, 5A, 5C, 6A, 7A, 7B, 8A
		Maintain and promote buffer zones	2A, 3A, 3B, 4A, 5A, 5C, 6A, 7A, 7B, 8A
Watershed values	NO	Area contributes to public or private water supply, including underground sources of water	3B, 3C, 4A, 4B, 5A, 5C, 6A, 7A
		Area is important to erosion and sediment control in watersheds developed for public or private water supply	2A, 4B, 5C, 6A, 7A
		Area contains major river/stream, water body, or contains and/or is the recharge area for major underground water resources	2A, 3A, 3B, 3C, 4B, 5A, 5C, 6A, 7A
		Areas that maintain flood control by naturally collecting water runoff	3A, 3B, 4B, 5A, 5B, 5C
		Areas that would be most adversely impacted by nonpoint source pollution, such as lands where riparian buffers have been removed	
Conservation of biodiversity and unique features	NO	Areas that are representative of any one of the 18 geoclimatic regions currently underrepresented in the land conservation stock in Puerto Rico	1A, 1B, 7B
		Areas with a unique or exceptional mix of ecological communities	5A
		Area contains ecological communities that are dwindling	1A, 1B, 2A, 3A, 3B, 3C, 4A, 4B, 5A, 5B, 5C, 6A, 7A, 7B, 8A
		Area has unique or exceptional geological/physiographic resources	3A, 3B, 3C, 4A, 5A
Fish & Wildlife Habitat	NO	Area contains outstanding habitat for one or more species	1A, 1B, 2A, 3A, 3B, 3C, 4A, 4B, 5A, 5B, 5C, 6A, 7A, 7B, 8A
		Area exhibits connective habitats, corridors, habitat linkages and areas that reduce biological isolation	1A, 1B, 2A, 3A, 3B, 3C, 4A, 4B, 5A, 5B, 5C, 6A, 7A, 7B, 8A
		Area contains plant and animal species on federal or DNER list as endangered, rare or of special concern	1A, 1B, 2A, 3A, 3B, 3C, 4A, 4B, 5A, 5B, 5C, 6A, 7A, 7B, 8A

⁴⁵ Reference to the expansions shown in the Map 1 on the Section 3 of this report.

Criteria Title	New criteria	Criteria Description	Represented in the expansion of the FLA ⁴⁵
Presence of endangered and endemic species		Area has unique, rare and/or important variety of vegetative cover types and size classes	4A, 5A
		Areas of nesting, resting and feeding of migratory species	1A, 2A, 5B, 7B
		Areas with significant wildlife population and critical elements	1A, 3B, 5A, 6A, 7A, 7B
	NO	Presence of endangered species habitat for federal, or DNER listed plant and/or animal species, or suitable habitat for such species that are documented on adjacent properties	1A, 1B, 2A, 3A, 3B, 3C, 4A, 4B, 5A, 5B, 5C, 6A, 7A, 7B, 8A
		Rare natural habitats, communities or ecosystems and their buffers	1A, 5B 5C, 6A, 7B
		Unusually diverse or otherwise special biological community	7B
		Forest lands necessary for the recovery or reintroduction of natural occurring species	2A, 5B, 5C
		Area includes locally important panoramic views	2A, 3A, 4B, 5C, 6A
		Area is situated along designated scenic road	2A, 4B, 5C, 6A
	Public recreation	NO	Existing or potential recreational uses such as water-based recreation, trails, day use recreation such as hiking, picnics, horseback riding
		Existing or potential natural resource-based recreation such as camping and nature tours	2A, 3A, 3B, 4B, 5A, 5C, 6A, 7B
		Areas critical for access to places of outstanding recreational opportunities or tourism resources	2A, 3A, 4B, 4A, 5A, 6A, 7A, 7B
		Areas with existing or potential eco-touristic resources	2A, 3A, 3C, 4B, 4A, 5A, 5C, 6A, 7A, 7B
Historic and/or cultural resources	NO	Areas that contain evidence of the earlier human occupation in Puerto Rico which comprises a unique and irreplaceable resource as do historic features, such as old coffee and tobacco plantation artifacts and structures, and vernacular landscapes.	
Primary or close to primary forest conditions	NO	Areas that have over 10% of the forested parcel in primary or close to primary forest conditions	
Promote the development of commercial timberland	NO	Areas under a management plan for timberland development or recommended by a management plan for such uses, including those areas already participating of other local or state, public or private programs	2A
		Potential areas for commercial timberland development and use	
		Productive soils with significance to forestry and agroforestry	2A, 4B, 5C, 6A

Table A-710. Characteristics of FLAs⁴⁶

Forest Legacy Area	General Location	Summary of Important Environmental Values (2000)	Additional Values 2021	Conservation and Protection Methods	List of Objectives	Public Benefits Derived	Entities that may be Assigned Administrative, Monitoring, and/or Management Responsibilities
1 Guánica Legacy Area	The Guánica Legacy Area is located on the southwestern corner of Puerto Rico, basically including the coastal area of the municipalities of Cabo Rojo, Lajas, Guánica, Yauco, Guayanilla, Peñuelas and a small portion of Ponce. It extends from Punta Cucharas on its southeastern portion, to the Cabo Rojo coast on its western portion, and to Laguna Joyuda in Mayagüez and Hormigueros on the north. The size of the Area is approximately 104,371 acres.	The Guánica Legacy Area contains the following significant resource areas: a. the Guánica State Forest and Biosphere Reserve and its buffer zone, b. the Boquerón State Forest and its buffer zone, c. the Sierra Bermeja (Cerro Mariquita) area, d. the Laguna Joyuda Nature Reserve Area, e. Laguna Guaniquilla Reserve, f. the National Wildlife Refuge of Boquerón, g. the Mogotes de Boca Prieta and those to the east of Boca Prieta, h. Guánica Lagoon, i. Ciénaga Anegado of Lajas, j. a portion of the Susúa's State Forest, k. DNER's Bird Refuge, and l. the caves of Pedernales in Cabo Rojo.	The expansion of the Guánica Legacy Area to the east (1A) will include the following significant resource areas: a. Designated critical habitat of the yellow-shouldered blackbird or mariquita (<i>Agelaius xanthomus</i>). b. Two proposed critical habitats under DNER's Regulation 6766: Puerto Rican nightjar (<i>Antrastomus noctitherus</i>) and Dry forest lizard's (<i>Anolis cooki</i>). c. Manjack (<i>Varronia rupicola</i>), federally listed species as threatened d. Three critical wildlife areas: Guayanilla Hills; Las Salinas Lagoon/ El Tuque; and Punta Verraco, Cerro Toro and Punta Ventana. e. Two Priority Conservation Areas (PCA): Lluveras - Punta Verraco PCA and Punta Cucharas PCA. f. Increase representativeness of unique geological and forest resources: Restricted Karst (PRAPEC) and the dry forest life zone. g. Additional Protected Natural Areas: Cueva el Convento, Punta Cucharas Nature Reserve and Cerro La Tuna Protected Natural Area. The expansion of the Guánica Legacy Area to the north (1B) will include the following significant resource areas: h. Model Forest	Fee simple acquisition and/or conservation easements. Conservation easements for tracts should address: a. Development rights b. Management of land for traditional forest uses ⁴⁷ , recreational purposes and wildlife habitat and scenic resources c. Incentives for private forest owners d. Public access e. Protection of rare and endangered species f. Mineral rights	a. Establishment of a buffer zone for the Guánica State Forest b. Protection of endangered species habitat c. Protection of scenic quality d. Public access for recreation e. Conservation of wildlife habitat f. Continuation of traditional forest uses g. Establish forest corridors as a climate change adaptation strategy h. Coastal forest protection	a. Enhance and maintain biodiversity b. Reduce threats or pressures of forest conversion to other non-forest uses on the designated limits of the Guánica State Forest and the surrounding buffer zone c. Enhance and maintain natural elements for ecotourism activities d. Provide traditional forest products e. Enhancement of livelihoods f. Reduce potential hazards to communities caused by wildland fires g. Increase resiliency for climate change and earthquakes	a. Commonwealth of Puerto Rico, Department of Natural and Environmental Resources, Bureau for the Management of Protected Natural Areas and Forests Services b. Local municipal governments c. The Conservation Trust of Puerto Rico/Para La Naturaleza d. Partners with collaborative/management agreements with the PRDNER: Protectores de Cuencas
2 Maricao Legacy Area	The Maricao Legacy Area is located on the southwestern portion of the Cordillera Central, extending to the west to the municipality of Mayagüez, to the east to a portion of the municipality of Adjuntas and to the north to the municipalities of San Sebastián, Lares and a portion of Camuy, including also portions of the municipalities of San Germán,	The Maricao Legacy Area contains the following significant resource areas: a. the Maricao and Susúa State Forest and their buffer zones, b. transitional tabonuco forest between these forest reserves; c. the Rodadero Peak area, d. the Indiera sections of Maricao, and e. the Cerro Las Mesas area of Mayagüez.	The expansion of the Maricao Legacy Area to the east and northeast (2A) will include the following significant resource areas: a. Connect to other three protected natural areas: Monte Guilarte State Forest, La Olimpia Forest and the Foreman Conservation Easement. b. Habitat of the critically endangered fern, <i>Thelypteris yaucoensis</i> . c. Portions of two proposed critical habitats: <i>Tectaria estremarana</i> and <i>Thelypteris verecunda</i> . d. Protect the corridor of the Puerto Rican	Fee simple acquisition and/or conservation easements. Conservation easements should address: a. Development rights b. Management of land for traditional forest uses, recreational purposes and wildlife habitat and scenic resources c. Public access d. Protection of rare and	a. Establishment of a buffer zone for the Maricao and Susúa State Forests b. Protection of endangered species habitat corridor c. Protection of scenic quality d. Public access for recreation e. Conservation of wildlife habitat	a. Decrease potential negative impacts on the Maricao and Susúa Forests b. Enhancements and maintenance of biodiversity c. Allow for development of ecotourism activities d. Provide traditional forest products	a. Commonwealth of Puerto Rico, Department of Natural and Environmental Resources, Bureau for the Management of Protected Natural Areas and Forests Services b. Local municipal governments c. The Conservation Trust of Puerto Rico/Para La Naturaleza d. Partners with collaborative/management agreements with the PRDNER: Fideicomiso del Bosque Modelo, Cofiesencia, Casa Pueblo

⁴⁶ Shaded texts are proposed changes or additions to the 2021 revision. Strikethrough text corresponds to premises that are suggested to eliminate/delete.

⁴⁷ Traditional forest uses, include timber management, and other recreational uses such as hunting, fishing, hiking, and similar recreational uses that are consistent with purposes of the FLP.

Forest Legacy Area	General Location	Summary of Important Environmental Values (2000)	Additional Values 2021	Conservation and Protection Methods	List of Objectives	Public Benefits Derived	Entities that may be Assigned Administrative, Monitoring, and/or Management Responsibilities
	Sabana Grande, Maricao, Yauco, Guayanilla, Peñuelas, Utuado and Las Marías. The size of the Area is approximately 215,630 acres.		<p>parrot (<i>Amazona vittata</i>), between the State Forests of Maricao, Guajataca and Río Abajo.</p> <p>e. Connect to three protected natural areas: Hacienda Margarita, Río Maricao and Río Camuy Caverns National Park, and to four PCA: Cerro Las Mesas, Cordillera Central, Carso Río Abajo and Carso Río Camuy; and also lands that are within the Model Forest.</p> <p>f. Increase representativeness of unique geological and forest resources: subtropical wet forest life zone and Restricted Karst (PRAPEC).</p> <p>g. Cover various municipalities with the highest number of management plans under the Forest Stewardship Program (Maricao, Yauco, San Germán and Las Marías).</p> <p>h. Include potential lands for forestry, conservation and agriculture (Gould et al, 2017).</p> <p>i. Important hydrological regions in the western part of the island.</p>	<p>endangered species</p> <p>e. Protection of public water supply</p> <p>f. Mineral rights</p>	<p>f. Continuation of traditional forest usesf.</p> <p>g. Establish forest corridors as a climate change adaptation strategy</p>		
3 Quebradillas Legacy Area	The Quebradillas Legacy Area is located on the northwestern portion of the karst region, extending towards the west to the municipality of Aguadilla, to the east to the municipality of Hatillo, including also portions of the municipalities of Isabela, Quebradillas and Camuy, San Sebastián and Moca. Also includes the north coastal areas of Camuy, Quebradillas, Isabela and Aguadilla. The size of the Area is approximately 85,992 acres.	The Quebradillas Legacy Area contains the following significant resource areas: a. the karst forest region, b. the Guajataca State Forest and its buffer zone c. the Quebrada Bellaca area, d. the Guajataca Gorge and the intermediate basin of the Guajataca Lake, and e. the caves of Terranova and Guajataca in Camuy.	<p>The expansion of the Quebradillas Legacy Area to north (3A) will include the following significant resource areas: a. area known as El Costillal. b. PCA known as the “Río Guajataca y sus Desfiladeros” and Bajura c. At least six listed species: <i>Auerodendron pauciflorum</i>, <i>Daphnosis helleriana</i>, <i>palo de rosa (Ottochulzia rhodoxylon)</i>, <i>matabuey (Goetza elegans)</i>, <i>Tectaria estremerana</i>, and the butterfly or mariposa arlequin (<i>Atlantea tulita</i>). d. Habitat of the Puerto Rican crested toad (<i>Bufo lemur</i>) or Sapo Concho PCA.</p> <p>The expansion of the Quebradillas Legacy Area to northeast (3B) will include the following significant resource areas: e. Proposed critical habitat for the listed species, <i>Tectaria estremerana</i>. f. Protection of underground water resources, as is part of the restricted karst and the associated hydrological reserve.</p> <p>The expansion of the Quebradillas Legacy Area to west (3C) will include the following significant resource areas: g. Cordillera de Jaicoa, part of the restricted karst (PRAPEC). h. Priority Conservation Area known as the</p>	<p>Fee simple acquisition and/or conservation easements.</p> <p>Conservation easements should address: a. Development rights b. Management of land for traditional forest uses, recreational purposes and wildlife habitat and scenic resources c. Public access d. Protection of rare and endangered species e. Protection of public water supply f. Mineral rights</p>	<p>a. Establishment of a buffer zone for the Guajataca State Forest b. Protection of endangered species habitat c. Protection of scenic quality d. Public access for recreation e. Conservation of wildlife habitat f. Continuation of traditional forest uses g. Protection of water resources, including underground sources. h. Coastal forests conservation</p>	<p>a. Decrease potential negative impacts on the Guajataca Forest Service b. Enhancement and maintenance of biodiversity c. Allow for development of ecotourism activities d. Provide traditional forest products e. Provide reliable sources of good water quality and quantity</p>	<p>a. Commonwealth of Puerto Rico, Department of Natural and Environmental Resources, Bureau for the Management of Protected Natural Areas and Forests Services b. Local municipal governments, c. The Conservation Trust of Puerto Rico/Para La Naturaleza c. Partners with collaborative/management agreements with the PRDNER: Ciudadanos del Karso</p>

Forest Legacy Area	General Location	Summary of Important Environmental Values (2000)	Additional Values 2021	Conservation and Protection Methods	List of Objectives	Public Benefits Derived	Entities that may be Assigned Administrative, Monitoring, and/or Management Responsibilities
4 Caonillas-Dos Bocas Legacy Area	The Caonillas-Dos Bocas Legacy Area is located on the northcentral region of the island. It includes portions of the karst limestone region and the Cordillera Central, extending to the west to the municipalities of Hatillo, Utuado and Adjuntas to the north to Arecibo, Barceloneta, Manatí, Vega Baja and a portion of Vega Alta. To the southeast, it extends to Orocovis and portions of Barranquitas, Villaba, Juana Díaz and Ponce. The size of the Area is approximately 324,160 acres.	The Caonillas-Dos Bocas Legacy Area contains the following significant resource areas: a. the basin of the Caonillas and Dos Bocas Lakes, b. the karst limestone region, c. the Lago Guineo area, d. the copper mines area, e. the Biáfara de Arecibo, Arrozal area, f. the Hato Viejo area, g. the Toro Negro State Forest and its buffer zone, h. the Rio Abajo State Forest and its buffer zone, i. the Bosque del Pueblo de Adjuntas State Forest and its buffer zone.	Karso del Noroeste. i. Proposed critical habitat for the <i>Tectaria estremerana</i> . j. Critical element <i>Buxus portorricensis</i> , a rare small tree. The expansion of the Caonillas-Dos Bocas Legacy Area to the north (4A) will include the following significant resource areas: a. Connect six protected natural areas: Caño Tiburones Nature Reserve, Cueva del Indio Nature Reserve, Cambalache State Forest, Hacienda La Esperanza Nature Reserve, Laguna Tortuguero Nature Reserve and Pantano de Cibuco Nature Reserve b. Karzo del Norte Conservation Priority Area The expansion of the Caonillas-Dos Bocas Legacy Area to the east-southeast (4B) will include the following significant resource areas: c. Proposed critical habitat for two critically endangered endemic species of ferns: the <i>Thelypteris inabonensis</i> and the <i>Thelypteris yaucoensis</i> . d. Habitat for the endangered tree palo de ramón (<i>Banara vanderbiltii</i>) e. Habitat for two species of birds: the Puerto Rican sharp-shinned hawk or alcón de sierra (<i>Acccccipiter striatus venator</i>), and the Puerto Rican broad-winged hawk or guaraguao de bosque (<i>Buteo platypterus brunnescens</i>). f. Connect four protected natural areas: Toro Negro State Forest, Tres Picachos State Forest, Finca Geraldo Colón and Finca Luis A. Zayas; and two Priority Conservation Areas (PCA): the Barranquitas PCA and the Cordillera Central PCA.	Fee simple acquisition and/or conservation easements. Conservation easements for tracts should address: a. Development rights b. Management of land for traditional forest uses, recreational purposes and wildlife habitat and scenic resources c. Public access d. Protection of rare and endangered species e. Protection of public water supply f. Mineral rights	a. Establishment of a buffer zone for the Toro Negro Forest b. Establishment of a buffer zone for the Rio Abajo State Forest c. Establishment of a buffer zone for the Bosque del Pueblo de Adjuntas State Forest d. Protection of endangered species habitat e. Protection of scenic quality f. Public access for recreation g. Conservation of wildlife habitat h. Continuation of traditional forest uses i. Establish forest corridors as a climate change adaptation strategy j. Protect important watershed areas k. Coastal forests conservation	a. Decrease potential negative impacts on the Toro Negro State Forest b. Decrease potential negative impacts on the Rio Grande State Forest c. Decrease potential negative impacts on the Bosque del Pueblo de Adjuntas State Forest d. Enhancement and maintenance of biodiversity e. Allow for development of ecotourism activities f. Provide traditional forest products g. Provide reliable sources of good water quality and quantity	a. Commonwealth of Puerto Rico, Department of Natural and Environmental Resources, Bureau for the Management of Protected Natural Areas and Forests Services b. Local municipal governments c. The Conservation Trust of Puerto Rico/ Para La Naturaleza d. Partners with collaborative/management agreements with the PRDNER
5 La Plata-Coamo Legacy Area	The La Plata-Coamo Legacy Area is located on the central and southern portion of the Cordillera Central, including a considerable section of the basin of the Plata River and a southern portion extending to the municipalities of Coamo, Santa Isabel and Salinas. In the north, it extends to the coastal areas of Vega Alta,	The la Plata-Coamo Legacy Area contains the following significant resource areas: a. the watershed of Lake La Plata, (one of the main providers of water supply to the San Juan Metropolitan Area), b. the Pasto and Piedras Chiquitas areas, c. primary Ucar forested areas in Salinas, and	The expansion of the La Plata-Coamo Legacy Area to the north (5A) will include the following significant resource areas: a. Various Priority Conservation Areas (PCA): Mogotes de Río Lajas, Nevarez, Ciénaga San Pedro y Sector El Caracol, Ciénaga Prieta. b. Proposed critical habitat for the endangered flowering plant <i>Daphnosis helleriana</i> and the critically endangered coquí llanero (<i>Eleutherodactylus</i>	Fee simple acquisition and/or conservation easements. Conservation easements for tracts should address: a. Development rights b. Management of land for traditional forest uses, recreational purposes and wildlife habitat and scenic resources	a. Protection of endangered species habitat b. Protection of scenic quality c. Public access for recreation d. Conservation of wildlife habitat e. Continuation of traditional forest uses	a. Enhancement and maintenance of biodiversity b. Allow for development of ecotourism activities c. Provide traditional forest products d. Provide reliable sources of good water quality and	a. Commonwealth of Puerto Rico, Department of Natural and Environmental Resources, Bureau for the Management of Protected Natural Areas and Forests Services b. Local municipal governments c. The Conservation Trust of Puerto Rico/Para La Naturaleza d. Partners with collaborative/management agreements with the PRDNER

Forest Legacy Area	General Location	Summary of Important Environmental Values (2000)	Additional Values 2021	Conservation and Protection Methods	List of Objectives	Public Benefits Derived	Entities that may be Assigned Administrative, Monitoring, and/or Management Responsibilities
	Dorado and Toa Baja. The size of the Area is approximately 174,390 acres.	d. the Tetras de Cayey Area.	<p><i>juanriveroi</i>).</p> <p>The expansion of the La Plata-Coamo Legacy Area to the east (5B) will include the following significant resource areas: c. "Habitat Paloma Sabanera" PCA. d. El Rabanal Conservation Easement.</p> <p>The expansion of the La Plata-Coamo Legacy Area to the southeast (5C) will include the following significant resource areas: e. Two critical wildlife areas (CWA): Cerro El Gato and Associated Areas and the Carite State Forest. f. Three PCA: Habitat Coquí Dorado, Piedras del Collado, and the Región Montañosa Carite State Forest. g. Designated critical habitat for the Golden Coqui, <i>coquí dorado</i> (<i>Eleutherodactylus jasper</i>), which is presumed to be extinct. h. Three proposed critical habitats under Regulation 6766: Puerto Rican broad-winged hawk (<i>Buteo platypterus brunnescens</i>), the <i>Thelypteris yaucoensis</i> and the Golden coqui. i. Connectivity between five protected natural areas: La Yeyesa, La Robleada, Cerro El Gato, Jájome and Carite State Forest.</p>	c. Public access d. Protection of rare and endangered species e. Protection of public water supply f. Mineral rights	f. Protection of water supply systems g. Establish forest corridors as a climate change adaptation strategy h. Protect important watershed areas	quantity	
6 Río Grande de Loíza Legacy Area	The Río Grande de Loíza Legacy Area is located on the central eastern portion of the Cordillera Central, extending to the west to the municipalities of Aguas Buenas and Cidra, to the east to Juncos, San Lorenzo and a portion of Las Piedras, to the north to portions of, Guynabo, San Juan, Trujillo Alto and Carolina. Includes the municipalities of Caguas and Gurabo. The size of the Area is approximately 138,528 acres.	The Río Grande de Loíza Legacy Area contains the following significant resource areas: a. the upper basin of the Carraízo Lake (Lake Loíza, the main water supply source of the San Juan Metropolitan Area), b. the immediate basin of Cidra Lake (another principal water supply source for the San Juan Metropolitan Area), c. the Carite Lake (a water supply source for the southern portion of the island), and d. the Carite State Forest and its buffer zone	The expansion of the Río Grande Legacy Area to the east-southeast (6A) will include the following significant resource areas: a. Carite State Forest critical wildlife area. b. Four conservation priority areas (PCA): Coquí Guajón, Sierra de Pandura and Guardarraya, Region Montañosa and Carite State Forest. c. Three protected natural areas: Las Casas de la Selva, Ulpiano Casal and Marín Alto. d. Two proposed critical habitats under Regulation 6766: <i>Thelypteris yaucoensis</i> and <i>Gonocalys concolor</i> .	Fee simple acquisition and/or conservation easements. Conservation easements for tracts should address: a. Development rights b. Management of land for traditional forest uses, recreational purposes and wildlife habitat and scenic resources c. Public access d. Protection of rare and endangered species e. Protection of public water supply f. Mineral rights	a. Establishment of a buffer zone for the Carite State Forest b. Protection of endangered species habitat c. Protection of scenic quality d. Public access for recreation e. Conservation of wildlife habitat f. Continuation of traditional forest uses g. Protection of public water supply h. Establish forest corridors as a climate change adaptation strategy i. Establish forest corridors as a climate change adaptation strategy j. Protect important	a. Decrease potential negative impacts on the Carite State Forest b. Enhancement and maintenance of biodiversity c. Allow for development of ecotourism activities d. Provide traditional forest products e. Provide reliable sources of good water quality and quantity	a. Commonwealth of Puerto Rico, Department of Natural and Environmental Resources, Bureau for the Management of Protected Natural Areas and Forests Services b. Local municipal governments c. The Conservation Trust of Puerto Rico/Para La Naturaleza d. Partners with collaborative/management agreements with the PRDNER or landowners: Tropic Ventures

Forest Legacy Area	General Location	Summary of Important Environmental Values (2000)	Additional Values 2021	Conservation and Protection Methods	List of Objectives	Public Benefits Derived	Entities that may be Assigned Administrative, Monitoring, and/or Management Responsibilities
7 El Yunque Legacy Area	The El Yunque Legacy Area is located on the eastern portion of the island on the Sierra de Luquillo Mountains, including the buffer zone of the Caribbean National Forest and Biosphere Reserve. It extends to the northeast coastal area from the Río Espíritu Santo Nature Reserve in Río Grande, including the Northeast Ecological Corridor in Luquillo and Fajardo and the Pterocarpus Forest in Humacao. The size of the Area is approximately 144,705 acres.	The El Yunque Legacy Area contains the following significant resource areas: a. the Caribbean National Forest and Biosphere Reserve and its buffer zone.	The expansion of the El Yunque Legacy Area to the southwest (7A) will include the following significant resource areas: a. Proposed critical habitat for the Puerto Rican broad-winged hawk (<i>Buteo platypterus brunnescens</i>). The expansion of the El Yunque Legacy Area to the north, northeast and southeast (7B) will include the following significant resource areas: b. Representativeness of the forests of all the life zones. c. 11 critical wildlife areas: Laguna Grande, Laguna Aguas Prietas and adjacent areas, Baja Swamp and Herrera River Mouth, Ensenada Comezón and Espíritu Santo River Nature Reserve, Fajardo Coastline, Laguna Grande, Laguna Aguas Prietas and adjacent areas San Miguel, Las Paulinas and El Convento Natural Area, Former Roosevelt Roads Naval Base Mangroves, Ceiba State Forest and Humacao Nature Reserve. d. Proposed critical habitat for the endangered Virgin Islands Tree Boa (<i>Chilabothrus monensis granti</i>). e. Designated critical habitat of the yellow-shouldered blackbird or mariquita (<i>Agelaius xanthomus</i>).	Fee simple acquisition and/or conservation easements. Conservation easements for tracts should address: a. Development rights b. Management of land for traditional forest uses, recreational purposes and wildlife habitat and scenic resources c. Public access d. Protection of rare and endangered species e. Protection of public water supply f. Mineral rights	watershed areas a. Establishment of a buffer zone for the Caribbean National Forest b. Protection of endangered species habitat c. Protection of scenic quality d. Public access for recreation e. Conservation of wildlife habitat f. Continuation of traditional forest uses g. Protection of public water supply. h. Establish forest corridors as a climate change adaptation strategy, i. Coastal forests conservation	a. Decrease potential negative impacts on the Caribbean National Forest b. Enhancement and maintenance of biodiversity c. Allow for development of ecotourism activities d. Provide traditional forest products e. Provide reliable sources of good water supply and quantity	a. Commonwealth of Puerto Rico, Department of Natural and Environmental Resources, Bureau for the Management of Protected Natural Areas and Forests Services b. Local municipal governments c. The Conservation Trust of Puerto Rico d. Partners with collaborative/management agreements with the PRDNER or landowners: Centro Para La Conservación del Paisaje e. El Yunque- USFS
8 Maunabo Legacy Area	The Maunabo Legacy Area is located on the southeastern coast of the island, including Patillas and portions of the municipalities of Maunabo and Yabucoa. It extends to the coastal area of these three municipalities. The size of the Area is approximately 37,864 acres.	The Maunabo Legacy Area contains the following significant resource areas: a. the Cuchilla Panduras Region	The expansion of the Maunabo FLA to the southeast (8A) will include the following significant resource areas: a. Pandura Mountain Range CWA b. One conservation priority area: Guajun-Sierras de Panduras y Guardarraya PCA c. Proposed critical habitat for the Puerto Rican rock frog (<i>Eleutherodactylus Cooki</i>)	Fee simple acquisition and/or conservation easements. Conservation easements for tracts should address: a. Development rights b. Management of land for traditional forest uses, recreational purposes and wildlife habitat and scenic resources c. Public access d. Protection of rare and endangered species	a. Protection of endangered species habitat b. Protection of scenic quality c. Public access for recreation d. Conservation of wildlife habitat e. Continuation of traditional forest uses f. Establish forest corridors as a climate change adaptation strategy g. Coastal forests conservation	a. Enhancement and maintenance of biodiversity b. Allow for development of ecotourism activities c. Provide traditional forest products d. Provide reliable sources of good water supply and quantity	a. Commonwealth of Puerto Rico, Department of Natural and Environmental Resources, Bureau for the Management of Protected Natural Areas and Forests Services b. Local municipal governments c. The Conservation Trust of Puerto Rico/Para La Naturaleza, Comité Pro Desarrollo de Maunabo d. Partners with collaborative/management agreements with the PRDNER or landowners: Tropic Ventures