

# Protected Natural Areas of Puerto Rico



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Protection of natural areas is essential to conserving biodiversity and maintaining ecosystem services. Benefits and services provided by natural areas are complex, interwoven, life-sustaining, and necessary for a healthy environment and a sustainable future (Daily et al. 1997). They include clean water and air, sustainable wildlife populations and habitats, stable slopes, productive soils, genetic reservoirs, recreational opportunities, and spiritual refugia. These are benefits that cannot be replaced by existing technology (Cohen and Tilman 1996, Daily et al. 1997). To best use our natural heritage, natural lands management and protection designation should be based on sound scientific information provided by research and experience. Social and historical factors, sustainable uses, existing conditions, restoration potential, and future scenarios should be considered to assure continued benefits, a good quality of life, and economic stability for the communities that depend on ecosystem services provided by natural areas.

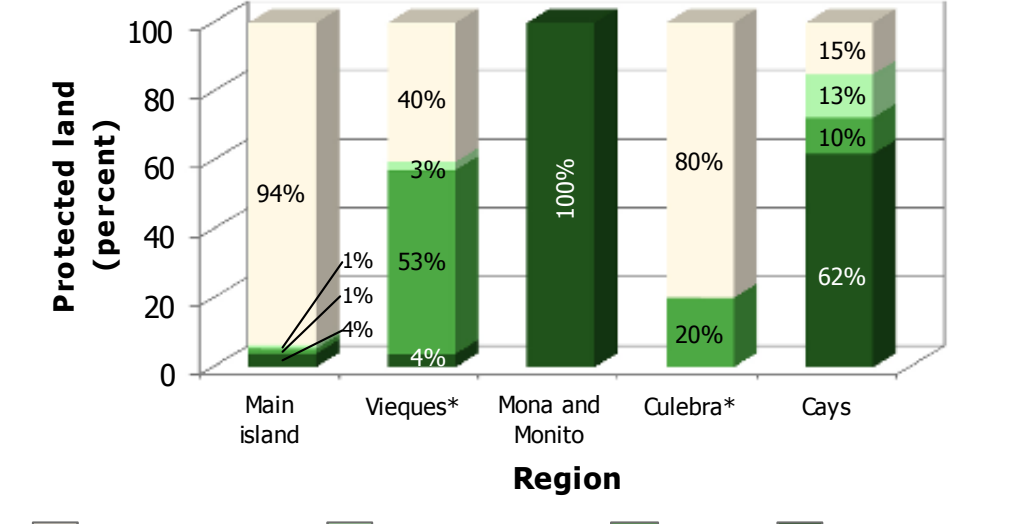
We portray the protected natural areas designated for natural resource conservation in Puerto Rico, as well as areas with government regulation that have the potential to enhance natural resource conservation. The designation of protected areas can be very dynamic as it is a product of ever-evolving social values. The information shown is a compilation of available geospatial data from various local and federal government agencies and nongovernmental organizations (NGOs). The primary map, "Protected areas by management," shows Puerto Rico's protected natural lands designated for conservation and managed by Puerto Rico Commonwealth agencies, U.S. federal agencies, and NGOs. The areas are identified by a numerical label that matches the area's name on the list below. This map also shows Puerto Rico's marine reserves and marine extensions of terrestrial natural reserves, which are all managed or co-managed by the Puerto Rico Department of Natural and Environmental Resources (DNER). Some or parts of the protected areas are owned by a different agency than the one that manages it, so a supplemental map, "Protected areas by ownership," identifies the protected areas as either parks, reserves, or state forests owned by the DNER or the Puerto Rico National Parks Company, areas owned by other Commonwealth agencies, Federally owned land, land owned by NGOs, and unprotected lands. The second supplemental map, "Regulated land," shows areas with some degree of government regulation, including the 2006 Puerto Rico land use plan draft (Junta de Planificación 2006) and additional local and federal laws that potentially provide protection of natural resources. It is important to note that there are areas not portrayed which were historically designated as part of the state forests of Boquerón (6), Ceiba (19), and Rifones (81). We were unable to determine their current status. Additionally, there are areas not included in this map that have been designated by the commonwealth government as special zoning areas, which have some conservation objectives but little enforcement (e.g., a parcel adjacent to the Tres Palmas Marine Reserve (110)).

**Summary.** Currently 8 percent of Puerto Rico's land is designated for conservation. This includes public and private properties classified as state forests, national federal forests, wildlife refuges, natural reserves, natural protected areas, conservation easements, recently acquired lands for conservation, and other lands managed for conservation.

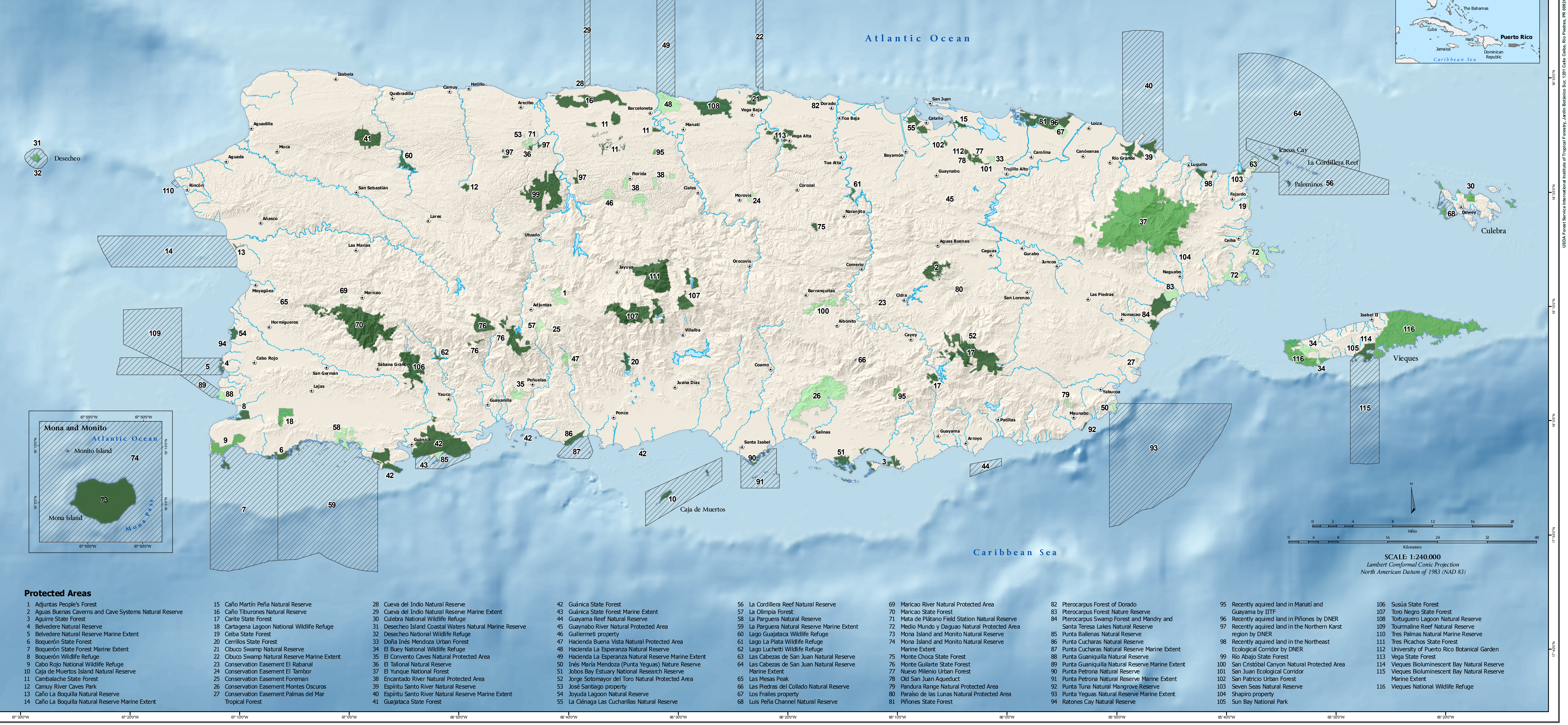
Puerto Rico currently has 116 protected natural areas with 21 marine reserves, of which 16 are marine extensions of terrestrial reserves. Eight of the 95 protected land areas are co-owned by various entities. The Commonwealth of Puerto Rico owns and manages the greatest area of protected lands (58 percent) and 57 percent, respectively, followed by the federal government (28 percent in both categories) and NGOs (14 and 15 percent, respectively). However, NGOs manage more individual protected land areas than the federal government (36 vs. 7). Protected areas are concentrated on the high peaks of the Central and Luquillo Mountains, the wetlands of the coastal plains, and the lesser islands and cays of the Puerto Rican Archipelago. These areas are relatively well-protected. Under protected areas include nonwetlands of the coastal plain, the karst limestone hills in northwestern Puerto Rico, and the coastal hills and lower slopes. The coastal hills form an important hydrological and ecological link between the upper mountains, the coastal wetlands, and the near-shore marine areas.

Mechanisms other than official designation as a protected area have been established to promote natural resource conservation, including local and federal laws, zoning regulation, planning, and permit processes for development. The Puerto Rico Land Use Plan, an island-wide regulatory obligation of the Puerto Rico Planning Board (Junta de Planificación 2006), has been in development for years although it is still unfinished and unapproved. Local and federal laws and regulations often protect specific landcover types, species habitats, and terrain not appropriate for development, e.g., flood plains, steep slopes, landslide-prone areas, and critical habitat. However, these mechanisms and the processes to enforce them do not always work (Fernández-Porto 1994, Lugo 1994, Lugo et al. 2004, Molina 1994). Development pressure, the politicizing of environmental agencies and decisionmaking processes, and the lack of knowledge and appreciation of the services provided by natural areas have historically impaired the ability of these processes to properly protect our land (Lugo 1994).

## Percentage of protected land by island region



## Protected areas by management



### Protected Areas

1 Adjuntas People's Reserve	15 Caño Martín Peña Natural Reserve	28 Cueva del Indio Natural Reserve	42 Guánica State Forest	56 La Cordillera Reef Natural Reserve	69 Maricao River Natural Protected Area	82 Pterocarpus Forest of Dorado	95 Recently aquired land in Manati and Guayama by IITF	106 Susúa State Forest
2 Aguas Buenas Caverns and Cave Systems Natural Reserve	16 Caño Tiburones Natural Reserve	29 Cueva del Indio Natural Reserve Marine Extent	43 Guánica State Forest Marine Extent	57 La Olimpia Forest	70 Maricao State Forest	83 Pterocarpus Forest Nature Reserve	107 Toro Negro State Forest	109 Torfuegos Lagoon Natural Reserve
3 Aguirre State Forest	17 Caribe State Forest	30 Culebra National Wildlife Refuge	44 Guayama Reef Natural Reserve	58 La Parguera Natural Reserve	71 Mata de Nísano Field Station Natural Reserve	84 Pterocarpus Swamp Forest and Mandry and Santa Teresa Lakes Natural Reserve	110 Tourmaline Reef Natural Reserve	111 Tres Palmas Natural Reserve
4 Belvedere Natural Reserve	18 Cartagena Lagoon National Wildlife Refuge	31 Desecho National Wildlife Refuge	45 Guaynabo River Natural Protected Area	59 La Parguera Natural Reserve Marine Extent	72 Medio Mundo y Daguan Natural Protected Area	85 Punta Ballenas Natural Reserve	112 University of Puerto Rico Botanical Garden	113 Vega State Forest
5 Belvedere Natural Reserve Marine Extent	19 Ceiba State Forest	32 Desecho National Wildlife Refuge	46 Guillermo property	60 Lago Guajataba Wildlife Refuge	73 Mona Island and Monito Natural Reserve	86 Punta Cucharas Natural Reserve	114 Vieques Biomimetic Bay Natural Reserve	115 Vieques Biomimetic Bay Natural Reserve
6 Boquerón State Forest	20 Cerrillos State Forest	33 Doña Inés Mendoza Urban Forest	47 Hacienda Buena Vista Natural Protected Area	61 Lago La Plata Wildlife Refuge	74 Mona Island and Monito Natural Reserve	87 Punta Cucharas Natural Reserve Marine Extent	101 San Juan Ecological Corridor	105 Sun Bay National Park
7 Boquerón State Forest Marine Extent	21 Cibuco Swamp Natural Reserve	34 El Duque National Wildlife Refuge	48 Hacienda La Esperanza Natural Reserve	62 Lago Luchetti Wildlife Refuge	75 Monte Guailate State Forest	88 Punta Guaniquilla Natural Reserve	91 Punta Petrona Natural Reserve Marine Extent	
8 Boquerón Wildlife Refuge	22 Cibuco Swamp Natural Reserve Marine Extent	35 El Convento Caves Natural Protected Area	49 Hacienda La Esperanza Natural Reserve Marine Extent	63 Las Cabezas de San Juan Natural Reserve	76 Monte Guailate State Forest	89 Punta Guaniquilla Natural Reserve	92 Punta Tuna Natural Mangrove Reserve	
9 Cabo Rojo National Wildlife Refuge	23 Conservation Easement El Rabanal	36 El Tallón Natural Reserve	50 Inés María Mendoza (Punta Yeguas) Nature Reserve	64 Las Cabezas de San Juan Natural Reserve Marine Extent	77 Nuevo Milenio Urban Forest	90 Punta Petrona Natural Reserve		
10 Cabo Rojo Natural Reserve	24 Conservation Easement El Tambor	37 El Yunque National Forest	51 Jobsos Bay Estuary National Research Reserve	65 Las Micos Peak	78 Old San Juan Aqueduct	91 Punta Tuna Natural Mangrove Reserve		
11 Camuy River Caves Park	25 Conservation Easement Montos Oscuros	38 Encantada River Natural Protected Area	52 José Sotomayor del Toro Natural Protected Area	66 Las Piedras del Colloado Natural Reserve	79 Pandura Range Natural Protected Area	92 Punta Yeguas Natural Reserve Marine Extent		
12 Caño La Boquilla Natural Reserve	26 Conservation Easement Palmas del Mar	39 El Espíritu Santo River Natural Reserve	53 José Santiago property	67 Los Frailes property	80 Paraiso de las Lunas Natural Protected Area	93 Punta Yeguas Natural Reserve		
13 Caño La Boquilla Natural Reserve Marine Extent	27 Conservation Easement Palmas del Mar Tropical Forest	40 Espiritu Santo River Natural Reserve Marine Extent	54 Joyuda Lagoon Natural Reserve	68 Luis Peña Channel Natural Reserve	81 Pifones State Forest	94 Ratonces Cay Natural Reserve		

## Protected Land Management in Puerto Rico

Management classes	Hectares	Percentage of protected lands	Percentage of island	Number of protected areas
Commonwealth	41 376	57	5	52
Federal	20 655	28	2	7
Nongovernmental	10 709	15	1	36
Protected	72 740		8	
Unprotected	821 022		92	

## Data sources:

**Bathymetry:** This data set was created with National Oceanic and Atmospheric Administration chart data compiled by Antonio González of the University of Turabo, Ana G. Méndez System. The Digital Elevation Model (DEM) was created at the International Institute of Tropical Forestry (IITF) Geographical Information System (GIS) and Remote Sensing Lab. The points were interpolated to a 30-meter raster file using the Spline interpolation in ArcGIS 9.2. Spatial Analysis Extension. A 10-mile buffer was calculated from the DEM using ArcGIS 9.2.

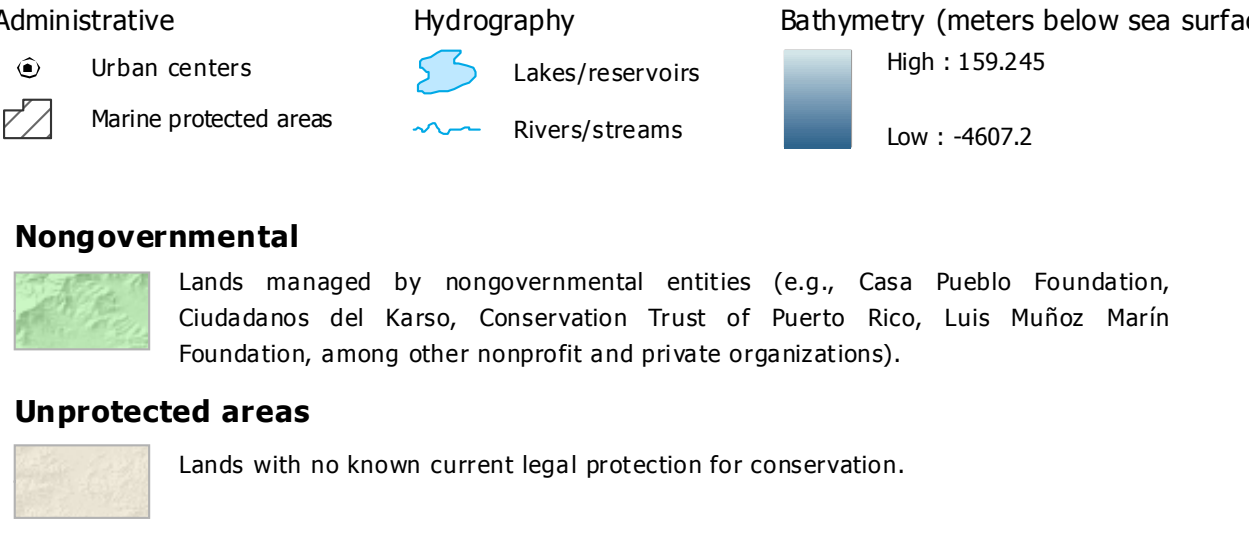
**Coastline:** The coastline data set is mainly based on 2007 digital aerial photographs, with small areas based on 2004 digital aerial photographs. IITF GIS and Remote Sensing Lab.

**Hydrography:** The hydrography data set was derived and generalized from The National Hydrography Dataset (NHD) published in 2005, Reston, Virginia. The NHD was originated by the USGS in cooperation with the U.S. Environmental Protection Agency, U.S. Department of Agriculture (USDA) Forest Service, and other federal, state, and local partners. This data set is presented as vector digital data generally developed at 1:24,000 (1:12,000 scale).

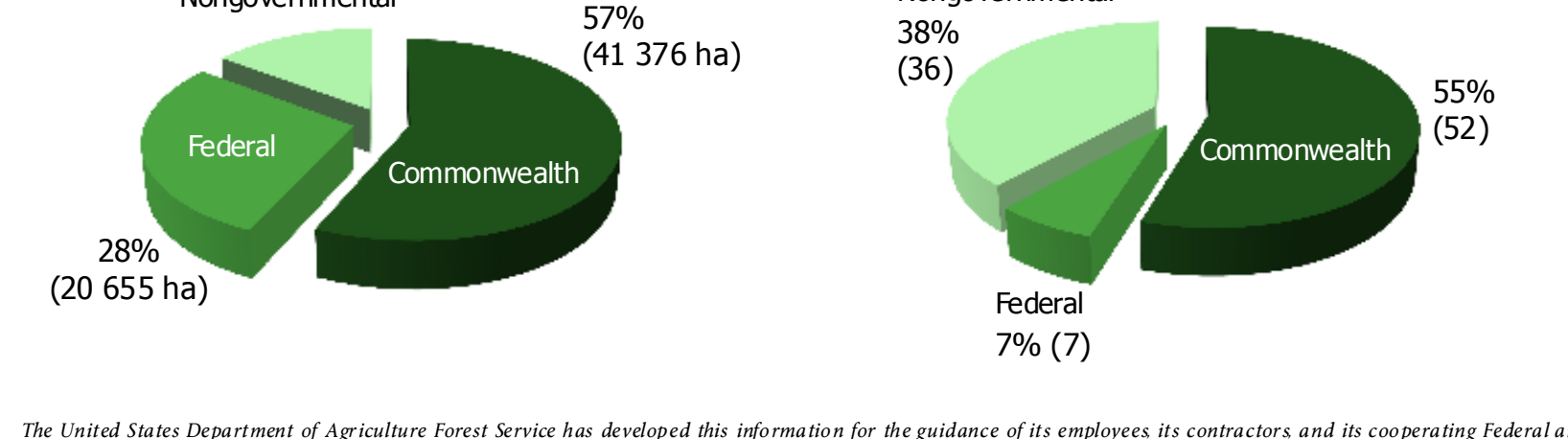
**Protected areas:** Updated from Gould et al. 2007. Marine reserves were added from data provided by the Department of Natural and Environmental Resources of Puerto Rico. Some boundaries were updated with more recent data provided by the agency or organization responsible for said areas, whereas other areas that were missing in the original file were added. The coastline of the original data was updated to a vector coastline based primarily on 2007 digital orthorectified aerial photographs, developed by the IITF GIS and Remote Sensing Lab. These are the most recent available data as of October 2010.

**Topography:** The elevation data were derived from the USGS National Elevation Dataset (NED) DEM. This data set is a raster product assembled by the USGS. The NED is designed to provide national elevation data in a seamless form with a consistent datum, elevation unit, and projection. NED has a resolution of one arc-second (approximately 30 meters) for the contiguous United States, Hawaii, and Puerto Rico and a resolution of two arc-seconds for Alaska. The hillshade was calculated by using ArcGIS 9.2. Spatial Analysis extension.

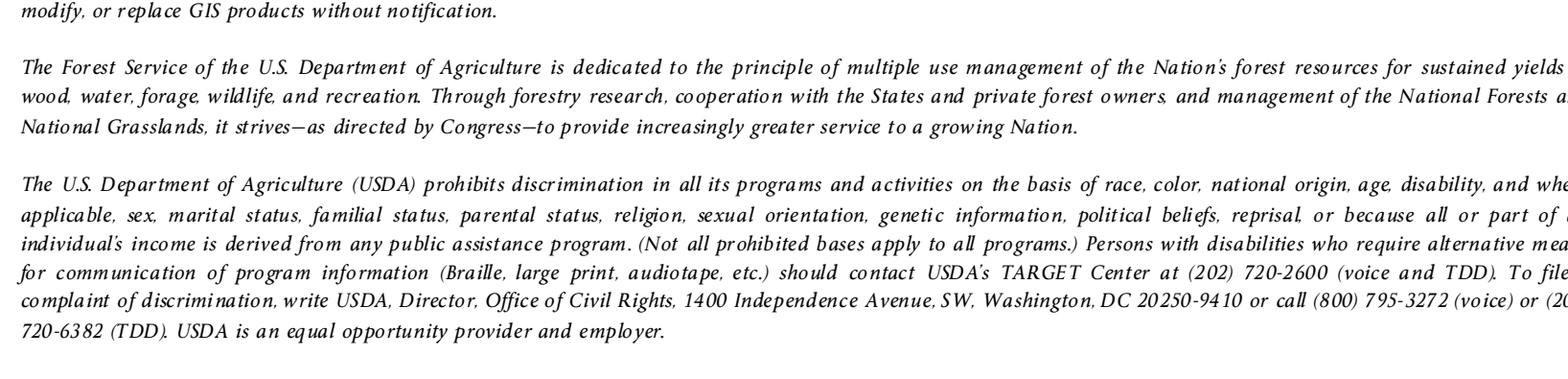
**Urban centers:** This data set was developed by the IITF GIS and Remote Sensing Lab using visual interpretation of existing maps. Each point in the data set represents the approximate urban center for each municipality.



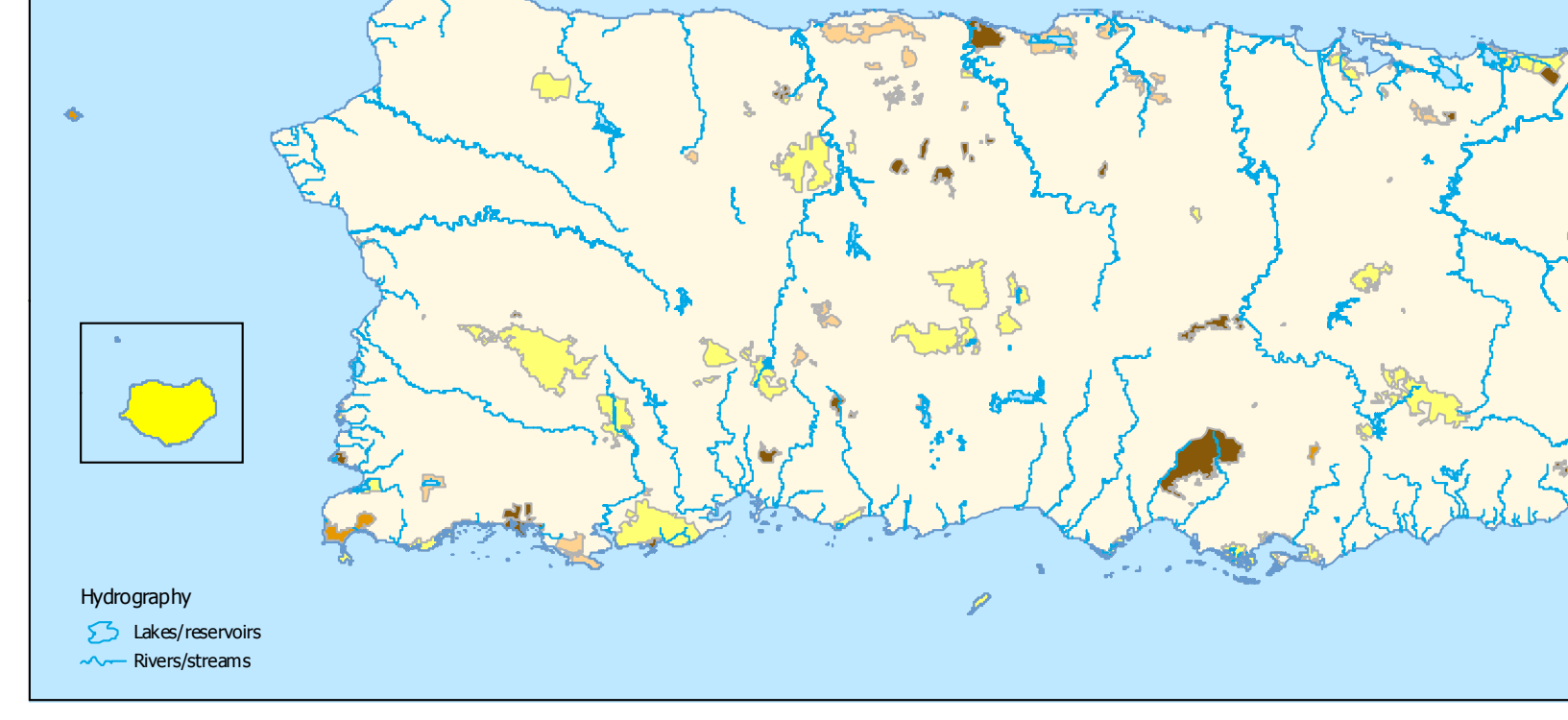
## Protected land distribution by management



## Number of protected areas distribution by management

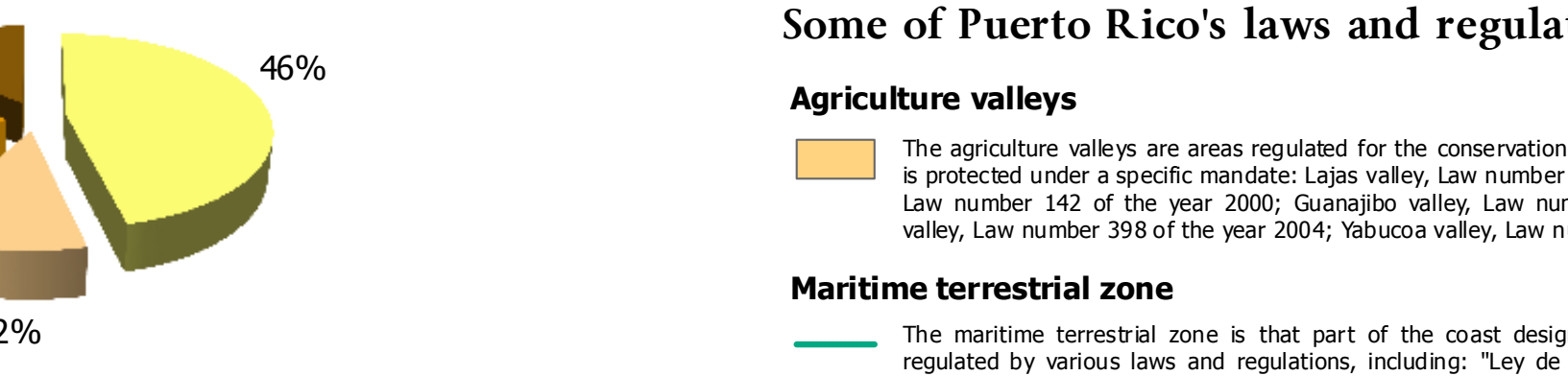


## Protected areas by ownership

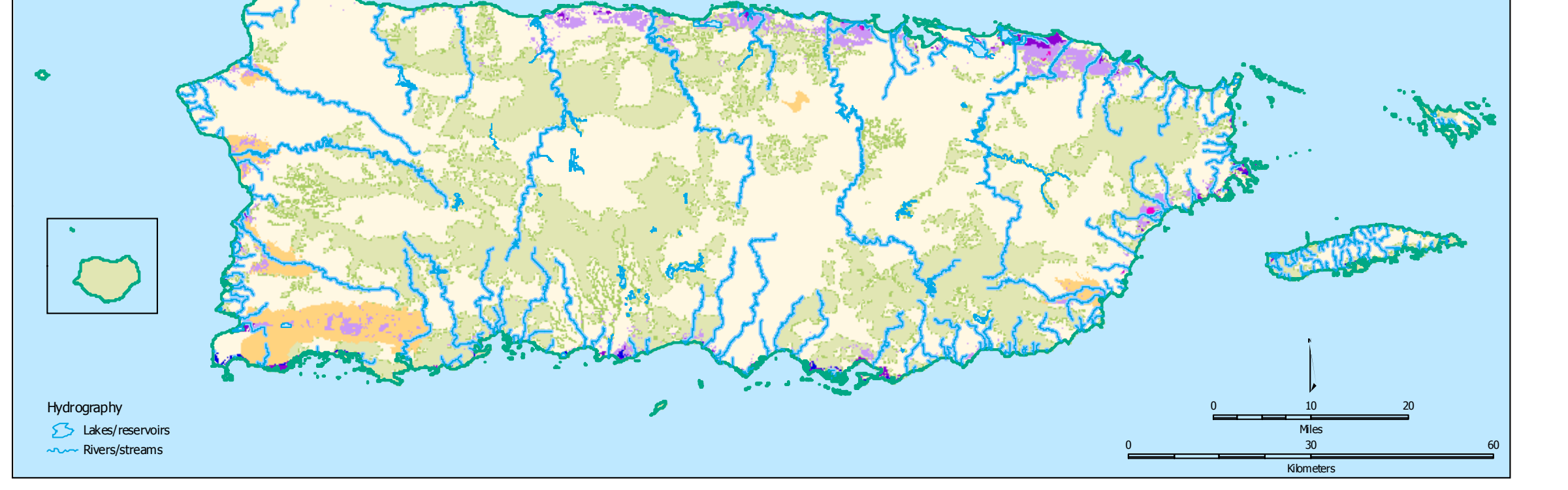


## Protected Land Ownership in Puerto Rico

Ownership	Hectares	Percentage	Number of protected areas
Commonwealth forests, parks, and reserves	33 704	46	40
Commonwealth institutions, counties, utilities	8554	12	23
Federal agencies, forests, parks, reserves	20 443	28	7
Nongovernmental organizations	10 039	14	33
Unprotected areas	72 740	100	



## Regulated land



## Some of Puerto Rico's laws and regulations that impact the conservation of natural resources

**Agriculture valleys:** The agriculture valleys are areas regulated for the conservation of agriculture activities. Each valley is protected under a specific mandate: Lajas valley, Law number 277 of the year 1995; Coloso valley, Law number 142 of the year 2000; Guaynabo valley, Law number 184 of the year 2000; Cibaoe valley, Law number 308 of the year 2004; Yabouca valley, Law number 49 of the year 2009.

**Riverbanks:** Law number 49 of January 2003 "Ley para Establecer la Política Pública sobre la Prevención de Inundaciones y Conservación de Ríos y Quebradas" establishes the protection and designation of public use for at least 5 meters of land to each side of a river. This law was established to protect the integrity of Puerto Rico's rivers. Municipalities can designate more than 5 meters for protection within their jurisdiction.

**Maritime terrestrial zone:** The maritime terrestrial zone is that part of the coast designated as public domain. Its use is regulated by various laws and regulations, including "Ley de Muelles y Puertos de Puerto Rico", "Ley de Aguas", "Reglamento para el Aprovechamiento, Vigilancia, Conservación y Administración de las Aguas Terrestres, los Terrenos Sumergidos bajo estas y la Zona Marítimo-Terrestre", "Reglamento de Zonificación de la Zona Costanera y de Acceso a Playas y Costas de Puerto Rico" (Lugo et al. 2004).

**Wetlands and mangroves:** Mangrove forests and the wetlands of Puerto Rico are protected by various local and federal laws and regulations to protect the integrity of the coast and other water bodies, including Law number 23 of the 20<sup>th</sup> of June of 1972 "Ley Orgánica del Departamento de Recursos Naturales y Ambientales", Law number 133 of 1<sup>st</sup> of June of 1997 "Ley de Bosques", Law 241 of 15 of August of 1999 "Nueva Ley de Vida Silvestre", Law 150 of 4 of August of 1988 "Ley del Programa de Patrimonio Natural", Law 314 of 24 December of 1988 "Política Pública sobre Humedales y designación de Caño Tiburones como Reserva Natural", Regulation number 17 "Reglamento de Zonificación de la zona costanera y acceso a las playas y costas de Puerto Rico", and the Federal Clean Water Act (DNRN, 2009).