EL YUNQUE
ECOSYSTEM SERVICES

Land Cover within and around El Yunque National Forest

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Introduction

People in the region surrounding El Yunque National Forest (El Yunque) in Puerto Rico depend on and benefit from a variety of ecosystem goods and services provided by the forest, such as clean air, water, biodiversity, and recreation. The availability of these ecosystem services is influenced by the type of land cover surrounding El Yunque. For example, surrounding forests protect watersheds from soil erosion, serve as filters to produce clean water for multiple uses to people in the region, and provide habitat and food for El Yunque's fauna. Conversely, urban and built-up areas can lead to landscape fragmentation or removal of forested lands, which in turn affect ecosystem structure and function and the services provided by forests within and around El Yunque.

This fact sheet summarizes land-cover data at three geographic scales in which land-use planning and decision making take place around El Yunque: municipal (county), regional, and proclamation area. Land-cover data were created from the digitalization of aerial photographs taken in 2010. Eight land-cover categories were used for the classification of the aerial photographs. These aerial photographs are the most current digital photographs available, thus providing the most up-to-date land-cover information for informed land-use planning and decision making at all three levels.

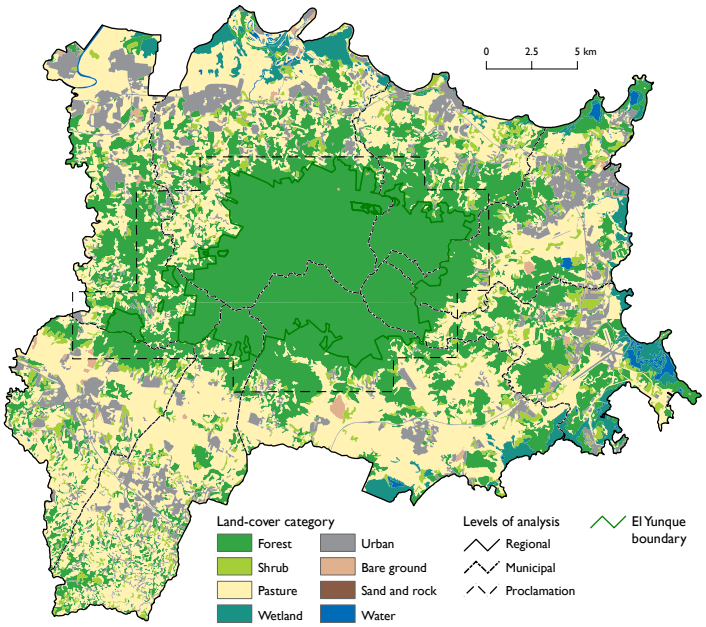

FIGURE 1. Land cover within and around El Yunque in 2010.

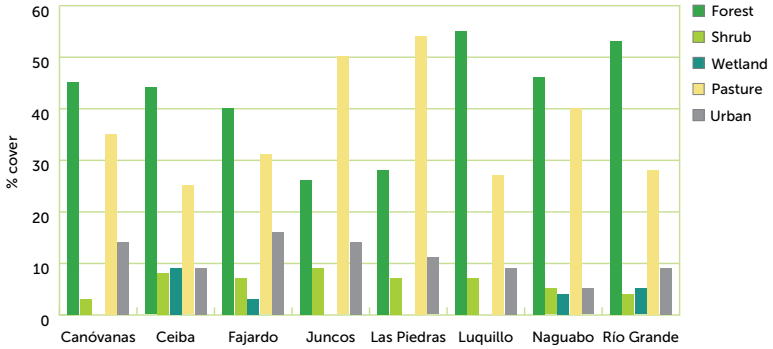

FIGURE 2. Percentages of land cover in each municipality in 2010 (for visualization purposes, only the land-cover types with more than 2% cover are shown in this graph).

Key Findings

Land Cover within the Municipalities

- Río Grande and Naguabo had the most extensive forest cover (20,648 and 15,116 acres, respectively), while Juncos and Las Piedras had the least (4,358 and 6,124 acres, respectively).
- Luquillo had the highest percentage of land in forest cover (55% of its area), followed by Río Grande (53%), and Naguabo (46%).
- Juncos and Las Piedras had the smallest percentages of land in forest cover (26% and 28%, respectively).
- Naguabo and Las Piedras had the largest amounts of pasture cover (13,213 and 11,690 acres, respectively), whereas Las Piedras and Juncos had the highest percentages of pasture cover (54% and 50%, respectively).
- Río Grande and Fajardo had the largest amounts of urban cover (3,542 and 3,007 acres, respectively), whereas Fajardo, Juncos, and Canóvanas had the highest percentages of urban cover (16% for Fajardo and 14% for Juncos and Canóvanas).
- Río Grande had the most abundant wetland cover (1,949 acres), followed by Ceiba (1,731 acres) and Naguabo (1,251 acres). However, Ceiba had the highest percentage of wetland cover (9%), followed by Río Grande (5%) and Naguabo (4%).

To convert acres to *hectares* divide the number of acres by 2.47. To convert acres to *cuerdas* (a unit of measurement commonly used in Puerto Rico to measure land) multiply the number of acres by 1.03.

Three levels of land-cover analysis

- **Municipal (county):** The area of each individual municipality that has a portion of El Yunque within its boundary. According to Law 81 of 1991 (the Autonomous Municipalities Act), each municipality should develop and implement a land-use plan. Currently, three municipalities have had their own land-use plans approved by the Puerto Rico Planning Board; the remaining five are in the process of developing their plans. Until these plans are developed, land-use planning within these five municipalities is guided by the zoning regulation of 1983.
- **Regional:** The total area of the eight municipalities in eastern Puerto Rico that have a portion of El Yunque within their boundaries. This is also the area included in the 1983 zoning regulation that guides land-use planning at the regional level *(Reglamento de Zonificación Especial para las Zonas no Urbanas de los Municipios Circundantes al Bosque Nacional del Caribe)*.
- **Proclamation Area:** The area outside the administrative boundaries of El Yunque. The proclamation area was designated by the U.S. Congress in 1950 as the zone where the U.S. Forest Service has the authority to purchase land to expand its area for forest conservation purposes.

TABLE 1. Area (in acres) of land-cover types for each level of analysis: municipal, regional, and proclamation area.

LEVEL	LAND-COVER TYPE							
	Forest	Shrub	Wetland	Pasture	Urban	Bare ground	Sand and rock	Water
Municipal								
Canóvanas	9,562	698	234	7,370	2,955	204		128
Ceiba	8,127	1,560	1,731	4,669	1,690	145	7	443
Fajardo	7,581	1,254	664	5,913	3,007	239	47	312
Juncos	4,358	1,492		8,518	2,362	254		10
Las Piedras	6,124	1,413		11,690	2,438	50		
Luquillo	9,133	1,150	158	4,541	1,452	24	35	23
Naguabo	15,116	1,491	1,251	13,213	1,692	262		61
Río Grande	20,648	1,386	1,949	10,860	3,542	234	31	236
Regional	80,649	10,444	5,987	66,760	19,138	1,412	120	1,213
Proclamation	46,514	1,225		6,694	892	43		1

Land Cover within the Region

- Forest was the most abundant land-cover type, covering 80,649 acres (43%) of the region.
- Pasture was the second most dominant land-cover type, covering 66,760 acres (36%) of the region.
- Urban areas covered 19,138 acres (10%) of the region.
- Shrubs covered 10,444 acres (6%) of the region.
- Wetlands covered 5,987 acres (3%) of the region.

Land Cover within the Proclamation Area

- Forest land cover dominated El Yunque's proclamation area, covering 46,514 acres (84%) of the area.
- Pasture covered 6,694 acres (12%) of its area.
- Urban areas covered 892 acres (2%) of its area.

Conclusion

Forest cover was the most abundant land-cover type within the region, in most of the municipalities, and within the proclamation area. This was followed by pasture and urban land cover. Land-cover information such as this can help policymakers, forest managers, municipal and land-use planners, and community members make informed land-use decisions. Questions such as how much forest cover is within each geographic scale, and how much and where forest cover can be increased, are the type of questions that this baseline land-cover data help to answer. Ultimately, the goal is to plan and implement land uses that can support El Yunque's functions and ecosystem services.

Land cover is defined as the classification of land according to the vegetation or material that covers most of its surface.

Land-cover data were developed by on-screen digitizing of digital aerial photographs taken in 2010. The resolution was 1.0 ft. (0.3m). Eight land-cover categories were generated during the classification:

- **Forest:** Open and closed canopy forest (more than 80% tree cover).
- **Shrub:** Early successional shrubby vegetation (more than 80% shrub cover).
- **Wetland:** Forested and non-forested wetlands (more than 80% wetland cover).
- **Pasture:** Active and non-active pasture and grasses, which can include agricultural lands (up to 20% tree cover, shrubs, or isolated housing).
- **Urban:** Impervious surface (more than 80%), including low- and high-density built-up land.
- **Bare ground:** Exposed soil.
- **Sand and rock:** Beaches and rocky shores.
- **Water:** Water bodies.

Additional Resources

López-Marrero, T. 2003. The study of land-cover change in a Caribbean landscape: what has happened in Puerto Rico during the last two decades? Caribbean Studies. 31(2): 5–36.

Lugo, A.E.; López-Marrero, T.; Ramos-González, O.M. 2000. Zonificación de terrenos en la Periferia del Yunque. Gen. Tech. Rep. IITF-16. San Juan, PR: U.S. Department of Agriculture, International Institute of Tropical Forestry. 12 p. In Spanish.

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Ramos-González, O.M. 2001. Assessing vegetation and land cover changes in northeastern Puerto Rico: 1978–1995. Caribbean Journal of Science. 37(1–2): 95–106.

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GIS Data

The 2010 land-cover GIS data are available and can be downloaded from the InterfaceSouth website at **www.interfacesouth.org/projects/el-yunque**

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For more information

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