



# Urbanization Trends and Zoning around El Yunque National Forest

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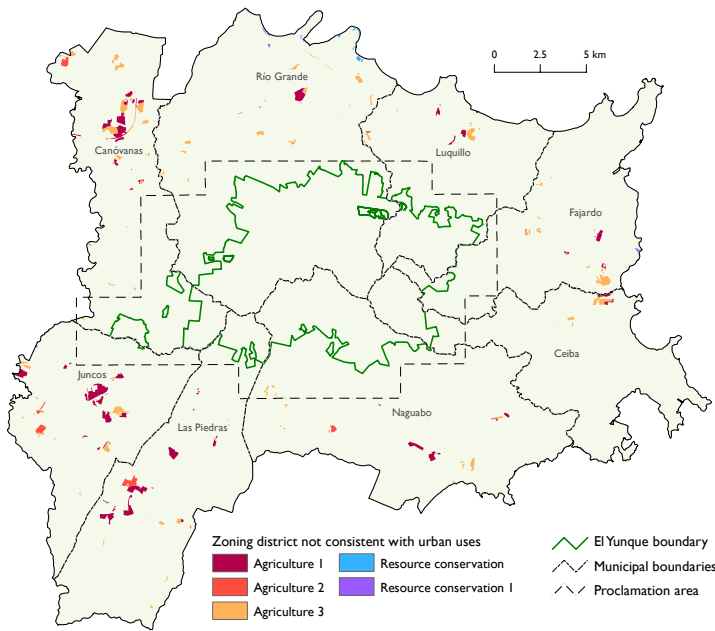


## Introduction

The eastern region of Puerto Rico has experienced a considerable increase in urban areas over the last few decades (Ramos-González 2001) and has put El Yunque National Forest (El Yunque) under high urban development pressures (López-Marrero 2003, Lugo and others 2004). In 1983, a regional zoning regulation was implemented by the Puerto Rico Planning Board for the eight municipalities that have El Yunque lands within their boundaries.<sup>1</sup> The main objective of the regulation was to limit urban expansion around El Yunque and minimize its effects on the forest. Due to poor enforcement and variations and exemptions granted from the regulation, approximately 85% of the urban expansion during 1985 and 1995 occurred in non-urban zoning districts, such as agricultural and forest zones (Lugo and others 2004).

This fact sheet provides information about where urban expansion occurred between 1998 and 2010 in the areas

around El Yunque that were included in the zoning regulation of 1983, and it presents a comparison with previous data from 1985 to 1995. It also provides information about where urbanization occurred in each zoning district at the municipal level for the 1998–2010 period. According to the Autonomous Municipalities Act (Law 81 of 1991), each municipality should develop and implement a land-use plan. Of the eight municipalities that contain El Yunque, three have developed their autonomous land-use plans, while the remaining five are in the process of developing them. The information offered in this fact sheet can be helpful to those municipalities that are currently implementing their autonomous land-use plans, and to those that will implement them in the near future. This information can also help forest managers, land-use planners, and decision makers develop and implement land-use plans more effectively.



**FIGURE 1.** New urban areas occurring between 1998 and 2010 in zoning districts not intended for urban expansion (for visualization purposes, only the categories with more than 1% cover are shown in this map).

**Zoning districts** listed in Table 1 (from Lugo and others 2000).

- **Agriculture 1 (A1):** Non-urban or developed lands with slopes up to 12% and productive capacity between I and IV based on the U.S.D.A. Natural Resources Conservation Service classification.
- **Agriculture 2 (A2):** Non-urban or developed lands with slopes of more than 12% and productive capacity between I and IV based on the U.S.D.A. Natural Resources Conservation Service classification.
- **Agriculture 3 (A3):** Non-urban or developed lands with productive capacity between V and VII based on the U.S.D.A. Natural Resources Conservation Service classification.
- **Interior Forests (B1):** Lands where tropical humid forests exist or are planned for reforestation.
- **Mangrove Forests (B2):** Low, humid lands that are subject to tide effects and are generally covered by mangroves.
- **Resource Conservation (CR):** Property where existing natural or artificial characteristics should be untouched.
- **Resource Conservation 1 (CR1):** Farms, or portions of them, whose characteristics should be untouched or enhanced.
- **Archeological Resource Conservation (CRA):** Lands or properties with archeological value.

## Key Findings

### 1985–1995 Period<sup>2</sup>

- Only 15% of the urban growth that occurred between 1985 and 1995 happened in zoning districts where urban land use was intended to occur; the remaining 85% did not.
- Of the urban expansion that occurred in non-urban zoning districts, the majority (87%) occurred in agricultural districts.
- The majority of the new urban expansion occurred in the “Agriculture 3” district (60%), followed by “Agriculture 1” (21%), and “Agriculture 2” (6%).
- Ten percent (10%) of the new urban expansion occurred in the “Interior Forests” zoning districts, closer to El Yunque.

### 1998–2010 Period

- Twenty-nine percent (29%) of the new urban growth between 1998 and 2010 occurred in zoning districts with intended urban uses; 71% of it occurred in non-urban districts.
- Similar to the 1985–1995 period, the majority of the urban growth in this period that has not been consistent with urban uses occurred in districts zoned as agricultural.
- The zoning district “Agriculture 1” was the agricultural district where most of the urban expansion occurred (34%), followed by “Agriculture 3” (29%) and “Agriculture 2” (6%).
- There was less urban expansion in the “Interior Forests” than in the previous time frame (0.2% compared to 10% in 1985–1995).

**TABLE 1.** Percentage of new urban areas not consistent with the zoning regulation: comparison between the 1985–1995 and 1998–2010 periods.

ZONING DISTRICT	1985–1995	1998–2010
Agriculture 1 (A1)	21	34
Agriculture 2 (A2)	6	6
Agriculture 3 (A3)	60	29
Interior forests (B1)	10	0.2
Mangrove forests (B2)	0.2	0.1
Resource conservation (CR)	0.7	1
Resource conservation 1 (CR1)	1	1
Archeological resource conservation (CRA)	0	0.2
<b>Total</b>	<b>85</b>	<b>71</b>

TABLE 2. Area (in acres) of urban expansion by municipality and zoning district not consistent with the zoning regulation: 1998–2010.

MUNICIPALITY	ZONING DISTRICT								
	A1	A2	A3	B1	B2	CR	CR1	CRA	TOTAL
Canóvanas	250	41	282						573
Ceiba	30		78						108
Fajardo	50		123		0.1		9		182
Juncos	322	58	149	5					534
Las Piedras	257	75	38						370
Luquillo	49		78		0.1	1			128
Naguabo	88	23	73						184
Río Grande	71	4	135		4	29	20	7	270

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.

### 1998–2010 Period: Municipal Level<sup>3</sup>

- A total of 2,349 acres were converted to urban land cover in zoning districts where urban uses were not intended. This represents 71% of the urban expansion during the period.
- Canóvanas had the largest amount of urban expansion occurring in “non-urban” zoning districts (573 acres), followed by Juncos (534 acres).
- Juncos had the highest percentage of its urban expansion occurring in “non-urban” zoning districts (86% of its urban growth during the period), followed by Ceiba (84%).
- Ceiba and Luquillo had the least amount of urban expansion occurring in “non-urban” zoning districts (108 acres and 128 acres, respectively).
- Río Grande and Luquillo had the lowest percentages of their urban expansion occurring in “non-urban” zoning districts (44% and 59%, respectively).

## Conclusion

Between 1998 and 2010, 71% of the new urban growth occurred in zoning districts where urban uses were not intended. Most of this expansion occurred in agricultural districts. Although this percentage is lower than the one reported for the 1985–1995 period (85%), it is still very

TABLE 3. Total area (in acres) of urban expansion in each municipality, area of new urban expansion occurring in non-urban zoning districts, and percentage of inconsistency: 1998–2010.

Municipality	Total Urban Expansion*	Urban Expansion Not Consistent with Zoning	Percentage of Inconsistency
Canóvanas	696	573	82
Ceiba	129	108	84
Fajardo	281	182	65
Juncos	619	534	86
Las Piedras	456	370	81
Luquillo	216	128	59
Naguabo	280	184	66
Río Grande	620	270	44
<b>Total</b>	<b>3,297</b>	<b>2,349</b>	<b>71</b>

\*See the publication “Expansion of Urban Land Cover around El Yunque National Forest” for more information.

high. Differences were found in the total amount and in the percentage of land converted to urban land cover in non-urban districts at the municipality level. This fact sheet provides useful information that can be used to evaluate the implementation of land-use regulation in the areas surrounding El Yunque during the past 12 years. The findings can also be used to promote more effective implementation and enforcement of current and future land-use plans at different levels and particularly at the municipal level.

1. For more information about the development of the zoning regulation and the specifics of zoning districts, refer to JPPR 1983 and Lugo and others 2000.
2. Refer to Lugo and others 2004 for more details.
3. We do not have information about urban expansion and inconsistencies with zoning regulations at the municipal level for the 1985–1995 period. We decided, however, to include this information for the 1998–2010 period since autonomous municipal plans have become effective only recently and this information can be useful for those municipalities developing and implementing their plans.





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## For more information

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