Federal Support and Local Action

Recovery & Resilience in Puerto Rico and the U.S. Virgin Islands

June 2, 2020

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Recovery & Resilience
Puerto Rico
Overview

- The Puerto Rico Climate Change Council (PRCCC) and the U.S. Global Change Research Program: Fourth National Climate Assessment (NCA4)
- The State of Puerto Rico’s Climate: Effects, Impacts, and Social-Ecological Vulnerabilities
- Puerto Rico’s Climate Policy: Mitigation, Adaptation and Resilience (Law 33, 2019)
- Hurricanes Irma and Maria (2017): Response and Damage Assessments, Public Assistance (§428, §06), Hazards Mitigation (§ 404), CDBG-DR
- Recovery: The new generation of Coastal and Islands’ infrastructure
Mission

...assess the state of Puerto Rico’s climate, using the best science and knowledge available, understand Puerto Rico’s social-ecological vulnerabilities and develop adaptation strategies to build a resilient society.

Membership: 150+
Geophysical and Chemical Scientific Knowledge

Ecology and Biodiversity

Society and Economy

Communicating Climate Change and Coastal Hazards
The U.S. Caribbean islands face many of the same climate change related challenges as Hawai‘i and the U.S.-Affiliated Pacific Islands (Ch. 27: Hawai‘i & Pacific Islands), including:

- isolation and dependence on imports, making islands more vulnerable to climate-related impacts;
- critical dependence on local sources of freshwater (Ch. 27, KM 1);
- temperature increases that will further reduce supply and increase demand on freshwater (Ch. 27, KM 1);
- vulnerability to drought in ways that differ from mainland regions (Ch. 27, KM 1);
- a projected significant decrease in rainfall in all (Caribbean) or parts (Hawai‘i and Pacific Islands) of these regions (Ch. 27, KM 1);
- sea level rise, coastal erosion, and increasing storm impacts that threaten infrastructure, property, and ecosystems (Ch. 27, KM 1).
40% WORLD POPULATION COASTS
54% WORLD POPULATION CITIES
70% ENERGY DEMAND
75% GHG EMISSIONS

68% WORLD POPULATION CITIES (2050)

SOURCE: Global Cities Institute
NCA4 (2018)
World Bank Group (2019)
## Puerto Rico’s coastal uses and assets at risk

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ECONOMICS</strong></td>
<td>GDP: $105 billion/year (PRPB2016)</td>
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<tr>
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<td>Tourism $2.5 Billion/year (7%)</td>
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<tr>
<td></td>
<td>Built up Areas/Coastline: 24%</td>
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<tr>
<td></td>
<td>Industrial Parks (81)</td>
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<td></td>
<td>Commercial/Recreational Fisheries</td>
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<tr>
<td><strong>HOUSING</strong></td>
<td>Public Housing (15)</td>
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<tr>
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<td>Individual Housing (xx)</td>
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<tr>
<td><strong>TRANSPORTATION</strong></td>
<td>Airports (11)</td>
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<tr>
<td></td>
<td>Ports (12)</td>
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<tr>
<td></td>
<td>Bridges, Culverts, Piers</td>
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<tr>
<td></td>
<td>Miles of Primary Roads (17,387mi/27,982km)</td>
</tr>
<tr>
<td><strong>HEALTH AND SOCIAL SERVICES</strong></td>
<td>Hospitals (3)</td>
</tr>
<tr>
<td></td>
<td>Treatment Centers (xx)</td>
</tr>
<tr>
<td><strong>EDUCATION</strong></td>
<td>Schools (36)</td>
</tr>
</tbody>
</table>

Coastal population: 2.3 million (61%) at 44 coastal municipalities  
Territorial waters: 9 nm \((A=5,078 \text{ mi}^2)\)  
Coastline: 799 mi/1,225 beaches

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Puerto Rico’s coastal uses and assets at risk

**ENERGY**
- Power generation systems (5 public, 2 private)
- Substations
- Distribution and transmission lines

**COMMUNICATIONS**
- Fiber Optic Cables (15)
- Internet Infrastructure
- Public comm systems

**WATER**
- PRASA infrastructure at coastal zone:
  - 200km potable water
  - 260km sanitary infrastructure
  - 6 water systems
  - Pump stations
  - Wastewater Treatment Plants (28)

**NATURAL AND CULTURAL RESOURCES**
- Protected Areas (Land) DRNA 8.7% (2015) – PA-CAT 16% (2016)
- Protected Areas (Marine) 27.2%
- Shallow coral reefs and associated communities designated as MPA: 49%
- Historical Properties (20+)

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HURRICANE MARIA RESPONSE

ESF 10
SUNKEN VESSELS REMOVAL

FEMA
UNITED STATES COAST GUARD
GOBIERNO DE PUERTO RICO
PEOPLE'S SECURITY DEPARTMENT

2017 Hurricane Season
Puerto Rico

377 vessel or beached vessels assessed
36 pollution incidents mitigated
260 vessels removed
16,330 gallons of oily water removed
Status of Puerto Rico’s Coral Reefs in the Aftermath of Hurricanes Irma and Maria

Assessment Report Submitted by NOAA to the FEMA Natural and Cultural Resources Recovery Support Function
MAX WAVE HEIGHT @ SJ / CAROLINA– HURRICANE MARÍA (SEP 20.2017)

Maximum simulated significant wave height (Hs, ft) for Hurricane María

97% Wave energy attenuation
Figure 3.3. (a) Pentad total of the number of hurricanes that achieved a maximum intensity of each category grouping as delineated by the Saffir–Simpson scale. (b) As in (a), but for the percentage of total hurricanes achieving each category grouping. Klotzbach and Landsea (2015)
Puerto Rico Climate and Ocean Trends and projections

**Atmospheric Temperature**
(2-9 °F )

**Precipitation**
(-10 to -40%)

**CO2**
416 ppm

**Ocean pH**
8.04

**SST**
80+

https://nca2018.globalchange.gov/chapter/20/
Observed sea level rise trends in Puerto Rico and the U.S. Virgin Islands reflect an increase in sea level of about 0.08 inches (2.0 mm) per year for the period 1962–2017 for Puerto Rico and for 1975–2017 for the U.S. Virgin Islands. The bottom panels show a closer look at more recent trends from 2000 to 2017 that measure a rise in sea level of about 0.24 inches (6.0 mm) per year. Projections of sea level rise are shown under three different scenarios of Intermediate-Low (1–2 feet), Intermediate (3–4 feet), and Extreme (9–11 feet) sea level rise. The scenarios depict the range of future sea level rise based on factors such as global greenhouse gas emissions and the loss of glaciers and ice sheets. Sources: NOAA NCEI and CICS-NC.
SEA LEVEL RISE SCENARIOS

International Airport
San Juan, Puerto Rico

3 ft
1 ft
10 ft

Art 3.- Public Policy
- PR Power grid progressively uses less fossil fuels
- Coal phase out
- Promote clean energy
- Improve energy efficiency
- Lower GHG emissions from other land uses and activities
- Promote the use of electric cars
- Reforestation and ecosystem services

Art 6.- Expert Advisory Committee

Art 7.- Mitigation, Adaptation and Resilience Plan

Art 10.- GHG Inventory (regularly update)

Artículo 14.- Funding mechanisms

Artículo 15.- Creation of a Joint PR Senate-House of Representatives Commission

Art 20.- Renewable Energy Goals: 100% by 2050 (20% by 2022, 40% by 2025, 60% by 2040)
Building Coastal Resilience

Planning and design:
- Land use plans, zoning regs, building codes
- Dynamic Setback/Coastal Construction Line
- Increase freeboard requirements (best BFE)
- Adaptive design
- Information, outreach and education

New generation of PR infrastructure:
Hybrid and Nature-based alternatives integrating structural and nature-based solutions (Coral reefs, Wetlands, Beach and Dunes, Swales, Horizontal levees, etc.)

B-C Analysis:
- Lower or similar cost
- Rapid return on investment
- Lower O&M (Operations and Maintenance)
- Longer design life
- Aesthetically attractive, tourism and recreation
FEMA 428, 406 and 404 projects

Title: Coral Reef facility eligibility

Keywords: Coral Reef, facility, eligibility, planting, beach,

Project Description: Coral Reef Restoration

Requestor: Puerto Rico Department of Natural and Environmental Resources (DNER)
Sector: NCR
Subrecipient: Puerto Rico DNER
Project Category: G
Project Size: $31,000,000

Policy Issue or Question: Is the restoration of a coral reef by the Puerto Rico DNER eligible for Public Assistance?
Hurricanes Irma and María (2017) • Earthquakes (2020)

$85+ Billion
Recovery & Resilience
Puerto Rico

Puerto Rico
02 JUN 2020

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