



# Puerto Rico Water Resources and Environmental Research Institute



The Puerto Rico Water Resources and Environmental Research Institute (PRWRERI) is one of 54 similar research centers in the United States, DC, Puerto Rico, Virgin Islands, and Guam/Federated States of Micronesia. Established in 1964 by the Water Resources Research Act, the institute conducts basic and applied research to solve water and environmental problems unique to Puerto Rico and Latin America. Its main objectives are to plan, conduct and otherwise arrange for competent research that fosters: the entry of new research scientists into water resources fields, the education and training of future water scientists, engineers, and technicians, the exploration of new ideas that address water problems or expand understanding of water and water-related phenomena, and the dissemination of research results to water managers, professionals, and the public. The Water Resources Research Act requires the Secretary of Interior to conduct a "careful and detailed evaluation" of the PR WRERI at least once every five years. The most recent review was carried out in 1998. The PRWRERI passed satisfactorily.

## Total Maximum Daily Load Assessment (TMDL) Program

- Section 303(d) of the Clean Water Act mandates that States and Territories identify water quality impaired lakes and rivers in order to propose management strategies, or TMDLs, for these water bodies. TMDLs provide a framework for controlling point and non-point sources of pollutants with the goal of attaining desired water quality conditions of targeted receiving water bodies.
- PRWRERI is currently contracted by Puerto Rico's Environmental Quality Board to develop the TMDLs for the Mayagüez Bay Watershed, which comprises the Río Grande de Añasco, Río Guanajibo, and Río Yagüez Watersheds.
- We are the first local institution to take part in this endeavor in the island.
- Research is being conducted to develop a new protocol for the allocation process.

## Nutrient Discharges from the Mayagüez Bay Watershed

Water resources in Puerto Rico are subject to tremendous pressure from urban, industrial, and agricultural activities. As a result, most surface waters exhibit some kind of impact from anthropogenic activities. High P concentrations in surface waters of Puerto Rico suggest this to be the single most important nutrient that must be controlled to reduce the accelerated eutrophication of fresh waters. Although local data is not available, agricultural non-point sources are believed to be the leading cause of nutrient (primarily N and P) and sediment contamination of surface waters. Still, diverse point- and non-point sources such as unsewered communities in urban, suburban, and rural areas, landfills, agricultural activities, and wastewater treatment facilities have been identified as major contributors of nutrient loads to surface waters in the island. A systematic approach to water quality and watershed restoration must first identify specific contaminant sources as well as characterize their pollution pattern (i.e., relative contribution, seasonal variability, etc).

We are performing an intensive research study to identify and quantify nutrient discharges along the main channel and major tributaries of the Río Grande de Añasco in the Mayagüez Bay Watershed (MBW). We will examine seasonal and spatial trends in sediment and nutrient (nitrogen and phosphorus) concentrations in areas of contrasting land use characteristics. Trends in total P concentrations in water will be related to land use, soil test P information, hydrologic discharge, and known point inputs to assess the relative contribution of different sources to the watershed. This information in combination with land use characterization will serve to better delineate the various nutrient contributing sources and establish a targeted nutrient management program for the watershed.

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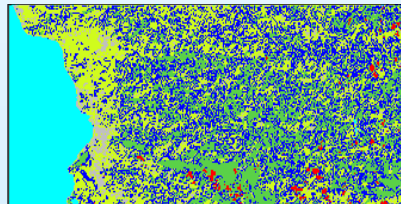
## Remote Sensing related project

### • Landsat Image Classification

- Used for landuse classification of different areas in Puerto Rico



Landsat image of the lower part of the Río Grande de Añasco watershed. The watershed has gone through a rapid change in landuse during the last 20 years. Notice the red rectangle that shows the sediment that is coming out of the river draining directly in the Mayaguez Bay.



General landuse classification of the Río Grande de Añasco watershed, using Landsat TM image from 2000.

### Water Quality Parameter Monitoring in the Mayagüez Bay

An effort to attempt to develop a practical tool for monitoring some of the most important pollutants in the bay. It is expected to identify a set of transfer function models to estimate the water pollution induced by rivers discharging into the bay. Also, experimental campaigns are to be performed to measure water-quality parameters and bio-optical data in order to validate remote sensing measurements over the Mayagüez Bay. This will enable the development of empirical equations to estimate water quality parameters based on remote sensing measurements.



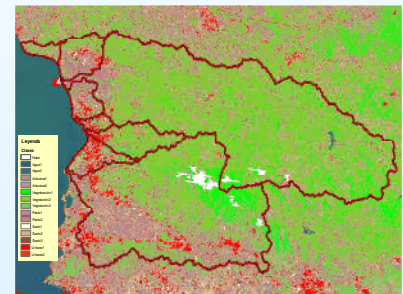
## Comprehensive Integrated Management Plan for the Mayagüez Bay Watershed

<http://www.ece.uprm.edu/cimp>

This project will develop a management plan for the Mayagüez Bay Watershed in the west portion of the Island. An organization structure was developed in which the decision-making power lies on the Stakeholder Forum. This is made up of four groups, namely, the government, industry and commerce, academia, and citizen groups. Two support committees were developed to assist the Stakeholder Forum; the Technical Advisory Committee and the Administrative Advisory Committee. These groups meet twice a year to discuss and develop restoration, conservation, and management strategies.

## Detailed Landuse Inventory of the Mayaguez Bay Watershed

- Grant from the P.R. Environmental Quality Board
- Mayaguez Bay watershed is located in the western part of Puerto Rico.
- Rapid change in landuse during the last 30 years
- Landsat 7, Thematic Mapper (TM) satellite image from 2004 used for a general land use classification
- Field visit used to develop the detailed landuse classification when needed



## Work with GIS and erosion modeling

- Grant from the USDA-Higher Education Program (HEP)
- The landuse generated in the project from the Río Grande de Añasco (explained before) was used together with climate, topography, and soil data. The data was part of a GIS that was used to manage the data and generate the average annual erosion using the Revised Universal Soil Loss Equation (RUSLE).



## Determining Highly Erodible Lands in Puerto Rico

- Collaborative agreement with the USDA-NRCS
- The erodibility index (EI) for a soil map unit is determined using a modification to the RUSLE equation and the soil loss tolerance (maximum amount of soil that can be lost for a soil in a year) as presented in the Food Security Act Manual (USDA, 1994).
- Highly Erodible Lands (HEL) are those with a EI > 8.

