

# Puerto Rico Water Resources and Environmental Research Institute

University of Puerto Rico, at Mayagüez



## PRWRERI is...

The Puerto Rico Water Resources and Environmental Research Institute (PRWRERI) is one of 54 similar research centers in the 50 States of U.S., 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, the Caribbean, 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 PRWRERI at least once every five years. The most recent review was carried out in 2003. The PRWRERI passed satisfactorily.



## Our Motivations is: Exploring, Encouraging, Educating and Finding Solutions.

**Exploring** – We conduct research to finding solutions to different problems related to water resources and the environment that affect us in Puerto Rico and other regions.

**Educating** – We involves students and engineers in our projects, applied curses and seminars.

**Encouraging** – We promote people to investigate and lead them to publish their research result as an initiative to be part of the solution. We are a multidisciplinary teamwork. New researchers are incorporated to our projects from different areas likes: Biology, Agriculture, Engineering, Chemistry, Social sciences and others. Our goal is that our research and work becomes standard to future generations.

**Finding Solutions** – We work to find solutions to different environmental and water recourses issues.

## PRWRERI On Going Projects

### Water Quality Index Development for Puerto Rico

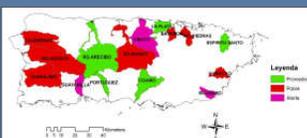
This work developed a water quality index (WQI) for Puerto Rico's rivers. This index classifies a representative water quality on a scale from 0 to 100 to classify the water quality as good, moderate, mean, warning and poor. Eleven rivers were evaluates to define it's local water quality condition. This index represent the water quality at a point on a day of sample collection. The WQI can be use as a tool for decision makers to establish management practice for the rivers and which are the parameters to consider.

**WQI Calculation** 
$$ICA = \left( 1 - N + \sum_{i=1}^N S_i^{-2.5} \right)^{-0.4}$$

Where: N = number of constituents  
S<sub>i</sub> = constituents sub index

Classification scale

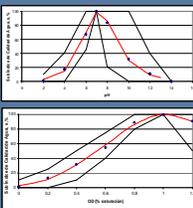
Clasificación a Coridas	Phaqas	Color
Buena	85 - 100	Green
Moderada	71 - 84	Yellow
Preocupante	51 - 70	Orange
Alto	31 - 50	Red
Pobre	1 - 30	Pink



This analysis were conducted using USGS WQ stations for the different watersheds.

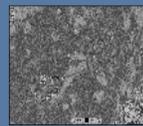
$$S_{\text{Diss}} = \frac{4.17 \cdot 10^{-10} \cdot q^2}{6 + (1.42 \cdot 10^{-10} \cdot q^2)}$$

$$S_{\text{COD}} = \frac{3.9q^{2.5}}{1.1 + (2.8q^{2.5})}$$

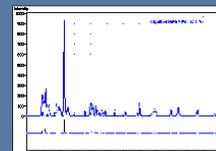


### Removal of Copper, Lead and Zinc Ions from Aqueous Solutions Using Low Cost Sorbent

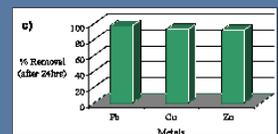
The environmental contamination caused by heavy metal pollution is a world problem concern. Regarding water cleaning operations, several techniques have been studied to remove heavy metals including chemical precipitation, electrochemical precipitation, membrane filtration, ionic exchange, and adsorption. In this study we have evaluated the effect of the type of adsorbent, solutions pH, time of contact and initial metal concentration on the metals removal efficiency from synthetic aqueous solutions. The objective is to determine the sorption capability of waste tire crumb rubber (TR) and dewatered sludged (DS) to remove Cu, Pb, and Zn ions below the limits of the discharge permits



A) Scanning-electron microscopy image.



B) X-ray diffraction analysis.



C) Total metal removal by considering a two-stages process.

### Conclusions

Crumb rubber is an excellent general sorbent for the removal of heavy metals like Cu and Pb. The sorption of those metals could be attributed to the presence of carbon black, a well-know carbonaceous adsorbent.

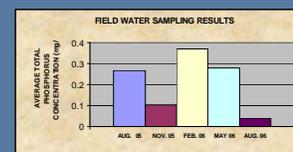
### Monitoring Phosphorus Content in a Tropical Estuary Lagoon Using Hyperspectral Sensor

Eutrophication caused by excessive nutrients contents threatens water quality and habitat in the San José lagoon. The United States Geological Survey (USGS) conducted a sampling at the San Juan Bay on December 1994. Based on that report, the highest nitrates concentration were recorded at the San José lagoon with 0.16 mg/l. Eutrophication conditions prevailing at the San José lagoon may cause, among others, death of aquatic life, shellfish poisoning, and reduction of vegetation productivity due to photosynthetic effect reduction. Hyperspectral Sensor, provides a Total Phosphorus monitoring alternative by using its reflectance properties of the visible and infrared spectral bands.

The sensor used for this project was the Hyperion Sensor. This sensor is capable of resolving 220 spectral bands, from 0.4 to 2.5 μm with 30 meter of spatial resolution.



Study area and sampling stations in San Jose Lagoon.



Mean concentration of nutrients as measured in 38 stations on San Jose Lagoon.