

**UNIVERSITY OF PUERTO RICO
SEA GRANT PROGRAM**

**Research and Information Needs for Innovative
Marine and Coastal Studies in the Caribbean**

Integrated Watershed and Coastal Hydrology
Universidad Metropolitana, Cupey

September 16, 2010

Introduction

The University of Puerto Rico Sea Grant College Program (UPRSG) is conducting a regional assessment to determine critical research and information needs for innovative marine and coastal studies in the Caribbean. Coastal and marine resources are coupled. Upland precipitation that produces runoff and carries sediment and chemical contaminants often has detrimental effects on coastal marine habitats. Coral reefs, beaches, mangrove forests and seagrass beds are among the most affected and provide essential habitat for important marine species. Therefore, surveying the regional community of water resource users, including watershed and coastal experts, is essential to an effective assessment of research needs. With this in mind, we carried out a discussion session (focus group) with 13 specialists in watershed and coastal hydrology from governmental entities, academic institutions and the private sector.

The discussion focused on addressing issues that are presently considered a concern among hydrology experts. UPRSG requested comments on questions regarding short- and long-term research needed for watershed and coastal management, information that can be used by scientists and resource managers to develop better models and become better decision-makers, and obstacles that are presently hindering research and/or assessments that may help improve management and conservation of our water resources.

Funding and Support

The NOAA award no. NA08OAR4170748 provided funding for this activity. Dr. Manuel Valdes-Pizzini (Associate Director-UPRSG), Dr. Kurt Grove (Research Coordinator), and Jasmine Seda (Project Assistant) coordinated this activity.

Dates and Venue

The focus group was held at the Universidad Metropolitana in Cupey, Puerto Rico on Thursday, September 16, 2010 from 10:00 am to 3:00 pm. Participation consisted of scientists, managers and experts from various agencies and institutions in Puerto Rico.

Goals

The main objectives of the focus group were the following:

1. Assess research needs of resource users, managers, and scientists for the improvement of watershed and coastal management on a short- and long-term scale.
2. Identify obstacles that may be hindering or delaying the development of research and strategies for watershed and coastal management in Puerto Rico.

Discussion Questions and Feedback

The following questions were presented for discussion:

1. What type of research or information is needed to manage efficiently/effectively our watersheds and coastal resources on a short-term (less than 5 years) and long-term (5-10 years) period?
2. What obstacles are presently hindering research/ assessments that can help better management and conservation of watersheds and coastal resources?
3. Elaborate three research projects that you consider urgent and would help make management and conservation more effective (preferably in your area of expertise).

Representatives from several governmental agencies (Department of Natural and Environmental Resources, Army Corp. of Engineers, US Geological Survey, San Juan Bay Estuary Program, USDA Natural Resources Conservation Service and the Environmental Protection Agency), academic and research institutions (University of Puerto Rico-Mayaguez Campus (Geology Dept., Agricultural Engineering Dept., Marine Sciences Dept.), Water Resources and Environmental Research Institute), and private agencies (RMA Environmental, Corp.) attended the discussion session. Each participant has over 10 years of experience in their field of expertise.

Responses to the first question regarding the short- and long-term research needed for watershed and coastal/hydrology management included:

- Indexes for watershed management; current data and indexes on river water quality
- Development of sustainable management and alternative use of abandoned agricultural lands
- Studies on the drainage patterns through the karst region of northern Puerto Rico. The areas has experienced increases of flooding events
- Study and evaluation of “brown” fields, toxic metals and pesticides (over 70 brown fields in 8 municipalities have been identified in Puerto Rico
- Studies on the implementation and effectiveness of risk management
- Studies concerning upland and marine sources of sand and how river and marine transport influence this resource
- Better bathymetric data, particularly coastline and sand sources; Dam and watershed modeling
- Up-to-date aerophotography
- Ecosystem restoration projects – habitat-based models to assess benefits; how can coastal/marine habitats be improved; how indicator species are affected; how to translate data to outputs of affects on organisms; how are habitats are improving after mitigation (environmental rehab efforts). Most data available is particular to temperate climates, not tropics.
- Studies on sediment bedload within the watershed and its transport; characterize coarse and fine sediment transport in watersheds with and without reservoirs; no data available for the tropics
- Studies on the effects of dredging
- Studies on groundwater transport to the coast and interaction with the marine environment
- Studies on the processes and influences of hyper-saline sources (lagoons, desalination outfalls)– e.g., water quality data
- Precise relief measurement and geoid determination is essential to effective modeling – needed for studies on sea level rise; an accurate determination of the gravity field around Puerto Rico and the US Virgin Islands needs to be finished and an accurate determination of

sea-level made available for all research in floodable upland and coastal areas.

- Evaluations of coastal and riparian structures
- Studies on best practice construction techniques in the coastal zones (e.g., gabions)
- Accurate documentation on coastal and inland flooding
- Evaluation and prediction of flooding in coastal wetlands
- Incorporating data generated and archived from different sources (weather, river, wind) in order to develop a global view of coastal and inland water processes.
- Studies on river protection (e.g., Río Grande, Manatí)
- Studies on native fish in rivers and estuaries – behavior, inventory, migration from river to ocean
- Studies on ecological flows (minimum water flow required to maintain its integrity) – no statistical data is currently available
- More data on Total Maximum Daily Loads (TMDLs) of key water systems and more stations are needed
- Models for runoff into rivers and other watershed processes and resources
- Develop and calibrate watershed models – identify key systems in order to preserve/maintain river systems, especially agricultural lands
- Studies on river restoration and how river systems function
- Developing management tools of modeling resources – need for converting research data into management tools
- Data on water quality during flooding events – monitoring of chemical transport, agricultural discharge; hydrographic and water quality data taken during sporadic extreme flow events
- Accurate and recent maps of flooding zones – events with historical data need to be included with modeled flood data. Models need to include integrated river flow, surge and wave data
- Studies on the effectiveness of best management practices with regards to climate change
- Research related to conservation buffers
- Information on subaqueous soils, including mangroves and seagrass beds that may serve as bio-filters
- Research on upland erosion on slopes greater than 20% (9 degrees) due to poor results when applied; watershed erosion affected by different land cover and uncovered (landslide sites) are topics that need attention
- Data on salt and fresh-water groundwater flows around Puerto Rico
- Studies on the bio-filtering capacity of mollusks associated with estuaries and coastal environments
- Population studies on fish species; data on harvest rates and practices, effects of regulation on water quality, and determining ecological functions associated with estuaries
- Evaluation and alternative solutions on how to organize and measure the processes and resources influenced during intense sporadic events
- Habitat mapping and identification of spawning aggregation sites (SPAGs) for both commercially and ecologically important species; needed for changes in response to potential climate change or anthropogenic impacts
- Create a data portal for Puerto Rico; a website where all water resource data can be found (however, data must be analyzed for quality prior to submitting)
- Studies on sediment delivery (land covers and uncovered areas)
- Studies on the spatial variability of rainfall, climate, runoff, discharge, evapo-transpiration and discharge at a 1-km scale and its distribution as a daily product in order to be useful for agriculture
- Development of water quality modeling (availability and quality); the prediction of

traditional water quality measures and non-traditional (e.g., pharmaceuticals) needs to be included

- Development of real-time modeling (more robust procedures to calibrate hydrologic models and real-time events; autocalibration process)
- Studies on paleoclimate data and paleotsunamis for a better understanding of long-term changes in weather (climate) and controlling influences; for example, studies on stalagmites from local caves may provide historical data regarding tsunami events
- Determine water sources that feed caves and karstic water resources; relating offshore springs with discharge from systems of upland caverns
- Develop non-point source pollution models of nutrients, sediments, oil grease; dispersed submarine seepage, springs and pollutants need evaluation
- Develop current models for estuarine water
- Develop environmental indicators and environmental/biological standards for public health tailored for the Caribbean
- Develop standardized land-use maps of watersheds
- Characterization of nutrients found in groundwater

Obstacles that are currently delaying the advancement of research and assessments that could improve watershed and coastal management:

- Need for standard formats when reporting data
- Lack of communication and unwillingness to share critical information between agencies on projects that are presently being conducted
- Need for teaching tools that help communicate a deeper understanding watershed and marine processes need to be developed and shared with lawmakers and resource managers; Inadequate efforts to educate lawmakers, resource managers and the general public
- Lack of active participation from agencies in meetings/activities that promote improving management
- Lack of up-to-date maps of flooding zones
- Lack of historical data
- Poor modeling resolution – need high quality resolution of elevations and bathymetry
- Lack of data availability and quality
- Need for more water quality stations in order to obtain more data
- Lack of implementation of regulations (mostly due to lack of funds or political will)
- Lack of clear mandates and continuity of priorities from executive branches to the governmental agencies (mostly due to political influences)
- Lack of looking for long-term solutions to the water resource crisis, instead of just short-term solutions.
- No updating of watershed assessments, which in turn, affect effective determination of TMDLs; data supporting TMDL determination is generally missing
- Difficulties in obtaining freely available information from agencies
- Missing data (e.g., nutrient levels from water quality data, microbial content)
- Difficulty in accessing information through websites; most agencies do not have data easily accessible from their websites
- Few sample stations, unknown detection limits, poor data quality, insufficient sediment data or other important characteristics make many data sets useless

Final Overview

In regard to studies that are needed for improving watershed management and understanding hydrologic processes in Puerto Rico, most of the participants agreed with the lack of historical and actual data necessary for moderating water quality, developing better models for flooding events and for predicting events due to climate change. In addition, we asked each participant to provide us with three (3) individual projects that they would personally conduct. We will be using this information to help determine specific research areas and may be considered for research topics in our subsequent request for proposals. The group also highly emphasized the need for an independent water authority that would help manage the implementation and regulation of local water resources. This entity would also be responsible for evaluating data quality and distributing this information via an online data portal, which would be freely available to managers, scientists and experts. UPR-Sea Grant hopes to continue serving as a liaison for establishing collaborations between governmental agencies and private sectors in order to improve water resource management in Puerto Rico.