TERRESTRIAL SEDIMENT DELIVERY AND NEARSHORE WATER TURBIDITY
–A CASE STUDY FROM THE EAST END OF ST. CROIX, USVI

Statement of Regional or State Water Problem

Water quality plays a critical role in maintaining biological integrity and preserving natural resources in aquatic ecosystems. In October 2010 United States’ Environmental Protection Agency (EPA) published a list of impaired and threatened waters in the U.S. Virgin Islands (USVI) that are targeted for the development of future Total Maximum Daily Load (TMDL) limits in the territory. The most common reported causes of impairment in near-shore waters were sedimentation, effluent discharges, dissolved oxygen (DO) deficiencies and bacterial contamination (US EPA, 2010). Of the 33 listed sites for St. Croix, 28 or 85% of the reported impairments were associated with high turbidity.

The government of the US Virgin Islands approved legislature that allocated 155.4 km\(^2\) of offshore marine habitat to the St. Croix East End Marine Park (STXEEMP) to protect the largest island barrier reef system in the Caribbean (DPNR, 2008). Federal and territorial coastal managers consider the watersheds that drain into the STXEEMP to be priorities for protection and restoration. Currently, there are 19 ambient water-quality monitoring sites that are managed by the Department of Planning and Natural Resources (DPNR) that are located in the STXEEMP. Eight of the 19 sites are currently listed as impaired. Seven of the eight impairment issues are due to turbidity, primarily as a result of land-based sources of sediment (DPNR 2010).

The small watershed that discharges into Boiler Bay is located within a no take management zone of the STXEEMP and has been identified as a major source of erosion and sedimentation (Figure 1). A preexisting 180 m long dirt road that is now used as a foot trail is experiencing massive erosion that directly discharges into the bay. Recent studies have estimated that 2.5 tons of sediment is annually delivered to Boiler Bay from the existing trail. Boiler bay is also comprised of an array of different aquatic habitats, (seagrass beds, linear reef and sand patches) which contain protected and endangered species (sea turtles, coral, etc.) (Figure 2). Understanding the extent of erosion and sedimentation in this area is important not only for TMDL development, but also mitigating the impacts on the existing marine ecosystems.

![Figure 0. STXEEMP Zoning. Map of park management areas as represented in draft rules and regulations. Courtesy of Department of Planning and Natural Resources, Coastal Zone Management, Government of the US Virgin Islands.](image-url)
Statement of Results and Benefits

Two concurrent studies have been conducted over the past two years that were designed to quantify sediment and particulate organic material production rates from natural and anthropogenic sources of sediment within the subtropical environments of the East End (Appendix I) and Boiler Bay watersheds (Figure 3).

The East End Bay project was part of a two year, National Oceanic and Atmospheric Administration and American Recovery and Reinvestment Act (NOAA-ARRA) funded “USVI Coastal Habitat Restoration through Watershed Restoration Project” (V.I. RC&D, 2009). Primary objectives of this study were to provide quantitative data describing factors that control erosion in the East End Bay watershed and to reduce sediment loading by restoring an eroding trail (previously, a dirt road leading to the beach).

During FY2010, the PI and project collaborators of this proposal were awarded a WRRI grant to quantify the amount of particulate organic material found in sediment samples that were collected in East End Bay and to
expand the study site to include the nearby Boiler Bay watershed as a comparative study (USGS, 2010).

Findings from these studies provided clear insight into what characteristics governed sediment production and erosion transport through watersheds typical of the USVI. In short, it was found that erosion rates from foot trail surfaces were about 16 times higher than natural hillslopes (Reale-Munroe & Ramos-Scharrón, 2010) and that sediment eroding from the fast-eroding trail surfaces experienced a depletion in the organic content found in the soil, relative to undisturbed hillslopes. In addition, vegetation cover was found to be a primary factor governing erosion rates. In summary, decreased vegetation cover and increased erosion of both inorganic and organic components resulted in a dramatic decrease in soil quality. A decrease in soil quality, as measured by organic content, theoretically further decreased the ability for successful plant colonization and therefore, decreased soil stability- a cycle that encouraged erosion even further.

The proposed project presented here, benefits from the plethora of information provided by the previous studies (mentioned above) in that a unique dataset is available to provide a meaningful and thorough investigation into how terrestrial erosion impacts water quality parameters, namely, turbidity in the receiving water bodies. The high temporal and spatial resolution that these datasets provide can be especially meaningful to the application of TMDL development that is mandated to take place in the near future, here in the territory.

Results from this proposed study would provide real-time, high temporal resolution (5 minute) turbidity measurements during both dry (ambient conditions) and wet conditions when runoff is being delivered to the bay. The site selected in Boiler Bay would provide an environment where the source of sediment (the trail) could be isolated to effectively evaluate resulting turbidity without interference from other non-point or point sources of pollution. The data could then be used to directly evaluate the effects of runoff, turbidity and the duration of the impacts in the water.

Data that quantifies sediment transport from eroding watersheds into receiving water bodies is critical to support informed management decisions in the development of TMDL limits relating to turbidity. The development of TMDLs, based on high-resolution water quality data, would help achieve and maintain the “fishable and swimmable” goals set by the Clean Water Act for the USVI (US EPA, 2010). The ability to provide a case study capable of illustrating the kinds of sedimentation processes that commonly occur here in the USVI would be most valuable to the development of meaningful TMDL limits. The type of high-resolution water quality data intended for this study is commonly discussed as an important, but lacking source of information in Local Action Strategy meetings conducted by NOAA, the VI-DPNR, and PR-DNER. The co-PI’s of this proposal are active participants in those local meetings and efforts, and these include the development of watershed plans for the USVI, such as those for the Fish Bay and Coral Bay areas of St. John (NOAA-ARRA; NOAA-LAS), Lameshur Bay and Salt Pond Bay in St John (VI National Park), STX East End (Horseley-Witten Group), and in Puerto Rico in Culebra (PR-DNER, NOAA-Coral Reef Restoration), Bahía Mosquito-Vieques (EPA, Vieques Conservation and Historical Trust), Fajardo (NOAA-LAS, Caribbean Coral Reef Institute), La Parguera (NOAA-CRES, CCRI, NOAA-LAS), Cabo Rojo (PR-DNER, NOAA-LAS), and El Río Grande de Añasco (UPR-Sea Grant). The results of this study can thus serve not only to understand the local water turbidity dynamics at Boiler Bay, but could also guide future monitoring efforts for projects having similar objectives in other parts of the USVI and Puerto Rico.
Nature, Scope, Objectives and Timeline of Research

Nature & Scope:

The nature of this proposal is ultimately aimed at providing meaningful data to support TMDL development to protect the marine environments in the USVI, which are rich in biodiversity and are vital in providing important socio-economic and ecosystem services that island communities depend on (Rothenberger, et al., 2008). Increased sedimentation into coastal waters resulting from land-based anthropogenic activities continues to be one of the main stressors threatening nearshore marine habitats (e.g. coral reefs) (Rogers, et al., 2008).

Therefore, the scope of this proposal would be to establish a clear link between known rates of terrestrial sediment transport through the watershed to the turbidity in the bay, as a result of direct discharge from runoff. Turbidity, DO, temperature and conductivity data would also be logged at frequent intervals to capture and quantify sedimentation events and other impacted water quality parameters. Turbidity data would also be correlated with rainfall patterns and estimated terrestrial sediment delivery rates.

Objectives:

The specific objectives of the proposed study are:

1. To link rainfall events to terrestrial erosion data and turbidity concentrations in the receiving water column.
2. To characterize the nature and extent of turbidity during ambient and sedimentation events for potential TMDL development.

Timeline of Research:

The timeline of research consists of three phases that would be performed over a one-year period. The timeline for field and laboratory data collection would be eight (8) months. Data analysis and a written report would be produced in two (2) months.

Phase I: March – May 2012 - equipment would be ordered and installed.

Phase II: April – December 2012 - precipitation, terrestrial runoff, and turbidity data would be collected.

Phase III: January – February 2013 - analyses of the data, a written report of the findings and potential recommendations would be compiled.
Methods, Procedures, and Facilities

Methods & Procedures:

Precipitation:
Precipitation events would be monitored by a tipping bucket rain gauge located on site. Precipitation data would be downloaded once a month (Figure 4) and would be used to generate a 15-min rainfall intensity database to calculate daily, monthly, and individual storm event precipitation totals and to maintain a daily record of antecedent precipitation index (API) (Dunne & Leopold, 1978). Storm total and API have been previously used to better predict the relationship between rainfall patterns and the generation of runoff and sediment from small catchments (Ramos-Scharrón & MacDonald, 2007). Precipitation would also be used to estimate sediment delivery rates from the Boiler Bay trail based on previously collected erosion data (Figure 5).

Terrestrial Runoff:
Crest gages would be used in an attempt to differentiate periods when runoff was delivered from periods when no runoff was generated in Boiler Bay. A crest gage is a low tech and inexpensive device used to register the maximum stage (i.e., water level) for a given runoff event or for a given time period. Gages are typically used in remote locations to record the maximum flood level in a stream (e.g., Waltemeyer, 1996), but have also been used to gage the elevation of sub-surface soil saturation levels (Ramos-Scharrón and MacDonald, 2007). The gage consists of two PVC tubes of different diameters and roughly equal length. Holes are carved into the bottom part of the large diameter PVC tube and this is secured vertically in a location where runoff is expected to flow. A handful of powdered corks are placed inside the tube before inserting the small diameter tube and placing a cap. When flow occurs the maximum water level is recorded by the markings of the powdered cork on the inner PVC tube. Although this method would not allow the estimation of total runoff entering Boiler Bay, it would allow us to differentiate which rainfall events yielded runoff. Crest gages would be checked on a weekly basis or just prior and immediately following announced major rainfall events.

Turbidity:
The proposed study includes the use of a U.S. EPA approved (YSI 6820/6920) sonde, capable of measuring and recording real-time turbidity shifts, as well as temperature, DO and conductivity in the receiving water column. The use of this turbidity data logger would allow us to clearly quantify and link terrestrial sediment transport with its impacts on water quality conditions in Boiler Bay.
The sonde would be mounted approximately 70 m north and 10 m east the point of direct discharge in order to capture sedimentation events as they occur (Figure 6). The sonde location was identified based on both visual observations of the direction that the sediment plume travels when it enters the bay and by determining the relative velocity and direction of local currents. The depths in Boiler Bay range approximately 5-20 feet and the topography varies greatly. The sonde would be mounted approximately 5 feet above the marine surface bottom and below wave break depths to minimize potential interference from bottom sediments or bubbles caused by surge or wave action.

Turbidity data, as well as temperature, conductivity and DO logged by the sonde would be downloaded and analyzed approximately twice a month. After the data is downloaded, it would be correlated with the collected rainfall data, as the timescale resolution is the same. The turbidity data would also be compared to the catchment-scale sediment delivery rates and analyzed for trends and seasonality. The sonde would be cleaned and calibrated on a bi-weekly schedule and batteries would be replaced at that time. The sonde would be brought to the laboratory and cleaned on an “as needed” basis.

**Facilities:**

The University of the Virgin Islands has a laboratory, Evan’s Center (EC) 208, which is being used for chemistry and biology classes, where the data sonde would be brought and cleaned, if needed. The use of EC 208 would not conflict with scheduled laboratory classes.
Related Research

Worldwide assessments suggest that land-based sources of pollution are affecting over 20% of the world’s coral reef systems (Bryant, Burke, J., & Spalding, 1998). Within the Caribbean Region, a decline in live coral cover has been in part, attributed to localized stressors (Gardner et al., 2003), out of which increased sedimentation. land-based sources of pollution consistently ranks among the most important threats (Rogers, 1990; Rothenberger, et al., 2008; García-Sais, 2008). Many coral reef systems within the Caribbean are at risk from land-based sources of sediment and this has prompted the U.S. Coral Reef Task Force to encourage local governments to develop erosion control strategies to mitigate their impacts as part of their Local Action Strategy plans.

In the USVI, increased rate of sediment delivery that typically accompanies land development is one of the greatest stressors threatening the coral reef systems (Rogers, et al., 2008). Literature reviews of locally-generated data shows a clear and significant onshore-offshore sedimentation gradient; nearshore sedimentation rates were six times greater than at mid-shelf reefs, and nearly 50 times greater than at offshore reefs (Rothenberger, et al., 2008). Single-year sedimentation studies conducted in St. John imply that current sediment settling rates at the bottom of bays impacted by development are between 3 and 73 times above undisturbed conditions (Gray et al., 2008). Furthermore, a similar onshore to offshore gradient was also found in a number of coral health indices, including bleaching prevalence and percentage of old mortality, indicating that sediment deposition may be in part, adversely affecting coral condition (Rothenberger, et al., 2008). It is apparent that clean, clear water is critical to maintaining healthy coral communities and seagrass beds (Jeffrey, et al., 2005).

There has been a growing awareness concerning how human activities in watersheds are affecting the downstream water resources and aquatic environments. Federal and local funds have been contributing to the effort to better understand and mitigate the high rates of erosion from unpaved roads and land use changes into local bays (MacDonald, et al., 2001; Ramos-Scharrón & MacDonald, 2007). Current research is underway throughout the USVI in an effort to better understand the relationships between increased terrestrial sediment inputs and the degradation of receiving marine ecosystems; however, the effects are not yet fully documented and understood.

Over the past five to six decades, the USVI and Puerto Rico have experienced rapid construction associated to coastal development and the growth of unpaved road networks, which contribute to the increase in sediment loading into the surrounding bays (Johnston, 1987; Valdez-Pizzini, Chaparro, & Gutierrez, 1988). Studies in Puerto Rico found that coral reef degradation is widespread in waters surrounding the island and is generally greatest offshore from watersheds with the greatest amount of urbanization (Larsen & Webb, 2009). Another study began to address the need for empirical data by quantifying the effects of land development on plot- and hillslope-scale sediment production rates in a tropical dry forest of southwestern Puerto Rico (Ramos-Scharrón, 2010).

In the island of St. John, USVI, several studies have been directed at measuring sediment production from unpaved roads. For instance, two such studies were related to measuring runoff and suspended sediment yields from road segments and developing event-based runoff and sediment prediction models, which were used to compare predicted sediment yields against measured values from an empirical road erosion model and from a sediment trap (Ramos-Scharrón & MacDonald, 2005; Ramos-Scharron & MacDonald, 2007). One study found that the measured and predicted erosion rates indicated that roads are capable of increasing hillslope-scale sediment production rates by up to four orders of magnitude, relative to undisturbed conditions (Ramos-Scharron and MacDonald,
The steep, small watersheds that are characteristic of the USVI have only exasperated these problems. Another study supports these findings by indicating that relatively undisturbed, vegetated hillslopes on St. John generate runoff only during the largest storm events, and produce very little sediment (MacDonald, et al., 2001; Ramos-Scharron & MacDonald, 2007). A GIS-based watershed-scale model was developed based on the empirical, road-segment and hillslope-scale data. Application of this model suggests that unpaved roads increased sediment delivery rates by 3–6 times for Lameshur Bay, 5–9 times for Fish Bay, and 4–8 times for Cinnamon Bay (Ramos-Scharron and MacDonald, 2007).

For the past two and a half years in St. Croix, USVI the Virgin Islands Resource Conservation & Development (V.I. RC&D) in partnership with universities, local governments, and other agencies were awarded funds to reduce sediment loading rates into the coastal waters of three USVI watersheds: East End Bay on St. Croix and Coral & Fish Bays on St. John (V.I. RC&D, 2009). This project also contained an effort to link terrestrial erosion to the amount of sediment actually settling on the receiving reef by use of sediment traps. However these linkages were not quantified in real-time, temporal scales or in terms of changes in water quality parameters, such as turbidity, temperature, DO, etc.

What distinguishes this proposed study from other efforts is that it attempts to directly relate sediment delivery rates based on locally-derived data to the consequential effect on water quality, as a result of direct discharge into the bay. Since we now have a thorough understanding of the nature and extent of sediment transport at the proposed study site, it would be most opportunistic to take advantage of the conditions in order to capture the real-time sedimentation events as they occur in the water. We are not aware of another related study that has quantified actual sediment production and then directly linked that data to the resulting changes in water quality parameters. Because a unique dataset exists from our recent studies, the proposed case study would lend itself to being applicable to the better development of TMDL limits by providing robust, high-resolution data.
Training Potential

This study would provide research experience for undergraduate students in the University of the Virgin Islands. Every semester two (2) students would be selected to register for CHE 495 (Directed Independent Research) for 1 credit under the supervision of Dr. Bernard Castillo. Dr. Castillo would also be in charge of the selection process of students from his CHE 151 and 152 classes. Students registered in CHE 495 would be involved in the following:

A. Field Components:
Initially, students would be involved in installing the sonde in Boiler Bay. The students with the faculty supervisor would calibrate the sonde and download rain data from the rain gauge. Students would be involved in removing the sonde and downloading the data, using Ecowatch software. After data is downloaded, the sonde probes would be cleaned and calibrated and then re-deployed into the bay. Data would be retrieved from the sonde twice a month.

B. Laboratory Components:
On an “as needed basis,” the sonde may be brought back to the laboratory for thorough cleaning. This would be performed in EC 208 during the days when the laboratory room is not being used for instruction.

Please see attached copy of syllabus for CHE 495, as approved by the College of Science and Mathematics.

Information Transfer Plan

Information would be shared by collaboration with the Department of Planning and Natural Resources and the Environmental Protection Agency. The findings of our work would be presented at a research symposium and colloquiums hosted by the University of the Virgin Islands. Furthermore, publication in a peer-reviewed journal would be sought.
Bibliography


Appendix I:

East End Bay Study Site

Figure 4 East End Bay study site locations. Green, red and gray dots represent undisturbed, disturbed, and cliff surfaces, respectively.
Appendix II

Chemistry 495 – Directed Independent Research in Chemistry (1 credit)
University of the Virgin Islands – St. Croix Campus
Spring 2012

Instructor: Bernard Castillo II, Ph.D.
Phone: 692-4028
Email: bcastil@uvi.edu
Office: EC 201

Course Description: Provides an opportunity for students, under the guidance of a faculty supervisor, to pursue scholarly research or study in areas associated with their academic field but outside of prescribed courses. Student and the prospective supervisor should develop and submit for approval a proposal to the Dean at least one month prior to the start of the course. For each hour of academic credit to be awarded, the student must have three hours of lab or study per week and one hour of consultation per week with the supervisor. Student may register for repeated enrollment in this course up to the maximum of six credits. Proposals must also include an evaluation plan. 

Prerequisite: CHE 254 with a minimum grade point average of 2.5.

Research Project: Student enrolled in CHE 495 for Spring 2012 will be working on three different research projects:

1. “Terrestrial Sediment Delivery and Nearshore Water Turbidity – A Case Study From the East End of St. Croix, USVI.” Funding is being sought through USGS-WRRI. 
   Students are expected to:
   • Go to the field (Boiler Bay) and download data from sonde;
   • Clean and calibrate water quality probes;
   • Deploy sonde after data download, cleaning and calibration of probes;
   • Analyze data. Correlate rainfall data with erosion rates and water quality and;
   • Keep a journal and attend weekly meetings.

2. “Screening of Ciguatera Toxins found in Indo-Pacific Lionfish (Pterois volitans/miles complex) in the US Virgin Islands.” Currently, start-up funds are being sought from VI-EPSCoR.
   • Dissect stomach content of lionfish;
   • Determine sex, length and weight of lionfish;
   • Prepare lionfish samples to be sent to FDA;
   • Depending on availability of funds, help set-up ciguatera extraction protocol. Extract ciguatera toxins from lionfish then send samples to FDA;
   • Perform geospatial analysis of lionfish with corresponding concentrations of ciguatera toxins and;
   • Keep a journal and attend weekly meetings.

3. “Ecological characterization of bioluminescence in Mangrove Lagoon, Salt River Bay, St. Croix, USVI.” Currently, there is a proposal submitted to the Department of the Interior for funds.
   • Go to Mangrove Lagoon and download data from sonde;
• Clean and calibrate water quality probes;
• Deploy sonde after data download, cleaning and calibration of probes;
• Analyze data. Correlate rainfall data and water quality;
• Obtain water samples for water quality tests;
• Perform water quality tests and;
• Keep a journal and attend weekly meetings.

**Weekly Meetings.** Students registered in CHE 495 are required to attend weekly meetings. Meetings are usually held on Mondays from 1-2pm. In each meeting, students will give an update on what they have done in the previous week and plan what they will do in the upcoming week. Students are required to present a peer-reviewed journal related to their work during the meeting. Each student will present at least 2 journal articles for the entire semester. At the end of the semester, the students are required to give a short summary of their work.

**Note:** The pre-requisites for CHE 495 will be waived since all the students who will be enrolled are the instructor’s students in CHE 152 for the Spring 2012 semester. The faculty supervisor will train the students in the use of the different instrumentation and software used in the different projects.

**Student Evaluation:** Students enrolled in CHE 495 will be evaluated according to the following:

Attendance to meetings, sampling and performing the experiments is

\[
\begin{align*}
& > 90\% \quad = A \\
& 81 - 90\% \quad = B \\
& 71 - 80\% \quad = C \\
& 61 - 70\% \quad = D \\
& < 60 \quad = F
\end{align*}
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**Research Symposia Presentation:** The students will also present their work during UVI Research Symposia. Depending on the availability of travel funds, students will also present their work in a regional or national research conference.
Investigator’s Qualifications

BERNARD F. CASTILLO II, Ph. D.
Assistant Professor in Chemistry, University of the Virgin Islands
Kingshill, VI 00850
Email: bcastil@uvi.edu Office No.: 340-692-4028

Education:
• Ph. D., Chemistry 2008
  University of Connecticut, Storrs, CT
  Thesis Title: A. Formal Synthesis of Laureatin B. Synthesis of Glycosphingolipids
  Advisor: Prof. Amy R. Howell
• B. S. Chemistry 1996
  Mindanao State University
  Marawi City, Philippines

Research Experience:
• Co-Primary Investigator 2011 to 2012
  • Grant funded by VI Water Resources Research Institute
• Primary Investigator 2010 to 2011
  • Grant funded by VI Water Resources Research Institute
• Graduate Research Assistant 2003 to 2008
  Advisor: Amy Howell, Ph. D.
  Department of Chemistry
  University of Connecticut, Storrs, CT
  • Studies toward the synthesis of laureatin and exploitation of unusual oxetanes
  • Synthesis of fluoroglycosides and glycosphingolipids
  • Handling air- and moisture-sensitive compounds
  • Using $^1$H and $^{13}$C NMR, IR, GC-MS

Teaching Experience:
• Assistant Professor in Chemistry 2009 to present
  University of the Virgin Islands
  Kingshill, VI
• Assistant Professor in Chemistry 2008 to 2009
  Bard College
  Annandale-on-Hudson, NY
• Graduate Teaching Assistant 2002 to 2003
  Department of Chemistry
  University of Connecticut, Storrs, CT
• Instructor 1997 to 2002
  Mindanao State University
  General Santos City, Philippines
Affiliations:
- CORE Foundation, Board Member
- American Chemical Society, member
- Phi Lambda Upsilon, Honorary Chemical Society Alpha Phi Chapter, member
- PADI, Professional Association of Diving Instructor – Open Water Diver
- Integrated Chemists of the Philippines (1996 to 2002), member

Workshops/Seminars:
- Poster Presentation
  NSF-CAREER Workshop
  Baton Rouge, LA 2011
- Student Presentation Judge,
  2010 Annual Biomedical Research Conference for Minority Students
  Charlotte, NC 2010
- Presenter, 237th ACS National Meeting & Exposition
  Carbohydrate Chemistry Division
  Boston, MA 2007
- Presenter, 22nd Philippine Chemistry Congress
  Biochemistry Division
  Tagaytay, Philippines 2007
- Facilitator, Pfizer Green Chemistry on Wheels Workshop
  University of Connecticut
  Storrs, CT 2007
- Pfizer Green Chemistry Workshop
  Pfizer Inc.
  Groton, CT 2005

Publications:


KYNOCHELEALE-MUNROE
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EDUCATION

2009  M.S., Natural Resources: Land, Water and Air
Concentrations: water resources management & engineering, aquatic ecology, water
supply & water quality, University of Connecticut
2004  B.S., Biology Idaho State University

CURRENT APPOINTMENTS

2011-present  Principal Investigator, “Quantifying Sediment and Organic Material Production
Rates from Surface Erosion Processes and the Effect on Marine Water Quality in
Small Subtropical Watersheds on the East End of St. Croix, USVI” USGS/WRRI
Grant. Project #: 2011V1195B
2010-present  Part-time Faculty, Team-teaching “The Natural World: The Caribbean” College of
Math and Science, University of the Virgin Islands
2009-present  Consultant, “USVI Coastal Habitat Restoration Through Watershed Restoration
Project,” NOAA Coastal and Marine Habitat Restoration Program-ARRA Grant, V.I.
Resource Conservation & Development Council, Inc.

PUBLICATIONS

Material and Erosion Rates in Small Subtropical Watersheds on the East End of St. Croix, U. S.
University of the Virgin Islands. Retrieved from

Machine in Proceedings from UVI-ECS 9th Annual Summer Research Symposium, College of
Science and Mathematics, University of the Virgin Islands, VI page 5. Retrieved from
http://www.uvi.edu/sites/uvi/Publications/Final%20abstract%20booklet%20-
%20summer%202011.pdf

Cumberbatch, J., Castillo, B., Reale-Munroe, K. (2011, July) Preliminary Results: Measurement of
Sediment Production and Particulate Organic Material in Small Subtropical Watersheds on the East
End of St. Croix, USVI in Proceedings from UVI-ECS 9th Annual Summer Research Symposium,
College of Science and Mathematics, University of the Virgin Islands, VI page 8. Retrieved from
http://www.uvi.edu/sites/uvi/Publications/Final%20abstract%20booklet%20-
%20summer%202011.pdf

South First Street Storm Water Runoff Basin, Pocatello, Idaho. Journal of the Idaho Academy of
Science 41: 1-7.
CONFERENCES & SEMINARS

2011  **Research Mentor**, The University of the Virgin Islands/Emerging Caribbean Scientists 9th Annual Spring Research Symposium  
“Particulate Organic Material in Small Subtropical Watersheds on the East End of St. Croix, USVI” The University of the Virgin Islands, St. Croix Campus, U.S.V.I.

2010  **Presenter, Poster**, Virgin Islands 10th Annual Nonpoint Source Pollution Conference  
“Erosion Rates in a Small Subtropical Watershed on the East End of St. Croix, USVI”  
V.I. Resource Conservation & Development, St. Thomas, U.S.V.I.

2008  **Presenter**, Natural Resources Management and Engineering Seminar Series  
“Reservoir Systems: An Integrated Modeling Approach to Water Management and Climate Change” University of Connecticut, Storrs, CT

2007  **Presenter**, Connecticut Conference on Natural Resources  
“Modeling the Effects of Reservoir Release Rules on Safe Yield” University of Connecticut, Storrs, CT

RESEARCH EXPERIENCE

USGS/WRRI grant. Project #: 2010VI170B

2009-present  **Consultant**. Project goals are to monitor and quantify terrestrial erosion rates and to protect coastal marine ecosystems by implementing erosion & sediment control practices

2007-2009  **Graduate Research Assistant**. Modeling and statistical studies were performed to test Connecticut release policies and their effects on safe yield, downstream flow, and implications on aquatic ecosystems

2007-2008  **Graduate Research Assistant**. Collaborated with the CT Department of Environmental Protection and the Instream Flow Scientific and Technical Workgroup to develop a behavioral model to test current and alternative reservoir release policies for instream flow regulation implementation

2006-2007  **Graduate Research Assistant**. Research was conducted to assess the extent and potential causation of Manganese contamination found in CT groundwater

2003-2004  **Student Researcher**. Experiments were conducted to determine the efficacy of a control structure to reduce suspended sediment concentrations in the Portneuf River, ID

2003-2004  **Student Researcher**. Tested the amount of nutrient removal efficacy of the Fairview Constructed Wetland, ID

2003-2004  **Student Researcher**. Conducted water quality sampling and analysis on the Portneuf River in Idaho for the Department of Environmental Quality and Idaho State University to determine levels of Coliform, *E. coli*, NH₃, PO₄³⁻, etc.

2003-2004  **Student Researcher**. Collected and identified samples of phyla from different depths in the Long Island Sound, Project Oceanography through UCONN
I. Education

2006-present Post-Doctoral Researcher, Dept. of Biology, UPR-Rio Piedras
Mass wasting and the transfer of carbon from hillslopes into the fluvial network in a
tropical montane system. Advisor: Prof. Carla Restrepo
Dissertation title: Measuring and predicting erosion and sediment yield on
St. John, U.S. Virgin Islands. Advisor: Prof. Lee H. MacDonald
Advisor: Prof. William E. Dietrich
1988 – 1993 Bachelor of Science, Department of Geology, Univ. Puerto Rico-Mayaguez

II. Work Experience

2009-2012 Co-Principal Investigator & Co-Project Manager for VIRC&D for the ‘USVI
Coastal Habitat Restoration Through Watershed Restoration Project’, NOAA
Coastal and Marine Habitat Restoration Program-ARRA.
2006-present Environmental Consultant, Dept. of Env. and Natural Resources-Puerto Rico:
Impact assessment and implementation of erosion control programs.
2003-present Principal Investigator, NOAA-Coral Reef Ecosystems Program, UPR- Caribbean
Coral Reef Institute, UPR-Sea Grant Program: Measuring and modeling erosion and
sediment yields in Puerto Rico.
2000-present Project Manager, Island Resources Foundation: Evaluate, develop, and implement
environmental impact assessment strategies to mitigate the effects of anthropogenic
disturbance on water resources of the Caribbean.

III. Selected Peer-Reviewed Journal Articles

Ramos-Scharrón CE, in press. Effectiveness of an erosion control method in reducing sediment
production rates from an unpaved road. *Journal of Soil and Water Conservation.*

Ramos-Scharrón CE, 2010. Sediment production from unpaved roads in a dry sub-tropical setting-


Ramos-Scharrón CE, MacDonald LH, 2007. Measurement and prediction of erosion rates from
natural and anthropogenic sources of sediment in St. John, U.S. Virgin Islands. *Catena Special Issue-
Soil water erosion on rural areas*, 71: 250-266.


IV. Selected Abstracts, Book Chapters, & Other Articles


V. Selected Presentations

“Land-based sources of sediment: Research tools to assess and mitigate their effects on the coral reefs of Puerto Rico”, Recomendaciones para la Conservación y Protección de los Arrecifes de Coral de Puerto Rico, Segundo Conversatorio, San Juan, Puerto Rico, 23 September 2011.
