CCRI Final Project Report

Year 1

Project Title:

Development of Software Applications for Assessing the Effects of Land Disturbance on Sediment Yields

Grantee:

Island Resources Foundation;

PI: Carlos E. Ramos-Scharrón, Ph.D.

Date:

November 13, 2009

1. WORK ACCOMPLISHMENTS

a. Progress summary

Project background

The CCRI *Land Disturbance on Sediment Yields* project is a continuation of a two-year (2003-2005) terrestrial sediment budget study funded as part of the NOAA'S CRES program. The CCRI-funded project began in July 2006 and continues to this date. The objectives of this study are:

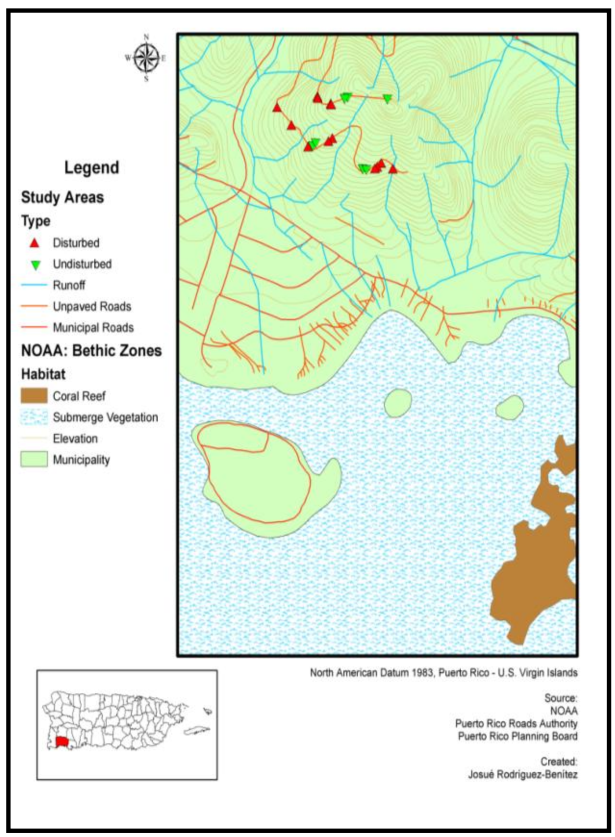
1) To collect field-based measurements in La Parguera to determine the impacts of land disturbance on sediment yields at the plot (3 m²) scale;

2) To combine data collected in La Parguera with measurements previously collected in St. John (USVI) to develop an empirical surface erosion model; and

3) To develop and apply software applications that estimate hillslope-scale sediment production and watershed-scale sediment yields.

Methods

The study design was meant to determine the effects of land disturbance, slope, vegetation cover density, surface soil texture, and rainfall in controlling erosion rates. The study design yields a total of nine different disturbance-type/slope/vegetation cover combinations, and each type is represented by at least two replicate 3 m² plots.



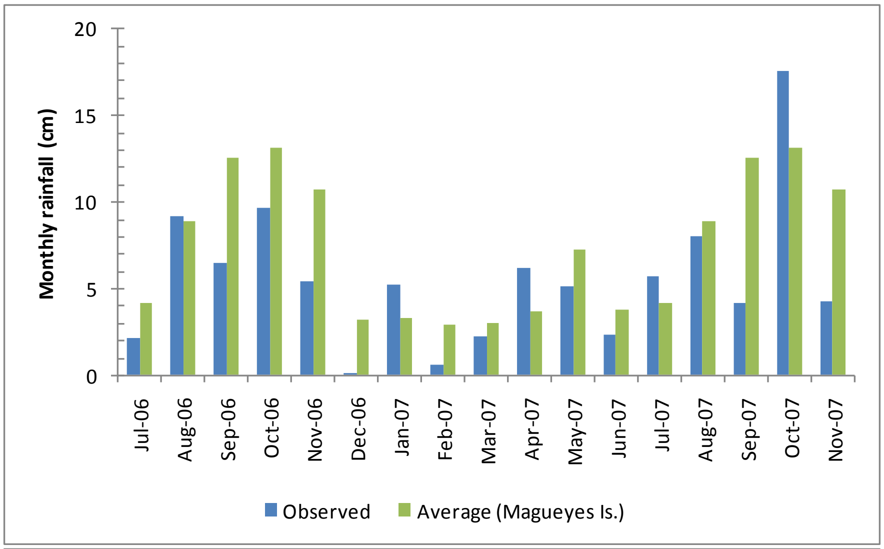
Rainfall was monitored with an automatic tipping-bucket type raingauge between 6 July 2006 and 18 August 2007 when the raingauge appears to have been vandalized. A total of 20 plots were installed between July and September 2006. Although the final set of plot measurements were taken in November 2007, most sites were monitored only until August 2007. Missing rainfall data after 18 August 2007 was taken from the Isla Magueyes long-term weather station.

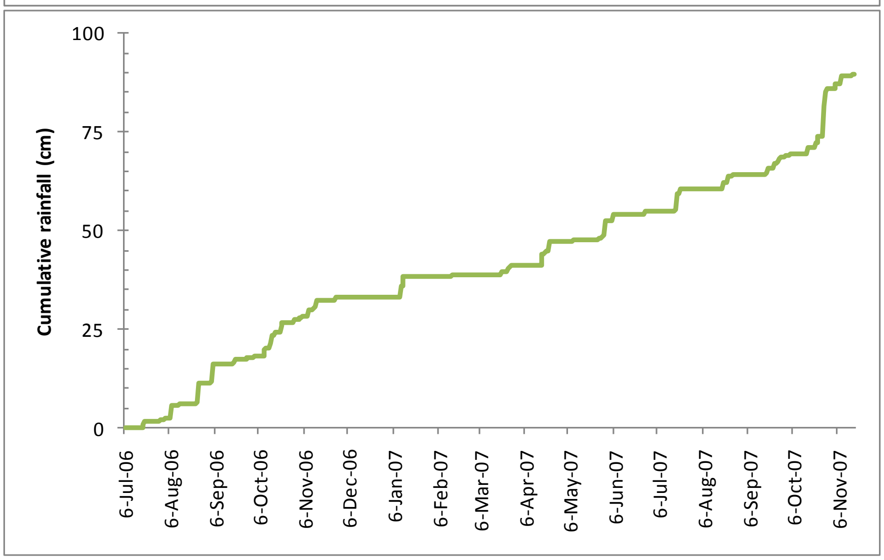
Plots were bordered on all sides by plastic flashing, have a total area of approximately 3 m^2 (3 m long x 1 m wide) and were equipped with a Gerlach trough, hoses and plastic containers. A Gerlach trough is a small sediment trap that allows for the collection of both fine and coarse sediment. While the coarse sediment was mostly retained by the troughs, hoses extending from the trough to plastic containers allowed for the collection of runoff (i.e., overland flow) and fine sediment. Sediment captured in the trough was collected and taken to the laboratory to determine its dry weight, while the concentration of suspended sediments was determined by the evaporation method.

Plots were checked once every two-weeks to once every several months at the final stages of the project. Each plot was checked about 9 to 13 times for an overall total of 234 measurements. In addition to total sediment losses as part of this project we are quantifying the loss of organic matter by surface erosion processes. The proportion of organic matter within the total material lost by erosion and collected in the Gerlach troughs or within the water containers was determined in the lab by the loss on ignition method.

Results-Rainfall

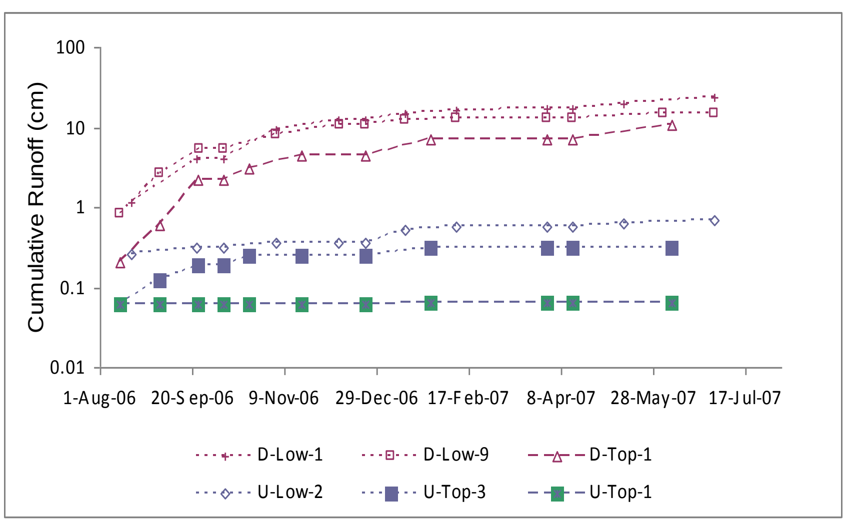
Monthly precipitation generally followed the normal seasonal trends, but rainfall was lower than normal during most of the study period. The total rainfall recorded was 95 cm, or only 75% of the expected rainfall (126 cm) based on the long-term average. The maximum 1-hr rainfall intensity recorded was 3.6 cm hr^{-1}, and this occurred during the largest individual storm event recorded (4.4 cm) on 5 September 2006. Rainfall was well distributed throughout the study period. The months of Dec-06 through Mar-07 were unusually dry totaling only 8.2 cm of rainfall.

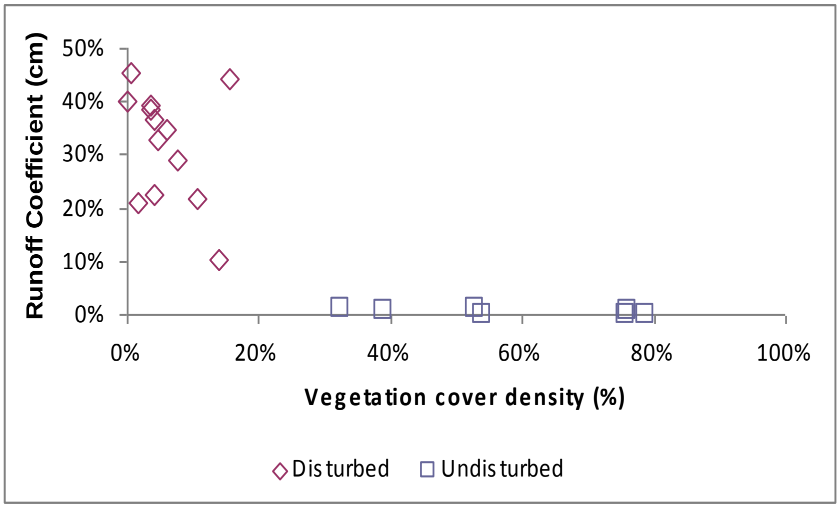




Runoff development

Runoff development from disturbed plots occurred at a higher frequency and magnitude than from undisturbed plots. Undisturbed plots (labeled in blue and identified by a 'U' in the graphs) produced runoff only 35% of the time measurements were taken (29 out of 81), while disturbed plots (labeled in

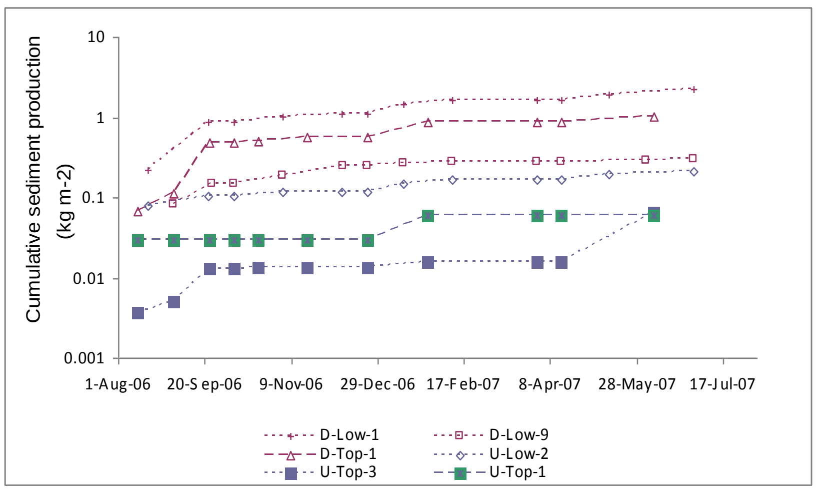


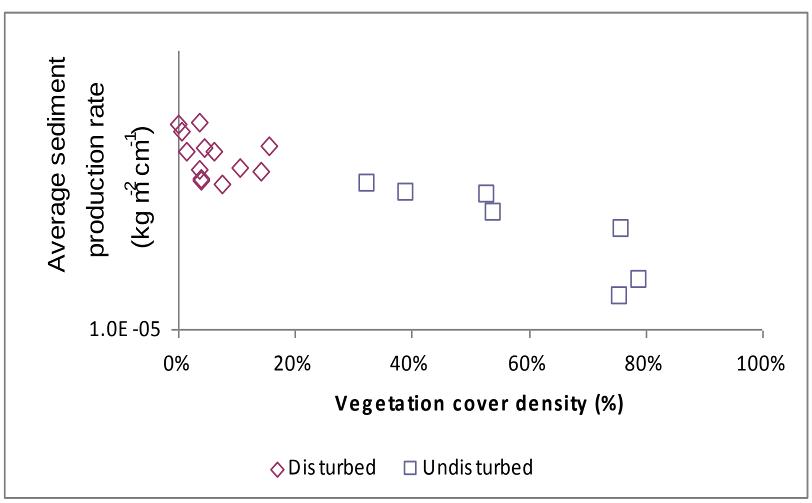


red and identified by a 'D') produced runoff 71% of the time measurements were collected (110 out of 153). The overall average runoff coefficient for disturbed plots was 32%, and this is 55-times higher than that from undisturbed plots.

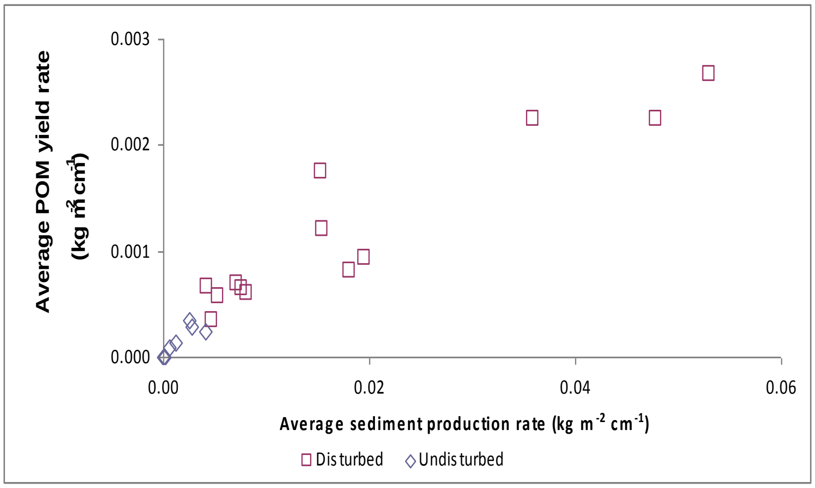
Runoff response was inversely correlated with vegetation cover density. Higher cover densities appear to reduce runoff rates by promoting losses by both evapotranspiration and infiltration. Variability in runoff coefficients for disturbed plots with similar cover densities may be caused by differences in surface texture.

Sediment production





The average sediment production rate from disturbed plots was 0.0019 kg m^{-2} cm^{-1} or 1.4 kg m^{-2} yr^{-1} assuming an annual rainfall rate of 77 cm yr^{-1}. These rates are 11 times higher than those from undisturbed plots (0.0016 kg m^{-2} cm^{-1} or 0.12 kg m^{-2} yr^{-1}). Variability in sediment production rates among disturbed plots appears to be related to differences in vegetation cover density and presumably surface texture. Sediment production rates were inversely correlated with vegetation cover density. Higher cover densities not only reduce runoff generation but they also protect the surface from the effects of rain-splash and the shearing forces of flowing runoff. Slope showed a very poor correlation with sediment production rates for disturbed plots (R^2 = 0.08), and this might be due to the relatively small plot length times slope product (L*S factor) of the 3 m^2 erosion plots, and the apparent dominant role of vegetation cover density and surface texture.



Particulate organic matter

POM yield rates were strongly correlated with sediment production rates for both disturbed and undisturbed plots (R^2 = 0.87 and 0.77, respectively). The strong correlation is due to the limited range of POM content values of the material being exported from the plots. POM content from disturbed plots averaged 7.5% and ranged only within 4.1% and 16%. POM content for undisturbed plots was 1.5-times higher (11%) and ranged within 6% and 14%. Therefore, POM yields are controlled by the same factors controlling sediment production (i.e., rainfall, vegetation cover, and presumably surface texture).

Comparisons with previous studies

The average sediment production rates measured from recently disturbed road surface plots as part of this study is 13-times higher than those measured from abandoned road segments in La Parguera between 2003-2005 (NOAA-CRES)[1]. Differences in sediment production rates can be

Source	Average sediment kg m^{-2} yr^{-1}	Mg ha^{-1} yr^{-1}
Abandoned road segments Parguera	0.11	1.1
Freq. graded road segments-St. John	11	110
Ungraded road segments-St. John	6.4	64
Abandoned road segments-St. John	1.2	12
Disturbed plots- This study	1.5	15
Natural hillslopes-Parguera	0.011	0.11
Natural hillslopes-St. John	0.001	0.01
Undisturbed plots-This study	0.12	1.2

[1] Ramos-Scharrón CE, 2007. Sediment production from natural and disturbed surfaces in dry tropical areas of the Eastern Caribbean. Proceedings of the 7th Caribbean Island Water Resources Congress, Sangchul Hwang (Ed.), Univ. of the Virgin Islands Water Resources Research Institute, St Croix, USVI, pp. 26-30.

attributed to a longer time since grading and higher vegetation cover densities reported for the previous study. Disturbed sediment production rates were only 13% and 23% of rates measured from frequently graded and ungraded active road surfaces on St. John [2]. The differences can be attributed to higher L*S values, higher rainfall intensities in St. John and to the effects of traffic.

Undisturbed sediment production rates measured as part of this study were one to two-orders of magnitude higher than rates previously measured in Parguera and St. John, respectively. The differences can be attributed to the larger spatial scales at which these previous measurements were taken (hillslope and subcatchment scale) and to higher vegetative cover densities.

b.1 Future work

The field monitoring component of this project ended in the fall of 2007. Laboratory analyses are 95% completed and will likely be finished by the end of 2009 at the Univ. of Puerto Rico-Extensión Agrícola soils lab (Dr. Victor Snyder). This includes all of the additional laboratory work required to complete a parallel project being conducted by the field/lab assistant for this study (Mr. Josué Rodríguez- see section b.2 for additional details). All work that was to be conducted in the Soils Lab of the Department of Geography at the University of Texas-Austin was completed on Sep-08 by this project's PI.

Data analyses (including all statistical work) will be conducted as soon as all laboratory work has been completed in order to develop the empirical erosion models to be used by the two software applications. The PI has also requested for clarification on some missing data from Mr. Josué Rodríguez.

GIS analyses and programming design and development began Jan-09 and are still ongoing. Historical aerial images of the La Parguera area were purchased with funds kindly provided by Dr. José Molinelli-UPR Río Piedras. The images were scanned and geo-referenced at the UPR-Rio Piedras Environmental Sciences Program GIS Lab (Prof. Daniel Díaz) and are being used to develop land use maps of the Parguera area. Road maps of the Parguera area were developed in the Fall of 2008. About a quarter of the image-processing work has been completed by Mr. Josué Rodríguez so far. The remaining work will be completed by the end of 2009. The classification system used consists of the following categories [3]:

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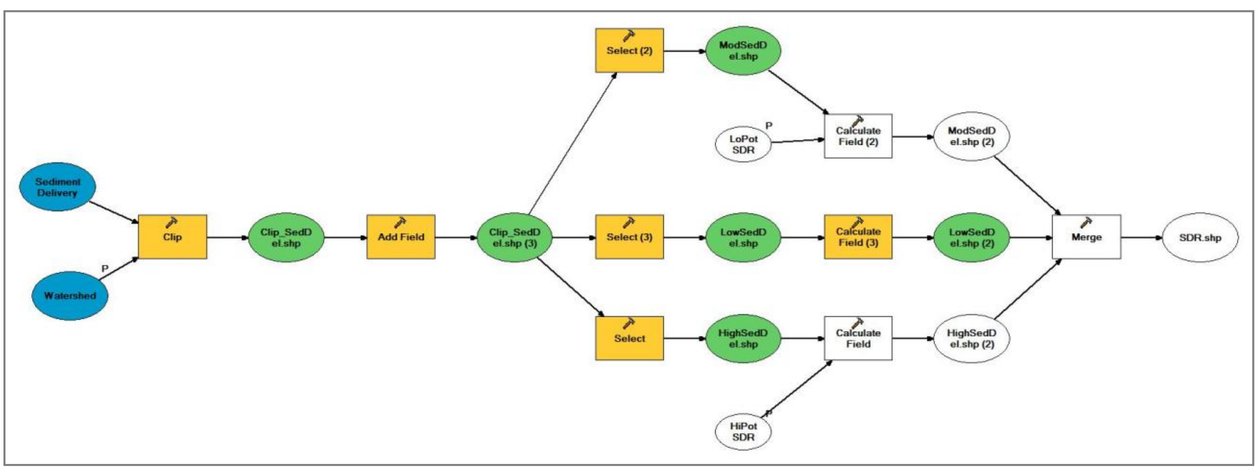
[2] Ramos-Scharrón CE, MacDonald LH, 2007. Measurement and prediction of erosion rates from natural and anthropogenic sources of sediment in St. John, U.S. Virgin Islands. *Catena Special Issue-Soil water erosion on rural areas,* 71: 250-266.

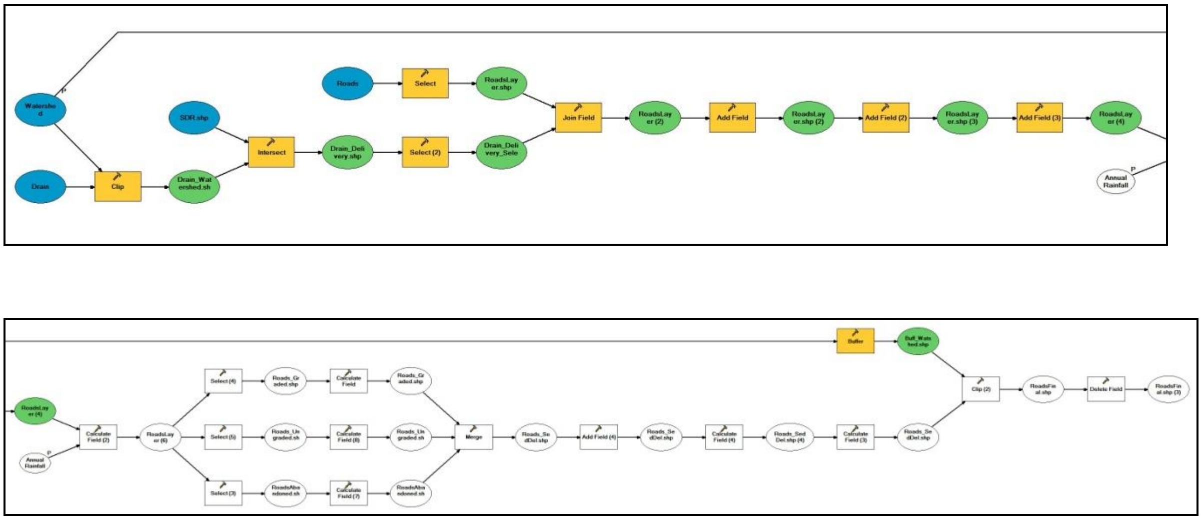
[3] Anderson J, Hardy E, Roach J, Witmer R. 1976. A Land Use and Land Cover Classification System for Use with Remote Sensor Data. *Geological Survey Professional Paper 964*.

Land-cover class	Description
1) Urban	Built-up lands, impermeable surfaces. This includes towns, cities, highways, shopping centers, commercial areas, residential areas, electrical power and transportation centers.
2) Agriculture	Areas designated for production of food and fiber. This includes crops, fallow lands, and confined feeding operations (cattle, poultry or hogs farms).
3) Rangeland	Areas where naturally occurring vegetation predominates, including grasses and shrubs.
3) Forest	Areas with dense concentration of trees, with 10% or more crown closure percentage
4) Wetland	Includes marshes, mudflats, and swamps, areas closely located bays, lakes, ponds or streams. Also include areas with either high or low wetland vegetation density.
5) Barren land	Land that is mostly uncovered, with less than one third of vegetation. Could be the result of natural processes (intense rain) or because it is 'in transition' to be developed or used for another activity.
6) Water	Areas that are covered by water, includes rivers, lakes, reservoirs, bays and estuaries.

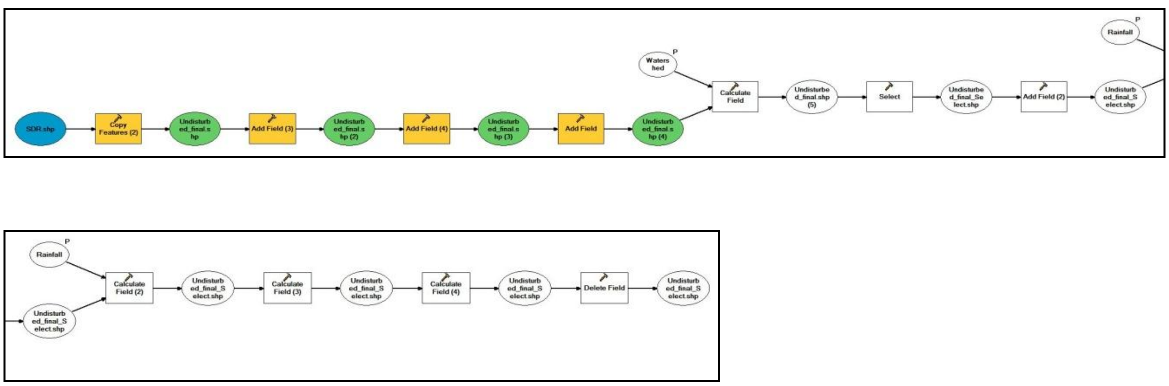
Several components of the GIS model have been completed so far as a series of routines developed using the Model Builder feature available within the ArcGIS 9.3 software package. These include a sediment delivery routine that assigns sediment delivery ratios to different sub-catchments, a road sediment contribution routine, and a routine to estimate contributions from undisturbed hillslopes. The model still needs routines to incorporate sediment sources such as construction sites (i.e., barren land). The algorithms that will be used by the model to estimate sediment production from the different land cover classes are pending final statistical analyses but the current GIS model structure has the flexibility to allow their incorporation.



Flowchart for routine that assigns sediment delivery ratios.



Flowchart for routine that calculates contribution from unpaved roads.



Flowchart for routine that calculates sediment contribution from undisturbed hillslopes.

b.2 Current problems or favorable developments

The project is currently behind its original timeline and this is due in part to the delay in obtaining the funds as originally scheduled and to the time it has taken to finalize laboratory and geospatial analyses. All laboratory, statistical, and historical land use analyses will be completed by Spring 2010. The GIS model will be completed by December 2009 and historical, watershed-scale sediment yield estimates will be available by the end of April 2010.

An important change in the original proposal is that we opted to substitute the development of one of the software applications with a new project objective. The PI for this project strongly believes that there is a reduced need for a new Windows-based software application to estimate sediment production rates from disturbed areas. The rationale for this decision is based on various factors, and this includes the availability of already existing and more comprehensive models (e.g., USFS WEPP) that appear to predict results that are very similar to those measured in dry tropical areas of the Virgin Islands [4]. The PI also believes that quantifying organic matter yields resulting from land disturbance is currently a very important topic due to its potential adverse effects on soil productivity, eutrophication of downstream aquatic habitats, and increasing atmospheric emission of soil carbon. It is important to clarify that the development and application of the GIS ArcTool component of the study will still be completed as originally proposed.

This project has benefited from the assistance provided by Mr. Josué Rodríguez. Mr. Rodríguez is an undergraduate student enrolled in the Environmental Sciences Program at UPR-Río Piedras and he was in charge of monitoring the field plots and conducting a significant portion of the laboratory analyses of both sediment and water samples collected from the erosion plots. Mr. Rodríguez' involvement in this project motivated him to develop a parallel study that will serve as the main topic of his undergraduate honor's thesis. The tentative title of Mr. Rodríguez' project is "*Organic matter yields from natural and disturbed surfaces in a dry tropical forest of southwestern Puerto Rico*" and it will add an important component not included in the initial proposal submitted to CCRI. Mr. Rodríguez will be completing his degree in the Summer 2010. This sub-project will try to determine if the factors that control the production of sediment from erosion plots (i.e., disturbance category, slope, vegetation cover density, and time since disturbance) also affect the production rates for organic material. Mr. Rodríguez co-authored a presentation with this PI at a special session titled 'Land disturbance and short term erosion processes' of the Geological Society of America 2008 Fall Conference in Houston-TX. Development of this new component of the study will allow us to publish at least one additional professional article that was not originally envisioned during the proposal writing stage.

b.3 Other significant information

N/A

2. APPLICATIONS

a. Publications, presentations, workshops

No new publications have resulted from the data collected as part of this CCRI-funded project. At least three publications are envisioned based on the research described here: 1) Description of runoff and sediment production at the plot-scale; 2) Description of organic matter production rates at the plot-scale; and 3) Land-use and long-term (1936-2008) sediment yields into La Parguera Bay from adjacent coastal watersheds.

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[4] Ramos-Scharrón CE, MacDonald LH. in prep. Effectiveness of an erosion control method in reducing sediment production rates from an unpaved road, St. John, U.S. Virgin Islands. To be submitted to *Journal of Soil and Water Conservation*.

Some recent publications and reports that the PI has released or is about to release since 2006 until the present include the following:

Journal Publications:

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 [pdf].

Ramos-Scharrón CE, MacDonald LH. 2007. Development and application of a GIS-based sediment budget model, *Journal of Environmental Management*, 84: 157-172 [pdf].

Ramos-Scharrón CE, MacDonald LH. 2007. Runoff and suspended sediment yields from an unpaved road segment, St. John, U.S. Virgin Islands, *Hydrological Processes,* 21(1): 35-50 [pdf].

Ramos-Scharrón CE, 2007. Maho Bay road erosion reduction project, St. John, US Virgin Islands. *Environmental Connection* 1(1): 18-20.

Forthcoming articles:

Fu B, Newham LTH, Ramos-Scharrón CE. 2010. A review of surface erosion and sediment delivery models for unsealed roads. *Environmental Modelling and Software* 25: 1-14.

Ramos-Scharrón CE, MacDonald LH. in prep. Effectiveness of an erosion control method in reducing sediment production rates from an unpaved road, St. John, U.S. Virgin Islands. To be submitted to *Journal of Soil and Water Conservation*.

Ramos-Scharrón CE, in prep. Controls on surface erosion rates from disturbed surfaces in a dry sub-tropical setting (Southwestern Puerto Rico). To be submitted to *Catena*.

Ramos-Scharrón CE, in prep. Anthropogenic effects on hillslope-scale runoff and sediment production on dry-tropical coastal watersheds of the Eastern Caribbean. To be submitted to *Journal of Hydrology*.

Miscellaneous:

Grove et al. [Ramos-Scharrón CE (editor)]. In prep. Assessment of Coastal Water Resources and Watershed Conditions at Virgin Islands National Park- St. John-USVI. Technical Report, Water Resources Division, National Park Service, 230 p.

Ramos-Scharrón CE. 2009. The effects of land development on sediment loading rates into the coastal waters of the islands of Culebra and Vieques. Submitted to the Coastal Zone Management Program, PR Dept. of Natural and Environmental Resources. 94 p.

Ramos-Scharrón CE. 2009. Qualitative assessment of sediment sources and guidelines for the design of a runoff and sediment yield monitoring strategy for the Body Ponds watershed, Antigua. Submitted to Environment-Tourism Consulting, St. John's, Antigua. 38 p.

Ramos-Scharrón CE, Lindsay K, Bacle JP. 2009. Erosion control strategy for the Fish Bay watershed. Final report submitted to the US Fish and Wildlife, Caribbean Region. 32 p [pdf].

Ramos-Scharrón CE, Rodríguez-Benítez J. 2008.Plot-scale sediment and organic matter yields from natural and disturbed surfaces in a dry subtropical forest of southwestern Puerto Rico. GSA Joint Annual Meeting Abstract No. 299-10.

Benavides-Solorio J de D, Ramos-Scharrón CE. 2007. Impacts of forest fires and roads on hydrologic and surface erosion processes of forested watersheds. In: Manejo Integrado de Cuencas Hidrológicas (In Spanish). *In:* Avances de investigación en agricultura sostenible IV: Bases metodológicas para el manejo integral de cuencas hidrológicas, Sánchez-Brito et al. (eds.). INIFAP, Centro de Investigación Regional Pacífico Centro. Michoacán, México, pp. 333-386.

Ramos-Scharrón CE, 2007. Sediment production from natural and disturbed surfaces in dry tropical areas of the Eastern Caribbean. Proceedings of the 7th Caribbean Island Water Resources Congress, Sangchul Hwang (Ed.), Univ. of the Virgin Islands Water Resources Research Institute, St Croix, USVI, pp. 26-30.

Ramos-Scharrón CE, Lindsay K, Bacle JP. 2007. Fish Bay Watershed assessment- Recommendations for an erosion control program. Submitted to the Gulf of Mexico Foundation and the National Fish & Wildlife Foundation [pdf].

Presentations

"Science in Translation: Application of hydrological research in the development of soil erosion control strategies in the US Virgin Islands and Puerto Rico". Department of Geography and the Environment, UT-Austin Seminar Series, 6 November 2009.

"Science in translation- Application of hydrologic research in the development of erosion control strategies for the Northeastern Caribbean." Special Seminar, Inter-agency Government Committee. St. Johns, Antigua, 8 January 2009.

"The effects of land development on runoff, sediment, and organic matter yields in a dry subtropical forest of southwestern Puerto Rico". 2008 End of the International Year of the Reef Symposium, Caribbean Coral Reef Institute, Rio Piedras-PR, 3 December 2008.

"Plot-scale sediment and organic matter yields from natural and disturbed surfaces in a dry subtropical forest of southwestern Puerto Rico". GSA Joint Annual Meeting, Houston-TX, 8 October 2008.

"Science in translation- Application of hydrologic research in the development of erosion control strategies for the US Virgin Islands and Puerto Rico." Semi-annual meeting of the Puerto Rico Federal and State Non-Point Sources of Pollution Inter-agency Committee. San Juan, PR, 11 June 2008.

"Sediment production from natural and disturbed surfaces in dry tropical areas of La Parguera, Puerto Rico, 2003-2005." 7th Caribbean Islands Water Resources Conference, St. Croix, USVI, 25 October 2007.

"Plot- and hillslope-scale sediment production from natural and disturbed surfaces in dry tropical areas of the Eastern Caribbean." AGU Fall Meeting, 11-16 December 2006.

"The Fish Bay watershed road erosion control project- Use of a Geographical Information System tool in the development of a sediment reduction program in St. John, U.S. Virgin Islands". U.S. Coral Reef Task Force 16th Meeting, St. Thomas, USVI, 24-28 October 2006.

"Progress Report: Development of software applications for assessing the effects of land disturbance on sediment yields". UPR-Caribbean Coral Reef Institute Principal Investigator Meeting, La Parguera, Puerto Rico, 4 August 2006.

b. Applications to management or research

The data collected from the CRES and CCRI studies will be combined with data collected from a previous study in St. John-USVI to improve an existing GIS-based sediment budget model (STJ-EROS), which will be applied to the Parguera area to document the changes in sediment production and delivery throughout the past 70 years.

The results of these three projects have been used in the development of the following research and erosion control programs:

2010-2012	Univ. of Puerto Rico Sea Grant College Research Program: "Application of the Soil and Water Assessment Tool (SWAT) to Estimate Discharge and Sediment Yields from the Río Grande de Añasco Watershed, Puerto Rico." (Principal investigator awarded).
2009-2011	PR Department of Natural and Environmental Resources- Coral Reef Conservation and Management Program: "Assessment of sediment inputs and marine habitat conditions form Laguna Joyuda to Punta Guaniquilla, Cabo Rojo." (Principal investigator, in review).
2009-2010	NOAA Coastal and Marine Habitat Restoration Project Grants, American Recovery and Reinvestment Act: "Coastal and marine habitat restoration through watershed stabilization- USVI." (Co-Project Manager, Co-Principal Investigator, awarded)
2008-2009	PR Department of Natural and Environmental Resources-Coastal Zone Management Program: "Development and application of an erosion control program to reduce sediment loading rates from land-based sources to the coral reefs of Culebra-Puerto Rico." (Program manager, in review).
2009-2011	Univ. of Puerto Rico-Caribbean Coral Reef Institute: "Long-term land use dynamics and erosion processes on the Río Fajardo watershed and its effects on coral reef communities". (Co-Principal Investigator, awarded)

2007-2009	PR Department of Natural and Environmental Resources: "The effects of land development on sediment loading rates into the coastal waters of the islands of Culebra and Vieques, Puerto Rico". (Principal Investigator, awarded, concluded)
2007-2008	U.S. Fish & Wildlife Service, Coastal Program, Caribbean Office: "Development and application of an erosion control strategy for the Fish Bay watershed, St. John, USVI". (Project Manager: awarded, concluded)
2006-2008	Univ. of Puerto Rico Sea Grant College, Seed-Money Program: "The effects of land development on sediment loading rates into coastal waters of Culebra, Puerto Rico". (Principal Investigator, awarded)
2006-2008	National Fish & Wildlife Foundation, Coral Reef Conservation Fund: "Fish Bay erosion control project". (Project Manager, awarded, concluded)
2006-2008	Gulf of Mexico Foundation: "Development and application of an erosion control strategy for the Fish Bay Watershed". (Project Manager; awarded, concluded).

c. Data and/or information products

Power point presentations and other reports available upon request.

d. Partnerships established with other federal, state, or local agencies, or other research institutions (other than those already described in the original proposal).

- All laboratory work for the current project has been conducted at UPR Extensión Agrícola soils lab in Río Piedras (Dr. Víctor Snyder), and this has led to the possibility of developing future erosion projects in collaboration with soil scientists and engineers affiliated to this program.

- Mr. Josué Rodríguez' honor's thesis is being co-chaired by Prof. Elvira Cuevas (Dept. of Biology-UPR Río Piedras) and is being evaluated by Prof. Molinelli and Prof. Rafael Ríos (Environmental Sciences Program-UPR Río Piedras) and they all have expressed interest in collaborating with this project's PI in the future.

- The PI has also developed partnerships with the PR-DNER Coastal Zone Program (Mr. Ernesto Díaz) and the PR-DNER Coral Reef Conservation and Management Program to assess the problem of unpaved road erosion and land development in Vieques, Culebra, and Cabo Rojo (Belvedere).

- In collaboration with IRF and Environment Tourism and Consulting, the PI has also completed a report titled: *'A qualitative assessment of sediment sources and guidelines for the design of a runoff and sediment yield monitoring strategy for the Body Ponds Watershed, Antigua'*. This was submitted as a component of a Global Environment Facility Project called: 'Demonstrating the Development and Implementation of a Sustainable Island Resource Management Mechanism in a Small Island Developing State'.

- The PI is also collaborating with Ms. Vilmaliz Rodríguez, a MS student from the Department of Geology working on a thesis titled "Spatial and temporal variations of suspended sediments in the Mayaguez Bay associated with land-based sources of sediment".

- A research proposal for the Rio Grande de Añasco watershed was recently awarded through the the UPR Sea Grant Program (2010-2012). This project will be done in collaboration with Prof. Fernando Gilbes, director of the GERS Lab affiliated to the Department of Geology, UPR-Mayaguez. The title of the project is: *'Application of the Soil and Water Assessment Tool Model (SWAT) to Estimate Discharge and Sediment Yields from the Río Grande de Añasco Watershed, Puerto Rico'*. The main goals of the project are to: 1) Apply the SWAT model to estimate water and suspended sediment discharge from the RGA watershed based on current land use conditions; 2) Validate and test model results based on existing water and sediment yield data; and 3) Understand the behavior of sediment plumes coming out of the RGA outlet once they enter the Añasco-Mayaguez Bay by use of remote sensing analyses.

- Other partnerships include collaborative agreements with the US Fish & Wildlife, National Fish & Wildlife Foundation, and the Gulf of Mexico Foundation to do a watershed assessment and implement an erosion control strategy in the Fish Bay watershed of St. John (organized by the Island Resources Foundation). This project has been included in the Eco-Index database kept by the Rainforest Alliance (http://www.eco-index.org/search/results.cfm?ProjectID=1170). In addition, a pair of proposals are currently under review competing for NOAA-ARRA awards and these include partnerships with UPR-Rio Piedras, UPR-CCRI, Coralations, the VI-Resources and Conservation and Development Council, VI-DPNR, Univ. of the Virgin Islands, and the Coral Bay Community Council, among others.

- There have been various requests for further information on the GIS application developed by the previously completed project in St. John-USVI (STJ-EROS) and that originating from this CCRI-funded project. These include: (1) Ms. Marissa Duff- MS Student from the Biological Systems Engineering Program at Virginia Tech who wishes to apply the model in an attempt to estimate sediment contributions from an unpaved road network in Brazil; (2) Ms. Chantale Bégin- PhD student from the Dept. of Biological Sciences at Simon Fraser University in British Columbia who wants to apply the model to several watersheds in St. Lucia and other islands of the Caribbean; and (3) Dr. Trent Biggs from the Department of Geography at San Diego State University who intends to apply the model to several watersheds in Tijuana-Mexico.

3. EXPENDITURES

The table below summarizes all project expenses up to the end of June 2007.

Fiscal Status Report for Year 1-
Caribbean Coral Reef Institute Project # R-IREF-10-07

EXPENSE CATEGORY	Budgeted Amount	Prior Exp. to 3/31/07	Current Exp. April-June 2007	TOTAL EXP. to 06/30/07
STAFF				
Carlos Ramos	18,000.00	14,280.00	6,510.00	**20,790.00**
Fringes @ 7.65%	1,377.00	1,092.43	498.02	**1,590.45**
SERVICES				
Students	6,000.00	4,176.00	999.00	**5,175.00**
TRAVEL				
Airfare	1,200.00	750.52	480.35	**1,230.87**
MATERIALS	2,600.00	2,119.73		**2,119.73**
OTHER DIRECT COSTS				
Communications, printing	200.00	169.74	77.35	**247.09**
Other (auto, lodging, etc.)	3,515.00	1,699.61	39.25	**1,738.86**
TOTAL DIRECT COSTS	32,892.00	24,288.03	8,603.97	**32,892.00**
INDIRECT COSTS (25%)	8,223.00	6,072.01	2,150.99	**8,223.00**
TOTAL PROJECT COSTS	**41,115.00**	**30,360.04**	**10,754.96**	**41,115.00**