

Collaborative Research: Landsliding, land use-change, and carbon dynamics in a Central American mountainscape (Carla Restrepo – University of Puerto Rico –Río Piedras and Anne Carey – Ohio State University)

## Summary

**Research Goals and Approach:** Landsliding is a dominant process that influences the short- and long-term dynamics of many steep landscapes worldwide. Complex interactions between ecosystem, geomorphic, and climatic processes most likely determine the integrated effect of landsliding on mountainscapes in at least two ways. First, landsliding contributes to the redistribution of plant biomass, soil, and regolith along the hillslope-fluvial system interface. Second, landsliding influences the rates at which ecosystems reorganize, soils develop, and bedrock weathers on the recently created substrates. Therefore, landsliding may play an important but unappreciated role in the large-scale dynamics of organic carbon through its effect on ecosystems and soil, the coupling between the hillslope and fluvial systems, and ultimately the residence time of carbon in mountainscapes. Deforestation and land-use change, however, may be currently influencing natural rates of landsliding, and this has the potential for altering the large-scale dynamics of carbon in mountainscapes. The overall goal of this proposal is to understand how ***land-use change in interaction with landsliding may modify the large-scale dynamics of carbon in tropical mountain systems***. Focusing on the hillslope system, and shallow landsliding in particular, as a major process transforming land cover in Sierra de Las Minas of Guatemala, this proposal has three specific aims, with individual hypotheses to address each of these

- 1) quantify the contribution of deforestation and shallow landsliding to land-cover change
- 2) assess the influence of land-use change on the coupling between shallow landslides and the fluvial system
- 3) estimate the size of carbon pools and fluxes associated with deforestation and landsliding

The proposed work relies on the analyses of multi-temporal remote sensed data to map landslides, forest and land-use types, the field characterization of vegetation and landslide deposits, and the spatial modeling of carbon in a geographic information system. This integrated approach will not only yield an improved understanding of the mechanisms underlying the formation of landslides in human-altered environments, but will also establish the relative contribution of deforestation and landsliding to the carbon cycle at yearly to decadal timescales.

**Intellectual Merit:** The proposed project will answer novel questions about regional causes and consequences of landsliding that inform both basic and applied science. Specifically, these results will contribute to *climate change*, *hazard assessment*, and *conservation*. First, results generated from this project will improve regional-scale estimates of carbon dynamics on timescales directly relevant to carbon mitigation projects. Second, in terms of *hazard assessment*, a better understanding of ways in which land use influences landsliding in tropical mountainscapes may help in the formulation of landslide susceptibility models with an increased predictive power. Lastly, in terms of *conservation*, a better understanding of the process of landsliding in natural ecosystems will help evaluate the impact of widespread landsliding in protected mountainscapes and set management protocols for these areas.

**Broader Impacts:** This project will contribute to the education of a new generation of scientists in an emergent field that recognizes important links between Ecology and Earth Sciences. This goal will be accomplished by engaging students traditionally under-represented in science across educational levels (undergraduate, graduate and postdoctoral) in fieldwork, satellite image analysis and modeling, and laboratory analyses. Students will benefit from the cross-cultural aspects of interdisciplinary scientific research in international settings. Two important

outreach activities will be developed during this project including the organization of a symposium-workshop entitled "Landslide Ecology-New Lessons from Tropical Mountains" during the 2011 meeting of the Association for Tropical Biology and Conservation and seminars at the Universidad del Valle (Guatemala) targeted at students, faculty, and professionals working at government institutions.