

Economic globalization is exerting an enormous impact on human and natural systems in Latin America and Caribbean (LAC). It is essential that we understand how these complex interactions behave; our response (e.g. land-use planning, conservation) will have impacts for generations. To address this challenge we propose a multi-disciplinary/multi-scale approach that will integrate global economic factors, with continental level changes in demography and land use in Latin America and Caribbean, and evaluate how these changes are affecting natural and human systems at the continental, country, and municipality scales. Specifically we will explore how demographic factors (e.g., rapid urbanization, international migration, falling rural fertility and mortality) economic factors (e.g. expansion of non-agricultural industries, decreasing price of agricultural produce, emigrant remittances, emergence of large-scale modern agriculture, and increasing global demand for food and petroleum alternatives), and ecological factors (e.g., ecoregion, slope, and soils) will affect land-use patterns. We expect to identify two major patterns: 1) extensive conversion of natural ecosystems to modern agriculture, particularly in areas with little topographic relief, and 2) abandonment of marginal agricultural and grazing lands, particularly in mountainous and remote regions, permitting ecosystem recovery. We anticipate that this dual trend will be most evident in countries and regions further along the demographic and economic transition axes, while developing nations and regions lagging in these transitions will experience relatively less intensification of lands through modern farming techniques and relatively more continued conversion of mountainous regions and remote frontiers.

To address these hypotheses we will combine demographic and socio-economic data from >18,000 municipalities (1980-2000) across LAC with land-use change based on vegetation index (NDVI and EVI) from AVHRR and MODIS sensors (1980-2011). Our hypotheses will be tested with two-level multivariate regression, which will identify significant associations at the municipal and national levels. We will complement these continental and country level analyses with rapid assessment of ecosystem recovery and interviews with community and municipal leaders, government officials and members of local non-governmental organizations. These local scale analyses will be conducted in at least four focal countries (e.g. Puerto Rico, Dominican Republic, Mexico, Guatemala, Peru, and Argentina).

Intellectual Merit: By integrating economic, demographic, environmental, land use, ecosystem recovery and interview data from continental to local scales, we will have enormous predictive power for creating models to facilitate economic development, land-use planning, and conservation strategies. To our knowledge, no other study has taken advantage of international databases, satellite imagery, and modeling tools to understand how these complex systems interact. To accomplish this we have assembled a team that has strengths in demography, geography, remote sensing, ecology, and modeling. Furthermore, all senior personnel have a history of working on a diversity of LAC research themes that often cross academic fields,

Broader impacts: The detailed, geographically extensive, and long-term data produced in this project will stimulate research questions that previously could not be addressed. Along with a series of workshops, we will also offer three 3-week summer courses for advanced undergraduates and graduate students. University of Puerto Rico is a minority institution and Sonoma State University is a relatively small university with a focus on liberal arts education. All students will receive an interdisciplinary training, and will be encouraged to conduct individual research projects. In the countries where we will conduct the ecosystem recovery research, interviews, and summer field courses, we will make a special effort to provide the local government agencies and NGOs with the data, maps, and results, and to assist them in a future scenario analysis of the region. A major contribution of the project to society will be a detailed database that integrates socioeconomic, demographic, land-use and ecosystem data, which will greatly facilitate regional to local planning. Another important benefit will be the development of young interdisciplinary scientists. Environmental problems are complex, and even when multidisciplinary groups are assembled, the success of these teams depends on a few key people that have cross-disciplinary experience.