

sDiv Workshop Summary "From water to land – SESYN 18"

Playing dominoes with tipping points? Exploring the linkages between anthropogenically-driven shifts in marine and terrestrial biodiversity and ESS in a rapidly globalizing coastal region within a biodiversity hotspot.

Summary

We seek to expand understanding of the ways in which increased market integration, new technologies, and demographic change impacts biological diversity, ecosystem services (ESS), and resource valuation in historically isolated coastal ecosystems. In coastal ecosystems (which are included within most of the world's biodiversity hotspots) resource use is characteristically diverse. Thus, accurately capturing the dynamics of these coupled human-natural systems under change requires analyses that move beyond identifying the relationships between humans and a singular natural system to explicitly consider the ways in which resource loss in one system (e.g., a marine system) may spillover to alter ESS use and valuation in another system (e.g., a terrestrial system). The Pearl Lagoon Basin, Atlantic Nicaragua, a coastal human-natural system situated within the Mesoamerica Biodiversity Hotspot, is uniquely well-suited for examining the mechanisms and consequences of rapid change on coupled marine and terrestrial ecosystems.

Historically, the Basin's communities have relied largely on their natural resource base for subsistence. The Basin is currently undergoing accelerated globalization following the 2007 completion of the region's first transnational road, while simultaneously experiencing rapid fishery decline. These changes appear to be affecting terrestrial ecosystem resource perception and use in an area historically characterized both by rich agricultural and unmanaged biodiversity. This research will draw from a suite of ecological, ethnographic, demographic, and economic data collected over four decades to identify which factors correlate with changes in terrestrial diversity and ESS across scales and to determine whether current policies are acting to conserve, enhance, or diminish them.

Goals

The iDiv meeting in June, 2014 was our Biodiversity and Ecosystem Services working group's second session. The overall goals of our group are to synthesize a suite of ecological, ethnographic, demographic, and economic data separately collected by our group members over the past decade in the Peal Lagoon Basin in Atlantic Nicaragua. Our overarching goals are to identify which ecological, demographic, and socioeconomic factors (at the household and community level) correlate with altered terrestrial biodiversity and ecosystem service use and to scale these relationships up to the regional level.

During the meeting, our immediate goals were:

- (1) To identify specific overlap of households among the household, fishery, and farming surveys completed by our different team members;
- (2) To combine landscape-level land use change information with biogeochemical analyses to project how land use affects terrestrial carbon sequestration; and
- (3) To define biodiversity metrics (e.g. phylogenetic, functional, abundance) we will use to assess the relationship between various demographic/spatial factors and agrobiodiversity.

During the iDiv workshop, we successfully linked the household, agricultural, and fisheries data and began to explore trends in shifting household livelihood strategies and connectivity to the recently completed road, NGOs, fishery status, and other socio-ecological factors. We finalized which agrobiodiversity metrics will be used to assess how proximity to the road, age and size of farm, engagement with agricultural NGOs, livelihood diversity, and a suite of other socio-ecological co-factors correlate with agrobiodiversity maintenance and began to complete these analyses. We also completed GIS image classification using regional images taken from the 1970s to present, which in conjunction with newly collected biogeochemical data, will be used as drivers in the InVEST terrestrial carbon stock model (www.naturalcapitalproject.org/models/models.html) to project how land use change affects Basin terrestrial carbon pools.

The working group time was evenly split between discussion and data analysis. Participating in the iDiv workshop helped us to develop a strong foundation for continued work on synthesizing our extensive social and ecological data sets on the Pearl Lagoon Basin of Atlantic Nicaragua.

We outlined several manuscripts, including:

- (1) An comparison of agrobiodiversity across three biodiversity metrics;
- (2) Assessing whether fishery depletion and increased globalization is correlated with a shift in livelihood balance between reliance on fishing and farming;
- (3) Modeling how land use change in the region affects soil carbon pools; and
- (4) A synthesis paper on the feedbacks between aquatic and terrestrial ecosystem services in rapidly globalizing coastal regions.

These manuscripts will include the efforts of two new collaborators: a PhD candidate in the Department of Integrative Biology, University of California, Berkeley and a staff scientist in the Remote Sensing Lab of The Center for Global Change and Earth Observations, Michigan State University.

In order to introduce iDiv and sDiv researchers to the context of our research questions, Dr. Urquhart gave a public presentation entitled, "Exploring Linkages Between Biodiversity and Human Activities on the Caribbean Coast of Nicaragua." This talk detailed the use of camera traps to estimate

mammalian densities across the Pearl Lagoon Basin, Nicaragua (including both forested and disturbed areas near farms, villages, and a recently completed road). The presentation highlighted the plight of the Baird's tapir, a critically endangered species found in Atlantic Nicaragua. Dr. Urquhart is involved in a collaborative project with the Nicaraguan National Zoo, The Caribbean Coast Regional Autonomous University (URACCAN), Michigan State University, and the Foundation for the Autonomy and Development of the Atlantic Coast of Nicaragua (FADCANIC) to help conserve this species which is the largest indigenous mammal in Central America and critical for tropical forest health.

The meeting concluded with setting a timeline for completing the defined analyses through the end of 2014 and scheduling our next working group sessions. Over the coming months, we will draft at least one manuscript and continue to work on our synthesis efforts prior to the next group meeting in early 2015.