

Fragmented Forests embedded within the Agricultural Matrix: Evaluating Social-Ecological Interactions in the San Juan La Selva Biological Corridor, Costa Rica

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1. Rationale:

- Tropical forests cover less than 23% of the earth's surface, contain over 50% of its biodiversity and provide essential ecosystem services to the entire globe (1).
- Massive conversion of tropical ecosystems to agriculture has caused widespread habitat loss and fragmentation and created human-dominated landscapes composed of patches of remnant forest embedded in an agricultural matrix.
- A new concerning trend has emerged: land in the agricultural matrix previously occupied by pasture or subsistence crops (a more heterogeneous land cover) is rapidly being converted to intensive plantation agriculture (3,4,5).
- In Latin America, the past 25 years have been characterized by dramatic expansion of nontraditional agricultural exports (NTAE) as the primary mode of economic development in rural regions (6).
- Impacts of intensive agriculture on social and ecological systems in the tropics are largely unknown.
- To achieve and sustain a resilient balance between conservation and human needs, we must understand the links between remnant forest patches, the agricultural matrix, and the local communities whose land use decisions determine matrix composition (7,8).**

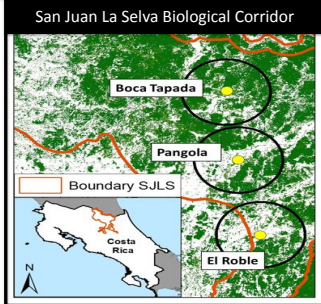
2. Aim: Our interdisciplinary research is designed to understand:

- How underlying (regional-scale) and proximate (local-scale) factors affect household land use decisions,
- How changes in land use affect forest structure and function,
- How changes in forest structure and function affect the provision of ecosystem services

3. Study Site:

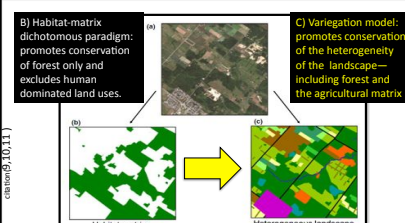
- This region began to be settled and deforested in the 1950s 1960s.
- As of 2001, 56% of the San Juan La Selva's (SJLS) 246,608 hectares remained forested and is now protected (12).
- This forest provides critical habitat for more than a hundred species of mammals, birds and reptiles and thousands of plant and tree species (13).
- Land use for pineapple in Costa Rica more than tripled between 2000 and 2006 to an estimated 38,500 hectares (14).
- Exports nearly doubled in the same time period, with approximately 90% of exports destined to either the U.S. or Europe.
- Costa Rica is currently the largest pineapple exporter in the world (15).
- The SJLS region accounts for 51% of Costa Rica's pineapple production

Site Selection: We used PCA analysis to choose 3 communities: Boca Tapada, Pangola, and El Roble representing a gradient of forest cover and NTAE (ex. pineapple) production.



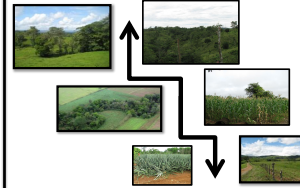
- Citations:
- Mace et al. 2005
 - Lambin et al. 2003
 - Morton et al. 2006
 - Scheffas & Sanchez-Azofeifa 2006
 - Gallford et al. 2010
 - Kay 2008
 - Chaston et al. 2009
 - Collier et al. 2010
 - Fahrig et al. 2010
 - Fischer and Lindenmeyer 2006
 - McIntyre & Barrett, 1992
 - Villate et al. 2009
 - OTF 2010
 - SEPSA 2007
 - Vagneron et al. 2009

4. Approach: Biodiversity Conservation in the Agricultural Matrix –A New Paradigm



- Deforestation and agricultural expansion result in forest fragments surrounded by a heterogeneous mosaic of agricultural land use types—an agricultural matrix.
- Forest fragmentation has direct and indirect impacts on biodiversity.
- The matrix may be itself an important biodiversity reservoir and can provide connectivity between fragments..

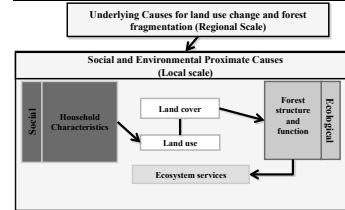
More like forest = More permeable land use



Less like forest = Less permeable

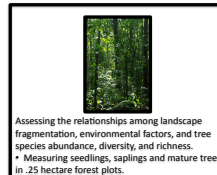
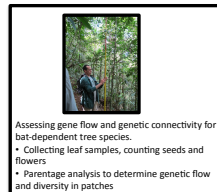
- Species movement and forest connectivity, is determined in part by the permeability of the matrix or how structurally and compositionally similar the land use is to remnant forest patches.

Conceptual Framework



Our conceptual framework describes the connections between the social and ecological systems in this landscape. Household characteristics are translated into the landscape structure through land use decisions. Land use decisions determine land cover in the agricultural matrix. Changes in matrix land cover influence forest structure and function by modifying regional species pools and affecting functional connectivity between patches. Ecosystem services (biodiversity conservation, carbon sequestration, and water storage) are dependent on components of forest structure and function.

5. Interdisciplinary Team Research:



Interdisciplinary Coordination at the Landscape Level



- Ecological research occurs in the forest patches surround by different agricultural land use types.
- Social research occurs in the landowners' households.

