Quantifying linkages among land-use policies, agricultural intensification, habitat fragmentation, and social-ecological systems in a neotropical biological corridor

Doctoral Students: Cleary, K., Shaver, I., Chain, A., Sanfiorenzo, A., Santiago, R.

1. Rationale
- Tropical forests cover <23% of the earth’s surface, but contain >50% of its biodiversity and provide essential ecosystem services (1).
- Massive conversion of tropical forests to agriculture has created human-dominated landscapes composed of patches of remnant forest embedded in an agricultural matrix (2).
- In Costa Rica, this matrix was historically dominated by food crops and pasture (2). Recently, these are being replaced by intensive (per hectare) plantations of non-traditional agricultural exports (NTAEs) such as oil palm, banana, and pineapple (3).
- For the past 25 years, the expansion of NTAEs has been the primary mode of economic development in rural regions (4).
- Impacts of NTAEs on the long-term resilience of social and ecological systems is unknown (5).
- Our goal: improve understanding of how large-scale policy trends drive rapid land use change in tropical landscapes, especially conversion to NTAEs, and how this process alters the links between social and ecological resilience in these landscapes.

2. Study Site: San Juan-La Selva Biological Corridor
- 246,608 ha.
- 56% forest cover (6).
- Contains 92 towns.
- Goals: 1. Protect biodiversity and habitat connectivity. 2. Support sustainable livelihoods and community involvement conservation.

3. Conceptual Model & Research Questions
- Non-traditional Agricultural Export Policies
  - Question Set 1: What national policies led to the establishment and spread of intensive (per ha) non-traditional export crops?
- Agricultural Intensification
  - Question Set 2: At the local scale of 3 focal communities, what is the status of the social and ecological indicators of resilience? Are communities with higher agricultural intensification more resilient than communities where it is lower?
- Ecological Resilience
  - Question Set 3: At the regional scale of the S1LS, how will current and alternative policy scenarios affect future land use, and how will future land use patterns affect ecological resilience?
- Question Set 4: How does future scenario modeling influence the perceptions of community members and land managers about social and ecological resilience and their interconnectedness?
- Participants will perceptually link social and ecological resilience more tightly after the stakeholder workshops than prior to workshop engagement.

4. Interdisciplinary Methods & Products
- Social resilience: Indicators of social resilience will be evaluated through interviews with large land holders and policy makers, interviews with households, and comprehensive review of relevant census data and gray literature.
- Ecological resilience 1: Forests and forest regeneration
  - Assessment of functional trait diversity and structure of old-growth and secondary forests will permit understanding of environmental, spatial and human factors determining community assembly and rates of forest recovery.
- Ecological resilience 2: Genetic connectivity of understory trees and their seed-dispersing bats
  - Assessment of population genetic structure and genetic connectivity for the participants in this bat-plant mutualism will permit a direct evaluation of the critical connectivity and genetic diversity components of ecological resilience.

References
1. Mace, G. et al. 2005. MPA
5. Brannstrom, C. 2009. AMBIO

Funded by:
University of Idaho Stillinger Fellowship

1. Rationale
- Tropical forests cover <23% of the earth’s surface, but contain >50% of its biodiversity and provide essential ecosystem services (1).
- Massive conversion of tropical forests to agriculture has created human-dominated landscapes composed of patches of remnant forest embedded in an agricultural matrix (2).
- In Costa Rica, this matrix was historically dominated by food crops and pasture (2). Recently, these are being replaced by intensive (per hectare) plantations of non-traditional agricultural exports (NTAEs) such as oil palm, banana, and pineapple (3).
- For the past 25 years, the expansion of NTAEs has been the primary mode of economic development in rural regions (4).
- Impacts of NTAEs on the long-term resilience of social and ecological systems is unknown (5).
- Our goal: improve understanding of how large-scale policy trends drive rapid land use change in tropical landscapes, especially conversion to NTAEs, and how this process alters the links between social and ecological resilience in these landscapes.

2. Study Site: San Juan-La Selva Biological Corridor
- 246,608 ha.
- 56% forest cover (6).
- Contains 92 towns.
- Goals: 1. Protect biodiversity and habitat connectivity. 2. Support sustainable livelihoods and community involvement conservation.

3. Conceptual Model & Research Questions
- Non-traditional Agricultural Export Policies
  - Question Set 1: What national policies led to the establishment and spread of intensive (per ha) non-traditional export crops?
- Agricultural Intensification
  - Question Set 2: At the local scale of 3 focal communities, what is the status of the social and ecological indicators of resilience? Are communities with higher agricultural intensification more resilient than communities where it is lower?
- Ecological Resilience
  - Question Set 3: At the regional scale of the S1LS, how will current and alternative policy scenarios affect future land use, and how will future land use patterns affect ecological resilience?
- Question Set 4: How does future scenario modeling influence the perceptions of community members and land managers about social and ecological resilience and their interconnectedness?
- Participants will perceptually link social and ecological resilience more tightly after the stakeholder workshops than prior to workshop engagement.

4. Interdisciplinary Methods & Products
- Social resilience: Indicators of social resilience will be evaluated through interviews with large land holders and policy makers, interviews with households, and comprehensive review of relevant census data and gray literature.
- Ecological resilience 1: Forests and forest regeneration
  - Assessment of functional trait diversity and structure of old-growth and secondary forests will permit understanding of environmental, spatial and human factors determining community assembly and rates of forest recovery.
- Ecological resilience 2: Genetic connectivity of understory trees and their seed-dispersing bats
  - Assessment of population genetic structure and genetic connectivity for the participants in this bat-plant mutualism will permit a direct evaluation of the critical connectivity and genetic diversity components of ecological resilience.

References
1. Mace, G. et al. 2005. MPA
5. Brannstrom, C. 2009. AMBIO

Funded by:
University of Idaho Stillinger Fellowship