Human community dynamics and social-ecological vulnerability in a biodiversity hotspot

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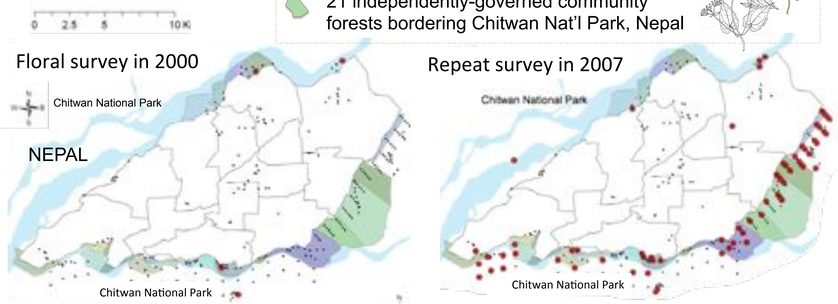
What factors lead to vulnerability of community forest socio-ecosystems to the catastrophic effects of unexpected natural events?

Hypothesis: Community forest vulnerability depends on both ecological & social factors, especially household relationships with **non-family organizations (NFOs).**

*Current theory posits that strong, collectively-managed and flexible institutions lead to social-ecological resilience following abrupt change. But what factors lead to strong institutions and flexible collective governance? Rural-to-urban transitioning societies tend to experience a proliferation of NFOs, including schools, stores, religious centers, health clinics, and employers – all of which are a source of **new ideas**. We hypothesize that community access and exposure to NFOs underlies successful forest management activities that buffer community forest (CF) socio-ecosystem from rapid environmental change.*

The problem:

- Presence of exotic, invasive plants, including 'Mile-a-minute weed', *Mikania micrantha*
- 21 independently-governed community forests bordering Chitwan Nat'l Park, Nepal



Mikania degrades endangered one-horned rhino and Bengal tiger habitat, and community forest resources on which rural communities depend. It spreads from wind-borne seeds and dropped stems after disturbance (floods, fire, and resource harvest behavior). *Mikania* can be successfully controlled manually by pulling and careful bagging – but this activity requires highly coordinated, organized forest management.

All community forest user groups in the Chitwan Nat'l Park buffer zone are concerned about *Mikania*, but invasion has led to more devastating outcomes in some community forests much more than others.

Why?

The plan:

Phase 1: **Survey** of *Mikania* invasion, biophysical variables, household resource use and location, community forest governance and management, and household access to NFOs.

Phase 2: **Social-ecological experiment**. Tmt group: Half of the community forest management committees receive training on *Mikania* control and prevention in year 1. Control group: The other community forest management committes receive no training (but will eventually be trained in year 3). Response variable: Before and after surveys of *Mikania* spread.

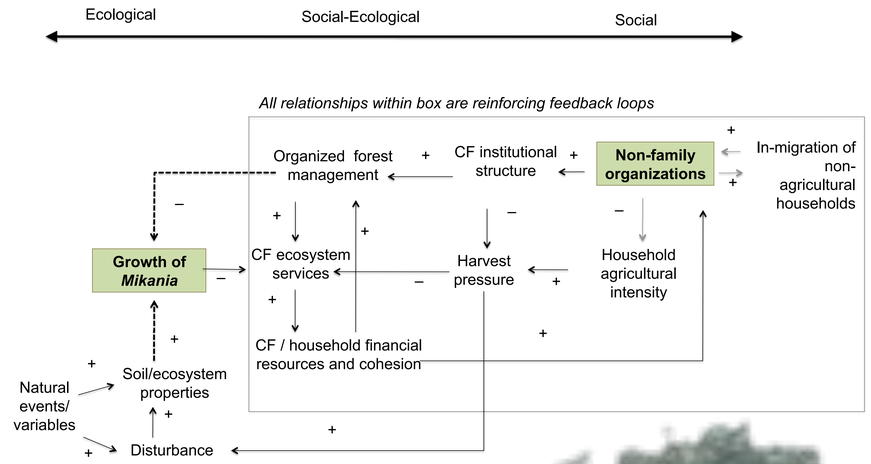
Phase 3: **Agent-based modeling** to test hypotheses and scenarios.

Hypotheses:

- Community forest (CF) socio-ecosystems are subject to a tipping point of exotic species invasion, after which ecosystem services and governance are unable to recover. This critical threshold of invasion will vary depending on social and endogenous ecological characteristics of the community forest socio-ecosystem.
- The success of community forest management in controlling invasive species, (tested through the social-ecological experiment) depends on the relative strength of changeable, social factors (e.g. NFOs and governance) and embedded, less changeable biophysical factors.

Knowledge of the feedbacks and interactions between households, governance institutions, NFOs, and the environment will help determine where intervention efforts may be most effective.

Hypothesized community forest socio-ecosystem in the buffer zone of Chitwan Nat'l Park, Nepal. (–) symbols represent inverse relationships (connected factors move in opposite directions); (+) symbols represent positive relationships (connected factors move in the same direction).



Dynamics of Coupled Natural and Human Systems Program