Perceptions of invasive species management: a case study in Chitwan, Nepal

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Question: How can we determine ecologically and socially feasible management techniques to control invasive species?

Effects of invasive species

Invasive species have been transformative throughout the world and are considered one of the main threats to biodiversity following habitat fragmentation. Invasive plant species in particular are capable of reducing species diversity and altering ecosystem services that contribute vital resources to rural livelihoods. Native plants of cultural, medicinal and construction purposes are especially important to livelihoods and are threatened by invasive species.

Plants of cultural importance

Medicinal plants

Thatch and fodder plants

Study location

The maintenance of plant diversity and community structure is of particular importance in areas like the community forests of Chitwan, Nepal (Fig. 1). This area is considered a biodiversity hotspot and sustains habitat for multiple endangered species.

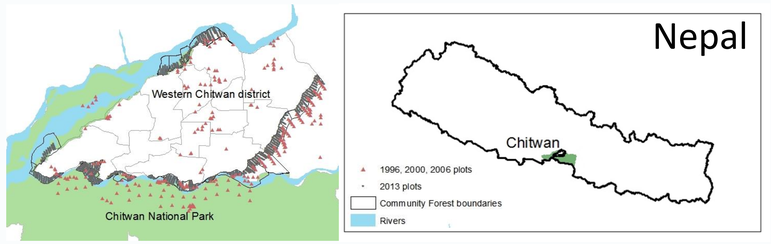

Figure 1. Location of ecological study plots monitoring the spread of invasive plant species throughout the 21 community forests.

Invading species of concern

Mikania micrantha and *Chromolaena odorata* are two highly invasive species included in IUCN's database of "100 of the world's worst alien invasive species." They have significantly increased their distribution across the community forests for the past 20 years (Fig. 2). *Mikania micrantha*, a fast-growing allelopathic vine species native to Central and South America, has been rapidly invading ecosystems in sub-tropical Nepal. Additionally, *Chromolaena odorata*, a shrub species known for its toxicity to cattle, is a species of concern in the national park and surrounding forests.

Chromolaena odorata: multi-stemmed perennial shrub, can grow up to 2.5 meters in height.

Mikania micrantha: climbing vine species capable of rapid growth and high seed production.

Current species distribution: in the community forests of Chitwan, Nepal, the abundance of invasive species has significantly increased over the past 20 years

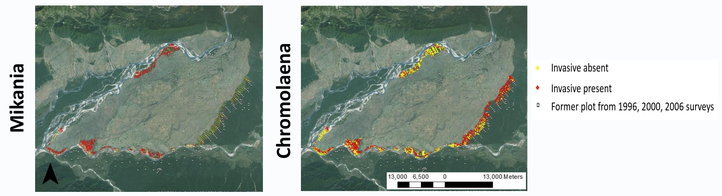

Figure 2: Presence of invasive species, *M. micrantha* and *C. odorata*, in 2013. Red circles indicate the current distribution of the invasive species.

Ecological experimental design

We are comparing the effectiveness of methods based on those currently used by local people to control the spread of *Mikania micrantha* and *Chromolaena odorata*. These include two techniques that are widely used by residents, burning and hand-pulling, and a third reduced burning and modified hand-pulling technique ("bag-and-bury") that is a targeted and meticulous removal process requiring uprooting of the entire plant and burying remnants to prevent re-establishment.

Community forest with invasive creeping vines.

Community members harvesting from the forests in Chitwan.

Even the most ecologically effective control techniques will never be successful without proper implementation and community support. Thus, our study seeks to understand the following question:

How will perception/attitudes towards current invasive species management facilitate or impede cooperation among forest members to actively manage invasive species in the future?

Social survey experimental design

We will distribute a survey to 50 household members to evaluate the influence of education and socio-demographic factors on people's attitudes and perceptions towards traditional and modified management regimes in the study region.

In order to understand the construct, **perceptions of invasive species management**, we will employ a multi-level model evaluating individual behaviors and attitudes of those who predominantly enter and harvest in the forest (women and adolescents), household level and community group/member perceptions.

Independent variables	Dependent variables
Demographics, nearness of residence to community forest, reliance on community forest natural resources, longevity of residence	Interest in management activities, familiarity with invasive plants, trust in community forest members and leaders, household level participation in community forest activities

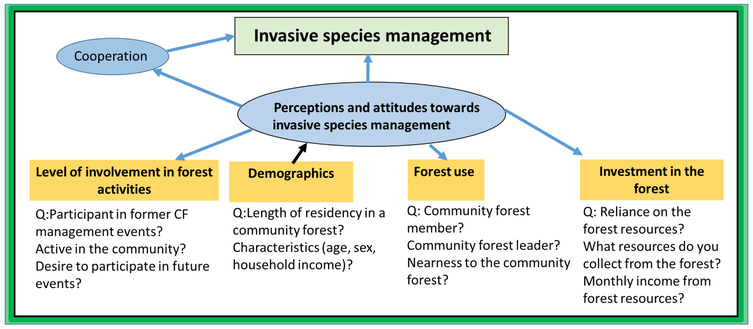

Figure 3. A conceptual model showing the linkages between the latent construct variables of interest (blue circles) and the management of invasive species. Yellow boxes are the observed variables we can collect through surveys to represent the latent construct variables. Arrows indicate directional relationships between the variables.

Hypotheses

We hypothesize the level of support for modified control techniques will be higher for people who have participated in "forest cleaning" events in the past and for respondents with high dependence on the forest resources.

- H1: People who are more involved in forest activities (have directly participated in former cleaning events) are more likely to view those events as successful and beneficial to species management.
- H2: People who do not live near the forest or those have no investment in the forest are unlikely to participate in future management events.
- H3: Women and adolescents are more likely to have been involved in 'forest cleaning' events in the past while gathering resources, so they are more likely to view management as important and necessary.

Ecological field surveyors and social survey team in Chitwan, Nepal

These hypotheses will be evaluated through multiple regression analyses in order to determine the variables that correspond to a greater propensity to implement new management strategies. We will also test differences in perceptions between user groups, forest members and non-members.

Future directions and conclusions

Modified control techniques are more likely to be ecologically successful in achieving management goals, but are more labor intensive and require meticulous attention to species removal. Identifying successful control techniques to combat invasive species establishment is of great importance to management programs. It is likely, that members who depend on natural resources from the forests will have a greater propensity to engage in management activities.

This research aims to understand public attitudes to determine whether current perceptions facilitate or impede cooperation among community members and their chosen management activities.

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