Household Food Security and Natural Capital in Nepal

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Food Security Defined

"Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" - World Food Summit 1996, 2002

Key Consequences of Reduced Food Security
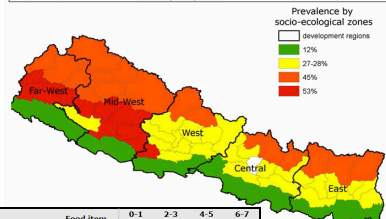
- Difficulty breaking poverty cycle
- Lower Education Achievements
- Reductions in Productivity
- Human Rights Violations

Food Security in Nepal

- 30% of the rural population does not have access to regular nutritious food (WFP, 2006)
- Seasonal food production (lean period: 2 weeks-2 months)
- Shocks: Natural (flooding, drought), Social (conflict)
- Poor education (64% with lowest food intake do not go to school)
- 50%-60% of children in poor food consumption households have stunting

Weekly intake for Poor Food Consumption Level (11% of population)

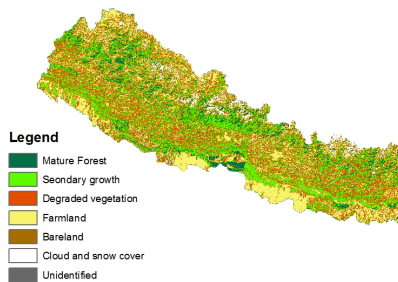Weekly intake for Very Good Food Consumption Level (3% of Population)

Natural Capital

The stock of natural ecosystems that provide a flow of ecosystem good and services defines natural capital. This study focuses on the role that natural capital quality plays in influencing household food security. Environmental degradation has been shown in several studies to be an important factor in maintaining food security (Baro and Deubel, 2006; Misselhorn, 2005; Feleke et al., 2005). Two general mechanisms by which degraded natural capital may influence food security are by

1) Directly influencing the productivity of farms in a region
2) Limiting the ability of residents of a location to generate an adequate income (from agriculture activities or in other industries).

Land Cover in Nepal

To capture the state of natural capital in Nepal we have measured the levels of forest degradation. Forest quality is considered an important measure of the available natural capital in an area. Along with elevation, soil quality, and other factors, forest degradation may also contribute to such things as soil erosion and flooding. This is another pa may have more direct impacts on agriculture production.

The map below shows the Village District Committees (VDCs) and land cover of Nepal.

Legend
- Mature Forest
- Secondary growth
- Degraded vegetation
- Farmland
- Bareland
- Cloud and snow cover
- Unidentified

Our measure of non-forest cover is measured as a percentage of total area that is either bare land or degraded vegetation. Alternatively, we have created a forested index, which includes both the mature forest and secondary growth.

Spatial Analysis

The hypothesis of the study is that those households in a VDC with less forest cover, weaker natural capital, will have higher food security levels. Additionally, we expect a spatial element of deforestation to be important. Therefore, we also take into account the land degradation in (5km, 10km, 20km, 30km, 40km, and 50km) buffers around the VDCs. These are seen below.

40 km buffer

10 km buffer
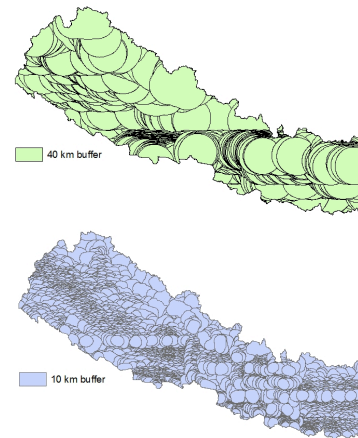
Additional Determinants of Food Security

Several additional indicators of food security are also incorporated into this study. These include household wealth, education level, social caste, ecological zone, levels of conflict in Nepal, and road density (per VDC). Below is a map of the primary roads throughout Nepal. Improved access to roads is likely to increase access to markets, improving food security.

main
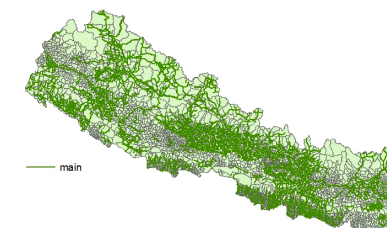
Econometric Modeling

The study uses a food security index based on the level of food consumption of each food type. This, along with the natural capital measures, and additional explanatory variables, are incorporated into an econometric model.

We consider the multi-level effects of both household level characteristics (i) and those at the VDC level (j). This is important, as the error term is effect by both individual household effects and VDC effects. Therefore, our general model is as follows:

$$\text{Food Index}_{ij} = \beta_{0j} + \beta_1 \mathbf{X}_{ij} + \varepsilon_{ij}$$
$$\beta_{0j} = \beta_0 + u_{0j} \qquad u_{0j} \sim N(0, \tau_0)$$

Initial Results

Dep Variable: Food Index	Model 1	Model 2	Model 3	Model 4
DEFOREST	-0.466*	-0.418	-0.442*	-0.519*
	-0.2	-0.22	-0.19	-0.2
WEALTH	-0.054	-0.055	-0.032	-0.036
	-0.04	-0.04	-0.04	-0.04
VDC POPULATION	0.232	0.225	0.258*	0.272**
	-0.12	-0.12	-0.1	-0.1
HH LANDSIZE	0.148***	0.147***	0.135***	0.126***
	-0.03	-0.03	-0.04	-0.04
HH OWNSEEDS	0.008	0.014	0.008	0.007
	-0.04	-0.04	-0.04	-0.04
VDC CONFLICT		-0.143**	-0.139***	-0.118***
		-0.05	-0.04	-0.04
HH JANJATI			-0.589***	-0.581***
			-0.08	-0.08
HH DALIT			-0.378***	-0.368***
			-0.1	-0.11
HH WATERDIST				-0.085*
				-0.04
VDC ROAD DENSITY				0.066
				-0.06
N	1672	1672	1672	1672

- Our forest cover spatial index is significant, showing a decrease in the food security index (worsening availability of food) in those households located in more degraded areas. Also significant are the caste measurements.
- Conflict, measured as total kills per VDC, also has a negative impact on food security.
- Lower caste households (Janjati and Dalit) are seen to have lower levels of food security.
- The further the distance a household must travel to reach a clean water source (WATERDIST), decreases food security.
- The land size available to household (LANDSIZE) is positively related to food security.

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