Livelihood Vulnerability Approach to Assess Climate Change Impacts to the Smallholder Farmers around the Gandaki River Basin of Nepal Himalaya

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Introduction

The climate of the Himalayan region is changing rapidly. Decreasing glacier and snow cover are the visible evidences of the change in temperature and precipitation pattern in the Himalayan region. Nepal is considered the fourth most vulnerable country to the impacts of climate change (Maplecroft, 2007), partly due to the reliance of most of the population on cropping and livestock raising for their livelihood (IPCC, 2007). There are few studies on how vulnerable mixed agro-livestock smallholders are and how their vulnerability differs across different ecological regions. It is essential to understand different factors and their impacts on livelihoods for developing adaptation strategies.

Mountain ecosystem and livelihood

Fig 1: Mountain specificities (Jodha, 1998)

Case study area

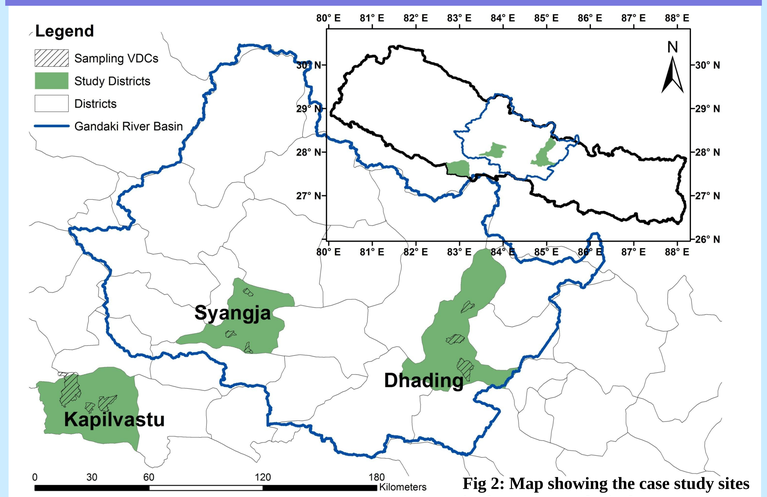
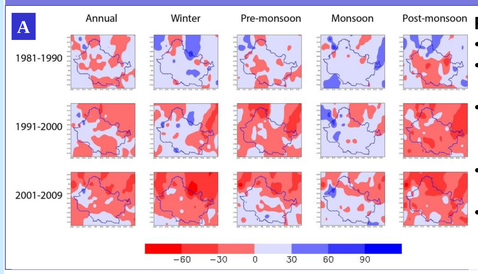


Fig 2: Map showing the case study sites in three agro-ecological zones.

Climate change – what data says?



Rainfall pattern

- No overall trend
- Deceasing in upper northern part (dry region)
- Decreasing in post-monsoon and winter season (dry seasons)
- Fewer rainy days but extreme events are increasing
- Dry regions and seasons are getting dryer and wet are getting wetter.

Temperature trend

- Warming observed throughout the basin for both day and night
- Warming is faster in high mountains
- Winter is warming faster
- Heat and cold impacts on people and livestock perceived to be increasing
- Recent decades are warmer

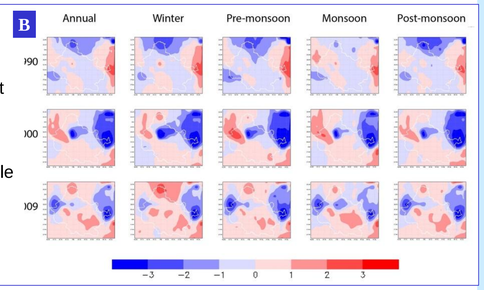


Fig 3: Precipitation anomaly in % (A) and temperature anomaly in °C (B) anomaly in the Gandaki river basin. Data source: Department of Hydrology and Meteorology (DHM), Nepal

Vulnerability assessment approach

Research question

How does the livelihood vulnerability vary with altitude and what are the major factors contributing to vulnerability in each of the agro ecological zones around the Gandaki river basin, which covers much of Central Nepal?

Method

Livelihood Vulnerability Index (LVI_d) = $\frac{\sum_{i=1}^{8} WmiMdi}{\sum_{i=1}^{8} Wmi}$, Mdi is the index of the major components contributing to vulnerability (Fig 4), and Wmi is the weight of the component determined by the number of sub-components that make each major components and are included to ensure all the sub-components contribute equally to the overall LVI. Those major components and their sub-components are shown below (Fig 4, table 1).

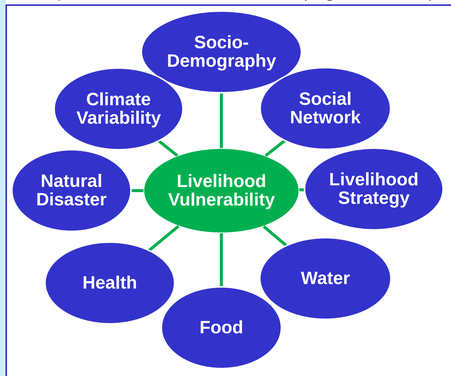


Fig 4: Major components of vulnerability (Hahn *et al.* 2009)

Table 1: Categorization of major components of vulnerability as recommended by IPCC

Exposure	Natural disaster
	Climate variability
Adaptive capacity	Socio-demographic profile
	Livelihood strategies
	Social network
Sensitivity	Water
	Health
	Food

Result

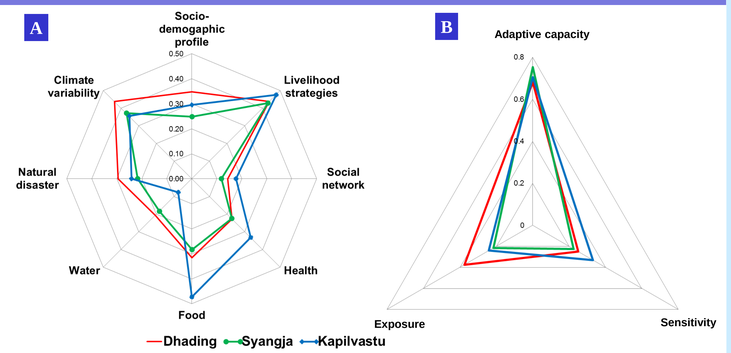


Fig 5: Major components of livelihood vulnerability indices (A) and the vulnerability in terms of IPCC framework (B)

Livelihood vulnerability Index (0=no and 1 = highest vulnerable)
Dhading: 0.2889 Kapilvastu: 0.2883 Syangja: 0.2461

Highest altitude district surveyed (Dhading) was the most vulnerable to climate change. This is controlled by climate factors such as extreme rainfall events and consecutive dry days.

Conclusion

The indexed values for each vulnerability component and sub-component varied noticeably across sites, which provides insight for the design and implementation of site specific adaptation strategies for smallholders. Rain-fed and subsistence agriculture are heavily impacted by increasing climatic extremes together with non-climatic factors. Among the three study districts, Dhading requires strategies to reduce vulnerability especially in water availability. Kapilvastu (lowland) needs better income and food diversification for reducing vulnerability.

References

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