Uncertainty in Adaptation to Climate Change in the Himalaya

A Case of Kaligandaki Basin, Nepal

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Presentation Outline

- Study Context
  - Human Ecology, Climate Change and Impacts, Adaptation Strategies and Barriers, and Livelihood Outcomes and Vulnerability

- Research Problem

- Objectives

- Study Rationale

- Theoretical Framework

- Methodology
  - Study Area, methods, sample size, analysis

- Results

- Discussions Conclusion
Study Context

Human Ecology, Climate Change and Impacts, Adaptation Strategies and Barriers, and Livelihood Outcomes and Vulnerability
Higher warming trend and projections, Variability in rainfall and increased erratic rainfall events, rapid retreat of glacier (Agrawala et al. 2003; IPCC 2007a; Manandhar et al. 2011; NRC 2012; Pandey & Bardsley 2013; Schewe et al. 2011; Shrestha et al. 1999; Shrestha et al. 2000; Xu et al. 2007; Xu et al. 2009)

Risk and hazards of snow - avalanche and Glacial Lack Outburst Flooding, monsoon flooding, making densely populated downstream vulnerable

Extinction of agro-biodiversity, tropical crops and vector borne diseases at higher altitude (Malla 2008; LFP 2009)

Resource degradation (Gentle & Marasani 2012)

CC induced migration (Bardsley & Hugo, 2010)
Study Context ...

Highly erosive Trans-Himalayan Landscape

Monsoon flood in Tarai

Snow avalanche flood in Seti River (05/05/2012), market centre swept away, 70 people died
Research Problem

• Adaptation studies are just emerging in Nepalese context, barriers are yet to explore

• Studies yet to cover heterogeneous Himalayan environment through location specific studies

• Lack of integrated studies: Human / Social- Ecological Implications (climate change, impacts, adaptation, barriers to adaptation, livelihood outcomes)
Objectives

- To explore the adaptation strategies adopted by farming households
- To investigate adaptation barriers faced by the studied communities
Study Rationale

- Severe impacts of CC in physical and anthropogenic environments, yet, there exists adaptation deficit
- Many research findings and global development policies call for adaptation (IPCC 2001; IPCC 2007b; IPCC 2014; Leary et al. 2007; Kyoto Protocol 1997; Schneider 2009; UNFCCC 1992)
- Adaptation is required to respond the change and reduce the impacts
- Local adaptation knowledge, interest, and efforts helps effective adaptation (Adger 2006; O’Neill & Hulme 2009)
- Knowledge of adaptation barriers provides opportunity for policy response that weakens the barriers and promotes adaptation
Figure 1: Theoretical Framework on Adaptation to Climate Change and Social Ecological Sustainability

Modified from Allen Consulting Group 2005; Atkins et al. 2011; Chambers & Conway 1992; Subedi 1995
Methodology: **Study Area**
Methodology: Sample Size

Face-to-face interview with household heads

<table>
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<th>Male</th>
<th>Total</th>
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<tr>
<td></td>
<td>Number</td>
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<td>47</td>
<td>30.7</td>
<td>106</td>
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<td>Lumle</td>
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<tr>
<td>Total</td>
<td>106</td>
<td>29.4</td>
<td>254</td>
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Guttman Scale and Score: peoples’ perceptions on climate changes, its impacts, adoption of adaptation strategies, and faced adaptation barriers were collected in unipolar scale of 1 (least) to 5 (most). These scales are treated as Guttmann scores later and calculated the proportion of general agreement.
• PRA Field methods
  • Focus group discussions
  • Key Informants Interview
  • Historical Timeline Calendar
  • Crop Calendar

<table>
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<th>Place</th>
<th>FGDs</th>
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<tr>
<td>Total</td>
<td>7</td>
<td>17</td>
<td>24</td>
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</table>

• A total of 31 adaptation strategies were asked,
• A total of 9 adaptation barriers were asked
Adaptation to climate change

Several adaptation methods to climate change are proposed, and many of them are already practiced by the communities of the different parts of the world (Adger et al. 2007; Adger et al. 2005; Allison et al. 2009; Dovers 2009; Gargi & Sejuti 2010; Hanak & Lund 2012; Kurukulasuriya & Rosenthal 2003; McIntosh et al. 2000; Moser & Ekstrom 2010; Mortimore 2010; Osbahr et al. 2008; Sivakumar 2011; Smit et al. 2000; Thomas et al. 2007; Yufang et al. 2012).

Suggested strategies from the literature are: farm management, infrastructural development, diversification and intensification of crop-livestock production system, landuse change, increase irrigation other inputs, crop-livestock insurance; change pricing policy and agricultural support policies, development and promotion of new crop varieties, livestock feeds, soil management, improve animal health, regulated distribution system, disaster management, and technological advancement.
Findings: Adopted Adaptation Strategies

Figure 2: Proportions of General Agreement of Adoption of Strategies in Kaligandaki Basin, Nepal

- Changed Crop Varieties
- Adopted Drought Resistant Crops
- Change in Crop Calendar
- Changed Cropping Pattern
- Use of Mulch, Reduced Tillage
- Changed Farm Size
- Changed Landuse Type
- Slope Transformation
- Increased Irrigation
- Regulated Use of Water
- Rain Water Harvest
- Agro-Training, Educated Member
- Increased Agro-Input
- Specialized Livestock
- Changed Livestock Types and Size
- Changed Source of Fodder
- Regulated Use of Forest and Pasture
- Added Heating/Cooling Facilities
- Changed House Structure
- Pray to God
- Integrated Agriculture
- Crop-Livestock Insurance
- Advocacy and Campaign
- Regulated Use of Forest and Pasture
- Received Food Aid/Subsidized price
- Changed Livelihood Options
- Migration for Agro-Activity
- Migration to Market Centre
- Migration to City
- Labour Migration Abroad
Findings: Adopted Adaptation Strategies …

Figure 3: Proportions of General Agreement of Adoption of Strategies in Kaligandaki Basin, Nepal by types and Ecological Zones

- Tarai
- Middle-Mountain
- Trans Himalaya

Intensity Score of Adoption (%)
Figure 4: Levels of Overall Adaptation

Overall Adaptation (Perceived by Respondent)
- Not Adapted at All
- Little Bit Adapted
- Well Adapted

Overall Adaptation (Average of All Adopted Strategies)
- Not Adapted at All
- Little Bit Adapted
- Moderately Adapted
- Quite Well Adapted
- % of General Agreement

Source: Field Survey, 2013
Figure 5: Level of Adoption of Various Strategies by Ecological Zones

<table>
<thead>
<tr>
<th>Ecological Zones</th>
<th>Overall Adaptation (Perceived by Respondent)</th>
<th>Overall Adaptation (Average of All Adopted Strategies)</th>
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<td>Tarai</td>
<td>Not Adapted at All: 29.5%</td>
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<td>Little Bit Adapted: 24.1%</td>
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<td></td>
<td>Moderately Adapted: 17.6%</td>
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<tr>
<td></td>
<td>Well Adapted: 7.7%</td>
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<td></td>
<td>% of General Agreement: 10.0%</td>
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<tr>
<td>Middle-Mountain</td>
<td>Not Adapted at All: 33.3%</td>
<td>Quite Well Adapted: 17.7%</td>
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<td>Little Bit Adapted: 28.5%</td>
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<tr>
<td></td>
<td>Moderately Adapted: 17.6%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Well Adapted: 7.7%</td>
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<td></td>
<td>% of General Agreement: 10.0%</td>
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</tr>
<tr>
<td>Trans Himalaya</td>
<td>Not Adapted at All: 34.5%</td>
<td>Quite Well Adapted: 17.7%</td>
</tr>
<tr>
<td></td>
<td>Little Bit Adapted: 30.0%</td>
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<td></td>
<td>Moderately Adapted: 17.6%</td>
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<td></td>
<td>% of General Agreement: 10.0%</td>
<td></td>
</tr>
</tbody>
</table>

Source: Field Survey, 2013
Findings: Adopted Adaptation Strategies …

Figure 6: Crop Calendar across the ecological zones of Kaligandaki basin
Flood Control through Concrete wall in the Trans-Himalaya

Flood Control Dikes and Retaining Wall along the Narayani River at Meghauli
Findings: Adaptation Barriers

Figure 7: Adaptation Barriers Faced by the Studied Households of Kaligandaki Basin, Nepal

Barriers

- Lack of Adaptable Variety
- Poorly Developed/ Not Suitable...
- Lack of Irrigation
- Resource Conflict
- Lack of Short and Longterm...
- Insufficient Adaptation Knowledge
- Financial Limitations
- Lack of Support from I/NGO and...
- Lack of Government Support

Percent of Respondents

- Little bit
- Occasionally
- Moderately
- Severe
- Profound
- General Agreement

- 54.6%
- 46.3%
- 45.8%
- 23.9%
- 88.3%
- 85.2%
- 72.6%
- 74.2%
- 75.3%
Figure 8: Adaptation Barriers Faced by the Studied Households Across the Ecological Zones Kaligandaki Basin, Nepal

Findings: Adaptation Barriers
Poor level of adaptation however, rich adaptation knowledge; consistent to the strategies suggested by literature

- Lack of social learning and knowledge transfer,

- Study agrees to: Adaptation process is determined by - technology, resource availability and distribution, institutional structure, stock of human and social capital, access to risk spreading mechanism, ability of decision makers on risk management and peoples’ attribution to stress or exposure to the change, willingness to innovate (Grothmann & Patt 2005; Gupta et al. 2010; Hansen et al. 2004; Moser 2005; O’Brien et al. 2004; Yohe & Tol 2002)

- Study agrees to: Having sound adaptive capacity not necessarily translated into adaptation action since people feel powerless and are constrained by antecedent development (Adger et al. 2007; Adger & Vincent 2005; van Aalst et al. 2008)

- Communities are undecided to adopt adaptation strategies because CC they perceived is non-linear, and existing barriers challenge the outcome of adaptation strategies
Thank You

Queries ??
Acknowledgements

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Reference

- Yufang, S, Jianchu, X, Andy, W, Julien, L, Qiaohong, L, Yao, F, Xing, M & Grumbine, RE 2012, 'Coping with climate-induced water stresses through time and space in the mountains of Southwest China', Regional Environmental Change, vol. 12, no. 4, p. 855.