Differential Vulnerability, Disaster Risk Management & Climate Adaptation: Priorities and Opportunities for Research and Policy

Reinhard Mechler
Risk, Policy, Vulnerability (RPV) Program

IIASA 40th Anniversary Conference
WORLDS WITHIN REACH: FROM SCIENCE TO POLICY
Parallel Session 4: Assessing Education, Human Capital and Vulnerability
October 26, 2012
• Impacts from disasters have increased over recent decades
• Anthropogenic climate change leads to changes in extreme weather and climate events!
Natural disasters are *unnatural*
Climate-related and socio-economic determinants of risk

- *nature and severity of hazard*
- *exposure*
- *vulnerability*

Source: IPCC, 2012
Even non-extreme weather and climate events can lead to extreme impacts if vulnerability is high.

- Africa’s largest recorded cholera outbreak
- over 90,000 affected
- over 4,000 killed
- began following onset of seasonal rains
- vulnerability and exposure increased risk

**Case Study: Zimbabwe**

2008

Source: IPCC, 2012
From climate-driven to vulnerability-driven analysis!

- Projections of natural hazards and climate change associated with long time scales and large uncertainties
- Information on today’s differential vulnerability (and exposure) as starting points for disaster risk management and adaptation assessments
- Offering benefits now and foundations for addressing future projected changes
From climate-driven to vulnerability-driven analysis
Starting points are vulnerability and exposure at scale of risk management
From climate-driven to vulnerability-driven analysis
Starting points are vulnerability and exposure at scale of risk management

<table>
<thead>
<tr>
<th>Vulnerability &amp; exposure at scale of risk management</th>
<th>Information on climate extremes across spatial scales</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Global: Observed and projected</td>
</tr>
<tr>
<td></td>
<td>Regional: Observed and projected</td>
</tr>
<tr>
<td></td>
<td>Scale of risk management: Available information</td>
</tr>
</tbody>
</table>
From climate-driven to vulnerability-driven analysis
Starting points are vulnerability and exposure at scale of risk management

<table>
<thead>
<tr>
<th>Vulnerability &amp; exposure at scale of risk management</th>
<th>Information on climate extremes across spatial scales</th>
<th>Options for risk management and adaptation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Global: Observed and projected</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regional: Observed and projected</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scale of risk management: Available information</td>
<td></td>
</tr>
</tbody>
</table>

Flow of information
Gaps and priorities in Vulnerability & Risk research

- There are many types of vulnerability and determinants: how to integrate?
- Linking to an estimate of risk
- Lack of useful information on differential vulnerability at scale of risk management (farmers, households, governments)
- Better understanding of longer term, indirect effects
Conceptualizing and modelling vulnerability and risk

- Hazard
- Exposure
- Physical & Environmental Vulnerability
  - Direct impact/risk (loss of life, economic loss)
Conceptualizing and modelling vulnerability and risk

- Climate and Weather
- Socioeconomic factors

- Hazard
- Exposure

- Physical & Environmental Vulnerability

Direct impact/risk (loss of life, economic loss)
Conceptualizing and modelling vulnerability and risk

Climate and Weather → Hazard
Socioeconomic factors → Exposure

Hazard → Physical & Environmental Vulnerability
Exposure → Direct impact/risk (loss of life, economic loss)
Conceptualizing and modelling vulnerability and risk

- Climate and Weather
- Socioeconomic factors

Hazard → Exposure

Physical & Environmental Vulnerability

Direct impact/risk (loss of life, economic loss)
Conceptualizing and modelling vulnerability and risk

- Hazard
- Exposure

- Physical & Environmental Vulnerability
- Socio-economic Vulnerability

- Direct impact/risk (loss of life, economic loss)
- Indirect impacts (poverty, debt, income effects)

Climate and Weather
Socioeconomic factors
Conceptualizing and modelling vulnerability and risk

- Climate and Weather
- Socioeconomic factors

- Hazard
- Exposure

- Physical & Environmental Vulnerability
- Socio-economic Vulnerability

- Direct impact/risk (loss of life, economic loss)
- Indirect impacts (poverty, debt, income effects)
IIASA research

- On macro and micro scales
- Focus on set of micro-scale assessments: Understanding interplay of extremes, risk and poverty for subsistence farming households in Asia and Africa
- Informing implementation of mechanisms to lift farmers out of poverty
Focus 1: Modelling extremes and poverty in Uttar Pradesh, India

- How do disasters affect livelihoods of subsistence farmers?
- Survey in 2 villages with n=204
- Study partners:
  - Institute for Sustainable Environmental Transitions, Nepal
  - Gorakhpur Environmental Action Group, India
  - Winrock International, India
Focus 1: Uttar Pradesh, India
Survey reports differential direct impacts

Survey results on direct losses in drought and flood events

Sources: Mechler et al., ProVention Consortium working paper #5, 2009
Focus 1: Uttar Pradesh, India
Survey results on coping mechanisms

- Money lenders: 48%
- Kinship Arrangements: 20%
- Sell fungible assets: 12%
- Outside Assistance: 10%
- School dropout: 5%
- Savings: 5%

Hochrainer et al., 2011
Focus 1: Uttar Pradesh, India
Survey results on coping mechanisms

- Money lenders: 48%
- Kinship Arrangements: 20%
- Sell fungible assets: 12%
- Outside Assistance: 10%
- Savings: 5%
- School dropout: 5%

Access to economic and social capital important

Hochrainer et al., 2011
Focus 1: Uttar Pradesh, India
... coupled with hazard: precipitation and changes

![Graph showing rainfall distribution](image)

Projections of climate change suggest
- More rainfall early in the main growing season
- Less rainfall later on during harvesting

Distribution of rainfall over 10 dekads (A2 scenario in CGMC3 climate model)

Source: Mechler et al., 2009
Focus 1: Uttar Pradesh, India...
... can be combined to an estimate of longer term risk.

Income dynamics with a drought shock as compared to a baseline for a representative farming household.

Points toward options accessing economic and social capital: community-based and donor supported microinsurance.

Source: Mechler et al., 2009
Focus 2: Understanding vulnerability and coping strategies in rural Uganda

- Apart from economic factors, what other determinants shaping vulnerability and coping?

- Survey in two districts, garnered by knowledge workers using smart-phone technology n=3258

- Partners:
  - LSE
  - Grameen Foundation, Uganda

Study areas in Uganda

Source: Helgeson, Dietz, Hochrainer
Ecology and Society, accepted
Focus 2: Uganda Coping strategies

- Sell livestock, 41%
- Reducing expenditures, 22%
- Reduction of food intake, 13%
- Sell land or home, 1%
- Change profession, 5%
- Begging, 6%
- Sell household items, 6%
- Borrow food, 1%
- Migrate, 1%
- Take children out of school, 1%
- Send children to live elsewhere, 1%
- Send children to work, 3%

Source: Helgeson, Dietz, Hochrainer
Ecology and Society, accepted
Focus 2: Uganda
Coping strategies

- Sell livestock, 41%
- Reducing expenditures, 22%
- Reduction of food intake, 13%
- Sell household items, 6%
- Sell land or home, 1%
- Change profession, 5%
- Begging, 6%
- Borrow food, 1%
-Send children to work, 3%
- Migrate, 1%
- Send children to live elsewhere, 1%
- Take children out of school, 1%

Source: Helgeson, Dietz, Hochrainer
Ecology and Society, accepted
Focus 2: Uganda
Probit regression results on determinants of coping strategies

• Livestock sale as dominant coping strategy:
  – Economic determinants (capital) important
  – e.g. crop surplus and share of income from farming reduce odds of selling livestock

• Reduced access to formal education: also human capital important:
  – Households with a more educated head less likely to choose coping strategies affecting children’s educational attainment
  – Points towards benefits of investing into human capital
Conclusions

• Extreme events exert heavy toll on affected, particularly lower income, farming households

• IIASA research in South Asia and Africa derives locale-specific information on differential vulnerability and risk

• Dominant coping strategies are shaped by factors related to economic capital, but also human and social capital play a role

• Focus on today’s and future vulnerabilities as starting points for analyses of disaster risk management and climate adaptation