Natural Disaster Hotspots:
A Global Risk Analysis

Risk Identification for
Disaster Risk Management

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Hotspots project objectives

1. global geographic resolution of natural disaster risk hotspots at non-national scales, with hazard- and place-specific case studies
2. input for prioritization of more localized risk management in highest-risk areas
3. demonstration of theory, methods and data requirements to improve risk assessments and their applications
Global analysis

- six major hazards
  - drought
  - earthquakes
  - floods
  - landslides
  - storms
  - volcanoes
- relative risks of two outcomes
  - mortality
  - economic loss
    - GDP per unit area
    - proportion of GDP per unit area

Case studies

- hazard focus
  - drought and disaster in Asia
  - landslides
  - storm surges
- location focus
  - Caracas, Venezuela
  - Sri Lanka
  - Tana River basin in Kenya

Calculation of relative risks (summary)

- divide land area into 2.5’ grid
- mask out low-population, non-agricultural areas
- for each grid cell and hazard calculate:
  - hazard frequency or probability
  - population and GDP hazard exposure
- weight the population and GDP hazard exposure for each cell by historical mortality and economic loss rates, respectively
  - historical loss data obtained from EM-DAT
  - computed for 28 combinations of 7 World Bank regions and 4 country wealth classes
Grided global data on elements at risk

- GPW population for mortality risks (CIESIN, below)
- GDP per unit area for economic loss risks (WB, not shown)

Mask out low population, non-agricultural grid cells
### Hazard exposure for each grid cell = hazard frequency x pop (or GDP)

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Hazardousness Parameter</th>
<th>Period</th>
<th>Resolution</th>
<th>Source(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>strength</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drought</td>
<td>Precipitation less than</td>
<td>1980-2000</td>
<td>2.5°</td>
<td>IRI Climate Data Library</td>
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<tr>
<td></td>
<td>75% of median for a 3-</td>
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<tr>
<td></td>
<td>month period (WASP)</td>
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</tr>
<tr>
<td></td>
<td>events</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Earthquake</td>
<td>Expected PGA (10%</td>
<td>n/a</td>
<td>sampled at 1°</td>
<td>Global Seismic Hazard Program</td>
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<tr>
<td></td>
<td>prob. of exceedance in 50</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>years)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Volcanoes</td>
<td>Counts of volcanic</td>
<td>79-2000</td>
<td>sampled at 2.5°</td>
<td>UNEP/GRID-Geneva and NGDC</td>
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<tr>
<td></td>
<td>activity</td>
<td></td>
<td></td>
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<tr>
<td>Landslides</td>
<td>Estimated annual prob.</td>
<td>n/a</td>
<td>30&quot;</td>
<td>Norwegian Geotechnical Institute</td>
</tr>
<tr>
<td></td>
<td>of landslide or avalanche</td>
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</tbody>
</table>

### Relative risks

- Outcomes for each grid cell
  - mortality risk index (population hazard exposure x historical mortality rate)
  - economic loss risk index (GDP per unit area exposure x historical economic loss rate)
    - Total economic losses
    - Proportional to GDP per unit area
- Grid cells sorted into 3 relative levels of risk
  - top 30% = red
  - middle 30% = yellow
  - lowest 40% = blue
Results

Cyclone

Mortality
Total economic losses
Disaster risk hotspots

Economic losses in proportion to GDP per unit area
Drought risk hotspots

Flood risk hotspots
Earthquake disaster risk hotspots

Volcano disaster risk hotspots
Landslide disaster risk hotspots

All hazards disaster risk hotspots
Relief costs and emergency lending

- Relief costs
  (OCHA Reliefweb FTS)
  - total relief costs from 1992-2003: $2.5 billion
  - of this, $2 billion went to the top 20 countries

- Emergency Lending
  (World Bank)
  - total emergency lending and loan reallocation from 1980-2003: $14.4 billion
  - of this, $12 billion went to the top 20 countries

All-hazard mortality risk hotspots:
Top 20 in relief costs

China, India, Bangladesh, Egypt, Mozambique, Turkey, Afghanistan, El Salvador, Kenya, Iran, Pakistan, Indonesia, Peru, Democratic Republic of Congo, Poland, Vietnam, Colombia, Venezuela, Tajikistan, Cambodia
All-hazard total economic loss risk hotspots: Top 20 in emergency loans

India, Turkey, Bangladesh, Mexico, Argentina, Brazil, Poland, Colombia, Iran, Honduras, China, Chile, Zimbabwe, Dominican Republic, El Salvador, Algeria, Ecuador, Mozambique, Philippines, and Vietnam

Applications and next steps
Strategy Level: Advocacy Tool

- Flagging CASs and PRSPs
- Ensure that DRM is integrated as a development priority
- CDs of 2006-7 CAS “hotspot” countries have been notified

Standard investment projects

- Protection of investments in high risk areas
- Risk management throughout project design and implementation
  - Evaluation of loss risks in expected rate of return
  - Adherence to hazard resistant standards
Hotspots risk reduction projects

- countries with high disaster risks
  - frequent disasters, significant losses
  - frequent ERLs and emergency reallocation
- project components may include:
  - risk assessment
  - policy review/reform
  - institutional strengthening
  - funds for high-priority risk reduction measures
  - risk transfer mechanisms (insurance, contingency funds, catastrophe bonds, commodity hedging, etc.)

ERL pre-project preparation

- in high-risk countries for high-risk areas
- trust funds or bilateral donor-funded
- emergency reconstruction standards and procedures pre-identified
- reduced interest rates, expedited approval for certified countries
- pre-identification of risk reduction measures for post-emergency funding
Next steps

- Publish Volume II
- Create internet access to Hotspots input data
- Work with partners to improve data
  - Earth Institute and ProVention, GRIP
  - Hazard data (drought, flood and landslide)
  - Economic loss data
- Move from static to dynamic risk assessment