The Integration of Land Use/Land Cover Data within the Modelling of Socio-economic Vulnerabilities

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Overview

- Introduction
- Vulnerability: Conceptualisation following the IPCC approach
- Modelling vulnerability units in a European vs. Asian context
- Integration of Land Use/Land Cover data
- Conclusions
BRAHMATWINN

→ Assessment of Natural Dimension (WP 3)
  → Land Use/Land Cover, Change detection, Snow distribution, Permafrost, Glacial retreat, Hydrological Response Unity (HRU)

→ Assessment of Human Dimension (WP 4)
  → Governance Analysis, Social Network Analysis & Vulnerability Mapping for Asia & Europe

Final Aim: Integration within 'Water Resource Response Units (WRRU)‘ → 'What-if scenarios'
Vulnerability definition in
Brahmatwinn

In IPCC terms:

- **Risk** = \( f (\text{Hazard} , \text{Vulnerability}) \)
  - \((H) = f (\text{Probability}, \text{Magnitude})\)
  - \((V) = f (\text{Sensitivity}, \text{Adaptive Capacity})\)

- **Vulnerability** (V)
  - The degree to which a system is **susceptible** to or **unable to cope** with adverse effects of climate change.
Vulnerability definition in BrahmaTWinn

Vulnerability to a specific hazard

Function of

Sensitivity
- Susceptibility Indicator 1
- Susceptibility Indicator 2
- Susceptibility Indicator 3
...  
- Susceptibility Indicator n

Function of

Adaptive Capacity

Social Capacity
- Skills Indicator
- Technologies Indicator
- Information Indicator
- Governance Indicator

Resilience
- Eco. surplus/eco. alternatives Indicator
- Cultural/social/political constraints Indicator

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'Europe vs. Asia'
European and Asian Case Study Area
Salzach Catchment

From data to indicators to information
Salzach Catchment
Regionalisation

Algorithm after Baatz & Schäpe (2000)
Salzach Catchment
Vulnerability Units
Salzach Catchment Decomposability

Adaptive Capacity

Sensitivity
Risk = \( f(\text{Hazard}, \text{Vulnerability}) \)
Derivation of socio-economic data from RS data

- **Domains extracted from RS data**
  - Distance metrics between objects and areas of relevance to socio-economic development
  - Land Use/Land Cover in relation to a given settlement
Assam

Derivation of socio-economic data from RS data

3 Km Buffer: road density and agricultural land use data were extracted
### Table 17: Domain weights derived for the village/town level analysis (%)

<table>
<thead>
<tr>
<th>Domains</th>
<th>Floods</th>
<th>Droughts</th>
<th>Bank erosion</th>
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<tbody>
<tr>
<td><strong>Sensitivity</strong></td>
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<tr>
<td>Livelihood</td>
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<td>Human health</td>
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<tr>
<td>Gender</td>
<td>10.9</td>
<td>12.6</td>
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<td><strong>Adaptive capacity</strong></td>
<td></td>
<td></td>
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<tr>
<td>Economic alternatives</td>
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<td>23.4</td>
<td>23.5</td>
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<td>Human resource capacity</td>
<td>10.3</td>
<td>12.6</td>
<td>10.2</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
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</tbody>
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### Table 18: Domain weights derived for the Tehsil level analysis (%)

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<tr>
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<tr>
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Assam Method

- **Multi-dimensional matrix of indicators**
  - Reduce its dimensionality
  - Indicators measured on different units

  ➔ Avoid biasing by converted to standardised Z scores
  ➔ Maximum likelihood factor analysis ➔ single factor for each domain
Assam Results

Total Population & Flood Vulnerability Quintiles
(Indian Census & LANDSAT 2001: Assam Study Area)

Map of Flood Water over the Affected State of Assam, India
Flood detection with RADARSAT & IRS Imagery Recorded from 2-3 August 2007

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Integration Land Use/Land Cover

- ‘Land Cover’ → properties of the Earth’s surface
  → Invariant spatial property (background matrix)
  → No vulnerable assets directly attached (‘silent land cover’)

- ‘Land Use’ → functional utilization of a particular subset by human activity
  → qualified and ranked as other assets

Constraints:
- ‘no places’ without any use? (esp. Europe)
- indirect functions attached to virtually any land cover → ecosystem services (‘economic value’)

→ Land Use/Land Cover as a one conceptual entity, with a focus on ‘use’ and assigning it an asset in terms of (human) vulnerability
Monitoring of LULC → operational ‘standard service’

→ Socio-economic data difficult to obtain (e.g. Census surveys)
→ Comparison of Land Use vs Land Cover → easier for ‘Land Cover’
→ Importance of LULC as vulnerability indicator
→ Knowing the importance of LULC → estimates on impacts (after flood) possible

→ From assessment to MONITORING
Conclusions

- Dependency on data sources → influence the development of integrating methods

- Delineation of two clear paradigms
  - EU: focus upon asset as a defining characteristic of vulnerability
  - ASIA: map of asset vulnerability is the inverse of a vulnerability map based upon community vulnerability

- LULC as important indicator
  - Ecosystem services
  - Assessment to monitoring

- Integration within 'Water Resources Response Units'
Thank YOU very much!

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Source: www.gadonet.com