Socio-economic scenarios in interdisciplinary integrated modeling projects

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I will show

- Two Examples
  - Glowa-Danube
    - Focus on households
      (but company level also important, e.g. drinking water supply, cooling water, shipping, water power, agriculture, ...)
  - Mountland
    - Formative Scenario Analysis; Stakeholder participation

- Comments on the use of socio-economic scenarios in discharge prediction in the riparian states
Glowa-Danube

- Agreement of different research groups on a set of “interesting” scenarios
- Climate, environment, farming, society
- Here focus on Households
- Main issues: water scarcity and floods

Modeling: Danube catchment

- **DSS DANUBIA**
  - Spatially explicit
  - Water cycle
  - Upper Danube catchment
  - Resolution: 1 km²
  - Time step: 1 month
  - 9,115 inhabited grid cells (km²)

- **Households**
  - Agent types (empiric lifestyles; SINUS Milieus®)
  - Water demand
  - Water saving innovations
  - Activation (psychological response to water related stress)

http://www.glowa-danube.de/atlas/index.php
## Combination of Scenarios: climatic – social

<table>
<thead>
<tr>
<th>Choice 1 Climate Trend</th>
<th>Choice 2 Climate Variant</th>
<th>Choice 3 Social Scenario</th>
<th>Choice 4 Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 IPCC regional</td>
<td>1 Baseline</td>
<td>1 Baseline</td>
<td>Intervention 1</td>
</tr>
<tr>
<td>2 REMO regional</td>
<td>2 5 warm winters</td>
<td>2 Open Competition</td>
<td>Intervention 2</td>
</tr>
<tr>
<td>3 MM5 regional</td>
<td>3 5 hot summers</td>
<td>3 Public Welfare</td>
<td>Intervention 3</td>
</tr>
<tr>
<td>4 Extrapolation</td>
<td>4 5 dry years</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Intervention 1**: Individual, Free market, Water as product
- **Intervention 2**: Social democratic, Government, Water as highly valued good

For example: Households and water supply companies are more sensitive.
Households’ response in respective scenario

<table>
<thead>
<tr>
<th>Parameter: Lifestyle groups characteristics</th>
<th>Parameter value in Baseline</th>
<th>Parameter value in Open Competition</th>
<th>Parameter value in Public Welfare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price sensitivity</td>
<td>Baseline values, different for some lifestyle groups</td>
<td>Increases</td>
<td>Unmodified</td>
</tr>
<tr>
<td>Environmental awareness</td>
<td>Baseline values, different for some lifestyle groups</td>
<td>Decreases</td>
<td>Increases slightly</td>
</tr>
<tr>
<td>Importance of peers</td>
<td>Baseline values, different for some lifestyle groups</td>
<td>Unmodified</td>
<td>Increases; only Hedonistic lifestyle group remains unaffected by social comparison</td>
</tr>
<tr>
<td>Risk perception (future orientation)</td>
<td>Baseline values, different for some lifestyle groups</td>
<td>Unmodified</td>
<td>Increases slightly; the most for Postmaterialists and Traditionalists</td>
</tr>
<tr>
<td>Avoidance (psychic defense mechanisms )</td>
<td>Baseline values, different for some lifestyle groups</td>
<td>Decrease</td>
<td>Strong decrease</td>
</tr>
</tbody>
</table>

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Soboll, A. et al. (2011) and Seidl (2009)
Floods and water scarcity lead to activation/uneasiness

- Perception and role of water depending on lifestyle trends
  - Drinking water scarcity
  - Flood events
    - Trend Public Welfare
    - Trend Open Competition
  - “Activation” may affect water use behavior or
  - Policies
Strengths and Limitations

• Dynamic perspective suitable for modeling
  — Time series data

• Socio-economic trends influencing psychology of households and companies (here: water supply)

• Compromise of interests
  — limitation to pre-selected climate/weather “stories”
Mountland

Sustainable land-use practice in mountain regions

Main system components

Geographic location and topographical map of the Visp region in the Visp-Saastal region.

Legend:
- Main town
- Municipal boundary
- Agricultural land
- Forested land
- Unproductive area
- Settlement area
- Water

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Formative Scenario Analysis (FSA)

• Structured and approved approach
• “Formative”
  – ‘giving form’ to a set of consistent and plausible scenarios of future development
  – comprises twelve steps, which can be sub-grouped into five different phases

Two lines of scenarios: global and local/regional
Formative Scenario Analysis and functional-dynamic participatory process

Formative scenario analysis (FSA) and an external consistency analysis in combination with a functional-dynamic approach to theory-practice cooperation. The figure illustrates the respective steps 1.1 to 5.4 of our analysis. The arrows indicate possible sequences within an FSA. The arrow that is drawn from “impact analysis” back to “impact factor identification” illustrates that the selection of impact factors can be reassessed.
Workshops with stakeholders
20 impact factors – activity and passivity

1. Natural hazards and extreme events
2. Environmental Quality
3. Construction activities; built environment
4. Hazard protection measures
5. Spatial Planning
6. Nature protection measures
7. Support of enterprises for local goods
8. Type of agricultural management
9. Type of forest management
10. Renewable energy management
11. Touristic infrastructure: strategy and investment
12. Destination management
13. Development of economic sectors
14. Budget of municipalities
15. Strategies for business support
16. Population change & composition
17. Quality of life: basic needs and recreation
18. Strategies for social and economic conditions for inhabitants
19. Local identity
20. Cooperation of communities
Relate local to global scenarios

Future states “global”

Future states local

Example: Global Scenario “Regional centers & protection”
Six multiscale scenarios

1. Clumping risks in a neoliberal world
2. Realize potentials based on green growth
3. Regionalized backwards development
4. Retirement residence and environmental sustainability
5. Export product Energy Upper Valais and environmental sustainability
6. Take the reins and green growth
Storylines (one example)

Storyline – clumping risks in a neoliberal world

The region is hit hard by several detrimental national and international developments. The globally unabated climate change results in Switzerland in temperature changes, with increases of +2.2 °C in winter and +2.3 °C in summer and a precipitation of -1.4 mm in winter and -8.1 mm in summer, results to the melting of glaciers by 90%, reduces the frequency of snow-secure weather conditions and increases drought and frequency of fires (+17%) in summer. In addition, the massive damages done on the mountain railways and the high competition among skiing regions lead to the decrease of gains in tourism. Due to the liberalization of the federal agricultural policy and the falling prices of agricultural products, the employment rate and the used area in agriculture shrink. Lonza follows the national trend and abandons the location of Visp to move to lowland agglomerations. Consequently, many well-educated people emigrate from the region. Moreover, forestry is strongly affected by the dry climatic conditions in summer. These disadvantageous developments amount to a “clumping risk“. To counteract these negative conditions, the region tries to jointly invest in top destination tourism and its marketing. This strategy, however, partly fails. Tax deficits lead to a decrease in the financial margin of the communities and affect the infrastructure for basic services, culture and sports as well as the overall quality of life. The population of the region faces the consequences of these detrimental developments. Cooperation between communities is high, but it is not enough to solve the problem.
Strengths and Limitations

• Aspects that are working well
  – Integration of knowledge from scientists (literature) and stakeholders
  – Identification of impact factors (active, passive, ambivalent, buffering)
  – Coupled global – local scenarios

• Limitations (for modeling)
  – Future state vs. process and time series
  – What about pathways?
Comments on the use of socio-economic scenarios in discharge prediction in the riparian states

• How are (inter)national socio-economic developments translated into developments in water use by the sector (low/high growth)?
  – Combining local scenarios and (global) context scenarios => consistency
  – Societal trends (e.g., more neo-capitalism or more solidarity)
    • Trends frame perception and behavior/decisions:
      => flood risk / low-flow prevention is matter of money or of social cohesion

• How does the sector anticipate on future changes in water availability and water requirements from the sector?
  – Societal trends – role/image of water and meaning risk of scarcity
  – “What is natural?” => e.g. river restoration: restore to what?

• On what time horizon does the sector prepare for future changes in water availability from the sector (2030, 2050, 2100)?
  – Scenarios for social developments only reasonable for ~25 yrs (uncertainty)
  – Planning in specific sectors may be longer – but probably depending on scenarios/assumptions

• Is there a temporal and/or spatial differentiation in the water use by the sector (e.g. only locally relevant, only during summer, only during low flow situations)?
  – Spatial: “Ripple effects” due to events: not only directly affected actors may be concerned – adapted risk perception and water use by others (networks)
  – Temporal: Decay function depending on actor type
Thank you