Socio-economic scenarios in interdisciplinary integrated modeling projects

Roman Seidl

ETH Zurich

Department of Environmental Systems Science,
Natural and Social Science Interface

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

Soboll, A. et al. (2011). Integrated regional modelling and scenario development to evaluate future water demand under global change conditions. *Mitigation and Adaptation Strategies for Global Change, 16(4), 477-498. doi: 10.1007/s11027-010-9274-6*

Modeling: Danube catchment

- DSS DANUBIA
  - Spatially explicit
  - Water cycle
  - Upper Danube catchment
  - Resolution: 1 km^2
  - Time step: 1 month
  - 9,115 inhabited grid cells (km^2)
- 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

Choice 1 Climate Trend	Choice 2 Climate Variant	Choice 3 Social Scenario	Choice 4 Intervention
1 IPCC regional	1 Baseline	1 Baseline	Intervention 1
2 REMO regional	2 5 warm winters	2 Open Competition • Individual • Free market • Water as product	Intervention 2 Intervention 3
3 MM5 regional	3 5 hot summers	3 Public Welfare • Social democratic • Government • Water as highly valued good	
4 Extrapolation	4 5 dry years		
	...		

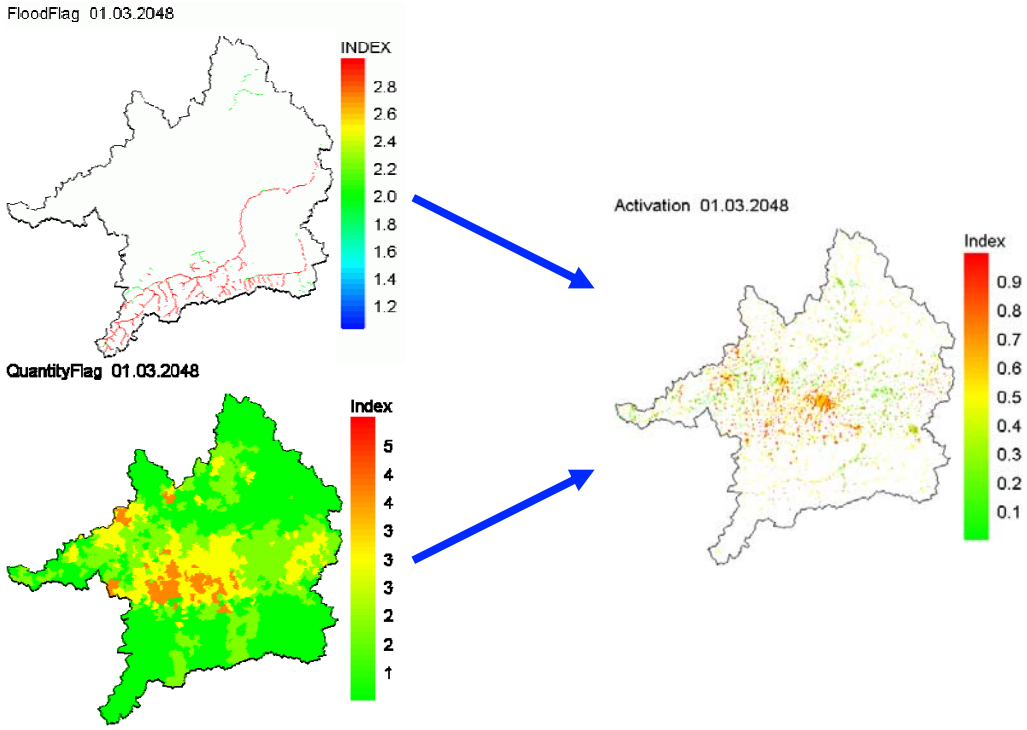
For example:
Households and water supply companies are more sensitive

Households' response in respective scenario

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

Soboll, A. et al. (2011) and Seidl (2009)

Floods and water scarcity lead to activation/uneasiness

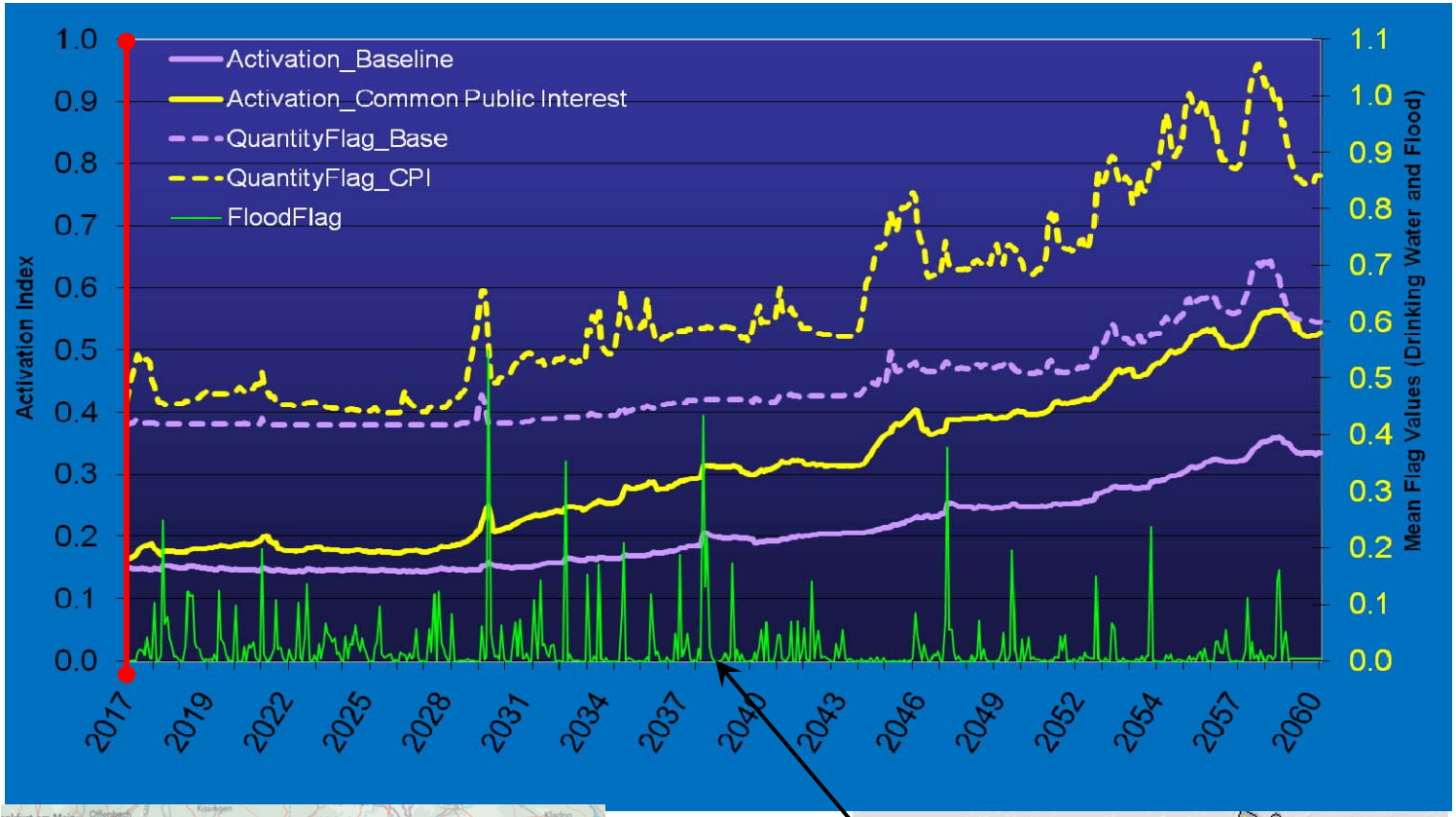


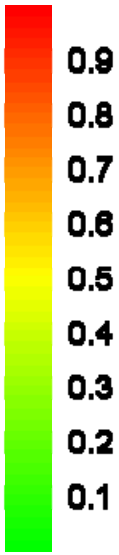
Drivers

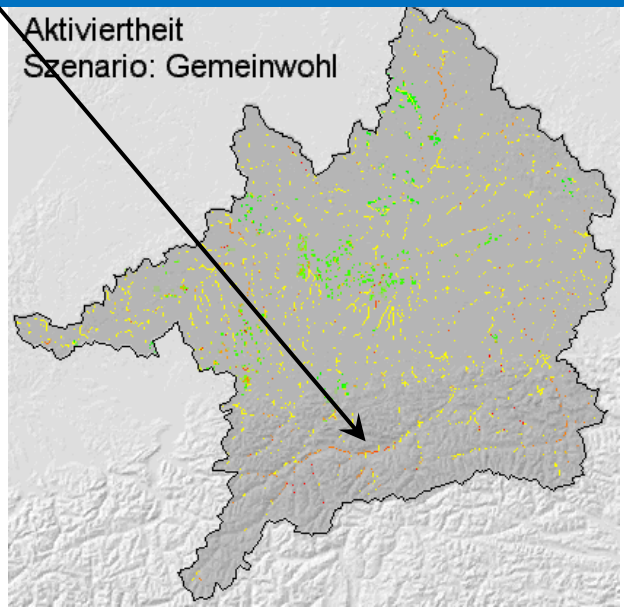
Activation

- 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

REMO – baseline







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

Brand, Seidl, Le, Brändle, & Scholz (2013). Constructing Consistent Multiscale Scenarios by Transdisciplinary Processes: the Case of Mountain Regions Facing Global Change. *Ecology and Society, 18(2).*

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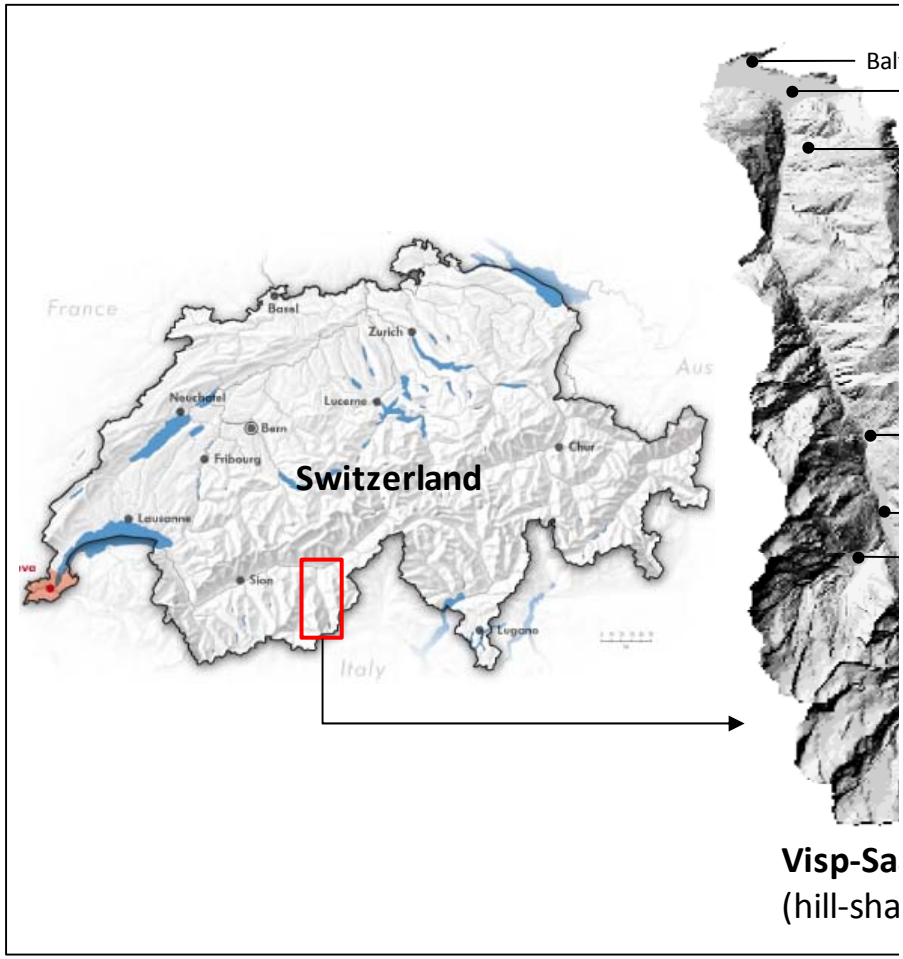
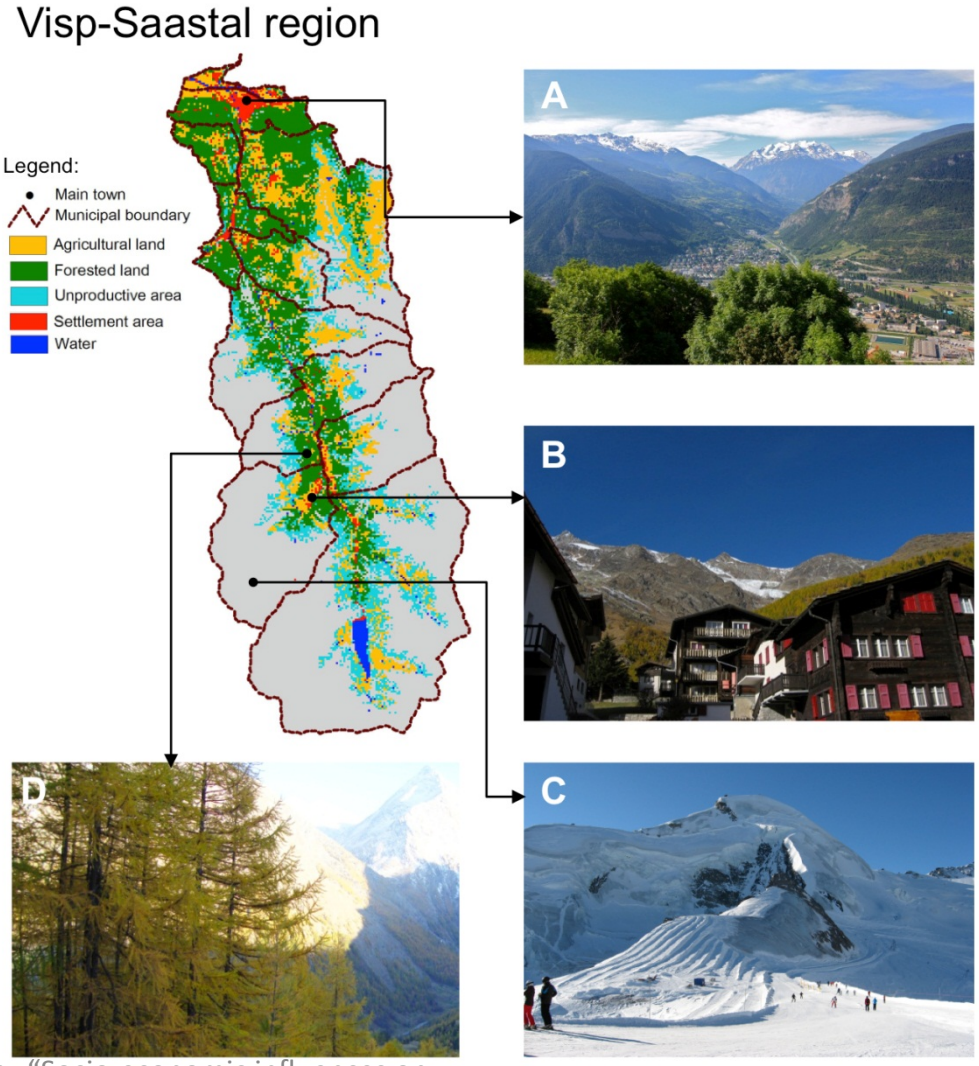
Competence Center Environment and Sustainability

Main system components



Geographic location and topographical map of the Visp region in the

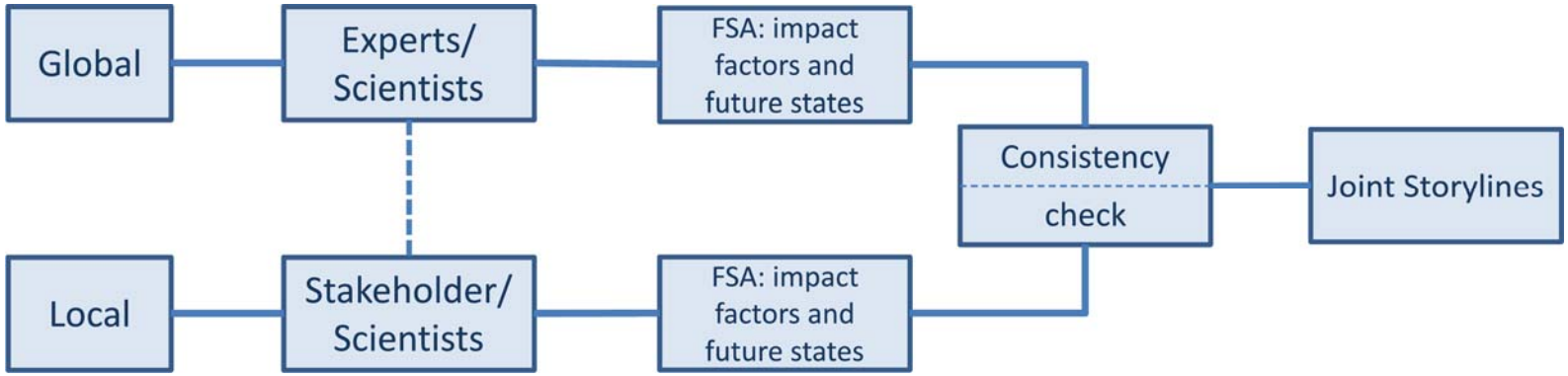


Formative Scenario Analysis (FSA)

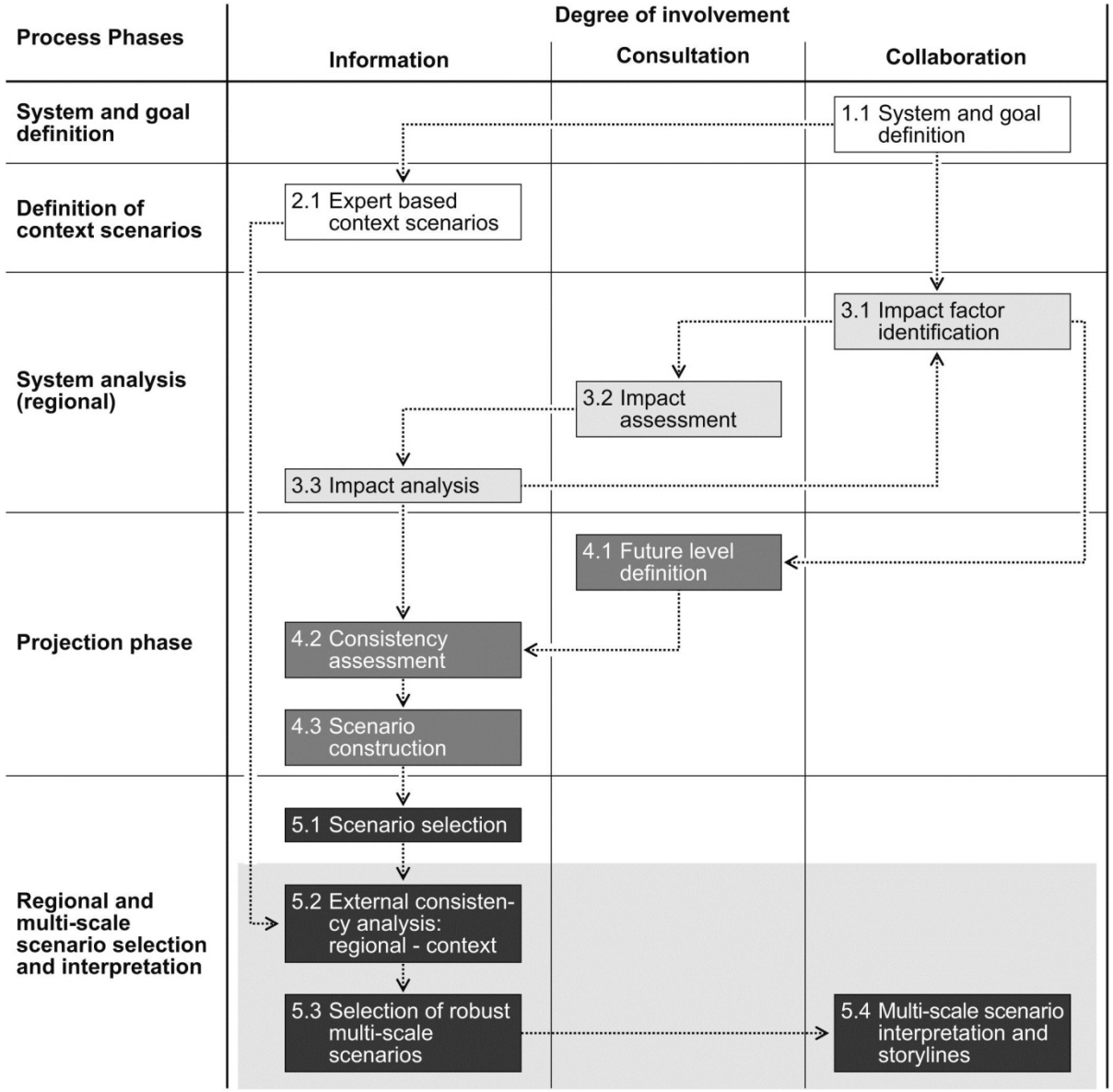
- Structured and approved approach
- "Formative"
  - 'giving form' to a set of consistent and plausible scenarios of future development
  - comprises twelve steps, which can be sub-grouped into five different phases

Scholz, R. W., & Tietje, O. (2002). *Embedded case study methods. Integrating qualitative and quantitative knowledge*. Sage: Thousand Oaks.

Two lines of scenarios: global and local/regional



Formative Scenario Analysis and functional-dynamic participatory process

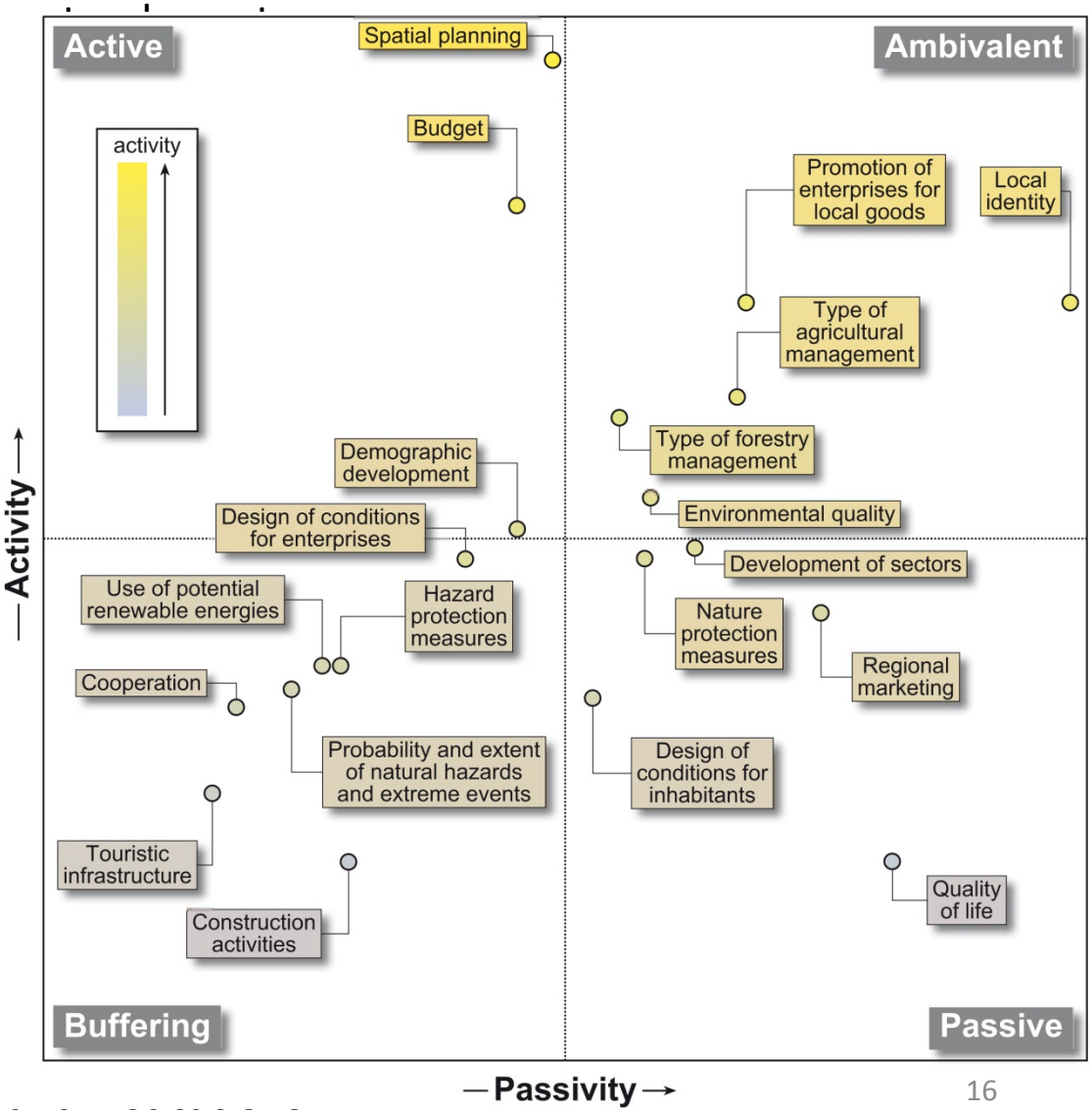


Formative scenario analysis (FSA) and an *external consistency analysis* in combination with a *functional-dynamic approach* to theory-practice cooperation.
The figure illustrates the respective steps 1.1 to 5.4 of our analysis. The arrows indicate possible sequences within an FSA. The arrow that is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

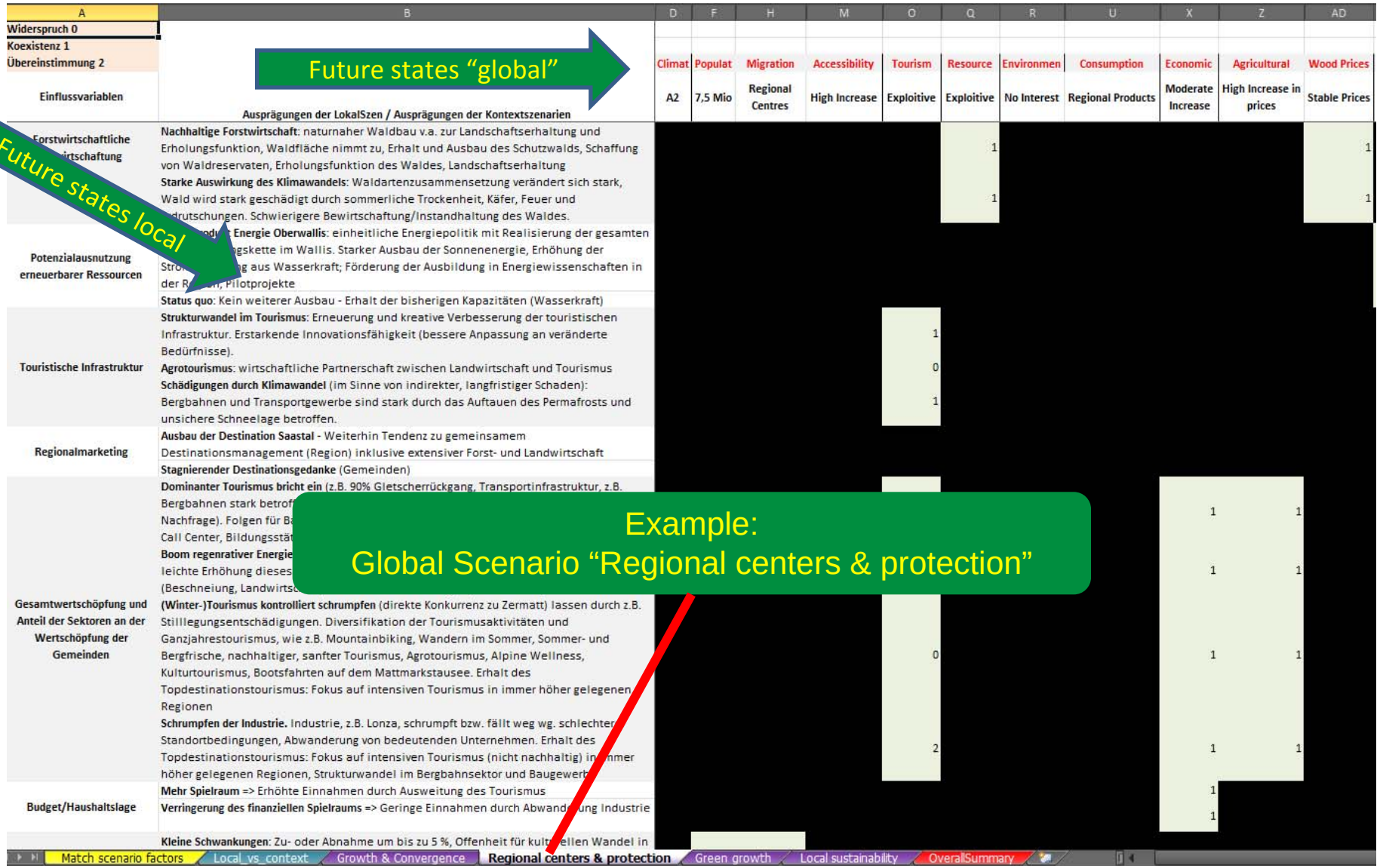
Workshops with stakeholders

20 impact factors – activity and passivity

1 Natural hazards and extreme
2 Environmental Quality
3 Construction activities; built
4 Hazard protection measures
5 Spatial Planning
6 Nature protection measures
7 Support of enterprises for lo
8 Type of agricultural manager
9 Type of forest management
10 Renewable energy managem
11 Touristic infrastructure: strat
12 Destination management
13 Development of economic se
14 Budget of municipalities
15 Strategies for business suppc
16 Population change & compos
17 Quality of life: basic needs ar
18 Strategies for social and ecor
19 Local identity
20 Cooperation of communities



Relate local to global scenarios



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