

# 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

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

CHR – 1st Spring seminar - “Socio-economic influences on the discharge of the River Rhine” - Bregenz, Austria, 26-27 March 2014

# Modeling: Danube catchment

- DSS DANUBIA
  - Spatially explicit
  - Water cycle
  - Upper Danube catchment
  - Resolution: 1 km<sup>2</sup>
  - Time step: 1 month
  - 9,115 inhabited grid cells (km<sup>2</sup>)
- Households
  - Agent types (empiric lifestyles; SINUS Milieus<sup>®</sup>)
  - Water demand
  - Water saving innovations
  - Activation (psychological response to water related stress)



# Combination of Scenarios: climatic – social

	Choice 1 Climate Trend	Choice 2 Climate Variant	Choice 3 Social Scenario	Choice 4 Intervention
1	IPCC regional	Baseline	Baseline	Intervention 1
2	REMO regional	5 warm winters	Open Competition	Intervention 2 Intervention 3
3	MM5 regional	5 hot summers	Public Welfare	
4	Extrapolation	5 dry years ...		

- Individual
- Free market
- Water as product

- Social democratic
- Government
- Water as highly valued good

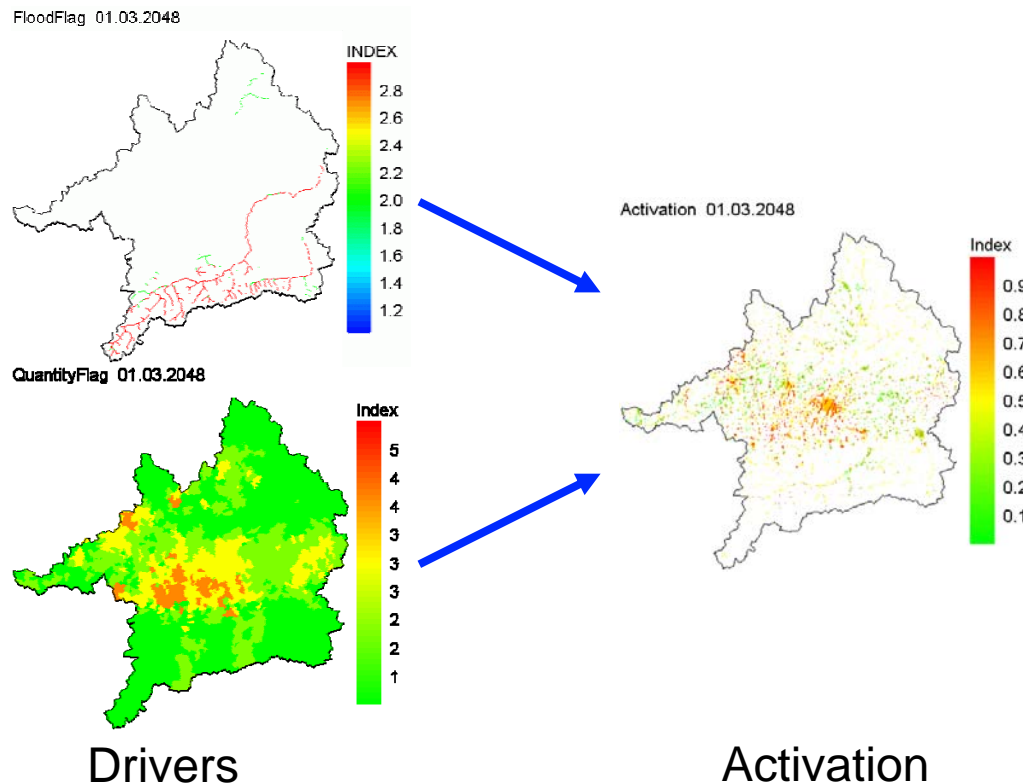


For example:  
Households and water  
supply companies are  
more sensitive

# Households' response in respective scenario

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

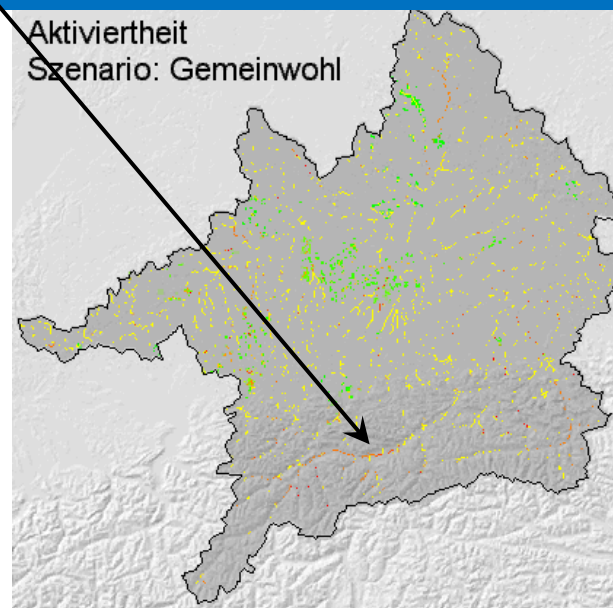
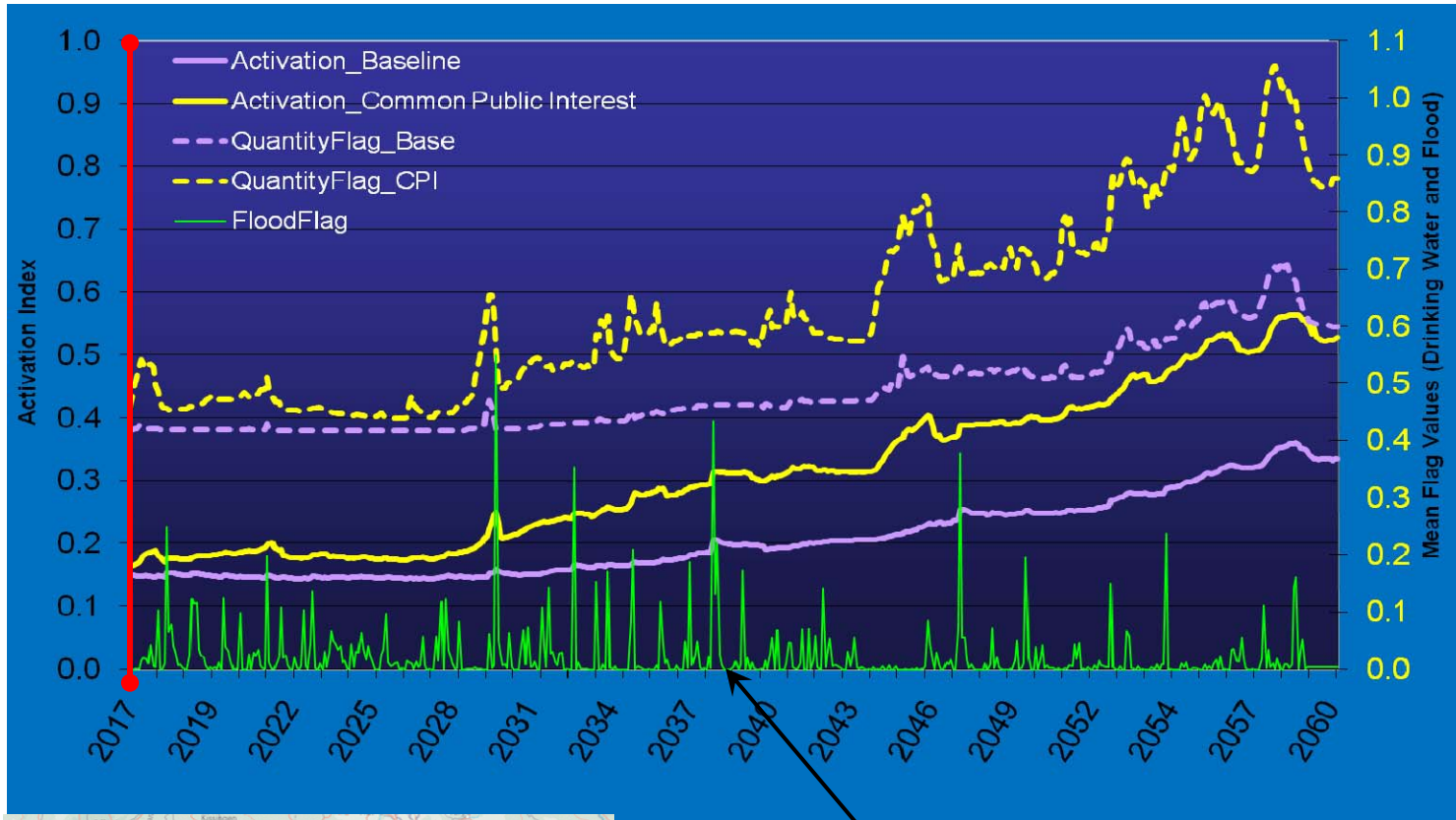
# Floods and water scarcity lead to activation/uneasiness



- 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



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

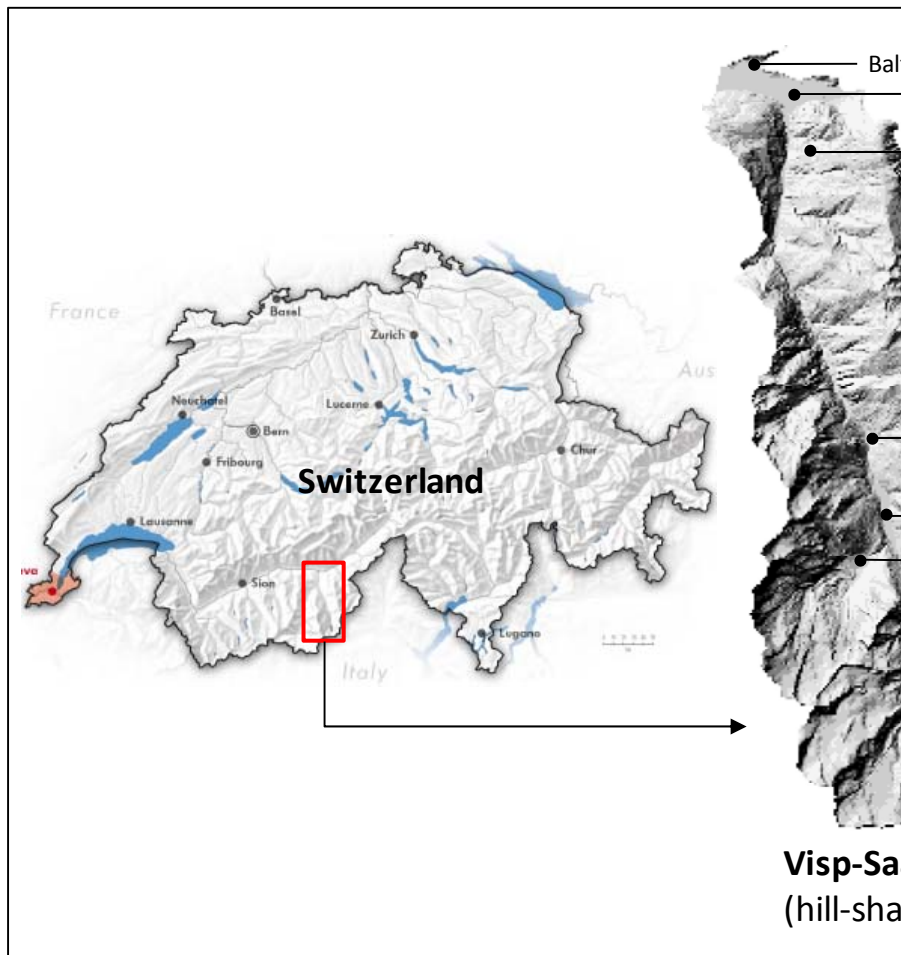


Brand, Seidl, Le, Brändle, & Scholz (2013). Constructing Consistent Multiscale Scenarios by Transdisciplinary Processes: the Case of Mountain Regions Facing Global Change. *Ecology and Society*, 18(2).

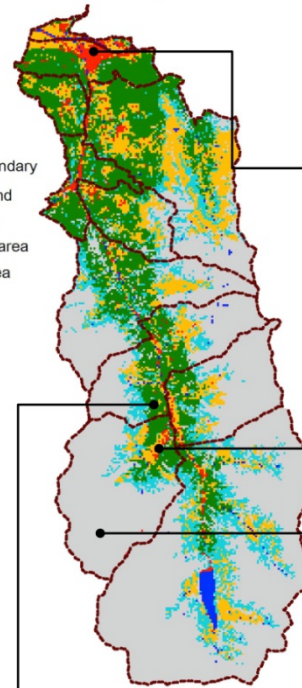
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# Main system components



## Visp-Saastal region

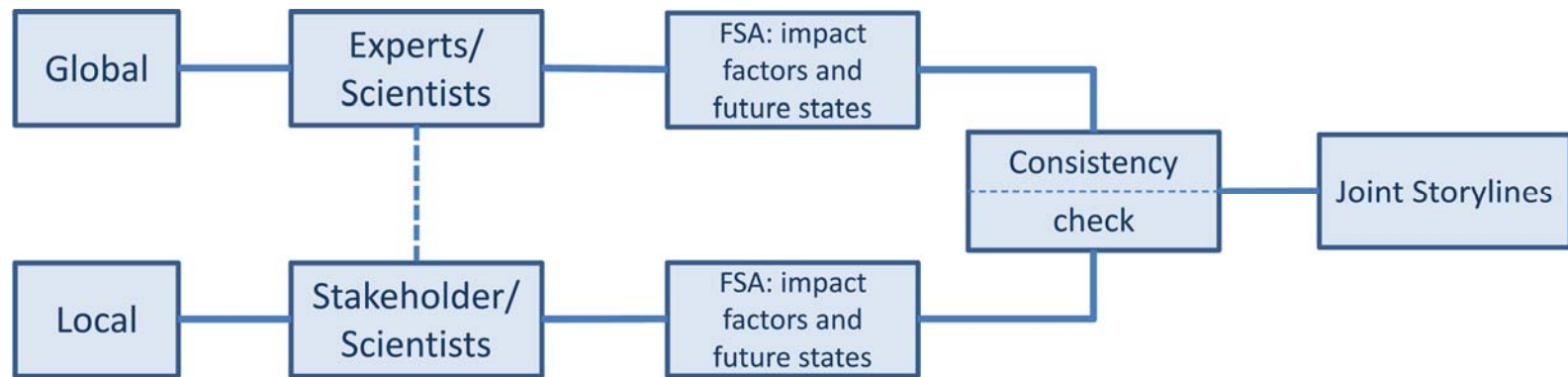


# Formative Scenario Analysis (FSA)

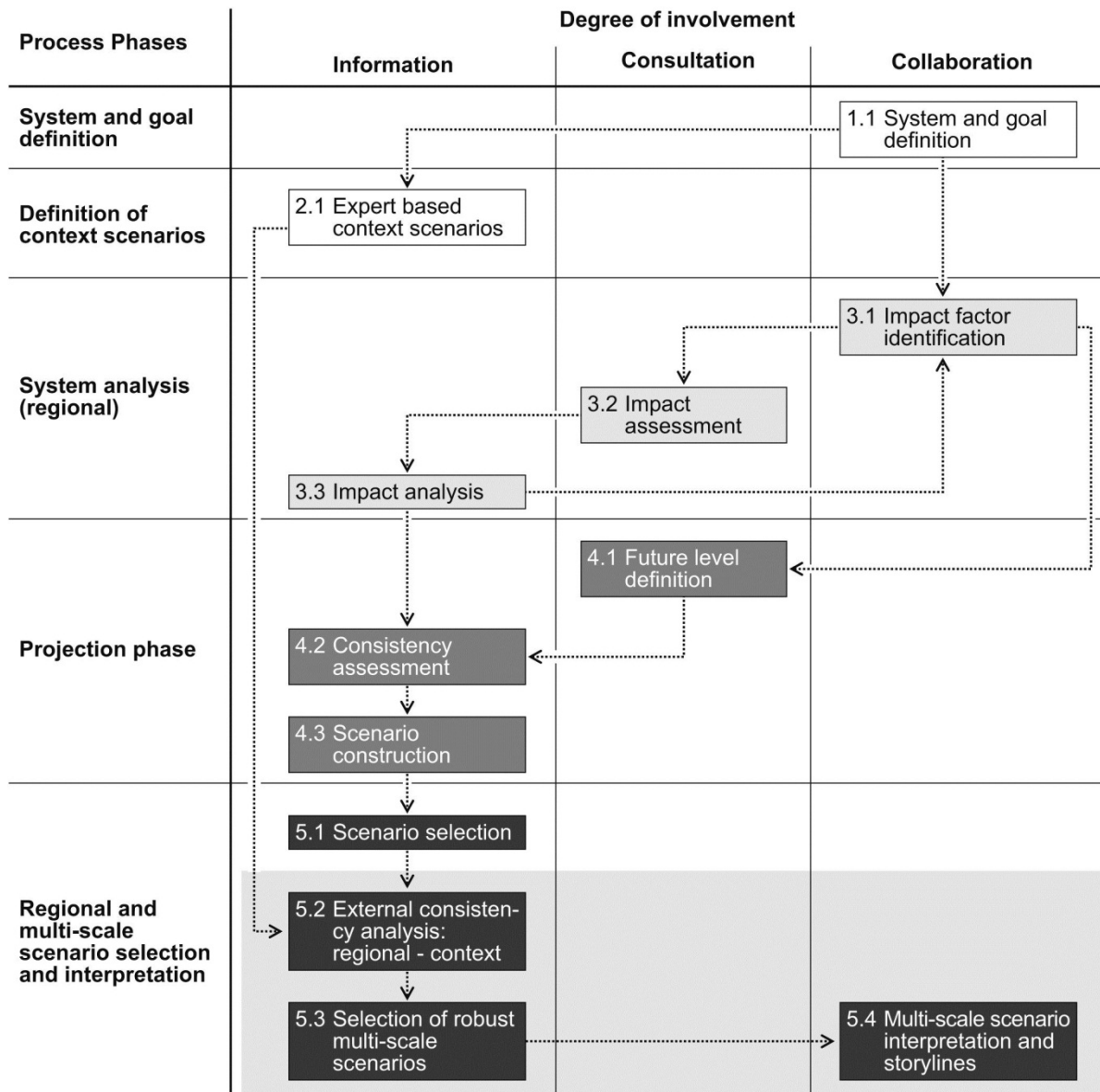
- Structured and approved approach
- “Formative”
  - ‘giving form’ to a set of consistent and plausible scenarios of future development
  - comprises twelve steps, which can be sub-grouped into five different phases

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.



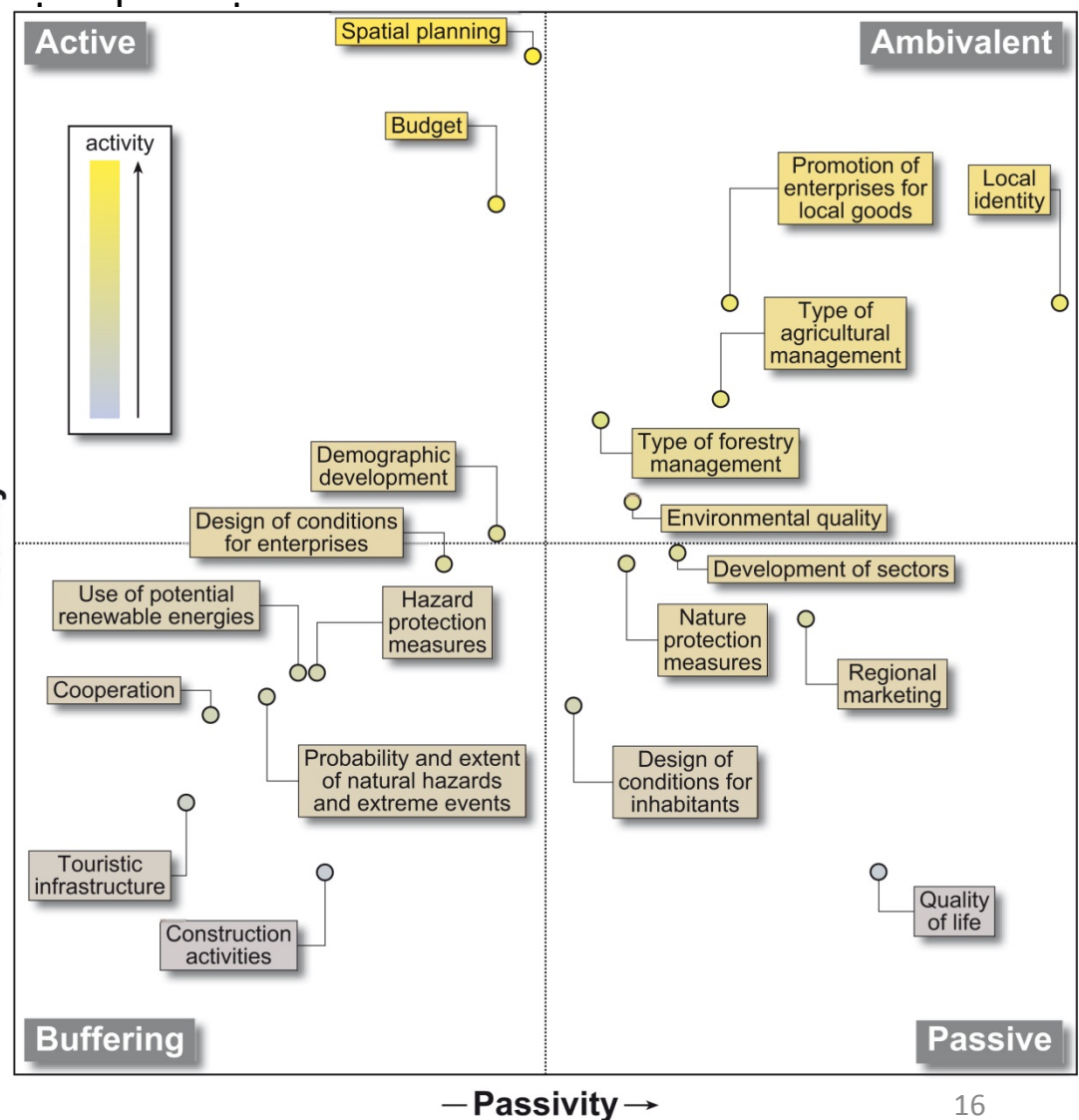
# Workshops with stakeholders



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# 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 supp
- 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

A	B	D	F	H	M	O	Q	R	U	X	Z	AD
Widerspruch 0												
Koexistenz 1												
Übereinstimmung 2												
Einflussvariablen	Ausprägungen der LokalSzen / Ausprägungen der Kontextszenarien	Climat	Populat	Migration	Accessibility	Tourism	Resource	Environmen	Consumption	Economic	Agricultural	Wood Prices
		A2	7,5 Mio	Regional Centres	High Increase	Exploitive	Exploitive	No Interest	Regional Products	Moderate Increase	High Increase in prices	Stable Prices
Forstwirtschaftliche Wirtschaftung	Nachhaltige Forstwirtschaft: naturnaher Waldbau v.a. zur Landschaftserhaltung und Erholungsfunktion, Waldfläche nimmt zu, Erhalt und Ausbau des Schutzwaldes, Schaffung von Waldreservaten, Erholungsfunktion des Waldes, Landschaftserhaltung <b>Starke Auswirkung des Klimawandels:</b> Waldartenzusammensetzung verändert sich stark, Wald wird stark geschädigt durch sommerliche Trockenheit, Käfer, Feuer und Stürme. Schwierigere Bewirtschaftung/Instandhaltung des Waldes.						1					1
Potenzialausnutzung erneuerbarer Ressourcen	Stromerzeugung aus Wasserkraft; Förderung der Ausbildung in Energiewissenschaften in der Region, Pilotprojekte <b>Status quo:</b> Kein weiterer Ausbau - Erhalt der bisherigen Kapazitäten (Wasserkraft)						1					
Touristische Infrastruktur	<b>Strukturwandel im Tourismus:</b> Erneuerung und kreative Verbesserung der touristischen Infrastruktur. Erstarkende Innovationsfähigkeit (bessere Anpassung an veränderte Bedürfnisse). <b>Agrotourismus:</b> wirtschaftliche Partnerschaft zwischen Landwirtschaft und Tourismus <b>Schädigungen durch Klimawandel</b> (im Sinne von indirekter, langfristiger Schaden): Bergbahnen und Transportgewerbe sind stark durch das Auftauen des Permafrosts und unsichere Schneelage betroffen.					1	0					
Regionalmarketing	<b>Ausbau der Destination Saastal</b> - Weiterhin Tendenz zu gemeinsamem Destinationsmanagement (Region) inklusive extensiver Forst- und Landwirtschaft <b>Stagnierender Destinationsgedanke</b> (Gemeinden) <b>Dominanter Tourismus bricht ein</b> (z.B. 90% Gletscherrückgang, Transportinfrastruktur, z.B. Bergbahnen stark betroffen, sinkende Nachfrage). Folgen für Baugewerbe, Call Center, Bildungsstätten <b>Boom regenerativer Energie</b> (Wind, Solar) - leichte Erhöhung dieses Sektors (Beschneigung, Landwirtschaft)									1		1
Gesamtwertschöpfung und Anteil der Sektoren an der Wertschöpfung der Gemeinden	<b>(Winter-)Tourismus kontrolliert schrumpfen</b> (direkte Konkurrenz zu Zermatt) lassen durch z.B. Stilllegungsschädigungen. Diversifikation der Tourismusaktivitäten und Ganzjahrestourismus, wie z.B. Mountainbiking, Wandern im Sommer, Sommer- und Bergfrische, nachhaltiger, sanfter Tourismus, Agrotourismus, Alpine Wellness, Kulturtourismus, Bootsfahrten auf dem Mattmarkstausee. Erhalt des Topdestinationstourismus: Fokus auf intensiven Tourismus in immer höher gelegenen Regionen <b>Schrumpfen der Industrie.</b> Industrie, z.B. Lonza, schrumpft bzw. fällt weg wg. schlechter Standortbedingungen, Abwanderung von bedeutenden Unternehmen. Erhalt des Topdestinationstourismus: Fokus auf intensiven Tourismus (nicht nachhaltig) in immer höher gelegenen Regionen, Strukturwandel im Bergbahnsektor und Baugewerbe						0			1		1
Budget/Haushaltslage	<b>Mehr Spielraum =&gt;</b> Erhöhte Einnahmen durch Ausweitung des Tourismus <b>Verringerung des finanziellen Spielraums =&gt;</b> Geringe Einnahmen durch Abwanderung Industrie						2			1		1
	<b>Kleine Schwankungen:</b> Zu- oder Abnahme um bis zu 5%, Offenheit für kulturellen Wandel in									1		1

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

A landscape photograph showing a wide riverbank covered in grey gravel. In the background, there is a dense forest of trees, some bare and some with green foliage, under a grey, overcast sky. The water of the river is visible in the foreground.

**Thank you**