A Conversation Starter: Communicating Socioecological Transitions With a Metabolism Approach

Kathryn Marshall, MSc Candidate in Environmental Management of Mountain Areas (EMMA)

universität innsbruck

unibz Freie Universität Bozen Libera Università di Bolzano Università Liedia de Bulsan

Introduction

A socioecological metabolism is an interdisciplinary concept used to describe interactions between nature and society. Environmental, economic and social capitals are used when evaluating the resilience of a community (Wilson 2010). Ecosystem services are benefits derived from interactions between humans and ecosystems, where the use of the ecosystem leads to human well-being (Fisher et al. 2007).

Combining ecological concepts of ecosystem services and sociological concepts of resilience in a socioecological metabolism is a way to compare energy practices of mountain areas through time and space.

How To Tell Sölden's Transition Story

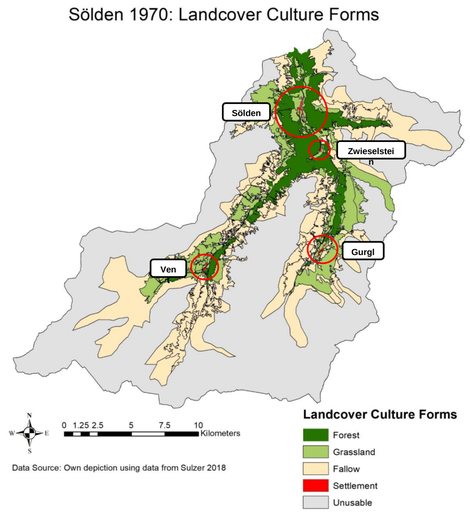
Aim One: Develop a conceptual model that describes nature-society interactions in a mountain municipality.

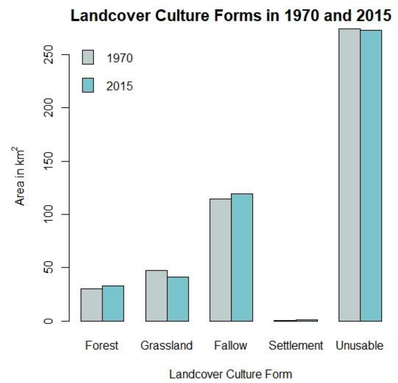
Aim Two: Apply the conceptual model developed in Aim One to the transition in the municipality of Sölden in Tyrol, Austria for the timestamps 1970 and 2010, using spatial analysis, socioeconomic indicators and metabolic trend indicators. *The socioeconomic data used in this study and presented in the figures came from Statistik Austria.*

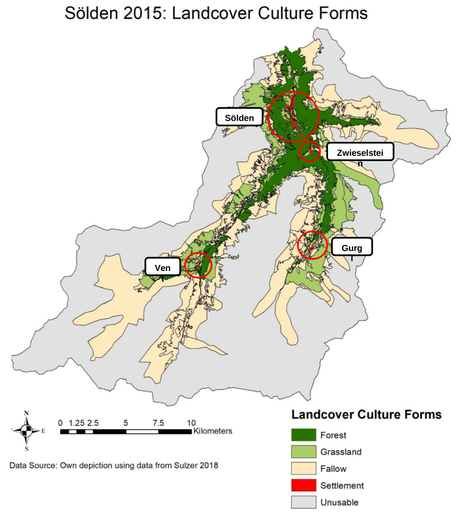
Spatial Analysis: Landcover change analysis performed in ArcGIS/ArcMap 10.5 using 1970 and 2015 landcover culture form data (Tasser et al. 2009, Sulzer 2018).

Indicator Analysis: **Residents:** Evaluated with employment sector change and energy consumption per capita. **Tourists:** Evaluated with overnight stays and approximate energy consumption per overnight stay. **Infrastructure:** Evaluated with households and ski lifts, and energy consumption per household and approximate energy demand for snowmaking. **Livestock:** Evaluated with livestock heads and approximate energy demand of grazing livestock (cows, goats, sheep, horses).

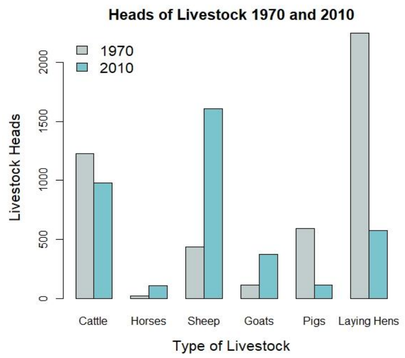
Aim Three: Communicate changes over time by weighting model categories, and use model to facilitate interdisciplinary conversation.





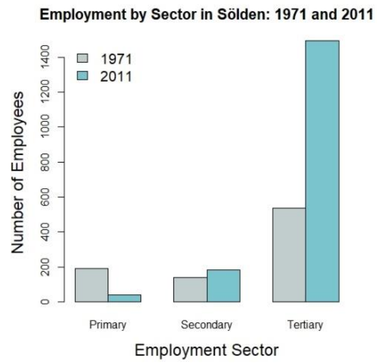


Socioeconomic Transition



	1970s	2011
Population	2372	3365
Youth-Dependency Ratio (population < 15 / working pop. 15-64)	1.01	0.25
Population Density (individuals per km²)	5.07	7.01
Farm Holdings	192	133
Winter tourist beds per resident	4.51	4.9
Summer tourist beds per resident	4.01	4.16

Table 1: Summary of socioeconomic indicators describing Sölden



Proposed Metabolism Model

Black boxes: The boundary of the 'black box' model defines a separation between nature and society.

Input and output arrows: Blue arrows represent exchange with the environment beyond the municipality level, and green arrows represent exchanges between society and nature within the municipality.

Indicator categories: Four indicator categories and a settlement area category communicate the socioecological metabolism of a municipality. The shapes are weighted to communicate changes, in this case energy demand 1970 -2010.

Figure 1: Municipality Metabolism Model

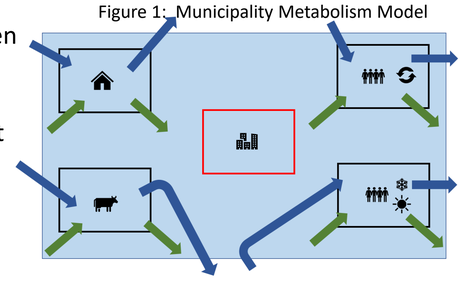
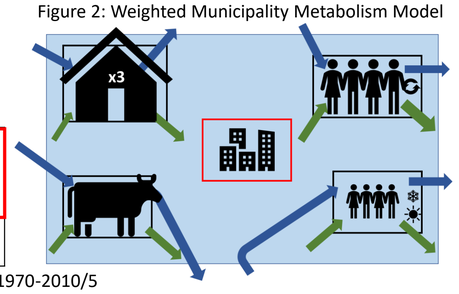


Figure 2: Weighted Municipality Metabolism Model



	Residents	Tourists	Infrastructure	Livestock	Settled Area
Percent Increase	281%	133.07%	3719%	305%	166.5%

Table 2: Summary of percent increase trend in energy demand of model categories and increase in settlement area 1970-2010/5

Results

There is limited landcover change and an increase in density and energy demand. In summary, the results of this study describe an acceleration of transition within an industrial regime in response to tourism pressures.

Discussion: Implications

The results suggest a bundling of ecosystem services, in the form of provisioning with energy and cultural for tourist recreation. Within resilience, an implied increase in dependency on resources from beyond municipality boundaries correlates with globalization trends and thus a pressure on the resilience of the municipality.

Ultimately, the metabolism model highlights the necessity of interdisciplinary studies – here, transition is described with three different levels that each tell a different story.

A Tool for Communication

The model presented in this study is an outline for mind mapping exercises to encourage experts and the public to think about nature-society interactions and to bring new perspectives to the table. For example, a sociologist, ecologist and economist would bring different perspectives on the the inputs and outputs of the tourist category alone!

Conclusion

Limitations: Metabolism research on a small scale (example municipality or village) is limited by data availability, making exact quantitative analysis labor intensive.
Future Research Suggestions: A detailed quantitative analysis on one or more categories, for example infrastructure and tourists. Also, a seasonal break down of metabolisms.
Mountain Areas: Transitions between and within regimes are occurring worldwide with implications for ecosystem service interactions and management for resilient communities. Details of these transitions are understood more fully with a metabolism approach.

References

Fisher, B., Constanza, R., Turner, R., Kerry, M.P. 2007. Defining and classifying ecosystem services for decision making. *CSERGE Working Paper EDM 07-04*
Sulzer, U., 2018. *Einfluss der Sazio-Ökonomie auf die Entwicklung der Landscahft in den Fraktionen der Gemeinde Sölden.* Diplomarbeit, Leopold-Franzens-Universität Innsbruck, Innsbruck, Austria.
Tasser, E., Ruffini, F., Tappeiner, U. 2009. An integrative approach for analyzing landscape dynamics in diverse cultivated and natural mountain areas. *Landscape Ecology* **24:** 611-628.
Wilson, GA. 2010. *Community resilience and environmental transitions.* New York, NY: Routledge.

Contact Information

Email: kathrynmarshall6595@gmail.com
LinkedIn (QR code):kathrynmarshallsmc17