relevant and sufficient empirical data on socio-technical levels and alongside varying phases of development across a selection of renewable energy projects.

To grasp this bottom-up transformation process, we propose a social network and social modelling approach. Most transformation studies are conceptual in character and serve a static analytical framework. Empirical applications are ex post evaluations of case studies. Our approach proposes an integrated conceptual framework that fills the gap as it serves to apply ex ante evaluation on the dynamics, role, performance, and development of social networks in the process of a regional energy transition.

To demonstrate the usefulness of our approach, we apply the case of a regional transformation process towards a sustainable energy system in a German county. The conceptual framework we use systematically reduces complexity and guides the collection of relevant empirical data across socio-technical levels, phases of innovation, and social, economic, and political factors influencing the local and regional energy transition. The empirical results we present demonstrate the first steps on how to select relevant project cases, to choose interview partners, and to collect sufficient data for a systematic social network analysis and an agent-based model.

Participatory scenario planning for reconciling food security and biodiversity conservation in south-western Ethiopia

Jan Hanspach, Tolera Senbeto Jiren, Jannik Schultner, Joern Fischer and Ine Dorresteijn

Sustainability science requires research processes that embrace and maneuver the complexities of social-ecological systems. This includes engagement with a broad range of stakeholders and recognition of the dynamic and uncertain nature of future developments. In this presentation we want to share our hands-on experiences from such a research process, which aimed at reconciling food security and biodiversity conservation in a case study area. In particular, we applied the method of participatory scenario planning to elicit possible future development trajectories in south-western Ethiopia. We conducted more than 40 workshops with stakeholders concerned with food security and biodiversity conservation, including local farmers and representatives of governmental institutions at different levels. A first round of workshops included the description of social-ecological dynamics and the identification of key uncertainties. Important factors influencing current and future dynamics were the modernization of farming methods, the access to forest ecosystem services, and the increasing influence of global markets, climate change and population growth. Based on this systems understanding, we derived a consensus causal loop diagram and developed narratives of four different exploratory scenarios describing plausible future conditions in 20 years from now. We evaluated these scenarios in a second round of workshops and identified the opportunities, risks and implications together with stakeholders. Finally, we visualized the scenarios and produced a wide range of outreach material including a booklet, posters, postcards and other information that we then distributed throughout the study area.Implications for sustainability: This study shows that a careful consideration of different development options is necessary in order to achieve a just and food secure future in which the unique biodiversity of the region will be maintained. Importantly, deep drivers such as population growth, that are neither tackled in the short nor in the medium term, need not to be overlooked.

Vision Modeling to Generate Target Knowledge for Transformative Change

Johannes Halbe and Jan Adamowski

Goals of a system are profound leverage points for system change, as noted by Donella H. Meadows. In fact, 'whole system goals' are often implicit and thereby "people within systems don't often recognize what whole-system goal they are serving" (Meadows, 1997). Thus, a first step towards using this high leverage point for sustainability transformations is to elicit current whole system goals as well as visions for alternative goals and related system designs. By collaboratively envisioning the goal of a transformation process, target knowledge is developed that can provide motivation and orientation for stakeholders and constitute a reference point for process evaluation (e.g., Halbe, 2016). There are different approaches for the development of joint future visions, such as written vision statements or visualization techniques. The use of systems modeling for the rigorous and systemic investigation of sustainability visions is an innovative research field. Various modeling approaches can be potentially applied to assess the internal consistency (e.g., existence of trade-offs), plausibility (are realistic constraints considered?) and desirability (are sustainability benefits reached?) of visions. Potential methods for conceptual vision modeling are systems thinking, influence matrices and functional analysis. Dynamic vision models build upon conceptual models and allow for quantitative analysis of the dynamics of a future vision, for instance by using system dynamics modeling or fuzzy cognitive mapping. This contribution will provide an overview of potential modeling methods and examples of their application for analyzing visions for sustainable food and energy systems.

Implications for sustainability transformations: Modeling of sustainability visions is a critical for assessing the coherence, plausibility and desirability of sustainability visions and thereby providing target knowledge for sustainability transformations.ReferencesHalbe, J., 2016. Governance of Transformations towards Sustainable Development - Facilitating Multi-Level Learning Processes for Water, Food and Energy Supply. Dissertation, University of Osnabrück.

The complex phenomenon of nutritional behaviour: Identifying leverage points for modification

Eva Hummel, Ingrid Hoffmann

As nutritional behaviour is a complex phenomenon, leverage points for successful modification must be deduced from a systems perspective.

A cause-effect model was developed by identifying factors directly or indirectly influencing the core factor "food consumption" and causal relationships between all factors on basis of current literature and expert consultation. The relationships were specified by strength (weak, medium, strong) and type (promoting, restricting). To develop the model and for subsequent analyses, elements of three instruments were combined: (1) Nutrition-ecological modelling (NutriMod, Schneider and Hoffmann 2011), further developed to NutriMod+ST (Strength and Type, Hummel and Hoffmann 2016); (2) Sensitivity model, amongst others for analysing the roles of factors in the system which e.g. indicate whether a factor is suitable as control lever or indicator (Vester 2007); Cross-Impact Balance Analysis, amongst others to analyse effects of external impulses on the system based on consistent scenarios (Weimer-Jehle 2013).

The model consists of nineteen factors, each aggregating several aspects of nutritional behaviour. Each factor's degree of influence on the system and each factor's own influencability is demonstrated. The model presents the interplay of all factors and relationships and therefore reveals cause-effect chains, feedback loops, multicausalities, side effects and consequently eigendynamics within the complex phenomenon. Four of the nineteen factors were identified as promising leverage points to modify food consumption: agent of socialization family, socio-economic status, social identity, and psychological resources. Additional results show that it is not sufficient to modify single factors. Instead, the relevant factors need to be considered in parallel (Hummel 2017).

To be more successful in modifying food consumption, the complexity of nutritional behaviour needs to be considered and dealt with. Based on the presented results, more targeted measures can be planned which prioritize and combine the identified leverage points.

Transformative design practices (4.6)

Design can be a transformative practice to address complex issues in social, environmental, and political contexts. This session considers design practices such as prototyping, transition design methods and design thinking tools; exploring how they bridge a knowledge-action-gap, develop sustainable innovations, and challenge paradigms.

Session Chair: TBA

Format: Talks and panel discussion

Room: 40.255

Re-thinking Design as a transformative research practice in Sustainability Science

Daniela Peukert

Transformative research approaches in sustainability science adress complex issues by including diverse perspectives, forms of cognition and knowledge production, as well as different bodies of knowledge. A challenge within heterogeneous project teams is to gain a common understanding of what is considered the problem and to facilitate mutual learning towards integration between partners with specific expertise. Different epistemic cultures, theoretical

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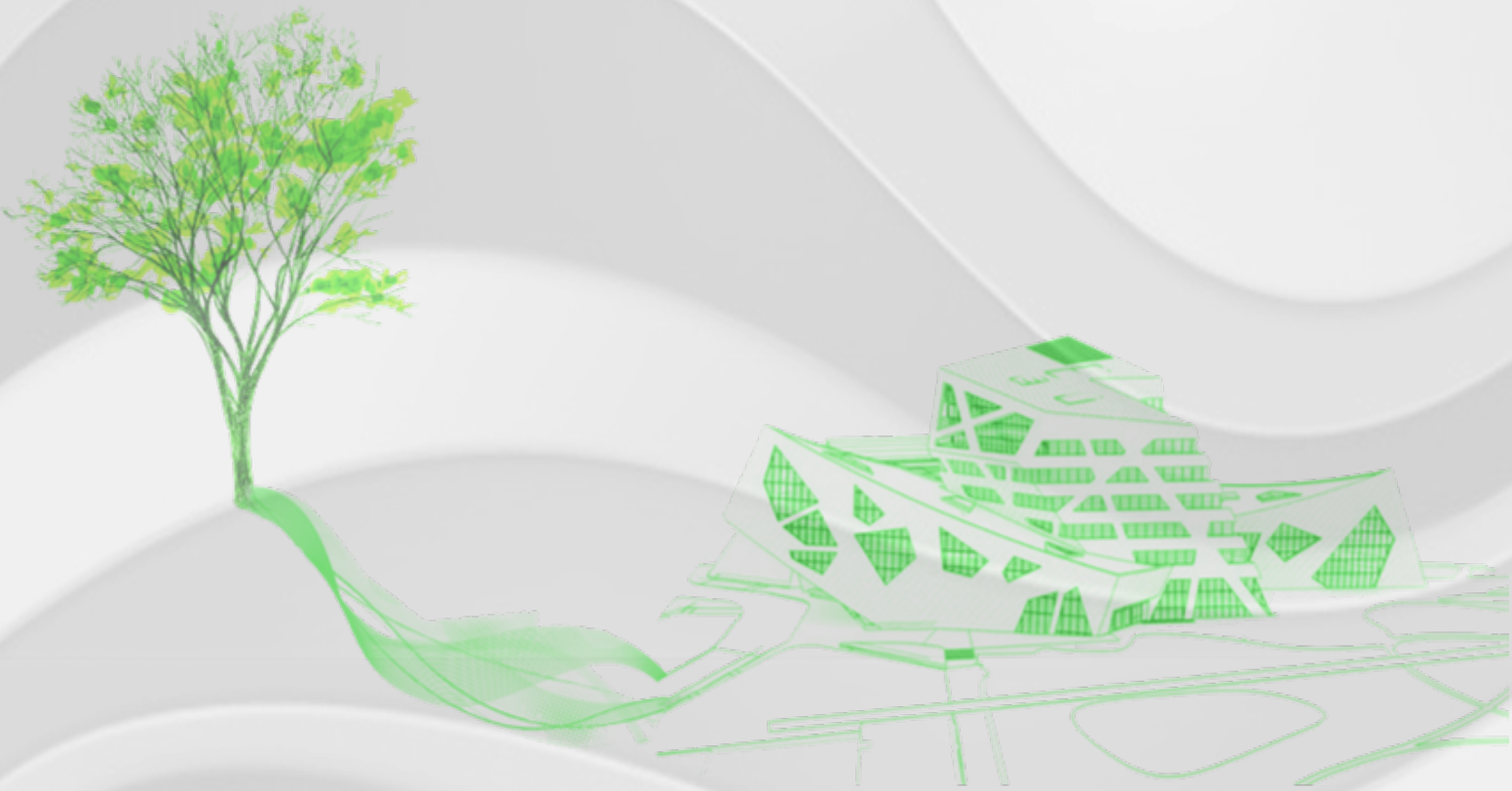

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