Commitment to Continuous Research Is a Key Factor in Transdisciplinarity

Experiences from the *Mountland* Project

Robert Huber, Andreas Rigling

Mountain ecosystem services are vulnerable to climatic and land-use changes. The Mountland project revealed that policy integration, network governance and integration of stakeholders are essential for developing sustainable land-use practices, as is researchers' long-term engagement for a successful transdisciplinary research process.

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Abstract

Transdisciplinary research in sustainability science needs “best practices”. Presenting the framework and main results of the integrative research project *Mountland*, we relate our approach to a concept for an ideal-typical transdisciplinary research process. *Mountland* investigated the impacts of climate and land-use changes on ecosystem processes in three Swiss mountain regions, building on interdisciplinarity and involving stakeholders. The project identified key characteristics relevant in all case study areas and names three aspects essential for an institutional framework to maintain and strengthen important mountain ecosystem goods and services: policy integration, network governance and integration of stakeholders. Comparing *Mountland* with an ideal-typical transdisciplinary research process, we highlight which components of such a process could or could not successfully be implemented, and discuss the coping strategies we used. Our key message: a long-term commitment to continuous research in a case study region plays a crucial role in successful transdisciplinary research.

Keywords

ecosystem goods and services, global change, inter- and transdisciplinary research, mountain regions

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Transdisciplinary research aims at bridging the gap between solving real world problems and scientific innovation (Lang et al. 2012). Transdisciplinarity is a key component in understanding complex human-environmental systems, as different studies show (e.g., Hirsch Hadorn et al. 2008, Brandt et al. 2013). The concept of an ideal-typical transdisciplinary research process has recently been described for sustainability science (Lang et al. 2012).

In this article, we reflect on our experience in the transdisciplinary research project *Mountland*, and discuss it with respect to the components of such an ideal-typical project. Specific challenges during different project phases are examined and strategies for coping with them presented. This allows enriching the concept of an ideal-typical process by including details about concrete approaches taken to handle specific challenges in a successful integrative project dealing with global change impacts on mountain regions.

The concept of transdisciplinarity is still associated with a wide range of different definitions and terminologies (Pohl 2010, Jahn et al. 2012). In *Mountland*, transdisciplinarity was defined as a research approach that involves different scientific disciplines (interdisciplinarity), which focus on shared problems and take into account the active input of practitioners from outside academia (see also Brandt et al. 2013).

The structure of this paper reflects both the interdisciplinarity and the stakeholder involvement of our approach. First, we introduce the goal of the project and give a brief overview on our interdisciplinary framework. We also describe our interactions with practitioners and summarize the main results. Then, we discuss the challenges that arose in *Mountland* and the coping strategies we used according to ideal-typical research. Finally, we discuss the implications for transdisciplinary research in general.

The *Mountland* Project

The goal of *Mountland* was to investigate the sensitivity of the provision of mountain ecosystem goods and services (EGS) to both

climatic and land-use changes, and to suggest alternative policies for mitigating the impact of such changes, as well as enhancing sustainable management practices in mountain regions (Huber et al. 2013 a). The project provided: 1. new scientific findings regarding the impacts of climate and land-use changes on ecosystem processes in three mountain regions of Switzerland (e. g., Dawes et al. 2011, Gavazov et al. 2013, Rigling et al. 2013), 2. an assessment of the feedback effects arising from changing ecological, socio-economic and political conditions using modelling techniques (e. g., Elkin et al. 2012, Huber et al. 2013 b, Zurbriggen et al. 2014) and stakeholder interactions (Brand et al. 2013), and 3. suggestions for alternative policy solutions to ensure sustainable land-use in mountain regions (Huber et al. 2013 c). The three case study regions were a pasture-woodland ecosystem in the Jura, a drought-sensitive inner alpine ecosystem in the Central Valais (figures 1, 2, p. 258) and a high alpine ecosystem in Davos.

Interdisciplinary Background

To achieve this goal, an integrative approach was applied, combining methods from economics and the political and natural sciences to analyze ecosystem functioning and management in mountain regions (Huber et al. 2013 a). The research was organized around three clusters: an ecological, a socio-economic and a

policy assessment task, involving ten research groups. The various groups collaborated from the very outset in order to achieve a holistic human-environmental perspective. Thus, our research did not produce a “cascade” of different findings for individual research tasks summarized at the end of the project, but explicitly considered feedback effects from changing socio-economic and political conditions on land-use and adaptation to climate change (Huber et al. 2014). The collaboration between the different research disciplines was based on three pillars:

1. The same set of research questions was addressed in the different case study regions to ensure a consistent focus.
2. All analyses in *Mountland* were based on a common set of scenarios (Walz et al. 2013). This strongly improved the feasibility of synthesizing the different research findings across regions.
3. The ecological and socio-economic models in the case study regions were explicitly coupled so that the feedback effects between the impact of climate and socio-economic changes on land-use and alternative policy measures could be quantified.

This approach resulted in truly interdisciplinary work, with the added value that the data and models had secure biophysical foundations and that local trade-offs could be taken into consideration (Huber et al. 2013 a).

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FIGURE 1: One of the three case study areas: Visp Region (Central Valais), a drought-sensitive inner alpine ecosystem. Together with extended stakeholder groups, *Mountland* developed regional “transition scenarios”.

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Stakeholder Involvement

The stakeholders were involved in a cross-sectional activity to provide guidance for the interdisciplinary research process in two tightly interlinked phases.

In the first phase, a steering group representing the core stakeholders was set up in each study region. They consisted of six to nine representatives of the typical stakeholder groups, who advised the project leaders from a “study region perspective” in an iterative process. Furthermore, the steering group reviewed and discussed the preliminary results and coordinated the involvement of specific stakeholders in the different activities.

In the second phase, regional “transition scenarios”, with extended stakeholder groups, were developed, using a functional-dynamic form of stakeholder involvement (Brand et al. 2013). The insights gained in other parts of *Mountland* served as the basis for these processes. Due to funding and time constraints, this second phase of the stakeholder involvement was only implemented in the case study region Valais.

In addition, the methods chosen for our interdisciplinary approach included agent-based modelling (e.g., Huber et al. 2013b) and policy network analysis (e.g., Ingold 2014). For these methods to work, good and intensive collaboration with residents and local decision makers is essential.

Main Conclusions from the First Project Phase¹

The main findings across disciplines and case study regions are summarized and synthesized in Huber et al. (2013c). They are organized according to the following key characteristics, which were identified as central to our case study areas: non-linearities and thresholds, heterogeneity, trade-offs, as well as feedbacks. We found relevant examples of these characteristics in all three case study regions. From this synthesis, we concluded that an institutional framework focusing on the following three aspects is essential for maintaining and strengthening important EGS in mountain regions.

1. Integrative approaches (“policy integration”) to strengthen cross-sectoral coordination should be supported (Ingold and Balsiger 2013). These approaches would allow for a more effective provision of mountain EGS in the presence of heterogeneity and thresholds.
2. Network management and steering (“network governance”) to strengthen multi-level governance would allow (local) stake-

¹ The project comprises two research phases. The first phase started in the year 2008 and was completed in 2012. The second phase, based on new research questions and a new research approach, started in the year 2013 and will end in 2015.

FIGURE 2: Site visit of *Mountland* researchers in the case study region Visp, Valais. Researchers’ long-term commitment and continuous research prove to be essential for a successful transdisciplinary research process.

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holders to be adequately integrated in policy formulation and implementation processes. Spatial planning instruments and methods addressing heterogeneity (Briner et al. 2013 a), trade-offs (Briner et al. 2013 b, Grêt-Regamey et al. 2013) and feedbacks (Huber et al. 2013 b) provide important policy alternatives in this context.

3. The integration of stakeholders would permit a focus on capacity building (Ingold 2014). This is important to reduce vulnerability to the changing climate conditions, socio-economic developments and related risks we identified in *Mountland*.

Experiences from *Mountland* Related to an Ideal-typical Transdisciplinary Research Process

Recently, Lang et al. (2012) published a set of principles for an ideal-typical transdisciplinary research process. They distinguish three phases: collaborative problem framing and collaborative research team building (*phase A*); co-creating solution-oriented and transferable knowledge through collaborative research (*phase B*); (re-)integrating and applying the co-created knowledge (*phase C*). In the following, we compare the experiences from our own transdisciplinary research to the components, that is, to the design principles, challenges and coping strategies in these three phases (see table, p. 261).

Phase A: Collaborative Problem Framing and Collaborative Research Team Building

Building a Collaborative Research Team

Integrating non-scientific interests was a first important challenge since the impact of climate change on the forestry and agricultural sector in mountain regions may not be visible within the next few decades. Thus, the tangibility of the problems is low and political responsibilities may not be clear or in place yet (see Lang et al. 2012). As a consequence, the project team identified stakeholders on the basis of existing contacts. As a result, they were mainly local people who had already cooperated on joint projects with the researchers working in these regions. Lang et al. (2012) call them the “usual suspects”. However, we were still able to involve stakeholders from different sectors and institutional levels, and found their problem awareness was generally high.

Creating a Common Understanding and Definition of the Sustainability Problem to Be Addressed

The challenge of collaborating on problem definitions was that the stated preferences of the stakeholders for research were often not stable over time. Their reported need for particular scientific information about climate change changed during the project, with initially more concern about water availability and then landscape preservation was seen as the most important challenge. Thus, the definition of the sustainability problem turned out to be difficult. However, the researchers in *Mountland* started working in the case study regions long before the actual project was set up, and they will continue to do so after the project has finished. This long-term

commitment, together with the regular stakeholder interactions that took place in the corresponding case study regions, somewhat cushioned this transdisciplinary deficit.

Collaboratively Defining the Boundary/Research Object, the Research Objectives and the Specific Research Questions

The long-term involvement of the researchers allowed research questions to be identified over a longer time horizon and be more sustainability oriented. This has the advantage that the research objects and questions do not only focus on current problems, which might be influenced by the media or current events and would thus be of less relevance for longer term problem framing. The disadvantage is that policy and research processes could not be directly aligned (see Pohl 2008). Thus, the “problem ownership” was to some extent unbalanced with more weight given to the scientific questions in *Mountland*.

Designing a Methodological Framework for Collaborative Knowledge Production and Integration

The main challenge was the alignment of thinking between natural and social scientists, which is a well-known problem in interdisciplinary research (Heberlein 1988). A key strategy in *Mountland* was to publish research articles at the interface between disciplines in a special feature of the journal *Ecology and Society*.² Writing manuscripts jointly emerged as strong incentive to agree on concepts and methodological approaches.

Phase B: Co-creating Solution-oriented and Transferable Knowledge through Collaborative Research

Assigning and Supporting Appropriate Roles for Practitioners and Researchers

The project had three different research focuses: ecological, socio-economic and policy research. The integration of stakeholders in the process was different in these different fields of research. While a formative scenario analysis resulted in a strong collaboration (Brand et al. 2013), other research activities focused on interactive workshops (Ingold and Balsiger 2013, Ingold 2014) or consultations with (local) experts (Grêt-Regamey et al. 2013, Hirsch et al. 2013, Huber et al. 2013 b). This corresponds with the definition of an analytical and dynamic approach to collaboration (Stauffacher et al. 2008). However, the interaction and roles for practitioners were limited in two of the three case study regions for various reasons: the Davos site had been “over-researched”, resulting in a certain stakeholder fatigue. In the Jura study area, funding resources were limited. In both cases, forcing a transdisciplinary approach, for example, by holding workshops with decision makers, would have threatened the mutual trust between researchers and local stakeholders. The *Mountland* representatives have a strong sense of responsibility about their interactions with stakeholders since they risk losing their reputations in the region where they want to continue their research.

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² www.ecologyandsociety.org/issues/view.php?sf=75

Applying and Adjusting Integrative Research Methods and Transdisciplinary Settings for Knowledge Generation and Integration

The real interdisciplinary collaboration that took place between the different *Mountland* research groups was the most important pillar for the successful implementation of the project. There was no conflict between researchers about suitable methods. However, the funding and time resources were insufficient to actually implement a coherent set of methods. Funding of transdisciplinary research projects remains a major challenge (see Holm et al. 2013). In this respect, the institutional anchoring and the project structure of *Mountland* were key factors in its successful implementation.

tions of the stakeholders and their limited time and resources to take into account transdisciplinary research still remains a difficult challenge. Second, depending on the knowledge created, the re-integration into practice may be difficult (Cornell et al. 2013), especially when it comes to climate change, where the communication of uncertainties play a major role. One example we experienced was that local foresters did not accept our first simulation results of the impacts of climate change on forest development in the case study region Valais as a basis for discussion. In their view, our simulation results, which were based on the most severe climate change scenario A1, were unrealistic. Only through the continued discussion of other results and assumptions and the clear communication of the uncertainties in our simulations

“Research tourism” – researchers leaving the case study region without re-integrating their results –, hinders an effective evaluation of the project and hampers effective stakeholder involvement in future projects.

1. Institutionally, the funding scheme of the *Competence Center Environment and Sustainability* of the ETH Domain (CCES) explicitly supported inter- and transdisciplinary research, which ensured the indispensable support for our research (Kueffer et al. 2012).
2. From the point of view of the project structure, the management board of *Mountland* supported a consensus-oriented collaboration between the scientists, resulting in a high level of mutual trust and confidence among project partners.
3. The scientific project coordination facilitated the publication-oriented collaboration between the different researchers involved in the project. The coordinator had the time and funding to create a platform for effective integration across the disciplines and knowledge types and to initiate joint publication projects.
4. Although different types of research integration are possible, for example, group learning, negotiation among experts, integration by leaders or modelling (Rossini and Porter 1979), in our case, a model-based integration of the findings in the different disciplines strongly supported collaboration.

Phase C: (Re-)integrating and Applying the Co-created Knowledge

Realizing Two-dimensional Integration

An outcome of the project was the publication of a large number of articles in peer-reviewed journals that addressed methodological aspects and interdisciplinary applications of our research (for specific results please refer to our project website³). Feeding the results into practice was, however, very challenging for two reasons. First, our stakeholders mostly work in the cantonal administration and had limited time to spend on interpreting and discussing the results. This (perceived) gap between high expecta-

was it possible for the foresters to accept such changes as potentially realistic.

Generating Targeted Products for Both Parties

The publication of two stakeholder-oriented but still interdisciplinary special issues in *Agrarforschung*⁴ for the agricultural sector and in the *Swiss Forestry Journal*⁵ for the forestry sector was important for our dialogue with stakeholders outside the scientific community in all three case study regions. The publications in German and French meant the project gained a much higher visibility and not only among stakeholders directly involved in the project. The above mentioned publication of a special feature in *Ecology and Society* with ten research articles drew the attention of the scientific community to the project and provided a synthesis and holistic overview of our research activities.

Evaluating Scientific and Societal Impact

The personal involvement of many of the *Mountland* researchers in “their” case study regions means the research findings will remain present in the region and their impact can be evaluated in the longer run. This influences the diffusion rate of the results. Research projects where the researchers are less personally committed may be affected by “research tourism”, where researchers or institutions leave the case study region after the project is finished, irrespective of the re-integration and communication of their results. Such “tourism” hinders an effective evaluation of the project and hampers effective stakeholder involvement in future projects.

3 www.cces.ethz.ch/projects/sulu/MOUNTLAND/output

4 www.agrarforschungschweiz.ch/archiv_11de.php (Agrarforschung 7/8, 2012)

5 www.szf-jfs.org/toc/swif/163/12 (Swiss Forestry Journal 12, 2012)

TABLE: Ideal-typical transdisciplinary research process, challenges and coping strategies in *Mountland*. Source: Lang et al. (2012), Brandt et al. (2013).

phase	design principle	specific challenges in <i>Mountland</i>	<i>Mountland</i> coping strategy
A: collaborative problem framing, and building a collaborative research team <i>overall challenge: lack of coherent framework</i>	Build a collaborative research team.	climate change impacts with hitherto low tangibility	stakeholders recruitment based on existing contacts
	Create joint understanding and definition of the sustainability problem to be addressed.	Stakeholder preferences for research were not stable over time.	long-term engagement to maintain trust of stakeholders
	Collaboratively define the boundary/research object, research objectives as well as specific research questions.	unbalanced problem ownership, that is, more scientific questions	"long-term problem framing" through (local) researchers to anchor scientific questions in real world problems
	Design a methodological framework for collaborative knowledge production and integration.	finding a common language between natural and social scientists took time – despite researchers' "experience" in inter- and transdisciplinarity	joint publishing as trigger for involvement of interdisciplinary teams
B: co-creation of solution-oriented and transferable knowledge through collaborative research <i>overall challenges:</i> 1. integration of methods 2. research process and knowledge production 3. involving practitioners	Assign and support appropriate roles for practitioners and researchers.	discontinuous participation – since participation took place only with clear added value for stakeholders	long-term project engagement to balance discontinuous participation and reduce stakeholder fatigue
	Apply and adjust integrative research methods and transdisciplinary settings for knowledge generation and integration.	lack of time and funding for the implementation of a coherent set of methods across disciplines	<ul style="list-style-type: none"> ■ consensus-oriented project management and model-centred synthesis to support integration ■ scientific research coordination to enable integrative work at the interfaces of disciplines
	Realize two-dimensional integration.	<ul style="list-style-type: none"> ■ stakeholders' lack of motivation to consider results as limiting factor for integration ■ climate change and ecosystem services with still under-developed "legitimacy" in administrative structures 	<ul style="list-style-type: none"> ■ long-term involvement to increase the probability that stakeholders will be aware of ongoing research ■ maintaining of trust and accountability of researchers to increase visibility of results
C: (re-)integrating and applying the co-created knowledge <i>overall challenge: generating impact</i>	Generate targeted products for both parties.	stakeholders from different sectors with different information networks	publication of special issues in sector-specific journals (agriculture and forestry) to increase visibility of research
	Evaluate scientific and societal impact.	only possible with a long-run perspective	personal and long-term involvement of researchers

Implications for Transdisciplinary Research

Transdisciplinary research has the potential to create a new knowledge base that supports real-world decision making in the context of sustainable developments (Pohl 2011, Lang et al. 2012). Different forms of integrating scientific knowledge into policy exist (Pohl 2008). However, knowledge production and policy processes may not be fully harmonized in the context of sustainability problems, which poses complex challenges for research (Wuelser et al. 2012).

Mountland had to deal with many challenges as described in the related conceptual papers on transdisciplinarity. Different coping strategies, such as joint publication efforts of interdisciplinary teams, have helped to address them. However, as the most important coping strategy for the different phases and design principles of an ideal-typical transdisciplinary research process, the long-term commitment of researchers emerged (see also Kiteme and Wiesmann 2008, Roux et al. 2010).

Such a commitment of researchers in "their" case study region does not only increase trust between stakeholders and researchers as well as their sense of responsibility for their recommendations (see Roux et al. 2010), but also allows long-term problem framing, a robust identification of applied research questions and a potentially increased trickle-down of research results over time. In an ideal-typical transdisciplinary research process, the joint problem framing and the collaborative definition of the research object are very important (phase A), as is the re-integration of the results in science and society (phase C). In *Mountland*, the time available for these phases was a key factor for the successful transdisciplinary process. Challenges for transdisciplinary research processes will continue to be the low tangibility of sustainability problems as well as non-parallel developments of policy processes and knowledge production. Based on our experiences, we conclude that ensuring researchers – and stakeholders – can make long-term commitments to continuous research should help coping with these challenges in an effective way.

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