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Regional Assessment of Global Change Impacts

The Project GLOWA-Danube

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Preface

The onset of Future Earth marks a new era in global change research and acknowledges that only integrative and transdisciplinary research will allow science to contribute adequately to solving the challenges of global change that humanity is facing in the coming decades (Mauser et al. 2013). Future Earth will heavily rely on codesign through science and society of research and knowledge production, which will allow societies to both form a sustainable future environment and at the same time to adapt to changing global conditions, be it in the field of climate, economy, or environment. Adaptation to these changes will mostly take place on a regional level. Different adaptation options as well as alternative development paths will have to be formulated as scenarios. Their consequences and trade-offs will have to be carefully analyzed and explored in order to identify the most effective, efficient, and appropriate adaptation decisions. This requires a structured dialogue between scientists and regional stakeholders. This FutureEarth mode of operation marks a considerable paradigm shift towards a maturing global change science, which understands itself as science for society.

The new transdisciplinary role of global change science evolved from a number of regional global change projects, which have been carried out during the last decade in order to develop and test a suit of methodologies to integrate the scientific disciplines from natural sciences and humanities into a new whole. The new whole becomes more than its parts and for the first time allows to explore and understand the full range of processes and interactions, which led to rapidly changing environments and societies and which will have to be instrumentalized by societies to develop towards sustainability. At the same time these projects for the first time in the history of global change research motivated their participants to leave their scientific comfort zones and to strongly engage in exploring new, participatory ways to communicate with society and its administrative, economic and political governance structures.

GLOWA-Danube, which started in 2001 and finished in 2011, was among the first of these new projects. It was launched by the German Ministry for Education and Research (BMBF) as part of the Global Change of the Water Cycle (GLOWA) initiative. GLOWA for the first time aimed at systematically exploring integrative and transdisciplinary scientific approaches to identify decision alternations for regional adaptation to global change. GLOWA purposefully chose water issues for this new kind of projects because water is among the most important, most universal and at the same time most vulnerable natural resources. There is hardly a sector of society which is not affected by change in the water cycle, and water availability and water use will strongly be affected regionally by climate change as well as by changing water demands by society, industry and agriculture.

GLOWA-Danube followed the ambitious goal to for the first time explore in full the interactions between nature and society in the context of global change (climate, demography, economy , etc.) by looking at regional water resources and their management. We chose the Upper Danube basin and its inhabitants as the natural laboratory for the GLOWA-Danube project. It covers the full Danube and its tributaries until it leaves Germany in Passau, has an area of 80,000 km^2 and is the home of 12 Mio. inhabitants, which enjoy one of the largest per capita GDP on the globe. The Upper Danube challenges any simulation of present and future interaction of nature and society because it is spatially, politically, and administratively heterogeneous and complex including the Alps and their forelands as well as five countries and six states. Its water resources are sensitive to climate change because slight temperature changes have large impacts mainly in the Alps.

Integrative, transdisciplinary research in GLOWA-Danube was based on two approaches:

- Firstly to develop and use a new simulation tool, which integrates the relevant natural as well as societal and technical components and their interaction to represent and simulate a man-made water cycle and the related water uses as they are typically found in rich, densely populated watersheds. For this purpose, it couples the latest dynamic process models in hydrology, plant science, snow science, and glaciology with spatially distributed actor models, which simulate the behavior and decisions of human actors like farmers, households, water suppliers, and tourist facilities in an open parallel simulation model. This enables to study in detail the interaction between nature and humans and allows, on the basis of an understanding of actors, choices to better simulate the consequences of today's decisions on future environmental and societal conditions.
- Secondly to explore the transdisciplinary codesign of research and co-creation of knowledge through a close communication process of project scientists and regional stakeholders. It consists of a spiral of steps which include the formulation of scenarios of desirable futures based on the existing knowledge of likely climate change and other influencing factors, simulation of the transient evolution of environment and society in the Upper Danube watershed according to these scenarios, and translation of the simulation results into relevant information, which can be communicated with the stakeholders and which can be used to prepare decisions to adapt to global change. For this latter purpose, the Global Change Atlas of the Upper Danube was developed as a living document, which evolved during the course of GLOWA-Danube.

The GLOWA-Danube Atlas was purposefully published in German, the language of the stakeholders, and is the common, easy to understand by practitioners and stakeholders scientific knowledge base for the dialogue among stakeholders and scientists. It documents purpose, philosophy, architecture, methodologies, scenarios, and results of the project. After 2 years of consolidation, refinement, and further communication with the stakeholders, we decided to translate the Global Change Atlas of the Upper Danube into English and offer it to the growing Future Earth research community as one possible blueprint for successful future global change science for society in their respective regions.

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Reference

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