AREA
CLIMATE CHANGE AND WATER RESOURCES

Research scope:1.1 Understanding ecosystem dynamics and developing approaches to enable functional carrying capacity

Description:

The goal is to enhance the knowledge on ecosystems' carrying capacity, its importance for providing goods and services and for sustainable development. Measures and indices for assessment of carrying capacity of natural and man-made ecosystems need to be developed. It is necessary to develop scenarios for the impact of global and especially climate change and to investigate to what degree, and how, these effects may be compensated by control of natural ecosystems dynamics and human intervention. Interplays between biocenosis and their abiotic environments (water, soil) should be considered as a basis for quantifying ecosystem processes and functions. Successful strategies to adapt and compensate global changes ought to address a variety of natural and man-modified ecosystems on different spatial and temporal scales.

Rationale/justification:

Degradation of landscapes is linked with degradation of soil, decrease of water retentiveness and biodiversity. The understanding of water, plant, soil interactions at different ecosystems is the key to understanding and optimization of landscape processes, controlling water retentiveness, restoration of biodiversity thus improving ecosystem goods, services and achieving good ecological status. **Integrated knowledge of interactions between hydrologic, geologic, soil and biological processes are basic to quantification of ecosystem processes and functions, and evaluation of functional carrying capacity and sustainability.** This is particularly important in the face of progressing global changes, which modify the abiotic framework for ecosystem functioning.

Research issues to be addressed:

- Understanding Soil-Plant-Atmosphere (SPA) processes and interactions and developing interdisciplinary approaches to quantifying processes (governing the transfer of water through the SPA continuum);
- Analysis of the SPA system responses to global changes;
- Assessment of global change impact on biodiversity and the consequences of pest and alien species;
- Understanding the impact of global change on the surface water - groundwater interface and soil water dynamics
- Assessing the role of surface water - groundwater interface, soil water dynamics and retention capacity of soils in extreme events such as floods and droughts;

- Understanding the impact of agriculture and forest management on ecosystem dynamics;
- Integrated understanding and assessment of carrying capacity of natural and man-made ecosystems.

Research scope: 1.2 Adaptation and mitigation strategies for use of water resources to promote sustainable development (societal stability, economic development and ecosystem protection)

Description:

The impact of global, especially climate change, on water resources and the different consequences to a wide variety of users need to be assessed and understood. Based on this knowledge, strategies and (possibly proactive) measures, policies and legal frameworks should be developed to support different users (e.g., farmers, fishermen, forest owners/users) in improving their practices towards sustainable use of water resources (e.g., human consumption, agriculture) and sustainable economic development (e.g., fishing, aquaculture, tourism). These measures should address incentives for the target groups, e.g., through developing mechanisms enabling them to profit from the functions they help to secure. This approach requires in-depth analysis of natural, economic, social and legal systems and solutions, for which there is not yet enough information and process knowledge. Such an approach increases appeal of new solutions to the public, enables potential conflict resolutions and changes social perception of environmental measures, which is especially vital for tackling global changes (such as climate uncertainty, population growth, market change, urbanization, landscape degradation, biodiversity decline).

Rationale/justification:

By modification of hydrological and ecological cycles, global climate changes will also impact societal stability and opportunities of economic development. Both environmental and economic practices in water resources have to be adapted to changing environment and opportunities, in order to ensure sustainability. There is a need to recognize the basic processes that influence sustainability and develop mitigation strategies.

Research issues to be addressed:

- Mitigation strategies for control extreme events - floods and droughts (e.g., optimization of hydro-technical infrastructure, landscape planning, assessment of consequences for areas of different use – urban, others);
- Adaption of production in aquaculture, agriculture, forestry;
- Adaptation of use of urban areas (e.g., sea level rise, erosion, flood risk assessment) in the face of global climate change;
- Mitigation strategies for pollution control;
- Strategies for human welfare and sustainability;
- Strategies facilitating the participation of land managers and other users in developing mitigation measures.

Research scope 1.3 : Development of tools to improve integrated modeling of global change effects and feedbacks at river basin scale

Description:

In order to provide integrated models ranging from the entire catchment area to the recipients, model interfaces and ecological effect modeling needs to be further developed. Quality data based on standardized protocols (e.g., sampling frequency, spatial distribution of sampling networks, chemical analysis, field measurements) need to be integrated into a unified database.

Rationale/justification:

Application of advanced techniques and model development is necessary for understanding and predicting global changes and their effects on water resources functioning and use. The challenge is to achieve truly harmonized data formats and fully integrated models “from rain to sea”.

Research issues to be addressed:

- Application of remote sensing for water dynamics evaluation;
- Definition of criteria for identification of adaptive measures;
- Definition and harmonization of protocols;
- Incorporation of harmonized model interphases in models using concepts such as the open modeling interphase (Open MI);
- Development of improved descriptions of interfaces between model compartments such as unsaturated and saturated zones or groundwater and surface water.