AREA
Water Resources Management

Research scope 2.1: Managing water demand in the context of multiple objectives (water for people, industry, agriculture, ecosystems)

Description:
Trade-offs between Water Framework Directive goals and other water-related policy goals and economic issues related to water quality, water scarcity, flood risk and waterway management and planning need to be addressed in future research. Water resources management will have to meet multiple, often potentially conflicting, objectives. There is a need for developing methodologies on basin scale in various geographical regions facing a number of various issues. Recognition should be given to environmental and economic risk assessment and the full-scale integration of Integrated Water Resources Management (IWRM) into long-term land development planning, an aspect that has not been sufficiently addressed, yet.

Rationale/justification:
Meeting multiple objectives, managing droughts, floods, erosion and water quality, is the major challenge for IWRM. IWRM also has to meet demands of people, industry and agriculture, as well as ecosystems needs, while it has to assure good water resources status according to the Water Framework Directive requirements. There is the need to develop methodologies for analyzing and managing supply-demand systems at basin scale, taking into account the multiple objectives. The demand itself must be subject to a constant scrutiny in the view of ecosystem functions and social context, as it may be changing in the future. (This may be the case due to unsustainable infrastructures developments in areas with limited water resources, change of economic circumstances etc.) Cost-efficient management schemes can only be developed based on analyses of development scenarios and assessment of potential economic and environmental risks.

Research issues to be addressed (examples):
- Identification of multiple objectives of water demand and addressing them in integrated management plans based on sound (mathematical) models;
- Development of supply-demand assessment methodologies;
- Development of concepts of an area-specific reasonable demand (in the long run);
- Full-scale integration of IRWM into long-term land planning;
- Managing droughts, floods, erosion, ecology and water quality as major challenge for IWRM;
- Modeling of economic and societal impact of technical measures taken, i.e.: development of multiple objective decision support systems.

Research scope 2.2: Elaborating measures for improving water quality and quantity

Description:

Identification of a hierarchy of factors determining deterioration of water quality and hydrological extremes problems; Development of joint and integrated measures (environmental; structural v non-structural, technological v ecosystem etc…) meeting potentially conflicting issues; Elaborating measures for integrated management of water quality and quantity and thus improved management of water resources.

Rationale/justification:

Water availability – both in terms of amount and sufficient quality - is still a critical issue in many regions of the world. Addressing both these issues simultaneously requires setting objectives and hierarchy of problems and measures (technological, ecological, ecohydrological) in a particular region/basin. There is an urgent need for transdisciplinary, cost-efficient approaches. Ecosystem biotechnologies offer promising approaches addressing both the water quality and quantity issues at the same time (e.g., floodplains management, water retention in wetlands) and meeting also the requirement of low-cost applications. Possibilities of using such new, low-cost approaches and technologies should be fostered and based on dedicated model-based decision support systems.

Research issues to be addressed (examples):

- Assessment of the efficiency of individual measures and their combined synergistic/antagonistic effects;
- Developing a multiobjective programme for water resources management based on integrated measures at a basin scale, addressing water quantity and quality, with flexibility to buffer extreme events;
- Coordination of measures in transboundary basins, solving potential conflicts;
- Identifying gaps and enhancement of knowledge on cost-efficient ecosystem biotechnologies;
- Water retentiveness, floods and droughts control, also by landscape patchiness development and increasing the water retention capacity of soils;
- Assessment of self-purification potential;
- New ecotoxicological methods for assessing water quality;
- Groundwater remediation.

Research scope 2.3: Harmonization of technological measures with ecosystem properties as a new management tool for IWRM, implementation of WFD, and other water-related Directives

Description:

The project aims at developing sustainability-driven, proactive measures and policy to integrate functioning of existing and planned hydrotechnical infrastructure with synergic integration of various ecotechnological measures at a basin scale. Research needs to address issues related to water, biota, soil, and unsaturated and saturated zones. It also addresses all types of water bodies, including inland waters and coastal areas as well as wetlands and all transitional systems. According to the

ecohydrological approach, operational procedures for the hydrotechnological infrastructures are to be developed, and multiple goals need to be addressed, e.g.,: social (e.g., flood protection, water supply), economic (e.g., hydropower production) and ecological (e.g., biodiversity conservation, re-establishment/conserving connectivity between terrestrial and aquatic habitats, and many others). These methods may also address maintenance and remediation of quality water resources, while concomitantly improve ecosystem services and enable creation of positive socio-economic feedbacks between environmental quality and society.

Rationale/justification:

Current research and methods are focused on environmental protection (elimination of threats) and do not include the opportunities - enhancement of ecosystem carrying capacity. Gaining a better understanding of ecosystem approaches will create opportunities for a better and more cost effective water resources management and lowering of its costs. So far such an approach seems to be still not satisfactory developed and still needs quantification in different types of systems.'

Research issues to be addressed (examples):

- Assessment of potential given by complementing ecosystem approaches with the existing socio-economic and technological systems (e.g., industry, agriculture; tourism and recreation; hydrotechnical structure, engineering; economics, sociology, etc);
- Ecohydrology;
- Assessment and enhancement of absorbing capacity of various ecosystems (e.g., based on different typology, climate and degradation gradient);
- Contribution to Water Framework Directive, Groundwater Framework Directive, and other water-related Directives and legislation;
- Analysis of best practices from the past (e. g. systems of water collecting channels in the forests of d' Izvoarele Nerei, Romania, or Banska Stiavnica, Slovakia, other regions);
- Harmonisation of emissions standards with receiving water ecological status and capacity (avoid excessive costs where ecosystem management is more cost effective than technological solutions);
- Development of knowledge and data on soil ecosystem buffering capacities;
- Development of knowledge on unsaturated and saturated zones buffering capacities;
- Development of knowledge on wetland buffering capacities;

- adjustment of technical measures (increasing potential/capacity of ecosystems, setting up IWRM to develop a holistic approach including both technical and ecological aspects, harmonization of technologies with self-purification potential of a given system, optimizing management strategies, defining measures/limits for applying technologies)