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THEMATIC AREA

HYDRO-ECONOMY MODELLING FOR RIVER BASIN MANAGEMENT

1. Description of the module

Hydro-economic modelling combines economic management concepts with an engineering level of understanding of a hydrologic system. Hydro-economic models have emerged as an effective tool for studying various water resources management problems around the globe: inter-sectoral water allocation, climate change adaptation, reservoir operation, transboundary water management, conjunctive management, water-food-energy nexus, investment planning, and others. The module will illustrate hydro-economic models that, on one side, integrate spatially distributed water resources, economic values, infrastructure, and management policies and, on the other, optimize water allocation between different uses across time and space, taking into account various physical, economical, environmental and institutional constraints. Moreover, the module will introduce the potential of hydro-economic modelling to serve as useful tools to guide the policy making process based on a clear understanding of trade-offs arising from conflicting stakeholders' objectives.

Methods and tools

Hydro-economic modelling employs two main categories: optimization- and simulation-based models. Simulation models answer to specific "what if" scenarios, whereby allocation policies are externally imputed. Optimization models, on the other side, help identifying the most appropriate management decisions based on the maximization/minimization of a stated mathematical objective function subject to physical, institutional and/or economical constraints.

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The Water Evaluation and Planning system (WEAP) is a water-planning tool that operates on the principle of water balance accounting, and represents different interconnected catchments, demand nodes, infrastructure, water flows and water transmission links to calculate the components of the hydrological cycle by simulating rainfall-runoff processes at the catchment level.

2. Module structure

1. Introduction to hydro-economic modelling
   - Schematization of the water resources system
   - Performance indicators
   - Data pre-processing

2. Tools for cross-country and river basin water management
   - Optimization method
   - Simulation method

3. Scenario analysis
   - Baseline assessment
   - Inter-sectoral allocation policies
   - Evaluation of development and management scenarios

4. The Water Evaluation and Planning tool (WEAP)
   - Introduction to the model
   - Potential application to the case scenario
   - Employment of the tool for policy making and planning

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3. Learning objectives

Taking into account national-, catchment- and basin-level scenarios, the module aims at increasing planning and management capacities to maximize the economic benefits of water resources allocation through sectors, according to the most relevant and updated hydro-economic principles. Through the presentation of simulation and optimization methods and the introduction of relevant tools, the training supports the assessment of the economic, hydrologic and institutional impacts and, accordingly, the formulation of efficient resource allocation policies.

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