Basin level modelling and seasonal forecasting for water allocation

Challenge: Too little water **Adaptation response:** Water allocation

Description

Basin level modelling for water allocation is one of the planning instruments that can help optimize water allocation among competing water uses and users in response to changing water availability – either seasonal, or long term. The key objective of modelling exercises for water allocation is to determine how to best optimize available resources among competing users, and to assess potential trade-offs of the same, while ensuring that enough water is left for the environment. Modelling various allocation scenarios can help managers to allocate scarce resources in ways that are most environmentally sound, but also economically beneficial for the society. Examples include model predictions on available seasonal water supply, sustainable extraction rates for ensuring environmental flows, estimations of the minimum amount of water required for irrigation, minimum requirements needed for hydropower generation needs, as well as maximizing economic benefits by allocating water for specific priority uses.

In addition to seasonal forecasting, similar models can be used to project the implications of future climate change on availability of water resources (e.g. in basin), and help inform both infrastructure development and land use planning decisions.

Implementation

There are numerous hydrological modelling tools available and the selection can be informed by the resources available, the spatial scale of analysis, degree of information detail required for managers, as well as access to- and quality of data series on water resources and water use trends, as well as the technical capacity of end users.

A combination of climatic, hydrological and economic data and models can be utilized for the modelling exercises. For example, the modelled seasonal water availability (based on past trends and future climate predictions), can be coupled with different water use scenarios to assess environmental and economic impacts of different allocation decisions in the basin.

Datasets required to inform analysis include key hydrological datasets (including existing water use trends and requirements of the various users and environmental water requirements), but also socioeconomic data on e.g. population growth trends, planned water intensive infrastructure development, hydropower production needs and forecasts. In addition, the scenarios may be informed by sociotechnical variables such as improved water use efficiency, impacts of new water management regulations, water rights of certain users, expected changes in water quality, and others, depending on the resource and data availability.

Modelled scenarios suggest most beneficial allocation of scarce resources, but implementation of the desired scenarios may also require establishment of necessary institutional and management arrangements to be able to implement the necessary changes and restrictions to the use.

Environmental Benefits

- Informed and well-planned water allocation helps ensure that sufficient amount of water is allocated

for environment, ensuring environmental flows and minimizing the risk of resource overabstraction, pollution and ecosystem degradation.

Socioeconomic Benefits

- Helps avert conflict resulting from uncontrolled competing uses of scarce resources

- Support equal distribution among various users, ensuring minimum water requirements are met for human use, economy, and environment

- Modelling exercises can help determine the most efficient uses of water that create most benefit to the society (economic or other)

- Adaptive allocation improves climate resilience and mitigates risks of water shortages resulting from changing resource availability and uncoordinated use.

Opportunities and Barriers

Opportunities:

- Modelling allows for a holistic approach to water management and can be used to estimate possible environmental and socio-economic effects of future scenarios (e.g. climate change, populations growth), also informing Integrated Water Resources Management plans
- Water allocation modelling exercises may also help inform and support water efficiency improvements for some users and uses.

Barriers:

- There are inherent uncertainties in future modelling scenarios based on climate or socioeconomic projections, which may necessitate revisions of allocation scenarios and agreements based on actual resource availability
- Reliable models require availability of good quality datasets for the basin, as well as overview and understanding of majority of user demands and patterns
- Institutional capacity (and political commitment) to enact and enforce allocation plans need to be present for the desired and equitable allocation scenarios to be implemented in practice.

Implementation considerations*

Technological maturity:	3-5
Initial investment:	2-4
Operational costs:	1-3
Implementation timeframe:	2-4

* This adaptation technology brief includes a general assessment of four dimensions relating to implementation of the technology. It represents an indicative assessment scale of 1-5 as follows:
Technological maturity: 1 - in early stages of research and development, to 5 – fully mature and widely used
Initial investment: 1 – very low cost, to 5 – very high cost investment needed to implement technology
Operational costs: 1 – very low/no cost, to 5 – very high costs of operation and maintenance
Implementation timeframe: 1 – very quick to implement and reach desired capacity, to 5 – significant time investments needed to establish and/or reach full capacity
This assessment is to be used as an indication only and is to be seen as relative to the other technologies included in this guide. More specific costs and timelines are to be identified as relevant for the specific technology and geography.

Sources and further information

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