

The emerging need for climate-informed and transboundary adaptive water management.

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28 January 2023

Abstract

Management of transboundary waters is increasingly becoming more challenging, particularly within a context of complex social and environmental changes. Population growth, often concentrated in the developing world, will increase pressure on already scarce resources. Climate change is likely to exacerbate these pressures, making it more difficult to manage water across boundaries (4). The 6th IPCC assessment and the 2023 IPCC synthesis report recognize transboundary risks across the food, energy, and water sectors, requiring climate-informed transboundary management.

Transboundary water resources, such as rivers, lakes, and aquifers, often traverse political boundaries, requiring cooperation among neighboring countries for sustainable and equitable management. The effects of climate change, including altered precipitation patterns, rising temperatures, and more frequent extreme weather events, pose significant threats to the availability and reliability of these shared water sources. Recognizing the interconnectedness of climate change and transboundary water management is essential for developing resilient and adaptive strategies.

Climate-informed transboundary water management is a critical aspect of addressing the challenges posed by climate change on shared water resources. As the impacts of climate change become more pronounced, the need for adaptive and collaborative approaches in managing transboundary water sources becomes increasingly evident. This article explores the key components, challenges, and strategies associated with climate-informed transboundary water management.

The aim of this article is to identify need establishing cooperative transboundary mechanisms to effectively adapt water management to climate change. Furthermore, this article will also address complex legal difficulties that existing transboundary water institutions face when attempting to adapt existing mechanisms to function in a changing climate.

Keywords: Transboundary water, adaptive management, climate-informed water management

Introduction

The world's water resources are facing unprecedented pressures from population growth and economic development. Estimates indicate that, with current practices, the world will face a 40 percent shortfall between forecast demand and available supply of water by 2030. Climate change is worsening the situation, making water availability more unpredictable and increasing the frequency and intensity of floods and drought

Sharing transboundary water resources is a major concern in many areas of the world. In many regions, there is simply not enough water to satisfy all needs. As the climate warms, additional stress is placed on the availability, allocation, and sharing of these resources. This problem becomes more acute when water crosses an international boundary. Presently, more than 250 river basins are shared by two or more countries. These shared basins occupy 43.5% of the surface of Earth, contain approximately 60% of the surface water flows, and house 40% of the population of the world (2).

History shows that transboundary water allocation arrangements can work for the benefit of the States involved, but only if they are well designed, jointly agreed, adaptable, and effectively implemented.

Despite this progress at the global level, there is still a need to enhance understanding of climate change and water at all levels of governance – from the local to the transboundary level. Increase in climate variability will change the way shared water systems function – hydrologically, ecologically, economically, and socially – requiring cooperative adaptation responses¹.

Why is it gaining increasing importance?

Climate-informed transboundary water management is gaining importance and this approach is becoming increasingly important due to many interconnected factors highlighting the urgency of addressing the impacts of climate change on common water resources.

Climate change is leading to more frequent and severe weather events, changing precipitation patterns, and rising temperatures. These changes directly affect water availability, quality, and distribution. Transboundary water management must evolve to address the increasing risks and uncertainties associated with the impacts of climate change.

Many regions already face water scarcity, and climate change is exacerbating this problem. Shared water resources often cross borders, and increased competition for limited water resources can lead to conflicts. To ensure sustainable and equitable use, climate-informed management becomes imperative, especially in regions where water scarcity is an increasing problem. Increasing population, urbanization, and increasing agricultural demands put additional pressure on water resources.

¹ According to the IPCC, adaptation describes “changes in processes, practices and structures to moderate potential damages or to benefit from opportunities with climate change.” IPCC (2007). Climate Change 2007: Synthesis Report, Annex II – Glossary. IPCC Secretariat: Geneva, Switzerland.

Climate-informed transboundary water management is crucial to anticipate and address these increasing demands, ensuring water allocations are sustainable and adaptable to changing climate conditions.

Climate change is associated with increasing frequency and intensity of extreme weather events such as floods and droughts. Transboundary water management systems need to be resilient to these events by combining early warning systems, adaptive infrastructure, and collaborative response strategies to minimize impacts on communities and ecosystems

Water cooperation and diplomacy

Shared water resources require international cooperation and diplomatic efforts. Climate change adds another layer of complexity to these relationships, as countries must work together to adapt to changing conditions, share data, and negotiate agreements that take into account evolving climate realities.

Water scarcity and competition can become a source of tension and conflict between nations. Countries can increase regional stability and security by proactively addressing the impacts of climate change on transboundary water resources.

Impacts on water availability can have serious humanitarian consequences, affecting communities that depend on these resources for their livelihoods. Climate-informed transboundary water management is crucial to protect vulnerable populations from the adverse effects of climate change.

In summary, climate-informed transboundary water management has become important and necessary due to the strong interrelation between climate change, water scarcity, ecological threats, and the need for international cooperation. Proactive measures and adaptable strategies are essential to ensure the flexibility and sustainability of shared water resources in the face of a changing climate.

Challenges in Climate-Informed Transboundary Water Management

Political tensions and historical disputes can impede effective collaboration among countries sharing water resources. Overcoming these barriers requires diplomatic efforts and a shared understanding of the urgency posed by climate change.

Limited access to reliable data and information-sharing mechanisms can hinder the development of informed water management strategies. Encouraging open data sharing and investing in monitoring infrastructure are crucial for addressing these challenges.

Countries involved in transboundary water management may have varying capacities to adapt to climate change. International cooperation should involve capacity-building initiatives to ensure that all parties can actively participate and benefit from shared solutions.

Adaptive Water Management

Adaptive water management refers to the flexible and responsive approach to the planning, allocation, and use of water resources in the face of changing conditions, uncertainties, and evolving challenges. This concept recognizes that water availability, demand, and environmental conditions can vary over time due to factors such as climate change, population growth, land-use changes, and other dynamic influences.

Key principles and components of adaptive water management is given in Figure 1

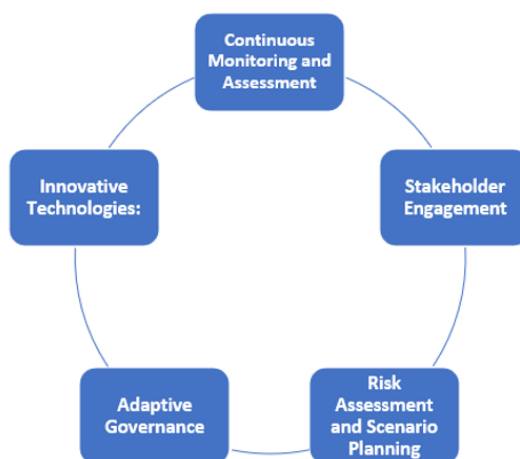


Figure 1 Key principles and components of adaptive water management

By incorporating these principles, adaptive water management seeks to enhance the resilience of water systems, improve the sustainability of water resource use, and address the challenges posed by a changing climate and other dynamic factors.

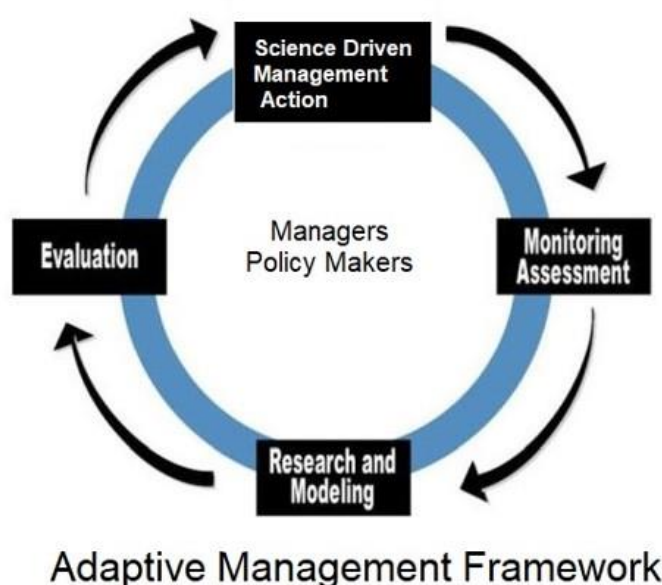


Figure 2 Adaptive Management Framework

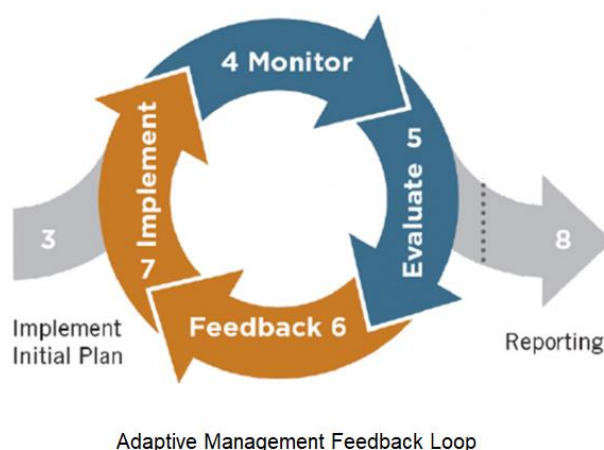


Figure 3 Adaptive Management Feedback Loop

Adaptive management is usually understood to refer to an iterative process of reviewing and making changes to programmes and projects throughout implementation. It begins implementation of an initial plan and continuous feedback loop as it is shown in Fig.3.

Adaptive Management Approaches role to manage transboundary water resources in the context of climate change

Adaptive management approaches (Fig.2) play a crucial role in managing transboundary water resources in the context of climate change. These approaches provide a flexible and iterative framework that allows water managers and policymakers to respond to uncertainties, changing conditions, and evolving knowledge (3).

Adaptive management extends to legal and institutional frameworks. Flexible legal structures and governance mechanisms are essential for accommodating changes in climate conditions and adjusting policies as needed.

The adaptive management approach facilitates international collaboration. It encourages ongoing dialogue and cooperation among riparian states, enabling joint responses to shared challenges presented by climate change.

In summary, adaptive management approaches provide a dynamic and responsive framework for managing transboundary water resources, allowing stakeholders to navigate the uncertainties associated with climate change and promote sustainable water management practices.

Transboundary Water Treaties

Today, there are approximately 300 transboundary agreements on record Of the 145 agreements negotiated in the 20th century(5).

History shows that transboundary water allocation arrangements can work for the benefit of the states involved, but only if they are well designed, jointly agreed, adaptable, and effectively implemented. Cooley and Gleick mentioned that (5) “Just over a third of the treaties address water allocation and include volumetric allocations among riparian countries. In cases where volumetric allocations are specified, they often are fixed, leaving little flexibility for changing flow conditions. As discussed below, this characteristic is especially problematic in the context of climate change. “

In the transboundary context, there are two major implications from a perspective of adaptive governance. First, responses to climate variability will probably increase the need for transboundary water sharing agreements and institutions where there were none. Although there are approximately 300 transboundary agreements recorded, currently 60 percent of the world’s 263 watercourses (158 transboundary river basins) have no cooperative management framework². Second, where agreements and institutions are already in place there may be a need to adjust the way water is managed in order to adapt to the realities presented by climate change. For instance, while international agreements usually account for seasonal variability, yearly precipitation fluctuations, droughts, flooding from unusually heavy rain fall, and consequences from climate change often remain uncovered³

The lack of effective and equitable water governance frameworks is also often a primary challenge to increasing adaptive capacity and reducing vulnerability to climate variability and change at the local, national, and transboundary levels.(4).

The risks and challenges posed by climate impacts on internationally shared waters will require high levels of transboundary cooperation and joint decision-making. To date, little planning for adaptation has been undertaken at the transboundary level, although this is slowly changing(4).

Strategies for Climate-Resilient Transboundary Water Management

Implementing early warning systems for extreme weather events can help riparian countries prepare for and respond to potential disasters, reducing the impact on water resources and communities. Establishing adaptive governance structures allows for the flexible adjustment of policies and agreements in response to changing climate conditions. This includes regular reviews and updates to ensure relevance and effectiveness.

Strengthening regional collaboration and fostering dialogue among neighboring countries is essential for building trust, sharing knowledge, and collectively addressing the challenges posed by climate change on shared water resources. Securing funding for climate-resilient water

² “Of the 105 international basins that employ some type of water management institutions, less than 20 percent of those basins with more than three riparians have multilateral agreements involving all of the riparians.” Eckstein, G. (2010). “Water Scarcity, Conflict, and Security in a Climate Change World: Challenges and Opportunities for International Law and Policy,” *Wisconsin International Law Journal*, Vol. 27(3), pp. 410-461, at p. 442

³ McCaffrey, S. (2003). “The Need for Flexibility in Freshwater Treaties,” *Natural Resources Forum*, Vol. 27, pp. 156-162, at p. 157.

management projects is crucial. This includes investments in infrastructure, technology, and capacity building to support adaptation and mitigation measures.

Conclusions

Most of the transboundary water agreements assume that future water supply and quality will not change. These agreements also do not take into account the increasing water variability caused by the climate change. Therefore, most of the water agreements cannot adapt to temporal and spatial changes in the amount of water.

Furthermore, despite the recommendation that the factors related to climate change should be included in new draft agreements, climate change has never been addressed and has never been included in these agreements.

Climate-informed transboundary water management is imperative for addressing the complex challenges posed by climate change. It provides a framework for adaptive, cooperative, and sustainable approaches to ensure the resilience and equitable use of shared water resources.

Climate-informed transboundary water management is a multifaceted challenge that requires a holistic and collaborative approach. By integrating climate science, adaptive governance, and inclusive stakeholder engagement, riparian countries can develop resilient strategies to address the impacts of climate change on shared water resources. As climate change continues to shape the hydrological landscape, proactive and cooperative measures are essential for ensuring the sustainable use and equitable distribution of transboundary water sources.

There isn't a specific international convention solely focused on transboundary water management that explicitly includes provisions for addressing climate change effects. However, climate change considerations are increasingly being integrated into broader agreements and conventions related to water resources and transboundary cooperation.

It's worth noting that discussions on the intersection of climate change and transboundary water management often take place in various forums and agreements. As the global community continues to address climate change and its impacts, future agreements may incorporate more explicit considerations for climate-related challenges in the context of shared water resources.

Until reaching an agreement on a specific international convention on this issue, adaptive water management can play a very important role in lessen possible growing tensions between riparian countries.

Adaptive management extends to legal and institutional frameworks. Flexible legal structures and governance mechanisms are essential for accommodating changes in climate conditions and adjusting policies as needed.

The adaptive management approach facilitates international collaboration. It encourages ongoing dialogue and cooperation among riparian states, enabling joint responses to shared challenges presented by climate change.

Climate change's adverse effect on water resources forces riparians to build flexibility and adaptive management mechanisms into the existing transboundary water agreements. In other words, transboundary water basin countries should consider incorporating the new mechanisms into existing treaties to allow for flexibility in response to changing climate conditions, emerging knowledge, and unexpected events.

Existing agreements should be reviewed to include provisions for adaptive management, dispute resolution in the context of climate impacts, and mechanisms for addressing unforeseen challenges. Therefore flexible allocation strategies and water quality criteria, provisions for extreme events, clear amendment and review procedures and joint management institutions need to be considered for existing and draft treaties.

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