

Transboundary water management is becoming more complex due to climate changes.

An Alternative water management concept is needed.

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Abstract

Only 2.5% of the water on earth is freshwater resources. However, the rate of usable freshwater resources in the world is below 1%.

In the last century, the world's population has tripled while water use has increased sevenfold. Water resources management is multi-purpose in every aspect. In water resources management, there are conflicting interests among users in the main sectors of socio-economic life (agriculture, industry, drinking water).

Competition over water resources occurs at local, regional, national, and international levels and among various users and stakeholders. Disputes regarding transboundary waters may be political, economic, environmental, or legal. Climate change is increasing the complexity of transboundary water management. Therefore an alternative water management concept is needed. This study aims to explain this emerging need

Keywords: *Transboundary water, climate changes, water management, water dispute*

I.INTRODUCTION

263 transboundary river basins on earth cross the political boundaries of two or more countries. These transboundary basins cover 45.3% of the world's land surface, host 40% of the world's population, and account for approximately 60% of global water flow. In total, the territory of 145 countries is located in transboundary basins[1].

In the arid and semi-arid climate zones of Africa, the Middle East, and Southeast Asia, and in geographies where developing countries have transboundary water resources, disasters (floods and droughts) caused by climate change can lead to collapse in the socio-economic structure and political instability.

For this reason, it is of great importance to take into account the uncertainty and risks created by climate change, especially in negotiations regarding the use and allocation of transboundary water resources between these states. However, these risks have not been taken into account in many bilateral or multilateral agreements on the allocation and sharing of transboundary water resources. Most transboundary water agreements do not cover natural changes such as seasonal/annual precipitation and flow differences, possible drought, and flood conditions.

For example, in 1987, a temporary protocol was signed between Turkey and Syria, which stipulated that approximately half of the flow of the Euphrates' waters in normal years (500 m³/second) would be released to Syria by Turkey.

However, this protocol did not take into account variability in river discharge due to climate change. The water-sharing agreement signed within the framework of the Jordan-Israel Peace Treaty (1994) did not take into account the drought conditions frequently experienced in this region. This deficiency caused a diplomatic crisis between the two countries as a result of the drought in 2001.

The adverse effects of climate change on water resources continue to increase. Therefore, in transboundary water negotiations, the parties should take into account the effects of climate change as well as the water allocation conditions. In addition, existing water allocation agreements should be updated according to these conditions and made more flexible.

II.CLIMATE CHANGE RISK IN TRANSBOUNDARY WATER MANAGEMENT

Transboundary water agreements are agreements that regulate the management of a common water resource, usually between two or more riparian countries. Such agreements often involve water resources in rivers, lakes, aquifers or watersheds.

Climate change affects the amount and distribution of water resources by affecting precipitation regimes and temperatures. These changes also have an impact on transboundary water resources. Increasing droughts and floods associated with climate change make the implementation of transboundary water agreements difficult and the management of water resources more complex.

The negative impact of climate change on water resources is increasing in some parts of the world. This situation causes a greater need for water resources at local, national, and international levels and causes allocation problems between countries. Therefore, the need to review transboundary water agreements that do not include the impact of climate change and to reorganize the use and management of transboundary water resources is also increasing.

In addition, the decrease or increase in precipitation directly affects sectors such as the environment, agriculture, and energy production. This situation also requires reviewing the allocation rules in transboundary water agreements.

More flexible water allocation agreement is needed

Today, there are approximately 300 transboundary agreements on record. Of the 145 agreements negotiated in the 20th century(3). 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 (3) *“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.”*

Considering the risk of climate change in transboundary water agreements, it is necessary to add flexibility and adaptation mechanisms to these agreements. Transboundary water basins, especially those that have physical water problems and disputes between riparian countries, should be examined in terms of climate change consequences. Climate change scenarios in these basins should be examined and appropriate for these scenarios. Anticipating solutions is critical for the long-term sustainability of agreements.

The adaptive water management approach plays a crucial role in managing transboundary water resources in the context of climate change. This approach provides a flexible and iterative framework that allows water managers and policymakers to respond to uncertainties, changing conditions, and evolving knowledge (4).

III.ADAPTIVE WATER MANAGEMENT

The flexible and responsive approach to the planning, distribution, and utilization of water resources in the face of changing circumstances and unpredictabilities is known as adaptive water management. This idea acknowledges that variables including population growth, land-use changes, climate change, and other dynamic effects can cause variations in water supply, and demand over time. Figure 1 shows the essential ideas and elements of adaptive water management.



Figure 1: Essential ideas and elements of flexible water management

By applying these ideas, adaptive water management aims to solve the problems caused by climate change and other dynamic elements, as well as to increase the sustainability of the use of water resources and the resilience of water systems.

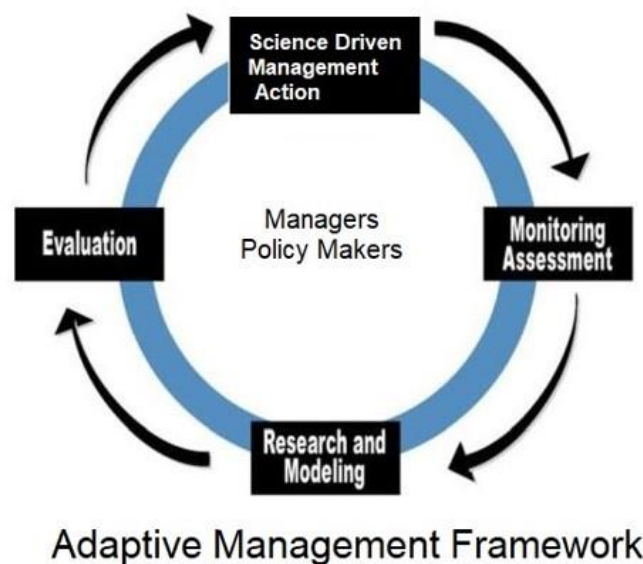


Figure 2: Framework for Adaptive Management

Adaptive management can be identified to be an iterative process that includes reviewing and modifying projects and programs throughout implementation ., It starts with the implementation of an initial plan and a continual feedback loop. Adaptive management consists of a methodical, iterative approach to making solid decisions in an unpredictable setting. Its objective is to

gradually lessen uncertainty through system evaluation and monitoring. It compiles the scientific and ecological response data required to enhance resource management in the future (6). When it comes to managing transboundary water resources in the context of climate change, adaptive management techniques (Fig. 2) are essential. These methods give water managers and policymakers an adaptable and iterative framework to deal with changing circumstances (3).

Adaptive management encompasses institutional and legal systems as well. It is imperative to have adaptable legal frameworks and governance systems to enable the adaptation of policies to changing environmental circumstances.

International collaboration is facilitated by the adaptive management strategy. It promotes continuous communication and collaboration across riparian governments, allowing for coordinated solutions to common problems caused by climate change.

In conclusion, adaptive management strategies offer a flexible and adaptable framework for transboundary water resource management, enabling stakeholders to promote sustainable water management techniques while navigating the uncertainties created by climate change.

Transboundary Adaptive Water Management

The prevailing transboundary water agreements presume that there would be no future changes to the quality or quantity of water. Furthermore, the rising water variability brought on by climate change is not taken into consideration by these agreements. As a result, the majority of water agreements are unable to adjust to variations in the volume of water over time and space.

Furthermore, climate change has never been discussed or incorporated in previous agreements, even though it has been recommended that the factors connected to climate change be included in new draft treaties.

Transboundary water management that takes climate change into account is essential for tackling the many unexpected issues. It offers a framework for cooperative, sustainable, and adaptable methods to guarantee the fair and resilient use of shared water resources.

Transboundary water management that takes climate change into account is a complex issue that calls for cooperation and a comprehensive strategy. Riparian nations can adapt to the effects of climate change on shared water resources by combining climate science, adaptive governance, and inclusive stakeholder engagement. To ensure the sustainable use and fair distribution of transboundary water sources, proactive and cooperative actions are crucial as climate change continues to modify the hydrological landscape.

There isn't a particular international agreement that addresses the consequences of climate change specifically and is only concerned with transboundary water management. However, larger conventions and accords about water resources and transboundary cooperation are increasingly including climate change implications.

Adaptive water management can be crucial in reducing the likelihood of escalating tensions between riparian nations until a definite international convention on the matter is agreed upon.

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International collaboration is facilitated by the adaptive management strategy. It promotes continuous communication and collaboration across riparian governments, allowing for coordinated solutions to common problems caused by climate change.

The detrimental impact of climate change on water resources compels riparians to include adaptable management strategies and flexibility in the current transboundary water agreements. It is necessary to examine current agreements to incorporate clauses regarding adaptive management, climate impact-related dispute resolution, and contingency plans for unforeseen difficulties. As a result, cooperative management organizations, transparent amendment and review processes, contingencies for exceptional events, and flexible allocation techniques and water quality standards need to be considered.

IV.CONCLUSIONS AND RECOMMENDATIONS

Transboundary water agreements are agreements that regulate the management of a common water resource, usually between two or more countries. Such agreements often involve water resources in rivers, lakes, or watersheds.

Climate change changes the amount and distribution of water resources by affecting precipitation regimes and temperature patterns, and this also has an impact on transboundary water resources. Increasing droughts and floods related to climate change make the implementation of transboundary water agreements difficult and the management of water resources more complex.

The adverse impact of climate change on water resources is increasing in some parts of the world. This situation causes water resources to be needed and demanded more at local, national, and international levels. Therefore, the need to review transboundary water agreements and reorganize the use and management of transboundary water resources is also increasing.

In addition, the decrease or increase in water resources directly affects sectors such as the environment, agriculture, and energy production. This situation also requires reviewing the sharing rules in transboundary water agreements.

Considering the risk of climate change in transboundary water agreements, it is necessary to add flexibility and adaptation mechanisms to the transboundary water agreements. Transboundary water basins, especially those that have physical water problems and disputes between riparian countries, should be examined in terms of climate change's adverse effects. Climate change scenarios in these basins should be examined and solutions suitable for these scenarios should be developed. These are very important for the long-term sustainability of agreements.

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Biography



Dursun Yıldız C.E. (MSc.) is a hydropolitics specialist and Director of the Hydropolitics Academy Association located in Ankara-Turkey. He is a civil engineer and used to be Deputy Director at State Hydraulic Works in Turkey; completed a hydroinformatics post graduate course at the IHE in Delft, a Technical training program in USBR-USA, and a master's degree in Hydropolitics at the Hacettepe University-Turkey. He has over 5 years of teaching experience in some Turkish Universities and now works as head of his own Hydro Energy & Strategy consulting company located in Ankara. He has published several international articles and 15 books. He received the Most Successful Researcher Award on International Water Issues from Turkish Agricultural Association in 2008 and from the Central Union of Irrigation Cooperatives in 2016. He received the Professional Services Award of Excellence from İstanbul Çekmeköy Rotary Club in 2021. He becomes a part-time lecturer at the IZTECH International Water Resources Department in In the 2020-2021 academic year

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