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Draft Summary Handbook on Water Allocation in a Transboundary Context

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Note by the secretariat

Summary

This Summary Handbook on Water Allocation in a Transboundary Context (Summary Handbook) contains the key information from the Handbook on Water Allocation in a Transboundary Context (Handbook) adopted by the 9th Meeting of the Parties (MOP9) to the Water Convention in 2021, covering the global practice of transboundary water allocation. It seeks to be a shorter and targeted practical resource for policy and decision-makers providing a snapshot from the Handbook of the key elements, frameworks and modalities to consider in the application of transboundary water allocation, while recognizing that every allocation context is unique. A wide array of case studies from different continents and geographical regions are noted under the relevant sections for further reading – these are listed in full in the Handbook.

The Summary Handbook is a timely update to the Handbook given the increasing prevalence of water scarcity and drought since the Handbook was adopted at MOP9. Severe droughts have developed or intensified in various regions of the world such as Western Europe, the Horn of Africa and South America. Equitable and sustainable allocation of scarce surface and ground water in transboundary basins is thus even more important in the effective management of shared freshwater resources, along with allocation's complementary approaches.

Numerous issues related to preserving water and its allocation in a transboundary context such as climate change adaptation, preservation of freshwater ecosystems, transboundary legal frameworks to name just a few, have also gained recognition during recent UN global processes and platforms. Most notably the UN Water Conference in March 2023 and the Water Action Agenda for achieving SDG6, but also the inclusion of freshwater ecosystems in the Post-2020 Global Biodiversity Framework. Hence, this publication may provide a valuable resource for policy makers to tackle these pressing issues.

SUMMARY HANDBOOK ON WATER ALLOCATION IN A TRANSBOUNDARY CONTEXT

I. INTRODUCTION

The question of how freshwater resources are allocated is becoming of increasing relevance to water managers today. Demand for water is growing globally. Factors including population growth, economic development and changing consumption patterns are driving this demand. At the same time, availability of water is increasingly limited by growing pressures such as water scarcity, deteriorating water quality, ecosystem degradation and climate change, which further exacerbates the situation in many already water- stressed basins.[1]

The question of allocation is especially heightened in transboundary contexts. Over 60 per cent of freshwater resources globally cross national boundaries, including 310 transboundary rivers and 592 transboundary aquifers.[2] Many of these shared basins are vulnerable to the effects of climate change and other growing pressures. Hence, water allocation can contribute to the effective management of transboundary waters when developed jointly by the riparian countries and in conformity with relevant international law. Transboundary water allocation is both a process and an outcome, either of which are not mutually exclusive. It is important to note that, water allocation is only one approach and is not an answer to all water-related challenges in transboundary settings.

Definitions and Objectives of Water Allocation in a Transboundary Context

This *Summary Handbook on Water Allocation in a Transboundary Context* (*'Summary Handbook'*) takes as its starting point the following set of definitions for transboundary water allocation, building on previous practice and guidance.[3]

Transboundary water allocation is an iterative planning and decision-making process and/or an outcome that determines the quantity, quality and timing of water between two or more States and grants associated entitlements.

Water quantity is most commonly specified as an average volume of water (per year, month or other period) at a certain location. It may also be defined as an average, as a minimum volume, as a percentage of available supplies (a share of flow or of the volume in storage), or by a particular rule on access (e.g. legal right or entitlement to abstract a certain volume under particular circumstances).

Timing relates to daily, monthly, seasonal or inter-annual variabilities and exceptional circumstances, both natural and human induced, in water quantity or quality. In transboundary contexts, this occurs at the border. Velocity of water allocated is a combination of quantity and timing, which concerns the quantity of water passing through the border within a designated time period.

Water quality concerns certain water quality objectives and criteria with associated parameters, including standards and testing, that make water suitable for the intended use.

Transboundary waters means any surface or groundwaters that mark, cross or are located on boundaries between two or more States; wherever transboundary waters flow directly into the sea, these transboundary waters end at a straight line across their respective mouths between points on the low-water line of their banks. This definition comes from the Water Convention (Art. 1(1)).

Transboundary contexts, in this Summary Handbook covers a range of settings where surface waters and groundwaters (including rivers, lakes and aquifers) mark, cross or are located on boundaries between two or more States.

Allocable water is the share of water resources utilizable for abstraction for different uses in the given basin or aquifer area. Ideally, this occurs after flows needed to meet environmental objectives have been reserved.

II. WATER CHALLENGES ALLOCATION MAY SEEK TO ADDRESS

Availability, Variability and Associated Uncertainty: Now and in the Future

Availability of freshwater resources for allocation in a transboundary context generally depends on the availability of renewable surface and groundwater sources. Many factors impact on water availability. Human activities directly affecting the availability of surface water resources for allocation consist of abstraction and water use, which may further be divided into non-consumptive and consumptive uses. The former means that water is removed from a water body or its quality is changed, while the latter means that water is not withdrawn from, or it is returned to, the same water body and may be reused or recycled.[4]

Increased and competing demands for water and water-related services and the resulting pressures on the available water resources have resulted in growing attention towards water allocation during the past decades. The key driver behind the interest in water allocation globally has been the overall and ongoing growth in water abstractions, primarily due to population growth, economic development and changing consumption patterns. Basin "closure", i.e. complete allocation of all available water resources, is an increasingly common problem in many parts of the world. Due to higher water demand, there is also greater interaction between depletion and pollution of both surface and groundwater sources.[5]

Water allocation can thus play an important role in addressing these major water issues of today and the future, many of which cross State and national borders. Moreover, it can be stated that "[a]ppropriate water allocation results in more socially and economically beneficial use of the resource while protecting the environment. Unsuitable or ineffective approaches drive water stress. Understanding water rights and water allocation is therefore key to understanding the solutions to global water stress".[6]

Water scarcity as a central challenge for sustainable water allocation

Water scarcity occurs when demand for freshwater exceeds supply. [7] It seriously affects the functioning of societies and undermines possibilities for sustainable development. ombating water scarcity requires reconsidering traditional supply management strategies such as increasing capacity of water infrastructure.[8] The focus needs to be shifted to demand management options such as increasing water use efficiency and water productivity. For successful integration of mitigation and adaptation strategies addressing water scarcity within transboundary allocation frameworks, the drivers and impacts of water scarcity need to be identified and understood in each context. ***Hence there is recognition that water scarcity conditions are likely to become more severe and frequent in the future supports reconsideration of certain prevailing approaches to water allocation in many river basins and aquifers around the world.***

Climate change as a cross-cutting challenge for allocation and potential risk multiplier

Climate change must be approached as a cross-cutting challenge for effective transboundary water allocation. Due to climate change, groundwater demand is expected to grow further in certain regions around the world, due to the higher demand for, and temporal variability of, surface freshwater flows.[9] Climate change further affects the availability and condition of freshwater resources by aggravating other growing pressures on water resources such as water scarcity, deteriorating water quality and ecosystem degradation.[10]

It is a potential risk multiplier that may necessitate adjustment of existing—and careful drafting of any new—transboundary water allocation agreements and arrangements. Ideally, transboundary allocation arrangements should factor in the increased uncertainty, inter- and intra-annual variability of precipitation, run-off and, in some cases, step reductions to cope with increasing frequency and extremity of drought and flood events.

Making transboundary allocation arrangements climate resilient also requires strong coordination mechanisms between different levels of governance, sectoral policies and stakeholder groups.[11] They need to be aligned with climate change adaptation and mitigation efforts, taking into account the different water requirements of different energy options, such as hydropower, solar and wind power and biofuels.[12] Renewable energy can drive sustainable water use and allocation and vice versa when the synergies and trade-offs in the water-food-energy-ecosystem nexus are appropriately addressed.[13]

Drought

Transboundary water allocation must look at the distributed risk of drought across a basin, so that the most at-risk parts/areas receive higher, or more assured, allocations to cope accordingly. The exposure to drought will further vary according to the type of water use, distribution of population in rural and urban areas, and environmental assets. Vulnerability to droughts and capacity to manage their impact may also vary significantly across the basin, influenced by water resource development and the distribution of water and shortage risks under transboundary water agreements.[14] Groundwater tends to be increasingly relied upon in drought situations, indicating the need to have a good understanding of the availability, renewability and trade-offs associated with groundwater resources. Hence, ***water allocation and entitlements are critical in determining what water resources will be available for abstraction and use during drought periods and how those resources will be shared***.[15]

Flooding

For transboundary water allocation, floods should generally be approached as exceptional events, the frequency and severity of which are likely to grow in the future due to climate change. Allocation quotas need to accommodate variability in water availability, but they may also act as flood management measures. Transboundary flood risk management requires basin-wide monitoring and warning systems. Therefore, it is equally necessary to integrate mechanisms for monitoring, data exchange, early warning systems and prior notifications of flow releases into allocation agreements between co-riparian States.

Water Uses and Needs

While water allocation typically focuses on current and (short-term) future water uses, it builds on historical use and development, and should also consider longer-term needs. Consideration of this temporal dimension thus links to the broader view on water and its role in the development of societies, including linkages to food and energy security, as well as the environment. ***The temporal dimension of water allocation can be considered through three main trends, or development trajectories: changes in the total water use of a society; comparative changes in the water use between sectors and functions; and changes in water availability due to changing climate and other alterations in the hydrological system.***

Environmental needs

Environmental needs within water allocation are best described with the concept of environmental flows, often used interchangeably with ecological flows, with both commonly abbreviated to “e-flows”. While multiple definitions of the term exist, the most comprehensive recent definition, from ***The Brisbane Declaration and Global Action Agenda on Environmental Flows (2018), describes***

environmental flows as "the quantity, timing, and quality of freshwater flows and levels necessary to sustain aquatic ecosystems which, in turn, support human cultures, economies, sustainable livelihoods, and well-being".[16]

Environmental flows have emerged as one of the key frameworks for informed, participatory decision-making in water resources planning to arrive at a balance among extraction, use and conservation of watersheds and their waters.[17] One of the key challenges of environmental flow management is to maintain a sufficient minimum flow of water in rivers and prevent over abstraction during low-flow periods. Periodic high flows are required for maintaining water quality, triggering fish spawning and migration, sediment transport, groundwater recharge and wetland inundation. As all aspects of the environmental flow regime are potentially important to the environment, ideally, water allocation arrangements should account for natural variability, predictability, seasonal timing and flood magnitude of the given aquatic system and its connections to other systems (e.g. surface and groundwater).

Water use sectors and functions

Water allocation has a key role in balancing water availability for different sectors and functions, ideally after the environmental flow requirements have been accounted for. While major differences in sectoral shares exist between countries depending on their socioeconomic structures, agriculture, including inland aquaculture, continues to be the biggest water user globally, constituting 69 per cent of water withdrawals.[18] Industries contribute 19 per cent, including water use in the energy sector, while municipal and domestic uses amount to 12 per cent.[19] The other main functions or in-stream water uses that depend on known or sustained water levels but do not contribute to water withdrawals per se include navigation, pollution dilution, tourism and recreational uses, cultural uses, freshwater capture fisheries and ecosystem maintenance.[20]

Agricultural priorities have traditionally dominated national water allocation arrangements globally. In many countries, agriculture's position has also been challenged by growing water demand from other sectors and uses such as industries and tourism. Now and in the future, agricultural water use must be balanced with uses in other sectors, especially in drought conditions.

Availability of water in the energy sector is critical for society and gaining increasing international attention as demand for resources mounts and governments continue to struggle to ensure reliable supply to meet sectoral needs.[21] Dams, particularly large-scale hydropower dams, may cause a range of direct or indirect impacts, including: environmental impacts, such as altered fish spawning, biodiversity loss and reduced sediment loads; social impacts, such as loss of livelihood and involuntary resettlement of local communities; and potentially exacerbating climate change impacts.[22]

A key parameter defining both surface and groundwater availability is the ratio between water consumption and renewable freshwater resources. A consumption rate higher than renewal results in water stress and depletion of the water source over time. Allocation arrangements therefore need to account for effects of water use by one user on water use by others, specifying consumption rates of various uses and return flows, including the water quality of the same or different water entitlements.[23]

Water use in industry and energy production

Besides its growing prioritization for economic reasons, industrial water use may limit water availability for allocation to other uses due to point-source pollution. Industrial water use is typically dependent on sustained quantity and quality of water, whereby sudden reductions in water availability can potentially lead to higher costs and/or production losses. Water use efficiency (SDG 6.4) in industries and energy generation can generally be improved with optimized processes, more efficient technologies and recycling, reuse, reduction or even, where appropriate, replacement of water use with waterless alternatives.[24]

Impacts on Allocable Water

Infrastructure as an enabling and limiting factor in water allocation

Water management infrastructure sets the physical basis for, and constraints on, how allocable water can be used. Historically, growing demand for water was typically first met with infrastructure development, increasing access to available water.[25] Investing in upkeep, repairs and modernization of existing infrastructure (e.g. canal networks) has significant potential to improve water efficiency and various demand management means overall. It may also reduce the need to spend on expanding new development for additional supply. Allocation planning is therefore useful in the development and operation of certain infrastructure and related water uses that pertain to the transboundary allocation of water resources.

Past infrastructure choices can limit existing and future allocation options. Large dams, water transfers and large-scale irrigation systems typically have profound impact on flow regulation, groundwater, the environment and downstream water uses. Poorly maintained large-scale infrastructure can lead to major transboundary risks of losses or water wastage, exacerbating water scarcity, water contamination and accidents such as dams breaks and flash floods. Inadequate infrastructure further reduces adaptive capacity to respond to drought and floods and longer-term changes in water availability and variability.[26] Disparities in infrastructure between/among States sharing transboundary water resources may also create unequal water utilization opportunities. ***Appropriate infrastructure choices, including size and location, may contribute to fairer water allocation between parties, avoid harm, provide more value to users and maintain a healthy environment.***[27]

Nature-based solutions to water allocation infrastructure rarely have negative transboundary impacts, while they simultaneously help to meet environmental requirements. Nature-based solutions may include those for managing water availability (e.g. natural wetland forests and wetlands' improved soil and vegetation management), water quality (e.g. forest, wetlands, grasslands) and water-related risks, variability and change (e.g. flood plains, surface and subsurface water storage and managed aquifer recharge).[28]

Ecosystem degradation

Ecosystem degradation is linked to water allocation in two major, interrelated ways. First, healthy ecosystems typically help to maintain overall availability of water, while, conversely, ecosystem degradation reduces it. Second, unsustainable water allocation and water use regimes have a negative impact on freshwater ecosystems, other ecosystems dependent on them and their biodiversity.

In terms of the first linkage, changes in upstream water use in different sectors and for different functions is the dominant external factor influencing the status of the water resources situation downstream. Notwithstanding, the status of ecosystems also affects the quantity, quality and variability of allocable water. Land ecosystems, especially vegetation, play a key role in regulating evapotranspiration and run-off from land. Vegetation typically supports water availability but, in some cases, removal of forests and alien species, for example, may also release more water to streams.[29] As surface and groundwater systems are connected, plant cover may also have a significant impact on groundwater recharge, which, when reduced, may lead to reduction or drying of rivers in low-flow seasons. Furthermore, freshwater ecosystems have multiple functions in flow and water quality regulation, as well as an important role in many other ecosystem services, ranging from food production, including freshwater fisheries, to recreational and cultural values.

In terms of the second linkage, multiple stressors are involved in having negative impacts on freshwater ecosystems. Changes to river flow regimes and connectivity as a result of water withdrawals and dam construction, water pollution and the general undervaluation of aquatic ecosystems and ecosystem

services have contributed to the loss of over 80 per cent of freshwater species populations since the 1970s, with climate change further exacerbating the situation.[30] Loss of biodiversity fundamentally weakens the balance and future resilience of the ecosystems. In turn, there are widespread impacts on both society and the environment through the weakening of the provisioning, regulatory, cultural and habitat-supporting services healthy freshwater ecosystems provide. Broad recognition of these impacts is reflected in the Post-2020 Global Biodiversity Framework which includes freshwater ecosystems. ***These realizations have resulted in water allocation frameworks that increasingly prioritize the needs of ecosystems.***

Preventing ecosystems degradation has been the main driver for national water allocation reforms in past years.[31] At the transboundary level, ecosystem protection is gradually gaining recognition but requires enhanced cooperative and coordinated efforts. Natural freshwater ecosystems have evolved to thrive in dynamic hydrological conditions. In almost all contexts, variations in flows and water levels are essential for freshwater species and for ecosystem functions such as sediment transport and fisheries. However, people need water too. In many contexts, the question of meeting ecosystem requirements is less about how to maintain pristine ecosystems and more about understanding how to maintain essential aspects of flow variation even while using water for human social and economic purposes.[32] Environmental flow assessment tools and approaches focus on providing answers to this question.[33]

While environmental flow assessment is underpinned by science, decisions about how much water to take from an ecosystem for human use are ultimately social and political in nature. It is crucial that such decisions are made with an understanding that maintaining healthy freshwater ecosystems is not in competition with human water uses; rather, safeguarding or restoring key aspects of ecosystem functioning, such as downstream water supply, freshwater fisheries or sediment transport to low-lying delta regions are strategically important.[34] ***Thus, ecosystem health should be a foundation of water allocation in a transboundary context as it is crucial for the long-term sustainability of the world's shared freshwater sources.***

RELEVANT CASE STUDIES AS CONTAINED IN THE GLOBAL HANDBOOK

CASE STUDY 1: United States of America and Mexico transboundary water allocation on the Colorado River and Rio Grande: the 1944 Water Distribution Treaty
CASE STUDY 2: Spatial limitations to abstracting non-renewable groundwater from the Saq–Disi aquifer
CASE STUDY 3: Allocation lessons from the United States' governance of intracountry cross-border rivers: drought contingency plan on the Colorado River
CASE STUDY 4: Developing climate-adaptable arrangements to manage floods and dry periods in the Pripyat River Basin
CASE STUDY 5: Ecological flow and water allocation in the Samur River
CASE STUDY 6: Springtime artificial ecological water releases in the Dniester River Basin
CASE STUDY 7: Allocation for irrigation with monitoring and maintenance systems in the Zarumilla River Basin
CASE STUDY 8: Vuoksi River hydropower generation and flow levels
CASE STUDY 9: Joint management of water infrastructure in the Chu–Talas River Basin
CASE STUDY 10: Value of investing in nature-based solutions and implementing measures where they make a difference, even across borders: flood protection in the Rhine River Basin
CASE STUDY 11: Addressing water quality in transboundary water allocation for the Great Lakes
CASE STUDY 12: Identifying ecologically sustainable levels of take: an intracountry, cross-border example from the Murray–Darling River, Australia
CASE STUDY 13: Allocation lessons from Australia's governance of intracountry cross-border rivers
CASE STUDY 14: Storage infrastructure and joint monitoring for flow reallocation needs in the lower Orange–Senqu River system
CASE STUDY 15: Determining allocation priority uses and proposal for a risk-based approach in the Incomati River Basin

III. ALLOCATION LIMITATIONS & COMPLEMENTARY APPROACHES

While potentially useful, water allocation has its limitations. ***Conceptually, the focus on water quantity, quality and timing means that water allocation does not really consider the broader aspects of water use, such as the linkages to sectors such as food and energy and to the broader development agenda, including the SDGs.*** Focus on water allocation may also conceal the need to progress from supply management options to demand management measures. Water allocation forms an important part of transboundary water resources management, establishing an agreed baseline for water quantity, quality and timing. At the same time, water allocation links to the broader approaches that are commonly used to both initiate and advance transboundary water cooperation and the related governance arrangements.

Allocation characteristics vis-a-vis broader approaches to transboundary management and cooperation

	Water allocation	IWRM	Basin-wide planning	Nexus (e.g. water-energy-food security)	Assessing and sharing benefits and costs and minimizing harm
Focus (simplified)	WATER: Quantity, quality and timing of water at a given point (country border)	WATER: Coordinated development and management of water integrating different uses and water sources	BASIN: Strategic planning of economic, social and environmental priorities within a shared water basin	SECTORS: Facilitating the synergies between water and related sectors such as food and energy	REGION: Considering regional economic and political benefits derived from transboundary water cooperation
Main scale	At a specific defined point; typically a country border	Transboundary basin, building on national management plans	Transboundary basin; beyond States	Applicable at different scales, here considered at regional scale	Regional scale (i.e. in and beyond basin scale)
Timing	Targeted, to ensure meeting a need or to address a specific issue	Short medium, long-term	Medium to long-term	Medium term and preferably also *before* sectoral plans impact on water use	Medium to long-term
Scope of action	Water supply/ bulk water	Water resources management, mainly at operational and tactical level	Water resources management, mainly at strategic level	Trade-offs and synergies between sectors	Seeing water's role for regional economic and political cooperation

Source: United Nations, 2021, Geneva.

Note: The characteristics are simplifications and intentionally emphasize the differences between the closely related and partly overlapping approaches.

Integrated water resources management

Integrated water resources management (IWRM) thus aims to ensure sustainable and equitable use of water and related resources with the help of key management instruments (e.g. allocation) and key institutions, as well as a broader enabling environment (e.g. policies and cooperation forums) and financing.

Basin-wide planning or strategic basin planning processes

During the past decade, basin-wide planning or strategic basin planning processes have emerged to complement IWRM implementation. Their best practices exemplify 10 golden rules:

- Develop a comprehensive understanding of the entire system;
- Plan and act, even without full knowledge (or perfect foresight);
- Prioritize issues for current attention, and adopt a phased and iterative approach to the achievement of long-term goals;
- Enable adaptation to changing circumstances;
- Accept that basin planning is an inherently iterative and chaotic process;
- Develop relevant and consistent thematic plans;
- Address issues at the appropriate scale by nesting local plans under the basin plan;
- Engage stakeholders with a view to strengthening institutional relationships;
- Focus on implementation of the basin plan throughout;
- Select the planning approach and methods to suit the basin needs.[35]

The water-food-energy-ecosystem nexus approach

The nexus approach to managing interlinked resources has equally gained prominence during the past decade as a way to enhance water, energy and food security.[36] The nexus approach aims to increase resource efficiency, reduce trade-offs, build synergies and improve governance among and between sectors, while simultaneously protecting ecosystems. Integrated planning, coherent policies and multipurpose investments are among the means to address nexus issues. Intersectoral or nexus assessments and dialogues, supported by analysis to varying degrees, have sought to point at such opportunities in policy and in taking technical measures.[37]

Identifying and addressing intersectoral trade-offs and synergies can inform water allocation decision-making processes, foster transboundary cooperation and increase resource use efficiency. The need for water allocation measures to address scarcity or its impacts could potentially be avoided by integrated planning and informed sectoral policies that are coordinated and take into account availability and variability of water resources. practical tools, UNECE has developed a methodology to assess such nexus interactions and synergistic solutions and applied it in eight basins to date.

Identifying, assessing and sharing benefits of transboundary water cooperation

The potential for sharing benefits from the use of water resources can help to prioritize water uses and needs. Integration of clear benefit-sharing measures into water allocation arrangements, including priority water needs to be secured and how any costs incurred in exceptional or changing circumstances should be dealt with, can help prevent related tensions and disputes. Understanding the benefits from the use of shared water resources and from transboundary cooperation broadly can:

i) inform and help design a more equitable water allocation;
ii) reinforce cooperation on basin management that contributes to, for example, sustaining the allocable water resource, ensuring the functioning of the necessary built or natural infrastructure and reducing transboundary impacts; and
iii) with a cross-sectoral (nexus) perspective, extend and diversify the types of benefits that can be realized through cooperation engaging economic sectors.

RELEVANT CASE STUDIES AS CONTAINED IN THE GLOBAL HANDBOOK

CASE STUDY 16: Identifying benefits of cooperation with a nexus approach as a broader perspective to revisit flow regulation in the Drina River Basin
CASE STUDY 17: Cooperation on the use of water and energy resources of the Syr Darya River Basin (Central Asia)

IV. LEGAL ARRANGEMENTS FOR TRANSBOUNDARY ALLOCATION

There are broadly three main mechanisms for allocating water in transboundary contexts:

1. ***Direct mechanisms*** - Direct mechanisms explicitly define a means for physically dividing water, such as a fixed volume or percentage of flow.
2. ***Indirect mechanisms*** - Indirect mechanisms establish a procedure for determining the allocations, for example, prioritization of uses or through a joint body.
3. ***Principle-based mechanisms*** - Treaties can also establish mechanisms based on principles that guide States in developing allocation mechanisms, for example, historical use or equitable use.

Approaches to transboundary water allocation and associated examples of considerations

Approaches to International Water Allocation	Examples of Considerations
Rights-based Approaches: Emphasizes the right to water based on hydrography or historical use; includes the concepts of absolute sovereignty and integrity.	Hydrography, historical use
Needs-based Approaches: Establishes allocation based on a riparian's needs rather than what they perceive to be their right. Needs can be based on various criteria, such as population or irrigable land area.	Population, irrigable land, future development, energy demand and consumption
Hierarchy-based Approaches: Allocates water based on priority. Most commonly, different sectors or uses are given priority (e.g. drinking water, agriculture), but this could also give hierarchy to historical, existing, or future uses.	Multiple types of hierarchies, for example: • Sectoral hierarchies: municipal, agricultural, industrial requirements • Temporally established hierarchies: previous, existing or future requirements
Proportionate Division Approaches: Allocation based on the physical division of water, either implicitly or explicitly.	Equal amounts of water per capita, absolute equality, or other proportion between riparians, based on temporal patterns, volume or percentage of water resources
Strategic Development Approaches: Allocates water by balancing competing needs. For example, this could include balancing economic development and environmental needs through the use of alternative scenarios, risk assessments and addressing uncertainty.	Future needs, considering multiple goals or needs, including but not limited to population growth, environmental, economic, development and risk-mitigation interests in a broader context; this can include plans for water use in an explicitly future-focused context and can include benefit- sharing outside of water resources to balance multiple needs and goals for a region
Market-based Approaches: Allocates water by market, based on the economic value it generates in different economic activities.	Supply vs. demand balance, efficiency, equity

Source: M. McCracken and others, "Typology of Transboundary Water Allocation: a look at global trends in international freshwater agreements" (forthcoming).

Cooperative Frameworks and Scales of Governance for Water Allocation

Usually, transboundary water allocations are first made based on area, for example, States, sub catchments or administrative areas, and thereafter further allocated based on purpose of water use, for

example, of sectoral user groups, or for irrigation or other water supply schemes. ***In international water bodies, the management scales are often nested within one another: while transboundary allocation is agreed between the countries, each country then implements the arrangement and agreements by applying its own allocation schemes based on its own national policies and legislation***.

Basis for Water Allocation in International Water Law

International law concerning freshwater resources of transboundary rivers, lakes and aquifers (international water law) constitutes the overall framework and foundation for transboundary water management and cooperation. ***In general, several key principles of international water law are today regarded as having developed into customary law rules, including the principle of cooperation that is the foundation for effective water allocation in a transboundary context.***[38]

The key international legal principles and rules governing transboundary rivers, lakes and aquifers can be found in customary international law (binding on all states), treaties (bilateral, subbasin, basin) and regional agreements applicable to transboundary waters, and in the two global international water law frameworks: the Water Convention and the 1997 Convention on the Law of the Non-navigational Uses of International Watercourses (Watercourses Convention), collectively referred to as "the United Nations (or UN) global water conventions". The conventions contain the recognized core principles of international water law that pertain to allocation, namely, equitable and reasonable utilization, no significant harm and the principle of cooperation.[39] The 2008 Draft Articles on the Law of Transboundary Aquifers provides further guidance on transboundary groundwater resources.[40]

Core Principles of International Water Law to Guide Transboundary Water Allocation

No significant harm (preventing, controlling and reducing transboundary impacts)

The requirement to prevent, control and reduce transboundary impacts is an expression of the no-harm principle. The no-harm principle is a customary international law principle and one of the normative cornerstones of both the Water Convention and Watercourses Convention (along with the principles of cooperation and equitable and reasonable utilization).[41]

The Water Convention requires the parties to take all appropriate measures to prevent, control and reduce any transboundary impact (Art. 2.1). Transboundary impact is a significant adverse effect on the environment within an area of another party resulting from a change in the conditions of transboundary waters (Art. 1.2). Transboundary waters include both surface and groundwaters, which mark, cross or are located on boundaries between two or more States (Art. 1.1).[42] Under the Water Convention, all appropriate measures to prevent, control and reduce transboundary impact include the exchange of information, and consultations between the origin and potentially affected States (Arts. 6, 9–10, 13). In terms of what constitutes "all appropriate measures", as this is a due diligence obligation, "the conduct of each Party shall be proportional to the degree of risk of transboundary impact. The 'appropriateness' of the measures also means that the measures depend on the capacity of the Party concerned, i.e. on the level of its economic development, and technological and infrastructural capacity. The 'appropriate measures' are therefore to be determined on a case-by-case basis."[43]

The Watercourses Convention stipulates that watercourse States shall, in utilizing an international watercourse in their territories, take all appropriate measures to prevent the causing of significant harm to other watercourse States (Art. 7).[44] In the same way, the Draft Articles on the Law of Transboundary Aquifers state that aquifer States shall, in utilizing transboundary aquifers or aquifer systems in their territories, take all appropriate measures to prevent the causing of significant harm to other aquifer States or other States in whose territory a discharge zone is located (Art. 6).[45]

Under the Watercourses Convention, where a State has taken all appropriate measures but significant harm is nonetheless caused, that State is required to do its best to stop or mitigate the harm through consultations with the affected State, with due regard to the principle of equitable and reasonable use. In addition, where appropriate, the States need to discuss the question of compensation (Arts. 6(2) and 7). Interrelated provisions under the Watercourses Convention also oblige States to prevent, reduce and control pollution (Art. 21), protect and preserve ecosystems (Art. 20) and protect and preserve the marine environment, including estuaries (Art. 23).

Equitable and reasonable utilization

The Water Convention obliges parties to take all appropriate measures "to ensure that transboundary waters are used in a reasonable and equitable way, taking into particular account their transboundary character, in the case of activities which cause or are likely to cause transboundary impact" (Art. 2.2).[46] To determine what equitable and reasonable utilization means in a particular case, all relevant factors and circumstances must be taken into account. Article 6 of the Watercourses Convention provides a non- exhaustive list of these factors (noting that no factor enjoys any inherent priority over another):

1. geographic, hydrographic, hydrological, climatic, ecological and other factors of a natural character;
2. the social and economic needs of the watercourse States concerned;
3. the population dependent on the watercourse in each State;
4. the effects of the use or uses of the watercourses in one watercourse State on other watercourse States;
5. existing and potential uses of the watercourse;
6. conservation, protection, development and economy of use of the water resources of the watercourse and the costs of measures taken to that effect;
7. the availability of alternatives, of comparative value, to a particular planned or existing use.

Principles of cooperation and good neighbourliness

Cooperation and good neighbourliness are collectively needed at every stage of the process of establishing and maintaining effective transboundary water allocation arrangements. Such cooperation may often prevail despite otherwise challenging relations between countries.[47] A State's general duty to cooperate is one of the main tenets of international law. Under the Water Convention, the riparian parties must cooperate based on equality and reciprocity. The aim for the cooperation is the prevention, control and reduction of transboundary impacts and the protection of the environment of transboundary waters and the environment influenced by such waters (Art. 2.6). The Water Convention further obliges the parties to conclude bilateral or multilateral agreements and to establish joint bodies for the prevention, control and reduction of transboundary impacts (Art. 9). The Watercourses Convention stipulates that States may enter into, or consider harmonizing, existing watercourse agreements with the basic principles of the Convention and may consider the establishment or joint mechanisms or commissions (Arts. 3, 8).

RELEVANT CASE STUDIES AS CONTAINED IN THE GLOBAL HANDBOOK

CASE STUDY 18: Indigenous water allocation and cultural flows in the Murray–Darling Basin
CASE STUDY 19: Vuoksi River water allocation and compensation for loss due to transboundary harm
CASE STUDY 20: Temporary cooperation arrangements bridging broader allocation disputes: the example of the Gabčíkovo–Nagymaros Project
CASE STUDY 21: Transboundary river basin legal regime for the Senegal River based on good neighbourliness
CASE STUDY 22: Public participation in overseeing allocation arrangements for the Zarumilla River

V. KEY CONSIDERATIONS IN TAILORING ALLOCATION AGREEMENTS

Transboundary water allocation today and in the future needs to balance multiple growing needs and, at the same time, deal with the increasingly limited and varying availability of water. Furthermore, different water uses have different scopes for coping with change and improving efficiency. Allocation in a transboundary context may thus include difficult and potentially contested decisions on water use priorities. ***The allocation process requires the assessment of available water resources and understanding of different water uses and needs across both temporal (current and future uses) and spatial (in different States, jurisdictions and geographical, hydrographical and geohydrographical settings) scales.*** It should address water availability, water entitlements and the potential conflicts among different water use needs in terms of water quantity, quality and timing. In cases where all water use needs and demands cannot be met with the available water resources, parties need to discuss their priority at both transboundary and national levels. Below are some of the key considerations and relevant frameworks as a basis for consideration when tailoring transboundary water allocation agreements to each specific context.

Allocation checklists and planning frameworks for consideration

The need for water allocation planning is connected with the management of system-wide allocation challenges. Accordingly, a river basin management plan can set out a clear framework for allocation. A clear and transparent process to facilitate stakeholder engagement in planning is also often needed. The required scale of planning depends on the particular water allocation challenges and may vary from the basin to sub-catchment and aquifer level.[48]

Transboundary water allocation planning must follow the principles and objectives discussed above regarding international law, such as equitable and reasonable utilization, no harm and cooperation. Speed and others (2013) provide 10 “golden rules” of basin water allocation planning based on international experience, all of which can generally also be applied in a transboundary setting:

1. In basins where water is becoming stressed, it is important to link allocation planning to broader social, environmental and economic development planning. Where inter-basin transfers are proposed, allocation planning also needs to link to plans related to that development.
2. Successful basin allocation processes depend on the existence of adequate institutional capacity.
3. The degree of complexity in an allocation plan should reflect the complexity and challenges in the basin.
4. Considerable care is required in defining the amount of water available for allocation. Once water has been (over)allocated, it is economically, financially, socially and politically difficult to reduce allocations.
5. Environmental water needs provide a foundation on which basin allocation planning should be built.
6. The water needs of certain priority purposes should be met before water is allocated among other users. This can include social, environmental and strategic priorities.
7. In stressed basins, water efficiency assessments and objectives should be developed within or alongside the allocation plan. In water-scarce situations, allocations should be based on an understanding of the relative efficiency of different water users.
8. Allocation plans need to have a clear and equitable approach for addressing variability between years and seasons.
9. Allocation plans need to incorporate flexibility in recognition of uncertainty over the medium to long-term in respect of changing climate and economic and social circumstances.
10. A clear process is required for converting regional water shares into local and individual water entitlements, and for clearly defining annual allocations.[49]

The national water allocation "health check" provided by OECD provides several aspects that are also applicable in the transboundary context for the institutional review of current allocation arrangements or estimating the need for new ones.[50]

The OECD "Health Check" for water resources allocation

Check 1. Are there accountability mechanisms in place for the management of water allocation that are effective at a catchment or basin scale?
Check 2. Is there a clear legal status for all water resources (surface and ground water and alternative sources of supply)?
Check 3. Is the availability of water resources (surface water, groundwater and alternative sources of supply) and possible scarcity well understood?
Check 4. Is there an abstraction limit ("cap") that reflects in situ requirements and sustainable use?
Check 5. Is there an effective approach to enable efficient and fair management of the risk of shortage that ensures water for essential uses?
Check 6. Are adequate arrangements in place for dealing with exceptional circumstances (such as drought or severe pollution events)?
Check 7. Is there a process for dealing with new entrants and for increasing or varying existing entitlements?
Check 8. Are there effective mechanisms for monitoring and enforcement, with clear and legally robust sanctions?
Check 9. Are water infrastructures in place to store, treat and deliver water in order for the allocation regime to function effectively?
Check 10. Is there policy coherence across sectors that affect water resources allocation?
Check 11. Is there a clear legal definition of water entitlements?
Check 12. Are appropriate abstraction charges in place for all users that reflect the impact of the abstraction on resource availability for other users and the environment?
Check 13. Are obligations related to return flows and discharges properly specified and enforced?
Check 14. Does the system allow water users to reallocate water among themselves to improve the allocative efficiency of the regime?

Source: OECD, Water Resources Allocation: Sharing Risks and Opportunities, OECD Studies on Water (Paris, 2015).

Existing and potential uses

There is continuous debate on the relationship between existing and potential uses in transboundary water allocation, and on the principle of the equality of rights among riparian States.[51] Changing the status quo of water allocation is often very difficult, especially in a transboundary context, even though transboundary water resources and water use needs may have changed. Moreover, the potential uses and their impacts can be difficult to predict and accurately plan for in allocation arrangements.[52]

When developing sustainable infrastructure for water allocation, the larger the infrastructure, the more careful its selection, size and choice of location needs to be and the more comprehensively co-riparian States and all other key stakeholders should be engaged in its development. Large-scale infrastructure is typically expensive to build and expected to last and serve for decades. In order to ensure its functionality in changing circumstances (e.g. impacts of climate change, structural changes in the economy, technological innovations), infrastructure needs to pass sensitivity and risk analyses and environmental and social impact assessments in different simulations and scenarios.

Decisions on balancing water uses are generally informed by socioeconomic aspects, existing water uses, assessments of environmental requirements and pre-existing institutional frameworks, among other factors. Such decisions are best coordinated as part of basin-wide planning, integrating

consideration of future scenarios, BAT and water management practices. Principles of international water law, including equitable and reasonable utilization, no significant harm, and protection of the environment, as well as the human right to water, provide a guiding framework for negotiations on priority uses within transboundary allocation (see below relevant frameworks as a basis for consideration). Considering that water allocation for human consumption, some national security-related uses and environmental requirements have limited scope for negotiation, the socioeconomic aspects should be analysed in detail, providing opportunities to understand how to make interventions in different water uses, and what both the best practices and the potentially sensitive and contested aspects are.

Socioeconomic aspects commonly focus on water-related livelihoods and economic sectors such as agriculture, industry and energy production, cultural features and well-being, including domestic water supply, as well as broader food security and energy security issues. The water needs for the different socioeconomic uses need to be evaluated against, and aligned with, the overall development and climate scenarios in the given context. Furthermore, after water for vital human needs and the environment has been allocated, national allocation among sectors may be made based on highest value uses (economic, cultural).[53] In a transboundary context, benefit-sharing and a nexus approach may provide means to further balance the socioeconomic interest of different parties and address challenging upstream–downstream dynamics.[54]

Once the overall availability of the shared water resources and the different uses and needs of the co-riparian States have been identified, it is possible to define water use priorities and formulate transboundary water allocation rules. The prioritization of uses of transboundary waters is guided by the principles of international water law and may be specified in an agreement among co-riparian States or through custom.

The parties to an allocation agreement may determine, for instance, that vital household needs are to be met first, followed by the needs of the environment, subsistence farmers, agriculture, hydropower and industry. The agreement may define which water uses are to be prioritized within the basin, which are allowed to continue as usual and what limitations need to be put in place. A transboundary water agreement may also prescribe precise water allocations (with numerical values) among the parties.[55] Determining the prioritization of uses is thus an established allocation approach and can be adaptable to the available water flows and to changing water demands.[56] In practice, transboundary agreements have examples on prioritization, but specific water uses have been prioritized only occasionally.[57]

The Watercourses Convention indicates that, in the absence of an agreement or a custom to the contrary, no use enjoys inherent priority (Art. 10(1)). Furthermore, where a conflict of uses of an international watercourse arises, it shall be resolved with reference to Articles 5 to 7, with "special regard" to be given to the requirements of "vital human needs" (Art. 10(2)). The concept of vital human needs has been defined in the preparatory works of the Convention to refer to "sufficient water to sustain human life, including both drinking water and water required for the production of food in order to prevent starvation". [58] Also, factors to be considered when determining what constitutes equitable and reasonable utilization include the population dependent on the watercourse in each State.[59]

The Water Convention follows a similar approach whereby the *Guide to Implementing the Water Convention* specifically makes references to and follows the approach of the Watercourses Convention on this issue. Under the Water Convention, the Protocol on Water and Health also aims to provide access to drinking water for everyone within a framework of integrated water-management systems (Art. 6).[60]

Water quality and good status

The allocation elements of transboundary water agreements often focus on the availability of water in terms of quantity. However, water allocation mechanisms also affect the quality of international waters.

The clearest link between water quality and allocation in a transboundary context actualizes when poor quality reduces the quantity of water resources available for allocation. ***When the water allocation arrangement provides for a certain volume and distribution of flow, it also impacts indirectly on water quality, in particular where those flows are important for diluting concentrations of substances.***

Addressing water quality issues in transboundary water allocation thus demands both national and transboundary coordination. Agreeing on acceptable water quality levels should be informed by desired uses for the given water source, and international and national environmental, chemical and health standards. Cross-sectoral interdependencies should also be addressed, as water quality objectives of an allocation regime may be undermined by incentives in other sectors that encourage pollution.[61] It should also be taken into account that reaching acceptable water quality levels for environmental requirements and human and sectoral needs may require dilution of flows or reservoir management that reduces the total volume of allocable water for all.[62]

Protection of ecosystems and rights of nature

The health of freshwater ecosystems is the foundation for the sustainability of water resources and the services and benefits derived from water. ***In modern water allocation arrangements environmental needs are assessed and an environmental reserve is recommended to be set aside before allocating water to other uses***.[63] The concept of ecological flows focuses on ecosystem needs as a part of the overall environmental flow.[64] When properly implemented, environmental flows can achieve multiple benefits, including: helping sustain and generate ecosystem services and livelihoods dependent on them; creating economic and recreational value; preserving rivers; sharing benefits of basin development more equitably; and in general contributing to the sustainable management of rivers.[65]

In transboundary settings, environmental flow assessments provide optimal results when undertaken as a joint exercise considering the river basin in a holistic manner. Assessments should account for interlinkages and interdependencies across political boundaries. Besides national- or State-level stakeholders, local stakeholders directly dependent on and affected by the flow regulations should be consulted.[66] A functional transboundary environmental flow programme requires harmonization of environmental flow methods in the basin, integration of environmental flows in the water planning and allocation and their effective implementation, operational rules (i.e. for reservoirs) and exchange of information.[67] Maintaining minimum environmental flows can thus be seen as an emerging legal requirement that enhances the implementation of an ecosystem approach in transboundary basins.[68]

There has been a gradual progression in certain rivers around the world being granted distinct legal rights, which in turn can have an impact on allocation frameworks.[69] A 'rights-of-rivers' approach is a part of a wider idea of the rights of nature, according to which nature has fundamental rights. Its roots arise from Indigenous traditions that regard humans as part of nature, not distinct from it. The rights-of-nature approach can be distilled in three central elements:

1. Nature possesses fundamental rights. It is not only human property. These rights may contain, for example, the right to exist and thrive and the right to restoration.
2. The rights of nature can be defended in a court of law. Nature has a legal standing.
3. Humans have duties to act as guardians or stewards of the rights of nature. Nature often needs guardianship bodies to uphold its rights and interest.[70]

Indigenous water allocation and cultural flows

Increasing attention is being given to the importance of water allocation for use by Indigenous peoples, including for cultural flows.[71] Cultural flows refer to specific cultural water allocations for Indigenous peoples. These water allocations meet their development aspirations as well as spiritual,

cultural, social, economic and environmental management responsibilities.[72] Many water management regimes, including in a transboundary context, have historically ignored, and thus may continue to ignore, Indigenous values, connections, knowledge and rights.[73] Indigenous peoples have often faced inequitable allocation rules.

To address inequalities and historical injustices where they may exist in transboundary water allocation contexts, States should consider the participatory rights of Indigenous peoples and their ownership and custodianship of water resources when allocating water resources at the transboundary level and within a country. States may find the concept of cultural flows useful in that regard.[74] The key is that the Indigenous peoples can decide where and when water is delivered on the basis of their traditional knowledge and aspirations.[75] The United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) recognizes Indigenous peoples' ownership over their cultural expression, including water, and thus may be a helpful starting point for incorporating Indigenous rights into allocation arrangements.

Water stewardship

Water Stewardship [is defined as] "use of water that is socially and culturally equitable, environmentally sustainable and economically beneficial, achieved through a stakeholder-inclusive process that involves site- and catchment-based actions."[76] Its logic and business case is built on the major water use and the impacts of water use in the operations and value chains of companies, the resulting water risks and the disruptions to business the companies face with the growing water challenges, and the responsibility and opportunities that working for water security brings for companies and their stakeholders alike.[77]

Water stewardship starts at the site, from the time water is accessed, extracted, used and processed, and extends to the time it is discharged back to the environment. The approach emphasizes stakeholder collaboration as water risks to business cannot be addressed merely with internal measures. The public sector is an important collaborator since sustainable water use and governance is ultimately under its mandate. The water stewardship and IWRM frameworks are mutually complementary: stewardship provides a clear incentive and structure for corporate engagement in water management and governance beyond the company fence, while IWRM has the potential to scale up and integrate corporate efforts to public policy processes.[78]

Water stewardship principles, policies and practices are therefore important to consider in conjunction with questions regarding sustainable and equitable water allocation, including in a transboundary context.[79] A key message to subsequently emerge is that "water allocation—a crucial issue in water resources management—tends to be side-lined in the discussion on water stewardship."[80] Consequently, discussions within the water stewardship approach as a whole "would benefit from refocusing on water withdrawals and water allocation across the geographies where companies operate, and on their interactions with other water users in those catchment and basins."[81]

Valuing water

The value(s) assigned to water resources within the context of a transboundary allocation framework will shape its processes and outcomes. Often, in the context of allocation, this is specifically related to economic valuations of water resources.[82] Such approaches may be applicable in other national water allocation contexts, but they remain largely untested at the transboundary scale between co-riparian States.[83] Notwithstanding, their premise and conceptual frameworks for valuing water in economic terms may be generally helpful in guiding transboundary allocation framework planning and certain conceptualizations may potentially be adaptable at the transboundary scale, if so decided by the riparian States.[84]

More recent conceptualizations of the valuing of water have tried to go beyond narrow financial and economic objectives and take a more holistic approach.[85] Several initiatives and reports have attempted to raise the profile of valuing water holistically, including the United Nations' *World Water Development Report 2021: Valuing Water*.[86] Their common denominator is the message that water is generally undervalued in societies and its price does not usually reflect its cost, nor its value. ***The High Level Panel on Water lists the following principles on valuing water and recommends their integration to water-related policies, initiatives and projects at all levels***:[87]

- **Recognize and Embrace Water's Multiple Values - Principle 1**. Identify and take into account the multiple and diverse values of water to different groupsand interests in all decisions affecting water;
- **Reconcile Values and Build Trust - Principle 2**. Conduct all processes to reconcile values in ways that are equitable, transparent and inclusive;
- **Protect the Sources - Principle 3**. Value, manage and protect all sources of water, including watersheds, rivers, aquifers, associated ecosystems, cultural values and used water flows for current and future generations;
- **Educate to Empower - Principle 4**. Promote education and public awareness about the intrinsic value of water and its essential role in all aspects of life;
- **Invest and Innovate - Principle 5**. Ensure adequate investment in institutions, infrastructure, information and innovation to realize the many different benefits derived from water and reduce risks.

When accounting for transboundary water resources, each riparian country's portion of surface and groundwater resources should be identified and recognized in any allocation framework. UNECE supports the implementation of the System of Environmental-Economic Accounting (SEEA) as the global standard. SEEA can be an important tool to inform environmental-economic policies and measure. sustainable development, and also SDG 6 on water and sanitation.[88] SEEA-Water includes managing water supply and demand as one of its quadrants of water policy objectives. The aim is to improve water allocation to satisfy societal needs as well as the needs of future generations and the environment. To achieve this aim it is important to monitor the amounts of water allocated for different uses, such as agriculture, energy production, water supply and industries, and measure the trade-offs in the allocation in economic terms.[89]

RELEVANT CASE STUDIES AS CONTAINED IN THE GLOBAL HANDBOOK

CASE STUDY 23: Southern African Development Community Revised Protocol and subsidiary instruments for developing transboundary water allocation arrangements
CASE STUDY 24: Transboundary water allocation incorporated in the peace treaty between Israel and Jordan
CASE STUDY 25: Developing an adaptable allocation treaty regime via a multi-phased project for Lesotho and South Africa
CASE STUDY 26: Genevese Aquifer Agreement, 1978: capping groundwater abstraction and managing aquifer recharge
CASE STUDY 27: Dniester River Basin: a joint body preventing and resolving disputes
CASE STUDY 28: River basin authority charter and technical body to advise ongoing allocations for the Senegal River
CASE STUDY 29: Important role of a joint body in transboundary water allocation in the Amu Darya River Basin
CASE STUDY 30: Adaptive capacity of water allocation arrangements: the Portuguese–Spanish Albufeira Convention
CASE STUDY 31: The Amu Darya River Basin: short- and long-term adaptability in water allocation
CASE STUDY 32: Allocation of flood control and hydropower benefits through coordinated management of the Columbia River
CASE STUDY 33: Genevese Aquifer Agreement
CASE STUDY 34: Agreement between Bosnia and Herzegovina and the Republic of Croatia

VI. KNOWLEDGE BASE FOR TRANSBOUNDARY WATER ALLOCATION

Information Needs for Water Allocation

A shared knowledge base at transboundary level ideally requires harmonized and comparable monitoring and assessment methods and data management systems. These are best established in a form of systematic monitoring and assessment programmes that provide information for planning, decision-making and water management at all levels to both guide and complement the existing national-level practices.

As a first step in the monitoring cycle, the key information needs related to water allocation cover water availability, different water uses and functions, and the allocation needs. The next step in the monitoring cycle, an information strategy, defines the best practical way to gather the data from different sources (e.g. from national monitoring systems, surveys, experts and statistics). The key aspects needed to establish a knowledge base on water allocation for a specific transboundary context can be gathered through an assessment(s) of water resources, environmental requirements, water uses and needs, and transboundary impacts.

Sustainable and equitable transboundary water allocation planning and agreements are best supported by a shared knowledge base, commensurate data and well-functioning monitoring and information-sharing systems. Furthermore, uniform reporting procedures can provide a common ground for deliberation, planning, negotiating, decision-making and operational water management.[90]

Joint Bodies

Joint bodies are permanent institutions with equal representation of the parties and are established to promote cooperation and coordination among the riparian States. They are an essential part of the governance structures of transboundary basins, interacting with the different actors, norms and measures that form the governing regime. Joint bodies should be neutral actors, safeguarding the interests of the shared basin and the riparian States as a whole, not of any individual basin State.

For water allocation in a transboundary context, joint bodies have an important role as they provide a forum and institutional framework for states and relevant actors to regularly negotiate and plan water allocations within a shared basin. In addition, joint bodies often form centres of information for monitoring and assessing transboundary water allocation. In practice, many joint bodies have water quantity issues included in their mandate.[91] That mandate, however, may refer to a number of different elements and specific cooperative actions on water allocation between basin states may vary in this regard. Joint bodies may, for example, be engaged in the management of flows, floods and droughts, navigation and hydropower generation, as well as specific economic sectors, the overall sustainability of water uses and the implementation of international water law principles.[92]

Integration of different forms of knowledge

The knowledge base for transboundary water allocation ideally builds on the existing joint monitoring and assessment systems as described above. The system design and data gathered are best built on various forms of knowledge available about the characteristics of the water resources and management issues, including best available scientific knowledge, but also relevant local and Indigenous knowledge. Local and Indigenous knowledge on water can provide invaluable inputs to both science and policy processes through the powers of observation of long periods and the recall of knowledge passed down from generation to generation. Besides knowledge on water resources, Indigenous approaches to water

allocation and conflict management may also provide useful methods to international negotiation settings.[93]

Bringing such different sources and even contrasting forms of knowledge together is often not easy, especially in a transboundary allocation context. It therefore requires well-structured facilitation. Key conditions for effective science-policy interaction in transboundary water governance include:

- recognizing that science is a crucial but bounded input into water resource decision-making processes;
- establishing conditions for collaboration and shared commitment among the various actors;
- understanding the role that social learning between scientists, policymakers and non-State actors can have to address complex water issues;
- accepting that the collaborative production of knowledge about hydrological issues and associated socioeconomic changes and institutional responses is essential to build legitimate decision-making processes; and
- engaging boundary organizations and informal networks of scientists, policymakers, and civil society when appropriate.[94]

Scenarios and transboundary water allocation

Scenario planning for transboundary water allocation can help policy-planners and decision-makers understand how future water management trends may unfold and what kinds of changes and uncertainties may affect water quality and quality in the short, medium and long-term. Climate change scenarios[95] are among the most important scenarios for planning transboundary water allocation. Yet other types of scenarios may also play a central role in allocation development, including scenarios about water demand, economic development or demography.[96]

It is important to note that scenarios are not definitive forecasts or predictions; rather, they are estimates of possible future baselines based on available information. In transboundary contexts, scenario planning for bilateral, multi-lateral or basin water management should preferably be jointly developed by all riparian States. Overall, water planning negotiations can benefit from an assessment of present and future water needs in the riparian States, including a detailed diagnosis of potential water allocation scenarios.

Assessing available water resources

Co-riparian States and particularly parties to joint bodies need a common understanding of the quantity, quality and regime of the available water resources for the purposes of allocation. Detailed guidelines for the monitoring and assessment of transboundary lakes,[97] groundwaters[98] and rivers[99] have been developed by UNECE. Generally, the available water resources can be assessed with the following three main steps:

1. Delineating and agreeing on the basin and/or aquifer boundaries, considering the biophysical and hydrological characteristics and administrative boundaries;
2. Assessing the surface and groundwater availability and quality, taking into account inter- and intra-annual variability, with hydrological and geohydrological analyses utilizing commensurate methods and data;
3. Estimating allocable water in different seasons and in different scenarios, based on the previous steps.

Determining sectoral water uses and needs

Changes in different water uses and needs are usually the main driver for water allocation and reallocation. Water uses are typically divided into domestic, agricultural and industrial, and water used for energy production, hydropower generation having the most central role in altering and regulating transboundary flows. Moreover, water is needed for environmental uses and navigation and transport.

There are a few general approaches on how to assess water use:[100]

- Monitored observed use, which is usually reliable for large urban, industrial or irrigation schemes. Mass balance modelling can also be utilized;
- Registered authorized use, based on records via licensing, permitting or billing;
- Estimation, via proxies like irrigated area or number of households.

Besides the quantity of water needed for different uses, its quality and timing of use or release are important to consider. Quality is especially critical for domestic and certain industrial uses that typically require purification before abstraction, whereby purification costs rise with decreasing quality of the source water. In addition to alterations in flows, ecosystems are sensitive to alterations in nutrients, sedimentation and pollutant concentrations. When it comes to timing, irrigation needs vary considerably between seasons, and ecosystems may be especially sensitive to flow alterations from hydropower at certain times of the year, for example. ***Ultimately, as water resources available for allocation are becoming increasingly limited, balancing different water uses and needs and clarifying their priority is one of the key tasks in the allocation process.***

Assessing Transboundary Impacts

Impact assessment is an essential part of the planning and decision-making processes related to any large projects, programmes or other initiatives, including those for or affecting transboundary water allocation. The aim of an impact assessment is to identify and evaluate the likely key effects (i.e. impacts) that the planned initiative is likely to have, along with the possible measures to prevent, reduce, mitigate and control adverse effects and to enhance positive effects. As a general recommendation in transboundary contexts, it is important to define the methods and scale
of the assessments together with the different parties, taking into account five key dimensions relevant for carrying out the assessment: geographic scope; sectoral mandate; level of integration; likelihood of compliance; and capacity to implement.[101]

International law has several different frameworks with related substantive and procedural requirements for EIA, SEA and the prevention, reduction and mitigation of transboundary impacts that may be applicable to water allocation, depending on the context. According to the Water Convention, States need to ensure that EIA and other means of assessment are applied to prevent, control and reduce transboundary impact (Art. 3.1h).[102] For this purpose, one of the tasks of joint bodies is to participate in the implementation of an EIA relating to transboundary waters (Art. 9.2j). States must also carry out joint or coordinated assessments of the conditions of transboundary waters and the effectiveness of measures taken for the prevention, control and reduction of transboundary impact (Art. 11.3). A joint exercise at the regional level resulted in the *Second Assessment of Transboundary Rivers, Lakes and Groundwaters*.[103] In the Watercourses Convention, EIA is linked to notification concerning planned measures with possible adverse effects upon other riparian States. Accordingly, such notification must be accompanied by available technical data and information, including the results of any EIA (Art. 12).[104] The Draft Articles on the Law of Transboundary Aquifers include a similar provision in relation to transboundary aquifers or aquifer systems (Art. 15.2).

Transboundary EIAs and SEAs can be relatively complex processes, as the riparian States may have differing institutional settings and differing views regarding the process. In addition to the United Nations global water conventions, the UNECE Convention on Environmental Impact Assessment in a

Transboundary Context (Espoo Convention) requires transboundary EIA and provides step-by-step procedural requirements, including for early notification, preparation of EIA documentation, consultations with authorities, public participation and taking into account their result in the final decision regarding the planned activity.[105] Accordingly, a State under whose jurisdiction a proposed activity is envisaged to take place must ensure that a transboundary EIA is undertaken prior to a decision to authorize or undertake a proposed activity listed in Appendix I to the Convention that is likely to cause a significant adverse transboundary impact (Art. 2.3). Appendix I of the Espoo Convention covers the following projects that can be relevant to transboundary water allocation:

- large dams and reservoirs;
- groundwater abstraction activities or artificial groundwater recharge schemes (annual volume of water 10 million m3 or more);
- transfer of water resources between river basins (over 100 million m3/year if the transfer aims at preventing water shortages; or over 5 per cent of the 2,000 million m3/year flow); and
- wastewater treatment plants (capacity exceeding 150,000 population equivalent).

Structured Decision Support and Management Responses for Water Allocation

Two practical methods and tools that are increasingly applied for structured decision-making in a transboundary context are presented here: multi-criteria decision analysis (MCDA); and decision support systems (DSS). ***Both MCDA and DSS offer possible options to assist decision-makers in transboundary water allocation planning and management.***

MCDA is a general term for systematic approaches that support the analysis of multiple alternatives in complex problems involving different objectives, intangible and incommensurable impacts and uncertainties.[106] They are especially useful when evaluating trade-offs and selecting alternatives. MCDA methods aim at improving the quality of decisions by providing an overall view of the pros and cons of the different alternatives. The main phases of MCDA are:

1) identification of objectives;
2) structuring them into a form of hierarchy;
3) developing alternatives;
4) assessing their performance with regard to objectives; and
5) collecting preference information.

DSS in the water management sector is often tailored for a particular case and can integrate different generic components, tools, methods and existing software packages, depending on the river basin characteristics and the decision-making process at hand. A DSS can combine databases, data and information management, simulation models, socioeconomic evaluation tools, decision analysis techniques, (GIS) and user interfaces in an informative way. A common feature of a successful DSS is that it is developed in close collaboration with end users, to ensure that it meets the requirements and to foster trust and commitment in the system. If deployed as part of a transboundary water allocation framework, riparian States must therefore together acknowledge the validity of the DSS to inform the decision-making process.[107]

A significant benefit of a DSS is that it can facilitate communication between stakeholders and riparian countries by providing an efficient platform for sharing information and supporting discussion about potential decisions and their implications.[108] ***Hence, a DSS can provide greater transparency in the decision-making processes, which is a crucial component for transboundary water allocation.*** **While a DSS can assist in decision-making, it does not replace well-trained, skilled managers and experts, and cooperative processes.**[109] **A DSS can be intended to be used on different time horizons. It can be used in long-range strategic planning and decision-making as well as analysing scenarios (e.g. hydro-climatic change, demand development, different policies and management plans).**[110] **On the other hand, a DSS can also be used for operational purposes in day-to-day allocation decisions, as well as in data- and information-sharing. Moreover, models**

included in a DSS represent different temporal and spatial scales and provide input to each other.[111]

Due to the increasing global attention on the topic, more DSS and modelling systems are being developed with several innovative projects recently initiated targeting sustainable transboundary water allocation planning and implementation. Two current examples in different regions are profiled below for consideration of possible approaches, noting these examples are non-exhaustive and others exist.

Modeling the Incomati river basin to enhance transboundary benefit sharing

Shared by Eswatini, Mozambique and South Africa, the Incomati is a basin of about 47,000 square kilometers. Due to development as well as climate variability and change, the basin faces growing water scarcity that undermines its ability to support the activities on which people and ecosystems rely. Management of the Incomati River Basin, shared by eSwatini, Mozambique, and South Africa, is currently governed by a 2002 interim agreement that stipulates precise volumes of water that must flow from one country to another. The agreement will soon be revised, and a basin-wide River Basin Organization – the Incomati Maputo Watercourse Commission (INMACOM) – was created in 2021 to support this revision process and foster more integrated and holistic approaches to basin management in the Incomati. Amid dynamic changes, transboundary management of the Incomati requires a simulation model of the entire basin.

In the context of the CGIAR NEXUS Gains Initiative, a key activity centers on developing such a basin-wide water resource simulation network model called Python Water Resources (Pywr). Pywr is a water resource systems analysis tool that supports multi-scenario simulation to understand the hydrological impact of future interventions in the basin. The model has several advantages over existing models for the basin: the depth of data on which it was constructed and its capacity to optimize cross-sector resource use to ensure sustainability.

In addition, users can access water resource models via Nexus-Strategy, which enables model development, visualization, sharing and running. Pywr produces simple, evidence-based, decision-relevant information on the status of water use and potential future climate scenarios. For example, the Pywr model can answer questions such as: a) how much water is being used by each member state? b) how much water is diverted for each sectoral use (irrigation vs. domestic vs. industrial)? c) how much water is remaining for potential future activities such as the development of new irrigation projects? or d) what will be the impact of basin development activities (such as reservoir construction) on downstream water uses? This type of information can potentially make a big contribution to advancing basin-wide management, thereby enhancing gains in the water–energy–food–environment nexus and increasing climate resilience.

The project partnered with INMACOM and member countries to hold a joint Pywr capacity development workshop in August 2022. Each country then nominated one young professional who has spearheaded data collection activities in their country. A key partner in this activity is the University of Manchester, which has provided technical expertise on Pywr model development. By late 2023, the expectation is that the model will be used to support a dialogue on shifting from the current "old-school" transboundary water division to a more dynamic approach of cross-country benefit sharing based on opportunities and risks afforded by actual water availability in any given year.

Source: https://www.cgiar.org/news-events/news/modeling-the-incomati-river-basin-to-enhance-transboundary-benefit-sharing/

WE-ACT: Water Efficient Allocation in a Central Asian Transboundary River Basin

Water Efficient Allocation in a Central Asian Transboundary River Basin (WE-ACT) aims to establish a new standard for sustainable water allocation, particularly in a transboundary context where competition for shared resources is increasing, by showcasing its innovative one-stop shop Decision Support System (DSS). The project started on 1 January 2023 and over the coming four years, FutureWater will contribute to the determination of water allocation for the current and future climate by combining modelling work on water availability and water demand in the region as part of work package two which is led by University of Twente, the Netherlands.

WE-ACT has an innovative approach which consists of two complementary innovation actions: the first is the development of a data chain for a reliable water information system, which in turn enables the second, namely design and roll-out of a decision support system for water allocation. The data chain for the reliable water information system consists of real-time in-situ hydrometeorological and glaciological monitoring technology, modelling of the water system (including water supply and demand modelling and water footprint assessments) and glacier mass balance, data warehouse technology and machine learning. The roll-out of the DSS for climate-risk informed water allocation consists of stakeholder and institutional analyses, water valuation methods, the setup of the water information system to allow for a user-friendly interface, development of water allocation use cases, and feedback on water use through national policy dialogues.

The work of FutureWater within the WE-ACT study will focus on estimating the water demand and water footprints of the different users and activities within the Syr Darya river basin. Therefore, the effects of water allocation on water footprints, unmet water demand and environmental flow violations will be evaluated using a set of hydrological models such as SPHY and Water Allocation models (WEAP). This will be done for both the status quo and future scenarios.

WEAP ("Water Evaluation And Planning" system) is a user-friendly software tool that takes an integrated approach to water resource planning. Freshwater management challenges are increasingly common. Allocation of limited water resources between agricultural, municipal and environmental uses now requires the full integration of supply, demand, water quality and ecological considerations. The Water Evaluation and Planning system, or WEAP, aims to incorporate these issues into a practical yet robust tool for integrated water resources planning. WEAP is developed by the Stockholm Environment Institute's US Center.

The Spatial Processes in Hydrology (SPHY) model is a hydrological modeling tool suitable for a wide range of water resource management applications. SPHY is a state-of-the-art, easy to use, robust tool, that can be applied for operational as well as strategic decision support. The SPHY modeling package is available in the public domain and only uses open source software. SPHY is developed by FutureWater in cooperation with national and international clients and partners.

Source: https://www.futurewater.eu/projects/we-act-water-efficient-allocation-in-a-central-asian-transboundary-river-basin/; **http://www.sphy.nl/ ; https://www.weap21.org/index.asp?NewLang=EN**

RELEVANT CASE STUDIES AS CONTAINED IN THE GLOBAL HANDBOOK

CASE STUDY 35: Exchange of hydrological data in the Sava River Basin: diverse providers and users unified
by a common policy and standards
CASE STUDY 36: E-flows knowledge base and capacity-building via stakeholder engagement in the Pungwe, Buzi and Save River Basins
CASE STUDY 37: Assessments of cumulative transboundary impacts in the Lower Mekong River Basin

VII. OPERATIONALIZING TRANSBOUNDARY WATER ALLOCATION

Phase 1: Assessing Motivations and Knowledge Base for Transboundary Water Allocation

Step 1: Understanding the setting and identifying the water management issues at stake

The target water-related issues to be addressed should be carefully considered from the perspective of whether they are best addressed with allocation measures in consideration with their limitations and complementary approaches, and whether their management has transboundary impacts and interdependencies and should therefore be treated as a matter of transboundary concern and cooperation.

Step 2: Identifying key stakeholders and institutional frameworks

The primary actors in transboundary water allocation processes are typically the co-riparian States with their representative organizations. This may include subnational entities sharing a surface or groundwater basin. To understand the differing views and forms of knowledge linked to water allocation, it is also advisable to identify and engage other key stakeholders relevant for the process and outcome, including the general public.[112]

Step 3: Shared knowledge base

A shared knowledge base building on joint monitoring and assessment systems and commensurate data is essential for sustainable and equitable transboundary water allocation decision-making.

Step 4: Identifying alternatives and addressing diverging understandings

In general, there are two main categories of alternatives for water allocation: broader alternatives and practical alternatives. Broader alternatives indicate the utilization of water resources management frameworks, river basin plans, a water-food-energy-ecosystem nexus approach or similar broader approaches to address water use and allocation in the given context. Practical alternatives consist of more focused arrangements, such as demand management measures, sharing benefits from hydropower dams or joint water quality management.

Phase 2: Transboundary Water Allocation Agreements and Arrangements

Step 5: Negotiating at transboundary level for suitable arrangements and agreements

The United Nations global water conventions set a framework for negotiating bilateral and multilateral transboundary arrangements or agreements. In general, each riparian State has the right to participate equally in the negotiation of transboundary water allocation arrangements and agreements.[113] The good faith principle is fundamental to the negotiation process and refers to carrying out consultations with honest intent, fairness, sincerity and no intention to deceive.[114]

Negotiating for water allocation agreements and other arrangements should not be viewed as a non-recurring process, but, rather, as a part of ongoing transboundary water allocation cooperation.

Step 6: Establishing water allocation agreements or arrangements

Joint arrangements, agreements and joint bodies established by riparian countries are key elements of well-functioning transboundary allocation systems, granting certainty and legal weight in the long-term.

The mandates of transboundary joint bodies should be broad and governance should have enough capacity to adapt to changing circumstances. Concerning the actual allocation, the riparian countries should be able to determine allocable waters and current allocation, establish clear allocation rules and take into account annual flow variation, flow forecasts, environmental flows and future water use needs, for example.

Step 7: Development of allocation mechanisms and plans

Transboundary agreements with water allocations should be able to accommodate and react to possible future changes in water availability. This can be done by including percentage allocations, escape clauses (i.e. special provisions for special situations such as extended droughts) or periodic reviews of usage and allocations. Arrangements and agreements should define procedures for negotiation or renegotiation of water allocations. If such procedures are not in place when circumstances previously defined as extreme and temporary become "the new normal", the risk for implementation problems and disputes grows.[115]

Phase 3: Implementation of Transboundary Water Allocation Arrangements and Agreements

Step 8: Implementation

First, States must enact national law and regulations and enter into cooperative arrangements, such as establishing joint bodies. Second, States need to adopt sufficient administrative measures. Third, States need to make sufficient human, financial and technical resources available for implementation.[116]

The Convention requires countries to take many national-level implementation measures related to water allocation, such as:

- promotion of sustainable water resources management;
- application of EIA and other means of assessment;
- prevention, control and reduction of the emission of pollutants at source (Art. 3.1);
- monitoring of the conditions of transboundary waters (Art. 4).

Concerning implementation measures at the transboundary level, the Water Convention stipulates that the agreements and arrangements must provide for the establishment of joint bodies and sets the following tasks, for example, for these joint bodies:

- elaboration of joint monitoring programmes concerning water quality and quantity;
- establishment of warning and alarming procedures;
- exchange of information on existing and planned uses of water and related installations that are likely to cause transboundary impact (Art. 9.2).

Step 9: Monitoring and ensuring compliance

Compliance is a central element of the implementation of water allocation arrangements and agreements. It can be defined as a State's behaviour in accordance with its commitments stemming

from the allocation agreements. A compliance system includes rules and procedures such as a compliance review that assess, regulate and ensure compliance. Monitoring compliance is an essential element of that system. Non- compliance may be a result of a State's unwillingness and/or inability to meet its commitments but can also relate to ambiguity and indeterminacy in agreement language.[117]

Concerning transboundary water allocation arrangements and agreements, active reporting and regular exchange of information is an essential measure for monitoring and ensuring compliance. Joint bodies are often charged with a monitoring task when compliance review and support mechanisms are included in the arrangements.

Under the Water Convention, the Implementation Committee's objective is to "facilitate, promote and safeguard the implementation and application of and compliance with the Convention". The Committee is meant to deal with specific cases of difficulties with implementing the Convention and is intended as an alternative to a dispute settlement procedure. As a dispute prevention and resolution mechanism, it is intended to be simple, non-confrontational, non-adversarial, transparent, supportive and cooperative in nature, building on the distinctive collaborative spirit of the Convention. Concerning compliance with the Convention, the Committee may serve as a means to prevent situations from evolving into a dispute.[118]

Step 10: Dispute prevention and resolution mechanisms

According to the Water Convention, parties to a dispute about the interpretation or application of the Convention must seek a solution by negotiation or by any other means of dispute settlement acceptable to them. Thereafter the dispute may be submitted to the International Court of Justice or arbitration for a compulsory dispute settlement if the parties have accepted such an option (Art. 22).

Dispute resolution mechanisms in international water agreements can be structured as a sequence of progressively intensive steps or elements from fact-finding to negotiation and dispute resolution:[119]

a. **Negotiations.** Within transboundary water regimes, negotiation is the primary mechanism for resolving disputes between the parties. Negotiations may take place through diplomatic channels or meetings of experts and can be assisted by a joint body. Negotiations may lead, for example, to the creation of a memorandum of understanding between the parties.
b. **Mediation and good offices.** Mediation involves a neutral external party that guides the negotiation process and helps to identify potential solutions to the dispute. The role of a mediator may range from encouraging the parties to resume negotiations and facilitate dialogue (i.e. good offices) to the investigation of the dispute and active participation in finding a solution.[120] Mediation may only be undertaken by mutual agreement by the parties.
c. **Conciliation.** In conciliation, an impartial person or a formal impartial commission studies the facts of the case, establishes the applicable law and makes solution proposals for the parties.
d. **Fact-finding and inquiry.** An impartial person or commission investigates factual or technical matters.
e. **Compulsory fact-finding.** According to the Watercourses Convention, a fact-finding commission can be established and it can make "such recommendation as it deems appropriate for an equitable solution of the dispute". However, the parties to the dispute are not bound by the commission's recommendation and may still invoke compulsory dispute settlement procedures, such as arbitration or adjudication (Art. 33).
f. **Arbitration.** Arbitration means that a dispute is submitted to a third party for resolution. The arbitrator is always a neutral expert and is not involved with the parties or the governing organization of the regime within which the dispute has arisen. Arbitration requires the prior consent of each party to the dispute. In the Watercourses Convention arbitration is provided for in Article 33 and complemented by the Annex that sets out the rules for the establishment and operation of an arbitral tribunal. Arbitration can be a voluntary or mandatory forum (based on

jurisdiction to hear the matter being accepted by the disputing parties) for dispute settlement, the outcome/decision of which is final and binding.

g. **Dispute resolution by a joint body.** The role of a joint body in preventing and managing disputes largely depends on its characteristics, operating environment and tasks. The regulatory and implementation powers of joint bodies vary, as does their capacity to manage and prevent conflicts. An effective joint body is generally more akin to a multi-issue body that is able to adopt a balanced approach to issues and resolving conflicts. Sometimes a joint body may be designated as the first or primary actor to resolve a dispute between the parties.
h. **Specific organizations.** Some organizations serve the conflict management needs of several transboundary water treaty regimes.
i. **Adjudication.** It is sometimes possible to refer the dispute to a national or international court. Concerning the International Court of Justice, its general mandate includes the settlement of legal disputes submitted to it by States. No State can be brought to the Court without its prior consent.
j. **Permanent international tribunals.** Unless otherwise agreed, a settlement of a dispute by a permanent international tribunal is final and binding and based on rules of international law.

Transboundary water regimes should be able to determine the conditions for dispute resolution. These include matters such as who may trigger a mechanism, what kinds of issues may be dealt with through it and what is the role of a joint body in dispute resolution.

RELEVANT CASE STUDIES AS CONTAINED IN THE GLOBAL HANDBOOK

CASE STUDY 38: Public participation and consensus-building in water management for the Great Lakes Basin
CASE STUDY 39: Jointly developed knowledge-based management of the transboundary deep thermal groundwater body in the Lower Bavarian/Upper Austrian Molasse Basin
CASE STUDY 40: Role of a third party in negotiating the Indus Waters Treaty
CASE STUDY 41: The International Boundary and Water Commission's use of Minutes for adaptable transboundary water governance: updates governing the Colorado River
CASE STUDY 42: Regional recommendations on transboundary water allocation from Central Asia and the neighbouring States
CASE STUDY 43: Joint management of Doosti Dam by Iran and Turkmenistan
CASE STUDY 44: Indus Waters Treaty dispute resolution mechanisms
CASE STUDY 45: Dispute prevention and settlement provisions in the Mekong River Agreement
CASE STUDY 46: Mechanism for settling differences and compensation in the Finnish–Russian cooperation framework

VIII. MAIN MESSAGES

1. Transboundary water allocation determines one or more of the following: the quantity, quality and/or timing of water at the border between riparian States; and grants associated entitlements. Simply put, water allocation determines who can use shared water resources, in what quantity and of what quality, for what purposes, where and when.

2. Effective, equitable and sustainable transboundary water allocation is increasingly important in the present rapidly changing water security contexts, to prevent conflicts and underpin development. With growing populations, rising wealth, dietary changes, urbanisation and rising industrial demands, most countries are placing unprecedent pressure on water resources. It is estimated that, with current practices, the world will face a 40 per cent shortfall between forecast demand and available supply of water by 2030. Climate change is worsening the situation by altering hydrological cycles, making water more unpredictable and increasing the frequency and intensity of floods and droughts. The 310 transboundary rivers and more than 500 transboundary aquifers in the world are vulnerable to these growing pressures. In an increasing number of them, in particular in water-scarce regions, available water resources are already fully utilized or overutilized.

3. Transboundary water allocation is a joint, iterative planning, decision-making and implementation process and an outcome between two or more water-sharing States that is highly context specific. Arrangements need to be tailored to the specific purposes and issues seeking to be addressed. Cooperation between riparian countries, the design of the process and the information supporting it are all crucial. Building and maintaining trust throughout the process is key.

4. Transboundary water allocation should be based on international water law. The United Nations global water conventions, the Draft Articles on Transboundary Aquifers, regional agreements and other relevant international agreements provide overarching legal frameworks for allocating water in transboundary basins and aquifers. These instruments contain the general principles of international water law (such as equitable and reasonable utilization, no significant harm, good neighbourliness and cooperation, protection of ecosystems, peaceful settlement of disputes, prior notification) that should underpin transboundary allocation arrangements. They also provide the governance tools (agreements, joint bodies) for developing, revising and implementing contextualized transboundary allocation agreements or other arrangements.

5. To respond to changing conditions, including but not limited to climate variability and change, transboundary water allocation agreements and other arrangements should be adaptable. New transboundary water allocation agreements and other arrangements need to be designed to be adaptable in the medium and long-terms to changing hydrological, climatic and other related factors (socioeconomic, geographical, cultural, etc.). Existing water allocation agreements and other arrangements, or adopted subsidiary instruments, may need to be revised to be able to respond to changing conditions. Adaptive capacity can be integrated into transboundary allocation systems and institutions to respond to changing conditions, impacts and opportunities. Examples of this include applying allocations in percentages instead of absolute amounts, periodic reviews and using objective thresholds (e.g. persistent low precipitation) as a basis if exceptional deviations from agreed allocations are needed.

a. **Climate change must be approached as a cross-cutting challenge to effective allocation**. It is a potential risk multiplier that may necessitate adjustment of existing—and careful drafting of any new—transboundary water allocation agreements and arrangements. Impacts of climate change on future demands and flows should also be anticipated and used to inform the negotiation of allocation arrangements. Transboundary allocation arrangements need to factor in the increased uncertainty and inter- and intraannual variability of precipitation and run-off to cope with increasing frequency and extremity of drought and flood events. Making transboundary allocation arrangements climate resilient requires strong coordination

mechanisms between and among different levels of governance, sector policies and stakeholder groups.

b. **The joint review of pre-existing usage patterns, and any transboundary allocation arrangements on which they are based, is an important step when adapting arrangements to evolving conditions and demands**. Such review should be based on equity and sustainability, especially as regards upstream and downstream water use allocations, including for the environment.

c. **It is also important to share and jointly develop or review plans for future water uses based on predicted foreseeable needs at the transboundary and State levels**. Water demands and flows evolve over time, due to many factors, including but not limited to changes in demography and land uses, and such evolutions need to be taken into account. Future plans with potential transboundary impacts should be shared as soon as reasonably possible in accordance with the principles of prior notification and consultation.

d. **Economic considerations (including impacts on prices, consumers and product surplus in the sectors concerned, fiscal impact and affordability constraints), along with social considerations (such as on employment), are important in managing demand and water infrastructure needs over time, as well as negotiating and implementing water allocation (rules and mechanisms, externalities, etc.)**. Cost-benefit analyses can help to structure the options in water allocation and to assess the impact of those options. However, it must be acknowledged that not all costs and benefits can be quantified and monetized usefully, and, therefore, those aspects should be included in other terms in the analysis. The coordinated design and management of infrastructure and incentivizing efficiency and cost-effectiveness can help to increase efficiency of water infrastructure and reduce water demands.

6. A main limitation of allocation can be its narrow focus on water quantity, quality and timing, within a bounded spatial area. Thus, transboundary allocation should always be considered in conjunction with complementary broader approaches.

a. **Intersectoral approaches, such as the water-food-energy-ecosystem nexus approach**, help to inform the choice of sectoral and integrated policies and decisions that increase efficiency, reduce trade-offs and build synergies.

b. **Long-term basin planning incorporating the principles of integrated water resources management (IWRM)** can reduce the need to resort to specific water allocation arrangements, or provide a foundation for transboundary water allocation. For instance, IWRM requires the holistic consideration of different water sources and uses, together with the management of both supply and demand in the basin.

c. **Considering all the benefits that can be derived from water management** provides a comprehensive perspective to negotiating transboundary water allocation arrangements, which helps in moving beyond addressing purely water-related issues to their broader social, economic, environmental and political impacts.

7. While designing and operationalizing water allocation arrangements is the product of a unique, context-driven pathway, the following three steps constitute an adaptable framework applicable to different settings:

i. identification of incentives, reasons/motivations and development of a knowledge base;
ii. negotiations of arrangements or agreements, including development of allocation mechanisms and plans, monitoring and ensuring compliance, and dispute prevention and resolution mechanisms;
iii. implementation, including national implementation.

8. Developing transboundary water allocation arrangements is an iterative process that requires cooperation across all its steps. It is advisable to start by setting out the States' terms of reference, identify one or more simple shared objectives, develop trust and then expand. It is recommended to incorporate feedback loops in order for States to jointly revisit and reassess important elements and steps in the process, as and when required.

9. An adequate shared knowledge base and understanding of the issues at stake is a starting point for evaluating whether water allocation agreements and other arrangements provide the most appropriate means to address the issues. This information can further assist with defining agreed allocations and system design, including related mechanisms and plans. Important elements of the knowledge base include water resource and availability assessments and analyses of environmental requirements, as well as use and impact assessments, preferably in different scenarios.

10. The identification of the net benefits of cooperation regarding transboundary waters can help with creating enabling conditions, including the political willingness, for strengthening cooperation on water allocation in a transboundary context. Tools are available to assist with this process. Allocation arrangements can thus contribute to broader peacebuilding and regional conflict prevention, mitigation or resolution.

11. Historical records of negotiations over transboundary water allocation arrangements indicate that they have tended to follow a needs-based approach rather than approaches focused solely on legal rights (whether absolute rights or other principles and entitlements). Needs-based approaches that are based on basin characteristics, or the tangible benefits that water brings, are more easily quantifiable for the purposes of allocation. Such approaches have often provided a common starting point for negotiations by offering practical methods for determining water-sharing baselines in a transboundary context. Notwithstanding, legal rights are a crucial component of any negotiations regarding transboundary water allocation.

12. Negotiations benefit from an assessment of present and future water needs in the riparian States, including a detailed diagnosis of potential water allocation scenarios. Any future water needs assessment should consider feasible options for managing water demands, prioritizing vital human needs and improving water use efficiency in riparian States and by their main water users.

13. A joint or coordinated assessment of vulnerability of water resources and of water-dependent sectors to climate change, and impacts scenarios are also useful tools. They foster a shared understanding of the future water outlook and can provide scope for periodic review of the terms of allocation and their modalities for implementation

14. Negotiating water allocation arrangements and agreements should not be seen as a one-off exercise. Rather, it is part of a transboundary water cooperation process that advances step by step and may eventually need to be revised. In some cases, technical solutions, informal or temporary arrangements may be instrumental in reaching an acceptable short-term solution. However, formal legal and institutional arrangements are more suited to providing a long-term and sustainable framework for transboundary allocation.

15. To ensure the sustainability and implementation of the water allocation arrangements, it is crucial to identify key stakeholders beyond government entities concerned with water allocation and engage them in both the process of negotiation and its outcome. These stakeholders may include international financial institutions, infrastructure operators, sectoral organizations, main water users or water user associations, civil society and citizens' organizations, local communities and Indigenous peoples. A stakeholder analysis can inform who should be involved, and an institutional analysis can inform the determining foundations for any arrangement. Special efforts are needed to involve traditionally marginalized and/or underrepresented members of society who rely on transboundary water resources, and to ensure gender equity. This broad participation brings benefits and contributes to an improved knowledge base, as well as enhanced equity and sustainability.

16. Identification of different allocation options and alternatives and their careful consideration before taking decisions is beneficial, and diverse valuation tools and needs-based evaluations can be of assistance, while taking into account that not all benefits or factors can be quantified. Multi-criteria decision analysis (MCDA), is one such means of providing transparent and systematic comparison. Various software tools and decision support systems (DSS) have been developed to support the application of MCDA and other methods in practice.

17. Uncertainty related to water availability, variability and events is inevitable, making it essential to integrate flexibility mechanisms and adaptive capacity in allocation arrangements. Better availability of data reduces uncertainty, but even a lack of data can be turned into an opportunity by sharing information and co-producing knowledge.

18. Integrating clearly defined dispute settlement mechanisms (both diplomatic and adjudicatory mechanisms) can help support the implementation of transboundary allocation arrangements. Given the often-contested nature of transboundary water use and allocation, it is beneficial to incorporate into any allocation agreement binding dispute settlement mechanisms that are agreed to by the riparian States.

19. Transboundary water allocation arrangements and agreements often need to be further specified to ensure effective implementation. This can be supported by developing allocation mechanisms, coordination and monitoring plans—considering different scales—which may also provide flexibility for allocation.

20. Implementation of transboundary water allocation arrangements relies on having effective legislation and institutions in place at the national and/or subnational levels, and may require revising and strengthening them. Seeking alignment and coordination between transboundary allocation arrangements and relevant State legislation is beneficial and should be taken into consideration as early as possible in the planning process. Other national and subnational instruments, such as regional limits on water abstraction, water entitlement or licensing systems, and annual water allocation process and monitoring systems for compliance and enforcement can be useful. Moreover, the institutional and technical capacity of all concerned national and subnational agencies should be taken into consideration in transboundary water allocation implementation plans.

21. While the implementation of agreed allocation measures rests with riparian States, transboundary joint bodies are key elements of well-functioning transboundary allocation systems. They provide a platform for negotiation and regular exchange, stability and predictability in the long-term. However, few joint bodies have a mandate with respect to water allocation. Moreover, even in the presence of a clear mandate, dealing with water allocation remains a challenging task for joint bodies that calls for strengthening their capacities.

22. Collecting and sharing reliable data and information is a critical foundation for the planning and implementation of water allocation in transboundary basins. Data and information should include both biophysical and socioeconomic aspects, as well as data and information needed to monitor future variability and change. Information-sharing can help to reconcile different understandings of the shared water resources between and among sectors and/or riparian States regarding water availability, status and significance for sustainable development. The following elements can strengthen the knowledge base for transboundary water allocation.

a. **Joint and/or coordinated monitoring and assessment systems, which utilize sound and financially sustainable technology, are key for the design and implementation of water allocation arrangements**. Harmonized methodologies and parameters, inspired by best practices, can further support consistency of cross-border comparisons and interoperability of data. Such systems can be useful in verifying allocation implementation and effectiveness and provide the transparency necessary for compliance and enforcement.

b. **Open, transparent and regular sharing of up-to-date information is important for allocation, but many States find this element challenging**. Sharing should include the exchange between States of, and/or access to, any relevant data (including metadata) on the current status and variability of transboundary water resources within each State, including various stakeholders. It should also include any plans for future water uses and related developments, including infrastructure projects, as soon as they are reasonably known, as well as forecasts/outlooks on the availability of waters. Nevertheless, not all data is always required (or simply not available) and this should not prevent decision makers from taking decisions under uncertainty.

23. Water allocation mechanisms can generally be divided into direct mechanisms, indirect mechanisms and/or mechanisms based on principles. These mechanisms are not mutually exclusive and can be used in combination and change over time. For example, groundwater is a distinct type of resource compared with surface water, and, by consequence, specific mechanisms refer to pumping rates, water table impact and spring outflow or relate to storage capacity of the aquifer. It is up to the States involved in allocation arrangements to determine the mechanisms that are most relevant and suitable to use in their context and any associated benefits they wish to prioritize.

a. **Direct mechanisms** typically specify: fixed quantities (for all or some States); percentage of flow; equal division; variable by water availability; variable according to time of the year; water loans; allocation of entire/partial aquifer/river (based on sole use); allocating time; and/or cap, limit or no allocation allowed.

b. **Indirect mechanisms** include: dividing allocation based on the priority of use; consultation and/ or prior approval; and/or the allocation mechanism determined by a river basin organization (RBO), commission and/or committee.

c. **Mechanisms based on principles** refer to one of the following: benefits-sharing; historical or existing uses; equitable use; sustainable use; or use of a market instrument.

24. Growing practice in some transboundary basins reflects the prioritizing of human and ecological needs before allocating available water resources to other needs. Water quality for human consumption is becoming an increasingly important aspect of transboundary allocation and the prevention and reduction of pollution loads a high priority. Preventing ecosystem degradation has also been a main driver for recent water allocation reforms.

a. **Vital human needs for drinking water, sanitation and hygiene are increasingly prioritized, especially in regions facing frequent drought events or chronic water scarcity**. Water scarcity may compromise water supply and sanitation services and can have negative impacts on human health. Deteriorating water quality diminishes available potable resources, while the need for treatment increases costs for water use.

b. **The state of freshwater ecosystems affects the quantity, quality and variability of allocable water**. Safeguarding or restoring key aspects of ecosystem functioning, such as downstream water supply, wetlands, freshwater fisheries or sediment transport to low-lying delta regions can thus be strategically important to transboundary allocation arrangements.

c. **Increasing use of environmental/ecological flow assessment tools and approaches, while ensuring the environment is determined to be a water user, reflects an understanding that maintaining healthy freshwater ecosystems has broader, strategic social, cultural and economic benefits, both direct and indirect**. This trend also recognizes the intrinsic value of the integrity of ecosystems. Numerous methods for defining e-flows have been developed beyond the basic definition of minimum flows.

d. **Ensuring obligations related to return flows and discharges are properly specified and enforced can further support the prioritization of human and ecological allocation needs**.

25. In addition to international water law, other branches of international law and their principles can be useful for the definition of transboundary water allocation arrangements.

a. **Multilateral environmental agreements can be applicable where appropriate in developing transboundary water allocation arrangements**. These include but are not limited to the: Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention); Convention on Environmental Impact Assessment (EIA) in a Transboundary Context (Espoo Convention); Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention); Convention on Biological Diversity; and United Nations Framework Convention on Climate Change (UNFCCC).

26. Several emerging principles and norms can be considered for inclusion in the development of allocation arrangements, depending on the context. These include but are not limited to: Indigenous values and water allocation in conjunction with the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) and cultural flows; the human rights to water and sanitation, and other rights; the community-of-interest approach; water stewardship; and the rights of rivers and ecosystems. Approaches to valuing water and supporting ecosystem services, for example, water pricing and payment for ecosystem services, have also gained increasing attention globally.

[1] UNESCO World Water Assessment Programme (WWAP), *The United Nations World Water Development Report 2020: Water and Climate Change* (Paris, 2020).
[2] International Groundwater Resources Assessment Centre (IGRAC), "Transboundary aquifers of the world map", 2015.
[3] See Water Convention text at https://unece.org/DAM/env/water/publications/WAT_Text/ECE_MP.WAT_41.pdf; Speed and others (2013); OECD, *Water Resources Allocation: Sharing Risks and Opportunities* (2015).
[4] See Kohli, Frenken and Spottorno (2010).
[5] Speed and others (2013).
[6] Tom Le Quesne, Guy Pegram and Constantin Von Der Heyden, "Allocating scarce water: a primer on water allocation, water rights and water markets", WWF Water Security Series, No. 1 (Godalming, United Kingdom, WWF-UK, 2007), p. 10.
[7] FAO, "Coping with water scarcity: an action framework for agriculture and food security", FAO Water Reports, No. 38 (Rome, 2009).
[8] David Molden, "Scarcity of water or scarcity of management?", International Journal of Water Resources Development, vol. 36, No. 2–3 (2019), p. 258–268.
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