

ANNEX: TYPOLOGY OF TRANSBOUNDARY WATER ALLOCATION

SUMMARY:

This Annex outlines the transboundary water allocation typology methodology developed for cataloguing and analysing allocation mechanisms in international water agreements that was used in a discrete piece of research specifically commissioned for this Handbook. The methodology and data used are just one approach to conducting a broad analysis of the global practice of allocation in international freshwater agreements.

1. Purpose of Research

Much of the literature on transboundary allocation outlines approaches to and considerations of how allocations can be negotiated between parties but provides minimal explanation for physically dividing and sharing transboundary waters between riparian States. In the process of developing the *Handbook on Water Allocation in a Transboundary Context*, the Water Convention secretariat, in conjunction with the Drafting Team, sought to include a broad assessment and synthesis from existing global practices and mechanisms in transboundary water allocation agreements.

The online International Freshwater Treaties Database (IFTD), housed within the Transboundary Freshwater Dispute Database (TFDD), contains both global and regional information in searchable tabular and spatial data sets, treaty and compact libraries, and GIS shapefiles available for download. Developed and maintained by Oregon State University College of Earth, Ocean, and Atmospheric Sciences, in collaboration with the Northwest Alliance for Computational Science and Engineering, the TFDD catalogues allocation mechanisms present within current and historical transboundary water agreements.

In order to provide an assessment and synthesis of global practice from international freshwater agreements, the full data set in IFTD has been extracted and coded using a new methodology developed for this research —Typology of Transboundary Water Allocation (TTWA). The TTWA was developed to catalogue and analyse allocation mechanisms present in international water agreements over transboundary surface and groundwaters. A synthesis of the results, including highlights and tables, is provided in the text of the Handbook.

This annex describes the new TTWA methodology for cataloguing and tracking water allocation mechanisms to address the gap between previous methods for cataloguing and recent discourses. It outlines the methodology and analyses the general approaches and their practical application. It concludes by addressing the application of the TTWA and how it relates to the theoretical approaches to allocation and to flexibility and adaptive capacity.

2. Context and Data for Research

The TTWA methodology builds on previous work tracking transboundary water allocation mechanisms.⁵¹⁷ The typology is based on overarching theoretical approaches that have shaped the allocation of transboundary waters, as well as examples of considerations that can be used to interpret and apply these approaches when developing an allocation mechanism. Moreover, the allocation mechanisms in the TTWA take into account theoretical approaches to allocation and their respective considerations, as described below. Furthermore, the methodology also enables comparison of the types of mechanism, such as direct, indirect, principle based and groundwater specific.

The results of this analysis of past and present international freshwater agreements—spanning from the 1860s to 2017—using the TTWA methodology has been highlighted in the text of the Handbook (see Box 4; Chapter II, section 3; Chapter VI, section 2; Chapter VII, subsection 2c). This analysis accompanies a broader update, spanning the period 1820 to 2020 of the IFTD, which is in process and will soon be published.⁵¹⁸ At the time of writing, there are 744 entries in the treaties database;⁵¹⁹ of these, 599 are coded for allocation mechanisms.⁵²⁰ Within this data set, there are 180 individual documents with at least one mechanism for surface and/or groundwater allocation. This figure can be compared with the 68 of 145 treaties identified by Hamner and Wolf in the first iteration of the IFTD,⁵²¹ and the approximately 80 of 215 treaties⁵²² considered by Giordano and others in 2014.

3. Typology of Transboundary Water Allocation Methodology

The TTWA (see Table 8 in Chapter VI and Table 12 in Chapter VIII), is comprised of three sections: groundwater allocation, surface water allocation, and hydropower benefits division. Consequently, these three sections are discussed separately in the Handbook, in Chapter VI, section 2.

Within the groundwater and surface water allocation components, the TTWA accounts for both why water is allocated (context clause) and how it is allocated (explanatory clause). It separates allocation mechanisms into these two components, pairing the explanatory clause with a context clause. The explanatory clause captures how water is physically allocated, divided or distributed between or among the riparian States. The second component of the TTWA is the context clause, which captures the purpose of the allocation mechanism, identifying why the water was allocated in a particular way. For example, a treaty might divide water using a fixed volume or flow rate for the purpose of irrigation, or the signatories may identify a percentage of flow that needs to be maintained to meet a basin's minimum environmental needs. Other potential contexts for allocation contained within the TTWA (see Table 7: Breakdown of Allocation Context Clauses) include minimum flows, hydropower, navigation or an undefined purpose.

As a result, the TTWA enables the study of how transboundary water allocation has changed over time, both in terms of the approaches used for allocation and *how* and *why* water was allocated. Through this, it is also possible to see how water allocation is context dependent. For example, it might be more common

517 Hamner and Wolf (1997); Giordano and others (2014).

518 McCracken and others, "Typology of Transboundary Water Allocation" (forthcoming).

519 This number includes all entries in the IFTD as of June 2020. Not all entries are treaties, nor do all of these fit the inclusion criteria. In addition, some maybe missing text or not coded.

520 This number includes all entries in the IFTD as of June 2020 that are coded for allocation mechanisms using the TTWA. The other agreements may be missing or in a language that is not able to be coded at this time.

521 Hamner and Wolf (1997).

522 Note that these values are not directly comparable to the current numbers nor the Hamner and Wolf (1997) study, as the Giordano and others (2014) study considers treaties based on their lineage and linked nature between primary agreements, amendments, and replacements.

to delegate water in amounts that vary depending on the time of year in areas with high agricultural activity, in order to allow for irrigation planning.

Additionally, the TTWA contributes a clarifying distinction between allocation mechanisms for surface and groundwater. Historically, the focus of allocation mechanisms has been on sharing surface water, which also forms the foundation for the approaches guiding transboundary water allocation. With growing attention and interest in the shared management of groundwater, there is a need for groundwater allocation mechanisms that are based on the unique properties and physical characteristics that distinguish groundwater from surface water. Therefore, in addition to separating allocation mechanisms for surface and groundwater, the TTWA also establishes several groundwater-specific explanatory clauses for how water is physically divided between States (see Table 6: Frequency of explanatory clauses in surface and groundwater allocation mechanisms in international water agreements). These include using pumping rates, water table levels and spring outflows to monitor or determine quantities for allocation, as well as mechanisms that divide water based on the pore space or storage capacity of an aquifer rather than the volume of water itself.

Past research has shown that one of the predominant purposes for allocation was hydropower; however, through new coding, McCracken and others found that States often allocate benefits from hydropower rather than allocating water volumes to hydropower projects.⁵²³ This led to the creation of the third section of the TTWA, the Hydropower Benefits Division. This code identifies the legal mechanisms for how benefits are shared or divided from hydropower, such as fixed quantities of power, percentages of power and value generated from power sales. A breakdown of the Hydropower Benefits Division is provided in Table 8: Frequency of different mechanisms for Hydropower Benefits Division.

4. Analysing General Approaches to Allocation

As detailed in Chapter II, allocation mechanisms can be organized into six core theoretical approaches, as shown in Table 1. The six main approaches are: rights-based, needs-based, hierarchy, proportionate division, strategic development, and market-based. These theoretical approaches provide a perspective or lens through which States can develop their position, interests or needs for allocations. Some of these approaches can be used collaboratively or cooperatively, which can encourage States to develop joint interests and needs that ultimately lead to allocation mechanisms that are relevant to the basin or aquifer and provide shared benefits to the riparian States.

The different explanatory clauses, as outlined in the TTWA, can be associated with multiple approaches, depending on how they are used and applied through the lens of a particular approach. There are three categories of explanatory clauses for allocation mechanisms to address *how* water is allocated: direct mechanisms, indirect mechanisms and principle-based mechanisms.⁵²⁴ Each of the approaches in Table 1 (in Chapter II) can be associated with multiple explanatory clauses and is paired with an example in an international water agreement. Also, there are explanatory clauses that can be used within more than one approach, such as “fixed quantity”. For example, a State can identify a set volume of water it requires based on its rights, needs or hierarchy of uses. The theoretical approach, therefore, influences how the volume is arrived at, as well as how the State might present an argument for requiring this volume in a negotiation. It is important to note that a “market-based” mechanism has yet to be implemented at the international scale, but this is increasing in the discourse at national and subnational scales. For example, new water entitlements based on “market mechanisms” have been issued for unallocated water or reallocated water at local and subnational levels.⁵²⁵

523 McCracken and others, “Typology of Transboundary Water Allocation” (forthcoming).

524 Giordano and others (2014); Drieschova, Giordano and Fischhendler (2018).

525 Speed and others (2013).

5. Application of the Typology

In applying the TTWA to the data set of international freshwater agreements extracted from the TFDD, it is clear that theoretical approaches to transboundary water allocation simply provide a general perspective or lens through which States can develop their position, interests or needs for allocations contextualized to their own situation. Some of these approaches can be used collaboratively or cooperatively, which can encourage States to develop joint interests and needs that ultimately lead to allocation mechanisms that are relevant to the basin or aquifer and provide shared benefits to the riparian States.

The other important element to note with respect to the application of the TTWA is that each allocation mechanism has differing degrees of flexibility that allow for effective reactions to changes in either the environment or political relations. As noted above, the presence of an allocation mechanism in a transboundary water agreement is a measure that has been used to evaluate the level of institutional capacity for the water resource.⁵²⁶ An allocation mechanism, depending on its degree of flexibility, has the potential to increase the adaptive capacity—the ability of the actors to respond, create or shape the system⁵²⁷—of the institutional arrangements in the basin or aquifer.

This analysis of international water agreements from the 1860s to 2017 shows that there has been an overall increase in the number of treaties with allocation mechanisms over time, which has the potential to increase the institutional capacity in those basins. However, not all allocation mechanisms are equivalent in increasing the adaptive capacity, as some explanatory clauses are not as flexible as others. An example of this would be “fixed quantities” vs. “percentage of flow”. Allocating water by a percentage of flow allows for water divisions to vary according to the seasonal or annual variability in the total flow rate for a river, while still maintaining a proportional division. Allocating water through fixed quantities, on the other hand, does not account for variability in flow, such as droughts, since it still mandates a set volume of water. The flexibility of a fixed quantity clause can be increased through the inclusion of other explanatory clauses, such as “variable by water availability” or “variable according to time of the year”.

Of the 175 surface water treaties with at least one mechanism for water allocation analysed from the IFTD, 148 allow for at least some flexibility to react to changes in the system, such as in the available supply, changing demand or an institutional change. The following explanatory clauses were identified as having some flexibility in water allocation mechanisms: “variable by water availability”, “variable according to time of the year”, “equitable use”, “sustainable use”, “equal division”, “percentage of flow”, “consultation and/or prior approval” and “water loans”. As for groundwater, all 14 identified treaties had at least one flexible mechanism (“variable by water availability”, “sustainable use”, “consultation and/or prior approval”). Some mechanisms allow for greater flexibility than others, and the degree of flexibility and the increase in the adaptive capacity it provides is dependent on the context of the basin or aquifer, including the physical and political characteristics of the resource. With climate change, as well as increases in water demand, it is crucial for States to consider the theoretical approaches and the degree of flexibility of allocation mechanisms to increase both their institutional and adaptive capacities.

526 Elizabeth J. Kistin and Peter J. Ashton, “Adapting to change in transboundary rivers: an analysis of treaty flexibility on the Orange-Senqu River Basin”, *International Journal of Water Resources Development*, vol. 24, No. 3 (2008), p. 385–400; Lucia De Stefano and others, “Climate change and the institutional resilience of international river basins”, *Journal of Peace Research*, vol. 49, No. 1 (January 2012), p. 193–209.

527 Margot Hill, “Characterizing adaptive capacity in water governance arrangements in the context of extreme events”, in *Climate Change and the Sustainable Use of Water Resources*, Walter Leal Filho, ed. (Heidelberg, Springer, 2012), p. 339–365.

6. General Conclusions

While the specific outcomes of this research are detailed within the text of the Handbook, highlighted here are several general, overarching conclusions that were drawn from this brief synthesis of the analysis of the 599 treaties coded for allocation mechanisms within the IFTD undertaken using the TTWA. First, there is a generally positive trend, with some fluctuations, in the number of agreements that include allocation mechanisms for surface and groundwater. This is beneficial as they are likely contributing to the institutional capacity governing these shared resources, as well as potentially adding to the adaptive capacity that will help in overcoming uncertainties due to climate change. Second, there has been a change in the type of mechanisms that States include in their agreements, moving towards indirect and principle-based explanatory clauses and away from direct mechanisms. Third, there is an increasing trend in the number of groundwater-specific allocation mechanisms since the 1970s; however, more work is needed to develop groundwater-specific mechanisms that consider the unique characteristics of international transboundary groundwater. Fourth, most allocation mechanisms do not define a purpose for their allocation (context clause). For those that do, agriculture/irrigation, hydropower, and domestic use are the most common; however, environmental needs and water quality have become more common since the 1970s.

7. Disclaimer and Additional Information

It is important for readers to note that both the TTWA methodology and the data set used in conducting this discrete piece of research for the Handbook is one approach to conducting a broad analysis of the global practice of allocation in international freshwater agreements. Other approaches may be used and this research and the Handbook does not advocate for one approach over another. Nonetheless, the IFTD in the TFDD is generally recognized as one of the most comprehensive and up-to-date databases of international freshwater agreements in the world, and the TTWA has been developed by eminent researchers who have previous experience tracking transboundary water allocation mechanisms, which is why they were selected for this task.

Additional information can be found on the TFDD website: <https://transboundarywaters.science.oregonstate.edu/content/transboundary-freshwater-dispute-database>

