

ГОДИШНИК НА СОФИЙСКИЯ УНИВЕРСИТЕТ „СВ. КЛИМЕНТ ОХРИДСКИ“

ГЕОЛОГО-ГЕОГРАФСКИ ФАКУЛТЕТ

Книга 2 – ГЕОГРАФИЯ

Том 115–116

ANNUAL OF SOFIA UNIVERSITY “ST. KLIMENT OHRIDSKI”

FACULTY OF GEOLOGY AND GEOGRAPHY

Book 2 – GEOGRAPHY

Volume 115–116

WATER SECURITY – LITERATURE REVIEW

IVAYLO VALCHEV¹, NIKOLAY LENKOV², KALINA RADEVA³

¹*Sofia University “St. Kliment Ohridski”, Sofia, Bulgaria, e-mail: valchev.ivo@abv.bg*

²*Sofia University “St. Kliment Ohridski”, Sofia, Bulgaria, e-mail: nikolaylenkov@abv.bg*

³*Катедра Климатология, хидрология и геоморфология,
e-mail: kradeva@gea.uni-sofia.mail.bg*

The concept of water security has emerged in response to global water scarcity and the increasing competition for water resources. It serves as a unifying concept to harmonize the diverse objectives of water resource management and is gaining attention globally in governmental, corporate, and non-governmental discussions and agendas. This paper examines the literature on water security in the context of global politics. Despite numerous publications since the Ministerial Declaration on Water Security in the 21st Century (The Hague, 2000), there is still no definitive definition of water security. This lack of consensus stems from varying definitions and perspectives, encompassing aspects like the scale of analysis from national to individual levels, the assessment of water-related hazards, and implications for human and ecosystem health. The multifaceted nature of water security contributes to the absence of a standardized operational framework. Positioned as a core challenge in the 21st century concerning economics and sustainable development, water security requires strong national and international political commitment and engagement.

Keywords: water security, national level, literature

INTRODUCTION

The Earth is currently undergoing what is termed a “climate transition”. While climate change is a natural phenomenon that occurs over time and across various regions, human activities have accelerated the planet's warming, heightening the likelihood of a significant rise in global temperatures in the foreseeable future. For every 1°C (1.8°F) increase in the global average temperature, UN experts predict a 20 percent decrease in renewable water resources. Consequently, issues are emerging due to insufficient water of acceptable quality to sustain livelihoods, human well-being, socio-economic development, and ecosystems.

Since the 1990s, the concept of water security has responded to issues such as reliability, quality, quantity, safe and equitable access, and environmental provision of water supply, and water security-related concepts have attracted the attention of academic communities of policy and practice, as well as governmental and non-governmental organizations and the private sector (Hope and Foster, 2010; UNESCO, 2019). There has been resistance to considering water as a common heritage of humankind, but this is slowly changing (Kpenou 2018). Since the Ministerial Declaration on Water Security in the 21st Century (The Hague, 2000), there have been plenty of publications on this topic, but also been a lack of comprehensive understanding of how water security is conceptualized and applied in particular contexts around the world. The reasons lie in different definitions and perspectives. For this reason, the definition of water security has been interpreted as a “multifaceted problem” (Srinivasan et. al., 2017) and is one of the greatest challenges of our century – together with population growth leading to uncertain water supplies and increasing demand for clean drinking water (Warner, 2010; Wagener et. al., 2010).

In the context of evolving geopolitical processes, international instability, and climate change, the imperative for implementing the concept of water security is becoming ever more pertinent. This need primarily arises in response to global water scarcity and the intensifying competition for water resources (Mirumachi, 2015; UNESCO, 2020). The absence of a unified framework for the concept of water security can be attributed to its multifaceted nature, which varies according to the geographical regions under consideration and the specific objectives of the relevant studies. For instance, in response to the prevalent issue of water scarcity that largely affects the country in socio-economic terms, the Chinese government has adopted a stringent water resources management policy as a novel approach. Consequently, as noted by Cook & Bakker (2012), the concept of water resource security is garnering increased focus in both policy-making and academic discourse.

This study aims to analyze both scientific and policy literature related to water security, identifying conceptual frameworks that vary across specific regions and issues, and underscore both the absence and necessity of a unified working framework. Furthermore, the analysis seeks to stimulate a national debate on

water security as one of the significant challenges of the twenty-first century, thereby advocating for the development of improved strategies for water resource management and enhancing water security across various regions and countries.

DATA AND METHODS

Water security is a topical issue and as such has been extensively studied in Western scientific schools, the USA and the Middle East, while no such studies can be found in the Bulgarian scientific literature.

To achieve the objectives outlined in this literature review, various scientific databases were explored. This research identified a substantial number of peer-reviewed articles and open-access working papers related to “water security”, spanning the period from the 2000 Hague meeting – identified as the apex of water security provision in the 21st century – to October 2023. The literature reading is done through the utilization of the “principle of systematicity and consistency”, as well as the implementation of three fundamental steps:

1. Review of scientific literature.
2. Identification and synthesis of peer-reviewed articles and working papers.
3. Analysis of the studies.

As a result of the implementation of the first two, the analysis of the studies was carried out in three groups as follows:

- *Theoretical research*: scientific publications presenting the definition and concept of water security;
- *Practical-applied research*: research in the field of water insecurity, subsequent problems and overcoming them through water monitoring, sustainable management, policies for “water literacy” of the population, building infrastructure, etc.;
- *Geopolitical research*: studies on the impact of water resources on the geopolitical and geostrategic interests of states.

Through the constructivist approach in geoscience, the applicability of the three groups of research in sustainable water resources development and water security provision in different countries is assessed.

According to Bakker (2012), most academic research on water security is relatively poorly integrated with the needs of policymakers and practitioners. Consequently, significant changes in funding, education, research frameworks, and academic incentive structures are needed to enable researchers to contribute more meaningfully to addressing the global water crisis (Proust, et al. 2017). Similarly, Wheeler & Gober (2015) argue that the human dimension needs to be fully integrated into water research and that the products of science need to emerge from iterative, collaborative, and two-way exchanges with the governance and policy communities. Therefore, this study aims to highlight the theoretical and methodological contributions of water security analyses to applied science research. It focuses on addressing climate change, adaptation, and managing

geopolitical uncertainties arising from water resource depletion, rather than offering a comprehensive literature review on the topic.

In each of the three groups, the literature analysis not only underscores the practical contributions of scholarly works but also tracks the evolution of theoretical, practical-applied, and geopolitical research related to water security during the review period. Additionally, it highlights the varied approaches and conceptual frameworks that primarily differ by region and issue.

RESULTS

Theoretical research

The term “water security” was first mentioned in 2000 by the Global Water Partnership (GWP) network, in which over 3,000 water organisations promote the effective, efficient, and sustainable management of water resources worldwide. But the definition addresses topics not only related to sustainable development, but also population, countries, access to food, integrated water resources management and ecosystem security. Several authors have explored the concept of water security theoretically, with the ‘water-national security’ nexus seen in most publications.

The main idea of the conceptual model for national water security is to identify the best way to optimize all water resources used by the ecosystem in countries that suffer from water scarcity (Ale et al., 2020). This optimization is mainly related to agricultural production, which in turn leads to food shortages for the population due to the scarcity of water in agriculture and the inability to produce agricultural products, as well as the inequality of different groups of people (Chahed, 2023). The results of this inequality in access to drinking water are a threat to state security due to the likelihood of poverty and conflict among citizens in a particular country. There is a need to formulate and implement approaches that engender equitable distribution and sustainable use of water resources (Babuna et. al., 2023). Grey & Sadoff (2007) also draw attention to the construction of water infrastructure. AlAfghani & Susetyo (2023) make the same point, adding that ownership of the water source is also important for the country (transboundary waters). Furthermore, for example, there is little engagement with groundwater, which is increasingly the main source of water in many countries, or with ice (mountain and polar), precipitation and atmospheric water (Cullet et al. 2021). Other authors describe water security as a multidimensional concept with widely differing interpretations (De Loë et al., 2007; Marcal et al.,2021.). Van Beek & Arriens (2016) and Falkenmark (2001) in their articles clarify the importance of linking water security to food and environmental security as a major key to achieving sustainable development (Mounmen et al., 2019). Similar research has been done by Evans (2011), Hoekstra et. al. al. (2018), and Zeitoun (2011). The concept is also linked to

ecosystem services (Fan et. al., 2023; Mishra, 2021) as part of water security and is an integral part of its definition.

Practical-applied research

Practical-applied research in this domain underpins the resolution of various challenges within water management. A comprehensive review of the scientific literature has delineated several principal areas of focus, including urban water security, the protection of freshwater resources, agricultural water security, water security for food production, and transboundary water security. Urban water security has been very topical in recent years and many publications on this topic have been seen in the database. Its definition is based on the concept of urban management and sustainable use of water resources.

An intriguing project in this context is introduced by Babel et al. (2023), aiming to develop a web-based digital instrument known as the Water Security Assessment Tool (WATSAT). This tool is designed to enable city authorities and decision-makers to objectively evaluate the water security status in urban environments. The methodology applied is based on indicators that measure five different dimensions of water security: 'Water supply and sanitation', 'Water productivity', 'Water-related disasters', 'Water environment', and 'Water management', which together culminate in the Water Security Index (WSI). Lautze & Manthrilake (2012) develop a similar methodology that promotes a more tangible understanding of the concept, with the authors developing an index to assess water security at the state level. The index consists of indicators in five components considered critical to the concept: basic needs; agricultural production; environment; risk management; and independence. A large study on urban water security is presented by Zainnuddin et al. (2023), who conducted a literature review of over 140 research papers on this topic. Gerlak et al. (2018) notes the importance of research and its applications for the proper management of urban water resources.

For instance, there is little engagement with groundwater, which is increasingly the primary source of water in many countries, or with ice (mountain and polar), rainfall and atmospheric water.

Food scarcity represents a significant global challenge, with water emerging as a critical factor in this context. Sub-Saharan Africa and West and Central Asia are regions particularly affected by this scarcity. Consequently, a substantial portion of research on the interplay between water, food, and security is concentrated in these geographical areas. The imperative of safeguarding agricultural security and ensuring adequate water resources for this economic sector has compelled Motaghd & Choobchian (2023) to investigate the pivotal role of water access in enhancing food production. This study maintains that access to water is essential for agricultural amelioration. Supporting this thesis, Sobhani et al. (2023) underscore the

significance of freshwater lake basins in meeting the socio-economic requirements of communities, particularly in supplying water for food production.

Geopolitical Research

Geopolitics, in theory, pertains to the competition among states and nations for the control of territory and resources. Water is a determining element in geopolitical strategies and dynamics, where securing access to water sources, waterways, and aquatic resources can significantly enhance a country's strategic positioning concerning military strength, trade relationships, internal stability, and influence over other nations.

Therefore, the following questions arise: What are the geopolitical aspects of water scarcity and how does it affect water security in the country concerned? What are the political and security risks associated with the need to import water? To what extent does international trade contribute to national water dependence? Are conflicts over scarce water resources a source of international conflict, or do they contribute to intensifying conflicts that have arisen from other sources (e.g. ethnic conflicts) (Haftendorn, 2000)? These and many other questions are the focus of geopolitical research related to water security from a national perspective.

The analysis of geopolitical studies related to water security shows the differentiated and multilayered nature of the authors' perspectives. The first, and perhaps most obvious, relates to water conflicts. Roughly three hundred international water agreements have been signed since 1948, however, there are many hot spots where transboundary waters are a source of tension, either because there is no agreement in place, or an existing water regime is disputed. Nowadays, there is no continent that is not affected by some type of water dispute. Thus, the geopolitical power of water has increased in recent decades as a result of water crises caused by physical and economic water scarcity and water stress in many regions of the world. In the scientific and applied discourse, there are a number of studies related to the historical and chronological context of water conflicts that have been focused on in recent years (Turhan, 2020; Angelakis, 2021; Gleick & Shimabuku, 2023). Of note are the numerous studies that emphasize theoretical, methodological, and conceptual approaches to address water conflicts, such as solutions through a supply and demand concept (Swain, 2001), methods to improve water policy and transboundary water agreements (Onishi, 2011; Zeitoun et. al, 2019), measures to implement a new security system (Wang et. al., 2017), improving water resource management strategy (Murshed & Kaluarachchi, 2018), tools to eradicate fears of water wars and mitigate the effects of water conflicts (Rahaman, 2012; Algamal, 2023), developing an interdisciplinary knowledge system (Tripathi, 2011), and others.

Naturally, the delineated approaches are delineated by the specific territory and the issue under investigation. During the reviewed period, the continents featuring prominently in studies on water conflicts are Asia (Selby, 2006; Joy & Paranjape,

2007; Amery, 2013; Tadevosyan, 2019) and Africa (Ashton, 2000; Warner et al., 2013; Swatuk, 2015; Turhan, 2020).

From another perspective, some authors such as Hoekstra (2019) view geopolitics through the lens of international water trade. He argues that importing water in virtual form can be an effective means for water-scarce countries to conserve their domestic water resources while exporting water-intensive commodities will increase water use and hence water scarcity in exporting countries.

CONCLUSION

The literature review conducted in this analysis emphasizes the current trends in the development of the water security concept, providing a comprehensive understanding of the multidimensional nature of the studied issues. The issue of climate change, a contemporary challenge, is just one component of the broader framework of this concept. Other domains explored in the literature include urban water security, agricultural water security (about food security), access to freshwater resources security, ecological water security, and in conjunction with traditional geopolitical water security, contribute to a contemporary model of the evolution of this concept.

While awareness of the nature of conflicts, approaches, and conceptual frameworks has improved over time, the probability of water conflicts persistently rises across nations, primarily fueled by water insecurity. There is a pressing need for the practical utilization of these three research sets in sustainable water resource development and the provision of water security within specific countries. Ensuring the security of water supply stands as one of the most significant challenges of our era, necessitating cooperation among the affected regions, academic communities, and relevant political and regulatory bodies.

REFERENCES

- Ale, S., Harmel, R., Nejadhashemi, A., DeJonge, K., Irmak, S., Chaubey, I., ... & Douglas-Mankin, K. 2020. Global water security: current research and priorities for action. *Transactions of the Asabe*, 63(1), 49–55. <https://doi.org/10.13031/trans.13839>
- Allan, C., Xia, J., Pahl-Wostl, C. 2013. Climate change and water security: challenges for adaptive water management, *Current Opinion in Environmental Sustainability*, Volume 5, Issue 6, 625–632.
- AlAfghani, M., Susetyo, B. 2023. Water Tenure Security for Palm Oil, Hydropower, and Geothermal. *IOP Conference Series: Earth and Environmental Science*. 1199.
- Algalal, S. 2023. An Assessment of Climate-Induced Conflict Risks Over Shared Water Resources in Africa.
- Amery, H. 2013. The Geopolitics of Water Scarcity. Chapter 3 of *Water and Food Security in the Arabian Gulf*.

- Andrea, K., Gerlak, L., Robert, G., Varady, Tamee A., Zúñiga-Terán, A., Routson de Grenade, P., Cook, C., Scott, C. 2018. Water security: A review of place-based research, *Environmental Science & Policy*, Volume 82, 2018, 79–89.
- Angelakis, A., Valipour, M., Ahmed, A., Tzanakakis, V., Paranychianakis, N., Krasilnikoff, J., Drusiani, R., Mays, L., Gohary, F., Koutsoyiannis, D., Khan, S., Giacco, L. 2021. Water Conflicts: From Ancient to Modern Times and in the Future. *Sustainability*, 13, 4237.
- Arjen, Y., Hoekstra et. al. 2018. *Environ. Pez. Lett.* 13 053002.
- Lankford, B., Bakker, K., Zeitoun, M., Conway, D. 2013. Water security: Principles, perspectives and practices.
- Babel, M., Chapagain, K., Shinde, V. 2023. How to measure urban water security? An introduction to the Water Security Assessment Tool (WATSAT). *APN Science Bulletin*. 13. 10.30852/sb.2023.2166.
- Babuna, P. Yang, X., Xavier, R. Supe, T., Dehui, B., Takase, M., Bismarck, Y., Han, C., Awudi, D., Li, M. 2023. Modeling water inequality and water security: The role of water governance. *Journal of Environmental Management*. 326. 116815. 10.1016/j.jenvman.2022.116815.
- Bauer, C. 2015. Water Conflicts and Entrenched Governance Problems in Chile's Market Model. *Water Alternatives* 8(2): 147–172.
- Chahed, J. 2023. A Conceptual Model for National Water Security in Water-Scarce Countries.
- Cook, C., Bakker, K. 2012. Water security: Debating an emerging paradigm. *Global Environmental Change*, Volume 22.
- Cullet, P., Bhullar, L., & Koonan, S. (2021). Water security and international law. *Annual Review of Law and Social Science*, 17(1), 261–276. <https://doi.org/10.1146/annurev-lawsocsci-010421-014915>.
- De Loë, R. Varghese, J. Ferreyra, C.; Kreutzwiiser, R. Water Allocation and Water Security in Canada: Initiating a Policy Dialogue for the 21st Century; Report prepared for the Walter and Duncan Gordon Foundation; Guelph Water Management Group, University of Guelph: Guelph, ON, Canada, 2007.
- Evans, M. 2011. Food and Water Security. *The Earth Times Encyclopedia*.
- Falkenmark, M. 2001. The greatest water problem: the inability to link environmental security, water security and food security. *International Journal of Water Resources Development*, 17(4), 539–554.
- Fan, Z., Wang, X., Zhang, H. 2023 Water security assessment and driving mechanism in the ecosystem service flow condition. *Environ Sci Pollut Res* 30, 104833–104851.
- Gleick, P., Shimabuku, M. 2023. Water-related conflicts: definitions, data, and trends from the water conflict chronology. *Environ.*
- Grey, D., Sadoff, C.W. 2007. Sink or Swim? Water Security for Growth and Development. *Water Policy*, 9(6), 545–571.
- GWP 2000 Towards water security: A framework for action Global Water Partnership (Stockholm: Global Water Partnership).
- Haftendorn, H. 2000. Water and international conflict. *Third World Quarterly* 21(1): 51–68.
- Hoekstra, A. 2009. Water Security of Nations: How International Trade Affects National Water Scarcity and Dependency. Threats to Global Water Security Conference, Part of

- the book series: NATO Science for Peace and Security Series C: Environmental Security (NAPSC), 27–36.
- Hope, R. A., and J. A. Foster. 2010. "Water Security: A Review of Place-Based Research." *Geography Compass*, vol. 4, no. 10, pp. 1245–1260.
- Briscoe, J. 2009. "Water Security: Why It Matters and What to Do about It." *Innovations: Technology, Governance, Globalization* 2009; 4 (3): 3–28.
- Joy, K., Paranjape, S. 2007. "Understanding Water Conflicts in South Asia." *Contemporary Perspectives* 1(2).
- Kpenou S. 2018. "Fresh water as common heritage and a common concern of mankind." In *Research Handbook on Freshwater Law and International Relations*, ed. M Tignino, C Bréthaut, pp. 2–30. Cheltenham: Edward Elgar
- Kreamer, D. 2012. "The Past, Present, and Future of Water Conflict and International Security." *Journal of Contemporary Water Research & Education*.
- Lautze J. Manthritilake. 2012. "Water security: old concepts, new package, what value?" *Nat. Resour. Forum* 76–87.
- Kumar, M., Kumar, P., Saraswat, C., Chakraborty, S., Gautam, A. 2021. "Water Security in a Changing Environment: Concept, Challenges and Solutions" *Water* 13, no. 4: 490.
- Marcal J, Antizar-Ladislao B, Hofman J. 2021. "Addressing Water Security: An Overview." *Sustainability*. 13(24):13702. <https://doi.org/10.3390/su132413702>
- Mirumachi, N. 2015. *Transboundary Water Politics in the Developing World*. Routledge, 2015.
- Motaghd, M., Choobchian, S. 2023. "Investigating and identifying indicators of water security in agricultural farming units of Hamedan province." *10.22059/ijswr.2022.341492.669243*.
- Moumen, Z., El Amrani El Idrissi, N., Tvaronavičienė, M., Lahrach, A. 2019. "Water security and sustainable development." *Insights into Regional Development* (4), pp. 301317. [10.9770/ird.2019.1.4\(2\)](https://doi.org/10.9770/ird.2019.1.4(2)).
- Murshed, S., Kaluarachchi, J. 2018. "Scarcity of freshwater resources in the Ganges Delta of Bangladesh." *Water Security*, Volumes 4–5, August–December 8–18.
- Neo, G., Jha, S. 2023. "Why water security is our most urgent challenge today."
- Onishi, K. 2011. "Reassessing Water Security in the Mekong: The Chinese Rapprochement with Southeast Asia." *Journal of Natural Resources Policy Research* 3 (4): 393–412.
- Petersen-Perlman, J., Veilleux, J., Wolf, A. 2017. "International water conflict and cooperation: challenges and opportunities." *Water International*.
- Popelka, J., Smith C. 2020. "Rivers as political borders: a new subnational geospatial dataset." *Water Policy*, 22 (3), 293–312.
- Proust, K. et al. 2017. "Transforming Water Governance: A Synthesis of Key Findings from the Governance and Sustainability of Water Systems Project." *Water Alternatives*, vol. 10, no. 2, 2017, pp. 1–18.
- Rahaman, M. 2012. "Water Wars in 21st Century: Speculation or Reality?" *Int. J. Sustainable Society*, Vol. 4, No. 1/2.
- Saha, A. 2023. "Water Security in Bangladesh: A Case of the China-Bangladesh Teesta Project." *Journal of South Asian Studies*. 11. 161–170. [10.33687/jsas.011.02.4394](https://doi.org/10.33687/jsas.011.02.4394).
- Selby, J. 2006. "The Geopolitics of Water in the Middle East: fantasies and realities." *Third World Quarterly*, Volume 26, 329–349.
- Shumilova, O., Tockner, K., Sukhodolov, A., Khilchevskiy, V., Meester, L., Stepanenko, S., Trokhymenko, G., Hernández-Agüero, J., Gleick, P. 2023. "Impact of the Russia–

- Ukraine armed conflict on water resources and water infrastructure. *Nature Sustainability* volume 6, 578–586.
- Sobhani, P., Esmacilzadeh, H., Deljouei, A., Wolf, I., Marcu, M., Sadeghi, S. 2023. Assessing water security and footprint in hypersaline Lake Urmia. *Ecological Indicators*. 155. 10.1016/j.ecolind.2023.110955.
- Swain, A. 2001. Water wars: Fact or fiction? *Futures* 33, 769–781.
- Tadevosyan, S. 2019. Hydro-Hegemony In Action: The Problem Of Water In The Israel–Palestinian Conflict. *International Journal of Eurasian Geopolitics*, Volume VIII (2).
- Tripathi, N. 2011. Scarcity Dilemma as Security Dilemma: Geopolitics of Water Governance in South Asia. *Economic and Political Weekly*, Vol. 46, No. 7 (FEBRUARY 12–18, 2011), 67–72.
- Turhan, Y. 2020. The hydro-political dilemma in Africa water geopolitics: The case of the Nile River basin. *African Security Review*, Volume 30, 66-85.
- Srinivasan, V., Konar, M., Sivapalan, M. 2017. A dynamic framework for water security, *Water Security*, Volume 1, 12-20.
- Van Beek, E., Arriens, W.L. 2016. *Water Security: Putting the Concept into Practice*. (TEC background papers; No. 20). Stockholm: Global Water Partnership (GWP).
- Wagener, T., Sivapalan, M., Troch, P. A., McGlynn, B. L., Harman, C. J., Gupta, H. V., Kumar, P., Rao, P. S. C., Basu, N. B., Wilson, J. S. 2010: The future of hydrology: An evolving science for a changing world, *Water Resour. Res.*, 46, W05301, <https://doi.org/10.1029/2009WR008906>.
- Wang, X., Zhang, J., Gao, J., Shahid, S., Xia, X., Geng, Z., Tang, L. 2017. The new concept of water resources management in China: ensuring water security in changing environment. *Environment, Development and Sustainability*, volume 20, 897–909.
- Warner, J. 2010. Water Security in the Twenty-First Century: The Role of the State and Global Governance. *Globalizations*, vol. 7, no. 4, 2010, pp. 579–594.
- Warner, J., Sebastian, A., Empinotti, V. 2013. Claiming (back) the land: the geopolitics of Egyptian and South African land and water grabs. *Ambiente & Sociedade*, XVI 2, abr. jun.), 1–24.
- Zainuddin, Z., Yahya, F., Mounq, E., Fazli, B., Abdullah, M. 2023. Effective dashboards for urban water security monitoring and evaluation. *International Journal of Electrical and Computer Engineering (IJECE)*, 4291–4305.
- Zeitoun, M. 2011. The global web of national water security. *Global Policy*, 2(3), 286–296.
- Zeitoun, M., Mirumachi, N., Warner, J., Kirkegaard, M., Cascao, A. 2019. Analysis for water conflict transformation. *Water International*.
- United Nations. “World Water Development Report 2020: Water and Climate Change.” UNESCO, 2020.