



The Hur-Al-Azim Marsh: A Shared Heritage under Threat from Transboundary Water Policies

Sara Berahman  & Irene Curulli 

Abstract

Climate change and increasing human water consumption have become major threats to global water security, creating challenges for sustainable water management. As water scarcity intensifies, transboundary water systems are vulnerable to inconsistent policies among neighboring countries. In this context, marshes as vital elements of aquatic ecosystems contribute to water purification, flood control, biodiversity preservation and the reduction of sand and dust storms. This study examines the environmental and socio-political consequences of the drying of the Hawizeh Marsh, a transboundary marshland shared between Iran and Iraq, emphasizing the importance of conserving landscape heritage and assessing policy impacts on the adjacent Hur-Al-Azim Marsh. It explores how climate change and inadequate governance have accelerated the marsh's desiccation, leading to ecological and social transformations. The findings highlight the urgent need for coordinated international efforts to safeguard transboundary water heritage under increasing climatic and anthropogenic pressures.

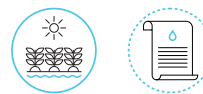
Policy Recommendations

- Developing joint rules requires a formal cross-border agreement defining minimum ecological flows, shared monitoring and coordinated emergency planning.
- Implementing these rules demands transparent, real-time water data so the responsible government authorities in both countries understand how actions in one territory affect the whole system.
- Investing in regional cooperation and enforcement mechanisms builds trust and ensures that all countries respect and follow the same environmental standards.

KEYWORDS

water management
water scarcity
landscape heritage
marshes
climate change

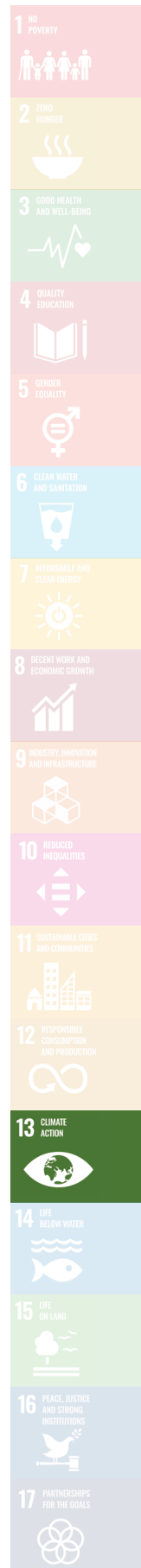
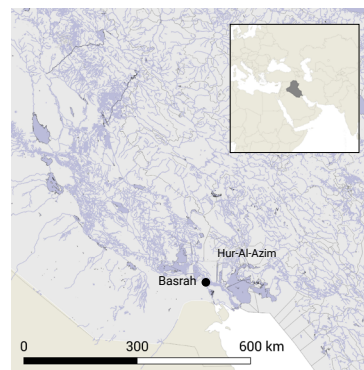
WATER VALUES



CLIMATE



BWh: Hot desert climate

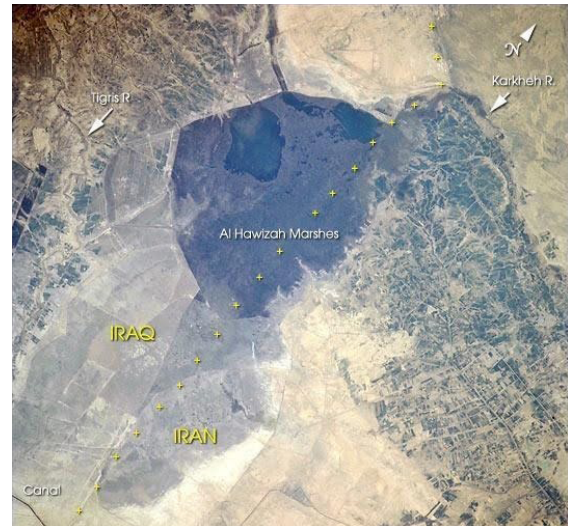


Introduction

Where rivers, lakes, or aquifers are shared between countries, transboundary water allocation and management issues remain a major challenge to the sustainability of inland water ecosystems (Brels et al. 2008). Their international significance has social, cultural, economic, political and ecological dimensions. While numerous theoretical water-sharing strategies exist, comprehensive decisions and policies concerning transboundary waters, which can trigger profound environmental, social, and economic changes, remain inadequately addressed. This neglect may result in irreparable issues over time. Marshlands, as species-rich and fertile ecosystems, play a crucial role in socioeconomic and environmental strategic planning (An and Verhoven 2019; Earle 2013). This research examines the Hawizeh Marsh, a transboundary marshland shared by Iran and Iraq, with a particular focus on its Iranian section, known as the Hur-Al-Azim Marsh. This marshland holds significant cultural and heritage value and has been strongly influenced by the policies of both countries.

The Hur-Al-Azim marsh, representing one-third of the Hawizeh marsh, the largest marshland in Khuzestan and one of Iran's major marshlands, has experienced a progressive drying-up due to various human-induced environmental factors, political decisions, and lack of international policies. The United Nations' Environmental Programme (UNEP) considers the drying of the Hawizeh Marsh in recent years an environmental and human catastrophe (Mokhtari 2009).

Protecting environmental heritage as a common heritage of humanity is a fundamental responsibility of governments, since it supports the lives of present generations and must be maintained to safeguard the needs of future



^ Fig. 2 The Al Hawizah marshes, photographed from the International Space Station (Source: NASA Earth Observatory, 2001).

generations. This article examines the factors and decision-making processes that have contributed to the marsh's desiccation. It shows how the Iranian government's disregard for landscape heritage, the prioritization of economic interests over environmental values, the absence of international policy agreements among countries and the lack of oversight by a higher governing authority have led to a crisis. This crisis represents not only an environmental disaster but also the loss of a valuable landscape heritage.

The Global Importance of Transboundary Water Resources

Globally, over 60 per cent of freshwater resources cross national boundaries (UNECE 2015). Transboundary water allocation today and in the future must balance multiple growing needs and, at the same time, deal with the increasingly limited and varying availability of water (UNECE 2015). When the water to be allocated is shared



^ Fig. 3 Mudhif structure in the Mesopotamian marshes (Source: Paul Dober, 2012. CC BY 3.0, via Wikimedia Commons).

by two or more political jurisdictions, the problem becomes more challenging. In these cases, water resources are not only affected by local policies and management: Any international condition and decision can affect them (Curulli 2022). Stable and effective policy instruments for managing transboundary waters have become critical for maintaining international cooperation and preventing economic or political crises. However, many of these agreements may not perform well in an increasingly volatile and uncertain climate (Draper and Kundell 2007; Dinar et al. 2010). As water heritage is found in spaces that are closely linked to traditions, rituals and narratives (Hein 2020), treaties and agreements about transboundary water heritage should be considered while paying attention to the environmental, social and economic benefits. In general, international water law is based on the idea that ecosystems are an integral part of sustainable transboundary water resources (UNECE 2013). The United Nations' global water conventions recognize the need to protect, conserve and, where appropriate, restore ecosystems (UNECE 2021).

The Hur-Al-Azim Marsh

The Hawizeh Marsh is a complex of marshes that straddle the Iran–Iraq border. The marshes now include three important sections, namely Central Hur, Hur Al-Hamar and Hur Al-Hawizeh. The Central Hur and the Hur Al-Hamar are the only two that are entirely in Iraq. Two-thirds of the Great Hawizeh marshes are located in Iraq, and one-third in Iran, where it is called Hur-Al-Azim. Hur-Al-Azim is one of the country's most important and valuable water habitats, which are crucial in terms of hydrology, biology, and ecology, supporting regional wildlife. This marshland is one of the largest permanent freshwater marshes in lower Mesopotamia, and in terms of ecosystems, it is one of the rarest marshlands in Iran and Asia (Papan Shoshtari 2008).

The Hur Al-Azim marsh, downstream of the Karkheh River basin in southwestern Iran, was regarded as Iran's food basket (Ahmad and Giordano 2010). The marsh has functioned as a natural flood regulator, mitigating disasters

exacerbated by the region's flat topography. Beyond its economic and environmental significance, the marshland has sustained a millennia-old way of life among local communities, who have relied on its resources for survival. Before the marsh's desiccation, which started around the 1970s (UNEP), these communities inhabited Mudhif structures (fig. 3) and floating islands, traditionally constructed from reeds using sophisticated mat-weaving techniques, which together formed a distinctive architectural typology and sociocultural system. The communities' livelihoods and diet – primarily based on fishing, rice cultivation and livestock products – were closely integrated with the wetland ecosystem, while their dwellings, built from locally available straw and reeds, reflected long-standing adaptive responses to harsh environmental conditions.

Over a period of centuries, the region's unique environmental and geographical characteristics shaped a specific lifestyle, employment pattern and architectural and cultural identity. The desiccation of the Hur Al-Azim marsh has led to the deterioration and abandonment of Mudhif structures and floating islands, resulting in the erosion and near loss of an important form of cultural and landscape heritage.

The Drying Up of the Hur-Al-Azim Marsh

Since the late 1980s, regional climate variability combined with large-scale hydrological interventions has severely degraded the Hur-al-Azim marsh ecosystem. Reduced surface-water inflow accelerated marsh desiccation during the 1990s, leading to the loss of vegetation, wildlife, and traditional livelihoods dependent on the wetland. Formerly productive palm groves and grazing areas were transformed into dry, saline surfaces, resulting in



^ Fig. 4 This natural-color image from the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Aqua satellite, according to NASA, "shows a camel-colored plume curving eastward along the Iraq-Iran border. That plume is thick enough to completely hide the land and water surfaces below. Thinner dust hovers over the Persian Gulf." (Source: NASA / Jeff Schmaltz, 2012).

increased dust generation and air pollution. Under natural conditions, the Hur-al-Azim marsh created a humid air mass that acted as a biofilter, limiting the spread of dust and aerosols in this high-evaporation region. Following the reduction of water inflow and the drying of large parts of the marsh, this function was lost, and the wetland became a significant source of dust and airborne particles.

Many economic and social disruptions have occurred in this region because of the degradation of the Hur-Al-Azim marsh and surrounding marshlands. The unfavorable economic situation has been driven by the loss of agricultural opportunities, the discharge of saline and industrial wastewater into the marshland and the death of fish and poultry. Furthermore, the increasing dust and aerosol levels have forced many residents to migrate, resulting in significant changes in the economic and social structure of these communities. In 2021, these disastrous environmental degradations

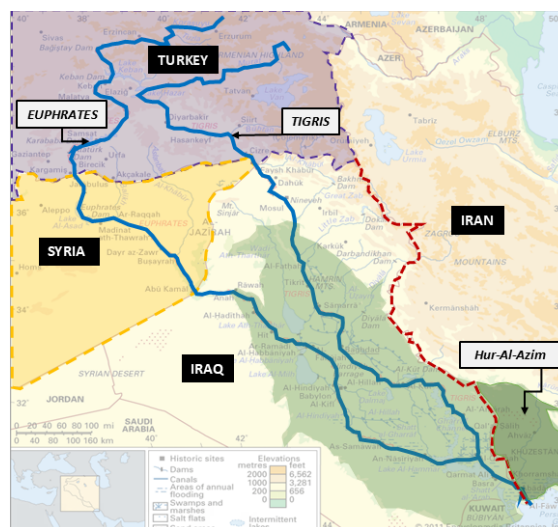
sparked widespread protests among residents of Khuzestan Province and communities living near the Hur Al-Azim marsh, who were responding to the loss of livelihoods that had long depended on the marshland ecosystem and to the policies and governance decisions that had contributed to this crisis.

Why is the Hur-Al-Azim Marsh Drying Up?

Multiple factors have contributed to the desiccation of the Hur-Al-Azim marsh, primarily stemming from a combination of misguided policies and insufficient public awareness and education, as will be discussed in the following three sections.

River and Dams

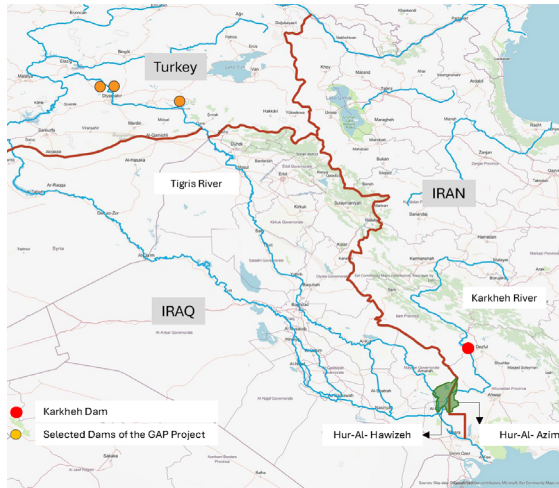
The Hur- Al-Azim marshes are fed by multiple water sources, including the distributaries of the Karkheh River (Hoveyl, Naysan and Karkheh Noor) and the Kahla and Masharah distributaries of the Tigris River in Iraq (Banihabib et al 2016). Since 2011, Turkey has built several dams as part of the GAP project (Southeastern Anatolian Project) on the Tigris and Euphrates Rivers. In this ambitious project, Turkey aimed to build 22 dams and 43 hydropower plants by diverting the flow of the Tigris and Euphrates to supply the water required for 1.4 million hectares of agricultural land. It is important to note that 85 per cent of Iraq's fresh water is supplied from the Tigris and Euphrates Rivers; thus, the GAP project has led to the reduction and drying up of Iraq's water resources, including the Tigris River, which has ultimately led to a decrease in the Hur-Al-Azim water levels (Tohidi and Keikhosravi 2019). Environmental issues related to dam construction have so far failed to generate constructive dialogue or effective agreements among Iran, Iraq and Turkey, due



^ Fig. 5 Geographical location of the Hur-Al-Azim marsh (Source: Sara Berahman & Irene Curulli, 2016).

to long-standing political tensions, including the Iran–Iraq War (1980–1988) and ongoing geopolitical conflicts among these countries. The persistent lack of cooperation underscores the urgent need for a supranational supervisory authority capable of safeguarding shared global water heritage, independently of national or political interests.

After the construction of the GAP project in Turkey, the Karkheh River became the most important remaining source of water inflow to the Hur-Al-Azim wetland. Originating in the Zagros Mountains, the Karkheh enters the Azadegan Plain in Khuzestan Province, where it divides into two main branches: Karkheh and Karkheh Noor. These two branches, together with several smaller tributaries across the plain, ultimately discharge into the Hur-Al-Azim wetland (Papan Shoshtari 2008). The reduction of water behind the Karkheh dam due to climate change, continuous droughts and the use of Karkheh water for agricultural purposes (Karimi et al. 2015) will decrease the flow of Karkheh water to Hur-Al-Azim marsh. The Karkheh Dam



^ Fig. 6 The location of major rivers, dams and the Hur-Al-Azim marshland (Source: Sara Berahman & Irene Curulli, 2026. © Esri and © OpenStreetMap contributors, licensed under the Open Database License [ODbL]).

was officially inaugurated in April 2001. It has a gross reservoir capacity of 7.8 billion cubic meters and is intended to irrigate 320,000 hectares of land in the Khuzestan plains. Increased irrigation at this scale is bound to significantly reduce the water influx into the remaining portion of the marshes. Irrigation return waters, which may be highly saline, will also affect the quality of the water entering the marshes. If plans to move water from the Karkheh Dam to Kuwait are realized, this will put even more strain on Al Hawizeh's already-dwindling water supply (Partow 2001). Water availability in the dam has been reduced due to poor water management in agricultural fields upstream of the Karkheh Dam, as well as uncontrolled rice paddy planting in these areas. The decline in water flow behind the Karkheh dam, as well as the failure to obtain Hur-al-Water Azim's rights, has caused it to dry up and devastate agriculture in this area. As a result, in response to agricultural demands in Khuzestan Province, the government constructed the Karkheh Dam, without sufficient consideration of its environmental impacts, particularly on the Hur-Al-

Azim marsh. This occurred because the project was implemented without a comprehensive scientific assessment and without adequate involvement of specialized expertise. Despite public protests on 22 June 2021 (Al Arabiya 2021) and local warnings about wetland degradation and agricultural decline, no meaningful policy adjustments were made. It was clear that the dam neither addressed water scarcity nor supported sustainable agriculture, instead contributing to wetland degradation and the loss of local farming systems.

Consequences of the Iran–Iraq War

During the Iran–Iraq War (1980–1988), both Iraq and Iran undertook localized construction of access routes and earthen works within and around the Hawizeh/Azim marshes to facilitate military movement and border control, contributing to limited alterations in the marsh landscape. By 1990, a large eastern swath of the marshes had partially dried out due to the construction of causeways to facilitate the transport of armored units during the war. Initially, control structures such as locks and sluice gates were constructed to manage water flows in the Tigris distributaries feeding the marshes. Earth embankments, ranging from six to eighteen kilometers in length, were subsequently created on the banks of the seven main Tigris distributaries to prevent overflow (Partow 2001).

These wartime structures had significant and long-lasting environmental impacts on the region. Following the war, Saddam Hussein regarded the Shi'ite Marsh Arabs as politically disloyal. Historically, the marshes had served as a refuge for those seeking to evade state control, offering a complex and difficult-to-govern terrain. The Al-Hammar marsh

was subsequently drained, leaving behind a devastated and salt-encrusted landscape. The environmental destruction was extensive: Villages were bombed and demolished, inhabitants were killed or displaced, aquatic life and valuable water buffalo were poisoned, and the surrounding rice fields were destroyed. Consequently, many residents of this area in Iraq migrated either to Iran or to other Iraqi cities. In the late 1970s and early 1980s, Iran also began constructing a border dyke in the Hur-Al-Azim region. Today, despite the presence of these dykes and access roads, the Hur-Al-Azim marsh remains divided into seven separate sections: five reservoirs located within Iran, a zone between the Iranian and Iraqi border dykes and one section within Iraq. The hydrological connection between these divisions is maintained only through artificial control valves (Niroumandfard and Shahidi 2018).

The decisions made by both Iran and Iraq during and after the war, without adequate consideration of environmental consequences, contributed to the desiccation of portions of the Hawizeh marshes and the significant reduction of the Hur-Al-Azim's water rights.

Oil Extraction

Oil exploration and extraction activities in the northern and southern zones of the marshland have significantly contributed to its further degradation. Makrouni et al. (2016) identify unregulated oil exploration, conducted without adequate consideration of environmental conditions, as one of the principal causes of the desiccation of the Hur-Al-Azim marsh. To facilitate these operations, the natural inflow of water from the northern part of the marshland was deliberately blocked to enable land-based oil extraction.

Furthermore, Ahmadreza Lahijanzadeh, deputy for Marine Environment Affairs at Iran's Department of Environment, stated in a 2021 interview that a Chinese company – operating under contract with Iran's petroleum sector – intentionally drained portions of the marsh to reduce the operational costs associated with extracting oil in aquatic environments. As a result, the Hur-Al-Azim marshland, once an ecologically vital habitat, effectively became a site of industrial productivity prioritized by Iran's Ministry of Petroleum (Entekhab News Agency 2025).

Conclusion: A Call for Regional and Trans-boundary Cooperation

A total of 100 million m³ of water has been released from the Karkheh Dam at various intervals to meet the water needs of the Hur-Al-Azim marshland. However, inadequate planning and the absence of coordinated regional management have limited the effectiveness of this measure and raised concerns about the long-term ecological stability of the ecosystem. Although Iran's Ministry of Agriculture Jihadhas implemented programs to adjust cropping patterns and train farmers (Vaelizadeh 2023), such local actions cannot ensure sustainable restoration without joint efforts among Iran and its neighboring countries that share interconnected hydrological systems.

Growing public awareness has increasingly translated into collective demands for action. Civil society initiatives, including public petitions urging national authorities to prioritize the protection and rehabilitation of the Hoor al-Azim wetland, reflect a broader societal recognition of the environmental crisis and a demand for concrete policy responses (Daadkhast 2023). This civic initiative underscores the necessity

of transboundary cooperation and collective responsibility in managing shared natural resources. Safeguarding marshlands like Hur-Al-Azim requires coordinated water governance, transparent data exchange, and harmonized environmental policies. Unilateral actions such as uncoordinated dam operations, unsustainable agriculture and oil extraction can trigger cascading ecological and socioeconomic impacts across borders.

The Hur-Al-Azim case illustrates how fragmented decision-making and weak regional coordination exacerbate environmental degradation. Addressing the ongoing desiccation requires not only national commitment but also cross-border collaboration and supranational oversight to ensure equitable water allocation, effective monitoring and integrated crisis management, independent of national or political interests. To prevent further decline, international and regional frameworks must evolve to recognize the cumulative impact of policy decisions and promote cooperative mechanisms grounded in reliable, shared data. Only through sustained regional cooperation, evidence-based management and such overarching oversight can the ecological integrity of this vital marshland be preserved for future generations.

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References

- Ahmad, Mobin-ud-Din, and Mark Giordano. 2010. "The Karkheh River Basin: The Food Basket of Iran under Pressure." *Water International* 35 (5): 522–44. doi:10.1080/02508060.2010.510326.
- Al Arabiya. 2021. "Public Protests in Ahvaz Against the Drying of Wetlands and Rivers." July 3, 2021. <https://farsi.alarabiya.net/iran/2021/07/03/>.
- An, Shuqing and Jos T. A. Verhoeven, eds. 2019. *Wetlands: Ecosystem Services, Restoration and Wise Use*. Cham: Springer.
- Brels, Sabine, David Coates and Flavia Loures. 2008. *Transboundary Water Resources Management: The Role of International Watercourse Agreements in the Implementation of the CBD*. CBD Technical Series, no. 40. Montreal: Secretariat of the Convention on Biological Diversity. <https://www.cbd.int/doc/publications/cbd-ts-40-en.pdf>.
- Curulli, Irene. 2022. "Environmental Disasters and Social Injustice: An Analytical Study of Two Trans-boundary Rivers." In *On Surveillance and Control at Borders and Boundaries: Landscape, Infrastructures and Architecture*, edited by Alejandro González-Milea and Olimpia Niglio, 93–122. Rome: Tab edizioni.
- Daadkhast. 2023. "Safeguard the Hur al-Azim Wetland." October 3. <https://www.daadkhast.org/en/petition/3327/>.
- Dinar, Shlomi, Olivia Odom Green, Amy McNally, Brian Blankespoor and Pradeep Kurukulasuriya. 2010. "Climate Change and State Grievances: The Resiliency of International River Treaties to Increased Water Variability." *Insights* 3 (22): 1–32.
- Draper, Stephen E. and James E. Kundell. 2007. "Impact of Climate Change on Transboundary Water Sharing." *Journal of Water Resources Planning and Management* 133 (5): 405–15. [https://doi.org/10.1061/\(ASCE\)0733-9496\(2007\)133:5\(405\)](https://doi.org/10.1061/(ASCE)0733-9496(2007)133:5(405)).
- Earle, Anton, Anders Jägerskog and Joakim Öjendal, eds. 2010. *Transboundary Water Management: Principles and Practice*. London: Routledge.
- Hein, Carola, ed. 2020. *Adaptive Strategies for Water Heritage: Past, Present and Future*. Cham: Springer. <https://doi.org/10.1007/978-3-030-00268-8>.
- Karimi, Mahshid, Kaka Shahedi and Motaleb Byzedi. 2015. "Analysis of Hydrological Drought Using Constant Threshold Level Method (Case Study: Karkheh River Basin, Iran)." *Journal of Watershed Management Research* 6 (11): 59–72.
- Entekhab. 2023. "ایجاد میدان نفتی جدید در تالاب هورالعظیم" [Creation of a New Oil Field in the Hoor al-Azim Wetland]. <https://www.entekhab.ir/fa/news/727429/>.
- Makrouni, Sarvar, Gholam Reza Sabzghabaei, Shahrar Yousefi Khanghah, and Sattar Soltanian. 2016. "Detection of Land Use Change Trends in the Hoor Al-Azim Wetland Using Remote Sensing and Geographic Information System Techniques." *Remote Sensing and Geographic Information System for Natural Resources* 7 (3): 89–99.
- Mokhtari, S. S. F. H. Soltani Fard and A. Yavari. 2010. "Consideration of the Changing and Self-Regulation in Hur-Al-Azim Wetland by Using Image Processing to Refer Landscape Ecology Approach-Khuzestan-Iran." *Natural Geography Research* 41(70):93-105.
- Niroumandfard, Fariba and Ali Shahidi. 2018. "هیدروپلیتیک ایران و عراق و بهینه کردن مصرف آب های مشترک مرزی" [Hydropolitics of Iran and Iraq and optimizing the use of common border waters]. *World Politics* 7 (2): 233–59. <https://doi.org/10.22124/wp.2018.3093>.
- Papan Shoshtari, F. 2008. *Comprehensive Wetland Management Plan Hur-Al Azim*. Shahid Chamran University.



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Partow, Hassan. 2001. *The Mesopotamian Marshlands: Demise of an Ecosystem*. Nairobi: United Nations Environment Programme. <https://digitallibrary.un.org/record/465842>.

Tohidi, Ahmad Reza and Mahdi Keykhosravi. 2019. "The Absence of Treaties: The Need for Investigating States' International Obligations in the Dam Construction Process from the Perspective of International Law." *International Law Review* 36 (61): 385–412. <https://doi.org/10.22066/cilamag.2019.83734.1477>.

United Nations Economic Commission for Europe. 2013. *Guide to Implementing the Water Convention*. https://unece.org/sites/default/files/2021-01/ECE_MP.WAT_39_Guide_to_implementing_water_convention_small_size_ENG.pdf.

UNECE. 2015. *Policy Guidance Note on the Benefits of Transboundary Water Cooperation: Identification, Assessment and Communication*. Geneva: United Nations. <https://unece.org/environment-policy/publications/policy-guidance-note-benefits-transboundary-water-cooperation>.

UNECE. 2021. *Handbook on Water Allocation in a Transboundary Context*. Geneva: United Nations. https://unece.org/sites/default/files/2021-12/ECE_MP.WAT_64_Handbook%20on%20water%20allocation%20in%20a%20the%20transboundary%20context.pdf.

Vaelizadeh, N. 2023. "Hur-Al-Azim is on the Verge of Destruction." Shargh, June 20. <https://www.shargh-daily.com>.



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