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Expanding Water, Deepening Injustice: How Istanbul's IBWT Projects Reshape Urban and Rural Lives

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Abstract
Inter-basin water transfer (IBWT) has become a key strategy for water authorities aiming to secure a reliable water supply for Istanbul's growing population. While IBWT projects have improved urban water availability, their negative impacts on rural communities in donor basins—and, to a lesser extent, on urban populations—remain insufficiently explored. Addressing this gap, this paper examines the impacts of Istanbul's two major IBWT systems, the Istranca and Great Melen, constructed in the 1990s and 2000s, respectively, through the lens of environmental justice. The study employs participatory observation, in-depth interviews with key stakeholders in both donor and recipient basins, and a review of relevant documents and archival materials. Based on this analysis, the paper proposes an evaluation matrix to comprehensively assess the true costs and benefits of large-scale water infrastructure projects, considering the distributive, procedural, and recognition dimensions of environmental justice.

The findings reveal that the costs of IBWT systems have been more extensive and profound than their benefits. Rural communities, in particular, have faced significant losses of income, livelihoods, and cultural heritage due to restricted or eliminated access to water, which has accelerated rural-to-urban migration. Urban populations, meanwhile, bear the economic burden of IBWT construction and maintenance, higher water prices, increased dependence on external water sources, and the pressures of migration, all of which degrade urban quality of life. Without addressing these interconnected environmental injustices, Istanbul's water crisis risks escalating to a regional scale, affecting both rural and urban areas beyond the metropolis.

Keywords: inter-basin water transfer (IBWT), Istranca System, Great Melen System, environmental justice, urban water management

Suyu Genişletmek, Adaletsizliği Derinleştirmek: İstanbul'un Havzalararası Su Transferi Projeleri Kentsel ve Kırsal Yaşamları Nasıl Dönüştürüyor?

Özet
Havzalararası su transferi, İstanbul'un artan nüfusuna güvenilir su sağlamak amacıyla su yönetimi aktörleri tarafından benimsenen temel stratejilerden biridir. Havzalararası su transfer projeleri, kentsel su arzını artırmış olsa da, bu projelerin şehir nüfusu ve su veren havzalarda yaşayan kırsal topluluklar üzerindeki etkileri yeterince incelenmemiştir. Bu çalışma, bu boşluğu doldurmak amacıyla, 1990'lı ve 2000'li yıllarda İstanbul için inşa edilen iki büyük havzalararası su transfer sistemini—sırasıyla Istranca ve Büyük Melen su temini projelerini—çevresel adalet çerçevesinde incelemektedir. Araştırmada, hem su veren hem de su alan havzalarda kilit aktörlerle yapılan derinlemesine mülakat, saha ziyaretleri sırasında yürütülen katılımcı gözlem, ilgili belgelerin ve arşiv kayıtlarının analizi yöntemlerinden yararlanılmıştır. Elde edilen veriler ışığında, çalışma, büyük ölçekli su altyapı projelerinin —özellikle havzalararası su transfer sistemlerinin— gerçek maliyet ve faydalarını çevresel adaletin dağıtım, usul ve tanınma boyutları çerçevesinde kapsamlı şekilde değerlendirmek üzere bir değerlendirme matrisi önermektedir.

Bulgular, havzalararası su transferi projelerinin maliyetlerinin, sağladığı faydalardan hem çeşitlilik hem de derinlik açısından daha ağır bastığını göstermektedir. Kırsal topluluklar açısından, suya erişimin kısıtlanması veya tamamen kesilmesi; gelir, geçim kaynakları ve kültürel miras kayıplarına yol açmış, bu da kırsaldan kente göçü hızlandırmıştır. Kentsel nüfus ise bu su transfer sistemlerinin inşası ve bakımıyla ilgili ekonomik yükler, artan su fiyatları, dış su kaynaklarına bağımlılığın artması ve göçün yarattığı toplumsal baskılar gibi sorunlarla karşı karşıya kalmakta; tüm bu etkenler kentsel yaşam kalitesinde düşüşe neden olmaktadır. Bu iç içe geçmiş çevresel adaletsizliklerden gerekli dersler çıkarılmadığı takdirde, İstanbul'un su krizi bölgesel düzeyde genişleyerek diğer kırsal topluluklar ve kentler üzerinde de olumsuz etkiler yaratabilecektir.

Anahtar Kelimeler: Havzalararası Su Transferi, Istranca Sistemi, Büyük Melen Sistemi, çevresel adalet, kentsel su yönetimi

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Introduction

The water crisis is one of today's foremost global challenges. Around 2.3 billion people reside in water-stressed countries, lacking sufficient water supply to meet their essential needs.[1] Furthermore, intensifying climate change creates detrimental impacts on water resources and infrastructure on a global scale.[2]

In response to this growing challenge, many countries are turning to inter-basin water transfer (IBWT) technology. IBWT refers to the engineered redirection of water from one river basin or watershed to another, typically to satisfy growing urban demand. Consequently, the world's largest cities, with populations exceeding 750,000, already transfer a staggering 504 billion liters of water per day, covering a cumulative distance of approximately twenty-seven thousand kilometers.[3]

The appeal of IBWT lies in its potential to provide immediate relief to recipient basins, promising enhanced water supply, economic growth, and improved water security.[4] However, donor basins often endure detrimental environmental and social consequences such as reduced stream flow, erosion, resource depletion, limited water access, socio-economic disruptions, displacement of local communities, and loss of livelihoods.[5] These repercussions all fall under the broad umbrella of the concept of environmental injustice, which denotes the unequal allocation of burdens and benefits among donor and recipient basins.

Crucially, the risks associated with IBWT are no longer confined to donor basins. As climate change intensifies and urban areas become more reliant on water transfer, recipient basins may also confront a cascade of vulnerabilities.[6] These include increased dependency on external supplies, unsustainable urban expansion, institutional fragility, and the growing threat of intra- and inter-regional water conflicts.[7] IBWT systems, rather than guaranteeing resilience, may in fact embed new forms of insecurity within the urban fabric—rendering cities more exposed to supply disruptions, governance failures, and long-term environmental instability.[8]

Hence, there is a pressing need to move beyond technocratic solutions and to critically interrogate IBWT within its full socio-political and environmental complexity. To contribute to this effort, this study asks the following question: What are the implications of IBWT systems for rural communities in donor basins and the urban populace of Istanbul?

This research draws significantly on insights developed through the project Tracing Possibilities of Urban Water Demand Management in the Climate Change Age in Türkiye: Deriving Lessons from İstanbul and Berlin, conducted during my 2019/20 Mercator-IPC Fellowship at İstanbul Policy Center (Sabancı University). I am indebted to Dr. Özlem Altınkaya Genel for her critical comments on earlier drafts. A preliminary version of this study was presented at the Istanbul Unbound: Environmental Approaches to the City conference, convened by the Istanbul Research Institute and Pera Museum in April 2021.

1 UN-Water, "Summary Progress Update 2021: SDG 6 – Water and Sanitation for All" (Geneva, 2021).

2 Martina Angela Caretta et al., "Water," chap. 4 in *Climate Change 2022: Impacts, Adaptation and Vulnerability*, ed. Hans-Otto Pörtner et al. (Cambridge University Press, 2022).

3 Robert McDonald et al., "Water on an Urban Planet: Urbanization and the Reach of Urban Water Infrastructure," *Global Environmental Change* 27 (2014): 96.

4 Edward Rollason et al., "Interbasin Water Transfer in a Changing World: A New Conceptual Model," *Progress in Physical Geography* 46, no. 3 (2022).

5 Brian D. Richter et al., "Lost in Development's Shadow: The Downstream Human Consequences of Dams," *Water Alternatives* 3, no. 2 (2010); Mine Islar and Chad Boda, "Political Ecology of Inter-Basin Water Transfers in Turkish Water Governance," *Ecology and Society* 19, no. 4 (2014); Mei-fang Fan, "Environmental Justice and the Politics of Risk: Water Resource Controversies in Taiwan," *Human Ecology* 44 (2016); Stephanie A. Higgins et al., "River Linking in India: Downstream Impacts on Water Discharge and Suspended Sediment Transport to Deltas," *Elementa: Science of the Anthropocene* 6 (2018); Jing Tian et al., "Impacts of Inter-Basin Water Transfer Projects on Optimal Water Resources Allocation in the Hanjiang River Basin, China," *Sustainability* 11 (2019); Rollason et al., "Interbasin Water Transfer."

6 Logan Purvis and Ariel Dinar, "Are Intra- and Inter-Basin Water Transfers a Sustainable Policy Intervention for Addressing Water Scarcity?," *Water Security* 9 (2020).

7 Zbigniew W. Kundzewicz et al., "Uncertainty in Climate Change Impacts on Water Resources," *Environmental Science & Policy* 79 (2018).

8 Giorgos Kallis, "Coevolution in Water Resource Development: The Vicious Cycle of Water Supply and Demand in Athens, Greece," *Ecological Economics* 69, no. 4 (2010).

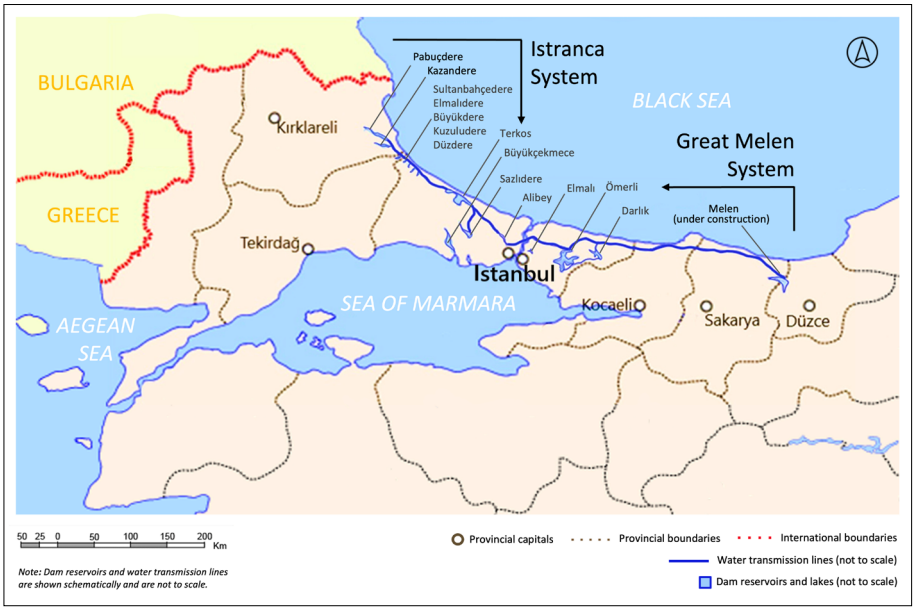

Figure 1: Istanbul's water infrastructure from Kırklareli to Düzce

Istanbul constitutes a strategically important and under-examined case for several reasons. First, it is one of the most water-stressed metropolises in the world, currently drawing nearly half of its water through large-scale IBWT from other cities.[9] Second, its water infrastructure is embedded in a complex web of geographical, political, and administrative relations spanning six provinces and approximately 32,000 km^2. Figure 1 maps the two main IBWT systems supplying Istanbul—Istranca and Great Melen—alongside the full network of contributing dams, including the yet-to-be-completed Melen Dam. Third, despite the size of this extensive network, the socio-ecological consequences of Istanbul's IBWT systems remain largely overlooked in both academic and policy discussions, particularly regarding donor basins. While there are studies on Istanbul's water infrastructure,[10] few have critically examined its IBWT systems through the lens of environmental justice or addressed how they reshape power relations, vulnerabilities, and dependencies across space.[11] Therefore, Istanbul offers a timely and illuminating site to explore the broader implications of IBWT systems under conditions of rapid urbanization, climate stress, and spatial inequality.

Accordingly, this study adopts an environmental justice perspective to interrogate how IBWT schemes reshape access to water, expose specific communities to disproportionate risk, and alter institutional and spatial power relations. It seeks to contribute to ongoing debates by extending the environmental justice framework into the domain of urban water governance, with a particular focus on megacities grappling with climate-induced stress and structural inequality.

The paper proceeds as follows: The next section, Section 2, outlines the conceptual framework of environmental justice as applied to IBWT. Section 3 presents the methodology. Section 4 provides an overview of Istanbul's IBWT systems developed over the past three decades. Sections 5 and 6 offer the empirical findings and discussion. The final section concludes with reflections on the spatialized injustices and systemic vulnerabilities emerging from Istanbul's continued reliance on inter-basin water transfers.

9 Istanbul Water and Sewerage Administration (İSKİ), *2021 Faaliyet Raporu* (2021).
10 Selmin Burak et al., "Assessment and Simulation of Water Transfer for the Megacity Istanbul," *Physical Geography* 43, no. 6 (2021); Nuray Akalın et al., "Assessing the Future Water Potential of Istanbul and the Need for Inter-Basin Water Transfer and the Trade-Offs for Water Allocation," *Water Supply* 25, no. 4 (2025).
11 İrem Daloğlu Çetinkaya et al., "Urban Climate Resilience and Water Insecurity in Cities: Evidence from Future Scenarios on Water Supply and Demand in Istanbul," *Urban Water Journal* 20, no. 10 (2022).

Vulnerable groups—such as Indigenous peoples, ethnic minorities, rural populations, and economically disadvantaged communities—are disproportionately affected by both anthropogenic and natural environmental changes. These disproportionate impacts are commonly referred to as environmental injustices. Environmental justice theory examines these injustices across diverse domains, such as mining and resource extraction, energy production, urban projects, waste disposal and landfilling, intensive agriculture and farming, and climate change.[12]

To better understand how such injustices are produced and reproduced, environmental justice theory has over the past four decades delineated multiple dimensions that can be categorized into three main areas. The distributive dimension, which interrogates the allocation of costs and benefits resulting from human-induced environmental changes, has remained a central concept in environmental justice theory since the 1980s.[13] The second is the procedural dimension, which underscores the importance of the participation of affected communities in decision-making processes concerning their own lives.[14] The third is the recognition dimension, which acknowledges and respects the diverse worldviews, cultures, practices, and needs of affected communities, thereby granting them a legitimate role in decision-making processes.[15] Scholars conceptualize the interplay among these three dimensions using a Venn diagram, illustrating them as distinct yet intersecting sets.[16]

While the Venn-diagram model helps illustrate that distributive, procedural, and recognition dimensions often overlap, it falls short in conveying the layered and interdependent nature of their relationship.[17] These dimensions do not merely coexist or intersect; they are embedded within one another in a layered, interdependent structure. Starting with the recognition dimension, if the diverse needs and demands of people are not recognized and accepted from the beginning, their participation in decision-making cannot truly happen.[18] Recognition also allows the inclusion of "subjects of justice," such as non-humans, as well as future and past generations, in the environmental justice framework.[19]

Moreover, recognition plays a key role how we understand the ecological aspects of environmental injustice,[20] thus shaping the basis of how justice is defined and pursued for many affected communities.[21] In this sense, recognition justice is not just complementary to procedural justice—it enables it. Only once recognition is established does meaningful participation (procedural justice) become possible. In turn, procedural justice is the

12 Marco Martuzzi et al., "Inequalities, Inequities, Environmental Justice in Waste Management and Health," *European Journal of Public Health* 20, no. 1 (2010); Stephanie A. Malin, *The Price of Nuclear Power: Uranium Communities and Environmental Justice* (Rutgers University Press, 2015); Ekaterina Gladkova, "Farming Intensification and Environmental Justice in Northern Ireland," *Critical Criminology* 28 (2020); Alex Karner et al., "From Transportation Equity to Transportation Justice: Within, Through, and Beyond the State," *Journal of Planning Literature* 35, no. 4 (2020); Ribesh Khanal et al., "The Effect of Environmental Justice on Social Sustainability: A Case Study of Budi Gandaki Hydropower in Nepal," *Environmental Technology & Innovation* 22 (2021).

13 David Schlosberg, "Theorising Environmental Justice: The Expanding Sphere of a Discourse," *Environmental Politics* 22, no. 1 (2013).

14 Katinka Wijsman and Marta Berbés-Blázquez, "What Do We Mean by Justice in Sustainability Pathways? Commitments, Dilemmas, and Translations from Theory to Practice in Nature-Based Solutions," *Environmental Science & Policy* 136 (2022).

15 Kyle Whyte, "The Recognition Dimensions of Environmental Justice in Indian Country," *Environmental Justice* 4, no. 4 (2011).

16 Eric Andersson et al., "Enabling Green and Blue Infrastructure to Improve Contributions to Human Well-Being and Equity in Urban Systems," *BioScience* 69, no. 7 (2019); Sigrid Engen et al., "Blue Justice: A Survey for Eliciting Perceptions of Environmental Justice Among Coastal Planners' and Small-Scale Fishers in Northern-Norway," *PLoS One* 16, no. 5 (2021).

17 Thomas Sikor, *The Justices and Injustices of Ecosystem Services* (Routledge, 2013).

18 David Schlosberg, "Reconceiving Environmental Justice: Global Movement and Political Theories," *Environmental Politics* 13, no. 3 (2004).

19 Brendan Coolsaet and Pierre-Yves Neron, "Recognition and Environmental Justice," in *Environmental Justice*, ed. Brendan Coolsaet (Routledge, 2020).

20 Kyle Whyte, "The Recognition Paradigm of Environmental Injustice," in *The Routledge Handbook of Environmental Justice*, ed. Ryan Holifield et al. (Routledge, 2018).

21 Johannes Langemeyer and James J. T. Connolly, "Weaving Notions of Justice into Urban Ecosystem Services Research and Practice," *Environmental Science & Policy* 109 (2020).

Figure 2: Dimensions of environmental justice

necessary pathway for realizing distributive justice. If affected people are excluded from environmental decision-making, they are unlikely to receive a fair share of costs and benefits—no matter how equitable the outcomes may appear on paper.

Therefore, recognition enables participation, and participation makes fair distribution possible. A Venn diagram fails to capture this sequence, as it suggests the three dimensions are equal and independent. Instead, environmental justice is more accurately depicted through concentric circles (fig. 2), where recognition forms its outermost foundation, centered within which is procedural justice, with distributive justice at the core as its innermost expression. This model emphasizes that each inner layer depends on the integrity of the outer one.

Environmental justice literature gives water governance a central place, particularly in discussions about rural communities whose livelihoods directly depend on it. These communities often find themselves marginalized and excluded from the economic benefits associated with new water-related commodities.[22] IBWT practices, in particular, raise concerns because of their various adverse effects, such as disruption of natural stream flow in donor basins and the drying of wetlands;[23] drastic reductions in river discharge, leading to challenges in delta maintenance;[24] potential delta retreat, seawater incursion, salinization, and land aridification;[25] and destruction of agricultural land, forests, and livelihoods due to hydraulic infrastructure development.[26] In addition, recent studies have also explored the more specific and uneven social impacts of IBWT projects, including their direct impacts on donor basins, such as decreasing water availability and the loss of economic means and livelihoods.[27] IBWT can exacerbate unequal access to water between urban populations and rural communities.[28] However, IBWT practices can also create negative consequences

22 Beatriz Rodríguez Labajos and Joan Martínez Alier, "Political Ecology of Water Conflicts," *WIREs Water* 2, no. 5 (2015).
23 Richter et al., "Lost in Development's Shadow."
24 Higgins et al., "River Linking in India."
25 Wen Zhuang, "Eco-Environmental Impact of Inter-Basin Water Transfer Projects: A Review," *Environmental Science and Pollution Research* 23 (2016).
26 Hai Liu et al., "A Comprehensive Study of the Impact of Large-Scale Landscape Pattern Changes on the Watershed Ecosystem," *Water* 13, no. 10 (2021).
27 Eli Moore and Eyal Matalon, *The Human Costs of Nitrate-Contaminated Drinking Water in the San Joaquin Valley* (Pacific Institute, 2011); Christoph Ernst Emil Hess et al., "Assessing Environmental Justice in Large Hydropower Projects: The Case of São Luiz do Tapajós in Brazil," *Desenvolvimento: E Meio Ambiente* 37 (2016); Laurel A. Schaider et al., "Environmental Justice and Drinking Water Quality: Are There Socioeconomic Disparities in Nitrate Levels in U.S. Drinking Water?," *Environmental Health* 18 (2019); Purvis and Dinar, "Intra- and Inter-Basin Water Transfers."
28 Elisa Savelli et al., "Urban Water Crises Driven by Elites' Unsustainable Consumption," *Nature Sustainability* 6 (2023).

for the recipient basins, such as escalating unsustainable urban water use and thereby exacerbating water demand,[29] creating a self-sustaining vicious circle of water use,[30] and increasing vulnerability to hydro-climatic variations due to growing dependency on water reservoirs.[31]

Despite the evidence of these shortfalls, water managers have historically prioritized large-scale supply-augmentation projects as their primary strategy.[32] Furthermore, factors such as population growth and climate-related hazards, including floods and droughts, are expected to heighten the demand for water extraction from rural communities.[33] Water authorities typically plan and execute IBWT systems through top-down decisions, often overlooking the direct and indirect consequences for affected rural populations. This persistence in approach stems from their perception that local interests can be sacrificed in pursuit of regional and national goals, inadvertently leading to greater environmental harms and injustices.[34]

Such environmental injustices reflect a broader pattern of marginalization experienced by rural communities. In particular, the urban-rural divide becomes especially evident in legal matters, where rural populations struggle to obtain fair representation, as legal services are concentrated in urban centers, thus increasing their vulnerability within the legal system.[35] Additionally, policymakers often overlook the unique environmental issues faced by rural communities, and centralized decision-making processes tend to marginalize rural perspectives.[36] As a result, the urban-rural divide is a critical aspect of environmental justice theories.

However, there is a symbiotic relationship between the urban and the rural: Cities rely on resources in rural areas, often leading to environmental degradation and a decline in the quality of life for rural communities.[37] At the same time, urban centers serve as sources of employment, goods, and services, as well as cultural influences, for rural regions.[38] This interdependence highlights the need for scholars to approach environmental justice within the urban-rural context.

Methodology

The research flowchart (fig. 3) begins with the following question: What are the implications of IBWT systems for rural communities in donor basins and the urban populace of Istanbul? The research follows a qualitative case-study method that allows in-depth exploration of complex social phenomena. During the literature review, secondary data were collected from yearly activity reports, strategic plans, climate action plans, investment reports, policy and legal documents, and the websites of the Istanbul Water and Sewerage Administration (İSKİ) and State Hydraulic Works (DSİ). İSKİ is the municipal entity responsible for water distribution, services, and investments in Istanbul and is subject to change through local elections, while DSİ manages Türkiye's water resources and infrastructure under the

29 Kallis, "Coevolution in Water Resource Development."
30 François Molle, "Why Enough Is Never Enough: The Societal Determinants of River Basin Closure," *International Journal of Water Resources Development* 24, no. 2 (2018).
31 Linda Kuil et al., "Conceptualizing Socio-Hydrological Drought Processes: The Case of the Maya Collapse," *Water Resources Research* 52, no. 8 (2016).
32 Jonatan Godinez Madrigal et al., "The Limits to Large-Scale Supply Augmentation: Exploring the Crossroads of Conflicting Urban Water System Development Pathways," *Hydrology and Earth System Sciences* 26 (2022).
33 Jhalak Gupta and Pieter van der Zaag, "Interbasin Water Transfers and Integrated Water Resources Management: Where Engineering, Science and Politics Interlock," *Physics and Chemistry of the Earth* 33, nos. 1–2 (2007); Roger Few et al., "Transformation, Adaptation and Development: Relating Concepts to Practice," *Palgrave Communications* 3 (2017).
34 Loka Ashwood and Kate MacTavish, "Tyranny of the Majority and Rural Environmental Injustice," *Journal of Rural Studies* 47 (2016); Miranda Forsyth et al., "A Future Agenda for Environmental Restorative Justice?," *The International Journal of Restorative Justice* 4, no. 1 (2021).
35 David N. Pellow, "Environmental Justice and Rural Studies: A Critical Conversation and Invitation to Collaboration," *Journal of Rural Studies* 47 (2016).
36 Ibid.
37 William Cronon, *Nature's Metropolis: Chicago and the West* (W. W. Norton & Company, 1991).
38 Kaitlin Kelly-Reif and Steve Wing, "Urban-Rural Exploitation: An Underappreciated Dimension of Environmental Injustice," *Journal of Rural Studies* 47 (2016).

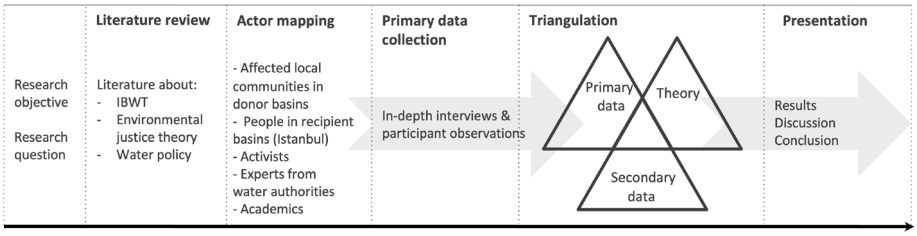

Figure 3:
Research flowchart

Ministry of Agriculture and Forestry.

During the actor mapping phase, five key groups were identified: (1) local communities in the donor basins directly affected by the Istranca and Great Melen IBWT systems; (2) residents of the recipient basin, Istanbul; (3) experts from water authorities; (4) academics; and (5) activists. The academics and activists consulted in this study have been actively engaged in research and advocacy related to water, climate, and spatial planning in the northern Marmara region. They are based not only in Istanbul but also in donor basin cities such as Kırklareli, Sakarya, and Düzce.

During the primary data collection, in-depth interviews and participant observation were employed. Comprehensive in-depth interviews were conducted with thirty-three individuals from the aforementioned actor groups (fig. 4). To gather firsthand insights, six field trips were organized to Düzce, Kırklareli, and Sakarya between 2021 and 2024, during which participant observation was conducted in the directly affected donor basins, and interviews were carried out with key actors. The Istranca IBWT case focuses on local communities whose villages were affected by the construction of the Pabuçdere and Kazandere dams in Kırklareli during the 1990s, which were the largest components of the Istranca System. The Great Melen IBWT case focuses on communities that had to evacuate their homes and livelihoods in anticipation of the Melen Dam's completion—despite the dam, located in the provinces of Sakarya and Düzce, still being under construction since 2014. These displacements occurred as part of the broader IBWT system developed in the 2000s. The majority of the in-depth interviews were face-to-face and extended beyond an hour. On

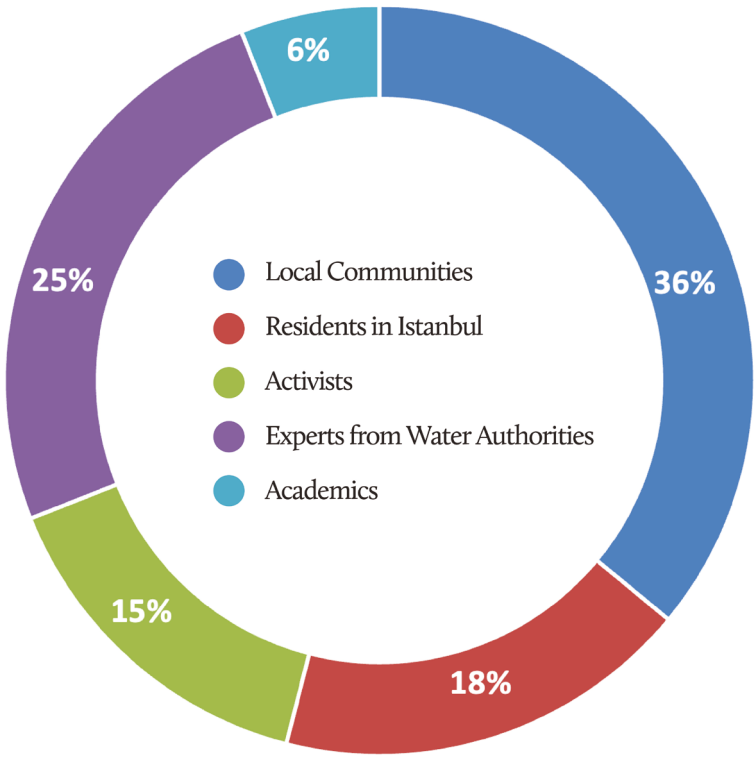

Figure 4: Distribution of interviewed actors by group

	Participative	Distributive	Recognition
Directly affected communities	• When and how were you informed about the IBWT project? Were your opinions taken into consideration at the project planning phase? • As a community, could you decide when to evacuate the village? • Did the authorities solicit detailed feedback from you about where and how you were to be resettled and what the associated costs would be?	• Were you fairly compensated for your properties? • Did you receive your compensation payment on time? • Was the money you received enough to build a new life elsewhere? • What do you do for living? Have you maintained your economic standards or fared worse/better economically?	• Were there any uncompensated items (e.g., trees, meadows, graveyards) in your village? • What has changed in your social and psychological life? • Do you keep in touch with your old neighbors? • Have you gotten used to your new life, or do you miss your old life in the village?
Residents of Istanbul, activists, experts, and academics	• Is IBWT technology the most effective solution to address the water scarcity problem in Istanbul? • Are any other measures such as rainwater harvesting and greywater reuse also integrated into Istanbul's strategies for mitigating water scarcity?	• What are the advantages and disadvantages of IBWT for Istanbul? • How do IBWT projects impact the sustainability of Istanbul's water supply? • What are the economic, environmental, and social costs associated with IBWT? • To what extent are these costs likely to increase in the future?	• Are different dimensions of water and diverse water management strategies recognized in Istanbul's current water governance? • Do people in Istanbul, activists, water authority experts, and academics acknowledge the problems that the local communities in the donor basins face? If so, to what extent?

Table 1: A selection of in-depth interview questions for actor groups

occasions when travel restrictions due to the pandemic posed challenges, interviews were carried out via telephone. To build trust, manual note-taking was opted for instead of recording, emphasizing the importance of maintaining a personal connection.

Reaching out to the directly affected communities in the Melen case was particularly challenging. Many of them had already relocated to different areas following the evacuation of their villages in 2014. The escalating political tension surrounding the ongoing construction of the Melen Dam, a matter of contention between the Istanbul Metropolitan Municipality and the national government since 2019, has contributed to a political climate where people are hesitant to openly voice their dissatisfaction. This reluctance initially led to their refusal to participate in proposed interviews. Despite these obstacles to engaging directly with local communities, contact was eventually established with key individuals who could effectively represent their communities and were willing to engage in conversation. Ultimately, six individuals, including former *muhtar*s from directly affected villages,[39] took part in the interviews. While the political climate in the Istranca case was comparatively more moderate, connecting with key stakeholders still presented challenges, as three decades had transpired since the construction of the dams. In the Istranca case, six key figures, including the *muhtar*s of affected villages, were interviewed.

In the preliminary stage of primary data analysis, the directed content analysis method was utilized, underpinned by the theoretical framework of environmental justice.[40] The distributive, participatory, and recognition dimensions of environmental justice were adopted as foundational thematic categories, facilitating a comprehensive exploration into the impacts of Istanbul's IBWT projects. Two different sets of in-depth interview questions aligned with these categories were tailored for the directly affected individuals and the

39 A *muhtar* is an official representative tasked with administering a specific village or neighborhood.
40 Hsiu-Fang Hsieh and Sarah E. Shannon, "Three Approaches to Qualitative Content Analysis," *Qualitative Health Research* 15, no. 9 (2005).

remaining actor groups (table 1). Individuals from directly affected communities were asked about the timing and their information regarding the projects, their involvement in decisions such as evacuation and resettlement, the fairness of payments for property expropriation, and how their lives and economic situations changed. The other actors were asked about the effectiveness of IBWT in addressing water scarcity, the integration of alternative measures like rainwater harvesting, IBWT's impact on sustainability and associated costs, the recognition of diverse water management strategies, and whether Istanbul's residents, experts, activists, and academics acknowledge the challenges faced by communities in the donor basins. The notes obtained from both sets of interviews and participant observations were carefully reviewed, structured, and manually categorized according to the three delineated dimensions of environmental justice.

In the triangulation phase, the condensed and categorized primary data were systematically analyzed alongside relevant secondary sources. The findings were then compared with existing environmental justice theories to enhance the study's analytical depth. This phase helped assess the validity and reliability of the primary data and provided a solid basis for confirming the strength of the study's results. By integrating these three components—primary data, secondary data, and theory—the research arrived at its conclusions, which are presented in the results and discussion sections.

Water Scarcity and IBWT Systems in Istanbul

Istanbul plays a crucial role in Türkiye, accounting for 30.4 percent of the nation's GDP[41] and housing 18.33 percent of its population.[42] With its vast capacity to supply water to sixteen million people, Istanbul establishes a benchmark for other Turkish metropolises facing critical water challenges stemming from frequent droughts and population surges. It has been designated an "attractive and competitive global city" and a "prime international asset" of Türkiye.[43] Istanbul's growth is strategically directed toward the Marmara Region, as seen in the expansion of logistics, infrastructure (including the water system), and urban development, all reflecting a deliberate plan for regional integration.[44]

Despite its limited freshwater resources, Istanbul has always managed to supply water to its residents through the construction of dams and water transfer systems.[45] Between 1970 and 1989, Istanbul's water yield nearly tripled as the city worked to meet the needs of its rapidly growing population (table 2). In response to population growth and recurring droughts, the first IBWT system, Istranca, was developed. It included five small dams built in Istanbul's hinterland near the Black Sea coast, extending into the neighboring province of Tekirdağ, followed by the later addition of the Pabuçdere and Kazandere dams in Kıyıköy, Kırklareli. During this phase, Istanbul faced a mounting water crisis driven by its historically most severe droughts, coupled with a growing population and high rates of non-revenue water, with losses across the distribution network estimated at around 60 percent.[46] These challenging conditions reinforced the perception that building IBWT systems was the only viable solution to drought, overshadowing efforts to repair the city's severely leaking water infrastructure.

Another significant development around the same period was the expansion of the authority of the DSİ's 14th Regional Directorate, a state agency under the Ministry of Agriculture

41 Turkish Statistical Institute, "Gross Domestic Product by Provinces, 2023," press release 12 December 2024, https://data.tuik.gov.tr/Bulten/Index?p=Gross-Domestic-Product-by-Provinces-2023-53575&dil=2.
42 Turkish Statistical Institute, "The Results of Address Based Population Registration System, 2024," press release, 6 February 2025, https://data.tuik.gov.tr/Bulten/Index?p=Adrese-Dayali-Nufus-Kayit-Sistemi-Sonuclari-2024-53783.
43 Jean F. Pérouse, "Region Versus Metropolis: Thrace and Sprawling İstanbul," in *The Heritage of Edirne in Ottoman and Turkish Times: Continuities, Disruptions and Reconnections*, ed. Birgit Krawietz and Florian Riedler (Freie Universität Berlin, 2019).
44 Özlem Altınkaya Genel and ChengHe Guan, "Assessing Urbanization Dynamics in Türkiye's Marmara Region Using CORINE Data Between 2006 and 2018," *Remote Sens* 13, no. 4 (2021).
45 Pierre de Tchihatchef, *İstanbul ve Boğaziçi, 1864* (Tarih Vakfı, 2000); James Crow, "The Imagined Water Supply of Byzantine Constantinople, New Approaches," *Travaux et Mémoires* 22, no. 1 (2018).
46 Ebubekir Yüksel et al., "Current and Future Strategies for Water and Wastewater Management of Istanbul City," *Environmental Management* 33, no. 2 (2004).

Water supply	Annual yield (million m3)	Operation year	Province(s)
Historical reservoirs	2.5	1620–1839	Istanbul (European side)
Terkos Dam	142	1883	Istanbul (E.)
Elmalı Dams 1 & 2	15	1893, 1950	Istanbul (Asian side)
Ömerli Dam	220	1972	Istanbul (A.)
Alibeyköy Dam	36	1972	Istanbul (E.)
Darlık Dam	97	1989	Istanbul (A.)
Büyükçekmece Dam	100	1989	Istanbul (E.)
Yeşilvadi Weir	5	1992	Istanbul (A.)
Istranca dams - Düzdere Dam - Kuzuludere Dam - Büyükdere Dam - Sultanbahçedere Dam - Elmalıdere Dam	75	1995–97	Istanbul (E.) Kırklareli Tekirdağ
Wells	25.7	1996–2007	Istanbul
Kazandere Dam	100	1997	Kırklareli
Sazlıdere Dam	55	1998	Istanbul (E.)
Pabuçdere Dam	60	2000	Kırklareli
Yeşilçay Weir	145	2004	Istanbul (A.)
Melen Weir	650	2007, 2014	Düzce & Sakarya
Total	**1728,2**		

Table 2: Istanbul's water supply: Dams, weirs, and wells, source: https://iski.istanbul/kurumsal/hakkimizda/su-kaynaklari

and Forestry responsible for Istanbul. In 1993, the directorate was granted the mandate to plan and construct hydraulic infrastructure for Istanbul over a vast area of approximately 38,000 km², stretching from the Bulgarian border in the west to the Melen River in the east and from the Black Sea in the north to the Marmara Sea in the south, and including five additional provinces beyond Istanbul.[47] This expansion legally paved the way for the establishment of dams and IBWT systems in neighboring provinces.

In this context, some of the dams in the Istranca IBWT System were built in neighboring provinces. The two largest, Pabuçdere and Kazandere, are located on the lower reaches of

47 State Hydraulic Works (DSİ), "Görev Alanı ve Tarihçe," accessed 2 May 2025, https://bolge14.dsi.gov.tr/Sayfa/Detay/1183.

their respective rivers, approximately 150 km west of the Bosporus. Pabuçdere discharges into the Black Sea about 3–4 km downstream, passing through the town of Kıyıköy, while Kazandere lies 2–3 km to the south and follows a similar path to the sea. Together, these dams supply up to 160 million cubic meters of water annually to Istanbul via a pipeline that connects them to the broader Istranca System and delivers water to Lake Terkos, which serves as a transit reservoir (fig. 1).

Despite being hailed as the ultimate solution to water scarcity, the Istranca System was already proving inadequate by the early 2000s. The drought of 2006–7 prompted the water authorities to start the construction of another IBWT system—the Great Melen. This project aimed to transfer water from the Melen River, which flows along the Sakarya–Düzce border, to Istanbul. Key components of the project included three water pipelines, the longest measuring 189 km, and the still-under-construction Melen Dam. The dam is located on the lower section of the Great Melen River, approximately 170 km east of the Bosporus and about 7 km south of the Black Sea, into which the river flows.

Despite the substantial volume of water transferred to Istanbul through the two pipelines of the Great Melen System, the 2013–14 drought revealed the complexities of managing water scarcity. That year, average water levels in Istanbul's reservoirs plummeted, the Melen River's flow dropped by 50 percent,[48] and the Pabuçdere and Kazandere reservoirs nearly dried up.[49] As a result, Istanbul was forced to extract water from an unusual source: the Sakarya River. This severe drought prompted authorities to accelerate the construction of the Melen Dam, with the groundbreaking ceremony held in 2014. The dam was expected to reduce the system's dependence on rainfall by enabling water storage. In the same year, villages in Sakarya directly affected by the project were evacuated. After a decade, the dam remains incomplete because of various issues, including significant cracks in the dam wall and risks related to the local soil structure, which have led to escalating public expenditures across multiple tender processes. Today, these two IBWT systems account for nearly half of Istanbul's overall water supply capacity, made possible by extensive and interconnected water infrastructure across the region.

The construction of the Pabuçdere and Kazandere dams as part of the Istranca IBWT System in the 1990s affected three settlements: a downstream town, Kıyıköy, located between two creeks; and two upstream villages, Aksicim and Hamidiye. Although the town and village centers were not submerged by the dam reservoirs, a large portion of their agricultural and forest lands have been either submerged or else closed to public access as part of the protection zones surrounding the dam reservoirs.[50]

The ongoing construction of the Melen IBWT System, on the other hand, has directly affected four settlements: the villages of Karalar, Köyyeri, and Beyler, and the small town of Ortaköy close to the Sakarya–Düzce border. With the launch of the Melen Dam in 2014, five thousand people in the aforementioned settlements had to migrate to other destinations. The affected communities' lives changed dramatically in a short period of time. Eleven years after the evacuation, the dam remains incomplete; construction has been halted, and it is unclear when or if it will resume.

Results

This section presents findings from participatory observations during field trips and in-depth interviews held with key actors from both the donor and recipient basins. The first part addresses the first-hand experience of the communities affected by the Istranca and Great Melen IBWT systems. The primary aim is to identify the dimensions of environmental

48 Sergül Keskin, "Melen Çayı'nın Debisi Yüzde 50 Azaldı," *Dünya Gazetesi*, 4 March 2014, https://www.dunya.com/gundem/melen-cayinin-debisi-yuzde-50-azaldi-haberi-239831.
49 Ali Aksoyer and İlhan Parçalı, "İstanbul'da Pabuçdere Barajı Kurudu," *Hürriyet*, 28 August 2014, https://www.hurriyet.com.tr/gundem/istanbulda-pabucdere-baraji-kurudu-27078087.
50 Regulation No. 30224 on the Protection of Drinking Water Basins defines four levels of protection zones around drinking water basins to keep the water supply clean: absolute protection zones (0–300 meters), short-range zones (300–1,000 meters), medium-range zones (1,000–2,000 meters), and long-range zones (2,000 meters–basin borders).

injustice that these communities have experienced so far. The second part shares insights from Istanbul residents, environmental activists, water authority experts, and academics in Istanbul, Düzce, Kırklareli, and Sakarya regarding access to water, IBWT, and future projections about water management.

Environmental Injustice Faced by Local Communities

Key actors from affected communities were asked questions (fig. 5) categorized under the participative, distributive, and recognition dimensions of environmental justice to address the impacts of IBWT systems.

Participative Dimension: Community Involvement and Displacement Challenges

To examine the extent of community participation in the planning, implementation, and operation phases of the Istranca and Melen IBWT projects, key local actors were asked when and how they first heard about the projects, whether their opinions were considered at any stage, and to what extent they were involved in decisions regarding village evacuations and resettlement conditions.

In both cases, affected communities initially learned about the projects through rumors. Formal communication began only much later through public information meetings. However, by then, some had already begun adjusting their lives based on informal knowledge:

> The rumors about the Melen Dam project started in the early 1970s. But decades passed with no action, and we thought we would not see it happen in our lifetime. However, some of us started shifting investments outside the village as a precautionary measure, buying houses or hazelnut groves in other towns and cities. Until the drillings and the first round of expropriations gradually started in the 2000s, we didn't really take it seriously. (*Local actor, Melen)*

Similarly, in the Istranca case, early technical activities signaled the coming changes:

> In the mid-1980s, DSİ hired someone from our village. For six years, this guy regularly calculated the water level of the river. That is how we learned about their plans. The droughts in the 1980s and the beginning of the 1990s were so dramatic that the dam projects were started earlier than expected. (*Local actor, Istranca)*

Public information meetings were organized primarily to announce project decisions rather than genuinely seek local input. According to the interviewees, expressing opposition was politically and socially unthinkable. Projects were framed as essential missions to meet Istanbul's critical water needs, leaving little room for dissent.

> Here in our village, we were only a couple of hundred peasants. We had no choice but to give the water. Istanbul was a giant whale, and our village was just a little fish. In our story, the whale swallowed up the little fish. (*Local actor, Istranca)*

Similarly, in Melen, resignation prevailed:

> We knew that the dam was the final component of the Great Melen System. None of us believed we could stop its construction. That's why we focused on negotiating the highest possible compensation for our properties rather than opposing the dam project. (*Local actor, Melen)*

Thus, although official procedures for public engagement were formally followed, the process offered no genuine opportunity for participation or influence. The affected communities were presented with the project under the guise of consultation, but in practice, it typically amounted to top-down information dissemination.

When it comes to evacuation and resettlement, local opinions differ on whether people were given enough time to prepare. These differences mostly reflect income levels: Wealthier households were able to make plans and relocate in advance, while lower-income families had to move with little preparation.

The *muhtar*s could select a resettlement site in Kocaali. However, financial disagreements emerged during the public information meetings. The government's offer required partial advance payments for new houses, which many either could not afford or were unwilling to pay without visible signs of their construction. The majority demanded that the Mass Housing Administration (TOKİ) take over construction due to perceived better payment terms.

> At the public information meeting, most of us didn't agree with the first plan, where the Ministry of Environment and Urbanization would build the new houses. They wanted us to pay part of the money up front. Nobody wanted to hand over that much money for something that didn't exist. We asked for TOKİ to take over instead, because we thought their payment terms would be better. But the legal process to get TOKİ involved took so long. This delayed the start of construction. In the end, we had to leave our villages long before the new houses were anywhere near ready. (*Local actor, Melen*)

Because of delays, many families were forced to evacuate their homes before suitable resettlement options were ready. Some households managed to secure new homes independently, but many faced traumatic and disorganized displacements.

TOKİ's eventual housing solution further disappointed the community. Instead of detached houses, apartment blocks were built, reducing the appeal for many and leading to widespread rejection of the new units. As TOKİ sought to recover its investments, unsold apartments were sold to outsiders, eroding the original community fabric.

> After the evacuation, more than half of the people moved to places outside Kocaali. The ones who stayed are now living in TOKİ apartments—but they don't even know who their neighbors are. If we had all been moved to the same place together, we could've kept our traditions and way of life. But in just ten years, our whole community has been scattered and broken apart. (*Local actor, Melen*)

Overall, although formal procedures for informing communities were implemented, genuine participation in planning and decision-making remained absent. Displacement processes were marred by insufficient preparation, financial barriers, and poor resettlement practices, leading to the fragmentation of community life and the erosion of traditional social bonds.

Distributive Dimension: A Narrow Understanding of Compensation

To understand the compensation issue, key local actors were asked if they received timely and fair compensation for lost homes and property, if the resettlement process was fair, and if they were economically worse or better off in the end. In both cases, communities initially expressed satisfaction with the payments, which were set above current market values.

However, this sense of security was short-lived. Many individuals, previously engaged in agriculture, lacked the financial literacy or experience necessary to manage sudden lump-sum payments. Consequently, rapid consumption of compensation funds, poor investment choices, and difficulties adapting to urban lifestyles quickly led to economic decline.

> The compensation for our properties was not bad, but many of us spent it in less than two years. I got my payment in 1997, but it lost much of its value after the devaluation in 1999. Most people's newfound wealth quickly eroded because they spent the money rapidly. (*Local actor, Istranca*)

In the Istranca case, the initial satisfaction with remunerations for property expropriation masked the long-term socio-economic vulnerabilities created by displacement. The community was temporarily dazzled by one-off financial gains, which ultimately proved insufficient to secure sustainable livelihoods:

> When the payments first came, most folks were blinded by happiness. But that didn't last long. It wasn't until the money was all gone that people really saw what had happened. And by then, it was too late. (*Local actor, Istranca*)

Beyond the financial dimension, local people in the Istranca case lost access to critical natural resources such as water and agricultural land. Despite living beside large reservoirs, villagers were denied any rights to utilize water for their needs. All the collected water in the Kazandere

and Pabuçdere dams goes through the water transmission lines of the Istranca IBWT System. Public access to the protection zones around the two dams also limits land use. This significantly constrained—and in many cases halted—their traditional economic activities.

> Kıyıköy is a tourist town. In summer, our population explodes—twenty, sometimes thirty times more people. Of course, that means a huge jump in water use. Last summer, the municipality was paying 225,000 liras every month just for the electricity to pump water from our only three wells. That's all we've got—three wells. We're not even allowed to use water from the dams. Here, people pay the municipality five liras for a cubic meter of water. To cover just one month's electricity, the municipality has to collect water fees for nine months straight. It's insane. The least Istanbul could do is give us some solar panels so we'd have another way to power the wells. (*Local actor, Istranca*)

Economic survival became increasingly difficult as agricultural and pastoral activities were curtailed:

> Our village turned into an island—trapped between two dam reservoirs and their no-go zones. We're not allowed to use the water, not even step into those protection areas. It's like we're fenced in. Our farming, our livestock—everything we used to live on—got choked off. Sure, we got some decent compensation back then, but it was a one-time payment. Meanwhile, Istanbul keeps taking water from here every single day. (*Local actor, Istranca*)

Furthermore, shifts in forest-management regulations following EU alignment contributed to the economic downturn:

> The problem isn't just about the dams. Forest rules changed too. Back in the day, we used to clear-cut parts of the forest with permission and a plan. The trees would grow back, and in the meantime, our animals could graze there. Lots of different herbs would grow where the sun hit the ground. But since the EU forest laws came in during the 2000s, clear-cutting has been banned. Now the forest is too dense, no sunlight gets through, and nothing useful grows underneath. Our village used to have around two thousand cattle—now we barely have two hundred. (*Local actor, Istranca*)

Today, only small-scale farming is possible in Kıyıköy, offering very limited income opportunities. Fishing has become a common alternative, but environmental degradation has led to declining fish stocks, further deepening the community's economic insecurity:

> There's barely any money left to make from the forest. No factory, no jobs either. Tourism doesn't help much, since Kıyıköy is a protected area. Here, you can't even hammer a nail into a wall without getting permission. So fishing is pretty much the only thing left to do. That's why a lot of folks put the money into fishing boats. We went from just five boats to nearly 180. But the fish stocks dropped too because the dams block the nutrients that used to flow from the creeks into the sea. (*Local actor, Istranca*)

In Melen, displacement had a more immediate but equally devastating impact. The evacuation of villages led to the destruction of homes, agricultural lands, and social networks. Many families were forced to move into urban apartments and to seek unfamiliar forms of employment, often with limited success.

> TOKİ built us apartments, not houses. When we drew lots, we got stuck with a ground-floor flat that gets barely any sunlight. We didn't buy it. By then, we had already settled into a better place with a small garden. But some folks didn't have that option. They had no choice but to buy those flats. The quality of life in those apartments is nothing like what we had back in our old village homes. (*Local actor, Melen*)

The destruction of agricultural resources further compounded economic losses:

> After the evacuation, they didn't just tear down our houses—they cut down our hazelnut trees too. It's been a decade, and the Melen Dam still isn't finished. What a shame. We could've stayed in our homes much longer. We could've been harvesting our beautiful hazelnut trees all this time, at least until the dam was actually built. (*Local actor, Melen*)

The differing nature of displacement in Melen and Istranca produced distinct migration patterns. In Melen, the evacuation process prompted a rapid and widespread migration,

with over half of the displaced population moving to other districts like Karasu, Adapazarı, and, to a lesser extent, Istanbul and Düzce.

In contrast, in Istranca, migration has been slower but continuous. Over the past three decades, the steady erosion of local economic opportunities has led to an ongoing exodus, particularly from the two villages upstream of Kıyıköy, which lack access to tourism or fishing-based income.

> Most people moved to Istanbul and the rest went to industrial towns, [like] Çerkezköy and Kapaklı in Tekirdağ Province. (*Local actor, Istranca)*

Although initial payments for property expropriation appeared generous, the lack of support for long-term adaptation, the destruction of traditional livelihoods, and structural barriers to new economic activities have resulted in lasting impoverishment and social fragmentation for the affected communities.

Recognition Dimension: Unrecognized Needs and the Loss of Community in Displacement

Understanding whether the needs of affected communities were recognized requires analyzing how displacement altered their lives beyond the merely material aspects. To this end, key local actors were asked about their experiences: how they felt about leaving their lands, with their natural and human-made features (e.g., trees, meadows, graveyards), behind; how their lives changed; and whether they adapted to these changes.

In the Melen case, despite allowing locals to choose the resettlement location, authorities failed to involve them in the subsequent planning and construction phases. This exclusion, coupled with construction delays, fragmented community ties and disrupted traditional social networks. As one local actor lamented,

> They gave us compensation once, and that was it. After that, they just left us to figure things out on our own. If only we could've kept those six hundred families—or at least most of them—together here, maybe this community wouldn't have fallen apart. (*Local actor, Melen)*

Similarly, in the Istranca case, the authorities overlooked the broader implications of land and water loss for local livelihoods. No meaningful efforts were made to facilitate economic transition or skill development:

> When they come around, some officials tell us not to leave our villages. They say it's a great place to live. Some even say we're lucky to be surrounded by all this greenery. But how are we supposed to stay if we can't make a living? Every year, more of us leave. Our community keeps getting smaller. More than half have already moved to Istanbul just to survive. (*Local actor, Istranca)*

The authorities' narrow focus on material compensation ignored the essential communal and existential dimensions of displacement.

Experiences varied markedly across generations. For elderly and middle-aged residents, adapting to new environments proved deeply challenging, while younger individuals, less tied to land-based livelihoods and traditions, adjusted more readily. In the Melen case, the emotional toll on older residents was profound:

> Do you know how leaves fall from the trees in autumn? We experienced something similar after the evacuation. In a neighborhood of one hundred households, eight elderly people died in just three days. We all knew that they died of sorrow. (*Local actor, Melen)*

The enduring attachment to ancestral land remained visible even a decade after relocation:

> Ten years have passed since the evacuation, but my mother still asks when we will return to the village. Her various undiagnosed ailments disappear as soon as she arrives there. (*Local actor, Melen)*

In the Istranca case, villages such as Hamidiye have become predominantly inhabited by elderly populations, with younger generations seeking livelihoods elsewhere:

> Only old people live in Hamidiye. I call it "the retirement village." . . . We are the last generation living in our villages. (*Local actor, Istranca*)

Beyond individual adaptation, displacement led to the erosion of collective memory, kinship ties, and the sense of a shared future. In the Melen case, the evacuation was perceived not merely as physical dislocation, but as the erasure of a communal existence rooted in shared history:

> We had to exhume the remains of our deceased ancestors and relocate them to a safer cemetery, but the nameless ones were left behind. . . . Living isolated from each other in different places, we have lost our common future, too. (*Local actor, Melen*)

The fragmentation of community life disrupted long-standing social structures, undermining the mutual trust and solidarity that once defined village life.

Across both cases, affected individuals emphasized that the monetary compensation they received could not adequately address the profound losses they experienced. The transition from vibrant, land-centered rural living to isolated apartment life accentuated feelings of alienation and impoverishment:

> Bairams hit me hard. Back in the village, it used to take me hours just to walk down the street and wish everyone a happy Bairam. But after the evacuation, that first Bairam, I walked home from the mosque and greeted a handful of people. Took me only five minutes. That lonely feeling hasn't gone away—I still feel it every Bairam. (*Local actor, Melen*)

> Funerals have become the only time we get to see each other. If the dam project were ever canceled, most of us wouldn't think twice—we'd move back and rebuild the village from scratch. (*Local actor, Melen*)

In the Melen case, the shift to apartment living—often among strangers and far from familiar landscapes—brought not only material loss but also deep emotional impoverishment. Similarly, in the Istranca case, the decline of traditional livelihoods such as agriculture, animal husbandry, and forestry forced many to migrate to urban areas, accelerating the disintegration of rural community life.

IBWT and Water Accessibility in Istanbul

Experts from water authorities, academics, activists, and residents of Istanbul were asked a series of questions (fig. 5) to understand the impacts of IBWT systems on water management in Istanbul.

Participative Dimension: Assessing IBWT as the Primary Water Management Strategy

The objective was to evaluate how IBWT is perceived as a solution to water scarcity and to what extent alternative water management strategies are considered or integrated into the system. There was consensus among experts that Istanbul must urgently adapt to the challenges posed by climate change, particularly the increasing frequency and intensity of droughts. However, views diverge on how best to achieve this adaptation. Some advocate for the construction of additional dams to maximize water storage capacity during rainfall events:

> Climate projections indicate that Istanbul will experience more intense and frequent droughts. Therefore, we are prioritizing projects to build additional dams in and around the city. (*Expert, Istanbul*)

Others caution against an overreliance on dams, emphasizing the significant energy costs associated with transporting water from distant sources and advocating instead for alternative strategies:

> More dams means more energy is required to transport all that water to Istanbul. The biggest cost of water is the energy for its transportation, which is over 60 percent of its overall cost. This should prompt us to consider alternative strategies such as rainwater harvesting and greywater reuse. (*Expert, Istanbul*)

Although alternative solutions such as rainwater harvesting and greywater reuse are increasingly discussed, their practical adoption remains limited. An example is the recent regulations now requiring new buildings to install greywater reuse and rainwater harvesting systems. Successful implementation is rare, reflecting broader structural challenges.[51] Many actors perceive these alternatives as complex because of the decentralized and participatory efforts they require, contrasting sharply with the centralized and technocratic nature of IBWT projects.

The complexity and perceived inefficacy of decentralized alternatives contribute to the continued preference for mainstream, large-scale projects like IBWT. This preference is reinforced by the institutional familiarity with centralized infrastructure solutions and the political and administrative ease they offer compared to participatory, bottom-up strategies.

Distributive Dimension: Evaluating the Costs and Benefits of IBWT for Istanbul

Interviews with key actors explored the environmental, economic, and social dimensions of IBWT projects. While the uninterrupted provision of clean water to a growing metropolis is recognized as a major achievement, significant concerns were raised regarding the broader costs associated with these projects. Many actors emphasized the serious environmental consequences of IBWT systems and related large-scale infrastructure projects. The destruction of forests and freshwater basins was frequently cited. These projects not only alter ecosystems but also compromise natural water-collection capacities:

> As a hiker, I have witnessed the destruction of many walking routes in the hinterlands of Istanbul. An example is the Great Melen System's water-transmission lines cutting through the once-beautiful and wild Şile Forest. The lines have split the forest in two, adversely affecting everything from the trees to the animals, along with the forest's capacity to collect water. (***Resident, Istanbul***)

Additionally, it has been argued that increased water availability from IBWT contributes to migration toward Istanbul. As the population grows, pressure on existing freshwater resources intensifies, leading to overexploitation and pollution. The resulting decline in the quality and capacity of local basins then compels authorities to seek water from increasingly distant sources, perpetuating a self-reinforcing cycle of environmental degradation.

Economic concerns were also prominently raised. Experts pointed out that the energy required to transport water over long distances, along with the expansion of infrastructure, has significantly increased the real cost of public water. Although İSKİ has maintained relatively low water prices because of the political sensitivity of water tariffs, this practice risks undermining the long-term economic sustainability of water management:

> Keeping water prices low masks the actual costs. This creates financial vulnerabilities within water utilities and could eventually impact the stability of urban water-supply systems. (***Expert, Istanbul***)

Another major economic issue involves the yet-incomplete Melen Dam project. A great amount of public money has been spent on the project, often through nontransparent procurement processes, yet the project's completion remains uncertain, fueling ongoing concerns.

Beyond environmental and economic dimensions, IBWT projects have contributed to broader social challenges. The perception that Istanbul's development is being maintained at the expense of rural environments and local livelihoods has deepened, highlighting the distributive injustices embedded within large-scale water-infrastructure policies.

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51 Ender Peker and Akgün İlhan, "Catalysing the Realisation of Rainwater Harvesting Systems Through Participatory Action Research," *Habitat International* 140 (2023).

Actors were interviewed to determine whether Istanbul's water governance authorities recognize various values and management strategies regarding water and to what extent actors are aware of the challenges faced by donor cities and affected communities in planning IBWT systems. Actors noted that water governance in Istanbul is framed predominantly as a technical issue, distancing water-related decisions from broader ecological and societal considerations. As a result, technocentric solutions like IBWT are often prioritized over more holistic approaches:

> Technofix approaches overlook a critical aspect: Water is not merely a substance transported through canals, pipes, and bottles. Water means rivers and lakes. It supports people, animals, and plants that depend on it. When water is removed from a place, all its intrinsic values associated with that location are stripped away. *(Activist, Istanbul)*

Consistent with the literature, most actors view IBWT as a logical act of transporting water from areas of abundance to areas of scarcity, reinforcing a technical and utilitarian understanding of water management.[52]

While experts in Istanbul largely support IBWT projects, the ones from donor regions have begun to voice concerns about the broader impacts on their localities. They highlight that transferring water to Istanbul may undermine their own long-term water security and restrict local economic development:

> Our water goes straight to Istanbul. So while Istanbul keeps growing, we're stuck. There won't be enough water left here for us to grow, too. With climate change and more people moving in, Sakarya's going to have serious water problems really soon. *(Expert, Sakarya)*

> It's fine that Istanbul uses Melen water—but not because we've got water to spare. If we wanted to use that water ourselves, we'd need to build a whole new treatment plant. The water's polluted. What's not fine is that we can't farm, build, or do much of anything in the protection zones of the dam. Just so the basin stays clean for Istanbul. *(Expert, Düzce)*

> Around here in Thrace, it often feels like our whole region exists only to serve Istanbul. They don't take just our water—they take our crops, our milk, even our workers. Whatever we grow, whatever we make, it all seems to end up in Istanbul. *(Expert, Kırklareli)*

These perspectives reveal growing local awareness of the trade-offs associated with Istanbul-centered water policies and the asymmetric burden borne by donor regions.

Despite recognizing the injustices experienced by donor communities, many actors justify the prioritization of Istanbul's water needs by invoking the metropolis's critical role in Türkiye's social and economic structure. They argue that Istanbul's development serves national interests and that most Turkish citizens have familial ties to the metropolis. This approach frames the issue as a collective rather than a regional concern. The perception is that enhancing Istanbul's water infrastructure benefits not just Istanbul residents but the broader Turkish population, supporting the notion of Istanbul as a global metropolis crucial to Türkiye's future.

Discussion

This section explores how water scarcity and strategies developed in response to it, particularly IBWT, can be analyzed through the lens of the environmental justice framework. This framework highlights several key discussion topics, which can be organized under the following themes: (1) the role of cultural and temporal factors in framing environmental injustices, (2) the prioritization of urban over rural, (3) the growing pressure on decision-makers to favor IBWT, and (4) the implications of Istanbul's IBWT systems for the Marmara region.

52 David Saurí and Leonardo del Moral, "Recent Developments in Spanish Water Policy: Alternatives and Conflicts at the End of the Hydraulic Age," *Geoforum* 32, no. 3 (2001).

Environmental injustices are not only experienced materially but are also framed and interpreted differently across cultural and temporal contexts. This study reveals a notable divergence between the Istranca and Melen IBWT cases in how affected communities articulate grievances and assign responsibility. This highlights socio-cultural and temporal dynamics that remain underexplored in mainstream environmental justice literature, which has traditionally focused on spatial distributions.

In the Istranca case, local narratives clearly critique the state's extractive policies, emphasizing the asymmetrical relationship between a small rural community and an expanding metropolis. This framing resonates with existing critiques of resource frontiers,[53] but differs in that the community's resistance is anchored in a historically rooted regional identity and a long-term perspective on displacement. The power asymmetry between the Thrace region as a resource hinterland and Istanbul's urban demands is explicitly expressed in the Istranca case. This research suggests that prolonged exposure to the long-term impacts of IBWT fosters more coherent and politically conscious critiques—an aspect that remains relatively undertheorized in environmental justice literature.

By contrast, affected communities in the Melen case, despite experiencing more recent and abrupt disruptions, display more cautious narratives that often refrain from direct critique of the state. This dynamic is shaped by cultural norms under which questioning large-scale state-led infrastructure projects is often perceived as a threat to national integrity and thus avoided. As a result, discussions typically focus on evacuation and resettlement rather than on the legitimacy or necessity of the IBWT project itself. While this pattern aligns with observations in other centralized states,[54] this study reveals how deep personal losses coexist with cultural deference, especially where infrastructural projects remain incomplete and outcomes uncertain.

Temporal factors deepen these contrasts. The Istranca communities have lived with the consequences of the project for almost three decades. This has allowed them to better assess the causes and effects of their dispossession and environmental degradation. In contrast, the Melen Dam remains incomplete after forced evacuations a decade ago. This creates a liminal state where some residents even hope for a return, delaying politicization and critique. It also illustrates how temporal aspects shape not just the lived experience but also the political framing of environmental injustices—another overlooked dimension in environmental justice research.

These findings contribute to calls for expanding environmental justice frameworks beyond distributive and procedural aspects by integrating recognition, social memory, and political culture. They underline the importance of narrative agency in shaping how injustices are publicly represented or silenced. While much of the literature portrays affected communities as passive recipients of policy decisions, this research builds on critiques showing how governance approaches marginalize local agency.[55] Instead of accepting passivity as given, this study highlights variations in community engagement and response under very similar biophysical and policy contexts.

The implications extend to urban environmental justice. As Istanbul relies increasingly on IBWT systems, the true economic and ecological costs of those systems are obscured by politically regulated, artificially low water prices. Although this price control may benefit urban consumers in the short term, it exacerbates long-term vulnerabilities, especially for economically disadvantaged groups. This research suggests that when tariffs eventually rise to reflect actual costs, new intraurban inequalities will emerge—due not to resource scarcity but to the political invisibility of the costs and harms incurred. Moreover, IBWT

53 Rodríguez Labajos and Martínez Alier, "Political Ecology of Water Conflicts."
54 Coolsaet and Neron, "Recognition and Environmental Justice."
55 Madrigal et al., "The Limits to Large-Scale Supply Augmentation."

projects contribute to rural-to-urban migration, fueling a vicious cycle that further strains urban water demand and infrastructure—an injustice often unrecognized by urban residents.

This study calls for a more historically and culturally informed approach to environmental justice. Future research should pursue longitudinal and comparative studies to better theorize how temporality, political culture, and narrative framing interact to mediate environmental injustices across rural and urban contexts.

The Prioritization of Urban over Rural

The Istranca and Melen cases demonstrate how IBWT projects institutionalize a long-standing and largely unchallenged policy bias in favor of urban centers, particularly Istanbul, while systematically marginalizing rural communities. Officially framed as responses to drought-induced crises, these projects reflect a deeper structural tendency to prioritize metropolitan water needs over rural livelihoods, rights, and well-being. In both cases, the specific material, social, and emotional ties rural communities hold to their environments, including their sense of togetherness and place-based belonging, were overlooked by the state.

This urban-centric framing echoes Giorgo Agamben's notion of the "state of exception,"[56] wherein emergencies such as droughts are used to legitimize extraordinary interventions such as expropriation and displacement. The affected residents were systematically exposed to official crisis narratives emphasizing severe droughts threatening millions in Istanbul. To strengthen this justification, authorities emphasized the disparity in population size, portraying the costs borne by rural communities of only a few thousand as acceptable losses for the benefit of the metropolis. As Loka Ashwood and Kate MacTavish argue, this framing diminishes the legitimacy of minority resistance, depicting their claims as obstacles to collective progress.[57]

Contrary to the reciprocal urban-rural connections envisioned in classical political ecology and reterritorialization frameworks,[58] IBWT systems operate on an extractive logic. Water is removed from rural basins without real compensation, recognition, or reinvestment, weakening not only rural access to essential resources but also long-term regional development. Protection zones and land-use restrictions around reservoirs further entrench stagnation and depopulation. Migration toward Istanbul and the city's growing dependence on external water sources have also heightened water vulnerability in both donor and recipient basins, challenging these projects' claimed contribution to sustainable growth.

These dynamics offer a temporal and relational perspective to the environmental justice literature. The cost of urban water security is not limited to immediate displacement; it also involves prolonged socio-economic decline, community fragmentation, and political disenfranchisement in donor regions. The Melen case reveals how an incomplete dam project can trap rural populations in a liminal state, delaying recovery and undermining collective agency. The Istranca case, in turn, shows how the decline of traditional ways of living causes people to gradually leave the area, leading to the breakdown of community life. These subtle and long-term impacts are mostly overlooked in current IBWT research, which often focuses on technical solutions or large-scale water distribution, without considering how these projects affect communities over time.

From a policy standpoint, this research underlines the need to revise IBWT planning frameworks to incorporate distributive, procedural, and recognition-based justice. Projects must move beyond utilitarian cost-benefit models and engage directly with the claims and knowledge of affected communities. Mechanisms for participatory decision-

56 Giorgo Agamben, *State of Exception* (University of Chicago Press, 2005).
57 Ashwood and MacTavish, "Tyranny of the Majority."
58 For these, see, respectively, Cronon, *Nature's Metropolis*, and Kelly-Reif and Wing, "Urban-Rural Exploitation."

making, livelihood restoration, and ecological co-management are essential to prevent the deepening of socio-spatial inequalities.

This study, while grounded in rich empirical detail from two cases, has limited generalizability. Broader aspects of the political economy of IBWT, such as centralized governance, municipal competition, and institutional inertia, need further investigation, as do the perspectives of non-displaced urban beneficiaries. Future research should investigate how crisis narratives operate in other donor regions, especially non-metropolitan ones, and pursue comparative studies to identify recurring patterns of environmental injustice. Longitudinal ethnographic work could further illuminate how memory, emotional loss, and symbolic attachments shape adaptation among displaced or marginalized communities.

The Pressure on Decision-Makers to Favor IBWT

Climate change, rapid urbanization, and the loss of forests and wetlands have significantly reduced the capacity of Istanbul's internal basins to collect and store water.[59] These areas are increasingly encroached upon by settlements and infrastructure projects, further diminishing their reliability.[60] Under these circumstances, water authorities perceive IBWT as an inevitable solution to meet the city's growing demand.[61] This corresponds to the urban water paradox: The more water cities consume, the more they expand supply infrastructures, thereby locking themselves into extractive cycles that intensify socio-ecological vulnerabilities.[62]

Empirical evidence from this study shows that, despite formal endorsement of climate adaptation technologies such as rainwater harvesting and greywater reuse, large-scale infrastructure remains the dominant policy response. While legislation mandates these technologies in new buildings and municipal plans support them, authorities often lack the technical expertise and managerial flexibility needed for effective implementation. The city's hierarchical governance structure resists the participatory processes critical to decentralized water systems.

This persistent reliance on conventional infrastructure is rooted not only in practical considerations but also in deeply embedded administrative cultures. As earlier studies have shown, technocratic governance in metropolitan settings often follows path-dependent trajectories that resist innovation.[63] Building on this literature, this study demonstrates how historical institutional memory, particularly the collective experience of severe droughts and widespread water cuts in the 1980s and 1990s in Istanbul, has shaped both public expectations and institutional behavior. These past crises have instilled a strong imperative to ensure uninterrupted water supply, even at significant ecological and social cost. In this context, everyday bureaucratic routines and risk-averse attitudes reinforce a continued preference for large-scale, centralized infrastructure. As a result, small-scale and decentralized water technologies are frequently dismissed as politically sensitive, administratively unfamiliar, or insufficient to address the city's needs.

This governance inertia has significant distributive consequences. Donor basins in Düzce, Sakarya, and Kırklareli endure land dispossession, economic disruption, and

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59 Cihan Erdönmez, "İklim Krizi Perspektifinden Orman-Su İlişkileri ve İstanbul Açısından Bir Değerlendirme," *Su ve İnovasyon* 3 (2021); Ahmet Özgür Doğru et al., "Detrimental Environmental Impact of Large Scale Land Use Through Deforestation and Deterioration of Carbon Balance in Istanbul Northern Forest Area," *Environmental Earth Sciences* 79 (2020); Abbas Şahin, "İstanbul ve Çevresinin Orman Varlığı," in *Ekosistem, İklim ve Kentsel Büyüme Perspektifinden İstanbul ve Kuzey Ormanları*, ed. Ünal Akkemik (Türkiye Ormancılar Derneği Yayınları, 2020); Muharrem Demiroğlu et al., "Geçmişten Günümüze İstanbul'un Su Yönetimi ve Su Havzaları," *Ölçü: Mühendislikte, Mimarlıkta ve Planlamada*, October 2019, https://olcuistanbul.org/index.php?sx=2019_ekim_07.php.

60 Hande Demirel et al., "Exploring Impacts of Road Transportation on Environment: A Spatial Approach," *Desalination* 226, nos. 1–3 (2008); Abdurrahman Geymen, "Coğrafi Bilgi Sistemleri Kullanarak Su Havzalarındaki Doğal Kaynakların İzlenmesi: Elmalı Havzası Örneği," *KSÜ Doğa Bilimleri Dergisi* 19, no. 2 (2016).

61 Başak Savun-Hekimoğlu et al., "Evaluation of Water Supply Alternatives for Istanbul Using Forecasting and Multi-Criteria Decision Making Methods," *Journal of Cleaner Production* 287 (2021).

62 Madrigal et al., "The Limits to Large-Scale Supply Augmentation."

63 Karen Bakker, *Privatizing Water: Governance Failure and the World's Urban Water Crisis* (Cornell University Press, 2010).

forced migration, with little opportunity for participation in decision-making. These asymmetries align with Erik Swyngedouw's notion of hydro-social territories, where water flows reflect political power as much as hydrological necessity.[64] While Istanbul's water agenda prioritizes urban supply security, rural donor communities experience systemic developmental decline.

For policymakers and practitioners, these findings highlight the need for institutional learning mechanisms that move beyond technical fixes. Advancing more equitable and climate-resilient water governance in Istanbul requires reflexive systems that integrate the experiences and needs of donor communities. This calls for embedding decentralized technologies within participatory frameworks that challenge existing hierarchies and address procedural injustices. Future research should support this transition by creating possible models of alternative systems, such as rainwater harvesting and greywater reuse, within Istanbul's complex socio-political context.

The Implications of Istanbul's Water Management for the Marmara Region

This study highlights the far-reaching socio-spatial consequences of Istanbul's IBWT-based water management strategy, particularly in its surrounding donor regions. Despite bearing the direct burdens of land dispossession, economic displacement, and environmental degradation, affected municipalities were able neither to influence decision-making nor to negotiate for long-term compensatory mechanisms, such as guaranteed water shares or financial redistribution. This systemic disempowerment reflects what the environmental justice literature frames as procedural injustice: the consistent exclusion of affected populations from meaningful participation in governance processes. Although Türkiye's legal-administrative framework recognizes formal mechanisms for public consultation, the cases examined here show that these mechanisms have functioned more as instruments of legitimization rather than deliberation. This is consistent with global critiques of IBWT systems, where decision-making remains technocratic, top-down, and extractivist in nature.[65]

Moreover, the state's decision in 1993 to grant İSKİ a regional mandate over water resource management in northern Marmara illustrates a key shift in scalar authority. This move effectively repositioned Istanbul not only as a consumer but also as a regulator of water across a broader geography.[66] Such scalar rescaling, while not uncommon in other global cities under water stress,[67] remains critically underexamined in Türkiye. This study contributes to this literature by exposing how rescaling in the name of metropolitan water sustainability can reproduce inter-regional inequalities and intensify environmental injustices across donor basins.

As the qualitative evidence shows, residents and stakeholders in Düzce, Kırklareli, and Sakarya are increasingly aware of the cumulative ecological and socio-economic burdens they shoulder for the sake of Istanbul's uninterrupted growth. Many participants described their towns as sacrifice zones—places where water, labor, and agricultural products are regularly taken to serve the needs of the metropolis, without fair returns or benefits. The symbolic framing of Istanbul as a national priority further legitimizes this asymmetry, rendering the needs of donor cities invisible or subordinate.

More critically, this uneven relationship has cascading effects. The rising frequency and intensity of droughts in donor districts like Kocaali and Karasu, alongside rapid population growth, are already compelling local authorities to consider IBWT-like solutions themselves.

64 Erik Swyngedouw, "The Political Economy and Political Ecology of the Hydro-Social Cycle," *Journal of Contemporary Water Research & Education* 142, no. 1 (2009).
65 Rutgerd Boelens, "Introduction: The Multiple Challenges and Layers of Water Justice Struggles," in *Water Justice*, ed. Rutgerd Boelens et al. (Cambridge University Press, 2018).
66 Ahmet İstanbulluoğlu et al., "Trakya Bölgesi İçme ve Kullanma Suyu İhtiyacının Belirlenmesi," *Journal of Tekirdag Agricultural Faculty* 4, no. 2 (2007); A. Cüneyt Gerek, "Büyük İstanbul İçme Suyu Projesi Melen Sistemi," *Su ve Çevre Teknolojileri* 21 (2008).
67 Savelli et al., "Urban Water Crises."

This indicates a form of policy diffusion, where Istanbul's infrastructural response to water scarcity becomes a template for others, regardless of its long-term viability. Such replication, however, threatens to trigger a self-perpetuating cycle of environmental degradation, forced displacement, and rural depopulation at a regional scale.

This study suggests that unless alternative, decentralized, and participatory models are integrated into water management, the Marmara region may witness the expansion of hydro-social inequalities. From a policy perspective, this calls for a critical reassessment of Istanbul-centric planning paradigms and the development of interregional water-sharing frameworks that incorporate the voices, needs, and ecological thresholds of all stakeholders.

While the insights from these two donor-basin cases provide a rich perspective on distributive, procedural, and recognition-based injustices, they are necessarily context-bound. Future research would benefit from comparative studies across multiple IBWT systems in Türkiye and beyond, incorporating quantitative modeling of water availability, climate change impacts, and socio-economic vulnerabilities.

Conclusion

This study employs an environmental justice perspective to critically examine the far-reaching consequences of Istanbul's IBWT projects. While these projects have expanded the metropolis's water supply and mitigated the risks of large-scale shortages, they have also caused considerable harm to the communities in donor basins. Although these communities received compensation for expropriated properties, they experienced profound disruptions: Limited access to vital water and land resources has undermined local livelihoods, eroded cultural ties, and triggered forced migration to urban centers. This illustrates a critical structural imbalance: Rural communities bear the brunt of the sacrifices made to benefit urban populations. Yet urban residents are not exempt from environmental injustice either. They face rising water costs, financially strained water authorities, growing dependence on external sources, heightened water insecurity, and worsening living conditions in cities—pressures intensified by the influx of displaced rural populations.

The underlying drivers of these interlinked injustices are multifaceted. Growing population pressures, rapid urbanization, and climate change are straining Istanbul's water resources. Although alternatives like rainwater harvesting and greywater reuse could help alleviate the situation, decision-makers remain hesitant to adopt them. This reluctance stems from a combination of skepticism about their effectiveness, a lack of technical expertise, and a deeply entrenched centralized approach to water management rooted in the trauma of past water crises. As a result, the expansion of IBWT projects has created a self-reinforcing loop. Originally intended to address water scarcity, these projects now exacerbate the same problems. They intensify drought risks, fueling rural-to-urban migration and further straining already vulnerable water systems. To fully understand these dynamics, this study presents an environmental justice matrix that maps the distribution of costs and benefits across urban and rural communities, shedding light on the far-reaching consequences of Istanbul's water management strategies.

The proposed matrix organizes the costs and benefits of IBWT projects across three key dimensions of environmental justice: distributive, procedural, and recognition (fig. 5). It offers three critical insights. First, the costs of these projects significantly outweigh their intended benefits, impacting multiple justice dimensions, not just the distributive aspect. Second, the consequences are felt not only by rural communities but also by urban populations, highlighting their interconnectedness. Third, deeper injustices are often overlooked when justice is narrowly framed in terms of distribution alone.

This research further advances the understanding of environmental justice by emphasizing temporality as a critical lens. The varied temporal experiences of donor communities—ranging from long-term exposure and cumulative losses in the Istranca region to the liminal, unresolved displacement in Melen—demonstrate how historical memory and evolving socio-political contexts shape the framing and persistence of environmental injustices. Temporality reveals that justice is not static but unfolds over time, influenced by collective memory, cultural narratives, and the shifting dynamics of power and resistance. Recognizing

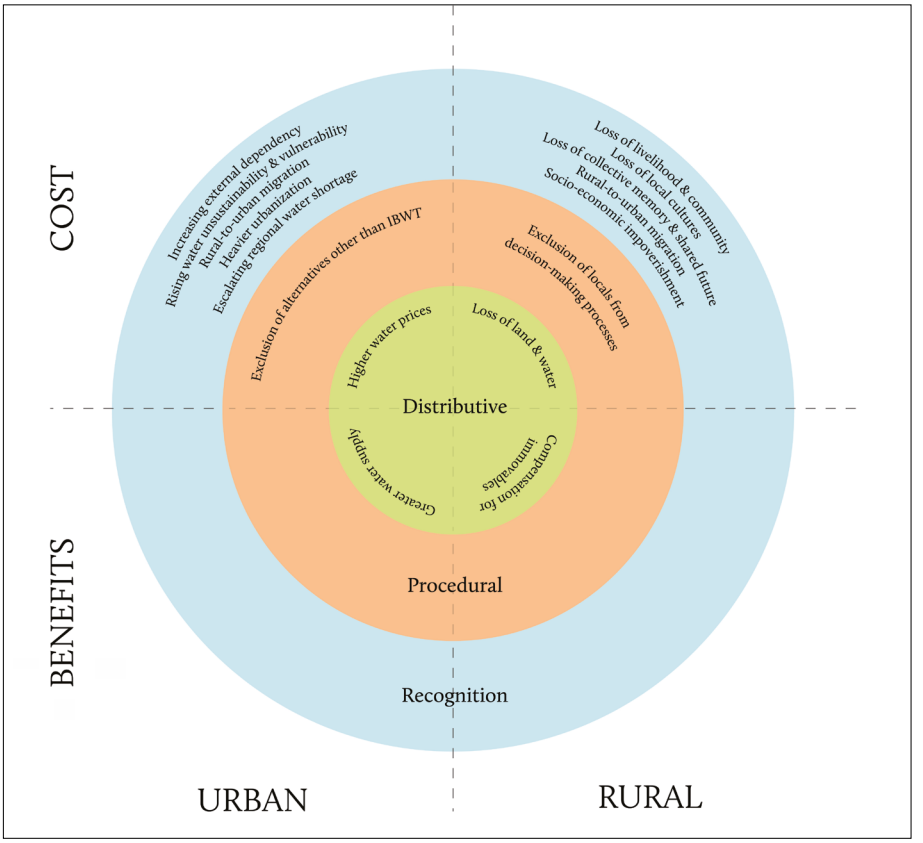

Figure 5: Cost-benefit matrix for urban and rural populations within the environmental justice framework

this dimension compels water governance to move beyond snapshot assessments toward longitudinal, culturally sensitive approaches that honor the lived histories and evolving identities of affected populations.

The matrix serves as a comprehensive tool for policymakers to address systemic flaws in water governance. It exposes how neglecting local needs and voices across governance scales can produce environmental injustices that ripple across entire regions, not just isolated communities. Understanding the interdependence of urban and rural areas is crucial for developing more integrated and sustainable water management approaches. Ultimately, achieving environmental justice requires prioritizing recognition and procedural fairness early in planning. Compensatory measures alone cannot resolve the deeper systemic injustices. True justice demands participatory decision-making processes that incorporate the rights, knowledge, and aspirations of all affected communities. Embedding justice into water governance is essential for securing equitable and sustainable water futures, not only for Istanbul but also for other global metropolises confronting rapid population growth and climate change.

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