



INN WATER



MIDDLE TISZA

➤ Policy Lessons

FROM EMERGENCY DROUGHT DEFENCE TO STRATEGIC WATER BALANCE MANAGEMENT

EXECUTIVE SUMMARY

The Middle Tisza region is increasingly exposed to water scarcity as a result of climate change and altered hydrological processes. The droughts of 2022 and 2025 provide two recent, well-documented stress tests for the regional water management system. While both years were characterised by low summer inflows and high water demand, the drought of 2022 was hydrologically more severe and revealed the structural limits of emergency-based drought defence.

In 2022, irrigation demands could only be met by extensive depletion of the Tisza Lake's strategic water reserves, leading to exceptionally low lake water levels and significant ecological and tourism losses. This experience demonstrated that reserve-based crisis management can prevent immediate agricultural damage, but does so at high public and environmental cost and cannot be sustained under increasingly frequent drought conditions.

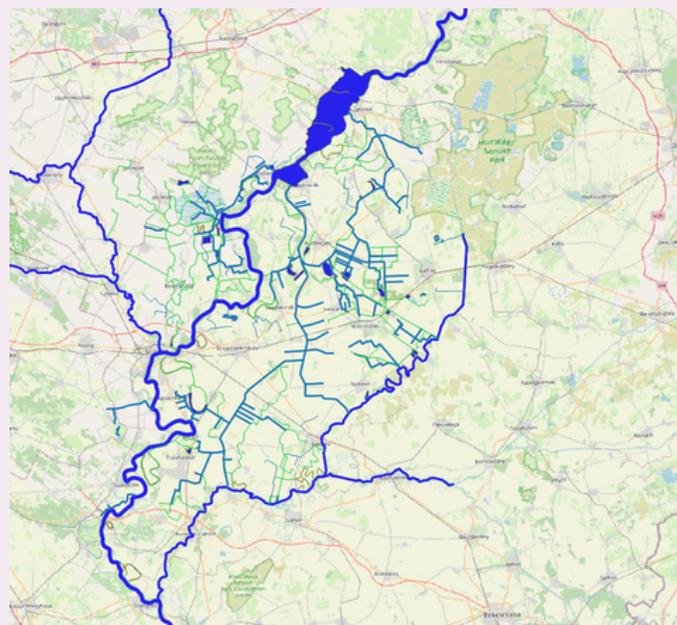
By contrast, the drought of 2025, even though less severe than the drought of 2022, showed that coordinated, schedule-based water allocation („scheduling”) at basin scale can fundamentally improve outcomes even under continued water scarcity. Through the application of dynamic water management, all critical water demands were satisfied in the Middle Tisza region, without depletion of strategic reserves in Tisza Lake.

The experience of 2025 confirms that organisational and governance innovations can significantly increase the efficiency, equity, and economic value of water use. However, the analysis also shows that summer drought management alone is insufficient to address the region's long-term water balance deficit. The only viable pathway to improving resilience lies in large-scale water retention and infiltration outside the irrigation season, first on semi-natural areas and subsequently on agricultural land with below average productivity.

This policy brief demonstrates the need for a strategic shift from reactive drought defence toward proactive, year-round water balance management. Drawing on operational, hydrological, and economic evidence from the Middle Tisza region, it shows that coordinated water allocation, combined with off-season water retention and infiltration, can significantly improve resilience to water scarcity while reducing economic and environmental losses. Based on this evidence, the brief puts forward specific policy recommendations focused on extending coordinated scheduling beyond the summer period, introducing a two-tier water allocation framework, and legally recognising public-purpose ecological water supply as a prerequisite for systematic, large-scale water retention.

Introduction

The analysis focuses on the Middle Tisza region of Hungary, an area where water availability is increasingly shaped by climate variability and the way the large-scale hydraulic infrastructure is operated. Central to the region's water management is the Tisza–Körös Valley Cooperative Water Management System (TIKEVIR), a basin-scale framework that coordinates the operation of rivers, canals, and reservoirs across the Hungarian parts of the Tisza and Körös valleys in order to manage both water scarcity and surplus through the integrated use of existing infrastructure. A substantial part of the TIKEVIR system lies within the jurisdiction of the Middle Tisza District Water Authority (KÖTIVIZIG), where much of our analysis took place. The River Tisza constitutes the system's primary water source, while Tisza Lake plays a key strategic role as a buffering reservoir, helping to regulate water availability during periods of low inflow.



The goal of this policy brief is to draw practical policy lessons from recent drought management experience in the Middle Tisza region, with a particular focus on how coordinated, basin-scale water allocation can improve resilience to water scarcity. Building on empirical evidence from the 2022 and 2025 droughts, the analysis examines the limits of reserve-based drought defence, the performance of coordinated water use scheduling, and the implications for long-term water balance management. The brief aims to inform decision-makers about policy and governance options that can enhance water security, reduce economic and environmental losses, and support a transition from reactive drought response toward proactive, system-level water management.

WATER SCARCITY IN THE MIDDLE TISZA REGION: EXPERIENCE FROM THE 2022 AND 2025 DROUGHTS

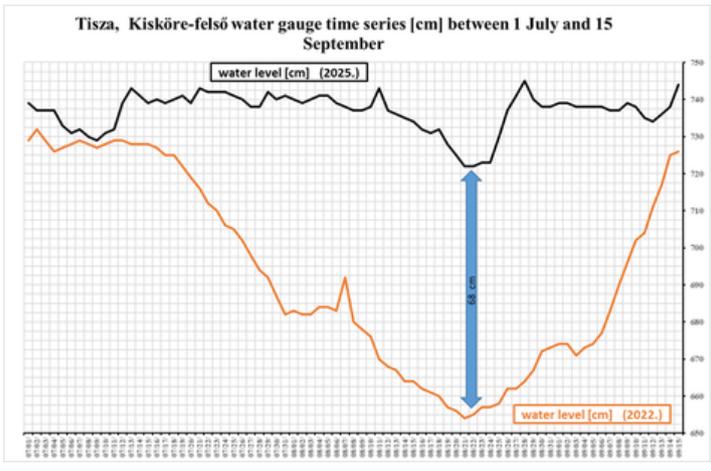
The summer of 2022 represents one of the most severe droughts experienced in the Middle Tisza region in recent decades. Extremely low inflows on the Tisza and its tributaries coincided with prolonged heatwaves and the ensuing sustained irrigation demand. Under these conditions, the fulfilment of irrigation water needs depended critically on tapping the stored water reserves of the Tisza Lake.

The summer water abstraction led to exceptionally low lake water levels, far below those typically observed during normal summer operation. These low levels caused significant ecological stress, impaired recreational and tourism functions, and generated negative public perception. Importantly, these impacts were not the result of mismanagement, but of a conscious operational decision: prioritising the satisfaction of irrigation entitlements under extreme scarcity conditions, in order to limit agricultural losses.

The 2022 experience revealed a fundamental trade-off embedded in the existing drought response model. Strategic reserves can buffer short-term scarcity and protect agricultural production, but they do so by transferring the adverse consequences of water scarcity to other fields, including tourism. As droughts become more frequent and intense, this approach becomes increasingly unsustainable.

The drought of 2025 was also characterised by low summer inflows and extended periods of water scarcity. However, hydrological conditions were less extreme than in 2022, and, crucially, water management outcomes were markedly different. In 2025, basin-wide, coordinated water allocation was employed for the TIKEVIR system, supported by daily assessment of available water stocks and dynamically adjusted scheduling of water use. This approach ensured that all critical water demands - including agricultural, municipal, industrial, and ecological needs - were satisfied without requiring a comparable depletion of the Tisza Lake reserves.

Tisza Lake water levels during the summer of 2022 and 2025:



COORDINATED SCHEDULING AS A GOVERNANCE INNOVATION

Rather than expanding storage capacity or further exploiting existing reserves, the Middle Tisza experience demonstrates that system-level efficiency gains are the most effective lever for improving drought resilience. Importantly, these gains do not stem from new infrastructure investments, but from improved coordination, better use of information, and more deliberate timing of water withdrawals and deliveries. Since no major new infrastructural investments are required, overall costs are modest, greatly improving the benefit cost balance of the intervention.

Water use scheduling reorganises water allocation in time rather than in volume. By coordinating when different users access water, scheduling reduces the simultaneity of withdrawals, lowers peak demand on the system, and alleviates pressure on conveyance capacity. The experience of 2025 shows that, through scheduling, the same volumes of water can serve more users with fewer conflicts.

In 2025, scheduling was applied across the entire Hungarian Tisza Valley, representing a significant scale-up from earlier, more localised applications in 2022. This basin-wide approach ensured equitable treatment of water users in different geographical locations, as they were treated similarly regardless of their physical position within the water system.

Implementing scheduling required continuous communication with water users, daily reassessment of available water stocks, and coordinated decision-making among regional water directorates. Importantly, this approach transformed drought management from a reactive, crisis-driven response into a managed allocation system characterised by transparency and predictability. As a result, water security improved and trust among users increased, as access conditions were clearly defined and consistently applied.

ECONOMIC BENEFITS OF THE 2025 DROUGHT MANAGEMENT

Ex post analysis for the Middle Tisza region – more specifically, the operation area of KÖTIVIZIG - shows that coordinated scheduling in 2025 avoided substantial agricultural losses. The value of irrigated agricultural production protected through improved water allocation is estimated at 26–30 billion HUF, with avoided damages in the range of 1.8–3.5 billion HUF. These estimates are conservative and reflect only direct agricultural impacts. By preventing extreme drawdown of the Tisza Lake water levels, scheduling also avoided losses in tourism and recreation comparable to those experienced in 2022. Based on observed patterns, the benefits from avoided tourism losses are estimated at 1.5–1.8 billion HUF.

These benefits underscore the public welfare generating character of improved water management. While irrigation benefits accrue primarily to the agricultural sector, stable lake levels support tourism related economic activities as well as nature. By contrast, the cost of drought management in the same region stayed well below the quantified benefits (the cost of the drought defense action plan, as shown in the diagram below, is only partially attributable to the agricultural and tourism sectors). Therefore, we can conclude that net benefits were generated for enterprises as well as society at large.

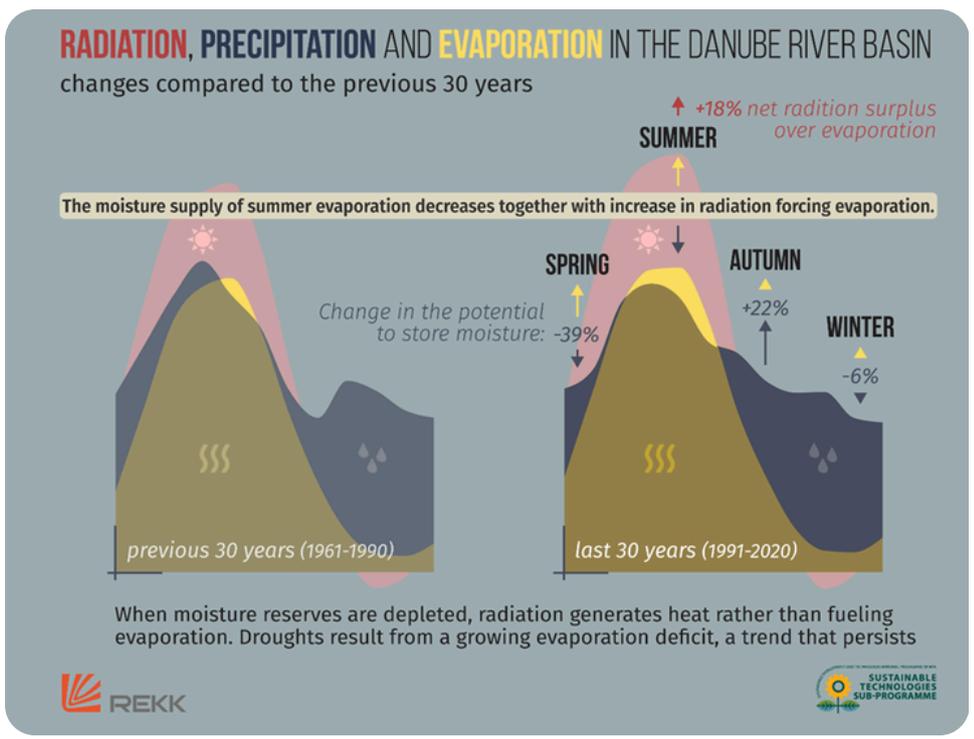
Costs and benefits of drought defense in the KÖTIVIZIG region in 2025:



THE ROLE OF OFF-SEASON WATER RETENTION AND INFILTRATION

Despite the success of scheduling in 2025, summer drought management primarily addresses symptoms, not causes. Long-term trends show a growing summer evapotranspiration deficit driven by increased net radiation, altered precipitation patterns, and declining soil moisture reserves. Increased net radiation results from higher air temperatures, as warmer air can hold more moisture and is therefore often associated with reduced cloud cover, allowing a larger share of incoming radiation to reach the surface rather than being reflected back. This increase in net radiation, in turn, leads to further warming of the land surface and the lower atmosphere.

Shifts of key climate indicators in the Danube river basin between 1961 and 2020:



Source: Báder, L., Szilágyi, J. (2023). Widening Gap of Land Evaporation to Reference Evapotranspiration Implies Increasing Vulnerability to Droughts in Hungary. Periodica Polytechnica Civil Engineering. <https://doi.org/10.3311/PPci.21836>

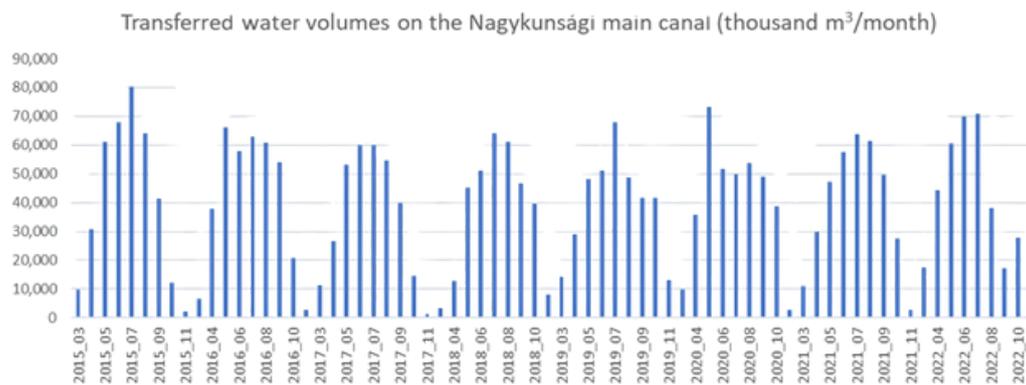
The scale of the evapotranspiration deficit in the Middle Tisza region far exceeds what irrigation alone can compensate. Even fully optimised summer water allocation cannot restore the region's water balance under current climatic conditions. The only viable pathway to addressing the structural deficit lies in retaining and infiltrating water outside the irrigation season, when water availability is higher and conveyance capacity is underused. Landscapes can store water effectively between seasons, allowing surplus flows to be retained and gradually released through soil moisture and groundwater recharge. Priority should be given to semi-natural areas such as wetlands, oxbow lakes, meadows, forests, and floodplain landscapes, followed by less productive agricultural land where there is openness to temporary inundation in order to infiltrate water into the soil.

The diagram below illustrates the monthly water volumes conveyed through the Nagykunsági canal system, the dominant part of TIKEVIR. It shows that the system's full transfer capacity is not utilised for much of the year, particularly during periods when water availability is not constrained. This indicates that both the water volumes and the conveyance infrastructure capacity needed for year-round delivery of water to the landscape are already in place. The remaining constraints are therefore not physical in nature, but institutional and organisational.

Targeting these areas first minimises economic losses and land-use conflicts, as they are better adapted to prolonged water presence, generate lower opportunity costs if water remains on the land for longer periods, and typically involve fewer ownership and compensation disputes than highly productive cropland.

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Transferred water volumes on the Nagykunsági main canal 2015-2022:



POLICY RECOMMENDATIONS

Achieving meaningful progress in off-season water retention and infiltration requires more than technical capacity or physical infrastructure; it depends on an enabling policy and governance framework. While recent operational experience has shown that sufficient water volumes and conveyance capacity are available outside the irrigation season, their effective use remains constrained by existing allocation rules, legal definitions, and management practices. The following policy recommendations address these institutional barriers and establish the conditions needed to mobilise surplus water in a systematic, planned, equitable and scalable manner, thereby supporting long-term improvements in regional water balance and climate resilience.

Policy reform should introduce a two-tier water allocation framework that clearly distinguishes between different types of water use. The first tier would cover guaranteed water uses, associated with a high level of supply security and corresponding to existing water use entitlements related primarily to irrigation needs. The second tier would

allow for conditional water uses based on surplus flows that are available only in specific periods and would require the active registration of water needs by landowners and land users willing to receive water for retention, infiltration, or other non-guaranteed purposes. For this tier, resource distribution should follow the principle of equal access among users within the given water administration unit. Such a framework would preserve established rights and legal certainty, while at the same time enabling more flexible and efficient use of water that currently passes through the system without being actively managed.

At the same time, large-scale water retention and infiltration activities aimed at improving the regional water balance and mitigating the impacts of summer heatwaves through enhanced evapotranspiration should be formally recognised as a public-purpose ecological water supply. Legally defining this category would not in itself create a financial basis for such activities, but it would establish the necessary legal precondition for assigning public.

More information

Middle Tisza Pilot Site - Profile

- Country: Hungary
- NUTS2 region: Northern Great Plain (Észak-Alföld)
- Water administration: Middle Tisza District Water Authority (KÖTIVIZIG)
- Landscape type: Lowland river plain
- Altitude: Approximately 80–100 metres above sea level
- Relief: Flat terrain with minimal elevation differences
- Hydrological character: Highly regulated system with controlled river sections, reservoir storage, and artificial conveyance infrastructure, including the Tisza–Körös Valley Cooperative Water Management System (TIKEVIR)
- Main water bodies: Tisza, Zagyva and Körös rivers, Tisza Lake, Nagykunsági Main Canal
- Climate type: Continental, increasingly drought-prone
- Recent major droughts: 2022, 2025
- Recent major floods: 1998–2001, 2006, and 2010
- Dominant land use: Intensive agriculture. Major crops include cereals (wheat, maize), oilseeds, and fodder crops
- Extensive rain-fed agriculture, while irrigation covers about 30-40 thousand hectares, depending on the irrigation needs of the year

Realisation

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About InnWater

InnWater aims to foster sustainable multi-level and cross sector water governance through social innovation. To this end, InnWater is developing a set of tools and services adapted to local needs for the benefit of water stakeholders, including a governance assessment matrix, guidance for stakeholders' engagement, as well as simulations linking water resources management and economic activities. To achieve its goals, InnWater engages with pilot site communities, co-developing tools to address specific water challenges like pricing policies, water quality, and infrastructure investment.



InnWater is coordinated by the International Office for Water and run from 2023 to 2026.

References

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