Szigetköz - Large-scale floodplain revitalization

Picture: Jozsef Kertesz, 2024

Problem

With the advancement of Danube navigation, the Szigetköz section of the river became prone to the formation of riffles, necessitating continuous intervention to maintain and improve navigational conditions. This led to a deterioration in the water supply of the tributary system. Slovakia and Hungary began planning and constructing a joint barrage system to address this issue. However, due to political changes, Hungary did not build the barrage system, leading to disagreements between the two countries. Consequently, Slovakia unilaterally put into operation the redesigned barrage system. As a result, there was an urgent need for ecological rehabilitation of the Hungarian tributary system.

Solution

Stakeholder Engagement

In the initial planning phase, water management experts had to rebuild trust with the local community and stakeholders since rehabilitation can only be ensured through water engineering interventions. The process began with involving stakeholders to define the project's objectives, emphasizing that the role of water managers was to meet the needs identified by the stakeholders rather than dictating demands.

Defining Objectives

During national debates, some NGOs advocated for restoring the area's natural, original state, which implied demolishing flood protection levees and reactivating the floodplain. However, consultations with local stakeholders and NGOs agreed on maintaining flood safety. The ecological goals for rehabilitation were thus set to reflect conditions after the construction of flood protection levees, acknowledging the area's vulnerability due to its low-lying, densely populated nature.

Compromise and Consensus Building

Water-related needs can rarely be satisfied continuously, as the availability of water resources in space and time often differs from the temporal and spatial occurrence of needs. Therefore, stakeholders can only resolve conflicts by forming compromises.

The planning process revealed conflicts of interest among stakeholders, notably between forest management and nature conservation and between tourism and conservation efforts. Initially, each group sought to optimize water conditions from their perspective. With the involvement of external experts,

stakeholders conducted a value analysis using the pairwise comparison method. This method determined priorities between different micro-regions, and the operating schedule was defined. As a result, flood safety, followed by the protection of drinking water bases, was prioritized.

Adaptation of Plans and Reference Period of Ecological Targets

Following extensive discussions, a temporary compromise was reached, agreeing on a dynamic approach to water replacement based on the natural flow patterns of the Danube to follow the natural flow of water in the low and medium water range. This approach also aimed to enhance the replenishment of tributary systems, which had suffered from reduced water levels since the 1950s. As a result, the target water levels for replacement were based on conditions from the 1950s and 1960s, (marking the beginning of the system's transformation) considering the vegetation periods.

Planning the water replenishment systems

To achieve good ecological potential, the branch system had to be created with hydrological conditions similar to the chosen reference period. The most important element was ensuring dynamic, daily, or short-term water level changes because seasonal averages disguise natural dynamics. Therefore, the active floodplain replenishment system was planned to follow the natural fluctuations of Danube discharges dynamically.

Establishing good water quality conditions is as necessary from an ecological point of view as reproducing water level dynamics. Based on the analysis of previous hydrobiological data, eutrophication processes take place in the branch system if the residence time is longer than four days. The minimum cross-section average velocity was also important, so the risk of clogging the riverbed was as small as possible. Based on calculations, that velocity was defined as 0.3 m/sec. The goal was to determine the minimum discharge to replenish the active floodplain. Hydrodynamic modeling was used to calculate flow dynamics in the branch system. For that, a geodetic survey of the branch system was carried out first, taking a cross-section every 200 m. Then the model established a minimum discharge of 50 m^3/sec, which complies with the required residence times and flow velocities.

For the operation, the following fundamental criteria were established:

- dynamically controlled system on a day-to-day basis,
- to have an average velocity larger than 0.3 m/sec,
- keep residence times shorter than 4 days in river branches,
- introduce a minimum of 50 m3/s discharge into the active floodplain branches,

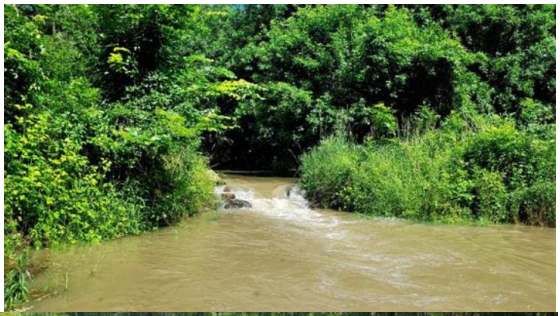
Replenishment system design and construction

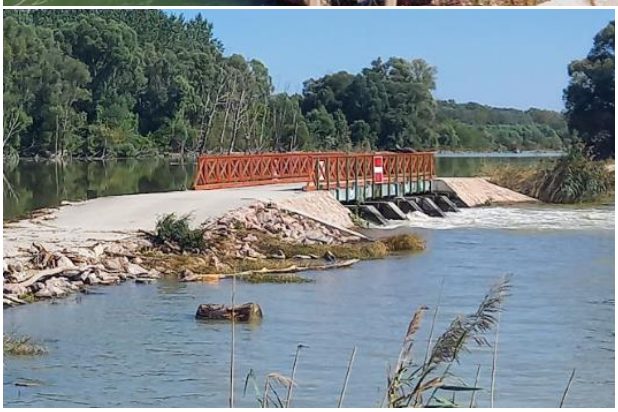
In 1995, the Upper Szigetköz floodplain replenishment systems between Rajka and Ásványráró were constructed. These systems use a gravitational method without pumping, relying on the Dunakiliti barrage and the Old Danube submerged weir. The aim was to mitigate past river regulation effects, like riverbed incision and disconnected water bodies. From 2014-2015, the replenishment system was expanded to the Lower-Szigetköz area, and the Mosoni Danube underwent ecological rehabilitation. This included constructing fish passes to ensure fish migration.

Picture: Jozsef Kertesz, 2024

From 2019-2022, the Mosoni-Danube outflow structure was built to counteract past river regulation issues. While plans for rehabilitating the Old Danube's water levels exist, they have not yet been implemented. A 1989 joint Slovak-Hungarian plan to build the Nagymaros barrage, which was intended to mitigate water level drops from continuous regulation and dredging, was never realized. The system's water flow, controlled by the Dunakiliti Barrage and submerged weir, depends on the natural discharge patterns of the Danube measured at Bratislava. The Mosoni-Danube receives a continuous flow from Cunovo, which is split between it and the historical floodplain replenishment system.

The active floodplain system's water is routed through numerous branches controlled by various structures, including fixed crest weirs. The historical floodplain system uses controlled gates and siphons for water replenishment and consists of over a dozen channels filled with flowing water, regulated by approximately 100 sluice gates. Fish passes ensure connectivity between the historical floodplain channels and the Mosoni Danube. The overall system operation mimics natural conditions with minimal maintenance, aligning with seasonal discharge patterns and allowing morphological changes to occur naturally.





Pictures: Jozsef Kertesz

Regulatory Framework

By then, the EU's Water Framework Directive had been adopted, and assessments of water status were underway. The affected Danube section and the water replacement system received a "heavily modified" designation, indicating that the goal was not to achieve a good ecological state but to develop a good ecological potential that considers and satisfies social needs. As a first step, stakeholder involvement was prioritized in determining water conditions. Involving stakeholders was also the initial step in drafting the operating regulations, which was the basis of the operating license.

Continuous Trust and Involvement

Post-construction, maintaining trust during operation became crucial; as a result, the Szigetköz Operating Committee was established. In addition to overseeing operations, the committee discusses modification proposals received from stakeholders on a case-by-case basis. The Water Management Directorate will implement the modification if everyone accepts the request. Today, because of consultations with Slovakia, the committee can also decide on creating high water conditions, considering the actual water flow and the key aspects of agricultural and ecological needs. For example, tourism needs are taken to the background at such times.

Since the committee began its operations, resolving disputes related to emerging needs in the region has always been ensured within its framework.