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Symposium

Water Resources Management: New Perspectives and Innovative Practices

September 23rd - 24th, 2021 | Novi Sad | Serbia

A handwritten signature in black ink, appearing to read 'M. Petrović', written over a horizontal line.

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Faculty of Civil Engineering and Architecture
University of Niš

International Symposium



**Water
Resources
Management:
New Perspectives
and
Innovative
Practices**

PROCEEDINGS BOOK

<http://www.swarm.ni.ac.rs/symposium>



**September 23rd – 24th, 2021
Novi Sad, Serbia**



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International Symposium

Water Resources Management: New Perspectives and Innovative Practices

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23-24 September 2021, Novi Sad, Serbia

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PREFACE

The University of Novi Sad, Faculty of Technical Sciences hosted the **International Symposium "Water Resources Management: New Perspectives and Innovative Practices"** from 23rd-24th September 2021. The Symposium was a part of the activities realized under the CBHE KA2 project SWARM "Strengthening of master curricula in water resources management for the Western Balkans higher education institutions (HEIs) and stakeholders" co-funded by the Erasmus+ Programme of the European Union. SWARM project is implemented by a consortium made up of seven HEIs from the Western Balkan Region and six HEIs from Program Countries: University of Niš, University of Novi Sad, University of Priština in Kosovska Mitrovica, University of Montenegro, University of Sarajevo, Džemal Bijedić University of Mostar, Academy of Applied Sciences of Kosovo and Metohija, University of Natural Resources and Life Sciences from Vienna, Norwegian University of Life Sciences, Aristotle University of Thessaloniki, University of Architecture, Civil Engineering and Geodesy from Sofia, University of Rijeka, Faculty of Civil Engineering, Universidade de Lisboa, and Public Water Management Company "Vode Vojvodine".

The main objective of the SWARM project is the education of water management experts in the Western Balkan Region in accordance with the national and European Union policies. This objective is further broken down into the following specific objectives:

- To improve the level of competencies and skills in higher education institutions by developing new and innovative master programmes in the field of water resources management in line with the Bologna requirements and national accreditation standards.
- To design and implement new laboratories in Western Balkan HEIs, in cooperation with project partners from Program Countries.
- to develop and implement LLL courses for professionals in water sector in line with EU Water Framework Directive.

The International Symposium was an interdisciplinary forum where the research results and best practices in the field of Water Resources Management were shared with all SWARM fellows and stakeholders from the entire world. At the same time, the event was the place for the promotion of the SWARM results to a wider audience.

We would like to express our sincere thanks to all session chairs, keynote speakers, presenters, Organizing and Scientific committees, as well as to many others who contributed to the success of this Symposium.

We are confident that the solid foundation created by the SWARM project will continue to build up and strengthen our unique international network.

In Novi Sad, September 2021

Symposium Chairs

Maja Petrović

Milan Gocić

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NATURAL WATER RETENTION MEASURES CONTRIBUTION TO INTEGRATED TRANSBOUNDARY TISZA RIVER BASIN MANAGEMENT-ENVIRONMENTAL AND FLOOD RISK MANAGEMENT OBJECTIVES SYNERGY

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Abstract: Contemporary water management incorporates number of criteria merged in a way to target economic development, social equity, and development. In the recent decades, Integrated Water Resources Management paradigm is incorporated in the policies and legislation with the Europe and Globally. Under the EU's WFD, the ICPDR is the platform for coordination for the implementation of the provisions of the Directive between Danube countries (including non-EU Member States and takes an active role in sub-basin planning. Transboundary cooperation within the Tisza River Basin generates the Updated ITRBMP 2019 that elaborates significant water management issues, water quantity and quality issues relevant for Tisza River Basin. To improve the synergy between EU WFD and EU FD objectives Tisza countries identified flood risk management measures that support EU WFD environmental based on commonly agreed methodology and official national data. Brief overview presented in this paper indicates that Tisza countries support natural water retention measures as a win-win measures for flood risk management that support WFD environmental objectives and address water quantity and water quality issues interlinkage of relevance for Tisza River Basin and integrated water resources management.

Keywords: EU WFD environmental objectives, flood risk management, integrated water resources management, natural water retention measures, Tisza River basin, transboundary water management

INTRODUCTION

The main goal of the contemporary water resources management is to address development, social equity, and environmental sustainability. To combat increasing pressures on water resources (water scarcity, pollution, climate changes, extreme hydrological events, land use changes, etc.) a new doctrine Integrated Water Resources Management (IWRM) is incorporated in policy and legal framework at national, transboundary, and global level. IWRM attempts to integrate prospects and processes of the hydrologic cycle, watershed features and economics, social interactions, and policies (Mayfield et al., 2004) considering external impact (Figure 1).

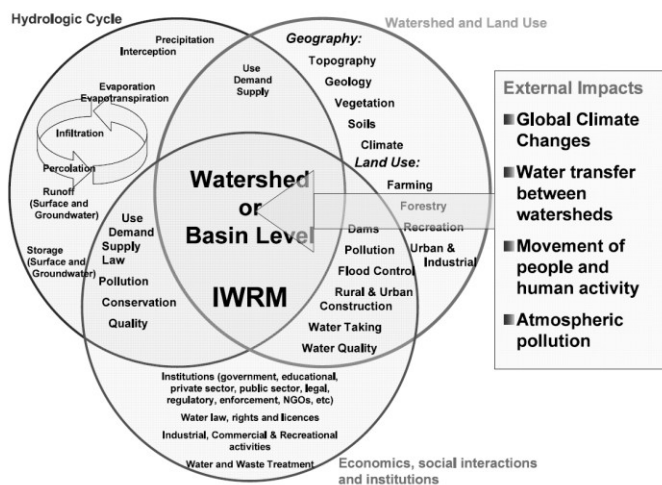


Figure 1. Conceptual IWRM integration (Source: Mayfield et al., 2004)

It is the understanding of basin retention opportunities that gets more and more important in contemporary water management due to its favourable contributions to sustainable development and integrated water resources goals achievement (Matić, 2019). Human activities, and climate change have caused an increase in the frequency of extreme climate events, including floods and droughts. At the same time, there is a clear need to implement measures that mitigates the negative impacts of fluctuating water availability on human economic activities and the environment (2015, GWP).

Natural Water Retention Measures (NWRM) are multi-functional measures that aim to protect and manage water resources using natural means and processes, therefore building up Green Infrastructure, for example, by restoring ecosystems and changing land use. NWRM have the potential to provide multiple benefits, including flood risk reduction, water quality improvement, groundwater recharge and habitat improvement NWRM policy document (EU, 2014). As a result, they contribute to achievement of the key EU policies such as the Water Framework Directive (WFD) and the Floods Directive (FD) among the others.

The main focus of applying NWRM is to enhance the retention capacity of aquifers, soil, and aquatic and water dependent ecosystems with a view to improve their status. The application of NWRM improves the quantitative status of water bodies and reduces the vulnerability to floods and droughts. It positively affects the chemical and ecological status of water bodies by restoring natural functioning of ecosystems and the services they provide (Strosser et al., 2015). The restored ecosystems, e.g., improved hydrologic ecosystem services (natural water retention capacity) contribute both to climate change adaptation and mitigation, and increase river basin resilience to hydrological extreme events and other changes due to human activities (Matić and Simić, 2017).

Improved planning processes coordination across different policy areas (e.g., River Basin and Flood Risk Management, but also nature protection, rural development, and land use/spatial planning) is identified as a pre-requisite to reinforce the chances of the NWRM multiple benefits considerations in the water and other sectors decisions making process. The links between the Floods Directive (FD 2007/60/EC) and Water Framework Directive (WFD 2000/60/EC) and potential benefits of NWRM and their contribution to integrated water resources management at the river basin level are elaborated in the Technical Report 078 (EU, 2014).

The largest sub-basin of the Danube River Basin is Tisza River Basin. Its transboundary water resources management is built on the Tisza countries (Ukraine, Slovakia, Romania, Hungary, and Serbia) co-operation within the scope of the International Commission for the Protection of the Danube River (ICPDR) Tisza Group. At the first ministerial meeting of the ICPDR countries (December 2004), ministers and high-level representatives of the five Tisza countries signed a Memorandum of Understanding (MoU), establishing the ICPDR Tisza Group for coordination and implementation of an international integrated Tisza River Basin cooperation under the umbrella of the ICPDR. More details regarding are available at the ICPDR Tisza Basin web page.

As presented in the following, this paper explains rationale of the NWRM measures integration in the Updated Integrated Tisza River Basin Management Plan 2019 (ITRBMP 2019) to provide synergy between flood risk management and environmental.

METHODOLOGY TO IDENTIFY ENVIRONMENTAL AND FLOOD RISK MANAGEMENT OBJECTIVES SYNERGY

The Tisza River Basin (Figure 2) drains an area of 156,869 km² is shared by Tisza countries and can be divided into two main parts: the mountainous Upper and the Lowland Tisza Basin. The Tisza River itself can be divided into three main parts: the Upper (- upstream from the confluence with the Somes/Szamos River), Middle (in Hungary which receives the which receives following tributaries: the Bodrog and Slaná/Sajó Rivers together with the Hornád/Hernád River, the Szamos/Somes River, the Körös/Crisuri River System and Maros/Mures River) and the Lower Tisza (located downstream from the mouth of the Maros/Mures River. This part of the Tisza receives the Begej/Bega River and indirectly other tributaries through the Danube – Tisza – Danube Canal system.

Map1. Tisza River Basin: Overview

Updated ITRBMP 2019

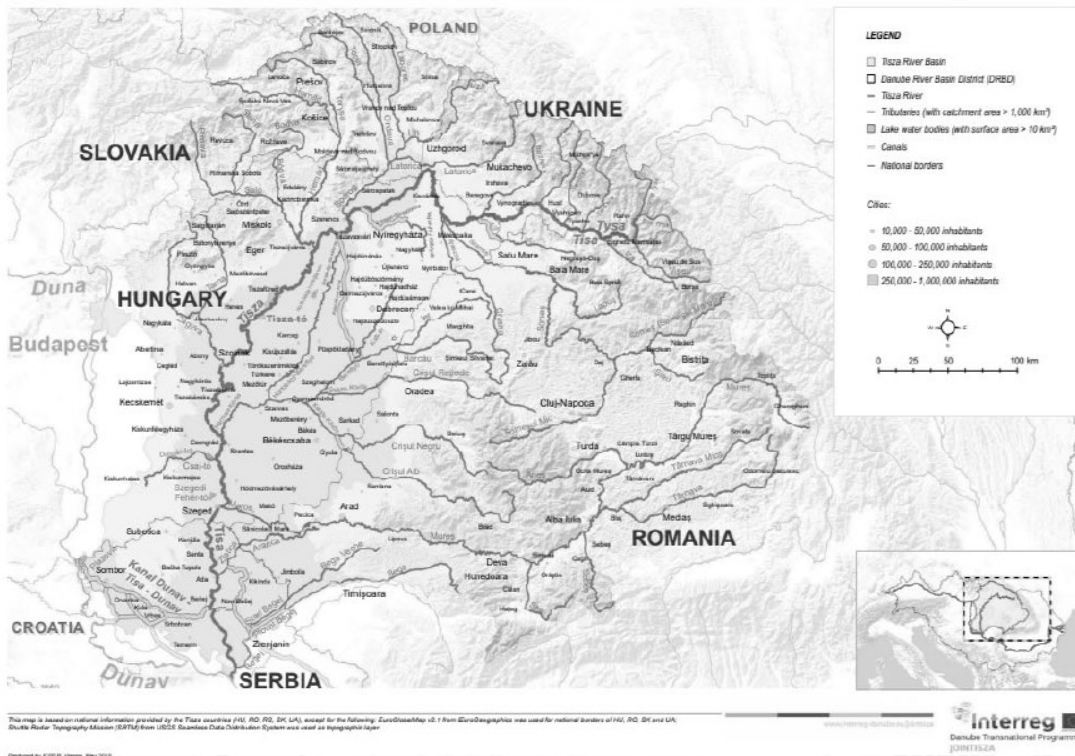


Figure 2. Tisza River Basin overview (Source: Updated ITRBMP 2019, maps, available at the: https://www.icpdr.org/flowpaper/viewer/default/files/nodes/documents/updated_itr bmp_2019_maps.pdf)

Integration of water quality and water quantity issues

In addition to Significant Water Management Issues identified for Danube River Basin (pollution by organic substances, pollution by nutrients, pollution by hazardous substances, hydromorphological alterations and ground water management issues) in the ITRBMP (2011) the integration of water quality and water quantity related issues has been identified by the ICPDR Tisza Group (ITRBMP 2011) to be relevant for integrated river basin management within the Tisza River Basin as presented by Figure I.3 in the Updated ITRBM Plan 2019). It is underlined that key water quantity issues for water quality and good status of water bodies are flood and excess water, drought and water scarcity and climate change.

Updated ITRBMP 2019 incorporates elements of the flood risk management plan – flood risk reduction measures reported by Tisza countries through ICPDR DANUBE GIS database following the procedures.

As a subcategory of these measures Tisza countries collected data and information and reported the potential identified win-win measures associated to flood risk management that might lead to achieve the objectives of WFD in the Tisza River Basin.

Among the measures collected from the Tisza countries, those measures that support both the Water Framework Directive and the Flood Directive were identified, considering the interlinkage between the flood risk management and environmental objectives since these measures are considered as most suitable for achieving future integrated water management. During the identification of these measures, the achieved principles and the goals declared in the Danube River Basin Management Plan and the Danube Flood Risk Management Plan were also taken into consideration (Updated ITRBM, 2019).

The Tisza countries filed agreed templates to provide official national data and information on legislation, competent authorities, coordination, units of management, and criteria and approach on integration of the Tisza River Basin Management Planning and Tisza Flood Risk Management Processes.

Each country reported Potential measures associated to flood risk management that might lead to achieving the environmental objectives. For each measure the field of action (prevention, protection, public awareness,

preparedness, response and recovery/ reconstruction) is reported, associated with measure category, type of measure and measure description.

The summary results on win-win measures for flood risk management that supports EU WFD environmental objectives (Article 4) are discussed in the results with emphasis on the NWRM.

RESULTS AND DISCUSSION: A CLEAR PRESENTATION OF EXPERIMENTAL RESULTS OBTAINED, HIGHLIGHTING ANY TRENDS OR POINTS OF INTEREST.

Table 1. Summary of the potential identified win-win measures associated to flood risk management that might lead to achieve the objectives of WFD in the Tisza River Basin

No of measures	Field of action	Measure category
15	Prevention	Organizational measures (legislative, institutional)
36	Protection	Natural water retention measures - associated to watercourses, wetlands, natural lakes, in accordance with Directive 2000/60 /EC, and other measures that advocate for increase of retention capacity
2	Public Awareness	Measures to increase community awareness
9	Preparedness	Preparedness measures /Improvement preparedness to reduce the adverse effects of floods
3	Response and Recovery/ Reconstruction	Post event recovery measures

As depicted in table 1 that presents summarised data, 36 measures are reported for flood risk management protection field of action by the Tisza River Basin. According to the ITRBMP 2019 (Table VII.2) they are categorized in the following way:

Natural water retention measures - associated to watercourses, wetlands, natural lakes, in accordance with Directive 2000/60 /EC;

Change or adapt land use practices (partial recovery of ecosystem functions or structures modified by changing or adapting land use practices) in urban areas;

Change or adapt land use practices (partial recovery of ecosystem functions or structures modified by changing or adapting land use practices) for forest management;

Other water retention measures.

With respect to type of measures there are 8 measures to restore retention areas (flood plains, wetlands etc.), 1 measure for Natural water retention measures in urban areas, 4 Natural water retention measures by changing or adapting land use practices in forest management, 5 measures to improve retention capacity at the level of river basin by creating polders and small retention reservoirs (made in the upper part of the river basin), and 1 measure type to improve retention capacity at the level river basin by increasing the safety of existing large dams / increasing the attenuation capacity of reservoirs towards projected capacity.

It is important to underline the note associated with win-win measures that support maintenance or increase of the natural retention capacity: Downstream cumulative effects of retentions along the Tisza in Hungary should be evaluated in the frame of bilateral cooperation between Hungary and Serbia. The Serbia is the most downstream country and given the foreseen increase in water use by agriculture, any significant changes or alteration in the water regime due to water retention measures has to be elaborated by national nominated experts in the bilateral commissions.

CONCLUSIONS

Integration of the win-win measures associated to flood risk management that might lead to achieve the objectives of WFD in the Tisza River Basin in the updated ITRBM reinforce synergy between flood risk management and environmental objectives. Proposed measures are extracted from the national catalogues of

measures and in line with measures reported in the Flood Risk Management Plan for the Danube River district. It is indisputable that more than 70% of measures reported by Tisza countries are within the NWRM category, both in urban and rural areas. The implementation of the JOINTISZA project generates ITRBMP 2019 endorsed by Memorandum of Understanding signature by Tisza countries during a high-level Ministerial meeting (September, 2019). Given the multi benefits of the NWRM, their identification enhances Tisza countries cooperation with respect to transboundary water management visions and objectives, improve integrated water resources management, and support cooperation among various sectors relevant for flood risk and water resources planning and management. Implementation of proposed NWRM within the Tisza River Basin addresses the water quantity and quality issues interlinkage and measures relevant for Tisza River Basin SWMIs.

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Conflicts of Interest: The authors declare no conflict of interest.

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