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Editorial

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Dear readers,

An extraordinary year will end soon. We hope that you have so far passed all the turbulences caused by COVID-19 in good health. Nine months ago, nobody would have thought how fast we would be able to train our skills in home office, video conferencing and distance learning. While this way, working life could at least function halfway indoors, field-work was at least complicated, if not stopped at all due to contact restrictions. The IAD conference, which should have taken place in July 2020, was finally postponed to June 2021 to increase the chances for a much-requested meeting with physical presence of the participants.

We are delighted that so many colleagues have agreed to provide insights into their research activities in our association bulletin "Danube News" during this troubled time. The Tisza, the longest tributary of the Danube, is the focus of the first article in Danube News 42. Dávid Béla Vizi and Tamás Právetz investigated options for improving the river's discharge capacity by restoring flood plains in a section of the Middle Tisza. Their work was part of the EU-funded project Danube "Flood-plain". The contribution of Barbara Stammel and her colleagues also originates from a project funded by the Transnational Danube Programme: "Improving Water Quality in the Danube and its tributaries through Integrated Floodplain Management based on Ecosystem Services" (IDES) aims to improve water quality management in the Danube and to identify synergies in the provision of ecosystem services. A short overview of

The Ottheinrichbach, a bypass river of the Bergheim hydropower dam on the Upper Danube in Bavaria, in winter.

investigations of microbial water quality in Serbian rivers is the main topic of the manuscript by Stoimir Kolarević and his colleagues. Finally, Hélène Masliah-Gilkarov presents the WePass project, which represents another milestone in the long-standing efforts to make the hydroelectric dams of the Iron Gates passable for aquatic fish and especially for the Danube sturgeon.

Many aquatic biologists mourn for Elsa Leonore Kusel-Fetzmann. The obituary in our News and Notes section honours her immense oeuvre in hydrobotany. Finally yet importantly, we advertise on our own behalf: On the initiative of IAD President Cristina Sandu, a children's book about Danube sturgeons was created as part of a project. "The Adventures of Starry, the Brave Sturgeon" is available in English, but also in nine different languages spoken in the Danube region.

Many thanks to everyone who contributed to this issue of Danube News. We wish our readers all the best and health for the coming months.

The possibilities of improving the conveyance capacity with restoration measures along the Hungarian Middle Tisza River section, based on a pilot area

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Abstract

Over the past decades, several extraordinary floods have occurred from rivers in the Danube River Basin. Each of the flooding levels that emerged were one of the centennial flood that caused significant human and economic damage in the affected countries. To handle increasing flood risks within the European Union, the No. 2007/60/EC Directive requires almost all river basin districts to identify areas where there is a significant potential flood risk. The identified flood risks are needed to be reduced as much as

possible to ensure greater human and economic security. This article presents the characteristics of the Tisza River, which are endangered by hydrological extremes. In the case study we attempt to identify the problems with the water conveyance capacity, especially in connection with the land use and forest management practices on the floodplain areas. According to our measurements, these activities have a significant effect on the conveyance ability of the floodplain directly and also indirectly. Land use in the floodplains has changed continuously in the last decades. The increase of forest area resulted in a decrease of the water conveyance capacity in the floodplain. It caused significant negative impact on flow velocity, sediment accumulation and flood levels. Following the remarkable flood events of the early 21st century, dyke sections in the Middle Tisza District were relocated to improve the conveyance in the floodplain area. The other challenge is to develop new practices related to use of the landscape for maintaining the conveyance capacity, taken into consideration the Water Framework Directive and the conservation of ecosystem services. Further aim is to demonstrate the applicability of a two-dimensional hydrodynamic model to study the effects of the restoration measures. In a pilot area, we tested the optimal restoration measures (dyke relocation, land use change and afforestation technique), which can significantly improve conveyance. Based on the modeling results, conveyance capacity of the floodplains can be increased, resulting in flood risk reduction. If the pilot area study gives satisfactory results in practice, it could be applied to other similar river sections in the Danube catchment area.

Introduction

The Tisza River Basin *(fig. 1)* drains an area of 156,869 km². Five countries are sharing this largest sub-basin of the Danube River Basin (Romania, Ukraine, Slovakia, Hungary, and Serbia). The Tisza River is the longest tributary of the Danube (966 km), and the second largest by flow, after the Sava River (ICPDR 2019).

The Tisza River itself can be divided into three main sections:

- **The Upper Tisza** upstream from the confluence with the Somes/Szamos River,
- **The Middle Tisza** in Hungary, which receives the largest right-hand tributaries: the Bodrog and Slaná/Sajó Rivers together with the Hornád/Hernád River collect water from the Carpathian Mountains in Slovakia and Ukraine, and the Zagyva River drains the Mátra and Bükk, as well as the largest left-hand tributaries: the Szamos/Somes River, the Körös/Crisuri River System and Maros/Mures River draining Transylvania in Romania,
- **The Lower Tisza** downstream from the mouth of the Maros/Mures River where it receives the Begej/Bega River and other tributaries indirectly through the Danube – Tisza – Danube Canal system.

The river regulation and dyke construction works were finished on the Hungarian section of the Tisza River in the early 20th century. These measures created a new situation for the Hungarian flood protection. Over time, one had to face new problems after the river has been confined between the dykes (Somlyódy 2011). The major challenges are that the river can deposit the transported sediment between the embankments. The other problem is that percentage of floodplain forests has increased tenfold over the last hundred years as a consequence of which morphology and pattern of the watercourse has been changed (Szlávik 2003). One of the largest increases in flood waves is caused by the rise of invasive species, which pose a serious challenge to the water management. The most invasive plant along the Tisza is the *Amorpha fruticosa* (Csiszár et al. 2013). These processes reduce the conveyance capacity of the floodplain areas and also increase flood peaks. As a result of these processes a lower maximum flood discharge can produce the highest ever measured water level *(fig 2.)*

Climate change is also a major cause of increasing weather extremes and affects the hydrological cycle (Mauser et al. 2018). Over the past decades, several extraordinary floods have occurred on the rivers in the Danube River Basin. Each of the flooding levels that emerged caused centennial flood waves and significant human and economic damage in 2000 along the Tisza River. Vizi et al. (2018) studied the

Figure 1: An overview of the Tisza River Basin. Credit: ICPDR

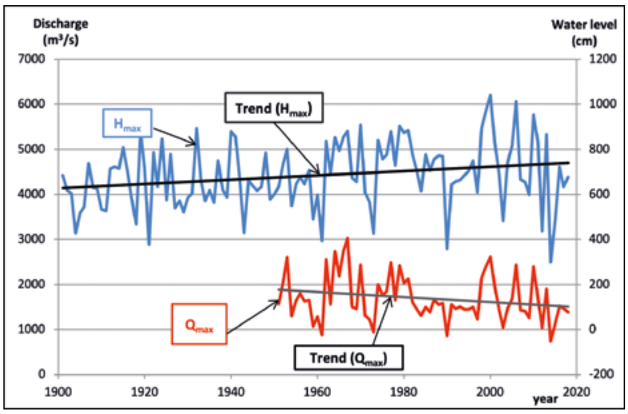

Figure 2: Maximum discharge and water-level of river Tisza at Szolnok. Credit: Dávid Béla Vizi

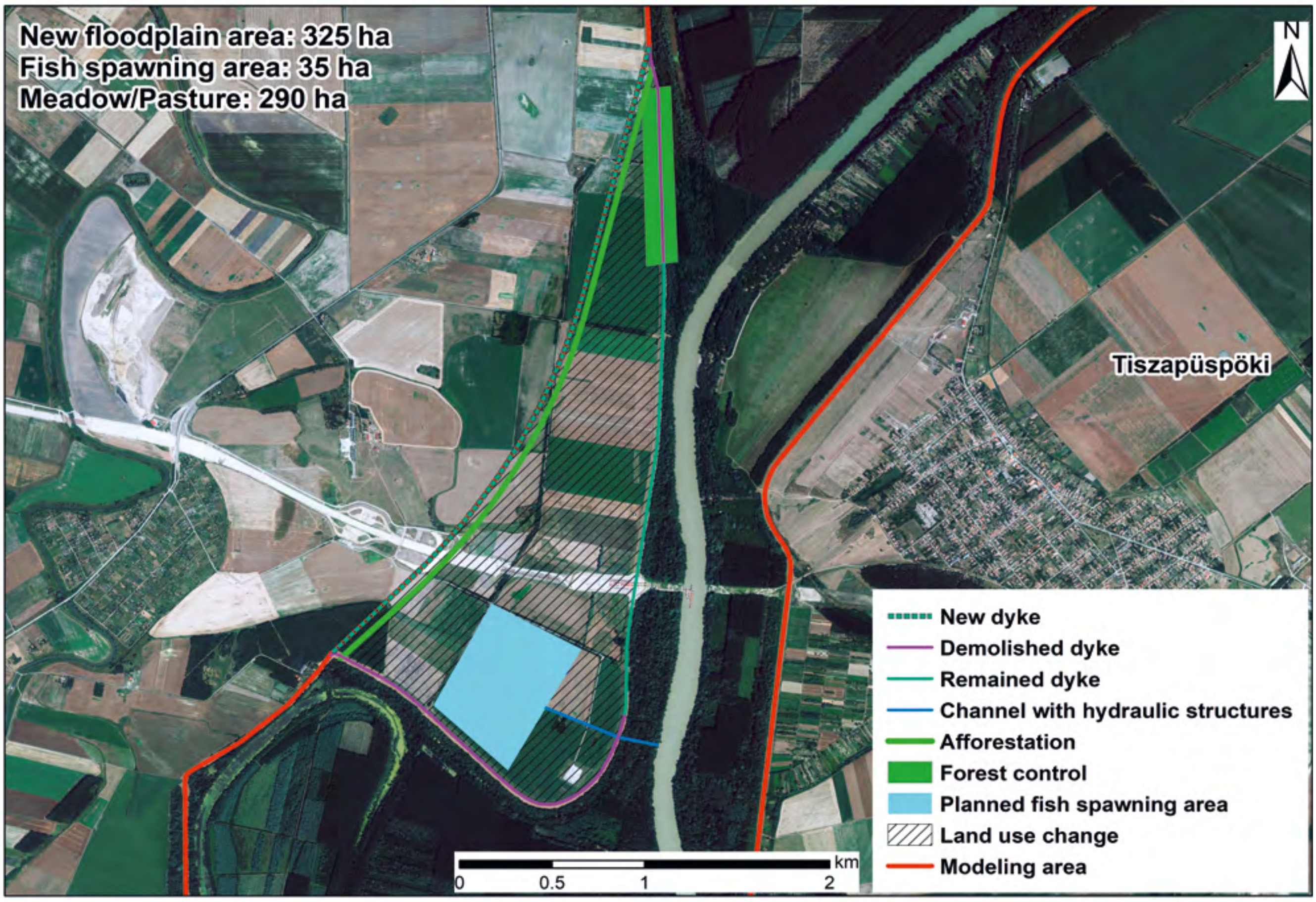

Figure 3: *Location of the pilot area near Szolnok, Hungary. Credit: Tamás Právetz*

impact of increasing flood peaks caused by climate change, which is further increased by declining conveyance capacity.

To handle increasing flood risks within the European Union the No. 2007/60/EC Directive requires almost all river basin districts to identify areas there is a significant potential flood risk or likely to occur. The identified flood risks are needed to be reduced as much as possible to ensure greater human and economic security. Following the remarkable flood events of the early 21st century, dyke sections in the Middle Tisza District were relocated to improve the conveyance in the floodplain area. The other challenge is to develop new agricultural and forestry practices related to the use of the landscape to improve the conveyance capacity, while taking into consideration the Water Framework Directive and the maintenance of ecosystem services (GDWM 2018).

The tool for this study was the two-dimensional HEC-RAS hydrodynamic modelling software. We had the opportunity to examine the impacts of different types of measures on floods. Hydrodynamic modeling has become an important tool for impact assessments. In addition to flood peak reduction, changes in flow conditions can also be analyzed.

Study area

The project area is Besenyszög-Fokorúpuszta in the floodplain on the left side of the Middle Tisza near Szolnok town *(fig. 3)*. The Tisza's full gradient is 30 m (5 cm/km) in Hungary. Based on the Middle Tisza District Water Directorate (MTDWD)'s hydrometric data, the minimum discharge of the river is 46.9 m^3/s, and the maximum discharge is 2,610 m^3/s at Szolnok. The long-term average discharge is 532 m^3/s at this river section. The highest ever measured water-level was 1040 cm at Szolnok in 2000. The water level fluctuation is 1,320 cm between the highest and lowest values.

A central element of the restoration is the planned dyke relocation. Approximately 6 km of the dyke will be relocated for a wider active floodplain between the dykes. The result of this relocation will yield an approx. 280 hectares larger floodplain area. For the new dyke construction, a borrow pit in the area will be used, that will be partly filled up with the material from the demolished dyke and used as a fish spawning area for ecological benefit. The planned main land use in the new floodplain area is grassland; lower parts will be left as periodically inundated for wetland habitats without an outlet. The fish spawning area is designed to be connected to the river Tisza with a canal. New forest zones are planned outside the major flood inundation area. In the future, they want to promote grazing in new floodplain areas, in order to help to maintain water conveyance capacity.

In a pilot area, we tried to identify the optimal restoration measures (dyke relocation, land use change and afforestation technique), which can improve runoff. The approach of an integrated river basin management has a high priority in

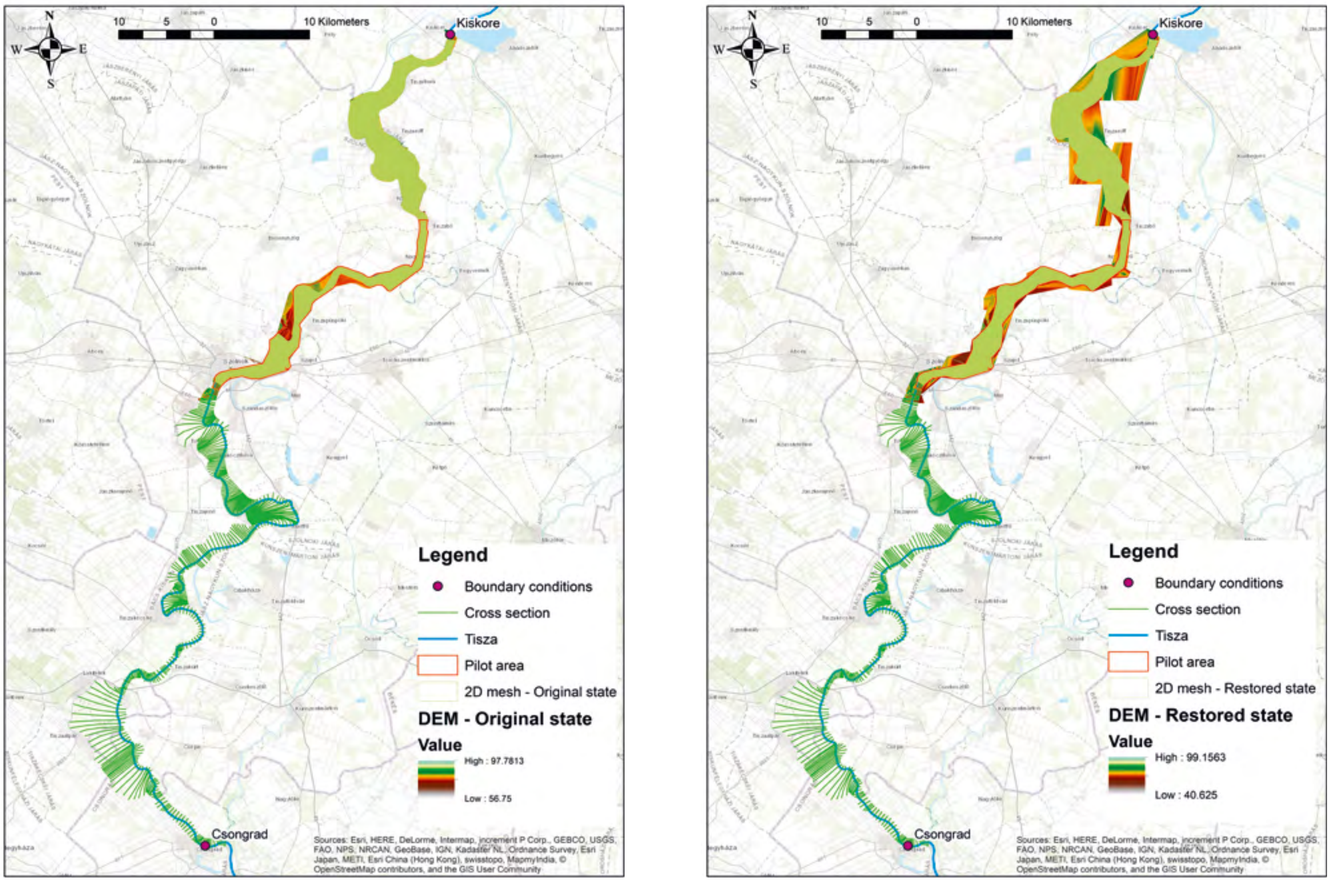

Figure 4: Model versions for original (left) and restored (right) states. Credit: Dávid Béla Vizi

Hungary. By identifying optimal interventions, flood protection can be brought closer to other water-related sectors. The study areas can serve as a good example at river basin level.

Methods

The HEC-RAS modelling software was developed by the Hydrologic Engineering Center (HEC) of the US Army Corps of Engineers. The program has been successfully used for one- and two-dimensional modelling in the United States of America for all major rivers (US Army Corps of Engineers 2016).

The model for the pilot study was developed by the MTDWD. The model geometry was based on a previous version (current state), which was used for the modelling of the impact of some measures along the Tisza. This model version was updated for the Danube Floodplain project (http://www.interreg-danube.eu/approved-projects/danube-floodplain).

The model includes an approx. 160 km long river section of the Tisza from Kisköre (403 river km) to Csongrád (246 river km). The model has two main parts: a 2D mesh between Kisköre and Szolnok, and a 1D river section between Szolnok and Csongrád. That 1D section was needed to have enough space between the pilot site and the downstream boundary. We did not increase the computation time as much with this solution as if we had increased the 2D mesh. The 2D mesh only included the floodplain area between the dykes, so there were no significant settlements in the pilot area.

We developed three different model geometries (original state, R1, R2). The original state version does not include any dyke relocation and afforestation measure, which were done in the last five years. This calibrated base model geometry represents the condition of the river in the early 2000's. We incorporated the new dyke relocation measure into the R1 and R2 versions. We also modified the roughness in every geometry version in order to reflect land use changes between the scenarios. The R2 geometry included a fish spawning ground and a new runoff area in the floodplain. Figure 4 shows the model versions for original and restored states.

The MTDWD has performed a survey in 2018, which was part of a Hungarian project. The main goal was to update the river geometries along the Tisza valley. The river bed and the floodplain area were measured separately. The Digital Elevation Model (DEM) was composed from the measurement of the river bed and floodplain, which was used in the Danube Floodplain project. The resolution of the geometry is 1 meter.

The geometries have a 2D flow area with 25 x 25 meters wide computation point spacing. The default Manning's value is set during the calibration and validation. The 2D mesh is the same in the R1 and R2 versions. Table 1 contains the relevant information regarding the 2D mesh.

Table 1: Information about the four geometries' 2D mesh. Credit: Dávid Béla Vizi

Geometry	Number of nodes	Nodes distance [m]	Nodes per km^2	Average cell size [m^2]	Default Manning's value
Original state	158,159	25	1,588	629.66	0.08
Current state	165,057	25	1,597	626.04	0.08
R1 state	170,182	25	1,602	624.19	0.08
R2 state	170,182	25	1,602	624.19	0.08

The cross sections are the basis of the one-dimensional models. The calibration and the roughness coefficient only partly compensate the possible inaccuracies of the cross-sections. The one-dimensional cross sections came from the Hungarian project from 2018. Cross-sections were measured every 100 m in the Middle Tisza district. The model stability is greatly improving if the cross sections are as dense as possible. Based on previous modelling experiences, the optimal distance between cross sections – from model point of view – is 400–800 m for the Tisza. The one-dimensional river section is the same in all model geometries. Between Szolnok and Csongrád (approximately 90 km), 342 cross-sections were integrated into the model.

We determined the land use types in the floodplain by aerial photographs, i.e. by ortho-photographs, as well as by the results of on-site inspections. The roughness factor was changed cross-section wise according to floodplain land use types. The roughness (smoothness) factor assigned was determined on the bases of Hungarian standard, as well as on the bases of values applied also by HEC-RAS and proposed by Chow (1959). The smoothness factors assigned to individual cultivation branches overlap each other as there is no possibility for making sharp difference between the categories of "sparse thicket" and "dense thicket".

The HEC-RAS model applied for the detailed description of the entire river system provided an opportunity for taking into consideration the hydraulic engineering structures, like bridges, barrages, culverts, overflow weirs, floodgates, bottom stages, bottom sills, side overflows and gates, static reservoirs, pump head stations and water intakes.

The model contained the dykes between Kisköre and Csongrád. The dykes were integrated into the DEM for the 2D river section. The cross-sections of the 1D river section also include the right and left dykes. The model also contained two bridges in the 2D mesh and one in the 1D river section near Szolnok. We took into consideration the bridges in the 2D section when we modified the DEM.

We used real events as a basis of our hydrological data. The MTDWD has made monitoring along the Tisza River. The

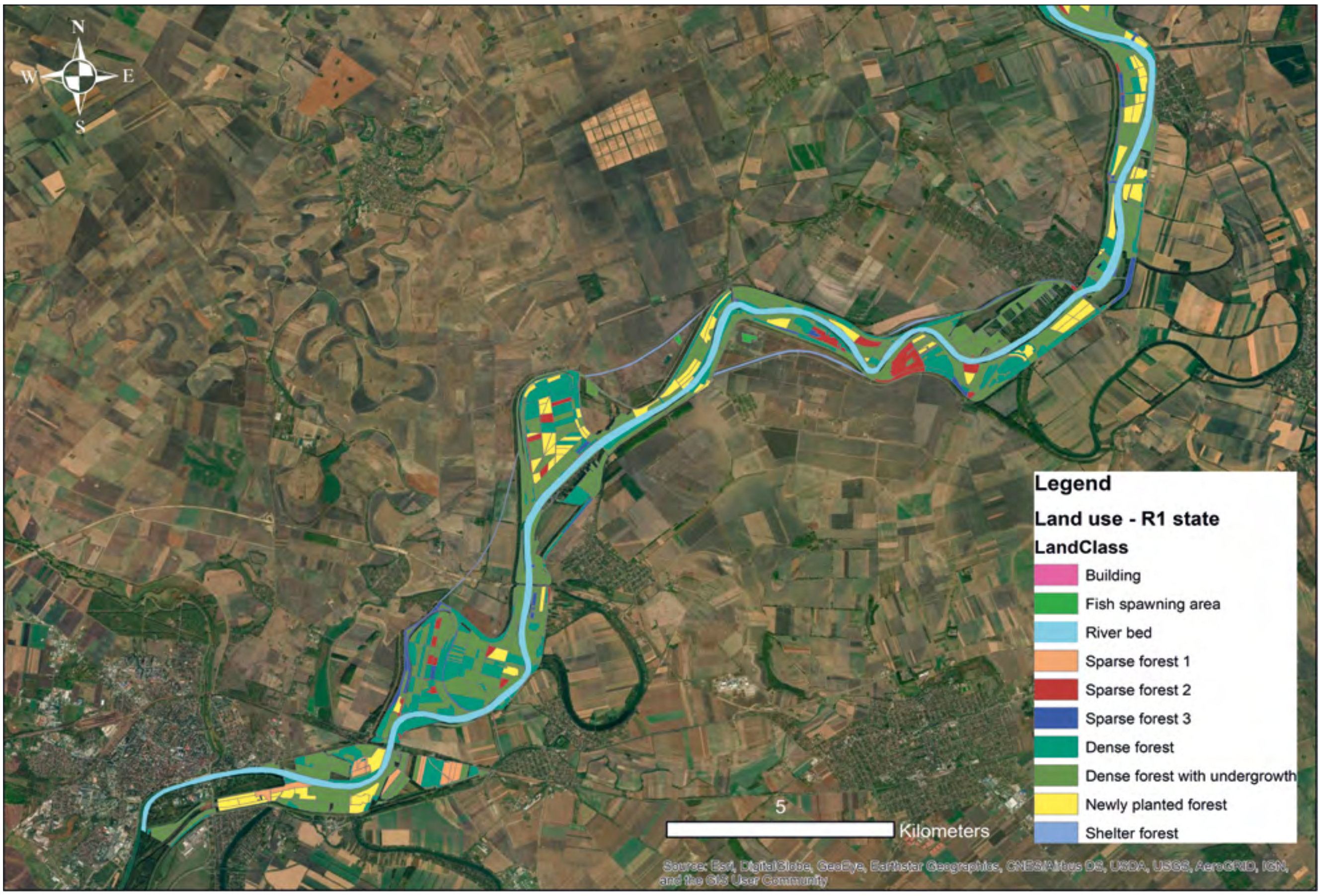

Figure 5: Land use in the R1 scenario. Credit: Dávid Béla Vizi

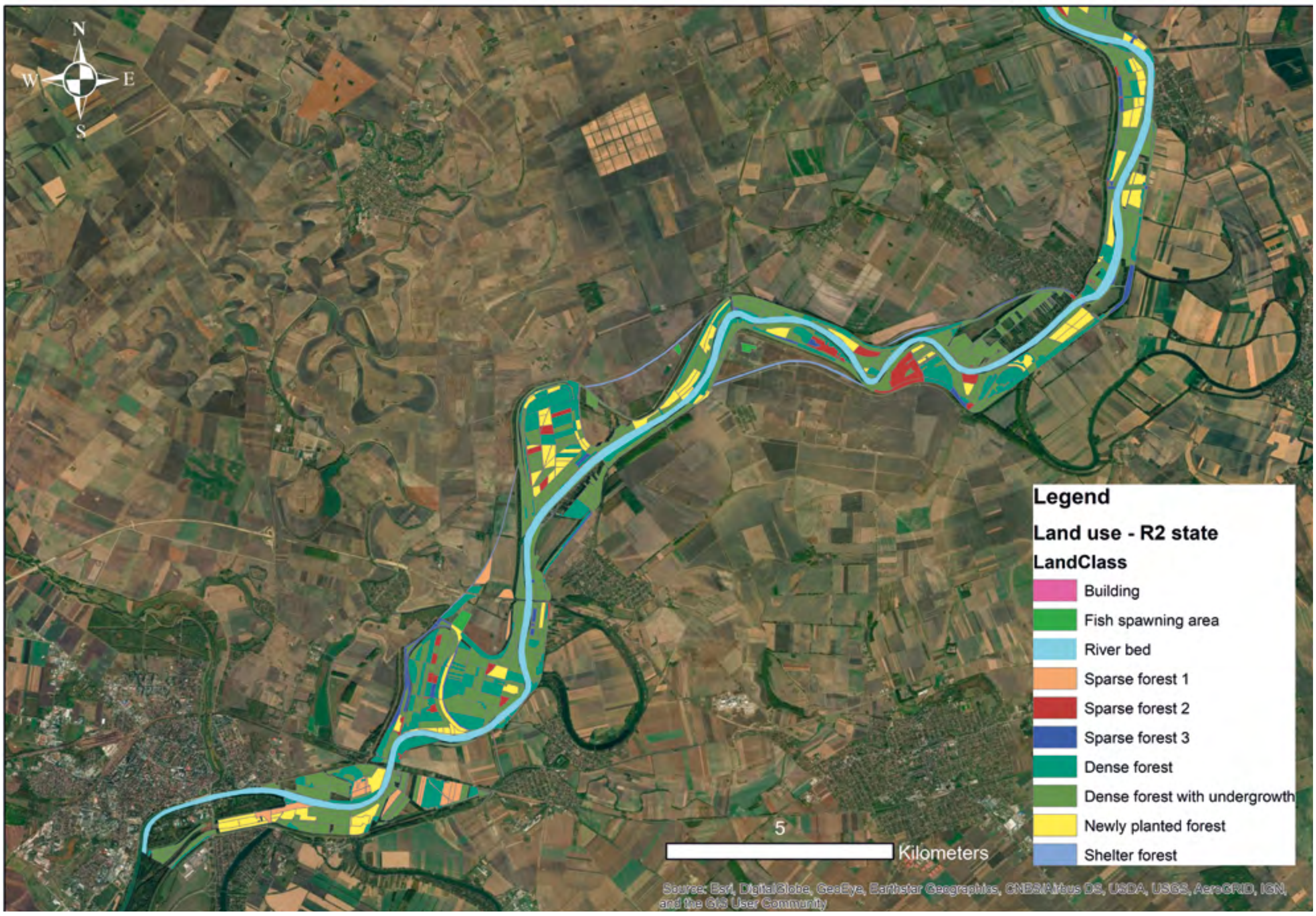

Figure 6: *Land use in the R2 scenario. Credit: Dávid Béla Vizi*

following events were simulated: HQ2, HQ10, HQ100. Each HQ is based on the same flood wave. We have the official HQ values for Kisköre, which is the upstream boundary condition in the model *(tab. 2)*.

We modified the flood peak according to the official HQ values for each HQ. Every model run had a one month long “warmup” period with a steady state value. We made that to have a more stable unsteady flow simulation. The steady state value was 512 m^3/s at Kisköre.

Each restoration scenario included dyke relocation measures. The new dyke course was integrated into the geometry. The R1 version considered the new floodplain area as a pasture (change in land use) *(fig. 5)*. There is an 80 m wide shelter forest next to the new dyke (change in land use).

Our main aim with R2 is to increase the effects of the restoration measures without harming the flood protection *(fig. 6).* The R2 version has a new fish spawning area in the pilot site (change in land use). There are some forest regulation measures in this scenario: shelter forest next to the dyke, and new floodplain forests in the floodplain areas where the water flow is negligible. The runoff is increased with removing the invasive species in an area where the vegetation is quite dense (change in land use).

The main challenge was that there was no substantial flood wave since the dyke relocations were finished on the Middle Tisza region. The original state scenario was needed for that purpose. We used the flood wave of 2000 for calibration with an old geometry, representing the characteristic of the early 2000’s. This flood wave produced the highest water levels in the Middle Tisza. The calibration of the model was accomplished gradually, starting with the shorter sections (1D and 2D separately). We assembled the individual sections and then performed the river sections. We had 3 calibration station: Tiszaroff, Tiszabő and Martfű. The average difference between the computed and the observed data is 5–10 cm at each control point which was considered as a good result.

Table 2: Discharge values for each HQ scenario

Scenario	Discharge [m^3/s]
HQ5	2,107
HQ10	2,363
HQ100	3,012

Results

The hydraulic simulations of the different scenarios in the Middle Tisza pilot area reveal neglectable effects in the peak discharge of the flood waves of below +/- 0.5 %. The time lag of the flood peak is notable in all events in the R1 scenario with a maximum 15 hours peak delay in the HQ100 event. The time difference is lower in the R2 scenario and there is no change in the HQ10 event.

The flooded area has increased through the dyke relocation by ca. 4.4 to 6.2 % and thus the storage volume is 3.9 to 5.0 % higher compared to the current state (CS). The average water depth can be increased through this augmentation of the flooded area by more than 6% in both restoration scenarios in all investigated hydrological scenarios.

We decreased the water level with the dyke relocation and land use change in R1 compared to the current scenario. The difference is 5-15 cm near to the pilot site. The R2 version did not cause further reduction in the water level. The aim was to increase the ecological status while the flood risk is not rising.

Locally the effect was visible in a decreased water depth upstream of the dyke relocation up to 0.5 m up to the upper model boundary. Downstream of the dyke relocation there is no change in the water depth. Looking at the velocity, the flow speed in the Tisza riverbed is decreased, but this reduction is just visible for ca. 7 km of the river length.

Table 3: Results of the 2D simulations. Credit: Dávid Béla Vizi

		HQ5	HQ10	HQ100
Q_{max} [m^3/s]	out CS	1,929	2,273	2,904
	out R1	1,927	2,275	2,905
	out R2	1,937	2,275	2,906
Delta Q_{max} [m^3/s]	R1-CS	-2	2	1
	R2-CS	8	2	2
Delta t [h]	R1-CS	8	4	15
	R2-CS	7	0	6
Change in flooded area [%]	R1-CS	6.2	5.0	6.2
	R2-CS	6.1	4.4	6.1
Change in volume [%]	R1-CS	4.5	5.0	5.0
	R2-CS	3.9	4.4	5.0
Average water depth [m]	CS	3.70	5.20	5.97
	R1	3.63	5.14	5.90
	R2	3.61	5.12	5.90
Average flow velocity [m/s]	CS	0.150	0.200	0.220
	R1	0.140	0.180	0.210
	R2	0.150	0.190	0.220

Conclusions

The flood peaks along the river Tisza have shown an increasing trend over the last decades. The process began during the dyke construction works in the 19th century. The river was confined in a narrower floodplain area between the dykes. That is the only area where the river can deposit the carried sediment. Due to this process and the increasing size of the dense forest areas, the water conveyance capacity of the floodplain was reduced. In response to these processes, the MTDWD started dyke relocations. The integrated water management practice was also promoted on the new floodplain areas.

In addition to increasing the conveyance capacity, more emphasis was placed on the design of optimal land uses. Primary runoff areas continue to serve the purpose of flood protection in the floodplain with increased conveyance. On the other hand, creating the fish spawning areas were both ecologically and economically beneficial and did not pose any flood risk.

During the pilot study, different measures could be taken into account in determining geometry (e.g. dyke) and land use (forest areas, grassland). The main challenge was to calibrate the model sufficiently. The last significant flood wave was in 2013 along the Tisza. The dyke relocations were finished after this flood wave, so we did not have a new flood wave with the current dyke course to calibrate or validate for the current status. That is why we created an original state version with the old dykes along the pilot area. We could calibrate the model for this version, and compare the new geometries with this.

The initially specified purposes of restoration were partly met: the conveyance capacity and the floodplain area were increased and show the significant effect in flood volume storage. However, the decrease of the flood hazard with the two restoration scenarios only can be considered as a local effect. The impact of ecological measurements should be determined by other tools (e.g. cost-benefit analysis).

Acknowledgements

The Danube Floodplain project is co-funded by the European Union ERDF and IPA funds focuses on interactions of two key aspects, improving transnational water management and flood risk prevention while maximizing benefits for biodiversity conservation.

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Microbiological water quality of rivers in Serbia

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Introduction

In response to the growing pollution pressures to which freshwater ecosystems are exposed, water protection becomes one of the most important issues for the European Union (EU). Therefore, EU has established the Water Framework Directive (WFD, EC 2000) together with several other Directives (EC 1991ab, 1998) such as Urban Waste Water Treatment Directive, Nitrates Directive, Drinking Water Directive, etc., which represent the integrative legislative for the protection of all EU water resources (surface and ground waters). In the Republic of Serbia (RS) in the 2012 year, for the first time, surface water monitoring which was in the line with the WFD requirement was performed. This was preceded by the adoption of the Water Law of RS in 2010 (Official Gazette of the Republic of Serbia 30/10) together with other by-laws which are harmonized with the WFD. For the surface waters, in the RS, a total of 498 water bodies has been chosen for assessment (the latest number has been significantly increased by update in 2020), and for each of them, one sampling site is used for monitoring by the Status of the Surface Waters of RS (strategic document of Serbian Environmental Protection Agency 2018 related to development of monitoring within river basin management plans). About 69% of all water bodies in Serbia is represented by rivers, 28% are significantly altered water bodies and 3% artificial water bodies. Due to the lack of financial and human resources unevenness in the realization of monitoring program between years can be noticed and also unevenness in the spatial distribution of realized monitoring sites.

Water quality of the smaller water bodies which are not included in routine monitoring should not be neglected. Their impact on the major water courses could be significant, especially from the aspect of possible pollution hotspots which could be overseen due to lack of control. Considering that some of the indicated water bodies are used for other human related activities e.g. irrigation, knowledge of their microbiological quality is of high importance. Therefore a comprehensive survey is planned which will cover 100 sites situated at natural, altered and artificial water bodies not included in the monitoring program.

Indicator bacteria which are widely used in the assessment of the sanitary aspect of water quality belong to the group of coliforms. Coliform bacteria, primarily *Escherichia coli,* and intestinal enterococci are considered the basis of faecal pollution monitoring (Byamukama et al. 2005, Kirschner et al 2014). In the current study, *E. coli* was chosen as precise indicator of faecal pollution and the potential presence of pathogens.

Samples and sites

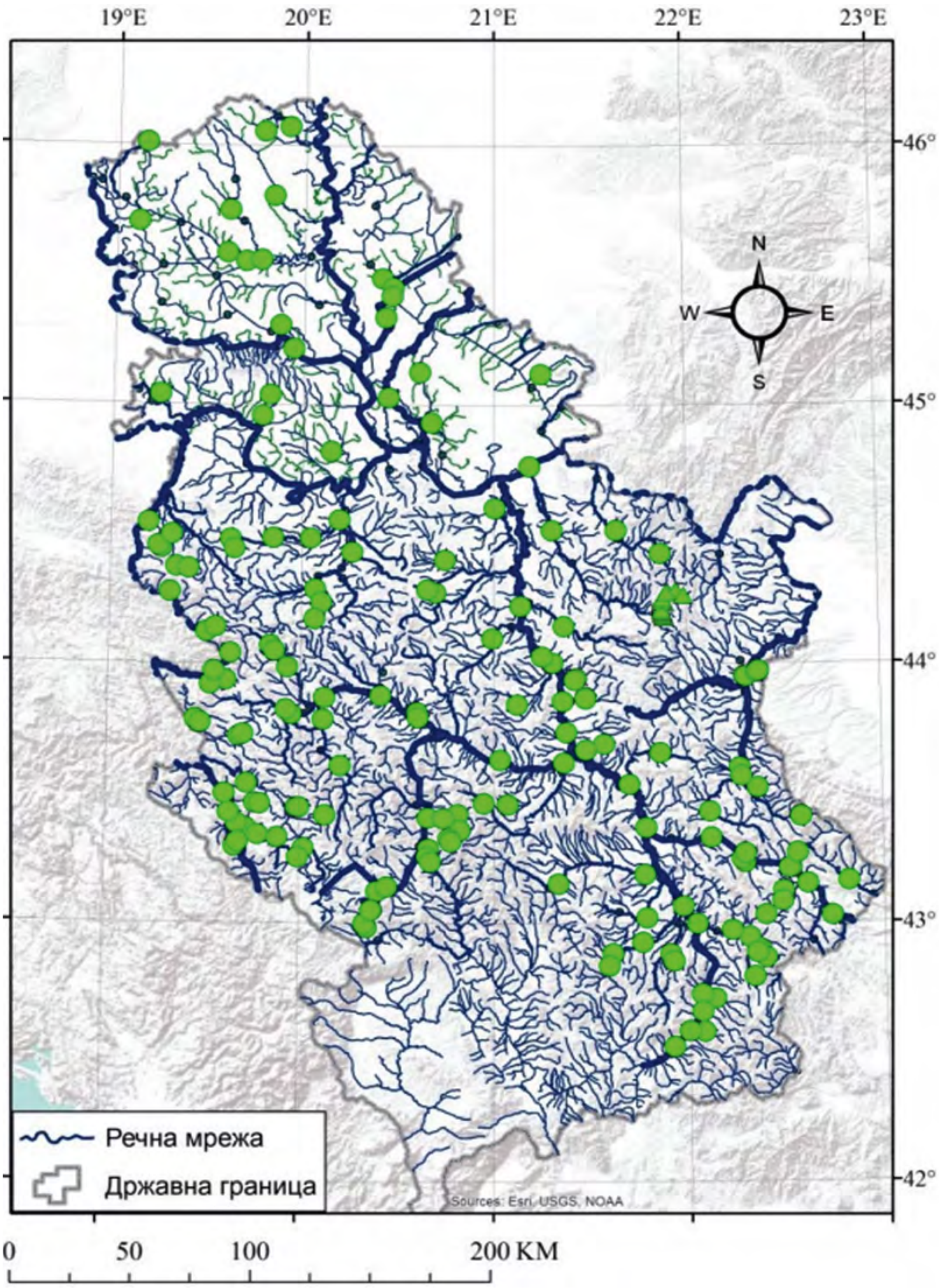
Water samples were collected in 2019 from 40 sites. An overview of all 100 sampling sites planned for the survey is indicated in figure 1.

Methodology

Water samples were collected in 500 ml sterile glass bottles approximately 30 cm below the water surface. Samples were stored in dark at 4 °C and transferred to the laboratory where samples were processed within 6 h of sampling. Quantification of *E. coli* was performed by Colilert Quanti-Tray 2000 system, which provides a Most Probable Number (MPN) result, based on a colour change/fluorescence in 97 tray compartments of the IDEXX tray. Powdered reagent Colilert-18 was used for cultivation following the instructions of the manufacturer. Trays were incubated at 37 °C for at least 18 h. For the assessment of the water quality based on *E. coli* numbers, a classification scheme developed for the Danube River was used (Kirschner et al. 2009).

Results and discussion

The results of the survey based on 40% of processed samples are summarized in figure 1. According to the numbers of *E. coli* in samples, 18% of the samples were characterized by a low level of pollution while 25% were moderately polluted. It is alarming that 57% of the investigated sites were found to be under the high influence of faecal pollution, thus belonging to the class of critical (25%) and strong pollution (32%). As expected, most of the sites where critical or strong pollution was recorded were located near settlements or cities where communal waters are discharged without any previous treatment. Among the investigated waterbodies, we have also selected a few irrigation channels used in agricultural areas. Most of these showed a moderate or critical degree of pollution. There are rural settlements near these sites, and detected faecal pollution most likely originates from the wastewaters of households or farms. In addi-



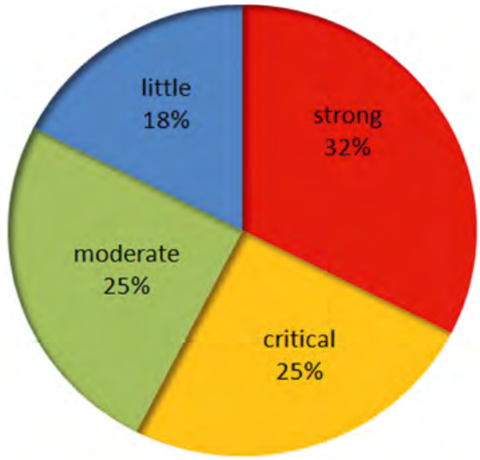


Figure 1: Above: Map of all 100 sampling sites (green dots) which will be addressed in the survey, 40 sites were used for microbiological analyses; grey lines: catchment limits. Pie chart: Distribution of the samples within different classes of pollution based on E. coli numbers.

tion, these channels are characterized by poor water flow, which results in the persistence of faecal pollution. On the other hand, sites on mountain streams and sites located upstream of populated areas showed the expected low or moderate pollution.

Conclusions

The survey is still in progress and the data obtained from the remaining sites is needed to provide a full insight into the status quo regarding the level of faecal contamination of water bodies in Serbia. Based on the samples processed so far, the seriousness of the situation is more than evident. In further research, the origin of faecal pollution at impacted sites will be traced using quantitative PCR - based assays for the analysis of general-, human- or animal-associated genetic Bacteroidetes faecal markers.

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Improving water quality for nature, humans and the Black Sea – the launch of the IDES project funded by the Danube Transnational Programme

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25 partners of ten countries along the Danube (Germany, Austria, Romania, Hungary, Slovenia, Slovakia, Bulgaria, Serbia, Croatia and Moldavia) join forces in the EU-funded project IDES to improve water quality in the Danube River and its tributaries by integrative floodplain management based on Ecosystem Services. Synergies instead of trade-offs, identified by an impartial evaluation tool, will foster the implementation of water quality management for a better environment both for nature and humans.

Background

National governments have committed themselves to the aim of reducing the nutrient loads transported by the Danube in order to ensure and enhance the ecological status of the Danube. The challenge of reducing the eutrophication of the Danube and its tributaries, and thus of the Black Sea, can only be met by transnational basin-wide cooperation. Diffuse pathways clearly dominate overall emissions, with rural emissions as major source. Emissions differ extremely between regions, but every region is affected: e.g. Germany and Slovenia produce the highest area-specific N emissions in the basin, Serbia generates the highest area-specific P emission rates (ICPDR 2015). Near-natural floodplains or buffer strips have high potential to reduce nutrient pollution, small but specific areas of them may even contribute significantly to reducing the nutrient inputs and to increasing the nutrient retention rates (Gericke et al. 2020). However, floodplains are subject to multiple human uses which strongly affect the water quality of rivers. Water quality management faces immense competition with other interests in floodplains (e.g. land use, fishery, navigation, flood retention), thus leading to very slow progress in implementation. So far, these uses have been managed sectorally (e.g. water management, nature conservation, agriculture), rarely regarding water quality or interactions between sectors. The ongoing project Danube Floodplain (Rîndasu-Beuran 2019) links attempts to improve flood retention and restoration, while water quality is not yet in focus. IDES project aims to add water quality targets to this effort and improve water quality by developing integrative floodplain management based on ecosystem services.

Ecosystems offer many services to human well-being (MA 2005). Along rivers and floodplains, nature provides manifold services, for instance flood protection, nutrient retention, drinking water, food and fibre production, habitats for biodiversity and possibilities for recreation, heritage or education (Grizetti et al. 2015). Degraded floodplains, in contrast, are not able to offer these goods or only in strongly reduced amounts. Taking into account all relevant ecosystem services, a multi-functional and sustainable water and floodplain management can be established. Implementation and awareness of the ecosystem service approach varies widely in the Danube region (Badura et al. 2018), but so far it has not been used pro-actively anywhere for spatial planning or as an official part of planning or permission procedures. The use of a River Ecosystem Service Index in Germany has shown that water management significantly improves when synergies between various ecosystem services, which reflect the various sectoral interests and targets, were identified (Pusch et al. 2018, Stammel et al. 2020).

The IDES Project

Against this background, a consortium of 11 project partners from seven countries (Germany, Austria, Slovenia, Hungary, Serbia, Romania, Bulgaria) and 14 associated strategic partners (additional countries: Slovakia, Croatia, Moldava and three international associations) started the project IDES – Improving water quality in the Danube river and its tributaries by integrative floodplain management based on Ecosystem Services in July 2020. After an application phase of almost two years, there are now 30 months of intensive cooperation for this task. Financial support is provided by the ERDF fund and the IPA fund in the Danube Transnational Programme.

The IDES project aims to develop and implement a transnational integrative ecosystem service approach to improve water quality management and thus to generate win-win-situations for multifunctional floodplains instead of trade-offs. In the future, the new IDES evaluation tool should enable the national key actors in water quality management to identify the most sustainable measures without neglecting the needs of other sectors and thus reduce target conflicts among different interests. The application of the innovative IDES tool in five pilot areas in Austria, Slovenia, Hungary, Serbia and Romania (fig. 2) will provide best practice examples and water quality management concepts co-created with local, regional and national stakeholders. On the transnational level, a joint strategy on how to employ this homogenous approach in water management will accelerate integrative management and thus the development of multi-functional green infrastructure in the Danube region.

Three workpackages, one single aim: development of the IDES tool

During the two-and-a-half-year implementation timeline, the actions of three technical work packages will focus on the following:

In work package 1 one focus is on the analysis of the actual situation of water quality and its pressures (mainly via the geographical explicit model MONERIS, Venohr et al. 2011) and of ecosystem services in the whole Danube region by GIS analysis and literature review. Based on these

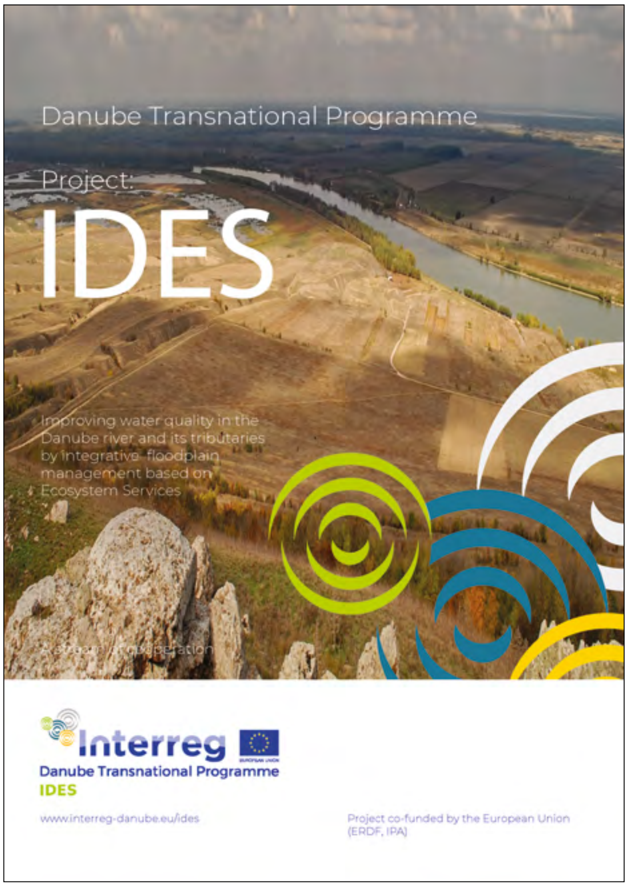

Figure 1: Official poster of the IDES project

enquiries, harmonization of already existing evaluation approaches and a joint framework of the new IDES evaluation tool will be developed. The tool will support planners in assessing all relevant ecosystem services, either provisioning, regulating or cultural services, homogenous in the same range and for the same spatial relation. The tool will enable spatially explicit assessment of the status quo and characteristic discharge situations (e.g. extreme flood events), but also of predicted water quality management options.

In work package 2 sustainable water quality management actions will be identified in five pilot areas reflecting different territorial and practical challenges. At two stakeholder workshops, innovative water quality management concepts will be jointly discussed and elaborated. Different scenarios will be assessed by the newly developed IDES tool leading to a smooth graphical visualization of the results and a more objective decision making. The results and the experience from the pilot actions will be summarized in the IDES manual and passed on to key actors of the participating countries during national training courses conducted by work package 1.

Work package 3 will subsequently develop a joint strategy to ensure the implementation of the IDES approach at political and administrative level. Both national action plans and a transnational strategy will provide the operational pathway to integrate the ecosystem service approach in future water quality planning processes. Based on the findings of work package 1, all partners will agree on areas of high priority for water quality management actions alongside transnationally relevant rivers. They will be identified by combining the spatial evaluation on nutrient emission and water quality-related ecosystem services. Based on experiences of work package 2, recommendations on applicable water quality management actions will be described. By bringing both packages together, the most effective and promising water quality management actions (both in terms of areas and measures) will be prioritized in spatially explicit national action plans to support the tasks and mandatory evaluations (e.g. EU WFD) of water management authorities. As an important step, feedback from a transnational stakeholder workshop will be included helping to fine-tune the IDES tool and strategy in the final phase and to foster its implementation.

At the end of the IDES project in December 2022, the project will have produced eight outputs:

1. IDES tool: a method to evaluate ecosystem services homogenously as a basis for integrative floodplain management
2. Stakeholder workshops in five pilot areas focusing on water quality and ecosystem services
3. Water quality management concepts in five pilot areas
4. Implementation of the IDES tool in five pilot areas
5. IDES manual, including best practice examples and recommendations
6. National training courses for key actors in the water sector on the application of the IDES tool
7. Transnational stakeholder workshop in September 2022 in Budapest
8. Transnational strategy for implementing the IDES approach including national action plans

Virtual kick-off

The IDES project started in July 2020, just before the summer break. The kick-off event in September took place in the castle of Grünau near Neuburg/Danube in Germany, where the Lead Partner, the Aueninstitut Neuburg is based. But, like most events in this COVID-19 affected year 2020, it was held virtually. The kick-off event brought together key stakeholders and international project partners, a to tal of 99 participants from ministries, authorities, agencies, NGOs and universities, and from different disciplines (water management, environmental science, planners, foresters etc.). A mid-term conference will be held back-to-back with the postponed 43rd IAD conference in the second week of June 2021, hopefully as a real meeting in Neuburg or, if the pandemic still determines our everyday lives, again as a virtual event.

For more information about the project co-funded by the European Union (ERDF, IPA) visit the website www.interreg-danube.eu/ides. If you are interested in regular information, please subscribe to the newsletter http://www.interreg-danube.eu/approved-projects/ides/campaigns.

Figure 2: Pilot Area "Braila Island" in the south-east of Romania along the heavily modified Danube with both wetlands and agricultural land providing many ecosystem services (source: RCSES; Tudor Racoviceanu)

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How "*We Pass*" is Opening the Iron Gates to Danube Migratory Fish Species

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A recent report (Deinet et al. 2020) found populations of migratory freshwater fish species to have declined on a global scale by 76% since 1970 – and the highest of those drops has been experienced in Europe. In order for migratory fish such as shad, barbel, and others to reproduce, they have to travel further upstream in rivers such as the Danube – the only such paths to their ancient spawning grounds. However, this important aspect of their life-cycle has been and continues to be hindered across the world. While dams along the Danube River certainly provide vital infrastructure and renewable energy sources for the region and citizens, their establishment presents a major blockage to the migratory routes of many Danube fish species. Sturgeons – the flagship fish species for the Danube – are also one such species of migratory fish, already long endangered before Danube dams blocked essential migration routes due to overfishing.

The We Pass project is an initiative aiming to facilitate fish migration in the Danube River Basin, set up in 2019 by the ICPDR, Jaroslav Černi Institute, DDNI, CDM SMITH | OAK Consultants, and the Norwegian Institute for Nature Research. The focus is on the preservation of habitat and reestablishment of migration routes for fish at the Iron Gates stretching over the river between Serbia and Romania. While sturgeons are by no means the only fish species impacted – though they are considered to be among the most endangered groups globally according to the IUCN Red List of Threatened Species – they are also a flagship species for the ICPDR. With concerted study and efforts such as We Pass though, these iconic fish can not only be saved from completely disappearing, but can have their numbers brought back up to healthy levels all along the Danube.

Efforts to raise awareness were highlighted at the We Pass kick-off event held on 9 April 2019 in Kladovo (Serbia) and included a site visit at the Iron Gates I Đerdap Hydroelectric Power Station. In attendance were project partners, stakeholders, representatives of the Đerdap Hydroelectric Power Station, and members of the public.

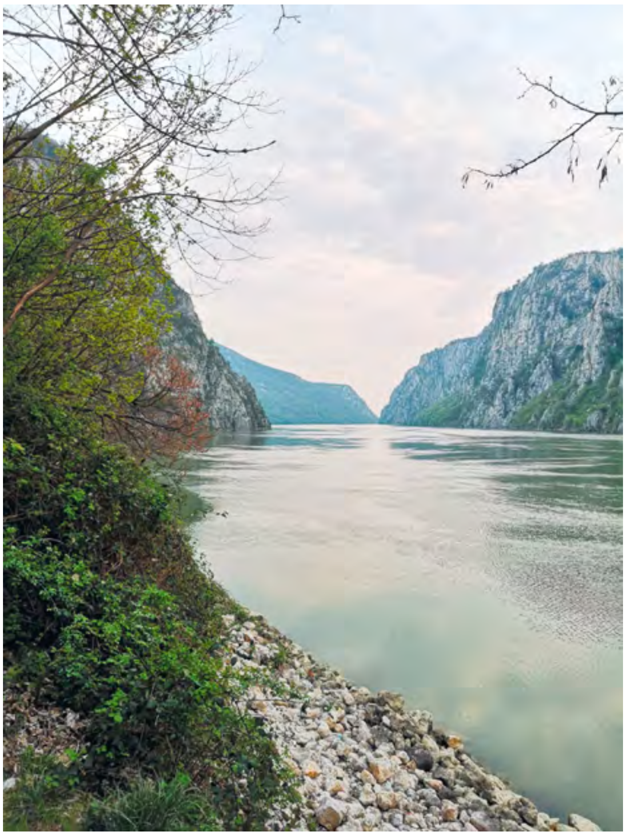

Figure 1: View of the Iron Gates gorge, Serbia-Romania border

The precise form of the solution We Pass will seek for the Iron Gates impasse is still under review. Initial studies are still ongoing, establishing the most effective and least disruptive way to get Danube fish migrating once again.

We Pass is combining its efforts with the similar and complementary programmes already in place across the region, addressing sturgeon migration, a key piece of the overall Danube conservation puzzle. Getting the sturgeon over this single set of obstacles will truly help them to reoccupy their former home upriver and to again become an expected and iconic sight all along the Danube.

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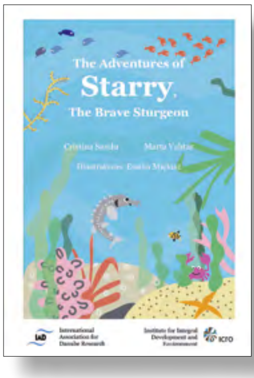
News and Notes

New children´s book on sturgeons released by IAD



As an active network, the International Association for Danube Research (IAD) wants to go beyond the development of scientific core topics on environmental issues. The IAD scientists know how important near-natural rivers and associated wetlands are for human well-being. The role of healthy river landscapes such as the Danube, which connects 10 countries in Europe, has become increasingly important in recent decades. In order to increase awareness of the conservation of aquatic habitats and their animal and plant species, the IAD has published an e-book for children in cooperation with the Institute for Integral Development and Environment, Slovenia. It tells the adventures of a small sturgeon in the river and sea and the challenges it faces in its habitats. "The Adventures of Starry, the Brave Sturgeon" is suited for children aged 8-13 years. A coloring book was also designed for children aged 4-7.

The e-book and the coloring book were written in English and translated into nine languages of the Danube region: Bulgarian, German, Croatian, Romanian, Serbian, Slovak, Slovenian, Hungarian and Ukrainian.

The e-books, pdfs as well as the coloring book are available free of charge under this link: https://www.danube-iad.eu/index.php?item=educational_issues

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Gertrud Haidvogl

Obituary Univ.-Prof. Dr. Elsa Leonore Kusel-Fetzmann

The *"Grande Dame"* of Austria's Hydrobotany, Univ. Prof. Dr. Elsa Leonore Kusel-Fetzmann has passed away on 16 April 2020. We sadly have to accept this ultimate incident of her long life.

Prof. Kusel began her studies at the University Vienna in 1950 and finished her doctoral thesis entitled 'Contributions to Algal Sociology' in June 1956. This study already sparked her interest on floodplain waters of the River Danube as well as on biomass estimates of algal abundances and algal cultivation (Fetzmann 1956). In the same year she was employed at the Institute for Plant Physiology, University Vienna, by her doctor-father and head of the Institute, Prof. Karl Höfler. In the following years, Kusel published physiological lab work on algae as well as studies in the field (e.g. Fetzmann 1958). Together with Höfler, she published a pioneering work on Neusiedler See in 1959 (Höfler & Fetzmann 1959) and participated in the SIL-congress held in Austria with a paper on algal sociology of Danube floodplain lakes (Fetzmann 1961a). Latest at the congress if not earlier, she met Prof. Heinz Löffler and Prof. Reinhard Liepolt, both crucial for her career. Her Habilitation described the algal vegetation in floodplain lakes of the River Danube (Fetzmann 1963). The 'Kardinal-Innitzer Award' was granted to her for this study and she acquired the 'venia legendi' for Plant Physiology, Ecology and Hydrobotany. A year later, 1964 she married Dr. Hermann Kusel, a schoolteacher and marine algologist. Her publication oeuvre from that time is multifaceted including articles with physiological, ecological or systematic content. Besides her continuous interest in peat bogs throughout her career (e.g. Fetzmann 1961b), her opus contains marine work (e.g. together with her later husband, Fetzmann & Kusel 1962), studies on macrophytes (e.g. Kusel-Fetzmann & Lew 1972) as well as investigations on special habitats

(e.g. Kusel-Fetzmann 1966). It must be emphasized that her focus was always directed towards Hydrobotany sensu Gessner (1955, 1959). Accordingly, Gessner's encyclopedic two volumes became the initial 'must read' and inspiration for many of her students. It is only logic therefore that she initiated a separate group on macrophytes once the title Univ.-Prof. was awarded to her in 1973, and particularly after she became head of the Hydrobotany section in 1977. Already ten years earlier in 1967, Kusel began to supervise doctoral, and later master students. Among the first 12 dissertations 5 were concerned with the Danube and adjacent floodplains, two studies dealt with different aspects of the shallow lake Neusiedler See, two others with lakes at Lunz and the three remaining were physiological studies. Among several other articles on floodplains and the River Danube, Kusel-Fetzmann, Naidenov & Russev (1998) remain an essential element in her legacy.

Kusel's enthusiastic performance in the field and in the laboratory, her taxonomic knowledge and immense interest in all hidden aspects of the subject inspired undergraduates. She had a lucky hand in choosing her students, guided them as much as necessary but left space to develop own ideas and activities. Moreover, she introduced her scholars to scientific meetings such as the annual congress of the International Danube Association (IAD). She also was keen to acquaint them with scientists in the field of hydrobiology which was an easy task for her as a well-known and internationally linked hydrobotanist. Consequently, it is not surprising that she was proud of several students and associates which luckily made career in science or scientific management.

All her manifold activities in science, teaching, excursions, her engagement in associations, conferences etc. would not have been possible without the continuous generous backup by her husband Dr. Hermann Kusel who cared about the two daughters and family issues, besides serving as a high-school-teacher, and being a scientist and a notable musician himself.

Besides her own comprehensive oeuvre Elsa Leonore Kusel bequeathed many scientists, in Austria as well as abroad, to dedicate their research activities to the field of Hydrobotany and Phycology. Their scientific studies and projects continue and expand her research legacy keeping her intentions in mind.

We will always remember Elsa Leonore Kusel as a lively person, an influential teacher, and an eminent researcher. We believe that the Danube research community will commemorate her for her scientific contributions.

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Hydrological catchment of the River Danube

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