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Editorial

Thomas Hein: *Institute of Hydrobiology and Aquatic Ecosystem Management, University of Natural Resources and Life Sciences, Vienna, Austria, e-mail: thomas.hein@boku.ac.at*
Cristina Sandu: *Department of Ecology, Taxonomy and Nature Conservation, Institute of Biology Bucharest, Romanian Academy, Romania, e-mail: cristina.sandu@dstf.eu*

Cristina Sandu, IAD president

Thomas Hein, IAD Vice president

Dear Readers,

Panta Rei – everything is flowing. Using this famous quote of Heraclitus of Ephesus, we refer to the current changes in the IAD. A strong association is like a dynamic ecosystem and needs to show a certain turnover of members in leading roles. A new team is in place since January 2017, ready to strengthen and develop new valences for the IAD presence in the Danube Region. Based on the vote of the general assembly at the 2016 IAD conference in Sibiu, the new IAD President is Cristina Sandu and the new Vice-president is Thomas Hein. The last years during the presidency of Thomas Hein were characterized by an intense cooperation with the International Commission for the Protection of the Danube River (ICPDR) in various issues and they were scientifically very active. IAD members led key initiatives in the Danube River Basin, such as the Danube Sturgeon Task Force (DSTF) and the Danube Invasive Alien Species (DIAS) and they were active in several other flagship projects of the EU Strategy for the Danube Region (DANUBIUS, DREAM, Danube:Future, etc). As a logic consequence, one of the key IAD members, Cristina Sandu, coordinator of the DSTF and several sturgeon related initiatives, is the new president. She is an expert in aquatic ecology and since 2002 she cooperated intensely with IAD, being appointed in 2009 as IAD representative in the ICPDR River Basin Management Expert Group, where IAD has observer status. Since 2012, she coordinates the DSTF established in the frame of the EUSDR Priority Area 6 (Biodiversity) with the goal to support the revival of the Danube sturgeons and other indigenous fish species in the Danube Region.

Furthermore, also the position of general secretary was renewed earlier than planned as Harald Kutzenberger had to step back due to personal reasons. We thank him for his extremely valuable work during his periods as GS starting in 2007. To mention only a few, he was active in bringing so many scientists from various Danube countries together, initiated the IAD summer camps and was a key promotor of the Danube Day activities all the past years. We really have to thank Harald for his amazing work especially in public participation groups and appreciate to have him on board as a very active IAD member in future as well. Following a decision of the IAD board, until the next elections planned in 2018, Doru Bănăduc was appointed as the new IAD General Secretary. He carries out his regular activity in "Lucian Blaga" University of Sibiu, and cooperated with IAD for over a decade for the organization of the biannual conferences "Aquatic Biodiversity International Conference", Sibiu/Romania, while in 2016 he contributed to the organization of the last IAD conference in Sibiu. In collaboration with IAD he also published the Transylvanian Review of Systematical and Ecological Research – The Wetlands Diversity. Doru Bănăduc is an expert in fish ecology and was the head of the Natural History Museum of Sibiu before moving at "Lucian Blaga" University of Sibiu. We welcome him in the new position and looking forward for a very fruitful cooperation.

Also for the IAD journal – Danube News, a new team of editors was selected after Georg Janauer ended his period. During his time as Danube News Editor, eight great volumes were produced, where a high diversity of topics and information concerning our association was presented. The new team of editors comprises Gertrud Haidvogl and Bernd Cyffka. The environmental historian Gertrud Haidvogl is senior scientist at the Institute of Hydrobiology and Aquatic Ecosystem Management, BOKU Vienna. Together with Martin Schmid she established and coordinates the IAD-expert group "Long-term socio-ecological research and environmental history". Her research focuses on long-term change of riverine landscapes, with focus on fish and human of rivers and floodplains. She is deputy coordinator of Danube:Future, a flagship project of EU-SDR

PA7, Know-ledge Society. Bernd Cyffka is head of the Floodplain Institute Neuburg / Danube (Aueninstitut Neuburg a.d. Donau) and IAD country representative for Germany. His main research fields are floodplain ecology and restoration, landscape ecology and ecosystem services. Furthermore, he is working on floodplain and river restoration as well as its monitoring and management, human influence on floodplains, habitats and nature conservation.

We hope that the new coordinating team will play a major role in mobilizing more IAD activities at Danube Basin level and increasing its role in transposing the scientific results into future policy tools of the Danube decision makers.

Bernd Cyffka: *Applied Physical Geography, Catholic University of Eichstätt-Ingolstadt and Aueninstitut Neuburg/Donau, Germany, e-mail: bernd.cyffka@ku.de*
Gertrud Haidvogl: *Institute of Hydrobiology and Aquatic Ecosystem Management, University of Natural Resources and Life Sciences Vienna (BOKU), Austria, e-mail: gertrud.haidvogl@boku.ac.at*

Bernd Cyffka,
Danube News Editor

Gertrud Haidvogl,
Danube News Editor

Dear Readers,

After four years of successfully editing the Danube News, Georg Janauer expressed his wish to withdraw from this duty in November 2016. We were very pleased to be appointed as a new team of editors and we are highly motivated to continue with similar commitment. Georg Janauer has prepared us excellently for the new task. He handed over the editorship with thorough instructions and recommendations from his many years of practical experience. We wish him all the best and ample time for his other commitments which he often had to neglect in the last four years in favour of the Danube News.

We look forward to our cooperation with the new presidency and general secretary of the IAD and strive for continuing the Danube News as a journal informing the IAD members and the interested readership outside this organisation about remarkable research and pressing questions related to the ecology of the Danube and the societal and connectional role of this large European river. The joint editorship and our different disciplinary backgrounds enable us to adequately address and consider a wide range of topics which are also reflected by the expert groups of the IAD. The envisaged mix of contributions from the natural and social sciences but also from the humanities will hopefully be appreciated by both authors and readers.

Our first Danube News issue, the 35th since September 1999, consists of three major research articles.

Uli Schwarz from FLUVIUS Floodplain Ecology and River Basin Management shares his experiences on the Save River, its threats and restoration potential with us. The structure of the riparian area is mapped within 40 classes, showing the huge extent of softwood and hardwood forests along this riparian corridor. The hydro-morphological assessment describes how human activities have altered the natural shape and flow of the river. Further focus is on protected areas and biodiversity, floodplain loss and natural flood mitigation. Main threats come from hydropower, dredging and sediment exploitation. With the goal to achieve good ecological status as defined in the WFD there is also river restoration planned along the Sava River. Its aim is to prevent further deterioration and to improve the hydro-morphological conditions.

Severin Hohensinner from the Institute of Hydrobiology and Aquatic Ecosystem Management, BOKU Vienna, and a team of co-authors from Austrian and German research institutes modelled productivity of the floodplain forests of the Viennese Danube around 1825, thereby illustrating the dominance of softwood communities as a consequence of fluvial dynamics. They compared historical and present timber yields and emphasized the high productivity of natural forest stands and concluded that re-established fluvial dynamics would significantly contribute to renewable energy production and support the legal requirements of European water and nature protection legislation.

Georg Frank describes a new project, which was selected for funding by the Danube Transnational Programme. DANUBEparksConnected aims at conserving the Danube as bio-corridor and to better promoting this function. In his contribution, he describes the envisaged pilot actions. WILDisland, Danube Riparian Forest Corridor, Danube Dry Habitat Corridor and Danube Free Sky target major aquatic and floodplain habitats and their specific plant communities as well the migration of birds.

The Sava White Book: Threats and opportunities for one of the most valuable rivers of Europe

Ulrich Schwarz: FLUVIUS, Floodplain Ecology and River Basin Management, Vienna, Austria, Ulrich.Schwarz@fluvius.com

Introduction

The Sava White Book, published by EuroNatur and River-Watch, gives an extensive and comprehensive overview of the current situation of the Sava River and offers suggestions for area-specific restoration projects. It is intended as a planning resource for building a vision for the future of the Sava river floodplain corridor.

The Sava River is the largest tributary of the Danube in terms of discharge. It has a catchment area of more than 97,800 km² and a length of 926 km (if considering the longer of two source branches, the Sava Dolinka; see figure 1). Its average discharge at the confluence with the Danube is 1,570 m³/s. The middle and lower Sava are internationally recognized for its huge hardwood forests, the large near-natural flood retention system around the famous Lonjsko Polje Nature Park in Croatia, and the Obedska Bara Nature Reserve in Serbia. The river reached international attention due to the 100 year flood event in 2014.

The alpine upper Sava in Slovenia crosses several breakthrough stretches and small basins, and today is partially impounded by hydropower dams. Downstream of Zagreb, the Sava valley is broad and the river continues with a small gradient all the way to the confluence with the Danube in Belgrade. The character of this meandering lowland river reach is influenced by the southern tributaries, which include the Kupa, Una, Vrbas, Bosna and Drina. At its lowest course, starting about 100 km upstream from the confluence with the Danube, the Sava is influenced by the backwater of the Danube dam Iron Gate I.

1. Current situation

Riparian land structure: For the first time, a continuous land structure mapping for the entire river corridor was carried out mainly based on high-resolution satellite images on a scale of 1:25,000. It includes more than 40 land structure classes. The lower Sava valley hosts large alluvial ash, oak and poplar forests mainly managed by state forestry companies. In addition, willow softwood galleries prevail along all banks. Numerous oxbows, floodplain swamps and wet grasslands characterize the river system. Together with faster flowing southern tributaries featuring numerous gravel bars, these rivers build a unique riparian corridor with rich landscapes and diverse habitats for many species.

The outstanding number of hardwood forests, totalling 63,300 ha in the active floodplain and another approximately 78,000 ha outside the flood protection dikes (influenced by high groundwater and back flooding from tributaries), as well as the large intact wet pastures within the active floodplain (about 25,000 ha) are of particular importance. In addition, pioneer stands on gravel bars cover up to 1,300 ha (mainly along southern tributaries) and are important for the whole river landscape but particularly for the lower Sava.

Hydromorphology: The hydromorphological assessment describes how human activities have altered the natural shape and flow of the river and document the modifications of the riverine landscape. Since some hydromorphological processes, such as incision of the riverbed, have very gradual effects on the river ecosystems, it is important to know about modifications of the past. Many large European river stretches fall in the range "moderately modified" to "extensively modified" (classes 3 and 4 or "yellow" and "orange", respectively) within a five class

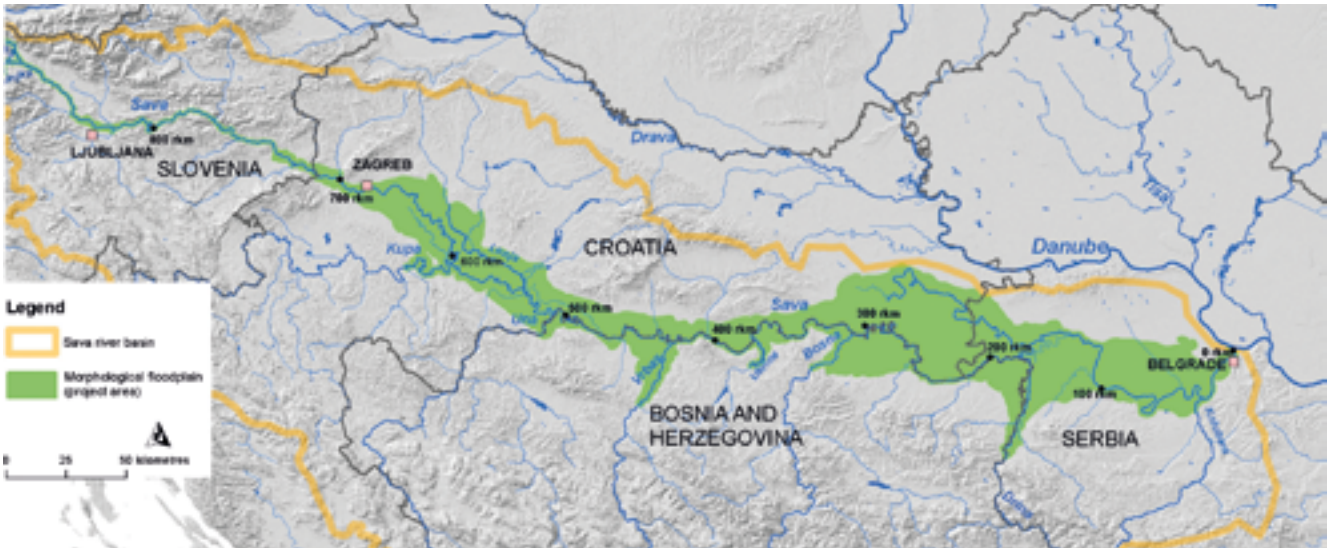

Figure 1. The morphological floodplain of Sava River with the Sava and its tributaries.

Figure 2. Areas of riparian land structure types with high ecological value (in total about 265,000 ha).

assessment system (European CEN Standards on hydromorphology). Impoundments have the lowest scores and fall into class 5. The Sava performs much better in the classification: 53 % of it falls into class 2 (slightly modified, "green"), predominantly in the long free-flowing middle stretch but also in the free-flowing upper stretches. A total of 4 % is rated as class 1, near-natural *(figure 3):* this comprises a

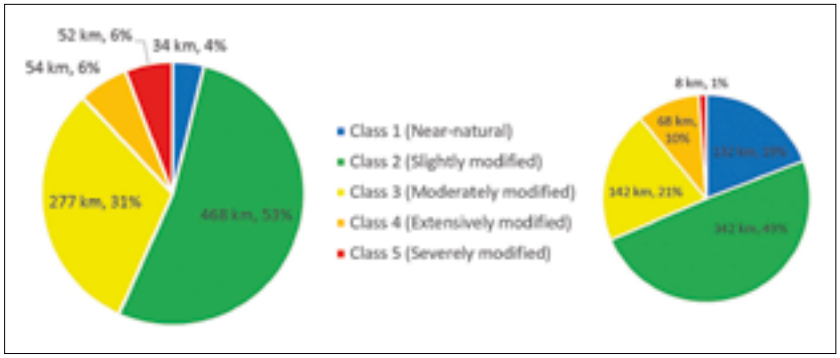

Figure 3. Overall hydromorphological assessment of the Sava (left) and its tributaries (right).

long gorge stretch on the upper Sava and some very short stretches in the meandering middle river reach.

This study's findings for the middle and lower Sava and its large southern tributaries contradict the official intention of the countries (International Sava River Basin Commission) to designate all of these stretches as heavily modified water bodies (HMWB), a classification that could potentially justify further significant alteration (e.g. hydropower, navigation).

Protected areas and biodiversity: The ecological importance of the Sava and its floodplains is reflected by the significant number and size of protected areas; about 36 % of the morphological floodplain [1)] (322,875 ha) and 64 % of the Sava river course (excluding the two headwaters) are designated as protected areas. The most prominent are the Lonjsko Polje Nature Park in Croatia and the Obedska Bara Nature Reserve in Serbia, both of which are Ramsar sites. In addition, large stretches of the Sava and tributaries in Croatia as well as some stretches in Slovenia are Natura 2000 sites. Furthermore, the Sava basin is a pan-European biodiversity hotspot, hosting about 250 breeding bird species (e.g. little tern, spoonbill) or endangered fish species such as the huchen, the Cactus roach and the sterlet.

Floodplain loss: Along the Sava and its tributaries an area of merely 2,067 km² can still be flooded (active floodplain), while originally, the morphological floodplain area was as large as 8,943 km². This reveals a total loss of 77 %. This ratio is comparable with that for the Danube or any other large river in the region. However, there are significant local differences along the Sava. In the middle Sava in Croatia, more than 60 % of former floodplains are still active, allowing for a significant capacity for water retention during floods. This part of the Sava represents a unique example of large-scale natural flood mitigation and could function as a blueprint for other river stretches. However, downstream the Bosna confluence, almost 85 % of the original floodplains are cut off from the active floodplain. This was the area where the historic flood wreaked so much damage in 2014.

Natural flood mitigation: Flood defences received high priority after the 2014 historic flood along the middle and lower Sava. Seven major dike breaches between the Bosna and Drina confluences flooded large areas in Bosnia and Herzegovina and areas south of the Bosut forest on the Croatian side of the river. This highlights the absence of retention capacity and the negative effects of the disconnected floodplains in this reach of the Sava. The flooding of Obrenovac in Serbia was caused mainly by dike failure on the Kolubara tributary and low retention capacities in the adjacent Sava. In strong contrast stands the Upper Posavina flood system (Croatia) with a retention capacity of 1.6 billion m³ which is sufficient to protect the towns of Zagreb (bypass into Odransko polje), Sisak and Jasenovac. This retention system is capable of topping off the peak discharges in the Sava at up to 1,500 m³/s, significantly lowering peak water levels downstream. Unfortunately, all countries affected by the 2014 flood event are now focussing on the reconstruction and reinforcement of existing flood defence dikes and have not formulated ambitions to reconnect retention areas to the flood regime, with the exception of an area close to the Bosut mouth that is intended to become a flood storage polder.

[1)] *The morphological floodplain is defined as maximum area originally influenced by floods.*

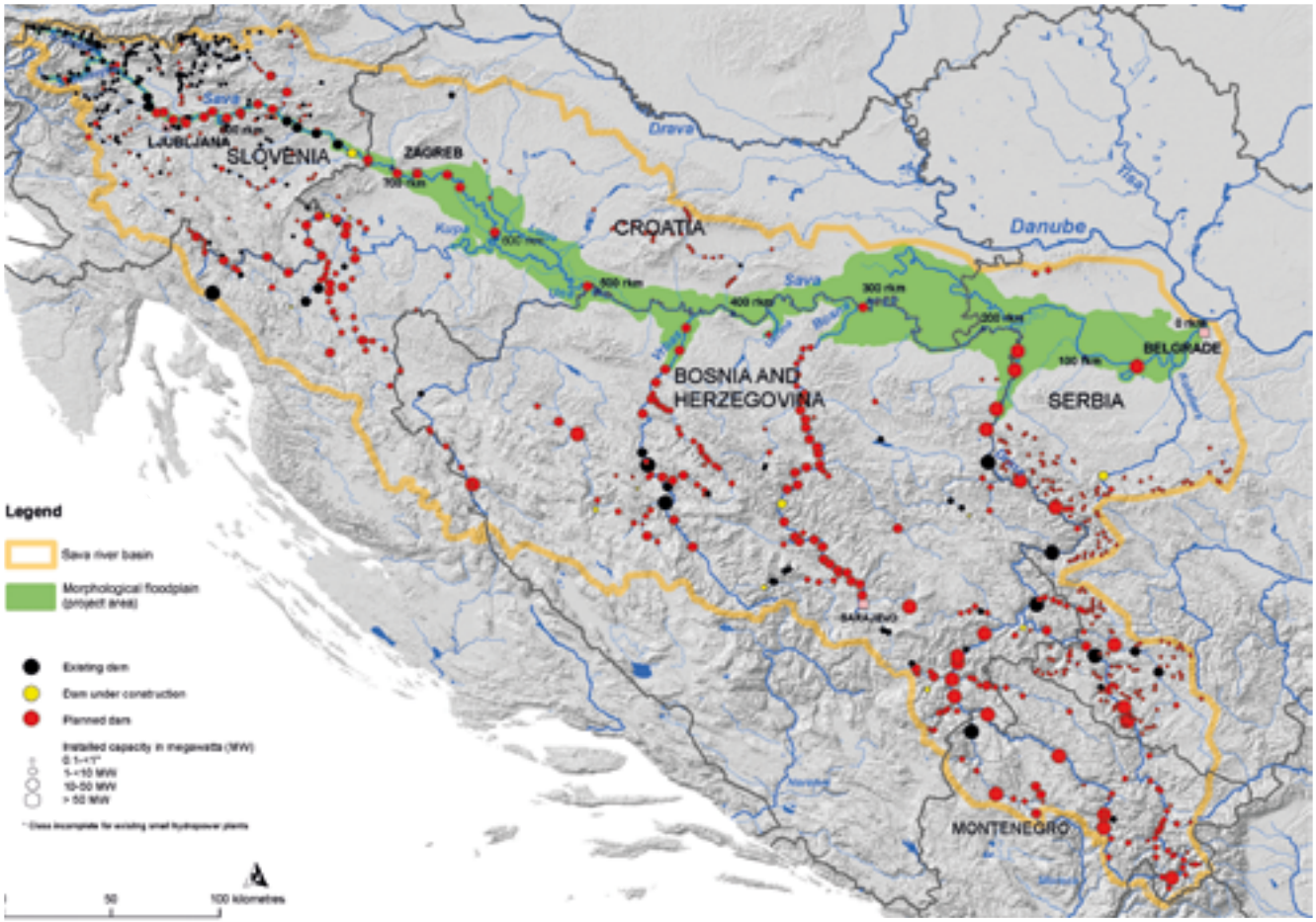

Figure 4. 582 hydropower plants are intended in the Sava basin.

2. Threats

The many **hydropower** projects in the Sava river basin constitute one of the greatest sources of pressure on the river. Proposals for a total of up to 582 new dam projects have been identified *(figure 4).* Dams on the tributaries would have a severely negative impact on the Sava, where they would cause river bed incision by holding back sediments. A total of 88 hydropower projects are planned within stretches populated by huchen. If implemented, this would lead to a decline of the Balkan population by at least 70 %.

Twenty new hydropower projects are envisaged for the Sava alone, adding to the seven already existing (and one under construction). Most projects are located in Slovenia, however, there are also dams projected in the almost entirely free-flowing middle and lower Sava and in all major tributaries.

Dredging and sediment exploitation from the river channels is widespread; over the last decades, significant amounts were extracted: on average 950,000 m³/year (m³/a) from Sava channel and 1.29 million m³/a from tributaries. Estimates based on the available dredging data show that the amount of material extracted from the river per year is up to ten times higher than the natural transport capacity for the Sava and more than four times higher for the tributaries. The impact of dredging on the sediment balances cannot be examined separately from the effects of trapping coarse material in the dam chains. The combination of dredging and trapping can lead to channel incision even in stretches that are not under serious pressure by dredging, particularly between the Sisak and Drina confluences. Hopefully, a preliminary legal decision in Croatia will drastically reduce the dredging amounts within the Natura 2000 sites. This law will require part of the material to be given back to the river, as practised in Germany and Austria, where sediment management has become an important tool for successfully stopping river incisions. More attention and monitoring should be given to potentially self-sustaining solutions in river stretches, such as the lower Drina along the Serbian-Bosnian border. This river is strongly impacted by dams in the upper and middle catchment, but just 20 km downstream of the last dam (hydropower plant (HPP) Zvornik) one of the most exciting and ecologically important river landscapes within the entire Danube basin can be found: the lower Drina. This river stretch is mostly free of riverbed- and bank fixation measures allowing for strong lateral erosion and a consequent loss of land, but the lateral movement of the river reduces the risks of dangerously big river bed incisions and as a consequence maintains natural groundwater tables in this fruitful landscape.

At the moment, **navigation** does not play a significant role in the economic development of the Sava river

Figure 5. The Sava River and its floodplains are a European lifeline and a natural flood prevention system (© Goran Šafarek).

basin, but the topic is on the political agenda at the national and European level. Navigation development, including the projected Sava-Danube canal through the Bosut-Spačva forest area, could cause serious changes of the river system. Regular maintenance dredging has a more severe impact if the extracted material is sold on the market – a common practice in the Sava river basin – as opposed to feeding the material back to the river. Proposals to improve the low water situation for navigation and river regulations include the construction of three ground sills, bank reinforcements (riprap and groynes) and further disconnection of river and floodplain (e.g. traverses to close side-channels). These constructions constitute the main impact on the river system by navigation. Major threats are new plans to raise the ECE (UN Economic Commission for Europe, Inland Water Transport) waterway class for the 594 km stretch between Belgrade and Sisak from III to IV (and on the Serbian part from IV to Va). This requires many significant river regulations, including 24 meander bend corrections and the stopping of nearly all lateral erosion by riprap and stabilising of the shipping channel. Necessary dredging is estimated at least at an initial 1.7 million m³ for the Croatian stretch, followed by continuous maintenance dredging. Another threat is the construction of new infrastructure, such as the proposed new harbour at Sisak, planned in an active floodplain area outside the town. These plans would have a huge deteriorating impact on the river and adjacent environment.

The following two maps *(figures 6 & 7)* summarize the current and potential future threats. Current threats *(figure 6)* cover nearly all activities that are threatening the ecological functionality of the river system: hydropower (impoundments, hydropeaking and sediment deficit), river regulation, frequent dredging and flood defence constructions. The second map *(figure 7)*, showing projected alterations, indicates that almost the entire length of all rivers in the morphological floodplain would be affected if hydropower and navigation projects were fully implemented.

3. Restoration potentials

The present study has attempted to identify the potentials for river and floodplain restoration along Sava River and the lower reaches of its tributaries. While river restoration means "giving more space to the river itself", the goal of floodplain restoration is "giving more space to floods".

With a view to achieving good ecological status as defined in the WFD, river restoration *(figure 8)* aims to prevent further deterioration and to improve the hydromorphologi-

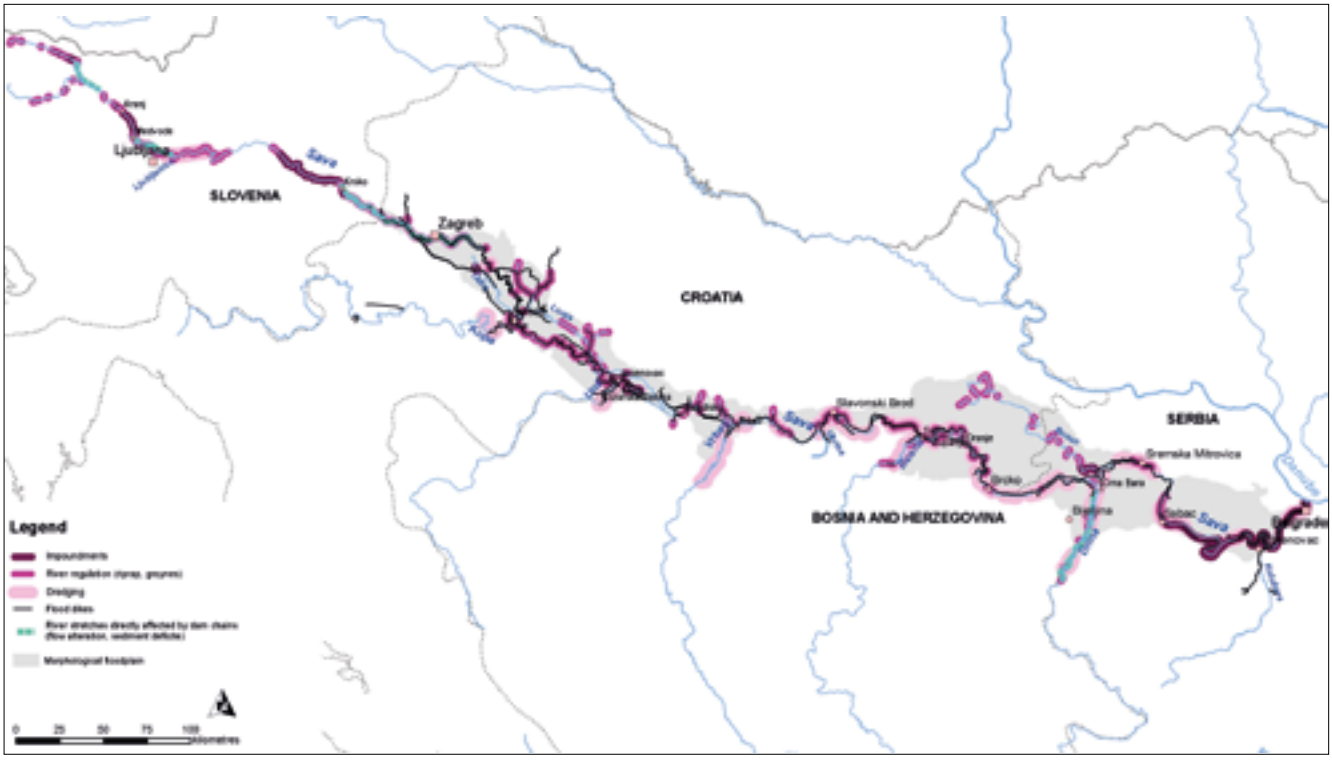

Figure 6. Current alterations and threats (impoundments, river regulation, dredging, flow alterations/sediment deficits and dikes) along the Sava and assessed tributaries.

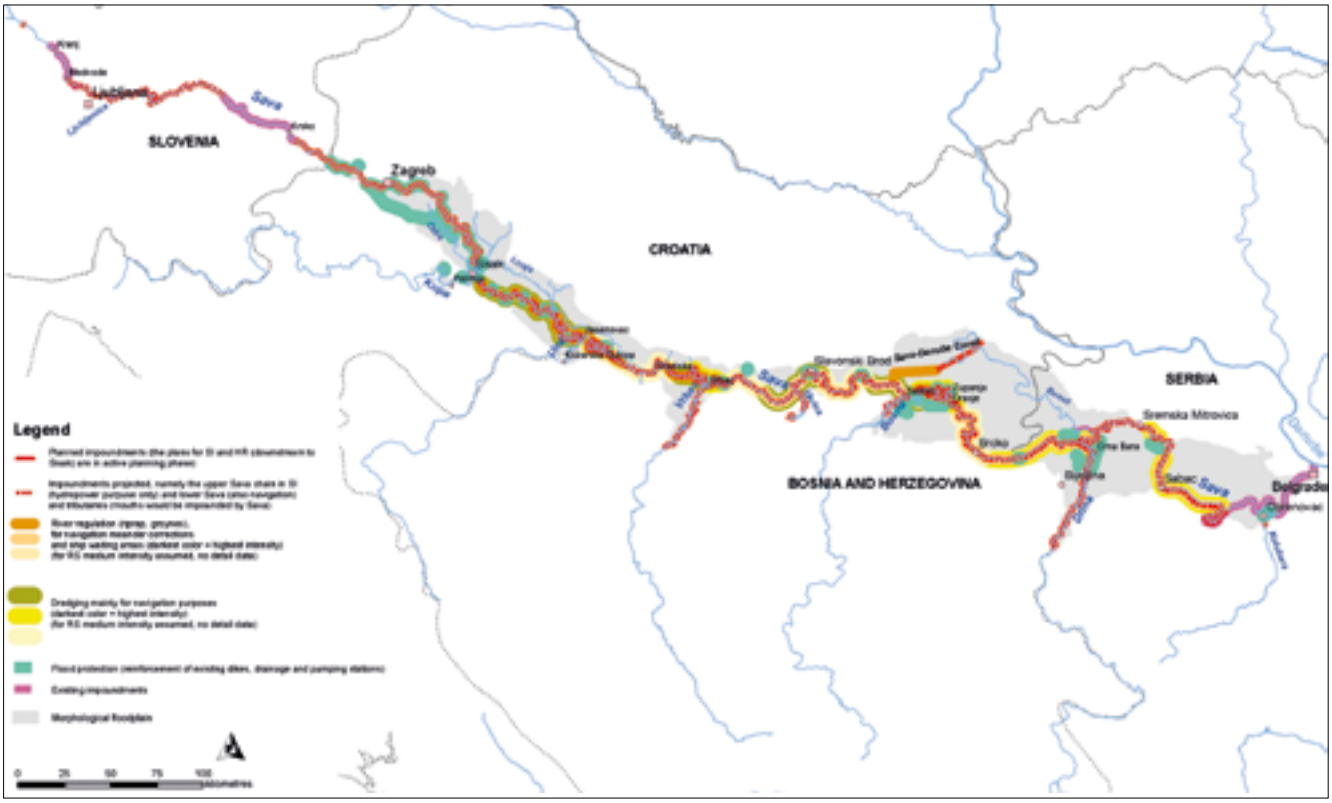

Figure 7. Projected alterations and threats (impoundments, river regulation, dredging, and technical flood protection). The entire Sava is at risk.

cal conditions. Altogether, 41 different river stretches with a length of 251 km have been identified (15 classified as highest, 22 as high and four as low priorities).

In terms of floodplain restoration *(figure 9),* an additional 143 potential areas have been delineated, covering a total area of 184,289 ha and reconnecting about 22 % of the floodplain area with the river. This would increase the overall flood retention capacity by approximately 3.1 billion m³. These areas have been evaluated and prioritized according to land structure, hydromorphology, protected area status, retention capacity and land ownership structure. Ten areas have come out with very high priority, 108 with *very high*

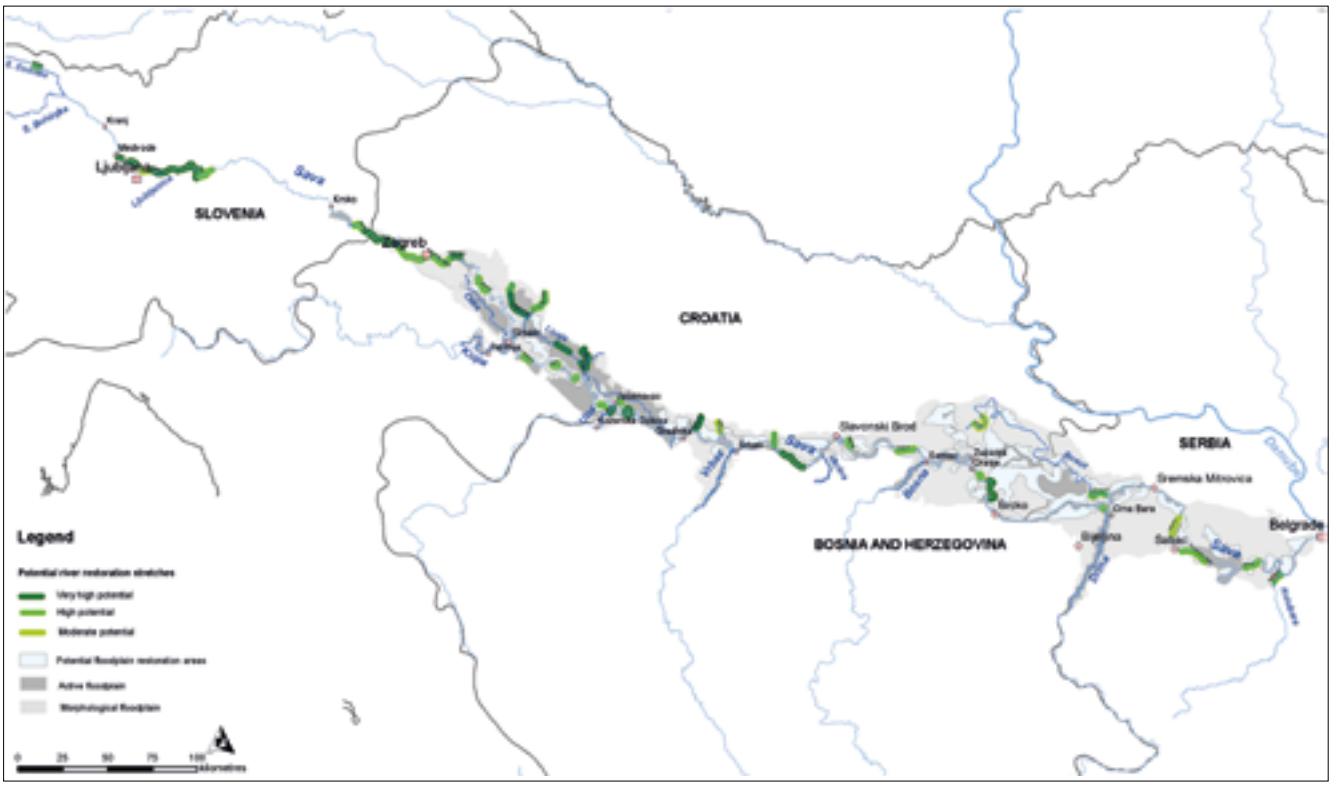

Figure 8. Potential river restoration stretches and their prioritisation. 41 river stretches with a total length of 251 km could be restored.

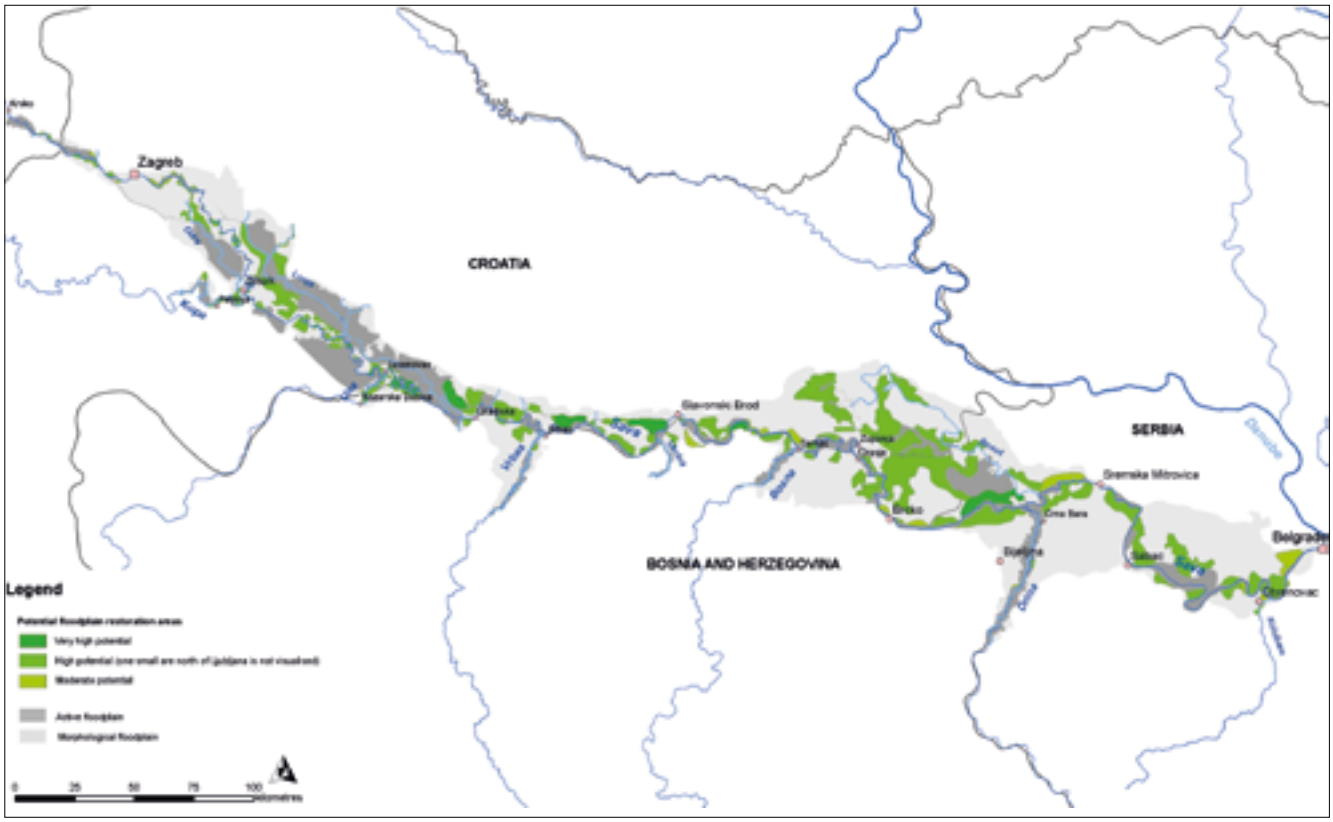

Figure 9. Potential river restoration stretches and their prioritisation. 41 river stretches with a total length of 251 km could be restored.

priority and 26 with *moderate* priority. The study also includes detailed proposals for several pilot restoration sites and areas.

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Wood resources in dynamic Danube floodplains – historical reconstruction and implications for management and restoration

Severin Hohensinner: *University of Natural Resources and Life Sciences Vienna (BOKU), Austria, severin.hohensinner@boku.ac.at*
Anton Drescher: *Karl-Franzens-University Graz, Austria, anton.drescher@uni-graz.at*
Otto Eckmüllner: *BOKU Vienna, Austria, otto.eckmuellner@boku.ac.at*
Gregory Egger: *Karlsruhe Institute of Technology (KIT), Rastatt, Germany, gregory.egger@kit.edu*
Sylvia Gierlinger: *Statistics Austria, Vienna, Austria, sylvia.gierlinger@statistik.gv.at*
Herbert Hager: *BOKU Vienna, Austria, herbert.hager@boku.ac.at*
Gertrud Haidvogl: *BOKU Vienna, Austria, gertrud.haidvogl@boku.ac.at*

What do we know about the natural productivity of riparian forests prior to river regulation and about their function as a source of raw materials and renewable energy? Can we draw conclusions for today´s sustainable resource management using historical vegetation models?

An interdisciplinary research team consisting of river morphologists, vegetation/forest ecologists, and environmental historians investigated the Viennese Danube river landscape around 1825. The main research goal was to reconstruct the potential annual timber yield prior to river channelization. The riparian vegetation models and the historical research show that the natural wood productivity in the pre-channelization Danube floodplain was higher than in comparable near-natural riparian forests today. In comparison, current commercial forests with hybrid poplars yield higher amounts of wood. However, they do not meet sustainable forestry standards because of nature conservation concerns. Our study results call for the partial re-dynamization of embanked river reaches. This would also comply with the requirements of the EU Habitat Directive, EU Water Framework Directive and the EU Directive for Renewable Energy Sources.

Introduction

Forests in general and riparian forests in particular face an area of conflict – that between forestry revenue maximization and ecological, nature conservation-oriented forest management. Many of the remaining riparian forests along large European rivers were designated as protected areas according to the Flora-Fauna-Habitat Directive (NATURA 2000, 92/43/EWG). In addition, consideration must

be given to the requirements of the EU Water Framework Directive (WFD, 2000/60/EC), which aims at achieving a good ecological status of river systems. Recently, the potential role of renewable energy sources to cover Europe's energy demand at least partially is gaining increasing public and political awareness (see Renewables Directive 2009/28/EC). Today, the fragments of the former riparian forests are heavily impaired by river regulation, construction of reservoirs and dikes, and drawdown of the groundwater table due to channel incision. Moreover, native tree species have been exchanged by other species or by alien species in order to maximize wood productivity. On the other side, current restoration projects aim at the partial re-dynamization of stabilized and degraded river-floodplain systems.

Against this background the project "Enough wood for city and river? Vienna's wood resources in dynamic Danube floodplains" was designed to model the natural productivity of riparian forests on the Danube River prior to regulation and to estimate their potential function as a source of raw materials and renewable energy. Based on preceding research projects, we selected an 11.8-km-long Danube section in Vienna prior to regulation around 1825 as a study site. It comprises the up to 8.5-km-wide postglacial valley floor (recent floodplain) close to the historical city center.

Method

The design of the research project required an interdisciplinary, nature-humanity oriented team consisting of river morphologists, vegetation/forest ecologists, and environmental historians who focused on three central topics: (1) The river morphological and forest ecological site conditions and natural productivity potential for wood resources in dynamic Danube floodplains before channelization; (2) the historical use of locally available wood resources in a biomass-based society; and (3) the development options of Danube riparian forests against the background of ecological and nature conservation requirements and the objectives for a sustainable management of renewable resources.

A new model for estimating the former wood productivity under dynamic hydromorphological conditions provided the basis for answering the research questions. Because site age is a key factor for the development of the riparian vegetation, emphasis was put on the detailed reconstruction of the fluvial dynamics and the persistence of the floodplain terrain since the 16th century (compare Hohensinner et al., 2013a, 2013b). Generally, two scenarios were distinguished: Scenario 1 ("total natural wood potential"), assuming that the entire Viennese floodplain in 1825 showed riparian forests without any direct human influences; and Scenario 2, taking into account the actual historical land uses and forest management. The resulting values for the wood productivity in the dynamic river landscape were then compared with sample data from different types of stabilized riparian forests along the Danube River today.

Results

Due to the high fluvial dynamics the potential natural riparian vegetation in 1825 (omitting human land uses) was primarily characterized by vegetation types that generally develop on gravel/sand deposits along active river arms. Accordingly, 87 % of the floodplain terrain featured communities referring to "mineral sedimentation series" *(compare figure 1).* Communities that evolve in abandoned river arms as a consequence of terrestrialization processes ("organic/mineral sedimentation series") amounted only to 13 % of the study site.

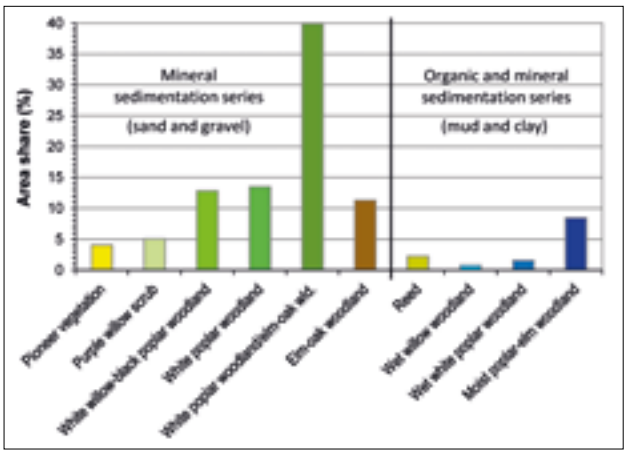

Figure 1. Modelled area shares of the potential natural floodplain vegetation types of the Viennese Danube River in 1825 (left side: mineral sedimentation series due to aggradation along active river arms, right side: organic/mineral sedimentation series due to terrestrialization in abandoned arms).

In particular, softwood communities, mostly located in the central river corridor and in silted up backwaters covered 34 % of the potential floodplain area. These were younger and up to 200 years old successional stages, as purple willows, and different forms of willow and poplar communities. Most of the older sites (> 200 years) featured transitional forms between hardwood and softwood forests due to the relatively small depth of the groundwater table and frequent flooding (48 % of the floodplain). Real hardwood forests, i.e. elm-oak woodland, could only develop on the highest and oldest sites of the floodplain (11 %). Most of them were located on more than 300 years old locations (Hohensinner et al., 2016).

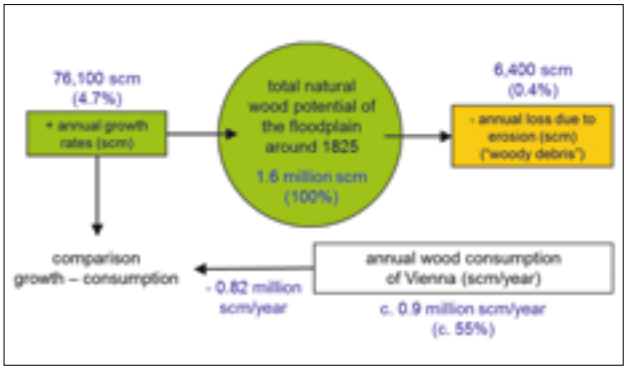

Figure 2. Synthesis of Scenario 1 ("total natural wood potential"; scm = solid cubic meter wood; percentages related to the total available wood in the floodplain).

Figure 3. Eroded riverbank with woody debris in the Austrian Danube Floodplain National Park (Christian Baumgartner, NP Donau-Auen GesmbH, 2009)

The main results for Scenario 1 are presented in figure 2. Accordingly, in 1825 the 77.07 km^2 large river landscape potentially featured approximately 1.6 million solid cubic meter (scm) of wood (c. 269 scm per hectare floodplain terrain). Productivity was highest in 45 – 100 years old willow stands and 160 – 200 years old poplar stands (both with more than 300 scm/ha). On average, c. 6,400 scm wood was released annually into the Danube River due to lateral erosion and avulsion processes ("woody debris" corresponding to 60 – 90 about 200 years old willows or poplars that were eroded annually per kilometer current river length). In comparison, the annual rate of wood growth was much bigger (c. 76,100 scm). Figure 2 also shows the annual wood consumption of the Viennese inhabitants at that time, which was more than 10 times higher than the annual growth rate. The riparian vegetation models show that the natural wood productivity in the dynamic pre-channelization Danube floodplain was higher than in comparable near-natural riparian forests that are used for timber production today.

On average, the annual growth rates of current near-natural floodplain forests are 25 % lower than in the historical reference state (standardized values per hectare forest). Even taking historical wood uses into account (Scenario 2), annual growth rates were slightly higher than in near-natural forests today. However, current commercial forests with hybrid poplars can yield much higher amounts of wood (44 % higher than the reference value). Nonetheless, such alien species are not an adequate choice because they do not meet the demands of modern sustainable forest management from the perspective of nature conservation (i.e. NATURA 2000).

Figure 4. Primary forest in the Austrian Danube Floodplain National Park (Werner Gamerith, 1992)

Conclusion

The results of the project show that a partial re-dynamization of embanked and stabilized river reaches would meet several legal specifications and socio-economic demands:

(1) According to the EU Flora-Fauna-Habitat Directive, originally typical softwood forests (priority habitats 91E0*) that are severely endangered today would benefit from the amplified fluvial dynamics.

(2) The restoration of riverbanks and floodplain water bodies supports the aim to achieve a good ecological status according to the EU Water Framework Directive. Here, the river-type-specific status functions as a reference.

(3) Given the high productivity of forest stands with intact fluvial dynamics it would provide new sources for ecological compatible and sustainable biomass energy as stipulated by the EU Directive for Renewable Energy Sources.

From the perspective of a modern management of riverine landscapes, this calls for a compromise between sustainable (commercial) forest uses, restoration of river-floodplain systems, and protection/promotion of dynamic riparian forests.

Acknowledgement

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The Danube River as European ecological corridor and its further development as Trans European Green Infrastructure by DANUBEparksCONNECTED

Georg Frank: DANUBEPARKS – Danube River Network of Protected Areas, Donau-Auen National Park, Austria, g.frank@danubeparks.org

The Danube – a transnational habitat corridor of European importance

The Danube is a hub of biodiversity and an essential lifeline of Europe. The large number of Natura 2000 sites and Protected Area impressively shows Europe's commitment to preserve this natural heritage (ICPDR 2009, ICPDR 2015).

Rivers, their riparian zones and riverine habitats form ecological networks and often build the backbone for bio-corridors. This pertains to the Danube in particular, due to its outstanding role as a link between more bio-regions than any other corridor in Europe. Facing e.g. an increasing future impact of climate change, intact corridors for migration and dispersal of species between the Black Sea Region, the Steppic Region, the Pannonian Region, the Continental and, finally, the Alpine Region, will gain increasing relevance, as such a corridor function could be ensured by a vital Danube river ecosystem.

Fragmentation of the landscape – a main threat for biodiversity in Europe

While Protected Areas preserve some of the most valuable natural sites, habitat fragmentation limits efforts to preserve a cohesive ecosystem (e.g. Crooks & Sanjayan 2006). Human infrastructure, extensions of urban areas, the establishment of new transport routes and energy infrastructure as well as the ongoing intensification of the land-use put growing pressure on the natural treasures of the Danube. Consequently, the isolation of Protected Areas is one of the main threats to biodiversity in the Upper Danube; the increase of fragmentation reduces ecological connectivity of high-value ecosystems in the Middle and Lower Danube.

To counteract, policies such as the EUSDR Action Plan call for actions to restore and preserve habitat connectivity (European Commission 2010) and to establish a Trans-European Network of Green Infrastructure (European Commission 2013).

DANUBEparksCONNECTED – towards a Danube Habitat Corridor

Interreg
Danube Transnational Programme
DANUBEparksCONNECTED

In January 2017, DANUBEPARKS, the Danube River Network of Protected Areas launched the initiative for the conservation and further development of the Danube Habitat Corridor. With funds of the Interreg Danube Transnational Programme, this project intends to raise awareness for the Danube River as bio-corridor. It aims to promote a better conservation of less-fragmented areas, and implements pilot actions to restore aquatic (WILDisland) and terrestrial (riparian forest, dry habitats) "stepping stones" within this eco-corridor, as well as the Danube as bird flyway (Danube Free Sky):

- WILDisland – the Danube Wild Island Habitat Corridor

Islands are flagship habitats in vital river ecosystems. They showcase the dynamic of river morphological processes like the relocation of sediments. The Joint – Danube Survey stressed the outstanding role of islands for characteristic indicator species (Schmidt et. al 2015).

DANUBEparksCONNECTED elaborates a concept for selected islands, gravel banks and sand bars to promote non-intervention management - a key to ensure natural processes in the future and characteristic habitat structures on a long term. Based on strategic cooperation with land owners, land users (e.g. waterway administrations, forest enterprises) and policy makers, "WILDislands" will be designated. The implementation of pilot actions for their conservation and rehabilitation should increase the habitat quality of Danube islands and will improve their functionality as stepping stones within the Danube Wild Island Habitat Corridor.

Figure 1. The WILDisland initiative promotes the non-intervention management of selected gravel banks, sand bars and smaller Danube islands. The designation of WILDislands should result in the establishment of a Danube Wild Island Habitat Corridor, to promote the importance of river dynamics and wilderness on European rivers. Credit: Persina Nature Park/Alehzander Ivanov

Figure 2. The Danube riparian forests form a green belt all along the river and provide numerous ecosystem services. Human impacts in the past decades and ongoing intensification of the land use limits these services and can interrupt the coherence of the riparian forest corridor. Credit: Donau-Auen National Park/Franz Kovacs.

- Danube Riparian Forest Corridor – the green lifeline of the Danube

Wetland forests are vital habitats serving multiple functions for flora, fauna and humans. Due to human intervention in the past, the loss of Danube floodplains can be assumed with at least 65-70 %. The remaining floodplains suffer from hydrological disconnection, fine sediment aggradation and the substitution of natural floodplain vegetation by poplar plantations (Schwarz et. al 2015).

Today, most of the last remaining large-scale floodplain forest complexes are protected by the Danube Protected Areas, famous for the richness in biodiversity. To counteract isolation of their wildlife population, ecological connectivity measures are needed. Under the coordination of Vojvodinasume Public Forest Enterprise, a Danube-wide "fitness check" of riparian forest ecosystems will be done. Remote census and the EU Copernicus Land Monitoring Services help to identify gaps within the Danube Riparian Forest

Figure 3, 4. The Danube Canyons host some of the most valuable (semi-)dry habitats along the river and act as core areas within the Danube Dry Habitat Corridor. Good practice management of grasslands like grazing is established within DANUBEparksCONNECTED, to further develop this eco-corridor. Credit:Duna Ipoly National Park/Zsolt Kalotás; Nationalpark Donau-Auen/Karoline Zsak.

Habitat Corridor. To overcome these fragmentations, pilot actions with focus on reforestation, the transformation of plantations into native stands, the management of invasive alien tree species and, finally, the promotion of characteristic species (Populus nigra, bats as indicators) will be implemented.

• Danube Dry Habitat Corridor

Beside aquatic and semi-aquatic habitat types, even dry habitats are an indispensable part of natural river ecosystems. Due to hydro-morphological alterations and changes in the traditional land use, today these (semi-)dry sites are often reduced to small remnants in the floodplain areas. These sites are home to highly endangered plant and animal communities. Eco-corridors for dry habitats are discussed to avoid isolation of these habitat patches.

DANUBEparksCONNECTED aims to contribute to a better conservation of core areas represented by the "Danube Canyons", home to diverse dry habitats and characteristic species. Additionally, good practice management for semi-dry habitats in the floodplain area ("Heisslands") is promoted by project activities. Finally, DANUBEparksCONNECTED intends to develop Green Infrastructure between these sites, e.g. by establishing cross-border grazing at the flood protection dykes which could act as ecological linkage for semi-dry grassland species in some sections of the Danube.

• Danube Free Sky – facing the risk of bird collision on electric power lines

The Danube River is a flyway for bird migration of European importance. In particular for bird species depending on aquatic habitats (waterfowl, storks, terns, gulls, waders, several species of birds of prey), the Danube and its riparian zone provide vital breeding, resting and wintering sites and, furthermore, form a "guiding line" across Europe for their short- and long-distance movements.

Danube Protected Areas, Natura 2000 and other valuable natural areas preserve core sites within this eco-corridor, but electric power lines are barriers along the Danube flyway. Due to the large quantity of birds on migration and the big ratio of bird species with relatively high risk of collision, large rivers have to be considered as hot-spots regarding the (potential) conflict of bird conservation and collision at electric power lines (FNN 2014). Each year, millions of birds are killed due to such collisions (TNL Umweltplanung 2017).

The Danube Free Sky campaign brings together nature conservation and the energy sector to exchange best practice experiences and boosts the implementation of technical solution for existing powerlines in the Danube riparian zone (e.g. marking power lines with bird converters).

Danube Habitat Corridor – a long-term multidisciplinary approach

The comprehensive development of Green Infrastructure to preserve the Danube River as a Trans-European Ecological Network (TEN-G) is a long-term approach. The DANUBEparksCONNECTED campaign implements first pilot actions. It aims to establish good practices towards habitat connectivity, and wants to initiate a long-term strategic process to further develop ecological connectivity.

Figure 5, 6. The Danube River is an important flyway for bird migration. For numerous species like waterfowl, waders, storks, pelicans and birds of prey, collision at electric power lines is a highly relevant mortality factor. In cooperation with the energy sector, Danube Free Sky promotes technical solutions for existing power lines along the Danube, which can reduce the risk of collision by 60–90 %. Credit: Nationalpark Donau-Auen/Georg Frank

Advanced tools to improve the functionality of bio-corridors have to be developed. Key stakeholders from navigation, forestry and the energy sector cooperate within DANUBEparksCONNECTED and promote the cross-sectoral approach in all work packages. International institutions, partner projects and policy drivers are part of the process and stand for long-term capitalisation of the Danube Habitat Corridor.

www.danubeparks.org
http://www.interreg-danube.eu/danubeparksconnected

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News and Notes

DIAS – A new network to cope with alien species in the Danube River Basin

Barbara Stammel: *CU Eichstaett-Ingolstadt, Aueninstitut Neuburg, Neuburg, D, e-mail: barbara.stammel@ku.de*

Invasive Alien Species (IAS) are one of the major threats of biodiversity worldwide, they are a big challenge in the global change we have to cope with in the future. The impacts of IAS affect not only the environment but also the economy and society (e.g. health care). The invasion can neither be stopped, nor can invaded species be eradicated completely. But targeted actions will help to reduce the threat to endangered indigenous species and to reduce the speed of invasion. In river landscapes there are many and important vectors and pathways for invading species. In particular, the Danube River and its floodplain are an outstanding part of the South-European aquatic invasion corridor. It links the Black Sea basin with the North Sea basin via the Danube–Main–Rhine Canal and it has been exposed to the introduction and influence of IAS. The International Commission for the Protection of the Danube River (ICPDR) acknowledges that IAS have become a major concern for the Danube River and that their further classification, analysis and management are vital for effective river basin management. The EU Strategy for the Danube Region (EUSDR), which was endorsed in 2011, also acknowledges IAS as a major threat to biodiversity and a liveable Danube Region. Consequently, some of the targets of the EUSDR, as defined in Priority Area 06, are to identify and prioritise IAS and their pathways, to control or eradicate priority species, and to manage pathways to prevent the introduction and establishment of new IAS. Further, in 2014, the European Commission set up the regulation No 1143/2014 on the prevention and management of the introduction and spread of IAS.

As invasive species do not care about human borders, tackling the issues of IAS should also not be limited to the national scale. In contrast, networking and cooperation on IAS in different scales is crucial for the prevention and management of IAS and can facilitate the implementation of existing IAS instruments. There are already several joint initiatives related to IAS in the Danube Region. Monitoring of aquatic IAS was included in the Joint Danube Survey 3 (ICPDR, 2013). In 2016, ICDPR finished a guidance document on Invasive Alien Species within the Danube River Basin. Furthermore, the network ESENIAS (Eastern and Southern European Network on Invasive Alien Species) already exists as a regional data portal at the Lower and Middle Danube River basin. This network implemented a joint project on potential threats to environmental and economic sustainability in the Danube and Black Sea Region together with the IAD.

Therefore, at the initiative of IAD, ESENIAS, IBER-BAS (Institute of Biodiversity and E cosystem Research at the Bulgarian Academy of Sciences) and the Priority Area 06 of the European Union Strategy for the Danube Region (PA 06 EUSDR), a kick-off meeting for a new network took place in October 2014 in Sofia: The **Danube Region Invasive Alien Species Network** (DIAS) with ca. 38 representatives from 10 countries from the Upper, Middle and Lower Danube River basin, as well as from the adjacent Black Sea. DIAS promotes an improved coordination among all actors in the thematic field of

IAS within the Danube Region. Politically independent, it will bring together scientists, authorities and stakeholders. The members aim to support exchange of knowledge as well as to promote the transfer of knowhow and expertise to actors at all administrative levels and between regions in a transnational context. Cooperation with existing European and global IAS networks and organizations will foster the success in order to contribute to a sustainable presence of and to a liveable future in the Danube Region.

A few joint projects in single regions were already developed:

1. Eastern and Southern European Network for Invasive Alien Species – A tool to support the management of alien species in Bulgaria (ESENIAS-TOOLS):

The project is funded by the Financial Mechanism of the European Economic Area 2009-2014, under the Programme BG03 Biodiversity and Ecosystem Services, and aims at networking and at the development of IAS tools within the frame of ESENIAS to support the management of alien species in Bulgaria and in the overall region, including countries in the Lower and Middle Danube River basin.

2. Pilot-study (data collection) on invasive alien species in the Danube Region with a smartphone application developed by the JRC (Danube-IASapp project):

The purpose of this project is to test the practical use of a smartphone app developed by the European Commission's Joint Research Centre (JRC) as part of the MYGEOSS project, in order to complement environmental monitoring and early warning of IAS occurrences in the Danube River basin.

At the moment, the main focus of DIAS is to develop and harmonize a common mid- and long-term strategy to improve the situation on IAS. The strategy will provide the goals and objectives, but also possible measures and recommendations on seven key topics. Region specific requirements should be mentioned as well as relevant actors. The seven key topics are: description of IAS in the Danube River Basin (also interactions and impact), species pathways of introduction, the creation of an information system and dissemination of knowledge, the classification of IAS: early warning, risk assessment and prioritisation (like black or alert lists), early detection and rapid eradication of IAS, management of established IAS and finally, awareness raising, communication & political work regarding IAS.

After completion of this strategy in 2017, the future work of the network will be to implement the strategy step by step and to develop a living network throughout the whole Danube River Basin and the adjacent region of the Black Sea. It will develop in a flexible way to cover the heterogeneity of the region (sub-groups lower, middle and upper Danube), the huge variety of aquatic to terrestrial species and the scientific complexity of the topic (division of expert working groups).

There is plenty to do! If you would like to join the network, do not hesitate to contact us.

8th International Symposium on Sturgeons (ISS8)

From September 10-16, 2017, the 8th International Symposium on Sturgeons will be organized in Vienna

ISS8 is organised by the World Sturgeon Conservation Society, the Leibnitz Institute of Freshwater Ecology and Inland Fisheries (Berlin), and the University of Natural Resources and Life Sciences, Vienna. It focuses on the dynamics and the drivers of the decline in sturgeon stocks worldwide, while at the same time transferring the lessons to be learnt from sustainable conservation attempts to make the investment in conservation successful.

ISS8 provides the unique opportunity to bring together sturgeon experts from all over the world to discuss and share their ideas and concepts to further improve the management of sturgeons along with their essential habitats. A second stronghold of the conference will be the aquaculture sector. Europe has a large share in sturgeon farming and caviar production. Traditionally, European traders have been the dominating distributors in caviar trade. Therefore, the European focus on caviar and caviar trade will provide a vital input for the conference topics. Quality control, alternative production methods, market trends and collaborative approaches in production and marketing, as well as control and enforcement are among the key issues to be addressed to meet the future challenges in this sector.

The conference will comprise scientific sessions on a variety of topics dealing with the ecology of sturgeons, status assessment and management of populations, aquaculture and human impacts. Specific sessions and workshops are dedicated to juvenile rearing, broodstock management and facilitation of large fish migration. Social events and excursions will be organised before, during and after the conference.

ISS8 intends to increase the interaction between presenters and the auditorium. A main aim is to facilitate and stimulate the discussion beyond cultural boundaries to increase the understanding of motivations and to expand on the applicability of new results under regional specific conditions.

For further details please have a look at the webpage: www.iss8.info/

Abstracts can be submitted by June 30, 2017

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Hydrological catchment of the River Danube

General Secretary:

International Association for Danube Research (IAD)
(Internationale Arbeitsgemeinschaft Donauforschung)
Dr. Doru Bănăduc
(ad.banaduc@yahoo.com; +40 0722604338)
Faculty of Sciences, Lucian Blaga University of Sibiu
5-7, Ion Rațiu Street, Sibiu, 550012, Romania

Editors:

Prof. Dr. Bernd Cyffka
Catholic University of Eichstätt
bernd.cyffka@ku.de
Dr. Gertrud Haidvogl
BOKU Vienna
gertrud.haidvogl@boku.ac.at

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