

L a y m a n ' s r e p o r t

Danube birds conservation







Introduction

The Danube is the largest river flowing through the area of the European Union – it is the longest river with the highest average flow and the biggest river basin, which is draining a major part of the Alps, almost the whole Carpathian range and large areas in the Balkans. Its character varies on the 2,860 km long route: the nature of a mountain river under the Alps changes to the mighty lowland river with extensive floodplains at the first meeting with the Carpathians, and continues through the series of canyons on the 100 km long section through the Carpathians in Serbia and Romania. Finally, it gets gradually bigger, slows down and creates the unique phenomenon – a broad delta on the coast of Black Sea. Naturally, these factors are reflected in the diversity of life in and around the river, which we can see at first glance – the lush vegetation of floodplain forests, meadows and wetlands, the abundance and species richness of fish or the great flocks of waterfowl.

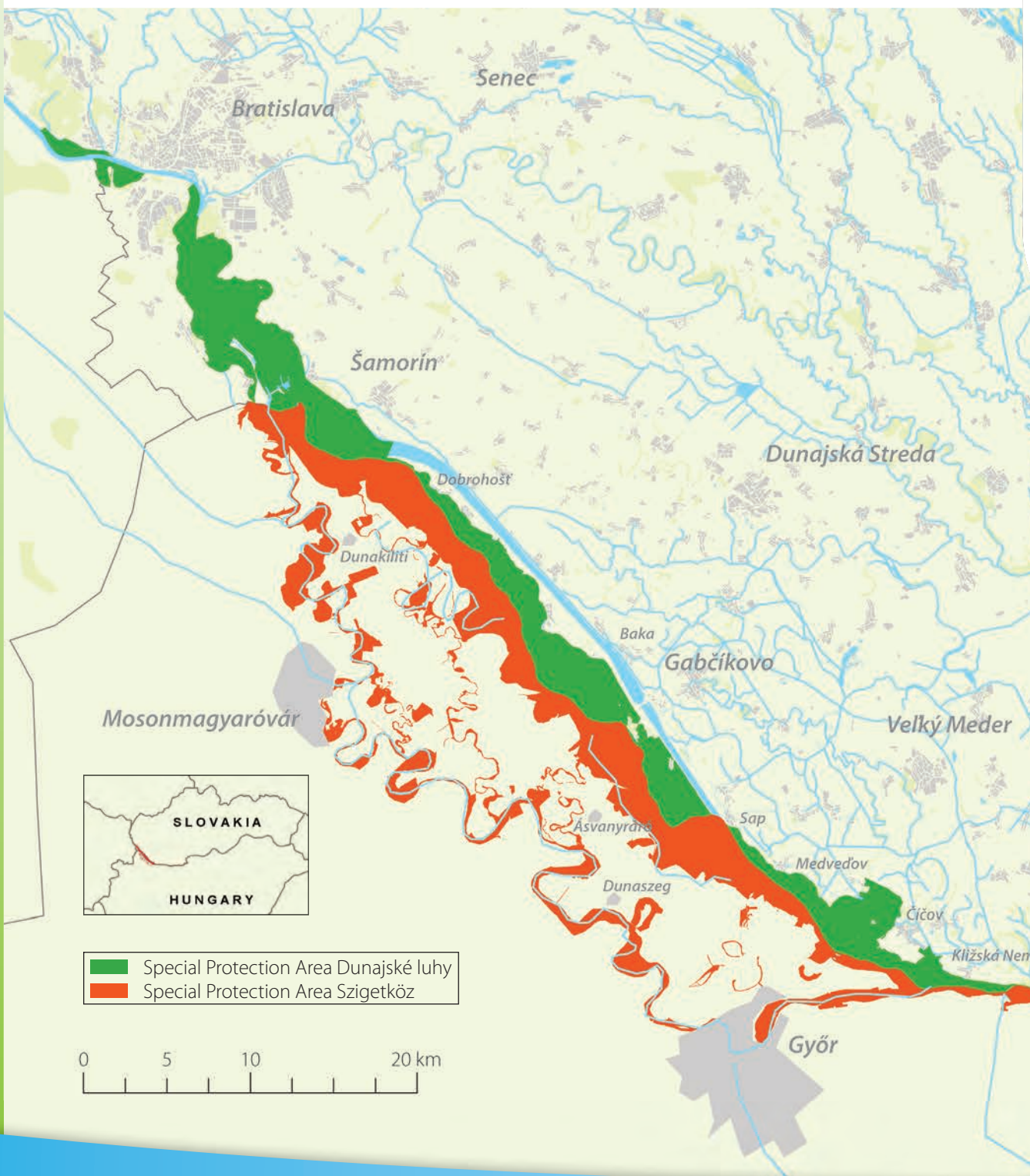
Within Europe, the Danube represents one of the places where unique natural treasures are threatened the most by human activities. Densely populated areas around the Danube caused its extensive regulation for the purposes of navigation, power generation, the conversion of floodplain forests and wetlands for the acquisition of agricultural land and plantations of non-native fast-growing trees, as well as water pollution. While water quality in some segments has significantly improved, habitat degradation and local extinction of endangered species are problems, which have persisted. In more preserved areas along the Danube river, protected areas were created that should ensure the survival of the disappearing river ecosystems but, unfortunately, even their existence can not guarantee their successful conservation.

One of the most unique places on the Danube used to be the so-called inland delta, which was located on the section of several tens of kilometres below Bratislava at the Slovak-Hungarian border. The character of the river is changing here from mountain to a lowland type of river, which is accompanied by gravel deposition. Therefore, the river bed was constantly changing and creating several major river branches, tangle of smaller river branches, side-arms and other water bodies. This dynamic and very varied ecosystem represented one of the largest and most diverse wetland complexes in Central Europe. Its vast parts were destroyed during the last decades; currently habitat degradation continues mainly as a result of the former regulatory interventions in the river and poor conservation of the area. We tried to change this situation.

Key issues that we identified in the territory were mainly changes in the hydrological regime and their consequences: the loss of momentum and the flow capacity through the river branches caused by their separation from the main channel of the Danube, the existence of artificial barriers in the river branches that prevent the natural flushing and act as barriers for fish migration, water shortages in some areas and the lack of natural steep banks. In addition, the bird populations are adversely affected by the poor state of the floodplain forests and meadows. The floods as well as native tree species are missing in the floodplain forests. Other large areas have historically been used as grasslands, but this activity has ended in most places and the grasslands were replaced with arable land or remained unused and started to gradually become overgrown mostly by invasive species. We started to address these problems. Most of riparian habitats are able to respond to the restoration activities rather quickly, so the actions may be very effective. It was the first attempt to implement such activities within the SPA Dunajské luhy and we managed to achieve significant successes.



Basic project information



Project title: Conservation of Endangered Bird Species Populations in Natural Habitats of the Danube Inland Delta

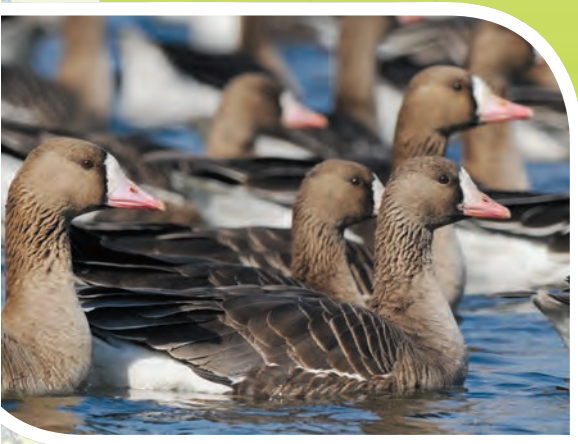
LIFE07 NAT/SK/000707

Project duration: January 1, 2009 – December 31, 2015

Coordinating beneficiary: Regional Association for Nature Conservation and Sustainable Development (BROZ), Slovakia

Project partners:

Water Management Construction, state enterprise (VVB), Slovakia
Comenius University in Bratislava, Faculty of Natural Sciences (PriF UK), Slovakia
Szigetköz Nature Conservation Association (SZITE), Hungary
North-Transdanubian Water Directorate (EDUVIZIG), Hungary



Total project budget: 4,577,663 €
EC financial contribution: 2,288,831 € (50 %)

Project area:

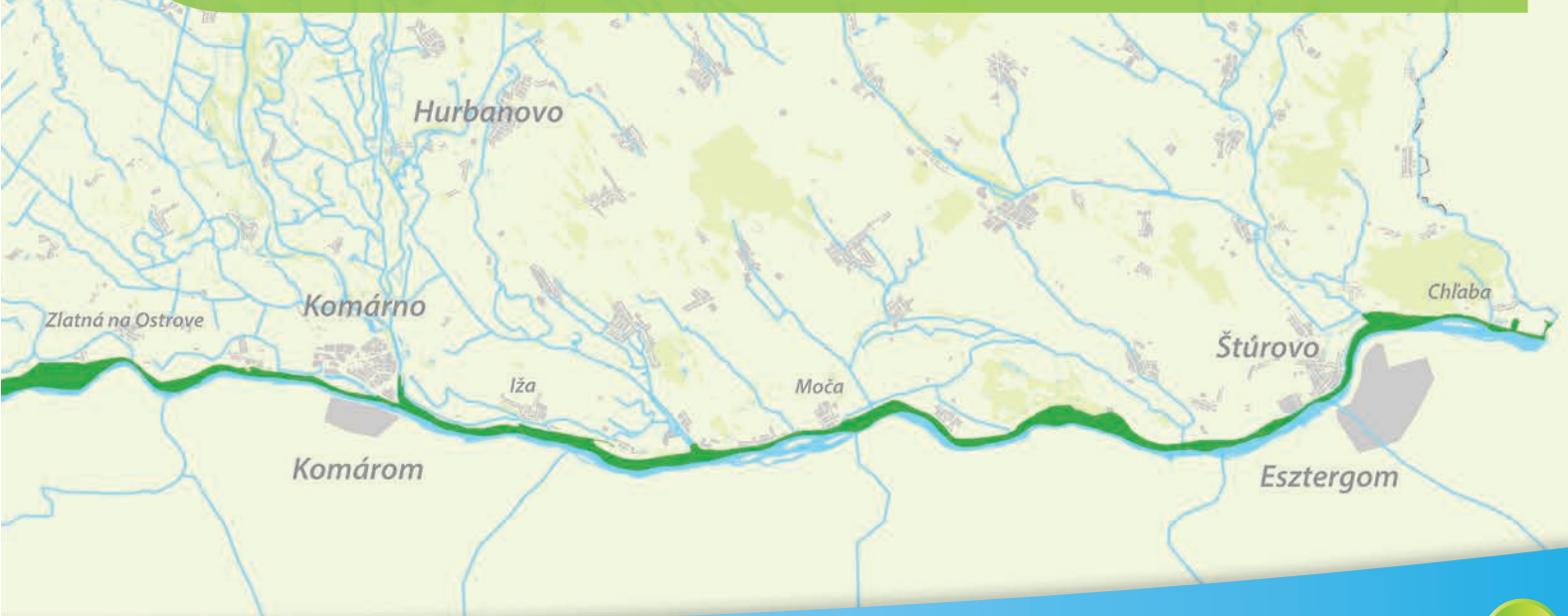
Special Protected Areas (SPAs) Dunajské luhy in Slovakia and Szigetköz in Hungary

General objectives:

This international project was focused on improving the protection of populations of endangered bird species in the Danube floodplains by improving the condition of their breeding and feeding sites. For this purpose, it was necessary to restore endangered habitats of target species; to establish acceptable management of the area; to create conditions for the sustainable conservation status of target species and raise awareness of the protection of riparian habitats.

Specific objectives of the project:

1. The restoration of the connectivity, flow capacity and dynamics of water regime of river branches of the Danube.
2. The elimination of fish migration barriers at strategic points.
3. The restoration of breeding sites in natural steep river banks.
4. The restoration of dry oxbows, wetlands and marshes.
5. The restoration of abandoned meadows as feeding and nesting bird habitats.
6. The restoration of tree species compositions of floodplain forests through the planting of native tree species.
7. The purchase or long-term lease of land for nature conservation purposes and introduction of appropriate habitat management.
8. The elimination of disturbances of sensitive species at their breeding and feeding sites.
9. The acquiring of relevant scientific data on target species and their habitats.
10. Raising the awareness of key stakeholders and public.





The Danube river flows through the centre of the vast area of inland Danube delta and the Slovak-Hungarian state border lies in the middle. Nature – and birds especially – are not aware of these administrative borders. From the ecological point of view, the area on both banks of the Danube is unified with common populations of birds inhabiting the entire area around the river. In the Hungarian part, there are several nesting colonies of herons that use to fly to the other side of the river for food. White-tailed Eagles nesting nearby Gabčíkovo in Slovakia like to use extensive wetlands on the Hungarian side of the river as hunting grounds. Within the country's accession to the European Union and the building of the European network of protected areas Natura 2000, SPAs were designated on the basis of scientific evidence on the occurrence of rare bird species within the countries. The adjacent SPAs on each side of the Danube were included into the project area for the purpose of a successful and coordinated protection of the birds of the Danube floodplains.

❁ Special protected area Dunajské luhy, Slovakia

Special protected area (SPA) Dunajské luhy was designated by the decree of the Ministry of Environment of the Slovak Republic in 2008 on the area of 16,512 ha in order to ensure the favourable conservation status of habitats of bird species of European significance and habitats of migratory bird species Black Stork, Sand Martin, Little Bittern, Mediterranean Gull, Black Kite, Red-crested Pochard, Garganey, Gadwall, Common Redshank, Marsh Harrier, Tawny Pipit, White-tailed Eagle, Common Tern, Kingfisher, Little Egret and to ensure the conditions for their survival and reproduction. The Danube represents an important migration corridor for waterfowl, but also for fish and other animals. With more than 70,000 regular wintering individuals, SPA Dunajské luhy is the most important wintering site for waterfowl in Slovakia. Therefore, the purpose of the SPA is also to ensure a favourable conservation status of habitats and conditions suitable for the survival and reproduction of migratory water bird species, creating the flocks during migration or wintering, like Common Pochard, Tufted Duck, Goldeneye, Greylag Goose, Bean Goose, Greater White-fronted Goose, Great Egret, Smew and many others. The area includes basically the whole part of the Danube situated in Slovakia except for the part in Bratislava. SPA Dunajské luhy is a rich complex of river branches and wetlands, mostly in the upper part of the stream where it changes from mountain river to bigger, slower flowing lowland river and created the Danube inland delta in the past. Majority of this area was destroyed by construction of the river dam Gabčíkovo, but its part – Hrušov water reservoir – still represents suitable habitat for some of the above mentioned bird species.

On the national level, SPA Dunajské luhy represents the largest area of floodplain forests and wetlands, it is the most important area with several habitats (e.g. plant communities of the so-called Danube forest-steppe – *Asparago-Crataegetum*) and species (e.g. water gastropod *Theodoxus transversalis*, dragonfly *Leucorrhinia caudalis*, fish species Balon's Ruffe, Striped Ruffe, Weatherfish, Ziege, Streber, Golden Spined Loach). Within Slovakia, the Danube floodplains are the most important nesting site for White-tailed Eagle, Mediterranean Gull and Common Tern and one of the few most important breeding sites for Little Egret, Black-crowned Night Heron, Little Bittern and Kingfisher.



Red-crested Pochard



Sand Martin



Great Egret



Eurasian Bittern



✿ Special protected area Szigetköz, Hungary

Special protected area Szigetköz was designated in 2004 on the area of 17,185 ha in order to protect nesting populations of Black Stork, Eurasian Bittern, Little Bittern, Black Kite, Black-crowned Night Heron, Purple Heron, Great Egret and Black Woodpecker. SPA is also significant in terms of the numbers of wintering species such as Goldeneye, Mallard, Common Teal, Pygmy Cormorant and Smew.

The name Szigetköz, translated literally means land between the islands. This part of the project area consists of a large inundation area on the river Danube, of the Mosoni Danube and of scattered well-preserved habitats between the Danube and Mosoni Danube. In this area, are the preserved floodplain meadows, marshes with large reed beds and river side-arms (e.g. Zátonyi Danube) and their remains are present. SPA Szigetköz ends at the town Gönyű. Szigetköz is a natural floodplain area with the greatest range across the Upper Danube valley in Hungary. The bulk of the territory is covered by forests, particularly softwood willow-poplar forests in the river branch system and drier hardwood oak-ash-elm floodplain forests near the Mosoni Danube. Extensive set of side-arms with dozens of islands are still very well preserved in the inundation area, where several of the islands are still not accessible by foot.

The area is under the administration of the National Park Fertő-Hanság and is part of the Protected Landscape Area Szigetköz; the Erebe islands in the eastern part belong to the Protected Landscape Area Pannonhalma.



The Öntés marsh (Szigetköz)



❁ **Black Stork (*Ciconia nigra*)**

belongs to the group of the most endangered bird species of Danube floodplains. It nests in remote rarely disturbed forests on old massive trees, hunting for food in shallow water and large uncovered river branches as well as in small river side-arms in the forests. It is a good indicator of the conservation status of the territory since it is sensitive to many negative factors. There are several reasons why the species almost completely disappeared from the area. One of them is intensive forest management focused on hybrid-poplar trees, where the Black Stork can not find suitable trees for nesting. Disturbance at nesting and feeding sites by forest maintenance works and hunters often caused nest abandonment. Missing water regime dynamics caused loss of hunting grounds in shallow water. In the end of the 20th century there used to be 20-30 nesting pairs in Danube floodplains in Slovakia and Szigetköz. Currently, there are only 1-2 nesting pairs in Slovak part and only a little bit more in Hungarian part.



Black Stork

❁ **Purple Heron (*Ardea purpurea*)**

is rare and relatively inconspicuous heron that likes to hide in the edges of reed and nests in large flooded reed beds. The nesting sites in Danube oxbows in the Slovak part of the area disappeared during 20th century as a result of construction of the Gabčíkovo dam, only rare and irregular nesting has been recorded in last decades. However, Purple Herons still regularly nest in colony of several dozens of pairs in the Hungarian part of the area – at the oxbow at Lipót. They use to fly to other river branches within a few kilometres for food, including Slovak part of the area. After the breeding, we can see them in the other parts of Danube floodplains and then they migrate for winter.



Purple Heron

❁ **Little Egret (*Egretta garzetta*)**

is the smallest of the herons and egrets present in the area. Its optimal sites for hunting are in unregulated river ecosystems where it looks for food in uncovered areas, mostly on gravel bars, exposed banks of side-arms and flooded meadows. It often stays in flocks, nesting in colonies together with other heron species, mainly on trees. The area of Danube floodplains is the northern border of its regular nesting area. During 20th century Little Egrets nested on several sites up to Bratislava, but most of them gradually disappeared and only one was left near the village Moča. 1-5 pairs were nesting here in the long term and so the population of Little Egret was particularly vulnerable in the area. However, during the project period, the breeding population has increased to approximately 30 pairs, which has created expectations for the return of the species to other parts of the territory as long as their natural hunting grounds – gravel and sand bars – could be restored.



Little Egret

✿ Black-crowned Night Heron (*Nycticorax nycticorax*)

used to be another typical inhabitant of the Danube surroundings. During favourable conditions the species had nested in big colonies often with other species. It is migratory species. During the nesting period it is quite inconspicuous and active mostly during dusk. For a feeding habitat it prefers wide oxbows and marshes and that's why the regulation of the Danube and construction of the dam Gabčíkovo harmed its population. Many of nesting colonies disappeared, the number dropped to a few dozen pairs. However, the population has grown to 200-300 pairs during the project period.



Little Bittern

✿ Little Bittern (*Ixobrychus minutus*)

is a typical inhabitant of oxbows living in dense inundated vegetation, mostly in reeds, where it builds its nest and hunts small water animals. It lives an extremely secretive life, even from a short distance it is difficult to spot it because of its plumage camouflage. Several dozens of pairs live in both sides of the river and even though they don't nest in colonies, the nests are often close to each other at sites with good conditions.

✿ Garganey (*Anas querquedula*)

is a smaller and relatively rare duck, which lives in the Danube floodplains regularly during migration period, but it nests here rarely. In the past, the nests were found in the Danube river branch system, but due to deterioration and destruction of the sites they disappeared. Currently, they rarely nest on facilities of the Gabčíkovo dam.

✿ Gadwall (*Anas strepera*)

has been the typical inhabitant of the Danube floodplains, but due to the worsening of environmental conditions has been slowly disappearing. Currently, it regularly nests in some parts of Hrušov reservoir. It appears here during the whole year, outside of the breeding season it creates smaller flocks with dozens of individuals.



Black-crowned Night Heron



Garganey



Gadwall



Black Kite

❁ Black Kite (*Milvus migrans*)

used to be one of the most abundant and characteristic birds of prey of the land around the Danube. In the years 1980-1990, 26 pairs used to nest in the area, but then they started to disappear and since 2010 there was no nesting pair recorded here. The causes of population decline are similar to those of the Black Stork: limited feeding options due to river regulation, but also due to the disappearance of grasslands, increased disturbance at nesting sites and intensive forest management.

❁ White-tailed Eagle (*Haliaeetus albicilla*)

is the biggest bird species in the Danube floodplains. It lives here all year-round and during the winter there are even more individuals flying here from the northern territories. In the second half of the 20th century the nesting population fully disappeared. Thanks to conservation activities in other areas of Europe the decrease of nesting population was successfully stopped and White-tailed Eagle started to come back to the territory and started to nest again in 1997. After the first increase of the population, several pairs are nesting at the Slovak as well as Hungarian side of the river. Despite the fact that there are new nesting pairs, others left their nesting grounds due to the disturbance and intensive forest management.



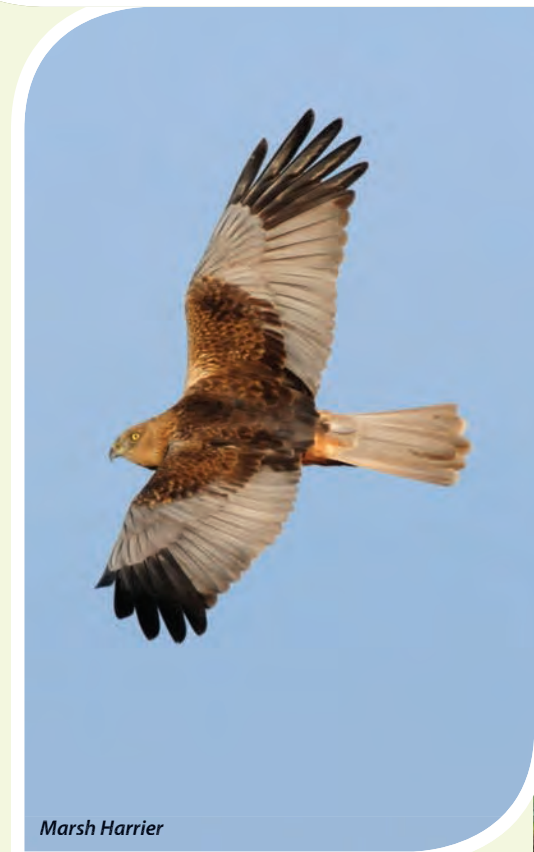
White-tailed Eagle

❁ Marsh Harrier (*Circus aeruginosus*)

is the third bird of prey in the Danube floodplains bound to the aquatic environment. In contrast with the Black Kite and the White-tailed Eagle it is nesting directly in the wetlands. It builds its nest in flooded reeds where it also hunts aquatic animals, but mostly tends to hunt in the surrounding agricultural land for voles. Marsh Harriers nest mostly in densely vegetated oxbows within Danube floodplains. The population seems to be relatively stable.

❁ Common Tern (*Sterna hirundo*)

is the original species of larger rivers. It was nesting in uncovered areas, mainly gravel or sand islands. For food it hunts small fish in larger water bodies, which it catches by flying over the water surface and diving into the water. The original population residing on the Danube gravel bars moved to man-made habitats as gravel pits. Currently several hundred pairs nest only on artificial islands in Hrušov water reservoir. The population is now dependent on the protection and the maintenance of the suitable conditions of nesting islands. When hunting, it often also goes to the river side-arms of the Danube.



Marsh Harrier



Common Tern

❁ Common Redshank (*Tringa totanus*)

used to be typical nesting species of shallow uncovered wetlands, mostly wet meadows and pastures. These were reduced to a minimum and now only small fragments remain. The regular nesting of the Common Redshank disappeared. A few pairs have started to nest in secondary habitats on the islands of the Hrušov water reservoir. The potential for a restoration of the population in the Danube floodplains arose after the species started to nest on the restored wet meadows in Čičov.

❁ Kingfisher (*Alcedo atthis*)

is a specialist of river ecosystems. These provide him with food consisting of small fish and also nesting sites – it builds its nests in steep clay banks. During the project, there were more than 40 nesting pairs recorded in SPA Dunajské luhy. The population of SPA Szigetköz is unknown, but due to the better preserved environment we expect the number to be higher. In the area it has limited nesting possibilities due to missing river dynamics in river branches and banks fixed with stones in the vast area. Often the bird is nesting in the clay among the roots of fallen trees, something what is recorded in disturbed sites. In some areas it could also be limited by lack of suitable hunting grounds.



Common Redshank



Kingfisher

❁ Black Woodpecker (*Dryocopus martius*)

has traditionally been considered a woodpecker of natural mountain forests but in the old floodplain forests it also has excellent living conditions and the density of nesting pairs here may be even higher. In the floodplain it is mostly nesting in old White or Grey Poplar trees. The main threat to this species is intensive forest management that reduces its feeding and especially nesting possibilities. Plantations of hybrid poplar are usually felled on the 25th year growth and only a short time before that the trees become inhabitable for the species. Felling on larger areas often takes place during the breeding season and the trees are cut down with the nests. In managed forests the survival of the species can be ensured by restricted logging in the breeding period and the retention of groups of native species of trees in the logged areas.



Black Woodpecker

❁ Sand Martin (*Riparia riparia*)

is related to the Swallow and the House Martin but in contrast to them, the Sand Martin is bound to a life around the rivers. It nests in steep clay banks, originally only in river banks, but today also around construction and mining works. It often seeks food above the water surface and also above meadows. It is a bird species, which can significantly contribute to reduction of the number of mosquitoes. In the past, it was regularly nesting all along the Danube and its river branches although the numbers were fluctuating according to the actual conditions. During floods, nesting sites were regularly renewed, but on the other side, most of the colonies were threatened and regularly flooded. Unfortunately, the Sand Martin was slowly suppressed in the Danube floodplains. On the one hand there has been an ongoing fixation of river banks by boulders and on the other hand the suitable banks were overgrown by vegetation after the change of water level dynamics in the bigger river branches. Therefore, it has been nesting only irregularly in the Slovak part of the area and its nesting in river branches disappeared completely. The situation is better in Hungary where there are much more banks without artificial stone embankment.



Colony of Sand Martin (Chlaba)



Birds are one of the typical bioindicators, easily noticeable also for a lay person. Their presence or absence is reflecting the condition of the environment they are living in. The main threats for rare bird species often represent threats also for overall ecological state and biodiversity of the area. Their removal or mitigation therefore does not just help target species of birds, but often also a wide range of other animals and plants.

1. River regulation. During the last 200 years massive changes have been carried out on the Slovak-Hungarian section of the Danube; the main aims of these interventions have been navigation and flood protection. The formerly continuous large inundation area has been divided by flood protection dykes into a small inundation area along the main river bed and into a large area without regular floods. In consequence, the area outside the new inundation zone is isolated from the direct impact of floods, whereas in the new inundation area this impact increased. Simultaneously with the building of dykes, the banks of the main river channel have been fortified with stones, large deposits of gravel in the river have been dredged and numerous river branches have been cut away from the river. In consequence, the formerly flowing river branches have stagnant water during the majority of the year, the river banks are stable, no new branches are being created and due to natural sedimentation the number and area of side-arms is slowly decreasing. The reduced dynamic processes lead to the reduction of several habitat types, e.g. shallow water areas, gravel banks or steep river banks.

2. Changed water levels. As a consequence of various activities, the average water levels in some parts of the project site have decreased. Locally this has led to drying of the disturbed areas. The most serious impact was on the wettest floodplain forests and shallow water bodies, in several cases large river branches or wetlands remained without surface water. Complete local extinction of aquatic plants and animals followed here.

3. Changed water level dynamics. In the river branch system the water regime is artificially controlled. The maintenance of one stable water level (or several values, e.g. one water level during the vegetation period and another during the winter period) is unnatural. The life of the river is intensely pulsing and the fluctuation of water level is a natural phenomenon. In the majority of the project area the sites with temporary water level and shallow water disappeared and thereby completely removing the environment for a lot of bird species bound to open water surfaces along with spawning sites for fish and amphibians as well as suitable sites for rare plant species.

4. Lack of food for bird species. The lack of aquatic invertebrates and amphibians inhabiting mainly temporary surface water is related to the previous factors and also causes a drop in bird populations. In the case of fish, a major threat is the absence of flooded areas and presence of different barriers on the stream (roads, dams) that prevent the migration of fish and regular access to their spawning grounds.



Nest of Black Stork abandoned due to the presence of nearby hunting tower



The side-arm dried out after backfill of the inflow (Vojka nad Dunajom)

5. Intensive forest management. The result of an intensive forestry program and decades of replacing natural floodplain forests with monocultures of non-native Euroamerican poplars is a significant drop in the number of older trees in the area. Moreover, there is a lack of native tree species in extensive areas, which causes the decrease in nesting options for several bird species.

6. Abandonment of the traditional use of meadows. A large proportion of the floodplain areas were traditionally used as pastures of domestic animals and mowed for obtaining hay. This long-term extensive land management has created specific rich mosaic of habitats. During the last decades the majority of extensive meadows have been abandoned and changed to arable land, hybrid-poplar plantings or just left unused. The unused former meadows without management are usually quickly overgrown with invasive plant species and the habitat of native plant, insect and bird species is disappearing.



Growing of hybrid poplar on a plantation (Bratislava)



After large-size felling, there are often no old solitary trees left

7. Excessive disturbance of sensitive species. Some bird species like Black Stork are extremely sensitive to the presence of people in its nesting territories. Regularly, unsuccessful breeding or even complete leaving of the territory has been recorded as a consequence of disturbance by man. The Danube inland delta used to be a system of inaccessible islands separated by a strong stream of water and impassable marshlands. Today, however, a dense network of roads and dams is built across the river branches which allow easy access by vehicles to the most of the area. Easy accessibility supports different illegal activities in the project sites such as poaching, shooting of birds, illegal net fishing, building of illegal camping sites and leaving different litter acting as traps for birds, such as fishing nets, lines, hooks, etc.

8. Insufficient scientific data. If the real risk of local extinction of the endangered species should be estimated and the conservation priorities should be set, reliable scientific data is necessary. Although the monitoring and research of many species took place in the area, existing data is still inadequate. Even within disappearing species the threats and their severity are not always exactly known. The lack of data is concerning bird species as well as habitats and also there is not enough non-biological data. For optimal protection of the area it is necessary to use hydrological data too.

9. Lack of awareness of authorities, decision-makers and public. Representatives of state administration bodies do not have sufficient information about the possibilities for alternative management of floodplain habitats that would favour the preservation of their biodiversity. And even if they do have some information, they lack the practical experience and relevant know-how. Lack of awareness in state administration bodies results in unsustainable or inappropriate management with a major impact on habitats and species within the whole project site. Lack of awareness applies to the general public as well. Although the public often see the presence of a number of conservation problems in the area, they are not aware of their importance and in particular of the necessary and possible solutions.



Senseless boulder embankment of the Danube river beaches (Zlatná na Ostrove)



Flood protection dyke illegally crushed by motor vehicles (Bratislava)



An overgrowing meadow without management (Bratislava)



❁ Situation before the project

Between Bratislava and Klížska Nemá, the Danube river created a unique inland delta – a system of river branches, marshes and islands overgrown with wild forests – a paradise for fish, birds and many other animals. This system was characterized by high dynamics, riverbeds, gravel banks, islands and oxbows were constantly appearing and disappearing. A regulation of this area was done step by step – first, a new Danube channel was created and partially embanked by stones. Subsequently, the inflows to the side-arms were dammed by stone weirs, which still allowed water income most of the year. This was also the case of Medvedovské river branch, which was still connected with the main Danube channel by six independent inflows in half of 20th century. These inflows were closed in 1980s one by one and moreover, the upper parts of the channels, up to hundreds of meters of length, were filled with gravel and earth. This caused water in Medvedovské river branch to stop flowing and the bottom started to be filled with fine sediments. Besides the flowing water, steep river banks, bare gravel banks and a lot of animals disappeared from the system. For example, between 2009 and 2012, there was no nesting of a Kingfisher recorded in this area, even if the feeding habitats were suitable.



Fish thrive the most in alive river branch systems

❁ Solution

The only solution that could have reversed the situation, was the reconnection of Medvedovské branch to the main Danube channel, which would allow water to flow again. During the preparatory phase, we encountered a number of constrains that resulted from the requirements of concerned operators. The first restriction was the requirement of the Slovak Water Management Enterprise and also of the Slovak-Hungarian Committee on Transboundary Waters that the water has to be concentrated in the main riverbed during the periods of low water levels. Other requirement of Slovak forests (state enterprise) was to maintain the possibility of passage for machines and vehicles for the purpose of forest management. Field measurements also showed that the volume of necessary works would be quite big, because in all closed inflows a huge quantity of materials was accumulated. This material was ranging hundreds of meters out from part of the inflow. Besides that, in some river branches other deposits of sediments were created, which reduced the possibility of their flow capacity. This considerably increased the costs of the action, and only one of the former inflows could have been opened. As the most appropriate, the second inflow was selected. The hydrological study planned the restoration of the original width (30 m). Due to expected financial costs, this solution was finally adjusted and the inflow was restored in the length of 220 m and bottom width 10 meters. The height of the inflow bottom was above the level of the low navigation and regulation water level. Also a passage for motor vehicles has been planned. This keeps restricted access to the area and water does not flow to the river branch during the low water level periods in the Danube. In this case a lower position of the inflow bottom was impossible, because the riverbed here is formed by gravel bank with the same height.



Lagoon with clear seepage water during lower water levels in Medvedovské river branch

Results

The above mentioned solution was implemented in 2012. In the beginning, the excavated inflow part of the river branch had a shape of straight channel with equal banks. In the end of 2012, immediately after termination of the restoration works, higher flows entered the branch and started fast lateral erosion. The result of this erosion process, which continued also in the first half of 2013, was the enlargement of the river branch to the originally designed 30 meters and also the change of shape of the channel – from straight to slightly meandering. One of unintended consequences was the sedimentation of washed away bank material, which increased its bottom further down in wider parts of the channel and caused restricted flow capacity at low and medium water levels. Subsequently, this material was excavated. Erosion and spontaneous „naturalization“ of river bed occurred only in the area of former river branch without threatening the surrounding land. Continuous erosion in the area of



Flowing water creates various habitats



Restoration of the inflow of the Medveďovské river branch



Riverbed is being cleaned at the higher water levels

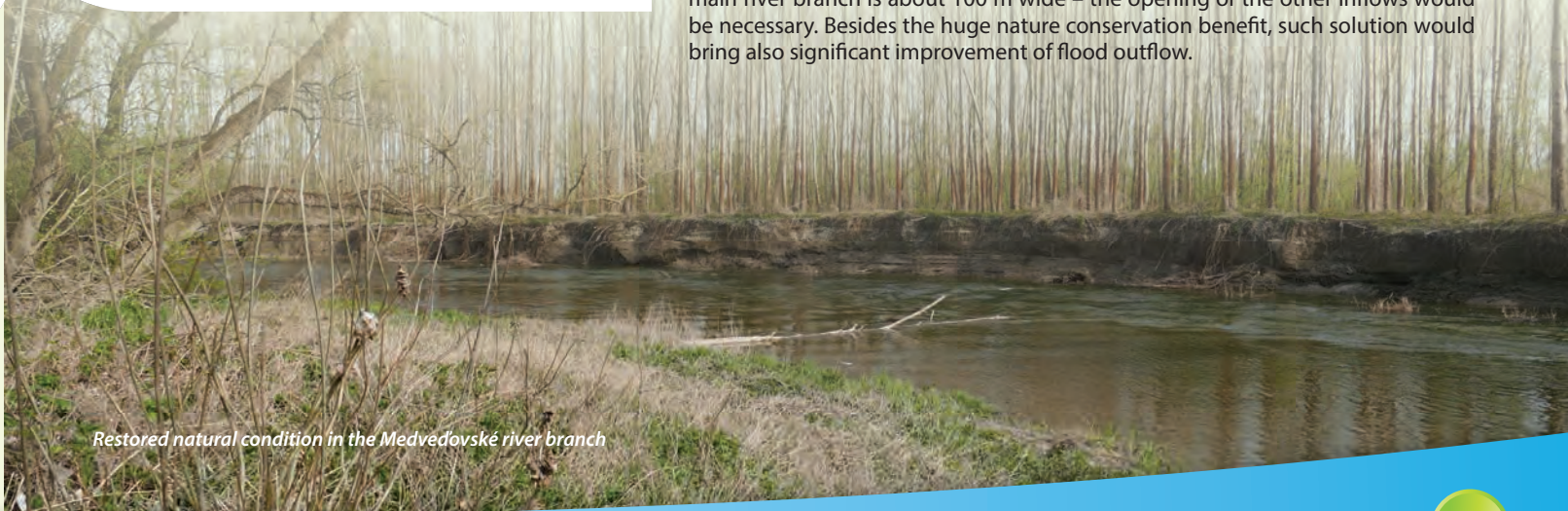
the inflow from the main channel was preventively stopped by the installation of a buried quarry stone dumping. It is worth noting, that the Danube flow $10\ 200\ \text{m}^3\ \text{s}^{-1}$ in Medveďov in June 2013, which is more than the hundred year flood, had no bigger influence on the shape of the river branch. During following years – 2014 and 2015, the river bed was not changing anymore and was stabilized.

The restored water flow had an immediate influence on animals and plants. Right after the river branch restoration, Kingfishers started to nest here. They used two concave banks for nesting, which were restored. Furthermore, the river branch provides them excellent opportunities for hunting – the flowing water creates depressions, which are filled by clear water during periods with low water levels. The Black Stork, which is in extinction in the area of the Danube floodplains, also started to visit the site for feeding. Of course, rheophilous fish species from the Danube main channel immediately occupied

the flowing branch, where they can find good conditions for life and reproduction during some periods. Other phenomenon, which was restored in the area thanks to the flowing water is the natural regeneration of the softwood willow-poplar floodplain forest on gravel and sand sediments along the river branch.

Future outlook

This activity has fully shown the vital power of the river. Relatively little action was needed to restore the natural processes, which are typical for river ecosystems. It is a unique restoration action on the Slovak section of the Danube between Bratislava and Komárno, where the free water-flow has not yet existed in any river side-arm. This new state also brings some problems – e.g. the access to the forestry for machines is limited to the low-water level periods, which lasts about 1/3 of the year, mostly in winter. However, such difficulties are definitely less significant than the benefits from the restoration of the main functions of the river ecosystem. This activity is important as a model sample solution. For a full and long-term functioning of the whole system of the Medveďovské river branch system – the main river branch is about 100 m wide – the opening of the other inflows would be necessary. Besides the huge nature conservation benefit, such solution would bring also significant improvement of flood outflow.



Restored natural condition in the Medveďovské river branch



❁ The past

The Veľkolélsky ostrov island is situated in the part of the Danube where the slope is already moderate and water flows slower, downstream of the Danube inland delta. Here, the presence of islands and river-branches is not so frequent, but on the other hand, they are more stable from a long term point of view. This is also the case of Veľkolélsky island, which has existed over centuries. The island is bypassed by the massive Veľkolélske rameno river branch, in some places more than 100 meters wide. As a result of a Danube waterway regulation, the river branch inflow was dammed by stone weirs. The water was flowing through these weirs most of the year except for the lowest water levels periods. In half of 20th century, the water was overflowing through five weirs and returning to the main Danube by two free outflows. This system was allowing the water-flow within most of the year, flushing the river branch during high water-flows, and also the fish migration between the branch and main river channel. Access to the island was usually possible only by boat or by ferry.

❁ Situation before the project

Regarding the construction works on Gabčíkovo-Nagymaros water dam system, significant water management changes have been made by the end of the 20th century at the Veľkolélske river branch and also at the island. This meant radical changes in river branch function. To avoid flooding of the island caused by the water dam operation, the island was left as an isolated polder. The inflows and outflows were dammed by dykes, which were situated slightly above the island terrain level. The main Danube channel and the river branch stayed connected only by two facilities – one in a part of the inflow and one at the outflow part. These were concrete culverts about 40 meter long and two meters wide. The river branch was also dammed by a road. Under this road only few small culverts were constructed for water flowing. All these factors caused, the Veľkolélske river branch to lose its flowing capacity, and was gradually diminishing and disappearing due to material sedimentation during floods and overgrowing by aquatic vegetation. The river branch stopped to be an important fish spawning site, because fish migration into the branch became very limited, and fish were able to migrate only by narrow and long culverts, which often stayed dry. That is why the fish also had problem with a way back to the Danube. In summer, the shallow water was warming up and the branch was drying out.



Veľkolélske river branch is one of the biggest river branches in Danube floodplains in Slovakia



Flow capacity of the river branch before the project was rather symbolic...

🌱 Solution

However, the river branch was still habitat for many aquatic animals and plants, and that was why an interesting scientific discussion proceeded the decision, how to perform the restoration action. The result of the discussion was the recommendation to restore the original water flowing regime in the river branch as much as possible. The main reasons were that slowing down or even stopping the ongoing degradation of the branch, and also the fact that flowing habitats are less common and more endangered than stagnant water habitats. The goal of the proposed construction works was to make the river branch accessible for fish so they would be able to migrate without restrictions between the branch and Danube main channel, as well as the restoration of the branch water flow to the highest possible extent.

During the process of designing the solution, the condition of Slovak Water Management Enterprise and of the Slovak-Hungarian Committee on Transboundary Waters was that the water has to be concentrated in the main riverbed during the periods of low water levels. Therefore, the elaborated project included the opening of both outflows on the level of the branch bottom, opening of one pair of the inflows on the level that it will let water in when it raises above the low navigation and regulation water level and also modification of the crossing dam with the road that it will be able to pass amounts of water corresponding to the inflows and outflows.

🌱 Result

Within 2013 – 2015, all three designed measures were implemented. The water inflows to the river branch by 100 meter wide inflow channel. One part of the crossing dam was substituted by a new bridge, which allows the water flow, and also allows the visitors and land managers to access to the island.

The water now flows through three 15 m wide fields and more than 4 m high, instead of two former culverts, just 2x2 m wide. On both outflows the dam was removed and the river branch is now freely connected with the main Danube channel. Between the outflows, a small island called Golden island is located. This small island is inaccessible by feet now. In 2015 the water flow in the river branch was restored after decades. Positive results and fast returning of wildlife to river branch are confirmed not only by scientists, but also by local fishermen.

🌱 Future outlook

Thanks to a river branch restoration and also thanks to cattle grazing and trimming the old pollard willows, the island starts to look like it did in the past. Optimal variant of river branch restoration contains the opening of the remaining three inflows and another 30 m wide bridge to be constructed.

Besides the limited river branch flowing capacity, sediments on the bottom are another problem. The large amount of small particles was sedimented in some parts of the river branch especially during the flood periods which reduced the width and depth of its riverbed. We can expect that the sedimentation in the restored branch will be significantly lower. But probably the majority of the already existing sediments will not be taken away. Therefore for the complex river branch restoration removal of the old sediments from the bottom will be necessary.



Conditions in the river branch are now ideal for Wels Catfish



Former culvert through the river branch had the size of 2x2 m



New bridge with three 15 m wide openings lets through enough of water



Even a layperson is able to notice that meadows, either grazed or mowed – unless this is done with too much intensity – represent places with rich species diversity. These meadows with all their biodiversity have almost disappeared from the Danube surroundings in the last few decades. Meadows in the project area are now rare and vanishing habitats of European interest – alluvial meadows of river valleys (6440) and lowland or mountain hay meadows (6510). Meadows are of great importance as a habitat for a number of bird species. Common Redshank uses meadows for nesting and other species like Marsh Harrier, Black Kite, Little Egret use meadows as feeding sites. Flooded meadow vegetation is ideal spawning site for a number of fish species and shallow ponds surrounded by meadows are good place for reproduction of amphibians.



The variety of species of grazing animal raises the biodiversity of the area

❁ The past

Meadows are very rare habitats in the Danube lowland, although it used to be covered by them almost everywhere until the 19th century. Even in the middle of the 20th century, permanent grasslands formed significant part of the Žitný ostrov island.

Grazing of different species of domestic livestock has been the traditional way of using the grasslands in the project area in the past. For centuries, grazing provided living for people. Herds of cattle grazed seasonally on many islands within the Danube river branch system. Commonly grazing took place in the forests and on grasslands with pollard willows, which served also as a source of wood. Periodic flooding of meadows had provided fertilization.

Specifically the height and structure of plant vegetation is important for birds. Short vegetation provides better visibility, which also helps with the catching of prey. A number of different types of insects including specialists in the decomposition of cattle manure, bind to the grazing area. In addition low vegetation and open space is necessary condition for a large number of bird species, which need to move on the ground during nesting or while picking the food.



In terms of biodiversity it is also good when the trees are growing on the pastures...



❁ The disappearance of grazing and meadows

The majority of grasslands in the Danube lowland was transformed into arable land after the draining of wetlands and the construction of dams preventing flooding. Grasslands have been preserved only in fragments, especially in flood areas of the rivers. Within the project area, grassland was converted to forest plantations, arable land or left unused. Abandoned meadows are now overgrown with invasive weeds and allergens (Goldenrod, Asters and others) and invasive trees (Box elder, Green ash and others). The remaining meadows usually lack proper management necessary for the bird protection. The traditional use of grasslands had disappeared, because its financial profit for the owners is not comparable to modern industrial agricultural production, where few crops are grown in big lanes.



Hoopoe – specialist for pastures



The growing of pollard willows allow simultaneous grazing and gathering of wood

❁ Renewal of traditional use of meadows

The largest area of alluvial meadows on the Slovak side of the Danube has been preserved on the Velkolélsky Island. However, these meadows were used only minimally after 2000 and they started to become overgrown, therefore our attention was focused right here. We purchased a herd of 70 cattle, 100 sheep, 20 goats and 8 Hucul breed horses and we have introduced a grazing system. Grazing is regulated through mobile electric fences. Cattle are clearly the best for restoration of abandoned and derelict areas. Sheep and horses are again appropriate to maintain low vegetation on already restored grasslands and pastures. Already during the first grazing season in 2009 we saw excellent results. Areas overgrown by two meters tall thicket of weed were managed by cattle in a short time and turned into the low grassy vegetation. The cattle are “mowing down” vegetation even in rough or flooded terrain and under scattered trees. It is impossible to do this

work with any kind of machine.

During several years of grazing animals reduced continuous stands of invasive plants, especially Goldenrod. On regularly managed meadows and pastures there has been a visibly better expansion of the rare and protected plant species such as Clematis integrifolia or summer snowflake.

The grazing was later supplemented with milling of the rest of the invasive tree species and mulching of the sprout shoots of removed plants. Grassing of arable land with seed mixtures of native herb species was used on an area of 20 ha near the villages of Velké Kosičky and Čičov. In cooperation with local farmers in the villages of Iža and Dunaszeg, we have improved pasture conditions by the Danube by removing non-native invasive trees and by supporting the pasture infrastructure. Overall, during the project we have restored floodplain grasslands and pastures on an area of nearly 200 hectares.

With the support of water managers in the Hungarian part of the area, we began the grazing of cattle on the flood-protection dyke and their buffer zones (out of project activities). Grazing improves the quality and structure of grassland and also saves operating costs for mowing and mulching of the dykes.



Cattle are ideal for restoration of long-term abandoned meadows





✿ Steep river banks

Steep river banks, as well as gravel bars and islands are a characteristic feature of functioning river ecosystems and they are created, maintained, changed and also destroyed by the action of the natural processes of erosion and sedimentation. Natural regeneration of alluvial forests is bound to these processes since willow and poplar tree saplings grow on uncovered areas created after the decline of water level.

Steep river banks of the flowing waters presented original nesting sites for Sand Martin and Kingfisher. The possibility of spontaneous recovery of such breeding habitats in the Slovak section of the Danube had been with few exceptions practically destroyed by river regulation and stabilizing of river banks with boulders. In the side river branches of the Danube, steep river banks largely disappeared as a result of deliberate closure of their inflows from the main channel and consequent limiting of the water flow.

✿ Solution

Today we know that these modifications are not always necessary and therefore it is possible to find a solution. The solution was the removal of stone embankment at selected river bank sections after the prior review and approval by the water managers. An important fact is that it was a model measure, which has not been done in Slovakia before and it was partly implemented by water managers themselves. Localities with former appearances of the Sand Martin colonies were picked for the restoration of nesting sites.



The nesting site of Sand Martin destroyed by new embankment (Bratislava)



Restoration of natural river bank (Zlatná na Ostrove)



Natural river bank of Danube with beach and steep wall (Chĺaba)

✿ Results

Steep river banks were restored on Veľkolélsky Island at the river kilometre 1782 within the section of 50 m and by the village Chľaba above the confluence of the Ipel' and the Danube rivers at the river kilometre 1709 within the section of 200 m. Our experience has shown that the longer and higher renewed section of the river bank is a more attractive nesting site for the target species. Kingfisher has started to nest in the steep bank on Veľkolélsky Island and has been nesting here regularly. Sedimented material and vegetation was removed from the bank in Chľaba and in 2012, we experienced great conservation success. A renewed nesting wall – reminiscent to the natural banks of the Danube after the flood – had been occupied by 970 pairs of Sand Martin. Referring to international monitoring of the Sand Martin across the Danube done by members of the network of the protected areas the DanubeParks, this colony was the largest colony of Sand Martin between the spring of the Danube in Germany and Serbia in that year.

✿ Future outlook

In Slovakia, we can just have a look on the opposite Hungarian side of the Danube river to see that extensive changes and fixing banks with stones is not necessary everywhere. There are studies suggesting that banks with the boulders are rougher and so they are slowing down the outflow during floods. Floods store large amounts of fine sediment behind the bulwarks of boulders on the banks, which slowly fill in the inundation area of the river. In the long term this leads to shoaling and decreasing the flow profile of the inundation area, which has an adverse impact during large floods.

In our project we have shown that there is a way of bringing back the part of the river bank to birds and nature. Steep walls and natural banks are inhabited by lot of other less eye-catching animal species, for example the hymenopteran insects. For long-term conservation of the Sand Martin populations of the Danube, it is important to restore the natural river banks to a much greater extent. First of all, the river banks should not be fixed with the boulders at places where steep river banks can be spontaneously created and the Sand Martins can inhabit them naturally. After all, natural river banks are more attractive also for us people for spending our free time by the water. One of the examples is long section of river bank in Bratislava – Petržalka – where people and the Sand Martin can co-exist next to each other and the Sand Martins could successfully nest in the frequently visited area of Danube inundation.



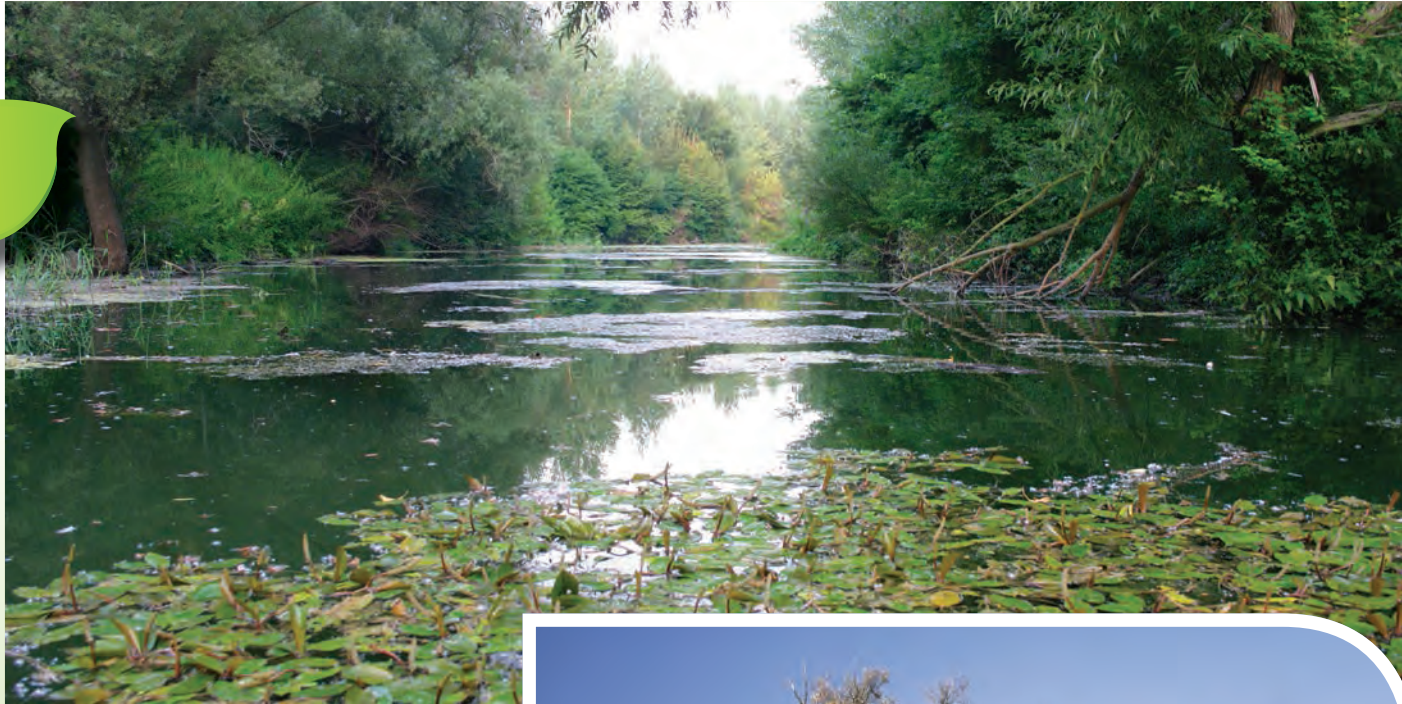
Kingfisher



Restored natural river bank (Chľaba)



Sand Martin



✿ The past

Istragov was one of the Danubian islands in Gabčíkovo area, which was surrounded by a narrow side-arm. The central part of the island was formed by a marshy lake of about several dozen hectares and it was connected to the main Danube channel. Water level fluctuations in this lake were depending on the Danube water level fluctuations. The edges of the marsh were covered by reed beds and flooded willows. During lower water levels, the marsh was drying up and the bottom was uncovered. Istragov was an important fish spawning site, an important nesting site for wild ducks nesting here in large numbers on pollard willows. Istragov was also the important site for numerous flocks of aquatic birds, especially herons, storks and spoonbills.



Istragov before 1993 during low water level

✿ Situation before the project

After the initiation of Gabčíkovo water dam in 1992, the water level decreased here. Istragov suffered fatal consequences – the side-arm and marsh were dried-up. Water in the side-arm was present only at high water level periods in the Danube, and the marsh was even worse – water was only flowing-in during flood events and only for a few days. The dried-out bottom overgrown by willow forest and fish and aquatic bird species disappeared completely.

✿ Solution

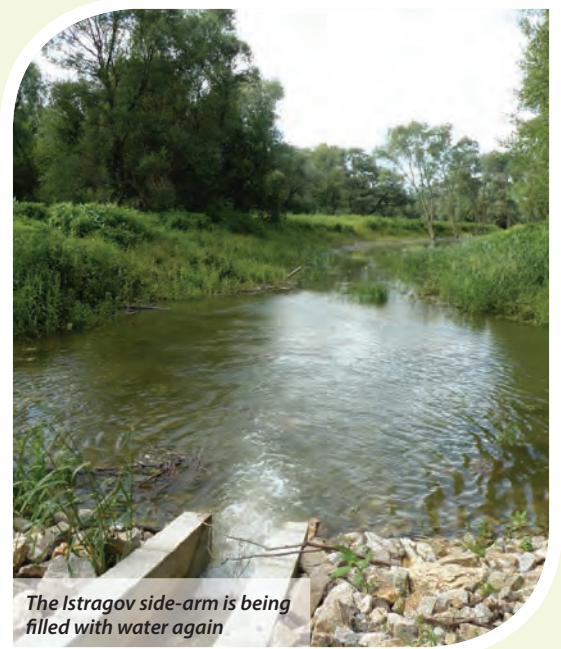
The situation on Istragov was critical after two decades without water, the floodplain character of the site was disappearing. Therefore, we tried to take steps towards irrigating at least part of the land as soon as was possible – it was literally a life-giving „infusion“. This was possible in real time only by use of the existing channels outside of the inundation area, which connect the seepage channel of the hydropower plant with oxbows fragments Velký háj and Dedinský ostrov. Water leaking from the seepage channel into the oxbows could be directed away after completion of a new short connecting channel.



The bottom of the Istragov marsh, which dried out and overgrown after damming the Danube

Result

In the field we started with the marsh restoration in 2012. Culverts enabling water inflow from the seepage channel were repaired and opened, the channels to Velký háj and Dedinský ostrov were cleaned and also missing parts of the channels were dug so that water from the seepage channel can flow up to Istragov. In the lower part of the Istragov side-arm a small weir was constructed, which can retain the water that it will not flow out to the old riverbed of the Danube. The effect of the inflowing water was seen in the site Velký háj immediately (see the next page); however, it was a bit smaller effect within the Istragov marsh, where the amounts of water are limited, especially during dry periods. Afterwards other supportive measures were implemented. Water level in the seepage channel was increased which caused higher water inflow into the system. The gravel bottom of the channel between Velký háj and Dedinský ostrov oxbows was sealed with clay, which helped to reduce loss of water through seepage into the ground. Since 2014, at least during major part of the vegetation season, the Istragov side-arm is filled with water and during some short periods even the Istragov marsh is being flooded. Some species of aquatic plants and animals appeared in the site again – for example, several species of amphibians started to reproduce here. Some water birds with less niche requirements are living again in the side-arm – Wild Ducks, Grey Herons, Great White Egrets, Kingfishers and also the rare Black Stork sometimes appears here.



The Istragov side-arm is being filled with water again



New channel for water supply



Istragov side-arm after restoration (2015)

Future outlook

Irrigation of the Istragov area showed, how difficult the restoration of disturbed water regime could be. In long-term view, the optimal solution would be to restore the water level in the Danube to the same height as it was during the first half of the 20th century. Then the original ecosystem functions of Istragov would be restored again, including fish spawning. However, also our recent solution brings a positive change – restoration of aquatic and floodplain habitats and a return of many aquatic plants and animals. Other relatively simple measures are possible to increase the amount of water flowing to Istragov and the water regime can be optimized even under the current water-management restrictions. We hope that these steps will be successfully implemented during the coming years.

Istragov in the past – an extent shallow lake connected to the river



✿ The past

For the Danube inland delta, river branches with flowing water, which were connected to the main river channel were typical. However, in the area around Gabčíkovo, there were also several large oxbows in the past. Supplied only by underground water, overgrown by reed and waterlilies, it was a completely different world, than of the river. Nesting sites of rare aquatic bird species were present here – for example Purple Herons and several duck species.

✿ Situation before the project

During of the construction of Gabčíkovo water-dam, these oxbows were destroyed: directly at these places there are water-dam facilities as the navigation channel, or they were filled up with the construction waste. A relatively big fragment was left preserved from the oxbow Veľký háj, however it remained without water for major part of the year and lost its former natural inhabitants.

✿ Solution

The only needed measure was to bring the water to the oxbow back. Afterwards, the nature itself will take care of the ecosystem recovery. The channel, bringing water from the right bank seepage channel to the former marshland of Istragov, crosses also the oxbow of Veľký háj. The system is designed in a way that it supplies the rest of the oxbow Veľký háj first, before continuing downstream.



European white water-lily



During 1992-2011, the oxbow was mostly without water

✿ Result

Since 2012, the Veľký háj oxbow is supplied with water and most of the year, the oxbow is flooded. Plant and animal communities started to recover unexpectedly fast. In the oxbow, several species of waterfowl are nesting and also the extinct nesting site of the critically endangered Ferruginous Duck was restored. Within the last 25 years, this is the only proven nesting site of this species in the Danube lowland in Slovakia.

✿ Future outlook

The example of Veľký háj oxbow restoration has shown, that the oxbow restoration is technically possible in some sites of the Danube floodplains. If we want to restore the aquatic bird species populations bound to such habitats, it will be necessary to improve conditions of several such sites in the surroundings.



Ferruginous Duck



The new culvert under a forest road allows the fish migration

✿ Fish migration

Only few people are aware of the importance of migration for fish. Not only a few sea species used to come here to reproduce, but also a lot of common inland fish species are migrating. These often change the places where they live: where they winter, reproduce and where the fish's offspring grows. At present, fish migration is limited by structures such as barrages, hydropower plants and weirs within the riverbed. The numbers of most fish species are incomparably lower than they were before the river regulation.

✿ Situation before the project

In the past, dozens of species of fish were present in huge, now unimaginable numbers and found optimal conditions in the river systems of the Danube inland delta. Artificial restocking was not necessary at all. Almost all of numerous and diverse water bodies are now cut off from the river and river branches are divided into small isolated sections. Fish do not have access to their natural spawning grounds and can not move freely between the Danube and side-arms.

✿ Solution

After launching of the Gabčíkovo dam, the Danube river branch system has been irrigated thanks to concrete weirs. Up to ten massive weirs are dividing the main river branches near Baka, which are impassable for fish. Within the project, we decided to create a biocorridor leading through small river branches and marshes, which bypasses five of these weirs and flows directly into the Danube.



Northern Pike

✿ Results

In 2014, a few kilometres long of biocorridor was built. New channels interconnecting separate river side-arms were dug at three places. Another channel was deepened and enlarged. At four sites, pairs of frame culverts with a size of 2x2 meters were placed where channels are crossing the forest roads. Immediately after completion of the biocorridor, fish started to use it and the water flowing through improved water supply in the small side-arms and marshes. In addition to fish, birds also responded to restored habitats – up to four pairs of Kingfisher started to nest here and other species like Black Stork, Grey Heron and Little Egret appeared at the sites.

✿ Future outlook

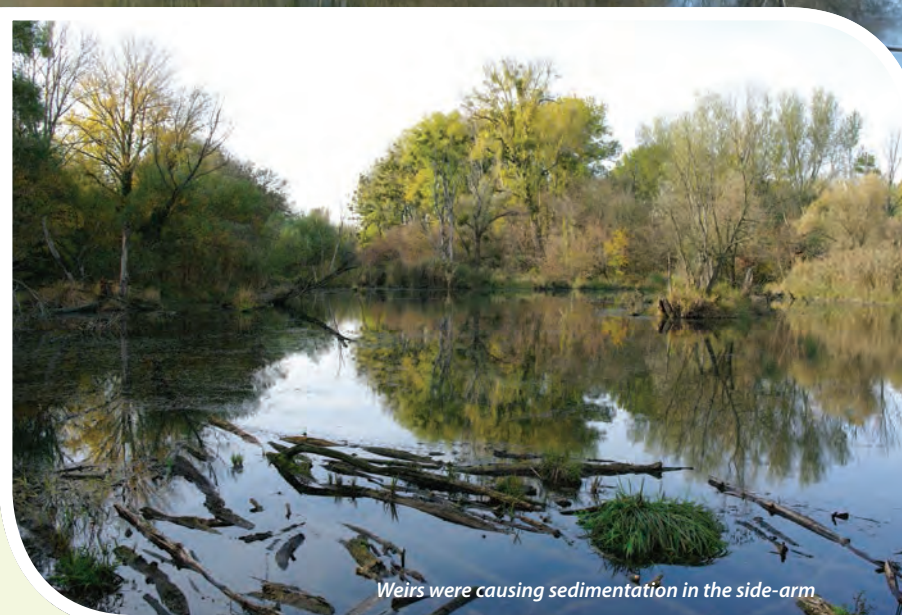
Patency of the Danube river branches is limited by a number of barriers. Restoration of links enabling the migration and reproduction of fish is among the most important challenges for the nature protection in the Danube floodplains. It is also a challenge for water managers to be able to create solutions where water facilities fulfil their functions and do not represent a barrier for fish.



❁ The past

A typical feature for the Danube section at Rusovce was the presence of river side-arms with rapid water flow, which were creating islands. The islands were relatively higher placed and covered with varied vegetation following moisture gradient of the terrain. There were various types of communities represented: from regularly flooded willow forests to extant and species-rich hard floodplain forests and open forest steppes. A large amount of riverbed residues occurred here representing the ideal places for amphibians.

Management in this area took place in rather sensitive way in the past, as there remained well preserved natural habitats almost in the whole territory. During the construction of the Gabčíkovo dam, most of this area should have been deforested and flooded as part of the Hrušov reservoir. Territory with the area of almost 200 ha made of two larger islands was saved during the construction of the dam. It was separated by a low dyke from the Hrušov reservoir and a polder was created. Thanks to exceptionally well-preserved floodplain forests and the fact that for decades there was an absence of significant human activity in the area, the nature reserve Dunajské ostrovy (Danube islands) was declared here. It is protecting the biggest complex of continuous floodplain forest on the Slovak section of the Danube, where no forest management takes place.



Weirs were causing sedimentation in the side-arm



Concrete weir posed a barrier in the side-arm

❁ Situation before the project

In the past the Rusovské river side-arm was crossed by four roads – concrete and stone weirs, which, did not have any function anymore. They act as a barrier in the side-arm, reducing water flow during floods, capturing various materials brought by water and allowing illegal entrances to the reserve. In addition, there were more residues of forest roads, which were separating smaller wetlands from the major side-arm and did not allow the fish to migrate to their spawning sites. These barriers covered with debris made the present water bodies visually smaller, making them less attractive for some waterfowl species.



Concrete weir also allowed illegal entrance of vehicles to nature reserve

🌱 Solution

We have proposed removal of all four weirs crossing the river side-arm as well as of three former forest roads in order to reconnect the existing wetlands.

🌱 Results

All artificial barriers were gradually removed in the years 2013-2014. The nature reserve now has a much improved natural look, now that the side-arms and wetlands are not crossed by concrete and stone weirs or roads. Immediately after completion of the work, during floods, the side-arm was scoured and large quantities of the debris were carried away. Former ordinary illegal entrances of vehicles to the inner part of the reserve have completely disappeared. The movement of people in remote parts of the reserve became less frequent, thus a zone without human disturbance appeared where many sensitive bird species found a refuge. We expect that the nesting sites of some of them will gradually reappear.



The removal of the barrier



The side-arm after the works and already without the weir



There are more than 6 km of side-arms without weir in the reserve now.

🌱 Future outlook

For optimal functioning of the Rusovské side-arm it would be suitable to ensure its year-long flow capacity and the possibility of fish to migrate between the main Danube channel and the side-arm. Such a solution is technically complicated mainly due to the different water levels in the reservoir and in the polder. However, it is a future challenge for nature protection and water managers to design and implement a properly functioning solution.



Pygmy Cormorant



❁ The past

In 1953, the nature reserve 'Island of the White-tailed Eagle' was declared on one of the large Danube islands near Baka. At that time, it was one of the first protected sites in the Slovak section of the Danube. The reserve had an area of 174 ha and it covered the whole island, which is situated in very remote and inaccessible place of the river branch system. The main reason for the declaration of the reserve was the nesting of the White-tailed Eagle, at that time it was becoming extinct. The reserve secured also protection of the well preserved floodplain forest and periodic and permanent shallow lakes in the middle of the site. Further development of the protected area is an example of the malfunctioning of nature conservation: right after the declaration of the nature reserve, the White-tailed Eagle left the locality. In 1984 the reserve was reduced to less than 23 ha, with a completely inappropriate shape, and in 1992, after the launch of Gabčíkovo dam, the water regime in the locality was changed and the lakes completely dried out. At the same time, parts of the native floodplain forests in the area were gradually cut down and replaced by the non-native Euroamerican poplars.

❁ Situation before the project

Between 1992 and 2013 a period of drought was at the site. As a result of water level decrease in the old Danube river-bed, all the wetlands on the island remained dry. Sporadically simulated floods, which were done within the branch system could not have influenced the site. The bottoms of the lakes were overgrown by vegetation, often by non-native and invasive species of plants. The most humid willow woods, typical for flood-events and marshland herbal stage, started to dry out, decay and loose the character of a flooded area. Step by step, waterfowl disappeared from the island. An important spawning site for fish and amphibians ceased.



During 1992-2013, marshes on the Ostrov orliaka morského island were dry



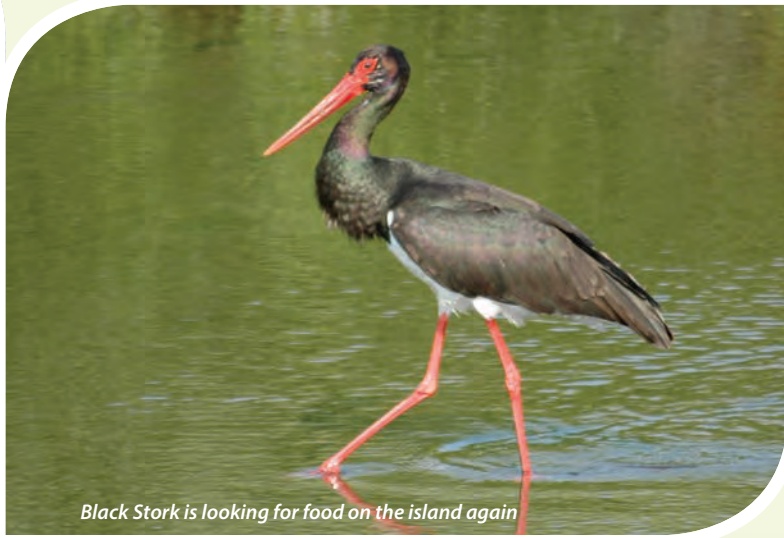
There is mosaic of floodplain forests and marshes in the reserve

🌱 Solution

The main problem of the site is lack of water and absence of floods. Therefore any kind of restoration has to start with improvement of the water regime. Because a complex restoration of the river branch system is a technically and financially difficult process, which is also time-consuming, we decided to stabilize the area of the island through improvement of the water regime, which the situation allowed. The water level in river branch upstream of the island is quite high that it is able to flood the dry lakes in the central part of the island and also the lowered parts of the floodplain forests. Digging of a channel connecting the branch and the dry wetlands in the central part of the island was designed. A simple sluice gate in the inflow part allows to regulate the quantity of inflowing water. The aim is to get some amount of water to the site all year long and a bigger quantity of water during some periods, especially in spring and summer, which allows the temporary flooding of depressions on the island.



The channel bringing water to the marshes since 2013



Black Stork is looking for food on the island again

🌱 Result

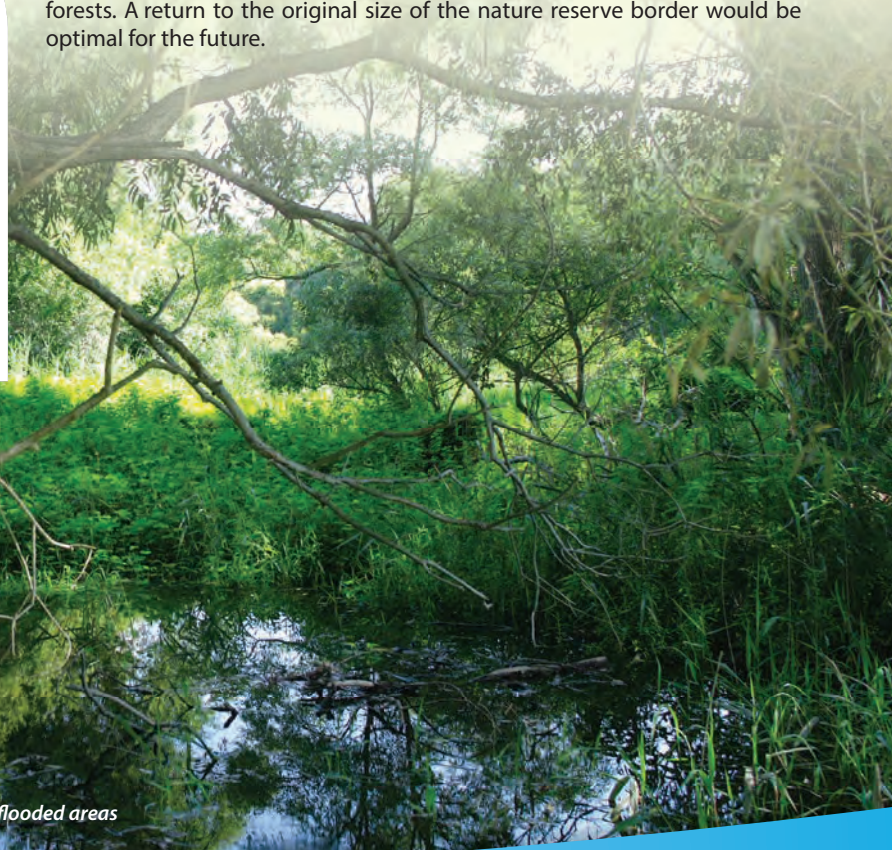
In 2013 the described solution was constructed and set into operation after agreement of the foresters. After more than 20 years, the water came back to the White-tailed Eagle island. Several of the depressions were permanently or temporarily filled with water. Although the restoration of natural vegetation requires more time, the locality already was re-occupied by aquatic birds – the Black Stork is regularly feeding here, the Kingfisher is nesting, and the Grey Herons and Mallards are coming here. Several species of amphibians started to spawn on the island again.

🌱 Future outlook

The implemented project helped to stop gradual loss of floodplain forest nature on the White-tailed Eagle island and helped to return water to the dry wetlands. But this does not mean that we managed to return the area to conditions of 1953. Problems that still need to be solved are the restoration of access of fish to their spawning sites, improving the flooding regime and restoration of natural floodplain forests. A return to the original size of the nature reserve border would be optimal for the future.



Restored marsh



It takes a few seasons, while dense terrestrial vegetation recedes from flooded areas



❁ Situation before the project

Many islands with higher edges and lower centre were typical for rich set of river branches near the village of Ásványráró, thus the depressions were periodically or even permanently covered by water. Islands with shallow water in the reed beds and floodplain forest provide a place for the survival of many species. Various species of fish and amphibians can spawn in such an environment and several species of waterfowl live here. The landscape was modelled by the Danube – its dynamics were ensuring renewal of permanent and periodic wetlands on the islands and their water supply. Regulatory interventions, the construction of the Gabčíkovo dam and the related changes in the hydrological regime, flow reduction and fluctuations in water levels in the river branch system and depositions of sediments that had been increasing river banks caused a gradual cut off of island wetlands and lakes from the water supply. The islands Szürke sziget, Kalap sziget, Alsó-Újsziget and Pókmacskási sziget also suffered this fate.

❁ Solution

To improve the situation and re-irrigation of wetlands, technically simple and financially undemanding activities were designed. As the terrain depressions are below the normal water level in the surrounding river branches, it is possible to restore the water regime by establishing or re-linking the lost connection between wetlands and river branches. It was therefore proposed to excavate new or clean existing channels that will bring water to the field depressions within the islands. These channels also allow fish migration between the river branches and wetlands.



Alsó-Újsziget – preparation of the restoration



Alsó-Újsziget – deepening of the channel



Restored channel bringing water to marsh in Alsó-Újsziget

Results

Planned restoration work was carried out at four locations in 2011. Because of the good results and project savings, the second phase was designed and implemented in 2013, where four other wetlands were recovered in a similar way. By the restoration of wetlands we managed to bring back water to the places that would otherwise gradually lose its specific nature and species richness. Overall, we improved the water regime of eight sites where we restored temporarily flooded wetlands on an area of 56 ha and permanent shallow lakes on an area of over 11 ha. Besides the lakes and marshes themselves, the water supply in the surrounding softwood floodplain forest was improved as well.



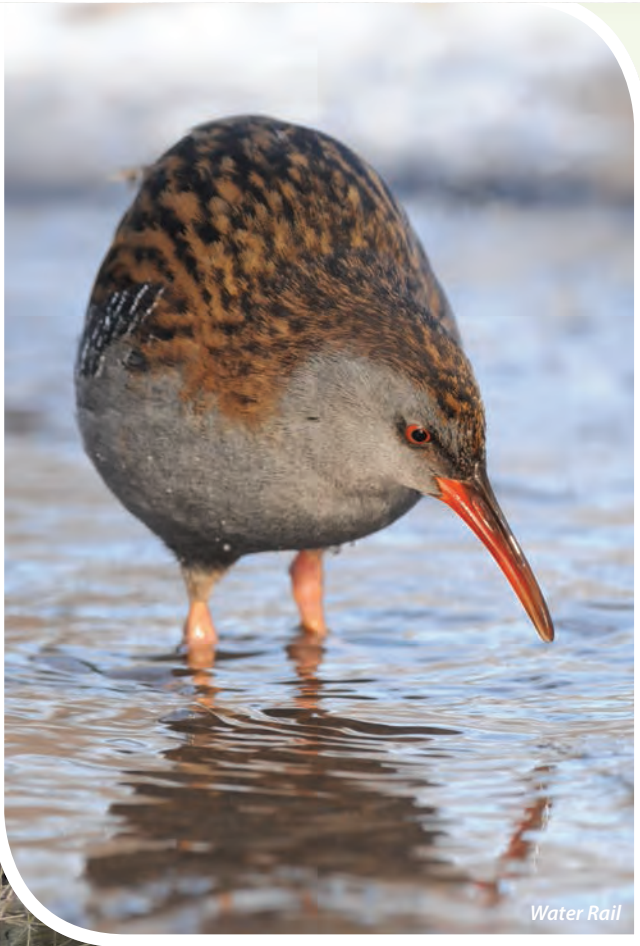
Marsh at Kalap sziget before the restoration



Marsh at Kalap sziget after the restoration

Future outlook

The long term goal of nature conservation in the Danube river branch system should be the restoration of the natural dynamics of river ecosystems. Such as a functioning system, which spontaneously creates various types of stagnant water bodies from temporarily flooded depressions, through drying shallow lakes to oxbows with diverse links with the river. As these processes are now disrupted and their recovery is technically and financially challenging, it is appropriate to implement measures in the meantime that will restore the disappearing shallow lakes and dried oxbows. This way the survival of many endangered species can be ensured. The restored wetlands on the islands near the village Ásvány have shown that this solution is very effective and we hope that they will become an inspiration for other localities.



Water Rail

Restored channel at Kalap sziget





❁ Situation before the project

The site Dunajské kriviny is located at the beginning of the upper part of the extant river branch system between Dobrohošť and Sap. The entire branch system has been supplied with water through an artificial channel since 1993. However, the area of Dunajské kriviny is situated upstream of this channel and normally it is not directly supplied from it. In the past, the area of Dunajské kriviny consisted of several small periodically flooded oxbows, which dried out from time to time. The area was surrounded by patchy mosaic of willow-poplar floodplain forests and pastures with pollard willows. After launching of the Gabčíkovo dam in 1992, the water level decreased by several metres in the old Danube riverbed, which was also accompanied by a similar decrease in the groundwater level in adjacent areas. In most of the river branch system this decrease was offset by the above mentioned water supply system, but the area of Dunajské kriviny was excluded. We saw the gradual disappearance of this site: oxbows and terrain depressions remained permanently dry, old poplars and willows started to dry and were slowly replaced by North American invasive species as Boxelder, Green Ash and Black Locust. There was one pipe culvert connecting the water channel and one of the oxbows at the site, but its capacity and vertical position did not allow the required irrigation. This fact was confirmed by the monitoring of the site when there was not any reproduction of amphibians observed in the whole area.



Dried oxbow in Dunajské Kriviny (2012)

❁ Solution

The supply channel did not allow water to flow to an adjacent part of the oxbow. The bottom of the supply channel and the pipe needed to be put lower so water could get to the area all year long. The original pipe culvert, which was approximately 30 m long and 1 m wide was therefore replaced by an open channel with natural banks and a width of several meters. At the intersection of the channel and road, a frame culvert measuring 2x2 meters was placed. At the same time, the bottom of the new channel is few dozen centimetres below the previous level and water stays here permanently. Open channel has a greater capacity and unlike the removed pipe, it does not represent a migration barrier for aquatic animals. In addition, the barriers from oxbows were removed, so water can also get to the two biggest terrain depressions at the site.



Sometimes you could only guess where the channel was (2009)

Results

Adaptation of water supply for oxbows in Dunajské kriviny was finished in summer 2013. Former dried oxbows got flooded in the length of approximately 1200 m. Some common fish species got to the side-arm basically immediately and since 2014 we can see gradual restoration of bank and aquatic vegetation and colonization by water animals. Already in 2014, we recorded breeding of Common toad and Agile frog, in 2015 we recorded eight species of water beetles. Kingfisher, one of the project target species, occurs here regularly as it found suitable feeding habitats. Improving water subsidies is also important for the surrounding floodplain forest. In the past, they have been reclassified from the category of commercial forests to protective forests because of lowering of the ground water and related problems with reforestation.



Creation of a channel for water supply



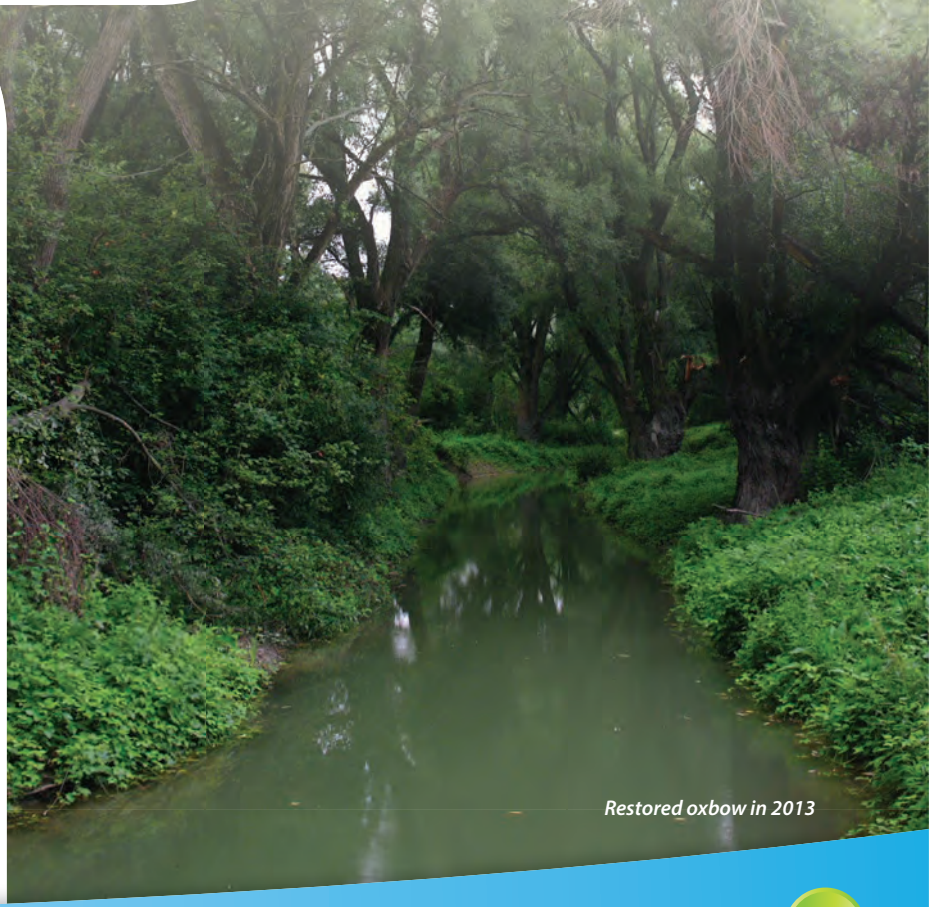
Barriers were put away from the riverbed of the oxbow

Future outlook

The presence of water is the basic condition for the functioning of river ecosystems in floodplain areas. The implemented solution returned water to places that had been dry for twenty years. The monitoring results indicate that the system is mostly attractive for some common species and species with less niche requirements, for instance there have been identified so far only two species of amphibians. Some of the species with higher niche requirements, such as the Fire-bellied toad and the Danube crested newt need periodic wetlands for their survival. However, it is possible to further improve the system and its functioning closer to the original state. This requires improvement the seasonal variations of water in the river branch system to cause a periodic inflow of the water into other adjacent terrain depressions and drying up of some parts of the system. Such water regime should also ensure the necessary supply of water for the surrounding floodplain forest.



Irrigated wetland with restored vegetation



Restored oxbow in 2013



✿ Situation before the project

The Száraserdő locality (Dry forest) is situated close to Dunakiliti, directly in the opposite of the Dunajské Kriviny, on the other side of the Danube – its cruel destiny was similar. A few kilometres long side-arm flowed here in the past, which was during the construction of the planned weir Dunakiliti dam divided into two parts and its flowing capacity was lost. Afterwards, since the start of the Gabčíkovo water-dam operation, the side-arm dried out. Although other arms in Szigetköz were flooded in 1995, the upper section of the Száraserdei arm remained dry.



Side-arm after 20 years of drought

✿ Solution

The bottom of the side-arm is situated lower than the water level of river branch system in surroundings, which is why to bring the water into it was not a technical problem. The restoration of the missing connection of the side-arm was necessary. Part of the original river bed was completely filled-up and overgrown by wood, and it had to be dug again. The side-arm was crossed by forest road and here the tube sluice was planned. In restored river bed, some deep parts were designed. They can serve as fish wintering sites.



A pipe culvert had to be put at the intersection of the side-arm and forest road

✿ Results

Side-arm restoration was ended in November 2011, when the water returned to the 1.5 km long part of the river bed. The return of life-giving water received a quick response. Native inhabitants started to return to the river-bed – many fish and water invertebrates found their homes here again. Several species of amphibians, the Grass snake and some aquatic bird species came to live here again. Floodplain forests in surroundings also get more humidity.

✿ Future outlook

The main problem of the side-arm – water absence – was successfully solved. While we want to obtain similar functioning of the side-arm as in the past, the restoration of water-flow would be necessary. But a massive dam leading to the weir Dunakiliti does not allow this step. A solution would be very expensive and dam removal or reconstruction would be necessary.



Filled up influx of the side-arm had to be dug again



White poplars planted into the gaps in monocultures

✿ Planting of native trees and restoration of nesting habitats

The original floodplain forest along the Danube was largely replaced by plantations of the fast growing non-native Euroamerican poplars. These monocultures are usually harvested after 30 years. For many species of birds and other animals that need old trees for living, these do not provide sufficient nesting and feeding opportunities. A number of typical tree species of varied floodplain forests had become rare under intensive forest management. To support species diversity within the forest and create a mosaic of possible breeding sites for birds in the future, we planted over 45,000 trees of several native species during the project. We planted mostly native poplars – Black and Grey Poplars, then White willow and Common alder at the moist softwood floodplain forest habitats. On the drier and higher situated sites of hardwood floodplain forest Pedunculate oak, Narrow-leaved ash and to a lesser extent also maples, elms and wild pears were used. Reforestation was carried out by planting of native trees in groups to gaps in non-native poplar plantations as well as planting whole forest stands of domestic species at places without trees. Trees were planted on land purchased from private owners or on land used by others after agreement.



Pedunculate oak planted into the dry part of hybrid poplars monocultures

✿ Purchase and long-term lease of land for nature conservation purposes

Purchase of land from private owners is an effective way to promote the conservation objectives without limiting the rights of the owners. BROZ concluded dozens of contracts with private owners, many of whom had for the first time financial profit from forests and other types of land along the Danube. We also concluded long-term leases for 30 years with more land associations for the improvement of their forest property and recovery of neglected areas. Thanks to this activity we can effectively protect nature on an area of 100 ha and carry out activities such as conversion of commercial plantations of non-native poplars to natural floodplain forests, restoration of grasslands and pastures and suppression of invasive weed species, wetland restoration and flooding of dried oxbows or limitation of illegal access of motor vehicles to protected areas. At these localities we can ensure long-term preservation of rare Danube nature in the future. Experience from abroad, but even our own shows that well managed and effectively protected natural areas can be attractive for visitors, contributing to the promotion of local communities which can bring more money and jobs to the region than intensive forest management.

well managed and effectively protected natural areas can be attractive for visitors, contributing to the promotion of local communities which can bring more money and jobs to the region than intensive forest management.



During implementation of the conservations actions we cooperate with land owners and land users, authorities and various other stakeholders. But we work also with children and young generation, as one day they can also be in decision making positions.

A range of project activities focused on promotion, awareness and presentation of the significance and natural values of the Danube floodplains.

News was regularly published on the project website <http://broz.sk/danubebirds>. We have published various materials printed in Slovak, Hungarian, German and English translations from material for the youngest children to the tourist guide map „Danube floodplains – from Moravia to Ipeľ”.

The traveling interactive exhibition about the life of Danube birds was seen by more than 20,000 visitors. They could find out about changes and evolution of river landscape, look for habitat in which particular species live and they could put together the food chain with their own hands as well as map of the Danube lowland and huge puzzle of the largest fish – Beluga sturgeon.



The interactive travelling exhibition



We believe that we should experience and protect nature directly in the field. That is why we organized dozens of trips, presentations, educational walks and excursions for the public, students and pupils of different ages to different sites. In the field, we placed 20 information panels.

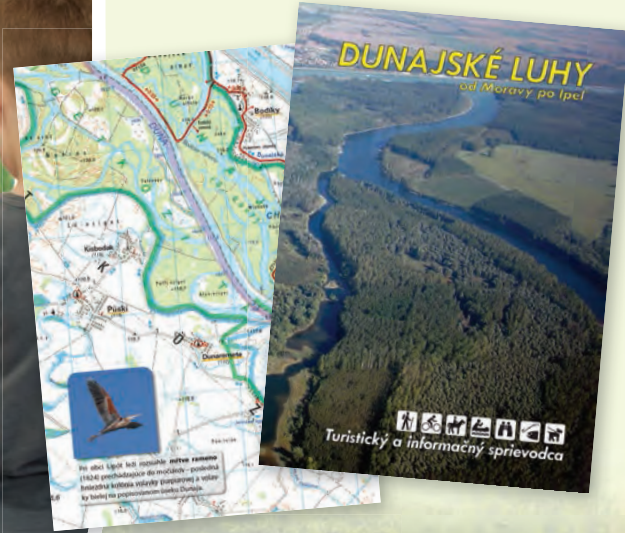
Ecofarm Island at the Velkolélský ostrov Island is providing experiential programs for schools and organised groups connected with exploring nature, getting to know life on the farm and domestic animals as well as traditional local land use practices such as panning of gold from sediments on the banks of the Danube.

There are two birdwatching facilities for undisturbed and comfortable birdwatching and nature observing. The first higher observation tower is located near the Danube dyke in the cadastral area of the village of Baka. The smaller one is placed in Bratislava – Čunovo. Both of them offer beautiful views of the oxbows, marshes and surrounding forests. After a while you can see a variety of bird species as well as beaver and other animals.

The project was presented at nineteen national and international conferences. For the acquisition of new knowledge and experience, we visited several protected areas on the Danube abroad. Then we again presented our activities and processes to implement them to many foreign experts and guests. Our so far innovative activities in Slovakia have been undertaken with the attention of the media. Interesting results of the project were in well over a hundred different media outlets.



Observation tower near Baka



Observation facility near Čunovo





Conclusion



The implemented measures have significantly contributed to the protection of target bird species by improving their breeding and feeding sites. But these results are by far not the only benefits of the project. In an effort to improve the environmental conditions we found common ground with many owners and land users, foresters and farmers. Even within activities concerning the water regime we are now at a different level of scientific and technical knowledge than decades ago. Together with water managers we found solutions for many local problems. Flood protection of the area has not worsened, on the contrary – it has often even improved. In the case of restored river branches and pastures in inundated areas, the flow capacity significantly improved, which contributes to better outflow of flood water and thus the long-term improvement of flood protection of the area without need of re-investment. The measures also contribute to improvement of water quality. In the restored flowing river branches there is a significantly improved self-cleaning ability with regards the water, which is for example minimizing decay processes occurring at the bottom of stagnant water. The bottom of the restored river branches is covered by gravel to a greater extent again and mud is carried away further downstream. Most of the measures also help to meet the requirements of the European Union defined in the Water Framework Directive.

Positive feedback also comes from locals and visitors of protected areas. They appreciate the improved possibilities of spending time in nature and the potential for tourism, for example, spending time in attractive environment such as the flowering meadows or flowing river branches. The project won prestigious international European Riverprize, where it earned a place among the first three best projects from all over Europe.

Project LIFE 'Conservation of endangered bird species populations in natural habitats of the Danube inland delta' brought several sample solutions to long-term conservation problems. Activities such as reconnection of the river branches with the main flow and restoration of significant side-arms were on the Danube and in Slovakia solved in this scale for the first time. Constructive cooperation between environmentalists and water managers finally began to bear fruit. Today we know that restoration of natural steep river banks and flowing river branches or removal of artificial barriers in watercourses is possible, normal and with expert and proper preparation it is also safe and generally beneficial.

There are many options on the Danube and other rivers where it is possible to apply the model example of project activities. We would be very grateful, if it would be inspirational, especially for managers of the streams and their floodplain areas. Positive effects on flood protection shown by the project opens the way to revive river ecosystems. Are we able to make the best of it?



✿ Natura 2000

Natura 2000 is name of network of nature protection areas in the territory of the European Union with the aim of protection the most valuable natural habitats, threatened species of plants and animals and biodiversity all around European Union.

The base of Natura 2000 are two EU directives:

- Council Directive 79/409/EEC – The Birds Directive – aims to protect all of the 500 wild bird species naturally occurring in the European Union.
- Council Directive 92/43/EEC – The Habitats Directive – ensures the conservation of a wide range of rare, threatened or endemic animal and plant species.

These two directives are the most complex law directives for nature conservation all around the world.

Natura 2000 is created by two types of areas:

- A special protection area (SPA) is a designation under the European Union Directive on the Conservation of Wild Birds
- A Special Area of Conservation (SAC) is designed under the in the European Union's Habitats Directive

Designation of the site into the Natura 2000 means the recognition of its natural values and expressions of interest for the European Union to maintain this area as part of the European natural heritage for future generations.



✿ LIFE programme

LIFE is a specialized financial instrument of the European Commission for the Environment and Climate, implemented since 1992. The programme aims to contribute to the implementation, updating and development of European policy and legislation in the field of environmental protection, nature and climate, which finance projects with European added value. LIFE supports the implementation of European directives in the area of nature and water conservation.

Within the EU and Slovakia as well, LIFE is an important tool for the protection of nature, halt and reverse of the loss of biodiversity and the development of Natura 2000 network.

✿ Acknowledgements

Beside of partners, we need to give special thanks to many other institutions, governmental and municipal bodies as well as individuals. Without their help it would be unable to carry out activities of this range. For their willingness and helpfulness we especially thank: Forests of the Slovak republic, state enterprise – administrative branch Gabčíkovo; Slovak Water Management Enterprise, state enterprise; State Nature Conservancy – Administration of Dunajské luhy protected landscape area and Slovak fishermen union.

Regional Association for Nature Conservation and Sustainable development (Bratislavské regionálne ochrannárske združenie – BROZ) was established in 1997. In our activities we focus on practical nature conservation and sustainable development support in the region of South West Slovakia.

In the Danube region our activities are focused on the protection of the rests of natural habitats and actively restore destroyed and damaged parts of the nature. We are supporting traditional land management as extensive grazing of cattle or trimming the pollard willows, which are important for preservation of



plant and animal species diversity. We are managing land within protected sites that we purchased from private owners or leased from land associations and villages.

We cooperate with various institutions dealing with nature conservation, forestry, water management and also with universities from Slovakia and from abroad.

We are trying to increase awareness of nature conservation by working with general public and schools, organizing excursions, presentations, lectures and seminars as well as preparing publications, exhibitions and documentary films.



Bratislavské regionálne ochrannárske združenie – BROZ

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