The natural sections of the Danube River and its large wetlands are part of our common European natural heritage. Numerous protected areas and NATURA 2000 sites along the course of the Danube reflect the high value of this transnational ecosystem and represent unique natural areas.

River dynamics and natural morphological processes are the key for the long-term preservation of the Danube River ecosystem. Intact water and sediment regimes, river dynamics and adequate space for the river determine the great habitat variety and species richness—qualities which are still characteristic for parts of the Danube floodplains. Human activities (e.g., agriculture, forestry) usually require stable hydro-morphological circumstances rather than dynamic, natural conditions. Regulation of rivers, cutting of side arms, embankments, dykes and other man-made hydro-morphological alterations have changed the ability of the habitats. Darwins have dramatically impacted longitudinal continuity and sediment transportation, resulting in, for example, riverbed erosion and accumulation. Blocking river dynamics stops these initiating processes; due to ongoing sedimentation, these characteristic habitats of natural rivers have become extremely rare. Consequently, the occurrence related to these dynamic habitats is highly threatened on a European scale, endangered also by the highest rate of extinct species of all habitat types along the Danube.

Accordingly, both the conservation as well as the restoration of dynamic river processes and habitats is a priority for future conservation on the Danube River. Protected areas of sediments, by erosion and accumulation. Blocking river dynamics stops these initiating processes; due to ongoing sedimentation, these characteristic habitats of natural rivers have become extremely rare. Consequently, the occurrence related to these dynamic habitats is highly threatened on a European scale, endangered also by the highest rate of extinct species of all habitat types along the Danube.

The formation of "new" habitats in the early stages of succession, such as steep tom wall, gravel islands or large scale sand banks could be done only by permanent relocation of sediments, by erosion and accumulation. Blocking river dynamics which initiates habitat processes or the changing of the river course, these characteristic habitats of natural rivers have become extremely rare. Consequently, the occurrence related to these dynamic habitats is highly threatened on a European scale, endangered also by the highest rate of extinct species of all habitat types along the Danube.

Both species are closely linked with and adapted to these river dynamic habitats. The Little Ringed Plover needs bare or sparsely vegetated gravel or sand banks, laying its brilliantly disguised eggs on blank sediments. However, natural river banks are often without "flocking" regulation and inducing such extensive gravel and sand banks have shrunk significantly over the last two centuries, especially in the upper Danube. Once abundant along the Danube, the Little Ringed Plover has been displaced from its natural environment by human impact.

The SMP needs steep natural river banks to burrow its nests. Breeding colonies indicate sites when natural lateral erosion is still active. Due to the high number of characteristic habitats, different threatened species and other organisms dependent on this habitat type, these sites are also of high conservation concern.

Both species were originally widespread along the Danube and are still relatively common in the Danube countries thanks to their adaptation to artificial secondary habitats. Being adapted to dynamic habitats, Little Ringed Plover and Sand Martin react rapidly to structural changes and provide good and quick indication of impacts on their habitats, whether positive (e.g. restoration actions) or negative (e.g. river regulation). Finally, the birds are easy to recognize, to identify and to monitor. As they are attractive species, monitoring could be shared with interested public, press and stakeholders. All this qualifies the Little Ringed Plover and the Sand Martin as drivers for river dynamic processes.
During the 2011 breeding season the whole Danube from the Black Forest to the Black Sea was surveyed for breeding pairs of Little Ringed Plover and Sand Martin. Nine Protected Area administrations from seven Danube countries took part in the monitoring and covered more than 3,100 kilometres, including the branches of the islands of Ballatalomót and Great Braila Island. Two surveys of the study area (each one in May and June) were completed; in the upper-most part of Germany and in a section in Serbia only one survey took place. The monitoring was mainly done by small boats and the survey was limited to the main stream of the Danube. All suitable habitats for both species were investigated; artificial areas like sand quarries were not considered in the analysis. For each site the number of birds and breeding pairs were counted or estimated by the observers. Details of the habitat were noted. For the Little Ringed Plover, habitat was classified according to one of six possible types (see graph).

Considering the compacted methodology with only two surveys, the maximum numbers of territories per location were used by the analysts. For visualization, the results were summed up for twenty-kilometre sections. The first survey in May was distinguished by a very low water level on the whole Danube, which results in very good breeding conditions especially for Little Ringed Plover. On the second run the water level was more heterogeneous and so there were various conditions in the different sections. Due to the direct influence of the water level on the population size of Little Ringed Plover, follow-up surveys are planned for the evaluation of the results, although first local verification of the data fits in well with the results of local monitoring programmes.

LITTLE RINGED PLOVER (CHARADRIUS DUBIUS)
The Little Ringed Plover is a widespread, long distance migratory bird of the wader group. It breeds in Europe from the end of March to the end of July. Primary breeding habitats are bare or sparsely vegetated sand or gravel structures of freshwater areas. Due to river regulation and damming (in particular for hydro power), this habitat type and its characteristic community is one of the most threatened in Europe. Although the Little Ringed Plover was found in a suitable habitat in central Europe, the species managed to use artificial nesting sites such as quarries or fishponds. Today, more than 90% of its European population breeds in secondary habitats.

SAND MARTIN (RIPARIA RIPARIA)
The Sand Martin is a common species in Europe and occurs in most European countries as a breeding bird. The European population winters in tropical Africa and the first birds return to Europe in March, breeding from May to July, in colonies of only a few up to several thousand pairs. Colony sites are mostly located near river or other freshwater sites and nests are bored into vertical sand or loam walls, basically resulting from lateral erosion of dynamic rivers. This habitat structure is shared by Sand Martin with a wide range of rare species. The loss due to river regulation was compensated by occupying artificial breeding habitats such as sand quarries.
During the breeding season, the Little Ringed Plover can be found along the whole Danube. In total, 369 territories of Little Ringed Plover on 218 nesting sites were recorded during this monitoring. The highest densities were detected between Vienna and Bratislava, up to 27 territories/20 km (river-km 1,900 to river-km 1,880) in the free flowing section in the Donau-Auen National Park. The border section between Romania and Bulgaria provides good breeding conditions over a long distance and, therefore, is of highest importance in terms of number of territories.

Upstream of Vienna this species breeds only in low densities due to the high degree of regulation and embankment. The good size of the breeding population along the free flowing section between Straubing and Vilshofen (river-km 2,320 to river-km 2,250), and the fact that small revitalized areas were also colonized, underline the high potential of the gravel-dominated Upper Danube for this species – before hydro-morphological alterations most probably the optimum habitat along the Danube. The high density along the “old” original Danube arm (up to 14 breeding pairs/20 km) parallel to the “hydropower channel” of Gabcíkovo hydropower plant – where the Little-ringed Plover is totally missing – stresses the fundamental negative impact of dams on this species. Also noticeable is also the gap in the distribution found in the back water of the Djerdap hydro dam, upstream of the Iron Gate.

The Little ringed Plover shows a clear preference for island structures; more than three-quarter of the territories were found on these structures (see graph). In particular, sand islands in the Lower Danube are of high importance for this species, as are gravel islands and banks. Consequently, the highest densities along the Lower Danube were found in the section between Nikopol and Ruse (river-km 500 to river-km 600), which offers huge complexes of sand islands and banks, providing habitat for 34 breeding pairs on 20 sites. For natural, river morphological reasons, the Little Ringed Plover seems to be rare in the area of the Great Brașlia Island and the Danube Delta is lacking in suitable habitats for this species.
The monitoring showed 22,817 breeding pairs at 82 different colonies along the whole Danube. Most colonies were found in the border section of Bulgaria and Romania (between river-km 845 and 374) as well as in the region of the Island of Balta lalomiţei (river-km 370 to river-km 250), which again highlights the high value of these areas. When higher plateau banks are sloped deeply by the Danube, the resulting huge natural river banks can offer perfect breeding sites; but smaller natural steep river banks at various places are also occupied by Sand Martin.

The largest colonies of Sand Martin were recorded in Serbia, with impressive colony sizes of more than 8,000 breeding pairs in two neighbouring colonies in the "Deliblato sands" Special Nature Reserve. Therefore, this section hosts by far the highest number of breeding pairs per river-km Danube-wide.

The total lack of this species along the Upper Danube is striking; there is no possibility for breeding directly on the main stream of the Danube because dynamic lateral erosion – the basic process initiating steep banks as suitable habitats – has ceased due to damming. Even in the last remaining free-flowing section of the Upper Danube, the river is more or less totally embanked and doesn't offer potential breeding sites.

Despite there being more potential habitats between Budapest and Belgrade, only very few colonies were recorded along the Danube in this section as well. Numerous colonies in artificial habitats in the hinterland were not counted in this monitoring.

Very similar to the distribution of the Little Ringed Plover, only few suitable breeding habitats are offered for this species by the Danube Delta with its huge reed areas and the Great Brăila Island with the banks mostly covered by woods.
Conservation of indicator species and their habitats

This monitoring was conducted to learn more from the distribution pattern of the indicator species along the Danube—status of dynamic river habitats, which are threatened on a Europe-wide scale. Consequently, the presence and absence of these indicator species illustrates the status of these habitats, showing the need for conservation or restoration. Apart from lower densities of Little Ringed Plover and Sand Martin in specific Danube sectors for natural reasons (e.g., on the Danube itself, human induced hydro-morphological alterations such as dams, embankments or channelling of the river are generally identified as the main factors impacting the distribution of these species. Conversely, important breeding river sections are generally identified as the main factors impacting the distribution of these species. Conversely, important breeding river sections are generally identified as the main factors impacting the distribution of these species. Consequently, the presence and absence of these indicator species illustrates the status of these habitats, which are threatened on a Europe-wide scale. Consequently, the presence and absence of these indicator species illustrates the status of these habitats, showing the need for conservation or restoration.

1. River dynamics and active morphological processes are vital to the Danube River ecosystem. Consequently, the conservation of new dams and hydropower plants along the Danube is not compatible with the preservation of river habitats and their characteristic coenoses! Development and implementation of hydro-morphological concepts are needed to ensure and restore the longitudinal continuity of sediment transport along the Danube and its tributaries, to ensure the balance in material load per section as well as to ensure the restoration of the natural river systems.

2. Permanent relocation of river sediments, arising from river regulation and embanking needs to be avoided at breeding colonies*, and the inclusion of the Danube Protected Areas has to be intensified to restore consequent lateral mobilization of sediments.

3. Breeding sites of Sand Martin are priority subjects of protection. In the Middle Danube, as well as existing colonies, potential nesting sites of Sand Martin (all steep natural river banks) are also to be strongly taken into consideration for conservation; embanking is to be avoided. Despite some remote Sand Martin sites in the Middle Danube, the number of breeding sites on the Danube between Budaöpolis and Belgrad is relatively low and should be positively developed (Potential, Sand Martin breeding sites indicate the capacity for natural positive recovery in this section).

4. Green and sand islands are key habitats in the Danube ecosystem! These sites must not be negatively impacted by further river regulation and should consequently be included in Danube Protected Areas. Their hydro-morphological inflating and obtaining processes Danube-valleys, as well as on a local scale, have to be preserved. Investigations should be done for creation of additional sites. In particular in the Middle and Lower Danube, building up networks of protected islands is seen as a relevant contribution.

5. In the Middle Danube, as well as existing colonies, potential nesting sites of Sand Martin (all steep natural river banks) are also to be strongly taken into consideration for conservation; embanking is to be avoided. Despite some remote Sand Martin sites in the Middle Danube, the number of breeding sites on the Danube between Budaöpolis and Belgrad is relatively low and should be positively developed (Potential, Sand Martin breeding sites indicate the capacity for natural positive recovery in this section).

6. The high restoration potential along the last remaining free-flowing sections of the Upper Danube needs to be used to restore dynamic river habitats! The highest abundance of Little Ringed Plover in some “green sections” underlines the potential capacity for this species and its characteristic habitat structures in the Upper Danube, additionally highlighting the positive impact of restoration projects. Removal of embankments is expected to create potential breeding slopes for Sand Martin.

7. In Danube sectors altered by dams and hydropower plants, the limited restoration capacity should be used by specific restoration actions. Small breeding “populations” of Little Ringed Plovers in these sectors show the potential to recolonize in particular at the beginning of backwaters. Involved in the restoration efforts are conservationists, scientists and local stakeholders.

8. The consequent implementation of NATURA 2000 and the Water Framework Directive, taking stronger river dynamics and morphological process into consideration, is to be used as a tool for the long-term conservation of these species, habitats and embanking processes.

The consequent implementation of these demands is a long-term investment in the future. In the short-term scale species react very quickly to changes in their habitats. Successful examples of river restorations have a positive influence not only on Little Ringed Plover and Sand Martin — transparent representatives for the endangered community of plant and animal species and, ultimately, on humans by providing habitats also suitable for recreation. Finally, conservation and restoration actions for the habitats of Little Ringed Plover and Sand Martin in the Danube are expected to contribute to ecological flood prevention by giving more space to the river. Long-term and integrative protection of the ecological value of the Danube has to be considered an essential task for the long-term conservation of the river ecosystem.

INVolvement of the Public

DanubeParks' extensive efforts to take more attention to river morphological processes as a key for nature conservation along the Danube. The adaptation of Little Ringed Plover and Sand Martin to their habitats means that dynamic habitats are indispensable. Special excursions in Protected Areas, school events on Danube Day, online video games on the DanubeParks website, press events and video clips produced for the EU Strategy for the Danube Region have accompanied the monitoring.

The great interest and positive feedback of stakeholders in terms of how to include the Little Ringed Plover and the Sand Martin as drivers for more river dynamics along the Danube.