

Natural and near natural floodplain habitats on the Lower Danube and their importance for Natura 2000 network and recent planning processes for the area

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1 Introduction

Due to the training of the Danube River characteristic floodplain habitats and their specific, site typical biodiversity suffered a large loss in the course of the 20th century. On the Upper and Middle Danube this loss is evaluated to 95% of the former flooded area (WWF-DCP & WWF-Auen-Institut 1999; Schneider et al. 2009).

The large loss of floodplains subject to regular floods (73%) from the 1960s caused also a large decline of characteristic habitats and species along the Lower Danube in Romania and Bulgaria. Despite of these losses and water quality changes by intensive land use and sewage discharge, the Lower Danube still presents outstanding spatial heterogeneity in the remained recent floodplain areas. Almost natural river banks, 134 natural and near natural islands and new emerging islands provide numerous site-typical habitats with a specific biodiversity of plants and well adapted macroinvertebrates and birds. These habitats in a dynamic hydrological environment are important elements for the ecological status evaluation of the river stretches and the measures to be taken for the implementation of the Water Framework Directive (WFD) and the Natura 2000 network as well as for the sustainable development on the Lower Danube River.

Such river stretches were studied during various projects by field research (2004-2009) including analyses of botanical and faunistic biodiversity. Habitats with structural elements for microhabitats, species number and abundance were compared with habitats on the upstream stretches of the Danube River.

The habitats are important for the functioning of the ecosystems with complex interaction processes between the river and its floodplains. We studied the possibilities for habitat improvement and restoration in strong relation to needed flood protection measures. Finally the authors underline the need of conservation measures and sustainable development of the area in the context of the Natura 2000 network and the WFD. In particular, some stretches for sites of nature conservation value are threatened by planned navigation projects (ISPA I and ISPA II) as these encompass bottlenecks for navigation with important and valuable habitats. To combine user interests with nature values and to find a compromise between different user interests are discussed.

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2 Characteristics of the floodplain habitat types on the Lower Danube

In the floodplain transect from mean to highest water levels, the vegetation distribution corresponds to the hydrological dynamics and the dynamics of sediments with varying grain sizes. Flood intensity, duration, moment and frequency play an important role. Even though man-induced changes occurred and near-natural floodplain forests have been transformed into hybrid poplar cultures, a vegetation distribution along ecological gradients is clearly visible from the lowest levels in the river bed to the highest levels of the floodplain.

When considering the historical situation, i.e. the time when the broad Lower Danube floodplains had not yet been cut off from the river, drained and transformed for agricultural use, it becomes apparent that given the former floodplain extension and the small gradient, larger marsh areas with extended rush and reed stands must have existed in comparison with forest areas (General map of Central Europe made by the Austrian-Hungarian Empire and the Royal Monarchy 1889-1915 vs. Harta Dunărei 1:50,000, Bucharest 1935). The high heterogeneity of the varying floodplain waters with their long and straight watercourses, flood channels, lakes of various sizes and depths that dry out partly during summer time is reflected by habitats that show a comparably large diversity as for their aquatic vegetation. Softwood floodplain forests were prevalent along the water courses and the main stream whereas hardwood floodplain forests were rare but still occur on the higher natural levees or on other more elevated floodplain spots (Schneider 2009).

Besides reeds, rushes and floodplain forests, grassland areas with alluvial meadows of couch grass (*Agropyron repens*) and creeping bent grass (*Agrostis stolonifera*) co-existed in the natural, dynamic floodplain. Extended grassland areas emerged along with the alluvial meadows as a result of floodplain forest clearings and the floodplains cut-off and drainage. At present this applies rather to grasslands used as pastures than to alluvial meadows that were subject to regular mowing.

Worth to be mentioned are the pioneer communities of ephemeral species developing on sand or mud banks that temporarily lay bare at low water levels. They may complete their life cycle within 2-3 months. Depending on the water levels, the so-called vegetation of muddy areas (Nanocyperion) in the river bed may occur yearly or in larger intervals. They comprise many rare species, which can live only in such places. Among the pioneer vegetation species are the characteristic macroarthropodes of the respective protosoils (Schneider et al. 2005; Schneider 2010).

3 The floodplain forests on the Lower Danube

Large areas of softwood stands with a predominance of white willow (*Salix alba*) are characteristic of the Lower Danube with its extended floodplains, low slopes and fine-grained sediments. They usually develop in the form of simply structured gallery forests along the river and on the islands. On the Lower Danube a large-scale natural regeneration of softwood forests is possible due to the existing natural river banks with protosoils. Intermediary stages between softwood and hardwood floodplain forests with white willow, black poplar (*Populus nigra*) and elm (*Ulmus laevis*) do mainly occur on the islands (Schneider 2009).

Here and there along the Lower Danube one may also find gallery-like forests that are characterized by black poplar and white poplar (*Populus alba*) in varying proportions. On sandier floodplain soils the white poplar also forms pure stands rather comparable to the Mediterranean *Salix alba* and *Populus alba* gallery forests as for their forest structure (FFH habitat type 92A0).

Due to the lowland river conditions with extensive reed-abundant wetlands, natural hardwood floodplain forests occur only on high natural river levees and are thus less expanded as compared to softwood forests. Moreover, with only few exceptions the hardwood floodplain forests disappeared as a consequence of man-induced changes in the course of decades or centuries. Only few patches of near-natural hardwood floodplain forests (Querco-Ulmetum) with Balkan oak (*Quercus pedunculiflora*), common oak (*Quercus robur*), elm (*Ulmus laevis* and *U. carpinifolia*) have been left. They may be found e.g. downstream of the mouth of Sâiu (Oltu Mic), along the Danube near the village of Navodari (Teaca), in the Cama Dinu area on the banks between rkm 510 and 521 (upstream of Giurgiu), near Greaca (downstream of Giurgiu, etc. and on the Bulgarian Vardim island. Locally, lianas like Greek

liane (*Periploca graeca*), wilde wine (*Vitis sylvestris*) and the swallow wort (*Cynanchum acutum*) form thick curtains adding a tropical character to the Lower Danube forests. As these hardwood oak/ash/elm forests are extremely rare they require special attention from a nature conservation point of view (Schneider 2003, 2008, 2009; Schneider et al. 2009).

Due to its hydrological and morphological dynamics and the formation of new sediment banks on the Lower Danube - in particular the growth of already existing islands and the formation of new ones - one may observe all evolution processes of pioneer stages in willow stands, the natural regeneration of white and black poplar, the formation of gallery-like softwood forests and first settlements of hardwood forests. The white willow and black poplar forests on some small Romanian and Bulgarian islands that emerged on natural habitats without human interference are actual pristine forests, that, together with the pioneer vegetation of ephemeral species in the river bed at low water levels (below the mean water level) reach the highest degree of naturalness. Their development and survival depend on the water level dynamics, on sediment erosion and accretion. They stand at the beginning of a whole series of developments and are the prerequisite for a natural development of floodplain forests. As they have considerably decreased all over Europe, they deserve special attention from the point of view of nature conservation (Schneider 2003, 2010).

4 Habitats of community interest (included in the Natura 2000 network) (Fig. 1)

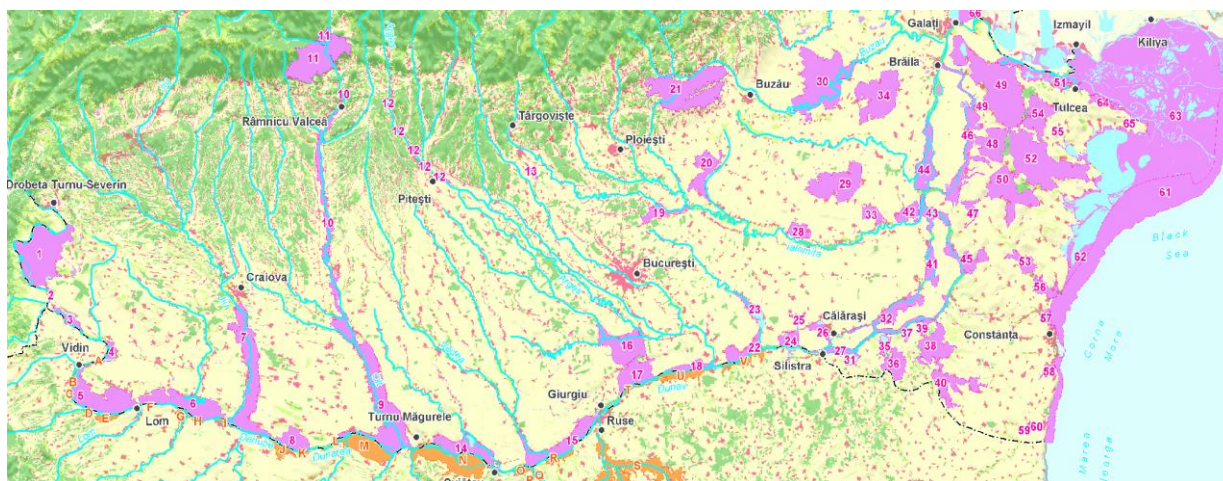


Figure 1. Sites of community importance on the Lower Danube and the Danube Delta (Schneider et al. 2009). Pink areas = Romanian Natura 2000 sites; yellow areas = Bulgarian Natura 2000 sites; numbers correspond to the list given by Schneider et al. (2009).

Among the habitat types occurring along the Lower Danube and studied from rkm 838 (Gârla Mare) to rkm 383 in 2004, from rkm 540-500 between 2007-2009, near Călărași in 2002), the following are listed in Appendix I of the Directive on the conservation of natural habitats and of wild fauna and flora (Doniță et al. 2005; Schneider & Drăgulescu 2005); the habitat numbers correspond to the numbers in the FFH Directive and the Interpretation Manual of the EU habitats (EC 2007); the * means priority habitat:

1340 Inland salt meadows

Small patches of this habitat type occur in the Danube floodplain, for example near the mouth of the Jiu River into the Danube and near Ghigera. This habitat type may also be found in some spots of the old Danube floodplain. The alterations of the Danube floodplain as a result of dyking and changed hydrological regime and a high evaporation due to the continental climate caused an extension of saline spots along the Lower Danube.

2340 * Pannonic inland dunes, incl. pannonic plain and neighbouring basins, e.g. dune area of Ciuperceni-Desa downstream of the town Calafat, dunes near Balta Luminoasă/Bechet, Dăbuleni.

3150 Natural eutrophic lakes with Magnopotamion - or Hydrocharition-type vegetation

This habitat type that includes old Danube branches and oxbow lakes occurs in different areas of the former and the recent floodplain of the Lower Danube (e.g. Balta Luminoasa, Balta Saica rkm 515-519, on the area of small Braila islands, and in the floodplains between Braila and the Danube Delta).

3260 Watercourses of plain to mountain levels with Ranunculion fluitantis and Callitriche-Batrachion vegetation

This habitat type occurs more rarely in the floodplains of the Lower Danube, it is however characteristic of smaller water courses and has been observed in the surroundings of Corabia. Along small groundwater streams that may be observed in the form of hillslope seepage along the floodplain borders one may also find a habitat type that shelters the watercress (*Nasturtium officinale*).

3270 Rivers with muddy banks showing Chenopodion rubri pp (pro parte) and Bidens pp vegetation

This habitat type is characteristic of protoil surfaces that lay bare when water levels fall below the mean water level and are then settled by ephemeral species (*Lindernia procumbens*, *Heleochoa alopecuroides*, *Cyperus michelianus*, *Gnaphalium uliginosum* and others). It depends on the dynamics of water levels and the morphodynamics allowing protoil surfaces to emerge. Such vegetation can only survive along natural and unspoilt river sections.

6120 * Xeric sand calcareous grasslands (in association with non-coastal dune complexes)

This habitat type comprises open stands of grasses and herbs which, as pioneer associations, are bound to xeric and calcareous sands. Along the Lower Danube it may be observed in the river's dune areas of Ciuperceni-Desa, near Balta Luminoasa / Bechet and Dăbuleni.

6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia)

This habitat type comprises grassland associations of arid and semi-arid stands which are classified with Festuco-Brometalia. It occurs along the floodplain borders on the slopes of the loess terraces.

6430 Hydrophilous tall herbaceous fringe communities of the plains and montane to alpine levels

This habitat type comprises moist tall herbaceous fringes, mainly composed of nitrophilous species that occur along the borders of the floodplains. Most frequent are fringes of Glechometalia and Convolvuletalia where the spurge *Euphorbia lucida* occurs as well. Specific for the Lower Danube are also fringes of *Aristolochia clematitis*, which is the foodplant for the caterpillar of the rare butterfly *Zerynthia polyxena*.

6440 River valley alluvial meadows of the Cnidion dubii

Temporarily inundated floodplain meadows of this type are very rare on the Lower Danube and do only occur in very small areas along hardwood floodplain forests (e.g. in the nature reserve Cama-Dinu upstream of Giurgiu, rkm 510-520). They shelter characteristic species such as *Clematis integrifolia*, *Galium rubioides*, *Carex praecox*, common skullcap *Scutellaria galericulata*, *Veronica longifolia* and others.

6510 Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)

Lowland meadows of this type occur rarely on the Lower Danube and usually show transition characteristics towards actual alluvial meadows of the Cnidion dubii type.

91 F0 Riparian mixed forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia along the great rivers (Ulmion minoris)

On the Lower Danube one may only find remains of hardwood floodplain forests that are composed of oak, elm and ash. Even though they were never really prevalent, oak-elm forests existed in some sections but have unfortunately been cleared. The last remains of this type of forest are extremely valuable as from a nature conservation point of view and deserve closer attention. The old oak trees of the floodplain offer habitats for a number of rare coleoptera species. To name only a few exemplary spots one has to mention the remainders next to the Sâiu (Oltu Mic)-mouth, along the Danube near the village of Navodari (Teaca), next to the Vedea River mouth (rkm 540), in the Cama Dinu area, on

the river bank between rkm 510 and 524, near Greaca downstream of Giurgiu, near the Arges River mouth, on the Bulgarian islands of Belene and most of all Vardim.

92A0 *Salix alba* and *Populus alba* galleries

Even though this habitat type is classified as floodplain forest with Mediterranean characteristics in the Mediterranean deciduous forests group, it may be considered as a characteristic habitat type of the Lower Danube. On the Lower Danube this habitat type shows a transition character between the typical Mediterranean gallery-like riparian forest and those of the Lower Danube. It is represented also at the lower stretches of Danube tributaries like the Jiu, Olt, Arges, Ialomita, Siret and Prut River.

92D0 Southern riparian galleries and tickets (*Nerio-Tamaricetea* and *Securinegion tinctoriae*)

Tamarisk shrubs (*Tamarix ramosissima*) occur along the Lower Danube and its tributaries, especially in places with a great dynamics where new sand areas do constantly emerge.

Natural or near-natural characteristic floodplain habitats do still exist in the Lower Danube area only, as it is subject to the river dynamics with periodical water level fluctuations, erosion and sediment deposition. These river stretches show high site typical biodiversity, habitat types and species, as exemplified above. Between rkm 838 and 383 the 50 sites analysed as base for proposals for the Natura 2000 network encompass 55 species of aquatic macrophytes and 961 species of semi-aquatic and terrestrial plants (Schneider et al. 2005; Schneider 2008, 2009). Two islands representative for the whole stretch, the protected sites Belene (BG) and Cama-Dinu (RO), are of high conservation value as for their biodiversity. In both areas 7 of the habitat types of community interest are present and a high plant diversity has been identified, in the Belene complex 372 species and in the Cama-Dinu area 331 species. The high degree of naturalness with site typical habitats and species is in contradiction with the status of the Lower Danube declared following the classification of the WFD as a heavily modified water body. Further, the planned measures for navigation improvement such as ground sills, groins and river bank reinforcements in the islands complexes of Belene and Cama-Dinu (ISPA II) will have serious negative consequences for the protected sites due to large-scale changes in hydrology deteriorating morphological structures, habitats and biota. Taking into account the high conservation value on the national and international level, it has to be reconsidered, which measures are strictly necessary and which can be reduced or cancelled. However, it is difficult to find an acceptable compromise for nature conservation, economic interests and sustainable development.

5 Conclusions

Despite of changes in discharge of the Danube (due to the Iron Gate power plants) and its tributaries (e.g. Olt, Arges, Siret) the analyses showed a high value from the viewpoint of biodiversity, many habitats and species being of community interest. This biodiversity is dependent on the still existing hydrological and morphological dynamics. If structures and dynamics are lost, all the various habitats will change or disappear. Considering these facts it is of great importance to pay special attention to the remaining natural or near-natural areas along the Lower Danube and to analyse very carefully how the state of habitats can be maintained and navigation improved, as these habitats depend on natural river banks and islands. The international importance of the Natura 2000 network must be stressed.

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