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BIODIVERSITY IN CONDITIONS OF STRONG ANTHROPOPRESSURE IN THE VISTULA DELTA (POLAND)

Joanna Fac-Beneda, Izabela Chlost
University of Gdańsk, Department of Hydrology
Bażyńskiego str., 80-952 Gdańsk, Poland, +48 58 5236530
geojfb@univ.gda.pl, chlost@univ.gda.pl

Abstract

The modern system of the hydrographic network of the Vistula Delta does not differ considerably from the one that was shaped during the intensified interference of man into water relationships, i.e. till the end of the 19th century. The long lasting and varying anthropopressure resulted in the fact that relatively natural processes occur only in the main channel of the River Vistula, while in the whole remaining area water relationships have been shaped by man and are under human control. The change of the course of watercourses resulted from man's actions and to a smaller extent from natural transformations related to cyclic floods. Radical changes in relationships and therefore in the hydrographic picture of the delta, which started around the late 14th and early 15th century, took place due to successive management of the delta. South-western and western regions of the lagoon and marshes accompanying it were reclaimed for agriculture by draining and melioration. On the reclaimed terrain, communication, settlement and above all water network accepted a regular form. The state of the present hydrographic network of the Vistula Delta has been determined mainly by the geographic environment, especially by the natural hydrographic system and the needs of agriculture. For many centuries the human interference in the Vistula Delta water relations was aimed at drainage of water excess. Despite of this fact enclaves of hydrogenic habitats preserved in the alluvial plains and indicate biodiversity of this area. On the other hand, there are valuable natural ecosystems developed as a result of human activity, related over this activity, and which became part of the natural landscape of the delta. In first group special attention should be paid to areas included in the Special Protection Areas of an European ecological network NATURA 2000. Within the Vistula Delta there are four such areas: Dolina Dolnej Wisły (Lower Vistula Valley), Ujście Wisły (estuary of Vistula), Zalew Wiślany (The Vistula Lagoon) and Jezioro Drużno (Lake Drużno). In generally areas under protection includes: boggy shores overgrowing reservoirs or reed-belt streams, reeds, floating vegetation, and locally habitats of alder and elm-ash character which are the refuge of waterfowl. The second group includes ecosystems depend on extensive forms of agriculture. Particularly livestock grazing and hay cutting, abandonment of which results in progressive loss of valuable species of meadow and herbaceous plants (*Triglochin maritimum*) and animals (*Planorbis carinatus, Bombus lapidarius, Pipistrellus pigmaeus*) are most important activities carried out in these areas.

Keywords: Wetlands, Vistula Delta, biodiversity, Natura 2000

1. INTRODUCTION

River deltas are areas whose hydrographic network as a result of hydrological processes that occur within the very delta, a result of the hydrological impact of the whole drainage basin and the influence of the receiver. In the part of Europe covered in the Pleistocene by the accumulative operation of the Scandinavian continental glacier, river deltas had been built only by natural processes for several dozen thousands of years. Only at the end of the first millennium of our era they started being formed with a growing participation of man.

The Vistula delta (Fig. 1) is one of the most interesting and important geographical regions in Poland. It is a region where the interrelation between the natural environment and the one artificially transformed by man occurs to an extent rarely noted in other regions of Poland.

The specific characteristics of aquatic habitats of the Vistula delta is determined not so much by the occurrence of rare or protected species, but the specificity of flora and fauna as a whole. This area is dominated by eurybiotic species (i.e. of a wide ecological range), characteristic of eutrophic habitats. Watercourses and their immediate surroundings show very high species diversity.

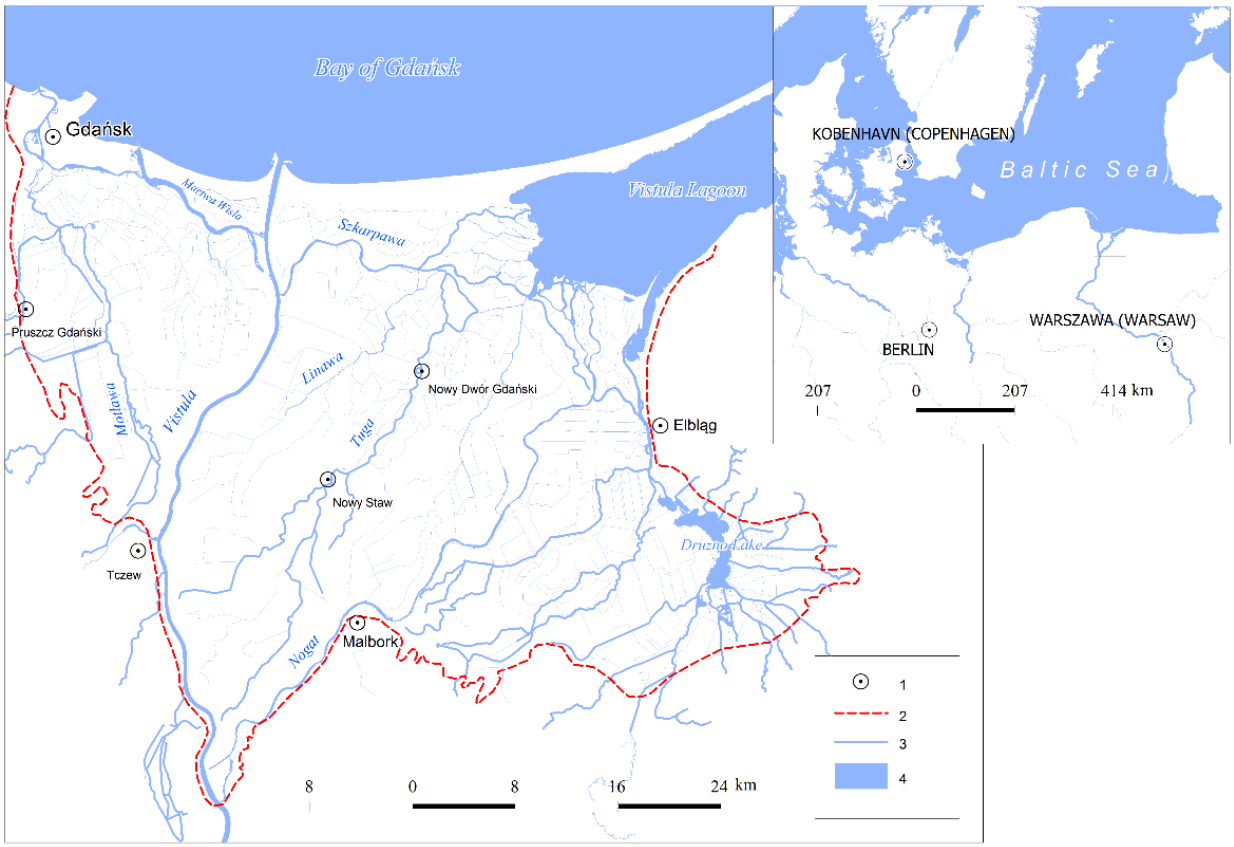

Figure 1. Study area.
Legend: 1 – cities, 2 – border of the Vistula Delta, 3 – rivers, 4 - water reservoirs

2. SPECIAL PROTECTION AREAS OF AN EUROPEAN ECOLOGICAL NETWORK NATURA 2000

Despite the centuries of human interference in the water conditions of the Vistula Delta aimed at draining excess water, enclaves of hydrogenic habitats were preserved on the alluvial plains giving evidence of the biodiversity of the area. On the other hand, there are also valuable natural ecosystems developed as a result of human activity and dependent on that activity, which became part of the natural landscape of the delta.

The areas which deserve special attention - and represent the first group - are those included in the European network of the protected areas the NATURA 2000 sites and nature reserves. Within the limits of the Vistula delta the following were delimited: four Special Areas of Conservation (SAC): Dolna Wisła (PLH220033), Ostoja w Ujściu Wisły (PLH220044), Zalew Wiślany i Mierzeja Wiślana (PLH280007) i Ostoja Drużno (PLC280001) as well as four Special Protection Areas (SPA): Dolina Dolnej Wisły (PLB040003), Ujście Wisły (PLB220004), Zalew Wiślany (PLB280010), Jezioro Drużno (PLB280013) (Fig.2). There is twenty seven protection habitats, including seven priority (Table 1).

In the Vistula delta six nature reserves have been created, including three floristic ones: Las Mątawski, Parów Węgry, Buki Mierzei Wiślanej and three ornithological ones: Ptasi Raj, Mewia Łacha, Kąty Rybackie.

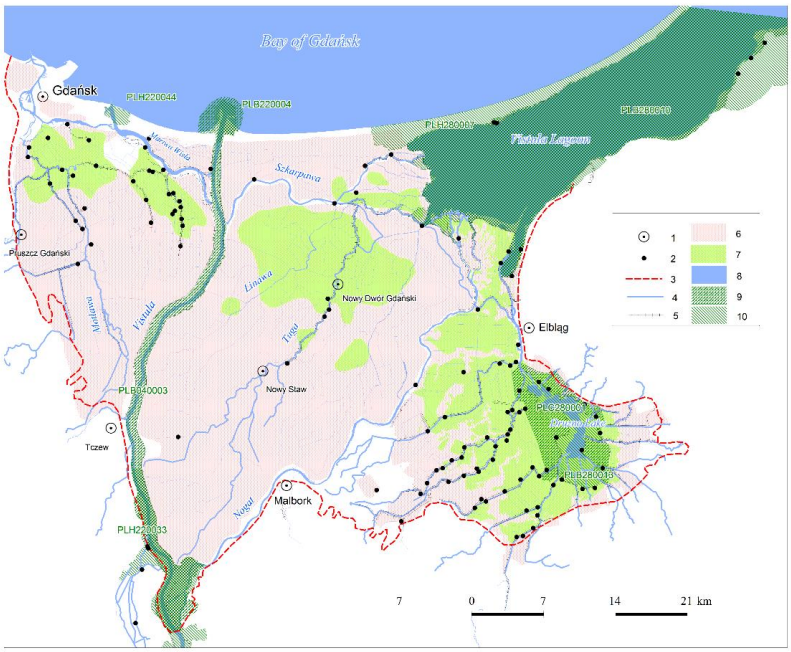

Figure. 2. Natura 2000 areas in the Vistula Delta.
Legend: 1 – cities, 2 – pomp stations, 3 – border of the Vistula Delta, 4 – rivers, 5 – dikes, 6 – polders, 7 – area below sea level, 8 - water reservoirs, 9 – Special Protection Areas (SPA) PLB…, 10 - Special Areas of Conservation (SAC) PLH…

Table 1. Habitats from Standard Form Date in the Vistula Delta.

No	Habitat from SDF		Natura 2000			
	Name	Code	1.	2.	3.	4.
1.	Estuaries	1130		x	x	
2.	Coastal lagoons*	1150			x	
3.	Annual vegetation of drift lines	1210				
4.	Embryonic shifting dunes	2110		x	x	
5.	Shifting dunes along the shoreline with Ammophila arenaria (white dunes)	2120		x	x	
6.	Fixed coastal dunes with herbaceous vegetation (grey dunes)*	2130		x	x	
7.	Dunes with Hippophaë rhamnoides	2160		x		
8.	Dunes with Salix repens ssp. argentea (Salicion arenariae)	2170		x		
9.	Wooded dunes of the Atlantic, Continental and Boreal region	2180		x	x	
10.	Humid dune slacks	2190			x	
11.	Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation	3150	x		x	x
12.	Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation	3270	x		x	
13.	Xeric sand calcareous grasslands (Koelerion glaucae)*	6120	x			
14.	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)*	6210	x			
15.	Hydrophilous tall herb fringe communities of plains and the montane to alpine levels	6430	x			x
16.	Stream bank butterbur grasslands	6430-2			x	
17.	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	6510-1	x		x	
18.	Degraded raised bogs still capable of natural regeneration	7120			x	
19.	Transition mires and quaking bogs	7140			x	
20.	Bog woodland*	91D0			x	x
21.	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)*	91E0	x		x	x
22.	Riparian mixed forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia, along the great rivers (Ulmenion	91F0	x			

	minoris)					
23.	Euro-Siberian steppic woods with Quercus spp.*	91I0	x			
24.	Asperulo-Fagetum beech forests	9130			x	
25.	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli	9160	x	x		
26.	Galio-Carpinetum oak-hornbeam forests	9170	x			
27.	Old acidophilous oak woods with Quercus robur on sandy plains	9190	x		x	

* Priority habitats

1. Dolna Wisła PLH220033
2. Ostoja w Ujściu Wisły PLH220044
3. Zalew Wiślany i Mierzeja Wiślana PLH280007
4. Ostoja Drużno PLC280001

2.1 Ostoja Drużno (PLC280001) and Jezioro Drużno (PLB280013)

Within the framework of the NATURA 2000 the protection usually covers marshy shores of overgrowing water bodies or streams with a belt of rushes, reed and floating vegetation as well as local habitat of an alder forest and elm-ash riparian forest forming a waterfowl refuge. Among these areas a particularly valuable place of international importance is the nature reserve of Lake Drużno saved under the Ramsar Convention as the Refuge Ramsar (3202 ha). The lake is a remnant of the Vistula Lagoon originating from the period of the Littorina Sea transgression, although the origin of the lake basin dates back to the beginning of the Pleistocene covering the periods of Allerød and Younger Dryas (Drwal & Gołębiewski, 2002). The lake lies in the catchment of the river Elbląg creating distinctive, concentric hydrographic system (DRSH), in the center of which is Lake Drużno. The lake serves as a recipient of potamic water of a dozen rivers flowing from the east, south and west, and the only outlet of the system leads to the north via the river Elbląg to the Vistula Lagoon and from there to the Baltic Sea. This link results in a periodic influx of saline waters into the lake during sea intrusions.

This is a shallow and eutrophic lake, but it plays an important role in preserving rare species, such as fringed water-lily *Nymphoides peltata*), and protected species, such as giant bellflower (*Campanula latifolia*) or aconite (*Aconitum variegatum*), which represents mountain species. In the alimentation streams endangered species were found, represented by *Catabrosa aquatica* and rootless duckweed (*Wolffia arrhiza*) (Buliński *et al*. 2013). Among the flowering plants and ferns in the lake a total of 12 species under strict protection were documented as well as 77 rare and endangered species, and therefore deserving special attention.

The surface of the water body is dominated by patches of floating-leaved communities such as white water-lily (*Nymphaea alba*), yellow water-lily (*Nuphar lutea*) and fringed water-lily (*Nymphoides peltata*). The riparian stand is composed of native trees: black alder (*Alnus glutinosa*), downy birch (*Betula pubescens*) and silver birch (*Betula pendula*), crack willow (*Salix fragilis*) and white willow (*Salix alba*), less often common ash (*Fraxinus excelsior*), forming communities of currant alder forest (*Ribesto nigri-Altenum*) or to a lesser extent, moss alder forest (*Sphagno squarrosi-Altenum*) or riparian forest of the *Alno-Ulmion* relation. Synanthropisation level is estimated at approximately 12% (72 species), and the anthropophytes showing the largest expansion include Canadian pondweed (*Elodea canadensis*), pitchfork weed (*Bidens frondosa*), sweet flag (*Acorus calamus*), brome grass (*Bromus carinatus*) and wild cucumber (*Echinocytis lobata*).

The area of Lake Drużno and its surroundings are primarily a refuge of wetland birds. It plays an important role for the breeding of native species and as a feeding place of migrating birdlife. In the first group terns are the dominant species, including whiskered tern (*Chlodonias hybrida*), making up nearly 15% of its national breeding population, and less often common tern (*Sterna hirundo*) and black tern (*Chlidonias Niger*). In addition, you can find here a large population of black-headed gulls (*Larus ridibundus*) - 3%, greylag goose (*Anser anser*) - 3%, gadwall (*Anas strepera*) - 4%, great crested grebe (*Podiceps cristatus*) - 2%, little crake (*Porzana parva*) - 2 % and others.

As a feeding and resting place along the migratory pathway running along the coast of the Baltic Sea, Lake Drużno has been chosen by the following bird species: bean goose (*Anser fabalis*), great white-fronted goose (*Anser albifrons*) and crane (*Grus grus*). It is estimated that each year the number of migratory species here reaches 10 000 - 20 000 individuals (http://natura2000.gdos.gov.pl/).

2.2 Zalew Wiślany i Mierzeja Wiślana (PLH280007) and Zalew Wiślany (PLB280010)

The area with similar specifics of flora and fauna of Lake Drużno and covered by the NATURA 2000 network is the Vistula Lagoon cut off from the Baltic Sea by the Vistula Spit. Under protection is the Polish part of the basin, together with the spit and the mouth sections of the rivers which flow into it. These are the branches of the mouth section of the Vistula (Nogat, Szkarpawa, Królewiec Vistula) and the rivers Elbląg, Bauda and Pasłęka. The Vistula Lagoon has small depths, of up to a maximum of 4.6 m (average 2.3). Through the connection with the open sea via the narrow Strait of Baltiysk (in the Russian part of the spit) sea water is pushed in during heavy storms, due to which the water of the lagoon shows variable salinity and is subject to large fluctuations in the levels of up to 1.5 m per day.
By the depressive, shallow and marshy shores of the reservoir there are extensive patches of rushes of a width of up to several hundred meters, which form of one or two strips parallel to the shoreline. Shallows and bays as well as river estuaries are overgrown with the plant species with floating leaves. Of particular importance are the communities of fringed water-lily (*Nyphoides peltata*) and a rich population of floating fern (*Salvinia natans*). The most valuable communities are also those built by submerged flora of classes *Potametea* and *Charetea*, creating underwater meadows with a broad participation of stonewort (*Chara aspera*), including the species recognised in Poland as extinct (*Chara connivens*). The representatives of the rare species of fauna include river lamprey (*Lampetra fluviatilis*), Amur bitterling (*Rhodeus sericeus*) and twait shad (*Alosa Falla*). Occasionally gray seal (*Halichoreus grypus*) appears in the lagoon.

The communities in the Vistula Spit have developed differently. More than 80% of its area is covered by forests. These are mostly acid oak forests of the birch-oak type (*Betulo Quercetum*) and a coastal crowberry coniferous forest (*Empetro nigri-Pinetum*) with Scots pine (*Pinus sylvestris*), juniper (*Juniperus communis*) and creeping willow (*Salix repens*) with common heather (*Calluna vulgaris*), crowberry (*Empetrum nigrum*) and lingonberry (*Vaccinium vitis-idaea*) in the undergrowth. Typical dune species include sea holly (*Eryngium maritimum*), whose habitat here is one of the largest in Poland, and *Linaria odora*. Halophytes are represented by prickly saltwort (*Salsola Kali*) growing on sandy beaches. In the depressions between dunes developed terrestrial hydrogenic habitats with high water table, overgrown with swamp birch forest (*Vaccinio uliginosi-Betuletum pubescentis*) or alder forest. Locally raised and transitional bogs also developed. Among the valuable peat species noteworthy is sundew (*Drosera rotundifolia*), marsh tea (*Ledum palustre*) and honeysuckle (*Lonicera periclymenum*).

The Vistula Lagoon creates one of the major refuge areas on the Polish coast for breeding wetland birds. The species here are similar to those given in the description of Lake Drużno, but there are also other ones. The numerous species include common shelduck (*Tadorna tadorna*), which makes up 10% of the national population, and spotted crake (*Porzana porzana*), which makes up 1% of the population. There is also mute swan (*Cygnus olor*) and - especially valuable - white-tailed eagle (*Haliaeetus albicilla*). In turn, on the Vistula Spit, especially in the reserve Kąty Rybackie, there is great black cormorant (*Phalacrocorax carbo*). Its population size is estimated at 8900-10 000 individuals, giving nearly 45% of the nationwide population. In the same reserve, around 550 breeding pairs of gray heron (*Ardea cinerea*) nest, which corresponds to approx. 5% of the population in the country. The colonies of both species prey on the Vistula Lagoon, seriously threatening the balance of the fish fauna of the reservoir. Of migratory birds, whose numbers during migration reaches approx. 60 000 individuals, greater white-fronted goose (*Anser albifrons*) should be mentioned. Moreover, this is the only wintering site of Canada goose (*Branta canadensis*) in the country.

2.3 Ostoja w Ujściu Wisły (PLH220044) and Ujście Wisły (PLB220004)

High biodiversity characterises the area near the Gdańsk agglomeration. Within the borders of the protected area there are two branches of the Vistula mouth: the closed branch of the Vistula Śmiała in the west and the active branch of the Vistula Przekop in the east. The occurrence of halophytes is characteristic of the area. Within this area there is the reserve Mewia Hurst, which is located on both sides of the mouth of the river, along with the accumulation fan in its foreground. Winter concentration of gulls and ducks in the reserve has more than 100 000 individuals. The second part of the area covered by the NATURA 2000 network is around the mouth of the Vistula Śmiała with the reserve Birds' Paradise, which includes two lakes – Karaś Lake and Ptasi Raj Lake.

The whole area of the Vistula mouth is dominated by inland waters, which occupy 30% of the area, and marine waters covering 17% of the total (Fig. 3). In contrast, terrestrial hydrogenic habitats are

represented by peat bogs and swamps, which constitute 12% of the area and are mainly in the reserve Ptasi Raj. Diverse mosaic of habitats according to the EU directive overlaps with those selected on the Vistula Lagoon and the Vistula Spit.

The species legally protected and endangered in the country is sea aster (*Aster tripolium*) which occurs on saline meadows and pastures of the Martwa Vistula and the Śmiała Vistula. Among the protected marine mammals in the estuary of the Vistula gray seal (*Halichoerus grypus*) is quite commonly observed. The dominating bird species is sandwich tern (*Sterna sandvicensis*), making up nearly 100% of the national population. Valuable representatives of the avifauna are also dunlin (*Calidris alpina*), greater scaup (*Aythya marila*), common merganser (*Mergus merganser*), which belong to the wintering species, or ruff (*Philomachus pugnax*). The rare species include oystercatchers (*Haematopus ostralegus*). The object of protection in the estuary of the Vistula is a total of 18 species of birds and three species of fish fauna, including - besides river lamprey and twait shad - also sabre carp (*Pelecus cultratus*).

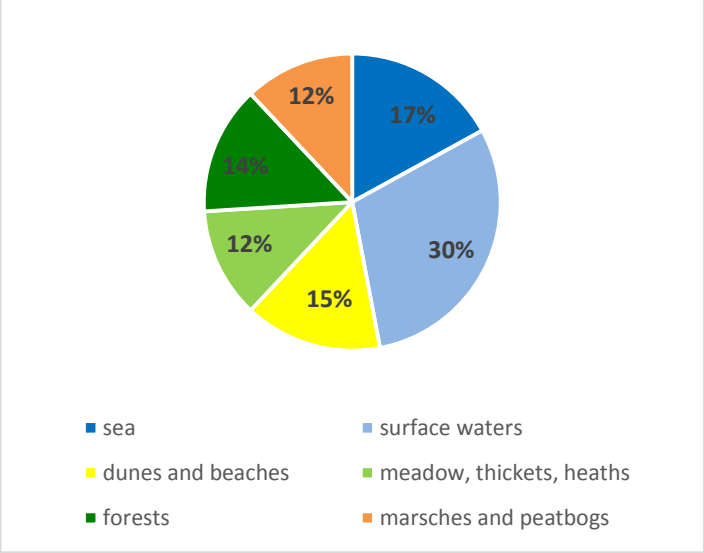

Figure 3. Types of habitats in the Vistula Delta.

2.4 Dolna Wisła (PLH220033) and Dolina Dolnej Wisły (PLB040003)

The area of the Dolina Dolnej Wisły within the NATURA 2000 network stretches along the Vistula for more than 260 km, between Włocławek and Przegalina. Only a portion of this section is located in the delta. This is the part to the north of the lock cutting off the Nogat branch from the Vistula. A subject to protection is the very river with shoals, islands appearing during low water and muddy stretches, as well as the valley between the embankments with numerous oxbow lakes. On the floodplain there are extensive waterlogged meadows and small fens. The banks are overgrown with the willow thicket or the remains of riparian forests. Thirty-eight percent of the area is used for agricultural purposes in the form of fields and pastures. Grassland and scrub habitats occupy 21% and forests 8% of the area.

Dolina Dolnej Wisły is the wetland bird sanctuary of international importance. Oxbow lakes form the main food source. In addition to the species already listed in other areas of this rank, the recorded bird species include populations of warbler (*Sylvia nisoria*), sand martin (*Riparia riparia*), corncrake (*Crex crex*), kingfisher (*Alcedo atthis*) and rosefinch (*Carpodacus erythrinus*). Among the migratory birds the presence of golden plover (*Pluvialis apricaria*) and curlew (*Numenius arquata*) is recorded. The concentration of individuals during the migration season in spring, autumn and winter exceeds 20 000. The Vistula Delta is now basically deforested. The most common tree species is willow growing on the banks of engineered river channels, canals and ditches, which has ingrained into the landscape of the Vistula Delta.

The Las Mątawski Reserve, located within the Dolina Dolnej Wisły, is one of few preserved, largest complexes of higher plants which are a relic of the ancient riparian forests that grow naturally in the delta. It is located between the Vistula and Nogat and separated from the rivers with flood embankments and dikes. The tree stand is formed of large specimens of oaks and ashes over 150 years old and several valuable silver poplars about 180 years old. Besides, under protection are habitats of the Pomeranian deciduous forests and elm-ash (*Ficario-Ulmetum minoris*) forests. The complex is located among the fields. It occupies a flat surface with a specific topoclimate characterised by high humidity and the presence of frost pockets. Such

climate features result from the isolation of the area sheltered from the wind by the levees. The embankments are also the cause of elimination of inundation by the waters of the two rivers, which results in a gradual transformation of riparian forests into deciduous forests (*Querco-Fagetea*).

The whole delta of the Vistula is a site of European beaver (*Castor fiber*), a species under strict protection. Its population is steadily increasing, which results in increased flood risk, as building lodges loosens the levees. However, the primary undesirable representative of fauna in the delta is American mink (*Neovison vison*). It was released in the areas of the former Soviet Union in the middle of the twentieth century and quickly spread to the Baltic States. It is a predatory animal which threatens native populations.

3. ECOSYSTEMS DEPENDENT ON THE EXTENSIVE FORMS OF AGRICULTURE

Another group of areas is represented by communities or individuals dependent on extensive forms of agriculture, especially cattle grazing and mowing meadows, whose failure results in progressive loss of valuable species of herbaceous and meadow plants as well as animals. In part, these areas overlap with the areas protected by law. The examples include the extensive management of grassland on the banks of the Vistula Lagoon or in the Lower Vistula Valley, preserving the habitats of birds, especially those nesting on the ground, while restraining the expansion of unwanted species. Sustainable farming relies on grazing or mowing at certain dates of the growing season, not jeopardizing reproduction. Other ways allow mowing at all times, but not over the entire surface, leaving 5-10% of the area not subjected to this treatment, or determine the height of mowing (5-15 cm) and its technique (prohibition of mowing from the outside to the inside of the field). The removal of the cut biomass is necessary in up to two weeks after mowing (Błaszkowska et al. 2008). In the case of grazing restrictions may rely not only on the introduction of the grazing season, but also a certain number of heads per 1 hectare (population before 20 July - 0.5 LU/ha, after 20 July - 0.5-1.0 LU/ha). Other restrictions refer to limiting the use of fertilisers and not using pesticides.

The bird species dependent on this type of management include: harrier (*Cirus pygargus*), corncrake (*Crex crex*), lapwing (*Vanellus vanellus*), dunlin (*Calidris alpina schinzii*), common snipe (*Gallinago gallinago*), Eurasian curlew (*Numenius arquata*), black-tailed godwit (*Limosa limosa*), black tern (*Chlidonias niger*) and others. From the group of insects it is necessary to mention buff-tailed bumblebee (*Bombus terrestris*), red-tailed bumblebee (*Bombus lapidarius*) and early bumblebee (*Bombus pratorum*) occurring by the Martwa Wisła, Upper and Lower Tina, Tuga and Święta and oxbow lakes along the Nogat, as well as caddisfly (*Ceraclea senilis*) identified over the Linawa. Of the molluscs snail (*Planorbis carinatus*) was encountered near the Fiszewka, Linawa, Wisła Królewiecka, Szkarpawa, Tina and Tuga. Some species of bats, such as soprano pipistrelle (*Pipistrellus pigmaeus*) preying on the Martwa Vistula, also require the maintenance of traditional grazing, which gives them abundant food resource.

Sustainable meadow management also favours maintaining the habitats of plants: reed bed with sedges (*Magnocaricion*), *Molinia* meadows and *Kadenia dubia* meadows or semi-natural wet meadows. It is often necessary to preserve individual species of herbaceous plants, as in the case of sea arrowgrass (*Triglochin maritimum*), sea aster (*Aster tripolium*), lesser centaury (*Centaurium pulchellum*), sea milkwort (*Glaux maritima*), blackgrass (*Juncus gerardi*), *Juncus ranarius* rushes, Winter's plantain (*Plantago winteri*) as well as *Spergularia salina*, and usually requires the overexposed areas. The stands of these plants were found by the Martwa Wisła.

4. CONCLUSION

The main threat to the flora and fauna and their habitats in the Vistula Delta is the water quality determined by human activity. This quality is influenced by water discharged from the polders, wastewater discharged from households as well as uncontrolled landfills. Toxic substances derived from wastewater can accumulate in organisms at all trophic levels (Kozak, 2012).

An additional threat is - progressing in recent years - intensification of agriculture. The use of fertilisers results in increased inflow of nutrients from fields and leads to water pollution and their eutrophication. Besides, expanding agricultural land causes depletion of potential food resources available to birds (seeds, invertebrates, small mammals).

Excessive and improperly performed engineering of watercourses may also have adverse effects, especially when it is done during the inappropriate season related to phenology of a given species. The species associated with river valleys, especially birds, are threatened in particular by any changes in the

hydrological regime and changes in geomorphology of the river valley and river channel, frequently leading to a rapid loss of habitat.

Deepening river channels, swamping oxbow lakes, draining field reservoirs formed in the depressions in the valley, removing scrub and riparian plantings, converting grassland to arable land – these are examples of measures accompanying engineering of watercourses, which adversely affect the species richness of plants and animals.

In the case of bats a serious threat may be the disappearance of the old building (or incorrectly performed repairs), because it provides these mammals with most of the daytime hiding places. A growing threat for this group of animals is also cutting down old trees, particularly the roadside alleys, as bats not only hide in tree hollows, but also use them as flight routes and feeding grounds. A threat for fish is poaching. Of environmental factors most dangerous for species diversity seems to be a mass occurrence of certain plant species (i.e. floating aquatic fern, rigid hornwort and water soldier) and the expansion of common reed. The most dangerous for valuable fish species is the occurrence of invasive alien species such as Prussian carp and Amur sleeper.

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