

Nutrient treatment efficiency of natural and constructed wetlands in the southern parts of Morava and Dyje River basins (Danube basin)

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The Morava river basin is one of the most important tributaries of the upper Danube and forms the second largest river basin in the Czech Republic. The basin is divided into two main sub-basins – the Morava river basin and the Dyje river basin. About 2.7 million people, more than the quarter of inhabitants of Czech Republic, are live in the basins. Land use in the southern parts of both sub-basins is intensive agriculture, which causes relatively high nutrient pollution.

It is possible to reduce pollution loads with wetlands and floodplains. This paper presents the results on monitoring and treatment efficiency of selected wetland localities (focused mainly on nutrients in the Morava and Dyje River floodplain areas between 2000 and 2009).

Some data derived from meanders and oxbows of the Dyje River between 2000 and 2006 (Rozkošný, Heteša, Marvan, 2007) is included. Assessment of the nutrient reduction potential of the monitored wetland types was based on our own methodology, and other research in the Danube River Basin following recommendations by the ICPDR (Tickner et al., 2004; Tomschi, 2001). These methods are based on the comparison of nutrient concentration in water from the inlet and outlet points of a wetland.

Selected constructed wetlands used for municipal wastewater treatment were also monitored and data on long-term N and P removal efficiency shown in Table 1.

Study sites: **Nesyt** – a pond with a large coastal *Phragmites area*; **Horní les** – a system of small pools in a floodplain forest; **Křivé jezero** – a cut meander of the Dyje River and flooded meadows with floodplain; **Louka u Trkmanky** – a flooded meadow with agricultural use; **Košárské louky** – flooded meadows within a floodplain forest; **Šibeník** – a pond with a large coastal area of macrophyta vegetation; **Úvaly** – a silted pond with a large coastal area of macrophyta vegetation; **Kurdějovský** – a treatment pond for pollution from agricultural land and diffuse pollution transported by a stream from the Kurdějov village; **Tvrdonice** – a system of pools, channels and old cut meanders within a floodplain forest; **Boří les** – a system of small ponds and wetlands within a forest; **Cut meanders and old oxbows of the Dyje River**.

The results allow the assessment of the function of selected wetlands and their ecosystems, with respect to pollution reduction of surface waters. Monitored natural and constructed wetlands had a positive impact on the nitrogen and phosphorus retention and uptake from polluted surface waters and diluted wastewaters produced by villages.

The efficiency range for all monitored parameters depended on water flux, retention time and season (see Table 1) and differed to the efficiency calculated for organic pollution and suspended solids (Rozkošný, 2008). The predominant condition of the water was anaerobic, with high levels of organic material, leading to a large decrease in nitrate nitrogen through the denitrification process. More information about the reduction of ammonia nitrogen is published in Rozkošný et al. (2005). The lowest efficiencies were observed in wetlands without larger areas covered by

macrophytic vegetation. During the winter period the treatment efficiency was lower generally.

Comparison of the treatment efficiency of constructed wetlands during vegetation and non-vegetation periods is discussed in detail in Rozkošný (2010).

The potential nitrogen reduction in monitored floodplain areas (Dyje River “Soutok”, “Herdy”; Morava River “Tvrdonice”) was calculated. Calculated value for the “Soutok” area is 320.5 ton of total N per year in average (1282 ha of suitable artificially or naturally flooded areas), for the “Tvrdonice” 77.5 t totN/year (310 ha) and “Herdy” 59.5 t totN/year (238 ha).

The average nitrogen load at the last Czech gauge station of the Dyje River (Pohansko) between 1999 and 2005 was 6445 t N per year, and about 380 t N could be removed by annual artificial flooding yearly at the study areas.

Locality	Monitoring period	Treatment efficiency (%)			
		N-NO ₃	N-NO ₂	N-NH ₄ ⁺	total P
Natural wetlands					
Křivé jezero	2001 - 2002, 2006	61.8	50.0	34.7	78.4
Flooded meadows Pohansko	2001, 2006	75.1	37.1	25.8	48.6
Horní les	2000 - 2002	57.3	42.8	13.6	27.2
Šibeník pond	2002, 2009	52.2	27.4	37.2	68.0
Úvaly pond	2002, 2006	42.6	---	52.2	46.6
Kurdějovský pond	2009	75.6	97.7	98.5	91.5
Flooded meadows Trkmanka	2001, 2006	84.6	40.0	---	16.7
Boří les	2004	99.3	96.8	87.4	57.6
Tvrdonice	2004	91.5	50.0	65.6	81.8
Constructed wetlands					
Dražovice	1999 - 2010	57.9	78.2	40.6	17.8
Žernovník	2006 - 2009	60.8	100.0	26.2	19.2
Olší nad Oslavou	2002 - 2009	42.7	89.6	65.0	22.6

Table 1.1 Nitrogen and Phosphorus treatment efficiency of the natural and constructed wetlands

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