

Buffer zones in the Lower Wieprz Natura 2000 site

Proposals for land use changes in the Dolny Wieprz Natura 2000 site to ensure continuity of buffer zones

The Dolny Wieprz Natura 2000 site PLH060051 (hereafter N2000 DW) covers an area of 8,182.30 ha. It is located in the Lubelskie Voivodeship in the Wieprz Proglacial Valley and the Middle Vistula Valley. Its main part covers a section of approximately 40 km of the valley of the Wieprz River with numerous oxbow lakes, stagnant areas, and several pond complexes in its lower course. The site is dominated by extensive meadows, often containing a high moisture content. Their total area is more than 5,600 ha, or 68% of the total area. A considerable part of them is currently not used. In some places, patches of riparian meadows, willow scrubs, and floristically rich thermophilous sand grasslands can be found. The Wieprz River Valley is characterised by exceptional landscape qualities - the river flows here in a strongly meandering channel of great naturalness.

The aim of the study was to propose a model of a buffer zone in the N2000 DW site for the effective reduction of nutrient load from agricultural areas. In particular, sites where the buffer zone should be restored were identified. In addition, land use requirements within such a hypothetical zone were proposed.

As a first step, a land use structure analysis was carried out using Copernicus data, the land registry, and field visits.

Taking the terrain, geology, and water conditions into account, it was assumed that the optimum width of the buffer zone should be 20 m on both sides of the watercourse, regardless of its type or size. A buffer of this width was set along all the watercourses. The locations where the buffer zones should be restored were then selected.

In the baseline option, the following types of buffer zones were proposed in the 20m strip separating the banks of the watercourses from the rest of the agriculturally used area:

1. Extensively used meadows - this type includes meadows and pastures where extensive use needs to be maintained or restored;
2. Conversion of arable land into a grassland buffer zone - arable fields within the designated buffer zone are only marginally still in use, a suitable step would be to restore extensive grassland on their surface.

On the other hand, the extended variant additionally proposes:

1. Meadows and woodland strips - this type of zone should be characterised by the presence of peat with loose strip planting of trees and shrubs;
2. Tree and shrub planting - the type within which the meadows should be restored by planting appropriate tree species.

Estimation of the current amount of run-off nutrients (Nitrogen and Phosphorus) into the Wieprz River, assessing the degree of their reduction using wetland zones

This study analysed the circulation of nutrients (N and P) in the N2000 DW site. The study area included a section of the Wieprz River (a tributary of the Vistula River), with a length of 71.4 km and a catchment area of 1,369.3 km².

To calculate the balance of nutrients in the analysed catchment, the following components were taken into account: atmospheric deposition, introduced by agriculture, domestic and industrial wastewater discharges, inflowing by the Wieprz River and Tyśmienica, and discharged by the Wieprz River from the N2000 DW site. Due to the availability and timeliness of materials, data from 1991-2020 were used for the analysis. The aim of the calculations was to determine the reduction of nutrient inputs to the Wieprz River waters by creating buffer zones (vegetation strips), in the zone adjacent to its bed.

The results of the calculations showed that the area nutrient load of anthropogenic origin entering the Wieprz catchment in this area was for: nitrogen 9927 t/year (72.5 kgN/ha/year), phosphorus 1,684 t/year (12.3 kgP/ha/year). The nutrient load flowing down the Wieprz River was, in the case of nitrogen, about 2% and phosphorus about 1% of the input to the catchment.

To reduce the nutrient inflow to the Wieprz River, buffer zones were proposed in the form of changing the use of agricultural land directly in contact with the riverbed over an area of 12.8 ha (to meadows or tree plantations) and eliminating fertilisation in a 20 m strip adjacent to the riverbed along the entire length of the Wieprz River. The proposed solutions did not significantly change the nutrient load reaching the river. This indicates that the Wieprz riverbed is relatively well buffered by current land use in its vicinity (the river valley is dominated by meadows and wetlands).

The results indicate that a significant reduction in the level of nutrients reaching the Wieprz River in the N2000 DW site will be possible by creating meandering channels on the watercourses flowing into the Wieprz River and by creating buffer zones at the channels of the watercourses flowing into the Wieprz River outside its area. The proposed solutions can reduce the leaching of nutrients into river waters by several dozen/some tens of percent.

Cost-benefit analysis of the creation of wetland buffer zones in the Lower Wieprz River catchment area

This section of the study analyses the costs and benefits of the planned creation of wetland buffer zones in the Dolny Wieprz River catchment. This analysis is needed because in a market equilibrium, the optimal distribution of a public good such as wetland buffer zones cannot be achieved. To this end, a decision scenario was defined, envisaging a change of land use in the Dolny Wieprz River basin within the boundaries of the N2000 DW site towards a lower intensity of use and a more natural agricultural landscape. For example, the curvature of small rivers in the Dolny Wieprz River basin, which had been straightened during land reclamation, would be restored, while a 20 m wide buffer strip of extensive meadows and pastures is suggested in the immediate riparian area. Ploughing, fertilisation, and the use of plant protection products are prohibited in this area. The functioning of both linear and area-wide wetland buffer strips would allow for a more effective reduction of nutrient loads, water purification, increased biodiversity, and enhanced flood protection, while at the same time changing the aesthetics of the landscape. All these benefit elements are referred to as ecosystem services.

To estimate the unit monetary values that characterise the costs and benefits of the project to create wetland buffer zones in the Dolny Wieprz Valley, a benefit transfer approach was used, which involves transferring the results of previously completed valuation studies to a new valuation object. Depending on the specific set of ecosystem services valued in money and the discount rate used, the wetland buffer zones project generates pure economic benefits ranging from 5.9 to 172 million PLN over 30 years. It is therefore cost-effective from a socio-economic perspective under the assumptions used in the analysis.

[Find the full report here \(only available in Polish\)](#)