CLEARANCE

CircuLar Economy Approach to River pollution by Agricultural Nutrients with use of Carbon-storing Ecosystems

Summarising and upscaling different benefits and costs of wetland buffer zones on the catchment scale

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SZKOŁA GŁÓWNA GOSPODARSTWA WIEJSKIEGO W WARSZAWIE

WBZ in 5 sub-catchments of Narew basin

Linear WBZs				
Sub-catchment	wetland banks	2-stage ditches	meandering channels	WBZ total length
Łojewek	6	-	2	51 km
Róż	5	2	4	44 km
Różanica	2	1	1	18 km
Ruż	12	2	2	135 km
Skroda	17	6	1	135 km
WBZ total length	297 km	40 km	46 km	384 km

WBZ in 5 sub-catchments of Narew basin

Polygonal WBZs				
Sub-catchment	rewetted fens	undrained fens	floodplain (mineral)	WBZ total area
Łojewek	3	-	1	236 ha
Róż	4	-	1	2218 ha
Różanica	4	1	1	493 ha
Ruż	1	-	1	1585 ha
Skroda	12	1	1	2652 ha
WBZ total area	6609 ha	78 ha	498 ha	7186 ha

Scenarios

For cost-benefit analysis we assumed that wet buffers development will be considered in 3 basic scenarios:

- development of linear wet buffers only,
- development of polygonal wet buffers only,
- development of both kinds of buffers.

costs or benefits at selected sub-catchment level

upscaling to the level of Narew river catchment

Direct costs

Taken into account:

- costs of engineering intervention,
- purchasing land (if relevant).

Procedure:

- preparation of generalized list of engineering works required for each WBZ type,
- estimation case by case the cost for each buffer with accuracy relevant to the concept phase (with regard to general water course and its valley characteristics).

Direct costs

Preliminary results of calculations (1194 sq. km):

- development of linear wet buffers only (384 km) - 9,4 mil EUR*,
- development of polygonal wet buffers only (7186 ha) - 0,7 mil EUR,
- development of both kinds of buffers - 8,9 mil EUR*.

In the whole Narew catchment (excluding Biebrza), which is 21 185 sq. km large, cost of WBZ development will be app. 17 times higher.

Indirect costs of polygonal WBZ

At functioning phase:

- changes in the ground water level or in frequency of over-bank flows,
- decrease of intensity of agriculture and changes in types of crops and farmers income

Indirect costs of polygonal WBZ

	income per ha [EUR]	difference per ha [EUR]
Potatos	748	599
maize (corn), high intensity	626	477
rape plant, high intensity	484	335
maize (corn), medium intensity	398	249
rape plant, medium intensity	289	140
green fodder for cattle, high intensity	623	474
green fodder for cattle, medium intensity	481	332
hay, high intensity	166	17
grass for hay-ensilage	297	149
hay from flooded / wet grasslands	149	-

Indirect cost of polygonal WBZ

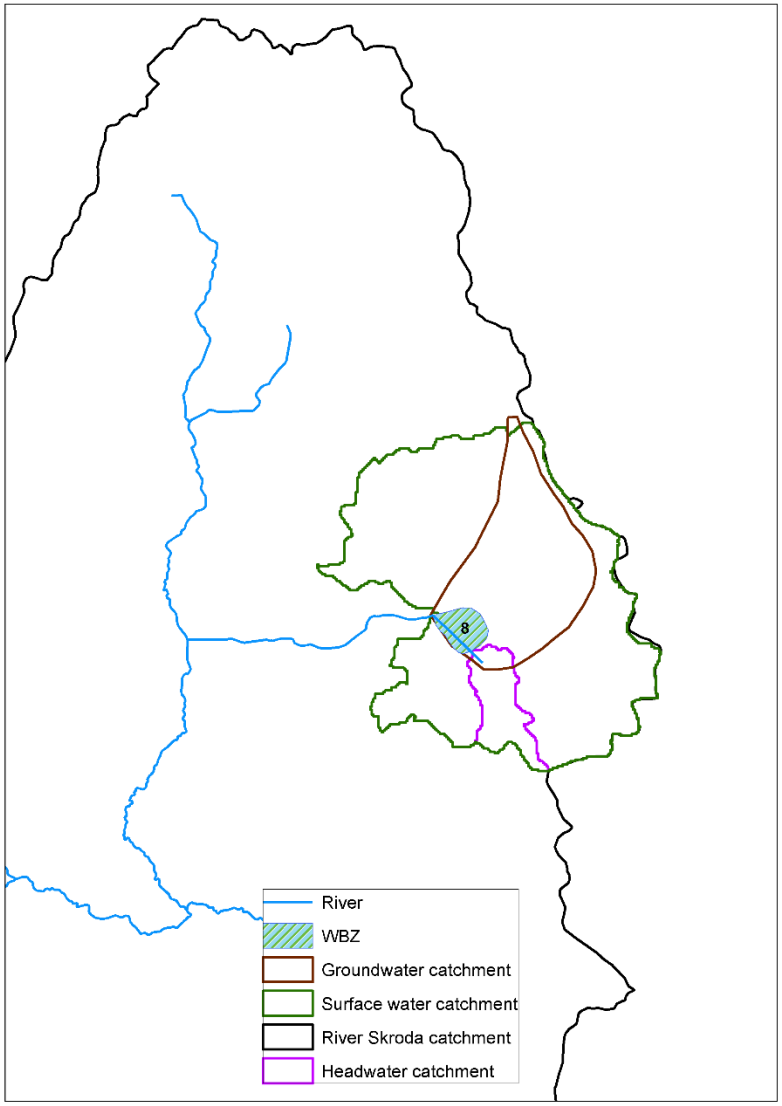
- average difference between these incomes stays on the level of 300 EUR per ha per year =
  = the level of payments under agri-environmental schemes,

- the level of compensation for lowered income in 5 sub-catchment areas (app. 7200 ha) will be around 2,1 mil EUR per year

Nutrient capture (polygonal WBZ)

Delineation of water supply to particular WBZ:

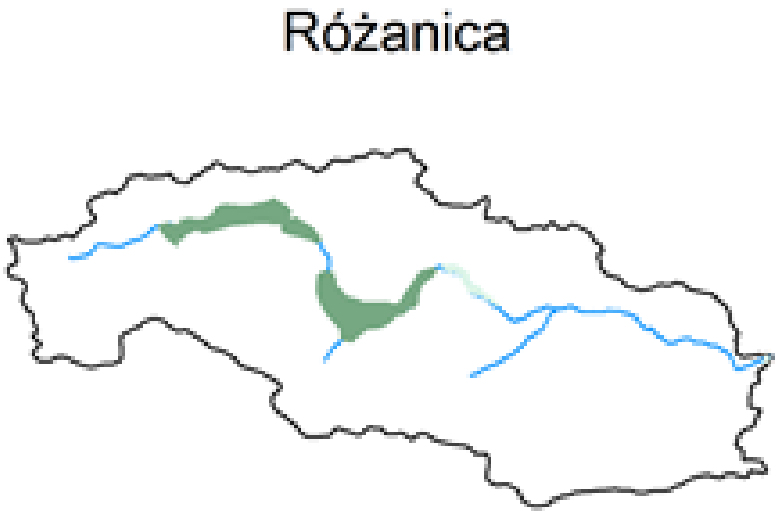
- headwater catchment – major origin of surface water and nutrients reaching WBZ when flooding,
- surface water catchment (excluding headwater catchment) - major origin of surface water supply flowing through WBZ,
- groundwater catchment – major origin of groundwater reaching the river (on the basis of groundwater flow modelling).

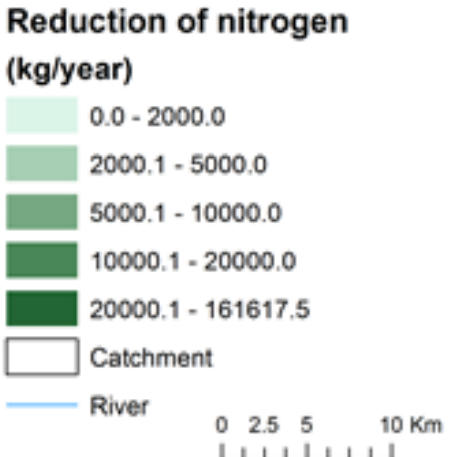


N reduction in particular WBZs – sum of N reduction processes (groundwater + surface water)

WBZ area: 7% of sub-catchment
30% N reduction
+ potential of 135 km of linear WBZ

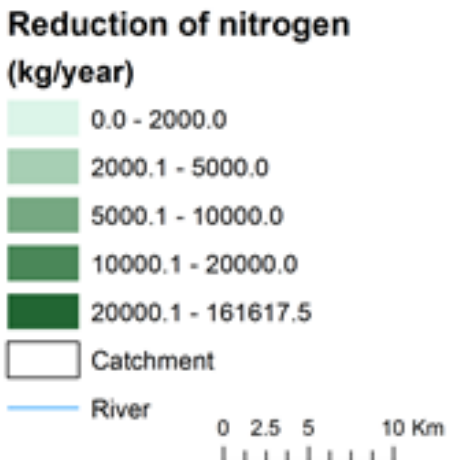
WBZ area: 5% of sub-catchment
18% N reduction
+ potential of 18 km of linear WBZ





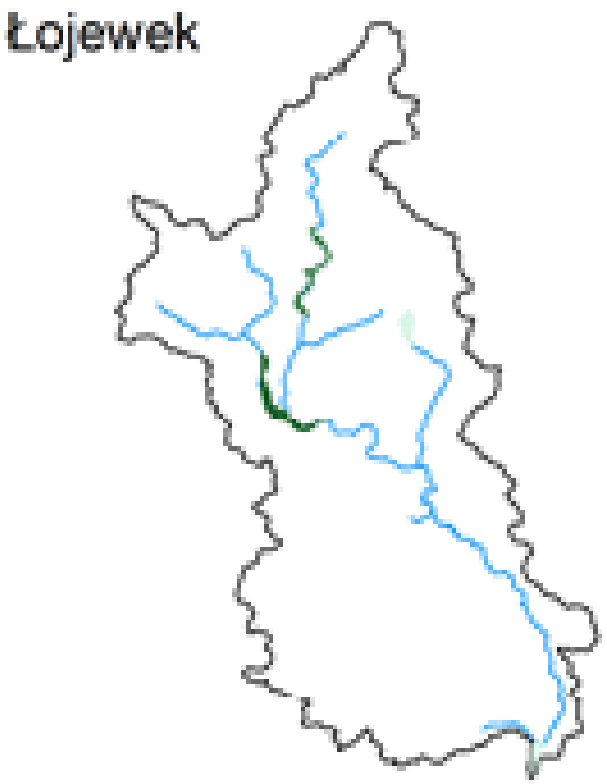
N reduction in particular WBZs – sum of N reduction processes (groundwater + surface water)

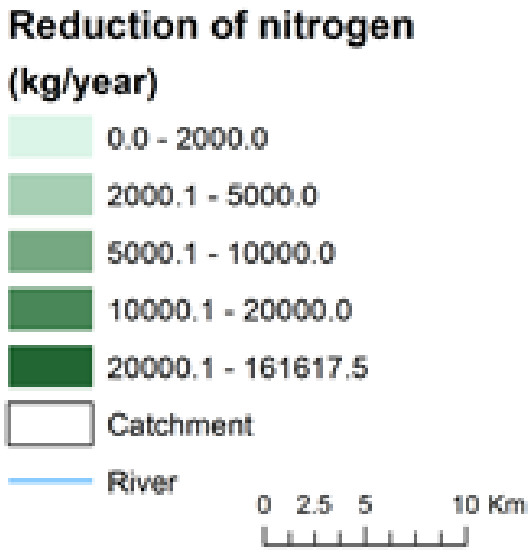
WBZ area: 13% of sub-catchment
47% N reduction
+ potential of 44 km of linear WBZ



WBZ area: 5% of sub-catchment
18% N reduction
+ potential of 135 km of linear WBZ

N reduction in particular WBZs – sum of N reduction processes (groundwater + surface water)





WBZ area: 2% of sub-catchment
14% N reduction
+ potential of 51 km of linearWBZ

Mitigation of the climate change

Protection of undrained fens and rewetting other ones in 5 sub-catchments would allow to avoid emissions of app. 142 000 tonnes of CO2 e.

Assuming that in Narew catchment (excl. Biebrza basin) there is app. 140 000 ha of area where fens might be protected or rewetted, we have almost 3 mln tonnes CO2 e of avoided emissions.

To summarize (1)

- you need 9 mil EUR to established WBZ in 5 sub-catchment,
- to extend wet buffer development for the Narew catchment you need 150 mil EUR,
- if you focus on polygonal WBZ only, the cost will be much lower (app. 1 mil EUR), but you will also have to compensate income forgone at the level of 300 EUR per ha per year

To summarize (2)

- 34% efficiency of N reduction of total load/year, which gives in Narew catchment 217 tonnes per year,
- avoided emissions: app. 3 mil tonnes of CO2 e per year,
- challenges: P reduction + N reduction in linear WBZ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