

ENVIRONMENTAL ASPECTS OF TRANSFORMATION IN LANDSCAPE SURROUNDING PLZEŇ ON THE EXAMPLE OF LUČNÍ POTOK - BROOK CATCHMENT AREA

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Abstract: The paper deals with environmental impacts of the landscape transformation, especially hydric part of landscape. Changes are demonstrated on the example of Luční potok - brook catchment area. We discuss impacts of motorway construction, changes of airport area function and revitalisation of water reservoir.

Key words: Luční potok - brook catchment area, landscape transformation, environmental impacts of socio-economic activities, water quality, revitalisation

1. INTRODUCTION

The Luční potok - brook catchment area is an example of area, which is transformed. The area along the south-west border of the district Plzeň - město (Plzeň - City) is a type of urban hinterland landscape. It was a part of natural resources base (black coal) for industrial development of Plzeň during the last century. Intensive agricultural production developed later. New economic conditions changed this landscape. The role of transport function increases, but the industrial areas and function of recreation and living hinterland of Plzeň are developed too. These changes are brought to landscape character, its structure and environmental quality. We study impacts of transformation on hydric part of landscape in this paper.

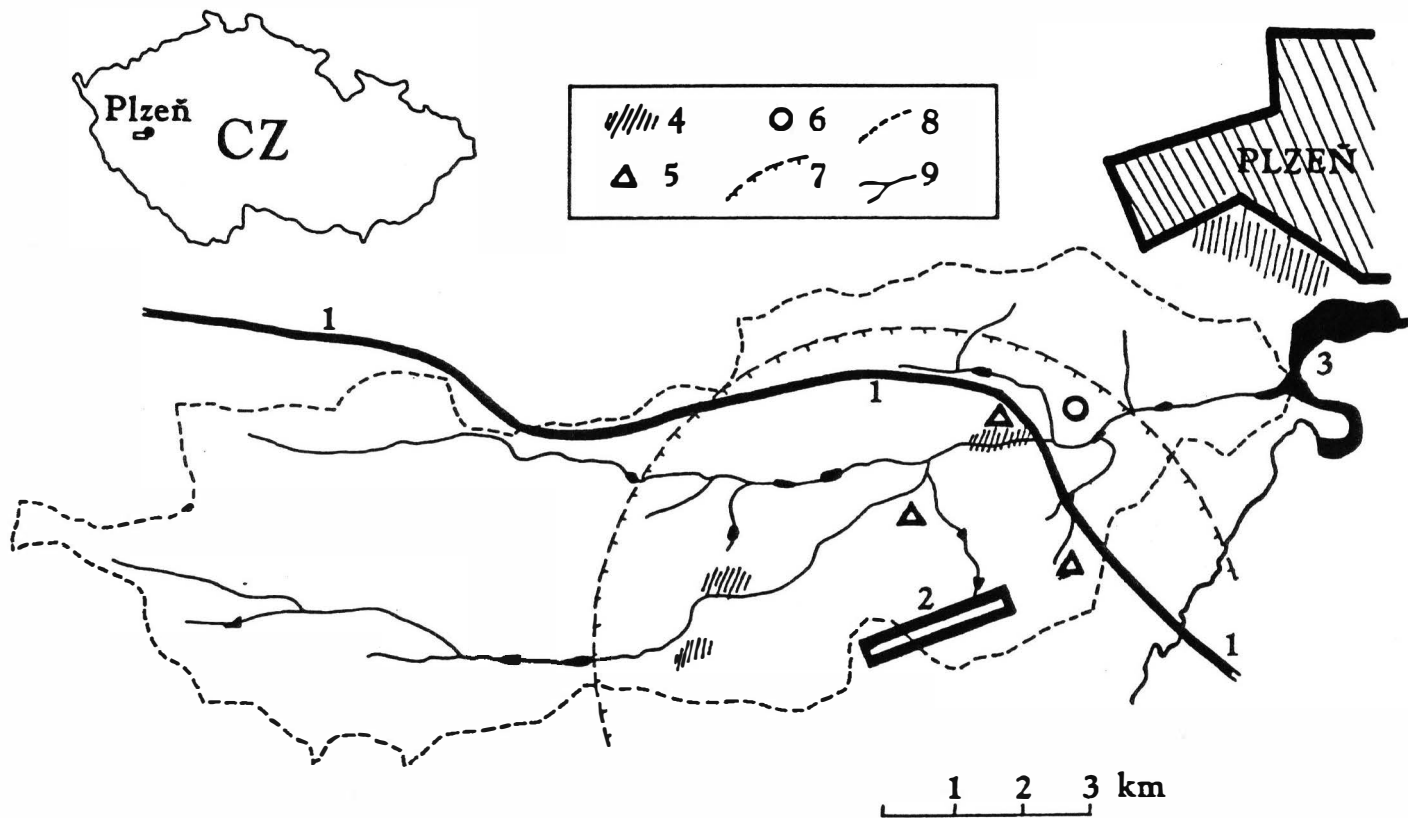


Fig. 1 New socio-economic activities in the Luční potok - brook catchment area

1 - motorway construction, 2 - change airport area, 3 - the water reservoir České údolí, 4 - new industrial zones, 5 - new living areas, 6 - industrial outfall damp, 7 - area of industrial and free-business zones for new airport project, 8 - catchment boundaries, 9 - water courses

2. THE CHARACTERISATION OF THE LUČNÍ POTOK - BROOK CATCHMENT AREA

Luční potok - brook is a small watercourse draining the area 61,8 km². For the catchment area is typical very small height diversity. The average cross profile gradient of watercourse is only 3,35 ‰. The geological structure is Perm-Carbon sediments of the Plzeň basin, partially covered with Miocene sediments. The bad local permeability of subsoil and flat relief creates conditions for rise of water accumulation on the surface in wetlands. The retention was supported by construction of small ponds. Hydro-geological relations with local reserves of underground waters were broken by the underground mining activity. The old mining galleries were flooded and today make drainage system for deeper underground waters.

The lower average annual rainfall (500 mm) and low runoff coefficient (the surface runoff part of rainfall is 13 %) make very low specific runoff in the catchment area ($q = 2,10 \text{ l.s}^{-1}$). The Luční potok - brook runoff is seasonally well-balanced, the average water discharge in estuary is $0,13 \text{ m}^3.\text{s}^{-1}$.

The water regime of the catchment area was broken by intensive arable land area and by partial drain areas. Few forests are above all in the west part of the catchment area. The part with non-forest cover is small. Forest growth (pine woods on sand and oak woods) creates ecologically important landscape segments. Water courses, water reservoirs and wetlands create ecologically important landscape segments in woodless part of the catchment area.

3. IMPACTS OF TRANSFORMATION ON THE LANDSCAPE IN THE CATCHMENT AREA

There are mentioned examples of changes in landscape and their impacts on the Luční potok - brook catchment area in the table 1.

Table 1 Impact of changes in landscape on the Luční potok - brook catchment area

No.	Changes in landscape	Impacts on the catchment area
1	Motorway construction	Water courses pollution, increase of surface runoff, barrier effect
2	Change of airport area function	Affect structure and stable landscape, wetlands liquidation, contamination hazard, increase of surface runoff
3	Revitalisation of the water reservoir České údolí	Improve water quality, change of water reservoir regime
4	Industrial development	Direct and indirect watercourses pollution
5	Seats development	Increase stress of sewage treatments

We aim at the first three problems:

1. The landscape is crossed by the newly built motorway, which connected Prague with the west Europe. The motorway surface changes the surface runoff character. The new thoroughfare area in the Luční potok - brook catchment area measures 0,15 - 0,20 km². Chlorides used for sprinkle of thoroughfares are the most dangerous. 1 kg.m⁻² of chlorides is used for sprinkle in winter. It is approximately 150 - 200 t of chlorides per one season. Over protect measures is difficult to prevent from exceeding limits of pollution in surface watercourses. Oil based contamination is other hazard. The banks are not covered with vegetation, so they are endangered by erosion in the first years after thoroughfares construction. Products of erosion mud small receiving streams. The other impact is barrier effect. We must watch the crossing of motorway and watercourses, which work as local bio-corridors.
2. The area of the former military airport Línč is a place, where can be placed new socio-economic activities. The least favourable variant is construction cargo - airport for the middle Europe with industrial and free- business zones. At present, area is surrounded by forests, which are environmentally important landscape segments. Consequences would bring the change of landscape structure and reduce natural ecologically stable landscape on the level of artificial areas. Socio-economic activities could induce liquidation of wetlands, which have positive impact.
3. Luční potok - brook flows into the Radbuza river on the periphery of Plzeň in the point, where was finished the water reservoir České údolí in 1973. This reservoir was intended for the daily recreation for Pilseners. However, this reservoir does not serve for recreation because water quality does not agree with hygienic requirements (intensive vegetation turbidity produced by planktic algae and cyanophyte, pH 10 - 11). The cause is in bad technical parameters of reservoir and supplied nutrients from the catchment area. Supply of phosphorus is approximately 9 g.m⁻² reservoir in the dry year and 50 g.m⁻² reservoir in the aqueous year. The revitalising project considers reduction in nutrients' flow, rehabilitation of bottom sediments and above all change in reservoir's order. The water reservoir will be divided by gate dam to the inflow part and the part designed for recreation. The part for recreation will be lateral reservoir with area 0, 8 km². Passing water will go through the artificial channel in the left of reservoir straight to the main dam.

4. DISCUSSION

Mentioned changes in landscape present negative and positive impacts on water quality and ecological function of surface waters in landscape. The agricultural production has negative influence on water quality in the Luční potok - brook. According to the natural characters the Luční potok - brook is sensitive on the anthropogenic impacts. Water quality is signed in the table 2.

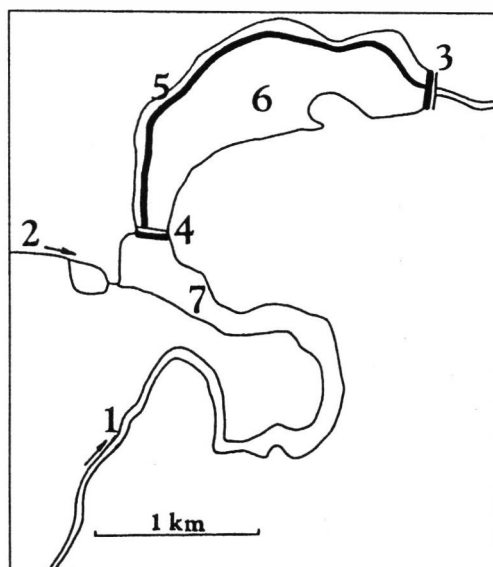


Fig. 2 The revitalizing project of the water reservoir České údolí
 1 - the Radbuza river, 2 - the Luční potok - brook, 3 - main dam,
 4 - interior dam project, 5 - interior channel project, 6 - recreation
 part of reservoir, 7 - inflow part of reservoir

Table 2 Selected average parameters of water quality in years 1997 - 1998

Parameter	biological oxygen demand	chemical oxygen demand - manganese	suspended solids	ammonia nitrogen
Average (mg/l)	3,6	6,8	11	0,93
Class of cleanness	3 th	3 th	2 th	4 th
Parameter	nitrate nitrogen	total phosphorus	iron	manganese
Average (mg/l)	4,3	0,25	1,48	0,66
Class of cleanness	3 th	2 th	4 th	5 th

(Data: Povodí Vltavy, laboratory Plzeň)

The content of organic matters is increasing mildly, self - purification is intensive. Water areas and wetlands in the catchment area have a positive impact. Presence of phosphorus and nitrogen is increasing with mildly positive development tendency. Incidence of iron and manganese is very high. We suppose the impact of industrial outfall damp Sulkov and former mining activity.

Today the landscape transformation has important impact on the development of water quality and of the water biocenoses. The project of revitalisation can support positive trend in landscape.

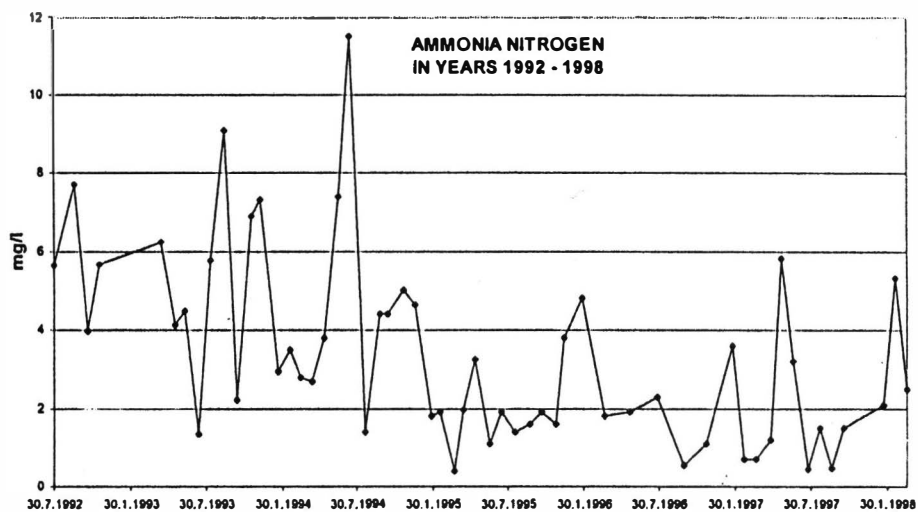
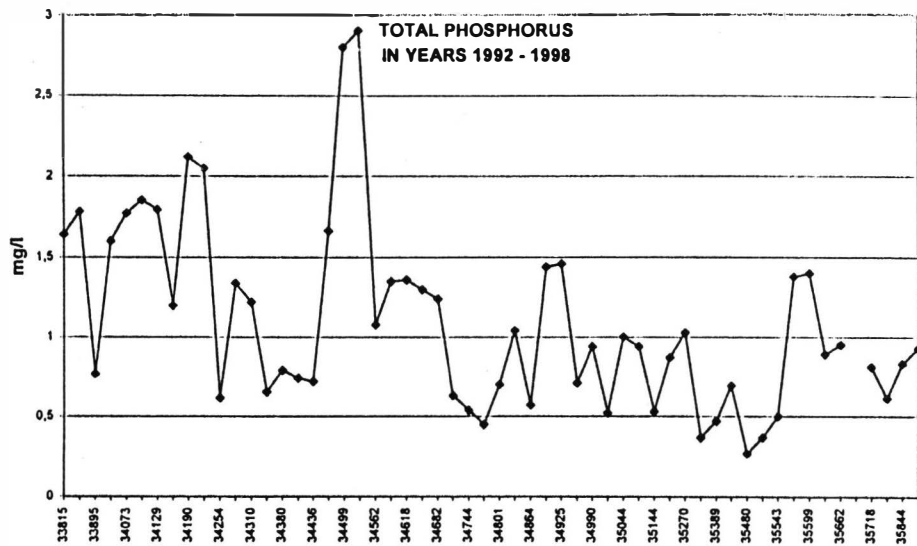


Fig. 3, 4 The Luční potok - brook water quality. Phosphorus and nitrogen - mildly positive trend in development ? (Státní meliorační správa)

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Resume

Environmentální aspekty transformace příměstské krajiny Plzeňska na příkladu povodí Lučního potoka

Na příkladu povodí Lučního potoka jsou ukázány vlivy nových socioekonomických aktivit v příměstské krajině Plzně. Uvedené příklady jsou poměrně typické pro krajiny v zázemí měst střední a východní Evropy. V příspěvku se zabýváme dopady změn na vodní složku krajiny.

Povodí Lučního potoka je charakteristické nízkým specifickým odtokem a malou vertikální členitostí. Vodní režim krajiny je z minulosti pozměněn intenzivním zemědělským využitím a podpovrchovou důlní činností. Kvalita vody je negativně ovlivněna komunálními a průmyslovými odpadními vodami a zemědělstvím. Z časových řad lze usuzovat na možné zlepšení některých parametrů kvality vody v posledních letech.

Nejvýznamnějšími změnami v povodí Lučního potoka jsou výstavba dálnice a změna využití areálu bývalého vojenského letiště. V souvislosti s těmito aktivitami diskutujeme možné zhoršení kvality vody. Nepříznivě zde působí malá vodnost recipientů. Neméně závažné je narušení biocenóz vodních toků, vodních ploch a mokřadů. Tyto prvky krajiny tvoří v zemědělsky využívaném povodí kostru ekologické stability.

Pozitivním příkladem je navrhovaná revitalizace vodní nádrže České údolí, která slouží k rekreaci. Zlepšení nevyhovující kvality vody má být dosaženo omezením přítoku živinových látek, asanačí dnových sedimentů a především zásahem do technického uspořádání nádrže.