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ENVIRONMENTAL ASPECTS OF WETLANDS EVALUATION (MODEL AREA OF THE PARÍŽ WATER STREAM)

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Abstract

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Wetlands belong to the most important natural ecosystems providing many specific functions (landscape-ecological, environmental, socio-economic, educational etc.). Many research projects deal with evaluation of these ecosystems because of their enormous sensitivity. Institute of Landscape ecology of SAS solves the APVT-51-037202 project – Integrated landscape management aimed at creation of the methodology of integrated landscape management as well as its application on supraregional, regional and local level. Integrated landscape management is a complex approach to landscape evaluation, which is composed of evaluation of natural abiotic and biotic resources, cultural-historical resources, human potential, economic, socio-economic and social conditions etc. The paper deals with evaluation of socio-economic conditions on regional level, namely the assessment of environmental problems on study area of the Paríž water stream. The problems are divided into following groups:

- Problems connected with reduction of ecological stability of the territory (negative impact of human activities on important elements of landscape structure).
- Problems connected with degradation of natural resources (negative impact of human activities on natural resources).
- Problems connected with worsening of life quality (negative influence of human activities on human health and environment).

Key words: wetlands, ecosystems, environmental problems, natural resources, human activities

Introduction

Many human activities connected, for example, with drainage, construction of large water works, regulation of water streams, peat exploitation, constructions of dikes and dams etc. have considerably reduced occurrence of wetlands in the present landscape. Therefore preservation of the remaining wetlands is very important and urgent. To the intent The Slovak Republic has acceded to The Ramsar Convention that declares protection of wetland ecosystems on the international level.

Protection of wetlands as well as sustainable use of their wider surrounding is important for preservation of wetland ecosystems and their rational use. The basic step for elaboration of proposal of sustainable mode of use of such localities and proposal of their management (which would provide protection of wetlands, as well as of nature, natural resources and desirable quality of environment of surrounding area) is evaluation of environmental problems and proposals for their elimination.

In this paper, we focus on definition of environmental problems of the catchments area of the Paríž water stream. This area has a surface of about 240 km^2 and wetland ecosystems included among Ramsar localities also occur there. The study area includes these territories of the villages Kolta, Jásová, Dubník, Rúbaň, Strekov, Gbelce, Nová Vieska, Šarkan, Ľubá, Svodín, Kamenný Most and Kamenín, which belong – according to the territorial-administrative differentiation of the Slovak Republic – to the district of Nové Zámky.

Material and methods

Evaluation of environmental problems is based on the LANDEP methodical steps (Ružička, Miklós, 1982) and is completed by evaluation of positive and stress factors mentioned in the methods of creation of Territorial systems of ecological stability (Izakovičová et al., 2000) and in the methods of creation of Landscape-ecological plans (Izakovičová et al., 2001).

Evaluation of environmental problems (Tóth, Golobics, 1998; Moyzeová, Izakovičová, 1988; Izakovičová, Moyzeová, 1999; Izakovičová, Moyzeová, 2000; Moyzeová, Izakovičová, Petrovič, 2003) lies in their specifying in the target territory and, at the same time, in their spatial representation. The environmental problems arise from spatial conflicts of positive elements and stress factors. Positive elements in the territory are represented by the most valuable elements of the present landscape structure including first of all the socio-economic elements connected with nature protection, with protection of natural and cultural-historical resources, as well as with protection of the immediate environment of human population in the settlements and recreation areas. The stress factors in the territory in question are represented by requirements, demands and pressures of human activities being manifested in the landscape by their barrier effect (in relation to migration of biota, localization of other socio-economic activities etc.), as well as by their attendant effects like air pollution, contamination of soil or water, damaging of vegetation.

Environmental problems are classified into the following groups:

- Problems of endangering of ecological stability and biodiversity of significant elements of landscape structure, which had been caused by the *spatial conflicts of stress factors with area of a high degree of ecological stability*, i.e. of areas under present or proposed legislative protection like elements of territorial nature protection, elements of territorial system of ecological stability, gene-pool localities and localities of significant habitats. The result of this conflict is a blanket decrease of ecologically stabilizing elements in the landscapes, as well as an endangering of their ecologically stabilizing functions.
- Problems of endangering of qualitative and quantitative parameters of natural resources resulting in *spatial conflict of stress factors with significant natural resources* like special purpose forests, water protection zones of II. degree and the best quality soils. Result of the negative influence is a decrease of these sources and increased level of xenobiotics in these resources.
- Problems of endangering of the overall life quality of humans resulting from *impact of stress factors directly on the man and his environment*. This negative influence is reflected not only in the generally decreased environment quality, but also in the worsened health of population, increase in incidence of civilization illnesses etc.

Evaluation and results

The whole river basin can be characterized as very important from the view of protection of nature and natural resources. We focused on analysis of these elements from the viewpoint of evaluation of the positive elements:

- *Legislatively defined territories of nature protection*

From the viewpoint of the territorial nature protection, the unique locality The National nature reserve (NNR) Parížske močiare is situated in this territory classified according to Ramsar Convention among the internationally significant wetlands. There are five proclaimed protected areas: National nature reserve (NNR) Kamenínske slanisko (halophilic community), Nature reserves (NR) Drieňová hora and Čistiny, Protected areas (PA) Alúvium Paríža (Floodplain of Paríž) and Park v Rúbani (Park in Rúbaň). All the proclaimed protected areas are simultaneously gene-pool localities with occurrence of many rare, endangered and protected plant or animal species. Out of this, there are next 5 localities being proposed to be proclaimed as protected areas: Parížsky potok, water reservoir and wetlands near Svodín, Korytnisko Kamenný Most, Les pri Ľubej and Vŕšok II Kamenný Most, as well as further 13 localities of significant habitats, mostly wetlands, forest stands, riverbank stands and water basins.

- *Elements of territorial system of ecological stability*

According to the proposal of Regional territorial system of ecological stability of the Nové Zámky district (1994), there are one supraregional biocentre – Gbelce and 4 regional biocentres – Kamenný Most, Nová Vieska, Paríž and Kamenín, as well as 2 supraregional biocorridors – the Hron and Paríž rivers.

From viewpoint of presence of other categories of protection of natural resources, the following resources are represented in the catchment area:

- *Special purpose forests*

In the cadastre of the villages of Dubník, Rúbaň, Strekov, Ľubá, Kamenín, Kamenný Most and Svodín, there are special purpose forests situated on a surface of 8389 ha and which play there a significant water management and anti-erosion role. Game preserves of fallow deer and wild boar with special management are situated in two localities within the special purpose forests.

- *Zones of hygienic protection of water resources*

From the viewpoint of water resources protection, there are zones of water protection of II. degree in the cadastre of the villages of Jásová, Nová Vieska, Strekov, Ľubá and Svodín. Altogether 16 water resources situated in these zones (8 among them are out of use) are under management of the waterworks company called Vodárenská spoločnosť a. s. OZ Nové Zámky. Their capacity ranges from 1.5 l/s to 20.0 l/s. However, most of the villages

take drinking water from the long-distance water main Gabčíkovo – the branch Nové Zámky – Kolta – Štúrovo through the local public water main (water main in the villages of Rúbaň and Kamenín is under construction).

- *Water streams of water management importance*

In the study area, there are 3 water streams classified, according to Decree of Ministry of Agriculture of the Slovak Republic No. 525/2002 from 12. 8. 2002, among the water streams of water management importance: Hron river with the rank number 308 and hydrological rank number 4-23-01-001, Perec and Waterway I. and II. with the rank number 353, with the hydrological rank number 4-23-05-051 and the Paríž water stream with the rank number 354 and with the hydrological rank number 4-23-05-061.

- *Protected deposits area*

Occurrence of geological resources in the study area is not significant. There occurs only one locality of protected deposit area identical with the exploitation area of brick clays near Gbelce. Surface area of this exploitation is about 12 ha, but active exploitation does not run there at present.

- *Protected evaluated soil-ecological units*

Category of soil protection in the study area is represented by the highest quality soils, and the whole area belongs to the agriculturally intensively used parts of Slovakia. Because of these agriculture used areas the high quality soils are, however, uneven located here. The highest concentration of these highly productive soils is in the cadasters of the villages Svodín, Strekov, Kamenín and Dubník, where these soils are used intensively first of all for a plant production.

- *Archaeological and architectonical monuments*

The area in question has a rich cultural and historical past illustrated by many archaeological localities with abundant findings of bronze objects from the Early Bronze Age, for example from the villages Kamenín and Kamenný Most, as well as many architectonical monuments, first of secular character. When analysing the negative phenomena we focused on evaluation of the primary and secondary stress factors. The primary stress factors are considered to be the primary causes of stress and they are manifested by an overall impact on natural ecosystems. They include all material semi-natural and anthropogeneous elements, which are represented in the study area as follows: *industrial areas and buildings* and their deposit facilities of local significance being situated in Gbelce, Jásová, Nová Vieska, Dubník, Šarkan, Kolta and Svodín; *farming areas and buildings* – focused to plant and animal production, among which those that are focused to animal production have a particular significance due to the produced negative influence, they are situated in Kolta, Dubník, Gbelce, Strekov, Rúbaň, Svodín, N. Vieska, Šarkan and Kamenný Most; *transport elements*, i.e. elements of road and railway transport; *waste dumps*, i.e. managed dump of

solid communal refuses in the cadastre of Kolta village and non managed dumps being out of use at present, in different stage of reclamation and dispersed on the all over the evaluated area; *settlement areas* – the individual housing constructions are typical of the study area; *lines of different products* – high tension transmission lines of 110 kV, pipelines (inclusively of water tanks and pumping stations) and gas lines of high and medium pressure; *degraded constructions and areas out of use* in different level of devastation – at present they are represented mainly by areas of the former cooperative or state farms.

In vicinity of technical elements, which represent primary stress factors, the protective zones are usually established in order to protect the surroundings against their unfavourable influences. In the study area, there were established protective zones of industrial and agricultural areas, as well as protective zones of the line technical elements (i.e. railways, roads, electrical transmission lines, gas lines and water mains).

The following secondary stress factors, as negative attendant effects of realization of human activities in landscape, were considered during the process of definition of environmental problems:

- *Air pollution*

According to the District Office of Nové Zámky, 4 large sources of air pollution (2 in Dubník, 1 in Jásová and Svodín) exist in the study area. They are connected with animal production and load an environment by ammonium. Beside it, there are almost 20 medium size sources (7 in Svodín, 4 in Gbelce and Dubník, 2 in Jásová, 1 in Ľubá and Kolta) represented by gas plant and kiln stations or livestock production plants. Out of the stationary pollution sources mentioned above, the wind erosion, transport and long-distance transfer of pollutants also contribute to the air pollution. In the study area, there are not defined areas requiring a special protection in this direction (§ 9 of the Act No. 478/2002 Coll.). According to the Landscape atlas of the Slovak Republic (2002), the average annual concentration of NO_2 is 10–15 $\mu g.m^{-3}$ and that of SO_2 is 5–10 $\mu g.m^{-3}$. It means a low or moderate load in comparison with other parts of the Slovak Republic. Deposing of nitrogen ranges from 700 to 800 $mg.N.m^{-2}$ (middle load) and that of sulphur from 1500 to 2000 $mg.S.m^{-2}$ (moderate load).

- *Noise load of environment*

According to the Directive of the Government of the Slovak Republic No. 40/2002 Coll. on protection of health against noise and vibrations, the determining variable of noise in outdoor space is the equivalent noise level of the A sound (L_{Aeq}). The highest acceptable equivalent noise level is set for noise produced by traffic and other sources, separately to the day and night time, and its value also depends on category of the area respecting the mode of its utilizing. The largest source of noise in the study area is *traffic*. According to the road traffic intensity, the most frequented road communications in the study area are the I. and II. class roads. The study area is also crossed by two railways. From the viewpoint of exposition of population, the I. class roads cross the settlement parts of the villages Kolta,

Kamenín and Kamenný Most. Railways are situated close to the settlement zones on the villages Strekov, Nová Vieska, Gbelce, Kamenný Most and Kamenín.

- *Soil contamination*

Assessment of loading of soils by heavy metals is based on Geochemical atlas of SR, part V: Soils (Čurlík, Šefčík, 1999) and Landscape atlas of the Slovak Republic (2002), in which the soils´ sampling is based on the principle of taking soil samples by horizons and on principle of covering the territory of SR by a grid of 10 km^2. In the study area, levels of the following metals were evaluated: arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg) and plumb (Pb). Basing on processing of layers of spatial differentiation of individual elements it can be stated that relatively clean soils occur in the study area.

- *Water pollution*

Assessment of surface water quality in Slovakia is based on water classification according to Slovak Technical Norm STN 75 7221, which classifies waters into 5 classes (from I. class – very clean water up to V. class – very strongly polluted water). The considered parameters of pollution of surface waters are classified into 8 groups (oxygen regime, basic physical-chemical parameters, nutrients, biological parameters, microbiological parameters, micropollutants, toxicity, radioactivity). In the study area, the quality of the Hron river is monitored.

Basing of the results of measurements of water quality, we classify this river into the III. class of pollution, as we recorded this pollution degree almost in all groups of parameters. Water quality in other streams has not been measured in the last years, but we expect them to be polluted. Villages in the study area have not constructed canalisation and there are direct outlets of wastewaters into the waters streams. Evaluation of spatial differentiation of pollution of groundwaters is difficult, because there are no overall and regular measurements. Besides, the groundwaters are endangered by many uncontrollable pollution sources, like infiltration from refuse deposits, field manure deposits, watertight cesspools, negative influences of chemicals used in agriculture etc. According to Landscape Atlas of the Slovak Republic (2002), we can classify the catchments of Paríž from viewpoint of groundwater pollution into four categories. The very high pollution is characteristic for surroundings of the villages of Gbelce and Svodín and also for the border parts of surroundings of the villages Dubník and Jásová. A high pollution was recorded in the central and eastern part of the surroundings of villages Svodín, Gbelce, in the area of the villages Šarkan, Ľubá, Nová Vieska and in the eastern part of Strekov. The greatest polluters of surface and groundwaters are agricultural farms (for example in Svodín, Kolta, Dubník, Strekov, Nová Vieska, Šarkan, Divá) and industrial enterprises (machinery enterprise TOS Jásová, viticulture plant in Gbelce etc.).

- *Vegetation damaging*

Degree of vegetation damaging reflects negative influence of *natural factors* – abiotic (wind, snow, hoarfrost, drought etc.) and biotic (subcorticolous insects, woodborers, wooddestroying fungi, tracheomycoses, field game etc.), as well as *anthropogeneous factors* – influence of

polluted air, influence of acid rains etc. Evaluation of damaging of vegetation in the study area is difficult, as there has not been carried out any field research of such character. Forest coverage of the area in question is relatively low, but state of health forests is not in danger according to the Landscape atlas of the Slovak Republic (2002). Damaging of forest vegetation of less extent occurs in the wood growth (forest stands) Rúbanský háj grove – Suchá hora forests.

It is necessary to mention occurrence of sediments among the natural stress factors, which is characteristic for the whole catchment of Paríž. Wind erosion appears first of all in the plain places and in the areas with disturbed ecological balance. In the study area, the surroundings of Dubník are especially endangered by wind erosion. Water erosion depends, for example, on length of slope, vegetation cover and soil sort. It occurs especially in the hilly areas with slope declination above 7°, but it also occurs on plots with slope of 3-7°. In the study area, the water erosion endangers most the soils in surroundings of the villages Ľubá, Dubník, Svodín and Kolta. From the viewpoint of natural radioactivity, the area can be divided into two categories: a low radon risk (average concentration of equivalent uranium about 2.0 ppm U in reference points) is characteristic of the south–western and the eastern sides of Hron river, whereas area with the medium risk (3.1–3.7 ppm) occurs in northwest of the area (surroundings of the Kolta village) and spreads towards south through the territory of the villages Svodín, Šarkan, Ľubá and Gbelce.

According to spatial conflicts of stress factors and positive phenomena the following environmental problems have been defined in the catchment of the Paríž stream:

1. Problems of endangering of ecological stability

- Endangering of protected areas, like Aluvium Paríža, Kameníske slanisko, Čistiny and the proposed protected area Korytnisko, by intensive agricultural production.
- Intensive agricultural production in the catchment area also endangers significant habitats in surroundings of Ág, the forest at Dolný majer, wetlands along the lower stream of Parížsky potok, river bank stands along the Hron river etc.
- Elements of territorial system of ecological stability, first of all biocorridors crossing the arable land – biocorridor near Kolta and supraregional biocorridors Paríž and Hron are negatively influenced by mechanization and chemicalization of agricultural production.
- Endangering of elements of territorial system of ecological stability by the barrier effect of built up areas and transport corridors, e.g. railway line Štúrovo–Nové Zámky and Štúrovo–Levice and road communications of I. and II. class ((I/76, I/75 a II/588, II/509, II/589).
- Endangering protected areas and elements of territorial system of ecological stability and significant habitats by illegal waste dumps in Kolta, Svodín and Dubník.
- Potential endangering of significant habitats – forests in Gbelce – by activities connected with delimiting of exploitation area in their immediate vicinity.
- Collision between damaged vegetation and fulfilling of its functions as element of erritorial system of ecological stability – proposed biocentre in vicinity of Rúbanský háj grove and Suchá hora mountain.

- Collision between reduced quality of water streams and their function as biocorridors (endangering of fish and aquatic animals in the Hron river – III. degree of pollution).
- Endangering of significant habitats by pasturing of young cattle, first of all sheep, in the localities Kolta and Kamenín.

2. Problems of endangering of natural resources

- Qualitative indicators of waters in water stream significant from the water management viewpoint, like rivers Hron, Paríž and Perec, are endangered by intensive agricultural production, in which industrial fertilizers are used, in the past even with content of heavy metals. In the study area, the potential sources of such pollution are the agricultural cooperatives in Kolta, Ľubá, Dubník and Svodín.
- Collision of the III. degree pollution of the Hron river with its water management function as a river of water management significance.
- Water quality in the Paríž water stream is negatively influenced by wastewaters from Jásová. There are wastewater outlets mouthing directly into the recipient.
- Water from the water sources in Strekov exceeds hygienic limits of levels of iron and manganese defined by the Ordinance of Ministry of Health of SR No. 29/2002 Coll. Also water from water sources of Svodín and Nová Vieska is endangered by chemicalization of intensive agricultural production.
- Water quality is also endangered by waste dumps. Although the refuse dump in surroundings of the Kolta village satisfies, by its parameters, the directives for deposing of refuses, there exists danger from refuses deposed in s.c. illegal dumps, which are dispersed the whole area over. For example the dump in vicinity of the water source Strekov and the dump in vicinity of the Paríž water stream in surrounding of Dubník.
- Endangering of water sources by animal husbandry, for instance in surrounding of Dubník.
- Further sources of endangering of qualitative properties of soil and water resources are industrial plants in Gbelce and smaller plants of local significance in Svodín, Jásová, Kolta, Dubník, Nová Vieska and in Šarkan.
- The best quality soils in surroundings of the villages Jásová, Dubník, Rúbaň, Strekov, in the lower part of Nová Vieska, in Gbelce, Kamenný Most, Kamenín and Svodín are disposed for dropping loesses.
- Endangering of the best quality soils in consequence of traffic emissions along the most frequented traffic corridors of the I. and II. class roads (I/76, I/75 a II/588, II/509, II/589).
- Endangering of the best quality soils in consequence of water erosion. The most endangered soils are in the surroundings of villages Kolta – northeaster part, Svodín, Strekov and Rúbaň in area of village borders.
- Potential endangering of forest resources in consequences of exploitation in the locality Gbelce.
- Endangering of the special purpose forests Rúbanský háj and Suchá hora by a 30–40% defoliation.

3. Problems of endangering of life quality

- Loading of settlement environment by influence of secondary stress factors. In Gbelce, there is situated a large stationary industrial source producing emission in the framework of the whole study area.
- Endangering of population by excessive noise from road traffic, first of all in the interior of the villages Kolta, Kamenný Most, Kamenín by I. class roads, but also in Jásová, Nová Vieska, Gbelce and Svodín by II. class roads. Noise produces by railway traffic endangers population of the villages Kamenný Most, Kamenín, Gbelce and Nová Vieska.
- Collision of settlement areas with protection zone of agricultural facilities exists in Rúbaň, Strekov, Nová Vieska, Gbelce, Jásová and Dubník.
- Disturbance of aesthetical perception by negative influence of technical elements (electrical line supports) in the villages of Nová Vieska and Gbelce.
- The medium radon risk exists in the villages of Svodín, Kolta and Gbelce.

Conclusion

Environmental problems are a result of incorrect use of landscape by the human community. Nature protection, protection of natural resources and environment can be assured not only elimination of arise and influencing of stress factors, but first of all by change in use of the landscape toward the ecologically optimal and functional use of the territory. Specification of environmental problems in the catchment of the water stream Paríž will contribute to development of multicriterial model for socio-economic evaluation of wetlands and to proposal of management oriented to the sustainable use of this territory.

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Moyzeová M., Grotkovská L.: **Environmentálne aspekty hodnotenia mokradí (modelové územie – povodie potoka Paríž).**

Mokrade patria k najvýznamnejším prírodným ekosystémom, keďže v krajine plnia mnohé funkcie (krajinnoekologické, environmentálne, socio-ekonomické, edukačné a pod.). Hodnotením týchto veľmi zraniteľných ekosystémov sa zaoberajú mnohé výskumné projekty. Ústav krajinnej ekológie SAV rieši projekt APVT-51-037202 – Integrovaný manažment krajiny zameraný na tvorbu metodiky integrovaného manažmentu krajiny a jej aplikácie na nadregionálnej, regionálnej a lokálnej úrovni. Integrovaný manažment krajiny predstavuje komplexný prístup k hodnoteniu krajiny, ktorý pozostáva z hodnotenia prírodných abiotických a biotických zdrojov, kultúrno-historických zdrojov, z hodnotenia ľudského potenciálu, ekonomických a socio-ekonomických a sociálnych podmienok územia a pod. Príspevok je zameraný na hodnotenie socio-ekonomických podmienok územia, konkrétne na hodnotenie environmentálnych problémov, a to na regionálnej úrovni – na území povodia rieky Paríž.

Problémy sú rozdelené do týchto skupín:

- problémy ohrozenia ekologickej stability a biodiverzity významných prvkov krajinnej štruktúry
- problémy ohrozenia kvalitatívnych a kvantitatívnych parametrov prírodných zdrojov
- problémy ohrozenia celkovej kvality života človeka.