

STRATEGY OF THE SUSTAINABLE DEVELOPMENT OF THE PARNÁ RIVER CATCHMENTS

ZITA IZAKOVIČOVÁ, MILENA MOYZEOVÁ

Institute of Landscape Ecology of the Slovak Academy of Sciences, Štefánikova 3, P.O. BOX 254, 814 99 Bratislava, The Slovak Republic, e-mail: Zita.Izakovicova@savba.sk, Milena.Moyzeova@savba.sk

Abstract

Izakovičová Z., Moyzeová M.: Strategy of the sustainable development of the Parná river catchments. *Ekológia (Bratislava)*, Vol. 25, Supplement 1/2006, p. 85–95.

The aim of this paper proposal of sustainable development strategy for the Parná rivulet catchments. This proposals consists of the following steps:

- evaluation of the current conditions of development of territory from aspect of the principles and criteria of the sustainable development
- specification of the weak and strong points of this territory
- proposal of the measures for elimination of the environmental and socio-economic problems of this territory
- proposal of the environmental management of the territory – harmonisation of the development of socio-economic activities with potential of this territory.

Key words: strategy of the sustainable development, weak points, strong points, environmental management, environmental and socio-economic problems

Introduction

Ecologization of economic activities in landscape is one of the principal precondition of implementation of sustainable development. In the practice, the ecologization of economy lies in introducing of environmental principles into all spheres of social development. Ecologically optimal use of a territory and support of activities oriented to increase of ecologic consciousness of population is a concrete example of implementation of the sustainable development idea in practice in accordance with integrated approach to use of nature and natural resources anchored in the Chapter 10 of Agenda 21.

Evaluation of the territory had an integrated character and its focus was oriented on identification and specification of environmental and socio-economic problems in the catchment evaluated and on proposal of measures for their elimination. Another aim of the project was implementation of ecologization of economic activities in the landscape by

engaging of large layers of landowners and land users into activities connected with the problems of sustainable development.

Theoretical and methodical starting points

The methodical procedure of elaboration was based on the basic methodical steps of LANDEP methods (Ružička, Miklós, 1982) and on methodical procedures modified for needs of evaluation of regions from the aspect of sustainable development, which have been published in the Regional Agenda 21 (2001). The methodical procedure used is presented in the Table 1.

Table 1. Methodical procedure

Analyses	Basic analyses and spatial differentiation of abiotic, biotic and socio-economic conditions creating basic potential for development of the territory evaluated
Syntheses Interpretations	Hierarchizing of the territory according to degree of landscape ecological significance and degree of loading of the territory by stress factors. This step results in defining of landscape-ecological dominants of the territory, as well as defining of areas with unfavourable life quality
Evaluation	Specification of environmental and socio-economic problems resulting from conflicts of interests (from conflicts of endangered phenomena represented by protected areas, elements of territorial system of ecological stability, natural resources etc. and endangering factors represented by the stress factors of the given territory), defining of problems resulting from unsuitable use of the given territory. This part also includes defining of weak and strong sides of the region development
Proposals	Measures for elimination of environmental and socio-economic problems in the territory, proposals of measures for moderation of influence of weak and strengthening of the strong sides of the territory development, as well as the overall proposal of strategy for the territory development in the sense of principles and criteria of sustainable development

Basic characteristic of the model territory

The model territory belongs, from the administrative viewpoint, to the district of Trnava. The defined area includes eleven settlements - Borová, Biely Kostol, Dlhá, Dolné Orešany, Horné Orešany, Hrnčiarovce nad Parnou, Košolná, Ružindol, Suchá nad Parnou, Zeleneč and Zvončín, inclusively of the adjacent part of the territory of the Trnava town with the Modranka town district. The total area of the territory is 16 837.96 ha, among which 75.1% are represented by arable land, 13.1% are covered by forest, 11.3% are represented by village interior and 0.5% are represented by water areas.

From the geomorphologic viewpoint, the area consists of two geomorphological units. The central and southern part belongs to the Trnavská pahorkatina hilly country belonging to the geomorphological subregion Podunajská pahorkatina hilly country, and subsequently to the, Podunajská nížina lowland. North-western part is created by the Little Carpathians. The altitude ranges from 145 m a.s.l. to 535 m a.s.l. According to typological differentia-

tion, the north-western part of the territory has character of a proluvial-eolitic undulating hilly country, whereas the south-eastern part has character of a proluvial-eolitic undulating lowland. Surface of the central and southern part of the target territory is predominantly flat; slopes up to 1° predominate, toward the Little Carpathians the slope declination increases. Slopes of 3–7° predominate there, whereas at the foot of the Little Carpathians the declinations exceed 12°.

Geological structure of the territory is a significant factor influencing pedogenesis in the target territory. Neogene is represented by Miocene gravels and limestone, on which cambizemes and rendzinas have predominantly developed in the territory northern part. Loesses and loess loams of the pleistocene age, on which brown soils and chernozem have predominantly developed, cover major part of the territory. Holocene is represented by alluvial sediments along the Parná river, on which first of all chernicas, a part of chernozems and fluvizems have developed (Izakovičová et al., 2001).

The main water stream of the target territory is the Parná river flowing from northwest to southeast; it flows into the Trnávka river under the village Zeleneč. Several water reservoirs are situated on the river – Horné Orešany, Trnavské rybníky and Suchá nad Parnou. Several small tributaries flow into the Parná river, the most significant of them are the brooks Podhájsky potok, Bohatá and Orešianka.

According to the phytogeographical differentiation of the territory of Slovakia (Futák, 1966), the target territory belongs to two phytogeographical areas. The north-western part belongs to the area of west-carpathian flora, the subdistrict of prae-carpathian flora, the district Little Carpathians. The territory remaining parts belong to the Pannonian flora (Pannonicum), district of Eupannonian xerothermophilous flora, and phytogeographical district of the Podunajská nížina lowland. In the species composition the thermophiles plant species predominate.

The present vegetation of the target territory has been considerably changed. Arable land and urban geoecosystems predominate there. Stands with natural composition occur, out of the Little Carpathians, only sporadically and often form only relics, mostly of changed forest communities being limited only on several small surfaces like the protected areas Trnavské rybníky fishponds, Suchovský háj forest, remnants of a floodplain forest in the Farský mlyn locality, riverbank stands etc. In the existing vegetation of the central and southern part of the target territory the man-made formations predominate, hence the communities arisen and maintained in artificially created habitats - fields, gardens, vineyards, orchards, in immediate surroundings of settlements, roads, railways etc. Their species composition corresponds to the local ecotop conditions.

A characteristic feature of the target area is existence of fully artificial habitats, first of all poplar lignicultures and locust tree stands. Lignicultures of cultivated euroamerican poplars (*Populus x canadensis*) were planted on the place of the original floodplain forests, in alleys along roads, farms, football grounds etc. Frequent vegetation formations in the target territory are the locust tree stands. The introduced tree species, locust tree (*Robinia pseudoaccacia*), had penetrated in the past into many woods or line tree formations. Line stands with locust tree occur, with exception of riverbanks, along roads, hedges etc. Along

the roads in the target territory, alleys of fruits trees with predominance of cherry and walnut trees are typical (Izakovičová et al., 2001).

From the biotic viewpoint, the forests of the Little Carpathians are the most valuable area, in which the beech forests (*alliance Fagion*) predominate. The predominant trees are beech (*Fagus sylvatica*), maple (*Acer pseudoplatanus*), elm (*Ulmus glabra*), hornbeam (*Carpinus betulus*) and oak (*Quercus robur*). The area of Little Carpathians is the most valuable geosystem of the target territory – it is a part of the protected landscape area Little Carpathians. Besides the protected landscape area Little Carpathians, two nature reserves and two protected areas have been proclaimed in the target territory. The protected area Trnavské rybníky fishponds represents significant aquatic and wetland habitats in the agricultural landscape. Other small-surface protected territories form a part of the Protected Landscape Area Little Carpathians.

Good quality soils predominate in the target area. Together with the favourable climatic conditions (moderate dry to dry warm climatic area) they create a high potential for development of agricultural production. A source loading the target territory by industrial enterprises is the town of Trnava. Smaller industrial plants like joinery enterprises, service stations, metallic enterprises, manufacturing of products from plastic materials etc. are concentrated in all settlements. Silvicultural activities are concentrated in the northern part of the territory, first of all in the villages Horné and Dolné Orešany. The forest stands show a high gene-pool and zoological value. Most of the forest stands of the target territory lay within the Protected Landscape Area Little Carpathians and require a special management regimen.

The target territory predominantly consists of rural settlements localised along the Parná river or along traffic corridors. In the settlement structure, as to the population size, the medium size (Biely Kostol, Dolné Orešany and Ružindol) to large rural settlements (Horné Orešany, Hrnčiarovce nad Parnou, Suchá nad Parnou and Zeleneč) predominate. Low population increments are characteristic of these settlements and result from low natural reproduction. The low natural reproduction also negatively influences the population age structure. Proportion of the older age group increases and, subsequently, the settlements are becoming older. The settlements with regressive type of population are represented by the villages Biely Kostol, Dolné Orešany, Hrnčiarovce nad Parnou and Ružindol. From the viewpoint of functional typification, the villages have a rural agricultural character and have a housing and partially also recreation function. In the housing structure, the family houses predominate. The largest proportion of family houses in the housing structure is in the Zeleneč village (94.95%).

Equipment of the villages by service is little satisfying, particularly in regard to the healthy care. In all villages evaluated shortage in number of pharmacies and special medical facilities, as well as shopping centres etc. was recorded. The inhabitants are forced to use services offered in neighbouring villages or in the regional centre Trnava. Equipment of the settlements is also insufficient from the viewpoint of recreation facilities. The accommodation and catering facilities are absent. However, hygienic and technical equipment of the settlements can be taken as favourable. According to number of inhabitants

supplied with drinking water and number of housing units fed from public water mains, the best equipped villages are Dolné Orešany, Ružindol, Borová, Biely Kostol and Zvončín. The less favourable situation is in the villages Košolná and Zeleneč, where a water main has not been built up. The most serious problem in the villages evaluated in the Parná river catchment is construction of canalisation network for wastewater drainage from the territory evaluated. The unemployment rate in individual settlements ranges from 9.89% to 17.5% and depends on the momentary offer of working possibilities. The largest unemployment rate is in the villages Ružindol and Borová.

From the environmental viewpoint, the territory represents a typical agriculturally used landscape with a very low degree of ecological stability and with specific environmental problems resulting, first of all, from development of agriculture.

Results of elaboration

From the viewpoint of sustainable development of the Parná river catchment, the main task was definition of weak and strong sides of this microregion. The weak sides, which can limit or inhibit development of this territory and which, at the same time, show problems, which are to be solved in this catchment, are represented by low degree of ecological stability, except of settlements lack of public greenery (except of settlements laying at the foot of Little Carpathians); unfavourable structure of arable land – creation of large deforested blocks of land, which creates conditions for erosion; a high proportion of wild refuse dump dispersed almost the whole territory over; localisation of industrial facilities close to housing estates, often with negative environmental impacts; low degree of socio-economic development of the territory, slow restructuralisation of economy and work market – weak development of services, destruction of agriculture in more settlements, vanishing of many agricultural enterprises, insufficient offer of working opportunities and subsequently a high unemployment rate of population, a high rate of commuting to work in conditions of continuously increasing traffic costs and, consequently, decrease of real salary; insufficient equipment by services in most settlements resulting in their decreased attractiveness; worsening age structure of population, getting old of the settlements; low degree of ecological consciousness of population, understanding of the concept of environment reduced on technological problems, insufficient interest of the population to engage in solution of environmental problems and inclination to passive attitude to these problems; low interest in public affairs, insufficient relationship of the population to the cultural and historical facts etc.

The basic strong sides, which can be taken as stimuli for development of the target territory are the following: a high species diversity, occurrence of protected territories and elements of territorial system of ecological stability, occurrence of gene-pool localities, especially in the northern part of the territory; occurrence of the most fertile soils in Slovakia, sufficient water resources; favourable accessibility of energetic resource – nuclear power plant in Jaslovské Bohunice; favourable localisation of settlements and their connection with the regional centre Trnava, good traffic linkage of settlements, relatively favourable

technical infrastructure of the settlements and engineering networks; in the whole-Slovakian context a relative good quality of environment; a high potential of confession influence on value orientation and education to sustainable development; favourable natural conditions, especially in the northern part of the territory, for development of recreation activities, very favourable natural conditions for development of agrotourism and viticulture.

The present problems in the catchment evaluated were also shown by results of investigation of public opinion in selected villages – in Suchá nad Parnou and Zvončín. The investigation was realized by means of questionnaires filled by 225 inhabitants representing 10.8% of the whole population. The questions were oriented on problems of sustainable development and environment, first of all on evaluation of the public opinion about life in the village, perspectives of the village development, collaboration of inhabitants with local autonomous authorities etc. We asked the people in the age from 18 to 78 years with basic (25%), secondary-school (63%) and university education (12%). Analysis of responses showed that up to 84.1% of respondents do not know problems of sustainable development. Among 51 identified environmental problems, 50% of respondents considered the missing canalisation as the most serious problem. Then the respondents named the following problems: wild refuse dumps, unfinished construction of water main (in the part Ružová dolina), high unemployment, missing pavements, lack of cultural events, bad housing situation, low frequency of buses, insufficient arrangement of the village etc., 45.5% of respondents evaluated the care of local authorities at the village development as average, but they would welcome a higher activity and effort of local autonomous authorities to engage in developmental programs and grant projects, which could bring more financial means to the villages. The present trend of society development has also reflected in the interpersonal relationships, which are characterized by 37.5% of respondents as worsened. Some reserves can be seen in collaboration of local autonomous authorities and citizens, as 33% of respondents characterized the degree of collaboration as low. Also the mutual communication between the citizens in the villages considerably decreased in the last years. 56.8% of respondents obtain most information from the local radio. An important agent integrating inhabitants of the villages evaluated becomes personality of the local priest. Results of analysis of responses were used for proposals of priorities, aims and concrete measures for elaboration strategies of sustainable development.

As follows from the above facts, the main activities aimed to improvement of environment in given territory are to be oriented to the area of suitable use and allotment of arable land, greening of the agriculturally intensively used landscape with the aim to increase the overall ecological stability, removing of negative impacts of chemicalization, improvement of hygienic and aesthetic quality of the settlement interior, suitable liquidation of refuses (liquidation of wild refuse dumps), effective use of natural resources, supporting of revitalization of popular traditions, environmental education targeted on promotion of sustainable development and support of change in value orientation of the population in order to be compatible with principles of the sustainable development.

Elaboration of Agenda 21 resulted in proposals for elimination of problems connected with endangering of ecological stability and biodiversity of the target territory, endanger-

ing of natural and cultural-historical resources and endangering of qualitative parameters of the immediate environment. The proposals are divided into four basic groups.

The first group is oriented on restoration and increase in spatial stability of the target territory. We proposed the following measures in the territory:

- regulation of development of construction of weekend houses in the Protected Landscape Area Little Carpathians and in the proposed biocentre Suchovský háj and to define definitive borders of recreation areas
- elimination of economic exploitation of timber in localities of small-surface protected areas and in the localities valuable from the view of landscape ecology
- harmonisation of timber exploitation in the Protected Landscape Area Little Carpathians and in localities representing elements of the Territorial system of ecological stability with the requirements of nature protection and stability of the territory
- providing legislative protection of the superregional biocentre Suchovský háj and to proclaim it as protected area
- including of forests in nature reserves and in protected areas into the category of the special purpose forests
- enlarging of legislative protection of the protected area Trnavské rybníky on a part of remnants of floodplain forests
- providing of planting of line and patchy greenery in the central and southern part of the target territory in order to it play function of interaction elements increasing spatial stability of the agricultural landscape
- revitalization, finishing (provide continuity) and creating of functioning elements of the territorial system of ecological stability, especially biocorridors – superregional biocorridor, regional biocorridors Parná and Trnávka
- insulating of the biocorridors by buffer zones of meadows or by shrubs in order to protect them against unfavourable effect of agricultural production
- creating of new realisation projects for planting newly proposed elements of the Territorial system of ecological stability – biocentres, biocorridors and interaction elements with detailed definition of species composition and differentiation of plots in regard to owners' relationships
- liquidation of the wild refuse dumps situated in the protected territories and elements of the Territorial system of ecological stability – Suchovský háj, Protected Landscape Area Little Carpathians, biocorridors Parná, Trnávka etc.
- including of landscape-ecological data into land planning documents.

The second group of measures was oriented to elimination of stress factors endangering qualitative and quantitative properties of natural resources. The aim of these measures was to:

- prevent needless wasting with natural resources due to losses during transport, for example the losses of water in main network, by means defining of consumption limits in dry periods according to momentary hydrological and climatic conditions
- realize the anti-erosion measures in field cultures, especially in foothill of Little Carpathians – create mosaic structures of management, with altering of permanent grassy

plots, non-forest woody vegetation and small blocks of arable land, apply contour ploughing and sowing, provide seeding of anti-erosion vegetation, a suitable structure of crops, conservation tillage with mulching interim crops, provide mellowing of compact sub-soil in order to increase the absorbing capacity of soils

- prefer biological forms of agriculture in the Protected Landscape Area Little Carpathians and to harmonize selection of the crops according to their nutrient requirements and natural production potential of the soils
- use the pod-bearing plants in crop rotation in order to increase supplying the soils with nitrogen
- separate land by hygienic vegetation along the intensively loaded traffic corridors Trnava-Suchá nad Parnou-Smolenice, Trnava-Suchá nad Parnou-Dolné Orešany
- regulate taking of water from streams, especially during dry periods, in order to prevent decline of water table under the threshold values and, as a result, endangering of their function as hydric biocorridors
- liquidate of wild refuse dumps, inclusive of manure deposits in fields, which negatively influence quality of water streams
- prevent illegal discharging of wastewater from households in order to increase water quality protection
- monitor water quality in water sources determined to supply the population with drinking water (especially in the water source Horné Orešany)
- realize separated waste collection in individual villages.

From the viewpoint of protection of cultural-historical resources it is necessary to:

- revitalize and protect not only the individual elements, but also the character of local regional identity as a whole and as a typical manifestation of agricultural and viticultural region under the Little Carpathians
- provide protection and use of monuments and cultural-historical structures represented in the target territory especially by the sacral buildings
- increase quality of use of cultural facilities in villages, especially use of Houses Culture and to support and develop organizing of cultural and social events
- support revitalization of popular traditions, local cultural traditions, development of traditional trades etc. and to provide revitalization of the Little-Carpathian wine route
- increase publicity and education in order to change the public consciousness and attitudes to cultural-historical structures.

The last group of measures includes measures oriented to environment protection. It is necessary to:

- liquidate all dumps of communal refuses, which are in collision with housing and recreation areas; the wild refuse dumps can be found almost in every settlement in the target territory - Zvončín, Smolenice, Dlhá, Košolná, Horné Orešany, Dolné Orešany, Suchá nad Parnou etc.
- build up gas mains in the Borová village
- build up canalisation in the villages without canalisation and finish the canalisation under construction as soon as possible

- build up water mains in the villages Košolná and Zeleneč and finish construction of water mains in the village Suchá nad Parnou
- provide planting of hygienic isolation vegetation around the facilities having negative influence on environment – agricultural, industrial and deposing facilities etc.
- apply the law about assessment of impacts on environment at newly proposed activities and to engage the local population into this process and to prefer alternatives with minimal impact on environment.

Proposals for improvement of life quality of inhabitants of the villages in the target territory were oriented to the following measures:

- providing of improvement of socio-economic conditions – applying of economic developmental programs, support of small and middle enterprises, elaboration of strategies of social and economic development of individual villages in order to increase number of enterprises in them, especially in the villages Zvončín, Suchá nad Parnou, Košolná, Borová etc.
- finishing of building up of service networks in individual settlements in harmony with their function in the settlement system
- increasing of healthy and social care by finishing and improvement of a functional network of facilities in order to improve the healthy state of the population, realization of programs of care at older people
- continuous improvement of education in area of environment policy and use of offer of non-governmental organisations in this field
- creation of favourable conditions for better communication between autonomous authorities and local population
- improvement of informing of population and providing an easy access to information
- promotion of program of sustainable development and engagement of all population layers in its realization, supporting of changes in value orientation of population compactable with principles and criteria of sustainable development etc.

The general measures for providing development of the region in sense of principles of sustainable development were divided into following groups:

- **spatial and organizatory** measures – oriented to change in use of the element of territory, in localities where the territory use is not in accordance with criteria of landscape ecology, especially completing of ecologically stabilizing plots – finishing of creation of a functioning skeleton of territorial system of ecological stability in the monotone agriculturally intensively used landscape, increase of proportion of ecologically stabilizing vegetation in the interior of settlements (parks, line formations etc.), providing of a 20–50 m wide buffer zone along the water stream in order to protect them against downwash of pollutants, afforesting or grassing of the plots endangered by erosion, introduction of the anti-erosion mode of ploughing and sowing, stabilizing of vineyard areas by anti-erosion measures, providing of planting of isolation vegetation around stationary and mobile sources of immissions endangering arable land, providing of planting of isolation hygienic vegetation around industrial plants and animal farms in order to eliminates their unfavourable hygienic impact on environment, liquidation of refuse dumps etc.

- **technological-functional measures** oriented on proposal of technological measures focused on reduction of influence of secondary stress factors – building up of effective facilities for protection of air, water and soil resources, proposals for building up canalisation systems, separate collection of communal wastes
- **revitalisation measure** – providing of revitalization of damaged or loaded areas, re-considering of environmental risks resulting from localization of wild refuse dumps and field manure deposits as potential sources of groundwater contamination and subsequent remediation and reclamation of the dumps, decontamination of soils etc.
- **spatially protective measures** – measures focused on proposal of legislative protection of ecologically valuable landscape structures and of their elements, providing of protection of biocentres of all degrees, biocorridors, gene-pool localities and other ecologically significant elements according to their real significance
- **diagnostically preventive measures** – oriented on finishing of building up of a complex monitoring system focused on providing information about state of individual components of the environment.

Conclusion

Evaluation of environmental problems, definition of weak and strong sides, as well as activities oriented to increase of ecological consciousness of population living in the target territory play an important role in ecologising the economical activities in the landscape and in proposals of sustainable development of the target territory. The aim of the proposed measures for solving of specified problems is, first of all, rational use of natural and cultural resources, preservation of ecological stability and, as a consequence, of function of ecological relationships and processes in the target territory and, of course, maintaining of adequate quality of environment for the population. These processes are time and cost consuming and require an interdisciplinary approach.

Realisation of the project presented is a contribution to the concrete implementation of the idea of sustainable development in practice, especially according to principles of the integrated approach to natural resource use given in the chapter 10 of AGENDA 21.

Realisation of many of goals and measures presented is, however, impossible only on local level, but is to be realised on national level. Especially the measures in the superstructure sphere like ecologising of economic and legislative instruments and ecologising of social consciousness based on providing of an educational system, needs participation of the whole society.

Translated by Zb. Šustek

The contribution is a result of solving the project APVT 51–037202 – Integrated landscape management.

References

- Agenda 21 and indicators of sustainable development, 1996: Ministerstvo životného prostredia Slovenskej republiky, Bratislava, 517 pp.
- Futák, J., 1966: Phytogeographical division of Slovakia (in Slovak). Flóra Slovenska I. Vydavateľstvo SAV, Bratislava, p. 535–538.
- Izakovičová, Z., Hrnčiarová, T., Moyzeová, M. et al., 2001: Ecological management of the Parná catchments – Local Agenda 21 (in Slovak). Združenie Krajina 21, ÚKE SAV Bratislava, 185 pp.
- Ružička, M., Miklós, L., 1982: Landscape-ecological planning (LANDEP) in the process of territorial planning. Ekológia (ČSSR), 1, 3, p. 297–312.
- Regional Agenda 21, 2001: Methodological procedure (in Slovak). IVASO, Bratislava, 46 pp.

Received 18. 11. 2003

Izakovičová Z., Moyzeová M.: **Stratégia trvalo udržateľného rozvoja povodia vodného toku Parná.**

V príspevku prezentujeme návrh stratégie trvalo udržateľného rozvoja povodia vodného toku Parná, ktorý vychádzal z:

- hodnotenia súčasného stavu rozvoja územia z aspektu napĺňania princípov a kritérií trvalo udržateľného rozvoja
- stanovenia slabých a silných stránok
- návrhu opatrení na elimináciu environmentálnych problémov vyšpecifikovaných v hodnotenom povodí
- návrhu ekologizácie hospodárenia-zosúladenia rozvoja socio-ekonomických aktivít s potenciálom územia.