ENVIRONMENTAL ASSESSMENT FOR LOCAL AGENDA 21: CASE STUDY OF TWO COUNTIES IN MINSK REGION, BELARUS

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In spite of global relevance of Local Agendas 21, there are no officially adopted local action-plans in Belarus. The absence of easy in use methodological tools for environmental assessment is an issue for such a situation. Thus, this study aiming at the compiling and verifying methodology for the county's environmental evaluation, is highly relevant. The methodology is comprised the data describing carrying capacity of ecosystems, and their economic utility. The former is based upon the ecological analysis of natural landscapes, as they understood by Russian (Soviet) physical geographers, since the detail landscape's survey has been made by Belarusian geographers for all counties. The economic utility is assessed as combination of potential land values for agriculture, forestry, recreation, water economy, wild nature protection, and extraction of mineral resources. The research included GIS-based analysis of ecological and economic databases for typical local communities - Dzerzhinsk and Miadel, which are respectively the most utilized and the most forested counties in Minsk region. The methodology has been approved by local environmental policy-makers. It is found that results of their assessment well correspond with our counties' evaluation. The study of all counties of Minsk region is to be made to adjust methodology to different geographical settings.

Introduction

Environmental assessment of landscape entities based upon natural-recourse potentials is an important step towards the bridging the gap between science and environmental management. Notions on natural potentials provide broader view of landscapes capacities and their land-use perspectives. On the one hand, they encompass carrying capacity and resistance to human impacts of both geographical factors and ecosystems (landscape complexes), on the other hand, the ability of landscape to satisfy needs and demands of society (1), (2).

In our study we are dealing with the problem at a county's scale, performing environmental assessment for natural landscapes within two counties featuring different land-uses, agricultural patterns, social and economic functions.

We understand carrying capacity as spatial index comprised of separate potentials for such components as: agriculture, forestry, water economy, recreation, wild natural protection, and extraction of mineral resources.

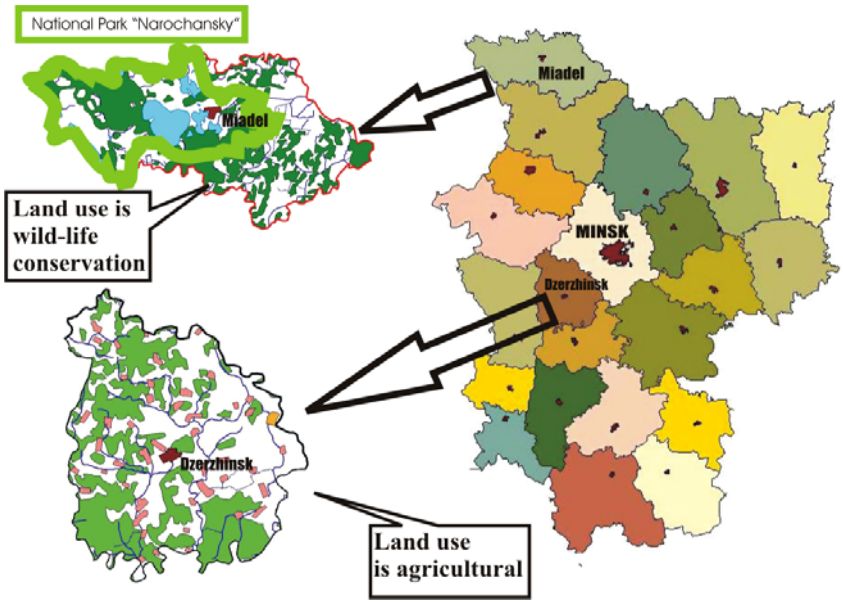
Mapping of landscape-ecological entities, their environmental features, and assessment values regarding the natural-recourses potentials can be particularly helpful for spatial planning and environmental decision- and policy-making at regional level.

Methods

The landscapes have been studied within the boundaries of counties, given that much of spatial planning and environmental decisions are taken at county's level, as well as many of governmental programes are designed for counties. The methodology elaborated was applied to two rather typical counties in Minsk Region - Dzerzhinsk and Miadel, shown at Illustration 1.

A lot of methods for the assessment of and its components have been developed by Russian/Soviet geographers and environmental scientists. In the Soviet science economic assessments of natural-resources potential typically use. Even National Strategy for Sustainable Development was created by the team of economists. In our study we largerly applied the methods of regional analysis mixed with methods of ecology, physical geography, regional economy, social sciences, and various multidisciplinary approaches.

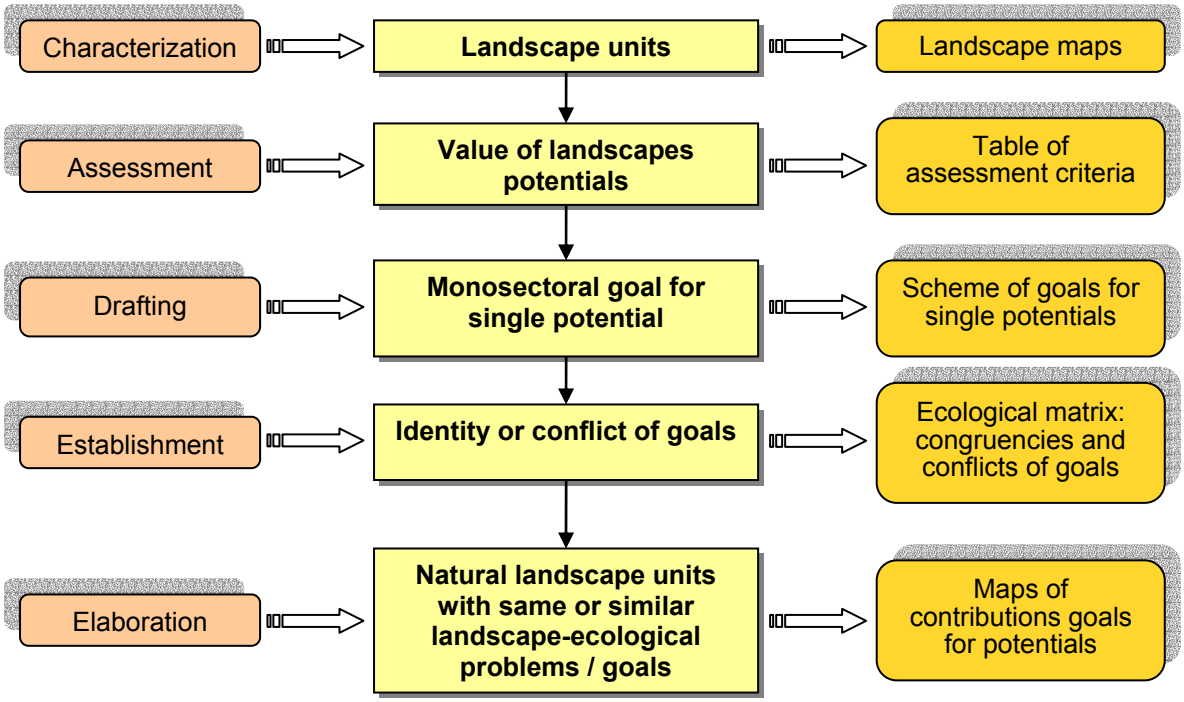
Illustration 1: Case Study (Dzerzhinsk and Miadel counties)



Our databases included Landscape map (scale 1:600,000) (3), Maps of biotopes, Land use map, Hydrological maps (4), statistic from counties' sources (5), and monographs (6), (7).

The procedure (Fig. 1) consists of several steps, beginning from the description of landscape units and assessment of natural-resources potentials, to the drafting of goals for each component of potential and finally to integrated ecological goals for each landscape unit and a generalization classification of landscape units with the same or similar goals).

Figure 1: Algorithm of the Procedure



The first step includes description and analysis of landscape units in Dzerzhinsk and Miadel counties.

The outcomes of the second step are set at the Table 1. According to chosen criteria, set of statistical database has been created and integrated into GIS. This step has been resulted in the estimation of landscapes.

Table 1: Table of Criteria for Value of Landscapes Potentials

Agricultural potential	**1**	**Fraction of agricultural lands**
	2	**Biotic yield productivity**
	3	**Soil erosion**
Forestry potential	**1**	**Fraction of lands under forest**
	2	**Fraction of damage forest**
Water economy potential	**1**	**Depth of occurrence of groundwater**
	2	**Index for groundwater pollution**
	3	**Index for mineralization of groundwater**
	4	**Index for surface waters pollution**
	5	**Water reserves of lakes, reservoirs**
Recreation potential	**1**	**Index for natural recreation condition**
	2	**Quantity of architectural sights**
Wild natural protection potential	**1**	**Fraction of conservation lands**
Extraction of mineral resources potential	**1**	**Stocks of minerals**

The next step includes the analysis of present and potential ecological threats, conflicts and risks caused by human activities (especially agriculture, forestry, water economy, recreation and extraction of mineral resources).

Present and potential threats include those affecting the following sectors: agricultural (increase of agricultural land and soil degradation caused by erosion); for forestry (deforestation); water economy (pollution of ground- and surface water, landfilling, disturbance of hydrological balance by intensive municipal, industrial and agricultural use); recreation (impact caused by noise, environmental pollution, loss of landscape diversity); extraction of mineral resources (reduction of mineral resources, soil degradation caused by mining).

Basing on the characteristics of each landscape unit and the assessment of components of natural-resource potential and goals, we have proposed targets for each potential (Fig. 2). Comparative relevance and priority for the measures to be taken are identified.

There is a probability of conflicts when implementing various goals. For example, preservation of highly-productive soils for agriculture can clash with the goal of increasing forestation rate. The intersections of different goals can be identified by ecological matrix. It includes such types of goals' interactions as positive, negative, indifferent, and mutually excluding. For example, preservation of fertile soils for agricultural purposes has positive interrelations with reduction of environmental threats and negative interrelation with control of soil erosion.

The last step includes recognition of the most relevant goals for Minsk region, which are reduction of agricultural lands (A1), preservation of productive soils for agriculture (A2), expanding of forested lands (F1), protection of groundwater (W1), protection of surface waters (W2), conservation of landscapes with high recreational value (originality, scenery, etc.) (R1), enlarging the areas under protection (C1), conservation of mineral recourses (M1).

Results

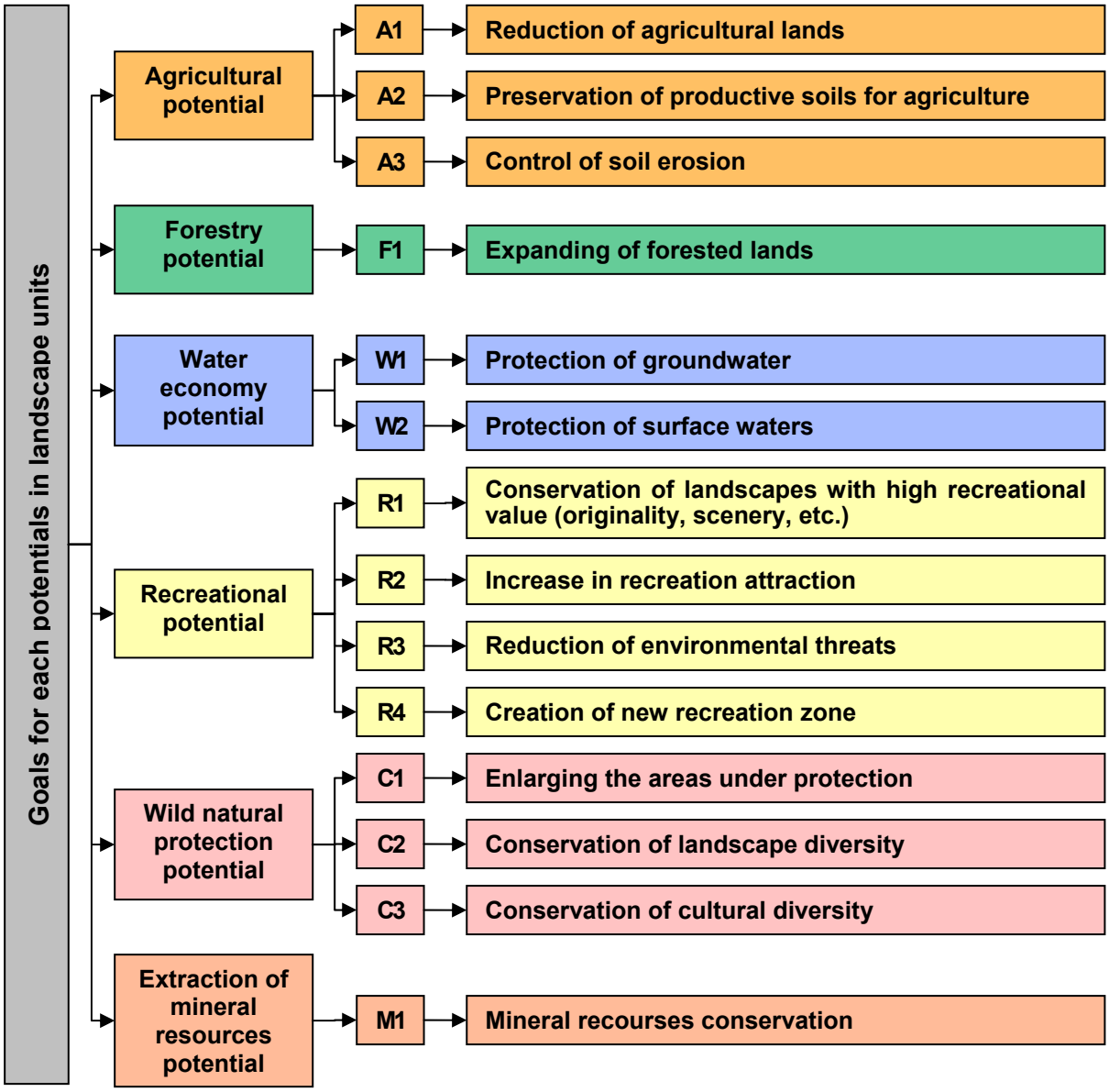
Dzerzhinsk county contains seven landscapes. The greatest areas occupy medium hilly moraine height with ravines, sinks; waved fluvioglacial plain with kames and moraine hills, dunes; waved fluvioglacial plain with moraine hills, sinks (more than 80%).

Miadel county consists of eleven landscapes. Hilly-waved moraine plain with kames and moraine hills, ravines, flat-waved fluvioglacial plain with lakes, dunes, kames, hollows and flat lake-marsh lowland with moraine hills, lakes are the most widespread.

Considering only eight goals, there are fifteen different types of landscapes concerning the landscape-ecological situation and goals in the testing districts (Illustration 2).

For example, within the reference units `Type 1' the ensemble of six goals (and related measures) are necessary: reduction of agricultural lands (A1), preservation of productive soils for agriculture (A2), expanding of forested lands (F1), protection of groundwater (W1), conservation of landscapes with high recreational value (originality, scenery, etc.) (R1), and mineral recourses conservation (M1). In contrast, `Type 14' demands only a protection of surface waters (W2) and enlarging the areas under protection (C1). Naturally, the number of such types can be reduced with an increasing generalization of parameters.

Figure 2: Table of Goals for Each Potential in Landscape Units



Discussion

Analysis of the resulting map has allowed to make a classification from which three levels of landscape units were derived.

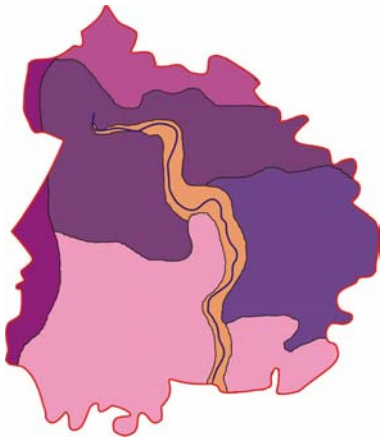
The first level includes the landscapes with five and more goals. This level contains only three landscapes: large and medium-hilly ridge moraine height with kames, medium hilly moraine height with ravines, sinks and waved fluvioglacial plain with moraine hills, sinks. These landscapes occupy more than 45% of Dzerzhinsk county. The main problem of this area is intensive agricultural land use. Consequently, actions directed to optimization of natural-resource potential use are necessary.

The second level occupies the largest territory of Miadel county, and about 45% of Dzerzhinsk county. This level consists of the landscapes with four and three goals. The main problems of these territories are varied and to consider it necessary realization of ecological actions by local environmental policy-makers.

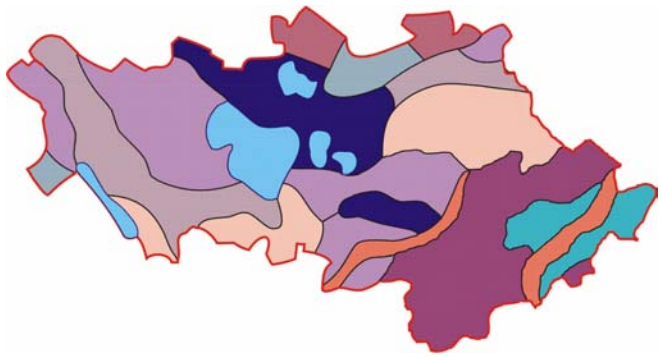
The last level includes the landscapes with one or two goals for local sustainability. There are two landscapes, which occupy about 10% in Dzerzhinsk district and 12% in Miadel district (waved fluvioglacial plain with kames, outliers of moraine plains and valley with flat flood-plain, local terraces). These landscapes are exposed to minimum antropogenic impact.

Illustration 2: Landscape-Ecological Contributions to the Elaboration of Goals for Potentials in Natural Landscape Units.

Dzerzhinsk county



Miadel county



1 A1/A2/F1/W1/R1/M1
2 A1/A2/F1/W2/R1
3 A1/W1/R1/C1/M1
4 A1/A2/F1/W2
5 A1/A2/F1/R1
6 A1/A2/F1/C1
7 A1/A2/C1/M1
8 A1/W2/R1/C1
9 A2/W2/R1/C1
10 A2/W2/C1/M1
11 F1/W2/R1/M1
12 A1/A2/F1
13 F1/R1
14 W2/C1
15 W2

Conclusions

The methodology described above is an attempt to introduce landscape-ecological facts and constraints into the regional planning practice and to bridge the gap between natural sciences and economical interests of human society.

The methodology has been approved by local environmental policy-makers. It is found that results of their assessment well correspond with our counties' evaluation. The study of all counties of Minsk region is to be made to adjust methodology to different geographical settings.

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