AENSI Journals

**Advances in Environmental Biology**

ISSN-1995-0756 EISSN-1998-1066

Journal home page: http://www.aensiweb.com/aeb.html

# New Opportunities of Geoplanning in the Rural Area With The Implementing of Geoinformational Technologies and Remote Sensing

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ARTICLE INFO

***Article history:***
*Received 15 April 2014*
*Received in revised form 22 May 2014*
*Accepted 25 May 2014*
*Available online 15 June 2014*

***Key words:***
*geoplanning, river basins, adaptive land development, rational nature use, GIS-technologies, remote sensing.*

ABSTRACT

the article considers implementation of the integral approach to geoplanning of rural areas based on the concept of basinal nature use and technological opportunities of geoinformational designing and remote sensing. The sequence of scientific and technical transfer to basinal arrangement of the area and the evaluation of results of geoplanning in one of the Russian regions is provided (based on generalization of the experience of design works for 62 basins of small rivers). Using the experience of realization of the concept of basinal nature use, the ways for optimization of the structure of the land are offered due to increase of areas of those, which provide environmental stability of the territory.



**To Cite This Article:** Fedor N. Lisetskii, Alla V. Zemlyakova, Edgar A. Terekhin, Anastasiya G. Naroznyaya, Yaroslava V. Pavlyuk, Pavel A. Ukrainskii, Zhanna A. Kirilenko, Olga A. Marinina, Olga M. Samofalova,., New Opportunities of Geoplanning in the Rural Area With The Implementing of Geoinformational Technologies and Remote Sensing. ***Adv. Environ. Biol., 8(10),*** *536-539, 2014*

## INTRODUCTION

Modern researches on scientific-technological substantiation of geoplanning of rural areas are developing at the junction of the landscape ecology, environmental modeling and geoinformatics [1]. In the course of geoplanning the choice of approaches and criteria is important for splitting of the space into spatial allotments. If necessary for mutual linking of problems of the land and water use, the choice of a river basin as an operational unit of geoplanning is perspective [1-4 etc.]. For the purpose of erosion-preventive control GIS is widely used for relief analysis. But as it is demonstrated earlier [5], with the help of morphofunctional analysis of slope landscapes it is necessary to reflect not only geomorphological processes and vegetative ground cover on catena, but also the differences of microscopic zones by climate and water conditions. Besides GIS the important place in geoplanning is occupied by the use of remote sensing data (RSD). If GIS has integration instrumental essence, then RSD is the source of the actual information. Using various features of the objects by RSD lets creating land maps [6] and types of agricultural lands [7].

The multilevel system of monitoring, based on the vision of hierarchy of levels of the natural systems, if offered also for monitoring of soils [8], and for the purpose of controlling their erosion losses [9]. Such system of monitoring is implemented also in the course of organization and management over nature use under the principles of the concept of basinal nature use (CBNU).

In the constituent units of the Russian Federation the practical arrangement of catchments areas is not yet performed purposefully. The basinal and administrative approach lets establishing effective spatial forms of interaction between the nature users [3; 10]. In the course of geoplanning under the key components (nature environment, population, economy) only three of its constituent parts are realized: formation of environmental carcass, settled and economic geoplanning, which permits by way of joint analysis coming out to agreement of the planning solutions [11] and the optimum between the economic effectiveness of the structure of the land management and the ecological stability of the area [12,14].

The purpose of the research was that to develop the integral approach towards geoplanning of rural areas based on CBNU and the technological possibilities of GIS-designing and remote sensing, which could provide conditions for steady ecological and economic functioning of the river basins.

*Methods:*

The object of the research was the territory of Belgorod region, where we performed the basinal and administrative approach towards rationalization of the nature management. For the type design of basins there

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was instrument "Iso *Cluster*" in *ArcGIS* used and the results of clustering were compared (from 3 to 10 classes). In the course of analysis of the type design results obtained it is established that the share of deviation if the least at the 4 classes. Under t-criterion with the accuracy of 80 % the types can be differentiated. For the purpose of geoplanning the rural area the up-to-date maps of the land are necessary, for the purpose of which there were highly detailed RSD used.*Main part:*

In the Belgorod region there are 63 river basins distinguished of 3-7 levels, of the area of 67-1517 $km^2$. The main territorial peculiar feature of the three river basins, which are substantiated as the result of cluster analysis is the underlying risk for erosion advancing due to high arability and low forest cover, therewith the qualitative evaluation shows that the condition of the agricultural lands is at the middle (types I and II) and high (types IIIa and IIIb) level. Actually, the erosion feature of the agricultural lands in various types of basins deviates from 19 to 58 %, but sometimes it may exceed 70 %. Land within the limits of types I-II of basins are the most dangerous as to erosion and require differentiated use of agricultural technologies. Land within basins of IIIa type are more erosion steady, for their arrangement there are organizational and economic and agro technical events sufficient.

For the purpose of improvement of management mechanisms in the sphere of rational land management in Belgorod region, the idea of CBNU has got its normative consolidation in the Concept of basinal nature use (approved by the resolution of the regional government as of 27.02 2012, #116).

The method of the territorial arrangement of the land fund included collection of the qualitative and quantitative information about the natural, the social and economic potential of the basin, reorganization of the structure of the lands, taking into account the ecological and the economic suppositions and the regulatory legal framework, calculation of ecological and economic efficiency of the territory arrangement (figure 1).

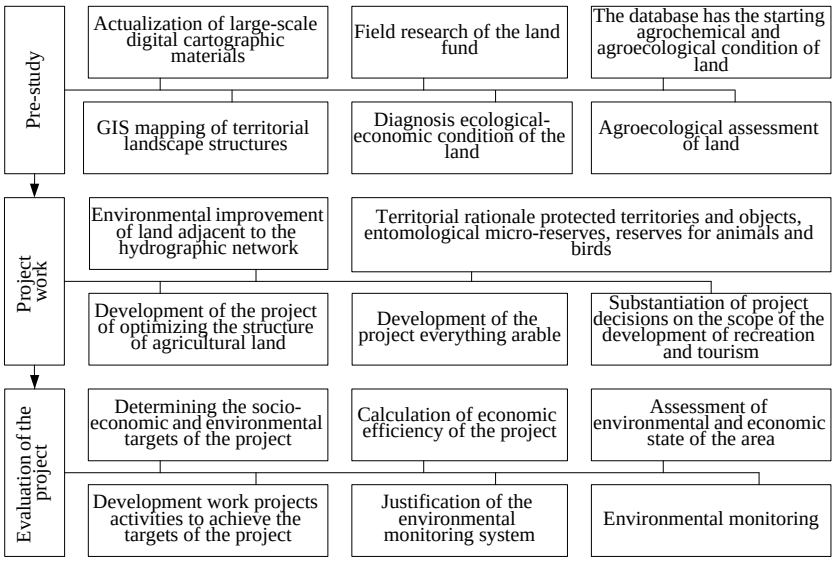


**Fig. 1:** Scheme of performing works in the course of implementing basinal concept in nature use (CBNU).

The basis for geoplanning under the principles of CBNU is reorganization of the lands structure. Arrangement of agricultural lands structure linked with the relief and soils (adaptive land development) and formation of ecological carcass have included the following stages: 1) land management of fields based on basinal and positional and dynamic principles; 2) foresting projects; 3) water conservation areas projects; 4) rationalization of using forage lands; 5) recreational areas projects; 6) detecting new natural reserves.

The land and water protective arrangement of the fields was performed with the help of GIS-technologies. To create the cartogram of agro ecological evaluation based on digital terrain model (DTM) there were multitopic grids by methods of spatial interpolation (extrapolation). Under the results of RSD deciphering and analysis of slope grids, derived from DTM, there were degraded sites detected, for which soil-protecting crop rotation was stipulated or the conservation mode. Based on modeling the outflow and under RSD there were thalwegs of fluvial chain differentiated for designing grassy water outflows.

As the result of scientific substantiation of CBNU and geoplanning of rural area at the level of the region, there was a method offered, as well as principles and criteria of nature management, type design of basinal structures was performed under target indices groups, measures on ecological sanitation and rational economic use of the territory developed, including events of biologization of the fields, increase of melliferous capacity, defining areas for natural self-restoration, plans of rational economic and recreational use of water objects developed, as well as optimization of ground roads networks.

Ecological monitoring based on CBNU projects is the most efficient, as the basins have objective boundaries and functional integral circularity of migration water flows, as well as dissolved solid substances. In the course of substantiation of the monitoring network it is necessary to take into account the specific features of the basins – the hierarchic structure, large number of various spatially dispersed elements, and diversification of functions. Therefore, for representation of the obtained data, the monitoring points shall be placed at different hierarchic levels of basinal arrangement. Via iterations in calculations the optimal strategy was determined, harmonizing the relations of the land and water use in certain environmental and economic situations [4]. The sample of results of CBNU designing for one of the rover basins is shown on figure 2.

As to geoplanning from CBNU position, the rotation areas in cultivated lands are differentiated and their shares are in the summary allocated as follows: field 71 %, seed and grass 23 %, soil-protective 7 %. Under the data of spatial analysis there were field sites detected, for which high erosion danger is established and they are recommended for conservation. A part of the filed on slopes (30 thousand ha) are allocated for arrangement of bee parks.

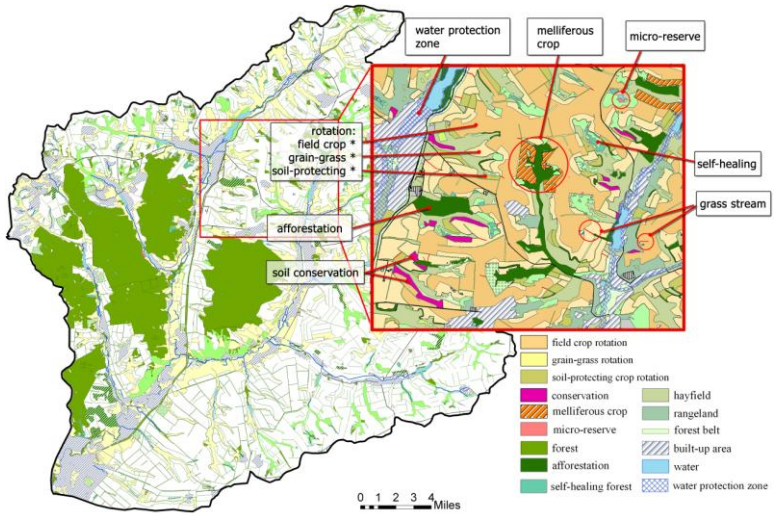


**Fig. 2:** Result of geoplanning of water catchment at basinal arrangement of nature use (on the example of Vorskla river within the boundaries of Russia).

Stabilization of the ecological situation of the region was reached by means of reallocation of the types of lands and change of their mode of use, and the efficiency of geoplanning based on CBNU was evaluated under the target indices and indicators. The areal indices belong to them: forestation, land conservation, grassing of water outlets, creation of remises and micro wildlife areas, stabilizing and destabilizing lands, as well as coefficients of ecological stability, natural protectiveness and ecological tension of the territory.

Realization of the developed concept of geoplanning under principles of CBNU will be able to provide high ecological and economic effectiveness of land using of the fields of Belgorod region. Introducing the results of project works shall permit increase of ecological stability of the territory by 33.3 %, having reduced the ecological tension by 22.7 %. The share of arability of the lands will reduce to 51 %, for grasses and grassing of water outlets there are 9.5 % of fields allocated; the area of trees and shrubs will increase to 20.9 % while the growth of the area of complete foresting (286.6 %) and reduction of forage land areas (by 17.7 %). A scientifically substantiated allocation of areas for hay-fields and increase of perennial grass planting will provide annual additional production of forages. Introduction of direct planting will permit reducing costs on fuels and lubricants by 24%, development of biological system of agriculture will permit reducing pesticide loading.

*Results:*

The integral approach to geoplanning of rural areas based on CBNU used for one of the Russian regions, has shown its efficiency in providing ecological and economic optimum of agricultural sphere development. As the result of scientific substantiation of CBNU and geoplanning of rural area at the level of the region, there are methods, principles and criteria of nature management offered, the type design of basinal structures under target indices is performed, measures on ecological sanitation and rational land use are developed, including events of biologization of fields, increase of melliferous capacity, plans of rational economic and recreational use of water objects and optimization of ground roads chain are developed.

*Conclusions:*

1. The target function of geoplanning under basinal principles shall become the substantiation of the optimum between the formed practice for nature use in the basins, the perspectives of the territory development, the nature and resource potential, measures on reproduction of natural resources and providing ecological safety.
2. Using basinal approach to geoplanning of rural area contributes to establishment of efficient spatial relations between the nature users, which permits arranging sustainability of resources by the most economically effective and environmentally acceptable way.
3. In the course of geoplanning basins the wide opportunities belong to integral approach to geoplanning of rural areas based on CBNU and opportunities of GIS-design and remote sensing.

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