THE DEVELOPMENT OF CONCEPTS OF LANDSCAPE FUNCTIONS IN VIEW OF OPTIMIZING THE ENVIROMENT CONSERVATION

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The tasks and objectives relating to the optimization of the environment conservation involve the determination of biotope sensibility, valuation and forecast of the landscape sustainability, excessive anthropogenic loads, assessment of ecological risks and possible adverse consequences, analysis of conflicts, choice of methods for protection and development of the territory, determination of proportions between the agricultural lands and priority trends in land use, compromise decision-making and elaboration of methods to bring in correspondence the interests of land owners. These tasks are solved on the basis of functional analysis of landscape. The major ecological functions are the following: bioecological (biotopic and biocenotic, bioproduced, bioenergetic, biogeochemical, concentrated, oxidation-reduced, destructed, activated-inhibited, sanitary); atmospheric (gaseous, heat exchanged, hydroatmospheric); lithospheric (relief-forming, lithological); hydrological and hydrogeological ones. Based upon the identification and assessment of ecological functions of landscapes the social-economic functions are determined to meet the requirements of the human society.

Keywords: functional analysis, landscape planning, projecting of agrolandscapes.

The intensive development of the science taken place in the second half of the XIX century led to its branching into numerous trends and disciplines. The scientists of encyclopedic knowledge yielded the times being replaced by professionals with profound narrow views. The huge amount of scientific information scattered in different fields of the science proved to be beyond comprehension and generalization. For this reason, the problem is arisen to integrate the information for solving practical tasks and planning new researches especially in such important problems as the environment conservation and agriculture in particular. It is worth remembering the idea of V.V. Dokuchaev (1892, p. 117) that "the factors lain down the foundations of agriculture are connected with each other to such an extent that in studying they should be considered as an integral and indivisible totality but not as separate parts or it will be impossible to govern them". Probably, a set of great innovative programs of global level is urgently required to be in correspondence with the scientific methodology based upon the biosphere ideology of the environment conservation and its sustainable development. The transition process from the anthropocentric paradigm to the biosphere one is inert. From the viewpoint of a new paradigm the basic concepts of the environment conservation must be revised especially the concept of "land". According to S.N. Volkov (2001, p. 10) in the land management there is the definition that "the land is the earth surface, a natural resource characterizing by space, relief, soil cover, vegetation, waters and an object of the social-economic relations, the main means of agricultural production and a spatial basis for allocation and development of all the spheres in national economy" [2]. Besides, from the viewpoint of this paradigm the land is a "natural-territorial complex characterizing by definite ecological and social-economic conditions (geological, climatic, lithological, biocoenotic, social-infrastructural) and different functions including environmental, social-economic, resource, recreational, etc. (Kiryushin, 2011, p. 73).

According to the above definition the land is a part of the biosphere and the soil is its basic component associated with the main functions of the biosphere. From this viewpoint the concept of soil is assuming a broader sense as compared to traditional one that takes into consideration only the productive function of soil. The interpretation of the fertility as a specific soil property to provide the crop yield needs to be specified and developed in ecological aspect.It is impossible to obtain the crop yield on many soils, for example on solonchaks, takyrs, etc. At the same time, the crops can give the yield on exposed soil-forming rocks and different substrata. The question is in the ecological-economic stability of the fertility and reproduction of its conditions, i.e. the soil fertility should be considered not only as the capability to yield but also to ensure the reproduction of the proper soil as a habitat for vital activity. Thus, apart from the productive function (yield and quality of agricultural produce) the soil performs the functions relating to the conditions of production, economic and energetic expenditures, recreational and the other demands as well as ecological functions providing the maintenance of conditions for the habitat of vital activity. These functions must be protected in accordance with demands of ecological imperative conditioned by the biosphere paradigm.

The classification of soil ecological functions has been proposed by G.V. Dobrovolsky and E.D. Nikitin in 1990 and was published even in textbooks of soil science [3]. However, it didn't receive its further development and constructive use in practice although global challenges of ecologization in the human activities have been clearly expressed. The ecologization meant its correspondence with ecological laws and the harmony between productive and ecological functions of landscape. Such concepts were applied in the native landscape science but seemed unsuitable for practical purposes. The experience in landscape design and planning gained in Germany found an application only in geography and landscape science but not in soil science of Russia. It is worthy of note that the Dokuchaev tradition to study the soil in landscape proved to be left behind. The soil has been considered as a result of interactions between the soil-forming factors but the relationships between the soil and landscape didn't take a proper place in landscape science. E.Yu. Kolbovsky, the noted landscape scientist (2007, p. 4) wrote "that the foresters and agronomists could not adapted the achievements of the landscape theory to their production demands and the landscape science being enriched with quite different theories seemed far from practice. It is especially vexing because in the other countries of Western Europe the geographers could give useful and concrete recommendations for forest landscape management, agronomy and creating a network of animate nature".

Due to dissociation of adjacent sciences about the soil, landscape, farming and land management there is no mechanism responsible for ecologization of agriculture as based upon the rational use of landscape functions to solve the problems aimed at:

– identifying, analyzing and assessing the landscape functions,

– detecting the biotopes sensibility (the capability to react upon the effects), sensibility threshold,

tolerance limits in which the biotope remains unchanged,

– evaluating and forecasting the ecological resistance of landscapes (the ability to maintain the structure and functioning),

– taking into consideration the acting anthropogenic loads and those planned in the nearest future,

– assessing the environmental risks and their possible consequences,

– analyzing the ecological conflicts, forecasting the influence on adjacent landscapes,

– developing and improving the use of territories taking into account the human society’s interests and the present-day land owners,

– determining the optimal proportions in agricultural areas within the landscapes and application of ecologically safe technologies in agriculture,

– detecting the priorities in the land use and intensity of human-made loads based upon the forecasting of reactions between the landscape components;

– comparing the alternative scenario and compromise decision-makings in many-functional land use on the base of analyzing the contradictions between ecological, economic, social, technological conditions and interests of land users,

– elaborating the methods oriented to co-ordinate the procedures for public discussion and alternatives in the development of the territory.

The initial position in elaborating the optimal systems of the environment conservation is the valuation of landscape functions. The literature sources contain different approaches to their classification. They have been generalized in the textbook “Landscape Planning” (2006) as the following grouping of functions:

1 – bioproductivity (bioresource),

2 –biocoenotic,

3 – gas-exchangeable, water-and climate-forming, regulating,

4 – soil-forming and partially mineral-and rock-forming,

5 – transport, forest, - water- and agricultural,

6 -sanitary-hygienic and recreational,

7 – information and culture-forming.

The given grouping is rather common by nature, being represented by a combination of ecological and social-economic functions of landscapes. More profound is the classification of soil ecological functions proposed by G.V. Dobrovolsky and E.D. Nikitin (1990). It contains ecological functions that are closely connected with the soil in order to show the role of the soil as a basic component of the biosphere to determine its functioning. This fact was of great importance in that time when the soil science was striving to be as a fundamental science about the independent natural-historical body of “land”. It was necessary to consider the soil but not the land as an object of agricultural use and reclamation. In that time the “soil-land” question was open to discussion; S.V. Zonn interpreted the concept of land widely adopted in the land management as “the concept that doesn’t reflect the importance of the natural resource vital for the country’s prosperity” [5]. Thanks to G.V. Dobrovolsky the soil science found its priorities, the concept of land was replaced by soil and only during the last decades this concept was revalued as associated with landscape.

It is high time to consider the soil in landscape and its functions in combination with the functions of landscape. In this case many concepts can be more definite. For example, the concept of the “soil fertility” and soil productivity is closely associated with a number of factors including climatic (heat supply, gas regime, precipitation, air moisture), hydrogeological (depth and quality of ground waters), phytosanitary (weeds, insects, deceases), agrochemical (application of fertilizers, amendments, pesticides, etc.). Meanwhile, the soil fertility has a concrete sense only with respect to definite crops and their species. The above factors are connected with each other to such an extent that after V.I. Vernadsky several scientists were convinced of considering the soil fertility as a part of the biosphere fertility.

For a better understanding of this problem it is necessary to study a totality of landscape ecological functions, to measure and evaluate them as attributed to social-economic functions of landscape. This approach intends to group the landscape functions. Among them are the basic functions such as bioecological (biotopic and biocoenotic, bioproductive, bioenergetic, biogeochemical, concentrated, oxidation-reduced, destructive, activated-inhibited, sanitary), atmospheric (relief-forming, lithological), hydrological and hydrogeological ones. When identifying and assessing the ecological functions of landscape it seems possible to determine the social-economic functions oriented to meet the human society's requirements. They are represented by functions capable to provide with resources including abiotic functions (heat, water, fuel, energy), biological natural (wood, peat, fish, etc.), biological cultivated (produce of crop production, animal produce, forestry), the functions capable to determine the space for allocation of industrial enterprises as well as the functions related to water management, transport, recreation, information, etc. The given approach permits to determine the productive function of landscape (social-economic) by crop yielding, its quality, economic and ecological indices of the agricultural production and its stability taking into complete account all the ecological functions. The bioproductivity function is of special importance permitting to detect the potential of landscape productivity and to regulate the functioning of agrolandscapes. The input of litter, biomass and crop residues to soil is vital for maintaining the biogeochemical (biological turnover), energetic, sanitary and the other ecological functions. In agriculture it is especially important to activate the field work connected with the stubble mulching, straw application, sideration, expansion of areas for perennial legumes, etc. Very acute is also the detection of optimal level in the content of the labile organic matter in soil. It becomes more evident that the optimal biotic parameters have to be elaborated to show the composition and amount of microflora and mesofauna in soil. Their optimization will be conducive to the soil self-loosening in case of minimum tillage and the direct sowing widely adopted in agriculture now. The soil revival is an indispensable condition for preventing its degradation. The ecological aspect of the soil fertility, the soil ability to resist degradation and its self-reproduction are also important like as the soil capability to provide the crop yield. The harmony of these conditions can be reached only in landscapes optimized by the major parameters taking into consideration the ecological functions (allocation of agricultural areas and crops, appropriate technologies and ameliorative measures, antierosion organization of the territory, etc.). The required condition for such an approach is the territorial planning, the latter being developed due to improving the land management projecting and the theory of landscape planning in order to tackle definite tasks relating to the environment conservation.

However, the problem is to replace several measures by the methodology to transform natural or natural-anthropogenic systems into the state favorable for social-economic and ecological functions. The definite experience has being gained in the course of elaborating and projecting of adaptive-landscape systems and scientifically-grounded technologies in agriculture [1]. The present-day achievements in soil science, agriculture, landscape science allow solving the tasks relating to allocation of agricultural areas, differentiation of farming systems, etc. However, many efforts are required to distinguish ecotones in landscapes, to use the principles of mosaics and polarization in the formation of agricultural landscapes and methods to create an ecological frame of the territory with account of natural and economic infrastructures. When elaborating methods for landscape planning, it seems reasonable to integrate the experience gained in the landscape planning and projecting of adaptive-landscape systems in view of optimizing the agricultural landscape and its different components. To provide such an approach, it is necessary to organize the scientific investigations at a new qualitative level, thus integrating all the trends in science.

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