

Method of Assessing the Degradation of Agricultural Land



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Abstract

The article considers the methodic of optimization of the ratio of farmland in the typical landscapes non-Chernozem zone of Russia, on the basis of the analysis of the characteristics of their device and the adaptive responses of plants to the land. The first stage is to study the peculiarities of the morphological device of agro geo systems, the main parameters which are the values of the squares composing them of Elementary Geochemical Landscapes (EHL). Based on the study of the natural environment of EHL carried out the analysis of their production potential and determine the nature of the potential distribution of land within agro geo systems. The potential structure of the land refers to the ratio of their maximum possible space in the agricultural landscape. It is revealed that geo complex not significantly differ in the maximum possible arable land, but the character of the distribution of hayfields and pastures, their specificity has a significant impact. During the "landscape of production" structure optimization of land potential structure transformer a it on the basis of a farm's specialization, and the proportion and location within the forests, wetlands and other nonagricultural areas. In the "ecological landscape" of the optimization, advanced calculation parameters "adaptive" structure of the land, based on the analysis of the dependence of plant productivity from areas of land. Comparison of "adaptive" and "po-tential" structures allows to determine the environmental limits of resistance of landscapes to anthropogenic press..

Keywords: correlation meadows, forests and arable land in agricultural landscapes; structural parameter of degradation of the landscape.

Abbreviations: EHL: Elementary Geochemical Landscapes; AGS: Agro Geo Systems; EGL: Elementary Geochemical Landscapes

Introduction

The idea of zoning of agricultural lands has been expressed in the landscape-geographical concept of Dokuchaev VV [1]. According to Lykov AM et al. [2] evaluation of the ratio of the areas of Autonomous, transitional and accumulative landscapes will objectively determine the necessary combination of the main lands: meadows, forests and arable land. This article covers methodological approaches to determining the ratio of meadows, forests and arable land in typical landscape conditions of Russia's non - black earth zone (large-hilly plains on moraine loams, "opolias" - moraine-erosion plains on pulverized loams and "woodlands" - flat sandy plains). They are based on the analysis of features of micro landscape device of territories and adaptive reactions of plants on parameters of grounds.

The first stage of optimization of the land structure is the study of micro landscape device Agro Geo Systems (AGS). The morphological structure of agro geo systems is characterized, the main parameters of which are the average values of the areas of Elementary Geochemical Landscapes (EGL). There are the main types of EGL:

1. Eluvial, located on the tops of hills and characterized by a downward current of water and nutrients. The balance of matter here is negative.
2. Transit- Occupying slopes of hills and ridges. Their distinctive feature is the lateral (parallel to the surface) transfer of water and nutrients. The balance of the substance here, in the absence of erosion processes, close to neutral.
3. Accumulative-Occupying depression and low places. The main geochemical process here is accumulation of water and nutrients from ground and alluvial waters. The balance of matter in these locations is generally positive.

When describing the natural environment of EGL, in order to determine their limiting effect on the production process of crops, first of all, the factors underlying their agro ecological classification are taken into account [3]. The characteristic is given on the basis of the analysis of field data, literature, stock and statistical materials. On the basis of this information, the analysis of the production potential of the main types of EGL and determine the nature of the potential distribution of

land within the study area. It is caused by the most probable direction of exploitation of the studied EGL.

Summary and Conclusion

Based on the mapping data on the area of EGL and operating characteristics of the land determine "potential" structure of the land. It determines the ratio of the maximum possible areas of land, due to the genetic characteristics of geo systems and their morphological structure. "Potential" structure assumes full use of the territory of the landscape in agricultural production. On its basis it is possible to draw preliminary conclusions about the orientation of the use of territories. For example, the studied geo complexes do not differ significantly in the possible area of arable land, while the nature of the distribution of meadow lands specific geo systems has a significant impact. If on the birefied sediments there is a practical equivalence of the areas of hayfields and pastures, then on the cover loams of the pasture are distributed slightly, due to the strong tendency of these geo systems to erosion, suffocation and water logging and weak resistance to overgrazing.

In the mode of landscape and ecological optimization, in addition to the potential structure, the parameters of the "adaptive" structure of the land are calculated on the basis of statistical analysis of the dependence of crop productivity on the area of land in farms. This structure reflects only the requirements of cultures to the spatial structure of the landscape. In the process of its determination, pair polynomials describing the dependence of crop yield on the parameters of land within the territory are calculated. The optimal values are considered to be the parameters of the land corresponding to the maximum yield of the crop. The inflection points of the limit curve of optimal or critical intervals of parameter values of wetlands. In the case of a graph, the function close to linear is determined only by the general nature of the dependence of productivity on the parameters of the land. When directly proportionate to the increased area of land contributes to increase crop yields, while inversely proportional to the decline.

The dependence of crop yields on the share of arable land in the landscape due to the fact that in small cultivated areas plants suffer more from weeds. Within them it is difficult to apply intensive methods of soil treatment, chemicalization and plant protection. When the share of arable land in the economy exceeds a certain norm, the processes of soil degradation – erosion, water logging, mineralization of humus, etc., increase. Under optimal proportion of arable land in agriculture in most cases there is maximum crop yield, as it creates the best combination of agro-ecological and production factors for its cultivation. The influence of variability in the proportion of hayfields on crop yields can be explained by the fact that, on

the one hand, they have a beneficial effect on the hydrological and thermal conditions of the terrain, contribute to the accumulation of humus in soils, improve soil structure, etc., and on the other, are the source of weeds. The optimal proportion of hayfields favorably affects the microclimate and soil fertility and does not lead to intense clogging of fields. The total share of pastures and hayfields is meadow farmland. In addition to the impact on the energy and hydrology of the landscape, they are sources of organic matter coming in the form of manure on the fields.

The "optimal" structure of the land is determined by comparing the parameters of the "adaptive" and "potential" structures. First, the ratio of arable land an area of "adaptive" and "potential" structures is calculated, which is the coefficient of conversion of land area. Given the close values of these parameters, as is the case in large-scale landscapes, the "adaptive" structure of the land is not subject to significant correction. In "Opole" landscapes the ratio of the area of potential "arable land to the area of "adaptive" is 0.8. This value is the conversion factor for all land. Thus change of their areas does not lead to transformation of ratios of a meadow, the wood and arable land. In cases where within the agro landscape it is impossible to allocate enough space for any type of meadow land clarification of the share of hayfields and pastures is carried out. So in "Opole" landscapes the areas suitable for pastures do not exceed 1.5%, while for the adaptation of crops pastures should occupy 12-14% of the total area of the landscape. In this case, all suitable areas should be taken under cultural pastures, and the deficit of organic fertilizers should be compensated by grazing on deposits and in forests.

Comparison of the parameters of the "adaptive" and "potential" structure of the agro landscape allows determining the ecological boundaries of the territory's resistance to the anthropogenic press. So, if within farms share of arable land is less than the potential value, and its location generally coincides with the potential, we can say that composing his geo complex are in a condition of sustainable ecological balance. When the share of arable land exceeds the potential norm, but does not reach the adaptive, we can talk about the unstable ecological balance in the agro landscape. It can only be maintained by spending additional anthropogenic energy. If the arable land share exceeds the values of the "adaptive" parameter, irreversible degradation changes occur in the landscape.

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