

Research Article

Development of a Territorial Model of Agricultural Land Use on a Landscape-Ecological Basis

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ABSTRACT.

In modern conditions of agricultural land use, one of the main problems is the ignoring of intra-farm land management projects, which is the main reason for the decrease in soil fertility, as well as the development of degradation processes. With common share ownership, it is difficult to develop all the components of the project, but the landscape-ecological approach to organizing the use of arable land and other agricultural lands should be implemented in both large and small agricultural enterprises, which will make it possible to: regulate land use regimes based on their natural properties, landscape features, soil suitability classes; set the allowable parameters of land for economic use; regulate the degree of land use; develop a system of measures to improve the productive properties of land.

Keywords: Landscape-ecological approach, Project of intra-farm land management, Soil suitability classes, Ecological-economic condition of agricultural land, Landscape-ecological mapping of the territory, Sustainable development.

INTRODUCTION

The use of a landscape-ecological approach in addressing issues of organizing the use of agricultural land involves the creation of sustainable land use. A special feature of this approach is the consideration of the suitability classes of soils for agricultural land use. In this regard, the purpose of the study is to develop a territorial model of sustainable agricultural land use on a landscape-ecological basis. As the object of research, the territory of Plemzavod-Yubileiny CJSC was adopted. Based on the goal, the following tasks were solved:

1. Investigate existing methodologies and scientific approaches to the formation of sustainable agricultural land use.

2. Establish the suitability classes of soil for agricultural land use under study.

3. To perform an analysis of the ecological state of agricultural land of the land use under study.

4. Conduct landscape-ecological mapping of the territory.

5. To establish the degree of the ecological and economic condition of agricultural land, to develop a set of measures for their rational use.

When developing a territorial model of agricultural land use, the authors used the following methods: abstract-logical, modeling, calculation varying, and landscape ecological mapping.

RESULTS

The basis for the allocation of suitability classes was the possibility of appropriate use of land for the main types of agricultural land. In the territory of Plemzavod-Yubileiny CJSC, the soils are represented by three suitability classes (Table 1):

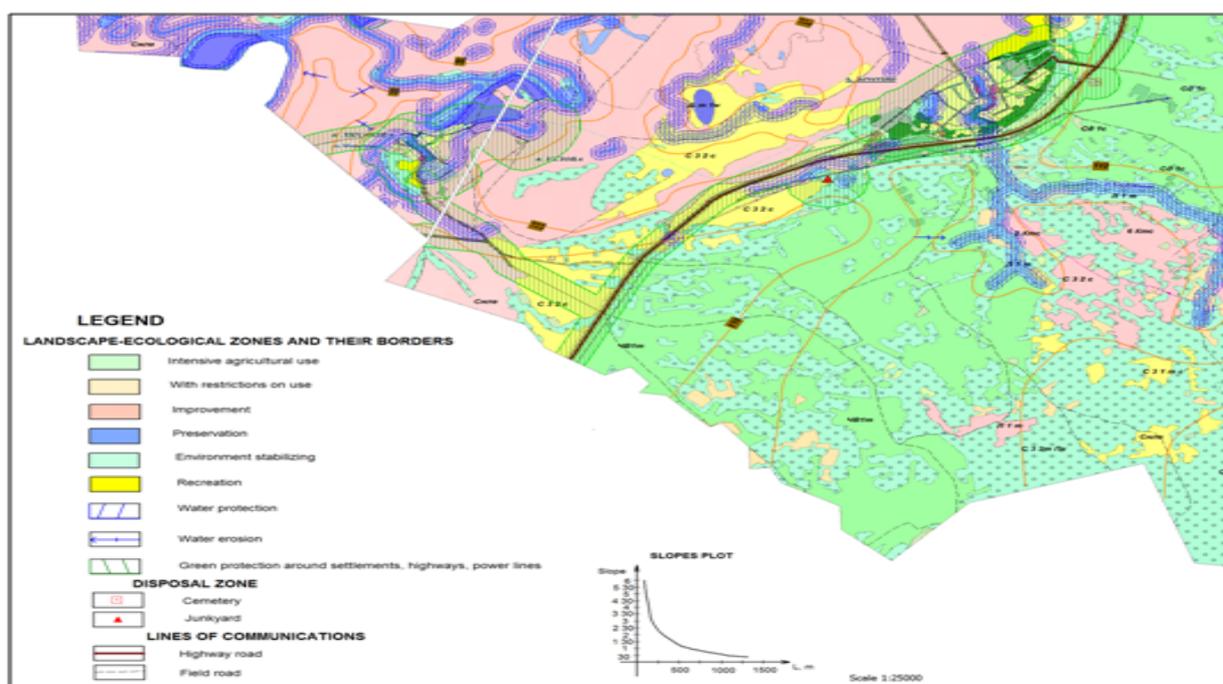
1. The second suitability class is characteristic of lands suitable for arable land with restrictions on use, which require measures aimed at increasing fertility, improving water-physical and other soil properties (black-earth soil, gray forest, meadow, black-earth meadow soils, and salt licks).
2. The third class is represented by lands suitable for forage lands that do not require restrictions in their use (black-earth and meadow soils).

| | | | | | |
|------|--|--|--|--|--|
| land | | | | | |
|------|--|--|--|--|--|

From the data analysis, it follows that: 97% of arable land is suitable for crops after carrying out measures to improve the soil; pastures and hayfields require plastering and liming of the soil.

An analysis of the ecological status of agricultural land has allowed establishing that negative processes in the territory of the land use under study are manifested in weak (29%), moderate (33%), and strong (38%) ecological stresses. To prevent negative processes, it is proposed to develop a project for intra-farm land management on a landscape-ecological basis.

Based on the fact that special attention is paid in this article to the state and prospects for the use of agricultural land, landscape-ecological mapping of the territory has been carried out.



3. The fourth class includes lands that are limitedly suitable for forage lands (salt licks and meadow-boggy soils).

Table 1: Characteristics of the agricultural land suitability

| Land | Agricultural land suitability classes | | | | |
|--------------------|---------------------------------------|-------|-------|----------|---|
| | 1 | 2 | 3 | 4 | 5 |
| Arable land | - | 2,600 | 1,000 | 298.7 | - |
| Hayfield | - | - | 1,964 | 2,752.73 | - |
| Pastureland | - | - | 2,650 | 2,452.42 | - |
| Total agricultural | - | 2,600 | 5,614 | 5,503.55 | - |

Fig. 1: Fragment of the scheme of landscape-ecological mapping

of the territory of Plemzavod-Yubileiny CJSC. As a result of landscape-ecological mapping, the following were identified:

- zone of intensive agricultural use (the area of the zone is 6,106.41 ha, this zone implies any permitted use);
- area with restricted land use (area of 5,585.52 ha, including areas: medium-eroded, medium washed, medium saline);

- recovery zone (5,093.87 ha) with an improvement subzone. The recovery zone involves special measures (phytomeliorative, chemical, recultivation);

-conservation zone (in the northern and north-western areas of agricultural land use, an area of 1,634.16 ha), see Fig.1.

When identifying landscape-ecological zones in the territory of the studied economy, the following is provided: uniformity of landscape-ecological conditions that determine the quality of the natural resource potential; the uniformity of manifestation of negative natural and anthropogenic processes causing different degrees of land degradation; uniformity of use of arable land and fodder lands; condition of land suitability; rationing and regulation of land use modes for medium-stabilizing and environmental protection purposes [1-4].

(54%) confirms that they are not equal in gross output (68%).

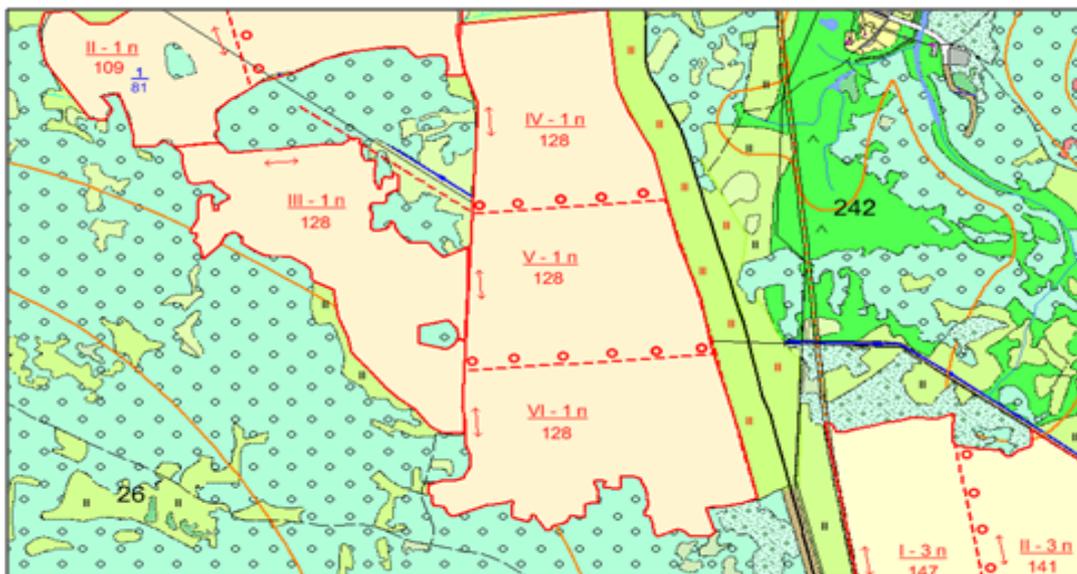
3. The processing direction does not meet the requirements for relief (46%) and the prevailing wind direction.

4. With the manifestation of wind and water erosion, the fields of crop rotations are only 27% protected from harmful winds.

5. Pasture lands are subject to moderate and strong salinization, in the structure of the land there are no pastures of surface and radical improvement.

6. Hayfields have a disseminated, small contour character, prone to salinization, waterlogging and water erosion are used in the system of haymaking.

On the basis of a comprehensive analysis of the organization and ecological-economic condition and use of agricultural land, the following was done (Fig. 2) [2-4]:



Conclusions and Recommendations

When developing a set of measures for the rational use of agricultural land, an analysis was made of the established organization of the use of arable land, hayfields and pastures:

1. All arable lands of the studied farm self-financing enterprise Plemzavod-Yubileiny CJSC are used for monoculture (wheat).
2. The current field road network system, which determined the boundaries of crop rotation fields, indicates that fields are not equal in area, and the inclusion of heterogeneous soils in fields



Field crop rotation (field number, crop rotation number, field area)

Fig. 2 Fragment of the project of intra-farm land management

of the territory of Plemzavod-Yubileiny CJSC.

1. A system of crop rotations has been developed, taking into account the established degree of environmental stress of arable land: field crop rotations have been preserved, out of crop land has been transferred to crop; soil-protective crop

rotations were introduced with a ratio of grain crops and grasses (50%:50%).

2. Fields are designed in accordance with the requirements for them. The following were used as the design methods: traditional (rectilinear), rectilinear strip-contour and a set of contours of arable land.
3. The existing system of field roads was improved, four rows of protective forest stands were projected on crop rotation arrays (12 m wide).
4. The volumes of improvement, transformation, and conservation of land were determined.
5. On the basis of strengthening the feed base, the introduction of beef cattle is planned.
6. The organization and engineering arrangement of forage lands was completed.

The economic efficiency of project activities is determined by the growth of net income; the coefficients of the capital investments effectiveness for a number of activities vary from 0.37 to 0.49. The payback period does not exceed the standard set.

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