LEASECON 2021
Conference on Land Economy and Rural Studies Essentials

MONITORING OF AGRICULTURAL LANDSCAPES TO THE INNOVATIVE DEVELOPMENT OF REGIONS

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Abstract

Innovative development of the regional agro-industrial complex is a combined system of effective use of such components as: integration of education, science and production, the use of scientific and technical potential, and, undoubtedly, technological modernization of the economy through the introduction of innovative technologies. Educational and experimental economies of agricultural higher educational institutions are the accumulating point of interaction of the elements of the integrated system, which allows to trace in the time space the interactions and interrelations between the landscape-forming natural components and the anthropogenic factors of agricultural activity interacting on them. The article considers the role of monitoring of agricultural landscapes of educational and experimental economies of agricultural higher educational institutions in assessing the contribution of educational organizations to the innovative development of regions and the outstripping growth of the agro-industrial complex. For the successful implementation of the modernization of educational and experimental economies into agro-industrial science parks, comprehensive monitoring of agricultural landscapes is necessary, since the development of precision agriculture and landscape agrochemistry in a changing climate is unthinkable without the development of the theory and practice of soil-agrochemical and environmental monitoring. Educational and experimental economies are one of the most dynamically developing production areas of innovative development of the region and the outstripping growth of the agro-industrial complex. A variety of soil and climatic conditions of the location of educational and experimental economies, the availability of the most modern agricultural equipment allow us to introduce scientific developments in many farms of the federal districts.

1. Introduction

Currently, the ownership structure of agricultural land is undergoing major changes. The area of agricultural land has decreased due to intensive, irrational development of agricultural territories. However, it is worth noting that the agricultural lands used by agricultural higher educational institutions as educational and experimental economies have not been reduced for many years.

Awareness of the need to implement the principles of natural and anthropogenic balance of resources in all forms and methods of production brings to the fore the design, even on a group of fields, such as educational and experimental economies of agricultural higher educational institutions, agricultural landscapes and farming systems in their organic interrelation as a fundamental basis for preserving natural resources and increasing land productivity.

2. Problem Statement

Currently, scientists pay close attention to the structure and functioning of agricultural landscapes, and therefore, under the close attention of scientists fall educational and experimental economies of agricultural higher educational institutions, which are the accumulating point of interaction between the integration of education, science and production, the use of scientific and technical potential and technological modernization of the economy through the introduction of innovative technologies. Educational and experimental economies of agricultural higher educational institutions through transformation into agro-industrial science parks can become key structures for promotion and innovation in the agro-industrial complex.

At the same time, for the successful implementation of the modernization of educational and experimental economies into agro-industrial science parks, comprehensive monitoring of agricultural landscapes is necessary, since the development of precision agriculture and landscape agrochemistry in a changing climate, which are the drivers of the advanced growth of the agro-industrial complex, is unthinkable without the development of the theory and practice of soil-agrochemical and environmental monitoring (Chursin, 2013).

3. Research Questions

Currently, an important role in the innovative development of the region and the outstripping growth of the agro-industrial complex is played by educational and experimental economies that combine the main elements of the educational, production and scientific processes of the system of higher agricultural education in Russia. It is the educational and experimental economies that make it possible to introduce the most effective production facilities and technologies to students of the agricultural profile in practice. In particular, bio-energetics is currently actively developing, based on the production and use of biofuels from agricultural waste (Shirokorad, Fadeeva et al., 2020). The production and use of biofuels from agricultural waste should not only meet the special requirements related to the technologies and equipment used, but also take into account the agricultural landscape of the territory.

As of January 01, 2020, the area of agricultural land in Russia was 221955 thousand hectares. Table 1 presents data on the area of agricultural land in the context of agricultural landscapes and federal districts.

Table 1. The area of agricultural land in Russia (Bosalaeva & Zakharova, 2020)

Federal district	Deposit (thousand ha)	Perennial plantings (thousand ha)	Pastures (thousand ha)	Arable land (thousand ha)	Hayfields (thousand ha)	TOTAL (thousand ha)
Central	429.9	530	5876.4	23849.6	2577.4	33263.3
Northwestern	241.4	121.5	1239.6	3422	1801.4	6825.9
Southern	33.2	333.4	13969	18519.6	873.2	33728.4
North Caucasian	23.2	174.5	5717.2	5624.2	553.5	12092.6
Privolzhsky	860.1	367	13866.6	36266.1	3671.7	55031.5
Ural	1042.3	106	3796.4	8234.3	3177.5	16356.5
Siberian	882.8	201.8	15087.3	22671	7009.1	45852
Far Eastern	1417.5	85.8	8845.8	4102.3	4353.4	18804.8
Russia	4930.4	1920	68398.3	122689.1	24017.2	221955

In general, agricultural land accounts for 12.96 % of the total area of Russia.
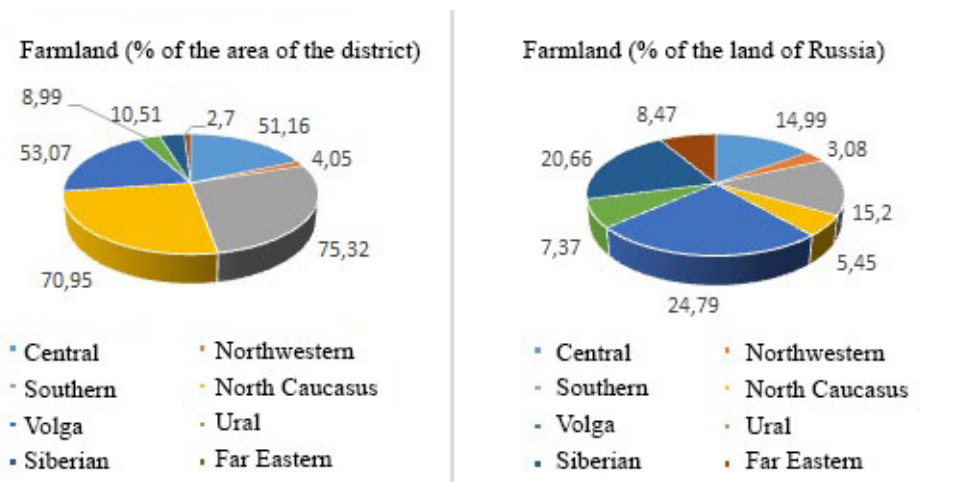

Figure 1. The share of the area of agricultural land in the context of federal districts, % (Bosalaeva & Zakharova, 2020)

The total area of agricultural land of agricultural higher educational institutions is more than 23156 hectares, of which the largest part is concentrated in the Siberian Federal District (Figure 1).
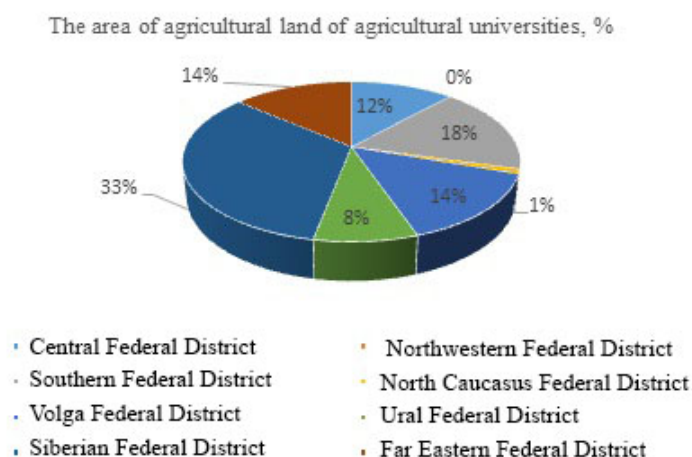
The area of agricultural land of agricultural universities, %

- Central Federal District
- Southern Federal District
- Volga Federal District
- Siberian Federal District
- Northwestern Federal District
- North Caucasus Federal District
- Ural Federal District
- Far Eastern Federal District

Figure 2. The area of agricultural land of agricultural higher educational institutions, ha (Shirokorad, Pafnutova et al., 2020)

4. Purpose of the Study

The article considers the role of monitoring of agricultural landscapes of educational and experimental economies of agricultural higher educational institutions in assessing the contribution of educational organizations to the innovative development of regions and the outstripping growth of the agro-industrial complex.

5. Research Methods

The methodology of studying the ecological situation of agricultural landscapes of educational and experimental economies of agricultural higher educational institutions requires improving the methods of environmental assessment when applying system analysis and using positive domestic and foreign technical experience, which requires the integration of the index of group files by target attribute, their generalization and systematization for possible forecasting and modeling, as a condition, as well as the development of agricultural landscapes, forecasting and prevention of their possible environmental risks in order to eliminate the threat of degradation of agroecosystems as a whole.

This involves the study of existing methodological approaches to the study of ecological agricultural landscapes in the domestic and foreign special scientific literature with the generalization of the methodological experience of leading research and design organizations for the development and improvement of methods for assessing the resource potential of natural agricultural landscapes.

The best tool for selective methodological selection is monitoring and system analysis, which allows you to use the classification features of indicator groups responsible for holocenotic processes that lead to changes in the ecological state of agricultural landscapes; to take inventory and properly organize them when developing a geographical information system of agricultural landscapes; to diagnose and prevent the risks of environmental degradation of agricultural landscapes when using GIT monitoring of agroecosystems; to predict the potential ability of agricultural landscapes to be sustainable (self-

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regulation, restoration, cleaning) to maintain their homeostatic state; identify and plan environmentally optimal environmental and agricultural measures to optimize the ecological state of rural areas (Medvedev et al., 2017).

In this regard, it is necessary: to determine the purpose of methods for diagnosing ecological agricultural landscapes; to identify indicative tasks for combining goals; to systematize object-subject and cause-effect relationships, as well as to conduct a structural and comparative analysis of groups of qualification indicators in order to form the parameters of the research algorithm; to remove duplication of methods in different research methodologies; to replenish stocks with groups of indicators and indices reflecting the integrity of the system research; to develop complex methods of system analysis of the ecological state of agricultural landscapes.

Thus, monitoring and system analysis will take into account various methods of environmental assessment of the agricultural landscape of educational and experimental economies of agricultural higher educational institutions, expanding knowledge about its ecological state in order to determine priority measures to eliminate potential environmental risks and create a program for restoring and preserving natural biodiversity for the sustainability of agroecosystems as a basis; planning a local ecological network; to develop programs for the sustainable development of agricultural landscapes of educational and experimental economies of agricultural higher educational institutions with further planning of environmental management.

6.   Findings

Natural-territorial systems are distinguished by a peculiar combination of their natural components and are located in different geographical conditions. The territory of each agricultural enterprise is characterized only by its characteristic diversity and combination of landscape complexes. Therefore, the landscape approach to land management should take into account the features of landscape differentiation of the territory both in the zonal aspect and in the microzonal aspect - within the morphological structure of a separate agricultural landscape (Denisova, 2021; Loshakov, 2020). The data presented in Table 1, Figures 1, 2 indicate the spread of agricultural land among the climatic zones of Russia, as well as their diversity from the point of view of the agricultural landscape. However, it should be noted that the educational and experimental economies of agricultural higher educational institutions are located in such a way that they allow us to study the characteristics of the agricultural landscape characteristic of the federal district in which agricultural higher educational institutions are located. This aspect allows us to pay special attention to the special features of the agro-industrial complex of a particular region and contribute to its innovative development.

7.   Conclusion

The strategy of advanced development of the agro-industrial complex of both a separate region and the country as a whole is based on innovative processes and research progress, which allow for continuous updating of production based on the latest achievements of science and technology. The development of agro-landscape monitoring of educational and experimental economies of agricultural

higher educational institutions, based on the accumulated positive experience, is intended to become a source of innovative development not only of a separate agro-industrial sector, but also of the region as a whole (Litvinenko & Kiyanova, 2017).

Agro-landscape monitoring contributes to the study of the entire complex of natural resources and natural and geographical conditions and allows the identification of external and internal relationships of morphological parts of the agro-landscape, the knowledge of effective methods for optimizing the potential of agro-landscape zones based on the study of the dynamics of ongoing processes.

The management of agricultural landscapes, their productive, environment-forming and environmental functions, is the most important state task in order to preserve, reproduce and ensure the productive longevity of agricultural lands in Russia, the very basis, the production basis of agriculture. Solving this problem is a key link in ensuring the country's food security.

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