

## Conference Paper

# Land Resources of Alagirskii District As a Factor of Sustainable Development of the Agro-industrial Complex

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## Abstract

The most important condition for the rational organization of the territory is the formation of a morphological appearance, which is distinguished by high productivity, ecological diversity, aesthetic appeal, and will satisfy sanitary and hygienic requirements. The use of land resources in the Alagirskii District of the Republic of North Ossetia-Alania and the development of measures for rational organization of the territory, with the creation of an effective system of land use, evaluation criteria of environmental reliability, social acceptability, economic efficiency and compliance with the legal regime of land use, are a necessary condition for the rational use of land. In this work, materials of land inventory for 2016--2018, data of the committee of land and property relations of the district, statistical data on the effectiveness of agricultural land were used. The developed data allows to establish the optimal ratio of natural ecosystems and agro-ecosystems for this natural-agricultural zone, to establish optimal areas of arable and forage lands that need improvement based on the landscape features of the territory for stability and development of agricultural production.

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## 1. Introduction

For many years, the Republic of North Ossetia-Alania has been considered a territory of active industrial and agricultural production with a well-developed infrastructure and the highest population density in the North Caucasus region. These factors have stirred up a significant degree of technological overload in the natural environment, increasing with each passing year.

At all times the agrarian question occupied the main place in the development of society and the country. The approval of the land code of the Russian Federation and other legislative acts aimed at a radical transformation of financial relations in the village contributed to the development of production based on the diversity of ownership forms and the creation of equal economic conditions for all types of business [1, 2].

## OPEN ACCESS

Fertility determines the value of land as the main resource of agricultural production in a economic activity. Fertility is the ability of the earth (soil) to meet the various needs of plants in nutrients, water, heat, soil, physico-chemical and chemical-biological environment and to ensure high quality products with a bountiful harvest.

For the normal development and growth of plants, improving the quality of the grown crop with obtaining a stable crop collection and avoiding land degradation, it is necessary to resort to integrated accounting of all environmental and agrochemical conditions, as evidenced by domestic and international experience [3, 4].

The need of plants for nutrients, as well as cosmic and terrestrial factors, is caused by the need to create optimal conditions for the growing season of plants, considering various elements (reaction of the soil environment, ecological, phytosanitary, etc.) adapted to specific soil and climatic conditions. Among the necessary chemical elements for normal plant growth, there are (N, P, K, Ca, Mg, S, trace elements) [5, 6].

Monitoring the territory is a prerequisite for protection against negative factors of intense anthropogenic pressure. The system of state monitoring of agricultural land should solve the following tasks:

1. systematic monitoring of changes occurring in agricultural land, detailed analysis of ongoing changes, implementation and development of farming systems and the use of developed improved measures and techniques to improve soil fertility to prevent and eliminate the effects of negative processes;
2. conducting systematic full-scale surveys of soil and vegetation fertility to assess the quality of the land and the effectiveness of the use of agricultural land;
3. maintaining a soil fertility cadastre of agricultural lands and keeping track of their condition using modern geographic information systems, software products (QGIS, Mapinfo);
4. providing user access to databases on the state of agricultural lands;
5. participation in international programs for the implementation of programs for monitoring the use of agricultural territories [7, 8].

One of the issues facing the Ministry of Agriculture of the Russian Federation in the coming years is the creation of regulatory legal frameworks and economic conditions in order to increase the interest of the constituent entities of the Russian Federation,

municipalities and agricultural producers in the development of land reclamation, efficient use of land reclamation objects and reducing the share of state ownership of the Russian Federation. Federations in the total volume of land reclamation facilities [9, 10].

Currently, the study of the state of agricultural land is of relevance, since indicators of their quality state are minimal (soil degradation, deterioration of fertility, low organic matter, etc.).

Of great importance are issues of land protection and their rational use, systematic monitoring of the state of land for the timely detection of changes, their assessment, prevention and elimination of the consequences of negative processes. A very significant aspect of monitoring is the acquisition and improvement of methods for collecting information on agricultural land [11, 12].

Based on the analysis of the literature, the following conclusions were made:

1. use of land should be carried out in ways that ensure the preservation of ecological systems, the ability of land to be a means of production in agriculture and forestry, the basis of economic and other activities;
2. when addressing the issues of organizing the use of land, it is important to know not only the characteristics of its constituent components -- topography, soil, vegetation, hydrology, hydrography, but also, in general, to assess the ecological state as an integrated landscape system.

## 2. Statement of the Problem

The object of our research is the Alagirskii district, the problem under study is the analysis of the use of land resources of the district and the development of measures for the rational organization of the territory, with the creation of an effective land use system.

## 3. Materials and Methods

In the course of the study, materials of the Alagirskii district land inventory for 2016-2018, data from the land and property relations committee for the Alagirskii district of the RNO-Alania and information on the efficiency of agricultural land used by agricultural producers from 9 control agricultural enterprises were used (tabl. 2)

## 4. Discussion of the Results

The territory of the Alagirskii district is located on the northern slopes of the Caucasus Mountains from the Vodorzdelny (Main) in the south to the Wooded ridges on both sides of the Ardon river and part of the Ossetian inclined plain. The climatic conditions of the area are influenced by the surrounding mountains, so the area is characterized by a vertical belt with a large variety of microclimatic zones. The laws of vertical zonality are clearly expressed here, according to which with the ascent of 100 m in the vertical, the air temperature drops to 0.5–0.6 °C. The effect of altitude on average annual air temperatures is well traced; in the foothills at an altitude of 400–700 m, it is 7.5 °C. In mountain basins with altitudes of 800–1000, the air temperature drops to 6.30, and above 2200 m the average annual air temperature values are negative and reach –6.1 °C at an altitude of 3653 m.

The soil cover of the area is represented by the following types and species: leached chernozem, gray forest podzolized, meadow chernozem. Leached chernozems form here on pebbles and on clay. In general, the content of leached chernozem by humus content is classified as moderately humified.

Mountain-valley winds are characteristic of the region. The average annual wind speed in the foothills and mountain valleys is 1.5–2 m/s. During the year, weak winds prevail, 2.0–5.0 m/s.

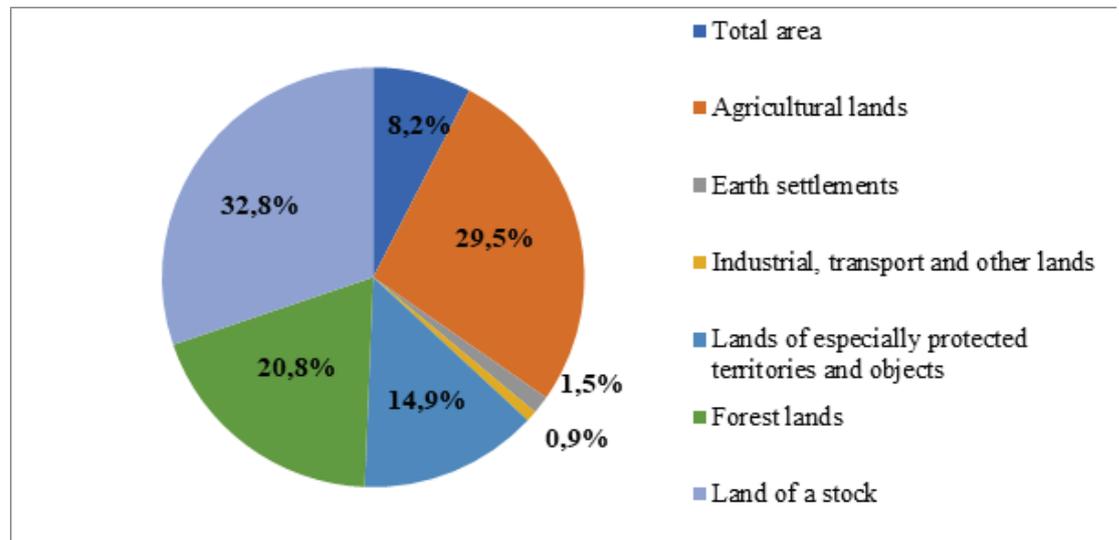
Due to phenic effects, closed mountain valleys and basins are much drier and warmer than the watersheds. Precipitation is associated with northwesterly moist winds, for this reason, the northern slopes (up to 1600 m) receive excessive precipitation. The precipitation is unevenly distributed throughout the year.

The first snow falls at the end of October, the snowfall ends at the end of April. Continuous snow cover is observed from October on the tops, in early December at the bottom of the gorge. The area in winter is avalanche. The depth of snow cover in the area is usually 35–50 cm, but often reaches 2 m or more.

Spring and autumn frosts in the territory of the considered area are noted annually. On the plain part, the duration of the frost-free period averages 190–200 days. In foothill and mountainous areas, depending on elevations, the duration of this period decreases.

As we move from north to south and the elevation of the area above sea level, steppe landscapes give way to forest-steppe, at the front ranges -- forest, in the high mountains -- meadow-steppe and meadow, at an altitude of more than 3700 m. y m. -- snowfields and eternal glaciers.

The population of Alagirskii district has about 40 thousand. The area covers an area of 2135 km<sup>2</sup>, most of it is in the mountainous part of the republic (more than 1/4 of the whole territory of the republic), people. An analysis of the distribution of land in the district by categories showed that 32.8 % of the territory is reserve land, the share of agricultural land is 29.5 %, and the forest fund lands occupy a large area (Fig. 1).



**Figure 1:** Structure of the land fund of Alagir district.

Evaluating the structure of the land fund of the district, it should be noted the need for the redistribution of reserve lands. In the Alagirskii district there are no objective reasons requiring such a large area. A positive trend, in our opinion, is an increase in the area of specially protected areas and objects (14.9 %). Many rare plants and animals listed in the Red Data Book of RNO-Alania grow and inhabit the territory of the region; it is here that the Tseyksy Federal Reserve, the North Ossetian State Reserve is located.

The results of explication of agricultural land are presented in table 1, the main area of arable land agricultural land is 10797.6 hectares or 55.7 %, and 6.9 and 36.4 % are under hayfields and pastures, respectively. Perennial plantings in the area occupy only about 183 hectares, or about 1 %.

There are 52 industrial, one motor transportation and 9 agricultural enterprises in the district. The economic changes that have taken place in the country and the Republic over the past decades have had a significant impact on the development of the agro-industrial complex. Agricultural land, of which there are about 20 thousand hectares, was redistributed between land users and landowners. An analysis of the distribution of the arable land by the forms of ownership and forms of management of the most productive agricultural land clearly demonstrates the need to support small business. Peasant -- farm enterprises occupy only 17 % of arable land in the region, while more

TABLE 1: Explication of agricultural land on 01/01/2019.

No.	Name of land types	Area, ha		Total
		in possession	not burdened	
1	Farmland	19369,72	18105,5	--
1.1	arable land	10797,6	--	--
1.2	hayfields	1338,55	692	2030,5
1.3	pastures	7050,67	17413,5	24464,2
1.4	perennial plantations	182,9	--	--
2	personal subsidiary plot	198,61	--	--
3	other	2,98	--	--
	Total:	19571,31	18105,5	37677

than half (56.2 %) of an arable land is in the use of large agricultural enterprises, for example, Agro-Ir LLC, Akh Master Master Birch LLC (Fig. 2).

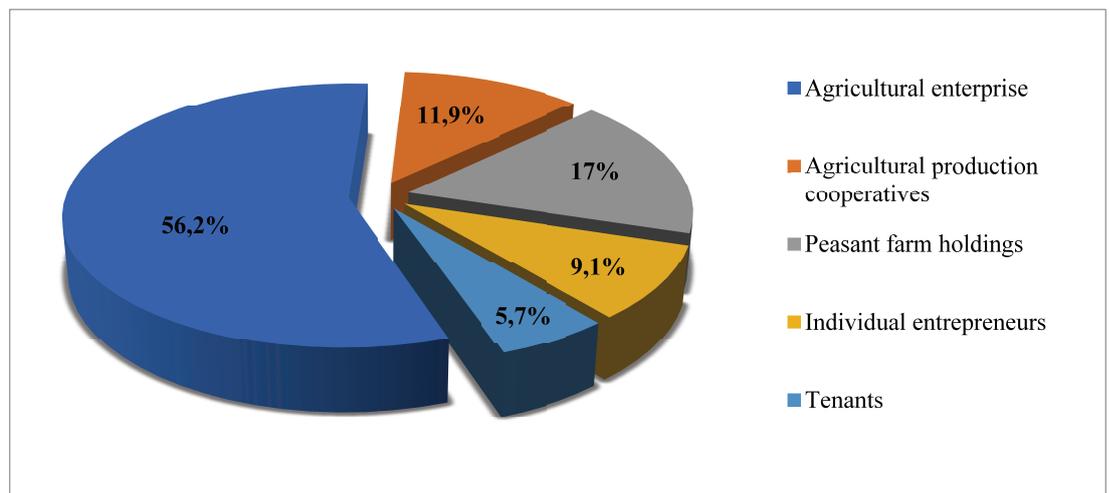


Figure 2: Distribution of arable land area by land users and landowners.

Rational land use is primarily the preservation and improvement of soil fertility and obtaining stable yields in any year according to climatic conditions. Soil fertility largely depends on the conservation of humus, which stimulates the development of plants and microorganisms involved in the conversion of mineral and organic substances in soils. With the existing system of farming in the region, insufficient use of organic fertilizers and relatively low specific weight of perennial grasses in the structure of sown areas, conditions are created for the rapid mineralization of plant residues in soils, weak humification, which is accompanied by a decrease in total humus reserves, and there is a threat of soil degradation -- worsening their physical properties, decrease in natural fertility and efficiency of use of mineral fertilizers. These adverse factors adversely affect

the yield of cultivated crops in several farms, as evidenced by the data in table 2. In Iilas Farm, SEC Niva, Vladka LLC, the yield of maize grain is 44.1–52.7 % lower than with LLC Fat-Agro.

In this regard, the task of research was to improve the organization of land use in the Alagirskii district to ensure food independence, increase the competitiveness of agricultural products based on the innovative development of the agro-industrial complex, ensure the financial sustainability of producers of the agro-industrial complex, create conditions for the preservation and restoration of soil fertility.

To solve the problem, the following questions were studied:

1. obtaining data on the state of the land, its processing;
2. systematic observation of the use of land based on their intended purpose;
3. analysis and assessment of the qualitative state of the territories, considering the influence of natural and anthropogenic conditions;
4. timely detection of changes in the state of the land;
5. elimination of degradation, pollution, cluttering, land disturbances and other negative (harmful) impacts of economic activities;
6. restoration of lands subjected to degradation, pollution, cluttering, disturbance, other negative (harmful) impacts of economic activities;
7. protection of land from the effects of water and wind erosion, mudflows, flooding, waterlogging, re-salinization, desiccation, compaction, contamination by radioactive and chemical substances, littering with industrial waste, pollution, including biogenic pollution, and other negative (harmful) impacts, the result of which is the degradation of territories;
8. detection of the incidence of plants, weed infestation of fields by weeds, shrubs and low forest, other types of land degradation.

In order to maintain and subsequently increase the indicators of soil fertility, protect the soil from water and wind erosion, protect the land from the influence of unfavorable natural and anthropogenic factors in the Alagirskii district, it is necessary to take measures to intensify agricultural production:

1. effectively use arable land with the use of a complex of modern agrotechnical and ameliorative techniques of rational farming;

TABLE 2: Yield and gross yield of main agricultural crops.

Name of company	arable land area, ha	Corn for grain			Potatoes			Perennial plantations		
		Cleaned, ha	Gross yield, t/ha.	Productivity, t/ha	Removed, ha	Gross yield, t/ha.	Productivity, t/ha	Cleaned, ha	Gross yield, t/ha.	Productivity, t/ha
1. Agro-Ir LLC	2000	1985	17468	8,8	15	300	20	--	--	--
2. Fat-Agro LLC	277	100	1163	11,6	87	2879	33	--	--	--
3. Vladka LLC	545	325	2112	6,5	--	--	--	74	300	4,5
4. Druzhba LLC	527	507	3473	6,9	--	--	--	--	--	--
5. Niva (Agricultural Production Cooperative)	110	70	490	7,0	--	--	--	--	--	--
6. Tilan (Agricultural Production Cooperative)	200	100	600	6,0	--	--	--	--	--	--
7. Ilas (Peasant farm holdings)	198	198	1089	5,5	--	--	--	--	--	--
8. Khor (Peasant farm holdings)	253	243	1822	7,5	--	--	--	--	--	--
9. Capital LLC	560	550	3850	7,0	10	210	21	--	--	--

2. reduction of economic burden on the arrays of depleted and degraded lands;
3. transfer of unproductive land to a deposit or reclaimed pastures;
4. in the shortest possible time it is necessary to complete the afforestation of the riverbanks, to carry out reconstruction of degraded forest belts;
5. to prevent contaminated soil, surface and groundwater household and building solid and liquid waste;
6. increase the area of mountain forests and reduce the depletion of their species composition;
7. to stop air and water erosion of plowed lands and downed pastures;
8. to prevent a decrease in the productivity of hayfields and pastures in areas overloaded with livestock;
9. constant study of agricultural land;
10. improve protective afforestation to stabilize soil fertility, create a favorable microclimate in agrocenoses and increase the collection of crop yields;
11. carry out a complex of agrotechnical, phytomeliorative and anti-erosion measures aimed at improving the state of agricultural land, increasing the content of humus and nutrients in the soil, and protecting the soil from erosion and salinization;
12. to move from chemical and technological to adaptive (adapted to nature) intensification of agricultural production by reducing the cost of irreplaceable energy resources (mineral fertilizers, pesticides, fuel, etc.) and more complete use of covered natural resources.

The soil and climatic conditions of the foothill and mountainous parts of the region allow to grow grain, vegetable, fodder crops, as well as perennial fruit (seed, stone fruit), to develop dairy farming. However, the current level of development of the agro-industrial complex of the region does not correspond to its natural-climatic potential. The main reasons for this are the unsatisfactory condition of most agricultural land (70 % of the land is acidified, degraded), problems with seed, organic and mineral fertilizers are not solved, the level of provision and the high wear of agricultural equipment and agricultural assets and peasant farms remain insufficient -- farm farms.

New agrotechnical and organizational technologies are being introduced in agriculture, and farmland is not being used effectively enough. The main production assets in the industrial and housing sectors are practically not updated.

In assessing the ecological status of the lands of the settlements, agricultural and non-agricultural objects were identified that pollute the environment, as well as negative soil processes.

## 5. Conclusion

At the present stage of development of agricultural and other types of production it is necessary to create conditions for high-intensity and at the same time environmentally safe use of natural resources. The organization of the territory should be carried out considering the landscape and regional features of the territory. The most important condition for the rational organization of the territory is the formation of a morphological appearance, which is distinguished by high productivity, ecological diversity, aesthetic appeal, and will satisfy sanitary and hygienic requirements.

In general, project proposals for improving the environmentally sound use of land resources can ensure efficient land use, while respecting the requirements of nature conservation; creation of favorable conditions for rational and equilibrium environmental management; prevent erosion, degradation and other negative anthropogenic and physiographic processes; to establish the optimal ratio of natural ecosystems and agro-ecosystems for this natural-agricultural zone with an optimal composition and ratio of land; to preserve the stability of natural ecosystems in terms of the content of matter, energy, information with rational parameters of all types of agricultural land; to establish optimal areas of arable and forage lands that need improvement based on the landscape features of the territory for the stability and development of agricultural production.

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