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Analysis of the condition of forest shelterbelts of the agro-climatic zone in Stavropol territory using the example of "luch" enterprise of Blagodarnensky region

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Abstract: The development of sustainable management by forest shelterbelts is one of the initial factors in the agricultural and forest sector. A long, productive, economically interesting interrelation of anthropogenesis and forest ecosystems entails a stable management of forest shelterbelts. In order to preserve forest resources and forest areas, a solid foundation is needed to exploit the needs of the future of humanity. The development of indicators of sustainable development of forest ecosystem use is rapidly moving all over the world. Forest shelterbelts have such undeniable features affecting the environmental factor as a unique forest floor, unique herbaceous plants, specific animal world, a rare microclimate, the direction of the soil-forming process, etc. The main economic role of forest plantations is certainly protective. Forest plantations have a positive impact on the state of agricultural land due to the ratio of various forms of land use, as well as the introduction of washed and semi-washed plots into economic circulation. Sometimes, forest belts also get into the risk zone; this can be due to both natural conditions and human exposure.

1. Introduction

Forest shelterbelts plantations are the main part of the system of protection of agricultural landscapes from the effects of droughts, dry winds, dust storms, cold and blizzard winds, as well as preventing soil erosion, regulating the wetting of adjacent areas and contributing to the better economic use of low-productive land. The greatest efficiency of agroforestal plantations is manifested in the case of the formation of a complete interacting system [1, 2].

Contrary to the fertile climate, manifestations of such negative factors as drought, dust storm, and hot wind have a detrimental effect on agriculture in the Stavropol Territory. All of the above processes significantly worsen the condition of agricultural lands, thereby causing harm to forest plantations, which in turn contribute to protective functions [3].

Considering heat, moisture supply, physico-geographical conditions, the Stavropol Territory is divided into four agro-climatic zones, the second of which is grain-sheep (arid), the largest one, in the territory of the region, occupies 36%. The zone includes the Blagodarnensky urban district, the Budyonnovsky municipal district, the Ipatovsky urban district, the Kursky municipal district, the Novoselitsky municipal district, the Petrovsky urban district, the Sovetsky urban district and the Stepnovsky municipal district [4, 5].

Protective forest belts at the age of 30 years in leafy condition reduce wind speed by 33%, wind energy – by 55%. Forest strips in the spring period increase the air temperature by 0.4-0.6 °C. The relative humidity of the air is increased by 2.6-4.0%. In the zone of protection of the bands, evaporation from the water surface decreased by 28-34% [6].

The total area of the zone is 2.4 million hectares. The structure of agricultural lands of the second zone includes: arable land – 1.6 million ha, pastures – 450.5 thousand ha, hayfields – 19.5, a fallow land – 6.5, perennial plantings – 10.9. The quality index of agricultural lands is 42.

The purpose of the research is a modern view of the state of forest belts, the development of methods for monitoring forest belts.

2. Materials and methods

The research results were obtained on the basis of the analysis of experimental data of the authors and the generalization of literature and stock materials. The materials obtained in the studies were analyzed, using analytical, statistical and monitoring methods that provide a representative assessment of the phenomena occurring at the object of study. Comprehensive assessment is given on the basis of taking into account various natural and anthropogenic factors [7].

The study identified the possibility of regional mapping of forests by means and methods of the earth remote sensing, as well as the identification of global changes.

3. Results

In Blagodarnensky urban district, the area of forest shelter plantations is 4963 ha. The afforestation of agricultural lands is 2.2% (Table 1).

Table 1. Quantitative state of the forest shelter plantations of the Blagodarnensky urban district*

District	Area of agricultural lands, thousand ha	The percentage of afforestation	The area of forest shelter plantations according to the results of the inventory, ha	Number of forest shelter belts
Blagodarnensky urban district	226.1	2.2	4963	2303

It is proposed to make their replenishment, felling, stubbing in the volumes indicated in Table 2. As the object of study, the territory of “Luch” enterprise of the Blagodarnensky urban district of the Stavropol Territory was chosen.

Table 2. Forest belts and proposed activities in the Blagodarnensky urban district

District	The number of forest belts,pc	Area, ha	Proposed activities			
			Addition, ha	Thinning, ha	Reforestation, ha	Stubbing, ha
Blagodarnensky urban district	2303	4963.2	478.8	840	4	163

At the time of the study, there were 327.2 ha of forest shelter belts in the farm of “Luch” enterprise. The system of existing forest belts is located in 300-500 m, depending on the terrain [8]. The characteristic of these forest belts on average 45 years of age indicates that their ameliorative and silvicultural condition for such climatic conditions of growth is very satisfactory.

Full-fledged forest belts make up 267.1 ha, or 81.6% of the territory. 108 items total forest belts. Their length is from 583 to 2250 m. The width is from 3 to 24 m. The width and length of a row of forest belts are poorly defined. Species composition - acacia and glaciation. Age from 35 to 45 years. The height of the forest stand is from 6 to 10 m. The diameter is from 18 to 25 cm [9].

Table 3. Forest shelter belts of "Luch" enterprise

	Inventory			
Indicators	2003	%	2018	%
Total area of forest belts, ha	246.5	100	327.2	100
Intact forest area, ha	-	-	267.1	81.6
Area of damaged forest belts, ha	-	-	60.1	18.4

Damaged forest belts make up 60.1 hectares, or 18.4% of the territory. Today, they not only are not tied to the direction of the prevailing winds, but also do not form a complete interacting system.

According to the survey data, the state of a number of forest belts is not satisfactory, a clear dropout of rows in field crop rotations is observed.

Figure 1. Example of damage to the forest belt "Luch" enterprise.

When drawing up the list of works, it is proposed to supplement 13.7 hectares and uproot 14.7 hectares (Table 4).

Table 4. Recommended Activities

Addition, ha	Thinning, ha	Reforestation, ha	Stubbing, ha
13.7	164.5	-	14.7

It is necessary to remove sick, dieback trunks, shoots outside the rows from the forest belts, i.e. to create the necessary construction of the forest belt - openwork, for the full impact of the forest belt in the adjacent territories and for the normal growth and development of the forest belt itself.

During the period from 2006 to 2018, there was an increase in the area of forest belts: 18 m by 72 ha, 12 m by 25 ha. On average, the width of all forest belts increased by 3-4 m due to arable land, which indicates the inefficiency of the use of agricultural land with a high score of bonitet.

Figure 2. The layout of forest belts on the territory of "Luch" enterprise.

Table 5. Dynamics of forest belts areas in the territory of "Luch" enterprise, 2006-2018

No.	Forest belts	Total width, m		Total length, m		Total area, ha		Difference of areas, ha
		2006.	2018.	2006.	2018	2006	2018	
1	18 m	360	380	36000	36000	1296	1368	72
2	12 m	696	928	11020	11020	77	102	25

An inventory of protective forest plantations in the second agro-climatic zone showed that the current state of protective forest plantations within the agricultural enterprise of "Luch" enterprise is generally satisfactory. However, the average age of the forest stand is 40-50 years. Care and sanitary work is carried out extremely irregularly. Most of them are ownerless (without legal status).

4. Conclusion

In order to increase the sustainability of the harvest of the main crops in the area, it is necessary to develop a unified General Scheme of the forest melioration organization. It will provide an opportunity to develop technical projects for protective afforestation within the boundaries of municipalities. To regulate forest management plantations, it is necessary to have a legal basis, and therefore, we propose to make a state cadastral registration of all existing forest plantations.

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