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Analysis of the state of forest shelter belts of the agroclimatic zone III in the South of Russia on the example of agro-enterprise

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Abstract. The article considers the current state of forest shelter belts on the territory of an agricultural enterprise in Petrovsky district. The main species of the breed-containing composition are indicated, the location of forest belts on the farm is revealed, and the age composition is also indicated. A number of specialized measures were proposed that ensure the assessment of the status of forest belts, aimed at their rational use, reproduction and protection, increasing their productivity and sustainability.

1. Introduction

Intensive farming on the slopes leads to the degradation of agricultural lands and the decrease in their productivity in the Stavropol Territory. Thus, the area of eroded lands is 284.1 thousand hectares, deflated - 245.7 thousand hectares. The age of most forest shelter belts is about 50 years. The forest belts here are an effective measure for the protection of crops from many unfavorable external factors. The zones of forest belts have different anti-erosion state and continue to shrink, which threatens the manifestation of soil erosion and the decrease in the yield of agricultural lands. In general, 35–45% of forest belts in the zone are in good condition. However, their health status is unsatisfactory everywhere.

History shows that the first reforestation work in the mid-1820s in the Stavropol province did not give successful results and led to the imminent death of all standing forests. The reason for these failures was the use of unacceptable technologies of planting and selection of forest crops used in the central regions of the Russian Plain, without taking into account the arid climate of Ciscaucasia [1].

The main used tree species are robinia, false acacia, three-blade glaciers, green and ordinary ash trees, pedunculate oak. Apricot vulgaris and cherry plum of different varieties were often introduced into the marginal series as accompanying breeds; tannery and yellow acacia were widely used [2].

Currently, the Stavropol region is working on the establishment of protective forest belts for state cadastral registration. At the same time, up to 90% of forest belts are made into the property of the region. In 2018, the governor of the Stavropol Territory, Vladimir Vladimirov, instructed the regional government to work out issues related to the further exploitation and maintenance of forest belts.

According to the scheme of agroclimatic zoning of the Stavropol Territory, the land use of LLC "Khleborob" under the terms of moisture supply refers to the agroclimatic zone III. The farm often has



strong winds - more than 15 m / s, which adversely affect crops, blow them out and contribute to their lodging.

2. Inventory of forest shelter belts

In the Petrovsky urban district, the area of forest shelter stands is 5118 ha. The afforestation of agricultural lands - 2.2% (table 1).

Table 1. Quantitative state of the shelter forest plantations in the Petrovsky urban district.

District	Area of agricultural lands, (thousand hectares)	The percentage of afforestation	The area of forest shelter plantations according to the results of the inventory, (ha)	Number of forest shelter belts
Petrovsky City District	234,2	2,2	5118	2642

It was also definitely the number of forest shelter belts within the boundaries of the urban district. It is proposed to replenish them on 14 hectares, to perform felling on an area of 1,359 hectares and it is necessary to uproot the forest belt area of 14 hectares (table 2).

Table 2. Forest belts and proposed measures in the Petrovsky urban district.

District	Number of forest belts, (pc)	Area. (ha)	Proposed measures			
			addition, (ha)	thinning, (ha)	reforestation, (ha)	Stubbing, (ha)
Petrovsky City District	2642	5118	14	1359	705	14

At the time of the work it turned out that within the boundaries of land use of LLC Khleborob there are 1,310 hectares of forest shelter belts (table 3). The network of existing forest belts is located every 300–500 m depending on the terrain and divides the fields of field crop rotations into 6–10 working sections (figure 1).

Table 3. Afforestation belts.

Indicators	2018	%
Total area of forest belts, (ha)	1310	100
Intact forest area, (ha)	530	40,5
Area of damaged forest belts, (ha)	760	58
Area of non-existing forest belts, (ha)	20	1,5

The characteristic of these forest belts on average 45 years old indicates that their ameliorative and silvicultural state for such climatic conditions of growth is very unsatisfactory.



Figure 1. Map of 3D model of land use LLC "Khleborob".

Full-fledged forest belts make up 530 hectares, or 40.5% of the territory. Total is 406 units of forest belts. Their length is from 440 to 5000 m. The width is from 3 to 32 m. The width and length of a row of forest belts are poorly defined. The breed composition is represented by the species - white acacia and glaciata. The age of the species is quite high and ranges from 40 to 50 years. The height of the stand is relatively uniform, ranging from 4 to 11 m. The diameter of the stems has an average value - from 22 to 31 cm.

The tree height distributions for the rows are smaller than for the diameter, the values of the coefficients of variability, and their values also decrease with age. The reasons are the same as for the diameter [3].

Damaged forest belts make up 760 hectares, or 58% of the territory. Today, not only they are not tied to the direction of the prevailing winds, but also do not form a complete interacting system (figure 3).



Figure 2. Damaged forest belts. Petrovsky district LLC "Khleborob".

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 2). In turn, indicators of forest belts can significantly affect both the microclimate of their proximity and the condition of crops of agricultural lands.

Forest shelter belts at the age of 30 years old in leafy condition reduce wind speed by 33%, wind energy - by 55%. Forest belts 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 forest shelter belts, evaporation from the water surface decreased by 28-34%.

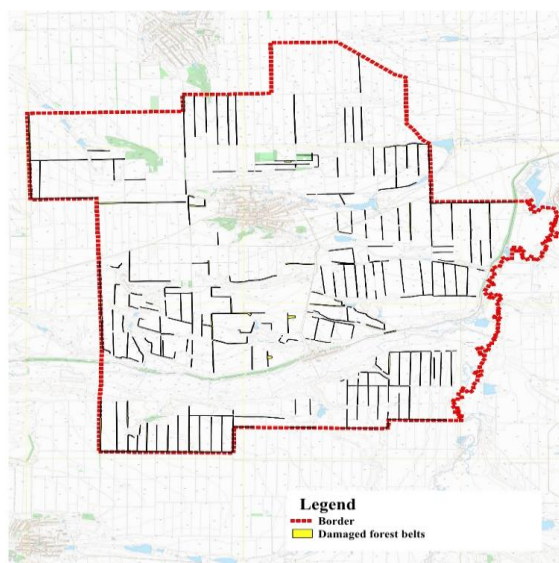


Figure 3. Location scheme of damaged forest belts.

When drawing up the list of works, it is proposed to add 42.15 hectares, remove from the main forest belts (cut for firewood, brushwood) and remove from the forest belts on the area of 530 hectares (table 4).

Table 4. Recommended measures.

Addition, (ha)	Thinning, (ha)	Reforestation, (ha)	Stubbing, (ha)
42,15	530	-	-

It is necessary to clean the sick, dieback trunks, underwood outside the rows of forest belts, i.e. to create the necessary construction of the forest belt - openwork, for the full impact of the forest belt on the adjacent territories and for the normal growth and development of the forest belt itself (table 5).

Table 5. Indicators of openwork construction of forest belts.

Forest belts construction	Clearance area, %		Wind resistance, %	
	between the trunks	in crown	between the trunks	in crown
openwork	15–35	15–35	30–70	30–70

The smallest decrease in wind speed behind the forest belts of this structure is observed at a distance of 2–5 N, and the range of their influence on the windy side is 5–7 N; on the leeward side, to 30–35 N. The total wind protection of the forest belts of the openwork structure is within 25–40% .

The reduction in the area occupied by forest belts can be attributed to natural causes, such as the age of trees, arid climate, but this indicator was particularly affected by the initial level of soil fertility [4].

3. Conclusion

The application of the basic conceptual provisions of agroforestry should ensure a significant environmental and economic effect: increase in yields, additional wetting of the area, lands protection from erosion, increase of biodiversity, an improvement of fauna and local population living conditions, reduction of incidence rate, and subject to the creation of forest shelter belts of various spatial-target forms in full - ensuring active influence on regional microclimatic conditions [5].

References

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