Development of the forest strip network in the territory of the Volokonovsky district by carrying out an adaptive landscape agriculture system

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Abstract. In the last decade of the twentieth century, there have been significant negative transformations of arable land in the main agricultural regions of Russia. Traditional and zonal farming systems were disrupted, extensive agricultural technologies began to prevail with low doses of mineral fertilizers, a sharp reduction in the number of soil treatments and the use of organic fertilizers and ameliorants, disruption of crop rotation, and burning of stubble. Under these conditions, degradation processes have developed extremely strongly: erosion and plowing, dehumification and acidification, alkalinization, and salinization. Many lands turned out to be abandoned, the weediness of crops increased sharply. With a decrease in the real (effective) land fertility and the level of technological culture of agriculture, the profitability of crop production fell sharply. The volume of soil protection and erosion control measures has sharply decreased. Traditional recommendations on soil-protective crop rotations and agrotechnics in the new economic conditions turned out to be practically inaccessible for most farms and cooperative farms, the necessary condition for the survival of which is a quick return on financial investments. The development of agricultural production in the current environmental and economic conditions (the vital need to increase the profitability of production, on the one hand, and a serious aggravation of the agroecological situation and, as a consequence, the increase in environmental and economic risks of production, on the other) requires a transition to adaptive landscape farming systems, which are the next stage of landscape-ecological detailing and economic and economic adaptation of previously developed zonal farming systems.

1. Introduction
Detailed adaptive landscape farming systems are developing practically in all the main natural and agricultural regions of Russia. The methodological and regulatory framework for their formation is being actively developed and tested in several research and educational institutions of the country.
At present, the issues of organizing the rational use and protection of land resources are especially relevant for agricultural regions, which include the Belgorod region.
The need for the formation of plans for adaptive landscape farming systems is determined by the incessant processes of soil degradation, a decrease in their fertility, and a complete shift to the worse side of environmental conditions. The basis for the design of farming systems in the landscape is based on the foundations, the use of which guarantees conditions for the development of soil fertility reproduction as well as sustainable management of the industry: a complex aspect that considers
zoning, adaptability of crops, and technologies for their cultivation to certain conditions of the agricultural landscape, socio-economic expediency, environmental sustainability.

The design of farming systems on a landscape basis is based on principles, the use of which provides conditions for the expanded reproduction of soil fertility and sustainable management of the industry: a systematic approach that considers zoning, adaptability of crops and technologies for their cultivation to specific conditions of the agricultural landscape, socio-economic feasibility, environmental sustainability.

The farming system, as a complex of interrelated agrotechnical, reclamation, as well as organizational and economic measures, should be aimed at efficient use of land, preserving and increasing soil fertility, and obtaining high yields of agricultural crops.

The main property of the landscape is its ecological potential - the ability of the landscape to meet the requirements set by man. Hence, the organization of agroecosystems must be differentiated according to the types and types of landscape, rely on zonal-provincial features, individual properties. In the agricultural landscape, the basis should be the role of protecting and reproducing the potential of soil fertility, depending on which the problems of locating agricultural production, infrastructure development, etc. are solved.

The work aimed to make an inventory of forest belts in all rural settlements of the Volokonovsky district. In the future, a register of planted forest belts will be compiled in the context of settlements in which agricultural enterprises operate. Financial support of measures for the development of forest belts on agricultural land in municipal ownership is carried out at the expense of economic entities. Agroforestry zoning and on-farm zoning of agricultural land in need of protection from erosion, deflation, and drought is extremely important for successful agriculture, ensuring comprehensive accounting and the most complete use of natural and economic resources, improvement and protection of the environment.

2. Materials and methods

In the successful solution of problems in the development of agriculture, the development and development of scientifically grounded agrolandscape farming systems are extremely important. When designing environmentally sustainable sites, it is necessary to consider a few conditions: exposure, relief, soil conditions, reclamation conditions, water balance of the territory, normalized width of the site, the connection of the boundaries of ecologically sustainable areas with natural boundaries.

An analysis of the works of several authors testifies that "a sustainable agricultural landscape can be formed only if the ratio of its main components (arable land, meadows, forests, water) is as close as possible to a natural, natural landscape" [1, 2].

Kiryushin V.I. believed that "an agrolandscape is a landmass consisting of a complex of interrelated natural components, elements of the system and organization of the territory and the general features of the ecological system" [3].

The adaptive landscape orientation of modern farming systems implies the adaptability of production and crop production to various agricultural landscapes, forms of management, levels of material and energy resources, market conditions based on the achievements of agricultural science [4].

Adaptive landscape farming systems are considered the next step in the formation of zonal farming systems. Their creation implies the rational placement of crops and varieties in a certain landscape following their requirements. The zonal system of agriculture was replaced by the concept of adaptive-landscape, meaning adaptation not only to natural but production factors [5].

3. Research Questions

Most of the Volokonovsky district is occupied by arable land. Large forests are confined mainly to the Oskol river valley and are oak forests and pine forests.
Figure 1. Schematic map of the steepness of slopes within the Volokonovsky urban settlement

From Table 1 in the structure of the land fund of the Volokonovsky district the main share is occupied by agricultural land - 109131 hectares (85%).

Table 1. Distribution of lands in Volokonovsky district by category, ha

| Category                        | Ha   |
|---------------------------------|------|
| Agricultural land               | 109139 |
| Lands of settlements            | 11690 |
| Industrial land                 | 1216  |
| Lands of specially protected areas and objects | 2 |
| Forest land                     | 6719  |

Table 2 shows the distribution of lands in the Volokonovsky district by category and land.
Table 2. Distribution of lands in Volokonovsky district by category

| land category                              | arable land, ha | perennial plantations, ha | hayfields, ha | pastures, ha | total, ha |
|--------------------------------------------|-----------------|---------------------------|---------------|--------------|-----------|
| agricultural land                          | 78165           | 705                       | 1969          | 16710        | 109139    |
| lands of settlements                       | 4967            | 243                       | 651           | 1864         | 11690     |
| industrial land                            | 4               | -                         | 12            | 101          | 1216      |
| lands of specially protected areas and     | -               | -                         | -             | -            | 2         |
| objects                                    | -               | -                         | -             | -            |           |
| forest land                                | -               | -                         | -             | -            | 6719      |

The table shows that most of it falls on arable land - 78165 hectares (94%) in agricultural lands, 4967 hectares (6%) in the lands of settlements, and 4 hectares (0.005%) in industrial lands. The next in terms of area is pastures, in agricultural land they are located on 16710 hectares (89.5%), in the lands of settlements on 1864 hectares (10%), in industrial lands on 101 hectares (0.5%).

Figure 2 shows the following distribution of soil types in the context of administrative districts.

Hayfields account for 1,969 hectares (74.8%) in agricultural lands, 651 hectares (24.8%) in settlements and 12 hectares (0.5%) in industrial lands. The smallest area of land is occupied by perennial plantations - 705 hectares (74.4%) in agricultural lands, 245 hectares (24.6%) in the lands of settlements.

A total of 11,923.81 ha (53.24%) of arable land subject to erosion on the territory of the Volokonovsky district: of which 10228.12 ha (45.67%) are weakly washed out, 1695.69 ha (7.57%) are moderately and strongly washed away. Erosion-hazardous soils are located on slopes with a steepness of 1-3 ° and occupy an area of 6034.02 hectares (26.94%).
Agriculture is a priority sector of the Russian economy, as it helps to ensure the country's food security. The Belgorod region is one of the leading regions in the country to produce the main types of agricultural products. To a large extent, it was the presence of chernozems that determined the development of its agro-industrial complex.

There are several main agricultural enterprises in the Volokonovsky district:
1) Rusagro-Invest Yutanovskoye;
2) Rusagro-Invest Pokrovskoe;
3) LLC Krasnogvardeyskaya Grain Company.

In the Volokonovsky District, most of the agricultural land is owned by Rusagro-Invest LLC. LLC Rusagro-Invest Pokrovskoe is in the village of Pokrovka, located in the western part of the Volokonovsky district at 130.0 km from the city of Belgorod. LLC Rusagro-Invest Yutanovskoye is in the village of Yutanovka, located in the western part of the Volokonovsky district, at 120.0 km from the city of Belgorod.

The land use of LLC Rusagro-Invest Pokrovskoe and Yutanovskoe for 2018 includes 26678.0 hectares and 31834.0 agricultural lands, a detailed explication of which is presented in Table 3.

| name of land       | area, ha | Pokrovskoe | Yutanovskoe | Total   |
|-------------------|----------|------------|-------------|---------|
| arable land       |          | 22396,0    | 31834,0     | 54230,0 |
| perennial plantings |        | 162,0      | -           | 162,0   |
| hayfields         |          | 625,0      | -           | 625,0   |
| pastures          |          | 3495,0     | -           | 34950,0 |

The design of farming systems on a landscape basis is based on principles, the use of which provides conditions for the expanded reproduction of soil fertility and sustainable management of the industry: a systematic approach that considers zoning, adaptability of crops and technologies for their cultivation to specific conditions of the agricultural landscape, socio-economic feasibility, environmental sustainability.

The underlying principles include the following provisions:
- the formation of an environmentally friendly architecture of the agricultural landscape;
- placement of crops, considering the distinctive features of the agricultural landscape and their genetic potential;
- forest reclamation soil protection measures.

Forest reclamation plantations, in combination with other measures, protect the soil from wind and water erosion, increase the moisture content of the fields, and weaken the harmful effects of droughts. Agroforestry of fields increases the effectiveness of the use of various agrotechnical methods, improves the relief, and improves the human environment.

The greatest reclamation effect is achieved when plantings form a system of protective plantings, rather than isolated plantings.

Shelter forest belts protect the soil from erosion, retaining surface runoff, improve its water supply, which increases soil fertility, improves climatic and hydrological conditions, weakening the influence of droughts and dry winds, and increases the yield of agricultural crops. According to long-term experimental data, the harvests in the fields located among the forest belts are 20 - 25% higher than in the area [6].

In the future, a system of forest plantations is envisaged throughout the territory of the Volokonovsky district, which, in combination with other measures, will improve soil fertility. Currently, we have found that the forest belts are in an extremely unsatisfactory condition. This causes
uneven distribution of snow in the fields in winter, in spring, respectively, uneven distribution of moisture, and blowing out of seeds. The implementation of this project will improve the condition of the soil. An equally important result of the maintenance and reproduction of forest belts is the creation of conditions for the development of fauna (there is an opportunity for movement and seasonal migration of animals and birds) [7, 8].

The economic efficiency of the projected activities is calculated as the ratio of costs and benefits. Costs are determined for all types of work performed. The implementation of many forestry activities requires monetary investments (in the purchase of new machinery and equipment, the cultivation of forest planting material).

In the Volokonovsky district, measures will be taken to plant and sow cultivated tree species. The total number of new forest belts will be 511, of which 291 are protective, 204 flow-regulating, and 16 forest belts will be repaired.

Financial support of measures for the development of forest belts on agricultural land in municipal ownership is carried out at the expense of economic entities. The project provides for the use of funds for 35 million 200 thousand rubles. Of them:
1) 14 million 516 thousand 800 rubles Rusagro-Invest Yutanovskoye;
2) 11 million 183 thousand 400 rubles Rusagro-Invest Pokrovskoye;
3) 9 million 500 thousand rubles of OOO Eastern Grain Company.

As a result of studying the materials of the soil and landscape conditions of the lands used in the Volokonovsky district, it is envisaged to create 677.0 hectares of protective forest belts (Table 4).

| forest belts | Pokrovskoe, ha | Yutanovskoe, ha | Total |
|--------------|----------------|-----------------|-------|
| near-border  | 211,3          | 274,7           | 486   |
| stock-regulating | 81,0        | 107,1           | 188,1 |
| repair of forest belts in the area | 4,7 | 7,2 | 11,9 |
| Total        | 297,0          | 380,0           | 677   |

On average, the load of forest reclamation activities will be 137.9 hectares per year in the period 2018 - 2022. The species composition of forest belts is determined following the compatibility of forest species and forest growing conditions at each site, considering the availability of planting material for the forestry enterprises of the region.

When assessing the economic efficiency of forest reclamation, many more of its other influences must be considered. Forest plantations, lowering the surface runoff of water, trap the solid particles of soil entrained by them and thereby protect reservoirs from siltation, increasing groundwater runoff, improve water supply to territories and increase summer runoff in rivers.

4. Conclusion
Currently, we have found that the forest belts are in an extremely unsatisfactory condition. The forest strips of the openwork-blown structure turned into solid - windproof structures, that is, thickets. This causes uneven distribution of snow in the fields in winter, in spring, respectively, uneven distribution of moisture, and blowing out of seeds. Restoration of forest shelter plantations should include the following principles:
1. Consider protective forest belts as an essential component of sustainable agricultural production.
2. Carrying out a complete inventory of the existing forest shelter plantations, determining their condition, and a plan for the reconstruction of each agricultural contour.
3. The total value of agricultural land must be established considering the presence and condition of protective forest plantations.
4. Make the users of agricultural land responsible for the condition of protective forest plantations.

An increase in the total forest cover of the territory of the Russian Federation, the creation of new protective forest plantations is a state task that must be fulfilled by state forestry enterprises on lands that have left their agricultural use.

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