The current state of irrigation reclamation in the Omsk region

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Abstract. The results of a survey of irrigated lands in the Omsk region are presented. As of January 1, 2021, more than 78 thousand hectares of arable land were classified as irrigated, while in fact no more than 15 thousand hectares were irrigated in recent years. For the effective use of irrigation systems in the region, it is necessary to carry out a number of measures for their repair and reconstruction. Irrigation systems, which in the past provided irrigation on 33 thousand hectares of this area, for various reasons, cannot be restored, and on 34 thousand hectares, major repairs are required.

1. Introduction
The productivity of agricultural crops is due to a complex of natural and agrotechnical factors, including the provision of plants with water and nutrients [1, 2]. The need for water in agricultural crops varies greatly, reaching 1.5-2.0 for drought-resistant crops, and 5-8 thousand m3 / ha for moisture-loving crops [3, 4]. Plants consume moisture throughout their life, it is especially important to provide them with water during critical periods of development, when the need for it is greatest. Increased sensitivity to a lack of moisture occurs during a period of intense morphogenesis, differentiation and maximum growth of reproductive organs of plants, when a high level of physiological and biochemical processes in meristem cells, their rapid division and strong elongation require an optimal amount of water, and any deviation from the optimum significantly disrupts synthetic and shaping processes.

In areas of insufficient and unstable moisture, irrigation, as a reclamation method, is the main means of artificially increasing the natural potential of lands and increasing their productivity [5, 6]. In this regard, irrigated agriculture is an integral part of general agriculture, with the specific goal of increasing the yield of agricultural crops and the quality of the crop based on methods and technologies for growing crops that guarantee the rational use of natural resources [7].

The history of the development of agricultural land irrigation goes back over a hundred years. Even in ancient times, people created irrigation systems in the valleys of various rivers in South America and Southeast Asia, arid regions of Mexico and other countries. Irrigation made it possible not only to ensure high yields, but also determined the stability of the development of entire countries and civilizations.

Irrigation in our country is of great importance, since arable chernozems are located mainly in the steppe and forest-steppe zones. Vast areas of fertile soils are in arid and semi-arid conditions, where the yield of agricultural crops fluctuates sharply and decreases with the onset of drought by 2 times or more. The focus on the production of water-intensive crops has led to extremely high water consumption in agricultural production. The vast majority of water is used for the needs of irrigated agriculture in the arid zone. In conditions of an arid climate, water shortage, and imperfect irrigation infrastructure, this
leads to a large withdrawal of water resources. The most important task is the use of water-saving irrigation while obtaining high and stable crop yields.

The leaders in the world in terms of the amount of irrigated land are China, India and the United States. In Russia, the potential of this type of reclamation is not fully disclosed, the area of irrigated and drained lands currently accounts for about 4% of the total arable land. Most of the land is characterized by unfavorable climatic conditions. For example, the share of US territories with less than 400 mm of precipitation per year is 1.1%, and in Russia - 40%, the share of farmland with 700 mm or more precipitation in the US is 60%, and in Russia only 11% [8].

2. Materials and methods
The research was carried out in the municipal districts of the Omsk region in various natural and climatic zones (steppe, southern forest-steppe, northern forest-steppe) with irrigated lands.

The purpose of the work is to monitor reclaimed landscapes to increase the productivity of agricultural lands based on the development of scientifically grounded adaptive farming systems, preservation of soil fertility, and the use of environmentally friendly technologies in crop production.

Visits were made to farms with reclaimed land, monitoring of the condition of irrigation land in various regions, sampling of soil samples and ground water to determine fertility indicators was carried out.

3. Results of research
In the Omsk region in the 50s of the last century, the irrigated fund reached 2 thousand hectares, and by 1967 - 2.5 thousand hectares. Irrigation was continued mainly in the suburban area of Omsk. During the years of intensive development of land reclamation in the region, a number of relatively large irrigation systems were built, and by 1990 the area of irrigated land had increased to 115 thousand hectares. In 1978, an eight-field crop rotation was laid at the Federal State Budgetary Scientific Institution "Omsk ASC" for scientific support of irrigated agriculture and revealing the direction of changes in soil fertility indicators under prolonged anthropogenic load on agricultural landscapes. Experiments also develop agricultural technologies for forage (perennial and annual grasses), grain and leguminous crops [9-11].

At the current stage of development of irrigation in the Omsk region, according to the Federal State Budgetary Institution "Omskmeliovodkhoz" (as of January 1, 2021), irrigated land is 78864 hectares, or 2.3% of the arable land area (table 1). At the same time, according to scientists [8], for sustainable development of agricultural production, it is necessary to have about 10% of irrigated land from the area of agricultural land. As a result of the survey of irrigation systems, it was found that almost 33 thousand hectares of this area, for various reasons, cannot be restored, and over 34 thousand hectares require major repairs. In fact, in recent years, no more than 15 thousand hectares have been irrigated in the region.

| Name of the Municipal District | Total   | Watered | Not watered | Can't be restored | To be restored |
|-------------------------------|---------|---------|-------------|------------------|---------------|
| Novovarshavsky                | 3680    | 440     | 3240        | 500              | 2680          |
| Tavricheskoy                  | 9225    | 570     | 8655        | 3228             | 5378          |
| Cherlaksky                    | 8060    | 187     | 7873        | 7170             | 840           |
| Azovskoy                      | 1586    | 0       | 1586        | 492              | 1094          |
| Kalachinsky                   | 2367    | 140     | 2227        | 1267             | 554           |
| Lyubinsky                     | 3890    | 0       | 3890        | 0                | 3890          |
| Omsky                         | 37045   | 5323    | 31722       | 9439             | 18549         |
| Bolsherechensky               | 2113    | 0       | 2113        | 747              | 1366          |
| Gorkovskoy                    | 3117    | 0       | 3117        | 3117             | 0             |
| Nizhneomsky                   | 6706    | 0       | 6706        | 6706             | 0             |
| Sargatsky                     | 683     | 240     | 443         | 0                | 143           |
| Tyukalinsky                   | 248     | 0       | 248         | 248              | 0             |
| Omsk city                     | 144     | 0       | 144         | 0                | 144           |
| Total by region               | 78864   | 6726    | 72138       | 32914            | 34638         |
Currently, the restoration of the reclamation industry is taking place thanks to the target subprogram "Development of reclamation of agricultural lands". All this is possible with the coordinated work of the Ministry of Agriculture and Food of the Omsk Region, agricultural producers, the Federal State Budgetary Institution "Omskmeliovodkhoz" with the scientific support of the industry.

The main directions of state support for agricultural producers are determined by the state program of the Omsk region "Development of agriculture and regulation of markets for agricultural products, raw materials and foodstuffs of the Omsk region", approved by the Government of the Omsk region dated October 15, 2013 No. 252-p (hereinafter - the Program).

Provided that the financing of the Program is preserved, it is possible to commission additional areas of irrigated land in various soil and climatic zones of the Omsk region. In the steppe zone, there are potential opportunities for expanding the irrigated area at the Siberian irrigation system of the Novovarshavsky region - up to 900 hectares; Solyanovskaya irrigation system of Cherlaksky district - up to 565 hectares; Tavricheskaya irrigation system Tavrichesky district PS II-1 and PS II-2 - up to 1800 and 2265 hectares, respectively (figure 1, 2).

![Location of irrigation systems in the Omsk region](image-url)

**Figure 1.** Location of irrigation systems in the Omsk region.
Figure 2. Serviceable irrigation systems in the Omsk region.

The main array of irrigated land is located in the southern forest-steppe zone of the Omsk region. Reconstruction measures in the Omsk municipal district at the Achairskaya irrigation system will increase the irrigated area up to 1000 hectares; Pokrovskaya irrigation system - up to 1100 hectares; Novooomskaya irrigation system - up to 950 hectares; Pushkin irrigation system - up to 600 hectares; Krasnogorsk irrigation system - up to 1,500 hectares; Krasnoyarsk irrigation system - up to 1800 hectares; Druzhba irrigation system - up to 1300 hectares; at the Lyubinskaya irrigation system and Rassvetovskaya irrigation system in the Lyubinsky District - up to 1100 and 500 hectares, respectively.

In the northern forest-steppe zone, irrigated areas are insignificant due to the high moisture supply in recent years. Potential opportunities for commissioning additional areas are possible at the Irtyskh irrigation system of the Gorkovsky District - up to 2000 hectares; Bolsherechenskaya irrigation system of Bolsherechensky district - 820 hectares.

4. Conclusions
The subprogram "Development of reclamation of agricultural lands" provides for measures aimed at restoring the reclamation fund (reclaimed lands and reclamation systems), including the implementation
of measures for irrigation and drainage of lands, increasing the productive potential of reclaimed lands and the efficient use of natural resources, increasing the area of reclaimed lands.

Farming on irrigated land gives full effect if reclamation measures correspond to the biological characteristics of crops and are combined with innovative agricultural technology. For the effective use of irrigation systems in the region, it is necessary to carry out a number of measures for their repair and reconstruction.

References
[1] Kuderyarov V N 2019 Soil-biogeochemical aspects of arable farming in the Russian Federation *Euras. soil sci.* 1 94–104
[2] Boiko V S, Yakimenko V N and Timokhin A Y 2019 The change in potassium status of soils of forest-steppe of Western Siberia in long-term agricultural use *Ecol. and Ind. of Rus.* 23(11) 66–71
[3] Chekusov M S et al. 2020 *The system of adaptive farming in the Omsk region* (Omsk: Maksheeva E A) p 522
[4] Boiko V S et al. 2018 *Improvement of the farming system on the reclaimed lands of the Omsk region* (Omsk: Maksheeva E A) p 32
[5] Dubenok N N, Borodychev V V, Lytov M N and Belik O A 2009 Peculiarities of soil water regime during drip irrigation of agricultural crops *Achiev. of sci. and tech. of the agroind. compl.* 4 22–25.
[6] Kireicheva L V, Yurchenko I F and Yashin V M 2017 *Scientific basis for the creation and management of reclamation systems in Russia* (Moscow: All-Russian Scientific Research Institute of Agrochemistry) p 296
[7] Yakimenko V N, Konarbaeva G A, Boiko V S, and Timokhin A Y 2020 Ecological evaluation of the content of heavy metals in soils of agrocenosis of western siberia *Ecol. and Ind. of Rus.* 24(12) 52-57
[8] 2008 *Irrigation of lands in ensuring food security in Russia* (Volgograd: RRIIA) p 205