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Structural Changes in Reclamation Lands and Their Efficient Utilization

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ABSTRACT: This article discusses the quantitative and qualitative changes in agricultural lands under reclamation, measures implemented to improve their reclamation status, and an analysis of changes in the composition of lands with poor reclamation conditions across different land fund categories.

KEY WORDS: salinization, waterlogging, degradation, reclaimed lands, land fund, irrigation systems, soil fertility, water erosion, groundwater.

I.INTRODUCTION

Improving the reclamation condition of irrigated lands, developing reclamation and irrigation infrastructure, and introducing intensive agricultural methods, particularly modern water- and resource-saving agro-technologies, as well as utilizing high-productivity agricultural machinery, are of great importance.

In recent years, the impact of global climate change and the Aral Sea disaster on agricultural development and people's livelihoods has necessitated the implementation of systematic measures to mitigate these negative effects.

Special attention is being given to promoting research and innovation, creating effective mechanisms for integrating scientific and technological advancements into practice, and establishing specialized scientific-experimental laboratories, high-tech centers, and technoparks within universities and research institutions.

At present, land reclamation and soil conservation are among the key state-level priorities. Addressing these challenges requires environmental protection measures, which are aimed at enhancing the efficiency of agricultural production.

II. LITERATURE REVIEW

The quantitative condition of reclaimed lands plays a crucial role in ensuring the efficient use of natural resources. The reclamation state of land is influenced by salinization, waterlogging, degradation, and other environmental factors, and assessing their extent requires taking into account several key factors.

1. Soil salinization worsens the reclamation condition of land as it reduces plant adaptability. Typically, saline soils can constitute 20-30% of the total land area. In such cases, reclamation measures, including ensuring the full functionality of drainage and irrigation networks, are necessary.
2. Waterlogging negatively affects plant growth. The proportion of waterlogged land can reach 10-15%, in which case the effective use of drainage systems is essential.
3. Land degradation is the deterioration of physical and chemical properties of soil, leading to a decline in productivity. The area affected by degradation can range from 20-40%. Reclamation measures should be implemented on such lands.
4. Reclamation measures aimed at improving land conditions include establishing drainage systems, properly organizing irrigation, and reducing soil salinity through planned interventions. Following these measures, the reclamation condition of lands improves, potentially enhancing the condition of up to 50% of previously degraded lands.

As of **January 1, 2024**, the total area of cultivated land in the Republic of Uzbekistan is **4,028.6 thousand hectares**, including **3,245.1 thousand hectares** of irrigated farmland. The total area of land with poor reclamation conditions amounts to **415.8 thousand hectares.**

Compared to **2010,** the area of land with poor reclamation conditions has increased in **2024** (*Table 1*).

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According to monitoring analysis over the past **15 years**, the area of land with poor reclamation conditions increased by **36 thousand hectares** between **2010 and 2016.** However, from **2017 to 2024**, this area decreased by **6.5 thousand hectares.**

As indicated above, the increase in poorly reclaimed land between **2010 and 2016** can be attributed to factors such as the **insufficient water supply** for irrigation due to water shortages, **deterioration of internal irrigation canals and flume systems,** and the **inability to deliver water to irrigated fields.** Additionally, the **rapid growth of the population** in Uzbekistan led to the conversion of agricultural lands into other categories, further deteriorating land reclamation conditions. As a result, a portion of agricultural land was withdrawn from agricultural circulation.

The decrease in poorly reclaimed land between **2017 and 2024** is associated with the restoration and cleaning of irrigation facilities.

Changes in the Area of Poorly Reclaimed Lands Across Land Fund Categories (2010–2024)
(thousand hectares)

T/p	Land Fund Categories	Land Areas as of January 1 of the Respective Years															
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Difference to 2010 (+;-)
1	Agricultural land	380,1	387,8	395,7	390,8	391,8	391,4	416,3	423	422,9	423	419,7	419,5	417	415	413,6	**+33,5**
2	Land of settlements (residential areas)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3	Land designated for industry, transport, defense, communications, and other purposes	-	-	-	-	-	-	-	-	-	-	-	-	0,1	0,1	0,1	
4	Land for environmental protection, health improvement, and recreational purposes	-	-	-	-	-	-	-	-	-	-	-	-	0,2	-	-	
6	Forest fund land	1,0	1,3	1,5	1,5	1,6	1,6	0,6	1,8	1,2	1,4	1,9	1,7	1,7	1,7	1,8	**+0,8**
7	Water fund land	0,1	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	**+0,1**
8	Reserve land	0,1	0,2	0,2	0,2	0,1	0,1	0,2		0,1	0,2	0,2	0,2	0,1	0,1	0,1	

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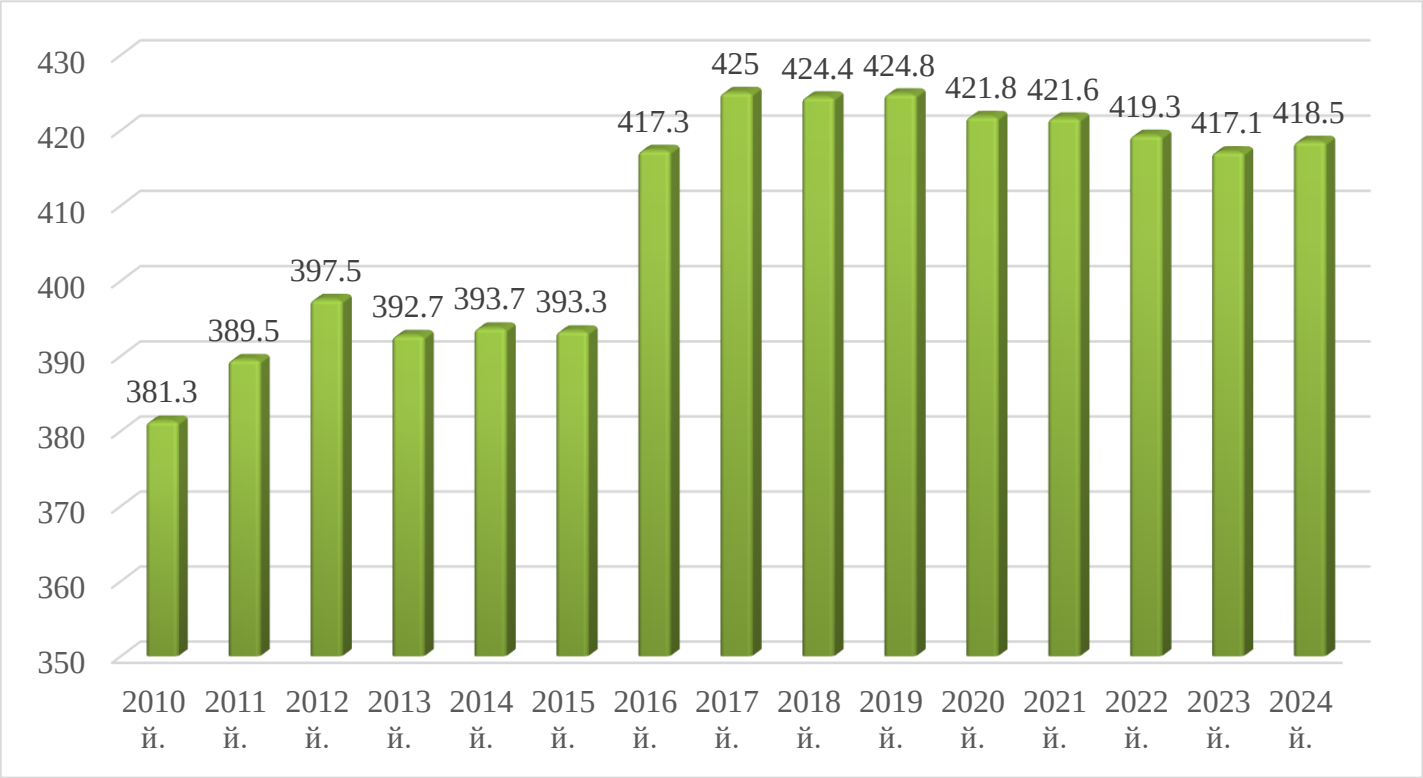
	Total land	**381,3**	**389,5**	**397,5**	**392,7**	**393,7**	**393,3**	**417,3**	**425,0**	**424,4**	**424,8**	**421,8**	**421,6**	**419,3**	**417,1**	**418,5**	**+37,2**

Picture 1. Dynamics of Changes in the Area of Poorly Reclaimed Lands Across Land Fund Categories by Year



This decrease is attributed to the restoration and regulation of irrigation facilities and the implementation of water-saving technologies in cultivated lands.

The quantitative changes in poorly reclaimed lands from 2010 to 2024 are presented in *Table 1* and *Figure 1*.

According to analytical monitoring data, in 2010, 1.0 thousand hectares of forest fund land were classified as having poor reclamation conditions, while by 2024, this figure increased to 1.8 thousand hectares (*Table 1*).

Analyzing changes in poorly reclaimed lands across different land fund categories, we observe that in 2024, agricultural land increased by 33.5 hectares, forest fund land increased by 0.8 hectares, and water fund land increased by 0.1 hectares. However, no significant changes were recorded in reserve lands (*Table 1 and Figure 1*).

It is well known that in agriculture, the development of crop farming, improving soil fertility in erosion-affected lands, and enhancing the reclamation condition of soils through modern innovative technologies are among the key objectives. The majority of irrigated lands in Uzbekistan are located on foothill slopes, making them more susceptible to irrigation-induced erosion. The degradation of the topsoil layer due to irrigation leads to a decline in crop yields and soil fertility. Therefore, in such farming systems, it is essential to use intensive farming methods and modern innovative technologies to restore soil fertility.

Based on these considerations, field experiments were conducted using effective innovative methods to restore soil fertility in irrigation-eroded lands and increase cotton yield.

The quality of land is determined by factors such as soil salinity, nutrient availability, topography, and reclamation conditions. More than half of irrigated soils in Uzbekistan have a relatively high soil quality rating (bonitet). However, in the process of soil salinization, anthropogenic factors have a greater impact than natural ones.

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One of the key components of the State Land Cadastre is the soil quality rating (bonitet evaluation), which plays an essential role. Today, evaluating the quality of irrigated lands in existing farms and using this data to determine crop productivity remains one of the most pressing issues. The bonitet evaluation data is also utilized for various agricultural planning and management purposes.

The Land Code of the Republic of Uzbekistan, the Law on the State Land Cadastre, and the Resolution No. 529 of the Cabinet of Ministers of the Republic of Uzbekistan, dated July 19, 2017, on *"Approval of the Regulations on the State Committee for Land Resources, Geodesy, Cartography, and State Cadastre of the Republic of Uzbekistan and the Fund for the Development of Land Relations and State Cadastres,"* serve as the basis for systematic soil quality assessment (bonitet evaluation) of irrigated lands.

One of the key methods for assessing soil quality is the evaluation of its natural fertility (bonitet assessment), which takes into account fertility-determining properties. The primary goal of bonitet assessment is to compare the relative and stable fertility characteristics of different soil types, determining how much better or worse one soil type is compared to another.

In this study, an analysis of soil salinity levels was conducted on 4,326.2 thousand hectares of irrigated land. The results showed that:

- 2,034.3 thousand hectares (47%) were classified as good-quality land,
- 2,098.8 thousand hectares (48.5%) were in a satisfactory condition,
- 193.1 thousand hectares (4.5%) were in a poor condition.

When investigating the causes of poor soil conditions, it was found that:

- 81.1 thousand hectares were affected by rising groundwater levels,
- 83.8 thousand hectares deteriorated due to salinization,
- 28.2 thousand hectares were classified as degraded due to both rising groundwater levels and salinization (*Table 2*).

III. RESEARCH RESULTS AND DISCUSSION

An analysis of salinized lands based on 2024 monitoring data shows that in the Republic of Karakalpakstan, salinized lands account for 71.2% of the total irrigated area. In Bukhara region, this figure is 47.9%, in Kashkadarya region – 43.3%, in Jizzakh region – 72.0%, in Navoi region – 74.5%, in Surkhandarya region – 28%, in Syrdarya region – 95.0%, and in Khorezm region – 99.2%.

In Jizzakh region, due to varying natural and geographical conditions, dark gray, typical gray, light gray, meadow-gray, and meadow soils are found. The majority of irrigated agricultural land consists of meadow-gray and gray-meadow soils, making up 82.6% of the total irrigated area. The bonitet score of 25,016.7 hectares, or 9.23% of irrigated lands in Jizzakh region, is below 40 points, classifying them as low-fertility lands.

In the region, 13.34% of irrigated agricultural lands have been affected by irrigation erosion. The process of irrigation erosion is particularly evident in irrigated lands, as well as in mountainous and foothill slopes. In the districts of Gallaaral, Zomin, Bakhmal, Jizzakh, and Zarbdor, different degrees of irrigation erosion have been observed in pastures,

rainfed lands, and irrigated lands. Irrigation erosion mainly occurs on sloped lands due to excessive irrigation, leading to soil degradation and a decline in fertility.

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Table 2
Information on the Reclamation Condition of Irrigated Lands (Cadastre) in the Republic as of January 1, 2023

Region names	Total Irrigated Area (thousand ha)	Salinity Level								
		Good		satisfactory		unsatisfactory		Cause of Unsatisfactory Condition (thousand ha)		
		thousand ha	%	thousand ha	%	thousand ha	%	Rise in Groundwater Level	Due to Salinization	Due to Both Groundwater and Salinization
Republic	**4326,2**	**2034,3**	**47,0**	**2098,8**	**48,5**	**193,1**	**4,5**	**81,1**	**83,8**	**28,2**
Karakalpak republic	517,0	143,8	27,8	323,5	62,6	49,7	9,6	24,3	18,5	6,9
gions:										
Andijan	271,1	98,9	36,5	163,0	60,1	9,2	3,4	6,3	2,5	0,4
Bukhara	276,3	42,1	15,2	221,4	80,1	12,8	4,6	8,0	2,6	2,2
Jizzakh	310,4	84,4	27,2	214,1	69,0	11,9	3,8	6,9	4,6	0,3
Kashkadarya	513,3	293,0	57,1	209,5	40,8	10,8	2,1	2,1	8,7	0,0
Navoi	123,1	29,0	23,6	87,8	71,3	6,2	5,1	1,6	4,5	0,1
Namangan	289,7	260,2	89,8	26,1	9,0	3,4	1,2	0,9	2,2	0,2
Samarkand	380,2	258,5	68,0	112,3	29,5	9,5	2,5	9,1	0,1	0,3
Surkhandarya	324,8	294,4	90,6	28,6	8,8	1,8	0,6	0,2	0,7	1,0
Syrdarya	287,2	10,0	3,5	230,1	80,1	47,1	16,4	13,4	28,5	5,2
Tashkent	400,2	366,3	91,5	33,1	8,3	0,8	0,2	0,8	0,0	0,0
Fergana	367,3	153,9	41,9	201,7	54,9	11,8	3,2	6,1	5,6	0,1
Khorezm	265,6			247,5	93,2	18,1	6,8	1,6	5,2	11,3

In Jizzakh region, 47.45% of irrigated agricultural land is affected by gypsification to varying degrees. Slightly gypsified soils cover 37.1% of the land, mainly in the Arnasay, Mirzachul, Zomin, and Zarbdor districts. Moderately gypsified soils make up 5.6%, found in Dustlik, Zafarabad, Jizzakh, Zomin, and Paxtakor districts. Strongly gypsified soils account for 4.8% and are primarily located in Zafarabad, Dustlik, Paxtakor, Zomin, and Jizzakh districts.

In Navoi region, soil quality assessments were conducted on 103,244.7 hectares of irrigated land. It was found that 73% (75,331.4 hectares) of the region's irrigated soils consist of medium and light-textured soils. Wind erosion mainly occurs in sandy and sandy-loam soils, affecting 5,995.8 hectares (5.8%) of the total land area.

Soil salinity level reflects the total amount of harmful (toxic) water-soluble salts in the soil. The primary causes of salinization are the lack of proper groundwater drainage and malfunctioning of irrigation and drainage networks. Soil salinization varies in degree, type, salt composition, the depth of the salt-affected layer, and the depth of groundwater.

In Navoi region, the total area of moderately, strongly, and extremely saline soils amounts to 69,872.8 hectares, which represents 67.7% of the region's irrigated land. Slightly saline soils cover 54.0% (55,764.8 hectares), moderately saline soils 11.9% (12,301.0 hectares), strongly saline soils 1.2% (1,280.9 hectares), and extremely saline soils 0.5% (526.1 hectares) of the irrigated area.

Syrdarya region is located within the Turon soil-climatic province, characterized by light gray soils. However, at present, light gray soils are scarce in the region. Instead, hydromorphic and semi-hydromorphic soils are widespread. The irrigated lands of Syrdarya consist of light gray, meadow-gray, gray-meadow, and meadow soils.

Non-saline lands in Syrdarya region cover 20,439.5 hectares (7.6%) of the total 267,391.7 hectares of irrigated land. Slightly saline soils make up 140,162.2 hectares (52.4%), moderately saline soils 55,357.5 hectares (20.7%), strongly saline soils 24,324.5 hectares (9.1%), and extremely saline soils 27,108.1 hectares (10.1%).

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The total gypsified land in Syrdarya region amounts to 76,600.4 hectares, or 28.6% of the total irrigated land. Among them, slightly gypsified lands account for 16.7% (44,774.1 hectares), moderately gypsified lands for 8.0% (21,516.2 hectares), and strongly gypsified lands for 3.9% (10,310.1 hectares).

According to research data, 265,191.59 hectares (99.18%) of land in Syrdarya region is free of stones, while 2,200.10 hectares (0.82%) exhibit varying degrees of stoniness. The irrigated soils of the region are not significantly affected by irrigation erosion.

The poorly reclaimed lands in the region mainly fall into the following categories:

1. Lands with deteriorated reclamation conditions – 11,802 hectares, including:
    - Waterlogged lands due to rising groundwater levels – 2,335 hectares
    - Severely saline lands – 9,468 hectares
2. Lands with insufficient water supply – 5,962 hectares
3. Lands degraded due to malfunctioning reclamation systems (collectors and drainage networks) – 88 hectares
4. Lands rendered unusable due to the continuous absence of agricultural cultivation – 1,225 hectares
5. Abandoned lands that have turned barren – 25 hectares

The reintroduction of currently unused lands into agricultural circulation is of primary importance.

In Bukhara region, research findings indicate that all irrigated and non-irrigated soils are prone to salinization due to the high groundwater levels. From a reclamation perspective, the lands in the Korkol, Gijduvan, Alat, Karakul, Romitan, Vabkent, and Shafirkan districts are considered relatively well-preserved.

The total area of salinized lands in the region amounts to 237,100 hectares (86.2%). The deterioration of agricultural land in the region is also attributed to gypsification and stoniness. The total area of gypsified soils in Bukhara region is 2,519 hectares, while stoniness affects 30,432 hectares.

Stone-covered soils are mainly susceptible to water and wind erosion, making it essential to implement anti-erosion measures in such areas.

CONCLUSION

Changes in the quantity and quality of reclaimed lands depend on salinity levels, soil fertility, and ecological conditions. The efficient use of these lands can be enhanced through improvements in irrigation systems and the implementation of modern technologies.

To ensure the effective utilization of land resources, it is essential to conduct continuous monitoring, implement water-saving management strategies, and place special emphasis on environmental safety.

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