CHANGES OF LAND COVER AND SOIL PROPERTIES OF AMUDARYA DOWNSTREAM AREAS UNDER THE INFLUENCE OF DESERTIFICATION

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https://doi.org/10.5281/zenodo.11086881

Abstract*. This article describes the soils common in the lower reaches of the Amu Darya and the Aral region, changes in the amount of humus in soils, fertility, agrochemical composition of soils, mechanical composition and changes in the properties of these soils under the influence of degradation and desertification processes. In particular, the article discusses the issues that during the main stages of desertification, the surface of irrigated soils of the lower reaches of the Amu Darya is covered with a layer of soluble salts, and brackish-loving halophyte plants spread on these lands. According to research data, the soil cover is occupied by Arabasis aphylla and Solsola rigiga plants, which form typical desert shrubs. Along with this, the article provides information that under the influence of desertification processes, it was noticed that infertile soils changed in the negative direction, the soil became compacted, layers of layers formed under the soil, the amount of humus decreased, the soil cover dried up, and the water depth level decreased. Sand has accumulated in the surface part of the soil around the plants, and, finally, the vegetation cover in these areas consists of saxaul.*

Keywords: *Amu Darya, Aral Sea, degradation, desertification, global climate change, agrochemical properties of soils, irrigated soils, humus, soil mechanical composition, salinization, melioration, fertility.*

Introduction. In a speech by the President of the Republic of Uzbekistan on September 9-10, 2017, at the first summit of the Organization of Islamic Cooperation on Science and Technology, which was held in the city of Astana, the capital of the Republic of Kazakhstan, on September 9-10, 2017, he said: “The problem of global climate change, erosion soils in most regions, the reduction of fertile land, desertification, lack of water, drought, providing the population with drinking water is becoming a serious problem,” he began his speech and spoke about the serious global environmental problems facing humanity today.

In his speech at the 72nd session of the UN General Assembly, the President stated that there is no other reasonable way to solve the water problem, except to take into account the interests of the countries and peoples of the region, that Uzbekistan supports the draft conventions on the use of water resources in the Amudarya and Syrdarya basins, developed by the UN regional center . Once again drawing the attention of the world community to one of the acute environmental problems - the draining of the Aral Sea, it was emphasized that the elimination of the consequences associated with the drying up of the sea requires active integration of efforts at the international level.

Today, the problem of studying the soils of the republic and protecting them from erosion, degradation and desertification is becoming more and more urgent. is in a critical ecological state. Soil is a living natural body, not only a source of agricultural products, but also the main

component of the earth's biogeocenosis, a powerful accumulator of earth's energy that regulates the composition of the atmosphere and hydrosphere, a strong barrier to the migration of pollutants.

It should be emphasized that this priceless and irreplaceable component of the biosphere is subject to several types of degradation. In this regard, Article 55 of the Constitution of the Republic of Uzbekistan states that "Earth, subsoil, water, flora and fauna and other natural resources are national wealth, they must be used wisely, as they are protected by the state." This became possible thanks to independence of our republic, the proclamation of an independent state, the achievement of full independence in the regulation and development of land relations on its territory, the rational use of land Adoption of the laws of the Republic of Uzbekistan "Land Code", "State Land Cadastre", "On Farms", "On Peasant Economy" aimed at deepening reforms in the agrarian sector of the Republic of Uzbekistan, created a legal basis for the efficient and rational use of land resources, protection against erosion, soils made it possible to pursue a unified state policy to preserve, increase and restore productivity.

The natural and climatic conditions of Uzbekistan, the susceptibility of soils to erosion processes, the study of the effect of eroded soils on fertility, measures to combat them and mitigate their negative consequences, increasing the fertility and rational use of soils subject to erosion processes are among the most pressing problems today.

In particular, the Aral Sea, once located between the vast deserts of the Karakum and Kyzyl Kum, softened the cold air masses entering the region from the Arctic zone in the winter months, softened the waves of hot summer heat, softened these hot air currents, and the appearance of air that appeared in its place Aralkum, as a result of the rise of a dust-salt mixture from a dry bottom into the air under the influence of deflationary processes, leads to a decrease in crop yields. The soil is a means of ensuring the material sustainability of nature and the main resource of agricultural production. People can produce 88% of their food by cultivating the land. Today, to ensure the food security of our country, the use of every square land, increasing soil fertility, their conservation and protection is of great practical importance.

Materials and methods of research

The soil cover is one of the main components of the biosphere and plays an important functional role in the creation and development of all ecosystems. The formation, transformation and productivity of the soil cover occur under natural conditions on the basis of certain patterns, and under these conditions an ecological balance is created between the soil and the factors that create it. However, anthropogenic changes in nature over the years have changed the balance between ecosystems. This situation has led to a change in the soil cover, plant and animal biodiversity, topography and climatic indicators, which are the main components of the biosphere.

In recent years, as a result of increased natural and anthropogenic impacts in the lower reaches of the Amu Darya, as a result of the deterioration of the ecological situation associated with the drying up of the Aral Sea, the interdependence and stability of soil components in the region have undergone negative changes, the natural balance has been disturbed, the processes of desiccation and desertification have intensified in the fields, which led to an increase in salinity. The increase in salinity led to the formation of levels and types (chemistry) of salinization in different parts of the region, as a result of desertification processes in the soil cover in large areas around the island, solonchaks were formed. A sharp deterioration in the reclamation and ecological state of irrigated lands, the accumulation of salts in the soil, the activation of secondary salinization processes, the annual increase in the area of saline lands, a decrease in the size of sown areas, etc.,

led to a decrease in the yield of cultivated crops. As a result of the processes of degradation and desertification, toxic salts accumulated on the bottom of the Aral Sea, carried out to irrigated land during deflationary processes, and as a result of the deterioration of the ecological and reclamation state of these lands, irrigated fertile lands in the agricultural turnover fund have been decommissioned to a certain extent. During the main stages of desertification, the surface of the irrigated soils of the lower reaches of the Amu Darya is covered with a layer of readily soluble salts, and brackish-loving halophyte plants spread on these lands. According to research data, the soil cover is occupied by Arabasis aphylla and Solsola rigiga plants, which form typical desert shrubs.

As a result, under the influence of desertification processes, it was noticed that infertile soils changed, the soil became compacted, layers of layers formed under the soil, the amount of humus decreased, the soil cover dried up, and the level of water infiltration decreased. Sand has accumulated in the surface part of the soil around the plants, and, finally, the vegetation cover in these areas consists of saxouls.

It is noted that the negative consequences of desertification processes are manifested in the soil covers of individual massifs of the left and right banks of the Amu Darya under the influence of natural and anthropogenic factors and are as follows: those. irrigated, reclamation. In complex soils, the groundwater level in 2010. In 2018, the groundwater level was close to the soil surface (on average 120-155 cm) in the Khodjayli, Shumanay, Amu Darya, Kungirot, Moinak and Nukus regions of the Republic of Karakalpakstan. In soil-forming processes, especially on irrigated soils, groundwater plays an important role in the formation of optimal underground regimes and balance, they have a complex effect on the formation of saline soils, serve as a means of redistribution by moving to other lands and neighboring territories with its flow. The higher the level of groundwater mineralization and the closer they are to the earth's surface, the more water evaporates from the soil, which accelerates the process of salt accumulation and secondary salinization in the soil. relief, lithological and geomorphological structure of the area, soil-climatic and anthropogenic-economic conditions, as well as hydrogeological and geochemical conditions

RESULTS AND DISCUSSION

The state of groundwater on irrigated lands is seasonal, after the end of the vegetation of plants (IX-XI) it drops to 2.5-3.0 meters, which is typical for all irrigated areas, rises to the surface when irrigated during the vegetation period (V-VIII months), 1 - 2 meters. As a result of the accumulation of salts in the upper layers of the soil that enter the groundwater under the influence of precipitation, vegetation irrigation, saline wash water, and the repetition of this process for a long time, it was clearly observed that the level of groundwater mineralization increased. In table №1 summarizes information about the depth, mineralization, type and degree of salinization of groundwater on irrigated meadow-alluvial, bog-meadow, barren-meadow and barren-meadow soils, the quality and composition of salts.

When assessing the reclamation state of irrigated soils, not only their level of salinity and the amount of salts is extremely important, but also the chemistry (type) of salinity, which is of great importance when choosing reclamation measures, when determining the norms for washing salts, as well as when determining the amount of "poisonous" salts in the amount of salts. According to the quality and component composition of salts, the qualitative composition of salts of sulfate and chloride-sulfate types of salinity naturally consists of $CaSO_4$, Na_2SO_4, $MgSO_4$ salts, in which sodium sulfate occupies the leading place, followed by $CaSO_4$ and $MgSO_4$ salt,

respectively. According to the level of mineralization of underground waters of the massifs that were carried out, there are slightly mineralized (1-3 g/l), medium (3-+10 g/l) and strongly (10-25 g/l) mineralized waters. Fresh (1 g/l), highly mineralized (25-50 g/l) and saline groundwater (>50 g/l) were not noted in the studies. The total amount of salts is fixed in the range of 1520-1480 g/l from 12280-17400 g/l in terms of dry residue. According to the types and degree of salinity, underground waters are chloride-sulfate and sulfate-chloride, slightly, medium and highly saline.

Features of the lithological-geomorphological structure and hydrogeological conditions of the territories of the Republic of Karakalpakstan, as well as the different state of groundwater, influenced the depth of groundwater, which was formed according to certain patterns. These territories are characterized by the absence of natural and artificial drainage on irrigated lands, therefore, in conditions of insufficient supply of groundwater, the state of groundwater is above the “critical depth” and the formation of concomitant processes of salinization and waterlogging. This situation was also observed on large areas not associated with irrigation. The location of groundwater near the surface of the earth is established in almost all irrigated lands of the Republic of Karakalpakstan. In the course of the research, it was found that the process of desertification affected 49.62% of the old irrigated soils of the Y massif. Okhunboboev of the Kungirotsky district, as a result of non-use, deterioration of the ameliorative state of lands, uneven application of mineral fertilizers, insufficient replacement of substances carried out with agricultural crops, the fertility and productivity of these soils to a certain extent decreased, and the area of lands with varying degrees of salinity increased. Studies carried out in the Shumanai region show that the soils of the region consist of a complex of weakly, medium, strongly, very strongly saline and saline soils. 14.77% of the district's land area is slightly saline, 16.74% is moderately saline, 20.82% is highly saline, 47.67% is occupied by very highly saline soils and solonchaks.

Table №1

The total content of salts and ions and the chemical composition of salinity in groundwater of irrigated soils of the lower reaches of the Amu Darya

Profile №	Depth, sм	Dry residue	HCO_3^-	Ch^-	SO_4^-	Ca^+	Mg^+	Na^+	Salinization	
			г/л						type	level
Old-grown meadow-alluvial soils of Yu.Okhunboboev massif										
81	145	11,625	0,994	3,660	2,516	0,810	0,882	1,355	S-ch	High
83	165	17,400	0,420	5,040	6,340	0,720	1,354	3,074	S-ch	High
75	180	7,900	0,152	2,128	3,168	0,350	0,744	1,145	Ch-s	Medium
73	120	15,570	0,185	3,570	6,240	0,570	0,356	4,045	Ch-s	High
76	130	12,280	0,384	3,370	4,742	0,860	0,842	2,254	S-ch	High
Old-grown meadow-alluvial soils of the Dustlik massif										
59	140	5,350	0,286	1,388	1,852	0,260	0,354	0,931	S-ch	Medium
48	160	4,812	0,257	1,071	1,870	0,540	0,228	0,636	Ch-s	Medium
50	150	10,750	0,580	2,980	3,704	0,850	1,260	0,565	S-ch	High

61	170	6,788	0,252	2,100	2,280	0,510	0,322	1,354	S-ch	High
49	180	3,200	0,180	1,120	0,950	0,200	0,300	0,452	S-ch	Medium
Meadow-alluvial and swamps -meadow soils of the massif										
3	160	2,390	0,177	0,518	0,778	0,160	0,128	0,349	Ch-s	Weakly
5	130	4,280	0,172	0,862	1,908	0,400	0,201	0,698	Ch-s	Medium
9	150	8,250	0,360	1,921	3,468	0,540	0,756	0,992	Ch-s	Medium
10	140	5,900	0,259	1,065	2,700	0,660	0,213	0,920	Ch-s	Medium
2	125	10,300	0,116	3,010	3,456	0,560	0,744	1,600	S-ch	High
Takyr-meadow and meadow-alluvial soils of the Sarialtin massif										
22	160	4,745	0,482	1,260	1,364	0,560	0,270	0,498	S-ch	Medium
30	135	6,580	0,567	0,998	2,982	0,520	0,311	1,103	Ch-s	Medium
40	120	13,440	0,142	4,700	3,270	0,670	0,350	3,452	S-ch	High
28	180	8,250	0,360	1,921	3,468	0,540	0,756	0,992	Ch-s	Medium
42	110	16,980	0,451	6,710	4,672	0,620	1,952	2,354	C-x	High
Meadow-alluvial and meadow-takyr soils of the Shurokhon massif										
31	98	1,610	0,366	0,301	0,432	0,260	0,126	0,003	Ch-s	Weakly
33	90	1,520	0,274	0,238	0,514	0,180	0,150	0,014	Ch-s	Weakly
35	85	2,455	0,427	0,686	0,526	0,290	0,180	0,184	S-ch	Weakly
25	90	1,825	0,305	0,504	0,490	0,290	0,150	0,060	S-ch	Weakly

In recent years, as a result of the decrease and drying of the general water level of the Aral Sea, the content of various salts in groundwater has increased. Climate is one of the factors affecting the accumulation of salts. As a result of air warming, evaporation of water has increased, various amounts of salts have accumulated in groundwater.

Thus, the formation of soil cover in the regions of the region is completely connected with the activity of the river, its water, i.e., its hydrography, solid, dissolved and irrigation reserves in its course. As a result of the construction of the modern "living" delta of the Amudarya, it was established that protected agrolandscapes, solonchak and eolian landforms and automorphic soils are being formed on the territory. In addition, it is noted that instead of dry lakes, solonchaks sometimes turn into barren soils, sometimes into barren meadow soils. As the level of salinity of irrigated soils, common in the areas of the island, increased, sulfate and chloride-sulfate types of salinization alternated with sulfate-chloride, and sometimes chloride types of salinization, and the organic content of chloride ions in salts was observed. According to the analysis of the qualitative composition of salts in irrigated soils and their quantitative indicators, there is a direct relationship between toxic salts and sodium ions in the soil, that is, with an increase in the amount of salts, sodium and chloride ions also increase in parallel. It was noted that the content of magnesium in the salts is higher than that of calcium, and sodium predominates among cations, and the level of toxicity of salts present in the soils of the studied massifs is much higher.

The diversity of lithological-geomorphological, hydrogeological, soil-climatic, anthropogenic-economic and other natural conditions in the soil of each large irrigation system in the territory of the Republic of Karakalpakstan requires the use of a set of agro-reclamation measures suitable for each object. In order to improve the ameliorative state of irrigated lands and

maintain it at a moderately acceptable level, it is necessary to create optimal conditions with a depth of 3.0 m and a specific length of at least 50 litter meters per hectare, and an annual inspection of sown areas. , first of all, lands in need of reclamation, soil reclamation groups, and it is necessary to determine the types of reclamation measures and apply a set of necessary measures. In the development of a complex of agrotechnical and agrochemical measures to increase the productivity of irrigated hydromorphic soils in the territories of the Republic of Karakalpakstan in low water conditions, improve land reclamation, prevent the state of groundwater, secondary salinization, dehumification and depletion of nutrients, eliminate their negative aspects, improve soil ecology - highly effective agro-meliorative, agrochemical methods of managing ameliorative processes, restoration, increase and protection of soil fertility in the development of enlightened recommendations.

Residual marsh soils, residual meadow soils, moderately hydromorphic soils, semi-hydromorphic coastal soils, and sandy desert and sandy soils are common in the protected and pasture areas of the region. In particular, the remnant bog soils of the Moinak massif were formed in modern sediments of the lower reaches of the Amu Darya. Sometimes they are common in areas periodically covered by river waters, and in subsequent years, under conditions of low water and under the influence of the retreat of the Aral Sea, wetlands formed. Residual meadow solonchaks are widespread in the Kazakdarya massif. Moderately hydromorphic saline soils are widespread in the forest area, which were formed under the influence of modern deposits of the Amu Darya and sea waters. In the formation of the mechanical composition of temperate hydromorphic solonchaks, they are widespread in areas along the island, where the sea recedes and groundwater is close to the surface. In the Akkala massif, semi-hydromorphic coastal solonchaks occupy large areas and are widespread in the former coastal areas of the Aral Sea. When analyzing the profile of residual bog soils formed in areas along the coast, it was noted that their layering and mechanical composition are different. As a result of prolonged subsidence and lowering of the groundwater level, these soils are currently undergoing transformation.

On the example of the sections exposed in the course of field studies (2016), the morphological characteristics of the residual bog soils formed in the modern sediments of the Amu Darya are identified. Residual bog soils are characterized by their composition as light to medium sands and loams, similar to soils formed in other alluvial deposits. Below is a description of the morphogenetic structure of the residual bog soils of the key monitoring area of the Moinak massif. In the course of the field studies, a wide distribution of these soils was noted in the massifs of the Moinak region.

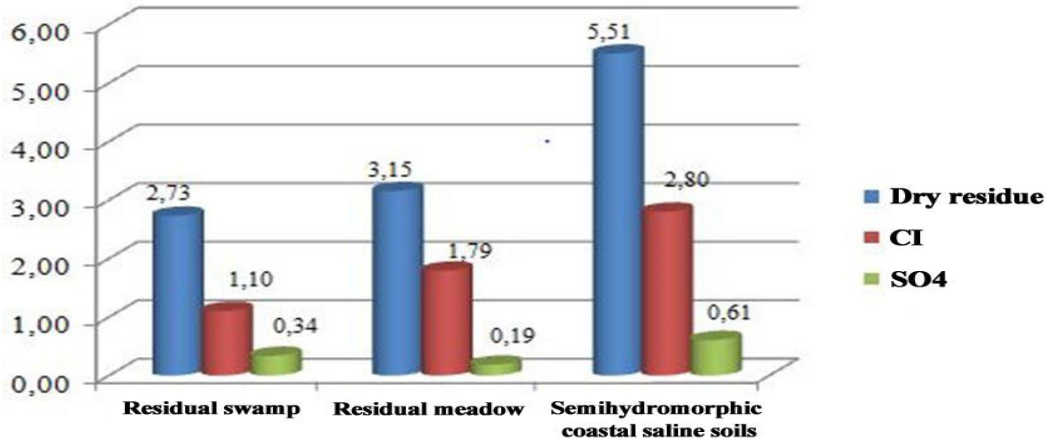
Profile No. 6. 2016 August Moinak district, Moinak massif. Residual bog soils, consisting of layered alluvial deposits of the Amu Darya, medium sandy, moderately saline. 6 km southwest of the village of Karadzhar, a weak flat area with many salt spots.

0-12 cm. Grey, the soil surface is moist and low humidity rises to the bottom, medium sandy, slightly compacted, there are scaly-separated lumps, semi-decomposed plant residues, reed roots and traces of underground insects, depending on the density and mechanical composition of the transition to the next layer.

12-27 cm. Grey, damp, sand, loose composition, moderately compacted, underground traces of animals were not found, reed roots are found, half-decayed roots are found, the transition to the next layer is gradual in color.

27-80 cm. Sometimes bluish spots with gray and rusty spots are visible, very damp, fine sand, fine (dusty) structure, moderately compacted, roots and half-decayed roots.

80 cm is limited to groundwater.



1-picture. The chemical composition of the soils of the Moinak massif in %, (profile No. 12).

The amount of dry residue in the upper layers of residual waterlogged soils of the Moinak massif is 2.73%, in residual meadow soils - 3.15%, in semihydromorphic coastal solonchaks - 5.51%. The amount of chlorine in these soils, in turn, is 1.10; 1.79 and 2.80%, and the amount of sulfate 0.34; 0.19 and 0.61% (Figure No. 1.).

Residual bog soils have a medium and light sandy mechanical composition, and in the upper layer of medium sandy soils, sand particles 35.3%, dust particles 25.2%, silt 7.3%, physical clay 42.2%; in light sands, sand particles were 24.3%, dust particles 33.7%, clay 2.3%, physical clay 27.1%. In terms of mechanical composition, residual bog soils accounted for 40.2%, dust particles 35.2%, silt 7.7%, and physical clay 24.0%. According to the mechanical composition, the residual meadow soils consist mainly of sand, sand particles 42.%, dust 28.0, silt 4.5, physical clay 28.7%. According to the mechanical composition, moderately hydromorphic soils - sand particles make up 23.5%, dust particles 49.3%, silt 4.6%, physical clay 26.2%.

Table № 2.

The mechanical composition of common soils in the Aral Sea region

Profile №	Depth, sм	Particle size in mm, quantity in %							Physical clay, %	Mechanical compound soil
		Sand			Dust			Clay		
		>0,25	0,25 - 0,1	0,1 - 0,05	0,05 - 0,01	0,01 - 0,005	0,005- 0,001	<0,001		
50	Residual swampy soils of the Muynak massif									
	02-12	12,0	4,4	35,3	6,1	25,2	9,6	7,4	42,2	Medium sand
	12-35	9,6	4,0	74,2	4,9	2,3	2,0	3,0	7,3	Sand
	35-76	16,0	6,0	55,4	7,6	9,3	3,5	2,2	15,0	Sandy loam

	76-120	24,0	6,0	55,7	4,9	6,2	1,0	2,2	9,4	Sand
	120-148	32,0	10,3	42,4	6,7	3,2	2,8	2,5	8,6	Sand
55	0-13	11,3	3,6	24,3	33,7	19,1	5,7	2,3	27,1	Medium sand
	13-30	10,4	2,8	32,1	23,6	17,1	9,7	4,3	31,1	Medium sand
	30-72	9,3	2,2	70,4	9,2	5,5	1,3	2,1	8,9	Sand
	72-105	23,3	5,9	56,2	4,9	6,8	1,0	1,9	9,7	Sand
	105-140	9,6	2,4	74,2	7,6	1,2	4,8	0,2	6,2	Sand
56	0-15	5,3	1,7	33,4	35,2				24,4	Medium sand
	15-32	30,5	9,4	46,6	7,3				6,2	Sand
	32-68	15,4	4,2	54,0	22,2				4,2	Sand
	68-95	9,2	2,6	70,2	7,7				10,3	Sandy loam
	95-130	14,2	6,2	68,0	6,8				4,8	Sand
	Residual meadow solonchaks of the Muynak massif									
60	0-11	0,5	0,1	40,2	35,2	8,6	7,7	7,7	24,0	Medium sand
	11-27	0,4	0,1	43,3	36,6	7,6	6,7	5,3	19,6	Sandy loam
	27-60	0,5	0,1	62,9	22,5	9,6	2,9	1,5	14,0	Sandy loam
	60-93	0,8	0,2	32,2	41,6	12,9	4,3	8,0	25,2	Light sandy
	93-128	0,4	0,1	24,4	41,0	16,0	8,5	9,6	34,1	Medium sand
65	0-11	0,8	0,2	23,5	49,3	16,1	5,5	4,6	26,2	Light sandy
	11-30	1,2	0,3	22,1	62,6	2,3	7,5	4,0	13,8	Sandy loam
	30-72	1,2	0,3	6,6	64,9	14,7	5,3	7,0	27,0	Light sandy
	72-98	0,8	0,2	15,5	65,2	11,9	1,0	5,4	18,3	Sandy loam
	98-134	0,4	0,1	7,7	80,7	6,6	3,1	1,4	11,2	Sandy loam

66	0-10	2,0	0,5	37,7	49,6	4,5	2,9	2,8	10,2	Sandy loam
	10-34	0,8	0,2	7,8	79,4	8,6	1,2	2,0	11,8	Sandy loam
	34-76	0,8	0,2	9,7	78,7	2,6	5,8	2,2	10,6	Sandy loam
	76-100	1,2	0,3	6,6	75,9	11,0	2,7	2,3	16,0	Sandy loam
	100-142	0,8	0,2	11,6	76,2	7,2	2,8	1,2	11,2	Sandy loam
70	Moderately hydromorphic solonchaks of the Muynak massif									
	0-14	2,0	0,5	57,1	23,2	7,3	5,1	4,8	17,2	Sandy loam
	14-30	1,6	0,4	67,9	9,8	10,5	5,4	4,4	20,3	Light sandy
	30-70	2,0	0,5	40,8	24,7	13,0	12,5	6,5	32,0	Medium sand
	70-105	0,8	0,2	61,3	27,5	7,6	1,5	1,1	10,2	Sandy loam
	105-140	2,0	0,5	51,3	35,0	6,1	3,6	1,5	11,2	Sandy loam
75	0-8	1,6	0,4	30,2	50,7	5,8	7,7	3,6	17,1	Sandy loam
	8-25	6,0	1,5	30,3	52,9	3,0	2,1	4,2	9,3	Sand

There is a close relationship between the mechanical composition of soils and their salinity; in heavy soils, groundwater quickly approaches the surface of the earth, and in soils with a light mechanical composition, on the contrary, slowly approaches the soil surface. through the capillaries. Soils with a heavy mechanical composition salinize faster than soils with a light mechanical composition. Residual wetlands in the area are undergoing dry processes and are expected to gradually become automorphic soils in the future. However, if the salinization process develops in these soils in the form of the above information, they can also turn into meadow solonchaks. The content of humus in the upper layer of residual bog soils averages 1.40-1.54%, the mobile form of phosphorus averages 14.0-26.0 mg/kg, exchangeable potassium 172-240 mg/kg, carbonates 936-10, 45%, gypsum 0.013-0.218%.

Table №3.

Agrochemical properties of the soils of the Aral Sea region

Profile №	Depth layer, sm	Humus %	Nitrogen	C:N	Nutrients				Carbonates %	SO_4 gypsum, %
					General stock, %		Mobile, mg/kg			
					Phosph	Potas	P_2O_5	K_2O		
Residual swampy soils of the Muynak massif										
50	0-12	1,400	0,089	9,1	0,27	1,506	26,0	240	6,936	0,218
	12-35	1,120	0,074	8,8	0,25	1,305	11,0	247	7,976	0,316
	35-76	0,910	0,083	6,3	0,22	1,506	5,8	247	12,25	0,107
55	0-13	1,370	0,089	8,9	0,26	1,107	15,0	189	9,248	0,014
	13-30	1,160	0,087	7,7	0,12	0,665	13,0	172	10,28	0,016
	30-72	0,860	0,077	6,5	0,16	0,603	5,9	160	8,318	0,012

56	0-15	1,540	0,091	9,7	0,17	0,663	14,0	172	10,46	0,013
	15-32	1,200	0,086	7,6	0,13	0,663	12,0	137	9,075	0,015
	32-68	0,835	0,076	5,3	0,14	0,600	5,9	128		
Residual meadow solonchaks of the Muynak massif										
60	0-11	0,834	0,088	5,3	0,24	0,904	22,0	265	7,656	0,014
	11-27	0,691	0,057	4,3	0,23	1,506	17,0	265	8,923	0,013
	27-60	0,434	0,037	2,7	0,22	1,00	10,0	203	7,867	
65	0-11	1,119	0,093	7,1	0,26	1,00	14,0	161	7,920	0,018
	11-30	0,742	0,069	4,7	0,25	1,001	12,0	108	9,926	0,018
	30-72	0,517	0,049	3,2	0,24	1,002	5,8	72		
66	0-10	0,850	0,091	5,4	0,25	0,904	13,0	204	8,237	
	10-34	0,875	0,079	5,5	0,23	1,054	11,0	201	9,345	
	34-76	0,692	0,061	4,4	0,13	1,054	5,8	72		
Moderately hydromorphic solonchaks of the Muynak massif										
70	0-14	1,552	0,09	9,8	0,26	0,947	23,0	224	9,292	0,014
	14-30	1,188	0,079	7,5	0,24	0,775	15,0	130	9,134	0,016
	30-70	0,867	0,075	5,5	0,18	0,572	10,0	144	7,603	
75	0-8	1,413	0,091	8,9	0,27	0,775	15,0	181	10,612	0,017
	8-25	1,406	0,091	8,9	0,24	0,861	11,0	144	9,821	0,019
	25-60	0,589	0,049	3,7	0,23	0,689	5,2	263	10,560	
76	0-10	1,548	0,093	9,8	0,25	0,947	15,0	188	10,243	
	10-26	1,354	0,0890	8,6	0,21	1,030	13,0	171	10,560	
	26-64	0,928	0,085	5,9	0,22	0,698	12,0	154		
Semihydromorphic coastal solonchaks of the Muynak massif										
80	0-10	1,388	0,027	8,8	0,31	1,054	21,0	160	7,920	
	10-27	1,040	0,024	6,6	0,27	1,048	16,0	200	7,867	
	27-64	0,843	0,020	5,3	0,26	0,904	10,0	248	6,811	
85	0-8	0,874	0,033	5,5	0,35	1,305	13,0	220	6,425	0,021
	8-25	0,720	0,031	4,5	0,27	1,300	11,0	180	5,375	0,023
	25-66	0,516	0,027	3,2	0,26	1,275	11,0	132	3,817	
86	0-10	1,204	0,017	7,6	0,27	1,605	11,0	248	10,296	0,019
	10-30	0,968	0,017	6,1	0,27	1,580	20,0	160	10,243	0,019
	30-70	0,570	0,018	3,2	0,26	13,0	13,	160		

The amount of humus in the arable layer of these soils is 0.746-1.246%, the mobile form of phosphorus is on average 23.35.0 mg/kg, and exchangeable potassium is 96-119 mg/kg. Quantitative indicators of humus and nutrients show that residual meadow sorghum is provided with humus and nutrients at a low and very low level of 204-265 mg/kg, carbonates 7.565-8.237%, gypsum in crystalline form was not found in the profile. semi-hydromorphic coastal outcrops, it was noted that gypsum is found in the soil in a small amount of 0.019-0.021%, semi-hydromorphic coastal outcrops are formed under conditions of severe drought in the Aral Sea zone (Table 3.). More than one percent of humus in the soil arises as a result of the accumulation and decomposition of organic residues over the years, and as a result of the development of these lands, it decreases again.

The content of water-soluble salts, the type and level of salinity in the virgin soils of the region are presented in the table below; in the upper layers of semi-hydromorphic marine solonchaks, fluctuations were observed within 3.965-5.790%. In the lands of the Muynak massif, strong salinization is observed and solonchaks are widespread (Table 3). According to the

chemistry of salinization, the soils common in protected areas and pasture areas differ significantly from the soils of the irrigated zone. It mainly consists of chloride, sulfate-chloride and chloride-sulfate types of salinization. The soil reaction depending on the concentration of hydrogen ions (N+) of the soil environment is 7.03-7.86, the soil environment is close to neutral and slightly alkaline.

This feature of soils is typical for all types of soils common in the Republic of Karakalpakstan. It is noted that the described soils have a high level of salinity, that is, the maximum amount of salts is in the upper layers of the soil. According to the degree of salinity, soils are classified as highly saline. Salinity and mechanical composition of soils are inextricably linked.

Conclusion. For the correct and efficient use of irrigated lands in the lower reaches of the Amu Darya, it is important to carry out agrotechnical and agro-reclamation measures in a timely manner to improve the reclamation and ecological state of the soil, regularly maintain and increase its fertility and productivity. The current environmental and reclamation situation on the lands of the Republic of Karakalpakstan, more than 75% of the area of which are saline, does not allow in the future to regularly increase crop yields. Of great importance is the prevention of degradation and desertification processes in soils common in the Republic of Karakalpakstan, the creation of conditions for the sustainable development of agriculture, the development of its mechanisms, the development of measures aimed at preventing the process of desertification and eliminating its negative consequences. consequences.

The mechanical composition of the residual bog soils formed on the dried bottom of the Aral Sea is due to the fact that they are formed depending on the sediments brought by the Amu Darya waters to this area. In addition, it was observed that the soils of the area were often under water, and as a result of sea retreat and lowering of the water table, these soils are in a transformation (transition) stage, and they have now turned into residual marshes. Of great importance in improving the reclamation and ecological state of soils are information about the level of salinity and the amount of salts, and the chemistry of salinity. These soils are mostly strongly saline, and the amount of salts in the upper soil layer on a dry base is 2330-2730% in residual bog soils, 2400-5230% in residual saline meadow soils, 5060-5790% in semi-saline soils in semi-hydromorphic maritime solonchaks, the maximum amount of chlorine ion was recorded in semi-hydromorphic coastal solonchaks, and its amount was 2.970%. The qualitative composition of the salts consists of CaSO4, Na2SO4, MgSO4 salts, where the leading place is occupied by sodium salts, followed by calcium and magnesium salts. As the level of salinity increases, chloride-sulfate types of salinity are replaced by sulfate-chloride, sometimes chloride types of salinity, an increase and predominance of the amount of chlorine ion in the composition of salts is observed. Depending on the absorption capacity of soils and the composition of absorbed cations, their mineralogical and mechanical composition, the degree of humification and water-physical properties, the amounts range from 10–11 to 14–15 mg/eq per 100 g of soil. It is noted that the rate of salt accumulation and salinization in the soil is stronger and more intense in the soil, which in terms of its mechanical composition becomes heavier from the lower layers to the upper ones.

In the chemical composition of salts, more chloride-sulfate and chloride salts can be found. Thus, it has been established that moderately hydromorphic soils are more saline in terms of chloride-sulfate and chloride types. From the data presented, it can be seen that all hydromorphic

soils with moderate salinity were affected. The development of these soils is difficult due to the severity of their reclamation and the proximity of the groundwater level to the surface.

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