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Dynamic Changes In Hydroecological Conditions For The Distribution Of Sokh Cones And Issues Of Their Protection

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Annotation. The article Fergana Valley soils were protected lands until the beginning of our century, and were developed at a high speed by digging the Big Fergana, Southern Fergana, Okhunboboev and other canals. The construction of large inter-farm reservoirs has reduced the level of water. The salinity of large salt marshes and highly saline lands has decreased to moderate or low salinity. However, the development of Fergana hills and desert massifs leads to the expansion of the area of saline lands in Central Fergana.

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1. Introduction

Currently, the requirements for information about the chemical composition of natural waters, the laws and trends of its change are increasing, and for many decades, work has been carried out on the collection of hydrochemical data. Retrospective data retrieval for landscape-ecological forecasting and environmental monitoring is of particular importance in the reconstruction of hydrochemical time series. Studying the seasonal water level in rivers is an urgent problem of our time. Research on the rivers of Uzbekistan is especially necessary.

Fergana Valley soils were protected lands until the beginning of our century, and were developed at a high speed by digging the Big Fergana, Southern Fergana, Okhunboboev and other canals. The construction of large inter-farm reservoirs has reduced the level of water. The salinity of large salt marshes and highly saline lands has decreased to moderate or low salinity. However, the development of Fergana hills and desert massifs leads to the expansion of the area of saline lands in Central Fergana.

Deterioration of collector-drainage systems, use of ditch water for irrigation has the same effect. The salinization of hills is completely different from that of Central Fagana. Salinity in these areas depends on the complex configuration of regional aquifers and the salinity of the rocks that make up the hills. At the beginning of our century, soil scientists studied the hills only for the purpose of raising cattle and carrying out dry farming. He did not think about irrigating the hills in difficult water conditions and did not say anything about salinization because the upper layers are not saline.

However, due to the complex lithological structure of the hills, after the implementation of irrigation, the complex impermeable layer and the ancient salinity of the rocks were revealed. Due to improper use of water in the hills, these two conditions are causing secondary salinity during irrigation. Therefore, if the salinity map made in the 1930s shows that the hills are not salted, the current salinity map shows that the hills are salted to different degrees and even salt marshes are formed.

In the conditions where the complex waterproof layer is located close to the surface of the earth, the collector and ditches are less affected. It will not be possible to lower the water level. Collecting data on their depth, level of mineralization, chemical composition, and other characteristics, especially quantitative indicators, is of great importance for melioration assessment of groundwater distribution character, natural conditions, seasonal change regime, and other hydrogeological features of the plains. Such information is very necessary in soil reclamation assessment (Table 1).

The degree of mineralization of underground water in most cases determines the salinity of irrigated soils, and the degree of waterlogging of near-surface waters. Groundwater has a strong influence on the soil cover, changing its optimal reclamation regime.

Therefore, the higher the groundwater level, the stronger the hydromorphic regime, and vice versa, the lower the groundwater level, the stronger the semi-automorphic and automorphic regimes. Therefore, the role of underground water in the transformation of automorphic geocomplexes to hydromorphic and hydromorphic geocomplexes to automorphic is extremely large.

2. The main part

Use of the nature and resources of river basins is a multi-faceted and multi-stage complex process. In the process of using one type of resource, other resources are also involved. In the production process, in many cases, it is necessary to use resources in a complex way. However, the efficiency of use depends on many factors, and in particular, the scientific principles of production organization and their adherence are of primary importance. In the microzones of the middle and lower slopes of the plains, where the mineralized groundwater lies close to the surface, moderately and strongly fragmented irrigated meadows, swamp-meadows and marshy soils and salt marshes are well developed (Table 2). The process of salinization and swamping is very active in these soils. Such processes make their reclamation situation even more complicated. In places where groundwater lies deeper than the surface of the earth, non-saline automorphic soils, especially gray-brown soils, are well developed. On the contrary, water and wind erosion, rather than salinization and waterlogging, are active in such soils.

The level of salinity of the irrigated soils in all areas of the plains, the level of mineralization of underground water, the thickness of the collector-drainage system has decreased by 0.5-1 meter of the seepage water in the Kuva inter-plains low. In the lands where the collector-drainage systems of the Sariksuv-Damkol and Achchikkol lowlands have been built, the seepage water has decreased to a certain extent. The soluble salts in the syzot waters of Central Ferghana are decreasing to a certain extent under the influence of irrigation.

As a result of the observations, it was found that the collector absorbs 9-10 times more chlorine and 1.2-2 times more sulfate salts than the water of streams and rivers. It can be seen that as a result of the irrigation and soil drainage works carried out in Central Fergana for the next 30-40 years, the amount of water-soluble salts in the seepage water was removed from the seepage waters of the lands adjacent to the collector ditches. Due to the slow movement of flood waters in the Sokh-Isfayram plain, their removal from salt water is very slow. In these lands, in 1929-1981, there was up to 50 grams of salt in each liter of syzoizot water, but now this amount has decreased. First of all, chlorine salts were washed out, while the contribution of sulfate salts prevailed.

In the Kuva inter-spreading plain, compared to 1929-1932, 70% of the salt of the seepage water went to the Syrdarya through the collector drainage systems. As a result, in many places of the region, the amount of salts in every liter of syzot water is only 0-1 gram. In Sariksuv-Damkol and Achchikkol sediments, the level of mineralization of seepage waters has become much higher than when mass exploitation began. This is definitely due to the reduction of waste water, the evaporation of a large part of the seepage water. In the lower terraces of the Syrdarya, large-scale irrigation reduced the amount of seepage water from 5-50 grams per liter to 1-3 grams in 1929-1931. The left bank of the Syr Darya is now 1-1.5 km long, and the content of seepage water is very close to the content of the river water.

Table 1. Fergana Valley irrigated areas mineralization level of seepage water

Year	Controlled areas	Mineralization of syzot waters									
		0-1 g/l		1-3 g/l		3-5 g/l		5-10 g/l		10 g/l above	
		to thousand	%	to thousand	%	to thousand	%	to thousand	%	to thousand	%
2015	265,5	153,2	57,7	108,1	40,7	4,1	1,5	0,1	0,0	0,0	0,0
2016	265,8	146,1	55,0	117,9	44,4	1,8	0,7	0,0	0,0	0,0	0,0
2017	282,6	245,0	86,7	33,8	12,0	2,8	1,0	0,4	0,1	0,0	0,0
2018	282,3	244,8	86,7	33,8	12,0	2,8	1,0	0,9	0,3	0,0	0,0
2019	282,4	244,7	86,7	35,4	12,5	1,8	0,6	0,6	0,2	0,0	0,0
2020	359,7	118,8	33,0	202,8	56,4	36,5	10,1	1,6	0,4	0,0	0,0
2021	359,4	92,7	25,8	200,2	55,7	63,2	17,6	3,2	0,9	0,0	0,0
2022	361,8	117,3	32,4	158,0	43,7	82,3	22,7	4,2	1,2	0,0	0,0

Table 2. The level of seepage water in the irrigated areas of the Fergana Valley

Year	Irrigated area	Division of areas according to the depth of the water table											
		0-1 up to a meter		1-1,5 up to a meter		1,5-2 up to a meter		2-3 up to a meter		3-5 up to a meter		>5 below a meter	
		to thousand	%	to thousand	%	to thousand	%	to thousand	%	to thousand	%	to thousand	%
2015	265,5	1,7	0,6	36,7	13,8	99,2	37,4	45,3	17,1	23,6	8,9	58,8	22,1
2016	265,8	2,1	0,8	41,0	15,4	92,1	34,7	47,9	18,0	23,4	8,8	59,3	22,3
2017	282,6	0,3	0,1	26,8	9,5	50,4	17,8	32,7	11,6	23,5	8,3	148,8	52,7
2018	282,3	0,2	0,1	21,8	7,7	50,8	18,0	36,3	12,9	24,1	8,5	149,0	52,8
2019	282,4	0,1	0,0	21,8	7,7	48,2	17,1	36,5	12,9	23,9	8,5	151,9	53,8
2020	359,7	1,5	0,4	28,5	7,9	137,0	38,1	95,8	26,6	17,5	4,9	79,4	22,1
2021	359,4	1,0	0,3	22,1	6,1	123,6	34,4	115,1	32,0	19,6	5,5	77,8	21,6
2022	361,8	1,0	0,3	26,0	7,2	141,1	39,0	97,1	26,8	17,4	4,8	79,2	21,9

In the hills, seepage waters are very deep and come close to the surface of the earth in some valleys and adiroldi slopes. Soil is the fertile top layer of the earth's surface. Soil is an inexhaustible natural resource for agricultural production, the main source of food and various raw materials necessary for human society.

It should be noted that the Fergana Valley has been one of the main centers of agricultural agriculture since ancient times. Sufficient internal water sources provide a great opportunity to turn the valley's pre-mountain prolluvial plains, conical expanses, mountain and mountain terraces, inter-hill and post-hill plains, deserts of Central Fergana, and even hills into irrigated oasis soils on a large scale. In particular, Syrdarya, Sokh, Isfara, Shakhimardan and many other rivers, streams and canals are an integral, most important component of geocomplexes, and actively participate in the formation of the landscape structure, its changes and stratification. Also, the Sokh plain is of great importance in the formation of the landscapes of Southern Fergana (Fig. 1).

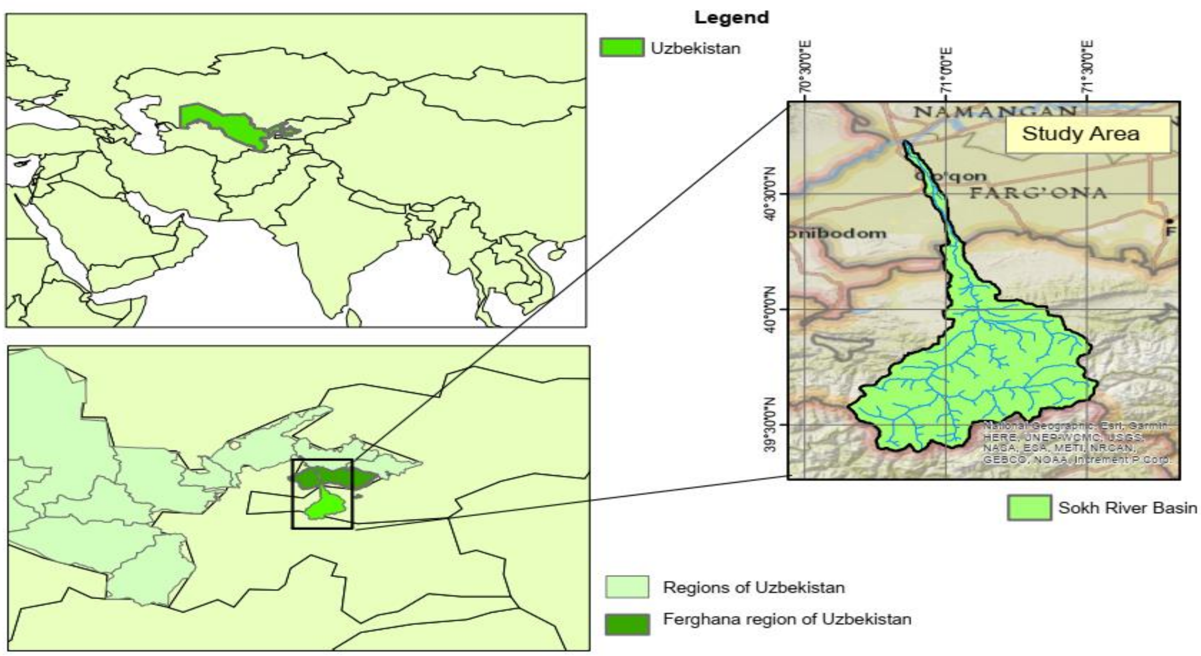
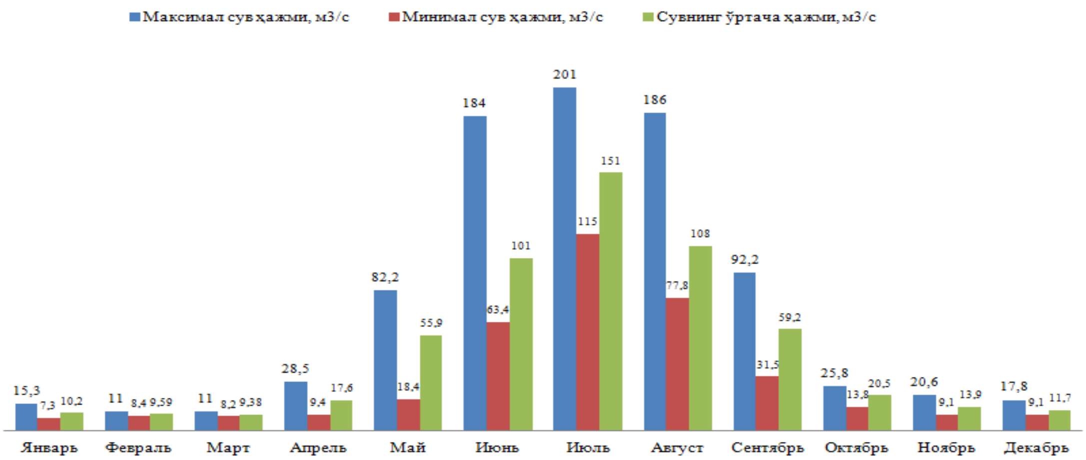


Figure 1. Sokh river

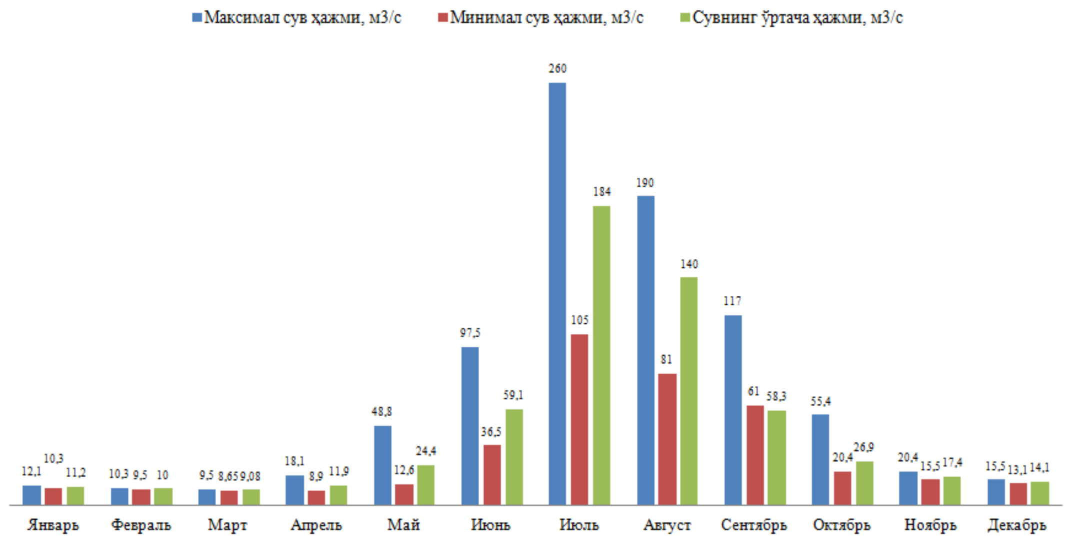
Irrigated agriculture remains the main consumer of Sokh river water. Therefore, any changes affecting the water resources of Uzbekistan have a high multiplier effect on various socio-economic aspects of the development of the regions. Therefore, the study of the seasonal water level of the Sokh River is important in forecasting and solving land irrigation issues in Southern Fergana.

The length of the Sokh river is 124 km, the water basin is 3510 km2. The Sokh River begins at an altitude of more than 3000 m near the village of Kurgon on the northern slopes of the Oloy Ridge, and is formed by the confluence of the Ok-Terek and Khoja Achkan rivers. It flows mainly northward. It serves as the main source of water supply in Southern Fergana in the middle stream. It reaches the Syr Darya mainly in winter. The source of saturation is mixed glacier-snow, as well as groundwater. High water is observed during the intensive melting of glaciers from June to September.

Due to the rapid growth of the population in the Sokh river basin, there is a shortage of water. According to estimates, Kyrgyzstan uses almost 23-30 percent of the river's flow to irrigate rice fields in the foothills of the Burganda massif. Fergana Branch According to the Uzgidrometeorology methodology, it was found that the development of the foothills located above the territory of Southern Fergana led to an increase in the level of underground water in Rishton and Altiariq districts. The results of the study are presented in Figures 1-2-3.



1- fig. The results of the study of the water volume of the Sokh River in 2017



2- picture The results of the study of the water volume of the Sokh River in 2019

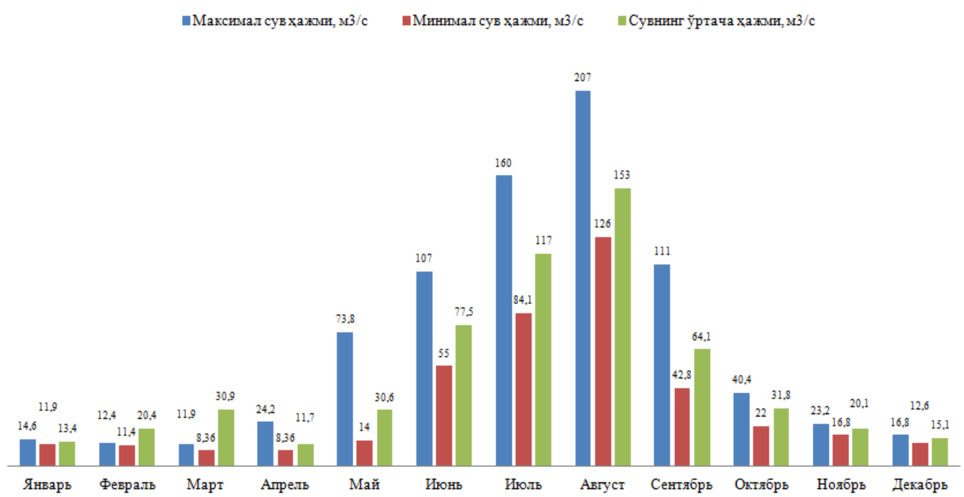


Figure 3. The results of the study of the water volume of the Sokh River in 2020

As can be seen from these tables and figures, the maximum volume of water during these periods was observed in August 2016 and was 400 m3/s (Figure 1). The minimum volume of water in the river was 7.08 m3/s in March 2018 (Figure 2). It can be seen that the maximum level of water is mainly observed in June-September, and the minimum amount of water is observed in January-March.

In order to meliorate the nature of distribution of underground water, natural conditions, regime of seasonal changes and other hydrogeological features of Sokh-conical flat landscapes, it is of great importance to collect data on their depth, degree of mineralization, chemical composition and other characteristics, in particular, quantitative indicators.

Such information is very necessary in the melioration assessment of landscape complexes. The degree of mineralization of underground water in most cases determines the salinity of irrigated soils, and the degree of waterlogging of near-surface waters. Groundwater has a strong influence on the soil cover of landscape complexes, changing their optimal reclamation regime.

Therefore, the higher the groundwater level, the stronger the hydromorphic regime, and vice versa, the lower the groundwater level, the stronger the semi-automorphic and automorphic regimes.

Therefore, the role of underground water in the transformation of automorphic geocomplexes to hydromorphic and hydromorphic geocomplexes to automorphic is extremely large. The hydrological regime of Southern Fergana is inextricably linked with human economic activity, changes in the landscape structure, and internal water sources (1-table).

In the microzones of the middle and lower slopes of the spread, in places where mineralized groundwater lies close to the surface, moderately and strongly fragmented irrigated meadows, swamp-meadows and marshy soils, as well as salt marshes are well developed. The process of salinization and swamping is very active in these soils.

Such processes make their reclamation situation even more complicated. In places where groundwater lies deeper than the surface of the earth, non-saline automorphic soils, especially gray-brown soils, are well developed. On the contrary, water and wind erosion, rather than salinization and waterlogging, are active in such soils.

Table 1. Amount of water used from water sources in Southern Fergana by administrative regions (million m^3)

Name of districts	Total amount of water taken	Including			
		From the river bed	From internal streams and rivers	From underground water	From Zovur
Besharik	337,9	281,6	38,7	8,5	9,0
Bagdod	303,6	195,6	99,4	2,3	6,3
Buvaida	264,7	205,9	44,4	0,1	14,1
Dangara	304,7	189,9	97,0	5,6	12,2
Uzbekistan	306,8	78,1	216,1	7,8	4,8
Uchkuprik	268,4	140,5	121,6	3,6	2,7

Source: Syrdarya - Sokh irrigation system is compiled based on the information of the basin administration.

The level of salinity of irrigated soils in all regions of the region is closely related to the level of mineralization of underground water. If the amount of mineral salts in the groundwater is low, the agricultural soils are less saline, and vice versa, the higher the level of mineralization of the groundwater, the stronger the soils are saline. The level of underground water and its level of mineralization in the Sokh conical spread obey certain laws in its geographical distribution. Based on this law, the level of mineralization of the underground water of the area increases from the top to the bottom, and the salinity level of the soil also increases in this direction.

The level of mineralization of groundwater on irrigated soils can be estimated as follows: if the content of mineral salts in groundwater is less than 0.5 g/l, it is most favorable for irrigated soils, if it is 0.5-2 g/l, it is favorable , 2-3 g/l is less comfortable, 3-4 g/l is very less comfortable, and more than 5 g/l is not comfortable. The interaction of groundwater and soil is given in the table.

In the melioration assessment of landscape complexes, it is necessary to take into account the qualitative state of their soil cover and the quantitative change that occurred under the influence of natural geographical processes. It is known that the soil cover of the Sokh conical spread is mainly composed of brown-brown, meadow, swamp-meadow, swamp and saline soils.

Along with the rise in the level of underground waters, their chemical composition is also changing. In Andijan - Shakhrikhan, Norin, Namangan, Iskovot - Pishkurgan, Koqumboy, Olmos - Varzik, Altiariq - Beshalish underground water fields, where mineralization of underground water is high, the development of hilly zones has a big contribution. In Andijan, Asaka, Shahrikhan districts, the total hardness of underground water is higher than the permissible norm (REM) due to the influence of agriculture and industry.

As a result of the development of new lands and the development of irrigated agriculture, the chemical composition of underground water in the upper right and left part of the Sokh basin has changed significantly. Before land development, the total mineralization of underground water was 0.2-0.8 g/l, the total hardness was equal to 3-7 mg.eq/l. Since 1990, their total mineralization has increased to 1.0-1.3 g/l, total hardness to 15-20 mg.eq/l.

By 1993, underground waters with changed geochemical composition covered an area of 140 km2 in the eastern part, 90 km2 in the western part, and a total of 230 km2. Currently, the mineralization of the Sokh underground water field around the Baghdad section is 1.35 g/l, the hardness level is 18.5 mg.eq/l, in accordance with the territory of Rishton district, it is 1.1-3.9 g/l, the hardness is 15.2 It is observed up to -40.1 mg.evk/l. In the Yaipan area of the Sokh mine, the pollution that was discovered in 1986 is still present.

Development of land development and irrigated farming can be shown as the main factors polluting underground water in the area of Isfara underground water field. The upper parts of the Isfara underground water field are distinguished from other areas by the high level of pollution. The average mineralization of the underground water deposit is 1.03 g/l, the hardness is 1.08 mg.eq/l, while the mineralization in its upper parts is 1.3 g/l., the hardness reaches 8-16 mg.eq/l. Andijan, Asaka, Polvontash and other hills in Aravon, Akbura, Karadarya basins were actively developed after 1970. By the end of the 1980s, 29,300 new lands were acquired in these areas, and 12 pumping stations were built to supply them with water. As a result, the total mineralization of underground groundwater increased from 0.5-1.0 g/l to 1.5-2.3 g/l.

Areas with increased mineralization are 1.5-2.0 km wide at the foothills, and 4-5 km wide at the foothills of Andijan-Asaka hills. In these regions, not only groundwater, but also the geochemical composition of underground water in layers from 50 to 180 meters in depth has changed. The mineralization of groundwater in these layers increased from 0.3-0.8 g/l to 0.8-1.2 g/l, the total hardness increased from 3-6 mg.eq/l to 8-12 mg.eq/l . The level of mineralization of underground water in Marhamat district also increased to 1.2-2.1 g/l in 1986. The total hardness level is 14-20 mg. reached eq/l.

The mineralization of ground water in the Olmos-Varzik underground water field is 0.5-1.1 g/l, the hardness is 5.7-8.35 mg.eq/l, the mineralization in the Shoyon-Baymoq area is 0.6-1.2 g/l. l, the hardness reaches 8.1 - 10 mg.eq/l. The hydrochemical regime of the Kosonsoy underground water deposit has a certain characteristic over the years. Its mineralization is 0.08 - 0.84 g/l, hardness is 4.7 - 9.2 mg.eq/l. There are areas higher than these indicators, and in some places the mineralization of underground water reaches 1.04 g/l, and the total hardness reaches 14.9 mg.eq/l. In the Chortoksoy and Namangansoy basins of the Iskovot-Pishkaron underground water field, there are areas where the mineralization of underground water is up to 2-2.1 g/l, and the total hardness is higher than 25.2-26.4 mg eq/l. The mineralization of groundwater in the Chust-Pop underground water field is 0.3-0.7 g/l, the hardness is 2.25-8.3 mg.equiv/l, in some places the corresponding mineralization is 1.4 g/l and reaches 9.0 mg.eq/l.

The Namangan underground water deposit is characterized by its complex hydrochemical condition. The hardness of underground water in this area is 8.3 - 25.6 mg.equiv/l, mineralization is 1.1 - 2.1 g/l. The main reason for the high level of mineralization of underground water is the exploitation of hilly areas and irrigation farming. The mineralization of water in the Norin underground water field is 0.3-0.7 g/l, the hardness is 3.7-4.45 eq/l, and in the eastern areas of the water field it rises to 9.2-9.8 eq/l . The main reason for this can be the exploitation of Moylisoy hills and the increase of soil salinization in the region.

Soil is a natural product formed from various rocks on the earth, it has a unique structure, composition and a number of special properties. V.V. Dokuchaev was the first in the world to establish the science of soil science, studied the soil on a scientific basis. He proved that the formation of soil depends on several natural conditions, climate, topography, flora and fauna, and he determined that soils specific to that land appear in the natural zones of the entire surface of the earth. V.V. Dokuchaev's teaching about soil and zones will greatly help the correct zoning of various branches of agriculture in our country. This doctrine allows solving various agrocomplex activities depending on the soil conditions, such as tillage, proper use of fertilizers, setting of irrigation norms, creation of rotation schemes, and correct implementation of land reclamation works. Soil differs sharply from rocks in several of its properties, especially its fertility, the ability to provide new plants with water, air, and other life factors.

The geoecological basis of using the nature of the river basins is of crucial importance. In this regard, the organization and implementation of production in ecological balance-ecological situation-environmentally clean technology and products-environmental cleanliness and health systems is of great importance. In this respect, geoecological principles are close to or complement geographical principles, which develop in mutual dependence and communication. Along with the balance of natural components in the biosphere, the principle of mutual ecological balance between living nature and non-living nature is also of practical importance. According to this principle, there is an equal relationship between two types of nature in each natural boundary area, which requires them to be in a certain balance.

However, the disturbance of one of them as a result of external influence leads to a long-term (hundreds of centuries) balance failure. Based on the parameters of this disorder, the event is determined by the influence of several other events on the composition (interconnection of the chain of causes and effects). The ecological balance is very fragile, and in many cases it is related to the state of the geosystems, the impoverishment of the flora, and the disturbance of the soil cover.

The principle of ecological cleanliness of human labor is of practical importance in solving problems. This principle justifies the necessity of releasing various solid, liquid and gaseous wastes generated in the production process and daily life into the natural environment after they have been thoroughly cleaned and completely neutralized before being released into the atmosphere and water bodies. The implementation of this principle in practice is the most effective in stopping environmental pollution and its sustainable cleaning. In our opinion, it will be possible to achieve a clean-up of the natural environment with a gradual transition to partial implementation at first and then full implementation over time.

It is obvious to everyone that irrigated lands are the most economically efficient. However, the amount of gross produce obtained from irrigated lands and their cost are different in different oases, in other words, the economic efficiency is drastically different from each other. According to the results of the analysis of this situation, everything depends on the state of land reclamation. In fact, in oases where economic efficiency prevails, soil-ameliorative conditions are characterized by their convenience for the growth of crops and vice versa. Water consumption is high in regions with severe ecological and reclamation conditions. In order to effectively use land and water and achieve economic efficiency, it is first of all necessary to radically improve land reclamation conditions, introduce the technology of efficient water use, and then proceed to the use of agrotechnical and agromelioration measures. Because the effectiveness of mineral fertilizers and other measures will not be felt until the land is completely desalinated.

3. Conclusion

Research on the problem of optimizing the use of nature has been carried out for many years. There has been some progress in this regard, but it is still too early to believe that significant or significant results have been achieved. In our opinion, one of the ways to optimize the use of nature is to have its own assessment of each of the resources, in which it is appropriate to carry out an assessment not only in general, but also in certain regions. Let's say that water has a certain price, and if it is used in a certain farm or enterprise, it is necessary to pay a fee for the used volume at the expense of the state, so that the farm (enterprise) receives only the necessary amount of water, and if it pollutes (that is, if it throws the excess water into the basin) must be notified in advance of paying an additional fine.

Another criterion for optimizing the use of nature is the transition to the principle of organizing production on the basis of an integrated geosystem. In this regard, as we said above, it is proposed to use this principle as an experiment in the most characteristic regions of the country, and if it is justified, then it is allowed to use it on a large scale. Based on the above analysis, the following conclusions can be reached;

- After the 1970s, a large part of the Fargogna valley, the Adirla zone, was used for irrigated farming, and the groundwater level is rising in these areas;
- Deterioration of the geochemical composition of underground waters is associated with the use of protected lands for irrigated farming in the period after the 1970s;
- It is advisable to carry out effective reclamation measures in the areas where the geochemical regime of underground water has deteriorated.

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