International Journal of Genetic Engineering 2024, 12(6): 104-110
DOI: 10.5923/j.ijge.20241206.07

Criteria for Erosion and Degradation Factors of Desert Pasture Soils

Nabieva Gulchekhra Mirergashevna[1,*], Nurgaliev Najmiddin Abdumajidovich[2]

[1]DSc., Associate Professor, Departament of Soil, National University of Uzbekistan named after Mirzo Ulugbek, Tashkent, Uzbekistan
[2]Researcher Departament of Soil, National University of Uzbekistan named after Mirzo Ulugbek, Tashkent, Uzbekistan

Abstract This article presents the research on the deterioration of soil properties under the influence of wind erosion in the "Todakol massivi" in the northern part of Qorovulbazar district of Bukhara region. The work explores the natural geographic location of the research area, soil cover, vegetation world distribution, climate conditions, and drought levels. The impact of wind erosion on the soils of the research area and the number of naturally distributed grazing plants were calculated through the 4 × 100 transect method. The laboratory studied soil salinity types, soil salinity levels, chlorine ion, dry residue. In particular, soil erosion due to the wind in the area and the amount of easily soluble salts in water were determined and factors that cause degradation processes evaluation criteria improved. As a result, an increase in wind speed and, as a result, erosion of soil particles in the protected area of the Bukhara region, a decrease in soil fertility was observed. In the last 10 years, the annual drought rate has dropped to the dry and hyper-dry type, and the maximum wind speed is. 0,25; 0,25-0,5; 0,5-1,0; 1-2; 2-3 caused the mm particles to be blown away, while the average wind speed was 0.25 mm particles.

Keywords Wind erosion, Desertification, Soil degradation, Soil salinity, Flora

1. Introduction

In recent years, soil pollution, increased salinization and desertification, water and wind erosion have affected the loss of the fertile soil layer. Such processes are clearly felt as a result of the soil spread in the basins of the Zarafshan River and anthropogenic effects on them [11,19]. The experience of using remote sensing services of soil and vegetation cover in arid regions has been widely used, including in 2020 and 2021, unfavorable weather and unscientific use of pasture lands caused the rise of dust storms, which resulted in the sand cover of pastures and accelerated the degradation process [5,27]. Analysis of modern desertification dynamics using geo-information technologies and aerospace data has shown that the area of degraded and desert lands in the region is increasing due to the influence of human factors [12]. Desertification and degradation of drylands have been studied through years of research to quantify the desertification process [13].

In recent years, the degradation processes of sandy desert grasslands have become a serious problem in some regions. This process depends on several factors. Quantitative assessment, the effects of the degradation processes of arid windy sandy areas on soil properties and their changes have been studied [2]. Effects on desert soils resulted in reductions in soil microbial biomass, enzyme activity, and nematodes [32,18]. Dunes were formed as a result of wind erosion in desert regions where vegetation is sparse [35].

In recent years, as a result of sudden changes in climate, the level of soil and vegetation degradation in the sandy desert areas has reached 35.7%, and it has been determined that the current state of grassland ecosystems in the Kyzylkum desert will undergo serious changes [33]. The condition of grassland ecosystems in the sandy desert massiv was comprehensively evaluated, and according to the research results, the development of degradation processes and the loss of natural fertility were observed as a result of irregular use of pastures [4,22]. In the desert zone, pastures, which are being excessively lost due to long-term monitoring of their land, occupy a small part of the Caspian lowland [16,17]. Biodiversity has been significantly damaged by changes in soil properties in the desert region by disrupting the water requirements of plants [29,6]. The process of desertification is active in various regions and is considered a major problem in changing the soil and vegetation cover [3].

FAO and UNESCO organizations have studied the desert region into several groups and named them as gray-brown, barren, sandy desert soils [21]. In the Bukhara oasis, scientists conducted extensive research on the formation of desert soils, the hydrogeological regime of their origin, climate, and soils [26]. In order to study the degradation of sandy desert soils, their distribution, mechanical composition, humus content, presence of total and mobile nutrients in the soil, salinity

* Corresponding author:
gulchekhra-nabieva@rambler.ru (Nabieva Gulchekhra Mirergashevna)
Received: Nov. 2, 2024; Accepted: Nov. 23, 2024; Published: Nov. 27, 2024
Published online at http://journal.sapub.org/ijge

level were studied [1,7,24].

Based on research conducted in desert areas, it is scientifically proven that various ecological problems and changes in vegetation cover are caused by relief features, soil-forming rocks, and moisture conditions [28,10,1].

It has been scientifically proven that the soils of the desert zone located in different regions of Kazakhstan differ in terms of regional climate characteristics, morphogenetic and chemical properties of soils, organic substances in their composition, and their group composition [23,9]. The formation processes of sandy desert soils, the formation of soils, their specific water regime and capillarity create a specific water regime [14,34,31]. It has been found that plants in desert soils are severely damaged by wind erosion [30]. In the desert region, the reduction of vegetation as a result of degradation leads to the activation of soil salinization [20,15].

2. Materials and Methods

In the study of the properties of degraded sandy desert soils distributed in the Todakul massiv of the Qorovulbazar district of Bukhara region, the generally accepted profile in soil science was studied on the basis of methods such as genetic, morphological, comparative geographical, and on the basis of methods generally accepted in laboratory conditions. V. Sayfutdinova's study guide was used to take soil samples and determine the amount of water-soluble cations and anions in the soil [25].

The following work was carried out under field conditions:

- studies were carried out on the study of the natural geographical location, soil cover, distribution of vegetation, and ecological conditions of the research area;
- studies of climate conditions and drought level of the research area were carried out;
- work was carried out to study the effect of wind erosion on the soils of the research area;
- soil samples were taken from the research area;
- the number of naturally distributed pasture plants in the research area was calculated using the 4x100 transect method.

Soil analyzes were carried out in the following ways:

- determination of soil salinity types according to Yu.P. Lebedev's classification;
- determination of soil salinity according to O.K.Komilov, A.U.Akhmedov classification;
- chlorine ion according to Mor's method;
- dry residue based on evaporation of the solution and weighing of the precipitate;
- correlation coefficient was performed in Microsoft Excel program and statistical analysis of obtained results was performed in Excel STAT interface.

Flora distributed in the study area. The geographical distribution of plants in the research area is divided into two groups: that is, plants distributed in sandy desert and irrigated areas. Grasslands are the main part of the plants scattered in the sandy deserts of the oasis. These plants also protect the soil from wind erosion. Their vegetation period is short, 210-215 days plants such as white haloxylon (Haloxylon persicum L.), black haloxylon (Haloxylon aphyllum L.), sagebrush (Artemisia tenuisecta L.), tamarisk (Tamarix hispida L.), harmel (Peganum harmala L.), seta (Salsola sclerantha L.), alhagi (Alhagi sparsifolia L.), sagebrush (Salsola arbuscula L.), black redroot pigweed (Amaranthus retroflexuss L.), sedges (Carex physodes L.), downy brome (Bmomus tectorum L.), barley (Eremopyrum Orientale L.), salty crabgrass (Aeluropus litoralis L.), alhagi (Alhagi psudoalhagi L.) are common (Fig. 1).

Currently, 528 unique species of plants can be found in the Bukhara oasis. These plants are common in oasis desert, sandy desert and irrigated areas. 220 types of weeds were found among agricultural crops in irrigated fields. Among them, there are 89 species with a wide geographic distribution specific to this ecological environment [8].

Study area. The research was carried out in the "Todakol massiv" in the northern part of Qorovulbazar district of Bukhara region. This area is mainly degraded and used as pasture, hilly semi-fortified sandy desert and alluvial-proluvial and lacustrine deposits (Fig. 2).

Qorovulbazar district of Bukhara region was established on January 12, 1993. This district borders with Bukhara district in the north, Mubarak district of Kashkadarya region in the south, Olot district in the west, and Kyzyltepa district of Navoi region in the east. The relief consists of low and high hills, divided by old riverbeds. The total area of the district is 219,580 hectares.

***Note:** (A)- alhagi Alhagi sparsifolia L., (B)-harmel Peganum harmala L.,*
(C) – black haloxylon Haloxylon aphyllum L., (D)-tamarisk Tamarix hispida L.

Figure 1. Plant species distributed in the study area

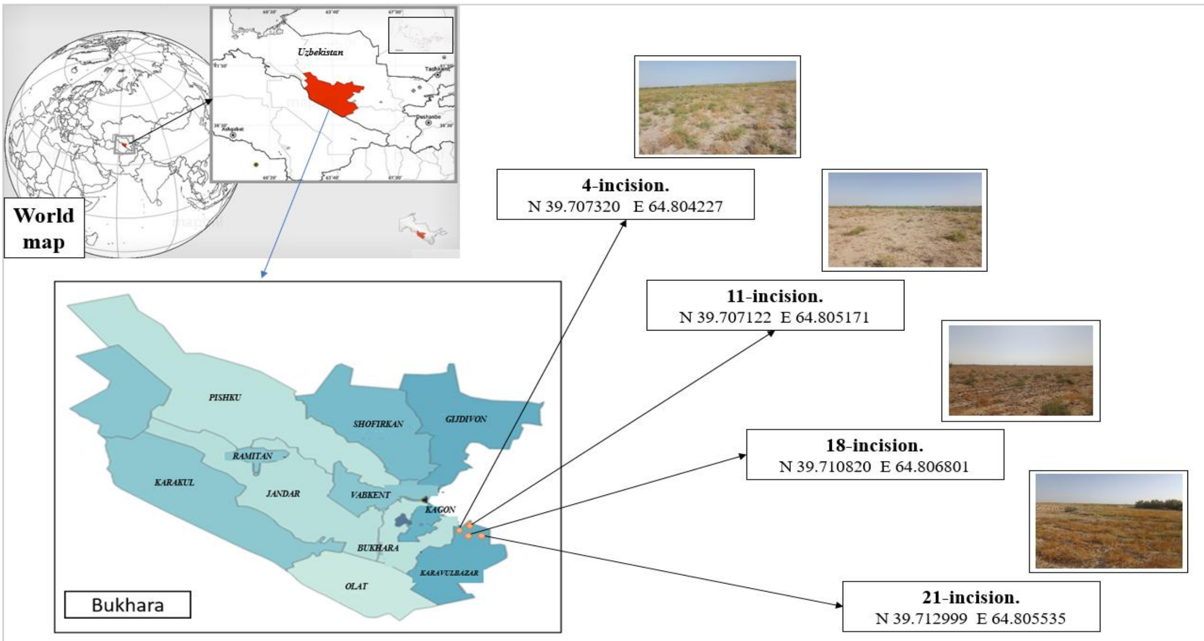

Figure 2. Geographic location coordinates of the research area, 2024

3. Results and Discussion

Indicators of soil deflation in the study area under the influence of wind. Today, desertification and land cover degradation caused by climate change is one of the major problems around the world. This process causes a number of problems related to the formation of sandy soils, especially in areas with limited water resources, including many areas of Bukhara region. In the soils of the Bukhara region, the fertile upper part of the soil is blown away by the deflation processes, especially under the influence of the wind. According to the information of the Hydrometeorological Service Center of the Republic of Uzbekistan, it was observed that during the period of 2012-2022, due to the influence of wind erosion, soil particles with a size of 0.25 mm were regularly eroded by wind (Table 1).

According to the results of the analysis, the maximum wind speed of the soils of the study area varied by 0.3-2.3 m/s between 2012 and 2022, that is, the wind speed index increased, which led to an increase in the situation of wind erosion. Therefore, in the last 11 years in the study area, it was found that 0,25; 0,25-0,5; 0,5-1,0; 1-2; 2-3 mm particles in the soil were eroded, 0.25 mm particles in the soil were eroded at the average speed of the wind.

The amount of easily soluble salts in the soils of the study area

Various salts in the soil have a negative effect on the growth and development of plants. As a result of an increase in the amount of salt in the soil, an increase in soda, chloride and sulfates in it, the quality of the soil deteriorates, its productivity decreases and the degradation processes increase. In this regard, in order to determine the amount of mineralization of the soils of the scientific research area, the samples taken from the soil sections were determined and analyzed in laboratory conditions using methods that passed the state standards (Table 2).

In the northern part of Qorovulbazar district of Bukhara region, the amount of total dry residue fluctuated between 0.115±0.2% and 0.190±0.4% according to the amount of easily soluble salts in the soil layers. The 21st section with the highest amount of dry residue was considered. According to it, the amount of HCO_3 in terms of total alkalinity was from 0.030±0.04% to 0.037±0.03%. Among the anions distributed in this section, Cl^- was from 0.016±0.02% to 0.025±0.02%, SO_4^{--} from 0.018±0.03% to 0.036±0.02%. According to the amount of cations, it was determined that Ca^{++} fluctuated from 0.008±0.001% to 0.066±0.02%, Mg^{++} from 0.002±0.001% to 0.005±0.003%, and Na^+ from 0.019± 0.02% to 0.023±0.02%. The degree of salinity was determined to be weakly saline and chloride-sulfate (ch.s) and sulfate-chloride (s.ch) types according to the type of salinity.

The amount of dry residue was determined at least in the 4th section. According to it, the amount of dry residue fluctuated between 0.115±0.2% and 0.131±0.2% in the layers. According to the total alkalinity, the amount of HCO^3 was from 0.030±0.03% to 0.037±0.02%. Among the anions distributed in this section, Cl^- was from 0.015±0.02% to 0.022±0.03%, $SO4^{--}$ was from 0.018±0.01% to 0.026±0.02%. According to the amount of cations, it was determined that Ca^{++} oscillated from 0.002±0.001% to 0.056±0.002%, Mg^{++} from 0.002±0.001% to 0.005±0.001%, and Na^+ from 0.012± 0.02% to 0.023±0.04%. The degree of salinity is weakly saline, and according to the type of salinity, it was determined that all layers are of chloride-sulfate (ch.s) type.

Table 1. Variation of wind speed and erosion rates of sandy desert soils in the study area (Hydrometeorological Service Center of the Republic of Uzbekistan, 2023.)

№	Years	Maximum wind speed, m/s	Erodible soil particles, mm	Average wind speed, m/s	Erodible soil particles, mm
1	2012	15,8	0,25; 0,25-0,5; 0,5-1,0; 1-2; 2-3	3,3	0,25
2	2013	16,6	0,25; 0,25-0,5; 0,5-1,0; 1-2; 2-3	3,3	0,25
3	2014	15,6	0,25; 0,25-0,5; 0,5-1,0; 1-2; 2-3	3,2	0,25
4	2015	16,0	0,25; 0,25-0,5; 0,5-1,0; 1-2; 2-3	3,3	0,25
5	2016	17,0	0,25; 0,25-0,5; 0,5-1,0; 1-2; 2-3	3,1	0,25
6	2017	17,3	0,25; 0,25-0,5; 0,5-1,0; 1-2; 2-3	3,3	0,25
7	2018	16,9	0,25; 0,25-0,5; 0,5-1,0; 1-2; 2-3	3,5	0,25
8	2019	15,4	0,25; 0,25-0,5; 0,5-1,0; 1-2; 2-3	3,4	0,25
9	2020	16,8	0,25; 0,25-0,5; 0,5-1,0; 1-2; 2-3	3,2	0,25
10	2021	17,2	0,25; 0,25-0,5; 0,5-1,0; 1-2; 2-3	3,4	0,25
11	2022	16,6	0,25; 0,25-0,5; 0,5-1,0; 1-2; 2-3	3,3	0,25

Table 2. The amount of easily soluble salts in the soil of the study area

Layer thicknes, cm	Dry residue	HCO_3	Cl^-	SO_4^{--}	Ca^{++}	Mg^{++}	Na^+	Salinity	
								Type	Deg-ree
Section 1									
0-28	0,118±0,2	0,037±0,02	0,016±0,03	0,022±0,02	0,003±0,002	0,002±0,001	0,018±0,02	ch.s	
28-48	0,116±0,3	0,035±0,03	0,015±0,02	0,018±0,01	0,008±0,001	0,002±0,002	0,017±0,03	ch.s	
48-71	0,115±0,2	0,034±0,04	0,016±0,01	0,020±0,03	0,009±0,001	0,004±0,001	0,012±0,02	ch.s	weakly saline
71-93	0,176±0,4	0,030±0,03	0,018±0,02	0,026±0,02	0,056±0,002	0,005±0,001	0,021±0,03	ch.s	
93-131	0,131±0,2	0,035±0,02	0,022±0,03	0,026±0,04	0,002±0,001	0,004±0,02	0,023±0,04	ch.s	
Section 11									
0-25	0,125±0,3	0,035±0,02	0,015±0,04	0,024±0,02	0,008±0,001	0,002±0,001	0,020±0,02	ch.s	
25-52	0,115±0,2	0,036±0,03	0,017±0,02	0,019±0,03	0,009±0,002	0,004±0,002	0,011±0,01	ch.s	
52-83	0,122±0,4	0,034±0,02	0,018±0,03	0,021±0,01	0,011±0,01	0,004±0,001	0,014±0,02	ch.s	weakly saline
83-115	0,150±0,3	0,034±0,03	0,021±0,02	0,026±0,02	0,025±0,02	0,004±0,002	0,021±0,03	ch.s	
115-140	0,169±0,2	0,032±0,02	0,018±0,04	0,026±0,03	0,046±0,03	0,005±0,002	0,022±0,02	ch.s	
Section 18									
0-15	0,127±0,2	0,037±0,04	0,018±0,02	0,024±0,03	0,008±0,002	0,002±0,001	0,018±0,02	ch.s	
15-32	0,128±0,3	0,037±0,02	0,024±0,03	0,018±0,02	0,011±0,02	0,003±0,001	0,016±0,03	s.ch	
32-55	0,118±0,2	0,035±0,03	0,015±0,02	0,020±0,03	0,009±0,002	0,004±0,002	0,015±0,02	ch.s	weakly saline
55-83	0,152±0,3	0,034±0,02	0,023±0,03	0,026±0,01	0,021±0,02	0,005±0,003	0,023±0,03	ch.s	
83-125	0,190±0,4	0,030±0,03	0,018±0,01	0,024±0,02	0,071±0,03	0,005±0,002	0,022±0,01	ch.s	
Section 21									
0-18	0,139±0,2	0,034±0,02	0,016±0,02	0,036±0,02	0,012±0,02	0,002±0,001	0,019±0,02	ch.s	
18-38	0,117±0,4	0,037±0,03	0,019±0,01	0,018±0,03	0,008±0,001	0,002±0,001	0,013±0,01	s.ch	
38-47	0,133±0,3	0,035±0,02	0,025±0,02	0,020±0,01	0,009±0,002	0,004±0,002	0,019±0,02	s.ch	weakly saline
47-78	0,174±0,2	0,030±0,04	0,018±0,03	0,026±0,02	0,053±0,03	0,005±0,003	0,022±0,03	ch.s	
78-108	0,188±0,3	0,030±0,02	0,018±0,02	0,026±0,03	0,066±0,02	0,005±0,002	0,023±0,02	ch.s	

Note: *(ch.s)- Chloride sulfate, (s.ch) Sulphate chloride. The results of the laboratory analysis were carried out in 3 repetitions and the average values were obtained*

Table 3. Factors that cause degradation processes evaluation criteria

Specification	Degree of degradation				
	Not degraded	**Soor degraded**	**medium - degraded**	**highly degraded**	**very highly degraded**
High harvest	3,5-4,5	2,5-3,5	1,4-2,5	0,8-1,4	0,4-0,8
Aboveground biomass, c/ha	150-180	120-150	90-120	50-90	20-50
The thickness of the humus horizon, cm (A+B)	40-50	30-40	20-30	10-15	5-8
Drought index	Wet AI≥0,65	Dry subhumid 0,5≤AI<0,65	Semi - dry 0,2≤AI<0,5	Dry 0,05≤AI<0,2	Very-dry AI<0,05
Volatility of soil particles by wind speed, m/s	3,3-3,8	4,5-5,3	5,5-6,8	11,2-13,1	14,5-17,6
pH environment	6-7	7,1-7,5	7,6-8	8,1-9	9,1-10
Number of plant species, PCs/ha	40	28-35	20-25	10-17	3-6
Turf zone, %	70-80	60-50	40-30	10-5	-
Projective covering of plants, %	45-40	35-30	25-20	10-5	2-1
Number of plants per $1m^2$	300-350	200-250	120-150	50-30	9-10
Humus, %	>1,0	0,6-1,0	0,4-0,6	0,2-0,4	<0,2
Physical Clay, %	30-45, 45-60	20-30, 30-40	20-30	10-20	<10
Dry residue, %	<0,3	0,3-1,0	1,0-2,0	2,0-3,0	>3

In order to assess the soils of the desert and semi-desert region, degradation metrics were improved taking into account the properties of these soils. On the factors that cause degradation processes, sandy desert soils, theinig assessment criteria were analyzed according to 13 different indicators and 5 different levels of degradation, and the following results were obtained (Table 3).

The cartilage yield was 0.8-1.4 s/Ha, the humus layer thickness (A+V) was 14-20 cm, the drought index was 0.05≤ AI<0.2 dry, the volatility of soil particles by wind speed was 16.6-17.3 m/s in maximal, the pH environment was 8.1-8.8, humus was 0.2-0.4%, physical Clay was 5.1-10.8%. The results showed moderate to strongly degraded levels. It was 1.0-2.0% on dry residue and showed an average degraded level.

The degree of degradation varies in many ways in accordance with the amount of precipitation, air temperature and pasture capacity. The drought of 2018 coincided with a hyper-Dry Index and had a very strong level of degradation.

4. Conclusions

In the research area, the annual precipitation has decreased by 39.8 mm in the last 10 years, annual evaporation has increased by 116.2 mm, the degree of drought has dropped to the dry and hyper-dry type. In the period from 2013 to 2022, the maximum wind speed (16.6-17.3 M/s) increased to 1.7 M/s. Maximum wind speed in 10 years 0,25; 0,25-0,5; 0,5-1,0; 1-2; 2-3 caused the MM particles to be blown away, while the average wind speed was 0.25 mm particles.

The data analysis shows that soil layers in the northern part of Qorovulbazar district of Bukhara region over the years, the increase in wind speed and as a result the erosion of soil particles is one of the main factors that reduce soil fertility. In the fight against soil erosion, the force of the wind can be reduced by planting trees and shrubs. These measures can be effective in maintaining soil fertility and preventing wind erosion.

According to the degree of salinity, it was determined that the soils are weakly saline, and the type of salinity belongs to chloride sulfate (ch.s) and sulfate chloride (s.ch) types. These results indicate that the soils in the area are in the early stages of the salinization process, and the composition and amount of salts may have a negative impact on soil fertility. Therefore, it is necessary to take these factors into account when carrying out agricultural activities on the soils of the area. Special agrotechnical measures are required to take additional reclamation measures and increase soil fertility.

The criteria for assessing the factors that cause degradation processes have been improved to a level corresponding to the research area, and sandy desert soils, whose assessment criteria have been analyzed and studied for 13 different indicators and 5 different levels of degradation, have shown that soils are moderately and strongly degraded.

REFERENCES

[1] Abdrahmanov T, Jabbarov Z. A, Mahammadiyev S. Q, Abdrakmanov Tokhtasin, Jabbarov Zafarjon, Fayzullaev Orzubek, Abdullaev Shokhrukh, Shomurodova Kamola, (2024). Chemical and agrochemical properties of soil-grunts formed in the dry bottom of the Aral Sea. https://doi.org/10.5281/ZENODO.12531202.

[2] Abdullaev S, Nomozov U. (2024). A biochar product can enhance soil fertility during drought conditions. https://doi.org/10.5281/ZENODO.11032960.

[3] Badmaeva N.V., Sangadjiev M.M., Erdniev O.V., Dordjiev M.V. (2019). Deserts in Kalmykia: Impact on the Natural Environment // Security in the Globalization of the World. Elista, 19-20 dekabrya. -P. 79-86.

[4] Bayrakov I.A. (2012). Degraded pasture ecosystems // Geology, geography and global energy. №4. (47). -P. 165-170.

[5] Biarslanov A.B., Zalibekov Z.G., Gasanova Z.U., (2021). Magomedova M.X., Gadjiev I.R. Experiment on the use of a vegetative index in long-term studies of the dynamics of soil cover productivity in the Terek-Kumskoy lowlands // Biological sciences №4. -P. 81-89. doi: 10.18522/1026-2237-2021-4-81-89.

[6] Djapova V.V., Gavinova A.N., Martishkina V.V., Xaglishova R.B. (2019). Formation of Kochia prostrata (L.) Schrad. in the desert zone of the Republic of Kalmykia. -P. 21-30. DOI: 10.22162/2500-4328-2019-6-21-30.

[7] Fayzullayev O, Abdullayev Sh.Z, Yagmurova D.A. (2024). Mechanical properties of soil-grunts formed in the dry bottom of the Aral Sea. https://doi.org/10.5281/ZENODO.12507402

[8] Gafurova L.A., Sharipov O.B., Maxkamova D.Yu. (2020). Biological activity of irrigated soils of Bukhara oasis and ways of their optimization // Monografiya. Toshkent. –P. 31-32.

[9] Jarnikova M.A., Alimbaeva J.B. (2018). Phytogeographical features and conditions of steppe communities in Mongolia (Based on the model polygon "Mandalgobi") // Biogeography and soil geography. -P. 46-56. DOI: 10.18101/2587-7143-2018-2-46-56.

[10] Kalibekova J.T., Kojabergenova A.B. (2021). Biodiversity of the flora of the Kokzhide sands // Vavilov readings November 24-25. -P. 94-99.

[11] Karimov M., Namozov N., Teshaboev B. (2021). Agrochemical properties of degraded desert sandy soils of Uzbekistan // XXII International Scientific Conference Energy Management of Municipal Facilities and Sustainable Energy Technologies. -P. 1-5. doi.org/10.1051/e3sconf/202124402025.

[12] Kulik K.N., Petrov V.I., Yuferev V.G., Tkachenko N.A., Shinkarenko S.S. (2020). Geoinformation analysis of the deforestation of the northwestern Caspian Sea // Arid ecosystems, tom 26, №2. (83). -P. 16-24. DOI:10.24411/1993-3916-2020-10091.

[13] Lazareva V.G., Bananova V.A., Nguen V.Z. (2020). Dynamics of modern vegetation during pastoral use in northwestern agriculture // Arid ecosystems, tom 26. №4. (85). -P. 26-34. DOI: 10.24411/1993-3916-2020-10115.

[14] Ma, J., Qin, J., Ma, H., Zhou, Y., Shen, Y., Xie, Y., & Xu, D. (2022). Soil characteristic changes and quality evaluation of degraded desert steppe in arid windy sandy areas. PeerJ, 10, e13100. DOI 10.7717/peerj.13100.

[15] Makhkamova, D., Gafurova, L., Nabieva, G., Kasimov, U., Juliev, M. (2022). Integral indicators of the ecological and biological state of soils in Jizzakh steppe, Uzbekistan. *IOP Conference Series: Earth and Environmental Science*, 2022, 1068(1), 012019. https://DOI 10.1088/1755-1315/1068/1/012019.

[16] Mashtikov K.V. (2018). Changes in pasture vegetation of the desert zone of the Republic of Kalmykia // Vestnik of the Institute. №2. (37). -P. 22-29. DOI: 10.24411/2071-7830-2018-10016.

[17] Mashtikov K.V. (2021). Comparative characteristics of the species composition of pasture plant communities in the desert zone // Vestnik instituta №1. (42). -P. 36-44. DOI:10. 24412/2071-7830-2021-142-36-44.

[18] Nabiyeva, G., Makhkamova, D., Kenjaev, Y. (2024). Microbiological activity of soils with difficult ecological conditions. *E3S Web of Conferences*, 2024, -P. 497. https://doi.org/10.1051/e3sconf/202449703003.

[19] Namazov X.K., Amonov O.S. (2019). Soil-improvement provisions of the Bukhra and Navoi regions // Promovarea valorilor social-economice in contextul integrarii europene 2019. -S. 345-353.

[20] Neronov V.V. (2018). Transitional structure and sessional dynamics of plant communities during the cultivation of sand massifs in southern Kalmykia // Botany in the modern world. Tom 2. -P. 100-103.

[21] Pankova Ye.I., Gerasimova M.I. (2012). Desert soils: development, soil-forming processes, classification // Arid ecosystems. tom 18, №2. (51), -P. 5-16.

[22] Rabbimov, A., Karshiev, S., Gafurova, L., Nabieva, G. Breeding and Seed Farming of Desert Forage Plants in Uzbekistan. BIO Web of Conferences, 020 (2024) https://doi.org/10.1051/bioconf/20248202028.

[23] Razakov A.M., Gafurova L.A., Sektimenko V.Ye., Nabieva G.M., Madrimov R.M. (2019). Evolutionary-genetic aspects of soil formation of gray-brown soils of the desert zone of Uzbekistan and the possibilities of their use // Soil Science and Agronomy, №4. -P. 45-57.

[24] Sattorova M.M, Turaeva N.N. (2022). Genesis, expansion, plentiful land and agricultural use of sandy desert soils in the Bulgarian region // Current issues of modern science. №3. -P. 51-56.

[25] Sayfutdinova V. (1992). "Practical exercises in soil chemistry" study guide. Toshkent; Universitet.

[26] Shadieva N.SH., Safarova G.T., Rustamova I.I. (2021). Hydrogeological regime of the Bukhara oasis // Ekonomika i sotsium www.iupr.ru №3.

[27] Shinkarenko S.S., Djamirzoev G.S., Vasilchenko A.A. (2021). Problems of depletion in the biosphere reserve Yunesko "Kizlyarskiy Zaliv" // Geograficheskiy Vestnik 4(59), -P. 99-112. doi: 10.17072/2079-7877-2021-4-99-112.

[28] Shulgina S.V., Azarenok T.N., Matichenkov D.V., Matichenkova O.V., Shibut L.I., Didishko S.V. (2018). Features of transformation of dernovo-podzolic soils of arable lands of Belarus under the influence of anthropogenic factors // Soils in the biosphere. Sbornik of materials of the World

Scientific Conference with international participation, dedicated to the 50th anniversary of the Institute of Soil Science and Agriculture SO RAN 10-14 September. -P. 150-153.

[29] Tashninova A.A. (2018). Main types of soils of the Kalmiki suxosteppe pastures // Northern steppes of Europe materials of the large international symposium. International Steppe Forum of the Russian Geographical Society. -P. 965-966.

[30] Turdaliyev A.T., Quldasheva M.I., Shoxobidinov A.Z. (2022). The problem is that the eroziyasini of the hospitable spirit of the people are not good enough // Science and innovation international scientific journal volume 1 ISSUE 8 ISSN: 2181-3337 -P. 189-197. doi.org/10.5281/zenodo.7338309.

[31] Valeysha Y.F. (2020). Geografiya pochv. Gorki BGSXA. 207 p.

[32] Yang H., Liu CH., Liu Y., Xing Z. (2018). Impact of human trampling on biological soil crusts determined by soil microbial biomass, enzyme activities and nematode communities in a desert ecosystem // European Journal of Soil Biology. -P. 61-71. doi.org/10.1016/j.ejsobi.2018.05.005.

[33] Yusupov S.Yu., Rabbimov A.R., Mukimov T.X. (2010). The modern state of the Karakulevodcheskie pastbish Kizylkumov and their ways of rational use // Arid ecosystems. tom 16, №2. (42). -P. 38-46.

[34] Yusupova M.A., Sultonova G.R. (2022). The idea of using the far-reaching idea was to // Educational Research in Universal Sciences ISSN: 2181-3515 VOLUME 1 | ISSUE 4. -P. 94-98.

[35] Zang Ch., Shen Y., Li Q., Jia W., Li J., Wang X. (2018). Sediment grain–size characteristics and relevant correlations to the aeolian environment in China's eastern desert region // Science of The Total Environment. -P. 586-599. doi.org/10. 1016/j.scitotenv.2018.01.270.