UDK 633.2:636.084:551.583

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TYPICAL ASPECTS OF SPECIALIZATION OF DESERT PASTURES FOR CULTIVATING VALUABLE NUTRITIOUS PLANTS UNDER CLIMATE CHANGE CONDITIONS

Abstract: This article presents information about the desert pastures of our region, particularly the size of the Kyzylkum Desert pastures, which occupy a large geographical part of the Republic of Uzbekistan, the problems that have arisen in the regions in the last 10 years under climate change conditions, the priority areas being implemented in our republic in the specialization of desert pastures for the cultivation of valuable food plants under global climate change conditions, and the associated costs.

Keywords: specialization, productivity, degradation, pasture, desert, climate, adaptation, seed production, territorialization, expenditure.

Introduction. The Kyzylkum desert, which occupies a large geographical part of the Republic of Uzbekistan and is one of the most important regions in the development of the economy of our republic, is located in our region (see Figure 1). Here, the mining industry, livestock breeding, in particular karakul breeding, which develop the national economy, have long been formed and flourished. The large- scale changes that have occurred in our political and socio-economic life in connection with Uzbekistan's achievement of state independence and the transition to market relations in the economy require the formation of a new sustainable development policy and its practical implementation.

Figure 1. Map of the territorial location of the Kyzylkum Desert.

The essence of the current reforms is that in the context of liberalization of market relations, it is important to increase attention to the study of regional aspects throughout the region of our republic, study advanced world experience, competently analyze complex processes in the regions, and form and improve the scientific and methodological foundations of the strategy for their effective development.

It is worth noting that the development and specialization of desert areas in our region have been poorly studied under current conditions. Initially, the initial research conducted in the Kyzylkum region concerned geology, mineral exploration, geomorphology, climatology,

geobotany, hydrogeology, soil science, and animal husbandry [1].

Analyzing and regionally assessing the natural resources of the desert pastures of our republic, identifying current problems, and developing modern solutions to them on a scientific basis are of great importance in today's global climate change conditions.

Literature review. The issue of effective use of desert and semi-desert areas in the context of climate change has become one of the most relevant scientific areas in recent years. Scientific studies have noted that global climate change, reduced precipitation, and increased soil degradation are negatively affecting pastures, especially desert pastures.

Many researchers emphasize the importance of introducing drought- and salinity-tolerant forage plant species to increase the productivity of desert pastures. In particular, in the brochure "Recommendations for the rational use of foothill semi-desert pastures and increasing productivity", prepared by scientists of the Karakul and Desert Ecology Research Institute A.Rabbimov and T.Muqimov in 2016 within the framework of the Central Asian Initiative for Land Resources Management Phase II "Knowledge Management" project implemented within the framework of the International Center for Agricultural Research in Arid Zones (ICARDA), it is recommended to plant promising high-nutrient plant species such as sedge, yarrow, teresken and astragalus to increase pasture productivity [2]. It is shown that such plants not only strengthen the forage base, but also help strengthen the soil and reduce erosion.

At the 2015 Regional Consultation on Sustainable Management of Grasslands and Rangelands in Asia, held by the FAO Bureau for Asia and the Pacific at Lanzhou University (China), Australian scientist Victor R. pointed out that the main problem of desert grasslands in our region is the degradation of the region due to population growth, the region's remoteness from the oceans, arid climate, improper use of land and excessive livestock pressure, and inefficient management of natural resources, as well as urbanization processes [3]. Therefore, the specialization of pastures, that is, their purposeful orientation to the cultivation of nutritious plants, and the development of effective management mechanisms for the use of natural resources, is considered a scientifically sound approach.

Also, in other scientific literature, agroecological approaches, resource-saving technologies and the selection of plant species suitable for the natural and climatic characteristics of the region are recognized as important factors within the framework of climate change adaptation strategies. However, existing studies are mainly based on general approaches, and specific regional conditions, in particular, the specific economic aspects of the specialization of the Kyzylkum desert pastures, have not been studied in sufficient depth. In this regard, this study focuses on the measures currently being taken to adapt the specialization of desert pastures in our republic to climate change, the costs associated with them and the results to be achieved in the future.

Methodology. This study was conducted on the basis of an integrated approach, aimed at identifying the specific aspects of the specialization of the desert pastures of the region for the cultivation of valuable food plants under climate change. The study was organized on the basis of a quantitative and qualitative approach. Theoretical analysis and empirical research methods were used in the work process.

In the first stage, existing scientific literature, articles, and reports on the topic were analyzed.

In the second stage, the Kyzylkum desert, located in our region, was selected as the research area, which is specialized in Karakul herding. The research process to determine the level of degradation in the desert pastures of our republic in 2025 was carried out with direct participation in the regions of Bukhara and Navoi regions, and the state of degradation in our republic was studied.

In the third stage, comprehensive data on the costs associated with the introduction and

[1]S.B.Abbosov "Kyzylkum" desert landscapes dynamics and Ecology" Monograph. Samarkand. SamSU – 2019.

[2] A.Rabbimov , T.Muqimov " Recommendations for rational use of semi-desert pastures and increasing productivity ". Tashkent-2016.

[3] of FAO Proceedings of the Regional Consultation Conference on "Sustainable Management of Grasslands and Rangelands in Asia". Lanzhou University-2015. p. 10.

establishment of seed production of valuable food plant species were studied and analyzed. To ensure the reliability of the research results, the data obtained were compared several times.

This methodology was developed by the Bukhara Scientific Production Center for Seed Production of Desert Pastures and Forage Plants in the Bidaykul massif of the Takhtkopir district of the Republic of Karakalpakstan, Gijduvan, Shofirkon, Jondor, Olot and Karavulbazar districts of the Bukhara region, Kyzyltepa and Konimekh districts of the Navoi region, Pakhtachi and Nurabad districts of the Samarkand region, Forish district of the Jizzakh region, Muborak and Mirishkor districts of the Kashkadarya region, and Kumkurgan district of the Surkhandarya region, based on the costs associated with the restoration of desert pastures in crisis in a region adapted to climate change, specialization in the cultivation of forage plants, and the establishment of seed production of promising crops. Today, in our republic, farms specializing in Karakul breeding are in crisis on 16.5 thousand hectares of desert pastures. The costs and expected results associated with the complete improvement of desert pastures encountered have been scientifically substantiated.

Main part. The Kyzylkum Desert is a vast sandy desert located in the Central Asian region, between the Amu Darya and Syrdarya rivers (on the territory of Uzbekistan, Kazakhstan and Turkmenistan). Most of it covers the Navoi, Bukhara and Khorezm regions of Uzbekistan and the Republic of Karakalpakstan. It borders the Aral Sea and the Ustyurt Plateau in the northwest.

Due to its remote location from the oceans, the natural climate of the Kyzylkum Desert is sharply continental, very hot in summer (up to +45°C) and cold in winter (up to −25°C), with very little precipitation (100–200 mm per year).

In terms of relief, the Kyzylkum Desert consists of sandy dunes, plains, and low mountain ranges, with rocky and clay soils in some places.

From a natural and economic point of view, the region has gold (for example, the Muruntau deposit is one of the largest gold deposits in the world), uranium, gas and oil reserves, and in agriculture, there is a high natural feed unit for livestock farming, and there is the possibility of farming in irrigated areas. In terms of industry , the mining industry is developed in some regions, and transport routes of international importance pass through some regions.

Despite its harsh natural conditions, the Kyzylkum desert region is an economically important area due to its rich mineral resources and extensive agricultural and livestock breeding opportunities.

A large part of the Kyzylkum Desert region is located in the region of our republic, mainly Navoi and Bukhara regions are geographically located in the Kyzylkum Desert region.

Bukhara region is geographically located in the southwestern part of the Kyzylkum desert and the Amu Darya valley. It borders Navoi region in the northeast, Kashkadarya region in the east, Surkhandarya region in the south, and Turkmenistan. The relief is mostly flat, consisting of the Kyzylkum desert zones and fertile oases around the Amu Darya.

Navoi region is geographically located in the central part of Uzbekistan, in the center of the Kyzylkum desert. It is surrounded by Kazakhstan to the north, Jizzakh and Samarkand regions to the east, and Kashkadarya and Bukhara regions to the south. The main part of the region's territory consists of the Kyzylkum desert, with only the southern and eastern parts belonging to the Nurota Mountains and the Zarafshan Valley.

These two regions of our country are economically rich in natural underground and surface mineral resources (gold, uranium, natural gas, natural feed for livestock) and are distinguished by their desert and oasis landscapes.

In our republic, the pasture fund constitutes a significant part of the country's land resources. The Kyzylkum steppe pastures occupy the largest share of the pasture fund . They are mainly used in the livestock sector and are unevenly distributed across the territory. The total area of pastures in Uzbekistan is [1]21.2 million hectares (about 45–50% of the land fund). Table 1. The main part of these pastures is located in the Kyzylkum steppe.

[1]https://api-portal.gov.uz

As can be seen from the table, the majority of pastures in our republic are located in the western and central desert regions. The Republic of Karakalpakstan and Navoi regions account for more than half of the total pasture fund of our republic.

A large part (75-80%) of the Kyzylkum desert, the main territory of which is located in the region of our republic and formed naturally, has long been specialized in livestock breeding (mainly Karakul cattle breeding) as pastures typical of the desert and semi-desert type.

Table 1

The size and distribution of the total pasture fund of the Republic of Uzbekistan by region[1]

T/r	Name of the regions	Total land area		Of these, hayfields and pastures	
		total	Including irrigated	total	Including irrigated
1	Republic of Karakalpakstan	16656.1	517	5261.8	35.8
2	Andijan	430.3	280.4	21	0.8
3	Bukhara	4183.1	280.2	2550.3	
4	Jizzakh	2117.9	304.9	702	
5	Kashkadarya	2856.8	513.5	1405.2	0.1
6	Navoi	10948.1	126	8887.6	
7	Namangan	743.3	289.7	163.8	
8	Samarkand	1677.3	379.4	793.2	
9	Surkhandarya	2009.9	325	824.5	
10	Syrdarya	427.6	287.2	19.9	
11	Tashkent	1515	393.7	442.5	1.4
12	Fergana	675.3	368.7	9.5	3.9
13	Khorezm	608.2	268.4	109.1	
14	Tashkent	43.5	8.4		
	Total:	**44,892.4**	**4342.5**	**21 190.4**	**42**

The geobotanical composition of the Kyzylkum desert pastures is divided into several groups according to plant cover and soil characteristics:

1. Sandy steppe grasslands are the most common type, with tree-like saxaul, sedges, and Circassian plants being the most common. In winter, these areas are a natural source of fodder for livestock.

2. Salt steppe and saline steppe pastures - these areas have a high salt content in the soil, where mainly saline (halophyte) plants grow. They are a natural source of feed for livestock in the spring and autumn seasons.

3. Rocky (hard) desert pastures are natural desert pastures with hard and gravelly soil, sparse vegetation cover and low productivity, but available for use year-round.

4. Ephemeral and ephemeroid (spring) pastures are pastures with a high feed unit value for livestock, mainly in the spring season, as they consist of short-lived plants with very high nutritional value.

Thus, the vast Kyzylkum steppe pasture fund, consisting of various geobotanical types, is of strategic importance for livestock breeding. However, its effectiveness is strongly dependent on natural conditions and human activity.

[1]Prepared on the basis of regulatory documents on the land fund of the Republic of Uzbekistan of the Cadastre Agency under the Ministry of Economy and Finance of the Republic of Uzbekistan

If we analyze the Kyzylkum desert pasture area located in our republic based on data confirming its status in the past, we can see that the total area has hardly changed, that is, the area is stable in terms of quantity, but has been sharply deteriorating in terms of quality in recent years due to climate change and anthropogenic factors. Table 2.

Table 2.

Desert pasture areas used for karakul herding in the Kyzylkum Desert, located in the territory of our republic, and their current status[1]

T/r	Regions name	Total pasture area, thousand hectares	from that	
			Degraded pasture area	Pasture area in use
1	Karakalpakstan Republic	4447.8	1600.6	2847.2
2	Bukhara	2283.2	922.1	1361.1
3	Jizzakh	619.5	238.5	381
4	Kashkadarya	1179.0	498.2	680.8
5	Navoi	6000.0	2489.4	3510.6
6	Samarkand	688.2	286	402.2
7	Surkhandarya	606.6	228.7	377.9
	Total	**15824.3**	**6263.5**	**9560.8**

It is worth noting that these degradation areas were formed based on the results of studies conducted in pasture areas specialized in general karakul breeding by the end of 2025 [2]by the republican working group formed by the Committee for the Development of Veterinary Medicine and Livestock, in accordance with paragraph 8 of the Decree of the President of the Republic of Uzbekistan No. PF-15 dated January 30, 2025 “On measures to introduce modern mechanisms for the protection and rational use of pastures”, in 2025-2027. The working group includes 4 scientific employees of the center: O. Qahramonov, J. Najmiddinov, B. Achilov and N. Kazokov, who were directly involved in the research work carried out in the Bukhara and Navoi regions.

So, as can be seen from Table 2 above, of the total 15,824.3 thousand hectares of pastures specialized for Karakul herding in our republic, 6,263.5 thousand hectares (39.6%) are currently degraded.

It is known that the Resolution of the President of the Republic of Uzbekistan No. PQ-3603 dated March 14, 2018 “On measures for the further development of the Karakol sector” The Bukhara Scientific and Production Center for Seed Production of Desert Pasture Forage Plants is the only state institution in our republic that is introducing desert forage plants and establishing their primary seed production in large areas of the Kyzylkum desert pastures of our republic in order to restore degraded desert pastures.

If we look at the scientific research conducted by [3]pasture scientists M. Makhmudov, Q. Haydarov , the system of partial (surface) and complete (fundamental) improvement of pastures in crisis with vegetation cover is scientifically based . Accordingly, in the superficial improvement of steppe pastures in crisis, only sowing with the help of machinery at a distance of 10-12 meters or only sowing of seeds in an open area using drones is carried out. In the case of complete improvement or the organization of a seeding area, the land area is cleared of all weeds and plants and is sown using special planting aggregates by establishing ichthyozas at a distance of 5-6 meters, and protection and maintenance work is carried out.

The “Practical technological map of labor and equipment costs associated with the cultivation, harvesting and planting of seeds of steppe pasture fodder plants in steppe pasture areas” developed

[1]Report of the State Committee for the Development of Veterinary Medicine and Livestock for 2025
[2]Decree of the President of the Republic of Uzbekistan No. PF-15 dated January 30, 2025
[3]M. Makhmudov, Q. Haydarov “Pasture Studies”. Tashkent-2010. pp. 196-217.

by the Bukhara Scientific Production Center for Steppe Pasture Forage Plant Seeds and the Center for Economic Analysis and Standardization of the Republic of Karakalpakstan, [1]currently estimates that 1,815.8 thousand soums will be spent on the complete improvement of one hectare of steppe pasture area and the organization of a seed production area. Table 3.

Today, to fully improve 1 hectare of desert pasture area and organize a seedbed, 10 kg of desert pasture nutritious plant seeds are used in planting work, as a standard [2].

According to the business plan of the Bukhara Scientific Production Center for Seed Production of Steppe Pasture Forage Plants, approved by the Center for Economic Analysis and Standardization of the Republic of Karakalpakstan, the cost of 1 kg of steppe pasture forage plant seeds is set at 41.2 thousand soums, and delivery service is set at 12.36 thousand soums. The total cost of 1 kg of steppe pasture plant seeds today is 53.56 thousand soums. Table 4.

Table 3

Expenditures on the complete improvement of steppe pastures and the organization of seed production areas there (for 1 ha)[3]

m ing in soums

No.	Cost types	Measurement unit	1 hectare to the field expenses	
			Quantity	Amount
1	Seasonal required number of people	man	0.06	
2	Consumable man day	that moment day	1.30	
3	Tariff wages (tractor and manual labor)	m ing soum		224.76
4	In the fall not caught expenses	thousand soums		26.97
	Total tariff amount	m ing soum		**251.73**
8	Current reward 20 %	m ing soum		50.35
9	Additional payment for class and internship	m ing soum		45.31
10	10% total production costs compared to the tariff	m ing soum		25.17
	Total tariff wage fund	m ing soum		**120.83**
12	Work about deductions 25 %	m ing soum		93.14
	Total wage fund 25%	m ing soum		**93.14**
13	**Tractor and machinery services 50% (MTP method)**	m ing soum		**315.00**
14	Diesel fuel costs at average exchange prices	liter	67.81	
		m ing soum		867 , 97
	Lubricating oil costs at average exchange prices	liter	3.05	
		m ing soum		167.13
	Total diesel fuel and lubricating oils	m ing soum	70.86	**1 035 , 1**
	Total planting season costs	**liter**	70.86	
		m ing soum		**1,815.8**

[1]"Technological map of the organization of sowing work in steppe pastures" for 2023-2027, prepared by the Center for Economic Analysis and Standardization of the Republic of Kazakhstan.

[2]Business plan of the Bukhara Scientific Production Center for Seed Production of Steppe Pasture Forage Plants, approved by the Center for Economic Analysis and Standardization of the Republic of Kazakhstan.

[3]Prepared by the Center for Economic Analysis and Standardization of the Republic of Kazakhstan based on the technological map for organizing sowing work in desert pastures for 2023-2027.

Therefore, currently, farms using desert pastures spend 1,815.8 thousand soums on planting to completely improve 1 hectare of degraded desert pasture area, and 535.6 thousand soums per 10 kg of seeds (10*53.56=535.6) for planting according to the standard, for a total of 2,351.4 thousand soums.

The Republican Working Group estimates that by 2025, 14,727,993.9 (6263.5*2351.4) million soums will be required to completely (radically) improve and increase productivity of 6,263.5 thousand hectares of pastures in crisis (Table 2) identified by the desert pastures of farms specializing in Karakul breeding, and to restore biodiversity in the region.

Table 4

Costs associated with the cultivation and delivery of 1 kg of desert pasture fodder plants in the seed fields of the Bukhara Desert Pasture Fodder Plant Seed Research and Production Center[1]

Based on the base calculation amount (in soums) *BHM= 412000*

No.	Type of expenses	Unit of measurement	As a percentage of GDP (%)	Amount (in soums)
1	Pre-planting costs	soum	1.0%	4120.0
2	Planting period costs	soum	1.5%	6180.0
3	Parenting expenses	soum	1.0%	4120.0
4	Harvest season costs	soum	1.5%	6180.0
5	Drying, cleaning, coating, packaging and loading service	soum	5%	20600.0
	Total			**41200.0**
6	Delivery service	soum	3%	12360.0
All				**53560 .0**

Together with scientists from the Bukhara Scientific Production Center for Seed Production of Desert Pasture Forage Plants, over the past 7 years, in order to completely improve the desert pasture areas of farms specializing in Karakul breeding in the Republic of Karakalpakstan (Takhtakopyr district, Bukhara, Navoi, Samarkand, Kashkadarya, Jizzakh, Surkhandarya) in the conditions of climate change, we have determined the terms for increasing the annual yield to 5-6 centners based on the viability of the plants and the amount of annual precipitation. That is, in order to completely improve the desert pasture areas with a crisis in vegetation cover, after the plants sprout, the annual yield will be increased to 5-6 centners, provided that the annual rainfall is on average 100-150 mm and conservation work is carried out, 2 years are required for annual plants and at least 4 years for perennial plants [2]Table 5. Biologically, during these required years, the plants adapt to the climatic conditions of the region, strengthen their underground root system and create a high-quality seed reserve.

Therefore, the use of fully improved steppe pastures with annual vegetation cover from the third year and fully improved pastures with perennial vegetation from the fifth year, divided into seasons, will create the possibility of continuous use in the future.

If we look at the table, it shows the productivity indicators of pastures that have been perfectly improved in the agrophyticenosis order over the years, and it can be seen that it is possible to achieve a productivity of more than 5-6 centners in the second year.

[1] Developed by the center based on a business plan approved by the Center for Economic Analysis and Standardization of the Republic of Kazakhstan.

[2]Report of the Bukhara Scientific Production Center for Seed Production of Steppe Pasture Forage Plants for 2025.

Table 5

The years required to increase the yield of cultivated forage crops to 5-6 quintals through complete improvement of desert pastures in crisis[1]

No.		**Feed mass by year** (ha/st)				
		1	**2**	**3**	**4**	**5**
1	Annual plants	1-2	5-6	7-8	8-9	10-12
2	Perennial plants	2-3	3-4	4-5	6-7	8-9
3	1+2+ ephemeral plants	4-5	9-10	12-13	16-18	20-22

Based on our scientific research in this area for the past 7 years, it is recommended to use pastures that have been perfectly improved in this way, divided into seasons, starting from the 4th year. This is because perennial fodder plants play a key role in preventing or completely eliminating degradation in desert pastures. Therefore, as we have said above, it takes at least 3 years for perennial plants to adapt to the climatic conditions of the region, significantly strengthen the underground root system, increase the number of growing branches, and create a high-quality seed reserve.

Scientists from the Scientific Research Institute of Karakul Breeding and Desert Ecology have determined the daily feed requirement of one Karakul sheep throughout the seasons [2]. Table 6.

Table 6

Daily feed requirements of one Karakul sheep[3]

	Spring (1st period 29 days)	**Spring** (2nd period 61 days)	**Summer** (3rd period 138 days)	**Autumn** (4th period 81 days)	**Winter** (5th period 57 days)	**Annual**
In terms of food unit	1.25	1.55	1.1	0.9	1.15	425
In terms of feed mass, kg	3	2.1	2.5	2.5	3.0	800

Based on the results of the scientific research, based on the years that can be used depending on the plant species and the data in Table 5, an average of 750 ha/kg of forage plant mass is produced per year in the third year from a perfectly improved pasture with annual plants, an average of 850 ha/kg of forage plant mass per year in the fifth year from a perfectly improved pasture with perennial plants, and an average of 1,700 ha/kg of forage plant mass per year in the fourth year from a perfectly improved pasture with agrophyticenosis .

Based on the above, in order to effectively use pastures in all seasons of the year and ensure the annual need of livestock for feed, today only complete improvement is carried out in the form of agrophyticenosis . Complete improvement, with a distinction between annual and perennial crops, is used only in the organization of seed fields.

For example, the total annual feed requirement of one Karakul sheep across the seasons is 800 kg (Table 6), and 1 Karakul sheep requires 1.06 ha of area in the third year of a perfectly improved pasture with annual plants, 0.94 ha in the fifth year of a perfectly improved pasture with perennial plants, and 0.47 ha in the fourth year of a perfectly improved pasture in the agrophyticenosis order .

Of 6,263.5 thousand hectares of desert pastures, which are currently in crisis , in the agrophyticenosis order, a feed base of 10,647.9 thousand tons per year will be created in the 4th year. Or, from the 4th year, it will be possible to feed 13,309.9 thousand heads of small ruminants throughout the seasons.

[1] Prepared based on the Center's 2025 reports .
[2] M. Makhmudov, Q. Haydarov “Pasture Studies”. Tashkent-2010.
[3] M. Makhmudov, Q. Haydarov “Pasture Studies”. Tashkent-2010. 188 pages .

Conclusion. Year after year, climate change, decreased precipitation, and the traditional use of pastures are causing the degradation of pastures to increase year by year, reducing the efficiency of pasture use in general.

By the Uzdavrloyiha State Scientific and Design Institute and its regional branches in 2018-2024 on a total of 21.2 million hectares of pastures in our republic , the average productivity of pastures and hayfields [1]was 2.5 tons/ha.

According to the standard, 3.2 (800/250) hectares of land are currently required to meet the feed requirements of one head of small-horned cattle in all seasons of the year. This means that our total pastures today can meet the annual feed requirements of 6,625.0 thousand heads of animals, assuming they belong to one species (21.2 million ha / 3.2 ha).

According to the final statistics of the Veterinary and Livestock Development Committee for 2025, a total of 20,589.1 thousand small horned animals were registered in farms under the committee across the republic.

Based on the concept of pasture capacity, we can see that pastures in our republic are currently used under three times higher pressure.

Based on the above, the complete improvement of desert pastures, followed by specialization in the cultivation of forage crops, plays an important role not only in creating a solid feed base for livestock , but also in ensuring ecological stability, reducing land degradation, and regulating the climate.

Therefore, it is important to correctly select and plant species that are resistant to salinity and drought and have high nutritional value for desert areas based on scientifically based approaches, one of the main priorities is the restoration of desert pastures in crisis, the proper organization of agrotechnical measures related to increasing productivity in pastures, and minimizing costs.

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