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INFLUENCE OF CATTLE GRAZING ON SOIL DEGRADATION IN MOUNTAIN TERRITORIES OF THE NORTHERN TIEN SHAN

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Abstract. The article discusses the results of studies on the degradation of soil and vegetation in the mountainous areas of Ile Alatau and the Uzynkara Range. The data of geobotanical studies of high-mountain and mid-mountain pastures of Ile Alatau and the Uzynkara Range showed the dominance of vegetation degradation over other processes. The soils of the mountainous areas are characterized by the thickness of the humus horizon, high gross humus content, large reserves of calcium and magnesium and a small phosphorus content. As our studies have shown, the thickness of the humus horizon of the studied soils is 40-60 cm, they are distinguished by a high fertility potential, but this potential is limited by such factors as soil trampling and the degree of pasture degradation. At the same time, with an increase in pasture degradation, there is a decrease in the humus layer, a decrease in the content of humus and nutrients in the soil. The assessment of plant communities as indicators of pasture degradation in the study area showed that due to excessive and unregulated grazing, the vegetation cover has been subjected to anthropogenic degradation. There is a transformation of the species composition of plants, a decrease in the productivity of pasture forages, soils, which in turn leads to a deterioration in the mechanical properties of soils: an increase in density in the 0-10 cm layer increases by 0.11%, valuable silt particles are washed away in the upper part of the profile, the content of water-stable aggregates and their water resistance decreases.

Keywords: degradation, pastures, soils, vegetation, pasture load.

INTRODUCTION

The problem of mountain pasture degradation in Kazakhstan is very urgent, it is caused by various factors, such as overgrazing, climate change, improper use of land, and disruption of pasture ecosystems. All this leads to a decrease in fertility, soil erosion, loss of organic matter, deterioration of soil structure and a decrease in its water-holding capacity, and loss of biodiversity. As is known, overgrazing can lead to the displacement of valuable forage plants by less resistant or inedible species, which worsens the quality of pastures, that is, reduces the species diversity of pastures, since some plant species disappear and others become dominant [1-5].

This also affects animals that depend on a variety of plants. In Kazakhstan, where pasture livestock farming plays a key role in the economy, the problems of overgrazing are particularly acute. Research in this area can help develop measures to restore pastures, improve the resilience of mountain ecosystems and ensure sustainable agriculture. Mountainous areas that have historically been used as pastures for grazing livestock are a degrading factor in the weakening of the soil cover of its natural ecological functions. Mostly degraded pasture areas are located near settlements, where most of the residents have farm animals. At the same time, the concentration of livestock on these lands turns them into barren

areas, since they are grazed for decades without any use regime.

Today, in the Republic of Kazakhstan, the area of mountain pastures (low and mid-mountain) is 8.9 million hectares, the forage reserve is 41.155.3 thousand centners of dry matter, 22.094.5 thousand centners of forage units. The area of hayfields is 0.2 million hectares. [6].

Overgrazing as an anthropogenic factor is the main cause of pasture degradation, which has been studied by many domestic and foreign researchers [7-10].

The purpose of the research is to study the degree of degradation of soils of mountain pastures.

MATERIALS AND METHODS

We conducted research in the territory of the south-east of Kazakhstan in Ile Alatau (high-mountain plateau Assy, Enbekshikazakh district) and in high-mountain and mid-mountain pastures of the Uzynkara ridge (Kegen, Raimbek and Uyghur districts). We carried out field work in the study area in spring (May), summer (June, July), autumn (September, October). We studied the territories of the Uzynkara ridge, Uyghur, Kegen and Raimbek districts. In Ile Alatau, we studied the pastures of Assy in the Enbekshikazakh district (figure 1).

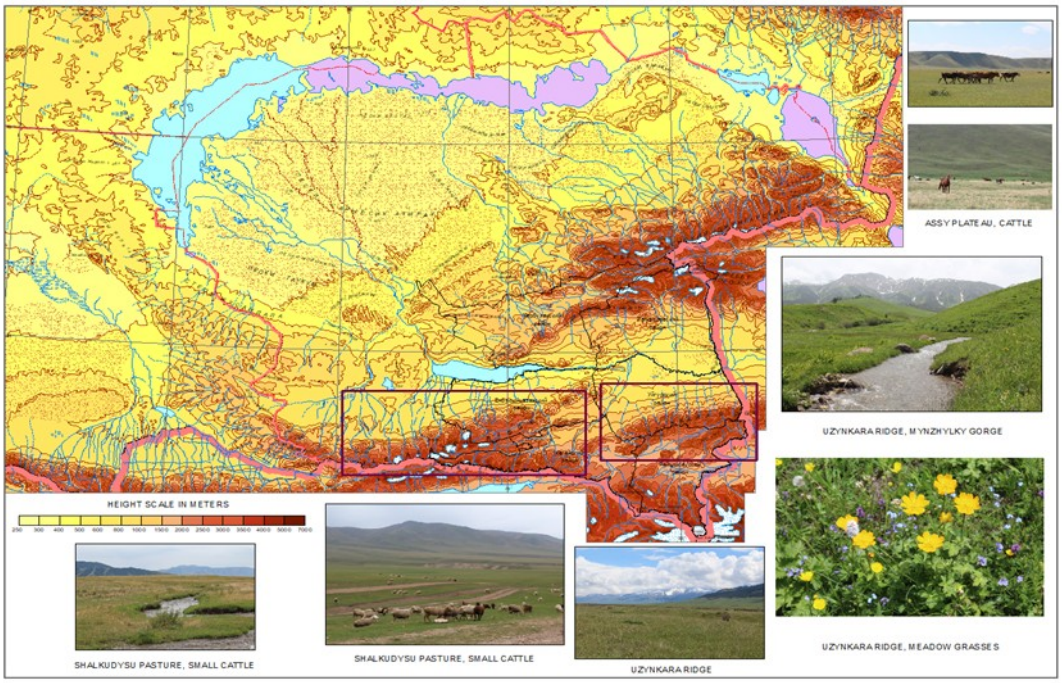

Figure 1 - Map of the study areas. High-mountain and mid-mountain pastures of the Uzynkara ridge, (Kegen, Raimbek, Uyghur districts) Shalkudysu pasture, h 2625 m (43°09'494"N 80°20'180"E). Ile Alatau (Enbekshikazakh district) Pastures of the Assy plateau, h 2887 m (43°14'364"N 80°20'180"E)

Determination of pasture load. The pasture period load was determined in the study areas depending on the number of livestock per 1 ha of pasture. The normal pasture load was established based on its productivity, the duration of the pasture period and the amount of pasture feed required for one head ofcattle per day [11].

Determination of pasture yield. Pasture yield was determined using a meter (1 m^2) that was laid loosely (not randomly) at 4 locations (points) of the

pasture plot. The grass on the meters was cut at a height of 3 cm from the soil surface. The cut samples from each meter were weighed separately in grams. The results were then summed up and divided by 4. The average yield in grams was obtained, then the average yield in grams was multiplied by 10.000 (the number of m^2 per 1 hectare) to obtain the pasture yield in centners/ha. Soil samples were collected during the dry season at most sites using a stratified random procedure.

Geobotanical research methods. Geobotanical research was conducted using generally accepted methods. During the geobotanical survey of natural forage pastures, the following were identified: composition and structure of the vegetation cover in its relationship with habitat conditions; seasonality of use, crop yield. During the field period, a reconnaissance survey of the territory was conducted. During the study, a description of the vegetation, soil, ecological state of natural pastures, and crop yield were conducted. The vegetation was described on plots of approximately 100 m^2; for floristically poor and sparse groups, larger plots were used. When naming pasture types by vegetation, the dominant plant was put first. Samples of all plant species were included in the description form. All species of a given description point were included in the list of plants. The dry mass weight per 1 m^2 was recorded after sorting, drying, and weighing the mown crop. Soil characterization was carried out based on soil survey materials by comparing geobotanical and soil contours. Plants were collected for the herbarium throughout the entire field period [12]. The abundance of species in phytocenoses was determined using the Drude abundance scale. The species composition of plants in plant communities was determined according to the relevant botanical guides, such as: "Flora of Kazakhstan" [13], "Guide to Plants of Central Asia" [14], "Illustrated Guide to Plants of Kazakhstan" [15].

All chemical soil analyses were performed at the U. Uspanov Kazakh Research Institute of Soil Science and Agrochemistry.

RESULTS AND DISCUSSION

According to the climatic zoning, the studied region of the southeast of Kazakhstan belongs to the continental region of the temperate zone. The climate of the mountainous part of Ile Alatau and Uzynkar is very different from the climate of the plains lying at their foot. According to the diversity of natural and climatic conditions, according to the conditions of heat and moisture supply, vegetation period, the territory of the Almaty region, to which the studied region belongs, is divided into the following agroclimatic regions: 1. A very arid foothill-plain region, occupying a strip of foothill (submontane) plains. 2. An arid foothill region, occupying an even more southern part of the study area, covering a narrow strip of the foot of the mountains. It is the foothills or "counters" of the Uzynkara and Ile Alatau ridges. 3. A mountainous region, on the Uzynkara ridge it begins at an altitude of 1200-1600 m. On the Ile Alatau ridge it begins from 1000 m to 1700 m - garden-steppe. The average air temperature at the Chundzha weather station in January is -11.2 ° C, in July + 24.5 ° C. The average amount of precipitation in the region is 261–350 mm, more than half (60%) of the precipitation falls in the spring. The climate of the piedmont-plain and foothill territory of the region is sharply continental and arid, with characteristic large daily and annual fluctuations in air temperature, moderately cold winters and long hot and dry summers. The average annual air temperature is 7.6–8.7°C. The average July temperature varies from +21,3 °C to +24.5 °C. The average temperature at the Uzynagash weather station in the warmest month of July is 18.9 °C, while the maximum is 35 °C. The coldest month is December, but the minimum temperature is - 29.3°C. The climate of the subalpine zone according to

the temperature regime according to the meteorological station of the Assy plateau is a cool zone. The temperature of the warmest month (June) is + 12.8-18.10, and the coldest (January) is – 7.3–4.30. The annual temperature amplitude is 20.3-22.40, the maximum is +29-35.0, the minimum drops to - 35-38,0, absolute amplitudes reach 700C. The duration of the period with a temperature above 10ºC is 115-146 days with a temperature sum during this time of 860-1990C. The last spring frosts are observed in May, and the first autumn frosts are observed in late September and early October. The frost-free period lasts from 106 to 146 days.

The average annual precipitation is 881-843 mm. The greatest amount of precipitation falls in spring and summer (74-68%). Sometimes precipitation is of a torrential nature, which contributes to the development of water erosion on the soils of the slopes. [16]. Table 1 provides annual comparative data from the meteorological stations closest to each study area: the Issyk and Assy meteorological stations for the Ile Alatau and the Kegen and Narynkol meteorological stations for the Uzynkara ridge (table 1).

Table 1 - Annual comparative data of meteorological stations

Name of weather station	Temperature, C air average	Temperature, surface soil average	Relative humidity of the air, %,	Atmospheric pressure, h Pa		The of precipitation. per day mm
				at tation level	Aa sea level	
Narynkol	-9.0	-14	79	820.3	2250	12.1
Kegen	-10.4	-12	82	815.4	1902	7.7
Assy	-10.3	-12	68	780.2	2680	2.1
Issyk	-1.8	-4	78	911.3	1756	44.7

As can be seen from table 1, in the Enbekshikazakh district the average air temperature according to the Assy weather station is -10.3°C, while in Issyk it is -1.8°C, in the Kegen and Raimbek districts it is slightly higher and is -10.4°C and -9.0°C, respectively. The soil temperature in the studied districts is approximately the same - 12°C, only in the Enbekshikazakh district in Issyk it is significantly lower and is - 4°C. The average relative humidity is approximately the same in all districts - 80%. In addition, the daily amount of precipitation in the Enbekshikazakh district is significantly higher, it is 44.7 mm, and in the Kegen and Raimbek districts – 12.1 mm and 7.7 mm, respectively. These comparative meteorological observations show that the climate of the study area corresponds to the climate of the Northern Tien Shan. Below are data on the total area of the study districts and the area of pastures currently grazed by cattle (pastures dominated by cereals and other herbaceous plant species, such as forbs from the families *Fabaceae, Poaceae, Asteraceae*, etc.). Studies to assess the impact of anthropogenic factors on the degree of degradation of pasture ecosystems in southeastern Kazakhstan are provided for the Almaty region in the territory of the Enbekshikazakh, Uygur, Kegen and Raiymbek districts. Table 2 contains data on the total area of the districts and the area ofpastures.

Table 2 - The share of pastures in the land use structure of the study areas

Districts	Area, thousand hectares		Share of pastures in %
	total area	pasture area	
Enbekshikazakh	780.7	530.9	68
Kegen	675.5	472.6	70
Raimbek	1420.0	442.5	31
Uyghur	876.6	386.6	44

From the data in the table it is clear that the largest percentage of pastures is in the Kegen district – 70%. The total area of pastures in the studied areas is given for the period of 2024 in accordance with statistical data (figure 2). The figure shows that the largest percentage of pasture area falls on two areas: Kegen (70%) and Enbekshikazakh (68%) areas. In the Uyghur area, the share of pastures is 44% and the smallest percentage of pastures falls on the Raimbek area - 31% (figure 2).

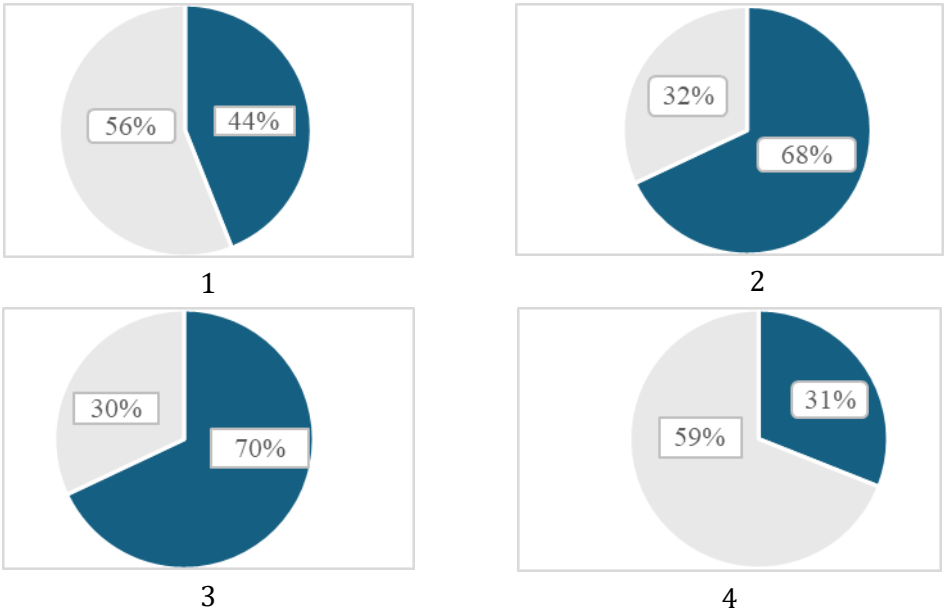

Figure 2 - Share of pastures from the total territory. 1. Uyghur region; 2. Enbekshikazakh district; 3. Kegen district; 4. Raiymbek district

To analyze the impact of livestock grazing on pasture degradation in southeastern Kazakhstan, we considered the numbers of cattle (cows, horses, camels) and small ruminants (sheep, goats). The impact of livestock grazing on pasture degradation depends not only on the number of farm animals grazing per unit area, but also on the duration of the grazing period. The duration of the period has a negative impact on both the soil and the vegetation cover of pastures. The physical properties of the soil are partially restored during the 21-week period after soil damage [17].

As can be seen from table 3, the comparative characteristics of the livestock indicators in the 4 studied districts by heads for 2021-2024 showed different numbers of livestock, where the Enbekshikazakh and Raimbek districts have a high indicator for the number of livestock (table 3).

Table 3 - Comparative characteristics of livestock indicators in the studied areas

Years	Total number of livestock	Enbekshikazakh	Kegen	Raimbek	Uyghur
2021	Sheep, goat population	228 778±40.096	200 996±18.183	236 532±18.183	197 774±9.49
2022	Horse population	86 464±9.639	48 824±5.271	54 038±2.639	65 723±6.515
2024	Cow population	21 061±2.255	28 172±1.475	37 007±3.159	13 722±1.715
2023	Camel population	108±18	-	-	25±7

Below in table 4, the number of small ruminants (sheep, goats) in the 4 studied districts is given (table 3, figure 3).

Table 4 - Number of sheep in the Enbekshikazakh, Kegen, Raiymbek and Uyghur regions for 2020-2024, heads

Regions	Pasture area, thousand hectares	Years				
		2020	2021	2022	2023	2024
Enbekshikazakh	530.9	813645	830416	857047	890869	567799
Kegen	472.6	618916	627753	652930	665623	513008
Raimbek	442.5	698096	724002	777744	799709	453125
Uigur	386.6	634563	646341	649 097	630088	484512

Figure 3 shows the annual change in the number of small ruminants (sheep, goats) in the Enbekshikazakh, Kegen, Raimbek and Uyghur districts for 2020-2024 (heads).

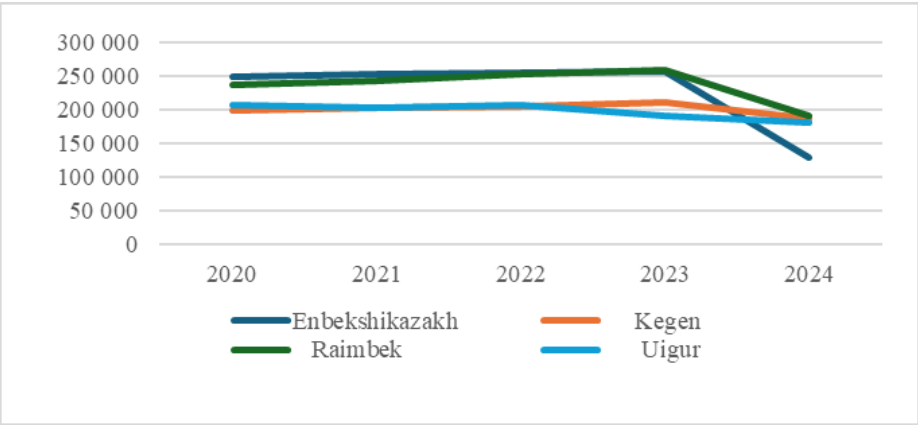

Figure 3 - Population of small ruminants (sheep, goats) in the study areas

Our studies have revealed that the vegetation cover of pastures in four districts (Enbekshikazakh, Kegen, Raimbek and Uyghur) of the Uzynkara and Ile Alatau ridges is represented by more than 99 species. Increased grazing leads to a sharp decrease in the number of species per unit area, a change in the structure and depletion of the floristic composition of the functioning part of the soil, represented by the cereal-wormwood-forb community, significantly exceeds the aboveground one. A study of pastures in four districts (Enbekshikazakh, Kegen, Raimbek and Uygur) of the Uzynkara and Ile Alatau ridges showed that as one approaches the cattle camp, the aboveground plant mass decreases, which is especially pronounced in sheep pastures. A slight increase in plant mass under heavy grazing pressure due to sheep is explained by an increase in the proportion of trampling-resistant, non-edible weed species in the herbage (*Polygonum aviculare, Artemisia austriaca, Urtica cannabina, Berteroa incana, Cirsium arvense, Chenopodium album, Artemisia annua, Urtica cannabina, Carduus nutans, Verbascum blattaria*). A sharp decline in plant mass in the studied areas indicates uneven grazing of the herbage during sheep grazing, which is due to a surge in the abundance of these non-edible synanthropic species. Under the influence of cattle grazing, the intensity of the process of depletion and reduction of the species richness of valuable forage plant species is expressed.

Thus, when studying the pasture load in all four districts (Enbekshikazakh, Kegen, Raimbek and Uygur) of the Uzynkara and Ile Alatau ridges, approximately the same patterns of vegetation dynamics were identified. To determine the grazing load, the existing livestock must be divided by the area of pastures. To determine the livestock load, it is necessary to take into account that sheep, cows, horses and camels do not eat the same amount of feed per day to maintain their life and produce products. The proportions of change in feed consumption are not linear with the change in animal weight. The smaller the animal, the more feed it needs per unit of its weight. Therefore, it is necessary to convert the existing livestock into a single standard unit. To convert the existing livestock into a standard unit, it was accepted to consider sheep and goats equal to one conventional sheep. For cows, five conventional sheep, six horses and eight conventional sheep for camels were adopted. As our studies showed, in 2024, due to the reduction in the number of animals, the grazing load on the pastures of the study area decreased significantly. In general, it should be noted that the lowest load on pastures is observed in the Raimbek district, and the highest in the Uyghur district. Data on the dynamics of the grazing load in the study area are given in table 5, figure 4.

Table 5 - Grazing load of cattle in the studied areas, conventional heads/ha

Regions	Years				
	2020	2021	2022	2023	2024
Enbekshikazakh	1.53	1.56	1.61	1.68	1.07
Kegen	1.31	1.33	1.38	1.41	1.09
Raimbek	1.58	1.64	1.76	1.81	1.02
Uigur	1.64	1.67	1.68	1,63	1.25

As can be seen from figure 4, in 2024, compared to 2023, 2022, 2021, the grazing load on the pastures of the study area has significantly decreased, which is due to a decrease in the number of animals. In general, it should be noted that the lowest load on pastures is observed in the Raimbek district, and the highest in the Uyghur district (table 4).

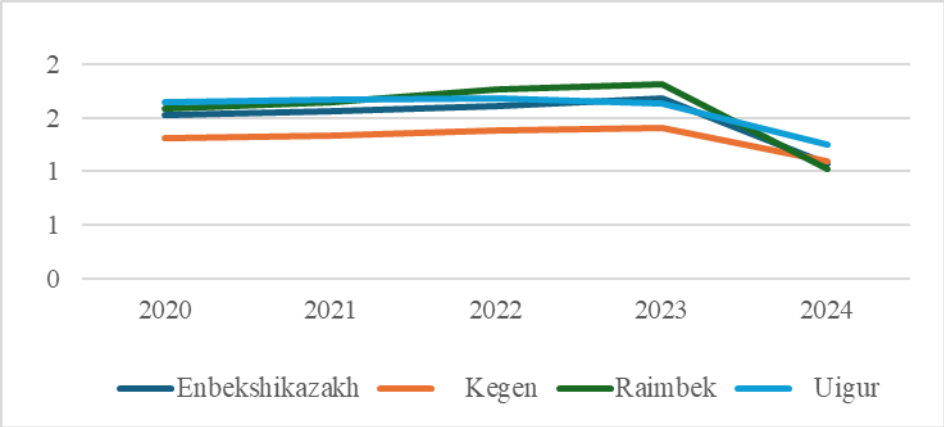

Figure 4 - Dynamics of grazing load in the study area, heads/ha

From the data in table 4 and figure 4, it is clear that from 2020 to 2022, the number of small ruminants (sheep, goats) was more or less stable in all 4 study areas. And starting from 2023, there has been a gradual decrease in the number of small ruminants (sheep, goats) in the Kegen and Uyghur districts. In 2024, there was a sharp decrease in the number of small ruminants (sheep, goats) in all four districts. The decrease in the number of small ruminants (sheep, goats) in the studied districts was due to the rise in the cost of feed for winter maintenance of animals.

The number of cows and horses in the study areas is shown in figure 5 and figure 6. As can be seen from figure 5 from 2020 to 2023, there was an increase in the number of cows in the Enbekshikazakh and Uyghur districts, and in figure 6. from 2021 to 2023, there was an increase in the number of horses in the Enbekshikazakh, Kegen and Uyghur districts.

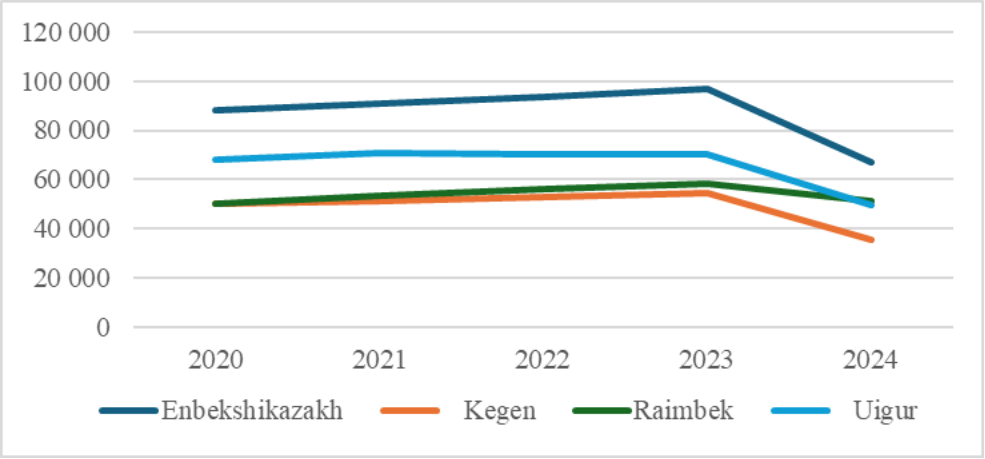

Figure 5 - Cows in Enbekshikazakh, Kegen, Raiymbek and Uygur regions for 2020-2024

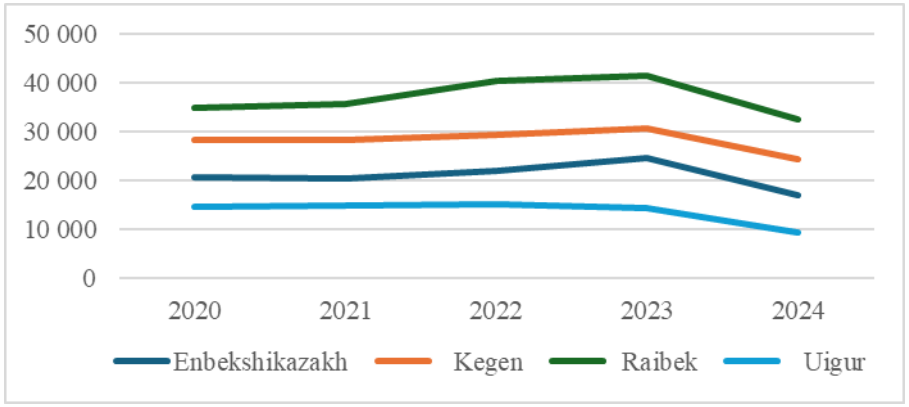

Figure 6 – Horses in Enbekshikazakh, Kegen, Raiymbek and Uygur regions for 2020-2024

The increase in the number of horses was due to an increase in the supply of kumiss and the treatment of the population due to the pandemic in the markets of the city of Almaty, and in 2024 there was a decrease in the number of animals in all four districts, which is associated with the rise in the price of winter feed for keeping cows and horses. In the study areas, camels are available in small numbers, mainly in the Enbekshikazakh and Uyghur districts (table 6, figure 7).

Table 6 - Number of camels in the Enbekshikazakh and Uyghur regions for 2020-2024, heads

Years	Districts			
	Enbekshikazakh	Kegen	Raimbek	Uyghur
2020	97	-	-	7
2021	116	-	-	28
2022	122	-	-	35
2023	132	-	-	30
2024	74	-	-	24

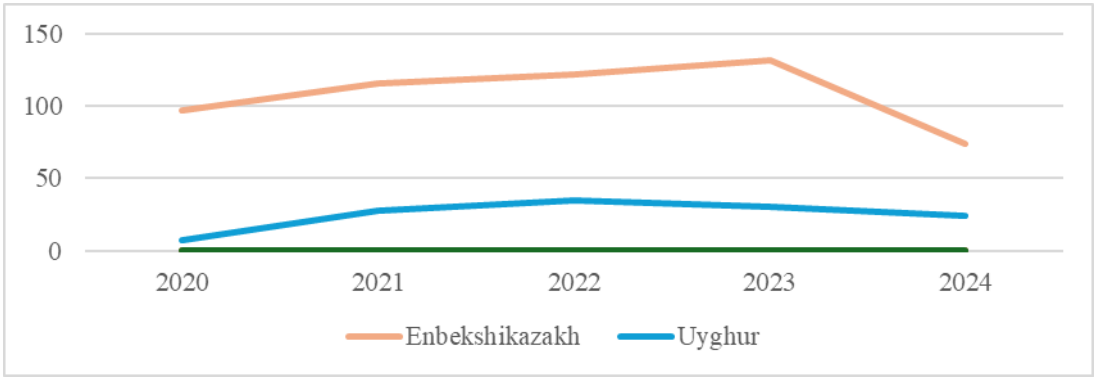

Figure 7 – Number of camels in the Enbekshikazakh and Uyghur regions for 2020-2024

Figure 8 shows the data on the chemical composition of the studied soils, where the characteristic features of mountain meadow soddy soils are: low thickness, strong sodding, good structure and high humus content. Chemical analyses of the alpine mountain meadow soddy soil shown in table 6 showed that the humus content was more than 15,1%, the pH value was acidic - 5. The absorption capacity is about 33 meq per 100 g of soil. Calcium predominates among the absorbed cations (Ca - 69%) (figure 8).

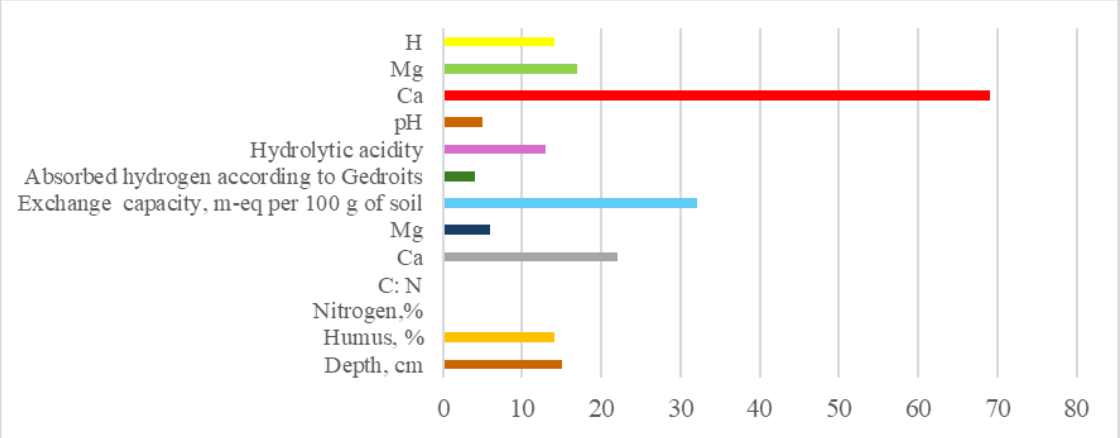

Figure 8 - Content of gross humus, nitrogen, absorbed bases and hydrogen in subalpine mountain meadow sod soil

According to the granulometric composition, the studied mountain meadow soddy soil is medium loamy fine sandy. The upper sod horizons have high moisture capacity. Despite the high mechanical strength of the sod, their structure is relatively poorly expressed. As a result of the fastening of lumps by fine roots, fractions >5 mm and microaggregate units predominate, and there are few granular fractions. Due to low biogeneity, high humidity and low temperature throughout the year, the processes of humification – mineralization of plant residues proceed very slowly (table 7).

Table 7 - Granulometric composition of the studied soils

Soils	Depth, cm	Fraction content, % of absolutely dry soil								
		Fraction sizes, mm								
		3	3-1	1-0.25	0.25-0.05	0.05-0.01	0,01-0.005	0.005-0.001	<0.001	<0.01
Mountain meadow turf alpine	0-20	0.9	8.3	0.1	10.1	41.3	14.1	18.0	11.7	43.1
Subalpine mountain meadow soil	0-15	7.1	5.3	0.8	8.1	42.5	14.7	17.9	13.2	46.0
	15-45	16.3	5.1	1.7	7.5	34.2	15.8	20.1	19.4	54.1
	45-75	27.9	16.0	2.7	11.5	28.6	12.8	16.8	17.4	45.1
Mountain meadow chernozem-like soil	-	-	-	14.21	37.11	12.20	18.51	24.48	53.25	-
	-	-	-	13.10	34.9	13.34	14.20	28.10	54.19	-
	-	-	-	14.00	30.74	17.20	14.19	28.78	59.10	-

Chemical analyses of subalpine mountain meadow soils (Assy pasture) also showed a high humus content (15.5%) in the upper horizon, below which its content drops sharply (8.1%). The total nitrogen content is quite high (0.70%). Soils that are not saturated with bases are acidic, but there are saturated ones with a neutral reaction. The absorption capacity is high (33.3% meq per 100 g of soil). Calcium predominates in the composition of absorbed bases (more than 80% of the capacity), which, along with a large amount of organic matter, determines the good granular structure of the soils (figure 9). This in turn determines their high water permeability, which reduces the development of erosion processes. However, the destruction of the turf leads to soil washouts and erosions. Table 7 shows that, according to the granulometric composition, the subalpine mountain meadow soil is heavy loamy silty-dusty. According to the soil profile, the coarse dust fraction (0.05-0.01 mm) predominates, and the silt fraction (<0.001 mm) increases in the lower horizons (16.4-19.6 %).

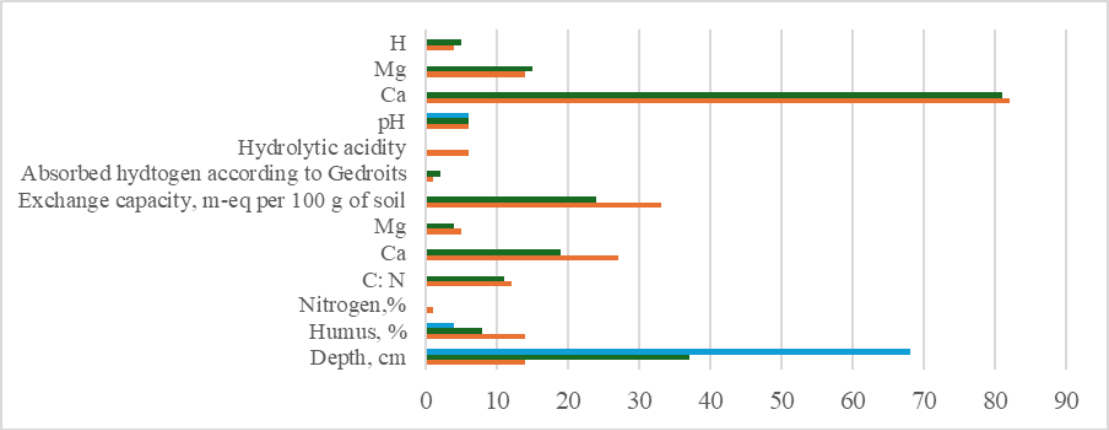

Figure 9 - Content of gross humus, nitrogen, absorbed bases and hydrogen in alpine mountain meadow sod soil

Due to the high biogeneity of mountain-meadow subalpine soils, more humic acids are formed in them, but due to the unsaturation of these soils with bases, most of the humic acids are represented by mobile forms. Mountain-meadow chernozem-like soils have a well-differentiated profile. Horizon A is black, with a granular structure, with a high humus content (10.5%), subdivided into 2 layers, the lower layer is distinguished by its stoniness. Further down the profile, the stoniness increases and becomes larger. Figure 10 shows data on the granulometric composition of mountain-meadow chernozem-like soils.

As can be seen from table 7, the granulometric composition of fine earth is heavy loamy silt-coarse-silty. The absorption capacity is within 22-32 meq per 100 g of soil. Absorbed calcium predominates, the pH of the environment is slightly acidic, associated with the presence of absorbed H +. In mountain-meadow chernozem-like soils, the energy of biological processes is increased: mineralization of plant residues, humus formation, nitrification capacity, energy of cellulose destruction, etc. Analysis of agrochemical properties showed that during pasture degradation there is a decrease in humus and nitrogen by 10-15% with weak degradation, by 25-30% with average degradation, and by more than 50% with strong degradation. The content of phosphorus and potassium changes insignificantly. According to the granulo-

metric composition of the soil in the upper horizon 0-15 cm sandy loam with a predominance of coarse and fine sand, in the lower horizon 15-30 cm light loam with a predominance of fractions of coarse and fine sand. The dispersion coefficient calculated from their indicators is high, which indicates the destruction of soil aggregates, the structure factor is very low, showing that the soil is not capable of structuring. The calculated erosion resistance indicator shows that the soil is not resistant to erosion. During degradation, the soil surface is destroyed and crushed by animal hooves, and crushed dusty and silty particles are carried away by wind and surface water. This leads to a decrease in physical clay (particles less than 0.01 mm) in the surface layer of the soil. As can be seen, the importance of high-mountain meadows as summer pastures is very great, but they require protection by regulating grazing. With excessive grazing, mountain meadows are displaced by inedible and poorly edible plants.

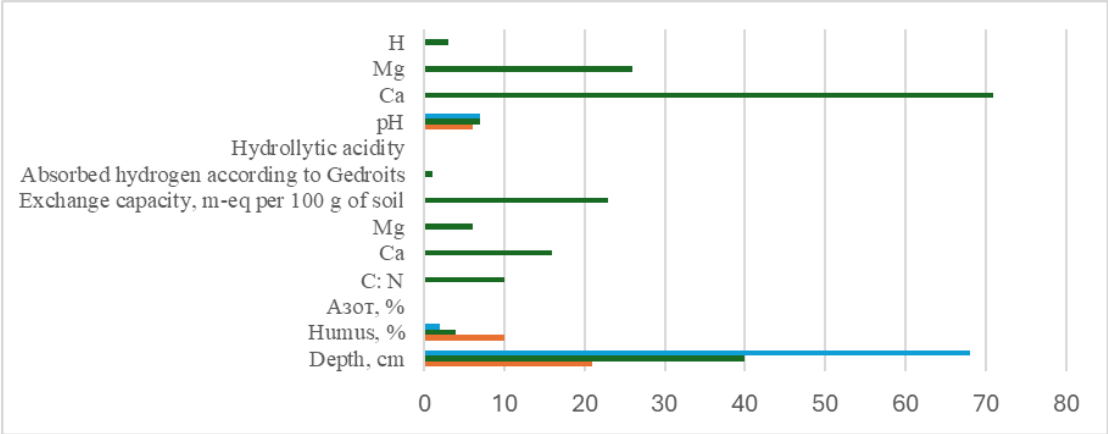

Figure 10 - Content of gross humus, nitrogen, absorbed bases and hydrogen in subalpine mountain meadow sod soil

In the studied areas of subalpine meadow soils, a progressive decrease in the above-ground plant mass was found on pastures with increased load and with an unregulated grazing regime. Exceeding the pasture load negatively affects the properties of the soil. Soils of degraded pastures are characterized by increased density and slightly lower indicators of structure [18]. Studies of pastures in 4 districts (Enbekshikazakh, Kegen, Raimbek, Uyghur) showed that the dynamics of soil properties differ depending on the type of grazing livestock. As the grazing load increases, the density of the upper soil layers increases. In deeper layers, soil indicators do not depend on the degree of grazing load. The compaction process is most pronounced in sheep pastures. In cattle and horse pastures, soil compaction is lower. Overgrazing has a negative effect on the structural state of the soil. With increasing grazing load, the proportion of valuable structural aggregates in the soil decreases. The study of the assessment of the development of degradation processes in the mountainous part of the Northern Tien Shan, the Uzynkara ridge, the Shalkudysu pasture and the Ile Alatau on the Assy plateau, showed that the study area in botanical and geographical terms is included in the Dzungar-Northern Tien Shan group of zonality types. Zailiysko-Northern Dzungar zonality type and the Kungey-Terskey-Ketpen zonality type [19]. Changes in the structure - transformation of the grass stand were assessed according to 4 degrees of transformation: 1 - not

changed; 2 - moderately modified; 3 - highly modified; 4 - broken.

Each of these degrees was assessed by the content in the grass stand of - plant species thinning out due to overgrazing; - increasing in abundance and - invasive species. The studies showed that our studied pastures can be classified as moderately and intensely degraded pastures, since the content of weed and poisonous invasive species in the grass stand (*Alchemilla sibirica, Aconitum soongaricum, Ranunculus natans, Polygonum aviculare, Urtica cannabina, Echinops chantavicus, Berteroa incana, Ambrosia artemisiifolia, Ligularia macrophylla, Chenopodium album, Cynara scolymus, Taraxacum officinale, Arctium tomentosum, Marrubium vulgare, Carduus nutans, Verbascum blattaria*) with moderate transformation of grass stand it is from 5 to 20%, and with intense degree from 20-40%, this in turn indicates that the state of our studied pastures is in a state of intense and moderate degree of degradation in terms of the grass stand transformation indicator (table 8).

Table 8 - The degree of ecological condition of the studied agricultural lands in the four studied areas

The degree of ecological condition of agricultural lands	Degradation of pasture grass		Tropinity (in %)	Soil erosion and deflation (destruction of the humus horizon) (in %)
	Productivity medium-long-term (in %)	Composition of grass stand		
Tense	13.6	a) thinning species (readily eaten) up to 40% b) increasing in abundance up to 40% c) penetrating species (weeds and poisonous) up to 20 units.	15-25	10-25
Crisis	25.6	a) thinning species (readily eaten) up to 20% b) increasing in abundance up to 50% c) penetrating species (weeds and poisonous) up to 40 units.	25-50	25-50
Destructive	less than 25	a) thinning species (readily eaten) less than 10% b) increasing in abundance up to 40% c) penetrating species (weeds and poisonous) more than 60 units.	more than 50	more than 50

With moderate pasture degradation, pasture productivity can decrease by 25%, and with severe pasture degradation, the reduction in the edible portion of the grass stand can reach up to 50% (table 9).

Table 9 - Degree of degradation intensity of the studied pastures

Degree of pasture degradation	Degradation intensity	Area, ha
Severe	strong	50 530.4
	medium	54 666.1
	weak	67 913.3
Moderate	strong	56 294.6
	medium	101 702.6
	weak	35 436.8
Total:		366 543.9

Of the surveyed area of 366.543.9 hectares of mountain pastures in four districts (Enbekshikazakh, Uygur, Kegen, Raimbek) in the southeast of Almaty region, all pastures are subject to varying degrees of degradation. The degree and intensity of degradation was determined by the condition of the grass stand: the content of edible and non-edible parts. (table 9).

CONCLUSION

Thus, the soil cover of the studied pastures of Ile Alatau and the Uzynkara ridge, where soil samples were taken, was described in the field. Analysis of agrochemical properties showed that with pasture degradation, there is a decrease in humus and nitrogen with weak degradation by 10-15%, with an average degradation by 30-35%, with strong degradation of more than 50%. The content of phosphorus and potassium changes insignificantly. According to the granulometric composition of the soil in the upper horizon of 0-15 cm, sandy loam with a predominance of course and fine sand, in the lower horizon of 15-30 cm, light loam with a predominance of fractions of coarse and fine sand. The dispersion coefficient calculated from their indicators is high, which indicates the destruction of soil aggregates, the structure factor is very low, showing that the soil is not capable of structuring. The calculated indicator of antierosion resistance shows that the soil is weakly resistant to erosion. During degradation, the soil surface is destroyed and crushed, especially by the hooves of small ruminants, and the crushed dust and silt particles are carried away by the wind and surface waters. This leads to a decrease in physical clay (particles smaller than 0.01 mm) in the surface layer of the soil. As can be seen, the importance of high-mountain meadows as summer pastures is very great, but they require protection by regulating grazing. With excessive grazing, mountain meadows are displaced by inedible and poorly edible plants.

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ТҮЙІН

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СОЛТҮСТІК ТЯН-ШАННЫҢ ТАУ АЙМАҚТАРЫНДАҒЫ ТОПЫРАҚТЫҢ БҰЗЫЛУЫНА МАЛ ЖАЙЫЛУЫНЫҢ ӘСЕРІ

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Мақалада Іле Алатауы мен Ұзынқара жотасының таулы аймақтарындағы топырақ пен өсімдіктердің деградациясын зерттеу нәтижелері қарастырылған. Іле Алатауы мен Ұзынқара жотасының биік таулы және орта таулы жайылымдарының геоботаникалық зерттеулерінің мәліметтері өсімдіктердің деградациясының басқа процестерден басым екендігін көрсетті. Таулы аймақтардың топырақтары қарашірік көкжиектің қалыңдығымен, жалпы қарашіріктің жоғары мөлшерімен, кальций мен магнийдің мол қорымен және аз фосформен сипатталады. Біздің зерттеулеріміз көрсеткендей, зерттелетін топырақтардың қарашірік көкжиектің қалыңдығы 40-60 см құрайды, олар жоғары құнарлылық потенциалымен ерекшеленеді, бірақ бұл потенциал топырақтың тапталу дәрежесі және жайылымдардың деградация дәрежесі сияқты факторлармен шектеледі. Сонымен қатар жайылымдық деградацияның күшеюімен қарашірік қабатының азаюы, топырақтағы қарашірік пен қоректік заттардың мөлшері азаяды. Зерттелетін аумақтағы жайылымдардың деградациясының көрсеткіштері ретінде өсімдік қауымдастығын бағалау шамадан тыс және реттелмеген жайылымға байланысты өсімдік жамылғысы антропогендік деградацияға ұшырағанын көрсетті. Өсімдіктердің түрлік құрамының өзгеруі, жайылымдық жем-шөптердің, топырақтың өнімділігінің төмендеуі байқалады, бұл өз кезегінде топырақтың гранулометриялық қасиеттерінің нашарлауына әкеледі: 0-10 см қабаттағы тығыздықтың 0,11% жоғарылауы, құнды лай бөлшектері профильдің жоғарғы бөлігінде шайылып кетеді, олардың суға төзімділігі төмендейді.

Түйінді сөздер: деградация, жайылымдар, топырақ, өсімдіктер, жайылым қысымы.

РЕЗЮМЕ

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ВЛИЯНИЕ ВЫПАСА СКОТА НА ДЕГРАДАЦИЮ ПОЧВ ГОРНЫХ ТЕРРИТОРИЙ СЕВЕРНОГО ТЯНЬ-ШАНЯ

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В статье рассматриваются результаты исследований по изучению деградации почвенного и растительного покрова горных территорий Иле Алатау и хребта Узынкара. Данные геоботанических исследований высокогорных и среднегорных пастбищ Иле Алатау и хребта Узынкара показали доминирование деградации растительного покрова над другими процессами. Почвы горных территорий характеризуются мощностью

гумусового горизонта, высоким валовым содержанием гумуса, большими запасами кальция и магния и небольшим содержанием фосфора. Как показали наши исследования, мощность гумусового горизонта исследуемых почв равна 40-60 см, отличаются высоким потенциалом плодородия, однако этот потенциал ограничен такими факторами, как выбитость почвы и степень деградации пастбищ. При этом, с возрастанием деградации пастбищ происходит уменьшение гумусового слоя, снижение содержания гумуса и питательных веществ в почве. Оценка растительных сообществ как индикаторов деградации пастбищ на исследуемой территории показала, что из-за чрезмерного и нерегулируемого выпаса скота растительный покров подвергся антропогенной деградации. Происходит трансформация видового состава растений, снижение продуктивности пастбищных кормов, почв, которая в свою очередь приводит к ухудшению гранулометрических свойств почв: повышение плотности в слое 0-10 см увеличивается на 0,11%, в верхней части профиля смываются ценные илистые частицы, снижается содержание агрегатов и их водопрочность.

Ключевые слова: деградация, пастбища, почвы, растительность, нагрузка пастбищ.

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