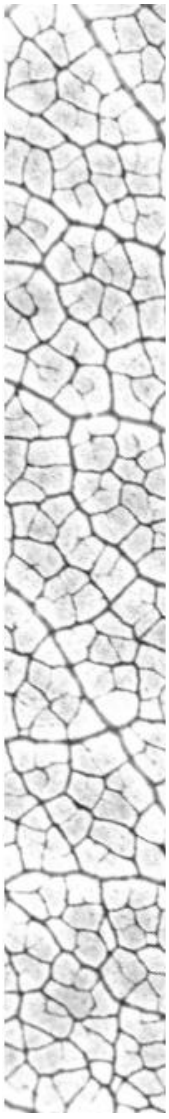

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The productivity of natural forage lands of Kazakhstan

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Abstract
The assessment of the agricultural landscape state of natural forage lands was carried out in 1997-2018 based on several components. The main ones that determine the essence of ecosystems of this type are the features of their formation, the development of a reaction to an anthropogenic process, are the genesis of natural forage lands, the degree of disturbance, resistance to external anthropogenic factors.
The distribution of natural forage lands, into conditionally indigenous and production (post-forest), show not only the degree of disturbance of natural vegetation, but also more accurately assess the resistance of ecosystems to grazing, since production, communities, as initially disturbed, are in an unstable state.
Field surveys are considered and presented in order to study the vegetation and soil cover of natural forage lands - hayfields and pastures of Kazakhstan in forest-steppe, steppe, semi-desert, desert, mountain zones, their yield and quality of the resulting forage for their rational use are shown. Protection and development of recommendations. The survey determined the agroecological state of natural forage lands, the occupied area, revealed the structure and communities of vegetation cover, typological composition, agrolandscape with territorial distribution of forage lands, modern use of natural forage lands, opportunities for rational use.

Keywords: yield, plant communities, particle-size distribution, soil, hayfields and pastures, natural forage lands, forest-steppe, steppe, semi-desert and desert, mountainous zone

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INTRODUCTION

The main fodder base for animal husbandry in various soil and climatic conditions in Kazakhstan with limited water resources is mainly natural forage lands. Area of pastures and hayfields for 2017 accounts for about 186. 6 million hectares or 70% of all agricultural land. However, in recent years, about 30% of pastures have been actively used for grazing farm animals due to their lack of water supply, remoteness from settlements, and reduction in the number of livestock, and also due to the incompleteness of land reforms (Postoyalkov, 1972, Bekmukhamedov, Risimbetov, Asanov, 2010).

Natural forage lands, being under the constant influence of human economic activity, are characterized by natural economic characteristics, zonal and climatic features, vegetation cover, and way of using the land, forage specificity and productivity.

What resources do these lands have today? According to our research, pastures annually renew more than 50 million tons of air-dry fodder, which is nutritionally equivalent to 20 or more million tons of feed units (Postoyalkov, 1972- Gossen, 2004).

According to the World Bank, the annual renewable fodder resource from pasture lands is estimated at 1. 2 billion US dollars.

Therefore, the primary task is to conduct an inventory of the agroecological and economic state of the pasture lands in Kazakhstan, which makes it possible to develop targeted proposals for the rational use and commissioning of new pasture lands.

MATERIALS AND METHODS

The object of research is the natural forage lands - hayfields and pastures of Kazakhstan, plant populations and their communities.

Geobotanical, large-scale surveys were carried out in 1997-2018 in three stages: preparatory, field, cameral.

During the field period, the available stock, literary and cartographic materials are collected, characterized by the knowledge of the natural conditions of

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conventional research (Classification of natural forage lands by zones of Kazakhstan).

Field geobotanical description was carried out at a scale of 1:100000 by a large-scale method, as well as using aerial photography. Carried out mapping of vegetation, description of plant communities attributed to a particular type of forage land (hayfields and pastures) by the similarity of species composition, structure of dynamic properties, confined to certain habitat conditions.

The cameral period of geobotanical surveys included:

-processing of materials for plant composition;

-forming a typological list, drawing up a legend;

-determination of the yield of pastures, the quality of fodder in terms of productivity and quality in terms of nutritional value;

-calculation of areas and fodder reserves;

-composition and registration of a geobotanical map of natural forage lands.

RESEARCH RESULTS

In the flat part of Kazakhstan, the following climatic zones are distinguished: forest-steppe, steppe, semi-desert and desert. The smallest area is occupied by the northernmost forest-steppe, the largest semi-desert and desert, about 62% of the entire Land of the Republic (Postoyalkov, 1972- Kashevarov, Benz, 1997).

The forest-steppe and steppe zones occupy an area of about 80 million hectares, of which 40 million hectares are natural pastures, located mainly on light soils, soils of the solonetzic complex and solonetz soils. Floodplain or estuary meadows along river valleys, around lakes, in low plains are used as hayfields, their area is 2. 0 million hectares (Kashevarov, Benz, 1997).

In the semi-desert and desert zones, natural pastures occupy most of the territory, their area is about 130 million hectares. There are 11. 5 million hectares of natural forage lands in the mountainous regions of the republic (Kashevarov, Benz, 1997).

The main life form in the steppes is herbaceous perennials, mainly from the family of cereals. There are not many dominant plants - cenose-forming in the steppe, these are, first of all, feather grass, sheep fescue, fatuoid, wheat grass.

During the growing season, several aspects change in the steppes, which is associated with different rhythms of development of individual plants that make up a particular community. The spring-early summer aspect is the brightest - the flowering time of mesophilic forbs (late May - early June). Early summer aspect - the period of flowering of early-ripe caespitose narrow-leaved xerophilous grasses: sheep fescue, pinnate feather grass, fatuoids and some species of forbs (June). The summer aspect - the period of earing and flowering of esparto grass and total wilting of vegetation (June-early August). The late summer - early spring aspects are due to the drying out of caespitose grasses and forbs and the best development of wormwood.

In the forest-steppe and northern part of the steppe zones, the most typical and widespread are forbs-cereal and cereal-forbs meadow steppes, mainly along relief depressions. They have a rich species composition of steppe and meadow-steppe plants. Of the grasses, the most common are reddish feather grass, sheep fescue, and timothy grass; from forbs meadowsweet, meadow pea, mustard. Productivity 8-10 dt/ha dry eatability (eatability 20%) with a single count and a cut height of 2-3 cm (hereinafter also everywhere).

Relatively provided, the meadow steppes are distinguished by a relatively good aftermathability, which allows them to be used as pastures for cattle at least 2-3 times during the growing season. The rest of their areas are mown.

Red-feather-grass-rich forbs steppes on ordinary chernozems are similar to meadow steppes in species composition and yield. Of the forbs typical for them, pasqueflower, sainfoin, saw-tooth wormwood. As a rule, they are found in a complex with low-productive steppes – sheep fescue forbs with goldilocks and solonetzic and sheep fescue-wormwood. The average yield of red-feather-grass-rich pastures is 5-7 dt/ha, sheep fescue with forbs and wormwood is 2-5 dt/ha.

In the steppe herbage on the southern chernozems, there is less forbs and it is more xerophytic (melilot, sage, eryngo, mustard, alfalfa). Grasses dominate: feather grass - reddish, sheep fescue, hair-grass. The yield is 4-7 dt/ha.

On the crushed chernozem soils of the hillocky areas, there are fatuoid steppes with a yield similar to feather grass steppes.

The largest area in the steppe zone is occupied by dry steppes on dark-brown and chestnut soils of the plains and on hillocky area (on the slopes of the peaks and hillocky plains). The latest in a heavily bushed types spera of and karagai.

On a plain and on a hillocky are a, on soils of different particle-size distribution and different deepness steppes are formed with the predominance of grasslands of feather grass, sheep fescue, less often fatuoid and wheat grass. The most common feather grass-sheep fescue steppes (red feather grass-sheep fescue, common cattail-sheep fescue, feather grass-sheep fescue, different feather grass-sheep fescue). Their yield is 2-7 dt/ha, on average - 3-5 dt/ha. To feather grass-sheep fescue steppes are very similar in all indicators sheep fescue-feather grass, resulting from intensive grazing. They occupy more area; the yield is from 2. 0 to 6. 5 dt/ha, on average - 3-5 dt/ha.

The landscapes of Central Kazakhstan presented by feather grass steppes on carbonate soils. Their herbage is usually lower than that of other feather grass steppes (20-30 cm) - on average 3-5 dt/ha. Yield, similar to the

Table 1. Feed resources for certain groups of types of pastures in the steppe zones of Kazakhstan

№	Groups of types of pastures, soils, plants	Area million ha	Yield, dt/ha	
			Dry mass	Feed unit
1	Bunchgrass-rich forb and cereal-forb meadow-steppe on ordinary chernozems and meadow-chernozem soils: feather grass, sheep fescue, timothy, reed grass, forbs	20	6,5	3,3
2	Bunchgrass, bunchgrass-forb steppe on southern chernozems, dark chestnut and chestnut soils: feather grass, sheep fescue, wheat grass, fatuoid, forbs	30,0	4,5	2,3
3	Sod-wormwood on saline and rank soils: feather grass, sheep fescue, wormwood	4,7	3,7	2,7
4	Saltwort, saltwort-wormwood on saline soils: kokpek, saltwort, black wormwood, Shrenk's	1,1	2,9	1,6
5	Juicy saltwort on saline soils: salt bush, seepweed, glasswort	0,4	2,9	10
6	Wormwood on zonal non-saline and saline soils: Lerch, Austrian	0,1	2,6	1,3
7	Saltwort-wormwood on saline soils: wormwood black and Shrenk's, nitric	2,2	2,7	1,5
8	Soft-stalked cereal and cereal-forb on meadow non-saline and moderately saline soils	0,3	10,0-13,0	6,7-3,2
9	Rough-stalked cereal on meadows, incl. swampy and saline soils: reed, reed bent, wild rye	0,4	9,0-11,0	5,1-10,0
10	Halophytic cereals on saline meadow soils: saltmarsh-grass, brome, wormwood	0,2	5,0	2,0
	Total	41,4		

feather grass steppes have steppes on crushed soils with the dominance of desert fatuoid and wheat grass on the plain. The area they occupy is relatively small (Asanov, Kohen, 2007, Yurchenko, 2013).

The yield of steppe herbage is influenced by the temperature of the previous autumn and the spring and early summer of the current one. The nature and intensity of the existing use is also important, the later and more intensively it was alienated, the weaker the renewals were in the next year. The yield of steppe phytocenoses depends not only on meteorological factors, but is also determined by the rhythms of development of individual plant species and their biological characteristics.

The main dominants of the steppe vegetation of Kazakhstan - feather grass and sheep fescue: due to the relatively deeply penetrating roots - do not particularly suffer from the most destructive spring droughts. The yield ranges from 20-50%. More stable yield of herbage on light soils. During the years of mass feather grass hatching, which does not occur annually in dry steppes, their yield is 20-30% higher.

Steppe herbage, that is, of all types, are used as spring-summer-autumn pastures for all types of livestock. In years favorable for meteorological conditions (50% of years), the steppes are partially mown, their yield is 2-5 dt/ha.

The modern pasture load of the territory in different parts of the steppe zone is not the same. It is much higher in the agricultural regions of northern Kazakhstan, where there is a noticeable shortage of pastures, than in southern ones. Overloading of monotonous unsystematic use leads to a decrease in the species composition of steppe herbage, to a decrease in their yield (Larin, 1950, Instructions for conducting large-scale (1: 1000-1: 100000) geobotanical surveys of natural forage lands of the Republic of Kazakhstan. -Almaty, 1975).

As a result of excessive grazing, pinnate feather grass first begins to fall out, while the amount of hair-grass and sheep fescue, later wormwood, may increase. In the west of Kazakhstan, herbage of the steppes, the number of Lerch and Austrian wormwood increases, in the hillocky area – narrow-lobular. Wormwood is not inferior in nutritional value to cereal steppe forage, and even higher in some indicators, but in summer they are poorly eaten by all types of livestock. For cattle, wormwood is also less nutritious because the taste of milk is bitter.

Weed infestation is less common, mainly in the northern regions of Kazakhstan. The process of displacing and replacing some plants with others in the steppe zone is rather slow. By judicious grazing, the composition of the vegetation can be regulated. Pastures in the extreme stage of poaching (with very sparse herbage, dominated by knotweed) occupy relatively small areas.

Feed resources for certain groups of pasture types in the steppe and dry steppe natural climatic zones are shown in **Table 1**.

Part of the stony steppe areas are plowed up for grassing. The productivity of sown herbages on such lands is higher than that of natural ones. However, most of the steppes, especially in the hillocky areas, remain in their natural state and can only be used as pastures. The expediency of preserving or improving certain types of natural pastures should be determined by the economic efficiency of the planned transformations, considering the use of forage lands by specific types of livestock.

Different types of steppe pastures hardly differ in the quality of forage, eatability, and nutritional value. The nutritional value of forage in the steppes of Kazakhstan has not yet been sufficiently studied; especially on reddish feather grass, desert fatuoid and many kinds of forbs. However, on the basis of the results obtained on the change in the nutritional value of steppe plants, the maximum is in spring and early summer, the minimum is in autumn, at the end of the growing season. If at the beginning of summer the forage of most types of pastures can be called good, 100 kg of it contains 70-85 kg of feed units or 10-14 kg of digestible protein, then by autumn it becomes low-nutrient - 30-40 feed units, 4-5 kg of protein (**Table 2**).

The eatability of feed until mid-summer is good, then, when the plants become dry and hard, the eatability worsens, but slightly improves in the fall, when young shoots begin to grow with the onset of rains.

Table 2. Nutritional value of forage plants in different phases of development per 1 deciton of dry mass

Forage plants	Feed units				Digestible protein			
	Development phases*				Development phases*			
	I	II	III	IV	I	II	III	IV
1) Wormwoods: - gray wormwood	65-77	48-52	38	22-30	9,0-12,7	5,3-6,8	4,8-8,4	2,2-3,5
- Lerch wormwood	80	68	71	98	-	-	8,5	5,5
- Turinese wormwood	60	48	40	38	7,0	6,1	5,0	5,0
- Shrenk's wormwood	73	54	70	65	13,0	8,6	10,7	8,0
- black wormwood	77	60	41	28	10,0	7,02	3,7	2,1
- narrow-field wormwood	48	50	47	27	13,1	10,7	5,7	2,1
Saltworts: - biyurgun	80	58-90	63-50	40-38	16,0	6,2	6,2	6,0
- kokpek	35	38	40-41	-	5,5	-	2,8	-
- tasbiyurgun	-	-	-	40	-	-	-	7,2
- Russian thirst-quenching	70	64	50	42	7,7	5,7	4,8	3,7
- warty salt bush	64	71	-	28	9,1	6,1	-	8,5
Psammophytes: - Siberian wheatgrass	74	58	48	35	11,7	7,1	4,0	2,2
- beaked sedge	81	85	-	-	11,7	11,1	-	-
Leafless calligonum	61	50	46	85	-	-	-	-
White saxaul	60	57	53	46	7,0	6,5	37	2,7
Keireuk (saltwort)	61	41	34	35	7,7	5,5	4,7	4,0
Terseken	63	51	31	-	10,0	8,6	5,3	-
Ephedra	73	-	70	-	5,3	-	8,4	-
Steppe cereals: - esparto grass	75	57	54	48	7,1	5,3	5,3	2,7
- sandy feather grass	-	68	-	-	-	5,8	-	-
- Lessing feather grass	75	75	60	34	8,4	8,8	4,8	2,7
- sheep fescue	68	60	50-34	48	8,1	7,0	4,4	2,7
- wheat grass	74	64	45	-	17,0	10,0	4,0	-
June grass	64	48	27	-	6,7	3,5	2,4	-

* Note: I- vegetation II- butanization-flowering III- flowering-fruiting IV- winter state

The aftermathability of steppe plants is not the same everywhere. It is higher in the north of the zone, in herbages on ordinary chernozems, and lower in the south, in herbages on chestnut soils. It depends on weather conditions and on the timing of the alienation of grass no later than June, especially if there is precipitation during this period.

Hayfields in the steppe zone are located along relief depressions. In river valleys around lakes and reservoirs. The most significant massifs are located in the valleys of the Irtysh and Ural rivers, where the floodplain is well expressed.

The technological composition of the meadows is rather monotonous. On non-saline or slightly saline meadow soils, wheatgrass, cereal-forb, forb-cereal sedge and reedgrass meadows are most often found: in humid habitats - reed and sedge; on saline ones - oriental and alkaligrass. The species composition of meadows varies, which is associated with changes in soil moisture and even contamination.

The yield of meadows is mainly determined by the condition of water supply to plants before the flowering phase (in spring and early summer). The sources of moisture are both as spring floods and higher groundwater, as well as atmospheric precipitation. The share of the participation of one or another moisture source in providing the herbage with moisture may vary in individual years. Human economic activity - the construction of hydroelectric power stations, reservoirs, irrigation of fields radically change the regime of rivers, and hence the regime of humidification.

The yield of the best quality meadows - small-stalked cereals, wheatgrass, boon, cereal-forb, established by the method of mowing (excluding losses during hay harvesting) is 10. 0 dt/ha. With good moisture, such meadows can produce 20 dt/ha of hay and more.

The yield of rough-stalked cereal meadows, mainly reed, averages about 17 dt/ha of hay, but rarely reaches 31 dt/ha of hay and more.

The condition of herbages in many meadows is not satisfactory due to irrational use: timely hay harvesting, prohibition of unsystematic cattle grazing on the aftermath of alternating haymaking and pasture rotation. The meadows are littered not only with hayfields, but also with pasture weeds such as licorice, Roman wormwood, etc. In some places it is necessary to clear the shrubs from the surface leveling. Correct use and fertilization could significantly increase the productivity of meadow hayfields.

In terms of the nutritional value of feed, the best indicators for small-stalked cereals are 55-62 feed units in 100 kg of dry fodder mass and the worst in reed and reedgrass about - 45 fodder units.

Areas of the steppes are also mown. The yield on them is lower than on meadows and it is not possible to mow them every year.

There are 20 times more pastures in the steppe zone of Kazakhstan than hayfields. If, in the calculations, take the yield of pastures at the level of 3. 7 dt/ha, and hayfields of 11. 0 dt/ha, the duration of the pasture period is seven months and the stall period is five months, then it turns out that the stall fodder is almost

two times less than necessary. The gap in the provision of pasture and stall fodder can be eliminated by increasing the yield of hay meadows and increasing the area suitable for haymaking by means of estuary irrigation or drainage of wetlands.

Most of the territory of Kazakhstan belongs to the desert and semi-desert zones. In the desert zone, precipitation falls on average 100-150 mm per year, in the semi-desert zone 200-250 mm. The zonal soils are light chestnut, brown, gray-brown, serozem (near the mountains). Large areas are occupied by complexes of zonal soils with solonetzes; there are many saline soils. Sand massifs of various sizes occupy about 30% of the desert zone (Bekmukhamedov, Risimbetov., Asanov, 2010, Classification of natural forage lands by zones of Kazakhstan, Kashevarov, Benz, 1997).

In general, the vegetation cover of the semi-desert zone resembles steppes only with a large number of wormwood, sometimes forming pure thickets. Black wormwood is the predominant species (Karynbayev, Yuldashbayev, Baimukanov, 2020, Karynbayev et al. 2020, Karynbayev et al. 2019).

On light chestnut and brown loamy soils of the semi-desert, feather grass-sheep fescue (dominated by one or several feather grass), feather grass-sheep fescue-wormwood, sheep fescue-feather grass, sheep fescue-feather grass-wormwood steppes are widespread. In the hillocky areas they are heavily bush with meadowsweet and pea shrubs. The yield is from 1. 7 to 8. 0 dt/ha, depending on the conditions of the habitat and the nature of use. Along with steppe herbage, a small area is occupied by wormwood and saltwort communities on solonetzes, which, in combination with steppe vegetation, are a typical feature of the semi-desert zone.

In the desert zone, the area occupied by wormwood communities is significantly increasing. On the watersheds, wormwood species other than in the semi-desert begin to prevail - the white-ground wormwood (gray) becomes dominant. Southern, Turanian forms of wormwood appear, but there is still a lot of black wormwood on the solonetzes. In the semi-desert zone, there are thickets of black wormwood, Schrenk wormwood, Lerha, narrow-lobular. Wormwoods form associations with sod steppe grasses-feather grass, sheep fescue and with holophilic hairy plants, chia, saltwort. Desert zones are characteristic of the plains; communities of wormwood with ephemera, selevins, keireuk, saxaul, and biyurgun are typical. In all these communities, ephemerals and ephemeroids are found in varying amounts. The projective cover is 45-62%. The height of wormwood of normal development is 25-35 cm. With dry spring, there are almost no undeveloped shoots in wormwood, and if it is also a very dry summer, then wormwood hardly grows, only their lower wooden part and a small amount of leaves curling from it are noticeable.

The species composition of wormwood communities is represented by 10-15 species. The maximum mass in wormwood communities as a whole depends on the species composition and the abundance of species composing it. Gray wormwood has a maximum mass by the end of spring, and black wormwood also. The average yield of the mass of the annual increase in different types of wormwood is not the same: wormwood Lerha - 3. 6 dt/ha, gray wormwood - 1. 7-4. 1 dt/ha, black wormwood - 1. 7-8. 0 dt/ha. All wormwoods are relatively sensitive to drought. Their yield varies significantly over the years depending on moisture availability.

Wormwood communities of semi-desert and desert are used as grazing land for all types of livestock in different seasons. In the presence of cereal pastures, it is recommended to use wormwood pastures in autumn and winter. Wormwood can be used in spring and summer when other types of pasture are scarce, especially for grazing sheep and camels. In wet years, small areas of wormwood are mown. Levant wormwood is a valuable medicinal plant. Feed from wormwood is close in nutritional value to cereal feed, and the amount of digestible protein in it is even greater (**Table 2**).

On saline soils in semi-arid and desert zones, solonetz communities (the family of Maryevs) are widespread. In the semi-desert, the dominants of the saltwort communities are: kokpek, biyurgun, tasbiyurgun; on highly saline soils - sarsazan, warty salt bush. The following communities are widespread:

- with the dominance of one type of saltworts - kokpek, biyurgun, sarsazan and others;
- with the dominance of several saltworts - biyurgun-kokpek, biyurgun-tasbiyurgun and others;
- with the presence of saltwort and wormwood - kokpek-black wormwood, biyurgun-black wormwood and others;
- with the presence of saltwort and herbaceous plants - kokpek-psathyrostachys, biyurgun-ephemeral, etc.

The largest area, about 20 million, is occupied by the biyurgun group communities, which are common especially in the Atyrau region. The yield of biyurgun pastures is 1. 7-4. 1 dt/ha, in dry years it is 0. 7-1. 2 dt/ha. Kokpek and selevin pastures occupy more than 4. 0 million ha each.

Biyurgun is a semi-shrub 6-16 cm high, with juicy fleshy stems and reduced leaves. It grows on brown, gray-brown plain-like saline soils and solonetzes: the projective cover in its communities for overgrowing plains is 20%, in the best areas 60%. The maximum yield reaches in June-July. In the semi-desert in summer, animals hardly eat biyurgun because of the abundance of salts, excluding camels. In the desert, due to the lack of other food, it is eaten well. In autumn and winter, biyurgun is well eaten and serves as a fatty feed. In terms of nutritional value, it is of good quality (**Table 2**).

Another widespread plants from saltwort forming a number of communities is kokpek (gray salt bush) - a semi-shrub 20-50 cm high, with fleshy leaves. The projective cover in its communities is 40-60%, the yield is 2-5 dt/ha, sometimes higher. The increase in mass stops by the beginning of summer, its value changes little until late autumn. Biyurgun suffers relatively little from drought. It is eaten by livestock, with the exception of camels, reluctantly in summer, quite satisfactory in autumn and winter. The nutritional value of kokpek feed is lower than that of biyurgun.

Typical plants for the plain with gravelly, sometimes underdeveloped soils is Russian thirst-quenching (foliaceous salt wort). Especially large areas with its dominance are found in Betpak-dala. Russian thirst-quenching is a shrub 31-47 cm high, with juicy leaves. It gives the greatest mass at the end of May, given its better eatenability in summer compared to other salt wort and the fact that its leaves usually fall off at the end of summer, Russian thirst-quenching communities can be used as summer pastures, as well as in other seasons. The yield of these communities is up to 10 kg/ha. In terms of nutritional value, the Russian thirst-quenching is close to the biyurgun. The observation showed that with an amount of precipitation of at least 170 cm in the period from October to the transition of temperatures in spring through 10°C, the yield of Russian thirst-quenching is possible up to 8-10 dt/ha, with 60-70 mm - up to 6 dt/ha.

Gravelly soils are characterized by pastures with a thorny shrub tasbiyurgun. They are found in many places, but they do not occupy large areas. In terms of the quality of feed, they are close to biyurgun. For the salt worts, the most typical are salt bush and sarsazan pastures. The warty salt bush and sarsazan are succulent semi-shrubs, satisfactorily eaten only by camels. The area occupied by such pastures is not large. Annual salt wort also forms grazing communities, but there are few of them.

A significant share in the pasture economy of the republic is occupied by sandy pastures on hilly and ridge loose sands and sandy plains. They are found in the form of separate massifs of different sizes. Especially large are the Kyzylkum, Sary-Ishikotrau, Muyunkum, Ural sands, Prioral Karakum. The vegetation cover of sandy deserts is specific and differs markedly from loamy and clayey plains. There are few saline areas among the sands. On loose sands, as a rule, a community is formed with a large number of shrubs, various species of zhuzgun, saxaul, astragalus. Along with shrubs, the communities contain wormwood, salt wort, and herbaceous plants.

Deserts of the northern type are also characterized by grasses such as Siberian wheatgrass and yerkek; for deserts of the southern type - ephemerals and ephemeroids; sedges, beetle bluegrass, wild rye, cheatgrass. On the developed sands along the tops of the dunes there are usually selins. On the more compacted sands of inter-mound depressions and smoothed hilly sands, there are often wormwood communities with wormwood Lerkha, gray Astrakhan, including a certain number of shrubs, saltwort, more often teresken, keyreuk, and kambak. Keireuk and teresken are quite often themselves dominants of a number of communities, both on the plain and in hilly sands. A large area is occupied by communities of white and black saxaul, meeting separately and together. Black saxaul usually grows on more compacted and weedy soils with fairly large groundwater. In addition to the grazing value, saxaul thickets are the forest fund used for fuel harvesting. Bakanas in Almaty and Kuskuluk in Zhambyl regions are the largest forests. Large areas of the Sary-Ishikotrau sands are overgrown with low shrubs - ephedra or kyzylchay.

In most cases, plant communities on sandy massifs are polydominant in composition, with indistinct boundaries, which gives the impression of an unformed vegetation cover. Communities of northern and southern slopes differ, and in the presence of large ridges, communities of peaks and inter-mound depressions. The yield depends on the predominant plant form. It is higher (8 dt/ha or more) with an abundance of shrubs, large semi-shrubs and herbaceous plants. The yield of ephemeral herb herbage is 2. 7-5. 2 dt/ha.

Pasture use has left a significant imprint on the vegetation cover of sandy pastures in many places, they are littered with sand wormwood (shagar), which is almost not eaten in summer, and Segmer's poisonous spurge. With unregulated intensive summer grazing, many plants disappear and species that are poorly eaten in summer are more widely dispersed, the surface breaks down to the state of loose sand. The greatest changes took place in small sandy massifs and on the outskirts of large ones, mainly in the watered area and near settlements. Secondary vegetation, partly of a weedy nature, a general thinning of the herbage, and in places bare areas, are observed on overgrown pastures. The largest areas of bare sands are found in northern Kyzylkum, along the border with Uzbekistan and on separate massifs in western Kazakhstan. Roughly they occupy about 250 thousand ha. Some of the plants that appear as a result of the load are eaten, for example, ebelek, ephemera, but they also have a low and unstable yield over the years. The weedy vegetation, which is almost not eaten in summer, is eaten in autumn and winter because, being rather high, it is not completely covered with snow.

Sandy pastures are used in different seasons of the year. A significant area is underutilized due to lack of water and the need for territory (Northern Kyzylkum, Sary-Ishikontrau). The yield of pastures is not subject to significant fluctuations due to their ability to condense moisture. The nutritional value of forage from sandy pastures is rather high (**Table 3**). The expedient use of

Table 3. Forage resources for separate groups of types of pastures in semi-desert and desert zones

№	Groups of types of pastures	Area, million ha	Yield, dt\ha	
			Dry mass	Feed unit
1	Bunchgrass including mowed (feather grass, sheep fescue, June grass, forbs)	8,2	4,3	2,4
2	Bunchgrass-cereal including mowed (feather grass, wheat grass, sheep fescue, wormwood)	17,0	3,7	2,2
3	Saltwort, saltwort-wormwood (kokpek, biyurgun, Russian thirst-quenching, black wormwood)	46,8	2,7	1,7
4	Wormwood (Lerch wormwood, gray, Astrakhan, Turinese)	10,5	2,7	1,4
5	Saline wormwood (black wormwood, Shrenk's, nitric, juncea, cheegrass)	2,6	2,4	1,3
6	Gray wormwood-saltwort with shrubs (gray wormwood, turin, Russian thirst-quenching, teireuk, saxauls, calligonum, tamirisk)	12,0	2,8	1,5
7	Green wormwood (sandy wormwood, paniculate, biyurgun, shrubs, forbs)	5,5	3,0	1,5
8	Bunchgrass-wormwood (Siberian wheat grass, gray wormwood, feather grass, sheep fescue)	10,0	3,3	1,7
9	Shrub ephemera (sedge, meadow bluegrass, brome, wild rye, calligonum, saxaul)	5,7	2,3	1,6
10	Wormwood-ephemera (gray wormwood, bluegrass, sedge)	5,7	3,0	1,7
11	Santonic wormwood (santonic wormwood, ephemera, saltworts)	0,2	2,3	1,0
12	Juicy saltwort (sarsazan, saltwort, warty salt bush, glasswort)	2,7	2,8	1,0
13	Ephemera-forb (barley, bulbous bluegrass, holtenia, caper-bush)	0,7	2,2	1,2
14	Cereal-sazan (pubescent wheatgrass, bulbous barley)	0,5	6,5	3,5
15	Soft-stalked cereal (wheat grass, saltwort barley, forbs)	0,4	9,7	5,7
16	Rough-stalked cereal (reed, woodreed, cheegrass, wormwoods)	2,8	12,1	6,7
17	Halophytic cereals (saltmarsh grass, wormwood, saltworts)	0,5	4,3	2,0
	Total	131,36		

sandy pastures is possible if the optimal operating mode is observed. Sandy pastures in the south of the republic are of particular interest for keeping Karakul sheep.

Between the Karatau mountains and the western Tien Shan there are semi-desert pastures with a different species composition - ephemeral and ephemeroidal; barley (kaltyk), hairy-wheatgrass-barley, hairy-wheatgrass-barley mown pastures are more valuable both in terms of fodder quality and yield.

The deserts of Kazakhstan have a fairly rich vegetation cover and, if used correctly, can produce a significant amount of vegetation. On pastures in a clay desert, grazing is best done in spring and autumn, in a sandy desert - in winter, early summer and autumn. Sheep, camels, horses and limited cattle can be grazed.

The yield of pastures is subject to significant fluctuations, especially on saline clay-gravelly soils. In different parts of the desert zones, the number of years with good and bad weather conditions is not the same. Observations have shown that the ratios of years with different yields are as follows: good 10-20%, bad 40-50%, average 30-40% (Kashevarov, Benz, 1997, Asanov, Kohen, 2007). Bad years can be bad in different ways in individual seasons or throughout the growing season. Therefore, the system of pasture use should be flexible, taking into account the mandatory percentage of years that are to some extent unproductive.

Hayfields in semi-desert and desert zones are relatively well-compacted areas - estuaries and river valleys with meadow vegetation. The largest number of estuaries is located in the West Kazakhstan region. Valley hayfields are found near the rivers Ural, Syrdarya, Chu, Ili. In long-flooded and waterlogged areas, there are usually reed thickets, in drier areas - meadows with reeds, reedgrass, wheatgrass, bentgrass with an admixture of sedges, and forbs. Along the depressions of the plains, especially near the rivers, along the estuary, there are halophytic meadows – wild ruttishness, chia, wild rye, saltmarsh-grass with an admixture of wormwood and saltwort. The yield of reed meadows is on average 10-25 dt/ha of hay, cereals, wheatgrass and reed meadows 8-15 dt/ha, wild ruttishness and chia 7-10 dt/ha. The condition of hayfields is not satisfactory everywhere. Due to irregular minimum irrigation, salinization and waterlogging are observed, as well as contamination by plants such as brunets, iris, licorice.

Forage lands in mountainous regions occupy about 11. 5 million ha in Kazakhstan. They are located in the mountains of Altai, Dzhungarskiy Alatau, Tien Shan as well as in relatively small mountains of the Mugodzhar ridge, Chu-Ili and others. The absolute height in large mountain ranges reaches 3000 meters above sea level and more. Well expressed in all vertical belts, in the flesh before the nival. In smaller massifs (up to 1000 meters), the vertical belts are correspondingly less. Between the ridges of high mountains, there are hollows with natural vegetation in the north and deserted in the south. Both the one and the other, in terms of the set of communities, their structure and productivity, do not differ significantly from the plain and lowland vegetation of the steppes and deserts. In Altai and more southern mountain ranges, the low mountains are covered with semi-desert vegetation, higher - steppe, then meadow-steppe, forest-meadow, subalpine and alpine. In all belts, the vegetation cover is interrupted with the emergence of bedrock. Rank soils, often of low thickness.

Steppe vegetation in all mountainous areas is generally similar. Forest-meadow in Altai is represented mainly by boreal mesophilic forms, in the southern mountains - xerophytic. In Altai, in the forest belt on the slopes of all expositions, there are forb-cereal and cereal-forb meadows with a large number of cocksfoots, a significant amount of sedge, forbs and legumes (globeflower, thoroughwax, cow-parsnip, timeritsa, lathyrus, pea vine). The height of the herbage is 50-120 cm, the projective cover is 90-100%. The yield of southern steppe meadows on stony and shrubby slopes

Table 4. Forage resources for certain groups of types of mountain pastures

№	Name of pastures	Total area, million ha	Yield, dt/ha	
			Dry mass	Feed units
1	Sod-wormwood (feather grass, sheep fescue, wormwood, shrubs)	4,1	3,7	2,2
2	Bunchgrass-steppe (feather grass, sheep fescue, beard grass, forbs, shrubs)	2,7	4,2	2,3
3	Sod-forb steppe	0,03	6,4	3,7
4	Cereal-forb, forb-cereal meadow and meadow-steppe (cocksfoot, false brome, forbs)	1,7	10,4	7,7
5	Shrub-meadow-steppe (meadowsweet, wild rose, pea shrubs, reedwood terraneous, feather grass, forbs)	1,31	4,0	2,6
6	Forbs, cereal-forb, alpine (lady's-mantle, geranium, vernal grass)	0,7	7,0	5,0
7	Kobresia-sedge-forb high-mountainous	1,4	6,2	4,1
8	Meadow depressions (cocksfoot, bentgrass, hair grass)	0,15	10,5	6,4
	Total	12,08		

is 4-6 dt/ha of dry mass, on mountain chernozems - 8-12 dt/ha and mountain-forest chernozem-like soils - 12-15 dt/ha and more. The meadows are often bushy with meadowsweet, wild rose, beaked, used as pastures for all seasons for cattle, sheep, horses, and are partially mowed.

An invariable component of all communities of the cocksfoot, the valuable meadow cereal, is highly nutritious. In 100 kg of dry weight, cocksfoots in the tillering phase are equivalent to 78. 4 feed units and contain 16. 5 kg of digestible protein in the heading - flowering phase - 67. 5 feed units and 6. 8 digestible protein.

With intensive pasture use, broad-leaved species fall out and the number of plants that are almost not eaten in summer increases: Russian iris, pediform sedge, and in more humid areas - white hellebore. When using mountain pastures, pasture rotation is of particular importance.

Many types of mountain pastures in Altai are heavily overgrown with species of tavalga and wild rose, which impedes the normal grazing of sheep and worsen the number of hayfields. On meadows with sufficiently thick soils, it is necessary to carry out cultural and technical work and destroy shrubs.

In the Dzhungar and Zailiisky Alatau, the forest belt is less pronounced. Along with meadow communities, there are quite a lot of meadow-steppe and steppe communities, especially on the southern slopes. The meadows here are also cereal-forb and forb-cereal, but cocksfoots are smaller. In addition to it, there are false brome, reed grass, awnless brome (straight), etc. Oregano, basil, and home geranium are widespread among the herbs. The yield of such meadows is 10-15 dt/ha of dry matter and more.

In the western Tien Shan and the region, it passes to dry subtropics, the vegetation of all mountain belts differs markedly in general appearance and species composition from the vegetation of other mountains of Kazakhstan. From the foot and altitudes up to 2000 meters above sea level, wheatgrass dominates in many communities. Above, it is found everywhere with the cocksfoot of the national team, awnless brome and other plants. The yield of communities with hairy wheatgrass on the foothills is 4-8 dt/ha, on mountain-brown and mountain-chernozem soils 5-12 dt/ha, more often 6-8 dt/ha. Wheatgrass is a rather valuable fodder plant; before it becomes coarse, it is readily eaten on pastures. At an altitude of about 3000 meters above sea level, there are the most inaccessible pastures - high-mountain meadows: cereal-herb, kobresia, sedge. The herbage on them is undersized, usually about 20 cm, often sparse. The soils are usually very gravelly, in places peaty, waterlogged from melting snowfields nearby. The species composition is represented by plants adapted to the harsh conditions of existence, such as Krylov's fescue, vernal grass, bluegrass species, timothy grass, and from forbs – lady's-mantle, geranium, buckwheat, aster, violet, kobresia (Smirny, Persian).

The vegetation of high-mountain pastures in terms of species, has a high aftermath and, depending on the habitat conditions, can give from 3-5 to 10 dt/ha of dry mass or more, but the pasture period here is very short 2-3 months. These pastures are good in terms of the amount of fodder, especially since their forage is always juicy, forbs, 100 kg of grass contains 20-25 feed units.

Meadows in the middle and high belt of mountains in the south of Kazakhstan are used for grazing in the summer. Due to improper operation, many high-altitude pastures have changed the composition of herbage, littered with non-feed plants, species more resistant to grazing are brewed on them: oregano, thyme, iris, kazrak, golden ray, wormwood, tarragon.

It is possible to improve the species composition and increase the yield of mountain meadows only through the organization of proper grazing and fertilization.

The total area (approximate) of individual groups and types of mountain pastures and their yield is shown in **Table 4**.

Most of the hayfields in the mountains are dry land, the herbage on them is of meadow and steppe nature, the yield is 10-20 dt/ha, the quality of hay is usually good. The yield of mountain hayfields can be increased by measures of surface improvement - fertilization, sowing of herbs, care of the meadow surface.

CONCLUSION

The effective use of natural forage lands in Kazakhstan requires, first of all, the study of natural vegetation, both from a biological and from an economic

point of view. Data on the geographical location of this or that vegetation, their biological properties: the rhythm of development, life forms, longevity, methods of reproduction, productivity, ability to change under the influence of various factors.

The study of forage lands is still an applied branch of geobotany, used by its theoretical settings. These attitudes on the issue - the principles of vision of a single vegetation cover - are largely declarative and make it possible to single out, taking into account the vegetation and the conditions of its habitat, units of equal volume. All this leads to the fact that institutions studying forage lands do not have a single typology, and therefore the results of the study are difficult to combine. Therefore, it is necessary to develop and approve a unified typology of forage lands in Kazakhstan. At present, no thoughtful survey and mapping have been carried out throughout the republic, there are no ecological stations for studying the biology of herbs.

When developing forage lands as pastures and hayfields, the importance of the chemical composition of individual plant species, their forage qualities in different growing periods is very important. The influence of various modes of use of forage lands on vegetation has been little studied, without which it is impossible to correctly plan their pasture use.

It is also important to accurately account for areas of hayfields and pastures in each farm and in the republic as a whole. The survey data can be used to assess the land balance of Kazakhstan.

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