Current state of mixed-Calligonum (Calligonum L.) type of pastures in North-Western Kyzylkum (Uzbekistan)

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Abstract. The article presents the current state of mixed-Calligonum (*Calligonum* L.) type of pastures in Northwestern Kyzylkum. As a result of the research, its area, the nature of the soil cover, the percentage of projective cover, landscape plant species, forage yield, and the recommended seasonality of pasture type use were determined. It should be emphasized that due to the highest nutritional value and yield of the forage mass of saxaul, seline, sedge and comb, seline-saxaul-Calligonum pasture variety (PR), saxaul-Calligonum PG, in some places with comb, saxaul-Calligonum PG with wormwood, sedge-saxaul- Calligonum PR with wormwood and syngreen are “depleted pastures”. The nutritional value of feed and the accumulated feed supply indicate a uniform distribution of indicators across the seasons. In this regard, this pasture type is recommended for use all the year round. Pasture lands and its fodder require reasonable management. The optimal way of the preservation and renewal assurance of pasture vegetation is standardized and regulated grazing.

1 Introduction

The largest environmental disaster in the Aral Sea region quite rightly raises awareness. Serious shortcomings in the use of water and land resources in the Aral basin caused a sharp decrease in the influx of river water in the delta of the Syr Darya, Amu Darya and into the sea, the hydrological regime radically changed and the quality of surface water deteriorated due to the pollution. As a result, aridization and salinization of hydromorphic landscapes occur in river deltas, the unique natural environment is significantly depleted, and the ecological and social living conditions of the local population are deteriorating. The main reason for the degradation of pastures in Uzbekistan is the Aral Sea drying up. The Aral Sea drying up has a number of negative consequences on pastures in the region: a reduction in pasture area, a decrease in pasture productivity and soil fertility, deterioration in the quality of feed, desertification, expansion of the area of desert lands, and soil erosion. In recent years, under the conditions of intensive livestock farming and irrational use of the arid zone of Uzbekistan, large areas of desert pastures represent anthropogenic transformations with forage reserves below their potential. Improper use of pastures has led

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to degradation, including the lack of monitoring of pastures, phytomeliorative measures, insufficient watering of pastures, low level of ecological culture of the population living in desert areas [1-4].

The Kyzylkum Desert is one of the richest regions of the Republic of Uzbekistan in terms of natural resources. The non-ferrous, mining and metallurgical, chemical industries, natural gas production, etc. are steadily developing here.

Vegetation is an integral indicator of the state of ecosystems. The Aral Sea drying up may affect the species composition, abundance, vitality, age structure, phytoproductivity of cenopopulations, horizontal and vertical composition and other parameters of phytocenoses of the Aral Sea region. Plant resources are of utmost importance for the sustainable development of pasture areas, including the development of livestock farming in areas with an arid climate. Vegetation is in close relationship with natural conditions and economic use of the territory [5-13].

2 Materials and Methods

During the period of field research during 2023, under the "Assessment of the current state of vegetation cover and pasture resources of the Republic of Karakalpakstan," State program 81 pasture varieties belonging to 15 types of pastures were studied in the southern part of Northwestern Kyzylkum.

Traditional methods of field geobotanical research were used to study pasture vegetation [14]. The projective coverage is determined by eye [15]. Latin names of plant species are given in accordance with international taxonomic databases [16]. The names of pasture types and varieties, as well as geobotanical data, determination of yield, establishment of pasture allocations are given in accordance with the "Methodological instructions for geobotanical survey of natural forage lands of Uzbekistan" [17, 18].

3 Results and Discussion

The Calligonum type of pastures consists of 8 pasture varieties (PD): 1. Mixed-Calligonum in places with saxaul (*Calligonum microcarpum, C. caput-medusae, C. acanthopterum, Haloxylon persicum*) on thin sands. 2. Sparse-Calligonum in places with saxaul (*Calligonum microcarpum, Haloxylon persicum*) on bare shifting sands. 3. Mixed-Calligonum (*Calligonum microcarpum, C. caput-medusae, C. acanthopterum, C. leucocladum*) on dune sands, with the participation of shrubs (*Ephedra strobilacea, Xylosalsola richteri, Astragalus villosissimus*). 4. Selinovo-saxaul-Calligonum (*Calligonum aphyllum, Haloxylon persicum, Stipagrostis pennata, S. plumosa, S. karelinii*) on semi-fixed sands. 5. Complex: Calligonum-silk (*Carex physodes, Calligonum leucocladum*) and wormwood-ephemeral-Calligonum with boyalysh (*Calligonum leucocladum, Ephedra strobilacea, E. przewalskii, Xylosalsola arbuscula*) on hummocky-ridge sands. 6. Saxaul-Calligonum (*Haloxylon persicum, Calligonum caput-medusae, C. microcarpum*) in places with comb beetle (*Tamarix ramosissima*) on thin dune sands. 7. Saxaul-Calligonum (*Haloxylon persicum, Calligonum microcarpum, C. caput-medusae*) on hummocky sands with wormwood (*Artemisia terrae-albae*) on the basins, in places with thickets of bramble (*Xylosalsola arbuscula*) and partak (*Convolvulus eremophilus*). 8. Sedge-saxaul-Calligonum (*Calligonum microcarpum, C. caput-medusae, Haloxylon persicum, Carex physodes*) on the dunes, with wormwood (*Artemisia terrae-albae*) and syngren (*Astragalus villosissimus*) on depressions.

This type of pasture is confined to the indigenous sands of the North-Western Kyzylkum coastal zone. Widely distributed in the sandy desert (Fig 1.). Calligonum is of

great value as a succulent vitamin feed during the summer feeding of sheep on desert pastures. Ripe fruits abscise quickly. At the same time, most of the one year twigs fall off, along with the fruits that make up animal feed. The total supply of forage depends on the abundance of bushes and varies on different types of pastures from several kilograms to several tens of kilograms per hectare. The twigs and fruits are well eaten by small cattle and camels. They begin to vegetate no earlier than February. In a cold spring, the beginning of the regrowth of green shoots is delayed until the first ten days of April. Flowering occurs in late April - early May. In May, mass fruiting begins, in June - ripe fruits abscission and twigs assimilation. Some shoots continue to grow until the end of September, sometimes until October. In the northern desert, the timing of the passage of the main phenological phases occurs 2-3 weeks later. In favorable years, the growing season prolongates. The average yield of dry fodder in different years ranges from 2.5 to 5 dt/ha.

Despite the abundant presence of the shrub fraction, the total projective cover does not exceed 20-30%. Depending on seasonal conditions and the biology of the species, the consumed forage mass of this type of pasture, according to our data, ranges from 0.5 to 5.9 dt/ha (Table 1). Landscape plants are the genera *Calligonum, Haloxylon, Astragalus, Salsola, Artemisia, Convolvulus, Ferula, Carex* (Table 2). In the communities formed by these plants, there are also different types of annual saltworts and ephemerals. Plant groups in sands are usually three-tiered. The upper tier is formed by saxaul, sand acacia, Calligonum and cherkez. The middle tier consists of herbaceous perennials and subshrubs: seline, bindweed and astragalus. The lower tier is silt, ephemeral plants. The main forage plants in this type of pasture are *Calligonum* and *Haloxylon* (up to 25-50%). With the onset of summer, syngrens, kandyms and some long-growing herbs begin to play an increasingly important role in the diet of sheep. The growing season of all shrubs occurs, and the fruits of the Calligonum ripen. Due to the formation of a large (up to 50%) edible part *of Haloxylon persicum,* the autumn yield reaches 2.8 dt/ha. The maximum value occurs in the autumn and winter, due to the maximum growth of annual shoots and the ripening of *Haloxylon fruits,* which are well eaten, the food supply is somewhat enriched due to annual saltworts.



Fig. 1. Mixed-Calligonum pasture variety with the participation of shrubs

Table 1. Data from the state cadastre of mixed-Calligonum type pastures in Northwestern Kyzylkum

Pasture type	No.	Pasture difference	Forage yield, dt/ha	Gross feed stock, dt/ha	Quality class (point)
1	2	3	4	5	6
MIXED CALLIGONUM	1	Mixed-Calligonum PR in places with saxaul (on thin sands	2.2	4.6	Poor pastures (22.5)
	2	Sparse-Calligonum PR in places with saxaul on bare moving sands	0.7	1.5	Very poor pastures (7.2)
	3	Mixed-Calligonum PR with the participation of shrubs	0.6	1.9	Very poor pastures (6.2)
	4	Selinovo-saxaul-Calligonum reservoir on semi-fixed sands	4.8	11.9	Depleted pastures (48.7)
	5	Complex: Silt-Calligonum, Calligonum-sedge and wormwood-ephemeral-Calligonum PR with boyalysh on hilly-ridge sands	0.5	1.4	Very poor pastures (5.5)
	6	Saxaul-Calligonum PR in some places with a comber on thin dune sands	5.9	23.8	Depleted pastures (59)
	7	Saxaulovo-Calligonum forest with wormwood, in some places with thickets of boyalysh in the basins	5	14.7	Depleted pastures (50.2)
	8	Sedge-saxaul-Calligonum PR with wormwood and syngreen on depressions	4.2	8,6	Depleted pastures (42.5)

The gross supply of pasture feed ranges from 1.4 to 23.8 dt/ha. The amount of gross food supply from shrubs and shrubs reaches a maximum in the summer, and the practical supply of food eaten by sheep at this time decreases almost to a minimum. The preservation of feed nutritional reserves this season is a positive indicator for rationing the number of livestock in the territory.

Table 2. List of grass type plant species:

No.	Name of plants	Height, cm
1.	*Haloxylon persicum*	105
2.	*Ammodendron conollyi*	150
3.	*Calligonum acanthopterum*	130
4.	*Calligonum microcarpum*	115
5.	*Calligonum caput-medusae*	125
6.	*Eremosparton aphyllum*	160
7.	*Salsola richteri*	155
8.	*Astragalus villosissimus*	55
9.	*Astragalus unifoliolatus*	30
10.	*Ephedra distachya*	15
11.	*Xylosalsola arbuscula*	80
12.	*Atraphaxis spinosa*	45
13.	*Artemisia terrae-albae*	35
14.	*Convolvulus divaricatus*	35
15.	*Convolvulus eremophilus*	25

16.	*Stipagrostis karelinii*	35
17.	*Stipagrostis pennata*	50
18.	*Ferula assa-foetida*	30
19.	*Heliotropium arguzioides*	20
20.	*Heliotropium sogdianum*	22
21.	*Carex physodes*	15
22.	*Poa bulbosa*	12
23.	*Salsola paulsenii*	20
24.	*Silene odoratissima*	40
25.	*Agriophyllum latifolium*	35
26.	*Eremopyrum bonaepartis*	12
27.	*Eremopyrum orientale*	14
28.	*Climacoptera turcomanica*	15
29.	*Climacoptera lanata*	20
30.	*Horaninovia ulicina*	25
31.	*Halimocnemis villosa*	15

Depending on the season of the year, the nutritional value of pasture varieties varies from 25 to 108 feed units. In the spring, all species accumulate more digestible protein, and it gradually decreases towards the autumn and winter. The main valuable food is *Calligonum* and *Haloxylon* - the nutritional value of which is 150 feed units in spring, 49 feed units in autumn and winter. Seasonal yield ranges from 1.8-0.6 dt/ha in feed units, decreasing in summer and winter. Due to a decrease in the nutritional value of feed in winter, the yield is 2.7 dt/ha according to the feed units. Due to the high nutritional value of feed in the spring, spring is a high-yielding season. The nutritional value of feed and the accumulated feed supply indicate a uniform distribution of indicators across the seasons. In this regard, this pasture type is recommended for use all the year round. According to the regional grading scale, for grading a pasture area based on forage productivity, this type of pasture scored from 5.5 to 50.2 points and was classified as “very poor pastures” and “depleted pastures.” In this area there are gas pipelines and power lines and there are dirt roads that are assessed as “conditionally in use.”

4 Conclusion

Thus, the results of the study showed that the Calligonum type of pastures usually consisted of three or four tiers; the first tier was dominated by saxaul and Calligonum. The forage yield in this type of pasture ranges from 0.5 to 5.9 dt/ha. The quality class varies from 5.5 to 50 points. Calculations of the yield of the eaten part, the nutritional value of feed and feed reserves showed that the Calligonum type of pasture is recommended to be used as a year-round type of pasture. The drying up of the Aral Sea led to the disappearance of many plant species that previously lived in this region. This reduction in biodiversity has a negative impact on the grassland ecosystem and its productivity. Climate change is also increasing the frequency and severity of droughts, further exacerbating the problem of grassland degradation.

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