

# The Influence of Pasture Protective Plants on the Productivity of Desert Pastures

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**Abstract:** *The expansion of desert areas as a result of climate change on the globe creates the need for efficient use of these areas. Desert lands are mainly used as pastures. However, climatic and anthropogenic impacts cause deterioration of desert pastures. In order to reduce the impact of climate factors, it is recommended to build pastures with forest belts. This article provides results of research regarding improvement of yield productivity of desert pastures. According to researches, forest belts have a positive impact on the growth and development of the pastures, and it has been found that the pasture yields increase by an average of 6.2 times.*

**Keywords:** desert pastures, forest belts, anthropogenic factors, productivity, agrophytocenosis, *Haloxylon aphyllum*, *Halothamnus subaphyllus* and *Ceratoides eversmaniana*.

## 1. Introduction

Desert pastures in Uzbekistan occupy about 25 million hectares. Under the influence of anthropogenic factors, there is a constant reduction of pasture lands and a decrease in the natural potential of the vegetation cover. As a result, desert pasture productivity is reduced by an average of 1.5% per year. The natural renewal of the plant cover in the desert is slow and often with the replacement of pasture plants with weed, non-eaten and poisonous herbs. This situation creates difficulties in using pastures. Pastures in steppe and semi-desert regions are the most affordable for the year, and are the cheapest forage. But their productivity is very low (1-3 centner/ha). To improve the quality and increase the number of livestock products, natural pasture yield productivity should be increased by using of phyto and forest meliorative methods. This process is accompanied by aridization and some salinization of soils, which reduces their phytoecological potential. With the use of modern technology, the creation of pasture protective forest belts, the time to restore the natural vegetation of desert pastures can be reduced to 4-6 years [2, 4, 6].

Initial surveys on the construction of forest belts in sandy steppes were conducted by T.Nechaeva. Results has shown that the reduction of sand movements in the region and the growth of the pastures productivity from 13 to 25 centners per hectare.

Around the natural pastures, it is important to create forest belts and organize artificial phytocenoses. It has been established in many experiments that forest belts are able to increase productivity by reducing the impact of some of the disadvantages of nature (wind speed, air temperature, soil and air humidity). Particularly, forest belts increase productivity of irrigated agricultural lands, regulate the distribution of snow rainfall in the mountainous regions, prevent the movement of sand by wind in deserts, improve microclimate and create favorable conditions for the development of growing plants in the pastures.

The most effective forest meliorative measure in desert lands is the creation of a pasture with protective forest belts. The

yield of fodder plantations under the protection of *Haloxylon aphyllum* (Minkw) Iljin is 2-4 times higher in comparison with open pastures, it consists of better developing perennial grasses and semi-shrubs, as well as shoots and seeds of the *Haloxylon* itself. The rich species composition of the vegetation cover of agrophytocenosis formed under the influence of pasture protection strips attests to the enormous role of forest meliorative measures in the creation of highly productive long-term pastures in the desert zone [1, 3, 5].

## 2. Materials and methods

The experiments were carried out at Bukhara State Forest Experimental Station. The climate conditions of the area are extreme continental, with an average annual temperature of + 14°C, the June temperature is + 38°C, and the January temperature is -20°C. Annual precipitation in the region is 103 mm, mainly in October-March. There is no precipitation at the time of plant growth and development. However, it was observed that there was precipitation during the whole seasons in certain years. Average relative humidity is 51%, high in winter and spring and very low in summer and autumn. The wind mode falls high in all seasons of the year, from the north in the vegetation period and from the south in the winter period. The direction of the wind in the territory of experimental station is constantly differ.

The dynamics of plant formation in the phytocenosis were studied in 10 experimental sites. In each phytocenosis, 3 continuous transects were identified between the rows and the row distances of the forest belts to produce systematic observations of plant growth dynamics. To determine the difference between the other fields, four control transects are selected with size 50x2 meters. The aggregate calculation of the species and quantity of plants was carried out three times a year (spring, summer and autumn) and in each transect.

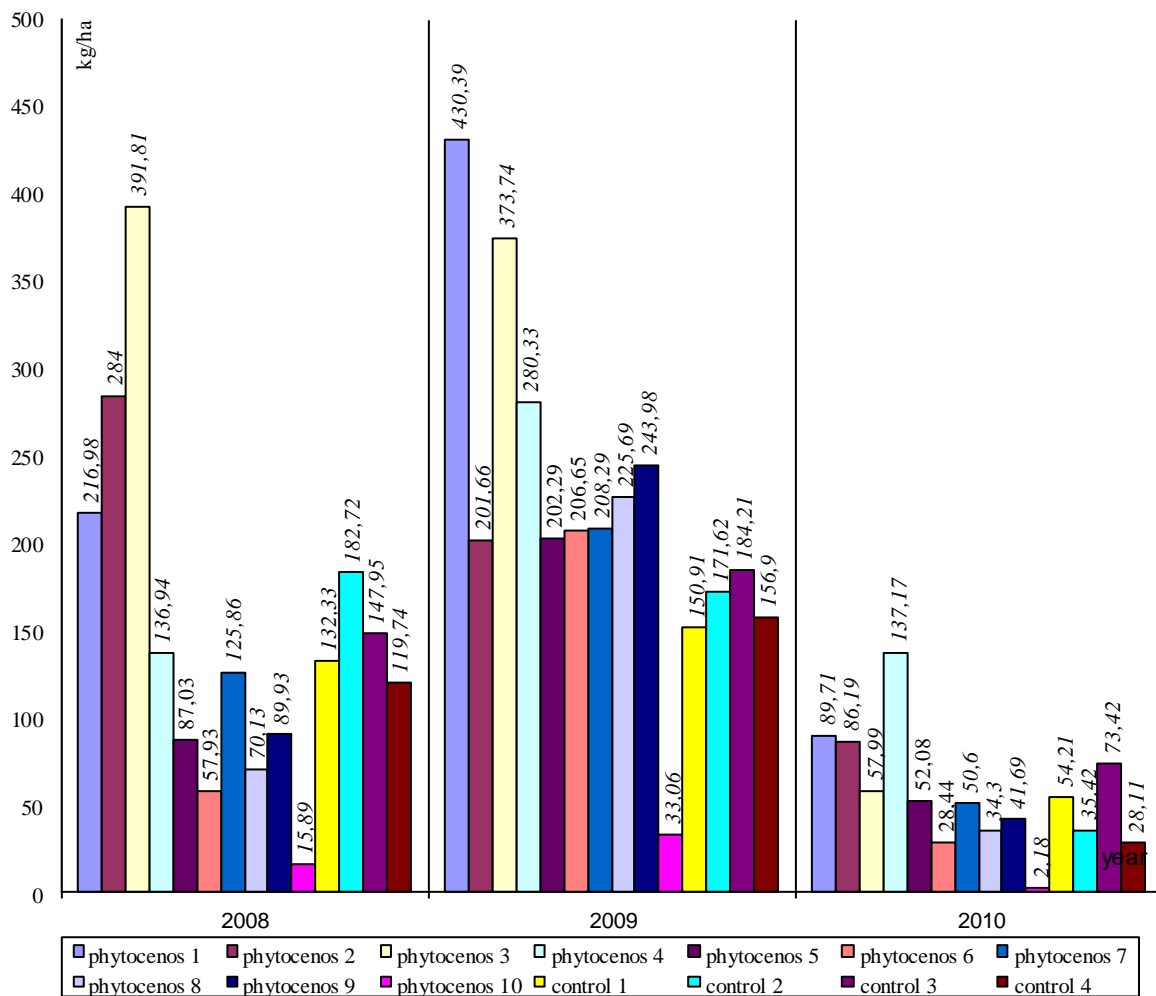
In determining the consumable phytomass, all the plants of the phytocenosis between the rows and the row distances of the forest belts were studied. Three plant species were selected from each plant species to determine the consumable phytomass. The green branches 2-3 mm thickness of bushes till 1.2 m in height, annual growth of

shrubs and bush, grass more than 2 cm above from the soil surface plants was measured.

At the experimental station, 10 agrophytocenoses are laid, differing from each other by varieties of desert soils that were created during the period 1982-1988. For the creation of pasture-protective and meliorative-fodder strips, psammophyte plants such as *Haloxylon aphyllum* (Minkw) Iljin, *Salsola Richteri* Karel, *Calligonum caput - medusae* Schrenk, *Halothamnus subaphyllus* (C.A.Mey) Botsch, *Salsola orientallus* S.G.Gmel and *Ceratoides eversmaniana* (Stschegl. ex Lozinsk) were used.

### 3. Results and Discussion

It is desirable to build forest belts and feed-meliorative lines in pastures by using of such plants haloxylon aphyllum (Minkw) Iljin, Halothamnus subaphyllus (C.A.Mey) Botsch, and Ceratoides eversmaniana (Stschegl. ex Lozinsk). Because of surrounding desert areas with forest belts and feed-meliorative lines will provide several outcomes, firstly they reduce deflation process, create a favorable microclimate for growth, and secondly, phytomeliorants such as one-year bar, fruit, seeds are additional nutrient for livestock. The influence of forest belts to the microclimate depends on many factors (tree species, their structure, condition, size, wind speed, solar radiation, etc.). Change of microclimate under the influence of forest belts is beneficial for the growth and development of natural plants. Long-term studies in southern Kyzyl Kum have revealed that the vegetation period began 10-15 days earlier than the open field and increased the pasture productivity by 55-65%.



**Figure 1:** Spring productivity of phytocenosis

As a result of the observations, it was determined that the forest belts have positive influence on pastry productivity. Among them, the amount of ephemerals is quite high and their percentage is about 50-60% in phytocenosis productivity. During this period phytogenous productivity was 15.89-391.81 kg/ha. In the first five phytocenosis indicators were significantly higher (136.80 - 391.81 kg/ha), while the remaining phytocenosis was lower (15.89 - 119.69 kg/ha). Productivity indicators during this period were 2.2-

5.4 times higher than control (Figure 1). In the summer season, the number of ephemerals has diminished, replacing bushes, shrubs, and one-year old herbs. They accounted for 70-80% of the total phyto-mass. The yield of phytocenosis in this season was 21.06 kg/ha to 366.40 kg/ha. This indicator is greater than 5.2-7.6 times rather than control version, mainly due to the high temperature of climate in the desert pastures (Figure 2).

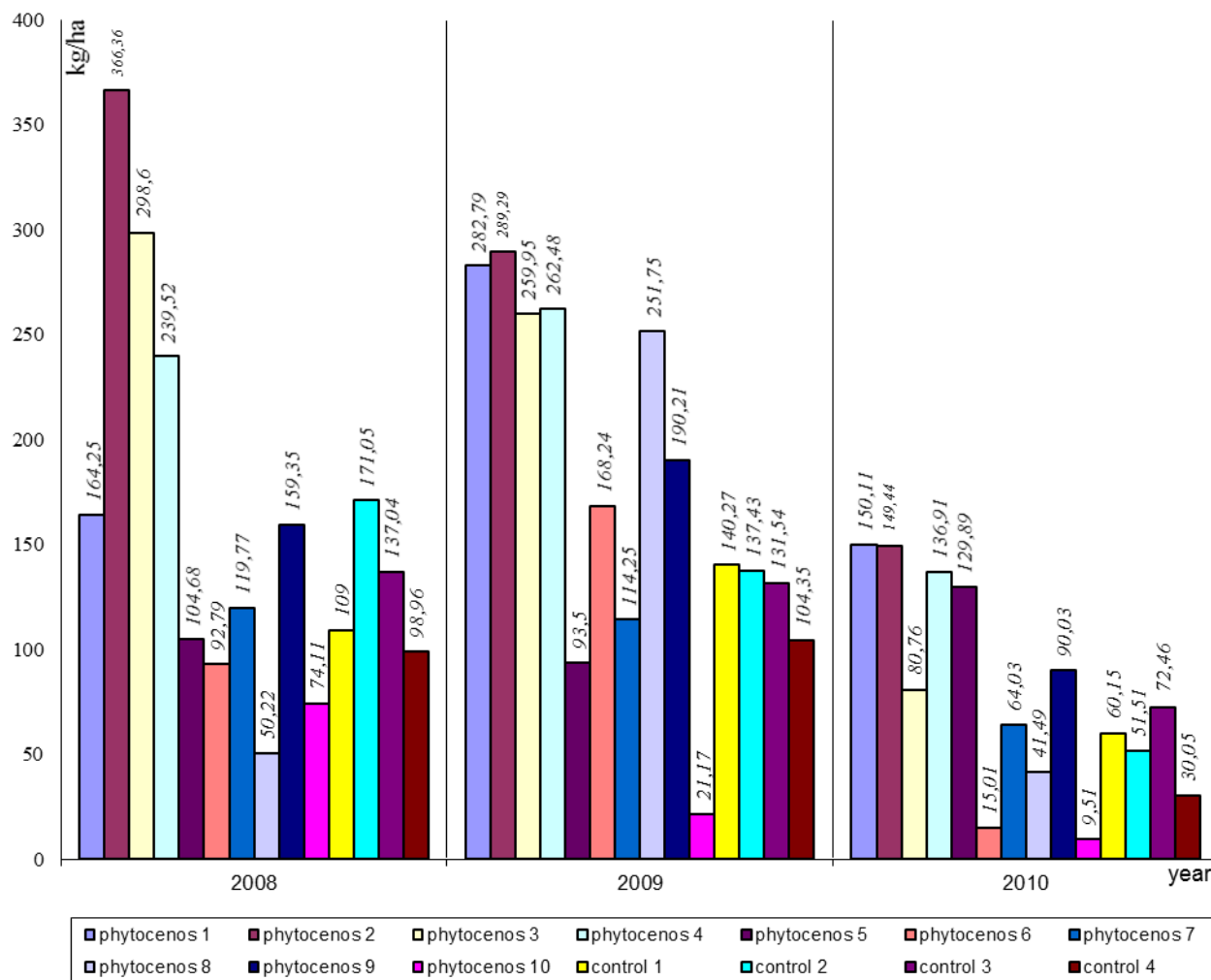


Figure 2: Summer productivity of phytocenosis

By the end of the autumn, the phytomass of the phytocenosis varied from 336.20 kg/ha to 1046.51 kg/ha, due to trees, shrubs, shrubs and perennial plants. It was found that this indicator was 9.8-10.2 times higher than in the natural pastures (Figure 3).

Due to the forest belts, natural vegetation growth and development have improved, productivity in artificial phytocenosis has increased to 165% and in the summer and autumn fodder has grown by 50-70%.

The natural vegetative cover at the time of laying crops was extremely poor and consisted of 4-6 species. However, at present 27-34 species participate in the formation of agrophytocenosis, most of which are eaten by animals. In addition, the culture of *Haloxylon aphyllum* (Minkw) Iljin, *Halothamnus subaphyllus* (C.A.Mey) Botsch, *Salsola orientallus* S.G.Gmel and *Ceratoides eversmaniana* (Stschegl. ex Lozinsk) gives a significant increase in yield (50-70% in the autumn period).

Under the influence of weather conditions in desert phytocenosis, there are sharp fluctuations in the number of

plants and the amount of phytomass eaten by year and season.

In the favorable weather conditions of 2009, the highest productivity of pastures was observed. On slightly-grown small-hummocky sands, it was 1093.88 kg/ha, on softly broken, broken and primitive sandy soils 1743.4 kg/ha, and on gray-brown gypsum-bearing soils 1219.26 kg/ha, exceeding the benchmarks in the 1.7- 2.5 times. Various biomorphs took part in the formation of the forage mass of plant communities: in the spring - ephemerals, in summer and autumn - shrubs, annual and perennial grasses. At the same time, the shrunken shrimp phytomass was determined only up to a height of 1.2 m from the soil surface (table).

The yield of spring grasses in agrophytocenosis decreases in arid years by 4-7 times, in the open steppe - by 7-10 times. 2010 was characterized by unfavorable climatic conditions. Very hot spring and lack of precipitation caused a weak growth and development of ephemerals, decreased the number of plants in pastures by 3-5 times, and pasture productivity in comparison with the previous year decreased by 1.2-7.1 times.

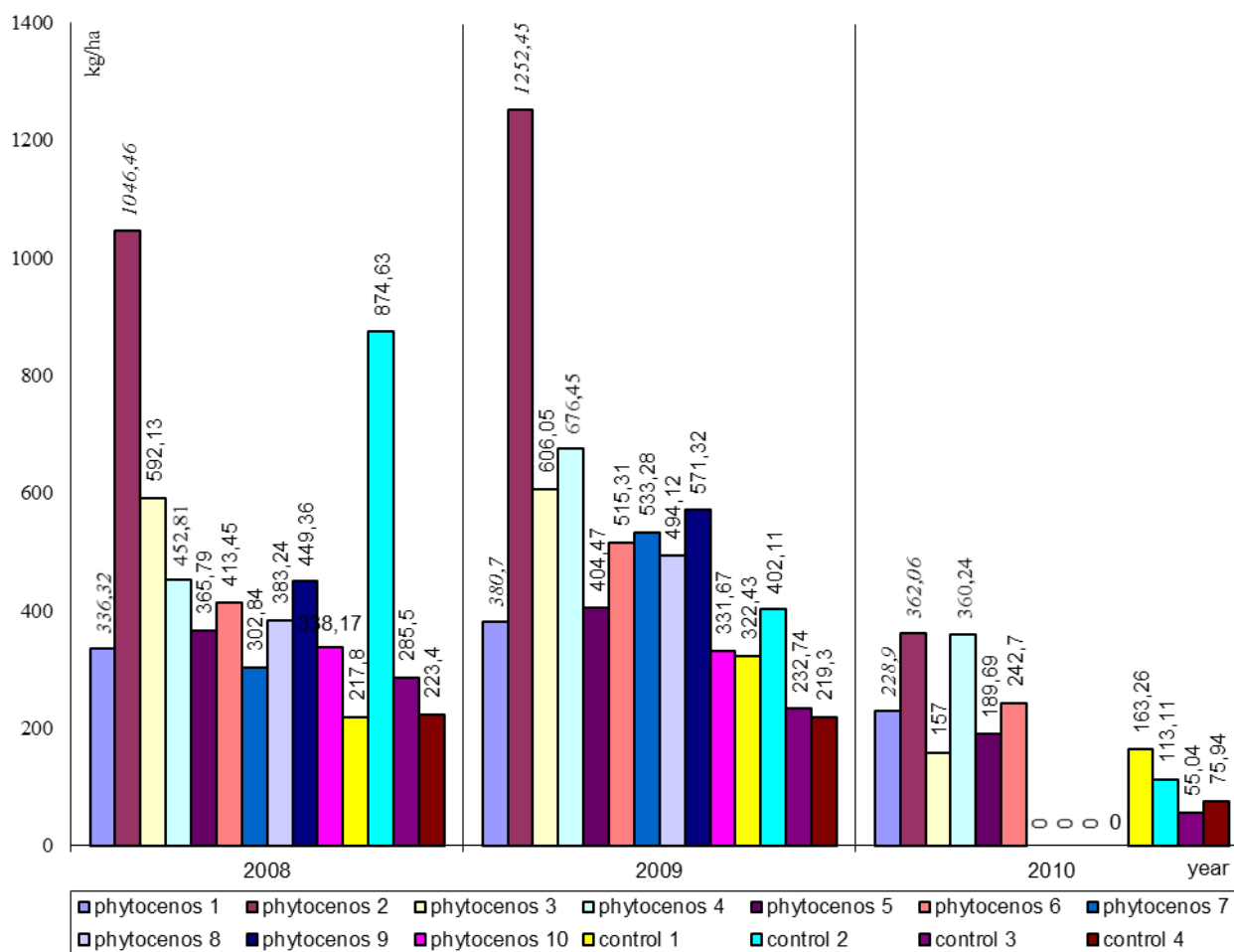


Figure 3: Autumn productivity of phytocenosis

Table: Feeding productivity of pasture agrophytocenosis, kg/ha

Number of agrophytocenoses and soil types	2008		2009		2010 r	
	experiment	control	experiment	control	experiment	control
N1, finely chilled	717.55	459.13	1093.88	613.61	468.72	277.62
N2, finely chilled	1696.82	1228,4	1743,4	711,16	597.69	200.04
N4, gray-brown	829.27	442,1	1219,26	480,55	634.32	134.1

At the same time, unfavorable weather conditions in 2010 year have shown the indisputable advantage of agrophytocenosis enriched with shrubs. The decrease in the yield of herbaceous plants in agrophytocenosis was compensated by the feed of shrubs, which amounted to 50-70% of the total yield of fodder. The lack of soil moisture most sharply affected agrophytocenosis, created on broken and primitive sandy soils, where the yield of fodder in comparison with 2010 decreased by 2.9-3.7 times, on gray-brown soils - 1.9-3.0 times, on finely hilly sand - 1.7 times.

#### 4. Conclusions

Due to the forest belts, natural vegetation growth and development have improved, productivity in artificial phytocenosis has increased to 165% and in the summer and autumn fodder has grown by 50-70%. Sowing of seeds for the natural reproduction of the bushes between forest belts and meliorative-feeding lines has great importance.

Positive results can be obtained due to the establishment of meliorative - feeding lines and forest belts in sandy and light

grass pastures, saline soils with heavy mechanical content, lumbered and low hill sand and fertile and forest reclamation.

Despite the unfavorable conditions of the year, the weak growth of ephemerals and annual grasses, pasture protective forest belts led to the best development of vegetation cover in agrophytocenosis and the productivity of pastures in them exceeded the benchmarks in different seasons of the year by 1.1-8.8 times.

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