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# ASSESSMENT OF NATURAL AND FOREST RECLAIMED FORAGE LANDS IN SEMI-DESERT CONDITIONS IN SOUTHERN RUSSIA

***Ludmila P. Rybashlykova*[1]**, *Candidate of Agriculture, Leading Research Scientist; ResearcherID: W-4197-2018, ORCID: https://orcid.org/0000-0002-3675-6243*
***Vladimir V. Lepesko*[2]**, *Candidate of Agriculture, Leading Research Scientist; ResearcherID: AAD-9953-2020, ORCID: https://orcid.org/0000-0003-2111-9636*
[1]Federal Scientific Centre of Agroecology, Complex Melioration, and Protective Afforestation, Russian Academy of Sciences, prosp. Universitetskiy, 97, Volgograd, 400062, Russian Federation; e-mail: ludda4ka@mail.ru
[2]Bogdinskaya Research Agroforestry Experimental Station, ul. BOS, 1, Kharabali, Astrakhan Region, 416010, Russian Federation

***Abstract.*** Haphazard use of pastures has become one of the factors of disturbance of their natural vegetation. Therefore, forest reclamation works were carried out and significant areas of strip plantations of shrubs were created in the Caspian Sea region in the mid-20th century. In the arid zone of Russia, one of the most important tasks in the field of scientific provision of protective afforestation is the improvement of methods and techniques of arrangement, increasing longevity and environmental, agricultural, and utilitarian efficiency of plantations. This study aims to determine the long-term impact of afforestation on the functioning of pasture ecosystems. The influence of tree and shrub layer on biodiversity and productivity of vegetation cover of pastures was also studied. The research objects are plantations growing on the reclaimed pastures. The research is based on the materials of biomonitoring and field experiments using standard methods of forest inventory and geobotanical survey. Rectangular-shaped test plots of 0.25–0.30 ha were laid out for the study of forest plots. Test plots were used for a detailed description of the location, soil composition, time, method, and technology of plantation development, as well as a comprehensive assessment of the growth and longevity of tree and shrub crops. Data from key plots were used to study the successional processes of vegetation cover. The research results have shown that deep plowing preparation of soil to obtain high results in rooting, preservation, and growth of shrub species has an advantage over other soil preparation technologies in the semi-desert zone. It was found that the shrub layer up to 45 years old retains its productive and generative abilities. Pasture protection belts from *Haloxylon aphyllum* and reclamation and fodder plantations from *Kraschenninnikovia ceratoides* and *Calligonum aphyllum* have a high cenosis potential and stability. In this case study, in semi-arid regions, afforestation with shrubs is the best way to improve and restore pastures.
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## *Introduction*

Further development of sheep breeding within pastures of the arid zone is impossible without strengthening the forage base, which is based on the rational use of reclaimed and natural forage lands. Vegetation cover is closely related to natural conditions and the economic use of the territory. Natural semi-desert pastures in the

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region are characterized by low yields (0.15–0.35 t/ha) [6, 15] and sharp differences in forage reserves by year and season [17], which restrains the rate of animal husbandry development.

Uncontrolled cattle grazing leads to the reduction and disappearance of valuable forage plants from the grass plantations (*Kochia prostrata* L., *Agropyron fragile* Roth., *Camphorosma lessisingii* Litv. and other species), destruction of the fertile soil layer, and development of land degradation [18, 20].

As a rule, low-value forage annual plants and pasture perennial weeds (*Peganum harmala* L., *Euphorbia virgate* Waldst. & Kit, *Anabasis aphylla* L.) settle in places where primary vegetation is destroyed, which leads to a reduction in forage reserves in pastures [13]. To prevent further deterioration of pastures, restore their natural productivity, and improve the quality of forage on pastures of the semi-desert zone, a set of measures is required to create systems of pasture protection and reclamation-forage plantations from the most valuable in terms of protective and forage function shrub and tree species [5, 11, 16].

Protective plantings create a more favorable zone for cattle grazing on pastures, the organization of grazing and load regulation is simplified [8].

Livestock keeping conditions are improving on forested pastures as forest plantations protect animals from heat, sun, dust storms, cold winds, and blizzards [4, 14].

Linear continuous strip plantations protect the pasture area from strong winds, which is important in cold weather conditions, since a decrease in wind speed moves the border of adverse cold from –4 to 0 °C, for example, from 4 m/s to 0 m/s [9]. However, in summer when it is calm, sheep are oppressed by overheating at an air temperature of 22–27 °C, and the oppression is noted at a higher temperature (25–29 °C) with a wind speed of 4 m/s.

The creation of savanna and diffusor-screen plantations diversifies the ecology of pasture spaces by forming zones with different air exchange intensities, light conditions, and temperatures in the habitat of grazing animals [9].

The research purpose was to determine the stability and current state of tree and shrub plantations and assess their ecological and reclamation impact on pastures in semi-desert conditions.

The study of the functioning of reclaimed pasture and forest-pasture ecosystems is of theoretical and practical importance in optimal and, especially, extreme conditions of the arid zone [7, 19].

Modern phytocenoses of natural pastures of the Astrakhan semi-desert develop according to the wormwood-ephemeral type. They are degraded and phytocenotically incomplete. Ecological niches of highly nutritious plants are occupied by low-value (analogous) species, which indicates the duration of the impact of adverse environmental factors.

Studies conducted within the territory of the studied region revealed forest pastures that have retained their functional purpose and have existed for about 50 years, which made it possible to assess the long-term reclamation effect.

## *Materials and methods*

The studied territory belongs to the Caspian subprovince and the North Turanian province of the Afro-Asian desert region according to phytogeographical zoning, and, in geomorphological terms, it is a marine plain of Late Khvalyn age,

modified by the Baer knolls and Aeolian landforms, such as ridges, barkhans and semi-fixed dunes [10]. See the figure.

The proximity of the Caspian sea and the intersection of sandy areas from North-West to South-East by the Volga river has no noticeable mitigating effect. Total annual precipitation is 100–200 mm. Mainly, low-snowy winters prevail, the thickness of the snow cover does not exceed 10–15 cm. The continental climate is manifested in the amplitudes of summer, winter, and annual temperatures. The maximum temperature is +42 °C. The minimum relative humidity during the growing season of plants is reduced to 10 %. Evaporation is very high (950–1100 mm) and exceeds atmospheric precipitation by 5–7 times. The average number of days with dry winds is 113 with a probability of 100 % according to the data of the Kharabali hydrometeorological station.

Location of the study area


The assessment of successive changes was carried out within pasture areas of the arid zone, where phytoreclamation and forest reclamation works were performed in 1975–1980. The research objects are plantations growing on the reclaimed pastures. The Priselskiy pasture plot covers an area of 306 ha. Pasture protection strips consist of *Haloxylon aphyllum* Minkw. (106 ha, seedling planting in 1978), reclamation-forage strips of *Krascheninnikovia ceratoides* L. and *Calligonum aphyllum* Pall. (200 ha, seedling planting in 1978). The terrain is a hilly plain that belongs to typical brown sandy loam soils. The plant association is ephemeral, with *Artemisia lerchiana* Weber ex Stechm. growing singly.

The Sokolovskiy pasture plot (213 ha) is represented by a hilly plain. It has a network of pasture protection strips with an area of 103 ha planted in 1976 and an area of 110 ha of pasture plantations of 1978. The soil is brown desert-steppe saline sandy loam and light loam in a complex with solonetz of 10 %.

The strips are 3-row, located across the prevailing winds. The width of the aisle is 4 m. The plant association is multi-herbaceous (*Barbarea vulgaris* R. Br., *Poa bulbosa* L., *Elytrigia repens* L., *Artemisia arenaria* DC., solitary *A. lerchiana*).

The Railway pasture plot (390 ha) is defined by a flat inter-mound depression. Planting on an area of 60 ha was carried out by the forest reclamation station in 1977, pasture protection strips – 100 ha, and pasturable strips – 230 ha. The soil is brown, sandy loam. Ground water is not revealed at a depth of 5 m. Pasture protection strips are 3-row with a 4-meter aisle. The soil is prepared according to the deep plowing method. The main plant species is *Haloxylon aphyllum*. Three pasture strips of

*Krascheninnikovia ceratoides* were planted into an inter-band space of 150-meter wide in 1980. The plant association varies from montley grass to white wormwood.

The Roadside pasture plot covers an area of 430 ha (100 ha in 1979 and 330 ha in 1981). The forest pastures were created on the Baer knolls, the soil is brown saline, sandy loam of II and III forest-reclamation category (FRC) and light loam in combination with solonetz of 10 %. The spaces between the strips are 30 m. The plant association is wormwood-cereal (bluegrass).

The Cordon pasture plot consists of 8 pasture protection strips (100 ha). The strips are 3-row; the width of the aisles is 4 m. The planting was carried out in 1977. Deep plowing was used for forest pasture strips. The inter-strip spaces are 30 m. First, the pasture protection strips of *Haloxylon aphyllum* were laid out, and after 2 years the reclamation and forage strips of *Krascheninnikovia ceratoides* and *Calligonum aphyllum* were laid out. Standard seedlings and planting machines SLCh-1 and SSN-1 were used for planting. The terrain is a slightly hilly plain. The soil is brown and sandy. Areas of wind-drifted sand are found in places along the strips. The ground water was not detected at a depth of 4 m. The plant association is ephemeral (*Avena fatua* L., *Anisantha tectorum* L., *Poa bulbosa*, solitary *Artemisia lerchiana*).

Soil tillage for planting protective plantations on pasture plots was carried out according to the following options: continuous deep plowing to a depth of 40–45 cm; partial deep plowing in order to form rows to a depth of 40–45 cm using the deep-cut ploughing machine KPG-250, followed by plowing the aisles to a depth of 22–25 cm in the spring and summer period; regular solid plowing to a depth of 22–25 cm.

Field work on the study of successional processes, geobotanical description and accounting of vegetation productivity was carried out during geobotanical surveys, according to generally accepted methods and instructions [2]. Data from key plots were used to assess succession. Each plot was characterized by a detailed description of 4 sample plots (size 100 $m^2$) by plant species diversity and indicators of its changes (number of species, life forms, structure of above-ground phytomass of herbaceous layer). An assessment of tree and shrub layer was based on taxonomic and morphological evaluation in the field conditions on 5 trial plots of rectangular shape, 0.25–0.30 ha, where the average height, diameter, nature of preservation of species, % of flowering and fruiting specimens were recorded [1]. Classification of plantations according to the value of state indices is as follows: healthy 1–1.5; weakened 1.6–2.5; severely weakened 2.6–3.5; dying 3.6–4.5; dead more than 4.6.

The nomenclature of vascular plant species is based on the Cherepanov's summary [12].

## *Results and discussion*

Monitoring of the current state of forest pastures on brown semi-desert soils and analysis of dynamics of successions of vegetation cover allows us to identify promising technologies restoration of degraded pastures, on the example of objects where the integrity and multi-layered structure of phytocenoses has been preserved.

High results of survival rate, integrity and growth of shrub species in all options of the experiment were obtained as a result of careful compliance with the technology of forest planting in the semi-desert zone, however, the undisputed advantages remain for the deep plowing preparation of soil [3]. The study results are presented in table 1.

Table 1

**Survival rate (%) of shrubs in pasture reclamation plantations, Priselskiy pasture plot**

| Plant species assortment | Soil tillage method | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Deep plowing | | | Flat-cut | | | Conventional | | |
| | 1978 | 1979 | 1980 | 1978 | 1979 | 1980 | 1978 | 1979 | 1980 |
| *Haloxylon aphyllum* | 96.4 | 38.5 | 89.2 | 92.4 | 67.2 | 70.1 | 91.1 | 65.4 | – |
| *Krascheninnikovia ceratoides* | 99.0 | 86.5 | 95.3 | 99.4 | 94.0 | 97.2 | 97.0 | 94.2 | – |
| *Calligonum aphyllum* | 95.0 | 97.3 | 97.1 | 97.0 | 95.8 | – | 93.0 | 94.1 | – |

Note: Planting was not carried out in the columns with a dash.

The low survival rate of *Haloxylon aphyllum* is explained by drying of the planting material during the deep plowing in 1979. Good indicators of survival rate of shrubs were also noted in other areas of the region in these years.

The results of 3-year observations of phytomass growth of shrub species showed that the maximum increase was observed in *Krascheninnikovia ceratoides* and *Haloxylon aphyllum* in pasture reclamation plantations in the second year of life. *Haloxylon aphyllum* can accumulate 0.7–0.9 t/ha of dry mass with moderate grazing (60 % increase), and *Krascheninnikovia ceratoides* can accumulate 0.8–1.0 t/ha, respectively. The yield of grassy vegetation was taken into account in inter-strip spaces and open semi-desert, along with the determination of shrub phytomass.

The yield of air-dry grass mass was 0.69, 0.52 and 0.37 t/ha on the pasture protected by forest strips on the Priselskiy pasture plot in 1978, 1979 and 1980, respectively, and on an open pasture (control plot) it was 2–3 times less: 0.38, 0.28 and 0.19 t/ha. Productivity was 0.61 t/ha in the system of pasture protective strips over a nine-year observation period (1978–1986), control – 0.36 t/ha. The increase in the yield of grasses under the protection of forest strips on the pasture plots was: by 0.17 t/ha – Cordon; by 0.21 t/ha – Sokolovskiy; by 0.11 t/ha – Railway.

After 2 years, the reclaimed plots (Priselskiy, Sokolovskiy, Railway and Roadside) were put into use after planting pasture protective strips. An intensive grazing of small cattle began in the amount of 1.5 ths heads during the growing season in disregard of enclosure pasturing. This had a negative impact on the growth of pasture grasses, and after 2 years, the yield of ephemeral plants was in control higher than in the inter-strip space of the Priselskiy pasture plot, since it was adjacent to the lands of the state forest fund. Cattle broke up the *Haloxylon aphyllum* plantings.

An analysis of the state of forest pastures revealed a change in the previous multi-layered structure, which lost the functional purpose of the following plots: Priselskiy in 1995, Sokolovskiy and Railway in 2000.

The Roadside and Cordon plots perform their functions due to their remoteness from populated areas (table 2).

Table 2

**The state of shrub vegetation in pasture-protective and reclamation-forage plantations, 2003**

| Pasture plot | Species | Age, yrs | Average height, m | Preservation, % | Spring moistening of soil, cm | | Ecological state |
|---|---|---|---|---|---|---|---|
| | | | | | In the strip | In the inter-strip space | |
| Cordon | *Haloxylon aphyllum* | 23 | 2.5±0.05 | 53 | 65 | 57 | 2.0 |
| Roadside | *Haloxylon aphyllum* | 22 | 2.8±0.02 | 68 | 71 | 63 | 1.8 |
| | *Kraschenin-nikovia ceratoides* | 22 | 0.7±0.04 | 73 | 73 | 68 | 1.5 |

An assessment of successional changes over a 30-year period (2013 surveys) of the study area showed the state of the forest pastures (table 3).

Wormwood-cereals (bluegrass) associations are formed in the conditions of the Astrakhan semi-desert on pasture lands with a very low yield of about 0.3–0.4 t/ha in May, and after gazing and burning of vegetation in August – 0.06–0.2 t/ha. This is due to the vegetation cover degradation, which cannot be restored due to increased pasture load, low autumn moisture reserves in soil and increased temperature during the growing season. Biodiversity is very low on the plots (8–19 species).

Studies have shown that the Roadside and Cordon plots have great biodiversity, and they preserve the tree and shrub layer after 35 years. Saxaul strips were preserved by 30 % on the Roadside plot; their average height is 2.2 m. Within the Cordon plot, the average height of *Haloxylon aphyllum* is 2.4 m, the preservation is 45 % (table 4).

The observations have shown that an increase in phytomass yield in the forest-agrarian ecosystems that are being formed can compensate the loss of annual productivity in 10–15 years after forest reclamation due to desertification, and provide an increase in fertility of reclaimed landscapes with full environmentally safe implementation of the agricultural resource potential of the territories in the future.

A monitoring of forest pastures gave the following results in terms of the state of plantings and the yield of grasses (table 5, 6).

The yield of grasses is greater than in spring period and is 0.75 t/ha in May within the Cordon plot, and 0.80 t/ha on the Roadside plot (table 5). The composition is *Artemisia lerchiana* (about 82 %) and *Poa bulbosa* (10 %). The yield of herbs does not increase at the end of August due to the lack of rainfall during the growing season (more weed poisonous herbs appear).

The best growth conditions for grassy ve getation are formed in the 30 m wide inter-strip space between pasture protective strips due to the best microclimatic characteristics. The yield of natural pasture vegetation was higher by 0.22–0.27 t/ha in both the spring and autumn periods by years.

Table 3

**Agroecological state of forest pastures of the Astrakhan semi-desert, 2013**

| Pasture plot | Year of succession | Analysis of current state | | | | |
|---|---|---|---|---|---|---|
| | | FRC, terrain, soil, salinization 1.5–2 m | Number of species, pcs | Composition of phytomass, % | Yield, t/ha | State of tree and shrub layer |
| Prisels-kiy | 36 | II and III FRC, wavy, sandy loam and light loam, slightly solonetz | 8 | Shrubs (*Krascheninnikovia ceratoides*) – 1 %; cereals – 20 %; *Artemisia lerchiana* – 19 %; motley grass – 45 %; Anabasis, etc. – 15 % | 0.26±0.06 | Tree layer died in 1995 |
| Sokolov-skiy | 36 | II и III FRC, wavy, salty, sandy loam and light loam in a complex with solonetz (10 %) | 9 | Shrubs (*Krascheninnikovia ceratoides*) – 1 %; cereals – 29 %; *Artemisia arenaria* – 10 %; *Artemisia lerchiana* – 10 %; montley grass – 50 % | 0.25±0.05 | Tree layer died in 2000 |
| Railway | 35 | II и III FRC, wavy, brown sandy loam | 10 | Shrubs (*Krascheninnikovia ceratoides*) – 3 %; cereals – 30 %; *Artemisia lerchiana* – 27 %; montley grass – 40 % | 0.38±0.06 | Tree layer died in 2000 |
| Road-side | 34 | II и III FRC, wavy, sandy loam and light loam, slightly solonetz | 19 | Shrubs (*Krascheninnikovia ceratoides*) – 10 %; cereals – 30 %; *Artemisia lerchiana* – 30 %; montley grass – 30 % | 0.59±0.16 | Good and satis-factory |
| Cordon | 36 | II FRC, wavy, brown sandy loam | 14 | Cereals – 50 %; *Artemisia lerchiana* – 20 %; montley grass – 30 % | 0.47±0.09 | Satis-factory |

Note: Classification of arid pastures. I FRC: desertified pastures with fine and medium barkhan sands and strongly eroded soils. II FRC: pastures on overgrown and weakly overgrown sands. III FRC: pastures with deflation-prone loamy-sandy soils. IV FRC: pastures on loamy and clayey deflation soils.

Table 4

**Bioecological characteristics of tree species populations in forest pastures of the Astrakhan semi-desert, 2013**

| Pasture plot | Species | Age, yrs | Average height, m | Average diameter | | Number of skeletal branches, pcs | Preservation, % | Ecological state |
|---|---|---|---|---|---|---|---|---|
| | | | | Crown, m | Trunk, cm | | | |
| Roadside | *Haloxylon aphyllum* | 34 | 2.2±0.02 | 1.4±0.04 | 12.5±0.8 | 6 | 30 | 2 |
| Cordon | | 36 | 2.4±0.04 | 1.6±0.09 | 14.5±1.2 | 7 | 45 | 2 |

Note: The classification of plantings according to the value of state indices is as follows: healthy 1–1.5, weakened 1.6–2.5, severely weakened 2.6–3.5, dying 3.6–4.5, dead > 4.6.

A survey of forest pastures in the spring of 2007–2010 showed that forage plants of various species predominate in pastures due to the protection strips, while species diversity is poorer in open pastures. Mainly, the following forage plants are represented: *Alyssum desertorum* Stapf., *Anisantha tectorum*, *Kochia prostrata*, *Poa bulbosa*, *Elytrigia repens*, *Setaria viridis* L., *Ceratocarpus arenarius* L., *Artemisia lerchiana* under the protection of 30-year-old strips of *Saxaula aphyllum*.

Table 5

**Yield of natural vegetation on pastures (2002–2005)**

| Year of research | Dry weight, t/ha | | Deviation from control |
|---|---|---|---|
| | Inter-strip space | Open pasture (control) | |
| *Cordon pasture plot* | | | |
| 2002 | 1.66<br>0.18 | 1.45<br>0.12 | 0.22<br>0.06 |
| 2003 | 0.17<br>0.09 | 0.12<br>0.05 | 0.05<br>0.04 |
| 2004 | 0.84<br>0.8 | 0.83<br>0.65 | 0.01<br>0.15 |
| 2005 | 0.75<br>1.0 | 0.60<br>0.72 | 1.15<br>0.27 |
| *Roadside pasture plot* | | | |
| 2003 | 0.18<br>0.13 | 0.12<br>0.07 | 0.06<br>0.06 |
| 2004 | 0.82<br>0.41 | 0.60<br>0.35 | 0.22<br>0.06 |
| 2005 | 0.80<br>0.74 | 0.69<br>0.67 | 0.11<br>0.07 |

Note: Spring yield of herbs in the numerator (May); and denominator (August).

A wormwood-ephemeral association with inedible plants (*Anabasis aphylla* L., etc.) prevails in open pastures (control).

The distribution of phytomass by layers during the research period is presented in Table 6.

Table 6

**Productivity of grasses under the protection of RFP and open steppe in the ground-level aerotope of pasture phytocenosis (May 2007–2010)**

| Year | Air-dry weight, t/ha | | | | | |
|---|---|---|---|---|---|---|
| | Total | | Edible | | Inedible | |
| | 0–14 cm | 15–30 cm | 0–14 cm | 15–30 cm | 0–14 cm | 15–30 cm |
| 2007 | 0.19<br>0.15 | 0.21<br>0.08 | 0.14<br>0.12 | 0.16<br>0.06 | 0.05<br>0.03 | 0.05<br>0.02 |
| 2008 | 0.41<br>0.23 | 0.17<br>0.22 | 0.28<br>0.17 | 0.12<br>0.19 | 0.12<br>0.06 | 0.04<br>0.03 |
| 2009 | 0.38<br>0.22 | 0.14<br>0.11 | 0.25<br>0.16 | 0.07<br>0.08 | 0.13<br>0.06 | 0.06<br>0.03 |
| 2010 | 0.32<br>0.26 | 0.13<br>0.10 | 0.21<br>0.15 | 0.07<br>0.06 | 0.11<br>0.11 | 0.06<br>0.04 |

Note: RFP – reclamation and forage plantations; in the numerator – the yield of pastures under the protection of RFP; in the denominator – the yield of pastures in the open steppe.

The yield of grasses in 2009 is less than in 2008, and in 2010 it is even lower due to the dry spring.

At present, the Priselskiy plot is 70 % plowed for vegetable crops. *Haloxylon aphyllum* is preserved on the tops of the Baer knolls. The state is satisfactory.

The Cordon plot retains reclamation functions on the lands of the state forest fund. The state of *Haloxylon aphyllum* strips is satisfactory.

Analysis of species composition and life forms of forest pastures showed that under extremely arid conditions and soil mobility, unregulated intensive grazing, the tree layer begins to thin out quickly. Up to 40 years, only clumps or single specimens survive. However, they play an important zoogenic and phytogenic role, contributing to the stability of plant communities. The shrub layer retains high productive and generative capacities for a long time (up to 45 years) on the Cordon plot.

## *Conclusion*

In General, it should be noted that the positive impact is observed everywhere in previously phytoreclamed areas for 34–36 years of succession changes.

Assessing the impact of the tree and shrub layer on biodiversity, it is necessary to distinguish forest pastures: the Roadside plot and the Cordon plot (14–19 species), where pasture protection strips of *Haloxylon aphyllum* and reclamation-forage plantations of *Krascheninnikovia ceratoides* and *Calligonum aphyllum* were planted.

Comparing the dynamics of composition and structure of ecological groups of forest pastures of the arid zone, it should be noted that the decrease in the proportion of biomass of forage species revealed everywhere in case of low moisture reserves due to the reduction of rainfall during October – December 2 times (by 30 mm) against the middle annual indicators, and also an increase in the load onto these areas due to a lack of forage in the neighboring pastures, where very low yields have been observed for 10 years.

These environmental factors led to a decrease in forage weight from 80–90 % to 40–50 %. At the same time, there was a sharp increase in the proportion of poisonous species from 1–3 % to 8–11 %, as well as ruderal species. The forecast of successions should be expected to be unfavorable, i.e. the further dominance of species that are not suitable for animals is probable. Phytocenoses will be formed as ephemeral and montley grasses, where inedible species will play a protective role. Therefore, it is necessary to carry out the phytoreclamation and forest reclamation work urgently.

The conducted research made it possible to assess the long-term reclamation effect. It showed that the advantage of created forest pastures is manifested not only in terms of increasing the phytoproductivity of forest-reclaimed territories, but also in terms of increasing biodiversity, forming more stable populations and phytocenoses, which contribute to prolonging a productive longevity and create more sustainable agricultural landscapes.

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# ОЦЕНКА ПРИРОДНЫХ И ЛЕСОМЕЛИОРИРОВАННЫХ КОРМОВЫХ УГОДИЙ В УСЛОВИЯХ ПОЛУПУСТЫНИ НА ЮГЕ РОССИИ

***Л.П. Рыбашлыкова*[1]*, канд. с.-х. наук, вед. науч. сотр.;*** *ResearcherID: W-4197-2018, ORCID: https://orcid.org/0000-0002-3675-6243*
***В.В. Лепеско*[2]*, канд. с.-х. наук, вед. науч. сотр.;*** *ResearcherID: AAD-9953-2020, ORCID: https://orcid.org/0000-0003-2111-9636*
[1]Федеральный научный центр агроэкологии, комплексных мелиораций и защитного лесоразведения РАН, просп. Университетский, д. 97, г. Волгоград, Россия, 400062; e-mail: ludda4ka@mail.ru
[2]Богдинская научно-исследовательская агролесомелиоративная опытная станция, ул. БОС, д. 1., г. Харабали, Астраханская область, Россия, 416010

***Аннотация.*** Бессистемное использование пастбищ стало одним из факторов нарушения их естественной растительности. Поэтому в Прикаспийском регионе в середине XX в. были проведены лесомелиоративные работы и созданы значительные площади полосных насаждений из кустарников. На территории аридной зоны России одной из важнейших задач в области научного обеспечения защитного лесоразведения является совершенствование методов и приемов обустройства, повышение долговечности, экологической, сельскохозяйственной и утилитарной эффективности насаждений. Исследование направлено на определение долгосрочного воздействия облесения на функционирование пастбищных экосистем. Также было изучено влияние древесно-кустарникового яруса на биоразнообразие, продуктивность растительного покрова пастбищ. Объектом исследования стали насаждения лесных полос на мелиорированных пастбищах. Использованы материалы биомониторинга, геоботанической съемки и полевых опытов с применением типовых методик лесной таксации. Закладывали пробные площади прямоугольной формы 0,25–0,30 га. Проводили подробное описание местоположения участка, состава почвы, времени, способа и технологии создания насаждений, а также комплексную оценку роста и долговечности древесно-кустарниковых культур. Изучение сукцессионных процессов растительного покрова осуществляли с применением данных ключевых участков. Результаты показали, что в зоне полупустыни для обеспечения высокой приживаемости, сохранности и роста кустарниковых пород при различных технологиях подготовки почвы преимущество остается за плантажной методикой. Как следует из опытов, кустарниковый ярус до 45 лет сохраняет продукционные и генеративные способности. Высоким ценозообразующим потенциалом и устойчивостью обладают пастбищезащитные полосы из *Haloxylon aphyllum* и мелиоративно-кормовые насаждения из *Kraschenninnikovia ceratoides* и *Calligonum aphyllum*. В полузасушливых районах облесение с помощью кустарников является наилучшим способом улучшения и восстановления пастбищ.
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*Ключевые слова:* аридная зона, бурые почвы, лесопастбища, геоботанические описания, многоярусная структура фитоценозов, мелиорированные кормовые угодья, полупустыня.

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