CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

http://doi.org/10.5281/zenodo.2604260

Available online at: http://www.iajps.com ***Research Article***

CURRENT STATE AND WAYS TO SAVE THE STEPPE ECOSYSTEMS OF STAVROPOL

Nina Lapenko[1], Evgenia Godunova[1], Lyudmila Dudchenko[1], Sergey Kuzminov[1], Andrey Kapustin[2]

[1]North Caucasus Federal Agricultural Research Center, Nikonov str. 49, Mikhailovsk, 356241, Russia., [2]North Caucasus Federal University, Pushkina str. 1, Stavropol 355000, Russia.

Article Received: January 2019 **Accepted:** February 2019 **Published:** March 2019

Abstract:

The article presents the materials of geobotanical survey of the steppe ecosystems of Stavropol. The purpose of the work is to show the current state of grassy natural communities and suggest ways to preserve them. Fragments of zonal vegetation represented by the feather-fescue-herb, the feather-black-cholophyte grasses and grass fescue and fescue-costera-grass steppes are considered. The real ways of preserving and restoring the grass stand of steppe ecosystems are proposed in the following areas: first, in the steppe communities located near rural settlements it is necessary to align the food intake of natural grass stands with the available livestock of animals in the individual sector. Secondly, we need a scientifically based mode of economic use of natural communities, including a rest mode for them. Third, the restoration of natural grass stands, similar to the primary steppe with an abundance of grass, legumes and other species, must be carried out in the place of degraded natural communities. Their implementation will ensure the preservation of biological diversity and productivity of the steppe ecosystems of Stavropol.

Keywords: *biodiversity, steppe restoration, degraded grass stand, pasture digression, steppe ecosystems.*

Corresponding author:

Nina Lapenko,

North Caucasus Federal Agricultural Research Center,
Nikonov str. 49, Mikhailovsk, 356241, Russia.

QR code

Please cite this article in press Nina Lapenko et al., ***Current State And Ways To Save The Steppe Ecosystems Of Stavropol.,*** *Indo Am. J. P. Sci, 2019; 06(03).*

INTRODUCTION:

Steppe ecosystems are the result of many years of evolution. In the past, they occupied the vast expanses of the Eurasian steppe, were sung by poets, and were floristically diverse. In their herbage, perennial turf-forming cereals predominated: Agropyron pectinatum (Bieb.) Beauv., Festuca valesiaca Gaudin, Koeleria cristata (L.) Pers., Stipa pulcherrima C.Koch, Stipa lessingiana Trin. Et Rupr. In addition to cereals, legume species are Amoria ambigua (Bieb.) Sojak, Lotus caucasicus Kuprian. ex Juz., Medicago romanica Pzod. and representatives of forbs - Falcaria vulgaris Bernh., Filipendula vulgaris Moench, Plantago media L., Potentilla adenophylla Boiss.et Hohen., Poterium polygamum Waldst. et kit. and others. At present, such natural communities are mostly at different stages of digression.

The problem of biodiversity conservation and productivity of steppe ecosystems is relevant because of their high economic and ecological importance in agricultural landscapes.

During the last century, the steppe landscapes of Eurasia, including the south of Russia, have gone through several stages of their development: pre-virgin, virgin, post-virgin. At each of these stages, no attention was paid at all to optimizing the natural environment, aimed at maintaining comfortable conditions for human habitation and economic activity [1, 2].

As early as 300 years ago, the Stavropol region in its present borders was almost completely covered with virgin steppe. At present, the steppe ecosystems of Stavropol, which occupy vast areas, are not rationally used by man. Pasture digression in the region began in the 50-60s of the last century with plowing virgin steppes and a simultaneous excessive increase in the livestock population. There was a loss of virgin plant species and the introduction of weedy, and as a result, a decrease in the biological diversity and productivity of steppe grass stands to 3-5 c / ha of hay. As a result, practicing everywhere unsystematic grazing of animals contributed to their transformation into secondary low-productive plant communities [1, 3].

The aim of the work is to show the current state of natural steppe ecosystems and propose ways to preserve their biological diversity and productivity in agricultural landscapes.

MATERIAL AND METHODS:

Research materials were obtained as a result of ground geobotanical survey. The description of vegetation was carried out at 10 accounting sites of 100 m² using the O. Drude system [5]. Determination of the biological yield of vegetation cover was carried out in the same way using a cutting method of 0.5 m² in six replications [5]. Latin names of plants are given according to S.K. Cherepanov [6].

The territory we study covers a number of administrative districts of the Stavropol Territory, including: Andropovsky, Grachevsky, Izobilnensky, Krasnogvardeisky, Novoaleksandrovsky, Trunovsky, Shpakovsky. Climatic conditions are favorable for the growth and development of steppe vegetation: the SCC varies from 0.9 to 1.1, the average annual rainfall is 450-550 mm. The territory of the zone belongs to the Predkavkazsky soil province, represented mainly by soils of chernozem type [7].

RESULTS AND DISCUSSION:

In Stavropol, you can still find the remnants of the zonal steppe with species *Agropyron, Stipa, Koeleria cristata, Medicago romanica, Onobrychis arenaria* (Rit.) DC. and other virgin species of wild flora. The data given in table 1 of the proof. Fragments of the zonal (conditionally reference) vegetation were encountered by us in the study area and were represented by feather-fescue-grass grasses (item 1), feather-black-holovnik grass grasses (item 2) and fescue-costa-forb grasses (item 3) by steppes distant from populated areas, formed in different l, and for the period of the survey - out of the mode of economic use (undigested, uncut) (Fig. 1).

Figure 1: Cattle-picking grass-forb type of vegetation with a predominance of beautiful grass in the grass stand.

Perennial grasses dominate in their herbage: *Bromopsis inermis* (Leyss.) Holub, *Bromopsis riparia* (Rehm.) Holub, *Festuca rupicola* Heuff., *Festuca valesiaca*, *Koeleria cristata*, *Stipa pulcherrima*. From legumes found: *Amoria montana* (L.) Sojak, *Astragalus austriacus* Jacg, *Astragalus onobrychioides* Bieb., *Medicago romanica*, *Onobrychis arenaria*, *Securigera varia* (L.) Lassen.

The floro-cenotic indicators of these communities are rather stable: the projective cover of the soil surface with the bases of the plants is 100%. Their floristic saturation within 100 m² is, on average, 40 species (34-45). The group of cereals, the creators of the main forage mass, ranges from 12.2 to 14.8% and is characterized by high abundance (Sp3-Cop3). Legumes contain from 8.8 to 13.3%. The share of perennials is high - 85.3-97.6%.

In the grasses of this type of land plays an important role turf grain – *Festuca valesiaca*. Its resistance to overloads under intense alienation, resistance to arid conditions, as well as a significant life expectancy of one individual (40-50 years) and good feeding qualities, along with species *Bromopsis*, *Stipa*, *Koeleria cristata*, characterize these lands as very valuable [9].

Table 1: Ecological-coenotic features of the steppes of Stavropol

№	Items, administrative districts	Species on 100 m^2	Projective cover, %	The type of vegetation, modification of	Usage mode
Non-degraded					
1	Sengileyevskoye Shpakovsky district	45	100	feather-tipchak-grass	virgin, no grazing
2	Old road Izobilnensky district	34	100	feather-blackhead and grass	virgin, no grazing
3	N. Beshpagir Shpakovsky district	41	100	fescue-costa-grass	virgin, no grazing
Degraded					
4	Moskovskoye Izobilnensky district	28	80	fescue-yarrow-grass	pasture grazing

5	Bezopasnoye Trunovsky district	23	70	wormwood-grass	near pasture grazing
6	Dmitrievskoe Krasnogvardeysky district	17	70	wormwood-grass	near pasture grazing
7	Karmalinovskoe Novoaleksandrovsky district	26	90	grassy-grass	pasture grazing
8	Vodorazdel Andropovsky district	11	70	fescue-grass	pasture grazing
9	Kyankiz Andropovsky district	25	80	fescue-grassy-annual	pasture grazing
10	Tuguluk Grachevsky district	24	60	sagebrush-annual grass	near pasture grazing, strong grazing
** In the names of types and modifications of vegetation in the first place is the species dominant in the herbage*					

Table 2: Floristic features of Stavropol steppes

№	Items, administrative districts	Floristic groups, %			Life cycles, %			Biological yield, t / ha
		cereals	legumes	grass	annuals	biennials	perennials	
Non-degraded								
1	Sengileyevskoye Shpakovsky district	13,3	13,3	73,4	4,4	2,2	93,4	31,2
2	Old road Izobilnensky district	14,8	8,8	76,4	11,8	2,9	85,3	22,0
3	N. Beshpagir Shpakovsky district	12,2	12,2	75,6	0,0	2,4	97,6	29,2
Degraded								
4	Moskovskoye Izobilnensky district	14,3	14,3	71,4	10,7	10,7	78,6	13,8
5	Bezopasnoye Trunovsky district	13,0	17,4	69,6	26,1	13,0	60,9	20,3
6	Dmitrievskoe Krasnogvardeysky district	17,6	5,9	76,5	41,2	0,0	58,8	18,0
7	Karmalinovskoe Novoaleksandrovsky district	15,4	15,4	69,2	7,7	3,8	88,5	26,5
8	Vodorazdel Andropovsky district	27,3	9,1	63,6	18,2	0,0	81,8	27,8
9	Kyankiz Andropovsky district	28,0	16,0	56,0	32,0	8,0	60,0	20,4
10	Tuguluk Grachevsky district	12,0	8,0	80,0	33,0	12,0	55,0	22,6

The biological yield of this type of vegetation at the time of the study ranged from 22.0 to 31.2 c / ha of hay. With pasture use of such land (alienation of feed 80%), the economic yield will be 17.6 and 25.0 centners per hectare, with haying use (70% of the productive mass) 15.4 and 21.8 centners per hectare, respectively. That is, these grass stands are floristically diverse, of high fodder value.

But more often among the steppe communities we find another picture (Table 1, 2) (paragraphs 4–10). Their excessive exploitation and lack of proper care for decades led to different stages of pasture digression - fescue-yarrow-forb, grassy-herb, fritillary-couch grass-one-year-old, etc. Their peculiarity is that valuable species are fallen from grass stands – *Agropyron pectinatum*, *Koeleria cristata*, species *Stipa*, *Bromopsis*. They were replaced by weed and ballast species of plants that do not have economic benefits, and even harmful forage – *Centaurea diffusa* Lam, *Phlomoides tuberosa* (L.) Moench, *Lepidium ruderale* L., *Bromus japonicus* Thunb., *Medicago minima* (L.) Bartalini, *Echium vulgare L.*, *Euphorbia iberica* Boiss., *Salvia aethiops* L. et al. Active distribution of these species is a consequence of the weakening position of steppe grasses-the dominant species, ecological niches that have taken less demanding in terms of power, postboston maloletnice (up to 40% or more) (Fig. 2). Their yield is (with fluctuations) from 13.8 to 27.8 C/ha of air-dry mass (table 2), but as it was noted in the herbage high proportion of little-eaten and non-eaten species.

Figure 2: Wormwood-grass modification, with the prevalence of Austrian wormwood, yarrow in the herbage.

For a comparative example of two floristic lists of plants (per 100 m²) - a fragment of zonal virgin and its modifications (near pasture) we show the species composition of natural communities - virgin (paragraph 1) and degraded (paragraph 6) (Table 3).

Table 3: Comparative analysis of the plant cover of a fragment of the zonal steppe and its degraded modification

Sengileevskoe (paragraph 1)			Dmitrievskoe (paragraph 6)		
plant species	abundance *	value **	plant species	abundance	value
Achillea setacea Waldst.et Kit.	Sp2	F, M	*Achillea biebersteinii Afan.*	Sp3	B
Adonis vernalis L.	Sp1	R, M, P	*Aegylops cylindrica Host*	Sp1	W
Amoria montana	Sp1	F, D	*Arenaria serpylifolia*	Sp1	B
Arenaria serpyllifolia L.	Sp1	B	*Artemisia austriaca*	Cop1	B
Artemisia austriaca Jacq.	Sol	B	*Bromus arvensis L.*	Sp1	W
Astragalus austriacus	Sp1	F	*Bromus japonicus*	Sp1	W
Astragalus onobrychis	Sp1	F, D	*Carduus hamulosus Ehrh.*	Sp1	W, M
Bromopsis riparia	Sp3	F	*Convolvulus arvense L.*	Sp1	W, P

Carex humilis Leyss.	Sp1	F	*Erodium cicutarium (L.)L'Her.*	Sp1	W
Centaurea apiculata Ledeb.	Sp1	D	*Eryngium campestre L.*	Sp1	W
Centaurea dealbata Willd.	Sp2	D	*Festuca valesiaca*	Sp1	F
Chamaecytisus ruthenicus (Fisch. ex Woloszcz.) Klaskova	Sp1	F, D, M	*Medicago minima*	Sp1	W, H
Dictamnus caucasicus (Fisch.et C.A.Mey.) Grossh.	Sp2	D, P	*Plantago lanceolata*	Sp1	W, M
Echium russicum J.F.Gmel.	Sp2	B, M	*Scorzonera stricta Hornem.*	Sp1	W
Euphorbia iberica Boiss.	Sp2	B, P	*Sideritis montana L.*	Sp1	W, P
Festuca valesiaca	Cop1	F	*Taraxacum officinale Wigg.*	Sp1	W, M
Filipendula vulgaris	Sp3	F, M, D	*Xanthium spinosum L.*	Sol	W, P
Geranium sanguineum L.	Sp3	F, D	Total: 17		
Gypsophila paniculata L.	Sp1	M, D			
Iris notha Bieb.	Sp1	R, D			
Iris taurica Lodd.	Sp1	R, D			
Jurinea arachnoidea Bunge	Sp1	B			
Koeleria cristata	Sp2	F			
Linum nervosum Waldst.et Kit.	Sp2	F			
Medicago romanica	Sp2	F			
Onobrychis arenaria	Sp3	F, M			
Paeonia tenuifolia L.	Sp1	R, D			
Plantago lanceolata L.	Sp2	W, M			
Plantago media	Sp2	F, M, D			
Poa angustifolia L.	Sp1	F			
Polygala caucasica Rupr.	Sp2	D, B			
Potentilla recta L.	Sp1	M, B			
Poterium polygamum	Sp1	F			
Ranunculus polyanthemos L.	Sp1	P, D			
Reseda lutea L.	Sp1	M, M, B			
Rosa canina L.	Sol	D, П			
Salvia tesquicola L.	Sp1	M, B			
Stachys atherocalyx C.Koch	Sp1	M			
Stipa pulcherrima	Cop1	F, R			
Teucrium polium L.	Sp2	F, D			
Thalictrum minus L.	Sp3	P			
Thymus marschallianus Willd.	Sp3	M, D, M			
Veronica spicata L.	Sp2	F, D			
Vincetoxicum hirundinaria Medik.	Sp1	M, P			
Xeranthemum annuum L.	Sp1	D, P			
Total: 45					

Note: * – *abundance of species on the scale of O. Drude;* ** – *qualitative assessment: F – fodder, M – medicinal, R – rare, D – decorative, W – weed, B – ballast, H – harmful, P – poisonous.*

As we see, the quantitative and qualitative indicators of the herbage in the two plots are different. A fragment of the zonal steppe (point Sengileyevskoye) is floristically rich (45 species per 100 m²), with a productivity of 31.2 centners per hectare of hay, consists of such representatives of the wild-growing flora as: *Astragalus austriacus, Astragalus onobrychis, Bromopsis riparia, Festuca valesiaca, Koeleria cristata, Medicago romanica* и др. Rare species of plants to be protected are found in its herbage: *Adonis vernalis, Stipa pulcherrima, Paeonia tenuifolia, Iris notha* and others. From an economic point of view, they receive good-quality pasture fodder.

The situation is different in Dmitrievskoye. This village is pasture and is currently used for grazing individual livestock and sheep. Grazing unregulated, exhaustive. Herbage is floristically poor (17 species per 100 m²), its productivity is 18.0 c / ha of hay. In the composition of its herbage almost all weed and ballast species — *Bromus japonicus, Carduus hamulosus, Eryngium campestre* and others who do not have feed value. This is the result of inefficient human activities. And such low-productive, floristically poor herbage, with a large abundance of non-virgin species occupy large areas in the Stavropol region.

Conservation and restoration of the steppes is a complex economic, economic and environmental problem. The solution to this problem is possible in the complex, in the following areas:

Firstly, in steppe communities located near rural settlements and intensively used practically for year-round grazing of animals of the individual sector, unregulated grazing can be considered as the main anthropogenic factor affecting the biodiversity and productivity of steppe grass stands. And here, in order to restore the natural balance, it is necessary to harmonize the food intake of natural communities with the available livestock of animals and, above all, in the individual sector [9].

Secondly, we need a scientifically based mode of economic use of natural communities, including a rest mode for them.
Third, the restoration of degraded low-productivity grass stands of steppe communities with low floristic diversity, which significantly lost virgin species [12].
It is obvious that it is necessary to create in their place grass stands of similar primary steppe with an abundance of cereal, leguminous and other virgin plant species. One of the effective ways to restore steppe ecosystems is the agrosteppe method. The method is known. It consists in the use of seeds of preserved virgin lands of a rich species composition and makes it possible to gradually solve the problem of restoring degraded grass stands. Its technology is simple and accessible to any form of management. Fragments of preserved zonal virgin soil can be sources of seed material in the implementation of remedial measures [11].
The main goal of human economic activity should be aimed at the rational use of natural resources, when the value of the results of activities exceeds the value of the natural resources consumed and does not damage its ecosystems [12].

CONCLUSION:

Long-term irrational use of steppe ecosystems has reduced their biological potential. In the past, perennial sodrophilous cereals prevailed in their herbage: *Agropyron pectinatum, Festuca valesiaca, Koeleria cristata, Stipa pulcherrima, Stipa lessingiana*. In addition to cereals, types of legumes – *Amoria ambigua, Lotus caucasicus, Medicago romanica* and representatives of the grass – *Falcaria vulgaris, Filipendula vulgaris, Plantago media, Potentilla adenophylla, Poterium polygamum* and others. At present, such natural communities are mostly at different stages of digression. Conservation of biodiversity of steppe ecosystems and their productivity, perhaps comprehensively, in the following areas: first, in the steppe communities located near rural settlements, it is necessary to align the feeding capacity of natural communities with the available population of animals in the individual sector. Secondly, we need a scientifically based mode of economic use of natural communities, including a rest mode for them. Third, the restoration of natural grass stands, similar to the primary steppe with an abundance of grass, legumes and other species, must be carried out in the place of degraded natural communities.

Thus, the creation of highly productive agrophytocenoses and the establishment of scientifically based rational environmental management regimes will ensure the preservation of biological diversity and productivity of steppe ecosystems.

REFERENCES:

1. Dzybov D.S., Lapenko N.G. 2003. Zonal and secondary bearded steppes of Stavropol. Monograph. Stavropol, Russia: Stavropol book publishing house.
2. Chibilyov A.A. 2016. Ecological optimization of steppe landscapes. Reprint edition. Orenburg, Russia.
3. Lapenko N.G. Conservation of the biodiversity of natural ecosystems of stavropol. Proceedings of the Orenburg State Agrarian University, 2014; # 1 (45): 130-131.
4. Korchagin A.A. 1964. Field geobotany. Moscow.
5. Konyushkov N.S., Rabotnov T.A., Tsatsenkin I.A. 1972. Methodology for the study of hayfields and pastures. Moscow: Selkhozizdat.
6. Cherepanov S.K. 1995. Vascular plants of Russia and adjacent states (Within the limits of the former USSR). St. Petersburg, Russia: Mir i sem'ya Publishing House.
7. Kulintsev V.V., Godunova E.I., Zhelnakova L.I. and others. 2013. The system of agriculture of

the new generation of the Stavropol Territory. Monograph. Stavropol, Russia: Agrus.
8. Dzybov D.S. To the selection and introduction to the fescue culture. Selection, seed production and protection of the gene pool of forage grasses of Stavropol. works of Stavropol Research Institute of Agriculture, 2003: 97-102.
9. Grebennikov V.G. Shipilov I.A., Zheltopuzov V.N., Khonina O.V. 2015. Recommendations on the norms of livestock loading on pastures in the municipalities of the Stavropol Territory. Stavropol, Russia.
10. Grebennikov V.G., Shipilov I.A., Zheltopuzov V.N., Khonina O.V., Turun I.P. 2015. Practical recommendations on the assessment, rational use of natural forage lands with the development of technology for their improvement in various climatic zones of the Stavropol Territory. Stavropol, Russia.
11. Dzybov D.S. 2010. Agrostepi. Monograph. Stavropol, Russia: AGRUS.
12. Gorbanev V.A. Nature management and sustainable development. Vestnik MGIMO, 2013; # 5 (3): 180-189.