Pasture phytocomplexes of Pridonye: ecological situation

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Abstract. The purpose of the work is to establish the ecological situation in the pasture phytocomplexes of the Don basin. The objects of research were plant communities on floodplain sod-meadow granular soils and on the sands of the Ilovlinsky massif of the Volgograd region. The occurrence of species on the Drude scale, the vital state of plants, the projective cover of vegetation, and the feed mass consumed were determined. It is established that the main mass of vegetation is oppressed or is in a satisfactory condition. The dominant phytocomplexes are representatives of the Asteraceae families that are resistant to anthropogenic loads and lodging, with a wide ecological amplitude (30% on floodplain sod-meadow granular soils, 38% on sands) and Poaceae (13% on floodplain sod-meadow granular soils, 29% on sands). On floodplain sod-meadow granular soils with a projective vegetation cover of 45%, the feed mass of autumn pastures was 51.2 g/m^2, on sands with an average projective vegetation cover of 21%, the feed mass was 24.4 g/m^2.

1 Introduction

The main areas of natural forage lands in Russia are concentrated in arid territories, where such livestock industries as beef cattle breeding, sheep breeding, horse breeding, camel breeding are successfully developing. Currently, the feed industry is aimed at creating a system of environmentally safe and cost-effective technologies that can restore biological diversity, fertility and the structure of disturbed ecosystems. The system for assessing the adaptive and productive potential of forage species and ecotypes makes it possible to predict the productivity and state of phytocenoses depending on the intensity of stress factors and the prospects for their use [1-4]. The main principle of adaptive land use of arid territories is the selection of optimal ecotypes, varieties, and species of cultivated grasses, which in the course of their phylogenetic development have adapted to the harsh environmental conditions of arid regions [5-8].

Vegetation as abiotic component of the natural ecosystem plays an important role in the structural and functional organization of the ecosystem. Adaptation and selection of species capable of coexisting occurs during the formation of phytocenoses in certain climatic and ecological systems. Each species develops a special life strategy and a set of adaptation that enable species to occupy a certain position in biocenoses. Plants as a result of natural selection develop a

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high potential adaptability to a combination of extreme environmental factors. Cenopopulations of pasture ecosystems are formed under the influence of abiotic and anthropogenic factors, which allows them to develop resistance to systematic animal eating and trampling [9, 10]. The ability of species to coexist in the system of phytocenoses allows them to reduce competition for resources, increasing interdependence and realizing their productive potential [11-13].

The relevance of the study is justified by the fact that knowledge of the bioecological and physiological characteristics of plants of the natural flora, the mechanisms of their adaptation and production process gives an idea of the state of the ecosystem and allows you to control the preservation of genetic potential and ecological balance in a certain area.

2 Materials and methods

The aim of the research was to establish the ecological situation in the pasture phytocomplexes of the Don basin. The objects of research were plant communities on floodplain sod-meadow granular (plot 1) soils and on the sands of the Ilovlinsky massif (plot 2) of the Volgograd region, Figure 1. The relief of the territory is flat, dissected by ravines and gullies. The method of grazing animals is uncontrolled..

Fig. 1. Research objects

The territory belongs to the chestnut dry-steppe zone of the white-wormwood-pyrethrum-cereal subzone with a well-pronounced mosaic and spots of halophytic vegetation type. Typical background associations for this subzone: *Artemisia lerchiana*, *Matricaria chamomilla*, *Stipa*, *Festuca valesiaca* with an admixture of xerophytic grass [14].

Monitoring of the sites was carried out in October. To identify the state of the ecosystem, the indicator of the vital state of the vegetation cover in points is visually determined. The evaluation criteria were such indicators as: compliance with the life cycle of development, leafiness, susceptibility to fungal diseases, the presence of dead and dying parts, signs of damage from grazed animals (depressed – 1, satisfactory – 2, good – 3, excellent – 4). The occurrence of species is determined by the Drude scale, where Un. – single instance, Sol. – single, Sp. – rare, Cop1 – quite abundant, Cop2 – abundant, Cop3 – very abundant, Soc. – entirely.

The feed mass consumed was determined by weighing the total phytomass without taking into account dried coarse branches, rotten foliage and other non-edible parts of plants.

3 Results and discussion

As a result of geobotanical surveys, it was revealed that 39 species from 21 families are found on the 1st monitoring site, 54 species from 15 families were identified on the 2nd site. Representatives of *Asteraceae* and *Poaceae* dominate at all sites, Table 1.

Table 1. Characteristics of phytocenoses of pasture ecosystems

№ №	Family	Type: abundance on the Drude scale[vitality]	
		Plot No. 1	Plot No. 2
1.	*Alliaceae*	*Allium praescissum:* Sol.[1]	-
2.	*Apiaceae*	*Eryngium campestre:* Cop1[2]	*Eryngium campestre:* Sp.[1]; *Eryngium planum:* Sp.[1].
3.	*Asparagaceae*	*Asparagus pallasii:* Sp.[1]	-
4.	*Asteraceae*	*Artemisia austriaca:* Cop1[3]; *Artemisia lerchiana:* Cop1[3]; *Cichorium intybus:* Sol.[3]; *Cirsium arvense:* Sp.[1]; *Crepis tectorum:* Sp.[2]; *Hieracium vulgatum:* Sol.[2]; *Lactuca serriola:* Sol.[1]; *Matricaria recutita:* Sol.[1]; *Tragopogon major:* Sol.[2]; *Xanthium spinosum:* Sp.[1]; *Xeranthemum annuum:* Sp.[2]; *Xánthium strumárium:* Sol.[2].	*Achillea millefolium:* Sp.[2]; *Ambrosia trifida:* Sp.[2]; *Artemisia austriaca:* Cop1[2]; *Artemisia lerchiana:* Cop1[2]; *Artemisia tschernieviana:* Cop2[1]; *Carduus acanthoides:* Cop1[2]; *Cirsium arvense:* Sp.[2]; *Conyza canadensis:* Sp.[1]; *Helichrysum arenarium:* Cop1[3]; *Lactuca serriola:* Sp.[1]; *Matricaria chamomilla:* Cop2[2]; *Tanacetum vulgare:* Cop2[3]; *Taraxacum officinale:* Cop1[1]; *Tragopogon dubius :* Cop1[2]; *Tragopogon major:* Sol.[1]; *Xanthium spinosum:* Sol.[1]; *Xeranthemum annuum:* Sol.[2]; *Xánthium strumárium:* Cop1[3].
5.	*Boraginaceae*	-	*Lappula squarrosa:* Sol.[2]
6.	*Brassicaceae*	*Capsella bursa-pastoris:* Cop1[2]; *Lepidium ruderale:* Sol.[2].	*Capsella bursa-pastoris:* Sp.[2]; *Lepidium ruderale:* Sp.[2]; *Sisymbrium altissimum:* Cop1[2].
7.	*Convolvulaceae*	*Convolvulus arvensis:* Sp.[1]	*Convolvulus arvensis:* Cop1[2]
8.	*Caryophyllaceae*	*Dianthus campestris:* Sol.[1]	*Melandrium album:* Sp.[1]
9.	*Chamaenerion*	*Chamaenerion mangustifolium:* Sol.[1]	-
10.	*Chenopodiaceae*	-	*Aellenia subaphylla:* Cop1[2]; *Atriplex cana:* Cop1[2]; *Ceratocarpus arenarius:* Cop1[2].
11.	*Cyperaceae*	*Carex arenaria:* Cop1[1]	*Carex arenaria:* Cop2[2]
12.	*Equisetaceae*	*Equisetum arvense:* Sp.[1]	-
13.	*Euphorbiaceae*	*Euphorbia virgata:* Sp.[1]	-
14.	*Iridaceae*	*Iris pumila:* Sol.[1]	-
15.	*Iris*	*Gypsophila paniculata:* Sp.[1]	*Gypsophila paniculata:* Sp.[2]
16.	*Lamiaceae*	*Thymus pallasianus:* Cop1[2]	-
17.	*Fabaceae*	*Glycyrrhiza echinata:* Sp.[1]; *Medicago romanica:* Sp.[2]; *Trifolium pratense:* Sp.[1].	*Alhagi pseudalhagi:* Sp.[1]; *Glycyrrhiza glabra:* Cop1[1]; *Medicago falcata:* Sol.[2]; *Medicago romanica:* Sol.[2]; *Trifolium pratense:* Sol.[1].
18.	*Euphorbiaceae*	*Euphorbia virgata:* Sp.[1]	-
19.	*Rosaceae*	*Potentilla bifurca :* Sp.[1].	*Potentilla argentea:* Sp.[1]; *Sanguisorba officinalis :* Sol.[2].
20.	*Rubiaceae*	*Galium verum:* Cop1[1]	*Galium verum:* Cop2[2]
21.	*Plantaginaceae*	*Plantago lanceolata:* Sol.[1]	*Plantago major:* Cop1[2]
22.	*Polygonaceae*	*Rumex confertus:* Sol.[1]	*Polygonum aviculare:* Cop1[2]
23.	*Poaceae*	*Agropyron elongatum:* Cop1[3]; *Alopecurus pratensis:* Cop1[2]; *Bromopsis inermis:* Cop3[3]; *Dactylis glomerata:* Cop1[3]; *Poa pratensis:* Cop1[2].	*Agropyron cristatum:* Cop2[3]; *Alopecurus pratensis:* Sp.[2]; *Anisantha tectorum:* Cop1[3]; *Bromopsis inermis:* Cop1[1]; *Calamagrostis epigeios:* Sp.[2]; *Eremopyrum triticeum:* Cop2[3]; *Festuca valesiaca:* Sp.[2]; *Leymus racemosus:* Sp.[2]; *Leymus arenarius:* Sp.[2]; *Poa bulbosa:* Cop1[3]; *Poa pratensis:* Cop1[3]; *Stipa lessingiana:* Cop1[2]; *Stipa pennata:* Sp.[3].
	Total	39	54

	Projective coverage, %	45	21
	Feed weight consumed, g/m^2	51,2	24,4

The main mass of vegetation is oppressed in autumn or is in a satisfactory condition. 56% of the species of the community are oppressed at site No. 1, 28% are in a satisfactory condition. On site No. 2, 25% of plants are oppressed, 57% of the vegetation cover is in a satisfactory condition. Plants experience severe stress due to the excessive load of livestock and extreme climatic conditions.

In a large number of species, with the deterioration of habitat conditions and the end of the growing season, the intensity of life processes slows down. On floodplain sod-meadow granular soils, isolated species can be attributed to the number of very vulnerable: *Allium praescissum* (it is listed in the Red Book of the Volgograd region)*, Lactuca serriola, Matricaria recutita, Dianthus campestris*, *Chamaenerion mangustifoliu, Iris pumila* (it is listed in the Red Book of the Volgograd region), *Plantago lanceolata*, *Rumex confertus*. On sandy soils, vulnerable species are: *Tragopogon major*, *Xanthium spinosum*, *Trifolium pratense*.

In good vital condition are species resistant to anthropogenic loads and lodging, with a wide ecological amplitude. In both areas, until late autumn, green fodder gives rhizomatous-loose grass grass *Poa pratensis*, which tolerates grazing well, grows quickly after grazing, is one of the most valuable forage plants and is well eaten by all types of livestock. In addition, xerophyte, a perennial rhizomatous riding grass *Bromopsis inermis*, grows well after grazing animals on these two sites. This species is used for phytomelioration of forage lands in areas of its natural distribution. Long-term rhizomatous-loose-bush riding grass *Alopecurus pratensis* is frost-resistant, but little drought-resistant, it occurs quite abundantly on floodplain sod-meadow granular soils, and rarely spreads on sands. After grazing, it grows slowly. With intensive grazing and low grazing, it may fall out of the herbage. The high-yielding *Carex arenaria* species occurs abundantly on medium-grown and overgrown sands, the species is thinned out on mobile sands. On sod-meadow granular soils, *Carex arenaria* is less common. The vital state of plants is oppressed. *Artemisia austriaca* and *Artemisia lerchiana* are quite abundant in both sites. But *Artemisia* are in good condition only on on floodplain sod-meadow granular sails, on sands their condition is satisfactory.

Mainly representatives of *Poaceae* families develop well on floodplain sod-meadow granular soils (plot 1) out of 39 species *(Agropyron elongatum, Bromopsis inermis, Dactylis glomerata)* and *Asteraceae (Artemisia austriaca, Artemisia lerchiana, Cichorium intybus).* Mesophyte, a well-leafed species of *Dactylis glomerata* is quite drought-resistant, is quite abundant on the site due to the fact that by autumn the grass becomes coarser, its quality decreases and is poorly eaten by cattle. The ruderal species *Cichorium intybus* occurs infrequently, but is readily eaten by cattle. Xerophyte, eutrophyte, halophyte, frost- and drought-resistant species *Agropyron elongatum* is quite abundant, actively grows on saline soils, is well eaten by animals.

On the sands (site 2) of 54 species, such representatives of *Poaceae* as *Anisantha tectorum*, *Poa bulbosa*, *Eremopyrum triticeum*, etc. grow and develop especially well. Invasive annuals, therophytes, mesoxerophytes and heliophytes *Anisantha tectorum* are found quite abundantly, can be eaten by cattle, is an indicator of disturbed habitats and pioneer communities, an explerent and ruderal species. Polymorphic, ecologically plastic, adaptable to environmental conditions, the valuable pasture species *Poa bulbosa* is readily eaten by all types of livestock, even in dried form. Due to the prevailing favorable conditions of autumn weather, rapid growth and development of the species has been noted, the vegetation of which will last 30-35 days, and then it will have a rest period of up to 11 months. The annual ruderal xerophyte *Eremopyrum triticeum* is well eaten by animals,

occurs abundantly, as it is resistant to intensive grazing. It grows in combination with *Capsella bursa-pastoris*, *Artemisia austriaca* and *Lepidium ruderale*. The friable perennial *Stipa pennata* feels good on sandy and sandy loam soils, vegetated in April-June and dries up by autumn, grows very poorly and is rare. New shoots of dense-turf perennial, xerophyte *Stipa lessingiana* grow well, which are readily eaten by grazed cattle, which is the limiting factor of its dominance. *Festuca valesiaca* coarsens after flowering, but leaves in a green state in winter; it is not resistant to intensive grazing, and therefore it is rare. Drought-resistant and winter-hardy, valuable forage species *Agropyron cristatum* is found quite abundantly, as it is resistant to pasture loads and is well eaten on pasture by all types of cattle only before earing; it is used to create cultivated pastures in areas of natural growth. *Calamagrostis epigeios* is rarely found; the death of its generative shoots and the aboveground part of vegetative rosettes is noted. Rhizomatous grass *Leymus racemosus* (characterizes the first stage of overgrowth of mobile sands) occurs sparsely on the sands, in small areas, does not occur on top of sandy mounds, when compacting the sands, the species disappears from the herbage; it is eaten by cattle satisfactorily, before earing cattle prefer leaves, later – spikelets. Hemicryptophyte, xerophyte with a wide ecological amplitude, dense-grain, grazing-resistant cereal *Festuca valesiaca*, as well as perennial cereal *Leymus arenarius* are rarely found and are in satisfactory condition.

In good vital condition on the sands are such representatives of the *Asteraceae* family as the little-eaten, drought-resistant, ruderal species *Artemisia austriaca*; a rod-rooted perennial, sand-steppe euryxerophyte *Helichrysum arenarium*, which spreads in small groups and diffusely; hemicryptophyte, a short-rooted perennial growing in groups *Tanacetum vulgare*; taproot annual, ruderal mesophyte, therophyte *Xanthium strumárium.*

4 Conclusion

The species composition of phytocenoses depends on the condition and use of pasturelands, since plants are sensitive to environmental disturbances. The floral compositions, productivity and projective coverage clearly reflect the change in the ecological situation of the territory and are indicators of the level of anthropogenic load on the natural environment. Scientifically-basic norms of load on pasturelands should ensure the yield of cheap livestock products and minimal negative impact on grassland.

Representatives of 39 species from 21 families are found on floodplain sod-meadow granular soils. 54 species from 15 families have been identified on the sands. Species of the *Asteraceae* and *Poaceae* families dominate in all areas. The proportion of *Asteraceae* species on floodplain sod-meadow granular soils reaches 30%, on sands – 38%. The proportion of species belonging to the *Poaceae* family on floodplain sod-meadow granular soils reaches 13%, on sands – 29%. The main mass of vegetation is oppressed or in a satisfactory condition. Autumn pastures on floodplain sod-meadow granular soils in the Don basin with an average projective vegetation cover of 45% yield 51.2 g/m^2 of feed phytomass consumed. On the sands, with an average projective vegetation cover of 21%, the feed phytomass consumed is 24.4 g/m^2.

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