

УДК 58.01/.08:574(574.3)
DOI: 10.36979/1694-500X-2024-24-8-249-252

**ВЛИЯНИЕ ПОЖАРНОЙ ДИГРЕССИИ НА СОСТОЯНИЕ РАСТИТЕЛЬНОСТИ
ПУСТЫНИ БЕТПАКДАЛА (В ПРЕДЕЛАХ УЛЫТАУСКОГО РАЙОНА
УЛЫТАУСКОЙ ОБЛАСТИ)**

Г.Т. Максутбекова

Аннотация. Исследуются изменения, происходящие в степных сообществах Центрального Казахстана, проводится их повторное картирование. Отмечено, что широкомасштабная распашка земель привела к уничтожению большинства типов плакорных и луговых степей, богато-разнотравно-ковыльные и разнотравно-ковыльные степи уничтожены на 90 % на равнинных участках. Рекомендованы меры борьбы с опустыниванием на основе результатов научных разработок с оценкой факторов и причин их возникновения, по предотвращению и искоренению данных явлений. Изучено влияние пожарной дигрессии на степные территории на примере Улытауского района Улытауской области и ее влияние на состояние растительности пустыни Бетпақдала (Центральный Казахстан). Пожарная дигрессия неизбежно ведет к деградации степных почв и растительностей на восстановление которых после низовых пожаров уходят многие десятилетия.

Ключевые слова: растительность; пожар; растения; Центральный Казахстан; Улытауский район.

**БЕТПАКДАЛА ЧӨЛҮНДӨГҮ ӨСҮМДҮКТӨРДҮН АБАЛЫНА
ӨРТ ДИГРЕССИЯСЫНЫН ТААСИРИ (УЛЫТАУ ОБЛУСУНУН
УЛЫТАУ РАЙОНУНУН ЧЕГИНДЕ)**

Г.Т. Максутбекова

Аннотация. Макалада Борбордук Казакстандын талаа жамааттарында болуп жаткан өзгөрүүлөр изилденип, кайра картага түшүрүлүүдө. Ири масштабдуу айдоолор аянычтуу жана шалбаалуу талаалардын көпчүлүк түрлөрүнүн жок болушуна алып келгени, бай чөптүү жана чөптүү талаалар тегиз жерлерде 90% талкаланганы белгиленген. Илимий иштеп чыгуулардын натыйжаларынын негизинде чөлгө айлануу менен күрөшүү, алардын пайда болушунун факторлорун жана себептерин баалоо, бул көрүнүштөрдүн алдын алуу жана жоюу боюнча чаралар сунушталат. Өрттүн дигрессиясынын талаа аймактарына тийгизген таасири Улытау облусунун Улытау районунун мисалында жана анын Бетпақдала чөлүнүн (Борбордук Казакстан) өсүмдүктөрүнүн абалына тийгизген таасири изилденген. Өрт дигрессиясы сөзсүз түрдө талаа топурактарынын жана өсүмдүктөрүнүн деградациясына алып келет, аларды калыбына келтирүү үчүн көптөгөн ондогон жылдар талап кылынат.

Түйүндүү сөздөр: өсүмдүктөр; өрт; өсүмдүк; Борбордук Казакстан; Улытау району.

**THE EFFECT OF FIRE DIGRESSION ON THE VEGETATION
OF THE BETPAKDALA DESERT (WITHIN THE ULYTAU DISTRICT
OF THE ULYTAU REGION)**

G.T. Maxutbekova

Abstract. Changes occurring in steppe communities of Central Kazakhstan are studied, their re-mapping is carried out. It is noted that large-scale land plowing has led to the destruction of most types of interfluvial and meadow steppes, rich forb-feather grass and forb-feather grass steppes were destroyed by 90% in flat areas. Combating desertification should be carried out in accordance with scientific developments, allowing, first of all, to assess factors and causes of desertification, to determine measures for prevention and eradication of these phenomena. Our goal is to study the impact of fire digression on steppe territories on the example of Ulytau district of Ulytau region. This article presents the

results of research on the impact of fire digression on the vegetation of the Bektakdala desert (Central Kazakhstan). Fire digression inevitably leads to degradation of steppe soils and vegetation which restoration after lowland fires takes many decades.

Keywords: vegetation; fire; plants; Central Kazakhstan; Ulytau district.

Introduction. Central Kazakhstan is not a very well studied region, which is due to the large size of the territories, the lack of a developed road network, and the small number of scientific expeditions. While the northern and eastern parts of the region have been better studied, as they contain forest areas of interest for science and nature conservation, the western and southern parts of the region have been studied very little. The steppe and semi-desert areas of the Betpaklada plateau, stretching from the northern Pribalkhash to the Ulytau Mountains, are particularly poorly studied. Most of this area is located in the Aktogai district of Karaganda oblast and Ulytau district of Ulytau region.

Ulytau region located in center of Kazakhstan on the territory of Central-Kazakhstan hilly area. It represents a strongly destroyed ancient mountain system, which as a result of long-term action of denudation and weathering processes turned into a hilly country with heights from 300 to 900 meters. The hilly area is characterized by the alternation of randomly scattered elevations with undulating plains, wide valleys and closed hollows [1].

Negative sides of geographical position of Ulytau region are expressed in aridity of climate, low amount of precipitation.

To improve the condition of hayfields, especially those located in the valleys of rivers and lakes, local residents burn old dead plant residues by provoking surface steppe fires. With 1-2 times use, dry coarse above-ground mass is destroyed, growth of young shoots is activated, and the age composition of wall communities is renewed. However, these fires are dangerous for turfgrasses and shrub steppes, as they can cause burning not only of above-ground but also of underground parts of plants.

It is worth noting such an important fact that the territory of Ulytau district of Ulytau region is the place of falling of the second separating stage of the Proton-M launch vehicle launched from Baikonur Cosmodrome. As a result of the fall of the separating parts of the rocket, they are strongly heated in the upper atmosphere. When falling to the ground, the debris provokes systematic steppe fires.

Thus, data analysis allows to determine that on the territory of the steppe part of Ulytau district there are 3 main factors of fire digression occurrence: cattle breeding and pasture farming, hunters and space activity. According to the degree of impact, the described factors were distributed as follows:

- 1 Space activities – degree of influence from 20 to 70 %.
- 2 Pasture management – degree of influence 10–15 %.
- 3 Hunting – degree of influence less than 5 %.

Objects and methodology. The object of research was steppe territories of Ulytau district of Ulytau region (Central Kazakhstan).

The research was carried out by route-reconnaissance and semi-stationary method.

Flora and vegetation were studied using traditional methods of field geobotanical studies [2, 3]. For each plant community, the full floristic composition was established, phases of phenological development of individual species, their vital state, abundance (on the Drude scale), distribution (on the B.A. Bykov scale) [3], morphometric parameters (height, habitus), life forms (trees, grasses, shrubs, etc.) were determined [2].

The vegetation was described according to the following sections:

Community name. The ratio of dominant, co-dominant plant species and other components is given visually.

Projective soil coverage by plants. Defined as the percentage of area occupied by projections of above-ground parts of all plants of the phytocenosis as a whole.

Floristic composition of the community. Latin names of plants occurring in the community were given. For each species, we noted its tier, abundance, life state, distribution, and phenological phase. Based on

the collected herbarium material and descriptions, a list of plants forming communities was compiled. The systematic belonging of species was determined by special plant identifiers [4, 5].

Abundance. This is a visual estimate of the number of individuals of each species in a community. It is determined on the Drude scale:

- soc (socialis) – “abundant”, the plants are interlocked with their above-ground parts, forming a pure thicket, other species are then very rare, isolated specimens;
- cop3 (copiosus) – “very abundant”, the plants are very abundant, they are background;
- cop2 – “a lot”, plants are frequent, abundant, scattered;
- cop1 – “quite a lot”, plants are found occasionally, scattered;
- sp (sparsus) – “few”, plants are found very rarely;
- sol (solitarius) – “singularly”, very few plants, only a few specimens per sample area.
- un (unicus) – “singularly”, plants occur in the territory in a single copy [6, 7].

Population density was estimated based on data on projective vegetation coverage. Thus, low population density was determined at projective vegetation coverage up to 20 %, medium – at projective coverage from 20 to 40 %, high – above 40 %.

On the study area we laid experimental plots with the area of 100–150 m², where we analyzed the degree of fire damage to the territory and plants. The obtained data were expressed in %. The following were taken as criteria of fire digression:

- Low degree – no more than 15–20 % of the territory was affected by fires;
- medium degree – from 20 to 45 %;
- high – more than 50 %.

Fire damage to plants was also assessed at different levels. Thus, the damage affects:

- only part of above-ground organs,
- significant burning of above-ground organs,
- complete burning of above-ground organs and part of litter,
- complete burning of litter and caudex of semi-shrubs.

The main criteria for vegetation disturbance are changes in:

- a) species composition;
- b) projective cover, abundance and productivity;
- c) vitality, degree of productivity;
- d) the number and proportion of weed-ruderal species in the composition of communities.

When using this method, descriptions of standard and disturbed communities of the same type are compared in plots selected on the basis of habitat similarity.

Conclusions. In Ulytau district of Ulytau oblast the main types of vegetation are described and their condition is assessed. The survey area is located on a significant area of the territory, which is characterized by a rather diverse vegetation cover, the distinctive feature of which is its spatial heterogeneity - complexity.

The following main desert and shrub steppe vegetation types were identified in the surveyed area: white-ground absinthic (*Artemisia terrae-albae*) and perennial solanaceous (boyalych, biyurgun, tasbiyurgun), which are one of the zonal vegetation types characteristic of the North Turanian deserts.

These vegetation types in the study area tend to occur either as homogeneous massifs or as components of complexes. The dominant species in the area are xerophytes and halophytes.

They mainly belong to the life forms of dwarf-shrubs, subshrubs, shrubs, herbaceous perennials and annuals with short (ephemerals and ephemerooids) and long growing seasons. Ephemerals and ephemerooids vegetate in the short spring period, while other species have summer or summer-autumn type of growth, i.e. the main phases of vegetation occur in mid- to late summer or in the fall.

The main areas in the surveyed area are represented by the following communities: vegetation of rolling, billowy, gently rolling, flat and sloping plains is represented by wormwood, wormwood-biyurgun, wormwood-boyalych with groupings of ferula, wormwood-tasbiyurgun, wormwood-teresken with groupings

of sagebrush, biyurgun-tasbiyurgun, biyurgun, tasbiyurgun, boyalych-tasbiyurgun, boyalych, boyalych-ferula, climacoptera-wormwood, hymenolim, chiyev, as well as dwarf-shrub-solanaceous, dwarf-shrub-ephemeral communities. The number of components in the communities ranged from 5 to 25 species.

Visually observed manifestations of fire-induced vegetation degradation are significant. The degree of anthropogenic transformation due to the impact of fires is observed in different points from low (0–30 %) to medium (about 50 %) and high (over 60 %).

Thus, in most of the territory the main factor of impact on the vegetation cover is fires, under the influence of which the territory is in a state from highly disturbed to slightly disturbed as a result of restoration processes. A different ratio of age groups for individual plant species (as an example of perennial herbaceous plants) was also noted. The age spectrum is a very indicative factor. Thus, the predominance of young and middle-aged plants shows the youthfulness or stability of plant populations, while the dominance of old individuals is a bad sign, which indicates the processes of population die-off [8, 9].

Different degrees of vegetation cover recovery were observed – from 0 to 15 %. In some cases, no secondary settlement was observed, while in other cases there is gradual settlement due to the introduction of weedy elements, *Artemisia terrae-albae* and *Ferula schair*. Full restoration of natural vegetation was not observed.

Thus, the following conclusions can be drawn based on the results of the conducted research:

1. The ways of occurrence of fire digression in steppe communities of Ulytau district of Ulytau region were revealed. These are pasture activity, hunting and space activity. The most significant damaging factor is space activity (from 20 to 70 %).

2. The dynamics of age composition of dominants of vegetation cover was studied. It was revealed that at low degree of fire degradation the share of old generative and senile individuals slightly increases, the number of undergrowth (virginile individuals) and young generative plants decreases. At medium degree, a shift towards virgin and senile individuals is observed (so-called disjunctive type of histogram). At a high degree of fire degradation there is a loss of virginile phase and young generative plants due to a significant increase in the share of old generative and senile individuals.

3. The species composition of steppe communities at different degrees of impact of fire digression was studied. It is established that at regular steppe fires there is a loss of perennial long-vegetative elements (plants of spring-summer-autumn development cycle), the share of ruderal herbaceous annual elements, as well as ephemerals and ephemeroids increases. Further, there is a gradual loss of shrubs, subshrubs and dwarf semi-shrubs; then turfgrasses and rhizomatous perennial plants.

Поступила: 23.05.24; рецензирована: 04.06.24; принята: 06.06.24.

Literature

1. Агроклиматические ресурсы Карагандинской области Казахской ССР. Л.: Гидрометеоздат, 1976. Р. 11–15.
2. Полевая геоботаника, Т. 1–5. Л.: Наука, 1959–1979.
3. Быков Б.А. Введение в фитоценологию / Б.А. Быков. Алма-Ата: Наука, 1970. 226 с.
4. Флора Казахстана. Т. I–IX. Алма-Ата, 1956–1966.
5. Региональные проблемы геоэкологии Центрального Казахстана. Жезказган: ЖезУ, 2000. 115 с.
6. Foster C.N. Effects of fire regime on plant species richness and composition differ among forest, woodland and heath vegetation / C.N. Foster, P.S. Barton, C. MacGregor, J.A. Catford, W. Blanchard, & D. Lindenmayer // *Applied Vegetation Science*. 2018. 21(1). Pp. 132–143. <https://doi.org/10.1111/avsc.12345>.
7. Карамышева З.В. Степная растительность Казахстана: некоторые итоги и перспективы исследования / З.В. Карамышева // Мат. межд. конф. Геоботанические исследования в семиаридных и аридных регионах: современное состояние, проблемы и перспективы. Алматы, 2001. С. 25–29.
8. Pandit Karun. Understanding the effect of fire on vegetation composition and gross primary production in a semi-arid shrubland ecosystem using the Ecosystem Demography / Karun Pandit, Hamid Dashti, Andrew T. Hudak Nancy F. Glenn, Alejandro N. Flores, and Douglas J. Shinneman // *Biogeosciences*. 2021. № 18. Pp. 2027–2045.
9. Краснощеков Ю.Н. Постпирогенная дигрессия лесных экосистем в горном Прибайкалье / Ю.Н. Краснощеков, М.Д. Евдокименко, А.А. Онучин // *Сибирский лесной журнал*. 2018. № 6. С. 46–57.