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КАРАТАУ ТҮШТҮК ТОО КЫРКАЛАРЫНЫН АНТРОПОГЕНДИК БУЗУЛГАН АЙМАКТАРЫНДА ӨСҮМДҮКТӨРДҮН ҮСТӨМДҮК КЫЛУУЧУ ТҮРЛӨРҮНҮН АБАЛЫН БААЛОО

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ОЦЕНКА СОСТОЯНИЯ ДОМИНИРУЮЩИХ ВИДОВ РАСТИТЕЛЬНОСТИ В АНТРОПОГЕННО НАРУШЕННЫХ ТЕРРИТОРИЯХ ЮЖНОГО СКЛОНА КАРАТАУ

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ASSESSMENT OF THE STATE OF THE DOMINANT VEGETATION SPECIES OF ANTHROPOGENIC DISTURBED AREAS OF THE SOUTHERN SLOPE OF THE KARATAU RIDGE

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Макалада аймактын өсүмдүктөр дүйнөсү жана өсүмдүктөрдүн катмары, ошондой эле өсүмдүктөрдүн басымдуу түрлөрү каралат. Өсүмдүктөр жамаатта-рынын тобунун түзүмү жана курамы, антропогендик факторлордун таасири менен өсүмдүк жамааттар-дын алмашуусу, анын ичинде өнөр жай ишканаларынын булгоочу чыгындылары, ошондой эле айрым түрлөрү-нүн реакциясы айлана-чөйрөнүн булганышына тийгиз-ген таасири экотоптордун экологиялык шарттарына жараша изилденген. Табигый экосистемада өсүмдүк-төр катмары өнөр жай объекттеринин техногендик чыгындылары оор металлдардын иондорунун негизги ажыратуучу булагы болуп саналат. Ушуга байланыш-туу өсүмдүктөрдүн организминде химиялык элемент-тердин ар кандай экзогендик жана эндогендик транс-формация жүрүүсү башталат, алар өсүмдүктөрдү флорасынын түзүмүнүн жана фито ар түрдүүлүгүнүн, жамааттардын өндүрүмдүүлүгүнүн бузулушуна алып келет. Демек, ар кандай жаратылыш катаклизмдери пайда боло баштайт, алар чаң-чапкын бороон, чөлгө айлануу, топурактын түшүмдүүлүгүнүн начарлашы жана башкалар.

Негизги сөздөр: *өсүмдүктөр, антропогендик фактор, экосистемалар, металл мазмуну, таасири, өсүмдүктөр, чөл.*

В статье рассматриваются флора и растительный покров территории, а также доминирующие виды растений. Изучались состав и структура растительных сообществ, смены растительных сообществ под влиянием антропогенных факторов, в том числе выбросов промышленных предприятий, а также реакция отдельных видов на воздействие загрязнения окружающей среды в зависимости от экологических условий экотопов. В природной экосистеме растительный покров является главным сорбирующим источником ионов тяжелых металлов техногенного выброса промышленных объектов. В связи с этим в организме растений начинают происходить различные экзогенные и эндогенные трансформации химических элементов, приводящие к нарушению структуры растительности флоры и фито разнообразия, продуктивность сообществ. Соответственно начинают происходить различные природные катаклизмы в виде пыльных бурь, опустынивание, ухудшение плодородности почв и другие.

Ключевые слова: *растительность, антропогенный фактор, экосистема, содержание металла, влияние, флора, пустыня.*

The article deals with the flora and vegetation cover of the territory, as well as the dominant plant species. The composition and structure of plant communities, changes of plant communities under the influence of anthropogenic factors, including industrial emissions, as well as the reaction of certain species to the impact of environmental pollution depending on the environmental conditions of ecotopes were studied. In the natural ecosystem, vegetation cover is the main sorbing source of heavy metal ions of industrial emissions. In this connection, various exogenous and endogenous transformations of chemical elements begin to occur in the plant organism, leading to disruption of the vegetation structure of the flora and phyto diversity, the productivity of communities.

Key words: *vegetation, anthropogenic factor, ecosystem, metal content, influence, flora, desert.*

Introduction. In the natural ecosystem, vegetation cover is the main sorbing source of heavy metal ions of industrial emissions. In this connection, various exogenous and endogenous transformations of chemical elements begin to occur in the plant organism, leading to disruption of the vegetation structure of the flora and phyto diversity, the productivity of communities. A distinctive feature is that in the territories of our Republic the degree of environmental pollution is varied, therefore the influence of anthropogenic factors on vegetation is unequal.

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To such an object that pollutes the environment is Bayaldyrsk lead-zinc tailing Kentau concentrator of the plant Achpolimetall, located near the city of Kentau. The number of tailings dumps of lead-zinc ores of the tailing is about 150 million tons with twenty varieties of flotation and aerating reagents, of inorganic and organic origin, added in the process of enrichment of lead-zinc ores. Physical and chemical characteristics of flotation reagents used in the process of enrichment of ores are considered to be particularly toxic, and occupy about 333.0 hectares of land in the south-western part of Kentau with open surfaces. Thus, in windy weather, a wind rose forms particles of tailings dumps, which covers the city of Kentau with its surroundings and the city of Turkestan with several settlements. At the same time, industrial emissions of Kentau excavator and transformer plants, as well as TEZ-5, to the atmosphere aggravate and aggravate the environmental situation in this region.

Materials and objects of research. The object of the study was the vegetation cover, namely, endemic plant species in the gorges of Bayaldyr, Biressek and Khantagi. The collection of samples of endemic plant species was collected from among the dominant phytocenoses of the Karatau Mountains, mentioned above. For analysis, averaged sample of a particular species was taken from plant organs. Samples were cleaned from soil lumps and dried in a dark place, then crushed. Preparation and analysis was carried out in the laboratory of physical and chemical research methods of the biological faculty of the Kazakh National University named after al-Farabi. Qualitative and quantitative analyzes of lead, zinc and copper were determined on an MGA-915MD atomic adsorption spectrometer. To determine the plants, an illustrated determinant of Kazakhstan plants was used [1].

Research results. The purpose of this study is to study the emissions of the industry of the city of Kentau and the salts of heavy metals, the open tailing of Bayaldyr on the species composition of vegetation, in the growing canyons of Khantagi, Biressek and Bayaldyr.

The study was carried out at the baldyr tailing of lead-zinc ores by the Kentau concentrator. In this regard, the tailings we examined were conditionally divided into three sectors: 1) fresh drainage water coming from the concentration plant; 2) stale pond on the surface (old drainage) of the tailing and 3) mine water. During the microbiological examination, 5 samples of mine water and water from the tailings storage dumps were taken. The obtained data of physicochemical characteristics indicate high mineralization of the sample due to the dissolution of oxidized forms of minerals due to the addition of flotation reagents of organic origin, such as T-66, T-80.

Table 1

The chemical composition of the tailings of enrichment tailings Kentau concentrator

Products	%	Products	%
Pb	1.88	SiO_2	54.75
Zn	4.90	$PbSO_4$	0.32
Fe	7.13	$PbCO_3$	0.52
FeS_2	11.25	PbS	0.95
$S_{general}$	8.90	Pb	0.11
S	8.46	$ZnSO_4$	сл.
MgO	0.45	$ZnCO_3$	0,73
CaO	4.89	$ZnSiO_3$	0,33
Al_2O_3	4.64	ZnS	3,84

Table 1 describes butyl xanthate and inorganic origin $ZnSO_4$, $CuSO_4$, $FeSO_4$, Na_2CO_3, Na_2S, NaCN, Na_2SiO_3. The content of sulphates reaches 2.37 g / l, carbonates - 0.25 g / l. All iron is in oxidized form.

During this survey, the waters of the tailings had a predominantly neutral and slightly alkaline reaction (pH 7.5-8.2). In a quantitative ratio of the content of ammonium ions in the water of the old discharge of the tailing dump is 0.6 mg / l, in the water of the new discharge of the tailing storage facility 2.0 mg / l, in the mine water 0.2 mg / l. Nitrite ions contain from 0.15 to 0.5 mg / l. As is known, in the process of enrichment of lead and zinc, potassium cyanide or sodium is used as a flotation depressant. Thus, at all sampled points, qualitative analyzes showed the presence of ammonium and nitrite ions. Apparently, this is due to the fact that there is a pumping station in the interval between the processing plant and the tailing pond, where ammonium sulphate $(NH_4)_2SO_4$ and soil are additionally added.

Table 2

Results of chemical analysis of the Bayaldyr tailing

Sampling points	T°	NH_4^+	NO_2^-	CN^-	CNS^-
Water from:					
Old tailings dump	19	0.6	0.5	не	обнар
New tailings dump	17	2.0	0.4	0,8	-
Top layer of pond	20	-	-	-	-
Mine water	18	0.2	-	не	обнар

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In the bed of the old plum of the Bayaldyr tailing, where there were vegetable thickets, black sludge formed by the consistency as a resin with a noticeable odor of hydrogen sulfide. Some parts of the coast, where the accumulation of organic matter leads to particularly intensive sulphate reduction, are practically lifeless due to the toxic effect of hydrogen sulfide.

The rivers Kantagi, Biressek and Bayaldyr take their origin from the ridge of the Karatau ridge. In the upper valleys of the narrow, canyon-shaped, often with significant differences in height, picturesque waterfalls are formed. The lower parts of the valleys are usually more gentle and wide. Only in some places, the rivers flow in narrow rocky clamps, where powerful water flows form rather deep hollows.

On the basis of the laboratory of biogeochemistry of metals at the Research Institute of Biotechnology of Zhetysu State University, the content of lead, copper and zinc in plants growing in the industrial landscape canyons of Khantaghi, Biresek and Bayaldyr in the city of Kentau was investigated. The true endemic species of this region are the representatives of *Tulipa alberti* - Alberta tulip, *Spiraeanthus shrenkianus* - Shrenk's blossoms, *Prangos equisetoides* - parangos horsetail, *Cotoneaster karatavicus* - dogwood Karatau, *Scutellaria karatavic* - Karatau skullcap [2].

Tulipa alberti	***Spiraeanths shrenkianus***	***Prangosequisetoides***	***Cotoneaster karatavicus***	***Scutellaria karatavic***

Figure 1. Representatives of some endemic plant species in the Karatau gorges adjacent to the city of Kentau.

Adjacent to the border of Kentau are the Khantagi, Biresek and Bayaldyr gorges, which originate from the tops of Karatau Mountain. We believe that the main polluting sources of the environment in Kentau and the above gorges are mainly TEZ-5 in Kentau, which is located on the northern side of the city, namely directly in the Khantagi gorges (Fig. 2).

Figure 2. Land cover study sites. *Note:* 1-gorge Khantagi, 2-gorge Biresek, 3-gorge Bayaldyr, 4-tailing Bayaldyr.

The purpose of TEZ-5 in Kentau is to generate electricity and heat supply. TEZ-5 releases into the atmosphere ash, dust, oxides of nitrogen, sulfur, carbon, ash fuel oil, hydrocarbons, oxides of nitrogen, chromium, nickel, silicon, manganese, carbon, dust, wood and abrasive, welding spray and hydrogen fluoride.

To identify the dependence of their accumulation, in the urban environment, we studied the lead content in individual organs below the plants listed. Data on the amount of lead in plants is presented in Fig.5. As can be seen from Figure 5, the skullcap Karatau, Alberta tulip and Shrenk's blossoms, selected in the gorges of Biresek and Khantaghi, accumulate lead to a high degree. Excess toxicity was observed in the leaves of representatives of the species Kizilnik Karatau, which amounts to 16.8 mg / kg.

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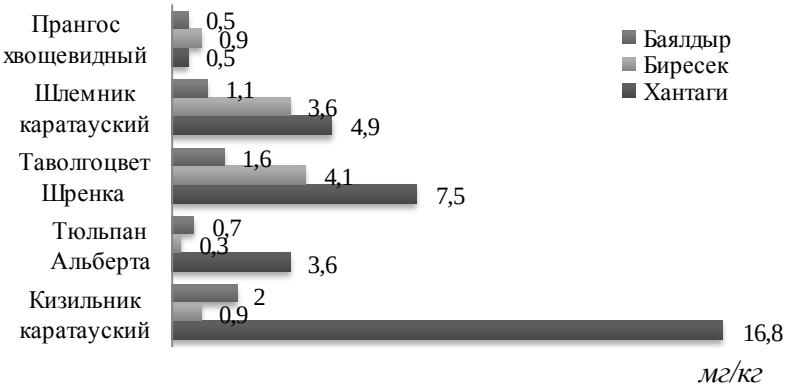

Figure 3. Lead content in the leaves of endemic plants in the Khantagi, Biressek and Bayaldyr gorges. MPC: lead -5.0 mg / kg Pb.

At the same time, lead from the representative of prangos is horsetail, in the above mentioned gorges, they accumulate in the smallest amount - 0.5-0.9 mg / kg Pb. A similar indicator can be observed in Karatau cotoneaster, the Biresek gorge -0.9 mg / kg Pb, also, in the Albert tulip in the gorges of Biresek and Bayaldyr - 0.3-0.7 mg/kg Pb.

Copper belongs to the class of heavy metals. As part of tailings dumps of lead-zinc ores of the Bayaldyrsky tailings, they are found in sufficient quantity [3]. As can be seen from Figure 6, the amount of copper in the leaves of endemic plants in the gorges of Khantagi, Biresek and Bayaldyr is heterogeneous. The highest content of copper is accumulated by the dogwood Karatau. Their number among representatives of Khantagi and Biresek is 7.8 and 8.2 mg/kg Cu, respectively (Fig. 6). The tail-shaped Prangos, the isolated Biresek gorge, is in the amount of 6.7 mg/kg, whereas the long shrenka color of their number reaches 5.0 mg / kg Cu.

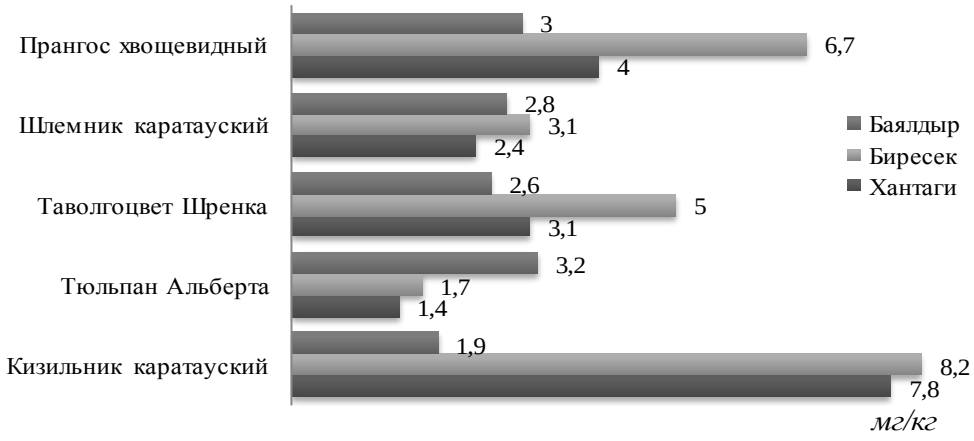

Figure 4. The copper content in the leaves of endemic plants of the gorges of Khantagi, Biresek and Bayaldyr. MPC: copper - 3.0 mg / kg.

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The specified amounts of copper containing in plants are dominated by MPC 2.0-2.5 times. It should be noted that the Alberta tulip, collected in the Bayaldyr gorge, the shrenk flowers of the shrenk selected in the Khantaga gorge and the Karatau skullcap from Biresek, the amount of copper in the leaves is within the allowable concentration, i.e. 3.2; 3.1 and 3.1 mg / kg Cu, respectively. MPC Cu - 3.0 mg / kg (Figure 4). The remaining representatives of the plants have a copper content below the maximum permissible concentration (from 1.4 to 2.8 mg / kg Cu).

Figure 7 shows the amounts of zinc content in the leaves of endemic plants of the Bayaldyr Gorge. It should be noted that the data presented in Figure 7, in terms of quantity, does not exceed the MPC. The MPC Cu value is 30.0 mg / kg.

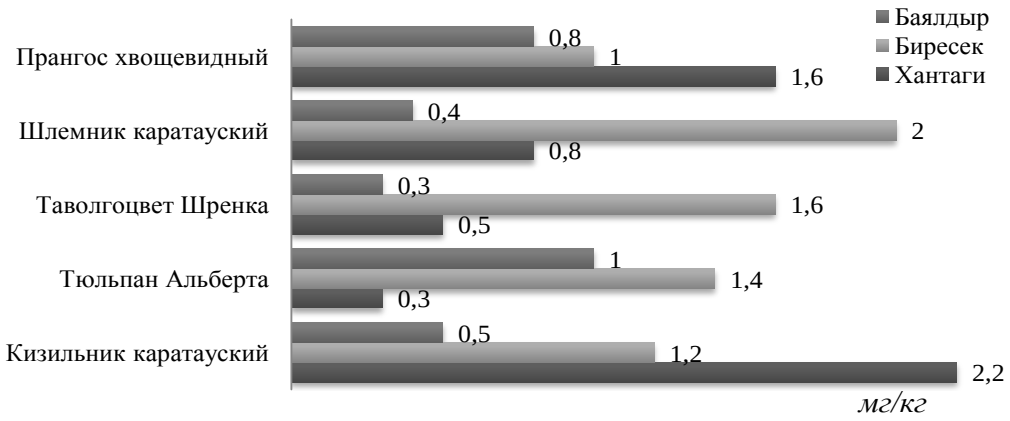

Figure 5. Zinc content in leaves of endemic plants of the Bayaldyr gorge.
MPC: zinc - 30.0 mg / kg.

The zinc (Zn) content is relatively high at the Karatausky cotoneaster (2.2 mg / kg Zn) selected in the Khantagi gorge. Zinc accumulates in the skullcap Karatau, allocated in the gorge Birsek, in the amount of 2.0 mg / kg Zn. In other types of plants, above the specified gorges, we find in insignificant quantity (from 0.3 to 1.0 mg / kg Zn) [4].

Thus, the different metal content in plants is explained by the fact that different plant species have different accumulative and selective ability and mechanisms of their resistance to metals. Our research has shown that the vegetation cover of the work area is influenced mainly by dust of varying degrees of dispersion, heavy metals contained in it.

As a result of chemical exposure, the resistance of plants and contaminated areas to adverse factors - climatic, biotic, anthropogenic - is reduced. External manifestations of impact are absent or are expressed in browning of leaves, twisting, burns, ugly growth forms, necrosis of leaf edge necrosis or needles dechromation.

Damaged leaves contain 2-3 times more Pb, 2 times more Cu and Zn. Increasing the area of leaf damage (or needles) causes premature defoliation; in severe cases, the death of plants occurs.

The long-term impact of a combination of anthropogenic factors leads to a change in the composition of phytocenoses to low-productive and low-species communities, as a result - to the formation of industrial wastelands.

In our conditions, within a radius of 5.0 km from industrial enterprises, premature drying and wilting of leaves and leaf necrosis were observed [5].

The Karatau Ridge, by its physiographic characteristics, is a gentle low foothill area. Along the river beds of the Inkai River there are tugai stripes. The number of endemic species and plants reaches 9.0%, this is one of the richest endemic areas in the world [6]. Despite the general dryness of the region, almost every gorge has a small river or stream. Due to this, they form the original microclimate, a kind of plant and animal world.

Conclusion. The article considered the flora and vegetation of the territory, as well as the dominant plant species. We studied the composition and structure of plant communities, the change of plant communities under the influence of anthropogenic factors, including emissions from industrial enterprises, as well as the reaction of certain species to

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the effects of environmental pollution depending on the ecological conditions of ecotopes.

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