



Studying of Plants Populations in the Conditions of Industrial Pollution in the Neighborhood of the Cities of the Karaganda Region

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Abstract

Objective

In the article the results of studying of structure of plant populations are given in the neighborhood of the industrial cities of Temirtau, Balkhash, Zhezkazgan and in adjacent territories.

Methods

Field researches were conducted route-recognistic and semiportable methods. For each vegetable community established full floristic structure, determined phases of phenological development of separate species, their vital state, abundance (by a scale of Drudae), placement, morphometric parameters (height, development). Population density was estimated on the basis of data on a projective covering of vegetation. The age structure of communities we studied with application of methodological recommendations of R. Rabotnov. Reference of plants to this or that age state - based on a complex of qualitative morphological features the fresh and herbarized plants.

Results

It has defined that round the industrial cities there is a loss long-term long vegetative elements, the share the ruderal grassy one-year elements increases.

Conclusion

The carried-out analysis of a ratio a bio morph showed considerable changes and in the ratio trees, bushes, semi-low shrubs, grassy perennials and annual and biennial plants.

Keywords

Plant community; Bio morphs; Industrial pollution; Ruderal species

Introduction

Present days the human population fully felt to global ecological crisis, which unambiguously indicates anthropogenous intoxication of the biosphere, fast reduction of a biodiversity, degradation of natural ecosystems on huge spaces [1].

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The vegetation is the main functional unit of any ecosystem. It carries out a role of the bioecological indicator, participates in formation of soils, and influences circulation of substances in the nature. In the nature, the vegetation can be considering the first indicator of ecological destabilization of ecosystems. On a current state of vegetable communities, their floristic and societal variety it is possible to judge the speed and an orientation of anthropogenous and anthropogenous and stimulated processes, dynamics of other components of an ecosystem (the soil, soil and a surface water).

The purpose of the present research was to compare structure of populations of plants in the neighborhood of the industrial cities of Temirtau, Balkhash, Zhezkazgan and on adjacent uncontaminated territories.

Materials and Methods

Field researches were conducted route-recognistic and semiportable methods [2]. Definition of plants carried out on "Flora of Kazakhstan" [3-11]. For each vegetable community established full floristic structure, determined phases of phenological development of separate species, their vital state, abundance (by a scale of Drudae), placement, morphometric parameters (height, development).

Population density we estimated to the basis of data on a projective covering of vegetation [12,13]. So, the low density of population was defined at a projective covering of vegetation to 20%, average – at a projective covering from 20 to 40%, high – is higher than 40%.

The age structure of communities we studied with application of methodological recommendations of Rabotnov [14]. Reference of plants to this or that age state - based on a complex of qualitative morphological features the fresh and herbarized plants.

Results and Discussion

Studying of components of communities in the territory of industrial zones of the cities and at distance from 5 to 40 km is carried out. As an inspection zone is described undisturbed plant communities.

It is noted, on control points the number of components in communities fluctuated from 12 to 47 species. The most widespread species were *Caragana frutex*, *Spiraea hypericifolia*, *Stipa valesiaca*, *Agropyron cristatum*, *Lonicera tatarica*, *Thalictrum simplex* and others.

The analysis of a ratio of vital forms of plants showed the following: the share of trees and bushes makes not less than 3-5%, semi-bushes and semi-low shrubs were 20-25%, grassy perennials plants were 55-60%, grassy annual and biennial plants were 5-10% (Figure 1).

The ratio of elements of natural vegetation and weed ruderal species was analyzed. It was revealed (Figure 2) that in nature the share of elements of natural vegetation made about 80-85%, and a share weed-ruderal plant was 15-20%, respectively.

In process of the movement from steppe part towards the industrial cities is noted progressing of processes of techno genic desertification.

Comparison of communities showed that in vicinities of industrial centers loss of elements of natural flora and replacement by a weed-ruderal species. They are steadier against anthropogenous influence (Table 1).

So, natural coenopopulations replaced on *Herba varia* – Weed, Weed and Wormwood, Weed-Wormwood-*Herba varia* and Weed-ruderal. Thus, round the industrial cities there is a loss of long-term-vegetative elements, the share of the ruderal grassy annual elements increases.

The conducted analysis of a ratio a bio morphs showed considerable changes and in the ratio trees, bushes, semi-shrubs, grassy perennials and annual plants. Directly in the territory of the cities and in their vicinities trees and bushes, afterwards semi-shrubs and grassy perennials, in particular, tussock and rhizomes plants (presented *Stipa capillata*, *Festuca valesiaca*, *Agropyron cristatum*, *Eremopyrum triticeum* and *E.orientale*) disappear.

In process of removal from industrial centers, there is a restoration of elements of a vegetable cover (Table 2).

There is a change of common projecting cover (CPC) in the various habitats. So, in vicinities of industrial centers of CPC of vegetation isn't great that makes from 10-15 to 40-50%, while in places of natural dwelling (in undisturbed territories) CPC – from 40 to 80% (Figures 3 and 4).

It is defined that extent of anthropogenous transformation due to influence of industrial centers observes in various points from low

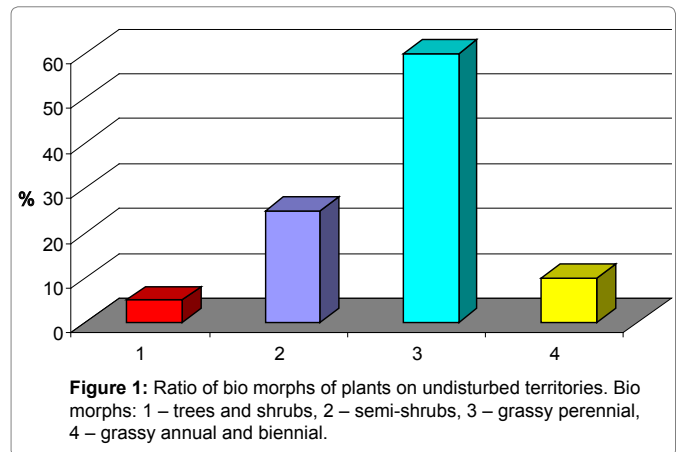


Figure 1: Ratio of bio morphs of plants on undisturbed territories. Bio morphs: 1 – trees and shrubs, 2 – semi-shrubs, 3 – grassy perennial, 4 – grassy annual and biennial.

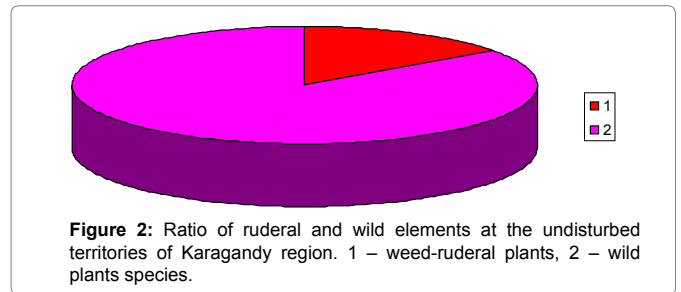


Figure 2: Ratio of ruderal and wild elements at the undisturbed territories of Karagandy region. 1 – weed-ruderal plants, 2 – wild plants species.

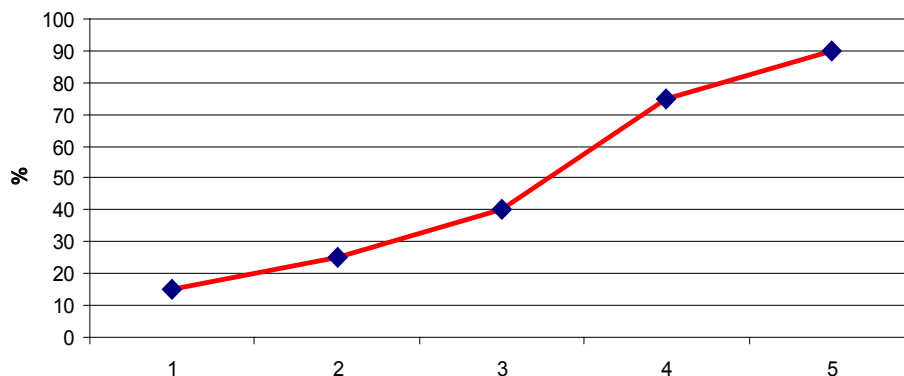


Figure 3: Increasing of common projecting cover of vegetation cover in dependence from increasing of distance from Balkhash city. 1 – Surrounding of industrial centers, 2 – distance from 1 to 5 km, 3 – distance from 5 to 10 km, 4 – distance from 25 km, 5 – distance from 40 km.

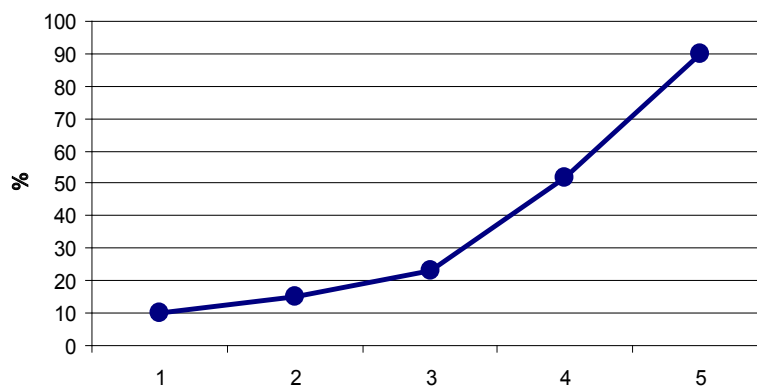


Figure 4: Increasing of common projecting cover of vegetation cover in dependence from increasing of distance from Zhezkazgan city. 1 – Surrounding of industrial centers, 2 – distance from 1 to 5 km, 3 – distance from 5 to 10 km, 4 – distance from 25 km, 5 – distance from 40 km.

Table 1: Ratio of elements of natural and weed vegetation on the studied communities.

Name of coenopopulation	Share of elements of natural vegetation, %	Share of weed-ruderal species, %
Surrounding of Balkhash city		
Cereal – Weed – <i>Herba varia</i>	75,0	25,0
Weed – Wormwood – <i>Herba varia</i>	10,0	90,0
Surrounding of Zhezkazgan city		
<i>Herba varia</i> – <i>Caragana frutex</i>	82,0	18,0
Surrounding of Temirtau city		
Weed	8,0	92,0
<i>Herba varia</i> – <i>Cereal</i>	73,0	27,0
<i>Patrinia intermedia</i> – <i>Caragana frutex</i>		
<i>Herba varia</i> – <i>Cereal</i>	100	0
<i>Herba varia</i> – <i>Fragaria viridis</i>	96,0	4,0
<i>Herba varia</i> – <i>Spiraea hypericifolia</i>	87,0	13,0
<i>Herba varia</i> – <i>Cereal</i>	85,0	15,0
<i>Herba varia</i> – <i>Medicago falcata</i> – <i>Fragaria viridis</i>	92,0	8,0
<i>Herba varia</i> – <i>Caragana frutex</i> + <i>Spiraea hypericifolia</i>	82,0	18,0
<i>Herba varia</i> – <i>Carex diluta</i>	80,0	20,0
<i>Lonicera tatarica</i> – <i>Cereal</i>	90,0	10,0
<i>Caragana frutex</i> – <i>Agropyron cristatum</i>	100	0
<i>Caragana frutex</i> – <i>Spiraea hypericifolia</i> – <i>Scabiosa isetensis</i>	84,0	16,0
	100	0
	100	0

Table 2: Dynamics of bio morphs of plants (in % from the general projective covering).

Bio morphs	Undisturbed territories	Balkhash surrounding	Zhezkazgan surrounding	Temirtau surrounding
Trees	5-7	0	0	0
Bushes	18-20	3-5	0	0
Semi-shrubs	65-70	5-8	3-5	3-5
Tussock plants	45-50	10-15	10-12	10-15
Rhizomes perennial plants	20-25	12-14	12-15	0
Annual and biennial plants	10-15	80-85	60-75	85-100

(10-30%) to average (about 50%) and high (60-80%). In vicinities of industrial regions 90-100% transformation of a vegetable cover is observed.

Conclusion

Thus, the studied communities are in various states: from background (similar to control sites) and the natural vegetable cover which partially degraded before elimination.

It is defined that round the industrial cities there is a loss long-term vegetative elements, the share of weed and grassy one-year elements increases.

The carried-out analysis of a ratio a bio morphs showed considerable changes and in the ratio trees, bushes, semi-low shrubs, grassy perennials and annual and biennial plants.

Directly in the territory of the cities and in their vicinities trees and bushes, afterwards semi-bushes, semi-low shrubs and grassy perennials, in particular, and tussock and rhizomes plants disappear.

In process of removal from industrial centers, there is a restoration of elements of a vegetable cover.

There is a change and CPC in the various habitats. For example, in surrounding industrial centers of CPC of vegetation it isn't great that makes from 0 to 40%, while in places of natural dwelling (in undisturbed territories) SPS – from 40 to 80%. Extent of

anthropogenous transformation of a vegetable cover defined: from low (0-30%) to average (about 50%) and high (over 60%).

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