



Ecological and economic assessment of agricultural lands contaminated with heavy metals for rational use of natural resources

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Ecological condition of soil cover

Ecological condition of soil has a huge impact on productivity of crops - the normative yield. It, in turn, is the initial indicator in determining *the normative price of the land*.

The ecological condition of the lands includes: soil erosion, aridization, degradation, chemical contamination of lands, the consequences of using pesticides.

Soil pollution – the accumulation in it of harmful substances and organisms, due to anthropogenic activity, in such quantities that lower its main quality index – fertility, as well as technological, nutritional and sanitary-hygienic value of cultivated crops, their quality.

According to the land balance data, as of November 1, 2015, there are 247.7 thousand hectares of disturbed lands in the republic, on which are placed dumps of overburden and rocks, tailing dumps, ash dumps, coal and mining quarries, oil fields and barns. The greatest number of the disturbed lands located in Karaganda, Kostanai, Mangistau, Akmola, East Kazakhstan, Aktobe, Pavlodar regions.

Table 1. Areas of eroded agricultural lands on November 1, 2015, thous. Ha

Name of regions	Total eroded agricultural land	including			Total eroded arable land	including			Degree of erosion of arable land	
		eroded	deflated	affected by water and wind erosion		смытые	deflated	affected by water and wind erosion	low	medium and strong
Akmola region	571,6	562,0	9,6	–	352,2	351,3	0,9	–	317,9	34,3
Aktobe region	2 582,5	473,1	2 101,1	8,3	34,2	34,2	–	–	33,4	0,8
Almaty region	5 767,9	815,5	4 952,4	–	98,2	58,2	40,0	–	85,8	12,4
Atyrau region	3 133,9	–	3 133,9	–	–	–	–	–	–	–
East Kazakhstan	1 292,6	426,6	864,5	1,5	247,9	235,1	12,2	0,6	234,0	13,3
Zhambyl region	2 636,7	222,7	2 414,0	–	54,3	52,7	1,6	–	52,8	1,5
West Kazakhstan	1 875,9	274,5	1 409,5	191,9	172,6	72,6	4,4	95,6	49,7	27,3
Karaganda region	960,1	200,4	759,7	–	111,3	83,2	28,1	–	95,7	15,6
Kyzylorda region	2 849,6	2,9	2 846,7	–	–	–	–	–	–	–
Kostanay region	769,9	158,7	611,2	–	93,5	63,4	30,1	–	77,5	16,0
Mangistau region	1 456,3	800,0	656,3	–	–	–	–	–	–	–

Pavlodar region	1 297,2	0,9	1 296,3	–	334,3	–	334,3	–	223,7	110,6
North-Kazakhstan	56,0	56,0	–	–	28,0	28,0	–	–	23,7	4,3
South Kazakhstan region	4 069,8	956,9	3 112,9	–	241,5	241,3	0,2	–	223,9	17,6
Almaty	0,1	0,1	–	–	–	–	–	–	–	–
Astana	–	–	–	–	–	–	–	–	–	–
Total	29 320,1	4 950,3	24 168,1	201,7	1 768,0	1 220,0	451,8	96,2	1 418,1	253,7

Only as a result of the activity of non-ferrous metallurgy enterprises, over 22 billion tons have been accumulated, including about 4 billion tons of mining waste, from toxic ones - over 1.1 billion tons of enrichment waste and 105 million tons of waste from metallurgical redistribution.

The area occupied by waste non-ferrous metallurgy is about 15 thousand hectares, of which 8,000 ha. of rock waste dumps, tailings of concentrating factories - about 6 thousand hectares and dumps of metallurgical plants - more than 500 hectares. The same amount of waste in the ferrous metallurgy and chemical industry.

In the East Kazakhstan region, the land is contaminated with compounds of copper, zinc, cadmium, lead, arsenic. Toxic waste is placed on landfills, which are not satisfying the sanitary and ecological requirements. Anomalies of lead cover the territory of Shemonaikha, Glubokovsky and Zyryanovsk regions. The area in the triangle between the cities of Ust-Kamenogorsk, Ridder, Zyryanovsk is the most unfavorable.

Modern methods of assessing land

The cost method is based on the calculation of the cost of reproduction of the estimated buildings and structures taking into account all types of depreciation and business profits;

the income method is based on the fact that the value of the property in which the capital was invested must correspond to the current the quality assessment and quantity of income that this property is able to bring;

the comparative method is based on information about recent transactions with similar facilities in the market and comparison of the property being valued with analogs.

The main problems in the assessment of contaminated land

the lack of a methodology for calculating emissions of heavy metals, which leads to a lack of a complete picture of what sources are being thrown out and for which they must report;

the lack of a methodology for assessing soils contaminated with heavy metals in the form of a regulatory document, where adequate corrections for pollution should be reflected. The current calculation methods allow obtaining estimates of polluting substances only with an appropriate degree of uncertainty.

strict laws and regulations in practice are not supported by real modern and complete methods for calculating all harmful substances contained in the emissions of enterprises.

Prof Oleg Gavrilenko
Lecture on “soils pollution of heavy metals, as one of the main factors of land degradation”

Abstract

Kazakhstan has a significant territory. The length of the country from east to west is 2,663 km, and from north to south - 1,652 km. As a result, Kazakhstan has quite a variety of landscapes: from highland glacial to desert. Nevertheless, most of the territory characterized by disturbed and degraded lands, which caused by both natural and agricultural and industrial factors. Natural factors caused by climate change, droughts, dust storms, desertification, waterlogging, torrential rains (flat flushing and erosion), hurricanes, mudflows, landslides, avalanches. The influence of agricultural activities manifested in the decline of the forest area, secondary salinization of soils and irrational management of agricultural work. Industrial influence manifested in the mining of mineral resources, pollution of soils with toxicants, the presence of water bodies, acid rain. For the Kazakhstan, the mining industry is a basic among industrial factors. The most significant land degradation occurs with the open mining of minerals and their processing. In this case, a large number of masses of rocks move in another place and many amount technogenic formations take up big areas. It maintain a negative effect on the environment, contaminating the land area with heavy metals. Metallurgical production aggravates the situation by increasing the load on nearby landscapes. At the same time, there is a significant degradation of land, which is associated with a decrease in the fertility of soil and the inability to produce qualitative agricultural products. Vision of the solution of problems in the near future is formation of public opinion on the need to prevent land degradation processes, obtaining knowledge and developing technologies aimed at preventing land degradation, training of specialists in the prevention of land degradation, implementation of methods for sustainable management of territories with degraded lands.

Marina Mizernaya

Lecture on “heavy metals in the soil of some North Eastern Kazakhstan cities”.

Abstract

The results of the ecological state of soil in the some cities of Kazakhstan studying are presented. The level of heavy metals disturbances of urban soil was evaluated. In Pavlodar and Semey cities was found similar forms of the compounds of copper in soils. The lead content was different in soils of different cities. Soil pollution of cities has base metal character and mosaic distribution, forming centers depending on the sources of emissions. The tested soil of cities in terms of the total soil contamination with the toxicity and amount of recorded metals is characterized as cadmium-lead.

Key words: soil, heavy metals, background levels, mobile forms, heavy metal compounds

Prof Andriy Bubnyak

The seminar is devoted to the possibility of using drones in Earth sciences and studying the degradation of lands in particular. The first part examines the technical characteristics of the drones and the software used for their management and processing of the results of shooting. In the second part of the report, we give examples and results of the use of quadrocopters to solve the problems of land degradation research. At the end of the report, the problem issues associated with the use of drones are discussed.

Andriy Bubnyak is a dean of the Faculty of Earth Sciences of the East Kazakhstan Technical University. His scientific interests include tectonics, structural geology, interpretation of seismic data, tectonic geomorphology, the creation of virtual models of outcrops, digital mapping.