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THE CAUSES OF DEGRADATION OF AGRICULTURAL LAND

Abstract

The article deals with the actual problem of degradation of agricultural land, one of the reasons for which is the anthropogenic activity of the population and the arid climate of the country.

As a result of urbanization and intensive agricultural land development in the south and east of the country, the natural vegetation cover is severely disturbed. The area of land occupied by mining enterprises is steadily growing. Over the past 10 years, the areas of oil and gas production, uranium ore mining, etc. Roads, pipelines and power lines, which are being laid at an ever-increasing pace, have a huge impact on the fauna. Land resources in the country are subject to structural and qualitative changes. The use of the existing model of agricultural development of raw materials leads to inefficient economic development and an ever-increasing burden on ecosystems.

The soil in Kazakhstan is very vulnerable, as it is comprehensively affected by various anthropogenic factors that lead to a constant deterioration of its quality. The current ecological situation in agricultural land use makes the problem of rational use of polluted lands relevant.

Key words: *agriculture, agricultural land, land management, environmental pollution, technogenic pollution, land protection, environment, natural resources.*

Introduction

Land as the main basis for all processes of society in the political, economic, social, industrial, environmental and other spheres has a value, an objective assessment of which is one of the most important conditions for the normal functioning and development of a multiform economy.

At present, pollution of the environment by wastes, emissions, sewage of all types of industrial production, agriculture, urban utilities have become global [1].

Recently, a steady trend of both qualitative land degradation and quantitative reduction in the area of agricultural land, including arable land, has been outlined and established. However, negative phenomena concerning the state of lands not only reduce the land and resource potential of the country and its individual regions, but also have a negative dynamic on the quality and quantity of other natural resources: water, forests, flora and fauna, etc. All these factors create the need to form such a system of land use, which would ensure rational, economically efficient and environmentally safe use of land resources.

The experience of the last decades shows an increase in the number of natural and anthropogenic disasters that have serious ecological and socio-economic consequences. Environmental risks associated with the presence of dangerous natural and anthropogenic factors are a prerequisite for the occurrence of disasters. Identification of the main environmental risks affecting the economy of Kazakhstan makes it possible to develop and implement a more effective state policy in the field of ecologization of the economy, production, development of nature-saving technologies, especially in the leading industries.

Environmental problems of the present time, their trends resulting from anthropogenic overload and irrational use of natural resources directly affected the condition of the soil cover in the territory of Kazakhstan. Disturbance of balance of ecological situation has led to degradation of soil cover in all natural zones of the republic. Self-renewal of soils has become an impossible phenomenon. At the moment there is an urgent need to develop a program of rational use, protection and restoration of natural disturbed soils, measures to prevent soil degradation, restoration of fertility of eroded and technogenically disturbed soils, as well as pastures and lands.

Under these conditions, land management is the main mechanism for organizing the rational use of contaminated land and mitigating the negative effects of pollution.

Materials and research methods

In the modern theory of land management, the questions determining its ecological and economic function as the effective mechanism of maintenance of ecological and economic balance of development of land tenure in the conditions of negative anthropogenic influences caused by pollution of environment are not sufficiently worked out.

In the course of the study various methods of economic research were used: economic-statistical - in the analysis and assessment of the current state, abstract-logical, used in identifying sectoral and regional peculiarities. In addition, the results of analyses and studies conducted by the authors of this article were used.

Land management in conditions of technogenic pollution of lands should be based on a comprehensive assessment of the pollution of the territory of the Republic of Kazakhstan, which will contribute to the organization of its differentiated use.

Research results

The main condition of carrying out land management on contaminated lands is ensuring a balance between economic aspirations of economic use of the territory and restoration, as well as preservation of the existing ecological systems disturbed as a result of pollution [2].

Statistically, the most productive, intensively used and densely populated lands are always the most exposed to pollution. In addition, these problems are exacerbated by a lack of financial resources to prevent and remediate the effects of pollution.

Everyone knows that the irrational use of land has led to a reduction in productive land, reducing its fertility and environmental degradation, which affect the reduction of agricultural production. According to researches of Russian scientists: Bogolyubov S.A., Vashukevich N.V., Kutliyarov A.N. and Kazakh scientists Kerimova U.K., Tireuov K.M., Pentaev T.P. [3,4,5,6], land is steadily continuing out of the balance of economic turnover, the level of soil fertility is falling, it is no longer a deterrent to production.

A large part of the country is occupied by arid or semi-arid ecosystems that are subject or have already suffered from land degradation. In particular, this applies to irrigated and rainfed cropland affected by salinization, soil erosion or loss of humus, as well as rangelands, which have been severely deteriorated by concentrated grazing on relatively small areas in the last decade, and forested areas degraded by illegal forest harvesting and fires. In Kazakhstan, about 14% of all pastures have reached an extreme degree of degradation. Most of these processes are observed in the areas of the Aral and Caspian seas and around lake Balkhash. The Northern Caspian Sea, area of Aral Sea, the delta of the Syrdarya river (Kyzylkum), the southern Balkhash deserts refer to a significant and high degree of land degradation under the influence of cattle grazing. Degradation of pastures occurs mainly in desert and semi-desert landscapes of Kazakhstan.

Land disturbance and degradation occur as a result of industrial activities. Degradation of pastures and arable lands is one of the priority national environmental problems. Extensive development of agricultural production in Kazakhstan has left a mark in the form of land degradation and impoverishment of landscapes. A significant part of the country's territory is subject to desertification, which leads to reduction of livestock and crop productivity. Over 40 years of exploitation of ploughed virgin and fallow lands as a result of wind and water erosion lost up to 1.2 billion tons of humus (Figure 1).

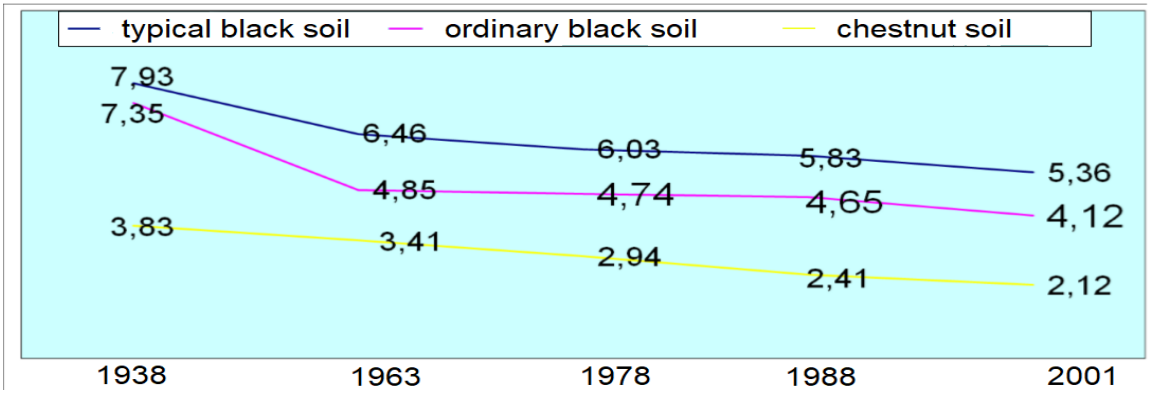


Figure 1 - Change of humus content in the main types of soils of Kazakhstan

Land is steadily continuing to withdraw from the balance of economic turnover, the level of soil fertility is falling, it is no longer a deterrent to production.

According to the data given below one can judge about the scope of anthropogenic human activity: the contribution of technogenic lead is 94 - 97% (the rest are natural sources), cadmium - 84 - 89%, copper - 56 - 87%, nickel 66 - 75%, mercury - 58%. Transportation is one of the main causes of air and soil pollution. Most heavy metals contained in dust and gas emissions from industrial enterprises are generally more soluble than natural compounds.

The trend of land contamination continues to grow. A 10-20% decrease in yields and suppression of plants is observed in the areas of most agricultural land suitable for agricultural production according to ecological parameters.

The volume of soil contamination significantly affects agricultural production. As a result, significant losses of crop production occur and their quality sharply deteriorates.

As a result of economic activities, the soil loses its fertility, degrades or is completely destroyed. This happens when human activity is irrational, environmentally unreasonable. To prevent the negative environmental consequences of human impact on the soil, it is necessary to pay the utmost attention to the issues of rational use and protection of soil.

In the areas of technogenic pollution of lands, first of all, in the course of land management, environmental problems must be solved, the implementation of which creates environmental and economic feasibility.

In order to improve environmental and economic efficiency, all actions related to land redistribution, organization of rational use of contaminated areas should be based only on land management projects, which brings to the forefront the problem of improving the theory and methods of land management design in areas of active man-made impact.

Anthropogenic pollution of lands, in the conditions of land management, should be based on a comprehensive assessment of territory pollution, which will contribute to the organization of its differentiated use. In this regard, based on the classification of pollutants, identification of the main sources of pollution of the territory of agricultural enterprises, establishment of the impact of pollution of soil, vegetation and air environment on agricultural production the system of indicators used in assessing its territory has been substantiated.

The result of this impact in most cases is the pollution of these environmental components and, as a consequence, deterioration of the ecological situation, reduced productivity of agricultural land, significant costs for the preservation, maintenance and restoration of the disturbed ecological balance of the environment.

The main condition of land management on contaminated lands is to ensure a balance between the economic aspirations of economic use of the territory and the restoration as well as preservation of the established ecological systems disturbed as a result of pollution. Currently, the leading factor of development and the basis of agricultural land use are technogenically modified agro-ecosystems.

The negative factor of technogenic impact on agroecosystems is pollution, which reduces their productive properties and limits the processes of self-regulation and other biosphere functions of agroecosystems, which causes significant damage to agricultural production and has a negative impact on the development of the environment and public health.

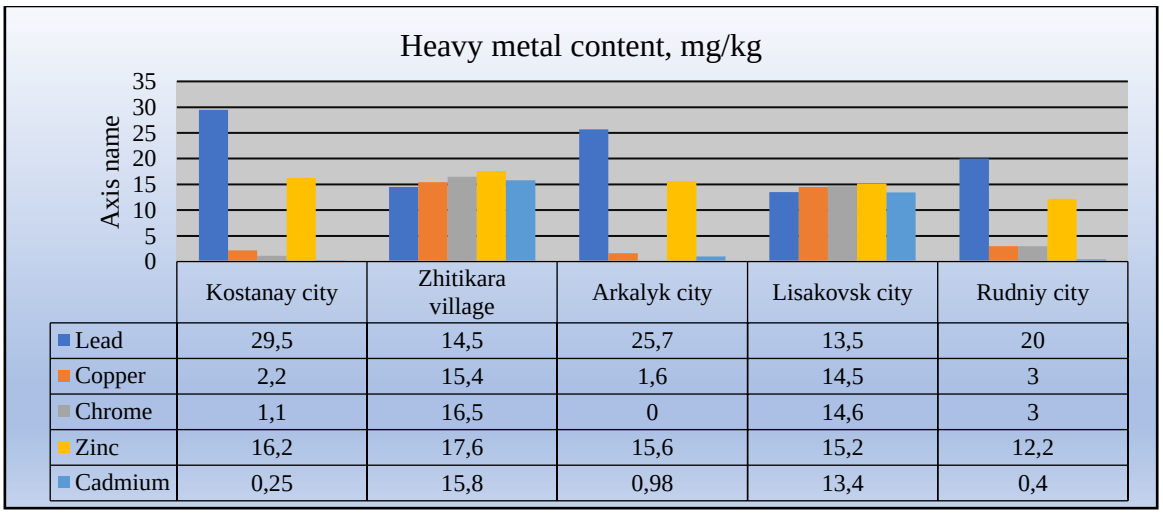
According to the land balance as of November 1, 2018, there were 248.42 thousand hectares of disturbed lands in the country, where overburden and rock dumps, tailings dams, ash dumps, coal and mining pits, oil fields and barns are located. The largest number of disturbed lands is located in Karaganda, Kostanay, Mangistau, Akmola, East Kazakhstan, Aktobe, Pavlodar regions [7].

The largest number of disturbed lands is in Mangistau (78.6 thousand hectares), Karaganda (45.3 thousand hectares) and Kostanay (37.8 thousand hectares) regions.

Technogenically polluted lands of Kostanay region are widespread in industrial areas of cities, mining and processing areas. In the region the issue of environmental pollution by the gold dumps of the Troitskaya GRES and the tailings of the Sokolovsko-Sarbaisky mining and beneficiation plant is acute. In republican volume of industrial production, the region accounts for 100% of production of iron-ore pellets, bauxites, asbestos. Enterprises of mining, processing industry, production and distribution of electricity, gas and water are functioning. Modern diversified industry is represented by combines, factories, modern small enterprises. About 700 enterprises employing more than 43 thousand people are engaged in industrial production.

Predominant impact on the condition of land resources of Kostanay region has enterprises of mining industry, agriculture, heat and power engineering. Technogenic disturbed and polluted lands are widespread in industrial zones of cities, places of extraction and processing of minerals. At open-cast mining on large territories there is alienation of lands for non-agricultural purposes: for quarries, dumps, tailings ponds, storages of mine and household water. All mining enterprises have a waste management system that includes all stages of the technological cycle of waste, such as prevention and minimization of waste generation, accounting and control, accumulation, as well as collection, processing, recycling, transportation, storage and disposal of production waste. [8,9]

Republican State Enterprise "Kazgidromet" conducts monitoring of soil conditions in 39 settlements in 14 regions of the republic and in the cities of Astana and Almaty. In Kostanay region land is polluted by compounds of copper, zinc, cadmium, lead and chromium. The following data on the state of soil contamination by heavy metals for the spring period of 2021 in Kostanay region according to the report of the branch of RGP Kazgidromet (Figure 2) [10].



	Kostanay city	Zhitikara village	Arkalyk city	Lisakovsk city	Rudniy city
Lead	29,5	14,5	25,7	13,5	20
Copper	2,2	15,4	1,6	14,5	3
Chrome	1,1	16,5	0	14,6	3
Zinc	16,2	17,6	15,6	15,2	12,2
Cadmium	0,25	15,8	0,98	13,4	0,4

Figure 2 - Status of soil contamination by heavy metals in Kostanay region in 2021

Ash and slag wastes from coal-fired power plants, placed in ash dumps, occupy large land areas. Ash removal and disposal is one of the main environmental problems of coal-fired power plants. The current practice of using hydraulic ash removal with subsequent storage of ash waste does not meet

the promising requirements and does not allow the effective use of ash and slag materials in the construction industry, leading to an increase in the accumulation of ash in the dumps by tens of millions of tons per year.

The land legislation of the Republic of Kazakhstan, regulates public relations in the field of use and protection of lands. Under its functional influence the land legal order is formed on the whole territory of the country. The land legal order is an important condition for economic and other activities of the peoples living in the relevant territory [11,12].

Thus, the issue of land protection in an aggravating environmental situation should become one of the most important areas of state policy, since improving the condition of the land opens up significant reserves to increase agricultural production and provides a significant improvement in the environmental conditions of human life.

Assessment of the condition of lands and the effectiveness of land protection activities shall be carried out with due consideration of environmental expertise, sanitary, hygienic and other norms and requirements established by legislation [13].

The introduction of new technologies, programs of land reclamation and improvement of soil fertility should be prohibited if they do not meet the environmental, sanitary, hygienic and other requirements stipulated by law [14, 15].

During construction and mining operations involving the disturbance of topsoil, the fertile soil layer must be removed and used to improve low-yield lands.

To assess the condition of the soil in order to protect human health and the environment, the Government should establish standards for maximum permissible concentrations of harmful substances, harmful microorganisms and other soil polluting biological substances. Soil, geobotanical, agrochemical and other surveys should be carried out to check the compliance of soil with environmental standards.

In order to prevent land degradation, restoration of soil fertility and contaminated areas it is possible to allow conservation of lands with their withdrawal from circulation in an order established by the Government.

Conclusions

Pollution of soils with heavy metals are industrial emissions, products of fuel combustion, agricultural chemicals, sewage. Even the use of high doses of fertilizers carries the risk of soil contamination.

The main conclusions are that the main levers of the organizational and economic mechanism of protection of agricultural lands from degradation are: land management, economic stimulation of rational land use and economic responsibility of owners, landowners and land users for violation of the established regimes of land use.

In order to obtain complete and objective data on land contamination it is necessary to carry out detailed ecological and geochemical studies throughout the republic, to develop recommendations on a systematic basis on the elimination and stabilization of negative impacts, using the latest technologies.

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ПРИЧИНЫ ДЕГРАДАЦИИ ЗЕМЕЛЬ СЕЛЬСКОХОЗЯЙСТВЕННОГО НАЗНАЧЕНИЯ

Аннотация

В статье рассматривается актуальная проблема деградации сельскохозяйственных земель, одной из причин которой является антропогенная деятельность населения и засушливый климат страны.

В результате урбанизации и интенсивного сельскохозяйственного освоения земель на юге и востоке страны естественный растительный покров сильно нарушен. Площадь земель, занятых горнодобывающими предприятиями, неуклонно растет. За последние 10 лет области добычи нефти и газа, разработки урановых руд и т.д. Дороги, трубопроводы и линии электропередач, которые прокладываются все возрастающими темпами, оказывают огромное влияние на фауну. Земельные ресурсы в стране подвержены структурным и качественным изменениям. Использование существующей модели сельскохозяйственного освоения сырья приводит к неэффективному экономическому развитию и постоянно возрастающей нагрузке на экосистемы.

Почва в Казахстане очень уязвима, так как на нее комплексно воздействуют различные антропогенные факторы, которые приводят к постоянному ухудшению ее качества. Текущая экологическая ситуация в сельскохозяйственном землепользовании делает проблему рационального использования загрязненных земель актуальной.

Ключевые слова: сельское хозяйство, сельскохозяйственные угодья, землеустройство, загрязнение окружающей среды, техногенное загрязнение, охрана земель, окружающая среда, природные ресурсы.

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АУЫЛ ШАРУАШЫЛЫҒЫ МАҚСАТЫНДАҒЫ ЖЕРЛЕРДІҢ ТОЗУ СЕБЕПТЕРІ

Аңдатпа

Мақалада ауылшаруашылық жерлерінің деградациясының өзекті мәселесі қарастырылады, оның себептерінің бірі-халықтың антропогендік қызметі және елдің құрғақ климаты.

Урбанизация және елдің оңтүстігі мен шығысындағы жерлерді қарқынды ауылшаруашылық игеру нәтижесінде табиғи өсімдік жамылғысы қатты бұзылады. Тау-кен кәсіпорындары алып жатқан жер көлемі тұрақты түрде өсіп келеді. Соңғы 10 жыл ішінде мұнай және газ өндіру, уран кендерін игеру және т.б. жолдар, құбырлар мен электр беру желілері өсіп келе жатқан қарқынмен салынып, фаунаға үлкен әсер етеді. Елдегі жер ресурстары құрылымдық және сапалық өзгерістерге ұшырайды. Шикізатты ауылшаруашылық игерудің қолданыстағы моделін пайдалану тиімсіз экономикалық дамуға және экожүйелерге үнемі өсіп келе жатқан жүктемеге әкеледі.

Қазақстандағы топырақ өте осал, өйткені оған әр түрлі антропогендік факторлар кешенді әсер етеді, бұл оның сапасының үнемі нашарлауына әкеледі. Ауылшаруашылық жер пайдаланудағы қазіргі экологиялық жағдай ластанған жерлерді ұтымды пайдалану мәселесін өзекті етеді.

Кілт сөздер: ауыл шаруашылығы, ауыл шаруашылығы алқаптары, жерге орналастыру, қоршаған ортаның ластануы, техногендік ластану, жерді қорғау, қоршаған орта, табиғи ресурстар.

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СУ РЕСУРСТАРЫН БАСҚАРУДА ПАЙДАЛАНЫЛАТЫН, ҚАШЫҚТЫҚТАН БАСҚАРАТЫН ҚҰРЫЛҒЫНЫҢ БАҒДАРЛАМАЛЫҚ ҚҰРЫЛЫМЫ

Аңдатпа

Жаңа экономикалық қатынастардың дамуы және меншік нысандарының алуан түрлілігі, су шаруашылығы мен мелиорация саласының техникалық және өндірістік әлеуетінің едәуір төмендеуі суды пайдалану процестерін метрологиялық қамтамасыз етудің түбегейлі жаңа әдістерін әзірлеу қажеттілігін туындатуда. Бұл суару жүйелері мен су шаруашылығы объектілеріндегі суды есепке алу және суды өлшеу саласына қатысты қазіргі таңдағы өзекті мәселелердің бірі болуда. Мақала авторларының зерттеулері бойынша, суару жүйелеріндегі технологиялық процестерді басқарудың отандық автоматтандырылған жүйелерін құру саласындағы белгілі және перспективалық әзірлемелер негізінде қазіргі заманғы жалпы су өлшеу құралдарын қолдана отырып, суару жүйелері үшін ақпараттық - өлшеу кешендерін құру бойынша ұсыныстар жасалынды.