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ANTHROPOGENIC IMPACT ON AGRICULTURAL LAND IN THE REPUBLIC OF KAZAKHSTAN

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Abstract
The purpose of the article is to consider the features of the anthropogenic impact on agricultural land in the Republic of Kazakhstan (RK).
The article deals with the current problem of agricultural land degradation, and desertification in Kazakhstan, where one of the causes is the anthropogenic activities of the population and the aridity of the country's climate.
Most of the territory of Kazakhstan is located in conditions highly vulnerable to anthropogenic desertification when in combination with natural factors of desertification the ecological situation is sharply deteriorating. Another cause of land degradation is urbanization and intensive degradation of desert habitats - unsystematic road network, regulation of river flows, illegal cutting of saxaul for firewood for sale. As a result of urbanization and intensive agricultural development of the foothill strip in the south and east of the country, the natural vegetation cover is highly disturbed. Roads, pipelines, and power lines, which are being laid at an increasing rate, have a great impact on the fauna. The area of land occupied by mining enterprises is steadily growing. In the last 10 years, the areas of oil and gas extraction, development of uranium ores, etc. in Western Kazakhstan, the Eastern Caspian Sea region, the Betpakdala desert, etc. have been sharply increasing.
As a result of insufficiently thought-out land management from water erosion 5.6 million hectares of arable land was affected and grain yield was reduced by 20-30%. Degradation of agricultural lands, including pastures, is 30-50% and higher %. in 9 of 14 regions of Kazakhstan.
The use of the existing model of agricultural development of raw materials leads to inefficient economic development and constantly increasing pressure on ecosystems.
The soil in Kazakhstan is very vulnerable, as it is comprehensively affected by various anthropogenic factors that lead to the constant deterioration of its quality. Soils near the Aral Sea and the Caspian Sea are subjected to the most intensive degradation, as wind erosion is widespread there.
Key words: agricultural land, degradation, anthropogenic impact, urbanization, soil erosion.

Introduction

Soils play an important role in ecosystem functioning. They provide provisioning ecosystem services such as water retention, regulating services such as carbon sequestration, and provisioning services such as nutrient cycling or habitat provision (Adhikari & Hartemink, 2016). Soils serve as archives of the customs and activities of humans over history and thus also provide cultural services (Yaalon & Arnold, 2000).
Soils have been widely transformed and degraded by human activities. The area occupied by soils that remain unmodified is decreasing, while recent rural outmigration and land abandonment provide new opportunities for soil restauration across a larger area. (Novák et.al, 2020)
The problem of land degradation or desertification is one of the most pressing problems of our time.
It is well known that irrational land use has led to a decrease in productive land, a decrease in its fertility, and a deterioration of the ecological situation, which affect the reduction of agricultural production. According to research by Russian scientists: Bogolyubov, Kutliyarov and Kazakh scientists Kerimova, Tireuov, Pentaev, the land is stably continuing to go out of balance of economic turnover, soil fertility level falls, it is not a deterrent for production anymore (Боголюбов, 2016).
Agriculture has an enormous impact on the ecological balance of much of the earth's surface. The limited natural land-resource potential for production purposes in agriculture causes the need to expand and develop the steppe and forest areas, which disturbs the natural balance, intensifies degradation processes, and reduces soil fertility. The desire to improve the agro-ecological condition of lands is based on the use of technogenic technologies leading to the destruction of land resources, and pollution of the atmosphere, water sources, and forest areas. Water erosion and deflation of soils develop, desertification of lands increases, production decreases, and its quality decreases. The current rate of erosion on agricultural land

is an order of magnitude higher than the rate of natural erosion or soil formation processes (Wall et.al, 2012) This requires a new approach to the technology of production of agricultural products and raw materials for industry, improving the environmental quality of food.
The Republic of Kazakhstan is the ninth largest country in the world in terms of land area. Its territory is characterized by deserts, semi-deserts, and steppes, which in combination with arid and continental climate determines the vulnerability of ecosystems to desertification/land degradation processes. Another factor influencing the aggravation of the problem is anthropogenic activities. (Yaalon, 2000)
The country's territory is more than 90 percent plain, with high mountains in the south-eastern and eastern parts of the country. A large part of the country is covered by arid natural zones (deserts, semi-deserts, dry steppes), while wet steppes and forest-steppes are found only in the northern region. (Материалы Республиканской научно- теоретической …, 2013)

Research methods and materials

There were used different methods to write the article. The economic-statistical method was used to analyze and assess the current state of agricultural land in RK. There was a summary and grouping of materials from various reports from 2019 to 2021 related to land management in Kazakhstan. Also, the abstract – logical method was used to identify sectoral and regional features.
Scientific conclusions and positions of foreign scientists of directions on the formation of land use based on the regulation of land relations were important methodological part of the research. The research is based on principles of the system approach and the techno-economic analysis of the results of research of experts in the field of land use in foreign countries.

Discussion and results

Soil salinization, water and wind erosion, reduction of humus, and secondary salinization at water discharge after irrigation are observed on more than 90% of the arable soils of the republic. The problems of irrational use of land in livestock and pasture management are currently aggravated by the large number of small agro-industrial and livestock formations, which do not have sufficient resources to fully manage the territories. (Kazakhstan Environmental Performance…, 2019)
The main areas of agricultural land subject to wind erosion are in the Almaty region (about 5 million ha), Atyrau and South Kazakhstan oblasts (3.1 million ha), Kyzylorda oblast (2.8 million ha) and Aktobe and Zhambyl oblasts (over 2 million ha). The largest share of eroded agricultural lands (over 30 percent of their total area) covers Almaty, Atyrau, and South Kazakhstan oblasts (Figure 1). (Пятый национальный доклад…, 2018)

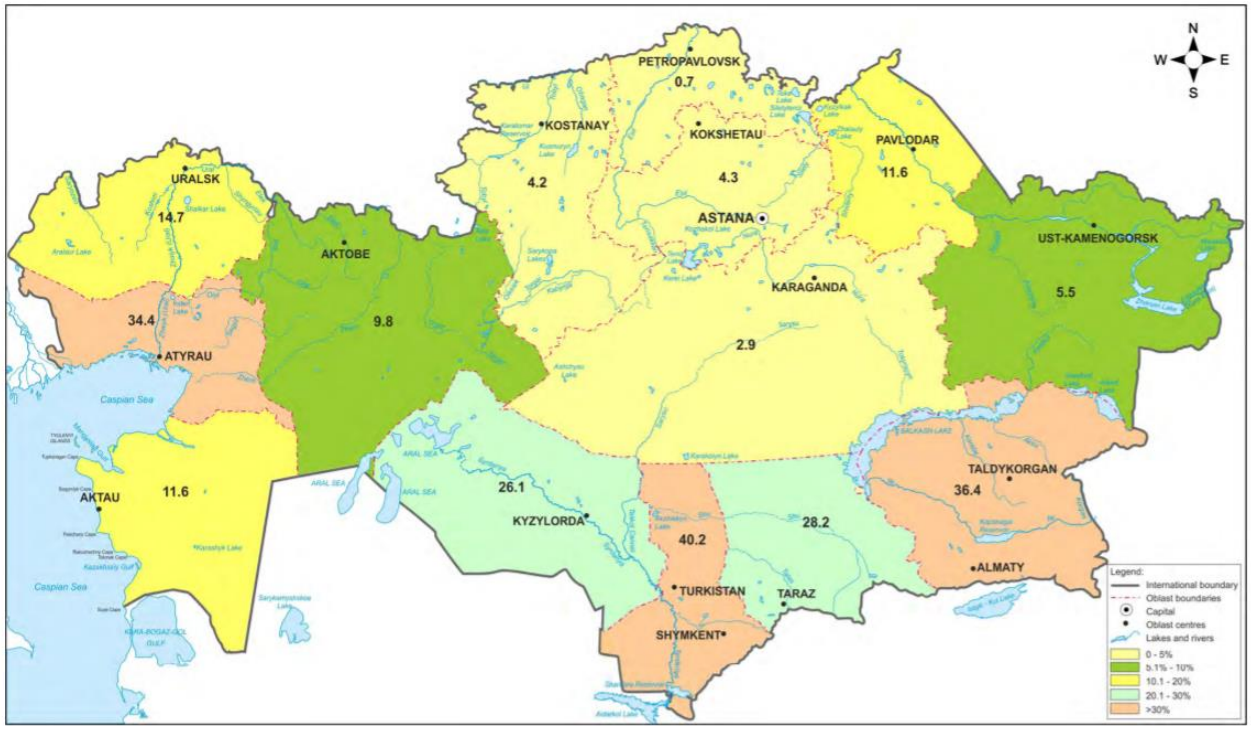

Fig. 1 - Eroded Soil of the Republic of Kazakhstan (2019)

Other causes of degradation of desert habitats are haphazard road networks, regulation of river flows, and illegal cutting of saxaul for firewood for sale. As a result of urbanization and intensive agricultural development of the foothill strip in the south and east of the country, the natural vegetation cover is highly disturbed. In the valleys of desert zone rivers - Ili, Syrdarya, Shu, Talas - due to the limitation of river flow highly productive floodplain communities are almost completely degraded; floodplain forests of the west of the country, riparian forests of the south and south-east, forests of steppe and forest-steppe zones of the north are under strong pressure. Due to the threat of an increase of water intake from the Ili river in its upper reaches in China for irrigation, there is a danger of a sharp drop in water level and degradation of ecosystems of Balkhash lake and Ili river valley; the same problem exists for transboundary rivers Irtysh and Syr Darya with the steady decrease of annual inflow by 2-3%. Roads, pipelines, and power lines, which are being constructed at an increasing rate, have a great impact on fauna. The area of land occupied by mining enterprises is steadily increasing. In recent years, the areas of oil and gas extraction, and development of uranium ores, etc. in Western Kazakhstan, the Eastern Caspian Sea region, the Betpakdala desert, etc., have been sharply increasing. Soils have been extensively transformed and degraded as a result of human activity.

Notable pollution of atmospheric air and soil occurs due to transport. Most heavy metals contained in dust and gas emissions from industrial plants are, as a rule, more soluble than natural compounds (Бутовский, 2005).

Unfavorable environmental properties of the soils of Kazakhstan are frequent exposure to erosion processes, salinity, and low natural fertility. The reason for this is both natural factors (natural desertification processes), the predominant sandy loamy texture of soils, and irrational economic activities. Such farming is manifested in non-compliance with agrotechnical rules of soil cultivation, which led to the active manifestation of water and wind erosion, soil depletion, loss of fertility, and, as a consequence, to dehumidification of arable soils. Wind erosion of soils (deflation) is developed on anarea of 45 million hectares, it has affected 18 million hectares of agricultural lands, and 18,9 million hectares are exposed to water erosion. Loss of soil fertility as a result of dehumidification and deflation is observed on the area of 11.2 million ha of non-irrigated lands and 0.7 million ha of irrigated arable land. (Сапаров, 2016)

A large part of the country is occupied by arid or semi-arid ecosystems that are subject to 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, the area of the Aral Sea, the delta of the Syrdarya river (Kyzylkum), and 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. The 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 a reduction in livestock and crop productivity. Over 40 years of exploitation of plowed virgin and fallow lands as a result of wind and water erosion lost up to 1.2 billion tons of humus (Figure 2).

The trend of land contamination continues to increase. Yield reductions of 10-20% and plant depression are observed in the areas of most agricultural land suitable for agricultural production according to ecological parameters.

Positive impacts and reductions in degradation rates (not including the natural regeneration of abandoned croplands and the creation of protected areas) have been achieved in some places locally by dispersing livestock from settlements, and in two other areas - the restoration of the Aral Sea and the increase in forest cover. The Kokaral dam built in 2005, which separated the Small Aral from the main water area, stabilized and raised the level of this now separate body of water and reduced its salinity. As a result, fish have reappeared in the Small Aral (in addition to the introduced flounder) and fisheries have revived. The area "Small Aral Sea and delta lakes of the Syr Darya" was included in the list of Ramsar sites in 2012. (Пятый национальный доклад…, 2018)

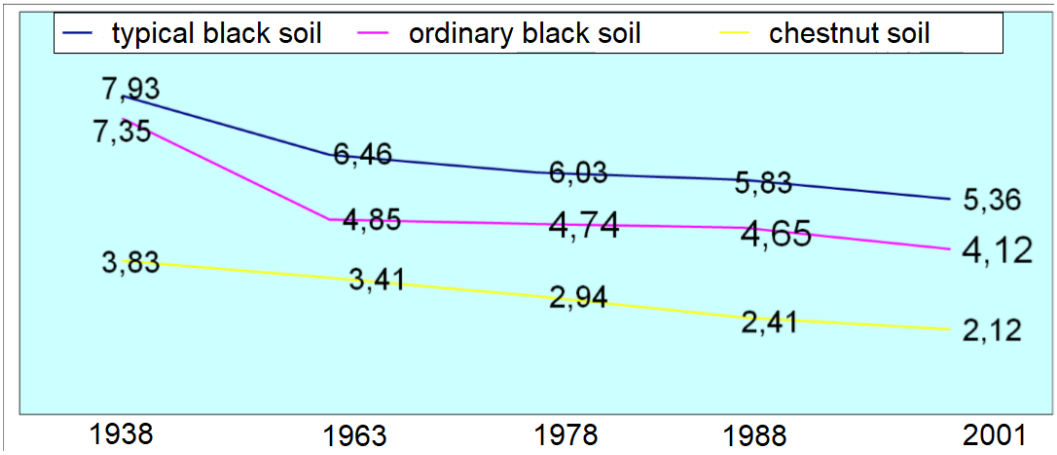

Fig. 2 - Change of humus content in the main types of soils of Kazakhstan.
Source: Национальный план действий …, 2020.

Conclusions and proposals

Kazakhstan is characterized by an arid climate, aridity, uneven distribution of water resources, low forest cover, and the dominance of steppe, semi-desert and desert landscapes, which leads to the low resistance of the natural environment to anthropogenic impacts, so the desertification problem for Kazakhstan is very urgent.

Most of the territory of Kazakhstan is located in conditions which are very vulnerable to anthropogenic desertification, when in combination with natural factors of desertification the environmental situation sharply deteriorates. The main zones of ecological stress and land degradation in Kazakhstan are the regions of the Aral Sea and the Caspian Sea region, as well as abandoned lands in the northern areas of the country. Wind erosion (deflation) of soils on sandy massifs and zones of spreading of soils of light texture and carbonate soils has the greatest spread in the territory of Kazakhstan (40.4% of agricultural lands). More than 11% of agricultural lands are exposed to water erosion.

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