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GEOECOLOGICAL STATE OF AGRICULTURAL TERRITORIES OF NORTH KAZAKHSTAN REGION

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Abstract

The article considers the current geoecological state of agricultural territories of the North Kazakhstan region and provides an ecological and economic assessment of their use. The region is a classic agricultural region, which is due to the optimal ratio of natural conditions: flat terrain, fertile soils, favorable climatic conditions for growing crops, etc. Agricultural land occupies 85.2% of the region's area, which creates a significant anthropogenic load on the region's geo-ecosystems. Studies have shown that agricultural development in the region has led to significant environmental problems, including soil degumification, soil pollution with pesticides, disruption of natural migration of substances in the soil, disturbance of soil structure, degradation of natural vegetation cover, etc. All this leads to degradation of soils, a decrease in their fertility, as well as to a decrease in the area of land suitable for agriculture. Thus, this leads to the fact that the region has the maximum total soil load in Kazakhstan, calculated by a set of indicators - plowing, type of agriculture, yield, crop rotation, etc.

Key words: agrogeosystems, agrolandscapes, dehumification, nutrient removal, agro-industrial complex (AIC), North Kazakhstan region, arable land.

ГЕОЭКОЛОГИЧЕСКОЕ СОСТОЯНИЕ СЕЛЬСКОГОХОЗЯЙСТВЕННЫХ ТЕРРИТОРИЙ СЕВЕРО-КАЗАХСТАНСКОЙ ОБЛАСТИ

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Аннотация

В статье рассматривается современное геоэкологическое состояние сельскохозяйственных территорий Северо-Казахстанской области и даётся эколого-экономическая оценка их использования. Область является классическим аграрным регионом, что обусловлено оптимальным соотношением природных условий: равнинным рельефом, плодородных почв, благоприятных климатических условий для выращивания зерновых культур и т. д. Сельскохозяйственные угодья занимают 85,2% площади области, что создаёт значительную антропогенную нагрузку на геоэкосистемы области. Проведённые исследования показали, что сельскохозяйственное освоение территории региона привело к значительным экологическим проблемам среди которых дегумификация почв, загрязнение почв пестицидами, нарушение естественной миграции веществ в почве, нарушение структуры почвы, деградация естественного растительного покрова и т.д. Всё это приводит к деградации почв, снижению их плодородия, а также к уменьшению площади земель, пригодных для ведения сельского хозяйства. Таким образом, это обуславливает то, что в области наблюдаются максимальные в Казахстане суммарные

нагрузки на почвы, рассчитанные по комплексу индикаторов – распашке, типу сельского хозяйства, урожайности, севооборотам и др.

Ключевые слова: агрогеосистемы, агроландшафты, дегумумификация, вынос биогенов, агропромышленный комплекс (АПК), Северо – Казахстанская область, пахотные земли.

СОЛТҮСТІК-ҚАЗАҚСТАН ОБЛЫСЫНЫҢ АУЫЛШАРУАШЫЛЫҚ ЖЕРЛЕРІНІҢ ГЕОЭКОЛОГИЯЛЫҚ ЖАҒДАЙЫ

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Аңдатпа

Мақалада Солтүстік Қазақстан облысының ауылшаруашылық аумақтарының қазіргі геоэкологиялық жағдайы қарастырылған және оларды пайдалануға экологиялық-экономикалық баға берілген. Аймақ табиғи жағдайлардың оңтайлы қатынасына байланысты классикалық ауылшаруашылық аймақ болып табылады: жазық жер, құнарлы топырақ, дақылдарды өсіруге қолайлы климаттық жағдайлар және т.б. Ауылшаруашылық алқаптары облыс аумағының 85,2% алып жатыр, бұл аймақтың геоэкожүйелеріне айтарлықтай антропогендік жүктеме жасайды. Зерттеулер көрсеткендей, аймақтағы ауылшаруашылығының дамуы айтарлықтай экологиялық проблемаларға, соның ішінде топырақтың дегмификациялануына, топырақтың пестицидтермен ластануына, топырақтағы заттардың табиғи көші-қонының бұзылуына, топырақ құрылымының бұзылуына, табиғи өсімдік жамылғысының тозуына және т.б. Мұның бәрі топырақтың тозуына, құнарлылығының төмендеуіне, сондай-ақ ауылшаруашылығына жарамды жерлердің азаюына әкеледі. Осылайша, бұл аймақтың Қазақстандағы топырақ жүктемесінің максималды жиынтығына, яғни көрсеткіштер жиынтығы бойынша есептелген - жер жырту, ауылшаруашылық түрі, егін өнімділігі, ауыспалы егіс және т.б.

Түйінді сөздер: агрогеосистемалар, агроландшафттар, дегумификация, қоректік заттарды кетіру, агроөнеркәсіптік кешен (АӨК), Солтүстік Қазақстан облысы, егістік жерлер.

Introduction

Geoecology is an interdisciplinary direction, the purpose of which is to study changes in the environment due to anthropogenic activities. To date, mankind has made significant scientific and technological progress, which has led to a significant impact on the natural processes occurring in the geographical shell at the local and global levels. This influence has gradually become so significant that modern science considers anthropogenic activity as one of the geological agents that influence the formation and development of the entire geoecosphere of the Earth. This article attempts to summarize the available research data on the ecological state of geo-ecosystems of the North Kazakhstan region (hereinafter referred to as the region) and to analyze the ecological state of agricultural lands in the region.

The region is a classic agricultural region, which is due to the optimal ratio of natural conditions: flat terrain, fertile soils, favorable climatic conditions for growing crops, etc. Agricultural land occupies 85.2% of the area, land occupied by forests, woody and shrubbery protective value (agroforestry strip) amount to 7% of the territory, and urbanized areas - 2% [1]. Thus, the development of agriculture in the region causes a significant anthropogenic pressure on the territory. This creates the problem of assessing the impact of human activities on the natural geo-ecosystems of the region in order to rationalize its economic activity in order to maintain economic and environmental sustainability of the use of the region’s resources.

The region under consideration is the most developed in the country and produces over 85% of the grain. It is important to note that the share of arable land in the structure of farmland has not changed much in the three major grain-sowing regions: in the North Kazakhstan region - 45.6%, Akmola - 34%, Kostanai - 28.9%. And only in the Pavlodar region for the post-virgin period there was a twofold decrease in the share of arable land - from 27 to 14.4%. Over 40 post-virgin years, in all subtypes of soils in Northern Kazakhstan, the humus content decreased by 5-20% or more, which is explained by the continuous plowing of the land without sufficient introduction of organic fertilizers, the concomitant development of water and wind erosion processes, and other factors. Over the years of agricultural land use, virgin lands out of 4.3 billion tons of humus arable layer stocks (0-25 cm) due to deflation and water erosion, mineralization of organic matter and removal from the harvest irretrievably lost about 1.2 billion tons or 28.3%.

According to the Ministry of Agriculture of the Kazakh SSR, after the development of the main massif of virgin wedge, the area of arable land by the beginning of 1956 was about 2300 thousand ha in the North Kazakhstan region, including about 80 thousand ha of fallows and deposits. During the years 1954-1955. about 400 thousand hectares of deposits were plowed and about 800 thousand hectares were reclaimed due to the inclusion of 580 thousand hectares of virgin lands, 150 thousand hectares of pastures and pastures, and about 70 thousand hectares of hayfields. Land funds of the 1st and 2nd categories of arable land, which make up about 750 thousand ha in the region, were almost fully used and land of the 3rd category of arable land was seized to a large extent. As a result, the average agricultural development of the region increased approximately 1.5 times (from 36 to 55%). At the same time, pasture and pasture lands were reduced from 53 to 19% of the region's area

This problem was partially reflected in the comprehensive description of the region's natural resources by V. Zvereyachenko and N. Tukacheva, who identified in their work «Natural Conditions of the North Kazakhstan Region» (2003) soil resources and related environmental problems caused by was the agricultural use of land. The work drew attention to the depletion of land resources and soil pollution, which is a consequence of the transformation of open spaces. High plowing of the territory and its intensive use contributed to a decrease in humus, on average, by 0.5-0.6% per year, the use of herbicides and other chemicals - to the deterioration of the soil structure and its other properties [2]. The authors pointed out the lack of studies on the actual content of various pollutants in soils.

The results of a study of the ecological state of the region were published by Taizhanova M.M. The paper identifies environmental problems caused by the development of new lands for agriculture. Analyzes the consequences of increasing the area of arable land for the geoecosystems of the region: «During the virgin epic, large areas of meadow and steppe were plowed, and the load on the remaining pasture plots increased manyfold. The total plowing of the territory of the region (the average agricultural development over virgin years increased from 40 to 65%) led to the replacement of natural ecosystems with agrocenoses, which causes 11.7% of the net primary production to be lost, and only in the destroyed ecosystems of the region where people dominate, 27% of primary production is lost» [3].

The main means of agricultural production is soil. The soil fertility depends on the physicochemical properties of soils and, consequently, their suitability for use in various agricultural sectors. The study of the region's soils was carried out by A. Gribsky, who described in the publication «Soils and Land Resources of the North Kazakhstan Region» (2004) the main soil types of the region, gave them a physicochemical characterization and indicated their geographical location reflected in the soil map of the region.

The most important property of soils is their fertility. The work of N. Beletskaya «On soil fertility in the North Kazakhstan region» (2015) is devoted to the study of the problem of conservation of soil fertility. The author considers the problem of dehumification of the soil cover, which has exacerbated for 40 post-virgin lands for all areas occupied in agriculture. All subtypes of these soils in the North Kazakhstan oblast are characterized by a decrease in the humus content by 5–20% or more. The reasons for the degumification were: continuous plowing of land, accelerating water and wind erosion of soils, insufficient fertilizer application, which led to a negative balance of nutrients and a deterioration in the physicochemical properties of soils. During the study, the researcher came to the conclusion that over the period of agricultural land use of virgin areas from 4.3 billion tons of humus arable layer reserves (0-25 cm) due to deflation and water erosion, mineralization of organic matter and removal with the harvest, about 1 was irretrievably lost. 2 billion tons or 28.3% [4].

A comprehensive study revealing the relationship between the state of the geyecosystems of the region and the trends in its economic development was carried out by S. Pashkov and reflected in the work «Environmental and Economic Aspects of Agricultural Development of the North Kazakhstan Region» (2014). The study showed that the region as a whole is characterized by an extremely non-ecological structure of the land fund. As part of the study, an analysis of statistical data was performed, the purpose of which was to study the scale and volume of application of mineral fertilizers in various areas of the Republic of Kazakhstan. The analysis revealed that the proportion of fields requiring fertilizer application in the region is very significant, despite the extremely small fraction of the country's area occupied by the region - 3%. For mineral fertilizers, it varies from 8 to 31% of the republican indicators, for organic fertilizers - from 0 to 35% [1]. The current situation has developed, first of all, due to the plowing of large areas under arable land, followed by monocultural farming - wheat cultivation. The existing farming system requires the continuous application of both mineral and organic fertilizers in order to maintain soil fertility and maintain a stable yield. At the moment, research in this direction is ongoing and measures are being taken to maintain sustainable agriculture in the region.

Studies have shown that agricultural development in the region has led to significant environmental problems, including soil degumification, soil pollution with pesticides, disruption of natural migration of substances in the soil, disturbance of soil structure, degradation of natural vegetation cover, etc. All this leads to degradation of soils, a decrease in their fertility, as well as to a decrease in the area of land suitable for agriculture. This leads to the fact that the region has the maximum total soil loads in Kazakhstan, calculated by a set of indicators - plowing, type of agriculture, yield, crop rotation, etc.

In conclusion, it should be noted that the economic development of the region, which, in essence, is a continual agricultural land use, has led to a number of environmental problems, among which the degradation of valuable agricultural resources: soil cover and vegetation, which leads to the depletion of natural diversity, stands apart. Not only is the reduction of agricultural land, but their quality is also deteriorating. It is no coincidence that it is in the North Kazakhstan region that the maximum total loads on soils in Kazakhstan are observed, calculated by a set of indicators - plowing, type of agriculture, productivity, crop rotation, etc. The environmental measures carried out are mainly palliative in nature, insufficient and do not constrain aggravation environmental issues. As a priority measure, it is necessary to reduce agricultural pressures by improving crop rotation and fully supplying them with organic fertilizers to prevent dehumification and soil degradation [1].

Conclusion

Despite a long period of research on environmental problems associated with the development of agriculture in the region, this problem has not lost its relevance. Over the past two decades, the causes and environmental consequences of irrational land use have been studied. However, in the process of writing this article, it was revealed that it is necessary to conduct a series of new studies to assess the environmental sustainability of the region's agriculture, since some of the literature is outdated and may incorrectly reflect the extent of the current anthropogenic load on the region's agricultural systems.

New research should also include not only research on environmental, but also economic aspects, since the reasons for the transformation of the natural environment by humans are economic. Thus, it is necessary to conduct a geoecological study reflecting the influence of modern trends in the development of the agricultural sector of the economy on the geoecosystems of the region.

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