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THE ANALYSIS OF ANTHROPOGENIC LOAD ON AGRICULTURAL GEOSYSTEMS OF NORTH KAZAKHSTAN REGION

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АНАЛИЗ АНТРОПОГЕННОЙ НАГРУЗКИ НА СЕЛЬСКОХОЗЯЙСТВЕННЫЕ ГЕОСИСТЕМЫ СЕВЕРО–КАЗАХСТАНСКОЙ ОБЛАСТИ

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СОЛТҮСТІК ҚАЗАҚСТАН ОБЛЫСЫНЫҢ АУЫЛ ШАРУАШЫЛЫҒЫ ГЕОЖҮЙЕЛЕРІНЕ АНТРОПОГЕНДІК ЖҮКТЕМЕНІ ТАЛДАУ

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Annotation

The article discusses the current state of the agricultural landscapes of the North Kazakhstan region – the leading agricultural producer of the Republic. The main problems of the region became soil digression and pasture degradation as a result of the total plowing of natural landscapes and their replacement by agrolandscapes and extensive land use. The study revealed that the region's plowed geosystems are characterized by excessive loosening, which is reflected in a decrease in the humus content, a decrease in nutrients and a high degree of cultivation. The removal of humus and nutrients is partially offset by mineral fertilizers, but it is not able to compensate for the losses. Pasture degradation is reflected in a reduction in the area of hayfields and an increase in the load on conserved grasslands. To determine the load, the areas of low– degraded and highly degraded lands are correlated. By means of a comparative analysis, it was determined that the land fund of the region has an extremely "non– ecological" structure of agricultural land, dominating arable land. It was concluded that one of the measures to improve the state of agrolandscapes should be the optimization of north–turn and the positive balance of nutrients.

Key words: agricultural ecosystems, agrolandscape, geosystem, cultivated, humus, biogen, agro–industrial complex (AIC), North Kazakhstan region,arable land.

Аннотация

В статье рассматривается современное состояние агроландшафтов Северо– Казахстанской области – ведущего сельскохозяйственного производителя Республики. В результате тотальной распашки природных ландшафтов и замены их агроландшафтами, а также экстенсивного землепользования, главными проблемами области стали дигрессия почв и деградация пастбищ. В ходе исследования выявлено, что для пашенных геосистем области характерна чрезмерная выпаханность, выражающаяся в снижении содержания гумуса, уменьшении биогенов и высокой окультуренности. Вынос гумуса и биогенов частично компенсируется внесением минеральных удобрений, однако оно не в состоянии восполнить потери. Деградация пастбищ выражается в сокращении площади сенокосов и увеличении нагрузки на сохраняемые травяные угодья. Для определения нагрузки соотнесены площади слабодеградированных и сильнодеградированных угодий. Путем сравнительного анализа определено, что земельный фонд региона имеет крайне «неэкологичную» структуру сельскохозяйственных угодий,

домиированием пашни. Сделан вывод, что одной из мер улучшения состояния агроландшафтов должна стать оптимизация севеооборотов и положительное сальдо биогенов.

Ключевые слова: сельскохозяйственные экосистемы, агроландшафты, геосистемы, окультуренность, гумус, биоген, агропромышленный комплекс (АПК), Северо– Казахстанская область, пахотные земли.

Аңдатпа

Мақалада Солтүстік Қазақстан облысының агроөнеркәсіптік ландшафтының қазіргі жағдайы, республиканың жетекші ауылшаруашылық өндірушісі талқыланды. Табиғи ландшафтарды толық аулау және оларды агроландшафтарды ауыстыру, сондай– ақ жерді кең пайдалану нәтижесінде, топырақты тереңдету және жайылымдық жерлердің бүлінуі аймақтың негізгі проблемалары болды. Зерттеу барысында облыстың егістік геосистемалары гумустың мазмұнының төмендеуі, қоректік заттардың азаюы және өсірудің жоғары дәрежесі сияқты шамадан тыс азаюмен сипатталады. Гумустың және қоректік заттардың алынуы минералдық тыңайтқыштармен ішінара өтеледі, бірақ ол шығындардың орнын толтыра алмайды. Көгалдандырудың жайылымы шабындықтар алаңының азаюымен және шөп шабындық жерлерге жүктеменің артуымен көрінеді. Жүктемені анықтау үшін төменгі дәрежелі деградацияланған және жоғары деградацияланған жерлер өзара байланысты. Салыстырмалы талдаудың көмегімен облыстың жер қоры егістік жерлер басым болып табылатын ауыл шаруашылық жерлерінің «экологиялық емес» құрылымына ие екендігі анықталды. Агроландшафттардың жай– күйін жақсарту жөніндегі шаралардың бірі солтүстік айналымды оңтайландыру және қоректік заттардың оң балансы болуы керек деген қорытындыға келді.

Түйінді сөздер: ауыл шаруашылық экожүйелері, агроландшафтар, геосистемалар, өсіру, гумус, биоген, агроөнеркәсіп кешені (АӨК), Солтүстік Қазақстан облысы, егістік жер.

Introduction

North Kazakhstan region (NKR) is traditionally considered to be a region of intensive farming and animal husbandry, in the structure of the gross regional product the share of the agro– industrial complex (AIC) is about 45%. The presence of land, which allows to obtain stable grain yields, predetermined the development of the region in two cardinal directions – the expanded reproduction of competitive grain of wheat and the development of meat and dairy cattle breeding.

The region is distinguished by high plowing of the territory and relatively low forest cover: the noted features form a “background”, which affect to the state of the region’s agricultural geosystems.

Modern agroecosystems of the region are part of natural ecosystems, strongly transformed as a result of economic activities. Plowing up of virgin and fallow lands (by 1960, the share of arable land in the structure of the land area of the region increased to 65–70% against 35–40% before the start of development) led to the replacement of natural ecosystems by agrocenoses, as a result of which 11.7 % of net production is lost in total, almost 27 % of the net primary production is lost in the destroyed ecosystems of the region where humans dominate / 1, p.26 /.

The best option for agriculture can be the creation of such agroecosystems that would be as close as possible to the natural landscapes, which would lead to an increase in agricultural productivity. Thus, our scientists proposed a landscape approach to the development of a modern farming system which in essence is the development of the ideas of V.V. Dokuchaeva, developed over 100 years ago – the creation of environmentally balanced sustainable agricultural landscapes, ensuring environmentally safe farming / 2 /.

During the post– Soviet period, the agrarianization of the economy only intensified in the region, but in the period 1992–99, as elsewhere, there was a decrease in agricultural land, including arable land – on 1156 thousand hectares The main reasons were in the economic sphere, when the old forms of rural management did not allow to carry out their functions and

compete. One of the most important factors of arable land loading on geosystems is the removal of nutrients from the soil with a crop. In the North Kazakhstan the soil is extremely "loosened" (to reduce humus).

On January 1, 1991, out of 2 million 437 thousand hectares of the surveyed lands, 193 thousand hectares had a humus content of 2 to 4%, 1 million 557 thousand hectares – 4-6% and 679 thousand hectares – 6–8% / 3 /. In the 90s. Farms of the region practically did not make mineral fertilizers, which gives grounds to assume the maximum decrease in the humus content in the soils during this period (calculations of the North Kazakhstan Experimental Station show that, with an average yield of about 1 hectare of arable land, about 2.5 tons of humus are removed, While from the root and crop residues no more than 0.7–0.8 tons are formed). Later, as the financing of the agro–industrial complex increased, there was a gradual increase in the application of mineral fertilizers, however, in the context of areas, today the data vary greatly: from 0.4 kg in Akzhar to 7.4 kg of active substance in Timiryazevsky district per 1 hectares of arable land, whereas in the late 80s the minimum figure for the region ranged from 12 kg / 4 /. For a deficit–free humus balance, it is necessary to use all possible sources of organic matter replenishment under the existing farming systems: manure, straw, green manure. The amount of organic fertilizer applied should be calculated based on the value of the coefficient of humification. When leaving 50 kg of humus from 1 ton of manure, for its deficit– free balance, it is necessary to deposit 10–15 tons per 1 hectare of the crop rotation area, and since manure has a long after– effect and introduces it once per rotation (4–5 years), the dose making it in grain– steam crop rotations will be equal to 40–60 t / ha, and in grain– cultivating and grain– grass two– field crops – 30–40 t / ha in two rotations. The deterioration of mineral nutrition conditions, other violations of the technology, its primitivization led to a deterioration in the quality of agricultural production in the region – a decrease in the protein content in grain, starch in potato tubers, and fat in oilseeds / 5, p. 98.

As mentioned above, the North Kazakhstan is characterized by an extremely non–ecological structure of the land fund; with some reservations it can be argued that it is the worst in the Republic here. Agricultural lands occupy 85.2% of the region's area, incl. arable land – 42.9%, pastures – 35.2%, deposits – 6%. The lands occupied by forests, trees and shrubs of protective significance (forest belts) add up to 7 % of the area of the region, and the urbanized territories – 2%. Compared to 1991, the structure of the land fund has changed little, which is reflected in the accounting system in the land administration authorities, in which "categories of land" are recorded, the so– called their functional purpose, and not the actual use. The structure of land use is much more dynamic, especially in the post– Soviet period: only from 1992 to 1999 the area under crops decreased from 3787 to 2631 thousand hectares, i.e. by 30% with the growth of pastures and deposits by 26%, which undoubtedly had a positive environmental value.

Comparing the degree of "ecological compatibility" of land structures in the context of administrative districts of the North Kazakhstan region, it is reasonable to use the ratio of areas (difference of shares) of arable land, disturbed lands, urbanized areas (lands of environmentally "harmful") and forest areas, perennial plantations, water bodies as criteria for their environmental friendliness. (i.e. ecologically beneficial land). Pastures and fallow lands are attributed to "ecologically neutral" lands and will not be taken into account. The analysis revealed areas with an "environmentally friendly" land use structure – Ualihanovskiy, Akkayynskiy, Kyzylzharskiy, while the Ualihanovskiy district indicator is crucially determined by the high proportion of water surfaces, the rest is due to the presence of large areas of forest areas and specially protected natural areas (Sogrovskiy and Sokolovskiy

reserves, respectively) . Gabit Musrepova and Tayinshinsky districts have the least ecological structure, which is caused by a high proportion of arable land and insignificant forest areas. The proposed indicator of "environmental friendliness" varies from 15% (Ualihanovskiy) to 71% (G. Musrepova), i.e. Districts vary greatly in the degree of background agricultural load (Table 1).

Table 1 The structure of agricultural land of the North Kazakhstan region by administrative districts (thous. ha) / 4

Districts	***Arable land***	***Pastures and hayfields***	***Deposits***	***Perennial plantations***	***The share of land in the district (%)***
Aiyrtau	386,3	323,5	22,6	9,4	77,2
Akzhar	244,1	386,1	105,7	3,2	91,9
Akkayynsky	233,3	159,1	0	7,5	94,9
G. Musrepova	714,4	292	36,7	5,3	94,5
Esilsky	303	138,5	0,9	5,7	87,1
Zhambyl	250	278,9	87,4	7,3	83,5
Kyzylzhar	216	226,7	0	7,5	73,1
M. Zhumabayeva	459,4	177,2	0	13	83,2
Mamlute	177,7	144,6	1,8	5,4	80,3
Taiynshinsky	587,4	350,2	125,2	6,2	93,4
Timiryazevsky	232,7	145,7	35,4	7,4	93,3
Ualikhanovsky	194	770,5	142,4	3,6	86,2
Shal akyn	203,4	158,1	53,1	4,6	86,5
Total area	4201,7	3451,1	611,2	86,1	85,2

Arable lands, in turn, differ in the intensity of the load, which is determined by the ratio in the sown areas of different crops. The best from an ecological point of view, the structure of sown areas is noted in the central regions of the region (Akkayinsky, Esilsky), where the share of perennial grasses is large. In the northern forest– steppe regions of the region – Kyzylzharsky, Mamlyut – the structure of sown areas is worse from ecological point of view, due to the fact that corn and sunflower (for silage) occupy a significant place in crop rotations, in addition to depletion of land contributing to development in soils. specific diseases and pests.

Current trends in the development of the agro– industrial complex of the region are such that for more than 10 years, as a result of a constant increase in arable land, the areas of hayfields and pastures have been reduced, with a simultaneous increase in the load on conserved grasslands. The calculations to determine pasture loads indicate a very high pressure on the vegetation cover of the region. The degree of pasture degradation is determined by the state of vegetation cover. In the feather–fescue steppes of the south of the region, dead cover is disturbed, steppe mosses fall out, the height of the grass stand decreases. Feather– grass and fescue concede supremacy wormwood appear bulbous bluegrass, weed pasture annuals. The final stage of digression – failure or "toloka" – a knocked out pasture in violation of the grass stand, where only annuals or non– fed plants grow.

Analysis of the data showed that the share of land with a strong grazing effect was 47% of the area, 12.7% of the pasture fund were in the final stage of pasture digression and only 10% had no effect of grazing, the rest showed weak or moderate digression.

The calculated coefficient of pasture digression on average in the region is equal to 7.6 (that is, the areas of highly degraded pastures are 7.6 times larger than the areas of medium and low– degraded pastures). Plant species, previously common to the region, are becoming rare and endangered. The pasture areas of the Kyzylzhar and Mamlyut districts are in a relatively better position compared to the above, where the lands are highly degraded by 3.1 and 4 times, respectively, in terms of area exceed the slightly degraded. Close to the regional average index of digression are the pastures of the Zhambyl and Esil districts. The pastures of Akkayinsky, Magzhan Zhumabayev, Shal akyn, Timiryazevsky districts are severely knocked out and exhausted / 4 /.

Conclusion

In conclusion, it should be noted: the economic development of the region's territory, which is essentially continual agricultural land use, has led to a number of environmental problems, among which the degradation of the most valuable agricultural resources stands out: soil cover and vegetation, which results in depletion of natural diversity. There is not only a decrease in the area of agricultural land, but their quality is also deteriorating. It is no coincidence that it is in the North Kazakhstan the maximum total loads on soils in Kazakhstan are calculated using a set of indicators – plowing, type of agriculture, crop yields, crop rotation, etc. The environmental measures taken are mainly palliative, insufficient and do not restrain environmental problems from aggravating. As priority measures, it is necessary to reduce agricultural loads by improving crop rotation and fully supplying them with fertilizers to prevent dehumification and soil degradation.

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