

Dynamics of Land Structures in Border Areas of Russia and Mongolia in Conditions of Desertification Processes

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Abstract— The article analyzes the land fund dynamics of border areas of Russia and Mongolia. These territories are distinguished by a low and medium degree of economic development of agriculture, mining and residential environmental management, which carries the greatest risk of the emergence and strengthening of desertification processes. Therefore, attention was paid to the analysis of residential and agricultural environmental management. An analysis of the structure of the land fund allows us to identify trends in the development of the territory and further predict characteristics of the course of desertification processes. The Russian regions are characterized by increased migration to the border regions and, therefore, an increase in areas of settlements and related land categories with a decrease in reserve lands, Special Protected Natural Areas. In Mongolia, there is also an increase in lands of settlements, but with the preservation and growth of forest and water resources, reserve lands, Special Protected Natural Areas, etc. The similarity of Russian and Mongolian border areas is revealed in the reduction of agricultural land. Changes in the land fund structure allow tracing the relationship between socio-economic processes and changes in various sectors of nature management and their impact on the intensification of desertification.

Keywords— *desertification; land fund; border areas; aimak; region; pastures, nature management.*

I. INTRODUCTION

Desertification is one of the serious problems that poses threat to individual countries and to the world as a whole, comparable to other global problems of mankind, such as climate change, loss of biological diversity, environmental pollution, etc. [2, 4, 5]. The Russian Federation has the most complicated problems associated with the processes of desertification of land in the south of the country. The processes of desertification are the result of the integral impact on the earth of several negative factors [11]. The problem of desertification is considered one of the main environmental threats in Mongolia [4].

Under these conditions, conducting comparative studies of desertification processes in Russia and Mongolia will be particularly relevant. In border areas of these countries, which are characterized by low and medium degree of economic development, the greatest risk for the emergence and intensification of desertification processes is the development

of primary nature exploiting sectors the development of agriculture and forestry, and the mining industry.

II. METHODS AND MATERIALS

As the analysis shows, the manifestation of desertification processes is characteristic of practically all categories of land, but agricultural lands are the most susceptible to them. "The anthropogenic factor causes changes in land use from grazing land to agricultural land and burdens the land due to over-cultivation, grazing, and collecting fuelwood. The dramatic destruction of vegetation as a result of human activity also accelerates the process of desertification. Human exposure can increase wind erosion from 4 to 10 times the natural speed "[10]. One of the prerequisites for enhancing the processes of desertification are changes in the territorial structure of land use, which reflect transformations in the socio-economic situation of the region.

To identify the features of the processes of desertification in the border areas of Russia and Mongolia, it is necessary to conduct an analysis of the structure of the land fund and features of environmental management. The greatest attention in the research should be paid to changes in the structure of agricultural land, industry, transport, communications, etc. For the analysis, the official statistics of Russia and Mongolia for the ten-year period (2007-2017) were used.

Among the Russian regions directly bordering Mongolia, four regions are distinguished, including the Altai Republics, Buryatia, Tyva, and the Trans-Baikal Territory. Eight aimaks of Mongolia border Russia: Bayan-Ulgii, Ubsunur, Zavkhan, Khuvsgel, Bulgan, Selenga, Khentei, Dornod. Among the Russian regions, the Trans-Baikal Territory and the Republic of Buryatia stand out for the total area of the territory, followed by the Tyva and Altai Republics. Among the aimaks of Mongolia, the largest territories in terms of area are Dornod, Khuvsgel, Zavhan, Khentei, Ubsunur, and the remaining aimaks are approximately equivalent in area.

III. RESULTS

a) *Analysis of the land fund structure of border areas of Russia*

The total area exposed to desertification in Siberia is more than 12 million hectares. Land desertification has acquired significant proportions in the flatlands of the Republic of Tyva (2.6 million hectares, or about 15%), in the southern part of the steppe zone of the Republic of Buryatia and the Trans-Baikal

Territory. In these territories, the processes of pasture degradation, water and wind erosion, dehumification, salinization and alkalinity of the soil have developed significantly [9].

An analysis of the structure of land fund of Russia showed that there were no significant changes over the period analyzed (Table 1). It should be noted the general trend of reducing the area of agricultural land, stock, Special Protected Natural Areas, etc., against the background of an increase in land area

of settlements, industry, transport, communications, etc., forest and water resources.

A more detailed analysis revealed regional features of the dynamics of the land fund structure in border areas (Table 1) [12]. Thus, in Altai, the area of agricultural land remained almost unchanged, over the ten-year period it decreased by only 0.2 thousand hectares. General trends in the reduction of agricultural land are characteristic of Buryatia in more than 1.3 times, to a lesser extent for Tyva and Transbaikalia.

TABLE I. STRUCTURE OF THE LAND FUND OF THE BORDER AREAS OF RUSSIA FOR 2007/2017

Region	Years	Agricultural land	Earth settlements	Lands of industry, transport, communications, etc.	Forest land	Water Fund Lands	Reserve lands, Special Protected Natural Areas, etc.	Total, thousand hectares
Altai Republic	2007	2621.5	32.9	8.5	3762.2	27.7	2837.5	9290.3
	2017	2621.3	46.9	10.3	3754.1	27.6	2830.1	
The Republic of Buryatia	2007	3709.6	145.3	492.8	25720.6	2124.7	2940.5	35133.4
	2017	2759.3	150.2	495	26912.0	2124.7	2692.2	
Tyva Republic	2007	3164.8	43.5	16.2	10874.6	96.3	2665.0	16860.4
	2017	3366.0	45.2	20.1	10874.6	96.3	2458.2	
Transbaikal region	2007	8072.4	233.9	1293.5	31904.6	122.1	1562.7	43189.2
	2017	7997.8	234.1	1316.7	31936.6	121.8	1582.2	
Total in Russia	2007	403177.0	19258.5	16687.4	1104975.9	27942.3	137783.1	1709824.2
	2017	383612.0	20377.5	17420.2	1126260.0	28070.4	136779.5	1712519.0

The structure of agricultural land also has a slight change. In Altai, there is a slight increase in an arable land and a decrease in an area of pastures, grasslands, and deposits. In Buryatia, a significant reduction in agricultural land was due to other categories of land, against the background of a small decrease in pastures and arable land and a slight increase in grasslands. In Tyva and Transbaikalia, there is a decrease in pasture areas, hay fields and arable land, amid a growth in the area of the deposit.

The reduction of a pasture area amid increasing livestock numbers increases the likelihood of desertification processes. "Natural pastures in the arid regions of southern Siberia occupy 70-85% of the territory. The degradation of natural pastures is accompanied by intensive soil destruction, the appearance of dust storms, and an increase in the area of waving sands" [9].

The researchers point out the urgency of the problems of desertification in certain border areas. So, Novikov A.N. and others note that "... the level of forage supply by steppe pasture ecosystems of the Transbaikalian Territory in the period 2000-2015 characterized by a steady decline due to regional climate aridization, which entails a decrease in the biological productivity of the steppe communities" [6]. "A common consequence of the anthropogenic load on the steppe ecosystems of Tuva is a violation of the established energy cycle, a decrease in the productivity of the transformed ecosystems, an increase in the degree of nakedness of the land surface and, as a consequence, the general manifestations of desertification of the territory" [8].

The largest increase in the area of land in populated areas occurred in Altai more than 1.4 times, in other regions these figures are much less. This indicates an increase in migration to these regions from other regions of the country. A 1.2-fold increase in the area of land of industry, transport,

communications, and others was noted in the Altai and Tuva republics, in other regions these figures are insignificant.

The area of forest lands increased slightly in Buryatia and Trans-Baikal Territory, remained unchanged in Tuva and slightly decreased in Altai. An insignificant reduction in the land area of the water fund is noted in Altai and Transbaikalia, in the rest - no changes. Only in Transbaikalia there was an increase in reserve lands, protected areas, etc., in other regions their decline is observed.

Thus, the analysis of the dynamics of land fund structure of border areas of Russia showed the presence of regional characteristics, including the difference in the reduction of agricultural lands. In the Altai Republic, there is an increase in arable lands, in the Republic of Buryatia, there is a slight increase in grasslands, in Tyva and Trans-Baikal Territory - growth in fallow lands. In the Republic of Altai, despite the all-Russian tendency, forest lands have been reduced, as well as water fund lands, as in the Trans-Baikal Territory. Only in the Trans-Baikal Territory, in contrast to the nationwide indicators, there was an increase in reserve lands, Special Protected Natural Areas, etc.

b) Analysis of the land fund structure of Mongolia's border aimaks

The basis of the Mongolian economy so far is livestock, formed as a result of a unique centuries-old culture of nomadic use of pastures and allowing to preserve the potential of natural resources. At the same time, with rapid urbanization occurring against the background of aridization of climate, the country has developed negative trends in the state of the natural environment and biological resources [7]. About 77.8% of the total territory of Mongolia is subject to desertification. In modern livestock production in Mongolia, based on a

combination of new and old environmental management rules, perennial rhythms in the dynamics of natural systems began to be significantly reduced, seasonal movement of livestock decreased, land use intensified near settlements, main roads and water sources [3]. The critical state of the land is 16.7%, where the degree of desertification is strong and very strong. Geographically, these territories coincide with steppe, dry steppe and partly forest-steppe zones [4].

As already noted, eight aimaks of Mongolia belong to the border areas, which differ from each other not only in area, but also in the configuration and length of the borders with the state

border of Russia. For all model objects, as well as for other regions of Mongolia, a large proportion of agricultural land is typical, which is natural, given the specialization of the national economy.

Over the past 50 years, the area of all agricultural land in Mongolia has decreased by 18%, while the largest contribution to this reduction was made by the reduction of natural meadows and pastures (19.4%), while arable land expanded by 16% due to an increase in acreage (19%) [1]. In the country, over the last 10 years, the area of agricultural land has decreased by 1% (Table 2) [14].

TABLE II. THE STRUCTURE OF THE LAND FUND OF THE BORDER AREAS OF MONGOLIA FOR 2007/2017

Aymak	Years	Agricultural land	Earth settlements	Lands of industry, transport, communications, etc.	Forest land	Water Fund Lands	Reserve lands, Special Protected Natural Areas, etc.	Total, thousand hectares
Bayan-Ulgiy	2007	3598.5	15.4	14.1	22.5	46.7	873.9	4570.4
	2017	3598.5	16.0	14.8	22.5	46.7	883.7	
Ubsunur	2007	4860.7	12.5	45.5	110.2	85.4	1844	6958.5
	2017	4834.1	16.7	46.1	110.2	85.4	1865.8	
Zavhan	2007	7062	15.7	5.5	490.7	81	590.4	8245.5
	2017	6990.2	18.7	6.5	490.5	80.5	658.8	
Huvsgel	2007	4479.2	18.6	5.7	4005.3	86.2	1467.7	10062.8
	2017	4476	19.3	7.7	4005.3	86.2	1468.1	
Bulgan	2007	2764.1	29.1	7.7	1905.1	22.1	144.9	4873.3
	2017	2730.8	33.1	7.8	1905	22.1	174.3	
Selenge	2007	2076.4	48.7	19.2	1534.1	19.4	417.3	4115.2
	2017	2059	61.8	22	1533.8	19.4	419	
Khentei	2007	5488.7	31.6	33.6	1131.6	18.9	1327.8	8032.5
	2017	5488.1	32.9	34.5	1130	18.7	1327.9	
Dornod	2007	9832.6	57.7	35.0	150.0	81.6	2202.3	12359.7
	2017	9634.6	88.4	50.1	174.6	91.1	2320.8	
Total for Mongolia	2007	115992.81	507.8	366.7	14226.5	666.0	24651.5	156411.5
	2017	14843.5	840.1	471.6	14341.2	686.0	25228.8	

Different trends are observed for aimaks (Table 2). The reduction of the area of agricultural land is noted in the Ubsunur, Zavkhan, Khuvsgel, Bulgan, Selenge aimags. A slight decrease - in the Khentei aimak, the area in Bayan-Ulgii aimak has not changed. There is a slight increase in the area of agricultural land in the Dornod aimag.

In the structure of agricultural land of border aimaks, one can note the main trends: reduction of pasture and hay fields; an increase in arable land and a sharp reduction in fallow land.

In recent decades, due to favorable climatic conditions, northern aimaks have become the breadbasket of the country where most of the crops are grown. Therefore, a sharp increase in arable land is not surprising, and in some cases, the indicators are quite impressive. Thus, in the Ubsunur aimak, arable land areas increased by 7 times, in Bayan-Ulgiy - by 5.2, in Zavkhan - by 4.9. The growth trend from 1.4 to 1.8 times also showed Huvsgel, Bulgan, Khentei, Dornod aimaks. Only in the Selenge aimak there was a slight increase in arable land. This is happening against the background of plowing over fallow lands, which is clearly seen from their reduction in all aimaks. Pastures and hayfields are also reduced, except for the Ubsunur aimag. There is an increase in pastures in Bulgan aimak.

The reduction in the area of pastureland with an increase in the concentration of livestock in aimaks and an increase in pasture load per unit of area certainly carries a huge risk for this category of agricultural land associated with increased desertification processes. Mass plowing of land, including deposits, to meet the growing needs of the population in potatoes and vegetables, subsequently brings with it the danger of depletion and land losses in this category. With the intensification of aridization and desertification processes, the risk doubles. Therefore, it is necessary to take a more careful approach to the choice of land use strategy at the present stage and to consider the likelihood of withdrawal of agricultural land from circulation due to increased desertification processes.

For all aimaks characteristic of the growth of land areas of settlements. The most impressive growth is shown by the Dornod aimag - by 1.5 times, more than 1.3 by the aimaks of Ubsunur and Selenge, by 1.2 times - aimak Zavhan. This shows the attractiveness of the territories of bordering aimaks for population migration and vividly illustrates the increase in population density in these territories. For all aimaks there is a small increase in the area of land in industry, communications, transport, etc., which is quite natural with the increase in population in these aimaks.

Since all aimaks are in the north of Mongolia, the share of forest lands is very large in their territory. Considering that the forestedness of the territory of Mongolia is small and makes up approximately 9.2% of the total area of the territory, most of the forest land is located in the border aimaks and provides a significant amount of ecosystem services. Therefore, the task of their preservation and rational use is particularly acute. Therefore, in Bayan-Ulgii, Ubsunur, Khuvsgel aimaks there is no change in the area of forest land, in others there is an insignificant decrease in the area over a ten-year period. This is also characteristic of the Russian border areas, which once again confirms the high value of the ecosystem services of these regions for countries.

The similar situation develops with the lands of a water fund. A slight reduction in the area is observed in the Zavkhan and Khentei aimaks, in all the others there is an unchanged indicator, apart from the Dornod aimag, where no more than 16% growth is seen. Regarding changes in areas of reserve lands, protected areas, etc., we note an increase in the area in all aimaks, in contrast to the Russian border areas, where they are on the contrary reduced.

Thus, Mongolia is characterized by a small reduction in the area of agricultural land, an increase in the area of land in settlements and industry, transport, communications, etc., as well as forest and water resources, reserve lands, Special Protected Natural Areas, etc. We note the impressive growth of land in settlements in the Dornod, Ubsunur, Selenge and Zavkhan aimaks. In forest lands, the situation is stable in Bayan-Ulgii, Ubsunur, Khuvsgel aimaks, in others - a small decrease in the area. A slight decrease in the land area of the water fund is observed in Zavkhan and Khentei aimaks, in others the situation is stable. For all border aimaks, there is an increase in the area of reserve lands, Special Protected Natural Areas, etc.

IV. CONCLUSION

Current trends in changes in the land fund structure of border areas of Russia and the aimaks of Mongolia reflect the dynamics of the socio-economic situation in the countries. A similar picture develops with an increase in the population density in border areas, which is evident in the trend of growth in lands of settlements, industry, transport, communications, etc. changes their area. In Russia, on the contrary, their reduction is occurring, which cannot but cause concern. It is necessary to conduct further research, which will allow revealing the peculiarities of the manifestation of desertification processes in border areas.

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