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Reproduction of agricultural land on the basis of ecological and economic rehabilitation

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Abstract

Negative processes of land degradation and violations not only reduce the area, the quality and the cost of agricultural land, but also have a negative impact on the economic efficiency of agricultural production. Despite the crisis in Russian agriculture, instability of the economic situation in general, there is an objective need to intensify the activities of the expanded reproduction of agricultural land. Reproduction cannot be achieved only by revegetation and reclamation of disturbed and degraded land. It must come from an integrated environmental-economic approach of technological methods, measures of economic support and impact of legislative instruments on land users. It is proposed to expand the system in order to reproduce disturbed and degraded agricultural lands with the help of «ecological and economic rehabilitation».

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Fertile lands are the primary means for agricultural production. The intensive use of agricultural land causes significant damage to their quality. Limitations of highly productive land in the world cause the demand and need for restoring soil quality and their return to agricultural use.

Problems associated with maintaining the quality of the land, and especially the potential fertility of agricultural land can be divided into two groups: soil degradation and loss of soil fertility due to improper unsustainable agriculture and land disturbance caused by mining, construction and other types of negative anthropogenic impact.

Degradation of agricultural land is a consequence of the agricultural labor. Natural components of degradation processes are mainly associated with the manifestation of erosion, and they are compensated by self-ecosystems [1]. Trend of declining soil quality is largely caused by intensive agricultural production, which primarily involves the use of backward technologies imperfect. N.Z. Milaschenko, O.A. Sokolov, T. Bryson, V.A. Chernikov distinguish 3 stages of development of agricultural technologies in the 20th century - the most intense period of their development. Mechanization stage (1930 - 1950), chemicalization stage (1960-1970 gg.), stage of biotechnologies (since the 70s) [2]. Each of these stages was due to the growth and intensification of agricultural production as a result of increased levels of efficiency. However, despite the positive results and objectives, implemented technologies have negative characteristics. You can combine them into a single characteristic feature - the maximum economic returns, excluding environmental factors. As a result, there was and continues to grow trend of disturbing the natural self-healing process of soil resources.

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Environmental changes, occurring under anthropogenic influence in the last century, are above the threshold of sustainability of natural ecosystems [3]. Under the influence of human activities, the properties and modes of soil, air quality, water quality and reserves and other components of the ecosystem are changing. Ecosystem itself acquires specific characteristics, which were not peculiar for it before human impact. There is the need to compensate the energy ecosystem, without which it is impossible not only to produce efficiently, but also to develop sustainable agriculture .

The research showed a significant reduction in the volume of performed work in order to restore the quality characteristics of soil fertility .

Table 1. Dynamics in work on chemical reclamation of Russian land [4]

Indicators	1990 г.	2000 г.	2005 г.	2010 г.	2011 г.	2012 г.
Processed with lime of acid soils million hectares	4,7	0,4	0,3	0,2	0,2	0,3
Logged ground limestone, mln t	31,4	2,8	2,3	2,0	2,0	2,2
Made of gypsum, phosphogypsum and other gypsum-containing rocks, kt	1361	86	6,4	0,7	0,2	2,3
Processing carried out with phosphorus acid soils, ha	-	54	43	3,7	2,3	3,1
Contributed phosphorite, kt	-	67	50	3,8	1,9	3,5
Contributed organic fertilizers, mln t	369,5	66,0	49,9	53,1	52,6	54,2

General trend of ecological state of Russian farmland based on our analysis of the past 25 years can be estimated by using qualitative indicators (Table 2). Quantitative estimates of most indicators were absent due to the lack of official data.

Table 2. Trend in land-quality indicators of Russian lands

Indicator	Tendency of change
Agricultural land , including arable land	reduction
Area of disturbed lands	Increase. For the year no more than 60% of disturbed lands are recultivated
Area of degraded lands	Increase. Over the past 25 years, the area of degraded land has increased on 1.6 times
Supply of humus in soils	reduction
The area of land with a reduction of humus	increase
The area of land with a lack of nitrogen	increase
Area of land with a lack of phosphorus	increase
Area of land with a lack of potassium	increase
Area excessively acidic land	increase
Overcrowded area of land and land with impaired grading	increase
Area of eroded lands	increase
Area of toxic soils	increase
Area of land contaminated with heavy metals	increase
Area of land contaminated by pesticides and insecticides	increase
Area of land contaminated with radionuclides	stable
Area of land with a high content of pesticides and insecticides	unknown
The area of land on which the rotations are not met	increase
Percentage of grasses in cropping patterns	reduction
Area of shelter belts	reduction
The area of land on which organic farming is active	unknown
The area of land where adaptive- landscape agriculture is going on	unknown
Protected area of valuable farmland	unknown

The average annual withdrawal of land for non-agricultural purposes	increase
Percentage of recovered and reclaimed land	No more than 3% of the total number of disturbed lands
The area of irrigated / drained lands	reduction

These tables show that the positive movement toward the optimal use of agricultural land in Russia is completely absent. Change of all parameters has a negative trend. Investigation of the environmental aspects of using agricultural land shows that most of the tools are ignored.

To solve the problem of reproduction of disturbed and degraded land cannot be achieved by individual activities and reclamation chemicalization. In our opinion, a set of measures that can be combined into a system of eco-economic rehabilitation of the land is required.

Ecological and economic rehabilitation of agricultural land includes a complex system of processing methods and measures of economic orientation, including institutional and organizational nature which enables to restore the broken potential and quality of farmland and provide cost - effective and sustainable agricultural extension products with regard to environmental factors [5].

Technological measures of rehabilitation include techniques of adaptive landscape, organic farming aimed at farming in accordance with the laws of nature, which ensure the maintenance of soil fertility through the use of topsoil stipulating closed nutrient cycling in the ecosystem, making organically bound nitrogen mainly in the form of manure and compost, green manuring plants capable of accumulating nitrogen, and the use of slow-release fertilizer.

Application of the proposed method creates a double effect: on the one hand, increases the yield of agricultural production due to growth in productivity through the use of natural factors, higher prices for organic agricultural products, i.e. resource potential of land is increasing. On the other hand, natural resources and environmental quality is to conserving, there is such thing as ecological restoration of soil fertility.

Reproduction of agricultural land is impossible without the use of resource-saving technologies, which provide production with the lowest possible fuel consumption and other energy sources, as well as raw materials, air, water and other resources for technological purposes. These technologies, including the use of secondary resources, waste management and energy recovery, a closed water system save natural resources and avoid pollution.

International experience confirms the need for the regulatory framework for ensuring the maintenance and reproduction of soil fertility and land reclamation. Framework should include documents, not only regulating reproductive processes of land, but also provide support for those agricultural producers who introduce technologies that contribute to the reproduction and maintenance of soil fertility.

No need to use all of the land in agricultural production. Part of the land should not be used because of low efficiency. In this case it is possible to suspend them, which will rehabilitate degraded land, including and due to the ability of an ecosystem to repair itself.

Comparative analysis of Russian and foreign regulatory issues of rehabilitation of land disturbed by mining and land degradation, shows that Russian law requires improvement.

In our opinion, its further development should serve two purposes:

1. Provide recovery and return to the business turnover of the disturbed lands that are already available at the moment;

2. To promote preventing the formation of new arrays of disturbed lands.

In this context, management mechanism of breaking ground for their recovery and return to economic turnover involves the following elements:

- Developing criteria for evaluation of disturbed lands based on the concept of risk to health and the environment;
- Development the procedures of land survey, which can be qualified as a violation in accordance with established criteria;
- Statutory requirements applicable to mandatory testing of land in transactions of purchase and sale, putting long-term lease, etc., plant closings, and in other cases;
- The creation of the general federal registry of disturbed land requiring restoration work in the first place;
- Development of plans on restoring damaged land considering the future use of each parcel of land;
- Determining the future use of the land, taking into account the views of the population;
- The establishment of mechanisms to control and monitor the rehabilitation works;
- The establishment of civil liability for violation of land rehabilitation;
- The establishment of funds for reclamation of derelict land, identifying sources of their formation and replenishment. Taking into account international experience funds may be formed by enterprises, the federal budget and the budget of the Federation, investors, land users.

Thus, the study of the state of agricultural land in Russia and the dynamics of change reflects the need for a set of measures in order to maintain and improve soil quality, taking into account environmental factors in the implementation process of their reproduction and during their further use. This makes the need for their environmental and economic rehabilitation. The economic effect of rehabilitation measures provided by the

increased market value of rehabilitated agricultural land, increases their fertility and, as a result, productivity. Environmental effect consists in restoration of the value of the natural potential of soils and agricultural landscapes.

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