Monitoring the current state of rural territories ecology in the Oryol region and some areas of their environmental development

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Abstract. This article proves that one of the main conditions for improving the ecological condition of rural areas is continuous monitoring. The current environmental situation in rural areas of almost all regions of the Russian Federation is characterized by many problems which impede their sustainable socio-economic development. In the article, based on the example of the Oryol region, an assessment is made of the environmental situation prevailing in rural areas, and typification of the regions is carried out. The authors formulated a set of proposals, the implementation of which will improve the environmental situation. Particular attention is paid to the development of the implementation of the proposal for the introduction of innovations in the production of agricultural products based on organic farming. Substantiated the need to develop state programs for the development of environmentally friendly organic farming, adapted in each region in accordance with the peculiarities of its development and the climatic conditions of agriculture, and presented a set of measures that make up their basis. The implementation of the proposed measures will improve the environmental situation in rural settlements of the country as a whole, and, in the Oryol region in particular, which will contribute to the rural areas entering the trajectory of dynamic sustainable socio-economic development.

1. Introduction

A special place in ensuring the sustainable development of rural territories is occupied by the environmental factor, which ensures environmental preservation. The "Strategy for the sustainable development of rural territories of the Russian Federation for the period until 2030 of 02.02.2015 N 151-p" states that a necessary condition for the sustainable development of rural territories is to ensure their environmental safety through the development of rational nature management and timely implementation of measures to prevent the negative impact of anthropogenic processes on the environment.

Environmental issues are one of the arguments that oppose economic growth and sustainable development. In recent decades, problems associated with environmental degradation have emerged [1]. The process of interaction between the man and the nature is the content of any production. The economy, in essence, is the art of rational and effective management of this process, otherwise, as the
world and our experience in managing and nature management show, economic and environmental crises are inevitable. The concepts of “economics” and “ecology” are inseparable, closely interconnected and condition each other.

The current ecological situation indicates that the human impact on the environment has reached such a level that its further growth under previous conditions can lead to irreversible changes that threaten the normal functioning of society [2].

2. Research methods

To assess the current state of the ecology of rural areas, generalized indicators are distinguished that characterize the state of atmospheric air, water bodies, lands, objects of flora and fauna, noise and vibration exposure, radiation safety, waste disposal and disposal, current environmental costs and environmental charges. In the system of indicators of the state of the environment in rural areas, specially protected natural territories and forests are of environmental importance.

The ecological component of rural areas is regionally specific and is mainly determined by vulnerability to climatic conditions, the intensity of the anthropogenic impact of production facilities, energy, transport and the population.

The Oryol region is not included in the list of regions with an unfavorable ecological situation, however, the observed accumulation of pollutants in the environment, the presence of even local but multiple zones of increased pollution, the existing anthropogenic load on a large territory, have formed a tendency to degradation of ecosystems, ecotypes, and a decrease in biodiversity. The greatest load is carried by water bodies, soils, forests, wildlife. The situation with atmospheric air is somewhat better.

The main air pollutants are industrial enterprises and transport. According to enterprises located in rural areas [Data on protection of atmospheric air for 2018. Form statistical reporting 2-TP (air)], the largest amount of pollutant emissions into the atmosphere was noted in the Oryol, Mtsensky and Livensky districts. Moreover, their number in 2017 increased by 1.7 times compared to 2009. The increase by 1.6 times was noted in the Oryol region, 1.4 times in the Mtsensk district, 2.3 times in the Livensky district, and 5.0 times in the Kromsky district. The largest enterprises which appeared to be the sources of air pollution in rural areas were: Znamensky SGC LLC, Otradinsky Sugar Mill JSC, Kolpnyansky Sugar Mill JSC, Kerama Marazzi LLC, Mtsensky Foundry JSC [Report on the environmental situation in the Orel region in 2018].

According to the State reports on the state of sanitary and epidemiological welfare of the population in the Orel region in 2013-2018 in the Oryol region, there is a decrease in the atmospheric air quality of rural settlements: the share of atmospheric air samples exceeding the MAC (maximum allowable concentration) in 2018 was 1.3%, while in 2016 this indicator was 0.2%.

Samples that do not meet hygiene standards were identified in the Dolzhansky, Oryol, Uritsky districts, Orel, Mtsensk and Livny.

There are problems in the region and with clean water. In the region as a whole, the share of the rural population provided with safe drinking water continues to increase annually, which is associated with the implementation of the activities of the regional program Centers for Pure Water at the expense of constructed and overhauled water intake facilities. The proportion of the population provided with safe drinking water in rural areas increased from 77.1% in 2016 to 77.8% in 2018. At the same time, drinking water in some areas does not meet hygienic standards. In 2018, excess hygiene standards in terms of hardness (more than 10 mg / equiv. L) were recorded in the Bolkhovsky, Znamensky, Oryol, Livensky, Uritsky districts. The indicator of unsatisfactory water quality in terms of sanitary-chemical indicators exceeds the average regional level (11.8%) in 7 administrative territories: Bolkhovsky, Znamensky, Maloarkhangelsky, Oryol, Sverdlovsky, Uritsky districts and the city of Oryol. In 7 administrative territories, an excess of the average regional level (0.9%) was recorded for microbiological indicators: Bolkhovsky, Maloarkhangelsky, Mtsensky, Novoderevenkovsky, Oryol, Uritsky districts and the city of Orel. The main reason for unsatisfactory water quality is the absence or unsatisfactory condition of treatment facilities, which leads to the discharge of wastewater into water bodies or soil, causing subsequent pollution of water bodies.
Unused and prohibited for use pesticides and agrochemicals continue to accumulate, their mass is 196.73 tons. By 2017, 82.81 tons (42.1%) were disposed of. Unused and banned pesticides and agrochemicals accumulate in all areas of the Oryol region, except Korsakovskiy and Uritsky areas. Unused pesticides and agrochemicals are concentrated in the following areas: Oryol - 31.0 tons, Livensky - 10.2 tons, Maloarkhangelsky - 18.7 tons, Glazunovsky - 16.1 tons, Krasnozorensky - 15.1 tons, Kromsky - 14.3 tons, Mtsensky - 13.6 tons.

The situation in the areas of rural settlements in the field of generation, use, disposal and disposal of waste contributes to an increase in environmental pollution which poses a real threat to public health. The formation of spontaneous dumps does not stop both in rural settlements and regional centers, and in places of recreation, on tourist routes, in bathing places and forests, along the river banks and reservoirs. The extremely negative impact of MSW landfills on the environment is the concentration of methane, hydrogen sulfide, ammonia, carbon monoxide, benzene in the air; accumulation of heavy metals, oil products, nitrates, hydrocarbons, etc. in the soil and getting into groundwater. In 2018, 3.4 million tons of industrial and household waste were generated in the region and only 64.5% of them are properly disposed of and disinfected. The unfavorable ecological state in terms of the amount of municipal solid waste is characteristic of the most populated Oryol, Livensky, Mtsensky and Kromsky districts. Here is the largest number of potentially dangerous objects of biological nature - cattle burial grounds (figure 1).

![Figure 1](image)

**Figure 1.** The number of non-anthrax and anthrax cattle burial grounds in the districts of the Oryol region [3].

Since 2018, in the region there are only two landfills for solid household and industrial wastes included in the State Register of waste disposal facilities, and one landfill for industrial wastes located on the territory of Avtoagregat JSC (Livny). At the same time, according to the monitoring of the Green Front environmental project, in the Oryol region there is a number of large unauthorized landfills in Dmitrovsky, Kromsky, Mtsensky, Livensky and Uritsky districts [4].

Unauthorized waste dumps are a place of accumulation of wild and homeless animals, and, therefore, a source of biological pollution of territories. Animals are carriers of pathogens of
zooanthropooses - natural focal and zoonotic infections transmitted from animals to humans. The sources of such infections are wild animals (foxes, ferrets, martens, raccoon dogs, minks, squirrels, badgers and hedgehogs), stray and domestic cats and dogs, as well as livestock infected due to contact (bites, scratches) with sick animals.

In the Oryol region there are many natural foci of zooanthropic infections. One of the most common diseases in all administrative territories of the region is rabies. Most often, foxes become a natural source of infection (37.5%). The second place is occupied by cats (30.3%), the third - by dogs (19.6%). In the region, 28 foci of rabies of animals with the involvement of people were identified. The most unfavorable sanitary and epidemiological situation is noted on the territory of Bolkhovsky, Znamensky, Kolpynansky, Kromsky, Novosilsky, Oryol, Uritsky, Sverdlovsky and some other areas of the region. Yet, rabies has not been reported among the population since 2009 [4].

Leptospirosis is an acute infectious disease, the main carriers of which are rodents (field voles, field mice, house mice, gray rats), dogs and cats get infected from them, and then it can be transmitted to people. The situation of leptospirosis in the Oryol region continues to be unstable, due to the presence of natural foci. So, in 2007, the disease was detected among residents of Dolzhansky, Zalegoschensky, Sverdlovsk, Uritsky districts, in 2008 - in Znamensky, Oryol and Khotynetsky districts, in 2011 - in Bolkhovsky and Kromsky districts, in 2013 - in Oryol, Soskovsky and Uritsky districts. In the period from 2014 to 2018, the disease was not registered in the population of the region.

In the Oryol region, there are also widely presented foci of tularemia pathogens. Their carriers are mouse-like rodents. Between 2004 and 2016, ten cases of human tularemia were recorded in the region. Over the past two years, no cases have been identified. Rodents are also carriers of the causative agent of hemorrhagic fever with renal syndrome. In the region in 2017 and 2018, 10 cases of the disease were registered, in 2016 - 9; 2015 - 8; in 2014 - 6 cases. Sick cases were detected in Bolkhovsky, Oryol and Maloarkhangelsky regions. Agricultural land in many regions, including the Oryol region, was exposed to radioactive contamination as a result of the Chernobyl accident.

An increase in the background radiation level was recorded in the region on April 30, 1986. The maximum levels of - background on April 30 - May 1, 1986 were: in the Bolkhov region - up to 2500 μR / hour (179 times higher than the natural background), in Dmitrovsky - to 1300 μR / hour (93 times higher than the background), in Orel - up to 800 μR / hour (57 times higher than the background).

More than 1 million hectares of farmland, including about 800 thousand hectares of arable land and about 200 thousand hectares of pastures and hayfields, were polluted. More than 85% of the area was polluted in the Dmitrov, Bolkhovsky, Kromsky and Glazunovsky districts, less than 10% - in Shablykinsky, Novoderevensky, Pokrovsky, Khotynetsky, Kolpynansky, Krasnozorensky districts. In other areas, the pollution area varied from 15 to 65%. By 1990, unpolluted territories in the region as a whole occupied about 59% of the total area, about 1% of the areas had a density of radiocaesium contamination of 5-10 Ci / km2 and about 40% - 1-5 Ci / km2. Doses to the population of the most polluted areas in 1986 were 0.4–2.5 rem; in 1987 - 0.2-1.2 rem; in 1988 - 0.1-0.5 rem; in 1989, 0.09-0.2 rem; in 1990 - 0.08-0.15 rem. [5]

At present, the radiation situation in the Oryol region remains stable and satisfactory. The radiation background does not exceed the established standards. The average individual dose to the population of the region in 2017 due to all sources of ionizing radiation was 2.34 mSv / year; in 2016 - 2.4 mSv / year; in 2015 - 2.33 mSv / year. The contribution of natural radiation sources amounted to 79.58% of the total dose, medical X-ray studies - 19.65%, other sources - 0.77%.

Thus, the analysis of the state of changes in the0 atmospheric air indicators, water bodies, production and consumption wastes, the radiation background of the state of the land, revealed a different ecological state of the rural territories of the municipalities of the Oryol region.

Based on the summation of the scores of diagnostic indicators for 2014, 5 levels of the ecological state of rural territories (very low, low, medium, high, very high) in the Oryol Oblast were identified (figure 2).

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Figure 2. Rating of ecological status of rural areas of Orel region [6].

The ecological differentiation of municipal regions was manifested depending on the uneven distribution of economic activity and, as a consequence, the uneven level and quality of life of the population by territory [7, 8].

Rural territories of the Oryol and Mtsensky districts according to the total score (10 and 11) are assigned to a very low level. The low level of the ecological state of rural territories by the sum of the points (13) highlighted Livensky district; The Khotynets and Dmitrov districts were characterized by an average level of ecological state in terms of the total score (16-17). The ecological situations in the rural areas of Maloarkhangelsky, Dolzhansky, Glazunovsksky, Zalegoshchensky, Korsakovsksky, Krasnozorensky, Novoderevenkovsksky, Novosilsky, Sverdlovsksky, Znamensky, Kromsksky, Verkhovsksky, Pokrovsky, Trosnyansky, Shablykinsky (18-20 points) were characterized by a very high level of environmental status. Air and water pollution in them are low. Natural ecosystems there have still retained a large natural resource potential for self-healing and purification. The ecological situation within the rural territories of Uritsky (16), Kolpnyansky, Soskovsky and Bolkhovsky districts (17 points each) was characterized by a high ecological status index.

Thus, the analysis of the environmental situation in rural areas of the region showed that in 18 of them there is a high level of environmental status and only in 3 municipal areas the environmental situation is characterized as unstable due to inadequate water and air quality standards, as well as due to the accumulation of harmful chemical funds. The revealed negative trends do not allow ensuring the high level and quality of life of the rural population of these territories fully and impeding the transition of rural areas to dynamic sustainable development.

3. Conclusions and prospects of development of this direction of researches

The study of the ecological state of the rural territories of the Oryol region showed not only problems which have an impact on development, but also ways to solve them. The following areas and priorities can be distinguished:

- verification of the activities of enterprises regarding compliance with environmental standards and requirements;
- assessment of the general characteristics of hazardous production facilities (areas of activity, location, climatic characteristics, characteristics of hazardous substances, etc.) [9];
- economic assessment of environmental risks and analysis of environmental safety (possible scenarios for the development of accidents, the number of hazardous substances released into the environment, the size of the likely areas of impact of damaging factors, possible environmental damage);
- making recommendations on environmental activities;
- introduction of amendments to the legislation aimed at toughening the requirements for the targeted use of land and neutralizing the monopoly on agriculture (it is important to focus on supporting incomes of farmers through subsidizing prices and compensation from the budget, on access of farmers to various markets controlled by the state, as well as reducing share of imports of agricultural products);
- encouraging the introduction of environmentally friendly technologies and production methods, increasing environmental protection costs, reducing polluting emissions;
- modernization of agricultural production using the latest inventions and breeding and genetic innovations;
- ensuring the participation of industrial enterprises in financing agricultural and rural development, access of agricultural enterprises and farms to financial markets, the use of long-term credit and leasing;
- the possibility of cancellation of debts of farmers, cancellation of taxes to agricultural organizations for five years, the replacement of taxes to farmers with patents for agricultural activities;
- State participation in the pledge of products through the allocation of budgetary funds and soft loans;
- Creation of regional investment funds aimed at the development of agricultural enterprises;
- compensation for losses to farmers due to rising prices for the consumed resources of industrial production;
- increasing the income of agricultural workers to the level of the national economy as a whole;
- integration of agriculture, forestry and crafts, processing of agricultural raw materials and wild plants, recreational use of rural areas.

The environmental problems of rural areas are prompting the search for new approaches and management methods. An effective method of solving problems can be the introduction of innovations in the production of agricultural products based on organic farming [10].

The result of organic farming is environmentally friendly products, one of the main competitive advantages of which, compared to industrial products, is concern for human health, and, accordingly, improving the quality and life expectancy of the country's population, which is one of the main state tasks.

Innovations in the field of organic agriculture will make it possible to meet the growing needs of the population for various food products made by domestic producers from non-chemical components and therefore beneficial to human health. However, it must be borne in mind that not all agricultural innovations give a positive result. On the contrary, individual achievements of scientific and technological progress in the agricultural sector (biotechnology, chemicalization, irrigation) negatively affect the condition and structure of the soil, cause its erosion, and lead to lower yields. In addition, pesticide residues in the environment negatively affect human health.

For the successful development of organic farming and organic farming as a whole in Russia, it is necessary to systematize the regulatory framework and develop regional programs to support the development of organic farming, whose goal will be to create conditions for its development and the production of organic food. In our opinion, this program should include the following activities:

- subsidization of agricultural producers specializing in organic farming, i.e. not using herbicides, pesticides and other chemical fertilizers in their activities);
- subsidizing a part of actually incurred expenses for the purchase of certified environmentally friendly planting material and seeds (but not more than 50%);
- conducting specialized trainings and master classes for agricultural producers in the field of organic farming and the production of organic food;
- informing the population about organic farming, organic farming, consumption and benefits of organic food;
- conducting public relations campaigns, promotional events, fairs, exhibitions, contests in order to promote and develop organic farming;
- initiation and promotion in the regions of the Russian Federation of the development of local regulatory acts that will facilitate the application of modern environmentally friendly biotechnologies, as well as initiate the development and implementation of measures to support the production and export of agricultural products through the system of ecological agriculture;
- creating a database of information technologies for managing plant productivity and productivity in natural and regulated conditions using the most modern equipment, software and hardware that meets modern international standards, as well as new information technologies and technical equipment corresponding to high-intensity agricultural technologies [11];
- creation of conditions for certification of production for export of products manufactured as part of the organic farming system.

This program should be developed in each region of the Russian Federation according to its developmental characteristics and climatic conditions. Funding for program activities should involve funds from the federal fund, regional budgets and extrabudgetary funds. The adoption and implementation of programs to support the development of organic farming in the regions of the Russian Federation will allow organic farming of the Russian Federation to develop successfully, which will increase the competitiveness of domestic products that will meet international requirements for the trade in organic food.

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