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LAND MONITORING APPLICATION RESULTS IN LAND MANAGEMENT ON THE SAMARA REGION EXAMPLE

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Abstract

The issues of monitoring of land use and application of the obtained data in land resources management on the example of Samara region have been studied. The mechanisms of land monitoring at the level of the Russian Federation region and below have been studied. Data on unused agricultural land in municipal areas are presented. The necessity of further improvement of mechanisms of state land management is shown. Proposals are made to improve mechanisms of land management in municipal entities. Firstly, it is necessary to make a complete inventory of all lands within the boundaries of a municipal entity. Second, it is necessary to establish boundaries of municipal entities and enter information into the Unified State Register of Real Estate. This will make it possible to clarify the information on the cadastral value of real estate objects within the boundaries of the municipal entity, which is carried out by state enterprises. Thirdly, it is necessary to create a unified organization for land resources management in the Russian Federation. The existing situation, when land management functions are divided into different ministries and federal services, leads to a decrease in management efficiency. Fourthly, it is necessary to improve the system of land registration for agricultural purposes, for this purpose annual monitoring is required. Fifthly, it is necessary to conduct passportization of agricultural lands for accounting of information on condition and properties of soils, etc.

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1. Introduction

Sustainable use of land, taking into account its natural characteristics and resilience to degradation, is only possible through the use of reliable information on the state of land resources. Under current conditions, the human pressure on land resources is increasing everywhere. This leads to water and wind erosion, dehydration, secondary salinization, desertification and other degradation processes. Therefore, an urgent issue is to organize monitoring of land use and degradation processes in order to improve land management mechanisms (Stürck & Verburg, 2017). One way of this improvement is to use relevant and reliable information to make management decisions, which can be obtained during land monitoring.

The state land resources management most important task is the land monitoring organization as a comprehensive system for monitoring the land resources state, assessment and forecast of changes in their condition under the influence of anthropogenic and natural factors. The monitoring is aimed at reception relevant and true information on the land resources condition, their quantitative and qualitative characteristics, their application, as well as on the condition of soil fertility (The Land Code of the Russian Federation No. 136-FZ of October 25, 2001).

1.1. General concept of land monitoring in the Russian Federation

The land monitoring object is all lands of the country, regardless of the form of land ownership, purpose and nature of use. The subject matter is the characterisation of subcomponent and complex changes in land condition and measurement processes. The information obtained has property and legal, sanitary and hygienic, environmental, engineering and construction and architectural and urban planning components.

State monitoring of lands in the Russian Federation is defined in the federal law as an organized system for monitoring the condition, qualitative and quantitative characteristics, land use, changes in soil fertility, as well as assessment and changes forecasting. Depending on the monitoring purpose, it is divided into land use monitoring and land condition monitoring. Land use monitoring is conducted to track the land plots use for their intended purpose (Decree of the Government of the Russian Federation of 01.06.2009 № 457 "On Federal Service for State Registration, Cadastre and Cartography").

1.2. Carried out land monitoring in the Russian Federation

State monitoring of lands belongs to ecological monitoring and is carried out (except for agricultural lands) by the Federal Service for State Registration, Cadastre and Cartography (Rosreestr) with certain criteria application. Such criteria in land use monitoring includes: total certain category land area; land plots with a certain type of dispersed use area; land plots not used for their destination, not used or with violations of land legislation identified area; land distribution by form of ownership; developed lands area; forest fund lands included into the state real estate cadastre area, etc. The data obtained in the land monitoring course is periodically published in the state (national) report on the condition and use of land in the Russian Federation form, as well as regional reports for each subject of the Russian Federation (Rosreestr, 2018). The condition and use of agricultural land monitoring is the responsibility of the Ministry of Agriculture of the RF, its results are also periodically published in the open press (Order of the Ministry of Economic

Development of Russia No. 852 dated 26.12.2014 "On approval of the Procedure for state monitoring of lands, except for agricultural lands").

When monitoring the lands condition, changes in the quantitative and qualitative lands characteristics observation, land disturbance, as well as assessment and forecasting of changes in the condition of lands shall be carried out. In this case, changes in the fertility condition of agricultural lands, their reclamation condition as well as the course of degradation processes: erosion, salinization, swamping, overwetting, waterlogging, pollution, desertification, disturbance, overgrowth, cluttering and others shall be analyzed. Soil degradation processes are a global problem and lead to significant losses (Sartori et al., 2019).

The conducting land monitoring structure shall be determined by the territorial division structure. According to the level of territory covered, land monitoring can be subdivided into

- Global (studies the state of the planet's land resources as a part of the entire Earth's biosphere);
- National (study of the state of the land fund at the level of individual states);
- Regional (monitoring of processes on the territory of a single large region or subject of the Russian Federation);
- Local general (study of the state of lands at the level of a municipal entity);
- Local local (structural; intra-city administrative units and elements of functional division - districts, quarters, etc.).

Depending on the nature of changes in land conditions, background (observation of lands not subject to anthropogenic impact is carried out in biosphere reserves) and impact (observation in places of significant anthropogenic impact) monitoring is allocated.

The table 01 contains materials and data to be collected for obtaining indicators of state land monitoring, identification of changes in the condition and use of land plots, analysis and making forecasts in order to develop recommendations for elimination of degradation processes.

Table 01. Characteristics of land monitoring objects

Land monitoring objects	Characteristics of the land monitoring object
Land used as agricultural land	Types of agricultural land: arable land, grasslands, hayfields, long-term plantings, deposits, deer pastures, as well as land under reclamation and restoration.
Land plots with buildings and structures	Types of building or construction: residential, industrial, public and business, etc.
Land plots with roads and structures on them	Types of roads and structures under them: iron, automobile, etc.
Land areas covered with forest vegetation	Forest types: urban forests and parks, forest nurseries, protective forests, wood and shrub vegetation; damaged forests, shrubs, whether protective strips, felling, burning.
Land areas with surface water bodies	Types of water body: river, lake, swamp, reservoir, sea, canal, brook, glacier, snow.
Other lands	Awkwardness, cemetery, waste dumps and landfills, disturbed land

Source: authors.

2. Problem Statement

Agricultural land use current status and monitoring in Samara region. Samara Region is located in the south-east in the European part the RF in the Middle Volga region. The territory of the region occupies an area of 53.6 thousand square kilometers, which is about 0.3% of the total territory of the country. The region administrative and territorial division is represented by 10 urban districts and 27 municipal areas. The regions include 13 urban and 292 rural settlements. Samara Region is home to over 3 million people, most of whom live in the Samara-Togliatti agglomeration. Samara-Togliatti agglomeration (STA) is one of the largest agglomerations in Russia and ranks third after Moscow and St. Petersburg agglomerations (Kondolskaya, Vasilieva, Parsova, & Antropov, 2019).

The region territory is situated on the boundary of two land-climatic zones: steppe in the southern part and forest-steppe in the north. Natural and climatic conditions caused the spread of the most fertile soils - chernozems - in the region. That's why agriculture is strongly developed in the region and most of the territory is ploughed (Voronin, Vlasov, & Vasilieva, 2013).

2.1. Characteristics of land use in the Samara region

The agricultural purpose lands dominates on the territory of Samara region, which occupy 75,93% of the territory, while the share of other categories is as follows: forest fund lands - 10,3%; settlements lands - 6,72%; water fund - 3,12%; specially protected territories - 2,6%; industry, transport and other special purpose - 1,32%; reserves - 0,01%. Agricultural lands use and condition in Samara Region is the most important factor both in ensuring food security and in creating ecological balance of the territory.

Information on unused agricultural land plots by municipal districts of Samara Oblast as of 01.09.2018 is presented in the table 02.

Table 02. Areas of unused land in municipal districts of Samara region (thousand ha)

№	Name of municipal district	Total area of agricultural lands	Not used in agricultural production (% of the district area)
1	Alekseevsky	134,809	9,511 (7%)
2	Bezenchuksky	100,969	1,199 1 (1%)
3	Bogatovsky	48,462	0
4	Bolsheglushitsky	186,794	0
5	Bolshechernigovsky	188,229	0
6	Borsky	113,069	22,794 (20%)
7	Volzhsky	100,148	17,651 (18%)
8	Elkhovsky	80,031	23,502 (29%)
9	Isaklinsky	79,812	6,342 (8%)
10	Kamyshlinsky	36,884	5,297 (14%)
11	Kinelsky	104,785	11,085 (11%)
12	Kinel-Cherkassy	161,562	10,692 (7%)
13	Klyavlinsky	60,402	6,308 (10%)
14	Koshkinsky	99,189	0
15	Krasnoarmeysky	150,247	17,937 (12%)
16	Krasnoyarsky	108,092	15,786 (15%)
17	Neftegorsky	98,459	0,941 (1%)

18	Pestrvsky	131,051	1,44 (1%)
19	Pokhvistnevsky	96,911	0,219 (0,2%)
20	Privolgsky	79,497	3,316 (4%)
21	Sergievsky	142,577	31,036 (22%)
22	Stavropolsky	143,516	16,427 (11%)
23	Syzransky	66,134	11,678 (18%)
24	Khvorostyansky	136,946	1,381 (1%)
25	Chelno-Vershinsky	68,621	2,746 (4%)
26	Sentalinsky	60,295	7,754 (13%)
27	Shigonsky	81,034	9,083 (11%)
	Total	2858,525	234,125 (8%)

Source: authors based on Rosreestr (2019)

On average 8% of agricultural land is not used in the Samara region. However, this indicator varies greatly from municipality to municipality. In some municipal districts (Bogatovsky, Bolsheglushitsky, Bolshechershnigovsky, Koshkinsky, Neftegorsky, Pestrvsky, Hvorostyansky and Pokhvistnevsky) this indicator is equal to or close to zero. But in some municipal districts it is significantly above the regional average: Elkhovsky - 29%, Sergievsky - 22%, Borsky - 20%, Syzransky - 18%, Volzhsky - 18%, Krasnoyarsky - 15%, etc. The municipal districts majority far from the regional centre have a small percentage of unused arable land. In peri-urban areas, on the contrary, this indicator is higher, as agricultural land is often purchased by individuals for conversion to another category and further resale.

It should be noted that the unused arable land total area in the Samara region has decreased in recent years: in 2007, 24% of cultivated land in Samara region was not arable (about 700 thousand ha), and in 2011 this ratio was reduced to 15% (417 thousand ha). Measures taken by the Ministry of Agriculture and Food to involve in the turnover of unused arable land have led to a reduction in the area of unused land. Road maps have been developed for some municipal districts (e.g. Krasnoyarsky) to organize and conduct an inventory of agricultural land in order to identify arable land that is not used for agricultural production and is not used for its intended purpose.

2.2. Consequences of not using land

Once land use in agro-landscapes has ceased to exist, if not managed, it is often naturally overgrown with woody and shrub vegetation. At the same time, the level of their natural fertility may decrease on chernozems, for the development of such land requires large capital investments, which makes it unprofitable to return them to arable land. It becomes expedient to transfer lands from the category of agricultural purpose to the lands of the forest fund. Thus, there is a reduction in the area of arable land. On the one hand, this process makes it possible to increase the area of unmanaged land. These lands, on which the anthropogenic impact is reduced, participate in maintaining the ecological balance of the territory (Kay et al., 2019). Increasing the acreage of vegetated lands allows reducing erosion losses (Panagos et al., 2015).

On the other hand, arable lands are of great value, therefore their losses are irreplaceable. There is a deterioration of soil fertility when agricultural lands are not used and forest vegetation is overgrown. Agroforestry is a promising area, which, compared to traditional agriculture, contributes significantly to carbon sequestration, expands the range of regulated ecosystem services and enhances biodiversity in the

region (Rega, Helming, & Paracchini, 2019). It is shown that a reduction in the environmental impact of agriculture (compared to other scenarios) can be achieved with a minimal reduction in agricultural production using new management solutions (Khasaev, Vlasov, Vasilieva, & Parsova, 2019).

3. Research Questions

In the territory of the Samara Region black soils prevail in the soil cover, and the category of agricultural lands in the land fund. Therefore, the region is characterized by significant anthropogenic transformation and high degree of plowing. Due to anthropogenic disturbance of the vegetation and soil cover, land degradation processes intensify. This leads to significant reduction of soil fertility and land quality. In this regard, improvement of land structure and monitoring at the level of municipal entities is particularly relevant.

4. Purpose of the Study

The purpose of the presented research is to study the application of land monitoring results to improve land use at the municipal level. Study of land degradation processes peculiarities on the territory of municipal entities of Samara region. Characterization of problems associated with the non-use of land or its unsustainable use.

5. Research Methods

The data of last year's reports on the condition and use of land in the Russian Federation and Samara region are studied in the article. The dynamics of changes in Samara region lands since 2007 is analyzed. The results of the conducted monitoring of land use - distribution of land by owners have been studied. The analysis of changes in the condition of agricultural lands was carried out. With the analytical method help, the regulatory and legal framework of the state monitoring of land and its role in the municipal entities land resources management were studied. Using tabular method, the studied information on land use in the region is presented.

6. Findings

The Department of the Rosreestr is responsible for the state monitoring of lands of all categories, except for the agricultural lands category in the Samara Region. On the agricultural purpose lands monitoring of lands is carried out by the Ministry of Agriculture and Food of the Samara Region (Order of the Ministry of Agriculture and Food of Samara Region No. 99-P "On evaluation of efficiency of agricultural lands use in 2017 in the territory of municipal districts of Samara Region"). The results of annual monitoring of lands of Samara region by categories of lands conducted by Rosreestr are given in the table 03.

Table 03. Dynamics of the Samara Region land fund

Name of land categories	Area (thousand hectares)			
	2007	2013	2017	2018
Agricultural land	4112,5	4070,1	4067,2	4067,2
Lands of settlements, including	344,4	359,3	359,8	359,8
- urban settlements	168,5	170,8	170,8	170,8
- rural communities	175,9	188,5	189,0	189,0
Lands of industry, transport and other special purposes.	69,6	70	71	71,5
Protected Areas	135,3	138,8	138,8	138,8
Forest Lands	527,0	534,4	549,6	551,5
Aquatic Fund Lands	167,4	167,4	167,4	167,4
Reserve lands	0,3	0,3	0,3	0,3
The total land within the administrative boundaries:	5356,5			

Source: authors based on Rosreestr (2008-2019)

The presented data analysis allows to draw a conclusion that there is a gradual decrease in the agricultural designation lands number, which amounted to 45.3 thousand hectares from 2007 to 2018. At the same time, the residential lands category area increases by 15.4 thousand ha, industrial and other special purpose lands by 1.9 thousand ha, specially protected territories and objects lands by 3.5 thousand ha, and forest fund lands by 24.5 thousand ha. The water fund lands area and reserve has remained unchanged in the Samara oblast since 2007. Thus, the main agricultural lands losses are related to urbanization mainly within the boundaries of the Samara-Togliatti agglomeration, as well as to settling of the long-used arable land and transfer of such land plots to the forest fund lands category.

6.1. Monitoring of land use in Samara region

In Samara region the agricultural purpose lands prevail (over 75%) in the general land fund structure, therefore more attention needs to be focused on monitoring these lands. The Samara region monitoring land use results as of 01.01.2019 are presented in the table 04.

Table 04. Monitoring of land use in Samara region (thousand ha)

№	Land Categories	Square	Owned by citizens	In the ownership of legal entities	In state and municipal ownership
1	Agricultural land	4067,2	2459,6	296,7	1310,9
2	Human settlements lands	359,8	70,3	20,1	269,4
3	Lands of industry, transport and other special purposes	71,5	0,7	1,6	52,6
4	Protected Areas	138,8	0	0	138,8
5	Forest Lands	551,5	0	0	551,5
6	Aquatic Fund Lands	167,4	0	0	167,4
7	Reserve lands	0,3	0	0	0,3
	The total land:	5356,5	2530,6	319,3	2658,3

Source: authors based on Rosreestr (2019)

The presented data analysis shows that Samara oblast privatized agricultural purpose category lands to the greatest extent (at that, more than 60% of the lands are owned by citizens). More than half (68%) of agricultural land in the region is owned by citizens and legal entities, while the rest is state and municipal property. Therefore, an important issue is to improve the complex of administrative and controlling measures for monitoring and management of agricultural lands. Much attention needs to be paid to monitoring the lands use or its intended purpose, especially those owned by agricultural organizations. It is necessary to continue taking measures to involve unused lands in circulation.

6.2. Monitoring of agricultural lands conditions in Samara region

In order to monitor and assess the agricultural land condition in the Ministry of Agriculture and Food of Samara region, a commission has been established to evaluate the efficiency of agricultural land use in municipal districts of Samara region efficiency has been established (Order of the Ministry of Agriculture and Food of Samara Region No. 99-P "On evaluation of efficiency of agricultural lands use in 2017 in the territory of municipal districts of Samara Region").

Criteria have been developed to evaluate performance: 1) cultivated arable land share (in %); 2) fallow fields (visually assessed) condition; 3) general agriculture culture (visually assessed condition of crops, presence of weeds, condition of field roads); 4) phytosanitary areas adjacent to production agroindustrial complex facilities condition; 5) carrying out of measures aimed at combating quarantine objects - weeds; 6) growth or decrease of the areas contaminated by quarantine weeds; 7) improvement of agricultural production facilities in the Samara region municipal district territory; 8) forest belts condition in the municipal district territory; 9) maintenance of territories adjacent to roads of local, regional and federal significance; 10) areas around poles condition, power lines, gas pipelines.

The Samara region agricultural lands monitoring results are presented in the table 05.

Table 05. Monitoring of agricultural lands conditions in Samara region (thousand ha)

№	Land type	Land area (01.01.2016)	Land area (01.01.2019)	Change of area +/-
1	Arable	2859,9	2858,5	-1,4
2	Long-term plantings	27,8	27,9	+0,1
3	Grasslands and pastures	805,5	805,5	0
4	Lands under tree and shrub vegetation	90,1	90,1	0
5	Forest areas	21,3	21,3	0
6	Building land	16,2	16,2	0
7	Land under roads, communications, streets, squares	41,7	41,7	0
8	Underwater lands	36,0	36,0	0
9	Marshes	34,6	34,6	0
10	Damaged lands	0,5	0,5	0
11	Blizzard lands	103,5	103,5	0
12	Other lands	26,5	26,5	0

Source: authors based on Rosreestr (2019)

In the agricultural land distribution by land analysis, it can be seen that arable land prevails, occupying 70% of the agricultural purpose land area. The pasture lands share is 18% of the territory of this category, the fallow lands share - 2.5%, hayfields - 1.2%, and perennial plantations - 0.7%.

There were no changes in the land areas distribution in 2019 as compared to the previous year. If we analyze the dynamics for the last three years, we can note a decrease in arable land by 1.4 thousand ha and an increase in perennial plantings by 0.1 thousand ha.

In the region, work is being done to increase the area under crops by putting unused arable land into circulation. In 2018 the total sown area amounted to 2092.5 thousand ha, which is 40 thousand ha more than in 2017.

Soil degradation processes on agricultural land are observed in Samara region. The last inspection cycle materials received by "Samarskaya" agrochemical service station showed that deterioration of humus state of chernozems is observed on the region territory, now soils with low humus and low humus prevail. At the same time, specific medium humus soils weight in arable lands has decreased from 31,9 to 10,7%, and weakly humus soils have grown from 19,3 to 40,0%. In the last 30-35 years, arable lands of the region lost 1.2 percent of humus during intensive agricultural use, which corresponds to the annual loss of 1.7 t/ha of humus reserves, and in some municipal areas the decline made up 2.7 percent. The region's soils are well supplied with potassium and medium with phosphorus. Almost all soils in the region have pH reaction close to neutral (6.1-7.5). The area of acid soils is small and makes up 40,583 ha or 1.4% of the total arable land area. The area of irrigated lands in the region is 140,2 thousand ha (no drained lands). There is no irrigated lands monitoring in the region, as well as of pasture and hay lands (805,5 thousand ha), lands under perennial plantations. The erosion processes in arable lands development is not monitored (Panagos et al., 2015).

It should be noted that agricultural land monitoring in many Russian Federation regions is carried out using outdated methods that do not take into account the degradation processes degree and the their modern course peculiarities. Therefore, there is a need to build a new system for accounting and agricultural land monitoring.

7. Conclusion

It is shown that under current conditions of increasing anthropogenic load on land resources with increasing population of the Earth and climatic changes, organization of land monitoring system is the most important task. All land monitoring types and levels (from global to impact) solve acute land use system problems and require the integrated methods and modern technologies use. For principles of rational lands use and land resources management system formation introduction it is necessary to create a land municipal formation use system. In the Samara region territory, which is a highly urbanized region with developed industry and agro-industrial complex and high anthropogenic transformation, land monitoring organization are of paramount importance issues.

Land use in Samara region monitoring organization allows obtaining actual and reliable information on the use of agricultural lands in the region, which is published in the open press, with insufficient attention paid to the qualitative condition of lands monitoring.

The following activities should be undertaken to address these issues:

7.1. Single land management agency creation, conducting a comprehensive all land categories and the municipal entities delimitation inventory

- First, to improve the land management mechanism, a single agency should be established. At present, the land management function is divided between the Rosreestr, the Ministry of Agriculture and other federal services;
- It is necessary to establish the municipal entities boundaries, which will improve the land cadastral valuation and other real estate within these boundaries
- A land comprehensive inventory within the boundaries of municipal entities will provide reliable and complete information on land use.

7.2. Planned works on the Russian Federation land legislation modernization implementation

A further land management improvement process is currently under way. By Order of the Government of the Russian Federation No. 2413 of 08.11.2018 the "Plan of measures to improve legal regulation of land relations" was approved. Development and adoption of the Federal Law, which should be aimed at protection of agricultural lands and at reduction of withdrawal of land plots from agricultural turnover, are envisaged. The given Plan of measures provides the basic directions of improvement of the ground legislation: first, establishment of criteria of assignment of the ground areas to especially valuable agricultural lands and their allocation in a separate territorial zone. Secondly, determination of the procedure for establishing and changing types of permitted use of land plots from agricultural lands. Third, establishment of restrictions on changing the types of permitted use of especially valuable agricultural land, as well as prohibition on open-cut mining of common minerals on agricultural lands. Fourth, improvement of the system for accounting of agricultural lands, including their inventory. Fifth, conducting passportization of agricultural lands for accounting of information on condition and properties of soils, etc. Adoption of these Federal Laws will allow to solve the problem of use of land resources and increase responsibility of legal entities and individuals working on land.

The Samara region territory is dominated by agricultural lands, it is impossible to carry out without development of measures to improve the land use efficiency, agricultural land rational use application principles, which will create conditions for increasing their productivity while preserving soil fertility and absence of damage to the natural environment.

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