Regional Land Use as a Condition for Sustainable Development of Rural Territories

Natalia Ovchinnikova[a]
Don State Technical University, pl. Gagarina, 1, Rostov-on-Don, 344003, Russia

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Abstract: The rational approach to land use is economically and socially beneficial for agricultural producers, since it allows them to obtain a long-term and sustainable effect based on scientifically grounded operational use of qualitatively preserved and constantly renewed land resources. Agricultural producers must take into account the ecological efficiency of land use as a fundamental element of their production activity. This, ultimately, will have an impact on the efficiency of their use of land resources. Land continues to be withdrawn from economic circulation, soil fertility has been degrading. Irrational use has led to a decrease in productive land, a reduction and decrease in agricultural production, and deterioration of the environmental situation. Serious problems of land and resource potential of agriculture caused by large-scale land disturbance, pollution and degradation of soils, loss of soil fertility are growing in the country. This research addresses the above mentioned problems.

1 INTRODUCTION

One of the main principles of agricultural land use is the principle of sustainable land use. As a unified ecological and economic concept, sustainable land use links the achievement of the necessary effect obtained from the economic exploitation of land at minimum costs with the simultaneous preservation and improvement of land in the process of its use.

Land misuse has led to reduction of productive land, decrease in its fertility and agricultural production, and deterioration of the environmental situation. Land continues to be withdrawn from economic turnover, and soil fertility is degrading (Immovable Property Cadastre, 2017; Ogryzek et al, 2018).

In the country, severe issues have emerged and are steadily growing in the preservation of the land and resource potential of agricultural sector, caused by large-scale land disturbance, soil degradation and loss of soil fertility (Ovchinnikova et al, 2019; Wilson et al, 2014). These issues can be conditionally divided into three main groups, which include:

1. Issues related to soil degradation and loss of soil fertility as a result of improper and unsustainable agricultural practices on land.
2. Issues related to physical and chemical influences on soils leading to soil disturbance, pollution, waterlogging and other negative phenomena.
3. Quantitative reduction of agricultural land caused by land acquisition for industrial and urban development needs.

The main reason for this situation is the lack of incentives for landowners to preserve soil fertility due to the fact that currently farming is carried out under conditions of insufficient control over the quality of agricultural land (Wójcik-Leńa et al, 2018).

In order to conserve and manage the land stock, criteria for land use sustainability and requirements that will lead to sustainable land use, shall be established (Han et al, 2020).

The lack of any ecological restrictions and requirements led to a large number of agricultural producers switching to monocultures with the highest market price after land reform and the transfer of a considerable amount of land into private hands, as their main objective was to make a profit. The abandonment of fallow land and the cultivation of crops that would restore the natural fertility of land has become the consequence of the transition to monocultures.

[a] https://orcid.org/0000-0001-8792-1758

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The second reason for the significant deterioration of soils was the "agricultural" ignorance of new land users and landowners, resulting in widespread non-compliance with traditional farming practices and disregard of scientifically grounded farming techniques.

2 MATERIALS AND METHODS

Rational use of agricultural land is aimed at ensuring that in the process of agricultural production owners of land plots, landholders, land users and tenants achieve the maximum effect in their implementation of land use objectives, taking into account the protection of lands and optimal interaction with natural factors, ways of their use which do not lead to significant reduction in the fertility of soils (Ovchinnikova, 2017).

A criterion for the rational use of land plots being a part of lands intended for agriculture is a certain level of yield of main agricultural crops (e.g. spring wheat, spring barley, peas), hereinafter referred to as level of yield of main agricultural crops.

A 15 per cent reduction in the yield level of major crops compared to the regional average is an indicator of unsustainable land use (Ovchinnikova, 2019).

The regional average yield of the main crops is calculated on the basis of soil fertility.

The criteria for sustainable land use are defined by means of quantitative and qualitative indicators (Lai et al, 2017). The quantitative criterion of rational land use is characterized by actual condition and use of the entire land fund, and is expressed by two main parameters:

1. Prudent use of land;
2. Rational combination of available objects.

The qualitative criterion for the rational use of land is expressed primarily in the preservation of the productive power as the main means of agricultural production. This implies the following (Mertz and Mertens, 2017: Lengoiboni et al, 2019):

- Establishing obligations for all land users which carry out work involving soil disturbance to remove, store and not disturb the soil fertile layer, which is capable of enhancing the fertile strength of the land even when separate from the parent rock (as a means of reclaiming other agricultural land, when used in greenhouses, glasshouses); limiting the use of agricultural land for non-agricultural purposes;
- Establishing a universal obligation to protect soils from erosion, contamination, pollution and other negative effects, because soil erosion, for example, eats up over 40 ha every day on the globe, including as a result of naturally occurring natural processes (washout by rain, deflation, etc.).

While the quantitative criterion for sustainable land use prevails in the non-agricultural land domain, the qualitative criterion prevails in the agricultural domain. Both the quantitative and qualitative criteria "work" for the agricultural land use sector. If the shortage of land can be compensated for in the economic sphere (in housing - by the construction of multistore buildings; in transport - by the arrangement of underground facilities, etc.), the shortage of land for agricultural use is generally irrecoverable. Considering that agriculture is vital for the population, the loss of this property would by catastrophic (Gilbey et al, 2019).

Therefore, the rational use of land has two main aspects: on the quantitative side, it is expressed in land conservation, avoiding wasteful allocation of land areas for non-agricultural facilities, and on the qualitative side, it involves ensuring the fertility of land.

3 RESULTS

Soil degradation is a set of processes that lead to changes in soil functions, quantitative and qualitative deterioration of its properties, gradual deterioration and loss of fertility. Soil degradation and loss of soil fertility consist in reduction of nutrients, namely, nitrogen, phosphorus, potassium, microelements, soil acidification, etc.

Soil degradation problems are caused by non-compliance with cultivation technology to maintain and increase soil fertility. There are several major causes of degradation: non-observance of crop rotations in farming, a predatory attitude towards land and agricultural ignorance.

Soil erosion is one of the most dangerous types of degradation, causing soil destruction and loss of soil fertility.

In the Russian Federation, soil monitoring was carried out in 79 municipalities, predominantly on arable land, including the detection of wind erosion (soil blowing) shown on Figure 1.

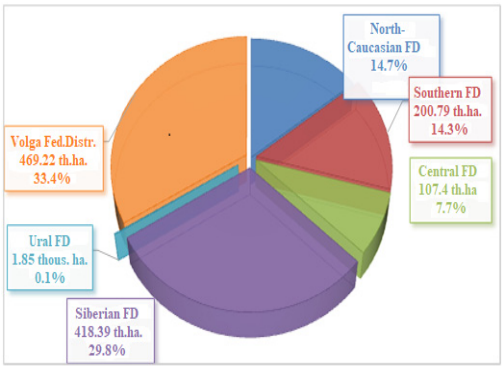
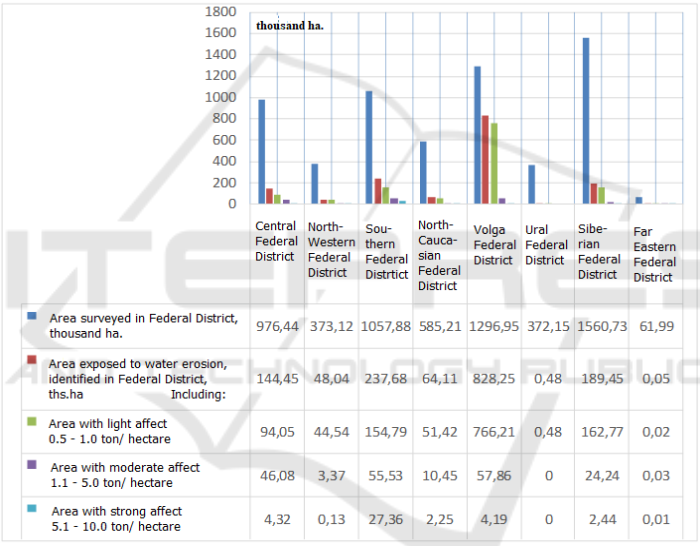


Figure 1: Breakdown of detected wind erosion (soil blowing) by federal districts of the Russian Federation.

The water erosion situation within each of the federal districts of the Russian Federation is shown on Figure 2, which demonstrates the areas exposed to water erosion identified in that federal district in relation to the area surveyed in that district.



	Central Federal District	North-Western Federal District	Sou-thern Federal Distrtict	North-Cauca-sian Federal District	Volga Federal District	Ural Federal District	Sibe-rian Federal District	Far Eastern Federal District
Area surveyed in Federal District, thousand ha.	976,44	373,12	1057,88	585,21	1296,95	372,15	1560,73	61,99
Area exposed to water erosion, identified in Federal District, ths.ha Including:	144,45	48,04	237,68	64,11	828,25	0,48	189,45	0,05
Area with light affect 0.5 - 1.0 ton/ hectare	94,05	44,54	154,79	51,42	766,21	0,48	162,77	0,02
Area with moderate affect 1.1 - 5.0 ton/ hectare	46,08	3,37	55,53	10,45	57,86	0	24,24	0,03
Area with strong affect 5.1 - 10.0 ton/ hectare	4,32	0,13	27,36	2,25	4,19	0	2,44	0,01

Figure 2: Share of agricultural land (arable land) with various degrees of water erosion in federal districts.

Constituent entities of the Russian Federation most affected by wind erosion (soil blowing) of arable land are shown on Figure 3.

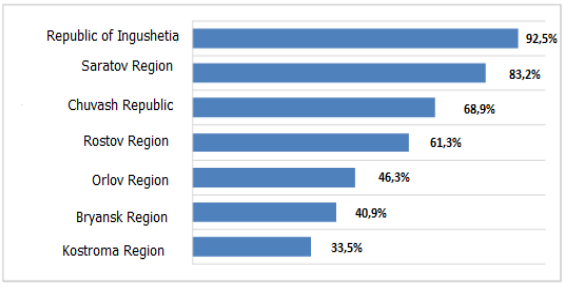


Figure 3: Constituent entities of the Russian Federation most affected by wind erosion of arable land.

3.1 Main Responsibilities of Owners of Land Plots, Land Holders, Land Users and Tenants for Rational Use of Land with the Purpose of Its Sustainable Development

Agricultural commodity producers being land owners, land holders, land users, tenants of land plots, in the context of maintaining agricultural land fertility, shall fulfill their responsibilities stipulated by the federal legislation and, besides:

1) Prevent degradation of agricultural land owned, possessed or used by them;

2) Conduct agrochemical survey of land plots intended for agriculture with the involvement of

specialized accredited organizations, at least, once every 5 years;

3) Prevent soil fertility from decreasing below levels documented by the results of the last agrochemical survey, in terms of the following indicators:

- Reduction in the content of organic matter (humus) in the plough layer;
- Decrease of the content of nutrients, i.e., phosphorus, potassium and microelements;
- Decrease (pHsol.) of soil acidity.

4) Not allow incineration of crop residues and by-products on agricultural land.

5) Prevent littering of lands with domestic and industrial wastes, overgrowing of agricultural lands with weed and shrubbery vegetation.

6) Implement measures to preserve and reproduce the fertility of agricultural land, including reclaimed land, and protect soils from wind and water erosion:

- Implement measures to preserve and reproduce the fertility of agricultural land, including reclaimed land and protect soils from wind and water erosion;
- Perform anti-erosion contour tillage (horizontally);
- Implement grassland renovation of erosion threatening slopes;
- Create protective forest plantations preventing wind and water erosion of soils;
- Not to place row crops (vegetables, potatoes, etc.) on slopes steeper than 3 degrees;
- Use soil-protecting (grain-grass) crop rotations on arable land with a slope steeper than 3 degrees with seeding of perennial grasses covering at least 40 per cent of the crop rotation area;
- Construct erosion control structures.

7) Carry out agricultural production by methods that ensure preservation and reproduction of the fertility of agricultural land, as well as exclude or limit the adverse impact of such activities on the environment, inter alia:

- Use methods for the application of liquid and solid organic fertilizers and composts based on them, including effluents, that ensure compliance with environmental quality standards and neutralize pollutant emissions (e.g., nitrogen dioxides, ammonia, hydrogen sulphide, mercaptans), in accordance with the projects approved by a specialized organization;
- Not apply liquid organic fertilizer to the soil if a groundwater depth level is less than 1.5 meters;

8) Avoid crop rotation which leads to the spread of plant pests and plant pathogens (e.g. sowing rape on a land plot earlier than four years after its cultivation on that plot, winter crops or spring spiked cereals on the same land plot for more than two consecutive years), as well as:

- Use one of the following biologization components in the cropping pattern: perennial grasses, leguminous crops, seeded and green-manured fallows;
- Use seeds of crop varieties and hybrids of high reproductions adapted to the conditions of soil and climate zones.

9) Comply with the standards, norms, rules and regulations in the context of ensuring the fertility of agricultural land as established by laws and other normative legal acts of the Russian Federation;

10) Provide data on the use of agrochemicals and pesticides to an authorized body.

The procedure for submission of data on the use of agrochemicals and pesticides to the authorized body shall be approved by that authorized body.

11) Avoid exceeding weed infestation limits set by competent authority for agricultural crops.

12) Promote soil, agrochemical, phytosanitary and ecological-toxicological surveys of agricultural land.

13) Maintain the capacity of the soil to provide gross agricultural output in accordance with the requirements of sustainable agricultural land management:

- Annually apply at least 20 kg/ha of mineral fertilizers on primary nutrient basis per 1 ha of cultivated area under crops (excluding organic farms);
- Annually apply organic fertilizer, including crop residues and cereal straw, in a quantity of, at least, 2 tons per hectare, and not apply organic fertilizer in doses exceeding those calculated for the project;
- Carry out chemical reclamation of sour soils on the basis of agrochemical surveys of at least 5% of the area of sour soils with a pH <5.0 per year;
- Ensure that the yield of the main crops (spring wheat, spring barley, maize, peas) is at least fifteen per cent compared to the regional average, in accordance with the state statistical reporting for the last five years;
- Prevent a significant reduction in the fertility of agricultural land and any use of agricultural

land that results in a soil washout of more than 2 tons/ha.

14) Maintain extended books of field history.

15) Inform authorized bodies about degradation of agricultural land and contamination of soil on land plots owned, possessed or used by them.

The procedure for submitting information on the facts of agricultural land degradation and soil contamination on land plots owned, possessed or used by them to an authorized body shall be approved by the authorized body.

16) Implement measures to ensure the maintenance of protective forest plantations, erosion control and etc.

4 DISCUSSION

Thus, in order to ensure the rational use of agricultural land, owners of land plots intended for agriculture, landholders, land users and tenants of agricultural land are obliged to implement measures in order to protect soils from erosion, preserve and recover soil fertility, comply with scientifically based principles of crop rotation in agricultural landscapes and rules of crop rotations.

Land users are obliged to maintain soil fertility in accordance with the requirements of the rational use of agricultural land.

Land users must comply with the rules for the use of agricultural land in water protection zones and protected shoreline belts in accordance with the requirements of the Water Code of the Russian Federation.

Land users are obliged to prevent a significant reduction in the fertility of agricultural land.

Land users shall keep books of field history.

Besides, land users shall comply with the following:

- Conduct obligatory activities on land improvement, comply with established regulations on the use of plant protection products, growth stimulants and fertilizers permitted in the Russian Federation;
- Not to allow a significant decrease in the fertility of agricultural land plots;
- Facilitate agrochemical surveys of agricultural lands;
- Implement mandatory measures to protect soils from erosion and other degradation processes in accordance with on-farm land management projects or the adaptive landscape farming system;
- Not to allow the use of agricultural lands resulting in overgrowth with weed and shrubbery vegetation, as well as littering with domestic and industrial wastes;
- Not to allow the burning of crop residues and by-products of agricultural crops on agricultural lands.

Land users are obliged to ensure the following:

- Implementation of seed breeding activities and phytosanitary requirements for the cultivation of crops;
- Observance of scientifically grounded terms of varietal change and varietal renewal of seeds of agricultural crops;
- Use for sowing of cereals and leguminous crops seeds not lower than the third reproduction;
- Implementation of phytosanitary measures on seed disinfection, weed and quarantine vegetation, diseases and pests control.

5 CONCLUSIONS

Therefore, it can be concluded that rational use of land means ensuring that all land users in the process maximize the effect of their land use objectives, taking into account land protection and optimum interaction with natural factors

It is the duty of land users to use the land efficiently, to treat it with care and to increase its fertility.

Rational use of land contributes to its continuous improvement, as well as to the balanced and sustainable development of agricultural production with preservation of soil fertility and prevention of land degradation processes, which in the future will enable implementation of attractive investment projects for the development of the municipalities themselves.

Measures for the rational use of land shall ensure its conservation, increase the productivity and fertility of agricultural land, prevent land erosion, pollution, etc.

In order to conserve and manage the land fund, it is necessary to establish criteria for sustainable land use and to set requirements that will lead to sustainable land use.

The rational use of agricultural land establishes mandatory requirements to owners of land plots, landholders, land users and tenants of agricultural land regarding the rational use of agricultural land.

It is also necessary to regulate the activities of land plots owners, land holders, land users and tenants of agricultural land plots aimed at preserving and restoring soil fertility, achieving a certain level of crop yield, increasing agricultural production and developing livestock production.

Actually, many agronomists and farm managers do not have at all or do not use in practice any on-farm land management project - a document that defines and substantiates organization and arrangement of agricultural land for the near future and contains a set of measures ensuring the best use of each land plot taking into account its individual characteristics, such as, fertility, technological properties, location, natural-historical, environmental and etc. as well as materials of agrochemical soil survey, which, in fact, should be the handbook of any competent farmers. This shall become their direct responsibility. Apparently, it is impossible to conduct production in the XXI century without a specific farming system that considers all local farm conditions and the fertility of each work plot!

Those farmers, who have come to work on the land for a long period of time and in a serious way, need to build an effective land-use model, prevent ecological mistakes and generate a profit. Those who have come to the land with one goal in mind - to make quick gains and leave, wasting the fertility of arable land - must be held accountable. However, for many farmers, requirements to ensure the reproduction of soil fertility have long been the norm for effective land use and an incentive to improve the professionalism of agricultural specialists.

It is necessary to ensure regular agrochemical inspection of agricultural land in every 5 years as well as systematic provision of agricultural producers with projects of on-farm land management and certificates of agrochemical inspection.

The adoption of legal acts with the purpose to protect soil fertility becomes even more urgent in a situation where there is a shortage of specialists in rural areas and especially when foreign investors, such as Chinese, are attracted to local agricultural production.

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