

# Encumbrances on Land Use as an Organizational and Economic Mechanism for Regulating Environmental Management under Market Relations

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**Abstract** – The prerequisite of the study was lack of an established system for regulating environmental management in Russia, which leads to inefficient environment management and overuse of natural resources under market relations. An organizational-economic system of land use regulation is proposed as part of the study based on a mechanism for encumbering the land with zones with special conditions of use of the territories to balance private and public interests with regard to protection of the natural and living environment using regulatory, economic, technical and other methods.

**Key words** – cadaster, land use, environmental management, geodesy

## I. INTRODUCTION

The diversity of forms of land ownership in Russia started in 1991, and land became not only the property of the state, but also a real thing of the owners, who used it for production purposes. This transition to the country's market economy strengthened private land ownership and created conditions for its use as a resource, commodity and means to make profit. The land used not only in agriculture and forestry, but also in mining, processing industry, commercial and residential spheres is a territorial basis that makes the basis for human activity.

Under market relations, environmental management can be realized through land rights only, since this primarily determines the possibility of using other resources of the land accumulated by both nature and man. That is, the idea of land use is the idea of nature management that involves the use of soil fertility, fauna and flora, mining, and communication functions [1]. However, private ownership of land should not permit the owner to carry out economic and other activities on the land since it can involve inefficient management of both the land and the resources. Therefore, an established system is required to regulate the use of land and other resources of the country.

## II. FORMULATION OF THE PROBLEM

Different types of land ownership entail rights and obligations concerning the land. In general, property as an institution to provide the powers of ownership, use and disposal of land imposes encumbrance of maintenance and the risk of its loss on the owner. The rights of all owners are identical in law similar to obligations that ensure the basic principles of the land law, contractual obligations, land use payment, compliance with the requirements, various rules and

regulations, land protection and others. Abuse of rights to land, implementation of rights and obligations is a large-scale problem, since it is associated with the uncertainty of legal norms of the state and municipal authorities, and their execution by the owners of land plots [2]. Legal uncertainties include legal relations that are associated with the use and protection of land with regard to registration, regulation change, compliance with the rules of its use, etc. For example, according to Federal Service for State Registration, Cadastre and Cartography, as of January 1, 2017, 92 % of the lands in the Russian Federation are owned by the state and local government, and information support for these lands, even in settlements, is insufficient. This is a catalyst for abuses in state and local administration of land. Therefore, in a market economic system, the advantages of the land right should be balanced over its deficiencies by effective and rational mechanism used to regulate environmental management through management of the land resources of the country.

## III. METHODS

The study uses a synthesis of general logical and theoretical methods. Analysis, methods of deduction and induction were used to develop an organizational system for regulating the use of land and other resources through generalization and clustering. Classification of zones with special conditions of land use (ZSCLU) is presented. The impact of the regulations in these zones on permitted activities was assessed by comparing the range of prohibitions stated in ZSCLU and permitted activities, and regression analysis. Formalization methods were used to develop a ZSCLU based algorithm for regulation and management of land and other resources [3, 4].

## IV. ORGANIZATIONAL AND ECONOMIC SYSTEM OF REGULATION OF USE OF LAND AND OTHER TYPES OF RESOURCES

### A. Encumbrances and restrictions as a control mechanism

In the modern system of Russia, one of the effective mechanisms of environmental management should be a general system of encumbrances to be used for regulation and control of economic, legal, market-based and other land activities. With regard to natural resources, the ZSCLU system should be considered to impose bans and restrictions on certain types of activities on private and leased land to protect infrastructure facilities, the natural and living environment.

Certain legal provisions have already laid the foundation for functioning of this type of system, but it does not work in the Russian realities due to the lack of methods and mechanisms.

Encumbrances and restrictions will create the mechanism to implement the following government functions:

- Achieving a balance of public and private interests.
- Protection of engineering infrastructure.
- Protection of the natural and living environment.
- Sustainable development.

Development of a scientific theory, including principles, a system of theories, views on regulation of processes on land through a system of encumbrances, is one of the most important methodological tasks to solve environmental, economic, legal, technical and social issues in the country.

The objectives of establishment of encumbrances are:

- to ensure living conditions of the population (free access to recreation facilities, social institutions, land use for hunting, etc.);
- to ensure legal conditions for performance of obligations, protection and the possibility of exercising the rights of third parties with respect to the land plot;
- to form operating conditions for industrial, engineering, and transport facilities;
- to comply with the terms and conditions of land development;

- preservation and restoration of the environment;
- to observe special conditions of use of land plots and activity mode in ZSCLU.

*B. Impact of restrictions and prohibitions in zones with special conditions of land use on permitted types of land activities*

The impact of ZSCLU on economic activities on land plots in accordance with the permitted use type (PUT) can be traced by comparing the rules for using the territory in ZSCLU with these PUTs.

The analysis performed in [5, 6] showed that, for example, when the land plot is located in a water body protective area, exploration and mining of common minerals occurring within it is prohibited, even plowing is prohibited in the coastal protective zone. In many ZSCLUs, land plots for a certain type of use are not allowed, but this does not mean that these land plots are not located there since many regulatory documents were developed after their formation in the respective zones. During the transition period of the 1990s in Russia, many land plots were formed with no respect to the regulations.

The results of the comparison with examples of land plots for agricultural (AO and K (F) X)), gardening and vegetable use in a simplified form are presented in Table 1.

TABLE I. ASSESSMENT OF THE IMPACT OF ZSCLU ON TYPES OF ACTIVITIES PERMITTED ON GARDEN, GARDEN AND AGRICULTURAL LAND PLOTS

No.	Activity type	ZSCLU (+ effect, – no effect on the considered activity type)										
		Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Z9	Z10	Z11
1. Garden plots:												
1.1	Construction	+	+	+	+	+	+	+	+	+	+	+
1.2	Farming	–	+	+	+	+	+	+	–	–	+	+
1.3	Recreation	+	–	–	+	+	+	+	–	–	+	–
1.4	Reclamation	–	+	+	–	+	+	+	–	+	+	–
1.5	Excavation work	+	–	+	–	+	+	+	+	–	+	–
1.6	Material storage	+	+	+	+	+	+	+	+	+	+	–
2. Vegetable plots:												
2.1	Construction (non-capital residential and household buildings)	+	+	+	+	+	+	+	+	+	+	+
2.2	Farming	–	+	+	+	+	+	+	–	–	+	+
2.3	Reclamation	–	+	+	–	+	+	+	–	+	+	–
2.4	Excavation work	+	–	+	–	+	+	+	+	–	+	–
2.5	Material storage	+	+	+	+	+	+	+	+	+	+	–
3. Farmlands:												
3.1	Construction	+	+	+	+	+	+	+	+	+	+	+
3.2	Livestock	–	–	+	+	–	–	–	–	+	+	–
3.3	Cultivation of perennial plantations	+	–	–	+	+	+	–	+	+	+	+
3.4	Excavation work	+	–	+	–	+	+	+	–	–	+	–
3.5	Irrigation	–	+	+	–	+	+	+	–	–	+	–
3.6	Waste management	–	–	–	–	–	+	+	–	–	–	–
3.7	Material storage	+	+	+	+	+	+	+	–	+	+	–
3.8	Fertilizer usage	+	+	+	+	–	–	–	–	+	+	–
3.9	Machinery use	+	+	+	–	–	–	–	–	+	+	–

<sup>a</sup> Note: Z1 – gas distribution network protected zone; Z2 – water body protective area; Z3 – coastal protective zone; Z4 – protective sanitary zone; Z5 – fenced off area of overhead power transmission line; Z6 – protected zone of underground cable power lines; Z7 – protected zone of substations; Z8 – sewer protected zone; Z9 – protected zone of water supply networks; Z10 – trunk pipeline protected zone; Z11 – a zone of regulation of development and economic activities.

For the owner, establishment of ZSCLU on the land plot can simultaneously cause negative effects and vice versa. Negative effects include those of a legal nature (additional borders of parts of the land plot, the need for compliance with the regime, liability imposed) technological nature (problems of using machines, the need for hand labor, impossibility of construction, growing crops, etc.); economic nature (increased production costs, damage from non-used area of the land plot, lost profit, decreased fertility, attractiveness of the land plot, its cost); ecological character (decreased purity and environmental friendliness of products, recreational value, habitat quality); social nature (impossibility of normal market turnover, psychological assessment of the damage of the land plot). Positive effects include: increased investment attractiveness due to engineering communications provided; increased market value of land due to its proximity to natural objects; aesthetic perception and increased recreational value of the land plot located close to cultural heritage objects, and those used for nature protection.

The presence of ZSCLU on land plots can cause land use deficiencies (rugged terrain, small sized land plots), which creates additional costs for tillage, idle turns of equipment, reduced income, and impossibility of using land in general. Thus, ZSCLU imposed on the land plot shows not only the mode of the territory use, but also its area and spatial location. The usefulness of the territory also depends on configuration of the plots, which can be of correct and complex shape. Spatial

analysis of ZUUITs in cadastral registration in the subjects of the Russian Federation showed more than 70 types and names, and provided allocation options for ZSCLUs on plots of different shape (Table 2).

TABLE II. ALLOCATION OPTIONS FOR ZSCLU ON LAND

No.	ZSCLU provision	Possible deficiencies of land use
1	Full coverage of the land plot by ZSCLU:	
1.1	by one ZSCLU	no
1.2	by several ZSCLUs intersections and overlays	Small size rugged terrain (if the mode of ZSCLU use significantly differ)
2	Partial coverage of the land plot by one ZSCLU	rugged terrain (of the land plot, its small size areas)
3	Partial coverage of the land plot by several ZSCLUs:	
3.1	without intersections and overlays	small size of the land plot areas
3.2	with intersections and overlays	small size of the land plot areas
4	Insertion of ZSCLU into the land boundaries	impossibility to use the land plot as a whole

To show the response of the land market to the presence of ZSCLU on the land plot, a regression model of dependence of the specific indicator of market value on price factors has been built. The simulation results are implemented through the example of industrial land plots of St. Petersburg and are presented in Table 3.

TABLE III. RATIOS OF PRICE FACTORS AND THEIR QUALITY INDICATORS

Price factors of the land plot	Regression factors (Ina <sub>i</sub> )	Function factor, C <sub>F</sub> (ai)	Percentage of the factor influence	Standard error	Level of significance	
Basic rate	8.21	3676.47		0.08	0.99	
Area	0.16	1.17	16.86	0.05	0.99	
Availability and type of entry	-0.12	0.89	-10.99	0.06	0.94	
Railway access	-0.07	0.93	-6.58	0.06	0.70	
Influence of the city center	0.20	1.22	22.39	0.07	0.99	
Influence of local centers	0.18	1.19	19.41	0.03	0.99	
Influence of highways	-0.13	0.88	-11.84	0.05	0.99	
Number of the price zone at the economic level	"1"-Zone	0.53	1.70	69.99	0.19	0.99
	"2"-Zone	0.22	1.25	25.07	0.12	0.93
	"4"-Zone	-0.16	0.86	-14.42	0.11	0.80
	"5"-Zone	-0.49	0.61	-38.89	0.14	0.99
	"6"-Zone	-0.77	0.46	-53.86	0.14	0.99
ZSCLU (share of more than 0.5)	ZSCLUENG	-0.35	0.70	-29.72	0.12	0.99
	ZSCLUURBAN	0.25	1.28	28.29	0.15	0.90
	ZSCLUCULT	0.12	1.13	13.08	0.10	0.70
	ZSCLUNATUR	-0.13	0.87	-12.57	0.10	0.80

In accordance with Table 2, all factors that take into account ZSCLU are of a high level of significance ( $\geq 0.7$ ), which indicates the reliability of the regression performed and the effect of ZSCLU on the market value.

*C. Organizational and economic regulation methods*

Changed living conditions change the degree of freedom in land-use rights. The principle that "freedom is the right to do everything that is permitted by law" indicated by Charles Louis de Seconde de Montesquieu does not work anymore,

and the need for state management and regulation of land use is practically and scientifically grounded. According to a number of practitioners, lawyers and jurists (I.Yu. Akkuratov, N.M. Korshunov, A.A. Khorev [7], V.F. Yakovlev [8], O.V. Bumazhnikova [9]), rejection of state management leads to failure of economic management [10]. Therefore, ZSCLU should be a regulator of state pressure, which is a mechanism to ensure the interests of the owner of both the land plot and the controlled-access object.

The interaction between the state and the owner should be carried out provided that the following conditions are met:

- ecological safety of people and environment through the introduction of restrictions imposed on the use of objects within the zones that provide a buffer space between hazardous objects and place of residence, economic activity, and recreation of the population;
- actual protection of the controlled-access object (power lines, roads, pipelines, water supply sources, etc.) from damage and destruction.

Figure 1 shows features of the system of regulation and management of land and other resources based on ZSCLU.

Objects of the established ZSCLU can be of two types: natural and anthropogenic, which have different purposes for ZSCLU establishment. In general, the proposed concept of a regulatory and management mechanism through encumbrances should be implemented based on measures that will serve a theoretical and practical basis:

- **Organizational measures:** improvement of the institution of civil society and creation of the institution of encumbrances; state assistance in accounting for all ZSCLU in the territory of Russia; increased level of culture and education to form awareness of the need to adhere to the proper use of land; informing about the presence or absence of ZSCLU in the territory; development and improvement of the methodological framework for assessment of the encumbered land; development and implementation of compensation procedures and methods for calculating damage to the owner in case of damage or loss of the controlled-access object.
- **Economic measures:** tax incentives for the owners of encumbered lands; creation of funds to ensure the consequences that are not identified when establishing ZSCLU; development and implementation of the methodology to assess the potential effectiveness of use of the encumbered land for transfer to other categories of land; insurance of damage and destruction of the controlled-access object; assessment of market and cadastral value of land with regard to ZSCLU.
- **Technical measures:** coordination and establishment of ZSCLU boundaries; preparation of documents to enter information about ZSCLU in the USRN; land planning based on spatial information about ZSCLU.
- **Socio-environmental measures:** supporting the turnover of encumbered lands; subsidies to agricultural enterprises with ZSCLU; obligations for the owners of controlled-access objects to use innovative technologies for clean production, forecasting of possible emergencies.
- **Legal measures:** approval of the limits and standards for ZSCLU establishment and its regulation; additional licensing of ZSCLU establishment by cadastral engineers due to the work complexity; development of target and state programs for creation of a cadastral

map of ZSCLU; specified types of liability for non-compliance with the regulations in ZSCLU, and for damage or destruction of the controlled-access object.

As previously discussed, the establishment of ZSCLU often leads to spatial and security related consequences. Therefore, it is necessary to provide measures to be implemented if land cannot be used:

- providing an equivalent encumbered land plot;
- compensation for losses to the owner of the encumbered land plot;
- providing the possibility of transferring a land plot to another category of land that can be used by the owner;
- in case of limited land use:
  - compensation for losses by the owner of the encumbered land for the regions that are impossible or restricted in use;
- changing the land boundaries due to adjacent regions if possible;
- reduction of the land tax of the encumbered land plot, for the reasons of regulations, small outbreak and rugged terrain.

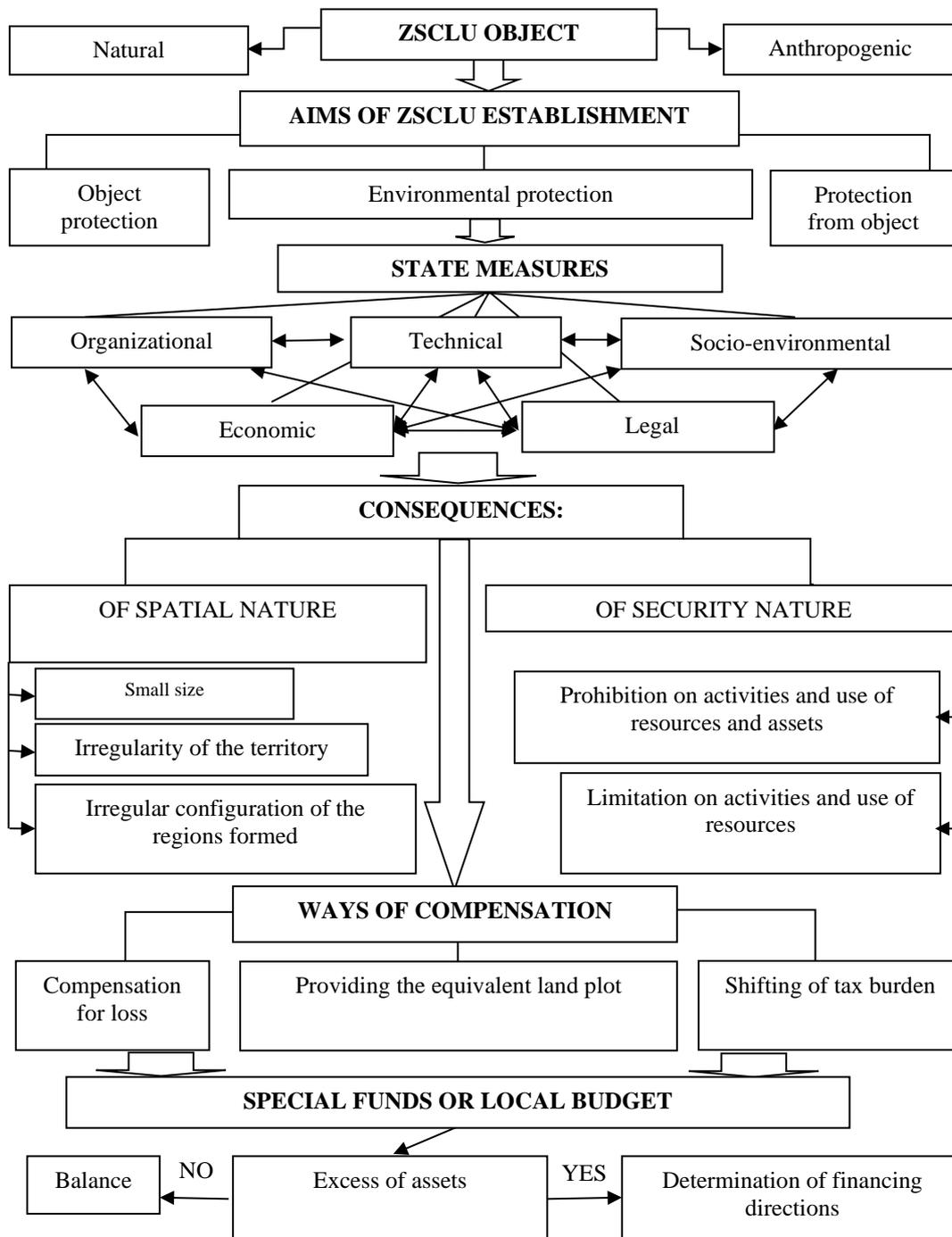
The ecological safety of people and environment, and the actual protection of controlled-access objects should be carried out using the following organizational methods:

- **Regulatory methods:** development and implementation of legal regulations and acts covering almost the entire range of issues related to ZSCLU, land resources and controlled-access objects.
- **Economic methods:** incentives, benefits, penalties, fines and sanctions.
- **Accounting and information methods:** cadastral accounting of all ZSCLU excluding land surveying to provide complete and accessible official information on encumbered lands.
- **Technical methods:** surveying of ZSCLU boundaries, their intersections, and agreement on acceptance of the established landmarks by the land owner.
- **Administrative methods:** management allowing interaction between the above methods to create an effective mechanism for territory management.

## V. CONCLUSIONS AND RECOMMENDATIONS

The study has revealed the following:

Firstly, the system of encumbrances and restrictions should become a mechanism for regulating and implementing such important state functions as balancing the interests of all subjects of land relations; environmental protection, protection of places of human activity and engineering infrastructure objects; sustainable development.



**Figure 1.** Detailed scheme of regulation and management of land and other resources based on ZSCLU

Secondly, classification of land encumbrances should be based on the difference in restrictions (disposal or economic activity) and grouping by types of security and controlled-access objects, and on regulation of land use.

Thirdly, the established restrictions on certain types of activities in ZSCLU show their negative impact on land use in accordance with the intended purpose (on average, more than

80 % of types of activities in ZSCLU are prohibited on the considered land plots).

Fourthly, depending on its location on the land plot, ZSCLU can lead to deficiencies in land use and in some cases to the impossibility of using the plot due to its small size and/or rugged terrain.

Fifthly, negative and positive consequences of ZSCLU establishment were highlighted, methods to achieve environmental safety and actual protection of controlled-access objects were proposed, and measures were developed to implement this balance. The concept of a mechanism for regulation and management of land and other resources through encumbrances should be implemented using organizational, economic, technical, socio-environmental and legal measures.

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