Geoinformation model of heterogeneity in the value of rural territories in the region

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Abstract. The article deals with one of the main problems of the state land management system - the problem of decision-making information support. Using the example of a geoinformation model of rural Altai Territories value heterogeneity, the possibility of determining such territories on the basis of integral accounting of market data on quotations (transactions) and statistical indicators characterizing the quality of population social security, in terms of minimum conditions for the comfort of living is shown. To understand the relative value of a particular point on the digital model, a semblance of price relief is built. With the help of the constructed model on the territory of the region, it is possible to unambiguously distinguish several categories of territories that differ in value. The factors that explain the existing categories of territories in the region are considered. A set of such models provides an effective tool capable of making forecasts and proposing specific mechanisms for improving the policy in the field of region’s land and property complex management, aimed at increasing its value.

1. Introduction
Organization of rational use of land is one of the strategic goals of any state. The mechanism for starting this process, as well as regulating and controlling it, is the system of state land administration. The rational use of land can be measured in various aspects: land management, economic, managerial, social, economic, and environmental. Considering the management aspect, in our opinion, the most informative indicator characterizing the degree of rationality of the territory use, land in particular, should be their value in the market turnover.

Depression of agricultural production in the 1990s and the subsequent decline in the quality of life in the countryside, unemployment problems and active population outflow have largely reduced the real value that rural areas could potentially represent. In different natural and economic conditions of the territories such a decrease was uneven; therefore, at present it is relevant to study the current level of rural areas value.

2. Models and methods

2.1. Object of study
The research object was the rural areas of the Altai Territory. Altai Territory is a typical agrarian region of the Russian Federation. According to Rosstat [1], the population of the region as of 2020 amounts to 2,317,153 people, the rural population makes up 43.05% of the total.
The land reserve of the region equals 16.8 million hectares, including agricultural land - 10.9 million hectares (64.7%); lands of settlements - 2.08 million hectares (12.4%). In total, there are 1,616 settlements on the Altai Territory, 1,598 of which are rural settlements.

For the purposes of this study, rural areas will be understood as the territories of rural settlements and inter-settlement areas.

2.2. Research methods
The method of geoinformation modeling was used as the basic method of the present research. The model of value heterogeneity of the region’s rural areas was built applying the TIN (Triangulation Irregular Network) technology, which allows building surfaces using irregularly located points.

3. Results and discussions
The strategic goal of the region’s land management system is a policy aimed at increasing the value of its territories. The concept of agrarian region’s territories value has several aspects.

The primary aspect of considering territory value is the possibility of its effective use as a natural resource and the main production means in agriculture. This aspect of consideration largely explains the spread of differential rent I across the territory. On the territory of the region under consideration this aspect of the territory value refers mainly to agricultural lands. In the second case, the value of the region's territories can be assessed from the point of its performance - as a product and an object of socio-economic relations.

Since rural areas combine both production functions and life support functions of the local population, the potential value of this part of the economic area should be derived from the combination of the two aspects of value described above.

This particular circumstance demanded an integral consideration of the initial data when constructing a geoinformation model of the value heterogeneity of the region’s rural areas, which will be considered in more detail (figure 1).

The model is based on the information about real estate transactions, as well as statistical indicators characterizing the development of population social security level, in terms of minimum conditions for comfortable living.

To understand the relative value of the point on the digital model, a semblance of a price relief was built. For this, the territory, depicted on the model, was divided into separate areas by isolines (in this research - value isolines) with a cross-section of 50 thousand rubles / m². Also, to compare the level of territories value, the values for cities and urban settlements are given.

With the help of the constructed model, four categories of territories can be clearly distinguished on the territory of the region. The first category is large cities of regional significance and those that directly constitute a suburb with them.

The second category is rural areas of the Barnaul agglomeration, rural areas adjacent to large cities of the first category, as well as individual territories of municipal districts. The first two categories of territories together make up 30% of the region's territory.

The third category is represented exclusively by rural areas of municipal districts, including large and small rural settlements. This is the main part of the model - it makes up 45% of the region's territories.

The fourth category is inter-settlement territories in municipal areas with weak socio-economic development, as well as small rural settlements which make up 25% of the study area.

Thus, most of the rural areas of the studied region have a reduced value, and some of its parts can even be attributed to areas of depressive development (see figure 1, shown in dark blue).
Figure 1. Geographic information model of the region’s rural areas’ value heterogeneity (on the example of the Altai Territory).

Further the factors that explain the existing categories of territories in the region will be considered. In our opinion, there are two main factors - the influence of large cities and the availability of regular transport links. The effect of these factors is clearly demonstrated in figure 2. The distance from a large city is shown with 100 km step.

Figure 2. The action of factors: the influence of large cities and the presence of regular transport links on the model of rural territories’ value heterogeneity (on the example of Altai Territory).

As world studies show, the solution of pressing issues in the land management system, including the construction of relevant land utility models, takes place applying modern information technologies [2–5].

In this study, based on the identified categories (types) of territories, further development of policy in the field of region’s land management should be based on the following scheme.

In relation to the first category of territories, where rural areas are represented by the suburbs of large cities, a policy of maintaining the existing level of value should be pursued; its further (value) increase is possible only through market mechanisms without active government participation. In rural
areas of the second category, maintaining and increasing value is possible by attracting additional investment, while requiring a minimum investment in infrastructure development.

The third and fourth types of rural areas are depressive, therefore, they require maximizing the efforts of the state to actually re-include them in the economic area of the region and active market turnover. Depression is associated both with the development of agrodepletion processes [6] and the insufficient provision of social living standards; in this case it is necessary to develop programs targeted at the strategic development of depressed rural areas, restoring both lost production and life support functions of the local population.

Thus, a set of such models provides an effective tool capable of making efficient land utility forecasts and proposing specific mechanisms for improving the policy in the field of land and property complex management of the region.

4. Conclusion
As a result of the study, the following conclusions were made:
Active transformation processes in the agricultural sector associated with changes in the forms of production activities’ arrangement and the property complex use, as well as the subsequent disintegration of a number of large agricultural producers, exacerbated social problems in the countryside, which largely reduced the real value that rural areas could potentially represent.

A feature of rural areas is that they combine both production functions and local population life support function. The potential value of this part of the economic area should combine two aspects of value: as a natural resource and the main means of agricultural production; and as a product and object of socio-economic relations.

A methodological approach to the construction of geoinformation models of the region’s rural territories value heterogeneity is proposed, based on the integral consideration of market data on quotations (transactions) and statistical indicators characterizing the development of population social security, in terms of minimum conditions for the comfort of living. Management measures are proposed for each of the identified types (categories) of territories.

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