Assessment of the soil cover in the Irkutsk Region by cadastral value

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Abstract. The article defines the specific indicators of the soil cadastral value for the agroclimatic subzones of agricultural landscapes in the Irkutsk Region. We calculate the cost of the soils most common in the region, which are present in the scales of land classification and in the Unified State Register of Soil Resources of Russia. For the first time for the Irkutsk Region, we assess the quality of agricultural land rather by soil types, taking into account the area of a land plot, standard yield, and technological (standard) costs, than by soil differences. Soils in the land-assessment zones are represented according to the USSR soil classification system of 1977 and the international WRB system. Average values of the specific indicator of the cadastral cost of lands are within 0.1 RUB/m² in typical sod podzolic soils (Albic Folic Luvisols (Cutanic, Different)); they reach 0.3 rubles/m² in sod alluvial saturated layered soils (Mollic Fluvisols (Orthofluvic AmphiFluvic)) and 3.1 rubles/km² in leached chernozems (Umbric Calcic Luvis Chernozems) as well as 9.3 rubles/m² in meadow chernozems (Chernic Phaeozems (Endocalcic)) and in sod alluvial saturated soils (Mollic Fluvisols). Low indicators of the cadastral cost of agricultural land are due to low values of agroclimatic potential, low humus content in these soils and low thickness of humus horizon. We indicate the sensitivity of the method for calculating the cadastral cost of lands (2017) to different soils and geographical conditions.

1. Introduction
In the modern conditions of the transition of Russia to a market economy, the state cadastral assessment of land resources and, primarily, agricultural land becomes a necessary condition for substantiating the country's food security and land management in general [1, 2], land value, land value tax, rent, and other payments in transactions with land plots. Creation and improvement of the unified state register of soil resources as a standard digital basis for the Russian soil inventory [3-6] based on the principles of information complexity as well as its compatibility and integration with other electronic resources (including the world reference database of soil resources, WRB, and the United Nations food and agriculture database, FAO) is a necessary condition for cadastral valuation of land. The constant improvement of techniques [7, 8], scientific and methodological support for monitoring the fertility of agricultural soils [9-11], and information support for land valuation [12] are also necessary for effective management of land resources and a high-quality cadastral valuation of land.

Currently, the cadastral materials for the Irkutsk Region contain data on the value of the land plots without the qualitative assessment of land by soil types and their area. The cadastral valuation of land in the Irkutsk Region using a new method of state assessment of lands [13] has not been carried out. In this study, for the first time for the soils of agricultural landscapes in the region, we assess the quality...
of land by soil types, taking into account of standard yield, technological costs, and climatic conditions in the region.

In terms of natural features, the region is divided into three agricultural zones: settled, forest-steppe, and taiga-subtaiga. More than 50% of all arable land in the region is located in the forest-steppe; 20% are located in the steppe, and the rest — in the taiga landscapes. The steppe zone is located in the Ust-Orda Buryat Autonomous Okrug and consists of two districts: Alar-Nukutsky and Ust-Orda-Bayandaevsky. Cheremkhovsky and Olkhonsky districts also belong to this Okrug.

The forest-steppe zone is located along the Trans-Siberian railway from Irkutsk to Tulun as well as on the right bank of the upper course of the Angara River (from Bokhan to Ust-Uda). This is the main agricultural zone in the region, which ensures almost 60% of the total regional manufacturing of agricultural products [14]. It has the most favorable climatic conditions.

The sub-taiga zone is the northern rural areas of the region located along the Taishet-Lena railway in the western section of the Baikal-Amur Mainline and the upper reaches of the Lena River. The area has insufficient heat supply of crops as well as good and average humidity during the growing season.

Farmlands occupy ≈3.6% of the area. In their structure, arable land is ≈ 62%; perennial plantations are ≈1.1%; hayfields are ≈13.9%, and pastures are ≈22.9%. The following crops are grown in the Irkutsk Region: wheat (spring), oats, barley (spring), rye (winter), buckwheat, millet, corn (for green feed), peas, sunflower (silage), rapeseed (spring), soy, potatoes, cucumbers, white cabbage, table beets, carrots, onions, perennial and annual herbs, and forage root crops [15].

Agricultural land in the Irkutsk Region should be assessed according to the accepted rules of cadastral valuation of agricultural land. Methodological guidelines recommend conducting a cadastral valuation of agricultural land based on the Unified State Register of Soil Resources [6] and the recommendations for calculating the standard yield and technological (standard) costs [13].

It should be noted that there is no experience of practical use of the new guidelines in the Irkutsk Region. It is possible to calculate the cadastral value of specific land plots by calculating the specific indicators of the cadastral value for various types of soil, taking into account the areas occupied by these soils. Such information is missing in modern cadastral materials that provide data on the cadastral value of land plots without the quality and area of the specific types of soil.

The obtained data can be used for production works to determine the cadastral value of agricultural land. This research is based on the official data used during the state cadastral valuation of lands.

2. Objects and methods

The soil cover in the Irkutsk Region is represented by various types and subtypes of natural soils as well as soils that have been modified and anthropogenically transformed to varying degrees. However, taking into account the specifics of this study, we will not analyze all of this wide natural diversity but will focus only on the soils that have been identified as the most common for the Irkutsk Region in the Unified State Register of Soil Resources and are present in the classification scales of lands, which the State Design Institute of Cadastral Survey "Goszemkadastrsyemka-VISKHAGI" have developed for all subjects of the Russian Federation.

Classification scales were compiled according to the list of assessment groups of the land-assessment areas in the subjects of the Russian Federation for each agroclimatic subzone, taking into account the agroclimatic zoning of the areas [16-18]. The Office of the Federal Service for State Registration, Cadastre and Cartography (Rosreestr) for the Irkutsk Region has approved these scales, and they represent the regional list of soils.

The scales include the information about humus content (%), humus horizon thickness (cm), physical clay content (%), prevailing terrain slope (°), and different types and subtypes of soils in the Irkutsk Region. The codes of soil-forming rocks and negative properties of soils were also used in these scales.

The data from the scales were converted into an electronic form of the Excel tables. The average values of humus content, humus horizon thickness, and physical clay content were calculated for each soil type selected by the compilers of the scales.

In each soil type, the most common combinations of these characteristics were selected. Thus, soils
were divided into groups. The average values of humus content (%), humus horizon thickness, physical clay content (%), and negative soil properties for each soil group were also calculated.

The cadastral valuation of land plots based on monitoring of various fertility indicators can solve different problems in determining the designated purpose of land and the direction of its agricultural use within the framework of sustainable development of territories [19-21].

The general procedure for determining the cadastral value of agricultural land can be described as follows. Firstly, a list of soils is compiled, and the areas that they occupy in the study area are determined. Each soil type is characterized, taking into account its properties, position in the terrain, and agroclimatic indicators. These data allow determining the list of crops that can be grown in this area (the second stage of the study), and optimal crop rotations can be composed.

The main optimality criteria are the maximum profitability and ecological compatibility of agricultural production. The list of soil types, crops, and standard yield for each crop calculated for each soil type are determined based on soil investigations [22, 23], materials of agroecological assessment of soils, and agroclimatic zoning of areas in the subjects of the Russian Federation [24, 25].

The areas of selected types and subtypes of soils in the assessed land plots can be determined by correlating the boundaries of plots occupied by selected types of soils (determined from soil maps) with the boundaries of land plots composed of agricultural lands (the data from the State Real Estate Cadaster). Next, the standard yield is determined by the formula:

\[ Y_s = \frac{33.3 \times 1.4 \times AP}{10 \times K_1 \times K_2 \times K_3 \times K_4} \]  

(1)

where \( Y_s \) is standard yield; \( AP – \) a value of local agroecological potential (according to [7]); \( 10 – \) the base value of \( AP; 33.2 – \) standard yield (t/ha) of grain crops on the reference soil, which correspond to norms of standard zone technology with the \( AP \) base value; \( 1.4 – \) conversion factor for the productivity level with the intensive technology of cultivation; \( K_1 ... K_4 \) – correction coefficients for soil properties.

Then, based on statistical observations, the sales (market) price is determined for each crop in the list. After that, the specific (i.e. per unit area) gross income is calculated for each crop:

\[ GI = Y_s \times PPI \]  

(2)

where \( GI \) is gross income; \( PPI \) – the projected price of its implementation.

For each crop rotation, the specific gross income is calculated:

\[ SGI = \sum_{N} SGI_{ci} \times NF_{ci} \]  

(3)

where \( SGI \) is specific gross income; \( SGI_{ci} – \) specific gross income from specific crops; \( NF_{ci} – \) the number of fields occupied by these crops; \( N \) – the total number of crop rotation fields.

The unit costs for cultivation and harvesting of each crop are also calculated based on technological maps and average annual market prices. They can be calculated per unit area for each crop rotation by summing up the products of the unit costs for cultivating specific crops (\( SGI_{ci} \)) of this crop rotation and the number of fields occupied by these crops (\( NF_{ci} \)) and dividing the result by the number of crop rotation fields (\( N \)).

Next, the land rent indicator (\( LRI \)) is calculated for each crop rotation:

\[ LRI = SGI - UGI - UCF \]  

(4)

where \( SGI \) is specific gross income; \( UCC \) – unit costs of cultivation; \( UCF \) – unit costs for the maintenance of soil fertility.

Among the calculated values of specific indicators of land rent for crop rotations, the indicator with the maximum value is selected. Based on the average market ratio of land rent and the market price of land plots comprising agricultural lands, the values of the capitalization coefficient (\( CC \)) are determined.

Then, using the latter two indicators, the specific indicators of the cadastral value (\( SICV \)) for each type-subtype of soil in the land plot are calculated:

\[ SICV = \frac{SIR}{CC} \]  

(5)

where \( SIR \) is a specific indicator of land rent; \( CC \) – capitalization coefficient. The last and final step is the calculation of the specific indicator of the cadastral value of the land in the assessed area (land plot) as a weighted average for the area with soil varieties.
Selection of the main types of soils and calculation of their characteristics was based on the scales for classification of agricultural lands by their suitability for the agricultural use in the Irkutsk Region.

3. Results and discussion

The soils in the Irkutsk Region are very diverse. The following factors have a significant impact on soil formation: underlying rocks, landforms, and climatic conditions. In the main agricultural areas, the following types of soils are widely distributed: sod podzolic and sod carbonate soils, gray forest, chernozems, meadow and swamp soils.

Sod podzolic soils predominate in taiga and sub-taiga zones, have low natural fertility and, hence, are poorly used in agriculture. Burozems and gray metamorphic soils (according to the Russian soil classification 2004 [26]) or sod carbonate soils (according to the USSR soil classification of 1977 [27]) predominate in the soil cover of Ust-Ordinsky Buryat Okrug, Bratsksky, Kachugsky, and Ust-Udinsky districts and have high natural fertility. Gray forest soils are located within the most developed areas of the region, mainly in the Irkutsksky, Usolsky, Cheremkhovsky, Zalariinsky, Ziminsky, Tulunsky, Kuitunsky, Nizhneudinsky, and Taishetsky districts. Chernozems, as the most fertile soils with a high humus content and strong humus horizon, are typical for steppe and forest-steppe regions [28, 29].

Podzolic and sod podzolic soils predominate in the western part of the region and on the higher surfaces of the Angara-Lena Plateau. They are formed on rocks with light granulometric composition covered woody vegetation. The humus content does not exceed 2%, and natural fertility is low. Soils are poorly used, but as forests are uprooted, the area of agricultural land will increase. It is necessary to apply fertilizers and carry out liming of these soils since the first years of the development of the lands.

Gray forest soils were formed from the weathering products of Jurassic sandstones and argillites under grassy light coniferous forests. In terms of the granulometric composition, they are medium- and heavy-loamy soils. The humus content in them varies from 2.5 to 7%. These soils are widely used in agriculture for a grain crop, whose area approximately by 50% consists of arable land (or 850 thousand hectares). Gray forest soils can be divided into light gray, gray, and dark gray varieties by their content of humus and thickness of the humus horizon. Dark gray soils are the most fertile, with humus content up to 7-8%.

Burozems and gray metamorphic soils (or sod carbonate) are widespread. They are distinguished by their brown or reddish-brown color and high content of carbonates. They are forming mainly on the weathering products of marls, argillites, limestones, and the Cambrian dolomites. Their granulometric composition is heavy- and medium-loamy, with a humus content from 3 to 10%. They have high natural fertility, which is confirmed by long-term experience of their agricultural use for grain crops without applying fertilizers. The local population calls these soils red-brown, “wheaten” or “centenary”. In agricultural use, sod carbonate soils account for 36% (635 thousand hectares). In terms of the content of humus and the intensity of eluvial processes, sod carbonate soils are divided into typical, leached, podzolized, and sedimented soils.

Chernozems are the most fertile soils; they have a good structure and a more significant humus horizon in comparison with other soils. They are formed on silty loams under meadow or steppe vegetation. Chernozems are common in forest-steppes of the Angarsky, Kuitunsky, and Ust-Ordinsky districts. They occupy the surface of river terraces, the foot of gentle slopes, and the bottom of large cavities. The humus content in them ranges from 5 to 10 %. Among chernozems, leached, typical, and carbonate subtypes are distinguished. Chernozem soils cover an area of 139 thousand hectares or 2.4% of arable land. In agriculture, they are usually used for grain and vegetable crops and show high yields [30].

In contrast to chernozems, meadow chernozem soils are located on the lower terraces of the valleys, bottoms of cavities, and lower parts of slopes and represent small areas throughout the region. Unplowed meadow chernozem soils are occupied by meadow grasses, have good moisture, silty structure, significant humus horizon (of 50-60 cm), and low fertility. The humus horizon is thick (50-60 cm). They account for approximately 5% of arable land (58 thousand hectares).
Alluvial meadow soils occupy relatively low landforms: low river terraces and bottoms of cavities. They are moister and usually occupied by various grasses and less often birch forests. Alluvial meadow or alluvial soils are formed on river sediments. A distinctive feature of these soils is their multilayering. They have a large number of nutrients, light mechanical composition, and give good yields of herbs. These soils cover an area of 11 thousand hectares or 0.6% of arable land.

The soils of mountainous area in the region have been still insufficiently studied. They are poorly developed tundra soils with a wide outcrop of rocks, mountain-forest, gray (podburs), podzolic, sod podzolic, burozem (sod carbonate), and other soils.

Swamp soils are widespread in the region. They occupy especially large areas in the Lower Tunguska basin, at the foothills of the Eastern Sayan Mountains, and the Patomsky Highlands and smaller areas – in the Baikal mountain system. They are also widely distributed in river valleys.

The soils in the region mainly have low and medium humus content. The area of soils with low humus content is 650 thousand hectares (37%), with an average content of 1036 thousand hectares (59%). The features of the soils in the region include of their small-scale structure due to large dissection of the terrain and diverse lithological composition of rocks, low temperature owing to deep seasonal freezing and slow thawing, and insufficient moisture caused by a small amount of precipitation and spring meltwaters flowing down the soils and subsols that are unthawed yet [28-31].

According to the reference book on agroclimatic zoning of the subjects in the Russian Federation, the Irkutsk Region is divided into four agroclimatic subzones [24]. The value of the agroclimatic potential represented by the sum of active temperatures greater than 10 degrees (STEM>10°C) and the moisture coefficient ranges from 2.3 to 3.6. For the northern areas of the region, the average annual temperature ranges from -4°C to -8.6°C; absolute minimum temperatures vary from -59°C to -64°C, and STEM>10°C is from 1200°C to 1500°C. The duration of the frost-free period is from 55 to 95 days. The amount of precipitation per year is approximately 400-470 mm. The southern areas of the region have an average annual temperature from -1.2°C to -2.6°C. STEM>10°C varies from 1500°C to 1700°C. The duration of the frost-free period is approximately 105-112 days. Annual precipitation varies between 380 and 440 mm.

At the first agroclimatic subzone, crops are not grown due to low values of agroclimatic indicators (STEM>10°C does not exceed 1400°C) and a continuous distribution of permafrost. Agricultural land of subzone is mainly used for hay and pasture. These territories (Katangsky, Bodaybinsky, Mamsko-Chuysky, and Kazachinsko-Lensky municipal districts) have low values of the cadastral value of soils (table 1, figure 1).

The lowest indices of 0.1-0.3 rubles/m² are recorded for sod podzolic and sod alluvial stratified soils. This is due to low humus content and low thickness of humus horizon in these soils. In sod carbonate soils, the values of specific indicators of cadastral value range from 2.5 to 2.7 rubles/m².

The highest indicators of the cadastral value (3.3-3.0 rubles/m²) were recorded for sod alluvial saturated soils and alluvial meadow saturated soils. We found the same pattern for the Republic of Sakha (Yakutia) [22].

At the second agroclimatic subzone, the maximum values of the standard yield were recorded for podzolic chernozem and meadow chernozem soils. The same soils showed the maximum indicators of specific cadastral values (2.8-3.4 rubles/m²). The variation of the cadastral value indicators is largely due to the spatial and temporal heterogeneity of the soil cover in the Irkutsk Region, which significantly affects the development of agriculture in the region [14, 33].

Despite rather high values of humus content and humus horizon thickness (figure 1), the soils of the Irkutsk Region are characterized by low values of specific indicators of the cadastral value, which do not exceed 3.5 rubles/m² [29]. This is due to the low values of agroclimatic potential, the value of which ranges from 3.5 to 3.6 units.
Table 1. Specific indicator of the cadastral cost of lands according to the scale of soil classification and land-assessment zones in the Irkutsk Region.

| No  | Soil type and subtype: The USSR Classification of soils, 1977 [32] / WRB [37] | Thickness of the humus horizon, cm | Content of humus, % | Physical clay, % | Additional properties (A) | Lithological structure of the soil profile (B) | Standard grain yield, C/ha | Specific indicator of the cadastral cost RUB/m² | The arithmetic mean of specific indicator of the cadastral cost RUB/m² |
|-----|--------------------------------------------------------------------------------|-----------------------------------|-------------------|----------------|-------------------------|--------------------------------------------|--------------------------|---------------------------------|-------------------------------------------------|
| 1   | Sod podzolic / Albic Follic Luvisols (Cutanic, Differentic)                      | 9                                 | 1.5               | 40             | 3                       | -                                         | -                        | 0.1                             | 0.1                                             |
| 2   | Sod carbonate / Cambic Calcric Umbrisols                                      | 27                                | 4.6               | 37             | 2                       | -                                         | -                        | 2.5                             | 2.6                                             |
| 3   | Sod alluvial saturated layered / Mollic Fluvisols (Orthofluvic Amphifluvic)    | 16                                | 1.0               | 16             | 21                      | -                                         | -                        | 0.3                             | 0.3                                             |
| 4   | Sod alluvial saturated / Mollic Fluvisols                                      | 44                                | 5.4               | 48             | 3                       | -                                         | 3.3                      | 3.3                             | 3.3                                             |
| 5   | Alluvial meadow / Mollic Endofluvic Endogleic Umbrisols                        | 37                                | 4.4               | 27             | 12                      | 2                                         | -                        | 2.1                             | 2.1                                             |
| 6   | Alluvial meadow saturated / Umbric Endofluvic Endogleic Umbrisols              | 52                                | 4.8               | 32             | 12                      | 28                                        | -                        | 3.0                             | 3.0                                             |
| 7   | Sod carbonate leached/ Cambic Calcric Umbrisols (Luvic)                         | 30                                | 4.7               | 30             | 2                       | 13.7                                      | 2.2                      | 2.2                             | 2.2                                             |
| 8   | Grey forest/ Greyzemic Luvis Phaeozems (Cutanic, Differentic)                   | 31                                | 3.1               | 27             | 2                       | 12.4                                      | 1.6                      | 1.75                            |                                                  |
| 9   | Dark gray forest/ Umbric Phaeozems                                             | 31                                | 3.6               | 47             | 3                       | 12.8                                      | 1.9                      | 1.9                             |                                                  |
| 10  | Podzolic Chernozems / Rentic Phaeozems                                         | 40                                | 6.4               | 34             | 2                       | 15.7                                      | 2.8                      | 2.8                             |                                                  |
| 11  | Meadow Chernozems/ Chernic Phaeozems (Endocalcic)                              | 41                                | 8.3               | 36             | 57                      | 2                                         | 15.8                     | 3.1                             | 3.3                                             |
| 12  | Meadow (Meadow Chernozem-like)/ Mollic Stagnic Umbrisol                        | 43                                | 6.6               | 32             | 2                       | 10.3                                      | 2.9                      | 2.5                             |                                                  |
| 13  | Sod alluvial saturated steepe-like / Mollic Fluvisols (Epicalec)                | 30                                | 4.2               | 29             | 2                       | 2                                         | 2.0                      | 2.0                             |                                                  |
| 14  | Chernozems leached / Umbric Calcic Luvic Phaeozems                             | 45                                | 8                 | 27             | 2                       | 3                                         | 3.1                      | 3.1                             |                                                  |
| 15  | Chernozems ordinary / Mollic Calcic Chernozems                                 | 37                                | 5.5               | 38             | 2                       | 2                                         | 2.9                      | 2.1                             |                                                  |

* codes of additional and negative properties of soils (A) and types of lithological structure in the soil profile (properties of soil-forming and underlying rocks) (B): A) 12 – surface salty soils of moderate salinization degree; 19 – sodium saline soils in the middle part of the profile; 57 – carbonate; B) 2 – water-permeable loams with a thickness of more than 1 m (filtration coefficient 0.1-1 m/day); 3 – water-permeable loams and clays with underlying weakly water-permeable loams and clays at the depth of ca. 0.5 m from the soil surface (filtration coefficient 0.1-0.01 m/day); 21 – sandy loams with a thickness of more than 1 m; 28 – soils with well-permeable humus horizons and underlying water-permeable loams at a depth of 0.5-1 m (filtration coefficient more than 1 m/day); 29 – soils with well-permeable humus horizons and underlying dense and poorly water-permeable loams at the depth of 0.5-1 m (filtration coefficient less than 1 m/day).
Figure 1. Specific indicator of the cadastral cost of soils in land-assessment zones of the Irkutsk Region: Land assessment zone No 1 (soils 1-5): 1. Sod podzolic (Albic Folic Luvisols (Cutanic, Differentic); 2. Sod carbonate (Cambic Calcaric Umbrisols); 3. Sod alluvial saturated layered (Mollie Fluvisols (Orthofluvic Amphifluvic); 4. Sod-alluvial saturated (Mollie Fluvisols); 5. Alluvial meadow (Mollie Endofluvic Endogleic Umbrisols); Land assessment zone No 2 (Soils 6-13): 6. Alluvial meadow saturated (Umbric Endofluvic Endogleic Umbrisols); 7. Sod carbonate leached (Cambic Calcric Umbrisols (Luvic); 8. Gray forest (Greyzemic Luvic Phaeozems (Cutanic, Differentic); 9. Dark gray forest (Umbric Phaeozems); 10. Chernozems podzolic (Rentic Phaeozems); 11. Meadow chernozems (Chernic Phaeozems (Endocalcic); 12. Meadow (Mollie Stagnic Umbrisol); 13. Sod alluvial saturated steppe-like (Mollie Fluvisols (Epicalic); Land assessment zone No 3 (Soils 14-15): 14. Chernozems leached (Umbric Calcic Luvic Phaeozems); 15. Chernozems ordinary (Mollie Calcic Chernozems). Soil types according to the WRB classification are shown in parentheses.

It should be noted that in the European part of Russia (the Kursk Region), the value of the agroclimatic potential is 7.7, and the value of the specific indicator of the cadastral cost for different subtypes of chernozems varies from 8.3 to 14.2 rub/m² [34]. The Tyumen Region also show the highest values of the cadastral cost indicators, which also has higher values of agroclimatic potential [35].

In the third agroclimatic subzone, a decrease in specific indicator of the cadastral cost for ordinary chernozems in salinity conditions is approximately 60%.

4. Conclusion
Despite the rather high values of humus content and humus horizon thickness, the soils in the Irkutsk Region show low specific indicators of the cadastral value, which do not exceed 3.5 rub/m². This is due to low values of agroclimatic potential varying from 3.5 to 3.6 units, the manifestation of erosion processes, and salinity of soils.

Significant fluctuations in the cadastral value of lands in the first land-assessment zone (from 0.1-0.3 rubl/m² in sod podzolic and sod alluvial soils to 2.5-2.7 rub/m² in sod carbonate soils) are due to the low humus content, the low thickness of the humus horizon in soils, and low agroclimatic indicators. This is the northern sub-taiga-taiga agricultural zone. Grain crops are not grown in this area due to the low values of agroclimatic indicators.
The maximum standard yield is typical of the soils of the steppe agricultural (second land-assessment) zone. In podzolized chernozems and meadow chernozem soils, the cadastral value ranges from 2.8 to 3.4 rub/m².

In the third forest-steppe land-assessment zone, the arable lands represented by chernozems (leached and ordinary) are in conditions of salinity and dismemberment of the terrain. Their cadastral value varies from 2.0 to 3.1 rub/m².

The fluctuation of the cadastral value indicators (from 0.1 to 3.5 rub/m²) is due to the specific conditions of soil formation in the region, including their small-scale structure due to large dissection of the terrain and various lithological composition of rocks, low temperature due to deep seasonal freezing and slow thawing of horizons, and insufficient soil moisture due to a small amount of precipitation and active influence of spring meltwaters flowing down the soils that are unthawed yet.

Therefore, the obtained data on the cadastral cost for different types of soils of agricultural lands in the Irkutsk Region demonstrates the sensitivity of approaches to cadastral valuation in various soil-geographic conditions. The obtained materials allow us to use the cadastral valuation data for optimizing land use and planning land management activities for sustainable development of the Baikal region in general.

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