Cadastral assessment of the land of settlements taking into account environmental factors

S E Badmaeva, Y V Badmaeva, Y V Gorbunova and S V Eutushenko
Krasnoyarsk State Agrarian University, Krasnoyarsk, Russia
E-mail: S.bad55@mail.ru

Abstract. The methodology for calculating the cadastral assessment of land in recent years has undergone a number of changes in general, and in particular in establishing the adequate value of land plots in settlements. When determining the cadastral value of land as a part of land in settlements, factors affecting pricing are not always taken into account. One of these factors can be ecological conditions of the environment and engineering - geological conditions of construction.

1. Introduction
Cadastral assessment of land is an important element of land management, therefore, the reliability and quality of its results is important both for the development of a scientifically based assessment framework and in practical activities in the field of land management in urbanized areas for its sustainable functioning. Information about the ecological state of the lands of settlements should form the basis for the creation of a system of performance indicators for the subsequent adjustment of the cadastral value of urban lands on the basis of taking into account ecological indicators. The system of diagnostic indicators includes the most important characteristics of the quality of urban lands, reflecting to a large extent the state of urban soils: natural and climatic, engineering and geological, chemical, bioindication, the level of sealing and greening of urban areas. When carrying out a cadastral assessment of the lands of settlements, it is advisable to determine the share of the contribution of each indicator, which makes it possible to increase / decrease the cadastral value of land plots. The method of calculating the relative value of urban land, based on the summation of the points assigned in advance to each pricing factor, often gives results that do not correspond to the real price levels for land in cities. An analysis of the regulatory documents shows that at present, in the cadastral assessment of urban land, the need to take into account the environmental component has been declared, but there is no single full-fledged approved methodology. Obviously, an adequate assessment of the ecological state will make it possible to obtain more correct economic indicators when creating a cadastre of urban lands [1,2,3].

The need to obtain a reliable assessment of the value of land plots is experienced by both central and local executive authorities in the management of land resources, the implementation of the prospective development of settlements, the implementation of a rational land and tax policy, as well as private subjects of the land law when making various kinds of transactions with land.

Depending on the intended use, the subject of assessment may be the ability of the land to satisfy the social needs of both a particular person and society as a whole, including satisfying needs from the standpoint of a spatial and operational basis for the location of various production facilities; ability to meet recreational needs, etc. [4,5,6].
2. Methods
The cadastral assessment is carried out at a certain point in time and according to a unified methodology for the entire territory of the Russian Federation and serves as the basis for the formation of a system of land payments and the effective development of land relations. Currently, the state cadastral assessment of land in settlements (SCALS) is regulated by the Methodological Guidelines for the State Cadastral Valuation of Land in Settlements, approved by order of the Ministry of Economic Development of February 15, 2007, No. 39. The method prescribes the establishment of the mathematical dependence of the change in the value of land plots on the degree of influence on it by each pricing factor based on the information about real estate objects. Thus, the cadastral value is calculated in accordance with the available actual values of the pricing factors. The methodology identified 17 types of permitted use of land plots within the land of settlements, for which the cadastral value can be determined and established. The methodological guidelines contain five approaches to determining the cadastral value of land plots, depending on the type of the permitted use.

Today there are adequate prerequisites in the Russian Federation for reforming the mechanisms of land taxation, rental charges for land in state and municipal ownership, as well as state policy in the field of land assessment for taxation purposes.

The functioning of urban landscapes, caused by the influence of conditionally natural, anthropogenic and socio-economic factors, determines the ecological situation on the lands of settlements. Despite the positive trends in the socio-economic sphere of the development of cities in the Krasnoyarsk Region, there are still problems that have been given special attention: ecological problems associated with a large number of enterprises in the residential area, congestion of the street and road network.

Analysis of the ecological situation in the city of Krasnoyarsk, statistical indicators of the level of negative impact obtained during the development of a forecast of the socio-economic development of the city for the period up to 2020 indicate its disadvantage due to the development of industrial and infrastructural potential.

To a large extent, the peculiarities of the industrial development of the city determine the existing ecological problems: significant levels of air pollution, water bodies, unresolved issues of waste management and others. The situation has become especially aggravated in recent years, caused by an increase in the number of vehicles, as well as an increase in the volume of household waste and a change in their structure.

Maintaining a high level of atmospheric air pollution from stationary sources is one of the most acute problems of the city of Krasnoyarsk. A significant part of the city's population lives in areas where concentrations of a number of pollutants regularly exceed sanitary standards.

3. Research results
Long-term observations of the state of the atmospheric air show that benzopyrene, suspended solids, formaldehyde, and nitrogen oxides are typical harmful substances polluting the city's atmospheric air. These pollutants have the main negative impact on the quality of atmospheric air and determine the high level of atmospheric pollution.

Recently, along with some stabilization of emissions from industrial enterprises in the city of Krasnoyarsk, there has been an increase in emissions of pollutants from vehicles. The scale of air pollution from emissions from stationary and emissions from mobile sources is becoming comparable.

The processes of dispersion of emissions from vehicles are significantly different from the dispersion of emissions from industrial enterprises. The entry of pollutants from vehicles into the lower atmosphere determines the high level of their surface concentrations. The maximum content of pollution is recorded at a height of 50-150 cm from the earth's surface, that is, it is located in the zone of human breathing. The main factors determining the dispersion of impurities are atmospheric stratification, including temperature inversion. Inversions impede vertical air exchange - turbulence is weakened and convection stops. The increased resilience of the atmosphere leads to increased air pollution, mainly due to low emission sources.
The formation of inversions in the city of Krasnoyarsk is facilitated by its location in the closed depression - cold air flows into the lower parts of the relief. In the vicinity of Krasnoyarsk the surface inversion is formed more than 240 days a year. The maximum number of days with surface inversion is observed in February - 76%, the minimum - 47% - in April. The rest of the period is characterized by close values of the frequency of occurrence of the number of days with surface inversion - 65-71%.

Radiation inversions are most characteristic in Krasnoyarsk, the probability of their formation, especially in summer, is greatest at night and early morning hours. According to long-term data the average power of surface inversions was 0.41 km in the morning hours. The minimum in the annual course is noted in April - 0.31 km, the maximum - in November - 0.50 km. According to the data of evening soundings, the average thickness of surface inversions varies from 0.15 km in April-May to 0.51 km in December and in average it is 0.26 km per year. The maximum power of surface inversions both in the morning and in the evening is observed in December - 2.0 km. The average annual of the maximum in the morning is 1.10 km, in the evening - 0.63 km. If the inversion layer is located directly above the emission source (pipe), then hazardous pollution conditions are created in the surface layer of the atmosphere because the inversion layer limits the rise of emissions and promotes their accumulation in the surface layer. If the layer of the raised inversion is located at a sufficiently high height from the pipes of industrial enterprises, then the concentration of impurities will be significantly lower. The inversion layer located below the level of emissions prevents their transfer to the earth's surface.

During peak hours, the concentration of nitrogen oxides, carbon and other harmful ingredients on the streets of Krasnoyarsk is 10-20 times higher than the maximum permissible concentration. In modern conditions, the determination of the cadastral value of land plots is the basis for accounting and registration of real estate, identifying the taxable base for the collection of an objective and adequate tax. The calculation of the cadastral value of urban land is especially relevant, since land plots are classified according to seventeen types of permitted use. In recent years, there have been lawsuits for revising the cadastral value, which differ by more than 40% from the market value of the real estate under consideration.

Currently, the market for land plots for individual housing construction is one of the fastest growing market sectors in Krasnoyarsk. It is confirmed by the growing volume, diverse supply structure, as well as increased consumer demand. The share of land for individual housing construction in the total number of land plots recorded in the state real estate cadastre is 20%. At the same time, according to the approved General Plan of Krasnoyarsk, it should increase by an order of magnitude by 2025. For this purpose territories are reserved in the Oktyabrsky district of the city - villages Udachny, Pines, Gorny, Serebryany Bor, district Clean, state farm "Oktyabrskiy", Fruit and berry station, villages Ovinny, Taimyr, Novomlinaya St., in the Central - microdistricts. Pokrovsky, Krazovsky; in the Soviet – microdistrict Nanzhul-Solnechny, village Gerbil; in Sverdlovsk - Divnogorskaya St., Tourist base St., villages Bazaikha, Vodnikov, Vavilov St.; in Kirovsky - microdistrict. Kuznetsovskoe plateau, Assemblers St., village. Suvorovsky; in Leninsky - village Shinnikov, Amurskaya St., Daurskaya St., village Upper Bazaikha.

We examined the cadastral values of two land plots located in different districts of the city with various ecological conditions. The land plot with cadastral number 24: 50: 0100212: 106 is located in the Oktyabrsky district of the city at st. Snezhnaya, 7. Land area - 1296 sq.m. Land category - land of settlements, type of permitted use - for the operation of a residential building. The cadastral value is set at 1 801 077.12 rubles. (Resolution of the Government of the Krasnoyarsk Territory No. 766-p of 03.11.2020 "On approval of the results of determining the cadastral value of land plots within the land of settlements of the Krasnoyarsk Territory"). The specific indicator of the cadastral value of the land plot is 1,389.72 rubles / sq. m.

For this land plot, according to the methodology, there are no industrial enterprises nearby, roads and railways do not pass, respectively, 100 points can be assigned for the ecological state of the environment. If we consider the engineering and geological conditions of construction, then at a distance of 150 m and 220 m south-west and south-east of the land plot with cadastral number 24: 50: 0100212: 106 there are two lakes, which causes a rise in the ground level and swamping of the surrounding area. Therefore,
the established cadastral value can be reduced by 10% and correspond to 1,620,969.41 rubles, and the specific indicator of the cadastral value of a land plot - 1,250.7 rubles / sq. m.

The land plot with cadastral number 24: 50: 0400023: 64 is located in the Soviet district of the city at the address. Bartatsky, 10. The area of the land plot is 864 sq.m. Land category - lands of settlements, type of permitted use - for the operation of a residential building. The cadastral value is determined at 608,100.48 rubles. The specific indicator of the cadastral value of the land plot is 703.82 rubles / sq. m.

This land plot with improvements is located near an agricultural production, there is also a private enterprise processing agricultural products nearby. At a distance of 1000 m there is a poultry farm, agricultural land and a greenhouse for growing vegetables and early green crops. The land plot is previously recorded and the date of entry into the Unified State Register of Real Estate is October 10, 2019. At a distance of 100 m from the land plot with cadastral number 24: 50: 0400023: 64, in addition to agricultural production and industrial enterprises, there is a highway and, accordingly, 25 points can be assigned for the ecological state of the environment. If we consider the engineering-geological conditions of construction, then this territory is located in low relief elements, there are streams nearby at a distance of 150 m, which determines the high standing of the groundwater level according to the results of soil-hydrological surveys. Therefore, for these conditions of construction, a land plot can be assigned 60 points. The established cadastral value can be reduced by 20% for environmental conditions and 10% for engineering and geological conditions of construction. Consequently, the combined interaction of the two factors gives a total decrease in the cadastral value by 30% and may amount to 425,670.34 rubles, and the specific indicator of the cadastral value of a land plot - 492.67 rubles / sq. M.

Our studies to clarify the cadastral valuation of land in settlements, by making adjustments for unfavorable external conditions, in particular for the state of the environment, for geomorphological conditions, are consistent with the studies of other authors [7,8,9]. These amendments are especially relevant for calculating the cadastral value of land for residential construction.

4. Conclusion
Thus, the assessment of land – part of land in settlements has undergone significant changes in recent years, which is associated with the Methodological Guidelines developed in different periods of time.

The analysis of foreign and domestic practices of cadastral assessment of urban land made it possible to identify differences in the use of ecological factors when carrying out land assessment works. In the Russian Federation, when determining the cadastral assessment of land in settlements, natural and anthropogenic factors are not distinguished into a separate significant group, while in European and international standards for assessing the value of land, ecological factors are included into special sections. It is necessary to improve the methodology for cadastral assessment of urban land by developing a system of assessment indicators for subsequent adjustments to the cadastral value of land plots. It is necessary to improve the methodological and technological principles of assessing the cadastral value of land, in which a significant role should be assigned to ecological factors.

References
[1] Badmaeva S E, Mironenko A B and Badmaeva Yu V 2020 Cadastral assessment of land in Krasnoyarsk Moscow economic journal 5
[2] Lelyukhina A M and Koroteeva L I 2001 The method of complex target zoning in the cadastral assessment of urban areas Land Bulletin of Russia 1(5) 9-11
[3] Timonov V A 2003 Development and research of methods for cadastral multifactor assessment of urban land (Novosibirsk)
[4] Petrov V I 2012 Assessment of the value of land plots: a tutorial Ed M A Fedotova (M :: KNORUS)
[5] Podryadchikova E D 2015 Development of a methodology for land appraisal works based on geoinformation analysis of socio-territorial interconnections of elements of urban infrastructure (Novosibirsk)
[6] Romm A P 1997 Cadastral valuation of urban land: methodological foundations and tools
Assessment issues Z 16-20.

[7] Sapozhnikova (Shabaeva) Yu I and Bykova E N 2013 Justification of the need to take into account the ecological state of the territory when assessing land *Rational nature management: traditions and innovations. Materials of the International Scientific and Practical Conference* (Moscow, Moscow State University, November 23-24, 2012) Ed prof. M V Slipenchuk (M.: Publishing house of Moscow University) pp 266-8

[8] Sapozhnikova (Shabaeva) Yu I and Bykova E N 2012 Analysis of the practice of accounting for environmental factors in Russia and abroad *Zapiski Gornogo instituta* 196 52-5

[9] Sviridova A V *Improving the cadastral valuation of urban land on the basis of environmental factors* Dissertation abstract [Electronic resource] Retrieved from http://earthpapers.net/