RESEARCH PAPER

METROPOLIZATION PROCESS IN THE RURAL SETTLEMENT SYSTEM OF THE CENTRAL CHERNOZEM REGION OF RUSSIA

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ABSTRACT. The Central Chernozem region of Russia has undergone significant changes in socio-demographic processes over the past half-century. The aim of this study was to establish the impact of metropolization on the demographic transformation of sparsely populated rural settlements for the Central Chernozem region and to develop a demographic forecast for 2030. The study's goals were to (1) determine the scale of regional metropolises; (2) identify the impact of metropolization on the quantitative indicators of sparsely populated rural settlements; (3) establish trends in their transformation; and (4) compile a medium-term demographic forecast for the Central Chernozem region. The set objectives were achieved by integrating methods for spatial-temporal and comparative geographical analysis, statistical methods, and a combination of official statistics with sociological methods. Analysis of the level of urbanization of the regions in modern conditions (20th and 21st centuries) showed that, although this process was and remained below the national average, it did not prevent the formation of regional metropolises (Belgorod, Stary Oskol, Kursk, Voronezh, Lipetsk, Tambov) as an obvious outcome of urbanization processes. A regional pattern of degradation of the network of rural settlements, mainly the smallest and small in terms of population (1-25, 26-50 people), which make up over one third of all settlements in the Central Chernozem region of Russia, was determined. A stable long-term trend of growth in the number of abandoned villages and hamlets was established. Between the last two All-Russian population censuses (11 years), their number increased by 45%. The forecasting results obtained confirm the established patterns in the medium-term trend of "compression" of rural settlement around regional metropolis (with some exceptions). The medium-term demographic forecast showed that population concentration in metropolitan areas and further socio-demographic desertification in peripheral areas will continue with growing territorial differentiation. The obtained results of the study of the transformation of settlement systems of the Central Chernozem region as a result of the metropolization of regional centers can help government institutions in strategic planning of territorial development.

KEYWORDS: metropolization processes, rural resettlement, disappearing settlements, socioeconomic development, spatial distribution, geographic information system, demographic forecast

INTRODUCTION

The historical settlement system in Russia was radically changed during the Soviet era and continues to change due to many factors: urbanization as a global socio-economic process, the demographic crisis, and scientific and technological progress. Ignoring objective changes in society and the population distribution system leads government institutions to make wrong decisions and have negative consequences of a socio-demographic and ekistics nature. The consequence of urbanization as a global socio-economic process are metropolises of various hierarchical levels (from national to regional). It should be clarified that in this article, resettlement refers to a network of populated areas (urban and rural) of a specific territory, and a regional metropolis is the main city

of the territory, the centre of political and economic life with an increased concentration of the urban population, that is, the top in the hierarchy of the regional settlement system. Metropolization is the result of urbanization, when a city (an agglomeration, a region associated with it) has achieved a systemically significant mission, structure, and status but transforms rural areas, leading to stagnation and/or degradation of deep peripheral areas (more often these are rural areas).

Socio-economic processes in rural areas are of interest to researchers (Lynch 2005; Nefedova and Treyvish 2015; Pivovar and Alekseev 2018; Nefedova 2018; Sokolova and Kuznetsov 2018; Nefedova and Treyvish 2020; Alekseev et al. 2020; Huseynova 2023; Chugunova et al. 2023), who note that agriculture in rural areas is receding into the background, since technical progress and industrial methods

of agricultural production reduce employment, contribute to the migration outflow of "extra" people from the rural community, leading to depopulation in many settlements and the appearance of abandoned (depopulated) villages. The formation of metropolises is the key to the modernization of society (Marshan and Samson 2004), but it is accompanied not only by the concentration of the population and economy in large cities but also by increased segregation of the population in the centre-periphery gradient (Chugunova and Likhnevskaya 2019; Chugunova et al. 2021). In Russian realities, In Russian realities, the deepening of space polarization (Kuzin 2019), the growth of economic and social contrasts, and the emergence of urgent problems in regional development (Yakovenko and Chugunova 2022; Zubarevich 2003) complicate the strengthening of the metropolization process in a market economy. COVID-19 showed that the pandemic damaged the economy and lifestyle of the urban population (Kochurov et al. 2021; Tikunov et al. 2022), but increased the attractiveness of rural settlements, mainly in the first suburban zone, and practically did not affect the periphery of the regions (in the context of the "center-periphery" concept). During the COVID-19 period, the phenomenon of suburban migration (from urban to rural or suburbs) was noted, since in Russian regions many urban families have garden plots with house buildings. Since 2019, under a new law, Russians have received the right to legalize their year-round residence with permanent registration in houses in garden associations suitable for habitation.

Rural settlements are, on the one hand, the result of the development of the country's territory, and, on the other hand, they are the contribution made by many generations of people to territorial development. The population settlement is broadly and socially defined as a spatial form of social organization, and in the second meaning, it is a set of localities within a certain territory. Rural areas also perform some ecological functions: they maintain ecological balance throughout the country, including cities. Agricultural landscapes, like urban lands, require erosion control (Lisetskii et al. 2014; Chizhikova et al. 2022) and control of pollutants in soil and water, as well as the introduction of a more general approach, such as environmental management of key resources (water and land) at the eco-regional level (Yermolaev et al. 2015; Buryak et al. 2019). Solving the water shortage problem, which is receiving much attention (Lisetskii 2021), requires a common basin approach (Buryak et al. 2022), which can replenish underground sources as the main resource for drinking water supply to the population. One distinctive feature of settlement development is its inertia, which, at a certain stage of change, can slow down the structural shifts caused by settlement factors. In particular, the development of geographically dispersed farms (Kaur K. and Kaur G. 2021) can constrain urbanization, which is important for maintaining the socio-economic climate in rural areas.

An analysis of published works revealed that most of the previous publications did not address the impact of metropolises on rural settlements, and did not study the results and development trends of the smallest and small rural settlements of the area, especially with the use of geographic information systems. The demographic approach is the main one in this article. This study, for the first time, uses a scientific and methodological complex for a fundamental study of the region's settlement system, distinguishing it from previous publications' results. It has been shown that there are no works that look at patterns in the growth of a network of disappearing rural settlements and how they are spread out in space in a region of Russia

that is so big in terms of population and land area that we felt the need to fill in the gaps.

This study refers to the important agricultural zone of Russia, where the Belgorod, Kursk, Lipetsk, Tambov, Voronezh Oblasts are located, forming the Central Chernozem region, which is home to 7.2 million people (4.8% of the population of the Russian Federation), and the district area is 1% of the country's territory. In the rural areas of the region, there are 9201 settlements with a population of 2.2 million people[1].

The subject of the study is regional metropolization processes, which cause transformation of settlement systems. The territorial object of study was the settlement system of the Central Chernozem region.

The study's main objectives, which determine its purpose, include: i) assessing the scale of regional metropolises; ii) identifying the impact of metropolization on the quantitative indicators of sparsely populated rural settlements; iii) establishing the trend of their transformation and developing a medium-term demographic forecast for the Central Chernozem region.

MATERIALS AND METHODS

The information base included the materials provided by the Federal State Statistics Service (Rosstat) and territorial bodies of the Rosstat (Belgorod, Voronezh, Kursk, Lipetsk, and Tambov regions), multi-year studies by the authors of the Central Chernozem region, and field surveys (materials obtained during expert interviews with rural settlement administrations). Official statistics have been used to compile the tables in this article. The main objectives of the paper have been achieved through the use of spatial-temporal and comparative geographical analysis methods, statistical methods, and a combination of official statistics and sociological methods. The functionality of the Geographical Information System (GIS) allows not only to visualize the territorial features of settlement systems but also to conduct cartographic modelling of demographic characteristics (Igonin and Tikunov 2019; Gaydukov et al. 2022). The study has given significant attention to geoinformation mapping (geoinformation technology – ArcGIS), enabling the visualization of processes and events over time, as well as demonstrating the appeal of regional metropolises to the population. The data of the data.nextgis.com service, tables of attributes, and spatial data served as materials for creating vector maps; the developed scales made it possible to visually reflect the mapped processes.

The quantitative analysis method was used to estimate the number of small settlements in municipalities with a population of 1-25 and 26-50 people. A medium-term demographic forecast was used to establish the expected transformation in the distribution of the population in the Central Chernozem region and the boundaries of areas of increased population concentration and socio-demographic desertification. Using the extrapolation method, the forecast is calculated based on data from the Federal State Statistics Service (01.01.2023).

RESULTS AND DISCUSSION

Metropolization processes in the Central Chernozem region of Russia as determinants of settlement changes

In recent decades, the settlement system in all parts of the Central Chernozem region (Oblast) has undergone radical changes. The main ones are the concentration of population in metropolitan areas and their areas

[1] Results of the All-Russian Population Census 2021 (2021) [online] Available at: https://rosstat.gov.ru/vpn_popul

(agglomerations), depopulation of the periphery, degradation of many rural settlements, and the growth of abandoned villages.

As of January 1, 2023, 146,424,729 people lived in Russia, of which 36,789,914 people lived in rural areas. In addition to the fact that the Russian rural area has lost about 30,000 settlements over the past 25-30 years, there are now 75,000 villages in the country with residents from 1 to 25 people[2]. These settlements are clearly doomed. Modern population changes occur at the regional level largely of a "turning point" nature (Kirillov and Makhrova 2019). In rural areas Central Chernozem region of Russia there are some villages 1499 where population is 2.3 million people (Fig. 1). A distinctive feature of the Central Chernozem region urbanization processes was their slow rate up to until the 1970s of the 20th century: the city inhabitants made up absolute minority of the region's population – from 33% in Kursk region, up to 46% in Voronezh region[3]. Industrialization of the regions gave rise to the "urban revolution" and caused a drastic increase in migration of rural inhabitants to cities. By the end of the 1970s (1979) Voronezh, Belgorod and Lipetsk regions, and later the Kursk and Tambov regions have overcome the urban transition, which indicates that the society has entered a new phase of evolutionary development.

The high rates of urban resident's growth were accompanied by metropolis formation and population concentration in and around regional centers. Metropolization differed significantly by regions: in 1989 in Lipetsk, the total number 37% including urban population (59%), was concentrated, while in Tambov, 23% and 41% respectively. The metropolization processes in the Belgorod region were more complex: the intensive development of the Kursk magnetic anomaly of union significance in the region's territory and the development of mining and ferrous metallurgy led to the active development of another metropolis – Stary Oskol; as a result, a polycentric (bipolar) metropolization was established. The presentation of urbanization growth rates of the regions and the dynamics of metropolis share in the regional population the Central Chernozem region of Russia can provide insight into Table 1.

Analysis of statistical data in Table 1 shows that the demographic transition was completed in Soviet time and shows that population tends to be concentrated in metropolitan cities. In the post-Soviet years, the share of urban population continues to increase slightly, which indicates that the urbanization development has completed an extensive stage and reached a qualitatively new level – the stage of "mature urbanization". This is evidenced by the concentration of population in metropolises from 40% to 49% of the entire and from 59% to 82% urban population, the formation of urban systems (agglomerations). Tambov region is an exception to the general trend of urbanization (and metropolises) development: it has the lowest share of the metropolitan population in the total (23%) and urban population (41%) according to the latest census (2021).

The demographic development of metropolises, the increase in the weight of economic potential, as well as the concentration of administrative and managerial functions, give the capitals advantages in competing for investment and population. However, metropolization also has negative consequences caused by the processes of "compression of space": the migration of population and productive forces from small and medium-sized cities and rural settlements to metropolises leads to territorial polarization of economic

Fig. 1. Location of the study area (the Central Chernozem region) within Russia

[2] Rural territories of the Russian Federation in 2021 (2021) [online] Available at: https://rosstat.gov.ru/storage/mediabank/sel-terr.html
[3] Federal state statistics service (2020) [online] Available at: http://kurskstat.gks.ru/wps/wcm/connect/rosstat_ts/kurskstat/resources

Table 1. Dynamics of urbanization levels and growth of metropolises in the Central Chernozem region of Russia in 1989-2021, as a percentage

Population size, %	1	3	5	7	9
	2	4	6	8	10
1989					
Urban population	63	61	58	62	56
Rural population	37	39	42	38	44
Metropolis (s) in the total population	35	36	32	37	23
Metropolis(s) in the composition of the urban population	54	57	55	59	41
2002					
Urban population	65	62	61	64	57
Rural population	35	38	39	36	43
Metropolis (s) in the total population	36	36	33	42	25
Metropolis(s) in the composition of the urban population	57	58	55	65	44
2010					
Urban population	65	64	65	63	58
Rural population	35	36	35	37	42
Metropolis (s) in the total population	38	38	37	44	26
Metropolis(s) in the composition of the urban population	58	60	57	69	45
2021					
Urban population	67	69	69	65	62
Rural population	33	31	31	35	38
Metropolis (s) in the total population	36	46	40	43	27
Metropolis(s) in the composition of the urban population	56	67	59	69	44

Note: According to the All-Union (1989) and All-Russian Population Censuses (2002, 2010, 2021). The materials were provided by the Federal State Statistics Service (Rosstat) and territorial department of the Rosstat.

1– the Belgorod region, 2 – Belgorod, Stary Oskol, 3 – the Voronezh region, 4 – Voronezh, 5 – the Kursk region, 6 – Kursk, 7 – the Lipetsk region, 8 – Lipetsk, 9 – the Tambov region, 10 – Tambov

and demographic development (Kuzin 2019; Litvinenko et al. 2020; Yakovenko and Chugunova 2022). Population concentration in metropolises and suburban areas is due to a size reduction of the rural settlement network, a growing number of abandoned (depopulated) rural localities, a decline in population, and abandonment of the earlier developed territories. The negative consequences of metropolization are particularly significant for remote and peripheral areas and for the network of small settlements (Alekseev et al. 2020).

Dynamics of rural settlement under the influence of metropolization processes in the Central Chernozem region

The development of rural settlement depends on a number of factors: socio-economic, demographic, infrastructural, natural, and institutional. A characteristic feature of the national policy the 1960s and 1970s of the 20th century – in the period of rural settlement reconstruction for consolidation of rural localities was treatment of small settlements as "unpromising". As a result, the rural settlement system underwent a radical change,

and the rural population has sharply declined. In the late Soviet and post-reform eras of Russia, the outflow of rural residents continued, but it was for other reasons. The globalization processes (Giddens 2004), their projection on the countryside, technological transformations in agriculture, and new social realities have set in motion demographic and migration processes. From 1970 to 2021 the number of rural inhabitants in the Central Chernozem region of Russia decreased by two million people, and the largest losses were sustained by the Kursk region (64%) and the Tambov region (56%). Can give an idea of intra-district differences in changing number of the rural population of the district Fig. 2.

The main trends in population changes in the Central Chernozem region of Russia testify to the long-term decline in the number of rural population in the rural-metropolis directions. The decrease in the number of rural residents has largely affected small settlements, leading to the emergence of new deserted (abandoned) villages and hamlets. Table 2 can provide an idea of the number of rurally depopulated localities.

By 2021, the number of abandoned villages in the Kursk region has almost doubled; in the Voronezh region, – one
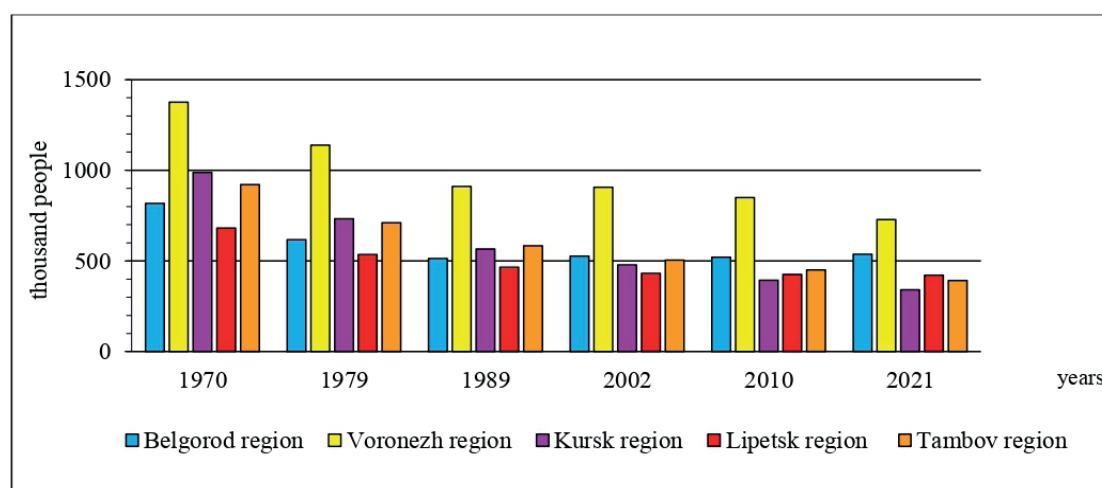
Fig. 2. Dynamics of the rural population of the regions of the Central Chernozem region of Russia, 1970-2021, thousand people (compiled according to Russian population censuses)

Table 2. Rural depopulated settlements of the Central Chernozem region (2010, 2021). Compiled and calculated according to Russian population censuses

Regions	Total rural settlements		Number of rural depopulated settlements		Share of rural depopulated settlements, %	
	2010	2021	2010	2021	2010	2021
Belgorod	1574	1573	69	104	4.4	6.6
Voronezh	1717	1699	74	118	4.3	6.9
Kursk	2770	2773	172	335	6.2	12.1
Lipetsk	1600	1601	110	135	6.9	8.4
Tambov	1638	1555	122	98	7.5	6.3
Central Chernozem	9299	9201	547	790	5.9	8.5

and a half times; in the Tambov region, it has decreased, which raises doubts among the authors of this article about the quality of statistical data coming from local municipalities (Strakhov 2022). Specifically, in the Petrovsky municipal district of the Tambov region, 15% of the settlements are devoid of population and abandoned. This means that the work of previous generations of people in depopulated villages is irretrievably lost.

In the rural settlement system Central Chernozem region of Russia a significant role is played by differentiation of rural "depopulated" localities. In Kursk, Lipetsk, and Tambov regions, there are more abandoned villages than the average number for the district; in the Tambov region, it is 1.7 times more than in the Voronezh region.

Our previous studies of rural settlement and analysis of statistical materials allowed us to state that the most radical changes have occurred (and will occur) in the growth and status change of the settlements, which we regard as "disappearing" ("smallest" (1-25 people) and "small" (26-50 people)). These conclusions are based on their consistent development trends: stably depressive state, population decrease and transformation of settlements into "depopulated" ones. The number of "smallest" rural settlements is maximum in the Kursk region (31.4%) and the Lipetsk region (29.2%), minimum in the Belgorod region (16.8%) and it is reached throughout the district Central Chernozem region of Russia 2325 or 24.8% network of settlements. To visualize the differences in the spatial distribution of the "smallest" rural settlements, cartograms were built for two different dates (Fig. 3, 4).

A comparative territorial analysis of cartograms of the distribution of the smallest rural settlements (from 1 to 25 people) in the Central Black Earth region between the last two population censuses revealed an increase in their number. In the Kursk region in 2021, they already made up one third of all rural settlements, and even more; for instance, they accounted for 50% in the Khomutovsky district and 42% in the Zheleznogorsk region. In the Tambov region, their share increased to 30%.

In 2021, the "leadership" in terms of the share of the "smallest" was retained and increased by the Kursk region (33%); it is followed by the Tambov region (30%) of all settlements. The number of "small" ones is less significant but it remains very "representative" in particular, it is a tenth of all rural settlements Central Chernozem region of Russia (Fig. 5, 6).

As follows from the cartograms, minimal changes were noted for the Voronezh region; it is the most ekistics "prosperous" both according to the data of 2010 and the 2021 census. In it, the total number of "small" settlements in 2010 was 8.7%, the most "problematic" is the Kursk region – 13.4% (in the Cheremisovsky, Shchigrovsky, Kurchatovsky districts their share reached 23-20%), in the Lipetsk and Tambov regions - the "golden" mean. In 2021, in all regions, there is a persistent trend of fragmentation of the network of settlements, and the type of settlements "26-50 people" accounts for 9% to 10% of the number of all rural settlements (122 in the Central Chernozem region).

The most emissivity "prosperous" both in 2010 and in 2021 remained the Voronezh region: the total number of "small" settlements (2010) was 8.7%, and the "problem" –
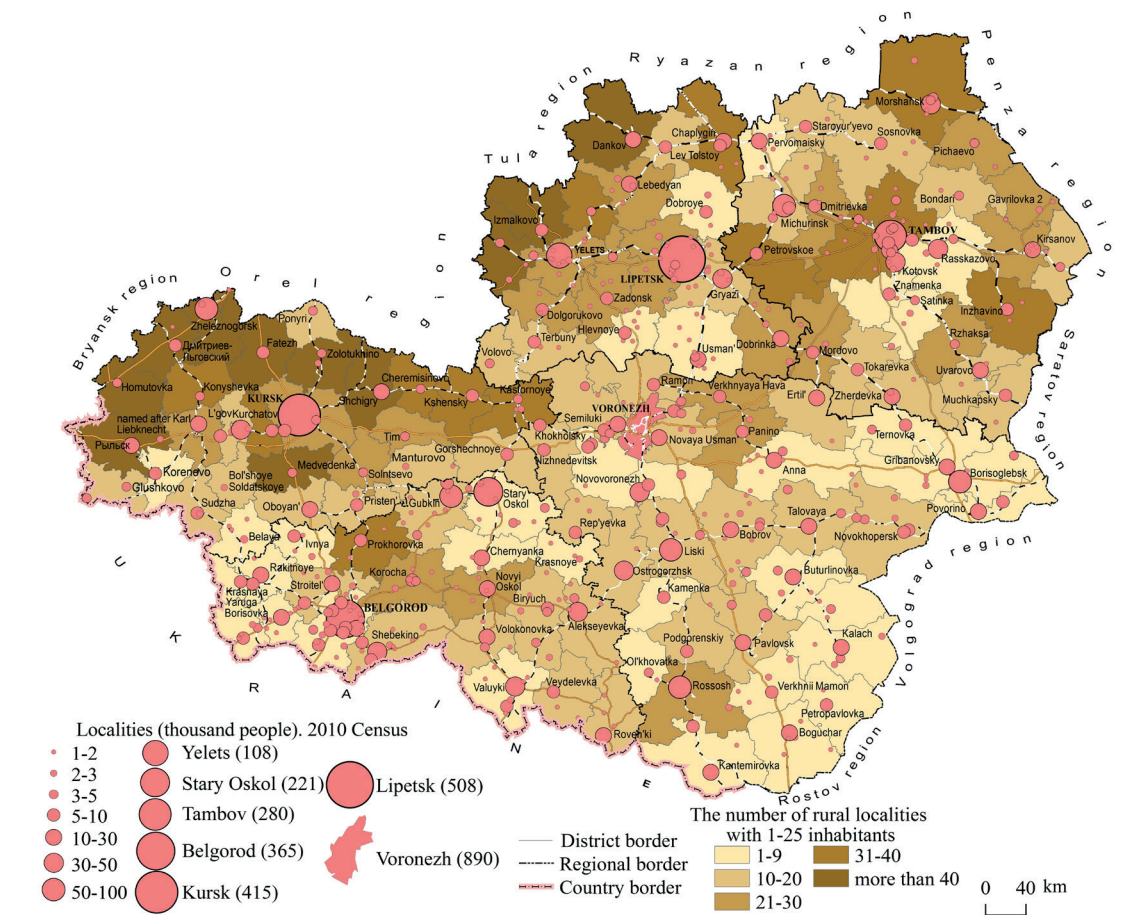
Fig. 3. Distribution of rural localities in the Central Chernozem region of Russia with a population of 1-25 people: 2010 Census
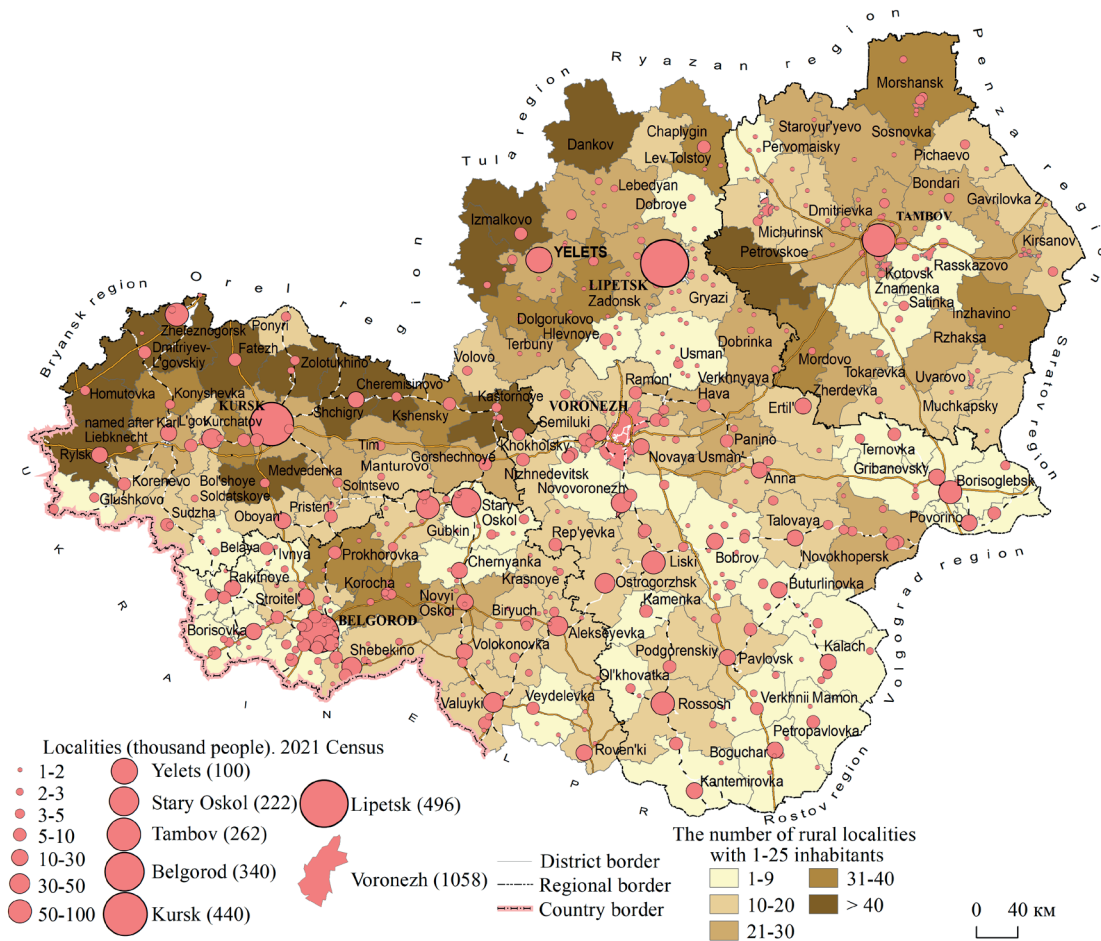

Fig. 4. Distribution of rural localities in the Central Chernozem region of Russia with a population of 1-25 people: 2021 Census
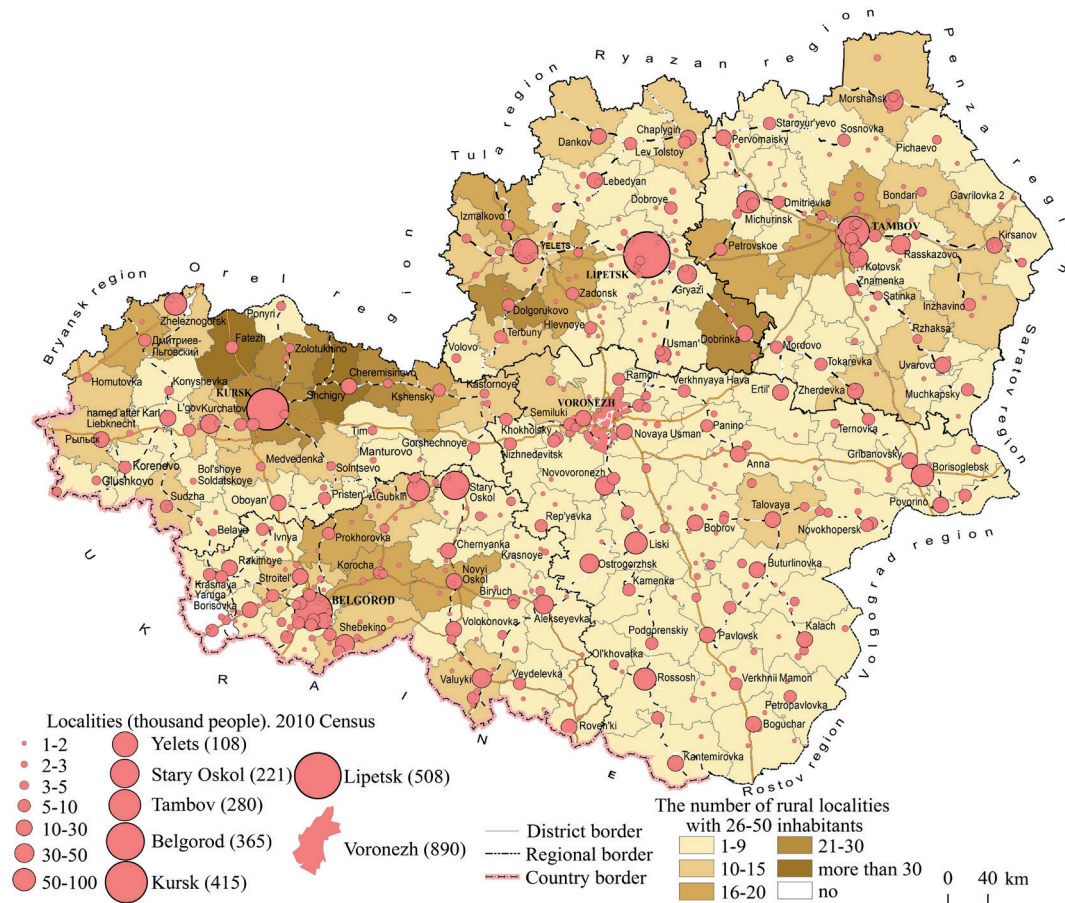
Fig. 5. Distribution of rural settlements in the Central Chernozem region of Russia with a population of 26-50 people: 2010 Census
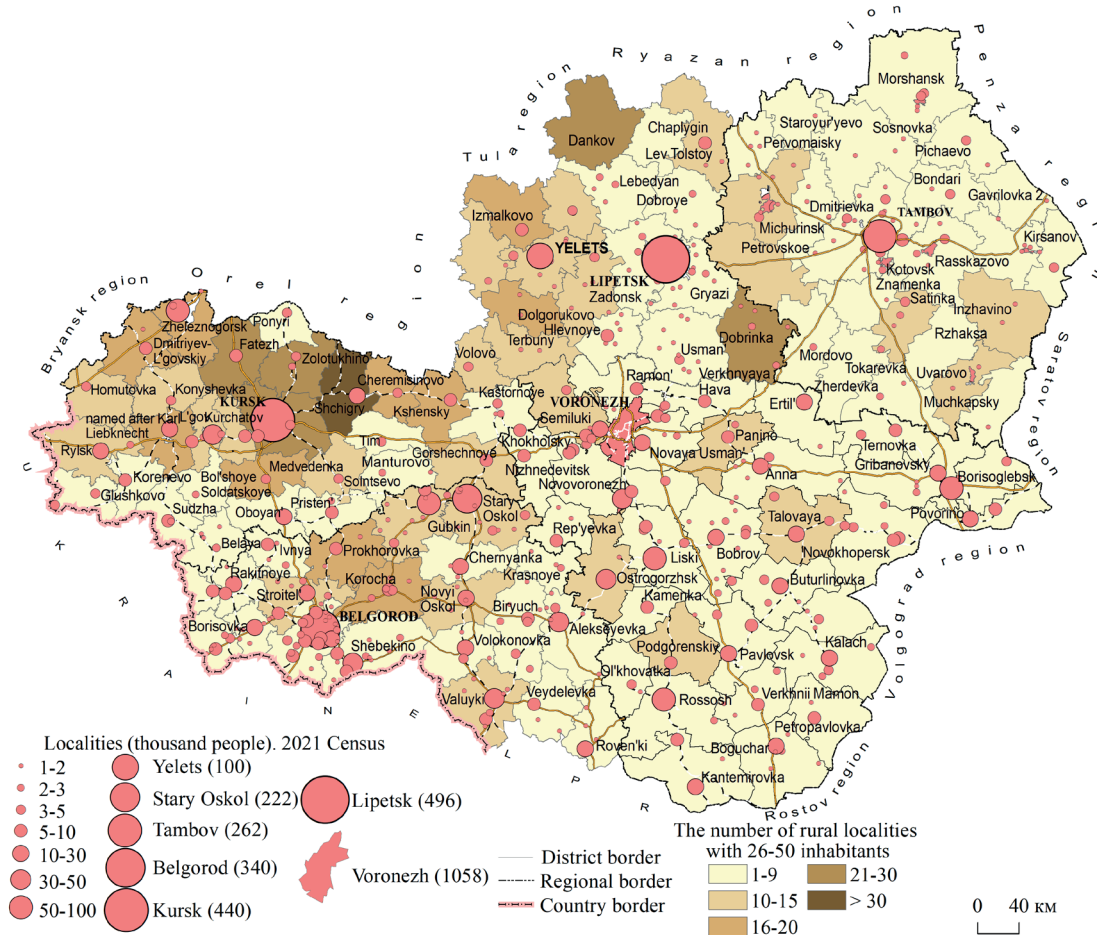

Fig. 6. Distribution of rural settlements in the Central Chernozem region of Russia with a population of 26-50 people: 2021 Census

Kursk region (13.4%), in the Lipetsk and Tambov regions – the "golden" mean; in 2021, in all regions, the trend of shrinking the network of settlements continues and, as a result, the share of the type of settlements "26-50 people" ranges from 9% to 10%. As a result, according to the latest population census, up to 45% (Kursk region) of rural settlements fell into the category of "disappearing" (Results … 2021). According to our calculations, in the coming years, some of the smallest settlements will move into the category of "depopulated", field observations in 2018-2022 convince us of the correctness of this conclusion. Their disappearance is natural in the context of the ongoing reforms and the increased demands of the population for the standards of quality of life. The degradation of rural settlements was aggravated by the destruction of social infrastructure of rural areas and the processes of its "optimization" in the country when small schools, kindergartens, and medical and obstetric stations were closed in settlements with up to 100 residents (and even larger ones), which became the determinants of the negative socio-economic conditions of life of rural residents, leading to their outflow to metropolises. The Kursk region, as the most sparsely populated in the rural settlement system of the Central Chernozem region, naturally became the one that suffered the most from the "optimization" reform. Smaller losses were suffered by suburban settlements in the region's metropolises. The prepared demographic forecast for the population system of the Central Chernozem region of Russia confirms our conclusions about further population concentration around metropolises and the socio-demographic desertification of the periphery of the five parts of the region (Oblast).

Demographic forecast for rural population of the Central Chernozem region of Russia.

The study is based on a medium-term forecast, which is considered optimal for determining the future parameters of territorial differentiation of the population (Vinokurov 2002), as well as allowing to determine the places of population concentration and socio-demographic desertification of the region. The estimated total population and rural population in particular for 2030 was calculated based on data from the Federal State Statistics Service[4] in accordance with the demographic forecast method (Borisov 2001), using the extrapolation method, which is applicable to demographic forecasts for the medium term (Medkov 2006).

The following calculation algorithm was used:

(1) population changes exponentially according to the Eq. (1):

$$P_t = P_0 \times e^{k \times t} \tag{1}$$

where P_t is the total population at the end of the forecast period; P_0 is the total population at the beginning of the forecast period; k is the estimated population growth rate in the forecast period; t is the value of the forecast period; e is the base of natural logarithms;

(2) according to the results of calculations, the classification of municipalities was carried out;

(3) maps for the entire population and separately for the rural population were constructed based on the obtained data (Fig. 7, 8).

The obtained forecast results indicate a possible trend of a steady decrease in the total population in the study area from 2023 to 2030 by 7.1%. The maximum decrease in
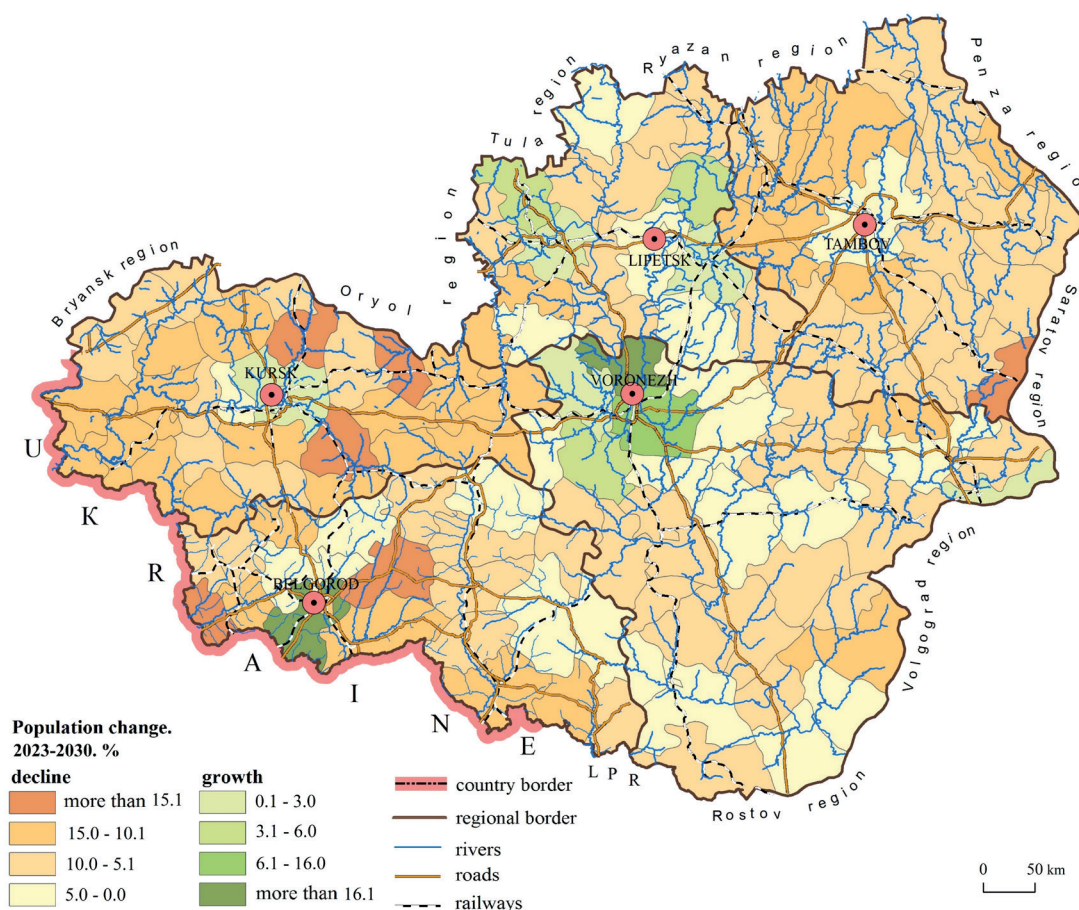

Fig. 7. Forecast of the total population distribution of the Central Chernozem region of Russia for 2030

[4] Regions of Russia. Socio-economic indicators 2022 (2022) Statistical compendium. Moscow: Rosstat (in Russian).

population is expected in the Belgorod region (-12.1%) (as a result of the border location with Ukraine) and, especially, in border municipalities. A new pattern has been identified that reflects the differences in the minimum reduction in the number of residents in all regions (except for the Tambov region) predicted on the periphery of the regions and the maximum reduction on the semi-periphery. According to the forecast for changes in the rural population in the Central Black Earth Region, depopulation will increase by 10.4%. As expected by 2030, the largest losses in the number of rural residents will be suffered by the Kursk (-18.4%) and Belgorod (-17.9%) regions, and the minimum by the Lipetsk region (-3.8%) (Fig. 8).

The forecast suggests that the transformation of the settlement systems of the Central Chernozem region of Russia will continue, which will be reflected in the concentration of rural residents in the suburbs of the capital's metropolises, and the demographic desertification of the semi-periphery and periphery of varying intensity.

CONCLUSION

The conducted study of the dynamics of demographic processes in the settlement system of the Central Chernozem region showed that regional metropolises acted as loci of post-industrial processes and sources of competitiveness, which was facilitated by the agglomeration effect and economies of scale. A certain role in this was played by the status of regional capitals. Metropolization transformed the regional space, involved territories in the processes of modernization and innovation, but also led to stagnation and/or degradation of peripheral (most often, rural) territories, causing an increase in the number of abandoned villages and hamlets, the number of which increased over the period 2010-2021 (according to the latest population censuses) by 44.7%.

The use of a geographic information system made it possible to identify the spatial distribution of "disappearing" rural settlements and its population in the Central Chernozem region. It has been established that the processes of urbanization of the Central Chernozem region of Russia until the end of the 1970s of the 20th century were strongly extensive in nature and caused by regional industrialization. In the region, the urbanization transition ended in the late Soviet period (80-90 years of the 20th century) and urbanization reached a qualitatively new level – the stage of "mature urbanization".

The level of urbanization of the regions in the 20th and 21st centuries was and remained below the national average; however, they did not prevent the formation of regional metropolises (Belgorod, Stary Oskol, Kursk, Voronezh, Lipetsk, Tambov) as a result of urbanization processes. An assessment of the ekistics development of the regional Central Chernozem region of Russia metropolization has shown their significant differentiation. In parallel with the formation of regional metropolises, there has also been phenomena such as a radical transformation of rural settlement systems, a decrease in the rural population and sparse inhabitation of settlements. In the Kursk and Tambov regions, the number of rural residents decreased by half or more. In the structure of rural settlements in the Central Chernozem region of Russia, the number of rural localities with the smallest and small population sizes has increased (3405), which already accounts for 37% of the network of settlements, and most of them will cease to exist and lose their population in the near future. The factors of rural settlement transformation included the impact of globalization processes on rural areas, industrial methods of production in agriculture, an underdeveloped social environment, the attractiveness of large cities for rural inhabitants, and a number of other reasons.
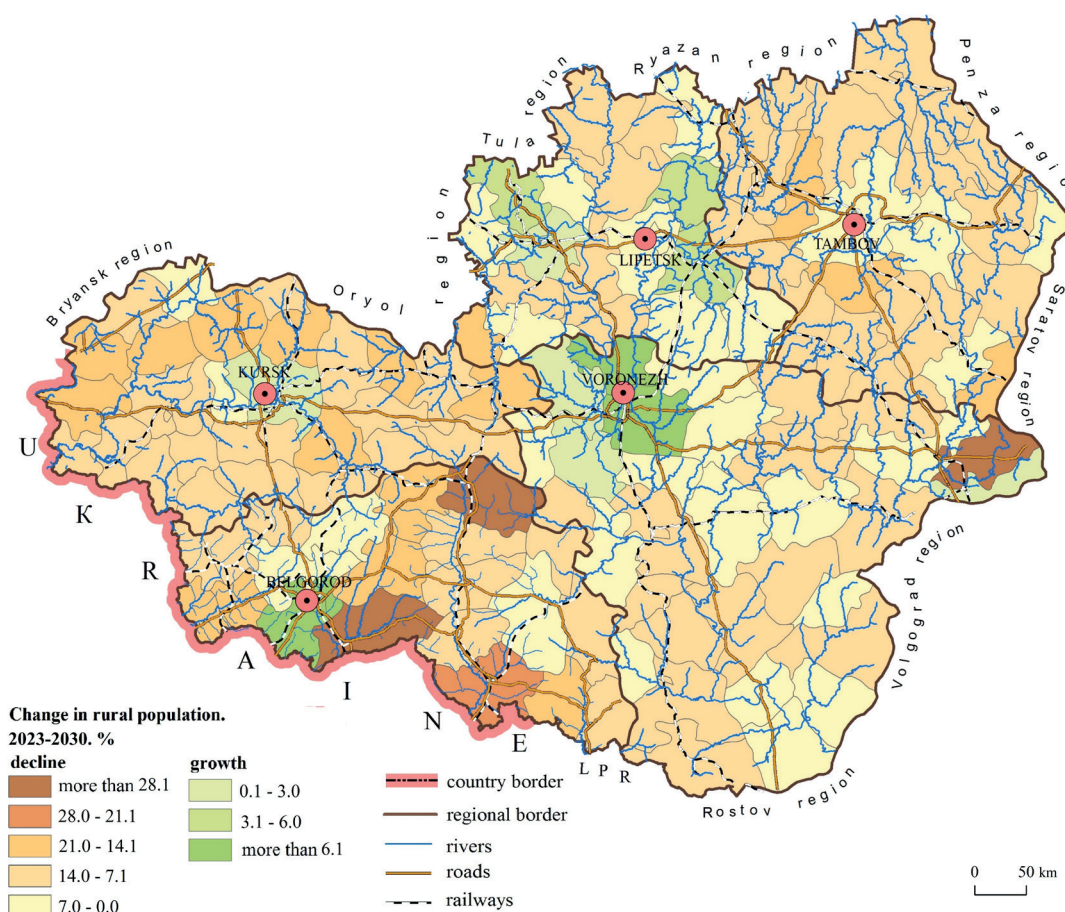

Fig. 8. Forecast of the total population distribution of the Central Chernozem region of Russia for 2030

The calculated medium-term demographic forecast provides a reduction in the total population and, more significantly, in the rural population, for population to be mainly concentrated in and around metropolises, further depopulation of peripheral rural territories, which will lead to increased polarization of the region's settlement system. The results obtained indicate that precisely under the influence of the metropolization process there will be a further consistent "compression" of rural settlement with significant spatial differentiation. The prospect of further developments on this topic may be related to current changes in depopulation of the Russian-Ukrainian border using previously developed methodology and the use of geoinformation technologies (Igonin, Tikunov 2018). The results of the work confirm the relevance of research into the features of metropolization in the regions of Russia and the need to identify patterns of transformation of rural settlements, and their spatial stratification using a geographic information system.

The study's practical significance lies in providing state institutions with the opportunity to make effective decisions for the timely improvement of the territorial settlement system. State policy should allow for the development of diverse types of settlements, and the quality of the living environment in different settlements should be comparable. ■

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