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DYNAMICS OF THE TERRITORIAL STRUCTURE OF AGRICULTURAL LAND USE IN THE LENINGRAD REGION

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This study aims to examine the current state and prospects of the territorial transformation of agricultural land use, with a view to identifying key development trajectories and potential risks associated with returning unused land to economic circulation. The analysis focuses on agricultural land use in the Leningrad region, a territory with a highly developed agricultural sector and an important part of the Baltic Sea region. The methodological approach combines an assessment of spatial changes in the territorial structure of agricultural land use with an examination of structural shifts in the distribution of farmland, arable land, and sown areas. Indicators of structural change and their growth rates were analysed at the municipal-district level between the 2006 All-Russian Agricultural Census and the 2021 microcensus. The study traces the intensity of territorial shifts in agricultural land use across three periods (1990—2006, 2006—2016, and 2016—2021) and identifies the main characteristics and directions of these transformations, including north–south and centre—periphery patterns. Particular attention is paid to the influence of urbanisation on territorial change, especially in areas bordering Saint Petersburg. The analysis also highlights spatial differentiation within the region and identifies three principal zones of unused farmland. The case of the northern, peripheral Priozersk District shows that, when supported by favourable socioeconomic and institutional conditions, agricultural land can retain its value for agribusiness despite broader structural pressures. The study concludes by outlining region-specific approaches to mitigating potential risks to agricultural land use, assuming that current transformation trends continue.

Keywords:
territorial shifts, municipal districts, areas, unused lands, land use, Leningrad region

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Introduction

With the national agricultural sector designated a strategic priority, the problems of efficient resource use remain on the agenda and have acquired renewed urgency. Particular emphasis is placed on the territorial aspect, which determines the features and efficacy of agricultural facility distribution across the country.

Under market conditions, Russia's agricultural sector has undergone pronounced spatial shifts. Driven by institutional and socioeconomic factors, these changes pose risks to agricultural land use. Their first stage involved the gradual transition from exclusively public land ownership to the introduction of a wide range of proprietors. The new forms of legal organisation in agriculture included, among others, farms and individual entrepreneurs.

The transition was carried out through dividing agricultural assets of kolkhozes and sovkhozes into land parcels allocated to workers and the educated segment of rural society, alongside the right to own them. This engaged an ineffective mechanism of land use, which proved to be an 'institutional trap' [1]. The allocated parcels did not correspond to actual land plots. Moreover, they were not only leased but also sold, enabling developers to bulk purchase land properties in periurban areas with a view to residential and commercial construction and infrastructure expansion, which entailed the withdrawal of these lands from agricultural use. This process accelerated urbanisation, which, prior to the market transition, the authorities had curbed primarily by restricting opportunities for resident registration in cities.

The convergent trajectories of land reform and urbanisation reinforced one another, eroding agricultural land use and accelerating population concentration in cities. Elsewhere in Russian regions, the allocation of land parcels facilitated the accumulation of land resources by major landowners such as Miratorg, the Tkachev Agrocomplex, Rusagro and the EkoNiva Group, while in less favourable locations these lands became idle. In districts remote from urban centres, especially in economically depressed areas, land parcels proved to be in little demand; kolkhozes and sovkhozes went bankrupt, and no new agricultural producers emerged.

The conjunction of these preconditions, accompanied by the dynamics of market relations, caused a substantial proportion of agricultural land, especially cultivated areas, to fall out of economic use. As of 1 January 2021, 44.5 million hectares of land dedicated to agricultural use nationwide, or 11.7 % thereof, remained uncultivated. The share of previously cultivated land that currently

remains unused is even higher, at 16.7 % (33.0 million hectares).[1] In response to the severity of the situation, a special State Programme was adopted in May 2021 for the effective return of agricultural land to economic use and for the development of the reclamation system in Russia.[2]

It should be noted that the distribution of unused land has a clearly defined spatial dimension shaped by the regional characteristics of natural and socioeconomic conditions of land use. As of early 2024, the percentage of cultivated agricultural land no longer in use across Russia's federal districts ranged from 1.3 % (North Caucasian FD) to 58 % (Northwestern FD), and across the country's regions from 0.0 % (Stavropol Krai, Republic of Ingushetia) to 78.9 % (Tver region). Although the share of unused agricultural land, including arable land, has tended to decline throughout the country, it remains markedly elevated in the regions of the Northwestern FD. Land-use indicators likewise exhibit pronounced differentiation within the Russian part of the Baltic region, with the Kaliningrad region at 32.8 %, the Leningrad region at 31.3 %, the Novgorod region at 54.8 %, and the Pskov region at 75.5 %. This situation calls for a regional approach to assessing the potential effectiveness of measures implemented under the relevant state programme, taking into account the territorial structural shifts that occurred during the market reforms and the potential risks associated with bringing abandoned land back into economic use, which is exactly the focus of this article.

Literature review

A review of the literature reveals that the main surge in publications on territorial shifts in agricultural land use and their ambiguous consequences and risks for agricultural production occurred between 2012 and 2020. In particular, the period following the 2016 All-Russian Agricultural Census is notable, as it provided new information on the state and use of land resources, whereas after 2020, only isolated studies have appeared. Publications addressing the territorial aspects of agricultural land use can be grouped into three categories: those examining the intensification of interregional disparities; those devoted to the impact of urbanisation on land use; and those investigating the problems of abandoned land.

Intensification of interregional disparities. In his work, Mikhail Kazmin [2] considers the transformation of agricultural land use across Russian regions

[1] Report on the Status and Use of Agricultural Lands in the Russian Federation in 2023, 2024, Moscow, Rosinformagrotekh, URL: https://cloud.mail.ru/public/k5yz/RJzLaBcqV (accessed 15.06.2025).

[2] Resolution of the Government of the Russian Federation of 14 May 2021, № 731, 2021, URL: http://government.ru/docs/all/134619/ (accessed 15.06.2025).

in the course of recent socioeconomic reform. He demonstrates that the most pronounced transformation processes occurred in the European part of Russia, extending from the developed central regions in the north to the forest-steppe and steppe zones in the south, as well as in southern Siberia and the Russian Far East. These changes have prompted a concentration of sown areas within the steppe and dry-steppe natural zones of European Russia, along with shifts in the distribution of agricultural and arable land across the country's economic regions.

Gennady Mukhin analyses the transformation of agricultural land in the European part of Russia from an ecological and economic perspective. His article examines the territorial features of land-use transformation across federal districts, with particular attention to Russia's Non-Black Earth Zone, which has seen high rates of reduction in agricultural land, arable land and sown areas. It is demonstrated that many interregional changes follow a 'north—south' pattern, while within regions they follow a 'core—periphery' one. The dynamics become more favourable when moving from the north (the Non-Black Earth Zone) to the south (the steppe zone), with sown areas, including those under grain crops, contracting to a lesser extent. At the same time, in most regions of the Non-Black Earth Zone, a polarisation in the scale of this reduction has been observed along the 'core—periphery' axis [3].

Evgeniy Kolbovsky, Olga Klimanova and Igor Bavshin present the results of a spatial analysis of the factors and consequences of agricultural land-use transformation in the Smolensk region, focusing on the level of rural settlements [4]. They note that, spatially, the differentiation of land overgrowth processes at the scale of rural settlements is most pronounced within a 30-kilometre band north and south of the main federal motorways crossing the region, while the degree of land development varies in a wave-like pattern from east to west, producing alternating zones of forested and farmland settlements.

Nikita Skobeev examines trends in land-use change in the Tula region through a comparison of data from the 2006 and 2016 All-Russian Agricultural Censuses and Rosreestr. Despite occasional discrepancies between these sources, he concludes that intra-regional polarisation of land use intensified over the study period. In the northern districts of the region, adjacent to the Moscow agglomeration, the area of agricultural land shrank, driven by changes in functional land use, whereas the southern districts saw a concentration of arable land. Moving from the south and south-east of the region towards the north and north-west, an increase in the area of unused land is observed [5].

Impact of urbanisation on land use. Urbanisation gives rise to a range of land-use problems in the suburban zones of major agglomerations, including those of Moscow and St. Petersburg. Across the literature, scholars arrive at similar conclusions: urbanisation and the expansion of cities, industrial zones and built-

up areas lead to a reduction in cultivated agricultural land and its withdrawal from agricultural use, as agricultural enterprises cannot compete for land with actors engaged in alternative forms of land use [6—8].

This situation is characteristic of almost all countries worldwide, most notably China, where rapid urbanisation drives competition between urban territories and highly productive periurban agricultural land, resulting not only in its reduction but also in the loss of fertile agricultural land [9].

Publications addressing uncultivated agricultural land in periurban zones present data from a range of countries. Scholars from Italy [10] describe such spaces on the urban periphery between built-up areas and farmland as marginal. Buildings, structures and infrastructure of expanding cities encroach upon agricultural land, splitting it and producing significant tracts that constitute 'voids at the margins of the city' and will inevitably be absorbed or transformed by urbanisation. The authors propose using these lands for urban recreation, agricultural services, local goods production, greenhouse-gas reduction and biodiversity conservation.

Urbanisation also has an adverse effect on land use in more remote peripheral areas, producing zones of abandoned land. This pattern is characteristic of many countries and is illustrated by the case of the Chinese urban agglomeration in the Pearl River delta [9], where rapid industrial transformation and modernisation triggered intense rural—urban migration, contributing to the abandonment of agricultural land on the periphery.

Problems of abandoned land. Tatyana Nefedova and Andrey Medvedev examined agricultural land use in relation to the contraction of already developed space in Central Russia. They concluded that, within this macro-region, the extensive agricultural and settlement system is being reshaped into a more nodal one as the human-occupied space contracts. The authors also raise entirely pragmatic questions as to which nodes may become drivers of development; what kinds of economic activity may emerge there; and what may occur in territories from which population and agriculture are retreating [11].

Contraction of human-occupied space is directly linked to the problem of agricultural land abandonment, that is, its transformation into desolated areas driven by socio-demographic, economic, technological, political, institutional and cultural factors. Rational economic behaviour aimed at profit maximisation and rising opportunity costs stemming from the specific features of agriculture generally predetermine the abandonment of marginal land [9].

Another contribution [12] presents the results of a study conducted using satellite imagery-based classifications of changes in agricultural land use, together with socioeconomic and agroclimatic data, for Vladimir, Ryazan, Tula, Kaluga and Smolensk regions within the Non-Black earth zone. The authors identify the following as the main factors determining the spatial distribution of

abandoned land: low agricultural productivity; location near the forest edge or seclusion within forest tracts; remoteness from municipal centres, settlements with populations above 500, and target markets. At the same time, it is concluded that biophysical factors exert rather limited influence on the spatial distribution of abandoned land.

Studies have shown a tendency for agricultural land to be abandoned in areas that are agroclimatically and socially marginal for agribusiness, located far from markets for agricultural produce and / or exhibiting negative demographic trends [13]. The reverse process — restoring agricultural land to use — is, from an economic perspective, fairly well explained by David Ricardo's theory of land rent, whereby unused land parcels with better locations (close to settlements), more fertile soils and available labour are prioritised for development [14; 15].

At the same time, decisions on the prospects for reclaiming specific abandoned plots are influenced by the characteristics and performance of the business entities involved, biophysical and natural conditions, evaluations of a plot's potential, and, importantly, by intentions to develop and reintegrate abandoned agricultural land into production [14].

Addressing the issue of unused land, Fellow of the Russian Academy of Sciences Aleksandr Chibilev argues that the steppe zone of Russia requires the revitalisation of sparsely populated areas through the adoption of new models of land use. This concerns 'the implementation of projects for diversifying agricultural production and developing the environmental, ecosystem, recreational and agricultural functions of the underutilised land fund, including the development of meat livestock farming, pasture-based livestock production and horse breeding, agritourism, the creation of protected steppe areas (including transboundary ones), and so on' [16].

Some countries are actively investigating and advancing alternative, non-tillage approaches to the utilisation of abandoned land. While examining uncultivated land in the forest regions of northern, central and southern Sweden, Karl-Ivar Kumm and Anna Hessle, following an economic assessment of alternative options, proposed establishing organic beef production [17].

An alternative perspective on the problem of unused agricultural land is offered by Corresponding Fellow of the Russian Academy of Sciences Yuri Tsypkin, who proposes implementing climate projects on these lands. Particularly, these projects involve creating carbon units and selling them on the carbon market to organisations seeking to offset their emissions [18]. This idea is supported by international publications, which highlight the link between agricultural land use and climate change and note that converting arable land into pastures or forests can aid the restoration and accumulation of organic carbon stocks [19; 20]. At the same time, it is emphasised that, to ensure stable carbon sequestration after agricultural activity ceases, abandoned agricultural land must be properly

managed. Effective management should account for a range of factors, including past and future land-use practices, local climatic conditions, soil quality and soil carbon content [21]. Thus, several approaches can be taken to address the problem of abandoned (unused) agricultural land: returning it to productive use, employing it for alternative activities or converting it into a site for carbon unit production.

The reviewed publications on the transformation of agricultural land distribution indicate that the process exhibits a number of recurrent regularities. allowing its future development to be projected. The following patterns can be distinguished:

— agricultural land transformation unfolds along 'north—south' and 'core—periphery' axes;

— at the local level, land transformation depends on the proximity of agricultural plots to forest edges and federal motorways;

— the driving force behind transformation is urbanisation, which shapes agricultural land use in periurban, peripheral and centrally located areas;

— changes in the structure of agricultural land use constitute the primary manifestation of territorial transformation;

— under market conditions, the transformation of agricultural land use compresses and fragments rural space;

— the most reliable indicator of this transformation is the change in sown areas for all agricultural crops;

— a problematic outcome of territorial transformation is the presence of abandoned (unused) land;

— the determinants of the expansion of abandoned land are defined by a combination of socio-demographic, economic, technological, political, institutional, motivational and other factors;

— unused agricultural land must be managed, and each plot, depending on its socio-economic and environmental efficiency, should be allocated either to agricultural production or to alternative uses.

Consequently, this study aims to analyse the current state and prospects of the territorial transformation of agricultural land use to identify both possible avenues and risks associated with reintegrating unused land into economic use.

This study seeks to achieve the following objectives:

— identifying territorial structural shifts in agricultural land use;

— determining the impact of urbanisation on the factors and regularities of territorial transformation of agricultural land use;

— revealing the determinants and patterns of the territorial of abandoned land distribution;

— assessing the risks to agricultural land use under ongoing transformation trends and proposing measures for their mitigation.

The object of this study is agricultural land use in the Leningrad region — a territory with highly developed agrarian production whose reproductive processes

are affected by the consequences of adverse conditions accompanying market transformations. The focus of the research is the regularities of territorial transformation in the use of the region's agricultural land.

Materials and methods

The study was carried out using data from the 2006 and 2016 All-Russian Agricultural Censuses (ARAC-2006[1] and ARAC-2016[2]) and the 2021 agricultural micro-census.[3] Additional statistical data were drawn from Rosstat, the Leningrad regional and municipal statistical offices and Petrostat.

The Ryabtsev index was applied as a criterion to identify changes in the territorial structure of agricultural land use across the Leningrad region [22—24]:

$$I_R = \sqrt{\frac{\sum_{i=1}^{n}\left(d_{i_1} - d_{i_0}\right)^2}{\sum_{i=1}^{n}\left(d_{i_1} + d_{i_0}\right)^2}},$$

where d_{i1} is the district proportion within total regional agricultural land, arable land and sown areas over the study period (2021), and d_{i0} is the share of districts in the total regional agricultural land, arable land and sown area in the base period (2006).

The scale proposed by Valery Ryabtsev was used to evaluate the significance of changes in territorial structures.

Scale for assessing the degree of structural differences according to the Ryabtsev index

Ranges of index values	Degree of structural differences
Up to 0.030	Identical structure
0.031—0.070	Very low degree of difference
0.071—0.150	Low degree of difference
0.150—0.300	Substantial degree of difference
0.301—0.500	Significant degree of difference
0.501—0.700	Very significant degree of difference
0.701—0.900	Opposite structure types
0.901 and over	Complete opposites

[1] Preliminary Results of the 2006 All-Russian Agricultural Census for the Municipal Districts of theLeningrad Region (Short Programme), 2007, Statistical Digest, St. Petersburg, Petrostat.

[2] Preliminary Results of the 2006 All-Russian Agricultural Census for the Municipal Districts of theLeningrad Region (Short Programme), 2007, Statistical Digest, St. Petersburg, Petrostat.

[3] Main Results of the 2021 Agricultural Micro-census for Leningrad Region], 2022, Official Publication, St. Petersburg.

Spatial changes in the distribution of agricultural land, arable land and sown areas were assessed using indicators of structural shifts that occurred between the 2006 ARAC and the 2021 agricultural micro-census.

The analytical indicators of structural shifts were:

a) absolute increase in structural shifts, pp ($d_{i1} - d_{i0}$);

b) growth rate of structural shifts, %:

$$K_d = (d_{i1}/d_{i0} \cdot 100) - 100.$$

Results

Spatial structural shifts in agricultural land use in the Leningrad region

The land reform entailed fundamental changes in the region's agricultural land use: new categories of commercial producers emerged — farming cooperatives (FCs) and individual entrepreneurs (IEs) — while the significance of agricultural organisations (AOs) and household plots (HPs) declined. According to the 2006 ARAC, the total area of land used by FCs and IEs amounted to 56.5 thousand hectares, or 3.5 % of all agricultural entities in the region. Moreover, almost the entire land area used by FCs and IEs (98.4 %) was cultivated land, whose share increased from 9.2 % to 10.4 % between the 2006 and 2021 agricultural censuses.

Municipal districts of the Leningrad region were grouped (Table 1) to assess how the land-use structure depends on the type of agricultural enterprise, which is largely linked to the size of agricultural land.

Table 1

Structure of agricultural land distribution by type of agricultural enterprise and size in the districts of the Leningrad region, based on data from the 2021 agricultural micro-censuses

District group	Grouping criteria, thousand ha	Number of districts	Share, %		
			AO	CFs and IEs	HPs and small holdings
I	Up to 10	4	33.6	46.2	20.2
II	10—20	6	82.7	9.5	7.8
III	Over 20	7	83.9	8.1	8.0
Total and regional average		17	81.1	10.4	8.5

Prepared based on the 2021 agricultural micro-sensus data.

As Table 1 shows, Group I, with land use up to 10 thousand ha (mainly in the north-east and east), is dominated by FCs and IEs, with a significant share of HPs and other smallholdings. In the other district groups, the share of FCs and IEs decreases, while that of AOs increases.

With regard to the territorial structure of agricultural land use, the intensity of its change across the Leningrad region was first assessed for the periods starting from 1990—2006 (Table 2).

Table 2

Intensity of territorial shifts in agricultural land use by all categories of enterprises in the Leningrad region (according to Valery Ryabtsev's methodology)

Type of land	1990—2006	2006—2016	2016—2021	1990—2021
Cultivated land	Low	Low	Low	Substantial
Arable land	Low	Low	Low	Substantial
Sown areas for all crops	Substantial	Substantial	Substantial	Substantial

Prepared based on data from the Leningrad Regional Statistics Office, the 2006 ARAC and the 2016 ARAC.

The data in Table 2 give a realistic picture of the transformations in agricultural land use, as the areas of agricultural land, including arable land, changed little over selected periods. Only the comparison of 2021 with 1990 reveals significant changes in the territorial structure. These structural changes occur solely due to differences in the dynamics of the areas under consideration.

The intensity of spatial shifts in the distribution of sown areas was substantial throughout all periods considered. This confirms the conclusion drawn from the literature review that the best indicator of agricultural land-use transformation is changes in sown areas for all crops.

Grouping municipal districts by the rates of negative growth in areas of agricultural land, arable land and sown areas between the 2006 ARAC and the 2021 agricultural micro-census made it possible to identify patterns of their territorial concentration and the associated structural shifts (Table 3).

Table 3

Territorial structure and structural shifts in the distribution of agricultural land, arable land and sown areas in the AOs of the Leningrad region by groups of municipal districts classified according to the growth rates of these areas between the 2006 ARAC and the 2021 agricultural micro-census

District group	Number of districts	Rate of increase, %	Share in regional total, %			Structural shifts		Rate of increase in structural shifts, %
			2006	2016	2021	2016 / 2006	2021 / 2006	
Cultivated land								
I	6	Up to – 50	38.8	48.3	52	9.5	13.2	34.0
II	5	From– 50 to – 60	34.6	35.5	35.1	0.9	0.5	1.4
III	6	Below – 60	26.6	16.2	12.9	– 10.4	– 13.7	– 51.5
Arable land								
I	5	Up to – 20	20.4	30.2	29.2	9.8	8.8	43.1
II	7	From – 20 to – 70	61.1	60.1	63.4	– 1	2.3	3.8
III	5	below–70	18.5	9.7	7.4	– 8.8	– 11.1	– 60.0
Sown areas for all crops								
I	6	Up to – 10	35.4	43.5	43.0	8.0	7.6	21.5
II	6	From – 10 to – 20	48.6	46.2	47.6	– 2.4	– 0.9	– 2.1
III	5	Below – 20	16.0	10.4	9.4	– 5.6	– 6.6	– 41.3

Prepared based on data from the 2006 ARAC, the 2016 ARAC and the 2021 agricultural micro-census.

Figure 1 illustrates the territorial differences among the municipal districts of the Leningrad region in terms of growth rates and structural shifts in agricultural land of AOs between the 2006 ARAC and the 2021 agricultural micro-census.

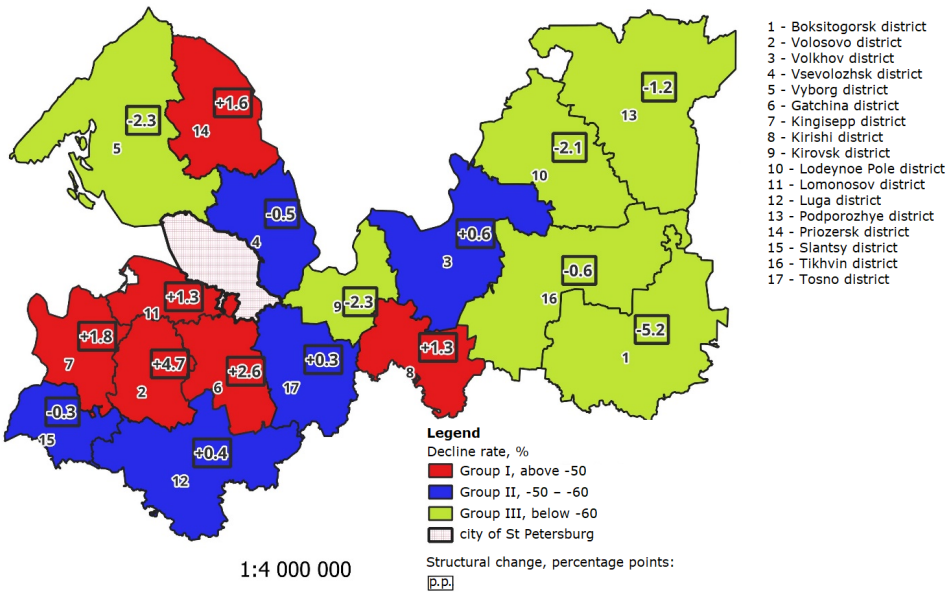

Fig. 1. Territorial differences among municipal districts in negative growth rates of agricultural land of the Leningrad region's AOs and in structural shifts between the 2006 ARAC and the 2021 agricultural micro-census

Prepared based on data from the 2006 ARAC, the 2016 ARAC and the 2021 agricultural micro-census.

Data in Table 3 show that Group I districts of the Leningrad region are characterised by relatively low rates of reduction in agricultural land (1st criterion), arable land (2nd criterion) and sown areas (3rd criterion). They also exhibit the highest share in the territorial structure of agricultural land and a high share of sown areas (comparable to Group II), along with positive structural shifts and high rates of their increase between the 2006 ARAC, 2016 ARAC and the 2021 agricultural micro-census.

Group II is associated with moderate rates of area reduction across all three criteria, the highest shares in the territorial structure of arable land (over 60 % of total regional figures) and sown areas. It also shows minimal values for both positive and negative structural shifts, as well as very low rates of growth.

Group III has the highest rates of reduction in agricultural land, arable land and sown areas, low shares in total regional indicators, high values of negative structural shifts between the censuses and the highest rates of their increase.

Comparison of the results of grouping by agricultural land, arable land and sown areas shows the following:

1. Group I, with all the criteria considered, includes the Kingisepp and Priozersk districts; according to two of the three criteria, the Kirishi, Slantsy and Tosno districts. The Kingisepp and Slantsy districts form a single area.

2. With all the criteria taken into account, Group II includes only the Volkhov district, but it should also include the Volosovo, Volkhov, Vsevolozhsk, Gatchina, Lomonosov and Luga districts, which fall into this group according to two of the three criteria. Notably, the Volosovo, Gatchina, Lomonosov and Luga districts also form a single area.

3. Group III, according to all the criteria, comprises five districts: Boksitogorsk, Vyborg, Kirovsk, Lodeynoye Pole and Podporozhye. The Boksitogorsk, Lodeynoye Pole, and Podporozhye districts form a single area, adjoining the Tikhvin district, which falls into Group III under the first and third criteria and is close to them under the second.

These rates of change thus lead to a reduction in agricultural land, including arable land and sown areas, across all identified groups. The fastest decreases in land use occur in the region's northern and north-eastern districts, as well as in the Kirovsk district adjoining St. Petersburg, and in the Vyborg district in the north-west. Districts south of St. Petersburg have largely maintained the scale of land use over the analysed period.

Hence, as observed by other authors for different regions, territorial shifts in land use in the Leningrad region also follow a 'north—south' axis. An exception is the Priozersk district in the north-west, which falls into Group I according to all the criteria.

The influence of the 'core—periphery' pattern on the transformation of agricultural land use is more complex: the Kirovsk district adjoining St. Petersburg is classified in Group III, with the most negative indicators of changes in territorial structure. Furthermore, in terms of preservation of agricultural land area, the Lomonosov and Gatchina districts south of St. Petersburg belong to Group I, while Vsevolozhsk and Tosno only fall into Group II.

The effect of urbanisation on spatial shifts in agricultural land use

Urbanisation processes in the Leningrad region are developing primarily in the districts adjoining St. Petersburg: Vsevolozhsk, Gatchina, Kirov, Lomonosov and Tosno. The combined urban population in these districts grew by 813.9 thousand people from the pre-reform period to early 2024, reflecting a growth rate of 184.2 %, while in the remaining districts of the region it fell to 90.4 %. In all suburban districts, the urban population grew by between 10.6 % (Kirovsk district) and 333.8 % (Vsevolozhsk district), while in the rest of the region, the population of cities and urban-type settlements declined by almost 10 % (Fig. 2).

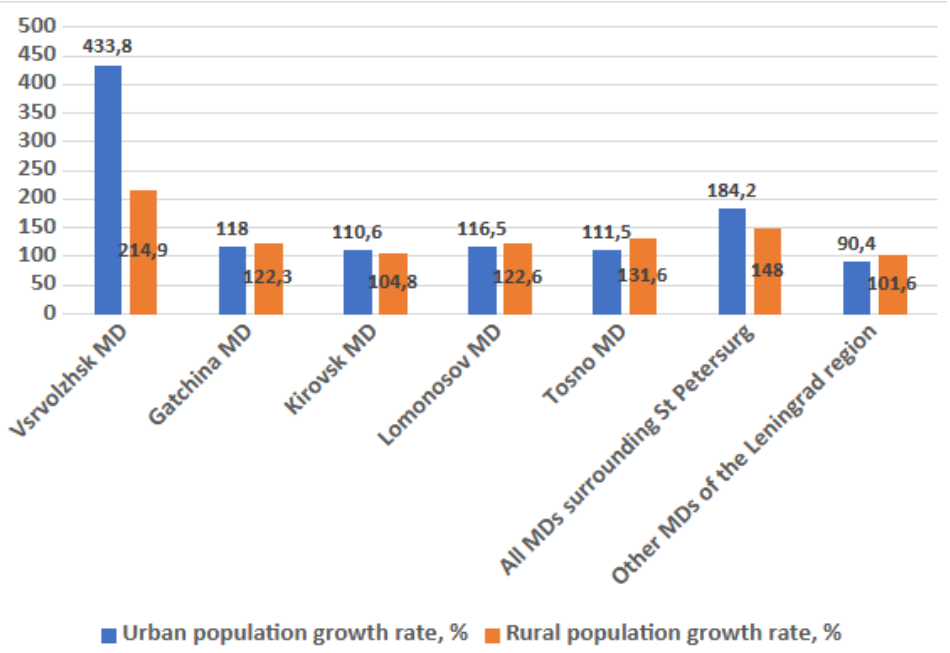

Fig. 2. Growth rates of urban and rural populations in municipal districts adjoining St. Petersburg and in the other districts of the Leningrad region, 1989—2024, %

Prepared using data from the 1989 All-Union Population Census and Rosstat data as of 1 January 2024.

Urbanisation has also had a strong impact on the dynamics of the rural population, which increased overall by 48 % in all suburban districts, compared with only 1.6 % in the other districts. This situation necessitates a reassessment of the role of suburban household plots in the agricultural land-use system. Previously, proximity to a major city was thought to promote intensive agricultural production, with the land effectively safeguarded by the state, but rapid urbanisation has altered this state of affairs. As cities expanded, new industrial enterprises and production and transport infrastructure — such as the ring road, warehouses, wholesale trade facilities, logistics centres, industrial parks, and others — emerged at a fast pace, displacing agricultural production from the land [25]. For example, the Ruchyi stud farm company lost 1,020 hectares of fertile arable land solely due to the construction of the St Peterburg Ring Road. After years of searching for land, it acquired plots in the Luga district of the Leningrad region, relocating part of its suburban production there from the suburbs [7].

Another new phenomenon is detached house communities erected on suburban land (Table 4).

Table 4

Changes in the number of AOs, their agricultural land area, and the number of detached house settlements in the municipal districts of the Leningrad region adjoining St. Petersburg

Municipal district	1990		2021 (agricultural micro-census data)		Rate of agricultural land shrinkage, 2021/1990, %	Number of detached house settlements as of 1 January 2025, each
	Number of sovkhozes and poultry farms, each	Agricultural land area, ha	Number of AOs not classified as small enterprises, each	Agricultural land area, ha		
Vesvolzhsk	12	31 289	14	5496	82.4	240
Gatchina	21	56 348	13	15 433	72.6	44
Kirovsk	7	23 960	6	1730	92.8	21
Lomonosov	19	41 919	8	7951	81.0	81
Tosno	13	46 644	10	9249	80.2	24
Total	72	200 160	51	39 859	80.1	410

Calculated based on data from the Leningrad Regional Statistics Office (Lenoblgorstat),[1] the 2021agircultural micro-census and the official website 'Suburban Real Estate in the Leningrad Region and St. Petersburg'.[2]

As Table 4 illustrates, among the districts bordering St. Petersburg, urbanisation has most strongly affected agricultural land use in Vsevolozhsk, where over the past nine years, four towns — Bugry, Koltushi, Kudrovo and Murino — and the urban-type settlement of Yanino-1 have appeared. Slightly earlier, in 1998, Sertolovo was granted urban status. According to the St. Petersburg and Leningrad Region Statistics Office (Petrostat), the total population of these settlements reached 398.3 thousand at the beginning of 2025.[3] Some of the agricultural land was converted into detached housing developments, the scale of which in the Vsevolozhsk district was an order of magnitude greater than in other suburban districts of the Leningrad region. As a result of urbanisation, the area of agricultural land owned by AOs in the Vsevolozhsk district decreased 5.6-fold; of the 12 AOs in 1990, only seven large enterprises remained listed in the registry as of 31 January 2024.

[1] Main Indicators of the Production and Economic Activities of State Farms in Leningrad Region in 1990, 1991, Statistical Digest, Leningrad.

[2] Detached House Communities intheLeningrad Region, 2025, URL: https://zagorod.spb.ru/kottedjnie-poselki/leningradskaya-oblast/rayon-vsevolozhskiy-lo?page=13 (accessed 15.06.2025).

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The effects of urbanisation were less pronounced in other suburban districts. Yet, in Tosno, for example, the former dairy-and-vegetable sovkhozes Shushary, Lensovetovsky and Fedorovskoe ceased operations entirely during the reform period, and their agricultural lands, totalling over 12 thousand hectares, were withdrawn from the agricultural land-use system. The area of agricultural land in the former Thälmann Sovkhoz also declined sharply, and its central facility — the settlement of Telmana — was granted town status in 2024.

Problems of abandoned agricultural land

All-Russian agricultural censuses report unused land only for surveyed entities, while abandoned land, i. e., land outside the boundaries of agricultural producers' holdings, remains unaccounted for. In contrast, the Report on the State and Use of Agricultural Lands of the Russian Federation in 2023 provides data on all unused and abandoned land within each region. Information on such lands is submitted to Russia's Ministry of Agriculture by regions, and it differs significantly from agricultural census data. For instance, according to the 2021 agricultural micro-census, the share of unused agricultural land in the Leningrad region was 21.4 %, whereas the above-mentioned report by the Ministry of Agriculture indicates 47.4 %. This discrepancy is understandable, as since 1990 the number of major commercial producers — AOs considered as census entities —has sharply declined in the region's north-eastern and eastern districts. For example, in the Boksitogorsk, Lodeynoye Pole and Podporozhye districts, no former agricultural enterprises remain despite the presence of agricultural land, now classified as abandoned.

Overall, in the Leningrad region, the proportion of unused land rose during the 2016—2021 intercensal period, with significant territorial variations observed (Table 5, Fig. 3).

Table 5

Grouping of Leningrad region districts by the share of unused agricultural land in AOs, FCs and HPs in 2021 and structural shifts relative to 2016

District group	Number of districts	Grouping criteria, %	Share of unused agricultural land, %		Structural shift, pp
			2016	2021	
I	5	Fewer than 15	11.5	10.3	−1.2
II	6	From15 to 30	20.1	21.9	1.9
III	6	Over 30	30.2	41.9	11.7
Total	17	—	19.6	21.4	1.8

Calculated based on data from the 2016 ARAC-2016and the 2021 micro-census.

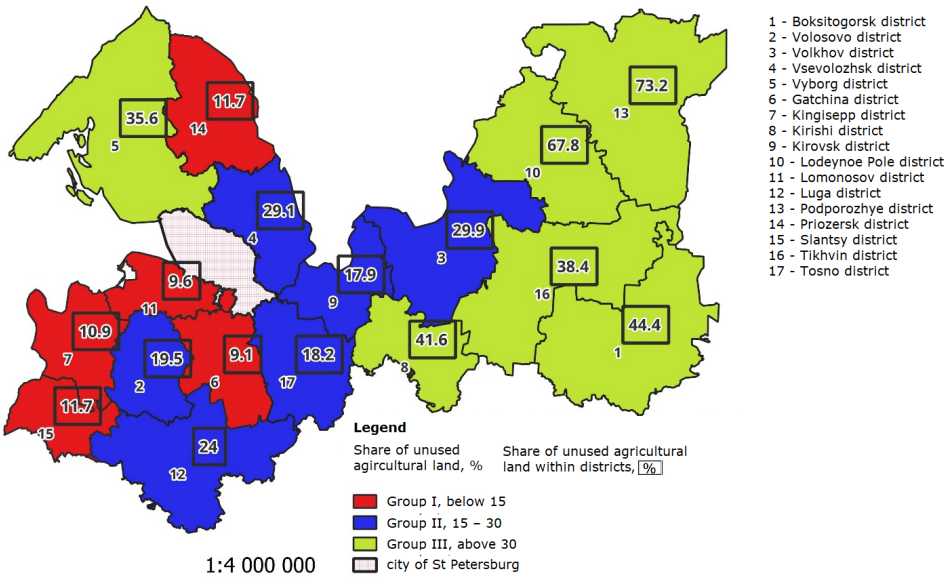

Fig. 3. Groups of Leningrad region districts by the share of unused agricultural land across all categories of farms in 2021, %

Calculated based on data from the 2021 agricultural micro-census.

The distribution of unused agricultural land across the districts of the Leningrad region (Fig. 3) closely relates to territorial differences in the rates of agricultural land increase and structural shifts between the 2006 ARAC and the 2021 agricultural micro-census.

As shown in Fig. 3, the territory of the Leningrad region is clearly divided into three main areas, based on the share of unused agricultural land across all categories of agricultural entities. With the lowest share of unused agricultural land, group I districts —Gatchina, Kingisepp, Lomonosov and Slantsy — are located to the south and south-west of St. Petersburg and belong to the group of the region's territories exhibiting the highest rent potential for this type of land.

The Volosovo and Luga districts, also classified among the territories with the highest land rent potential, fall within the group with medium shares of unused agricultural land. The Luga district is included in this group because of its peripheral location, over 100 km from St. Petersburg, whereas the unused agricultural land in the less remote Volosovo district, which belonged to Group I in 2016, should be prioritised for reintegration into agricultural use.

Lying beyond the zone of districts with a low share of unused agricultural land, the Priozersk district is located on the northern Karelian Isthmus on the periphery relative to St. Petersburg. Based on previous groupings, it ranked among the top

districts of the Leningrad region in terms of the dynamics of agricultural land, arable land and sown areas, while showing one of the lowest land rent potentials, including the lowest soil quality scores for agricultural land and arable land in the region (averaging 51 and 56 points, respectively) [26]. The combination of these factors suggests that the Priozersk district should reasonably be classified in Group III across all the indicators considered above, similar to the neighbouring Vyborg district, which enjoys a more favourable position owing to its southern territories bordering St. Petersburg.

However, the determining factor in maintaining the scale of agricultural land use in the Priozersk district was a coalescence of socio-economic and institutional factors:

— specialisation of AOs almost exclusively in milk production and pedigree livestock breeding contributed to the preservation of agricultural land for the cultivation of roughage and succulent fodder;

— since the pre-reform period, seven AOs in the district, operating as pedigree Holstein cattle breeding farms, have been maintained and further developed, receiving regular state subsidies;

— during the challenging transition to market relations, local AOs secured stable milk sales and fair pricing by entering into a partnership in May 1995 with the dairy processor, the Piskarevsky dairy plant;

— for decades, the district based its activities on scientifically grounded strategies and long-term economic development programmes, and it is currently implementing the 2025—2030 municipal programme Development of the Agro-Industrial Complex of the Priozersk Municipal District of the Leningrad Region;

— within all administrative units of the district, a high standard of management has traditionally been maintained; at different times, the Priozersk district was headed by future Chairman of the Government of Russia Viktor Zubkov and State Duma deputy Sergey Yakhnyuk.

In addition to the Volosovo and Luga districts, Group II also includes three territories directly adjacent to St. Petersburg —Vsevolozhsk, Kirovsk and Tosno. In these districts, the increase in unused agricultural land is associated with the influence of the St. Petersburg agglomeration. The Volkhov district, also part of this area, has a share of unused agricultural land of 29.9 %, just below the group's upper limit of 30 %. In terms of its parameters, Volkhov is closer to Group III, making it a prospective candidate for inclusion in the area formed by the north-eastern and eastern districts of the region.

This area is defined by a combination of factors conducive to further growth in the extent of unused agricultural land, including:

— peripheral location of the districts along the 'core—periphery' axis;

— unfavourable position along the ‘north—south’ axis;

— relatively low land development and a high proportion of irregularly shaped plots (no more than 10 % in the north-east), with agricultural land, particularly arable plots, fragmented into small parcels;

— significantly diminished production and resource potential required to keep agricultural land in the utilised category.

At the same time, the land rent potential, including the average soil quality scores for arable and agricultural land, is relatively high throughout the area, except for the Lodeynoye Pole district, with values of 62—63 and 56—57 points respectively, considerably exceeding those on the Karelian Isthmus [26]. The Vyborg district, due to conditions similar to those in the region’s eastern territories — particularly as long as the ‘north—south’ axis is considered — and the lowest land rent potential across the region, including the lowest average soil quality score for agricultural land (46), has likewise been classified in Group III of districts with a low share of utilised land. Like the Priozersk district, Vyborg lies outside the singled out areas.

Probable threats to agricultural land use under the current transformation trajectory and measures to mitigate them

The multifaceted territorial heterogeneity of agricultural land necessitates a differentiated approach to solving this problem.

In districts bordering St. Petersburg, further expansion of the metropolis’s negative impact on agricultural land use should be anticipated, including a reduction of agricultural land and the emergence of new abandoned plots. The planned construction of additional metro lines to Expoforum and Yuzhny Gorod, together with high-speed tram lines to Kolpino, Slavyanka, Yuzhny Gorod and elsewhere, may stimulate residential development in the Lomonosov and Tosno districts, resulting in the conversion of additional agricultural land. In the Vsevolozhsk, Kirovsk and Tosno districts, abandoned suburban land, which resulted from the disbandment of former sovkhozes, has remained unused for housing, industrial, or infrastructural purposes to this day. These districts require the reclassification of such land from agricultural use to urban or industrial land.

In the north-eastern and eastern districts, owing to the factors outlined above, the trend towards an increase in unused land area may intensify. To mitigate this threat, a strategy of differentiated land use can be proposed, incorporating the following elements:

1. As noted above, highly fertile plots should be incorporated into the agricultural land-use system of FCs, with additional incentives provided in the

form of tax preferences and subsidies. One option is to use these plots for growing medicinal herbs, taking advantage of the favourable environmental conditions in the districts.

2. Irregularly shaped agricultural plots scattered among forests, overgrown with shrubs and young trees, can be used for forestry purposes, including beekeeping, Christmas tree cultivation, and related activities.

3. Plots with unique recreational qualities are suitable for public leisure, tourism, functioning as hunting estates and other similar uses.

In this group of districts, the largest and most favourably located parcels can be brought into economic circulation to substitute for agricultural land that is being lost due to objective reasons.

The south-western districts of Volosovo, Kingisepp, Luga and Slantsy, which have the most favourable soil and climatic conditions and a high proportion of arable land, should become the main focus in plans to bring unused land into economic use and prevent its loss. On the Karelian Isthmus, attention should be given to bringing unused natural forage lands into use, as they are essential for the further development of dairy cattle breeding. Overall, there is an urgent need to implement additional measures to stimulate land demand in areas experiencing depression-marked processes in land use, through mechanisms such as dedicated regional target programmes.

Conclusion

The study identified substantial challenges in the transformation of the agricultural land-use system, many of which stem from the inadequately designed land reforms of the 1990s. These reforms resulted in a marked contraction of agricultural and arable land, as well as a significant decline in crop production. They also contributed to widespread land idling among rural producers and the emergence of abandoned plots outside formal farm holdings.

The ongoing structural changes exhibited a pronounced territorial orientation, including along the ‘north—south’ and ‘core—periphery’ axes, which led to a differentiation of districts according to the severity of agricultural land-use problems. Thus, it became possible to delineate areas within the Leningrad region with relatively homogeneous conditions. The boundaries of areas identified on the basis of different indicators largely coincide and closely align with the existing agricultural zoning, indicating the sufficient accuracy of the findings.

The region has witnessed the active implementation of a comprehensive set of state agrarian policy measures, including initiatives aimed at stimulating investment and innovation among agribusiness entities, which have significantly slowed or mitigated the adverse effects of market mechanisms. Equally important is the factor of ‘path dependence’, namely the high resource potential of the

sector accumulated under the planned economy, which has been preserved and scaled up through technical modernisation of production. This has allowed the Priozersk district, whose territory occupies an unfavourable location in the northern periphery of the region and has low soil quality, to ensure more efficient use of agricultural land through the targeted implementation of a combination of effective socio-economic and institutional factors governing the development of dairy cattle breeding. According to the indicators of agricultural land, arable land and sown area dynamics discussed above, as well as data on unused land, the Priozersk district consistently grouped with the Volosovo, Kingisepp, Luga and Slantsy districts, which have the most favourable soil and climatic conditions for agricultural production.

As a result of urbanisation, the scale of agricultural land use is declining, and abandoned land plots are emerging in territories adjacent to St. Petersburg. In the more remote parts of the region, specifically the Boksitogorsk, Lodeynoye Pole and Podporozhye districts, the rates of agricultural land withdrawal from economic circulation are the highest.

The continuation of the current trend of declining agricultural land area and the rising share of unused land poses significant threats to agricultural land use. Owing to the multifaceted territorial heterogeneity of agricultural land, measures to counter these threats should be implemented through a differentiated approach and the execution of targeted programmes. Such a programme-based approach should be informed by continuous monitoring and in-depth analysis of the situation in the districts, including comparisons with previous years, to evaluate the outcomes achieved and the territorial shifts in land demand and the expansion of sown areas.

However, as correctly noted in a previous study [27], information gaps can lead to distorted and potentially biased assessments of the situation. The primary detailed source of data on land holdings is the All-Russian agricultural census, conducted only once every ten years. Although agricultural micro-censuses are conducted in the intervals between full censuses, they cover only a limited set of indicators. Data from Rosreestr and the Ministry of Agriculture of Russia do not always coincide, and no information is available at the municipal level within regions. The ongoing digital transformation of the agro-industrial complex, which is aligned with state agrarian policy priorities to advance digitalisation in land-use management and to develop regional datasets for the Unified Federal System of Agricultural Land Information and other national and regional databases, has the potential to support the resolution of this issue in the medium term.

The study indicates that the implementation of the state programme for the reintegration of previously withdrawn agricultural land requires new mechanisms and tools to smooth territorial disparities in land use and to ensure that the

quantitative and temporal parameters of expected outcomes are justified and realistic within the contemporary institutional environment. It is also essential to provide the necessary resources simultaneously in accordance with the established planned indicators for the regions. This conclusion is corroborated by other researchers studying the long-term strategic development of the agro-industrial complex [28—30].

In the context of structural shifts in agricultural land use, current territorial changes also underscore the need for a systematic examination of interregional differentiation dynamics to enable timely identification of emerging trends in the formation of growth points or depressed areas in the development of agricultural production and rural territories.

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