



Factors and Patterns of Current Development of Territorial Units in the Kaliningrad Region

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Abstract The article examines social and economic factors and laws shaping patterns of development of the regional area over the past 100 years – settlement and land-use systems (retrospective analysis of their variation and mechanisms impacting landscape environment), influence of geopolitical factors (borders: their position, functional types and mechanisms of impacting landscape environment), and principal trends and scenarios in the future development of the Kaliningrad Region. The current settlement system of the Kaliningrad Region is defined by a settlement network of East Prussia established by 1945, which largely followed the pattern of hydrographic network and landscape structure of the territory, by the postwar system of administrative-territorial division and management, by transformation of the regional transport system, by specifics of socioeconomic development of the area shared by all former Soviet Republics, and by current demographic processes. Using the Kaliningrad Region as a case study, some notions of landscape environment as a zone of intersection of areal and network components and their borders were introduced; a number of new directions in the development of geographic lymology were validated.

Keywords Current landscape, Land use, Settlement systems, State and administrative borders

Contents

1	Introduction	180
2	Theoretical Background	180
3	Methodology	181
4	Research Results and Discussion	183

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4.1	Retrospective Analysis of Settlement System Development over the Past 100 Years and Its Results: Evidence from Landscapes	183
4.2	Factors Causing Changes in the Settlement System in the Territory of the Kaliningrad Region	184
4.3	Spatial Features of the Current Settlement System in the Territory of the Kaliningrad Region	185
4.4	Retrospective Analysis of Land-Use System Over the Past 100 Years and Its Result: Evidence from Landscapes	186
4.5	Current State of the Land-Use System of the Kaliningrad Region	188
4.6	Current State of Areal-Networking Components of Landscape Environment	189
4.7	Current State of Network Components of Landscape Environment	193
4.8	The Influence of Borders on Other Components of Landscape Environment (Historical, Functional, and Spatial Aspects)	196
5	Conclusions	197
	References	198

1 Introduction

At present, the landscapes of the Kaliningrad Region area represent a complex system of territorial units with various degrees of their natural base transformation as well as at various stages of their development. At the foci of growth, an intense land use and planning continues with further construction of a cultivated landscape. In distressed regions, landscapes growing feral as well as feral landscapes predominate (using terminology proposed by Tyan-Shanskyi [1]). Landscapes growing feral and feral landscapes correspond to different stages of secondary succession. Without denying the fact that present-day landscapes in any territory are formed on the basis of natural landscapes, we believe that it is not a viable option to limit oneself to the study (and considering the duration of their anthropogenic transformation, also restoration) of only natural basis [2]. Over the past several centuries, the landscape environment of the Kaliningrad Region has been affected primarily by social and economic factors, which shaped the present-day layout and state of extant landscapes. Using these landscapes as a basis for analysis, we have suggested a new methodology for studying landscape areas subject to a long-term reclamation. The suggested methodology claims that studies of extant landscapes should comprise not only investigating structure of natural landscapes in a given area but should also investigate a spatial aspect of settlement systems as well as land-use dynamics over the period under investigation.

2 Theoretical Background

Up to date several research paradigms for investigating extant landscapes can be distinguished in international and Russian geographical science. Specific features of the Russian school of landscape study are related to its being rooted in physical geography, while Western school of landscape studies has been developing within

the framework of social geography following K. Sauer's work [3]. The authors of the present study draw upon classical works in Russian geography, which represents a complex geographical approach without division of geography into physical and socioeconomic branches, Rodoman [4] and Solntsev [5], as well as ideas of contemporary scientists Kolbovskiy [6], Gutnov and Glazychev [7].

The area of the Kaliningrad Region does not have any landscape borders; however, it has many other kinds of borders: administrative, state, and ethnic which have been repeatedly transformed during contemporary history. Thus, the region appears to be a suitable object of inquiry for specifying the principal factors and patterns shaping contemporary territorial units – landscapes.

3 Methodology

The source material for investigating current landscapes of the Kaliningrad Region forms several strata (blocks) of evidence. The first (base) stratum of information comprises the structure of natural landscapes and their genetic appearance as identified based on relief and quaternary deposits constituting the area. This evidence is provided by the map of genetic types of landscapes using the data of landscape survey of the area carried out in 2003–2011 [8].

The second stratum of evidence comprises a present-day system of settlement in spatial relation. The third stratum is analogous to the second one and deals with a spatial concept of the previous settlement system (for this we have selected a time sample – 1939). E.A. Romanova compiled maps of the actual population density for two-time samples – 1939 and 2009 [9]. The population distribution over the area shows not only the dynamics of settlement landscapes but also the intensity of landscape load. Private subsidiary farms – dachas and vegetable plots – occupy mostly the areas nearest to inhabited localities. Recreational load is higher around the towns; the closer one gets to major populated areas, the higher is the road network density, etc. Calculation of real population density was carried out both within settlement borders and the areas located within walking distance from the inhabited locality taking into account the specifics of their landscape and land use.

Superimposing the second and third base strata using GIS enabled us to compile a map reflecting the degree of transformation of current landscapes, which shows areas with variable degrees of secondary succession of landscapes, which, in fact, helps to identify the areals where transformation of landscapes by anthropogenic activity continues or, on the contrary, has practically discontinued. Nevertheless, this kind of evidence cannot be absolutely reliable, since thanks to advanced technologies humans have learned to alter relief, soil landscape, and vegetation cover even on uninhabited terrain. For instance, there are several military training areas in the Kaliningrad Oblast (Region), such as artillery practice and bombing grounds, both operating and abandoned ones. The areas have already been uninhabited for several decades. In order to eliminate such errors, the compilation

of the map of areals of anthropogenic relief was complemented by a ground observation carried out in the last 5 years by participants of a landscape expedition.

Moreover, a cross-spectrum analysis of the first, second, and third strata makes it possible to establish a link between population settlement and natural environment. In 1939, the areals with high population density (over 100 people/km²) covered almost the entire area of the region forming an uninterrupted band along the Sambia coastline, along the Pregel River, and concentrating around the towns of Königsberg (Kaliningrad), Instenburg (Chernyakhovsk), Gumbinnen (Gusev), and Tilsit (Sovetsk). The high population density areals in the western and eastern parts of the region were counterbalanced. Low population density areals (below 10 people/km²) were located in the northwest of the region, where there are still massifs of lowland and raised bogs, as well as in individual remote areas covered with forests. According to 2009 data, the areals with population density over 100 people/km² had become dissociated, while their area had considerably decreased. The southmost tip and eastern and southeastern areas of the region are almost unpopulated. Most of the area of the Kaliningrad Region has population density below 10 people/km². The western seacoast of Sambia Peninsula as well as its central areas is scantily populated. The majority of the population of the region is localized in the regional capital and around it. Compared to the 1939 settlement system, the current settlement system shows stronger association with natural landscapes than the prewar one. There is also a strong correlation between low population density in the areas and their specific landscape features creating conditions unsuitable for land use.

The fourth stratum of evidence – the current land-use system – has been compiled in the course of a more detailed investigation of the area at the level of municipality and lower. The fifth stratum of the information is confined not to areals but to a network. Depending on the scale, it comprises information on the existing point (fixed) and linear facilities (settlements, roads, dams, etc.). Combining areal and network approaches in studies of cultural landscapes not only increases research possibilities but also serves as a basis for forecasting their further transformation patterns. Moreover, comparing and contrasting various areal strata enable us to obtain additional strata that facilitate understanding of the nature of the phenomenon. In this respect, settlement zones play a special role since depending on the research scale they can be regarded as either areal or as network ones.

The application of the methodology described above allowed to identify two principle factors which form the current landscape environment of the Kaliningrad Region and influence the main developmental patterns of its territorial units both conventionally natural units (forests and specially protected nature conservation areas) and conventionally anthropogenic ones (settlement zones agricultural land).

4 Research Results and Discussion

4.1 *Retrospective Analysis of Settlement System Development over the Past 100 Years and Its Results: Evidence from Landscapes*

Settlement system of any territory is formed under the influence of a range of factors – the level of socioeconomic development of society, the distribution of economic units, demographic composition of its population, administrative and territorial system, as well as natural features of the area. The settlement system appears to be more dynamic than the extant network of settlements and reflects primarily socioeconomic and administrative-managerial state of the region since it depends on a network of administrative-territorial division, which predefines population service system and geography of the labor market [10, 11]. Obviously, a landscape structure of the area indirectly affects the settlement system via established network of settlements, which is directly related to relief features, hydrographic network, as well as soil and vegetation cover. Besides, the natural conditions of the area affect the existing current settlement system because they determine the efficiency of capital investment in infrastructure development and construction, as well as the positioning of industrial facilities utilizing natural resources. In order to investigate current landscapes of the Kaliningrad Region and determine the degree of their transformation, it is necessary to consider not only the current settlement system in the region but also to compare it to the previous one – the settlement system which existed in the prewar period.

The Kaliningrad Region is an old-cultivated area whose settlement system has been developing over many centuries. One of the specific features of the region is a complete substitution of the local population, which took place after World War II due to the accession of part of the former Eastern Prussia to the Soviet Union as part of the Russian Federation. Repatriation of the German population completed in 1948 and population of the area with immigrants from Central Russia, Belorussia, and the Ukraine, establishing a new political and economic system, had triggered dramatic changes in the management system and determined special aspects in redevelopment of residential places and trends in infrastructure development. The extant settlement system of the region demonstrates, on the one hand, some similarities with settlement systems characteristic of other subjects of the Russian Federation in the non-black earth zone (non-chernozem zone) of the Russian Plain, and on the other hand, it is the system inherited from the settlement system in the northern part of Eastern Prussia.

Before the termination of World War II, the area presently occupied by the Kaliningrad Region belonged to Eastern Prussia and was densely populated. The total population that lived within the borders of the present-day region in question as of 17.05.1939 was 1,107,197 people. The total population of the Kaliningrad Region as of 1.01.2015 is 968,944 people. In 1939, the average population density

was 83.5 people/km², while as of January 1, 2009, the average population density was only 70.7 people/km², and as of January 1, 2015, it was 64.06 people/km².

In 1939, the north of Eastern Prussia was largely rural. Industry concentrated in the regional capital and major towns, while locally only small businesses operated whose production was based on local raw materials. In 1939, the rural population was 479,777 people (43.3% of the total population); at least 60% of the economically active population was involved in agricultural production. In individual territorial subdivisions, average rural population density was high – 30 to 63 people/km². Average population size of a rural settlement varied from 138 people (Schlossberg region) up to 525 people (Samland Region) [12]. There were some regional variations in the distribution of the rural population. In lowlands of the Neman River and other major river valleys, linear settlements predominated; the population also centered along the canals. In upland areas small and medium-sized isolated farmyards adjoining forest edges typically occurred. Circular and star-shaped settlements around Königsberg extended as far as the seacoast [13].

In 2009 the rural population of the Kaliningrad Region was 219,935 people (23.5% of the total population of the region). Average population density for individual municipalities varied from 6.7 people/km² (Krasnoznamenskiy District) up to 38 people/km² (Zelenogradski and Guryevski Districts). Average population size of a rural settlement varied from 109 people (Ozyorskiy District) up to 284 people (Slavski District). The maximum in rural population for the Kaliningrad Region was observed in 1960 (219,400 people), since then it has been steadily declining. The minimum rural population size in the region was recorded in 1983 (179,200 people). Since 1994 until 2009 there was a trend toward an increase in not only absolute size of the population of the region but also an increase in the share of the rural population in relation to the residential population of the region – from 21.6% (1994) up to 23.5% (2009) and 22.3% (2015). An increase in the size of rural population in the 1990s is generally linked to the outflow of urban population into rural areas due to the systemic crisis of that period [14]. An increase in the size of rural population in the past 5 years can be explained exclusively by migration processes since natural population growth in many districts of the region still remains negative.

4.2 Factors Causing Changes in the Settlement System in the Territory of the Kaliningrad Region

The current settlement system of the Kaliningrad Region has been shaped by the following factors:

- A settlement network of former Eastern Prussia established by 1945 which was largely associated with patterns of hydrographic network and landscape structure of the territory

- A postwar system of administrative-territorial division and territory management
- Changes in the transportation network of the region which manifested themselves in downsizing of the regional railroad network and interrupted routes of communication with the southern neighbor for decades
- Specifics of social and economic development of the area shared by all post-Soviet republics which determined specialization of production units of the districts and were consequential for population settlement
- Demographic processes

Postwar changes affected the transportation system of the territory. Until 1990, the Kaliningrad Region was a closed territory. The roads connecting it with its southern neighbor were blocked (at the moment, there are four operating border-crossing points on the southern border of the region). On the contrary, northern and eastern borders of the region were connecting it to the mainland of the country in the Soviet times. Road communications there did not stop until the Baltic Republics regained their state independence (at present, four border-crossing points are in operation there). Eastern Prussia had an extended railroad network providing connection to all major and smaller towns of the region as well as to many rural settlements. After the war, most railroad tracks were removed and at present only the main lines are in operation. Unlike railroad tracks, road network has been almost entirely preserved.

The settlement system in the region was also affected by the demographic factors, which, in general, held true of many other regions of the Russian Federation, mainly, a negative natural population increase. Another characteristic feature of the region is a constant migration inflow of people.

Among the factors outlined above, natural characteristics of the territory play a special role. On the one hand, it was a landscape structure of the territory which had shaped the structure of the prewar settlement system. On the other hand, the settlement system itself has been dramatically transformed over the past decades and has acquired some features similar to other regions of non-chernozem belt of Russia, namely, it has become more polarized.

4.3 Spatial Features of the Current Settlement System in the Territory of the Kaliningrad Region

Comparison of settlement systems of the Kaliningrad Region in 1939 and 2009 reveals that at present the territory of the trigon is less densely populated than it was before the war, while the majority of the population is currently concentrated in the regional capital. Within the region, one can distinguish several zones whose settlements have become distinct in terms of their economic role and geographical position [15]: the west of the region (including Kaliningrad and its residential neighborhoods, seaside resort subzone, coastal defensive-industrial subzone, access

to the Russian-Polish border and agricultural inside of the peninsular), a farther commuter zone (the west of Gvardeiskiy, Polesskiy, and Pravdinskiy Districts), the north or the northern periphery of the region (Prinemanye, i.e., the Neman River area), the inside periphery (including Chernyakhovskiy, Gusevskiy Districts, and eastern Gvardeiskiy and Polesskiy Districts), and southeastern cross-border periphery (including Ozerskiy, Nesterovskiy Districts, as well as eastern Pravdinskiy District). The residential neighborhoods are the most populated areas with population density 186 people/km², which is approaching European indicators, while the near-border areas are the least densely populated and low urbanized [14, 16].

Changes in the settlement system are manifest in landscape changes. At the first stage of succession, derelict and neglected farmyards are overgrown with *Petrophytum* plants and later on, alongside primary soil formation on top of construction waste, the weed stage follows. Further direction in the evolution of the land plot depends on the degree of humidification of the area.

4.4 Retrospective Analysis of Land-Use System Over the Past 100 Years and Its Result: Evidence from Landscapes

In any area, a land-use system defines a current state of its landscapes. A land-use system is dynamic in terms of both time and space. In landscape structure of individual territories, alongside anthropogenic modifications of geographic systems, there are landscapes withdrawn from economic use and being at various stages of renaturalization. At the same time, some previously fallow lands are reintroduced into economic use, and some of the lands change their category – some lands are allotted for residential or production uses, while others become involved in agricultural use.

Timewise, such variations in land use are generally synchronous for all parts of the country and the region since they are related to certain events on a global and national scale.

Spatially, however, variations in land use are not synchronous since they depend on a multitude of local factors: geographical position of a regional unit in question, its natural conditions and resources, quality of human capital, regional policies in industry and agriculture, as well as accessibility of advanced agricultural technologies to the producer.

Russia has experienced two major crises in land use over the past 70 years: the former was related to World War II, while the latter was caused by a transition from socialist state-controlled type of economy to a market-driven one. During the first crisis, vast areas of land in the European part of Russia were not only abandoned but also altered in the course of military operations. During the second crisis (in the 1990s), much of the agricultural lands became derelict, and livestock population considerably decreased. Thus, arable land, hayfields, and pasture grounds became overgrown. In the past 20 years, post-agricultural progressive

(secondary) successions have become a typical process in most of the rural regions of Russia [16, 17]. At the same time, the process of recovery of previously derelict lands to agricultural use has been observed in some Russian regions.

Likewise, the Kaliningrad Region did not manage to evade the land-use crises. However, the process of current landscape formation in the region possesses some specific features, which are conditioned both by its natural peculiarities, and the entire history of land assimilation and development [18].

Before World War II, the area of the Kaliningrad Region formed the northern part of Eastern Prussia. In 1939, the forests covered 14% and bogs covered 12% of its territory, while the rest of the land was occupied by settlements, road network, and agricultural lands. Most of the forests were reclaimed, and replanting of fir trees and oaks was carried out. Forest areas reclaimed by planting common alder were subsequently replanted with more valuable species of trees. According to the Central Statistical Office data, in 1943 the share of land involvement in agricultural production in the part of Eastern Prussia that later on formed the Kaliningrad Region was very high – up to 76% (the same indicator in the Leningrad Region for the same period was 11–12%) [19]. In the prewar period, among agricultural land the share of arable land was 68%, the share of hayfields was 12%, and pasture grounds was 18%. Another 2% was accounted for by orchards and other land types. Agriculture in Eastern Prussia specialized in dairy cattle husbandry and swine rearing but also had a considerable share of crop growing represented mainly by forage production. The techniques used in agriculture were considered to be the most advanced at that time.

A special feature of the territory is a vast area of polder land, which is the largest in Russia at the moment. Most of the polder land is located in the ancient estuary of the River Neman. Over 50% of the old alluvial low-lying area is covered with polder land. Before the war, up to 80% of the region's area was drained. Polder land occupied about 78 thousand hectares of land comprising 58 polders and 96 pumping stations. At present polder system in the old estuary of the River Neman covers the area of 65.7 thousand hectares comprising 32 polders with 65 pumping stations (49 of which are currently functioning). Polders are areas of land where controlled irrigation-drainage land reclamation is carried out using field or subfield drainage. The system includes a drainage network, constructions for water discharge, and border (protective) dikes. Polders are used in intensive agriculture, mainly for growing forage grasses, potatoes, and vegetable crops. Moreover, many rural settlements are located in the polder areas. In the years after the war, the features of land use in the newly founded Kaliningrad Region were shaped by the following factors: changes in the number and quality of human resources (the German population that left the region was never sufficiently replaced by migrants from other regions of the USSR and demobilized servicemen), vast areas with disturbed lands and most recent belligerent landscapes, poor state of the reclamation system and extensive littering of the upper surfaces, and soil with metal and explosive materials (bomb shells, land mines, and other kinds of weapons). Such conditions made for a very slow regeneration of agriculture in the region. By 1965, the area of

agricultural lands had increased up to 54%; among them, 46% was arable land, 22% was hayfields, and 32% was pasture grounds. Crop yields were low and so were milk yields.

By the end of 1980s and early 1990s, a certain increase in agricultural production was marked: by 1985, cereal crop yields had reached 3 60 kg per hectare (36 dt/ha); yield of potatoes was 110–120 dt/ha. The area of reclaimed land had reached a postwar maximum: in total, 1,036 thousand hectares of land had been drained (about 65% of the region's area), out of which 730 thousand hectares was agricultural lands. Specialization of agriculture had not changed focusing primarily on cattle breeding and forage production.

The crisis of the 1990s affected the economy of the Kaliningrad Region in the same way as it affected other non-chernozem regions of Russia. The level of production in agriculture dropped: from 1990 to 1999 the areas under crop decreased by 36%, cattle population decreased by 65%, and among them cows decreased by 56%. The proportion of livestock production in gross production had gone from 70% in 1990 down to 51% in 2000 and 45% in 2004. According to official figures, the share of agricultural land was reduced to 48% in 2006 [20]. A similar trend was observed in most Russian regions.

4.5 Current State of the Land-Use System of the Kaliningrad Region

At present, a sustainable growth of agricultural production in the Kaliningrad Region is observed. In June 2014, the area under crops made up 222 thousand hectares (in 2009 and 2011 the area under crops was 165.2 and 143.6 thousand hectares correspondingly) [21–23]. Involvement of unutilized lands in agricultural turnover is one of the priorities in the agricultural sector of the Kaliningrad Region. In order to address the challenge, the Government of the Kaliningrad Region adopted a target program for the Kaliningrad Region “Involvement of agricultural land unused for its intended purpose in agricultural production in the Kaliningrad Region for the period of 2011–2016.” Within the framework of the program, over 100 thousand hectares of cultivated land was reintroduced in economic turnover during 2011–2014, and now the proportion of utilized agricultural land makes up on average 65% in the region. The areas under crops had increased by half, namely, by 78.4 thousand hectares. In 2014, agricultural producers planned to reintroduce into turnover over 20.0 thousand hectares of unutilized land. As of July 21, 2014, 18.3 thousand hectares had been reintroduced. The other 22 thousand hectares of land reintroduced into agricultural production are accounted for by hayfields and pasture grounds. It has been planned to increase the proportion of reintroduced agricultural land up to 75% by the year 2016. Spatially – in terms of individual municipalities in the region – this process is nonsynchronous. For example, in 2013 the proportion of areas under crops in different districts was on average 23.4% of the total cultivated

land with maximum values marked in Gusevskiyi and Nesterovskiyi Districts (40.5 and 52.0% correspondingly), while minimum values were marked in Gvardeiskiyi, Bagrationovskiyi, Zelenogradskiyi, and Slavskiyi Districts (11.2–15.0%).

Grain crop yield is an indicator of intensive agriculture. In 2014, due to favorable weather conditions, mean yield of grain legumes in the region reached 410 kg per hectare (41 dt/ha). This figure placed Kaliningrad Region within the top ten regions of Russia. The region took the first place for rape yield (25 ht/ha). Croppage has increased recently. As of November 2014, the harvest of grain crops and grain legumes was 438 thousand tons and including rape made up 530 thousand tons. In terms of regional areas, these indicators were distributed unevenly.

In recent years, alongside traditional dairy cattle husbandry, a new direction in agriculture has emerged – beef husbandry. In Nesterovskiyi District, the number of livestock had increased from 9.2 up to 15.4 thousand heads, while in Ozyorskoyi District it had increased from 3.2 up to 27.6 thousand heads from 2009 till 2013. Consequently, this trend resulted in increase in areas covered with forage crops as well as hayfields and pasture grounds. The largest areas with forage crops were planted in Bagrationovskiyi and Nesterovskiyi Districts (42.7 and 42.9% correspondingly of the total area under crops) in 2013. Dairy cattle husbandry continues to develop: average milk yield per cow per year was 5,486 kg in 2013 (which was only 4,285 kg in 2009).

Interestingly, land areas under crops and the number of workers involved in agriculture have decreased compared to 1990, while the croppage has increased due to application of intensive methods in agriculture. At present, all stages of transformation of the landscape environment are represented in the territory of the Kaliningrad Region including those where a progressive succession continues. Over decades, many of these territorial complexes have turned into a kind of “nature reserves.” They have had a beneficial influence on biodiversity of the territory and become nodes for emerging ecological framework of the region. A mosaic pattern of current landscapes in the Kaliningrad Region makes it necessary to study thoroughly the local conditions when developing spatial and strategic plans. Only using this approach the peculiar feature of landscape environment can be turned into an advantageous feature ensuring a sustainable development of the region in the future.

4.6 Current State of Areal-Networking Components of Landscape Environment

Settlement zones are referred to as areal-networking components of a landscape environment. On the one hand, patterns of settlements represent a networking element of areal settlement systems, and reduction in a plotting scale makes even large settlement zones appear as dots on the map. On the other hand, on closer inspection, any settlement zone can be regarded as an areal formation because it

occupies a certain area and, therefore, allows for a further subdivision into districts within this area, which is one of the main properties of an areal. On these grounds, settlement zones can be classified as an intermediate type of spatial formation.

Kaliningrad There is only one truly large town in the Kaliningrad Region just like in the former northern Eastern Prussia – Kaliningrad, former Königsberg. According to V.P. Semenov-Tyan-Shanskyi's terminology, it can be referred to as the town "proper." Indeed, the population size of Kaliningrad is 419.2 thousand people (01.01.2014), which is over 40% of the population in the region (currently the Kaliningrad Region). The town was founded due to its convenient geographical position (river estuary, close access to the sea, intersection of trading routes) and has been developing under the influence of economic and geographical factors. Kaliningrad (Königsberg) is by definition the capital city of the region.

However, it is not only its geographical position, which makes a peculiar feature of Königsberg but also the fact that it was a university town. Beginning with 1,545, it was Königsberg University that singled out Königsberg from the list of provincial German towns. Gradually, natural sciences and studies became prevailing there. University buildings (institutes) were located all over the town area. The faculty of some of them included hundreds of researchers and teachers.

Many of the world's greatest towns fall by the wayside at certain moments of their history. The same destiny befell Königsberg. The devastating World War II did not bypass that once flourishing town. Uncertainty in the future of the town during the first postwar decades, mentality of the new inhabitants of Kaliningrad and general trends in the Soviet policy and economy management common for the entire country were largely responsible for the present-day image of the town which has been formed for over half a century.

Despite the diversity of spatial organization, the town has preserved its major directions of traffic and radial-ring structure characteristic of ancient European towns. Besides, there are many historical buildings in the town (built in the nineteenth century and earlier). In fact, considering recent infill construction, over half of the buildings in the residential area were built before the war. Buildings of the Soviet period account for about 25% of all buildings, while most recent construction accounts for about the same level – 23%. The calculation was carried out based on the area covered by buildings of a corresponding time period (age). The calculation of the correlation in question carried out in relation to square meters presents a distorted picture: low-story houses and private detached houses prevailed among the prewar buildings (in square meters, prewar housing constitutes only a quarter of the entire housing stock of the town).

Among special features of the current landscape structure in Kaliningrad is a traffic network, which was inherited from the prewar period and ensures continuity of spatial structure of the town.

The inherited traffic network is a principle source of current problems in the town. Traffic capacity of the main streets does not meet the demands of growing traffic flows. The complicated situation is further exacerbated by another fact: there are fewer bridges across the river than there used to be before the war (there are only

five bridges in operation including Trestle bridge). All of these factors have led to a significant congestion of the traffic streams at several points in the town center, which enhances contrasts of Kaliningrad urban environment.

Sovetsk This is the second largest town in Kaliningrad Region. Its population size is 42.6 thousand people. This is a historical town, whose name was Tilsit before the war. Significant landmarks in European and Russian history are associated with this town. In terms of landscape, specific features of the town are related to its riverine and cross-border location. It is located on the River Neman, which is not the largest river in the region but serves as a natural historical frontier. Sovetsk suffered less significantly in the last war and thus retained entire blocks with densely situated multistory buildings of the prewar period (in Königsberg, by contrast, such blocks were turned into ruins and did not survive until the present time). Spatial structure of the town is semi-radial because unlike the regional capital, it is situated on one slope of the river valley. Road network gets more crowded at the main river crossing point, the famous Queen Louise Bridge. Industrial enterprises also tend to be located closer to the river. There is a river port in the town. Besides, Sovetsk is an important railroad junction in the region. Unlike Kaliningrad where railroad lines divide the town into distinct zones (“islands”), a spatial structure in Sovetsk is less complex because the railroad cuts off only the westmost section of Sovetsk without entering the center. A special feature of Sovetsk is vast green areas such as parks, squares, and forested areas which occupy over 30% of the entire town area. Residential areas make up about 45% of the town territory, while about 20% is accounted for by industrial and transportation zones. Residential outskirts of the town are more rural rather than town-like in appearance: low-story detached houses are situated on large plots of land.

Chernyakhovsk The town is situated at the junction of major highways connecting the region through neighboring states with Central Russia and Moscow. The population of Chernyakhovsk is 39.4 thousand people. The town is located at the confluence point of the two rivers, Angrapa and Instruch, and was named Insterburg before the war. In terms of landscape, a specific feature of the town is a large area with prewar buildings including castles of the Teutonic Order Insterburg and Georgenburg. Another feature is a large number of garrison towns scattered over the area. This is a totally inherited feature because military units are housed in the prewar barracks. The relief of the town was formed in river valleys which makes it more complex compared with the abovementioned towns. Just like in Sovetsk, a railroad junction is located away from the town center and cuts off southern outskirts from the main area of the town. Residential areas occupy up to 60% of the town area (including almost rural outskirts and garrison towns); about 20% of the town area is covered with green zones including flood meadows of Instruch floodplain. Industrial and transportation zones occupy about 15% of the town area.

Other towns There are over 18 smaller towns in Kaliningrad region whose population size does not reach the officially adopted in Russia “urban requirement” of 12 thousand people. The largest among smaller towns is Baltysk. In terms of

population, it is followed by Gusev and Svetlyi, which fall into the category of “semi-medium” towns. Krasnoznamensk is the smallest town among them (3,751 people). All of these towns apart from Primorsk function as administrative centers which is their primary function because the industrial potential of these towns is quite insignificant.

Rural settlements There are 1,801 rural settlements in the Kaliningrad Region (2009). Their distribution over the area of the region is uneven. The maximum settlement density (over 10 settlements per 100 km²) is found on Kaliningrad Peninsula as well as in Guryevskiy and Poleskiy Districts, that is, within the commuter belt around Kaliningrad.

Overwhelming majority of the present-day rural settlements (98%) have a prewar history. In general, these settlements have retained their prewar nucleus of buildings and houses. There is usually an old church ruined to a varying degree in the center of the settlement. Afterwar construction occupies on average from 30 to 60% of the residential area in the settlement. However, the spread in values over the regional area is quite significant: many small settlements and isolated farmyards comprise entirely prewar buildings, while larger settlements, previously former collective farm (kolkhoz and sovkhoz) premises, are made up almost entirely by buildings dating to 1960s–1980s. Landscape appearance of the settlement depends totally on the period of its construction.

The prewar residential areas consist, as a rule, of spacious redbrick dwelling houses or stuccoed houses on a foundation made from crude stone. Household outbuildings, mostly well wrought, roomy, and high, are also made from boulders or red brick. These are horse stables, cattle sheds, and thrashing barns. The buildings of the Soviet period are standardized and thus typical of all districts in the region (and almost of all non-chernozem regions in Russia). Dwelling houses are designed for one family and built from sand-lime brick. Nearby are low sheds or pre-engineered two-story apartment buildings. Here and there, farms can be found. They are low concrete constructions. Post-Soviet buildings are, generally, represented by detached houses varied in their architectural design, which quite often have a garage.

Other residential areas A special type of a residential area, which does not fall into any settlement category, is represented by dacha settlements (or gardening communities). The phenomenon of *dacha* (a small cottage in the countryside with a vegetable plot and a garden), as a unique type of “a town dweller’s second house” having agricultural purposes (typical of the Moscow region and of Central Russia, in general), has been studied in detail by Russian researchers [24]. In Kaliningrad Region, dacha settlements frequently either occupy partially the territory of a town (as, e.g., in the regional capital) or are situated in the suburban areas of larger settlements. The following types of dacha settlements (referred to as dachas for short) can be distinguished based on their location: dachas within the area of the regional capital; dachas of Kaliningrad dwellers located outside the town; and dachas of dwellers from other towns in the region. The dachas in the region differ

from each other not only in their location but also in their building type, size of a land plot, and land-use pattern.

4.7 Current State of Network Components of Landscape Environment

Network components of landscape environment comprise primarily objects that have linear or point-type character, in other words, elements of transport and industrial infrastructure.

Motorways and their infrastructure Kaliningrad Region has a dense network of motorways, most of which have hard covering. The density of motorway network varies from one regional district to another from 16 km/100 km² in the central region to 89 km/100 km² in the south. Average density of motorway network with hard covering constitutes 41.7 km/100 km² (cf. 0.37 km/100 km² on average in Russia and 36 km/km² in the vicinity of Moscow). Many of the motorways in the region have over a 100-year-long history and specific appearance in terms of landscape. Because of trees planted on either side of the roads, they looked more like alleys with Berlin highway being an exception among prewar motorways. Along the motorways, not only various species of linden (occurring most often along the roads) were planted but also valuable species of tree such as oaks, ash trees, maple trees, and even fruit trees in the south. Another special landscape feature of old motorways is their large sett or cobblestone paving that has been preserved in some road sections (e.g., a sett pavement near the settlement Mezhdurechye on route to Moscow).

Infrastructure of the motorways comprises road interchanges, crossovers, and bridges. Road interchanges are associated with recent roads, but a few road interchanges were retained on Berlin Highway. Most of the crossovers are located in the regional capital, but there are also crossovers in Sovetsk and Chernyakhovsk. They were built before the war and pass over (or under) railway lines. The region has an extensive river system; therefore, there are many motorway bridges in the region built both recently and before the war. Some bridges are of historical significance, for example, an old bridge across the River Pregolya in the settlement Znamensk, a suspension “Dutch-style” bridge across the River Lugovaya in Slavskiy area, and a railroad bridge across the River Krasnaya near the settlement Dmitriyevka.

Railways and their infrastructure Before the war, the territory of the region used to be covered with a dense network of railways. In 1939, their total mileage was 1,823 km (including 442 km of narrow-gauge track with track gauge 750 mm). Besides 184 stations and 240 roadside stations were in operation. At present only major railway lines are retained with the total mileage about 730 km. Most of the railroads in the region are single-track and non-electrified railways (only 14% of the railroads are electrified, mainly railways leading to the seacoast). The gauge width

of the railways complies with Russian standards (1,520 mm). An exception to this rule is a spur track going from South Railway Station to Poland (and farther to Berlin) as well as direction from Zheleznodorozhnyi to Chernyakhovsk, which has a standard European gauge width (1,435 mm). European track also enters the territory of the region in Bagrationovsk. Transshipment of cargo from European to Russian gauge width is carried out at stations Chernyakhovsk and Dzerzhinskaya Novaya in Kaliningrad.

Railways that disappeared after the war (which means about two thirds of their prewar mileage) form a special type of landscape, which, despite “natural” character of vegetation, still retains some features of a cultural landscape:

- Firstly, the forms of relief least prone to damage have been preserved (bodies of railroads, excavations). Sixty years later, after the railway line was removed, they can be clearly seen on the surface of the ground. The vegetation of the former bodies of railroads (which can be over 4 m high) is similar to that of earth dams (since railway bodies were made from boulder-pebbled material).
- Secondly, in some places the infrastructure of a removed railway line has been preserved; generally, these are crossovers. For example, on Kaliningrad Peninsula there used to be a narrow-gauge track connecting Marienhof station (present-day Pereslavskoye-Zapadnoye) and Gaffken station (present-day Parusnoye). A large viaduct of that railway built from crude stone still exists today. The viaduct goes across the valley of the River Nelma and is still used as a country road. Besides there remained some deep excavations (up to 15 m deep) in places where the railway crossed western spur of terminal moraine upland.
- Thirdly, preserved platforms and station buildings have become special components of a cultural landscape. Because many railways disappeared after the war, these constructions survived only in settlements. Station buildings are used as dwelling houses, while storehouses are used as sheds. Besides, in some places, platforms remained intact.

Airfields and their infrastructure There are several airfields in the region; however, not all of them are used for their intended purpose, and some of them have been suspended.

Water routes The position of the Kaliningrad Region predetermines the presence of harbors and port facilities. The port complex of the region comprises commercial port and fishing port in Kaliningrad, a port in Svetlyi, a port in Pionerskiy, terminals for transshipment of oil products in settlement Izhevskoye and Kaliningrad, as well as a ferry terminal in Baltyisk. The base of the Baltic Naval Fleet is located in Baltyisk. Port infrastructure includes not only mooring areas but also Kaliningrad Sea Canal, river boat yards, and bulkheads, which come under the authority of Maritime Administration of the Port of Kaliningrad. Many rivers and canals in Kaliningrad Region suitable for navigation have hardly been used for this purpose since 1994. The system of inland waterways comprises rivers Neman, Pregolya, Deima, Matrosovka, Nemonin, and Lugovaya as well as canals Primorskiy, Poleskiy, and Ozerkovskiy.

The presence of a river or sea port largely shapes spatial structure of the town, because it is waterways which have been the most convenient means of transportation since medieval times. In coastal and riverside towns, circular streets usually follow the contour of former defensive walls, while radial streets converge either in the town center (which in most European and Russian towns is located at the point of a river bend) or in the sea harbor. Thus, spatial structure of Kaliningrad, Sovetsk, and other ports of the region is not exceptional in this respect.

Industrial zones and enterprises Most of industrial enterprises in the region are located in Kaliningrad and its suburban area. In fact, all industrial centers in the west of the Kaliningrad Region (to the west of Polesk–Pravdinsk line) belong to Kaliningrad industrial hub. The other two smaller hubs are located in the north (the hub Sovetsk–Neman) and in the east (the hub Gusev–Chernyakhovsk) of the region.

In terms of space, the Kaliningrad industrial hub is heterogeneous: the concentration of industrial zones increases in the direction of the regional capital getting more crowded at its borders and then stretches in tongue-shaped areas in western, north-eastern, and southern directions from it, following largely the contours of a hydrographic network and railway lines.

Similar spatial patterns are inherent to industrial hubs of a lower order in the region: older enterprises tend to gravitate to rivers and railway lines, while more recent ones tend to be located in the suburbs of towns and quite often oriented toward motor routes.

Oil-recovery facilities and quarry-dumping complexes represent a special type of industrial landscape. Over 25 oil deposits have been discovered in Kaliningrad Region in recent time (two of them located in the Baltic Sea area). Commercial oil production has been carried out since 1975. The company OOO “LUKoil-Kaliningradmorneft” is developing 18 land oil deposits [25], which are located in Bagrationovskiy, Pravdinskiy, Gvardeiskiy, and Slavskiy Districts. Twenty-two kilometers from the coast, an offshore oil deposit Kravtsovskoye (D-6) is being developed. From there, oil is transferred to an oil-gathering facility “Romanovo” via a subsea pipeline.

There are numerous quarry-dumping complexes over Kaliningrad Region, which differ in their size. They are developed mostly for construction materials such as sand and sand-gravel aggregate (less often, red glacio-lacustrine clay). The largest quarries are confined to old alluvial deposits of the River Pregolya (settlements Ozerki and Pushkarevo), fluvio-glacial formations or uplands of terminal moraines.

The quarries are an example of a recent landscape, which has completely lost its natural foundation. Drastic alterations impact not only vegetation and soil cover (which become completely destroyed and never recuperate to their original condition) but also a relief and geological foundation because a multimeter stratum of quaternary deposits is extracted.

Power engineering facilities The following types of electric power plants are located in the Kaliningrad Region: thermal power plants, small hydro power plants, and alternative sources of energy using wind power.

An essential component of the power system is power transmission lines. These are linear objects, which cross all landscapes and condense at the points of large populated areas. In the forests, they pass along cutover patches.

The other components of landscape environment in the Kaliningrad Region comprise belligerent landscapes and point-type objects, recreational facilities, hydro-engineering objects (of ameliorative and transportation significance), as well as objects of communications and navigation.

4.8 The Influence of Borders on Other Components of Landscape Environment (Historical, Functional, and Spatial Aspects)

A significant role in landscape development is played by borderlines. A border is a real or conceived line separating territories with distinct quantitative or qualitative spatial properties: natural, social, economic, and political. Borders perform a variety of functions as barriers, points of contact, reflection, connecting points, etc. The functions of borders can change over time. To a greater extent, this concerns human-made borders. The borders can be subdivided into natural and anthropogenic ones. Both types of borders can be either real, objective ones or constructed, defined solely by human volition (they are usually shown on the maps but cannot be seen afield).

Natural borders in the Kaliningrad Region Natural borders are always real ones, they are different in their width, they can be more or less clearly defined, and they have a different degree of fixedness. Running a boundary line correctly depends entirely on the accuracy of the method of their definition. Hydrographic and orographic boundaries as well as boundaries of areals of quaternary deposits distribution are clear and narrow since they visually reflect changes in natural habitats: heights, roughness of relief, grain-size composition of deposits, and coastline of a water body. These boundaries influence other landscape components and determine soil moisture and distribution of plant associations. They are the most stable boundaries since their evolution progresses very slowly. On the other hand, this border type can be quite dynamic. The most dynamic is a coastal zone border, which is quite mobile and changes not only due to disastrous natural phenomena but also due to wave-built processes and longshore currents.

Anthropogenic borders in the Kaliningrad Region Boundaries of land-use and functional zones are most clearly defined in the region: boundaries of industrial, settlement, agricultural zones, etc. The boundary of the sea resort zone of the Kaliningrad Region is also well delimited. This is a narrow band of settlements with organized leisure/holiday activities (Baltyisk, Yantarnyi, Primorye, Otradnoye, Svetlogorsk, Pionerskiy, Kulikovo, Zelenogradsk) and some areals of unofficial leisure/holiday activities. These boundaries are a result of a purposeful

influence of human activity on the landscape. However, under certain circumstances (e.g., change in the land use and development rules or change of owner) they can disappear over time. Another feature of these boundaries is their natural and historical pre-determinacy.

Administrative and state borders are entirely different by nature. They are defined and delimited by humans, sometimes without taking into consideration any natural features of the territory, though quite often natural divides are used as a basis for drawing an administrative or state border.

For example, the northern border of the Kaliningrad Region passes along the River Neman, while its southern border was drawn arbitrarily (in terms of landscape). Another feature of these borders is their crucial influence on the land-use and settlement systems, the changes in which immediately affect all processes of recent landscape genesis. In this respect, the leading role is played by state borders. Transformation of a landscape environment of the Kaliningrad Region, which was manifest in change of direction of development (some territories growing feral and others being developed), took place as a result of changes in state borders position after the war, which caused dramatic changes in the systems of settlement and land use. Before World War II East Prussia was divided into three government districts: Königsberg, Gumbinnen, and Allenstein. The area of the present-day Kaliningrad Region occupies part of the government districts of Königsberg and Gumbinnen.

Current borders of administrative units in the Kaliningrad Region are not easily identifiable on-site because they are meaningful only from the point of view of territorial management. They determine a land-use type of landscapes, but since land-use types in adjacent districts are practically identical, they do not affect landscape appearance to a large extent.

5 Conclusions

At present, the landscapes of the Kaliningrad Region represent an elaborate system of territorial complexes manifesting various degrees of their natural base transformation and being at various stages of their development. In the past centuries, the landscape environment of the Kaliningrad Region territory has been formed under the influence of socioeconomic factors, which shape current appearance and condition of extant landscapes. Based on their analysis, a methodology for studying landscape areas subjected to long-term reclamation has been suggested. According to the methodology, investigating recent landscapes should comprise not only studies of natural landscape structure of the area, but it is also necessary to carry out the analysis of the present-day and previous settlement systems from a spatial perspective and to consider land-use dynamics of the area over a time period in question.

The current settlement system of the Kaliningrad Region is defined by a settlement network of East Prussia established by 1945, which largely followed the pattern of hydrographic network and landscape structure of the territory; by the

postwar system of administrative-territorial division and management; by transformation of the regional transport system, which was manifest in reduction of the railway routes and discontinued communication with the southern neighbor of the region; by specifics of socioeconomic development of the area shared by all former Soviet Republics, which determined specialization of district economy and had effect on patterns of settlement; and by current demographic processes. Comparison of settlement systems over the Kaliningrad Region area in 1939 and 2009 showed that, at present, the area is less densely populated than before the war, and the majority of the population now is concentrated in the regional capital and around it, which impacted landscape appearance in the northeast of the region.

Having overcome several crises related to World War II and transformation of the economic system in the 1990s, the present-day land use in the Kaliningrad Region is characterized by the growth in agricultural production, which is manifest in involvement of previously derelict land in agricultural turnover. At the same time, all stages of landscape environment transformation are represented in the regional area including those with secondary succession. Many of those territorial complexes have turned into unique nature reserves, which affect biodiversity level of the territory. The main feature of the regional area is a mosaic pattern of recent landscapes since natural frontiers are enhanced by the specifics of land-use and settlement systems.

Of special significance for current landscape genesis are state borders of the Kaliningrad Region, whose recent age determined the time span of landscape transformations caused by their change in the postwar period.

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