

BASIC PRINCIPLES AND PLANNING TASKS OF THE LANDSCAPE AND RECREATIONAL ARRANGEMENT OF THE LADOGA LAKE COAST ATTRIBUTABLE TO AREA FEATURES

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Abstract

The paper discusses natural and climatic characteristics of Ladoga Lake coastal areas and their influence on the landscape and recreational arrangement of the coast. Basic principles of spatial arrangement are provided which are based on the continuity of the natural and environmental structure and the continuity of recreation areas and points of attraction backed by transport and pedestrian connections. The rugged terrain of Ladoga Lake coastal areas can and should be used as effectively as possible for creation of a landscape and recreational space. Due to climatic characteristics, special attention should be paid not to beach recreation but to other types of recreation and health improvement based on unique and diverse natural constituents of the Ladoga Lake coast. A spatial arrangement model of recreational functions should be able to transform considering the seasonal use.

By virtue of natural and climatic factors, terrain features, historical and cultural significance of the Ladoga Lake coast, nature tourism (eco-tourism) should become one of the basic directions for arranging recreation areas. Assurance of the preservation and sustainable restoration of natural resources (water resources, forest resources, etc.) through provision of an integral natural and environmental structure of the area gains paramount importance in the process of arranging the landscape recreation.

Keywords

Natural and climatic features, natural and environmental structure, landscape and recreational arrangement, Ladoga Lake coast.

Introduction

Coastal areas include historical types of landscape and have a significant natural and recreational potential. The Ladoga Lake coast is capable to stabilize ecologically a significant area, provide the population of the Leningrad Region and the Republic of Karelia with a wide range of recreational functions, a variety of recreational activities and types of recreation, health improvement and tourism.

Ladoga Lake is a major source of water supply being a part of the Volga–Baltic Waterway and the White Sea–Baltic Sea Canal. Processes of its active development trigger the need for the elaboration of new principles and foundations for the landscape and recreational arrangement of coastal areas, creation of specific models in conditions of the North-West of Russia. Those should

be based on preservation and enhancement of natural constituents of the landscape, opportunities for improving the quality of the environment, arrangement of recreation areas, tourist routes, recreation centers.

To ensure efficient implementation of the basic principles and methods of the landscape and recreational arrangement of a large water body coast, a differentiated approach is required considering numerous conditions and factors, such as the area urbanization level, geographical, natural and climatic characteristics, cultural and historical image of the area.

By now, priorities of social and economic development for settlements in municipal districts of the Leningrad Region and the Republic of Karelia have been legislatively determined, general layouts and land-use planning

schemes have been prepared. However, no coherence in planning and management with regard to the Ladoga Lake coast can be achieved. There is no long-term strategy and conceptual models for the development of coastal areas, no historical, urban-planning, theoretical, methodological or legal basis for the development and adoption of spatial planning solutions. The existing structure of recreation is characterized by disorganization, fragmentation and lack of uniformity, there is a tendency of linear development of recreation areas along the coastal lines with fragments of deep integration — perpendicular to the coastline, appearance of individual recreation centers in the form of holiday hotels and resorts, arrangement of seasonal tourist routes along the coast and islands of Ladoga Lake.

As for coastal areas, when arranging the landscape recreation, the "dominant resource type" (a term suggested

by V. V. Vladimirov) is a water body itself the influence of which on the coastline is reflected in terrain and climate.

Theoretical and methodological background

In the course of any type of territorial planning, a number of tasks arise which are to be solved in various aspects of the territory development. Among such aspects in relation to the landscape and recreational arrangement of the coast the following can be distinguished: functional, cultural, aesthetic, ecological, territorial, environmental, social and economic aspects.

The functional aspect involves the formation of new ways of use and revitalization of coastal areas as a basis for the urban-planning arrangement of the environment, as well as the formation of new relations and point of attraction, buffer zones between sites of various purposes.

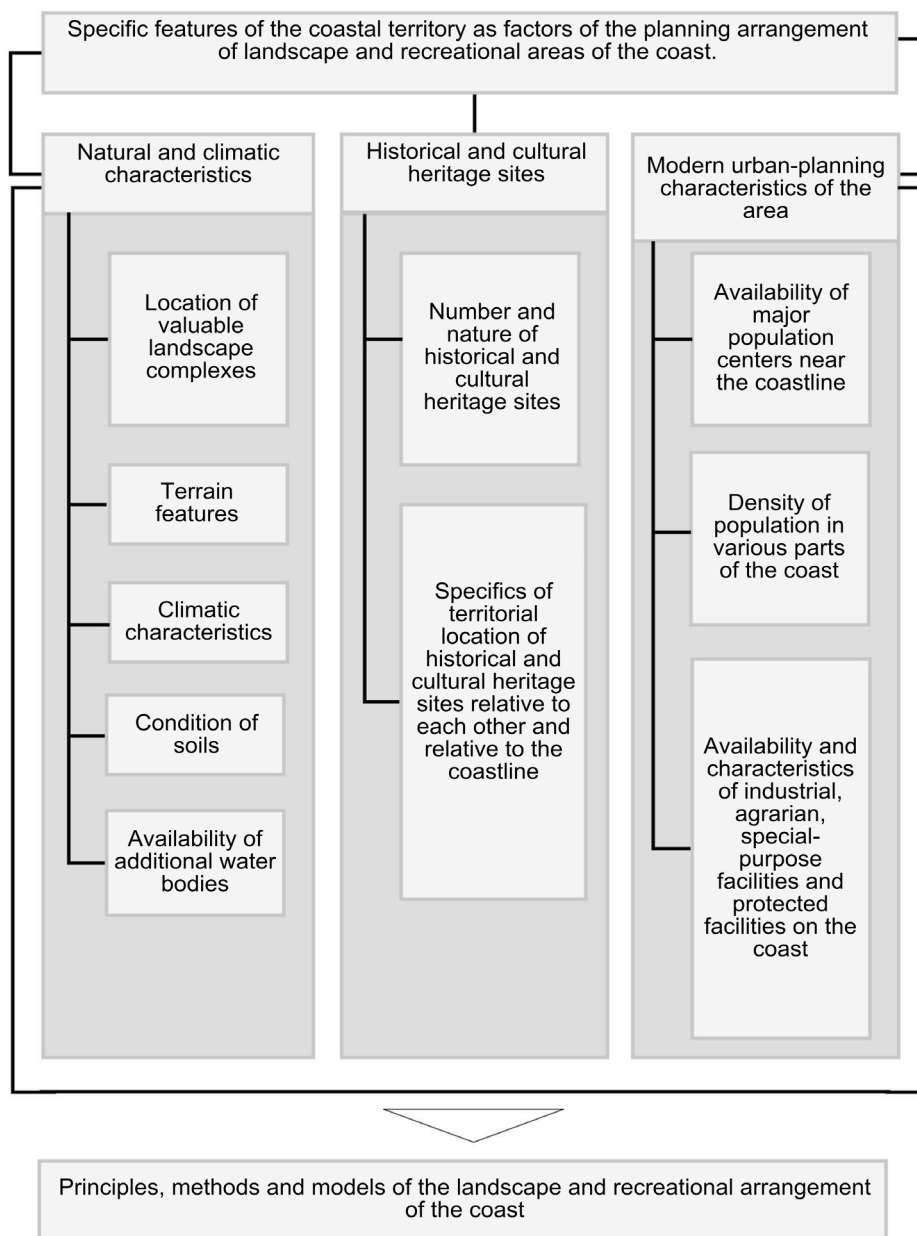


Figure 1. Specific features of the coastal territory as factors of the planning arrangement of landscape and recreational areas of the coast

Attention to the *cultural aspect* is evident in studies and restoration of traditions and cultural heritage, assurance of the historical connection of cultures. The creative potential of water spaces is unlocked by creating new forms of development and design of coastal areas with regard to latest trends and promising directions of cultural development.

When arranging the landscape recreation of the coast with regard to *aesthetic aspect*, the aims are to form new qualities and preserve the valuable existing features of the landscape image, draw attention to the importance of the natural constituent of the environment and enhance the role of the water space.

The ecological aspect consists of providing conditions for protection and sustainable use of natural resources, preventing the degradation of coastal landscapes under the influence of recreational activities through regulatory and legal control, approval of urban-planning regulations and protective measures, and implementation of environmental and biological measures.

The territorial aspect of the landscape and recreational arrangement of the coast implies the development and adherence to the principles of the arrangement of recreational facilities in conjunction with population centers, industrial, transport, engineering and other facilities, transport and pedestrian infrastructure, protected natural areas, as well as the arrangement of recreation areas of various use intensity, functions and specifics of seasonal activity if compared to each other.

The environment aspect implies the establishment of the favorable environment for the landscape and recreational arrangement through architectural and engineering structures, amenities. The variety of landscape recreation provides the conditions for the development of diversified recreational formations, thereby contributing to the implementation of the functional aspect of coast development (Pankeyeva, 2011).

The elaboration of models, principles and strategies for transforming the landscapes of coastal areas into recreational ones should be carried out by assigning and

Table 1. Landscape and geographical characteristics of the Ladoga Lake coast

Location of the Ladoga Lake coast	Landscape and geographical characteristics	Features of the coast having recreational value	Administrative affiliation
Northern, north-eastern, north-western coast	<ul style="list-style-type: none"> - a rocky coast with deep narrow bays (similar to Norwegian fjords in miniature); - granite and gneiss cliffs rising above the water; - small and high skerries abundant at bays and their outlets. Islets of skerries are always covered with pine forest. 	<ul style="list-style-type: none"> - picturesque rocky esker hills covered with coniferous forest (Figure 2); - over six hundred skerries, the largest of which are Riekkalansari, Mantsinsaari, Lunkulansaari, Kilpola, Valaam, Konevets; - two gulfs: Lunkulanlahti and Uuksunlahti separated from the lake by one of the largest islands of the Ladoga — Mantsinsaari. 	Republic of Karelia, Priozersky District, Leningrad Region
Eastern coast	<ul style="list-style-type: none"> - the coast is flatter than the northern one; - the rocks intersperse with sandy areas. 	<ul style="list-style-type: none"> - wide sandy beaches including 50 m wide beach with dunes overgrown with pine forest, located in the area from the Olonets town to the Svir river outlet 	Lodeynopolsky and Volkhovskiy Districts, Leningrad Region
Western coast	<ul style="list-style-type: none"> - the coast is slightly indented; - dense mixed forest and shrubbery located close to the coastline along the boulder-strewn ground; - dangerous underwater shelves due to a ridge of stones stretching from the capes far into the lake. 	<ul style="list-style-type: none"> - a variety of vegetation typical for zones of the middle and southern taiga; - a plain coast. 	Priozersky and Vsevolozhskiy Districts, Leningrad Region
Southern, south-eastern, south-western coast	<ul style="list-style-type: none"> - the coast is flat, slightly indented, covered with pebbles and boulders; - availability of wetlands since the coast is flooded due to the neotectonic submeridional distortion of the lake; - a large number of shelves, stony reefs and banks; - bed of rushes and reeds on the coast. 	<ul style="list-style-type: none"> - three large bays: Svirskaya, Volkhovskaya and Shlisselburgskaya bays; - a plain coast (Figure 3). 	Kirovskiy, Volkhovskiy and Vsevolozhskiy Districts, Leningrad Region



Figure 2. Rocky esker hills of the Ladoga Lake, a photo (<https://sezony-goda.rf/Ladozhskoe%0zero.html>)

solving issues within each aspect of spatial planning. In this case, the potential of the coastal area itself, its features and characteristics represent factors assessment and analysis of which allows determining methods for arranging the landscape recreation of the coast.

The ratio of landscape environment constituents varies from place to place, and such constituents become primary or secondary factors only depending on specific natural, social, urban-planning conditions (Figure 1).

Spatial planning tasks when forming a recreational structure of the area

The coastal line of Ladoga Lake is over 1000 km. When arranging the recreation of the Ladoga Lake coast, the availability of forest and lake landscapes at the places where rivers flow into the lake (more than 40 rivers in total) and just one river, the Neva, flows out, is of particular importance. The largest rivers flowing into Ladoga Lake: the Vuoksa, the Volkhov and the Svir.

Natural and landscape characteristics of the area are conditioned by its geographical location in the north-west of the European part of Russia. The border of the middle and southern subzones of taiga passes through the Ladoga area, the direction of this boundary is submeridional. The eastern and northern parts of the Ladoga area belong to the middle taiga subzone, and the north-western, western and southern parts of the Ladoga area belong to the southern taiga subzone. The convoluted history of the area development →at the junction of two tectonic structures→ resulted in the formation of a large variety of landscapes (Table 1).

Typical features of the natural terrain of Ladoga Lake coastal areas include: 1) a diversity of terrain from plain one on the southern, south-western and south-eastern coast to rocky one, with pronounced layers and terraces, on the northern coast; 2) abundance of forest and river landscapes, including the places where the large rivers Svir, Vuoksa and Volkhov flow into the lake; 3) a developed network of ravines and draws in the places where rivers flow into the lake; 4) a significant number of wetlands, increasing towards the southern coast; 4) tectonic destruction; 5) availability of three large bays on

the southern and south-eastern coast, as well as many narrow bays on the northern coast (Rumyantsev, 2012) (Alyabina, 2010).

In case of the rugged terrain, the development of recreational functions should consider the geomorphological parameters. Since the Ladoga Lake coast is characterized by the difference in elevation (from rocky hills to low flat areas of the coastline, it is reasonable to use the terracing method to perform space zoning with steps, landscaping of individual sections of horizontal shore cusps considering their features.

In order to develop a planning structure of the Ladoga Lake recreation in depth from the coastline, it is necessary to ensure cross-linkages: mountainous plateau–flat coast. At the places where the coast is flatter and terrain features are less pronounced, the spatial development of recreation areas is largely dependent on the functional-planning structure of recreation centers. When arranging the landscape recreation, the river terraces, which are abundant on the coast of Ladoga Lake, provide a high potential.

The natural structure of the Ladoga Lake coast is formed by areas with different functional purposes:

- federal, regional and local nature reserves;
- forest areas and protection forests;
- areas of lowland river landscapes;
- landscapes of open spaces and recreation areas, including agricultural and recreational areas.

In the territory of the Ladoga Lake coast, on the side of the Leningrad Region, such nature reserves (NAs) as the state Nizhne-Svirsky nature reserve and the state Kokkorevsky nature reserve are located. The Republic of Karelia hosts the Olonetsky state federal nature reserve, Tuloksky nature reserve, North-Ladoga state game reserve (faunal area), Sortavala botanical reserve, medicinal plants reserve (common bearberry) and other regional reserves (Vampilova, 2008).

In order to preserve the ecosystems of the lake water area coast, the Administration of the Leningrad Region intends to create a number of other regional NRs: Svir River mouth, Juniper communities of the Cape Shuryagsky, Southern Ladoga, Zelentsy Islands, Morye (Osnovnoy), Kuznechnoye, Motornoye–Zaostrovye (Government of the Leningrad Region, 2012).

NRs, both the existing and future ones, valuable forest and river landscapes impose certain restrictions on the recreational arrangement of the Ladoga Lake coast, however, they are the key to environmental stability and the basis for preserving the natural and landscape environment.

The specific character of seasonal recreational activity mainly depends on climatic features such as the duration of cold and hot periods, maximum temperatures, typical winds and humidity. The climate of Ladoga Lake is moderate, transitional (from moderately continental to moderately marine). This results from a relatively small amount of solar heat. A passage of a cyclone which determines the weather at Ladoga Lake is accompanied by the change of a south wind carrying heat to a cold

north wind. Sometimes, when cyclones pass to the north, an anticyclone manages to wedge in. Then it is hot in summer and cold windless and sunny weather in winter.

Due to the small amount of solar heat, moisture evaporates slowly. In average, there are 62 sunny days per year. Therefore, during most of the year, cloudy days with scattered lighting prevail. The day length varies from 5 h 51 min during the winter solstice to 18 h 50 min during the summer solstice. "Twilight all night" can be observed over the lake during more than 50 days.

Due to climatic features, the coast of Ladoga Lake has seasonal arrangement of recreational activities. The summer period is characterized by increased intensity of using the coast for recreation, mainly in the areas of a flat coast with beaches, an increase of mobile recreation in the coastal area. In winter, recreational activities in the coastal area actually stop. Prime attention shall be given not to beach recreation but to the selection of recreation and health improvement types based on the variety of natural constituents of the Ladoga Lake coast and on the value and uniqueness of historical and cultural heritage sites.

Ladoga Lake and its basin host a number of monuments of history, architecture and culture attracting (or having the potential to attract) tourists. Among the monuments of architecture, the following can be mentioned: the Korela Fortress (13th–14th centuries), the Valaam Monastery (992), the Petrokrepost Fortress (1323), the Konevsky Monastery (1393), the first capital of Russia, Staraya Ladoga, etc. A number of historical monuments are located in the Karelian and Novgorod parts of the Ladoga basin. Tourist routes pass through Ladoga Lake to other regions.

The famous historical waterway "from the Varangians to the Greeks", connecting Northern Europe, the Baltic States and Veliky Novgorod with the countries of the Mediterranean region, passed through Ladoga Lake. As studies show, the greatest concentration of attractive heritage sites is located along the ancient water-and-portage routes and near water bodies. In the opinion of Yu. A. Vedenin, the ancient water-and-portage ways are the most valuable objects of natural and cultural heritage requiring in-depth study and protection (Vedenin, 2009).

Current activities on the coast of Ladoga Lake are related to the life of people in such cities as Priozersk, Novaya Ladoga, Syasstroy, Vidlitsa, Pitkyaranta, Impilahti, Sortavala, Lakhdenpokhya and others. Therefore, the arrangement of recreation areas within walking distance with horizontal connections, providing access to the coast and valuable landscape and recreational complexes of residents of nearby cities, is of particular importance (Zadvoryanskaya, 2009).

The main spatial and planning tasks for provision of the landscape recreation of the Ladoga Lake coast can be described as follows:

- a differentiated approach to the arrangement of the landscape recreation considering the complexity of the terrain structure, in particular, geomorphological parameters;



Figure 3. Southern coast of the Ladoga Lake, a photo (<https://sezony-goda.rf/Ladozhskoe%0zero.html>)

- arrangement and improvement of tourist routes allowing assessing the diversity of terrain and natural features of the coast in the most comprehensive way possible, increase the attractiveness of landscapes for studying;
 - active participation of water resources in the formation of recreation areas, including through the use of additional utility systems and water transport;
 - provision of year-round recreational activities through the formation of recreation areas considering the seasonality of their use and development of a flexible system of spatial arrangement which can be transformed depending on seasonal features;
 - provision of infrastructure of indoor facilities for public and recreational purposes in the structure of green spaces and major tourist routes, including creating conditions for the development of winter recreation and active sports;
 - arrangement of zones of various visiting intensity and functional use; sites aimed at more or less active types of recreation;
 - creating conditions for exploring and studying historical and cultural monuments, artifacts of the cultural landscape by including them in pedestrian routes, arranging museum, educational and exhibition centers;
 - alternation of recreation areas with the territories of specially protected and valuable natural complexes and nature reserves;
 - preservation of the coastline for recreation by constructing the main roads no closer than 500 m from the water's edge with minimum traffic in the coastal area, limiting the development of the coastline with a width of 100 m;
 - arrangement of a system of pedestrian spaces in the coastline and horizontal connections between the coastline and main roads;
 - removal of industrial and agricultural enterprises and utility services, not related to water intake facilities, beyond the coastal recreation area;
 - saturation of coastal areas located near urban centers with recreation areas (Litvinov, 2011).
- Assurance of the preservation and sustainable restoration of natural resources (water resources, forest

resources, etc.) through provision of an integral natural and environmental structure of the area gains paramount importance in the process of arranging the landscape recreation of the Ladoga Lake coast. The valuable cultural and historical, scientific and educational, urban-planning objects and sights allow making the landscape recreation diverse and educationally interesting (Tukmanova, 2011).

By virtue of natural and climatic factors, terrain features, historical and cultural significance of the Ladoga Lake coast, creating the conditions for nature tourism (eco-tourism) may become one of the basic directions for arranging recreation areas. Nature tourism means visiting natural and cultural landscapes to explore geological and geomorphological as well as water objects, flora and fauna, monuments of nature, history and national culture for scientific and educational, nature protection and other purposes.

Some Russian regions have already created natural (ecological) routes and trails, for example, in the Baikal region, the Urals, the North Caucasus and the Krasnoyarsk Krai, etc. (the Silk Road, the Small Bear Trail, the Great Baikal Trail). However, in Russia, nature tourism has not yet become widespread due to the lack of long-term prospects for the development of tourist routes (Olifir, 2016) (Akhobadze, 2009). Natural aspects encouraging modern tourism on the coast of Ladoga Lake may be related to such directions as eco-tourism, agrotourism, rafting, diving, wildlife viewing, trekking, etc. Waterways near the northern islands are popular routes among tourists. The picturesque nature of Ladoga Lake (especially its northern skerry part) offers prospects for the development of recreation which can be combined with amateur fishing and other forms of active outdoor recreation.

In 2012, the State Program for the Development of Tourism in the Russian Federation for 2013–2020 was adopted. It provides for priority in the development of inbound and domestic tourism in comparison with international tourism. It is domestic tourism that is the basis for identifying and advertising exotic objects and tourist destinations. For this purpose, Russia offers favorable prospects and resources, and one of such resources is the largest water body in the territory of the Leningrad region and the Republic of Karelia — Ladoga Lake.

The lack of a sufficient legislative base in the field of ecology, legal regulation and control over the use of the resources of Ladoga Lake, as well as the lack of

coordinated functioning of regional administrative, social and urban-planning institutions hamper the achievement of future sustainable development of the landscape and recreational arrangement of the coast.

Due to the existing system of economic development, economy structure, growth of population in the Leningrad Region, the coast of Ladoga Lake is subject to high human-induced impact. Meanwhile, Ladoga Lake as the largest freshwater body in Europe is of great importance for maintaining the ecological stability in the North-Western region and creating zones and centers for recreation and health improvement. The combination of diverse forest areas, vast water areas, upland and lowland bogs, rocky hills and beach areas of the coast determines the species wealth of flora and fauna, as well as the diversity of natural complexes.

The coastal landscape of Ladoga Lake has a number of features that, although causing a lot of difficulties in planning the routes, are interesting for creating broad prospects and memorable looks. As for natural and geographical features of the coast, ridge-hilly terrain predominates alternating with flat plateau, wetlands in the southern part, fjords and skerries in the northern part of the Republic of Karelia. Features of the coastal landscape should be used as effectively as possible in planning and creating a common landscape-recreational and spatial composition. Moreover, the model of the spatial arrangement of recreational functions should be transformable considering seasonal use.

The value of natural landscapes and historical and cultural heritage of Ladoga Lake coastal areas allows us to conclude that it is necessary to create a unique image of the coast for the purpose of forming a social space. This image can and should be based on nature (eco-) tourism in combination with other types of tourism (cultural and historical (educational), pilgrim (religious), archaeological, event, ethnographic, etc.).

This tourist destination will allow us to fully appreciate the diversity of terrain and unique natural features of the coast, increase the urban-planning importance of monuments of geology, history, culture, architecture. In the course of territorial planning and modeling of spatial development systems for recreational functions, it is necessary to consider the principles of environmental sustainability, allocating and arranging nature reserves and areas of specially protected natural monuments, landscape recreation and eco-tourism on the coast.

References

- Akhobadze, D.T. (2009). Organizacionno-ekonomicheskie mekhanizmy realizacii strategicheskikh prioritetov razvitiya turizma i rekreacii na Severo-Zapade Rossii [Business mechanisms for implementing strategic priorities for the development of tourism and recreation in the North-West of Russia]. *Economic and Social Changes: Facts, Trends, Forecast*, 2 (6), pp. 107–126. (in Russian)
- Alyabina, G.A., Sorokin, I.N. (2010). Bassejn Ladozhskogo ozera kak istochnik vozdejstviya na ekologicheskoe sostoyanie ozera [The Ladoga Lake basin as a source of impact on the lake ecological condition]. *Regional Ecology*, 4 (30), pp. 27–35. (in Russian)
- Government of the Leningrad Region (2012). *Skhema territorial'nogo planirovaniya Leningradskoj oblasti [Land-use planning scheme of the Leningrad Region]*. Approved by Resolution of the Government of the Leningrad Region No. 460 dd. 29.12.2012, as amended by Resolutions of the Government of the Leningrad Region No. 415 dd. 29.10.2015, No. 490 dd. 29.10.2015, No. 39 dd. 01.03.2017, No. 5 92 dd. 22.12.2017. (in Russian)
- Kropinova, E.G., Afanasyeva, E.P. (2014). Ustojchivoe razvitie pribrezhnyh territorij kak osnova kompleksnogo upravleniya pribrezhnyimi zonami [Sustainable development of coastal areas as a basis for integrated coastal area management]. *Bulletin of the Immanuel Kant Baltic Federal University. Series: Natural and Medical Sciences*, 1, pp. 140–147. (in Russian)
- Olifir, D.I. (2016). Prirodnyj turizm kak faktor razvitiya konkurentosposobnosti turisticheskikh destinacij Leningradskoj oblasti: Geografiya: razvitie nauki i obrazovaniya [Nature tourism as a factor of the development of tourist destinations' competitiveness in the Leningrad Region. Geography: development of science and education]. Saint Petersburg: Publishing House of the Herzen State Pedagogical University of Russia, pp. 392–397. (in Russian)
- Pankeyeva, T.V. (2011). Metodika ocenki landshaftnogo potentsiala (na primere Bol'shogo Sevastopolya) [Methods for assessing the landscape potential (using the example of Great Sevastopol)]. *Bulletin of the Vernadsky Taurida National University. Series: Geography*, 24 (63), pp. 197–203. (in Russian)
- Rumyantsev, V.A. (2012). Ladozhskoe ozero: ekologicheskie problemy, prichiny, puti resheniya [Ladoga Lake: environmental issues, causes, solutions]. *Regional Ecology*, 1-2 (33), pp. 7–13. (in Russian)
- Sevastyanov D.V., Grigoryev A.A., Korostelev E.M., Zelyutkina L.O. (2016). *Rekreacionnoe prirodopol'zovanie i turizm v Severnyh i gornyh regionah Rossii: Geografiya: razvitie nauki i obrazovaniya [Recreational nature management and tourism in the Northern and mountainous regions of Russia. Geography: development of science and education]*. Saint Petersburg: Publishing House of the Herzen State Pedagogical University of Russia, pp. 404–408. (in Russian)
- Tukmanova, Z.G. (2011). Rekreacionnaya transformaciya pribrezhnyh gorodskih territorij – process regeneracii ot stihijnyh antropogenno-urbanizirovannyh landshaftov k pozitivno-kul'turnym landshaftam [Recreational transformation of coastal urban areas: a process of recovery from spontaneous human-caused urbanized landscapes to positive cultural landscapes]. *Bulletin of the Kazan State University of Architecture and Engineering*, 2 (16), pp. 69–74. (in Russian)
- Vampilova, L.B. (2008). Turistsko-rekreacionnoe rajonirovanie v skheme territorial'nogo planirovaniya Leningradskoj oblasti [Tourist and recreational zoning in the land-use planning scheme of the Leningrad Region]. In: *Proceedings of the 3rd International Scientific and Practical Conference "Tourism and recreation: fundamental and applied research"*. Moscow: Sovetsky Sport Publishing House, pp. 330–337. (in Russian)
- Vedenin, Yu.A. (2009). *Puti formirovaniya integral'noj sistemy osobo ohranyaemyh istoriko-kul'turnyh i prirodnyh territorij (osnovnye principy i metody sovremennogo podhoda k sohraneniyu kul'turnogo i prirodnogo naslediya) [Methods of creating an integrated system of historical, cultural and nature reserves (basic principles and methods of a modern approach to the preservation of cultural and natural heritage)]*. Arkhangelsk: Bulatov Publishing House, pp. 14–25. (in Russian)
- Zadvoryanskaya, T.I. (2009). *Landshaftno-gradostroitel'naya organizaciya rekreacionnyh zon v strukture pribrezhnyh territorij krupnyh gorodov (na primere Voronezha) [Landscape and urban-planning arrangement of recreational zones in the structure of coastal territories of large cities (using the example of Voronezh)]*. PhD Thesis in Architecture, Saint Petersburg, pp. 12–15. (in Russian)