



МЕЖДУНАРОДНАЯ КОНФЕРЕНЦИЯ
«ЛАНДШАФТНЫЙ ДИЗАЙН ГОРОДА»

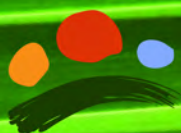
CONFERENCE PROCEEDINGS

СБОРНИК ТРУДОВ КОНФЕРЕНЦИИ «ЛАНДШАФТНЫЙ ДИЗАЙН ГОРОДА»

Three pillars of landscape architecture: design, planning and management. New vision.

Новое направление в ландшафтной архитектуре (дизайн, планирование и управление).

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**THREE PILLARS OF LANDSCAPE ARCHITECTURE:
DESIGN, PLANNING AND MANAGEMENT. NEW VISIONS**

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**НОВОЕ НАПРАВЛЕНИЕ В ЛАНДШАФТНОЙ АРХИТЕКТУРЕ
(ДИЗАЙН, ПЛАНИРОВАНИЕ И УПРАВЛЕНИЕ)**

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Сборник трудов конференции «Новое направление в ландшафтной архитектуре (дизайн, планирование и управление)» содержит тезисы, которые прошли процесс рецензирования, организованный М. Игнатъевой и И. Мельничук, с помощью рецензентов из различных европейских университетов. Конференция проводилась в Санкт-Петербурге с 7 по 8 июня 2017 года. Эта конференция была также изначально задумана и поддержана администрацией города Санкт-Петербург, Санкт-Петербургским государственным лесотехническим университетом и Шведским университетом сельскохозяйственных наук в Упсале.

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St. Petersburg green infrastructure and methods of its formation

Irina Melnichuk

St. Petersburg State Forest Technical University

E-mail: melnichuk.irina@mail.ru

Introduction

St. Petersburg is the largest northern metropolis in Europe, with more than 5 million people, and its urban ecosystems are characterised by high anthropogenic pressure. The city is located in the transitional zone from moderately continental to moderately-marine climate. The average annual air temperature in St. Petersburg, according to long-term observations, is 5.6 °C. The coldest months of the year are December and February, with an average temperature of -7.9 to -10.4 °C, while the warmest is July, with an average daily air temperature of 19.5 °C. Another important characteristic of St. Petersburg that influences green area development is its geographical location on the shores of Neva Bay of the Gulf of Finland and islands of the Neva River delta. St. Petersburg is in a zone of high precipitation, with an annual average of 653 mm (<http://www.infoeco.ru/>). Air humidity is 78% on average. Water occupies 7% of the surface area of the city, which is among the highest for cities world-wide. There are 308 waterways (totalling 217 km) and 108 reservoirs, lakes, ponds and artificial pools (>1 ha), which occupy a total of 2087 ha. Most of the city's elevation is no higher than 4 m a.s.l. (Ignatieva et al., 2011).

Green areas are important components of the urban ecosystem and more are needed to improve the quality of the environment. In particular, urban vegetation forms the architectural and artistic image of the metropolis and gives it individuality and originality. At the same time, green areas are the basis of the urban ecological framework (Gorokhov, 2003).

In many cities in Russia, the green infrastructure is just a random collection of gardens and parks, boulevards and street plantings, which does not create a favourable ecological environment. The most significant limitation of such a system is considerable underdevelopment and lack of green areas in central regions of cities and their isolation from larger green patches in suburban residential areas and green belts (Vladimirov, 1986; Bolshakov, 2003). A similar situation prevails in St. Petersburg.

The low level of funding for the maintenance of green areas of St. Petersburg, against the background of increasing anthropogenic pressure (overuse, increasing traffic and related pollution), has led to significant deterioration of urban green infrastructure in recent decades. This is due to the lack of timely high quality maintenance, protection and restoration of green spaces (Frolov, 1998). There is also an urgent need for creating a comprehensive and innovative design and planning system. In addition, the fragmentation of green spaces and their uneven distribution across St. Petersburg (low level of availability of green areas in central districts compared with peripheral areas) are also resulting in decreasing ecological functions and in failure to supply important ecosystem services (Kurbatova, 2014). The problem of preserving the existing green infrastructure of St. Petersburg, increasing the amount of green areas and enhancing their quality is extremely urgent.

In accordance with the provisions of the Law of St. Petersburg (23 June 2010), the city's green infrastructure (also called «green fund») is a set of all green areas (including urban forest and other green areas in «green and forest-park zones» (a specific category usually recognised in Russian cities)) within the administrative boundary of St. Petersburg. These green areas are divided into the following five types:

- 1) Common green areas – areas used for recreational purposes by an unlimited number of people.

- 2) Green areas that perform special functions – areas occupied by green spaces or intended for greening, or located in areas within a protection zone (drinking water supply sources; sanitary, noise and water protection green areas; buffer zones and fire zones; cemeteries); within the right-of-way roads, railways and engineering structures, and in other areas that require the establishment of protective planting, including street planting (within the boundaries of the St. Petersburg road network).
- 3) Green areas of limited use – located in various land use zones (parts of land) owned by St. Petersburg and occupied by green spaces, but to which access is limited or restricted by their rights holders.
- 4) Protective forest areas – urban forests and (or) forest park zones located in the territory of St. Petersburg, the boundaries of which are defined in accordance with the requirements of forest legislation.
- 5) Green areas of specially protected natural territories – the green areas located within the boundaries of specially protected natural areas of St. Petersburg (Law of St. Petersburg, 2005).

Methods

In this study, we examined laws and legislative documents related to green areas and their organisation and planning that were available from St. Petersburg Administration and district administrations. An inventory of individual sites of various types of green area in St. Petersburg was carried out. The data in passports (documents which contain common information about the type and characteristics of green areas) of green common areas, green plantations performing special functions (including street planting), greenery of residential areas were analysed. An assessment was carried out on the condition of trees, shrubs and lawns, and on architectural and design elements. During the inventory of green spaces in St. Petersburg the following data were usually taken into consideration:

Trees: Type of plantation (common, group planting), tree numbers, species, age, diameter, and current condition.
 Shrubs: Type of plantings (alley or group), species, age, number of bushes, length (for avenue plantings) and current condition.

Lawns and flowerbeds: Area and coverage.

The state of a green area was determined by the following characteristics:

Good – *Trees and shrubs*: healthy plants with a well-developed crown, without significant damage. *Lawns*: Well-developed grass stand. *Flowerbeds*: No wilted plants.

Satisfactory – *Trees*: The plants are healthy, but with a badly developed crown, with significant damage or damage that is not threatening to the life of the tree and hollows in the trunk. *Shrubs*: Stand is without weeds and with occasional presence of sprouting. *Lawn*: Poorly maintained. *Flowerbeds*: Wilted parts of plants visible.

Unsatisfactory – *Trees*: incorrect and poorly developed crown, with significant damage and visible infection by diseases or pests which threaten the tree's existence. *Shrubs*: Presence of sprouting and dead parts, as well as weeds. *Lawns*: Patchy, dying and full of weeds. *Flowerbeds*: Large amounts of dead flowers and wilted plants.

The inventory plan showed the number of trees and shrubs in the target area. Based on the corrected graphic material and the full records from a work diary, a final inventory plan of the area was drawn up. The plan also included:

- external boundaries of a landscape-architectural object with linear dimensions
- description of the external situation outside the boundaries
- boundaries and numbers of recorded areas and biogroups.

During the analysis of materials, computer databases were created using GIS technology. Mathematical and statistical processing of research results was carried out using Excel applications (2010). The recording of green spaces and elements of landscaping was carried out using the computer

programme "Electronic Passport of the Green Areas of St. Petersburg" (technical passports of green areas created by the Committee for the Improvement of St. Petersburg).

To analyse public opinion on the state of the green infrastructure in St. Petersburg, the express method was used.

Results and discussion

The total area of St. Petersburg is 143999 hectares, and the area of green infrastructure is 35390 hectares, which is 24.6% of the total area of the city. Around 65% of the green areas of the city are located within the territory of urban forests (22,900 hectares), concentrated mainly in the five administrative districts of St. Petersburg: Kurortnoye, Primorsky, Vyborgsky, Krasnoselsky and Petrodvorets (Table 1).

Fifteen specially protected natural areas with a total area of 6142.5 hectares have been established. Green common areas cover 5980 hectares, which is 16.9% of the total area of green spaces of the city. The area of street planting is 2420 hectares (6.8% of total green area) and the area of residential greenery is 1410 hectares (4% of total green area) (Table 1).

Table 1. Green infrastructure of St. Petersburg

Code	Type of green area	Area, hectares	%	Notes
1	Urban forests	22900	64.7	
2	Common green areas	5980	16.9	85 parks, 134 gardens, 1618 green areas in squares, 108 boulevards
3	Street greening	2420	6.8	
4	Residential housing green areas	1410	4	
5	Green areas that perform special functions	2690	7.6	
	Total	35390	100	

Although about a quarter of St. Petersburg is occupied by greenery, the distribution of green areas within the boundaries of the city's districts is extremely uneven (Fig. 1).

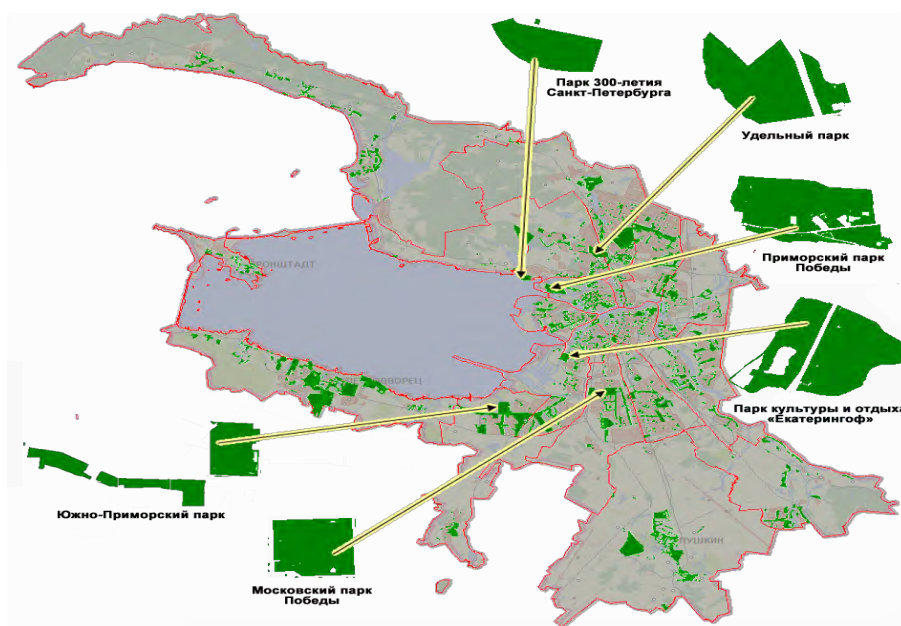


Fig. 1. Location of common green areas in St. Petersburg (Regional Information System, 2015).

The Law "On green plantations in St. Petersburg" (Law of St. Petersburg, 2010) sets standards for the quality of green spaces and the minimum standards for the provision of the population of St. Petersburg in all types of green areas. The standards for the quality of green spaces are established for the entire territory of St. Petersburg according to the biological indicators of the state of the environment and the stability of natural complexes.

Currently, the indicator of the per capita provision with green areas is determined for each district of St. Petersburg as the ratio of the sum of types of green areas (common green, limited use and multifamily greenery) to the total number of persons registered in the district (Analysis of security, 2015) (Table 2).

Table 2. Provision of green area per capita in St. Petersburg

District	Area of common green, m ²	Area of multi-family green area, m ²	Green areas that perform special functions, m ²	Total area of green, m ²	Number of inhabitants (2015).	Minimum standard of provision of green area, m ² per person	Actual provision of green area, m ² per person
Admiralteisky	942 900	130 480	526 185	1 599 565	172 704	6	9
Vasileostrovsky	751 600	493 400	578 405	1 823 405	207 267	6	9
Viborgsky	6 106 100	1 321 700	657 555	8 085 355	482 450	12	17
Kalininsky	4 402 200	1 118 700	1 549 519	7 070 419	447 984	12	16
Krasnogvardeisky	1 780 400	999 700	793 603	3 573 703	293 923	12	12
Krasnoselsky	5 242 000	801 800	1 051 927	7 095 727	356 074	12	20
Kirovsky	2 397 800	1 192 300	788 615	4 378 715	334 028	12	13
Kolpinsky	2 270 800	299 300	1 460 678	4 030 778	185 497	6	22
Kronstatsky	487 700	53 500	162 935	704 135	44 335	18	16
Kurortny	2 397 400	777 000	3 888 380	7 062 780	69 691	18	101
Moscovsky	2 862 700	1 530 500	503 182	4 896 382	276 141	12	18
Nevsky	2 520 800	1 892 800	709 879	5 123 479	467 919	12	11
Petrogradsky	2 254 800	128 710	1 946 540	4 330 050	139 298	6	31
Petrodvorets	10 957 500	535 300	9 649 903	21 142 703	133 668	18	158
Primorsky	5 303 900	916 000	581 931	6 801 831	544 032	12	13
Pushkinsky	5 908 100	485 700	425 853	6 819 653	109 289	18	62
Frunzensky	2 408 500	1 359 000	904 048	4 671 548	405 745	12	12
Central	781 900	106 100	707 431	1 595 431	226 390	6	7
Total	59 777 100	14 141 990	26 886 569	100 805 659	4 896 435	12	21

The minimum standard for provision of green area per capita in St. Petersburg is as follows: For the Admiralty, Vasileostrovsky, Petrogradsky, Central, Kolpinsky districts of St. Petersburg it is 6 m² per capita; for Vyborgsky, Kalininsky, Kirovsky, Krasnogvardeisky, Krasnoselsky, Moscovsky, Nevsky, Primorsky and Frunzensky districts it is 12 m² per capita; and for Kronstatsky, Kurortny, Lomonosov, Petrodvorets and Pushkin districts it is 18 m² per person (Law of St. Petersburg, 2010).

The actual provision of green area to residents of St. Petersburg ranges from 7 to 158 m² per capita (Table 2) In Kronstatsky and Nevsky districts, the actual provision of green areas is lower than the standard, while in the Central, Krasnogvardeisky, Kirovsky, Primorsky and Frunzensky districts, the provision is approaching the level of the minimum standard.

For an objective assessment of this indicator, we advise a change in the methodology for calculating the green area per capita indicator for St. Petersburg. It is important to include in the calculation all types of green areas that are part of the green infrastructure and are located within district's administrative boundaries. A similar practice is applied in other regions of the Russian Federation and throughout the world.



Fig.2. One of St. Petersburg parks.

Actual improvement of the current situation is possible if the city provides new territories for the creation of public green areas. This can be done for example using some areas of reserved greenery which, in accordance with the land planning documents, are intended for development of the 'green fund' of St. Petersburg. Another way is by increasing the percentage of green areas during the planning stage for new residential and non-residential developments. In the Central district of the city, where additional land for greenery is completely absent, an increase in green areas is possible by redevelopment of the former industrial belt (released after the withdrawal of industrial enterprises from the historical part of the city), as well as areas that are freed after demolition of various buildings that have no historical value, including dilapidated old housing. In order to actually implement these measures, it is necessary to amend the Law on the Master Plan of St. Petersburg in terms of increasing the areas for recreation and gardening in places where the provision of green areas is most acute issue (Nefedov, 2002).

At present, there are 1.68 million trees and 3.77 million shrubs growing in common green areas and street planting of St. Petersburg (Regional information system, 2016). The predominant species are broadleaved trees (79.33% of the total population), followed by coniferous trees (20.67%). Around 78% of these trees are over 20 years old. According to our monitoring of the status of tree species, 30% of aged trees have approached the natural limit of their life expectancy. Therefore, the most important problem is the preservation of old-growth trees and an increase in planting to fill the gap left by lost specimens. The existing practice of annual planting of about 20 000 trees and 200 000 shrubs in common green areas and street planting (Committee for the Improvement of St. Petersburg, 2003-2015) is not sufficient for St. Petersburg and should be revisited.

In addition, to improve the sustainability of urban green areas in selecting species of trees and shrubs, it is recommended to use a comprehensive method for assessing the suitability of woody and shrub vegetation for the urban environment: gas resistance, resistance to anti-icing materials (which is a reality in St. Petersburg) and winter hardiness (Egorov, 2008; Analysis of the impact of anti-icing materials, 2015).

We have developed a list of recommended gas- and winter-resistant trees and shrubs for street planting and common green areas in St. Petersburg. It includes 19 species and varieties of coniferous and 131 species and varieties of deciduous trees and shrubs.

To increase the resilience of urban green plantations to negative anti-icing materials, it is recommended to use the system approach in organising the planting structure. The main principles of this approach are: while determining the site of planting trees and shrubs, take into account the recommendations for optimal distances from the edge of the road carriageway and organise appropriate water drainage and air exchange in the zone of green plantings (Analysis of impact of anti-icing materials, 2015). In addition, the most important component of success in improving the sustainability of urban plantations is ensuring compliance with technologies for planting and quality of maintenance and management of green plantations, especially young trees.

According to the results of our sociological survey of St. Petersburg citizens, the level of improvement of the urban environment in St. Petersburg was estimated by residents at 3.3 points on a five-point scale (Express analysis, 2015). The level of urban green areas and their improvement were rated 3.7 points. Most residents were worried about the poor condition of the lawns, the lack or neglect of green areas and the lack of or insufficient number of well-maintained green areas (Fig.2).

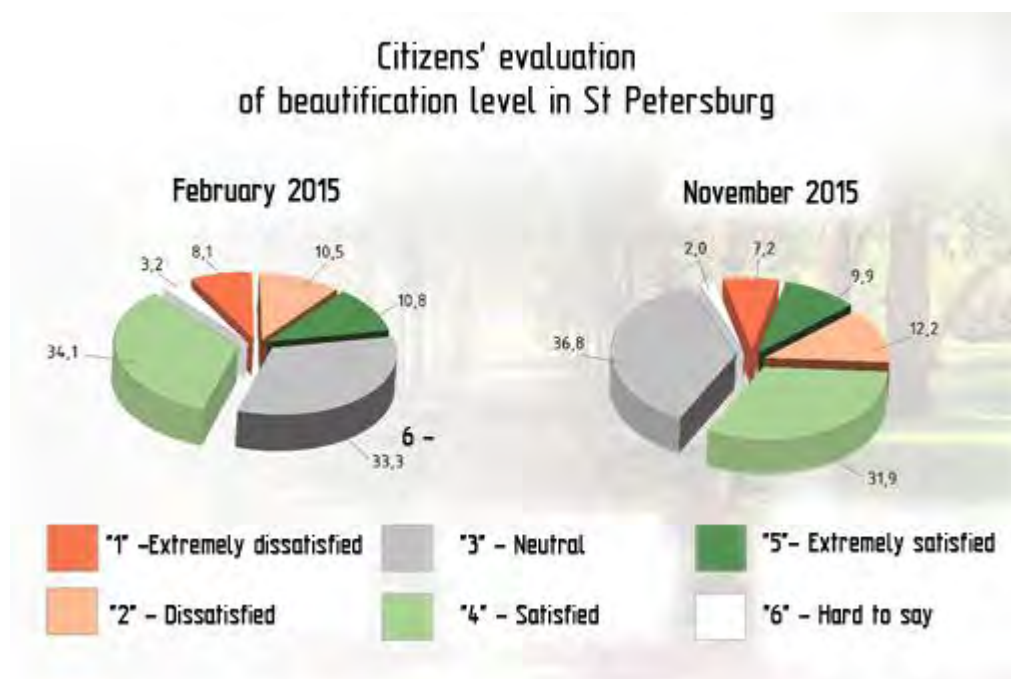


Fig.3. Results of the sociological survey of residents of St. Petersburg (Express analysis, 2015).

The most unfavourable conditions, according to residents, are in the Central, Admiralty, Vasileostrovsky, Nevsky, Primorsky, Vyborgsky and Krasnogvardeisky districts. The results of the survey were well-correlated with the actual data on the provision of green areas per capita (Table 1).

Analysis of the green infrastructure of St. Petersburg from the point of view of providing recreational activities and ecological function revealed the following problems:

Currently, the green infrastructure of the city includes 1945 items that have the status of the common green areas, including: 85 parks, 134 gardens, 1618 public gardens and 108 boulevards. At the same time, 387 items (with a total area of 620.58 hectares and which cover 10.4% of the total area of common green areas) are, in fact, unsuitable land for landscaping. They would need significant input of resources and time.

Special attention should be paid to the category of the special protected natural areas within urban boundaries. The limited regime for the use of such areas does not allow comfortable visits and rec-

reation of citizens in the territory of nature reserves. Thus, most of the territories of green spaces fulfil only the ecological function. There is a need to find a balanced strategy which would address both ecological and recreational functions.

Conclusions

Green areas in St. Petersburg do not work as a united system because of the large autonomy of green elements, isolation from suburban spaces and lack of green spaces in central districts. For a qualitative improvement of St. Petersburg's green infrastructure system and its recreational and environmental functions, it is necessary to reinforce the main axes of the green infrastructure as a logical continuation of certain green elements of the districts. At the intersection of such axes, it is advisable to form relatively large green zones which can be seen as centres of ecological activity.

Elements of green infrastructure must penetrate into all structural urban links, including residential and industrial areas. The green infrastructure and its biological characteristics must correspond to the specific local natural, economic and cultural characteristics of St. Petersburg.

Our vision of the preservation and the development of St. Petersburg green infrastructure as a united system can be implemented in the following ways: the formation of "green centres", "green corridors» and the primary links of the green infrastructure. It also includes the formation of a "green belt" (by involving urban forests) and the integration of all elements of green infrastructure into one united system.

Preservation, increasing qualitative biological characteristics and reducing green area fragmentation will increase the stability of green infrastructure and ensure sustainable development of St. Petersburg.

References

- Analysis of security. 2015. *Analysis of the security of the population of St. Petersburg territories of greenery*: <http://gov.spb.ru/gov/otrasl/blago/>.
- Analysis of anti-icing materials. 2015. *Analysis of the impact of anti-icing materials on green plantations and proposals for changing their composition and methods for combating winter slipperiness in the territory of St. Petersburg* / Committee for Nature Management, Environmental Protection and Ensuring Environmental Safety / - St. Petersburg, 2015.
- Bolshakov A.G. 2003. *Urban planning organization of the landscape as a factor of sustainable development of the territory*. Thesis. Dr. arch. Irkutsk.
- Committee for the Improvement of St. Petersburg. 2003-2015. *Plans for planting trees and shrubs of the Committee for the Improvement of St. Petersburg from 2003 to 2015*. The archival data of the CB St. Petersburg.
- Committee for the Improvement of St. Petersburg. 2016. *Technical passports of the greenery of the Committee for the improvement of St. Petersburg*: <http://gov.spb.ru/gov/otrasl/blago/>
- Ecological portal of St. Petersburg Committee for Environmental Management, Environmental Protection and Ensuring Environmental Safety*: <http://www.infoeco.ru/>.
- Egorov A. 2008. *Development of a sustainable assortment of woody plants of the main green plantations of St. Petersburg* / Report on research work. Scientific. Hands. SPb., 102pp.
- Express analysis. 2015. *Express analysis of the results of monitoring the public opinion of the population*

of St. Petersburg "Estimation of the situation with green areas in districts in 2015 by residents of St. Petersburg" / portal of the St. Petersburg Information and Analytical Center of the Committee on Information and Communication: <http://iam.iac.spb.ru/page>.

Frolov A. 1998. *The environment of a large city and the life of plants in it*. St. Petersburg..

Gorokhov V.A. 2003. *Green nature of the city: Textbook for high schools*. M. Stroiizdat. 528 p.

Ignatieva M., Konechnaya G. and G. Stewart. 2011. St.Petersburg: Plants and Habitats of European Cities. *Vegetation and Plants of European Cities*. Kelcey, J. and Muller, N. (eds.). Springer-Verlag: 407-452

Kurbatova A.S. 2004. *Ecology of the city* (A.C. Kurbatova, V.N. Bashkin, N.S. Kasimov, M. Naucheds). World 624 p.

Law of St. Petersburg. 2010. *Law of St. Petersburg* from 23.06.2010 № 396-88 "On green plantations in St. Petersburg".

Law of St. Petersburg 2005. *Law of St. Petersburg* of 21.12.2005 № 728-99 "On the General Plan of St. Petersburg and the boundaries of zones of protection of cultural heritage sites on the territory of St. Petersburg".

Nefedov V.A. 2002. *Landscape design and environmental sustainability*. SPb: Polygraphist, 295 pp.

Regional information system. 2016. *Regional information system of the "Geoinformation System of St. Petersburg"*: <http://rgis.spb.ru/>.

Vladimirov V.V. 1986. *City and landscape: problems, constructive solutions*. (V.V. Vladimirov, E.M. Mikulina, Z.N. Jargin. M. Misl, eds) 238 pp.

<http://www.infoeco.ru/>