

MTMSD 2022**I International Conference «Modern Trends in Governance and Sustainable Development of Socio-economic Systems: from Regional Development to Global Economic Growth»****THE GREEN FRAME OF SAINT PETERSBURG: ASPECTS,
FUNCTIONS AND GREEN PLANT SYSTEMS**

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(a) Saint Petersburg State University of Architecture and Civil Engineering, St. Petersburg, Russia,
dasdanilova@gmail.com**Abstract**

A series of theses on the theme of the Green Frame of St. Petersburg deepened the design specifics of the new educational direction 35.03.10 “Landscape Architecture” and the introduction of a theoretical knowledge base on landscaping, botany, soil science in synthesis with the design competencies of an architect. The article reflects several main vectors of modern architectural and landscape solutions in the framework of design and research activities: the creation of a sustainable ecosystem with the attraction of birds and insects, the maintenance and elimination of hydroecological problems of urban spaces with flooded areas, digitalization of the landscape, landscaping of highways, areas near the metro and transport arteries. The structure of buffer protective landscaping is considered. The typology of landscapes in the structure of the Green Frame is presented. Methodological connections for design are revealed, a landscaping matrix is recommended for further design and theoretical studies. The analysis of theses has revealed eco-niches for the climate of St. Petersburg; unique functions and systems of green spaces have been extensively proposed, reflecting all the possible diversity of elements of the Green Frame. A competent and diverse combination of different types of plantings and assortment provides visual compositional and functional connections between spaces, the formation and restoration of the ecosystem. The percentage of landscaping has been increased. The research is aimed at the formation of a unified Green Strategy of St. Petersburg, as an important stage in the development of the city within the framework of the concept of sustainable development.

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1. Introduction

Urbanization is one of the biggest threats to biodiversity and ecological connectivity (Chapman & Hall, 2022). Landscape planning can and should underlie urban planning and the formation of the General Plan with the participation of residents, since the health of citizens for generations to come and the sustainable development of the metropolis are directly related to the quality of green spaces.

The restoration of the Green Frame of St. Petersburg is an urgent goal that unites society in the trend of world practice (Washbourne, 2022). The frame ensures the improvement of the environment, a comfortable microclimate of the city and the creation of recreational areas, the creation of conditions for the contact of Man and Nature, the multiplication of Flora and Fauna, the restoration of ecosystems, and sustainable development. Many aspects influencing the development of such target programs need to be rethought since Soviet times. It is important to plan and design on a regional scale in order to have a significant environmental impact (Danilova, 2021a).

2. Problem Statement

The restoration of the Green Frame of St. Petersburg is an urgent goal that unites society in the trend of world practice (Washbourne, 2022). The frame ensures the improvement of the environment, a comfortable microclimate of the city and the creation of recreational areas, the creation of conditions for the contact of Man and Nature, the multiplication of Flora and Fauna, the restoration of ecosystems, and sustainable development. Many aspects influencing the development of such target programs need to be rethought since Soviet times. It is important to plan and design on a regional scale in order to have a significant environmental impact (Danilova, 2021a).

3. Research Questions

The article reflects several main vectors of modern architectural and landscape solutions in the framework of design and research activities: the creation of a sustainable ecosystem with the attraction of birds and insects, the maintenance and elimination of hydroecological problems of urban spaces with flooded areas, digitalization of the landscape, landscaping of highways, areas near the metro and transport arteries .

4. Purpose of the Study

The research is aimed at the formation of a unified Green Strategy of St. Petersburg, as an important stage in the development of the city within the framework of the concept of sustainable development.

5. Research Methods

In 2022, students of the “Landscape Architecture” direction as part of the undergraduate degree work under the guidance of Danilova S.B. (consultants: Boitsova D.V., Trubocheva T.A., Khmarik A.G.)

developed a comprehensive improvement of public spaces in the general concept of a unified Green Frame of St. Petersburg - design sites were selected jointly with the city administration. This made it possible to deepen the design specifics of the new educational direction 35.03.10 “Landscape architecture” and the introduction of a theoretical knowledge base on landscaping, botany, soil science in synthesis with the design competencies of an architect (S. B. Danilova & Khmarik, 2023).

6. Findings

Based on the results of the analysis of domestic and international experience, the principles (Grădinaru & Hersperger, 2019) were applied, some of which are given below:

- i. The principle of environmental friendliness. Determines the trend of reducing the impact of design decisions on the existing natural environment and contributes to a decrease in the gas pollution index of the urban environment, air dustiness, and a decrease in wind load due to trees and shrubs.
- ii. The principle of the socialization of the environment. Identifies the need for area planning, taking into account potential functional adjustments and changing needs.
- iii. The principle of biodiversity. The assortment is formed taking into account the dynamics of seasonal decoration, the general concept and functional purpose of a particular zone.
- iv. The principle of the safety of the urban environment. It is necessary to create comfortable conditions for the physical and mental health of citizens. Integration of objects of the natural environment is a new approach to improving the health of the population, physical rehabilitation.
- v. The principle of integrity. Restoration of a single green frame, consisting of ecological cores, ecological corridors, buffer zones, point elements, spatial links.

From the point of view of the covered typology, the following landscapes were identified for the restoration of the Green Frame of St. Petersburg: public spaces, ecological landscapes and objects with conditions for the development of Flora and Fauna, water-green objects, fertile landscapes, transitional landscapes, transport infrastructure objects, objects with a high degree of digitalization, health landscapes.



Figure 1. Stages of Design. Green Frame sites, Green Ring - ecological zoning scheme, master plan, dendroplan, biotope with assortment

Climatic factors and landscape zoning are presented in this approach in the ecological zoning scheme and the landscape zoning scheme. These two schemes in pre-project research and design began to play an important role as a methodological link. The works present the appearance of a biotope or landscape niche. They should be carried out in further studies (Figure 1). The range of plantings based on the scheme was compiled taking into account climatic, environmental and anthropogenic factors and existing landscaping with an interconnection with the preserved and projected function and typology. The final assortment in each work was systematized in the form of a simple table, but in the process, the form of the landscaping matrix was revealed with visualization of the appearance and parameters of each landscaping element (Figure 2).

As a result of the survey of the territory, the required number of ecological niches was identified in each project proposal. For each ecological niche, the authors selected the main, additional and limited ranges of plantings that meet the conditions. Plants were selected for areas such as: entrance group, buffer zone, theme gardens, playground, sports ground, water body (aquatic biotope), recreation area, walking promenade, eco-trail, dog walking area, city beach, buffer zone along highways, etc. At the same time, the goal was to restore eco-chains.

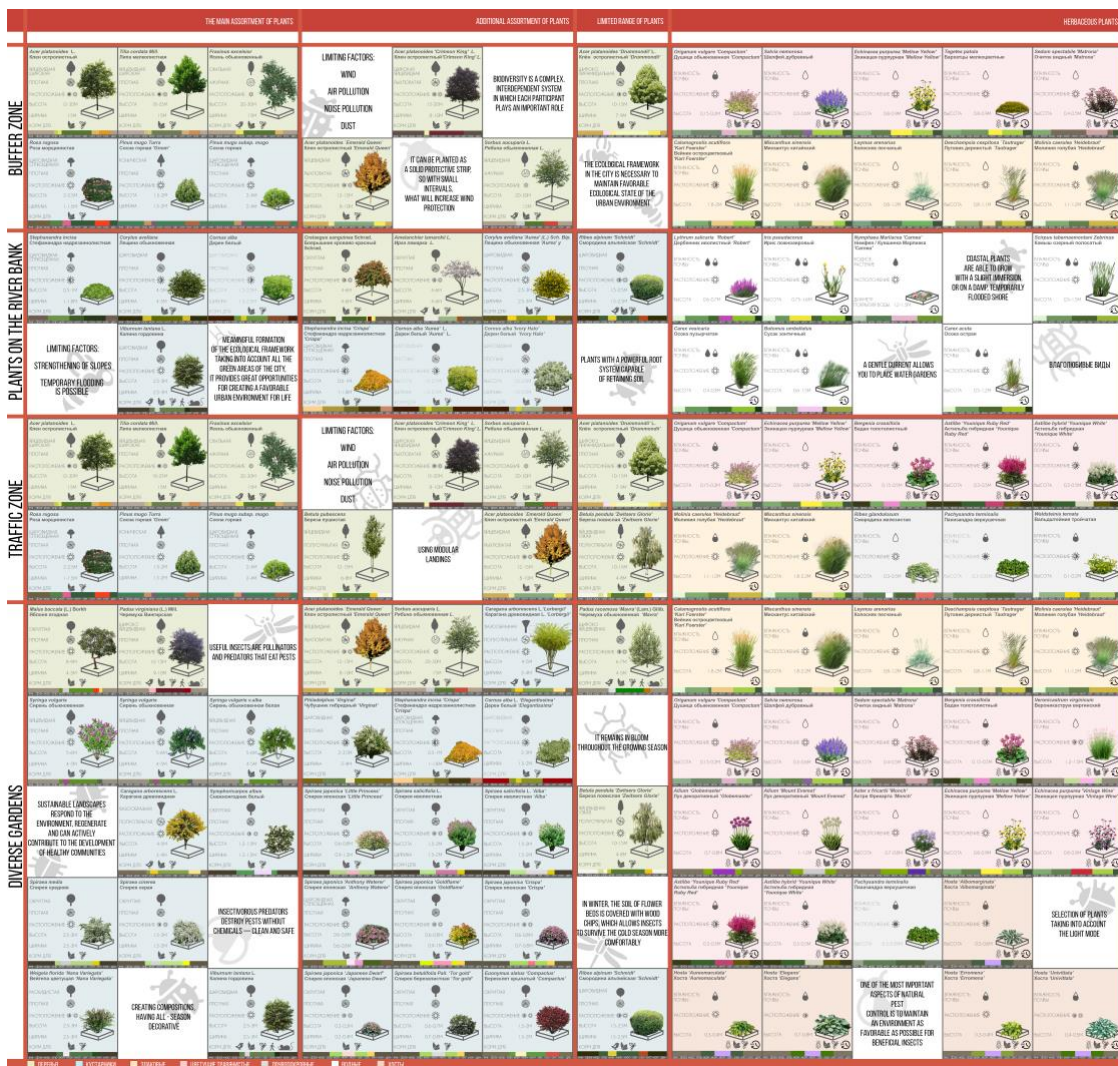


Figure 2. Greenery Matrix. Kurik Agata

As a result, unique functions and systems of green spaces were extensively proposed in the theses, reflecting all the possible variety of elements of the Green Frame:

- i. Plants of coastal and aquatic biotopes
- ii. Vertical gardens with climbing plants
- iii. Sirengaria with gradual continuous flowering
- iv. Blooming garden with fruit plants and shrubs
- v. Perennial flower beds of continuous flowering
- vi. Shady flower beds under the canopy of existing trees
- vii. “Rain gardens” with water-loving plants
- viii. Grain fields
- ix. “Birch Groves”
- x. Combinations of ground cover plants instead of lawn
- xi. Use of meadow lawns and herbs
- xii. “English garden”
- xiii. “Labyrinth of Feelings”
- xiv. “Community garden”
- xv. Apothecary garden
- xvi. “Agricultural land” (agricultural park)
- xvii. “Swamp”
- xviii. “Ecopaths”
- xix. Mini-eco-park in the wetland “Green Valley”
- xx. Green amphitheater area
- xxi. Urban beach area with coastal flower beds
- xxii. Reed garden
- xxiii. Linear garden with shrubs
- xxiv. White garden
- xxv. Rose garden
- xxvi. Spiraea garden
- xxvii. Green area for playgrounds
- xxviii. Coniferous garden, etc.

Particular attention deserves work aimed at creating a sustainable ecosystem with the attraction of birds and insects. It is this approach that can contribute to the restoration of wildlife in the city with native plants, biodiversity and the restart of sustainable “eco-chains” with the involvement of representatives of the entomofauna and fantails. Mowing the grass often leads to the mass extinction of local insect species, which cannot but be noticed by residents who have been sounding the alarm for years. The authors proposed an assortment, unique small architectural forms (insect hotel, bird houses, etc.) and lawn solutions (Figure 3).



Figure 3. Green Ring of the Frunzensky District. White Garden ornamental shrubs and hotel for insects

Within the framework of the WRC, conceptual solutions were aimed at maintaining and eliminating the hydroecological problems of urban spaces with flooded areas, in particular, those that regularly occur on the territory of Polyustrovskiy Park. When developing modern solutions, the goal is to transform problematic aspects into a favorable modern park environment, taking into account the growing needs of users. The proposed solutions were thought out in accordance with the main set of rules for the planning and improvement of park areas. The introduction of a swamp in the context of the project proposal plays the role of additional aesthetic maintenance of the natural space. The swamp is a system of geoplastics, with a translucent coating for additional collection and retention of water with reed plantings. A system of a walking route and small groups of plantings of moisture-loving woody plants has been laid through the swamp. On the coastal zone of the pond, plantings of hydatophytes, hydrophytes and the main moisture-loving plants are formed, capable of supporting the lake shoreline (S. B. Danilova & Kurik, 2023).

Digitalization today opens up new opportunities for improving the ecological characteristics of the environment and integrating new functions of increased social activity, for example, such as public gardens and food courts, areas for selling farm products and conducting modern recreational activities (S. B. Danilova, 2022). For example, in the project of the Square of Liberators Warriors, it was proposed to place interactive zones for the residents of the area - a public garden and public agricultural land. All this is supported by trade pavilions where you can buy household items and various home products. The sale of products can be carried out with preferential terms for those who participated in the planting of the material. Authenticity of participation can be controlled by issuing special qr-codes and entering them into the database at the time of the event. Public gardening sites should have a system for collecting, processing and displaying up-to-date information on plantings in each separately designated area through the operation of a special application. This will simplify the care of planting material and will literally show in which zone which plants lack certain care. The distribution of care responsibilities can also be done remotely, through an application on a smartphone or through a website (S. B. Danilova, 2022).

The use of digital technologies also opens up new opportunities to touch the lost historical culture, including those associated with landscape history and endangered plant species.

The landscaping of highways, areas near the metro and transport arteries is a constant focus of attention of specialists - it is there that contact with Nature becomes a factor of comfort and increasing the attractiveness of a place for short-term recreation for residents on the route “home-work-home” with a dominant transit and transport function, and international The study demonstrates the challenges of maintaining long-term survival and landscaping diversity along highways and highlights the importance of species selection (Krasilnikova, 2014). It can be safely argued that boulevards and green belts along highways should be the most sustainable and fundamental corridors and buffer zones of the Green Frame.

A series of works demonstrated the connectivity of solutions, when linear objects with points of attraction are combined into closed systems with pedestrian infrastructure, such as the Green Ring of the Frunzensky District, connecting to metro stations (Leninsky Prospekt and Veteranov Prospekt), as well as others ecological corridors of the Green Frame (Figure 4) (Robinson et al., 2022).

The main tasks of buffer landings in the development of such project proposals included such criteria as: protection from the negative impact of transport (dust, dirt, noise); wind protection; aesthetic criteria. Tentatively, two types of buffer landscaping are proposed for implementation in projects:

1. Alley two-four row plantings with three tiers of landscaping along highways. The upper tier is made up of trees, the middle tier is tall shrubs 1.5-3 meters and the lower tier is ground cover plants and stunted shrubs up to 0.5 meters (Salisbury et al., 2022).

2. Picturesque buffer landscaping - consists of groups of shrubs, trees and ground cover, forming dense natural massifs. The upper tier consists of various tree species (ash, linden, maples), the middle tier - tall shrubs 1.5-3 meters and the lower tier - ground cover plants and stunted shrubs up to 0.5 meters. As accents, compositions of perennial flower species and ornamental shrubs are proposed in combination with elements of land art, which is a real and economically viable alternative from the point of view of spending budget funds to the existing, but obsolete practice of using annual planting material with a short flowering period.



Figure 4. On the left is the buffer landscaping of the Leninsky Prospekt metro station, on the right is thematic gardens and the historical and cultural cluster near the Staraya Derevnya metro station

It is a competent approach to landscaping highways, taking into account all factors and loads, that can become a significant and targeted contribution to the formation of the Green Frame and the image of St. Petersburg (S. Danilova & Yefimov, 2023).

It is important to note that according to SP 42.13330.2011 “Urban planning. Planning and Development of Urban and Rural Settlements” in the projects, the area of green areas was taken to be at least 70% of the total area within the boundaries of the design site. The adopted landscape solutions take into account the natural, climatic and natural conditions, the surrounding buildings and the functional purpose of the sites. A competent and diverse combination of different types of plantations and assortment provides visually compositional and functional connections of spaces among themselves, the formation and restoration of the ecosystem (Krasilnikova, 2014).

7. Conclusions

Thus, the article reflects several main vectors of modern architectural and landscape solutions, methodology and elements, describes the unique functions and systems of green spaces, which are aimed at the formation of a unified Green Strategy of St. Petersburg, as an important stage in the development of the city within the concept of sustainable development. The scientific novelty is the systematization of landscaping elements into a matrix by types and ecological niches. Particularly relevant are proposals to create conditions for the development of flora and fauna in the city, taking into account climatic features, the introduction of digitalization, the elimination of hydro-ecological problems of urban spaces with flooded areas, the landscaping of highways, areas near the metro and transport arteries. It is important to introduce into the process of developing design solutions an ecological zoning scheme and a landscape zoning scheme within the framework of the educational direction 35.03.10 “Landscape architecture”. The proposals were highly appreciated by experts and specialists within the framework of graduation qualification works in 2022 on the basis of the Federal State Budgetary Educational Institution of Higher Education “St. Petersburg State University of Architecture and Civil Engineering” (SPbGASU).

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