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## **THE IMPORTANCE OF APPLICATION OF URBAN ECOLOGY PRINCIPLES TO URBAN REGENERATION OF PUBLIC OPEN SPACES – PARKS OF NOVI GRAD IN PODGORICA**

### **SUMMARY**

The rapid growth of modern urban environments is accompanied by degradation processes causing the need and application of urban ecology principles in urban regeneration of public open spaces. The public open spaces of functionalist residential areas built in the second half of 20th century nowadays represent the inherited spaces shaped over the decades of their use, often without specific purpose, and characterized by buildings and urban complexes built according to the standards of the time, different socio-economic, technical and technological conditions, but with the continuity of green open spaces organized as parks or linear green areas that still represent a special quality of these parts of the city.

Learning about the role and importance of park areas on a concrete example of Novi Grad in Podgorica, as well as about the role of the city in creating its identity, importance and experience for urban parks users, then the principles of urban ecology, along with the application of the ecological planning models provide further strategic guidelines for urban regeneration which can be incorporated in the planning documents and thus improve the relationship between the built environment and landscapes, all in order to create environmentally sustainable and self-sustaining space within the urban tissue.

**Keywords:** public open spaces, urban regeneration, urban ecology, urban parks, sustainability

### **INTRODUCTION**

The concept of landscape represents a part of nature, an element of landscape architecture, a selected unit that requires the observer's view, imagination and empathy, but as the segment of urban environment it becomes something that people interpret, model and create for their use. The landscape seems to stand opposite to contemporary city model, industrial production and technology that make it difficult to perform the play of harmonious relationship between man and nature.

As for the public open spaces and urban parks, the analysis of the possibility to integrate human activities and nature we are bound to and by, has been performed. Or, in other words, the question is what one can incorporate in

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the concept of landscape. Certain locations can be reformulated, planned and designed as a landscape. The openness of the landscape concept that can be made even in the broader city area leads to not only the cultural landscape concept, but also to the aesthetic landscape, along with the society capability to draw attention to certain elements, through the authenticity and recognizability.

In today's developed countries` cities that have similar principles of spatial organization, where the borders between the city and suburbs are disappearing, the significance of park is increasing as it highlights the cultural identity, the inherited natural characteristics and its connections to forests. The management of the integration of space, conservation, education and sustainability aims at establishing the overall quality of space.

The inconsistent content of the planning documents and the current situation in terms of the lack of ecological urbanism and sustainability indicators in the execution and implementation phase are the results of unsustainable urban design in social, economic and environmental aspects. Avoiding the traditional trend of urban planning and management that pay little attention to the environment, determining the effective indicators of sustainability and ecological urbanism is an important step towards the possibility of urban space regeneration.

Evaluation of existing systems of public open spaces - park areas of Novi grad shows the need for urban regeneration and aims at setting goals and standards for the design of future parks, and thus the development of the community.

**The importance and the role of parks.** The content and the role of a park as a public space is also visible in ecology, aesthetics, sociology and sports and recreation. The variety of different user groups` interests and needs are reflected in ways the space is used. Park planning and design, a selection of style, target groups and the context are the elements and requirements facing the urban planners today. The area of today's park is a product of the urbanized, industrialized and democratic society. It represents a cultural environment used to express and explores the nature and significance of public open spaces of the city, a meeting place of people from different social classes, backgrounds and ages; a place for unobtrusive observers and active participants in a wide range of activities. Entertainment, relaxation, play, refreshment are just some forms of recreation in contemporary parks that were also present in 19th century traditional parks, the archetypal green oasis, surrounded by the densely built neighborhoods. Parks cannot survive without public monitoring and cultural affirmation. The problem arises when these conditions are not met, as, then, the essential difference between parks and open space disappear.

**Urban ecology.** The complex relations between man and nature conditioned by economic development, infrastructure and bio-geo-physical elements within the urban environment indicate the multidisciplinary character of

urban ecology studies which determines its specific position within the group of scientific disciplines dealing with the environment.

A number of causal relationships determine the human environment in an urban area, with social influences prevailing and modifying the effects of a geobiosphere. An ecosystem represents a coherence of a biotope (a habitat) and biocenosis as a specific community of plant and animal populations. The changes of biotope through the construction of various facilities or through intensive agricultural activity lead to changes in the relative stability of the ecosystem. The anthropogenic processes as a possible consequence of the built environment, seriously encumber the natural components, causing a change of tolerance and dynamic balance.

Marina Alberti points out that cities are hybrid phenomena driven simultaneously by people and biophysical processes (Alberti, 2008), and the urban ecology is the study of the ways that humans and ecological systems evolve together in urbanizing areas.

Through urban environmental planning, designers help in mitigating the human impact on natural environment by harmonizing human activity with the activity of other living organisms in the given environment. The concept of observing human settlements as ecosystems appeared in the fourth century BC when Hippocrates argued on the effects of air, water and a place of living on human health while Vitruvius in the fifth chapter of the book "On architecture" refers to the importance of building orientation toward the sun, the winds, and with particular regard to climate. Frederick Olmsted and Lewis Mumford promote the importance of understanding the nature and the complex interaction between nature and human beings and their products, whether they are: buildings, cities or landscapes. Kevin Lynch (1984) describes the city as part of nature considering the role of nature from a more scientific point of view. Peter Calthorpe, and later David Owen, when dealing with the environment planning, incorporate sustainability as a defining objective in many environmental efforts.

White (2002) agrees that the ecological city is the one that provide acceptable standards of living for its residents, without exhausting its ecosystems and biogeochemical cycles it is dependent on. The idea of sustainability is an important element of the ecological park, which implies the possibility that the park offers its best in present, without compromising the future needs.

Inclusion of urban ecology as the main component of urban planning implies understanding the nature of cities, integration of humans and other living beings in the ecosystem, the causes of climate change and the need to use renewable energy sources through the use of elements from nature. In the process of city planning, urban ecology explores the human activities that cause the changes of natural or artificial elements, through defining the spatial characteristics of environmental conflicts (load, degradation, pollution), as well as social and psychological reactions (resistance, tolerance). All the above mentioned constitutes the basis for developing the guidelines for space urban revitalization that should be harmonized with other scientific disciplines.

## MATERIAL AND METHODS

The general scientific method used in the scientific research is analytical and synthetic method, while the basic method of case study provides critical research and describe the studied phenomenon - the need of setting environmental standards and standards of environmental sustainability and urban planning in an appropriate spatial context.

In the part of the research that implies the establishing of theoretical basis of the topic and the problem and formulating the analytical research apparatus, the method of critical analysis of theoretical sources will be applied. Along with the method of case study, the method of scientific analysis of planning documentation and critical analysis of texts that are indirectly related to the research subject and problem. In this research, the grounded theory method will be used as well, as one of the qualitative approach methods that includes constant comparison and theoretical sampling of the research materials, particularly applicable in the ecological urbanism.

The final part of the study contains the organization and evaluation of the information obtained by interviewing the citizens about the use and opportunities to use public spaces in Novi Grad neighbourhoods. The survey was conducted in the autumn of 2015, and involved 86 residents of Novi Grad neighbourhood. The paper also contains the results of a survey on the assessment of the current situation and future needs that was published in the Spatial urban plan (SUP) for the capital of Podgorica - up to 2025. (SUP, 2014.). This survey included 120 citizens and 10 urban planners and architects.

In order to evaluate the existing system of park areas and set goals and standards for planning the future green areas within the city districts, the analyses of the urban complex of Novi Grad, part of the urban core of Podgorica located on the right bank of the River Moraca, was carried out.

## RESULTS AND DISCUSSION

**Spatial and functional aspects of Novi Grad.** The geostrategic position of Podgorica, at the confluence of the Moraca and Ribnica rivers had a crucial influence on the formation and morphological characteristics of the urban matrix of Stara Varos, Nova Varos and Novi Grad (Fig.1). Nova Varos and Novi Grad have similar geometric models developed on an orthogonal system of blocks, in contrast to the organic grid of the Stara Varos. The difference in size and organization of the blocks of orthogonal grids indicates the various stages of formation: Novi Grad, the functionalist organization of free-standing buildings on the open agricultural land has been built for 30 years, in the second half of the last century. Moraca river bed separates Novi grad from the rest of the city, but it is well connected by pedestrian and boulevard bridges with the city center which is in the walking distance, so the strategic location of this urban settlement is very favourable and attractive.

Novi Grad did not use properly the potentials of the green belt along the river, except as a landscaped area around the buildings for public use, without

continuity and the access to the river bank, or as open unplanned green zones. The revision of the General Urban Plan in 1990. recognized a landscaped green river belts with "special landscape and recreational forms" that are connected to the park green zones of Novi Grad and Nova Varos making the "the green sleeves (green street, alleys, green spaces in the blocks) and to the forest parks of the hills Gorica, Ljubovic and Malo brdo.

Urban green spaces of Novi Grad are classified as:

- Park greenery;
- Linear greenery (avenues and hard landscaping);
- Greenery of central activities;
- Greenery of pedestrian areas;
- Residential building blocks greenery.

In the basic underlying principles of the revision of General urban plan from 1990 it is stated that "it is necessary that parks as basic elements of traditional space design become more present in future urban planning, primarily in the narrow urban area, and that the concept of urban extensions and construction on new areas should ensure a norm of  $3\text{m}^2$  per an inhabitant (MP 1990)". The revision of the General urban plan for Novi Grad in 1990 prescribe the arrangement of the attractive river banks which would allow social and functional integration of all parts of the city area into a unique whole.

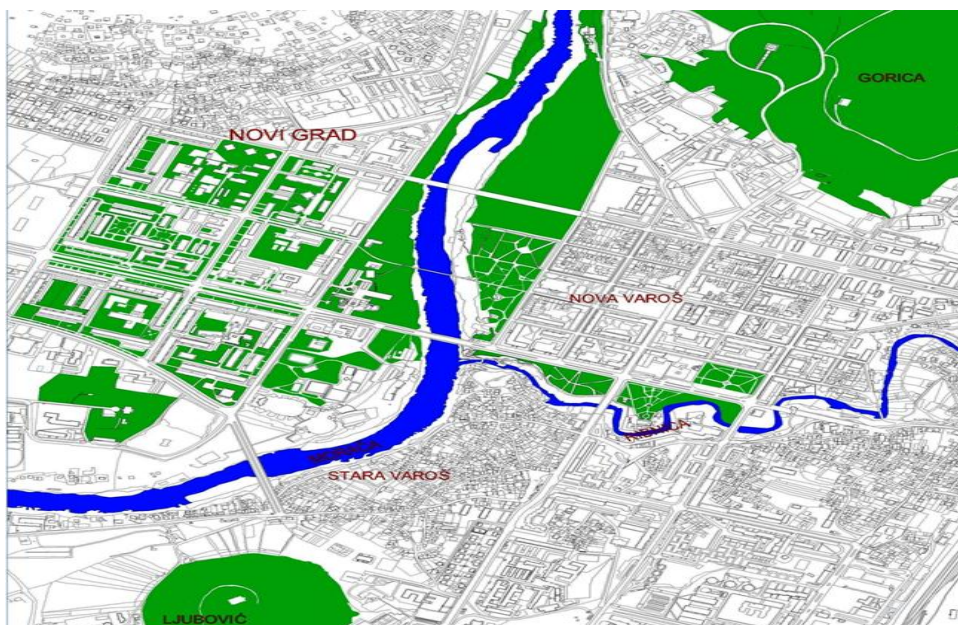


Figure 1, The position of park areas in Podgorica - Novi grad

The necessity of urban reaffirmation of open areas has been recognized in planning documents of Novi Grad. Detailed urban plans from 2006 and 2011

allowed construction on certain unoccupied locations within the blocks, thereby increasing density within the existing and added street network. Moreover, the introduction of tertiary activities in new buildings and in the ground floors of the existing buildings, with the activation of the central functions in contact zones causes an increase of passive transport: parked cars occupying open green areas within blocks, degrading the space created in accordance with the standards of the time in which this part of the city was founded. With a lack of maintenance and inadequate management of green areas, and the very obvious decay of urbanity, it becomes clear that urban regeneration of these important spaces is necessary.

Guidelines for environmental protection prescribed in Spatial urban plan of Podgorica (SUP, 2014.) recognize the need to preserve the environment by identifying the need for determining measures to protect the land from the "pollution by harmful substances (pesticides, heavy metals deposition from air pollution, the effects of acid rain, traffic impacts, untreated industrial water and wastewater from the roadway, waste, accidents, etc.); changes in physical, chemical, biological, microbiological and other characteristics of the soil (a decrease of humus content, soil compaction), permanent conversion (legal and illegal construction of buildings, infrastructure, exploitation of mineral resources), soil erosion (due to inadequate agricultural practices and forestry practices, the consequences of forest fire). (SUP, 2014).

One of the priority measures of soil protection was "development, or updating, and implementation of an integrated program for formation of protective forest plantations in accordance with the measures and programs of other sectors. The realization of other biotechnical measures on reducing the intensity of erosion (care for vegetation cover, maintaining of terraces, etc.)"; As a permanent measure, it is stated: "To perform regulatory measures of use of perennial crops instead of annual plants, as well as the obligation to maintain anti-erosion forests on slopes, and the like."

On the issue of guidelines for landscape design of space, the Landscape Plan has set a target of "effective optimization of space use that ensures the greatest possible protection of natural and cultural values, thus creating the concept of "sustainable development". The plan can also determine development of detailed studies of landscape that include the analysis of a small area or location through:

- identification of landscape elements;
- recognition of significant landscape elements, landscapes and views;
- evaluation of landscape elements;
- vulnerability assessment;
- suitability assessment.

From the standpoint of landscape planning and according to the Spatial urban plan, the term protection of nature refers to activities which "directly or indirectly assist the maintenance and improvement of plants and animals, as well

the protection and improvement their basis of life in the whole area" The very nature protection tends to:

- genetic variation in populations of animals and plants;
- species diversity within the biocenosis;
- biologically diverse landscape;
- long-term care of complex visual images or landscape images.

The planned concept of landscaping of Podgorica takes and develops the concept of the green system of the city set in the General urban plan in 1990, amended by the newly planned green areas taken from the current detailed urban plans.

When creating Spatial urban plan of Podgorica (SUP, 2014), a survey was conducted among citizens and professionals with the aim to assess the current situation and future needs. As stated in Spatial urban plan, it is important that the opinion of citizens and experts perceptions are almost identical to the results of the analytical part, especially in identification of the problem and quality in the area of Podgorica.

Some of the answers to the question "How will Podgorica look like by 2025?" were:

- a modern city in the environment, it is necessary to restore the soul of the city, enrich the public spaces of the city-monuments, fountains, cedars, green oasis-city gardens and alleys, pay more attention to greenery and parks (irrigation systems), to provide the citizens better city life, no vandalism and crime;
- to raise public awareness on environmental issues by enabling citizens to engage actively in environmental protection (to introduce a decree on the arrangement of green areas in peripheral parts of the city, on the improvement of city public spaces, continually educate people and raise environmental awareness);

Some answers to the question "What are the qualities of Podgorica today?" are:

- geographical location and climate;
- the wealth of water and greenery;
- The question "What are the biggest problems in Podgorica today?" was answered as follows:
  - preservation of greenery and municipal sanitation services;
  - water supply and sewage and storm water channeling;
  - We will also mention several responses to the question "In your opinion, what is of the most important precondition for quality of life in the city/suburban area?"

- urban planning in line with the needs of the city (consistent implementation of urban plans);
- healthy environment;
- well-designed and eventful city public space (parks, squares, pedestrian streets);

According to the survey results, most citizens of Podgorica believe it will be a modern city with nice and, in terms of their content, interesting public spaces (parks, green oasis, squares, bicycle and pedestrian paths), with a renewed cultural heritage and identity of urban spaces that make the "soul of the city". That is why it is necessary "to protect the environment and provide a higher quality of life in the city." (SUP, 2014). It is evident that respondents recognized the importance and necessity of preserving and activating the city green areas, as well as raising environmental awareness.

In an independent survey of 86 residents of Novi Grad neighbourhoods, of different age and gender, conducted in autumn 2015 (according to data from the Detailed urban plan of Novi Grad from 2012, there were 16,035 inhabitants in this part of the city, but there is no official data on the number of adult inhabitants) by asking questions about their perceptions and attitudes on the use or possible use of public spaces of Novi Grad neighbourhoods, we got the answers that indicate the importance of public space in the social life of the neighbourhood.

The survey results point to the problem of urbanity, and only:

- 2,6% organize and maintain the space around their buildings;
- 13,9% most often socialize with neighbours in the neighbourhood open space;
- 51,8% of respondents never spend their leisure time in a neighbourhood public, and
- 31,7% of respondents spend some time in the space around their buildings ones or twice a day.
- In most cases, the open spaces near their buildings are considered:
- 39,1% as a public urban space,
- 22,6% of respondents think it belongs to the residents of the surrounding buildings.
- 38,3% of respondents think it belongs to all the residents of Novi Grad neighbourhood.

When it comes to free response questions, predominantly expressed is the need for the higher level of organization and maintenance of park areas (87% of respondents mentioned one or both of these problems).

When answering the question of whether they think that living in this part of the city is a privilege, 83% of respondents gave a positive answer to this question, emphasizing the advantages of the position of the city in relation to the functions and comfort that provide large greenery areas.

The conclusion is that there is a presumed relationship between public space, territorial practice and the space design. It is important to take into account the identified differences in perception and attitudes of respondents in relation to the use and importance of park areas not only for the residents of this part of the city, but also for the city as a whole.

### **Models for implementing ecological planning**

Interviewing the residents of Novi Grad neighbourhoods and all potential users and stakeholders, as well as professionals in the field of architecture/urban planning and landscape architecture, bringing stakeholders to the location and consideration of their views, opinions and recommendations represent an important tool for urban planners.

In the planning literature we can find many examples of research models that are useful in analysing the specific processes of urban design and that are applicable to this specific case – parks in Novi Grad, and thus to a complete park area in Podgorica.

Steiner proposed ecological planning process consisting of 11 steps (Palazzo and Steiner, 2011):

1. Problem and/or opportunity identification
2. Goal establishment
3. Regional-level inventory and analysis
4. Local-level inventory and analysis
5. Detailed studies
6. Planning concept
7. Landscape plan
8. Education and citizen involvement
9. Detailed designs
10. Plan and design implementation
11. Administration

The ecological planning model synthesizes other processes of regional and landscape planning. Its main references are the ecological methods for design and planning formulated since the 1960s by Ian McHarg (Palazzo and Steiner, 2011), which formulated the idea of linking environmental information through ecological knowledge to design and planning decisions by what McHarg called the “layer-cake model.” (Fig.2)

Planning involves managing land use in cities, agriculture areas and forests, in terms of process. The planning and management of natural resources can be achieved by using the principles of a stewardship defined as concern for

the planet, counting on human and individual responsibility in relation to the common good.

According to Sexton (Sexton et al. (1999); Palazzo, Steiner: 2011), the process can be implemented in seven steps:

1. Identify the problem, decision makers, their authorities, the stakeholders, and the decision-making process.
2. Define the problem and refine the objectives.
3. Develop alternative actions to achieve the objectives.
4. Compare each alternative with the objective.
5. Choose a preferred alternative.
6. Implement the chosen alternative.
7. Monitor and evaluate.

The application of the ecosystem approach is mainly used in the implementation of the development, conservation, restoration and rehabilitation, which refers to the urbanized and natural/rural areas. Ecological landscape planning was applied in a similar manner in urban environment. In Europe, the implementation has been focused on environmental problems arising from the rapid intensification of land use that creates extreme competitiveness between agriculture, forestry, industry and urban development, which is understandable given the dominance of the human impact on land and landscapes of Europe. By contrast, in North America the focus is on the planning of the network of habitats and wildlife conservation in rural and natural areas, with special emphasis on the conservation of biological diversity and the sustainable use of land. (Ndubisi, 2002).

Ecological planning emerged in North America during the 1960s through the pioneering studies of McHarg (1969) and others, and then evolved in 1980s.

Steiner (Palazzo and Steiner; 2011) provides ecological planning model and a list of elements, from regional to local, to be inventoried in the design process:

- Regional climate - temperature and precipitation;
- Geology-geological maps to evaluate the suitability of an area as a construction site;
- Terrain - physiography (elevation and slope);
- Water - water budget (precipitation, uses, and groundwater), hydrological cycle, flooding areas, water quality, hydrologic system, water supply, and sewage treatment systems
- Soils - characteristics, soil survey and soil capability classification (the survey particularly helps with understanding land uses and land values for specific activities)
- Microclimate - ventilation, solar radiation, albedo, and temperatures

- Vegetation - plant communities; rare, endangered, or threatened plants; native and disturbance adaptive plants
- Wildlife - species; habitat values; habitat of rare, endangered, or threatened species
- Existing land use and land users - the physical arrangement of space utilized by humans, ownership (public and private), settlement patterns, buildings, and open space types.

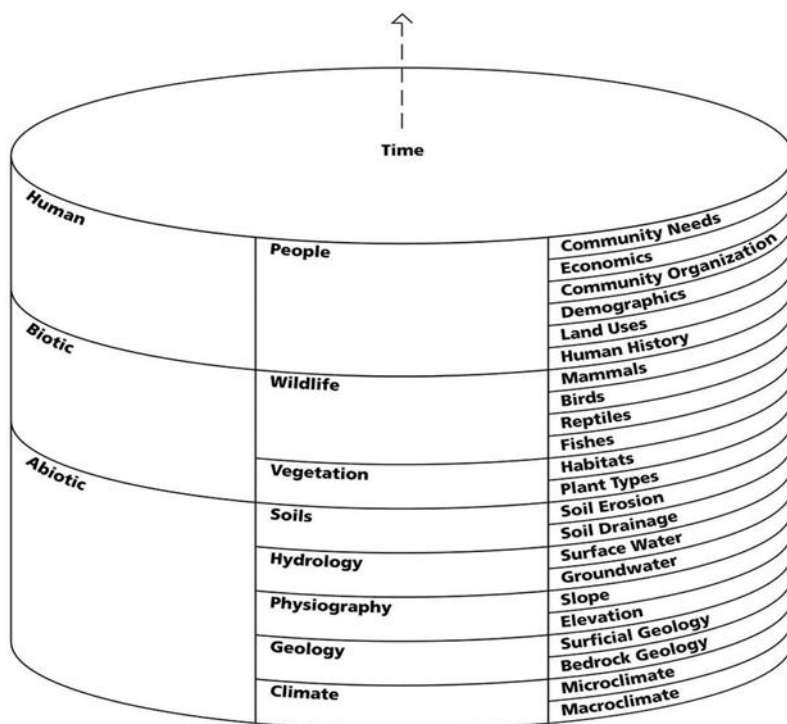


Figure 2. Layer-cake model. (Palazzo and Steiner 2011)

The **ecological footprint** concept that was developed by Wackernagel and Rees (Palazzo and Steiner, 2011) involves measuring the consequences of human actions, especially in urban uses, on ecosystems. The analysis compares the resources needed to support the project with nature's ability to regenerate those resources and to produce ecosystem services. As a result, the designer could estimate demand for water, food, and energy as well as waste and carbon produced by the project. The ecological footprint measures the impact of consumption and subsequent waste discharge by converting impact variables into the single unit of land. This includes land appropriated by fossil energy use, the built environment, gardens, crop land, pasture, managed forest and land of limited availability, including untouched forests and non-productive areas. This

concept could be applied at various scales, but at the urban level, this approach can be used to calculate the equivalent amount of land consumed in order for a city to function.

Presented survey results shows the differences in perception and attitudes of respondents of Podgorica's district Novi Grad in relation to the use and importance of park areas, but also indicate the overall importance of educations of citizens about urban ecology and the consequences of human actions on ecosystems.

Those models of ecological planning incorporated in planning documents, with education and active participation of citizens and all stakeholders can significantly contribute in terms of evaluating the existing system park areas, determining the needs of urban regeneration of open public spaces and setting goals and standards for the future green areas within the city districts.

### CONCLUSIONS

The specific character of the location determines the prevailing conditions and directs the ecological approach in urban planning. The tendency of integration of natural and cultural characteristics in the self-sustainable system will support the desire to promote the location condition.

Urban environmental development is important for the sustainability development of an urban environment and it should be considered at all stages of urban planning and design. The main research results are as follows:

- To present a suitable method for the evaluation of the development strategy from the environmental point of view.
- To prepare the indicators and factors for the development of the urban scale evaluation in order to achieve a form of sustainability.
- Method of population participation in the evaluation may lead to easier environmental problems detection.
- Knowledge of all environment characteristics as a guiding principle in urban regeneration of space defines a strong sense of place and identity.

The existing awareness of the role and importance of green spaces in the urban environment and recognition of the need for urban regeneration in the light of modern technological progress and social change, imposes the application of the principle of an effective urban ecology model.

With the aim of finding the guidelines for the urban revitalization of public open spaces and park areas, further investigation and identification of the citizens preferred modes of use is needed, along with constant research on the effects of such uses to the existing ecosystem.

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