

## INTERACTION OF NATURE AND ARCHITECTURE

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**Abstract.** *With the emergence of a large number of cities, new environmental problems arise. Such problems include: air pollution, noise pollution, increase in the average temperature of the city, the release of large amounts of carbon dioxide and high electricity use. As a consequence of these factors, the city's ecosystem may deteriorate and also cause health problems for people. To reduce the negative effect, city authorities are introducing many innovations aimed at cleaning up urban space and reducing the impact on people and the planet. One such way is to preserve the natural ecosystem of cities (such as parks), while also introducing new systems (such as vertical gardens and facades). This work underlines the significance of the positive impact of green spaces on cities and describe some of their types.*

**Keywords:** *green space, heat island effect, pollution, urban ecosystem, vertical gardens*

### **Introduction**

Currently, more and more people are moving to live in urban areas and this number is constantly increasing. More than half of the world's population now lives in towns and cities, and by 2030 this number will swell to about 5 billion [1]. A large number of residents causes more and more environmental problems, such as air and noise pollution, high use of energy resources, which negatively affects the city's ecosystem and, accordingly, the quality of life of people. That is why recently cities have been actively introducing green spaces, such as parks, alleys, vertical gardens and facades, as well as preserving and improving existing ones. Preserving natural areas within city limits will slow habitat destruction, conserving the ecosystem as cities expand [2].

At the global level, there are the Sustainable Development Goals promoted by the UN. These goals are aimed at improving human life and protecting the planet. UN Sustainable Development Goal №.11 is: Sustainable cities and communities, which emphasizes the importance of increasing the introduction of green spaces into the urban ecosystem to improve the quality of life and protect the planet [3].

### **Urban Green Space**

Urban green spaces are open spaces reserved for parks and alleys in an urban area, which form an important part of it and serve various purposes: from economic to the physical and emotional well-being of a person. Urban green spaces can range from smaller green space features such as street trees and roadside vegetation to larger green spaces that provide various social and recreational functions, like parks, playgrounds, greenways and urban woodlands, and larger blue spaces like ponds, coastal zones, riverside footpaths and beaches [4].

Green space can bring a number of positive impacts to urban areas. In cities there is such an effect as the "Urban Heat Island Effect", which is caused by high energy consumption and a large number of surfaces that absorb solar heat [5]. Urban heat island effect can increase urban temperatures by 5°C [6]. In this case, it is necessary to use green spaces that will provide the city with the necessary amount of shade and reduce the overall temperature of the city, which helps reduce energy costs used to cool buildings. This method is widely used in Tokyo, where the

temperature of concrete surfaces can rise to 55 degrees in mid-summer. One of the most famous examples is Roppongi area, which is home to many companies and offices, but is full of nature with numerous parks and gardens [7].

Populated areas also experience high levels of noise pollution from traffic and other sources, which can be stressful and creates health problems for people. Urban green spaces in overcrowded cities can largely reduce the levels of noise depending on their quantity, quality and the distance from the source of noise pollution [5].

Another area that is associated with pollution is air pollution, which occurs through the release of carbon dioxide, various chemical substances and simply dust particles. In this case, green spaces also play an important role, because they convert carbon dioxide into oxygen. Thus, the more plants there are in the city itself, the cleaner the air will be.

There are also a number of psychological reasons: firstly, green spaces provide a great proportion of the total outdoor leisure opportunities [5]. Secondly, being in the fresh air improves a person's psychological and physical condition. People who were exposed to the natural environment, the level of stress decreased rapidly as compared to people who were exposed to the urban environment, their stress level remained high [6].

To conclude this topic, we can also add that green cities are becoming more and more attractive to live in. Such cities attract large financial investments for further development, which contributes to rapid economic growth, as has happened in Singapore and Kuala Lumpur, Malaysia [5].

### **Vertical Gardens and Facades**

Often in large developed cities there is not enough space to set up gardens or parks, so in such cities vertical gardens and facades are becoming increasingly popular. As mentioned earlier, vertical gardens absorb some of the solar radiation, which reduces the energy costs for cooling buildings. In addition, they improve the aesthetic perception of buildings and help improve a person's mood and condition.

A very simple way to grow an urban garden is to use climbing plants with metal grids and cables where the plants cling to and grow, creating a vertical vegetation cover. There are usually small stalls, where substrates are inserted for plant roots to develop. A light structure of galvanized metal or stainless steel, resistant to weather and corrosion, is usually spaced between 5 and 20 cm from the facade, allowing the plant to grow with an ample amount of free space [8]. Good examples of this method are buildings such as: School of Arts in Singapore and Amazon Spheres in Seattle, USA.

Another popular type is green walls or "living walls," which consist of container plants or modular green panels placed across the wall. For green walls, herbaceous and shrubby plant species are usually used. There are different types of green wall systems. For example, in a substrate-based system, plant growing media are packaged in containers and trays can be used to collect runoff water. In hydroponic systems, plants are attached to an inert medium, such as a felt mat or garden foam, which holds moisture for the plants to use [9]. Such walls can be either open or closed. A good example is Tower Four at Collins Square in Melbourne.

### **Conclusions**

Green spaces are socially responsible because they provide a range of benefits that contribute to improved physical and mental health, a healthier and more sustainable built environment, social interaction and community building, and economic development. By prioritizing the creation and maintenance of green spaces, we can create more livable and equitable communities for all [10].

We gave the definition for 'urban green spaces', identified positive aspects for the environment and the quality of human life. Were named alternative ways of greening cities. Were given real examples of successful implementation in the urban ecosystems.

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