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Nicolai M. Demin (deminmaster@gmail.com)

orcid.org/0000-0002-3144-761x

Kiev National University of Civil Engineering and Architecture

Olga O. Mykhailyk (mykhailykolga@gmail.com)

orcid.org/0000-0003-3648-9410

State "Research and Development Design Institute of Urban Development", Kyiv

Water areas and the city: problems and principles of their coexistence

Obszary wodne i miasta: problemy i zasady ich współistnienia

Abstract

This article examines the prevalent state of river ecosystems in the forest-steppe area of Ukraine with special focus on preservation methods and the revitalisation of river ecosystems in the coastal territories.

Keywords: coastal territories, river ecosystem, natural factors, urban development, revitalisation measures

Streszczenie

W artykule przeanalizowano powszechny stan ekosystemów rzecznych w leśno-stepowym obszarze Ukrainy, ze szczególnym uwzględnieniem metod konserwacji i rewitalizacji ekosystemów rzecznych na obszarach przybrzeżnych.

Słowa kluczowe: terytoria przybrzeżne, ekosystem rzeczny, czynniki naturalne, rozwój miast, środki rewitalizacji

1. INTRODUCTION

American urban scientist Lewis Mumford defined the concept of a city as follows: "This is a geographic plexus, an economic organisation, an institutional process, a theatre of social action, and an aesthetic symbol of collective unity. The city promotes art and as an art it creates a theatre. It is in the city itself, as in the case of theatre, human actions take place through conflict and cooperation between individuals, events and groups and thus concentrate and reach their expression in important climaxes"[1]. Mumford has consistently argued that the physical plans of cities and their economic functions are secondary in their relation to the natural environment and the social and spiritual values of the given community. In a complex urban environment, preserved natural areas constitute nutrition and protection for people, a source of renewal of vital energy.

2. MODERN PROBLEMS OF RIVER ECOSYSTEMS

The rivers and water bodies in cities enrich the urban environment: they are means of formation and conservation of landscapes, and they are a health resort destinations because they moisten the air with convection currents, splashes, ionisation background, and they enrich the flora and fauna of the city. The modern practice of urban planning does not significantly contribute to the solution of problems regarding the protection of balanced, rational and harmonious urban use of coastal areas: construction near the rivers is haphazard, and a large percentage of it is covered with hard concrete. The aesthetic level of industrial and communal warehouse development is low, forming a panorama of the city from the river and from residential and public areas with an absence of green zones in the coastal strips and an absence of lawns and gardens. Embankments in modern cities are narrow strips with dense construction in the built-up multifunctional territory; they are transport corridors rather than places of promenade: the promenade of the Danube in Budapest, and the embankment of the Vltava river in Prague, the banks of the Seine in Paris, the embankments in the historical areas of Moscow and Saint Petersburg, and Naberezhno-Khreshchatytska street in Kiev (Ill. 1). The transformation of the coastal areas of the city from the former embankments, port warehouses, industrial premises and industrial zones to the wealthiest areas is the greatest visual manifestation of gentrification – the modern trend of 'ennobling' (from the English 'gentry' – 'noble people', 'nobility') urban space by investing to increase its attractiveness for the wealthy population.

The coastal areas which are adjacent to urban roads, industrial enterprises, residential areas, and where there are parking lots and landfills, are in the worst condition. Many rivers have changed their course due to urbanisation. The riverhead is under construction, the surface flow has changed, the river bed is straightened, chained in trays (Ill. 2), or in

underground tunnels. Coastal protective strips are reduced to 1–2 rows of trees along the coast and consist of such tree species that do not perform a protective function.

There are outlying coastal areas that are in a degraded state: there is an absence of shore verdurization, and the presence of a built-up and reforested floodplain that deprives the coastal areas of their natural water-protective function. The rivers are devoid of natural biofilters as a result of excessive ploughing and construction of coastal areas which provide unobstructed access of surface contaminated wastewater to the stream, an increase of soil erosion, and polluted water areas, and thereby results in violations of the natural regime of rivers. The strait of the channel is accompanied by frequent flooding, which leads to blurring and flushing of soils, coastal destruction, and the flooding and bogging of reclamation systems. Often, the embankment collapses at the turning points of the river flow, where the dynamic axis is close to the banks, which are often eroded and convex, especially during the flood period. Blur occurs at the moment when the upper layers of water are directed to the shore, which descend to the bottom and return to the middle layer of the bed. In the reverse direction of the flow, there is a steady state of the banks[2]. The most degraded are the ecosystems of small rivers, the least degraded are mountain rivers with significant dismemberment of the relief and shallow occurrence of crystalline rocks[3].

Anthropogenic activity plays the role of a catalyst for natural processes and leads to negative consequences that gradually accumulate, but eventually accelerate and the accumulated amount passes into a new quality (the law of emergence in ecology). Such a transition is accompanied by irreversible processes in ecosystems, which causes the emergence of environmental disasters. Anthropogenic loading on river basins leads to significant changes in morphology, the dynamics of the river bed, the hydro-biological conditions and the water chemistry. As a result of the discharging of untreated wastewater, the pollution of atmospheric air, soil and vegetation, the river microclimate and the coastal landscape are changing.

Large-scale drainage reclamation has led to a decrease in the area of wetlands (especially in Polesia, the natural edge of swamps), the reduction of groundwater levels, and the destruction of forests, which directly affected the reduction of the number and unification of flora and fauna. Thus, the oak forests of Polesia and Forest-steppe have been replaced by low-productivity birch, hornbeam and maple forests. The average forestry in Ukraine is 14.3% and, unfortunately, this is the smallest of the countries of Europe[4]. In such modern realms, water areas with their coastal areas require protection and revitalisation. In order to reduce the negative impact of industry on river ecosystems, it is necessary to adhere to the limit values with regard to the anthropogenic load. In order to introduce innovative technologies of integrated and non-waste natural resources, it is necessary to carry out reclamation and revitalisation measures for useful purposes.

3. PRINCIPLES OF URBAN DEVELOPMENT OF COASTAL AREAS IN UKRAINE

The compact planning of cities reduces the valuable coastal areas. It is widely perceived that the urban space and the coastal zone should be aesthetic and expressive. While planning the organisation of cities, it is necessary to take into account the principle of aesthetics and expressive panoramic surroundings which is sufficient size of open coastal area is maintained. Built-up areas and open space should be the main considerations while planning coastal area development.

While engaging in the architectural planning of the coastal area, it is important to consider having maximum open space towards the coast. In this architectural ensemble, the water area is dominant, and the coastal area is dependent on it. The architectural and compositional construction of the coastal zone should be part of the overall composition of the city and create a single visual and complex 'apartment-coastal zone-water area', which is oriented towards the surface of the water.

3.1. CREATION OF WATER-GREEN SYSTEMS

The ecological balance of reservoirs becomes much more effective when combined with green plantations. Greenery enhances the oxygen percentage in the localities – this significantly cleanses the atmosphere of harmful impurities, protects it against wind and overheating, and reduces the amount of evaporation. Landscape design should create alternating closed and open spaces with the help of green groups and decorative solitary trees, natural 'windows' with the disclosure of near, medium and long distances and scenic landscapes. When creating panoramas of landscapes, prime consideration should be given to water surface and plantations. The assortment of plants for the coastal zone should take into account factors such as: geobotanical zoning, soil conditions, the ratio of plants to air humidity, insolation, growth rate, gas resistance, the possibility of fixing slopes and ravines with trees and bushes, plant size, plant crown shape and its transparency, availability in plants of thorns, colouring of leaves and corms, time of appearance and fall of leaves[5].

By increasing connectivity in various parts of the city (Budapest) and increasing economic power, the interconnected decision of urban and suburban green spaces creates environmentally sustainable and efficiently functioning water-green systems settlements. For settlements in small and medium-sized cities, the formation of water-green systems should be of a simple style, where planting along the main river is an important consideration; the formation of water-green systems of large cities should be limited to the creation of a water-green diameter with harmoniously connected additional water-green arrays. The water-green diameter of the large parks of the largest cities should be associated with linear water-green arrays.

The recreational value of urban water areas is increasing with the presence of recreational infrastructure – organised beaches, ship stations, berths, catering, hire, entertainment,

sanitary facilities and medical care. When organising zones of short-term rest in the coastal areas, the coast should have dry areas with a natural landscape without steep slopes; the bathing area should have a depth of 0.5 to 2 m, a width of 20 to 50 m; the beach should be of sand, small gravel, husked soups. The optimum flow velocity should be 0.3 to 0.5 m/s; the most comfortable water temperature is 18–24°C. Sandy beach strips are better located in the middle of a comfortable climate zone. To neutralise the heat cells that are created in the open coastal zone due to the influence of the reservoir, due to the relaxation of air circulation and the decrease of humidity. Where direct solar radiation increases (i.e. perpendicular to the line of water) it is necessary to plant high-skid elongated woods having a wide crown that will facilitate the free movement of air flow from the water body to the coastal area. This will lead to significant increases in the recreational value of water areas and the presence of forests or forest bands on the shores. The creation of water parks involves the lack of traffic (especially transit) and the lack of industry. Such measures, which are based on methods and techniques of increasing the level of tourists, will increase the formation of aesthetic and investment attractiveness of coastal areas.

Town-planning regulation for the development of the coastal area is based on the principle of classification of the territory into natural and functional zones. Classification of territory into zones is characterised by different regimes and parameters for the functional use of the coastal area, the primary objective of which is to preserve the natural state of the water bodies. Guidelines DBN B.2.2-12: 2018 'Planning and Developing of Territories' and 'Green Lines' enable solving these problems. One of the ways of regulating urban development and economic development of the coastal area is the establishment of restricted zones I, II, III categories of protection of the ecosystem of the river. The green line is the boundary of the regulation line which limits the ecosystem of the small river in order to preserve its integrity. The green line delimits the zone of protection of the river and coastal area: the protection of ecotones (zone I of protection category), the protection zone of the floodplain – limited (zone II protection category) and anti--erosion zone (zone III protection category), the size of which is determined by the degree of coastal area. Each small river ecosystem is a unique natural phenomenon, so the definition of the green line should be individual in nature. Determining the limits of the protection zone of the coastal area – the green line I, II, III categories of protection – belongs to local communities.

4. INTERNATIONAL EXPERIENCE OF COEXISTENCE OF WATER AREAS AND THE CITY

The condition of rivers in Ukraine require urgent measures for revitalisation. Channels are regulated by rocks, which turns the river into a cascade of ponds. Due to the performed large-scale drainage reclamation, water is polluted with sewage and sludge, the rivers lose their natural mobility and die. International experience shows that the river ecosystem may be partially or completely revived; it is already possible to see the results of revitalisation

programs of coastal areas around the world. In the state of Michigan (USA), a beautiful park on the Belleville Lake was created on a narrow coastal strip in the valley of the Goury River, which flows into Lake Ern. The contour of the coastline was developed by increasing the protruding sections of water and creating a system on peninsulas and capes in a picturesque form and an extension of the coastline and an extension of the park. In the immediate proximity to the water, there are playgrounds and beaches connected by a system of footpaths and horse-riding trails. The focal point of the park is a beautiful fountain (Ill. 3).

In Germany, the reconstruction of water passageways basin has been performed. Since 1994, a plan for the areas of the river Rhine has been developed. The plan for the organisation of the river Netskar valley plain, where the river forms the axis, has been conducted. Zoning at the district level with the allocation of zones of a 43e axbiotope-forming purpose, strictly regulated nature conservation purpose has been performed and certain sections of the river have been identified as the main outlets of surface drain flow. The territorial historical and natural axes are allocated. The next stage was the development of local project proposals at the level of individual cities and districts. Baden-Württenberg has undergone work on the removal of harmful plants, the landscaping of coastal areas, reconstruction, and the clearing and rehabilitation of small river basins: Netsar, Murr, Phils, Elzentz, Porinz, Krajh, etc. Improving the watercourses that feeds the main river has had a positive impact not only on the general condition of the Rhine River but also on the coastal areas of the whole basin. This made it possible to restore the recreational potential, to get new places of recreation in close proximity to places of residence. Planning works were performed at different territorial levels, and often already developed territories, for example, the district of the city of Karlsruhe.

In 2000, a port area on the islands was reconstructed in Hamburg in the middle of the river Elbe. In addition to homes and offices, the Philharmonic and the Maritime Museum were created here by means of the reconstruction and adaptation of old warehouses. In Amsterdam, in 2003, a large-scale transformation of the old port areas into residential and public areas began. Built in the year 1899, in Vienna on the waterfront, gas pipelines were converted into public and residential buildings. The 20 million euro spent on the revitalisation of the Ljubljana River in Slovenia has not only paved the banks, but also created a number of public spaces related to the river and the possibilities of organising public life around it.

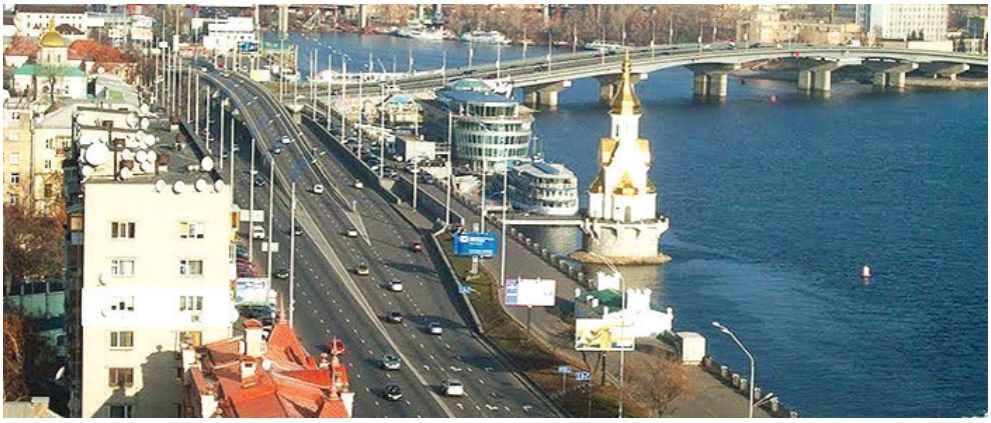
The ecological principle lies in the creation of tourist waterways and ecological museums. The creation of the ecomuseum is based on the regional identity of the landscape and on the authenticity of the region, and the cultural space is organised on the basis of the historical and cultural traditions of the region. The beauty of nature and the organisation of attractive infrastructure helps you to relax in your native land, getting to know its authenticity, culture and nature. The first ecommission was created in Le Krezau in 1974 by Frenchman Hugo de Warin in 1971. The creation of ecomuseums has become widespread in Poland, in Dolny Śląsk and Babia Góra, Lanckorona, Opatów-Iwaniska, Tarchalice and Lubiąż on the Odra; in Sweden, Falbygden-Ätradalen; and in France and Japan, etc.[6]

5. CONCLUSIONS

The contemporary development of Ukraine ranges from parks and techno-parks at micro level, which are basically micro level fragments of the urban environment to software that covers larger areas of macro level development. This also applies to the formation of a coastal zone – the spatial and functional transformation of the urban environment, organic and aesthetic harmonisation and preservation of the natural potential of areas for recreation, psychological comfort and ecological rehabilitation. The organisation of the planning of most projects is connected with the problem of the organisation of cultural space, with priority being given to human and natural values. This kind of planning is particularly reflected in the conceptualisation of recent projects designed for the purpose of humanising the environment of highly urbanised territories. The organisation of coastal zones needs to be improved in order to restore the damage caused to the environment and hence create conditions for the harmonisation of the environment. Environmental measures need to be implemented in a comprehensive manner and direct them across the catchment basin – a basin principle that will contribute to preserving the system's integrity of the river ecosystem. Saving the small river basin is key to maintaining the status of the catchment basin of the middle and large rivers. Only the river, in the valley of which are the most preserved natural complexes, is capable of complete self-regulation and self-purification.

People need to learn from nature: to observe its harmony, integrity, interconnections, to adhere to the laws of nature, and to maintain its consistency and beauty. There is nothing superfluous, everything makes sense, and existing connections in ecosystems work to maintain and extend life processes. Thus, any natural and artificial coast is a complex system with elements of self-protection of the coast and engineering protection of the coastal area should take into account the principle of natural analogues: the closer the constructive approach to coastal protection structures are to the elements of self-protection of the shore, the more reliable they are in operation. Nature is always alive; it is more sensitive and wiser than us. Restoration and conservation of coastal areas is an important link in the environmental balance of the environment. With regard to your country, of utmost importance is the preservation of the priceless remains of the primitive nature of Ukraine in general and the specific component of this global program is the restoration of river ecosystems, which are a natural decoration of our region. BC Herodotus, when describing Scythia, was impressed with the beauty and grandeur of our rivers and noted that "here the rivers are numerous and majestic".

Translated by Maya Martynchuk and Evgen Vasiliev



Ill. 1. Naberezhno-Khreshchatytska street in Kiev, 2018

Ill. 2. River Lybid in Kiev (photo by Olga Mykhailyk, 2018)

Ill. 3. Fountain Park on Lake Michigan Belleville, USA
(photo by Olga Mykhailyk, 2015)

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