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Sustainable Landscape Between Buildings

MAJERSKA-PALUBICKA Beata[1, a *]

[1]Faculty of Architecture, Silesian University of Technology, Akademicka 7, 44-100 Gliwice, Poland

[a]beata.majerska-palubicka@polsl.pl

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Abstract. Currently, there is a tendency in architecture to search for solutions implementing the assumptions of the sustainable development paradigm. A number of them are components of architecture, which in the future will certainly affect urban planning and architecture to a much greater extent.
An issue of great significance is the need to integrate sustainable system elements with the spatial structure of environmentally friendly architectural facilities and complexes in order to achieve harmony between the built and natural environment, which is a basis of sustainable development. In this article, the author would like to solve the problem of how to design buildings, housing estates and towns so that their impact on the environment will be acceptable, i.e. will not exceed the possibilities of natural environment regeneration.

Introduction

The contemporary model of life, highlighting nonchalance towards Nature, has led to a wasteful exploitation of raw materials, the production of pollution and toxic waste, expansive use of soil and waters and, in consequence, natural environment degradation. Moreover, the progressing urbanization leads to the development of transportation and uncontrolled occupation of areas for development, thus drastically reducing the size of biologically active areas. This creates significant threats to both human development and natural environment, which is already finding it hard to neutralise and absorb the waste and pollution. As hindering the development is inadvisable, or simply impossible, it is necessary to make it sustainable.

In the field of shaping architecture as an important element of sustainable development including the ecological, economic and social aspect, it is necessary to introduce a number of changes – starting with a change in the system of values and needs, through a change of the quality of social spaces and structures, and finishing with a change of users' and designers' mentality. This generates changes in design goals. Currently attempts to improve the environment are already being made, especially in the context of reducing the consumption of energy and raw materials, application of renewable energy sources and a reduction in the emissions of greenhouse gases to the atmosphere. However, it is still necessary to enhance care over the quality of the environment and to improve the quality of urbanized areas' landscape by changing the approach to the management of land, biologically active areas and surface waters, which leads to the process of sustainable development of areas around buildings.

Use of urban space and structure for the purposes of improving the quality of built environment

Impervious surfaces in towns, such as streets, pavements, downtown squares, car parks as well as building roofs, hinder the development of biologically active areas by worsening the natural hydrological management. Rainfall on urbanized areas is usually discharged to rain sewage systems, which results in their complete loss and in the context of global shortage of clean water for household use, creates a situation that poses a significant threat. Rainwater should therefore be treated like goods of nature, a precious raw material, and not like sewage waste, whereas biologically active areas, which develop thanks to rainwater, should become a public good.

A priority for sustainable activities undertaken on the premises of housing estates and towns is to eliminate impervious asphalt, concrete and plastic surfaces in order to obtain a greater biological diversity as well as to improve hydrological, microclimatic and landscape conditions. There are numerous possibilities of sustainable land development. Their common feature is primarily the minimization of man's influence on natural environment and his intervention in the soil morphology and landscape, which involves attempting to restore naturally occurring processes that consist in:
- infiltrating the biologically active areas which need to be designed and maintained as well as increasing their share in the total surface area of urbanized terrains and systems of pipes, drainage, open and closed ditches so as to enable the flow and absorption of water.
- retention related to the designing of open or underground water reservoirs, depending on the level of investment and land development as well as development density. Other elements of land development which are important for retention include absorptive ditches, wells, water holes, retention ponds, gardens and greens with plants resistant to temporary flooding with rainwater, integrated in extensive systems for urbanised areas drainage, swamp ecosystems, which at the same time purify water or systems of flower beds directly connected to drainage systems as well as adsorption reservoirs for periodical inundation, purification or evaporation of rainwater [1].
- transpiration and purification that consist in applying properly selected species of plants, the so-called plant passageways, which are a natural system of filters on retention and adsorption areas [2].

The solutions can be divided into three basic groups:
- landscape solutions, related to the shaping, protection and development of biologically active areas and water management, which consist in designing systems of infiltration, retention, transpiration and purification of waters in a particular area,
- technical infrastructure solutions, related to sustainable design of drainage systems and the surface of transport roads and other hardened areas,
- architectural solutions involving design of natural green elements integrated into the structure of facilities in a form of green roofs, terraces, walls and elevations.

When related to the context of place and integrated into the systems of housing estates and town space, the landscape solutions take a form of greens, public parks, housing estate parks and landscape gardens, playing a role of recreation areas. Their major function, related to infiltration, retention, transpiration and purification, requires large surface areas, so they are created on the edges of built-up areas and, in consequence, constitute an element linking the urbanised and natural landscape, which does not mean, however, that they are not adjusted to and created in densely developed areas.

The slowing down and reduction of rainwater flow is related to the threat of creating a malarial microclimate and multiplication of mosquitoes, therefore it is important to enable the area airing and purification, first of all by using the existing wind rose, applying the properly selected elements of small architecture and adequate location of buildings.

Architectural solutions in the context of shaping a microclimate of urbanised areas play a more complex function. On the one hand, they are a building element (for example facades, roofs) and, on the other hand, similarly to landscape solutions, they are fragments of biologically active areas of housing estates and towns [3, 4].

Both landscape and architectural solutions are supported by technical infrastructure solutions, which should be based on a natural hydrological cycle.

Examples of constructions

A characteristic and most known example of sustainable shaping of area development is BedZED housing estate, built on reclaimed post-industrial areas in the district of Beddington in London (Fig. 1), in which the basic assumption was to erect buildings that are energy self-sufficient and, therefore, do not emit pollution into natural environment and to restore biologically active areas the size of which would equal the surface from the time before the housing estate was built. It

was achieved by replacing technical solutions with natural ones, integrated into the structure of buildings, such as the use of natural greenery on building elevations as shading elements, designing green roofs and gardens on roofs – sky gardens, and leaving maximally big natural green areas between buildings (Fig. 2). Where it was impossible, pervious surfaces were applied so as to enable infiltration and retention of water in the area [3, 5].

Fig. 1 BedZED – sky gardens on the top of buildings (Photo by J. Ciechanowski)

Fig. 2 BedZED – natural green areas between buildings (Photo by J. Ciechanowski)

Currently there are more and more examples of such housing estates, e.g. Heerlen near Mastricht, Theodor Korner Strasse in Graz, Wilhemsburg Mitte in Hamburg and others. In Theodor Korner Strasse housing estate the high standard is reflected in the use of natural local materials and functionally designed flats with green terraces on building roofs. It is also visible in the integration of buildings into the existing green areas and leaving maximally big biologically active areas in a form of lawns, green roofs and surfaces hardened with pervious materials [3].

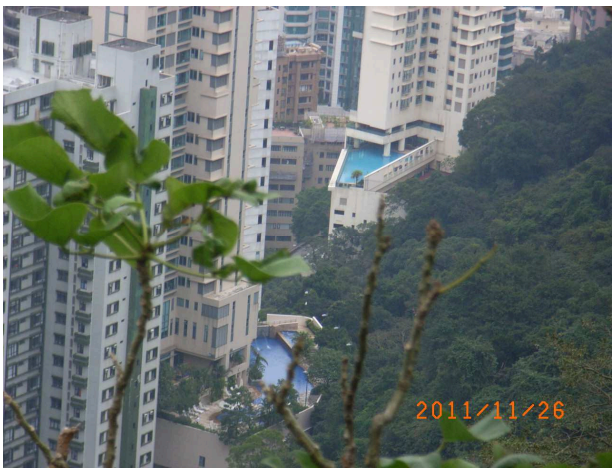

Fig. 3 Hong Kong – green enclaves in a big city (Photo by B. Majerska-Palubicka)

Fig. 4 A downtown park in one of Hong Kong districts (Photo by B. Majerska-Palubicka)

Such activities are a consequence of the sustainable life concept, which assumes favourable conditions for both man development and the existence and development of natural environment, e.g. by leaving ecological corridors for fauna on built-up areas in order to ensure animals a possibility of moving between their typical habitats. This takes place both in low plot ratio areas and in the centres of big towns, where green enclaves (biologically active areas, gardens, parks, water reservoirs, fountains, green roofs and building elevations as well as greenery on the ceilings of

underground structures and others) incorporated in urban development systems are an important element which improves the local microclimate (Fig. 3, 4).

Sometimes building elevations in the centres of big urban agglomerations are an extension of public recreation areas in the vicinity of which they are located. This is the case in Fukuoka (Japan), where green areas with small architecture elements – an amphitheatre, a system of paths and contemplation spots have been created on the elevation of ACROS building having a terrace construction. There is also a possibility of going out directly into the biologically active area of the elevation, whereas from the side of a busy downtown street the building forms a part of the big-city development (Fig. 5, 6) [6].

Fig. 5 ACROS Fukuoka – a green elevation (Photo by B. Majerska-Palubicka)

Fig. 6 ACROS Fukuoka – an elevation from the side of the street (Photo by B. Majerska-Palubicka)

Benefits resulting from sustainable development of urbanised areas

In sustainable design the ecological, social, economic and aesthetic aspects, resulting from sustainable development, are equally important. For this reason, the benefits resulting from activities related to sustainable development of urbanised areas should be considered in a broader range of aspects important from the point of view of sustainability:

Ecological benefits:

- reducing the effects of hydrological cycle disturbances caused by any human intrusion in natural environment,
- extension of biologically active areas as well as increasing the biodiversity and, in consequence, the development of fauna and flora on urbanised areas,
- reduced risk of floods and uncontrolled inundation of areas,
- reducing the effects of the phenomenon of urban heat island, improvement of the microclimate and air quality on urbanised areas.

Social and economic benefits:

- ensuring an accessible and user-friendly environment, the infrastructure of which integrates into the environment context, which is related to the regulation of the Preamble of the Conference on Environment and Development, stating among others that human beings have a right to a healthy and creative life in harmony with nature,
- improving the quality of housing estate and town areas with regard to aesthetics and functionality,
- reducing the demand and consumption of water owing to its re-use for the purposes related to household needs and irrigation of green areas,
- lower expenses for the systems of optimal microclimate maintenance inside buildings thanks to the improvement of town environment microclimate (temperature, humidity, air cleanliness),

- reduction of incidence of allergies and respiratory system diseases among the inhabitants and improvement of their physical and mental state,
- increasing the efficiency of work and reduction of absence,
- improving the quality of living on urbanised areas.

Aesthetic benefits:
- human-friendly social spaces that create a safe and healthy living environment,
- innovative, highly aesthetic architectural and building solutions with elements of green roofs, terraces and elevations.

Summary

In the context of environmental threats caused by excessive consumption, the spreading of urbanisation and transport system extension, the designing of sustainable land development becomes an important process enabling the lost balance between the natural and built-up environment to be restored. Care over biologically active areas as well as collection and utilisation of rainwater is a way to ensure sustainable development of urbanised areas, bringing ecological, social and economic as well as aesthetic benefits, which fulfils the basic requirements of sustainable community development.

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