

# IMPROVING URBAN ECOSYSTEMS BY INCREASING THE NUMBER OF VEGETATED ROOFS

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## Abstract

Urban ecosystems are often characterised by a lack of greenery. This results in a deteriorating environment for citizens, but also in the extinction of many animal and plant species. One solution that is being offered is to gradually increase the areas covered by vegetation, especially on buildings that are often otherwise unused.

The article analyses the possibilities of using all possible green areas with practical examples.

## Keywords

Vegetated roofs, biodiversity, urban ecosystem, sustainability, blue-green infrastructure

## 1 INTRODUCTION

With increasing urbanisation around the world, urban sustainability has become one of the biggest challenges we face as a society. The urban ecosystem is significantly different from natural ecosystems. Cities are characterized by an increased proportion of unnatural materials such as concrete, asphalt and metal that outweigh the original natural elements. Artificial surfaces absorb and retain heat, contributing to the so-called urban heat island (UHI) effect [1]. This is manifested in cities by increased temperatures compared to the surrounding landscape (Fig. 1). In smaller cities, these differences can be as low as 1–5 °C in summer, while in large cities, the temperature difference can be as high as 10 °C.

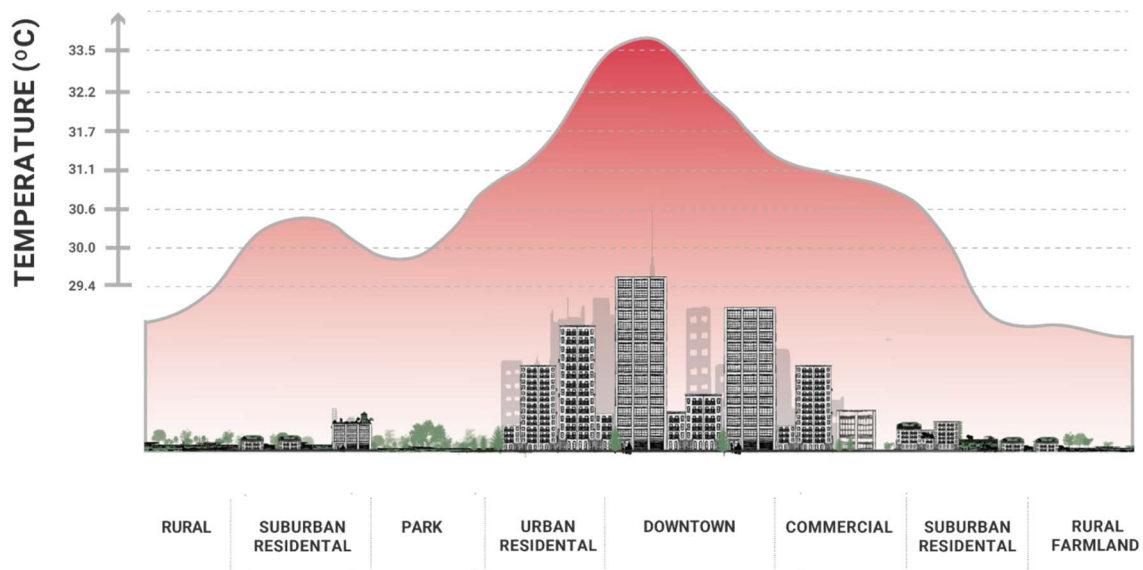


Fig. 1 Urban Heat Island Effect Profile, [1].

Urban operations (transport, industry, energy consumption, supply, waste) lead to an increase in the production of pollutants. These contribute significantly to increased emissions of greenhouse gases and other air pollutants. Deteriorating air quality and the loss of green spaces affect biodiversity, microclimatic conditions, soil processes and the hydrological system in cities.

Through sustainable urban planning and the implementation of green infrastructure in cities, we can minimise these negative environmental impacts of urbanisation [2].

The size, quantity and quality of green spaces are important for maintaining ecosystem function. Areas with a larger area and therefore a greater diversity of habitats have a positive impact on the biodiversity of the area [3]. Smaller urban parks are often too small to maintain biodiversity and therefore it is necessary to maintain the connection between the green spaces within the city and the ecosystem that surrounds the city. The ideal form of green space arrangement beneficial to the urban ecosystem is a system of larger, but also smaller parks linked to bio-corridors [4].

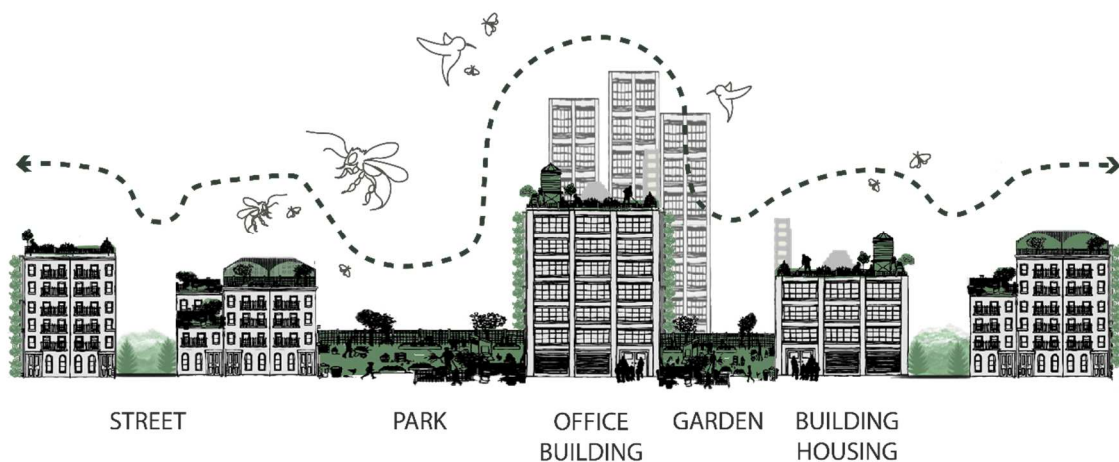


Fig. 2 Biocorridor connectivity in the urban environment [4].

The creation of functional biocorridors can be achieved, among other things, by designing vegetated roofs and facades [8]. Vegetated roofs can provide habitat for birds, bees, butterflies, and other beneficial insects by growing certain plant species (Fig. 2).

### **Selection of suitable roofs for the placement of vegetation**

When designing new buildings, we usually already plan the greening of roofs or even facades. However, this is not enough to create effective bio-corridors. Ideally, existing buildings should also be greened, which brings with it a few legislative problems.

## **2 METHODOLOGY**

Several important factors must be considered when selecting existing roofs suitable for greening. In my diploma thesis, a selected area was analysed and then buildings suitable for greening were identified in the existing development [6]. First, I focused on the functional structure of the site (public amenities, commercial amenities, housing, etc.). Next, I addressed the issue in terms of building ownership (private, corporate, municipal, or state), and the suitability of individual roof types for greening (flat, pitched, residential loft). Subsequently, I dealt with the suitability of the location of the different types of roofs in terms of statics (load-bearing capacity of the roof structure on selected buildings) [7]. Fig. 3 shows the types of suitable roof structures for reconstruction.

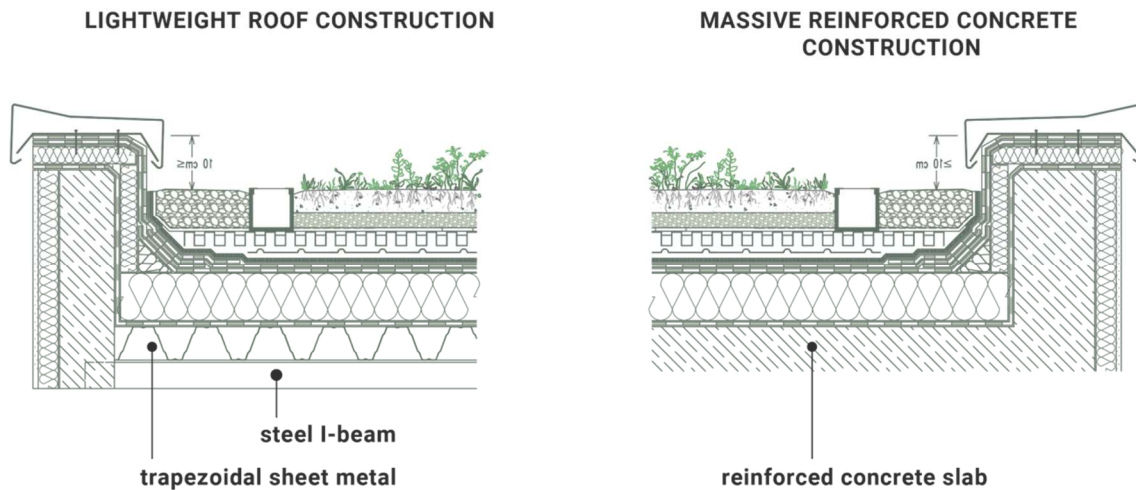


Fig. 3 Types of roof structures suitable for reconstruction [author's archive].

### 3 RESULTS

Based on all analyses, objects suitable for greening were selected (Fig. 4). Commercial buildings and residential buildings owned by the City of Brno appeared to be the most suitable objects, especially in terms of minimizing conflicts of interests among multiple owners. In the case of commercial buildings, it can be assumed that the owners of the building are interested in increasing the prestige of the company, for example, by designing and implementing a community garden or a rooftop farm on the building (Fig. 5).

#### Examples of selected objects from the thesis



Fig. 4 Design of a community garden on a residential building (owned by the City of Brno) [author's archive].



Fig. 5 Design of a community garden and rooftop farm at the Albert Shopping Centre [author's archive].

## 4 DISCUSSION

Threats to biodiversity are a problem for all living organisms on Earth. Many plant and animal species are also of vital importance to humans. They are used for food, medicine, or as raw materials to produce various materials [8].

Individual animal and plant species are interconnected in nature, and the extinction of one species can cause the extinction of others. As a result, species that have served as food for the extinct species may overpopulate, or non-native species (species from a different geographical area) may invade at the expense of native species.

The main changes in biodiversity are caused by human activities. As a result of urbanisation and industrial development, natural habitats for many animals and plants are being fragmented and lost. As the size of the natural environment decreases, biodiversity decreases. This is creating (a few) isolated islands.

The preservation of biodiversity is an essential prerequisite for the maintenance of urban ecosystems. Numerous studies have shown that blue-green infrastructure (an interconnected network of water and green features) can support many species compared to the alternative without vegetation. Vegetated roofs offer a significant improvement over artificial roofs in densely built-up areas [9].

## 5 CONCLUSION

Designing blue-green infrastructure, including vegetated roofs and facades, is one important strategy for ensuring a healthy urban environment, helping to restore natural habitats and connect isolated islands into functional units [9].

I would like to follow up on the issue of vegetated roofs in my PhD studies. Vegetated roofs not only play an important role in biodiversity conservation but offer many other benefits for the health of inhabitants and the sustainability of the urban environment.

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