STRATEGIC SOLUTIONS FOR POLLUTION REDUCTION AND RESTORING THE RURAL ENVIRONMENT - GREEN ROOFS

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Abstract

In building tall residential buildings and institutions, advanced industrial buildings and factories on large surfaces, paved roads and bridges, people draw on natural resources which include trees and shrubs, lush greenery or wild flowers. We can return the favor by creating green roofs on buildings. More and more "green roofs" are built around the world, on the initiative of small and large public projects. Green roofs are modern, environmentally friendly layers, partial or complete, with soil that allows vegetation to grow on the surface of the roof. This study shows that this is one of the most effective solutions for improving the environment.

Key words: green roofs, eco-parcel, pollution, gardens, ecological

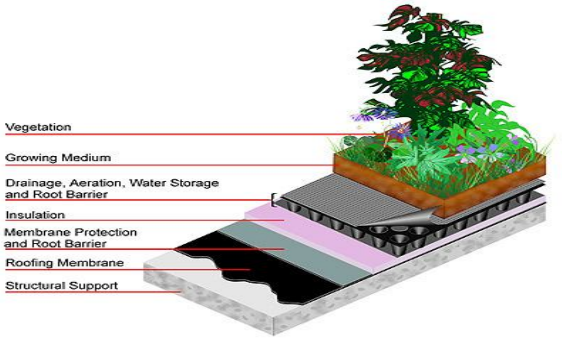
The first green roofs ever recorded in history were the famous Hanging Gardens of Babylon, built around the year 500 BC. In other areas of the world too, such as Scandinavia, Kurdistan and regions of Africa, vernacular traditional architecture made use, since the earliest times, of green roofs in order to protect homes from cold or heat, as required.

In the 19th century, green roofs, and roof gardens in particular, made a comeback in Western architecture, but were available to wealthy clients exclusively. In the 20th century the trend continued, and accelerated in the postwar period, almost exclusively in Germany and the German cultural area, thanks to a combination of factors such as considerable environmental awareness, the pressure from environmental groups and methodical research activity in the field (in Germany, Switzerland, Austria, United Kingdom, United States and the Netherlands). Originally green roofs emerged from a simple practical necessity. A layer of soil or turf was laid over birch bark on the roof. Bark acted as an impermeable barrier while soil only maintained the stability of the bark. In recent decades, architects, developers and urban planners from around the world have increasingly turned to green roofs, not because of aesthetic reasons – which were a secondary concern rather - but because of their practicality, and the ability to mitigate environmental extremes specific to conventional roofs[2].

MATERIAL AND METHOD

A **green roof** does not mean a green roof as some might think, rather it is a roof covered in lush vegetation, like a garden. In fact, it is a layer of plants, i.e.: grass and lichens, laid on top of the existing roof, which can grow and develop naturally without human intervention. Usually, the cultivated plants require minimum attention and care. It is generally recommended to grow native plants which are resistant to extreme temperatures and develop roots in a short time to prevent the soil drying up and hardening.

A green roof is actually a garden terrace that provides the green space that was displaced due to the construction of the building and is located on top of the building, the best way to return to nature what we took away. Yet green roofs require distinct attention in terms of planning and care, waterproofing being the most important thing without which such a roof would not be possible.



[2]In 2009, Toronto was the first city in the world to adopt legislation requiring new buildings to be provided with ecological roofs, with the requirement also applying, since 2011, to industrial structures. Some 10% of roofs in Germany

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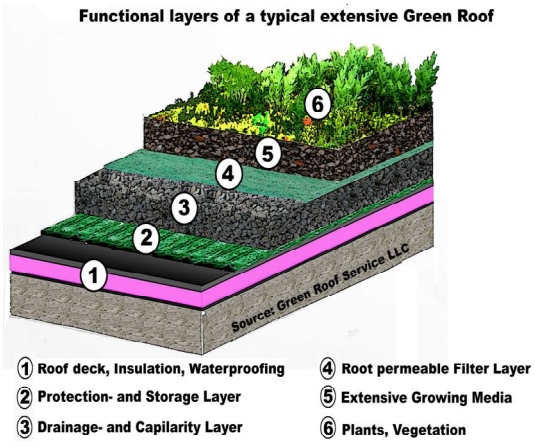
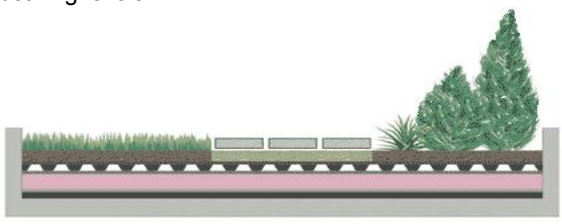
are classified as green, and the largest green roof is on the headquarters of Santander Bank in Madrid, Spain. Research has shown that in Egypt green roofs are major source of soil for vegetable and fruit gardens.



Source: Minke, Gernot - Acoperişuri înverzite simplu şi eficient- proiectare, detalii de execuție, sfaturi practice, Editura Arhiterra Bucharest, 2006

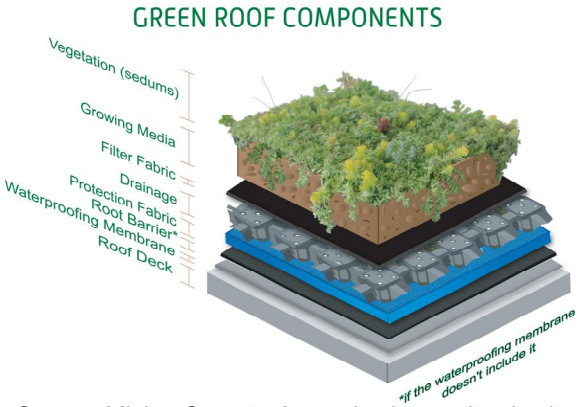
When we talk about a **green roofs** or **green terrace**, we refer to buildings whose roofs are entirely or partially covered with soil and vegetation that grows naturally on top of special membranes with additives that provide water insulation and prevent root penetration and a filtering and drainage system that channels water to the spouts fitted on the roof, while maintaining appropriate hydration of the soil through water reserves. The water drainage layer may be 2-6 cm high and is shaped as egg casing, successfully replacing the gravel used so far.

For such a project, the hanging garden can be intensive (shrubs, bushes, trees) or extensive (grass, flowers). The difference lies in the thickness of the soil layer, taking into account the building's load bearing levels.



Roof gardens are becoming ever more popular, as the benefits of incorporating green roofs can be assessed at several levels. Essentially, there are many environmental benefits to adopting a green roofing system, as opposed to black or reflective white membrane roofs. The most obvious advantages are rain water management and reduced energy costs. While in Romania green roofs are largely at an early stage, abroad these roofing systems are a certainty, tested and implemented successfully for decades. The desire to offset excessive urbanization has led, among other things, to the creation of green terraces, plots and gardens on the roofs of buildings in urban and rural areas.

Green roofs are a beneficial concept for the tourism buildings and structures: a roof that consists of a layer of vegetation and a structure to support and to insulate it, to prevent heat (which means less energy for cooling air) and to keep warm in winter (which means less energy consumption for heating).



Source: Minke, Gernot - Acoperişuri înverzite simplu şi eficient- proiectare, detalii de execuție, sfaturi practice, Editura Arhiterra Bucharest, 2006

There are multiple benefits to green roofs, below we will enumerate the most significant ones.

RESULTS AND DISCUSSIONS

Green roofs provide extra space for leisure activities without entailing costly expenses as in the case of classical facilities at ground level - a characteristic that is particularly relevant in relation to congested urban areas where green areas are virtually impossible to create.

Lower refurbishment expenses!

The lifetime of the waterproofing is extended thanks to the additional protection offered by this concept against UV rays, extreme temperature differences and hail. It is assumed that the lifetime of the waterproofing membrane increases by 40 years when used alongside the roof garden set-up.

Reduced cost of rain water collection!

A green roof system reduces water runoff by 50-90% and any surplus is removed much less quickly. Vegetation planted on parcel ensures that less water is collected by drainage pipe systems, with implications for the costs of maintaining drains and sewers.

Green roofs – an alternative for lost green areas!

A roof garden can facilitate a more intensive use of the property, serving as a substitute for the lack of green areas, which are often sacrificed for the sake of crowded built-up structures.

Reduction of the heat island effect!

Green roofs retain and filter dust particles and any other matters which are suspended in the breathable air. These systems improve the microclimate by means of the active process of

cooling and humidifying the air.

Research indicates that over the span of spring and summer, the amount of heat penetrating the layer (during the day) dropped by 85%, while lost heat (at night) decreased by 70%. Temperature gap over 24 hours is reduced from 46°C to 6°C, which has important implications in terms of energy consumption for heating.

A study conducted by researchers at the Environmental Institute found that green roofs facilitate a reduction of air cooling energy requirements for a house by 26% and a reduction in heat loss by 26% in winter.

Decreased noise levels!

We have became so accustomed to constant traffic noise that we can hardly realize when it has disappeared once we leave urban areas and move towards more peaceful, rural places. Due to the lightweight materials used in the construction of such systems, there is an absorption rather than a reflection process of sound waves. Using the system provided by the roof garden, the sound insulation of the building can be improved, thus reducing the intensity of outside noise by up to 8dB.

Natural habitat for animals and plants!

Among many other benefits, roof gardens can offset losses of green areas, sacrificed in favor of excessive real estate development, which destroy the habitats of plants and animals. Therefore, an appropriate selection of the type of plants will reduce the environmental impact and encourage the development of wildlife.

Use of high-quality recycled materials!

Recycled rubber and polyethylene are used for fabrication of drainage systems. A highly important criterion is the quality of the construction materials used, which is why these are constantly checked and certified by authoritative institutions.

Energy savings!

Green roofs can provide considerable energy savings. Regulating the indoor temperatures is easier for a house with a **green roof**. For example, a black asphalt roof can easily heat up in the summer to up to 80°C.

With a layer of soil above and plants that keep the shade, a **green roof** is protected so that its temperature does not exceed the temperature of the ambient air. In addition to this effect, the plants help with the evaporation of the water, creating a cooling effect and giving a feeling of humidified air.

Wind insulation and protection!

During the winter season, the soil layer on top of the membrane roof provides additional insulation. As regards the protection against cold wind that a **green roof o**r a facade clad in ivy may provide, it can also be considerable in monetary terms.

Reduced green house effect!

This effect can directly influence the temperature in cities, so that the temperatures recorded in urban areas are much higher than in rural areas. The main cause for the present situation is the accumulation of large quantities of stone, concrete, asphalt in cities, which absorb the solar heat during the day and release it at night. This situation is exacerbated by the lack of vegetation and trees in cities. This is why during the night the temperature rises and people cannot sleep because of the higher temperature. There have been cases where elderly people died because of very high temperatures.

In this context, green roofs can be a beneficial choice as it provides shade, stops heat storage in the roof membrane, while through perspiration plants release humid air which helps to improve the local climate.

Protection from electromagnetic radiation!

Research carried out by German Professor Gernot Minke has proved that green roofs can reduce the effects of electromagnetic radiation which are particularly damaging to life.

CONCLUSIONS

"In the beginning God created the heavens and the earth. Now the earth was formless and empty, darkness was over the surface of the deep, and the Spirit of God was hovering over the waters. Then God said, "Let the land produce vegetation: seed-bearing plants and trees on the land that bear fruit with seed in it, according to their various kinds." And it was so. The land produced vegetation: plants bearing seed according to their kinds and trees bearing fruit with seed in it according to their kinds. And God saw that it was good. (Bible, Genesis).

Regardless of any metaphorical position and the place given to the human species in the world, man has no right to destroy a species, whether a plant or an animal, under the pretext that it serves no purpose. We do not have the right to exterminate what we did not create. An insignificant plant, a small insect contain more mysteries than the greatest of our designs. Nobody can predict the future of policies to prevent pollution in the coming years, that is why the long-term effects of pollution can often be viewed as subjective and variable, depending on what will happen in the future.

Pollution destroys the future of the planet, and the population should be more concerned about climate changes, which seem to draw our attention to the negative effects of our work on the entire planet.

Green roofs or eco-roofs present an alternative for reducing pollution and are among the most innovative and effective solutions for restoring the environment – by diminishing the greenhouse effect, filtering polluted air, removing dust particles and carbon dioxide from the air. It is beneficial that on the roofs of buildings we can establish genuine gardens with lawns, plants and flowers that bring a breath of fresh air to the surroundings, leisure areas, communion between nature and the urban environment and greatly enhance the quality of life, contributing to improved living conditions in the wider community, by reducing temperature and mitigating the effects of global warming.

Without disregarding the economic interest, eco-roofs are about to trigger a beneficial "invasion" owing to their many positive effects, being one of the major contemporary methods to improve both the quality and image of new architectural constructions in urban and rural areas.

We still have the opportunity to restore and to create a new life without pollution, enabling us to in harmony with nature. To ensure that the Earth remains a living planet, human interests must be correlated with the laws of nature.

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