

Roof Gardening: The Blooming Trend for Elevating Urban Greenery

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A green roof is a building's roof that is partially or totally covered with plants and a growing media that is planted at the top of a waterproofing membrane (Yu *et al.*, 2017). Additional layers, such as a root barrier, drainage, and irrigation systems, may be included. The world's ever-increasing population is putting a lot of social, economic, and ecological stresses on the environment. It will also increase food demand in the future. Cities industries and automobiles are lowering the quality of water and air, causing health issues. The temperature of the atmosphere has been rising day by day as a result of climate change. One of the most vital reasons for creating a roof top garden is the aesthetic vision of a green area in the city, which not only contributes to the people's quality of life but also provides fresh veggies. Roof gardens can provide nutritious food, temperature management, hydrological benefits, architectural embellishment, habitats or pathways for pollinators, and more. (Rao, 2016).

History and Evaluation

Roof gardening is not a new concept; it has ancient origins dating back to the Hanging Gardens of Babylon. However, it has gained renewed interest in recent years, particularly with the rise of urbanization. In the early 20th century, the concept of rooftop gardens was popularized by the likes of Frederick Law Olmsted, a landscape architect distinguished for his work on Central Park in New York City. Today, innovative technologies and a developing interest in sustainable living have propelled roof gardening into the mainstream. Rooftop gardening in India has a rich history rooted in ancient Indus valley civilization and has evolved over time to address modern environmental and urban challenges. It continues to be a valuable practice that contributes to sustainable living and environmental conservation in the country.

Benefits of Roof Gardening

Environmental Benefits

- **Mitigating Urban Heat Islands:** Roof gardens help reduce the urban heat island effect by absorbing sunlight and releasing it slowly, thereby lowering temperatures in cities (Akbari *et al.*, 2009).
- **Improved Air Quality:** Plants on rooftops filter pollutants and carbon dioxide, contributing to cleaner air and reducing the carbon footprint of buildings. (Nowak *et al.*, 2000).

Energy Efficiency

- **Insulation:** Green roofs provide natural insulation, reducing heating and cooling costs in buildings.
- **Stormwater Management:** They absorb rainwater, reducing runoff and the strain on urban drainage systems (Wong *et al.*, 2003).

Biodiversity and Habitat Creation

- Roof gardens create habitats for birds, insects, and even small mammals, contributing to urban biodiversity (Lohr *et al.*, 2004).

Aesthetic and Social Benefits

- **Aesthetic Appeal:** Roof gardens enhance the visual appeal of urban landscapes, making cities more attractive and liveable.
- **Recreation and Relaxation:** They provide spaces for residents to relax, unwind, and connect with nature, improving overall well-being (Blanchard *et al.*, 2019).

Types of roof top gardens

Green roofs/ Living roofs

In such type of roof top garden, crops are directly grown into shallow beds in a soil based growing medium that is planted over a waterproofing

membrane. It may also include additional layers such as a root barrier and drainage and irrigation systems.

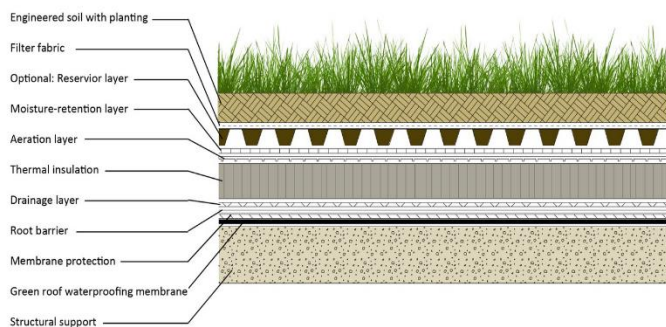
Roof top container garden

It involves the cultivation of vegetables in the containers which is made up by the plastic, wood, cement or soil etc. Plastic grow bags or empty plastic bags with high thickness, empty tin container can also be utilized to grow plants. Different size plastic beds are also available in market which can also be used to grow vegetables.

Hydroponic system

It involves the cultivation of vegetables in the soil less medium, water based nutrient solution provided for the growth of the plants instead of soil. Hydroponic system can be installed in the open-air system or in the closed system. This system required on going fertilizer inputs for higher yield.

Image representing basic structure of green roof garden



Source: <https://architizer.com/blog/product-guides/green-roofs>

Crop selection for roof gardening

The specific crops you choose will also depend on your personal preferences and the unique conditions of rooftop garden. Regular monitoring, proper care, and experimentation with different plants will help to discover what thrives best in our rooftop environment. Some of the easy and hardy crop that can be selected for growing on the roof top garden are mint, fennel, ginger, lemongrass, dill, basil, bay leaf, parsley, rosemary, gladiolus, marigold, rose, gerbera, hibiscus, periwinkle, strawberry etc.

Challenges and Solutions

While the assistances of roof gardening are substantial, there are challenges to overcome:

1. **Structural Considerations:** Roofs must be able to support the added weight of gardens. Engineering solutions, such as lightweight soil and modular systems, have been developed to address this issue (Oberndorfer *et al.*, 2007).
2. **Maintenance:** Roof gardens require regular maintenance. Automated irrigation systems and drought-resistant plants can help reduce maintenance efforts (Snodgrass and Snodgrass, 2010).
3. **Initial Costs:** Setting up a roof garden can be expensive. However, long-term savings on energy bills and increased property values often justify the investment (Cameron and Olexsak, 2011).
4. **Accessibility:** Safeguarding that tenants have access to these green spaces can be a challenge in some buildings. Creative design solutions, like rooftop lounges and common areas, can address this (Rowe, 2011).

Inspiring initiative: Bengaluru's "Green Roof Policy"

In September 2021, Bengaluru in the Indian state of Karnataka, had been actively exploring the implementation of a "Green Roof Policy" to encourage sustainable urban development and environmental conservation.

Key Features: The policy may have included the following features:

1. **Mandatory Green Roofs:** In some cases, the policy may have made it mandatory for certain types of buildings, especially large commercial or government structures, to include green roofs as a part of their construction plans.
2. **Incentives and Subsidies:** To promote the adoption of green roofs, the policy may have offered financial incentives, tax benefits, or subsidies to building owners who incorporated green roofs into their projects.

3. **Guidelines and Standards:** The policy likely provided guidelines and standards for the construction and maintenance of green roofs, ensuring that they are ecologically sound and provide the intended benefits.
4. **Biodiversity Promotion:** Encouragement of native and drought-resistant plant species on green roofs to support local biodiversity.
5. **Monitoring and Compliance:** Mechanisms for monitoring compliance with the policy and penalties for non-compliance may have been included.

Future Directions and Research Opportunities

Rooftop gardening is a feasible option for sustainable urban agriculture, and there are various future possibilities and research opportunities to expand its use and impact. These prospective research directions can aid in addressing current challenges, enhancing techniques, and expanding the benefits of rooftop gardening. The important issues for future research are plant selection and adaptation, water Management and irrigation strategies, ecological impact and biodiversity and economic feasibility and social equity. The knowledge and practice of rooftop gardening can be innovative by concentrating on these research directions, making it more effective, sustainable, and available for urban settings.

Conclusion

Roof gardening shows a symbiotic relationship between nature and urban existence. As cities expand, embracing this trend can help minimize environmental concerns, improve citizens' quality of life, and reinvent the aesthetics of urban design. Roof gardening is poised to become a vital aspect of sustainable urban development, paving the way for greener, healthier, and more lively cities in the future, thanks to ongoing technological and architectural improvements. So, if you've ever gazed up at the skyline and fantasized about a green refuge above, it may be time to take gardening to new heights and explore the world of roof gardens.

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