

# A Review on Terrace Garden - Sustainability and Environment

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**Abstract** – Terrace gardening is a live piece of art in which plants are arranged on a terrace. The need to rehabilitate green space is becoming increasingly vital to safeguard environmental quality as building replaces woods, agricultural fields, and suburban and urban regions with impermeable surfaces. As a result of the population explosion, all open spaces are being consumed by concrete buildings, with one dwelling for every person on the planet. As a result, an ecological imbalance has developed, with the potential to harm future generations significantly. Planting material on rooftops has a number of ecological and economic benefits, including stormwater management, energy conservation, mitigation of the urban heat island effect, and improved roofing membrane durability, as well as creating a more aesthetically pleasing working and living environment.

The various forms of terrace gardens, their design, the benefits of terrace gardens in terms of sustainability, the urban heat island effect, and the role of terrace gardens in environmental improvement are all discussed in this paper. The ability to save energy is one of the most tempting aspects of terrace gardening. Resources can be saved to some extent by employing the building's terrace garden. Furthermore, it aids in the prevention of ecosystem destruction. As a result, the terrace garden is a social boon

**Key Words:** Terrace Garden, Utilizing the open space, Sustainability, Energy Efficiency, Environment and Health

## 1. INTRODUCTION

Agriculture has long been the backbone of the Indian economy, providing jobs and a means of subsistence. The world's population is expected to double in the next 30 years, resulting in an increase in the number of urban poor. As a result of urbanization and population growth, there is a severe threat to sustainability. To some extent, people can contribute to the preservation of sustainability. One of these choices is to have a terrace garden. A terrace garden is one that is grown on the roof or terrace of a building. The open parts of the terrace can be put to good use.

Energy reduction, water conservation, bird and insect attraction, and lowering urban air temperature and moderating the heat island effect are just a few of the benefits of terrace gardens. It also aids in the betterment of the renters' health. Terrace gardens are required for a variety of reasons, one of which being their contribution to building insulation and energy conservation. Many barriers exist, including the building's construction standard, proper terrace water proofing, the building's strength to support the added weight, available water and drainage systems, and correct garden management.

## 2. TERRACE GARDEN

A terrace garden is one that is set out on a house or building's roof or terrace where planting area is limited. In big cities and towns, rapid urbanization, industrialization, land scarcity, multistory building development, vast roadways, workplaces, and markets have all resulted in a dearth of usable land for gardening activity. Terrace gardens are often constructed on three levels: the rooftop of a building, porches, window boxes, porticos, balconies, and other extended levels out of a tower block, above the ground floor, and at the podium level, around the base or on the roof of large basements. Greenery and vegetation in the urban fabric, among other things, can help to alleviate the harmful consequences of the urban heat island effect, pollution, and global warming. Green roofs provide a number of purposes for a home, including absorbing rainwater, providing insulation, giving wildlife habitat, and relieving tension among those who live near the roof by providing a more appealing appearance. The terrace garden's contribution to building insulation and energy savings is the primary basis for its existence.

### 2.1 Types of Terrace Garden

The different types of terrace garden are:

#### 2.1.1 Intensive terrace garden

A roof garden featuring a diverse assortment of trees and plants is known as an intense roof garden. An elaborate roof garden typically includes lawns, flower beds, seating places,

and planters. This roof garden has a deeper soil depth, which necessitates a load-bearing terrace or roof that is physically solid. It requires routine maintenance like as irrigation, fertilization, and weeding. The benefits of intensive roof garden include high level of insulation, wide range of plants and ecosystem, membrane with longer life span, improved energy management and storm water retention.

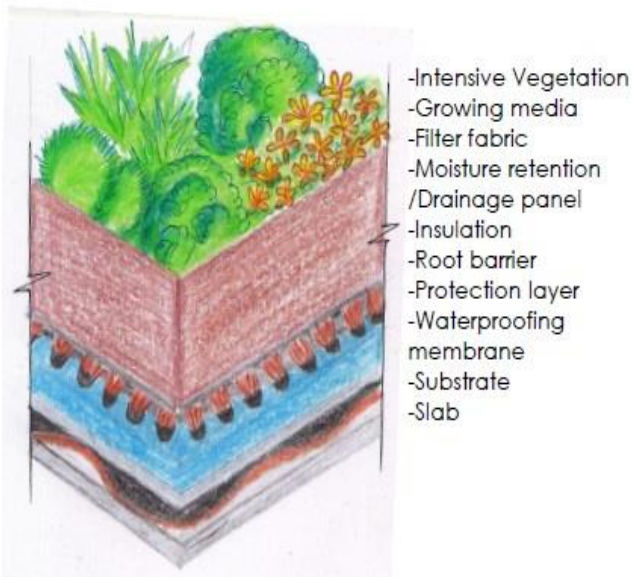


Fig - 1: Intensive terrace garden

Source: Akash Patel | May – 2008

### 2.1.2 Extensive terrace garden

An enormous terrace garden is defined as a terrace garden with a simple cover of grass, sedum, and bushes. It's easy to set up and maintain the plantation. Green roofs can readily be retrofitted onto existing structures. Large green roofs have the most significant advantage of requiring relatively little upkeep. Since the plants need very little water if they are chosen correctly for the environment, an irrigation system is not necessary. Fertilizers aren't needed unless weeds need to be managed, which is uncommon. All that is needed is a periodic inspection to ensure that the trays are in good condition and the plants are growing well.

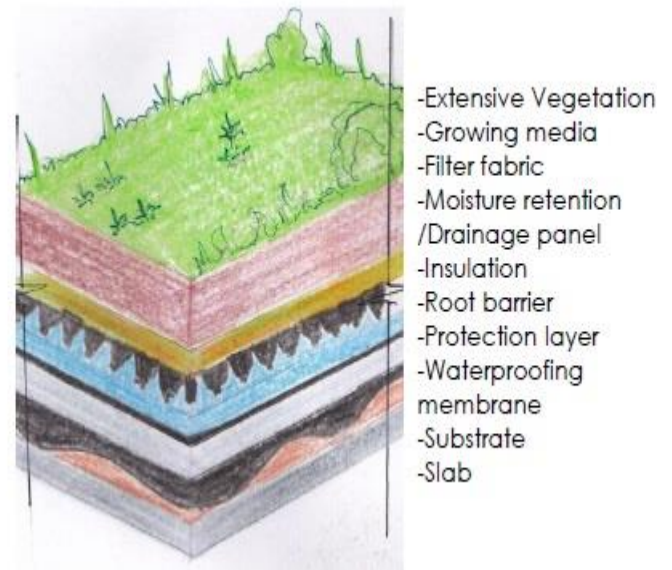


Fig - 1: Extensive terrace garden

Source: Akash Patel | May – 2008

## 3. BENEFITS OF TERRACE GARDEN IN SUSTAINABILITY

Various benefits of terrace garden in sustainability are as follows:

### 2.2 ENERGY CONSERVATION

Rooftop gardens make use of some of the most insulating soil and plants available. The tree canopy keeps the area beneath it cool and breezy by shielding it from direct sunlight.

On hot or sunny days, heat will naturally flow through the building if it does not have an insulating layer on top. To maintain a comfortable temperature, air conditioning systems are used, resulting in a waste of money, energy, and resources. The cost of cooling accounts for 70% of some residents' energy bills during the summer.

Rooftop gardens are excellent ventilation systems that can help reduce a building's cooling costs. Although the soil acts as a natural insulator, the plants on top may help to lower the temperature through photosynthesis and transpiration. When water evaporates from moist soil, the surface below is naturally cooled. This process is particularly beneficial in the summer, as rooftop gardens will prevent heat loss from the house. In most weather conditions, a layer of roof insulation keeps temperatures constant in buildings and protects them from severe and harsh weather conditions.

### 2.3 REDUCES CO2 EMISSION

Carbon dioxide emission is one of the key causes of climate change on Earth. Despite making up only 0.4–0.9% of the worldwide land surface area, urban regions are responsible for more than 70% of all pollution. CO<sub>2</sub> emissions make for the majority of greenhouse gas emissions created by humans. If green roofs were developed, we could reduce this percentage while still preserving energy. Rooftop gardens can absorb CO<sub>2</sub> from the atmosphere and replace it with oxygen, resulting in a healthier urban climate.

### 2.4 STORMWATER MANAGEMENT

Storm water runoff sucks up toxins and contaminants from conventional roofs, paved fields, and highways, and transports them to the ocean. Since rainwater cannot percolate into houses, asphalt, or concrete surfaces in urban areas, polluted storm water often enters natural rivers, streams, and sewage lines rather than percolating through soils. Rooftop gardens capture water and delay its fall to road-level surfaces, allowing communities to better handle the massive quantities of water that flow over them during extreme storms. Green roofs have been shown to minimize water run-off by up to 50%, enabling cities to maintain healthy quantities of water to keep them cool when the sun returns. As many big city buildings install green roofs, the burden on storm water drainage systems is significantly reduced, which is already under strain due to climate change and the subsequent superstorms.

### 2.5 ROOF LIFE LONGIVITY

Green roofs contribute to the longevity of both building insulation and roof surfaces, which is one of their primary advantages. The green roof's plants and growing media help to keep the roof cool and protect the waterproofing membrane. It protects roofing materials from UV rays and temperature fluctuations, which cause insulation and roofing to deteriorate. The membrane is weakened by direct sunlight, which allows it to expand and contract. It also accelerates ageing and decreases the longevity of bituminous materials. During the day, solar radiation is absorbed by exposed roof membranes, increasing their temperature. The temperature rise is affected by the membrane's color, a light-colored membrane is cooler because it reflects solar radiation.

## 3 ROLE OF TERRACE GARDEN IN IMPROVING ENVIRONMENT

Environmental sustainability focuses on conserving natural resources and renewable energy, preventing energy supply depletion, reducing waste production, emphasizing waste re-use and recycling, and reducing emissions in industries and agriculture. As previously stated, a green roof limits the use of non-renewable resources, allows for the storage of renewable energy, emissions control, and environmental protection.

### 3.1 IMPROVING AIR QUALITY

Plants absorb contaminants through their pores and separate them with their leaves; they may also break down special organic compounds such as poly aromatic hydrocarbons in plant textures or soil. Green roofs can reduce carbon dioxide in the atmosphere in two ways: they are the main component of plants and are naturally absorbed and decomposed in plant textures via photosynthesis and in the soil bed via bush and root, and they can also reduce energy via building insulation and reduction of the urban thermal island effect. Greenery increases air quality because, in addition to photosynthesis, it can trap dust and other airborne contaminants, which it then washes down the drains during rainy seasons. As a result, the plant serves as a natural buffer for dust and other pollutants. As a result, plants purify the air in and around the greenhouse.

### 3.2 IMPROVING HEALTH OF OCCUPANTS

Chemical fertilizers and pesticides are not used in the organic yields from one's own garden. Rooftops are ideal for growing food, particularly in densely populated areas where garden space is restricted. In traditional roof gardens, food-producing plants may be used instead of ornamental plants. Herb species have also been shown to thrive in the free-draining soils found on large roofs. Special medicinal herbs, vegetables, and fruits can be cultivated and eaten to enhance the health and efficiency of occupants.

### 3.3 IMPROVES ECOLOGICAL BALANCE

Terrace gardens help to maintain ecological harmony by providing homes for wildlife such as birds, earthworms, and butterflies. Many species have been displaced as a result of the degradation and clearing of vast swaths of natural environments for urban growth. Rooftop gardens have breeding areas and insect habitat, attracting a variety of



birds. Rooftop flowering plants provide vital food and shelter for bees, who have recently been in dire need of assistance.

### 3.4 EASY RECYCLING OF WET WASTE

Pouring the wet waste produced in the house into the terrace garden is a simple way to recycle it. The waste is turned into manure after six weeks. To absorb moisture, dry leaves are used. Tea stubs, vegetable peelings, dried leaves, egg shells, and coffee grounds are composted and used as manure in the terrace garden. The soil would become more nutrient as a result of this addition. Cow dung may be used as manure as well. By utilizing these products in the greenhouse, the cost of manure can be reduced, and waste can be disposed of in a more efficient manner.

## 4 URBAN HEAT ISLAND EFFECT

Due to excessive human activity, an Urban Heat Island (UHI) is a portion of a city or metropolitan area that has a much higher temperature than its rural counterpart. During the night and when the breezes are faint, the temperature difference is most noticeable. When the summer and winter seasons are at their most intense, the UHI is visible. It's also known as a heat island. In general, such expressions are used to describe any region with high temperatures compared to the surrounding area, although they are most commonly associated with regions with a high amount of human activity. Concrete, asphalt (tar), and bricks, which are used for pavements, roads, and roofs, are opaque and do not transmit light, but they have a larger heat capacity and thermal conductivity than rural areas with more open space, trees, and grass.

Green roofs in urban areas can minimize impervious surfaces and soften streetscapes because rooftops make up a considerable part of the reflecting non vegetated surfaces in the city. People who live in cities spend a lot of energy to keep their homes cool, which results in greater emissions than people who live in rural areas. To provide a cooling effect, plants employ heat energy for evapotranspiration. The ambient temperature is lowered as a result of reducing heat gain through the roof, resulting in less energy consumption and reduced electricity consumption for air conditioning. It is estimated that lowering the internal building temperature by 0.5 degrees Celsius will minimize air conditioning electricity use. Green roofs may also be advantageous at night since they emit less heat than a dark or hard surface. When compared to a standard roof, a green roof is more effective at reflecting sunlight and minimizing heat

absorption. UHI reduction is difficult to assess because a big area of green roofs is needed to make a significant difference. Green roofs help reduce UHI by lowering air temperatures, according to studies.

The heat island effect could be mitigated by covering urban rooftops with greenspaces. These rooftop gardens not only help to cool the air, but they also help to remove dangerous pollutants using natural filtering systems. They improve the health of both people and the environment by making living places healthier. The use of light-colored concrete and a white roof, which reflects light, as well as providing cool pavement and green parking spaces, can all help to lessen urban heat island.

## 5 CONCLUSION

Agriculture is an important part of a country's growth and has long been the primary source of employment and income. There is an urgent demand for terrace gardens as the world's natural resources are depleted and forest and garden areas are lost due to urbanization. Green roofs have the potential to reduce the loss of natural ecosystems and the negative consequences of fast urbanization. Green roofs add to the aesthetic value of a property in addition to the energy savings they provide on a small or private scale. Terrace gardens should be thought of as a boon to the environment and sustainability. The diminishing open areas for private and public gardens in the cities are being compensated.

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