

## “TERRACE FARMING FOR SUSTAINABLE SMART CITY”

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### Abstract:

As the rate of urbanization increases over time, food production sites should be increasingly located near main consumption centers. The combined issues of Population explosion, rapid urbanization and climate change are posing great threat to the Food Supply. Terrace farming is a process of using innovative scientific farming techniques to produce high yield and high quality of fresh organic food in very limited urban areas like terraces and balconies, all year -round. It is seen to have many advantages including non- dependence on vagaries of Climate, use of recycled water from Sewage and treated Wet waste as compost, proximity of producers to consumers, reduction of carbon footprints etc. This paper tries to study these operational models of terrace Farms from the aspect of repeating the same model in other regions. The objective of this paper is to provide information on the different types of terraces and their functioning, and to describe advantages and disadvantages of terraces farming and providing information about terrace farming helps to sustainable development of smart city.

*Keywords: Climate change, Food security, urbanfarming, Ecosystem, smart city, sustainability,land value, Solid waste and sewage management*

### Introduction

Roof or Terrace farming is the unique concept in now days. It is Very much growing in the urban societies because of their benefits. It has the potential to be a source of great social and environmental good within a city. In India, the share of urban population was just 30% in2010, a report by UNDP estimates that this will raise to 40% in 2030 and over 50% by 2045. The urban population in India is to increase from the current3.5 billion to more than 6 billion by 2050\*Areas under cultivation increase by just a miniscule 2% annually in comparison to the Urban growth. The combined issues of population explosion, rapid urbanization and climate change are composing a great threat to food supply. The Farmer population has decreased and

various factors contribute to the poor yield of existing Farmlands. The youth are taking to non-agricultural vocations and employment in non -agricultural sectors. Thus the Urbanizing communities are confronted with urban growth, changing life-styles and food security problems. Rooftop agriculture is the production of fresh vegetables, herbs, fruits, edible flowers and possibly some small animals on rooftops for local consumption. Productive green roofs combine food production with ecological sustainability, such as reduced rainwater run-off, temperature benefits such as potential reduction of heating and cooling requirements (resulting in reduced emissions), biodiversity, improved aesthetic value and air quality. Most green roofs designed by architects however do not give attention to the productive potential of the roof tops, whereas green roofs developed by Community Based Organizations and Non-Governmental Organizations often take this as the starting point (production of fresh vegetables and herbs in containers, on “tables”, in popular hydroponic systems, etcetera).- Agricultural green roofs or direct producing green roofs on which crops are directly grown into (shallow) beds in a soil-based growing medium, that is possibly placed on top of a waterproof membrane or additional layers such as a root barrier, drainage layer and an irrigation system.

## **Methods**

Throughout the study, I utilize a combination of interviews and secondary sources in order to get a thorough understanding of city’s urban agriculture movement. A large portion of the research consisted of a series of interviews with urban farmers and individuals involved in support organizations.

There are many different reasons to start an urban garden or to devote one’s time and energy to urban agriculture. To assume that all gardens and support organizations have the same goals would have been an insult to the participants and a hindrance to the study. Next, participants were asked how they determined the success of an urban garden. Again, this gives the interviewee ownership over how his or her organization or garden is analyzed. Participants were then asked to speak about challenges they faced in the promotion of urban agriculture. The result of these interviews was a clear picture of the goals of each urban agriculture organization, the degree to which these organizations have met their goals, and the factors that prevent their goals from being recognized.

## **Sustainable Development Model**

A glance at the definition of Sustainability “Sustainable development means ensuring dignified living conditions with regard to human rights by creating and maintaining a widest possible range of options for freely defining life plans. The principle of fairness between the present and future generations should be taken into account in the use of Environmental, economic and social resources. Putting sustainability into practice entails comprehensive protection of biodiversity in terms of eco-systems species and genetic diversity, all of which are vital foundations of life.” (Barnwal, 2012).

## SUCCESS STORIES IN URBAN FARMING

Urban Farming activities in urban and peri-urban residential areas are making significant contributions to sustaining and distribution of knowledge within the community of practice. There are also other benefits from them such as community building, management of green spaces, ecosystem service provision, including improvement of local climate Biodiversity and cultural services .Let us study some of the very successful urban farming initiatives taken up by Learned persons in our own cities with a view let their experiences guide us to determine the key principles involved for success and sustainability of Urban Farming. We have selected two individual Farmers, two voluntary farming communities and two groups of commercial farmers for our study.

### *A. Case study-1: Green terraces roof-top, Kerala*

Vegetable farming by CLUSTERS of farmer land in Kerala remains water logged for most of the year. Hence vegetable prices went high. The Kerala state department of horticulture has taken initiative of promoting roof-top cultivation of vegetables in urban as well as Peri-urban areas. Vegetable initiatives for urban clusters: they use grow bags to cultivate cauliflower, tomato, bottle gourd, bitter gourd etc. on terraces and on sticks, poles too. The farmers receive training from the state department who has taught them to grow vegetables on terraces, sticks and poles too. They grow cowpea and cucumber too.

Two Farmer Interest Groups (FIG) having 25 members each in peri-urban areas have registered under the companies act and also under Vegetable and Fruit Promotion Council of Kerala. The VFPCCK has set up a market and the urban farmers are able to sell their produce for a good price. The peri-urban farmers are happy with the scheme.

### *B. Case study-3: Garden city Farmers Trust, Bengaluru*

This is a committed group of intellectuals leading a highly successful movement in Bengaluru to encourage citizens to take up organic terrace farming. The Trust is managed by a group of nine people. Nearly 10,000 people have already turned farmers in Bengaluru city. The group is now trying to raise the funds for distributing of creepers in city slums, where people are deprived of clean food and air. It hopes to bring back the green standards that the city was known for before the IT sector revolution. Dr. V. Kadur, founding father explains there is nothing like 100% yield in agriculture. 15-20% is always lost to insects and birds. We have to learn to live with insects

and other micro-organisms and go ORGANIC. Otherwise we may be permanently damage the ecosystem. Motto-“ Eat what you grow and grow what you eat.” They have been motivating citizens to convert all available spaces in and around their dwellings into green, edible patches.

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The effort is slowly snow-balling, with many such groups greening vacant plots in the city.

#### *C. Case study-4: Roof Top Revolution in Sakthikulangara, Kerala*

S.K., a sea-side local municipal corporation is a village famous for fishing and fishery related activities. The soil there is highly acidic and unfit for cultivation of any kind. Agriculture held no promise. Now all this is a thing of past. The initiative of Anthony john has transformed this barren area into a hub of a new garden revolution. Each family is encouraged to produce fresh, hygienic organic vegetables.

#### *Anthony john 's formula:*

Growth medium: treated coir pith, bio-char 95% & local soil 5%. Plantation of seeds in PVC channels split length-wise in half, kept in stacks. Irrigation: drip method using a timer automatic Compost: by converting his own kitchen waste and other bio-waste for which he developed low cost aerobic bio-composting unit. Ooze(activated compost tea): the liquid which oozes one of the garbage is enriched with bio-fertilizer and friendly microbes and the liquid is sprayed on the plants. Also diluted sea water is used for providing essential nutrients. He is highly successful in cultivating a variety of vegetables, lettuce, kale, tomato, brinjal and cabbage etc. And now he is a role model for terrace farming all over Kerala too.

### **Opportunity:**

#### **Improve the drainage system**

Sustainable drainage is an important component of any building, as a way to counter flooding in the event of excess rainfall. Traditionally, a network of pipes connected to the sewage system has helped control water. However, as a result of increasing urban development, as much as 75% of water is running off into urban areas. To counter this threat, green roofs are a terrific option. Water is stored in plants and substrate, before being released back into the environment naturally.

#### **Increase the lifespan of the roof**

A rooftop is continually under attack from the elements and has plenty to cope with throughout the year. Not only will a roof need to sufficiently deal with wind and rain, but ultraviolet light and fluctuating temperatures too. As such, it's common for both homeowners and businesses to consider an alternative option for the roof.

Green roofs offer this opportunity and have proved to double or even triple the life expectancy of your rooftop. The barrier of greenery helps protect the waterproof membrane underneath and ensure your rooftop's life expectancy lasts well for decades.

### **Boosting thermal performance**

Without doubt, one of a green roof's most beneficial advantages is thermal performance and it's staggering just how much of a difference this can make. One of the biggest problems facing a typical roof is poor insulation, leading to substantial heat loss in winter and sweltering conditions over the summer months.

This all changes with the aid of a green roof. By implementing a green roof you can ensure to improve energy efficiency and limit the usage of air conditioning too. Plants absorb the sun's energy and therefore reduce the temperature of the roof in summer, whilst aiding thermal efficiency in the colder winter by locking heat inside.

### **Helping out the environment**

The release of carbon dioxide is one of the key contributing factors to global warming and as such, the government has been charged with meeting stringent EU targets by 2020. Green roofs are ideal for doing exactly this. According to the UKQBC, 44% of total CO<sub>2</sub> emissions are released from buildings.

In a similar vein to the point above, green roofs reduce the need for air conditioning, whilst also ensuring less heat is required for the winter. Both air con and the generation of heat create CO<sub>2</sub>.

### **Supporting wildlife habitats**

Green roofs also help support wildlife and in turn, can create a healthy habitat. Whilst they won't directly replace ground environments, they're perfect for attracting birds and other wildlife to create a thriving eco-friendly habitat.

Each green roof will support varying habitats, dependent largely on the type of vegetation included. According to a survey in Switzerland, the study of 11 green rooftops found there to be an incredible 172 separate species.

### **Aiding air quality**

Air pollution remains an important issue in the India and day by day climate is changing rapidly. Terrace farming is helps to adding fresh air to climate. In other hand Trees are less in urban as compare to village area.

**Distress from city life.**

Although you are physically located in the city, you can escape from city life temporarily by heading over to a rooftop garden nearby and watch your plant grow. Having a personal project on the weekends can help reduce mental stress, as you focus all your energy on planting and forget about your daily troubles.

**Grow your own organic vegetables.**

Organic produce is especially expensive in India, since most of them are imported goods which often cost double the price of local produce. At rooftop gardens, you can grow your own vegetables for free and enjoy the health benefits of chemical-free vegetables.

**Challenges:****Roof Garden Weight and Structure**

The structure and weight of a roof garden can cause problems for the overall building. Soil and planting pots are both heavy -- whether you create a soil planting bed in your roof garden or use pots, you are significantly adding to the weight placed on the roof structure. Patio slabs and furniture further add to the weight on the roof. Most building roofs will require proper reinforcement before a roof garden can be grown safely. High roof gardens may have problems with high winds damaging plants and young seedlings.

**Water Supply**

A roof garden places a heavier strain on a building's water supply. If no water outlet is available on the roof, you will have to either install water in the roof garden or carry water from inside the building. A traditional land garden can drain freely, but a roof garden will require a special and expensive drainage system. This system will make sure no water from the garden leaks into the building through wall cracks or crevices. Additionally, the drainage system will have to ensure no water from the garden is dripping down the outside of the building.

**Insurance and Safety**

If your building has a roof garden, chances are that insurance companies will charge a higher premium than they would to cover the same building without a roof garden. Greater insurance

costs represent another way in which a roof garden is often more expensive than a typical garden. Roof gardens may be more dangerous than typical gardens, due to the risk of falling. If you have or invite over children to your roof garden, ensure the edges of the garden are barricaded so nobody can fall from the roof.

### Membrane Installation

If a roof garden has soil beds, a protective membrane needs to be installed between the soil and the building's rooftop. Installing this membrane is a specialist job and can be expensive. Roof garden membranes can become degraded over time or ruptured by screws, nails or the use of garden tools. A ruptured membrane can leak water and soil into the building structure. Renovating or replacing the membrane may necessitate complete removal of the roof garden, which sets you back to square one in terms of garden planning and plant development.

### CONCLUSION

It can be safely concluded from all the above discussions that terrace farming can be taken up as an important tool for urban development. Urban farming can play a vital role in building more resilient and livable cities. Economic considerations People's livelihoods have to be at the center of any discussion about sustainability and making changes. It concludes that the terrace farming is one of the unique idea to grow the organic vegetable for house to make health strong. It is direct or indirect helps to make the sustainable development for the city.

### References

- "Farm Gardens: Planting the Seed." *NYC Parks: Official Website of the New York City Department of Parks and Recreation*. 2014.  
<http://www.nycgovparks.org/about/history/community-gardens/farm-gardens>.
- "Ministry of Environment, Forest, and Climate Change." *Government of India*. Accessed Jan 14, 2015. <http://envfor.nic.in/>.
- Bevan, A. and Conolly, J. 2011. Terraced fields and Mediterranean landscape structure: an analytical case study from Antikythera, Greece, *Ecological Modelling* 222: 1303–1314.
- "Urban Agriculture Policy Overview." San Francisco Environment: A Department of the City and County of San Francisco. 2015.  
<http://www.sfenvironment.org/urbanagriculture/overview/urban-agriculture-policy-overview>.
- Cohen, Nevin, Kristin Reynolds, and Rupal Sanghvi. *Five Borough Farm: Seeding the Future of Urban Agriculture in New York City*, edited by Chou, Jerome. USA: USA Print Craft, 2012.
- Crouch, Patrick. "Evolution Or Gentrification: Do Urban Farms Lead to Higher Rents?". Detroit, Michigan: Grist, 2012.