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Feeding peoples in future: Urban farming and vertical farming

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Abstract

Considering worldwide patterns, for example, environmental changes and asset shortage, a significant test of future urban communities will be to diminish urban impressions. Also, urban communities need to get or stay reasonable for their occupants and offer social and financial chances. Numerous urban areas on the planet are attempting to upgrade manageability by improving urban greenery and advancing urban farming. By introducing green rooftops with urban cultivating, it is conceivable to accomplish natural, social and monetary manageability for the structures in urban communities since it can add to the increasing of natural issues, improvement of network capacities and advancement of urban food security frameworks. Accordingly, reconnecting food production and urban communities offers promising potential. The dissemination of urban cultivating mirrors a rising consciousness of how nourishment and growing can shape our urban areas. A developing number of urban cultivating ventures exist in and on urban structures, including open housetop ranches, housetop nurseries and indoor cultivating as well as vertical gardens can be used to produce foods in densely populated areas where land is insufficient for traditional food production. As vertical space is utilized huge quantity of food is produced which can be supplied fresh in the urban markets.

Keywords: Rooftop farming, urban horticulture, food security and vertical farming

Introduction

These days, numerous urban communities on the planet are confronting issues of urban heating island (UHI) and absence of greenery space. Some urban areas are attempting to upgrade manageability by improving urban greenery and advancing urban horticulture or cultivating. By introducing green rooftops with urban food production, it is conceivable to accomplish ecological, social and monetary maintainability for the structures in urban communities since it can add to the alleviation of natural issues, upgrade of network capacities and improvement of urban nourishment frameworks.

Urban horticulture is an expansive term which portrays food production and animal husbandry on urban and peri-urban land. Grassroots just as foundation drove urban farming tasks are as of now mushrooming in the urban communities of the globe, reshaping urban scenes, trying different things with options in contrast to the industrialist association of urban life and now and then setting up undeveloped types of reproducing the commons. While this re-established enthusiasm for land development and nourishment generation is drawing in expanding enthusiasm for a wide scope of controls – from intending to scene and social examinations – it stays a minor and practically unexplored field of human topography.

Reports from United Nations demonstrated that to an ever increasing extent individuals will occupy the urban regions than the provincial ones (UN, 2010). The degree of world urbanization will increment from half in 2009 to 69% in 2050. By 2050, urban occupants will represent 86% of the populace in the more created locales and for 66% of that in the less created districts. This makes critical strain to keeping up the biological harmony and fitting the connection between nature furthermore, the individual.

This paper shows the findings of research to investigate green rooftop urban cultivating for high-thickness urban communities. The advantages and capability of housetop urban cultivating are analyzed; a few encounters on the planet are depicted. It is trusted that the examination data will be valuable to advancing maintainable structures and condition in urban areas.

Roof Top Farming

Previously viewed as unusable space, the scene of housetops is being recovered for profitable and economical purposes. The utilization of green rooftop innovation in urban farming can possibly lighten a portion of the issues, without antagonistically influencing the advantages gave by urban horticulture. It would not just empower the utilization of land for improvement and horticulture, yet may likewise encourage the development of formal space and water use understandings, and empower redistribution of ground-level assets among urban farmers. This could diminish the utilization of tainted land and water at ground level and ease wellbeing concerns. Before green rooftop innovation can be joined into urban agribusiness on a bigger scale, establishment costs must be decreased, rooftop weight confinements ought to be surveyed, and fitting administration practices ought to be created which will guarantee that the advantages of green rooftops, for example, vitality reserve funds and tempest water the board, are still given to urban networks.

Housetop or rooftop vegetable planting is a creation framework in urban horticulture dependent on green rooftop innovation. To widen the extent of this training, the utilization of moderately shallow substrate profundities must be investigated, since most existing level rooftops can't bolster much included weight. Three developing frameworks - a green rooftop, raised green rooftop stages, and in-ground are generally used for vegetable and herb growing. Tomatoes (*Solanum lycopersicum*), green beans (*Phaseolus vulgaris*), cucumbers (*Cucumis sativus*), peppers (*Capsicum annum*), basil (*Ocimum basilicum*), and chives (*Allium schoenoprasum*) are contemplated in view of their normal use in home nurseries. The studies reveals that with appropriate administration, vegetable and herb growing in a broad green rooftop framework is conceivable and beneficial.

Benefits of Rooftop Farming

As compared with non-horticultural green rooftops, housetop cultivating has different advantages. In short, horticultural green rooftops are intended for four primary purposes: Food Production, Recreation purposes, Re-utilizing waste (fertilizer, rainwater), Educational Purposes.

Major benefits of green roof urban farming

Environmental Sustainability

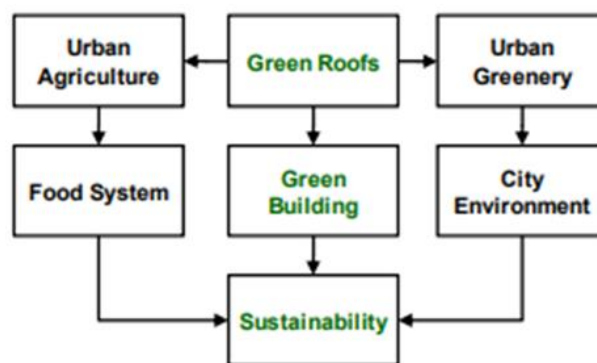
- Reduce food transportation
- Reduce wastes by generating less packaging
- Recycle organic wastes by composting
- Mitigate urban heat island
- Increase biodiversity
- Improve air quality
- Improve urban rainwater management
- Sound insulation and noise absorption

Social Sustainability

- Active community participation
- Community green space and gardens
- Social inclusion: provide fresh food to the poor
- Education
- Local employment
- Amenity space for exercise and recreation
- Aesthetic value

Economic Sustainability

- Increase local food production and sale
- Increase local food security
- Sell organic vegetable and food
- Access to open space/views, increases property value
- Improve roof durability
- Reduce building cooling load and energy costs
- Increase roof life span
- Increase availability of bio-fuels



Urban farming is a limited nourishment framework wherein the generation, handling, dissemination, get to/utilization and transfer/reusing of food happen in and around the city. The farming exercises can improve the worth and personal satisfaction regarding monetary, socio-cultural perspectives by developing plants and creatures utilizing different spaces in urban regions.

There are three primary kinds of urban horticulture: patio gardens, network nurseries, and business farms. Patio cultivators use land around their homes or develop on housetops and galleries. Network plant specialists utilize bigger parts of land or rooftop that are subdivided among a few family units. The produce from the two sorts of gardens are utilized fundamentally for home utilization. Urban business farms are set up revenue driven organizations and may join with business kitchens to make esteem included different food items and offer to farmer markets and restaurants.

Food security benefit of urban agriculture is confirmed by 100–200 million urban farmers globally giving the city markets with fresh produces. Urban horticulture favors social improvement since the poor spend up to 85% of their salary in buying foods and most urban farmers have a place with least fortunate populaces. Sociologically urban cultivating favors both social consideration and decrease of gender imbalances, as 65% of urban farmers are ladies. Urban agriculture has natural advantages by diminishing the city squander, improving urban biodiversity and air quality, and by and large decreasing the ecological effect identified with both food transport and capacity. The creation of green products shows the primary advantages of urban farming. Foods grown from the horticultural crops give significant returns, up to 50 kg m²/year, a more efficient use of agricultural inputs, high added value, and rapidly perishable products, that can without much of a stretch substitute the local production in the nearby market. Urban farming is the most aggressive part of urban cultivating because of the significant expense of urban land and with the need of high water-and manure use proficiency. Traditional urban agriculture frameworks are grouped in four sorts: assignment and family gardens, improved broad frameworks, shifting farming, and intensive garden frameworks.

Recently, US city has passed the bill for urban farming which states as follows “New York City Passes Bill Requiring Green Roofs on New Buildings”

- One hundred percent of new residential and commercial buildings may soon be required to install green or solar rooftops following the passage in the City Council of three bills. If signed into law, it would make New York the largest city in the USA to pass such a requirement.
- All new buildings and any homeowner doing renovation on their existing building, they will have to invest in the green infrastructure on the rooftops.
- The package of bills includes three pieces of legislation from Council members Rafael Espinal, Donovan Richards and Stephen Levin. They will require 100 percent of the roof area to be covered, a more aggressive requirement than that of other cities, which only require 25 to 50 percent of the roof to be covered.
- “Now more than ever, New Yorkers, and my colleagues, have become aware that climate change is an existential threat that we have to take on and really focus on moving forward,” Espinal told the Brooklyn Eagle. “The U.N. climate report stressed the fact that we are on a limited timeframe.
- “We have to be more aggressive, especially when our federal government continues to roll back a lot of the progress that has been made. It takes large cities like New York to implement aggressive green policies to fight climate change.”
- Under Espinal’s bill, all commercial and manufacturing buildings would be required to install a green roof.
- Richards’ bill pertains to residential buildings with five stories or fewer with less than 100 square feet of rooftop space. Those buildings would be required to install either a green roof or a solar-electricity-generating system, depending on their dimensions. The bill would also require the Department of Housing Preservation and Development to study the potential impact of green roofs on the affordability of buildings.
- Levin’s bill would increase the real property tax abatement for the installation of a green roof to \$15 per square foot.

A. Spaces for Urban Farming

Numerous huge abandoned housetops of school structures, modern structures, shopping centers, or exercise rooms, can be destinations for urban farming. The empty rooftop spaces of huge open structures, for example, modern, business, or network structures are potential locales for vegetable nurseries. Despite the fact that there are a few troubles, for example, moving the vegetations, finding the access to rooftop territories, or keeping up vegetations on the rooftop, the throughout the day exposure to daylight is appropriate for vegetable developing.

Swot Analysis of Rooftop Farming

Strengths

- Fresh food, safe & reduce transportation
- Many environmental & social benefits
- Better use of roof spaces

Weaknesses

- Lack of roof spaces for farming
- Perceive agriculture as decaying industry
- Lack of research & development

Opportunities

- Growing demand for safe & organic foods
- benefits of community & leisure farming
- Need to manage/rehab many old buildings

Threats

- Lack of information and opportunity
- Lack of information on urban farming
- Typhoon attack & air pollution

World Scenario

USA: The potential for food production in urban communities in USA is extraordinary, and many model tasks have exhibited effectively that urban farming is both fundamental and suitable. A developing shopper interest for new, neighborhood, also, regularly natural organic food has made new markets for urban food production. Some notable projects in USA are shown here.

- Brooklyn Grange Farm in Queens, New York City: 4,000 m² (one acre). Anonymous (2019^a)^[3].
- Eagle Street Rooftop Farm in Brooklyn, New York City: a 600 m² on a warehouse rooftop. Anonymous (2019^b)^[4].
- Uncommon Ground, Chicago: the first certified organic rooftop farm in United States. Anonymous (2019^c)^[5].



Fig 1: Eagle Street Rooftop Farm in New York City

Canada: In recent times urban horticulture has increased significant force in North America. For example, in Canada there are intriguing ventures and activities on housetop gardens expecting to create successful techniques for urban horticulture. Additionally, some civil and common governments in Canada have embraced green rooftop and urban cultivating into their urban planning and approaches.

UK: In the UK, informed by low-carbon strategies, city specialists have considered and executed measures to advance the advancement of rooftop nurseries and vegetable garden rooftops. For example, about 14% of London's inhabitants as of now grow some food in their rooftop gardens. It is evaluated that London individuals could create up to 18% of the population's food needs. Recently, an intriguing pattern is about general stores changing over their rooftop space into vegetable gardens.



Fig 2: Urban rooftop farming with bee keeping in Hackney, London, UK



Fig 4: An organic rooftop herb and vegetable garden on a high-rise building in Lak Si District in Bangkok

Singapore: About 95% of all vegetables consumed in Singapore are imported on the grounds that Singapore is densely developed and land accessible for farming is restricted. Housetop cultivating and constructing incorporated farming can conceivably create 25% of the vegetables consumed in Singapore. To investigate this potential, an exhibition of housetop cultivating utilizing hydroponics green rooftop was set up at Changi General Clinic in 1988. A proposition to create housetop cultivating in people in general lodging homes in Singapore was advanced to address the issue of food security and decrease the carbon footprint related with food imports.



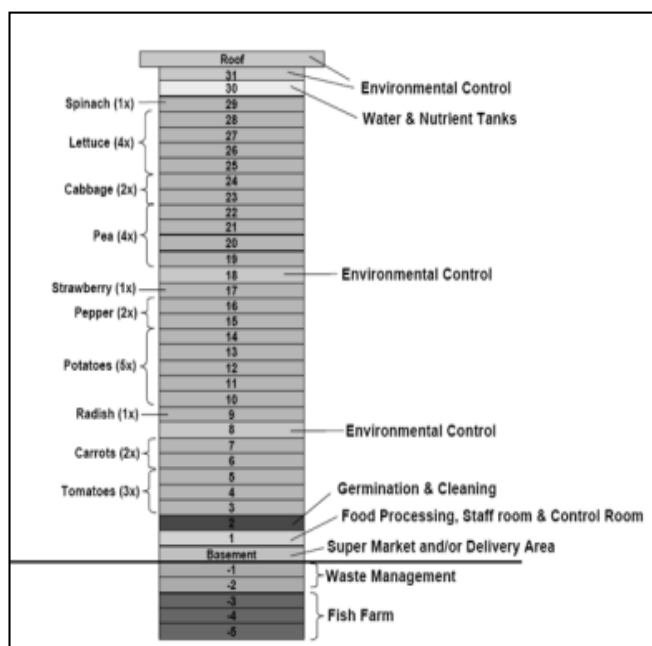
Fig 3: Demonstration of rooftop farming using hydroponics green roof at Changi General Hospital

Thailand: Bangkok, the capital city of Thailand, used to have enough useful grounds to reasonably create plentiful food for its residents since it had an ideal climate and a lot of water assets for irrigation system. However, in view of the development of urban improvement and the loss of urban horticulture, the city couldn't supply enough food for individuals and prompts food security issues. An intriguing case of housetop garden in Bangkok is appeared in Figure. This rooftop garden is developed by the Area Office in Laksi, Bangkok. The principle reason for it is to build the profitability of the zone, improve the green zone, decline a worldwide temperature changes and increment the measure of solid vegetables developed for family unit utilization. By utilizing home natural waste in treating the soil, it is additionally a way to diminish the measure of waste that should be overseen by the region.

Vertical Farming

Characterizing Vertical Farming (VF), it is an arrangement of business farming whereby plants, animals, fungus and other living things are developed for nourishment, fuel, fiber or different items or administrations by falsely stacking them vertically over one another (Possess Definition).

A model for a Vertical Farm remains in Suwan, South Korea. There, the Country Improvement Organization is examining Vertical farming innovation. The office is three stories in stature totalling a zone of 450 m². Nearly half of the vitality prerequisite is provided through sustainable assets like geothermal and sun powered exhibits, which is chiefly important for warming, cooling and fake lighting necessities. Presently lettuce is being developed through cautious guideline of light, moistness, carbon dioxide and temperature. Scientists venture five years of further research before this innovation is prepared for the market. The issue is of scale, none of these are sufficiently large to for all intents and purposes show the extent of this innovation.



Layout of the Vertical Farm

Advantages of Vertical Farming

Vertical Farming gives a change in outlook in the manner in which we know and do agribusiness. Regarding space, surrendered urban properties, deserted mines or even

peripheries of structures can be changed over into food generation focuses subsequently disposing of the requirement for costly developments. Inferable from ideal utilization of vertical space 1 indoor section of land is proportional to 4-6 open air sections of land or more, contingent on the yield (For example, strawberries: 1 indoor section of land = 30 outside sections of land), something that is incomprehensible if there should arise an occurrence of regular or nursery farming. This escalates horticulture as opposed to extensifying it. Because of arrangement of artificial light at the required wavelength (380-450 nm in the violet end and 630-700 nm in the red end) for an ideal span, crop production turns into an all year venture, practically identical with other producing ventures.

It likewise makes new work and research openings. Innovations created for VF may demonstrate to be helpful not just for remote research stations like in the shafts, yet in addition in exile camps particularly in overwhelmed or earth tremor influenced zones where camp inhabitants need to be encouraged for delayed timeframe.

Conclusion

On the planet these days, an ever increasing number of housetops are being tackled to improve the earth of urban communities and improve the personal satisfaction of occupants. It is accepted that urban agribusiness is another effectiveness idea for sustainable and livable city. In spite of the fact that there are limitations and a few constraints in food production in the urban communities, the advantages of urban horticulture are immensely more than the city food supply.

Vertical gardens can be used to produce foods in densely populated areas where land is insufficient for traditional food production. As vertical space is utilized huge quantity of food is produced which can be supplied fresh in the urban markets. Urban green rooftop and vertical gardens can give numerous natural as well as social advantages to highly populated urban areas. Also it play significant job in building an environmentally friendly society.

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