Urban Retrofitting: Utilising Existing Landscape For Green Infrastructure As An Apt Remedy For Food Security

Osore, O.T, Adetona, O.A

The Federal Polytechnic, Ilaro, Ogun State, Nigeria, Department of Architectural Technology, C/O Osore O.T, Dept. of Architectural Technology. The Federal Polytechnic, P.M.B 50 Ilaro, Ogun State, Nigeria. dareosore@gmail.com

The Federal Polytechnic, Ilaro, Ogun State, Nigeria, Department of Architectural Technology, C/O Adetona O.A, Dept. of Architectural Technology. The Federal Polytechnic, P.M.B 50 Ilaro, Ogun State, Nigeria. gbengadetona@gmail.com

Abstract: In the late 20th century, the World Resource Institute estimated that 56% of the world’s population was living in urban centres. WRI further stated that by the year 2030, this initial estimate would increase by 27% meaning no less than 5billion people will be residing in urban centres world over. A significant implication of this being increased challenges in food production due to an overwhelming surge in demand and supply of food, which would be as a resulting effect of the population increase. This paper therefore seeks to review the plausibility and benefits of how existing green infrastructure can be retrofitted to facilitate urban agriculture with the sole purpose of enabling urban areas with adequate food production capabilities to feed its host population and also creating a conducive bio-diversified environment in the process. The paper then concluded that adopting integration of green infrastructure and urban agriculture is a sustainable means of food production.

Keywords: Food-Security, Green Infrastructure, Urban Agriculture, Retrofitting.

INTRODUCTION

Green Infrastructure is a term that encompasses connected networks of multifunctional, predominantly unbuilt, space providing support for both ecological and social activities and processes’ [1]. The concept of ‘green infrastructure’ has gained prominence in urban planning and environmental management and this is especially evident in the potential use of green infrastructure for climate change adaptation. Land use planners, environmental managers and policy makers are increasingly responding to the failure of the international community to reach a consensus over strategies for climate change mitigation by directing their efforts toward adaptation initiatives, such as urban greening [2]. Urban and Peri-Urban Agriculture (UPA) in definition is the production, distribution and marketing of agricultural produce and other related services within the core of a metropolitan area. The facilities employed in actualizing this includes the following; Community & School Gardens, Court Yard systems, Roof top Horticulture and other innovative food production methods that use of small spaces. UPA is a complex activity, addressing issues central to community food security, neighbourhood development, environmental sustainability, land use planning, agricultural and food systems, farmland preservation, and other concerns as cited in [3]. Upon reviewing existing literature of other authors on the subject topic, it was discovered that emphasis on required facilities were only laid on the physical spaces like abandoned plots and unused spaces within the city core. These authors, the likes of [4], [5], [6], [7], [3], [8] and [9], in spite of the successes recorded based on their approach, it is important to state here that much more will be achieved if the focus is shifted towards the utilization of green infrastructure. The focus of this study is therefore centred on assessing the benefits of a sustainable food production network with the prime objective of supporting both human and wildlife. Contained also in this study, is the underlining of the significance of green infrastructure and how it promotes sustainable architecture with the resulting effects being enhanced interpersonal and community bonding. From the foregoing, the intentions are simply identifying and maximising the benefits of multinational green infrastructure through Urban Agriculture (UA) on the basis of available resources and capacity to deliver optimal ecological services as required by the community it’s purpose to serve. [10].

REVIEW OF RELEVANT LITERATURE

Understanding Green Infrastructure

There are varying levels to which Green Infrastructure can be implemented, ranging from individual plots, local communities even up to multinational level. In the words of [11], Green Infrastructure is a network of reorganised interventions that permit the flow of rainwater into the ground thereby revitalizing the water table and invariably reducing top soil runoff. The Landscape Institute, London, went a step further by defining Green Infrastructure as a network of natural and semi natural features, green spaces, rivers and lakes that intersperse and connect villages, towns and cities. The changes in local demand and urban form over time, as well as the potential as a climate change intervention has been the driving force in the past decade, it has attracted burgeoning interest in Green infrastructural development [12]. Green infrastructure is believed to possess considerable potential to adapt cities to some emerging climate change impacts such as heat-island impacts, increased flooding, higher wind speeds and more episodic rainfall, especially in higher-density cities where larger green-spaces may be scarce [13]. Beyond the fact that Green Infrastructure (GI) has contributed immensely in helping reduce the effect of climate change, it entails establishment of green networks and green ways, enhance disaster prevention and mitigation, as well as storm water management. Urban and Peri-Urban Agriculture (UPA), to simply put, implies that any form of farming activity carried out around and within cities or urban...
areas is urban agriculture. This can be achieved through varied production techniques one of which shares similarities to green housing planting that favours vertical planting which involves training vegetables to grow upward in a controlled environment. [14] noted that: “electricity demand in cities increases by 2-4% for each 1°C increase in temperature”, urban greening therefore has the potential to save more than $10 billion annually in energy use. A significant benefit of urban agriculture is the reduction of environmental impacts (fossil fuel emissions) resulting from food transportation. Urban Agriculture amongst its numerous benefits has been found improving property values through the attraction of food-related businesses like restaurants, farmer’s markets, etc. [15]; [16]; [17]. Growing food crops, plants – flowers, and herbs, that can be used in various ways and for multi-varied purposes, in a place that is central, visible and accessible, that serves as a local destination, that promotes interactions with nature, people and also urban agriculture can reduce air pollution, storm water runoff, can also enhance biodiversity and preservation of species in the urban spaces’ [17]; [16]; [15].

From Green Infrastructure to Food Production
Retrofitting existing landscape to facilitate green infrastructure for food production purposes cannot but continue to improve on the successes of GI. This is simply because green infrastructure retains and maintains all its benefits and take on the benefits of that of urban agriculture by being the avenue for food production within & around cities and urban spaces. However before delving into the retrofitting process, there are considerations that must be addressed before implementation. They are as follows;

Evaluation of Site and Existing Conditions
In order to adapt urban agriculture into green infrastructure, it is imperative that existing GI facilities are assessed to ascertain if they are fit for urban agricultural development. Indices measured include the following;

- **Facility Suitability**
  This usually involves assessing the system currently in place. Physical conditions of facilities are assessed to determine if structurally stable, availability of space, food production compatibility etc. photographs, sketches and field sheets are tools used I collecting the necessary data.

- **Soil Quality**
  Suitability assessment will be carried out on the soil in the area, depending on the intended vegetation. Soil tests will be conducted by the appropriate professionals to help determine the quality of the soil if desired crops can be grown and whether the soil has enough resistance to contaminants.

- **Site Characterization**
  The scope of the project determines the type of land and space required. On that note the site characterization is of utmost importance being that the sites historical, chemical, physical, and biological characteristics must reviewed through available records and collecting samples from the site.

- **Access & Convenience**
  One of the more significant objectives is the ease of access to site for without it implementation becomes impossible. Hence the pre-existing green

network must be identified so as to determine how convenient it is to negotiate within this network while attempting to incorporate food growing within the intended green area.

- **Funding, Skills and Management**
  After determining goals and objective for the site and facility the important next step is finance. The means of funding schemes must be available highlighting the sources of funds either through government, partner organisations, private citizen funding etc. also skilled and unskilled labour required to execute these project must be readily available, local participation must be encouraged. Also to ascertain that this project doesn’t collapse, proper legally binding management policies must be put in place.

**Urban Farm Typology**

The second most important consideration to be taken is the typology of urban farm to be adopted. It is central to the planning of these project that the typology be identified making convenient in understanding the scope of the project. The current scenery of urban agriculture is made up of a regularly evolving and newly emerging frameworks of urban forms. These urban farms are a response to a series of urban conditions. This is because there are varying site conditions that each farm is unique to. Each and every farm typology is dynamic and specific due to vegetation cover that changes with each season, region and crop type. Also certain farms are having differential operational budget from each other and also require different set of professionals whereas other farm setups makeup with just community participation without any formal training. Rooftop farms such as Brooklyn Grange are a form of green roofs that offer a solution to contaminated soil and high demand for land-use sites. The urban farm typologies are categorised based on placement

- **Green roof Farming**
  On top of a roof. They also extend the life of a roof because the presence of plants and growing media reduces the amount of solar radiation reaching the roof’s surface, decreasing roof surface temperatures and heat influx during warm-weather months [18]. Utilizes open air exposure

- **Vertical Farming**
  Attached to the façade exterior or interior of a building. Utilizes open air exposure while growing medium is Planter- Grown in a raised planter. Built into its context and not easily movable.

- **Underground Farming**
  Underneath a structure or below ground. No natural sunlight. Plants are grown using other plant lighting technologies.

- **On Ground**
  On the ground in or near a city, by the virtue of using parks, sidewalks gardens etc. Protected from the elements, but still uses sunlight as primary source of lighting and heating.

**Urban Retrofitting: Using Green Infrastructure for Food Production.**

Urban retrofitting: using green infrastructure for food production model if implemented in urban areas or cities, Boulevards and plazas will be made more attractive and will also improve the vibrancy of local economy and provide
employment opportunities when green space, street trees, green roofs and green walls are full of edible and fruit bearing plants introduced in these areas, creating an attractive setting for shopping, leisure and sale point freshly harvest fruits and vegetables. Our settlements are made more liveable when street trees and green space are introduced not just because they provide cooling, shade and cleaner air, creating spaces for relaxation and healthy living, and deliver multiple economic benefits [19], but also that these places produce food in these settlements. Green Infrastructure assets when used for food production will still make our city attractive and attractive settings encourage investment, and investment encourage a sustainable transport system, sustainable urban drainage, rainwater collection and wastewater cleansing and waste management. These assets help in creating attractive and distinctive workplaces, reducing flood risk and the impact of climate change, and creating space for nature [19], having in mind that these assets will also help in make the city or urban area food sustainable. Green Infrastructure assets enables landscapes to deliver social, economic and environmental benefits simultaneously [19] and more importantly food production, and these benefits has a multiplier effect by being connected to a wider network of spaces. By retrofitting urban agriculture into green infrastructure will also increasing tree-canopy cover within the city or urban area, which will reduce the urban heat island effect through evapotranspiration and shading, also improving air quality, connected green infrastructure assets will create wildlife corridors to enable richer species movement and a more vibrant biodiverse habitat is created in the face of a changing climate. Effectively annexing the benefits of green infrastructure and effectively retrofitting urban agriculture in our existing cities or urban areas presents a win – win situation for all.

Theorized Benefits
Below are the potentials and environmental benefits the proposed integration will supply

- **Heat amelioration:** [20] have shown that open spaces with a higher number or larger area of trees have been found to have lower temperatures compared to those with fewer trees. Trees and shrubs provide protection from both heat and UV radiation by direct shading. It is a proven fact that GI reduces heat effects along it links and it connected space, this benefit is further enhanced by making these spaces food producing spaces by replacing the trees with fruit bearing trees and one of the benefits of GI is still maintained based on the above studies.

- **Improving air quality:** The role of vegetation in mitigating the effects of air pollution has been highlighted as one of the potential benefits of urban green space [21] Trees in urban green space can influence air quality in several ways; for example, through direct absorption of gaseous pollutants and interception of particles onto leaf surfaces, by lowering air temperatures through transpiration which can reduce the formation of ozone, and through the direct production of oxygen during photosynthesis.

- **Reducing flood risk:** Green infrastructure provides a means through which to restore natural environmental features to the urban environment and can provide hydrological benefits in two key areas: flood alleviation and water quality. The following range of studies help to illustrate this important contribution. [22] showed that the increased hydraulic roughness associated with planting native floodplain woodland along a 2.2 km grassland reach of the River Cary in Somerset could reduce water velocity by 50%, and raise the flood level within the woodland by up to 270 mm for a 1 in 100-year flood.

- **Environmental Justice:** Urban agriculture offers a potential entry point to alleviate environmental justice problems, by working to increase food security, creating green jobs, beautifying blighted neighbourhoods, offering locally grownnutritious fresh produce and bringing communities together through stewardship, thus contributing to asense of neighbourhood pride and identity. Farms also improve neighbourhood aesthetics by creating additional spaces for recreation, which in turn increase property values.

**RECOMENDATION AND CONCLUSION**

The objective for this study was to investigate retrofitting within the green infrastructure network to accommodate urban agriculture, a process of producing food in the city and urban space by incorporating green architecture, that will enhance community, family, and interpersonal bonding, as well as give identity and pride to residents’ [3], and by creating habitats that enhances biodiversity within the existing urban areas. It is has been shown that Green Infrastructure (GI) effectively fused into our existing infrastructure such as roads, railways, bridges, buildings and energy networks [23] to integrate better or function with, green infrastructure without demolishing but maximising the opportunities presented by these grey infrastructures by introducing green roofs, green wall, street trees and other green assets where it is possible, in order to bring about a network that is also meant to produce food within the urban settings a true ecological network that is of benefits to both humans and wild life.

**REFERENCES**


Author’s Profile
Name: OSORE, Oludare Temitope.
Institution: The Federal Polytechnic, Ilaro
City Name: Ilaro
Country: Nigeria
Tel. No.: +2348035790908
Email: dareosore@gmail.com dare.osore@federalpolyilaro.edu.ng

Academic qualifications:
a) Master of Technology (M.Tech) in Architecture
b) Bachelor of Technology (B.Tech) in Architecture

Area of interests:
a) Architectural Design
b) Architectural Sciences
c) Place making
d) Sustainable Architecture
e) The Built Environment
f) Computer Aided Design & Drafting and Building Information Module

Pictorial Identification

---

[Image 311x48 to 391x143]