

Potential role of urban and peri-urban agriculture in sustainable development of Dehradun city

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Abstract

Urban growth in city brings series of changes within and around the city environment. Due to rapid urbanization, the rate of encroachment of urban activities into the agricultural landscape of the peri-urban areas increases. The change in land-use pattern of city from green space to build up area creates various impacts on agriculture land. Physical expansion of the city declines the proportion of land under agriculture and related activities. Series of these changes brings serious problems to the city. Rapid population growth, increase in the no. of urban poor, food insecurity, poverty, degraded environment, lack of green spaces, and pollution are the major problems. Urban agriculture provides the remedy to all these problems and considered as a benefactor to sustainable city development. Through this research, an attempt had been made to promote Urban Agriculture and how it helps in sustainable city development. Urban farmers have been facing some challenges including shortage of inputs and lack of land. This study thus aims to investigate the level of contribution of urban crop production to household food security. It also seeks to establish some of the challenges faced by urban farmers and come up with some recommendations on how the activity may be implemented in a sustainable way.

Keywords: rapid urbanization, urban poor, food insecurity, urban agriculture, green spaces, urban crop production

Introduction

'Development' refers to the state of special situation and the process of change made by it. In the context of human history, economic advancement was considered to be an indicator of development and development was quantified and quantified by economic conceptions. Due to changing nature of time human and environmental relations emerged. The action and activity of the human beings determine the position of society. Therefore, processes also depend on the types of resources available, how technologies are used. High availability of technology and resources raises the level of development. It is said that development is a concept, process, in which economic, social, and environmental progress has seen or it promotes positive and favorable change in society, environment and economy. It is not necessary that the development which is positive for human beings is also positive for environment. Human activities were also due to which the exploitation and problems of environment and depletion of natural resources continued to grow in qualitative proportion, which directly affected the human activities.

The changing nature of rural morphology into urban morphology indicates change in the social and physical phenomena. The availability of basic facilities pulls rural population in urban area. Increasing population growth, rural-urban migration and the re-classification of settlements from rural to urban have contributed to the rapid urbanization of our towns and cities. These populations settle down within or around the city. This leads to the rapid urbanization and city expands in horizontal and vertical context. These growths directly affect the green spaces of the city and leads to haphazard development. Due to the increase of population, the pressure creates on the fulfillment of various types of comfort

facilities. People have to face different food and daily supply related difficulties and they become economically and socially vulnerable. The physical congestion of the city manifests into the unassertive features of urban houses, daily utility and infrastructural shortage that cause public health problems, pollution and sanitation related problems. City becomes more congested when green spaces are dissipating by the build-up and non-agricultural activities.

Therefore, in today's context of increasing urban poverty and pollution caused by rapid urbanization, urban agriculture is being considered as an aid to city management in a sustainable manner. The world food price crisis has rendered the importance of understanding and confronting the causes of food insecurity of the urban poor. Poor urban dwellers, being largely net food buyers are depending mostly on markets for their food supplies. Urban Agriculture is one of the solutions that are perceived globally to meet the demand of food for urban population. There are a number of ways through which urban agriculture can positively impact on urban food security. At the household level, urban agriculture can be a source of income; can provide direct access to a larger number of nutritionally rich foods in and out seasons.

Urban agriculture can be described as any form of food and non-food growing or processing of produce that is sold to consumers both within and on the margins of an urban area (Mougeot 2006). Urban Agriculture is one component of local food system which can be defined in many ways and will need to be adapted to the local context. Urban agriculture can be defined as the growing of plants and the raising of animals for food and other uses within and around cities and towns, and related activities such as the production, processing and marketing of products. It also includes activities like animal

husbandry, aquaculture, agroforestry, urban beekeeping, horticulture and floriculture. Urban Agriculture is located within or on the fringe of a city and comprises of a variety of production systems, ranging from subsistence production and processing at household level to fully commercialized level agriculture. Urban and peri-urban agriculture (UPA) is one set of activities resulting in greater food production, improved livelihood opportunities for urbanites and the enhanced environmental quality of cities (Mazumdar, 2005) [5].

The concept of sustainable city/urban development have emerged over the last decades as a new requirement for metropolitan and urban level public action which involves conceptual principles and practices as applied in land use planning. The need for sustainable urban planning and development reached an important point in 2008, when half of the world's population was defined as living in cities. A sustainable city enables all its citizens to meet their own need and to enhance their well-being. Planning as the framework within which urban development occurs, can play a major role in helping to ensure sustainable urban development. This study seeks to articulate the contribution of urban agriculture in Dehradun. It will particularly address the Urban Agriculture activities in Dehradun taking into consideration its impacts on urban food security, Health, Sustainable Environment and Poverty alleviation which leads to the Sustainable city development.

Statement of Problem

The Dehradun city recently added in the list of smart city. The different provision will provide to city to develop in a sustainable manner but to develop population with the infrastructure is not only way or method to achieve the concept of smart city. The local should have the accessibility, availability and affordability of any kind of basic facility which leads to the overall development. The city has the 28% of household under lower-middle category, 11.6% under upper-middle, 7.6% under below poverty line and 6% under the category of high class category. There is on-going urban agriculture in the area. This is practiced both inside the residential stands and on public land adjacent to roads, railways and electric way leafs. It is also carried out in unutilized spaces next to schools and public amenities. Local people need to have Food Security as the area has the relatively high level of poverty. The area can also be considered as being both urban and peri-urban and has good transport infrastructure. The growth of cities is due to the natural growth of urban population and migration from the rural areas to the cities. There is general consensus that urban populations will continue to grow rapidly in most developing countries in the decades to come. Many cities cannot cope with such massive population growth. City authorities around the world face enormous challenges in creating sufficient employment, in providing basic services such as drinking water, sanitation, basic health services and education, in planning and maintaining of green spaces, in managing urban wastes and waste water and in decentralization and creation of efficient local autonomy.

Growing urban poverty goes hand in hand with growing food insecurity and malnutrition in the urban areas. Urban agriculture has always been part of city life. Urban citizens

develop many different strategies to improve their livelihoods and urban agriculture is one of them. The adaptation of urban agriculture has a direct response to urban farmers for conducive urban policies and programmes, stimulating and enabling urban agriculture to fulfill certain functions required for sustainable city development like local economic development, food supply as well as recycling of wastes, verdant greenery, maintaining open green zones, provision of recreational services, and social inclusion of disadvantaged groups etc. It is no surprise then, that agriculture within cities can have many different functions. Some of the functions of agriculture can be valued in monetary terms while with others this is hardly possible (aesthetical or sentimental values). The sustainability of urban agriculture is related to this multi-functionality. Urban agriculture adapts and develops along with the city according to the wishes of stakeholders who represent these diverse functions. Therefore, Urban Agriculture is very needful to the city to cope up with the various city dynamics and city problems. The Habitat II Conference of 1996 recognized urban agriculture as a realistic and desirable land-use option in urban areas and as an integral part of the urban system. Habitat III, the UN's conference on October, 2016 explored urban agriculture as a solution to food security. Urban agriculture was acknowledged for its potential role in increasing food security, employment and income generation, poverty alleviation, community resources development and conservation, waste management and environmental sustainability.

Objective

The overall objective of the research is to examine the role of Urban Agriculture in food security, poverty alleviation, health and environment justice and how it will leads to Sustainable City Development.

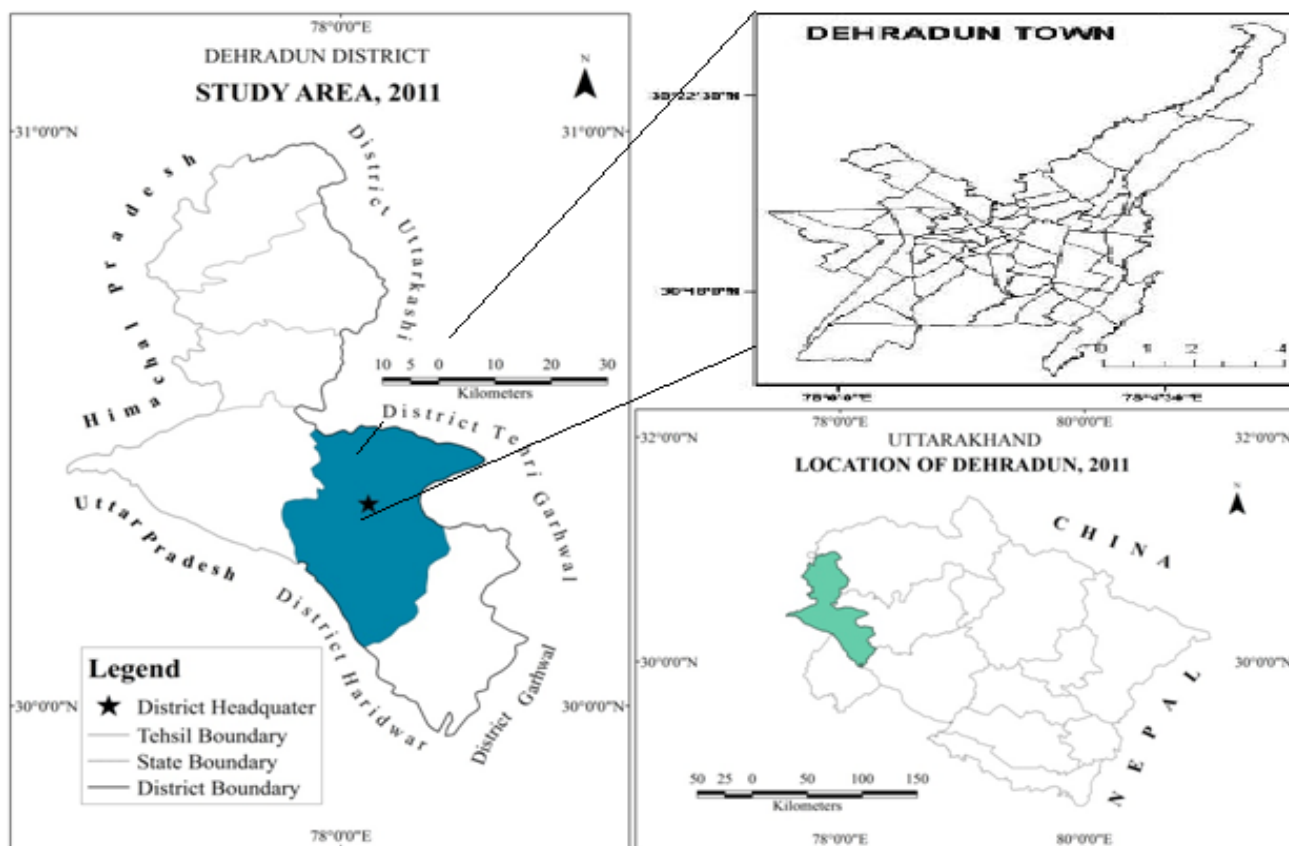
Study Area

Dehradun is the administrative centre and the interim capital of Uttarakhand. Dehradun is bounded by the Himalayas in the north, the Shivalik hills in the south, the Ganges in the east and the Yamuna River in the west. Dehradun city covers an area of 58.46 k.m.² The geographical extension of Dehradun town is between 78°00' E to 78°15' E longitudes and 30°15' North to 30°25' N latitudes. According to the Census of India, total population of the study area was recorded as 574,840 persons with the population density of 9833 per sq.km in 2011. Dehradun is located in a synclinal valley within the Siwalik formation. Dehradun is situated at the Himalayan foothills in the fertile Doon Valley. The salubrious and slightly milder climate and natural beauty makes Dehradun as one of the favorite residential cities. The climate of Dehradun is quite pleasant even in summer; the average maximum temperature is 36.6°C and minimum of 26.7°C. The winter temperature ranges from 5.2°C to 23.4°C. The annual rainfall is up to 177.8 cm to 288.6 cm and the monsoon lasts from June to September.

Dehradun is well known for its tourism spot, scenic natural beauty, beautiful sal forests, waterfalls, picturesque landscape and surroundings. Apart from this, the town also performs administrative, commercial, and defense related functions. A large number of educational institutes as well as research

institutes are situated in Dehradun town therefore it's also known as the school capital of India. Survey of India, Forest Research Institute, Indian Institute of Remote Sensing, Oil and Natural Gas Corporation, Zoological Survey of India, Indian Military Academy, Wadia Institute of Himalayan Geology and

Indian Institute of Petroleum are major institute in city. Rapid expansion of built up areas at the cost of forest and agriculture land is a common feature in this town. Therefore, an effective land-use planning is required for the overall development of the town.



Source ¹: <http://technical.cloud-journals.com/index.php/IJARSG/article/view/Tech-409>

Source ²: Prepared by Researcher

Fig 1: Location of the study area

Methodology

This research deals with the Urban Agriculture in Dehradun, which includes assessment and dynamics of Urban Agriculture, awareness of people and food security of urban and peri-urban areas. The methodology of research is analytical and descriptive. The main purpose of this section is formulating a methodology comprising of:

i) Nature and Sources of data

The primary information is collected with the help of observation method, survey, in-depth interviews and questionnaire. The secondary data was taken out from different published and unpublished literature, internet sources, and government websites, like city development report, census of India, District census handbook, Dehradun, statistical abstract of Uttarakhand, horticulture department, JNNURM-city development plan, and District Administration Dehradun etc.

ii) Data Collection

With the primary source of data, questionnaires and in-depth interviews were the main tools to obtain primary information.

Majority of the primary data was collected with the help of questionnaire and personal interview. The researcher used questionnaires with both open and closed ended questions which were administered to the 100 households. The questionnaires were filled up in Dehradun Tehsil; where information gathered from Kashmiri Colony. The Simple Random sampling technique has been used for the collection of data.

iii) Analytical Techniques

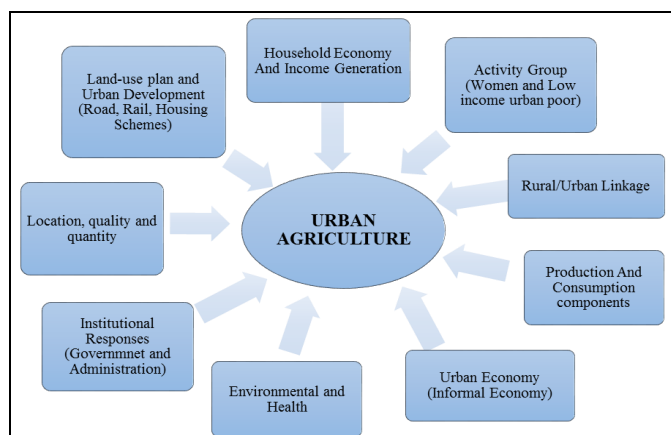
The data obtained during the survey was analyzed using both qualitative and quantitative approaches. The methodologies employed to analyze the data for this research included both descriptive and inferential statistics. Quantitatively the data has converse into frequencies, Tables, Pie Charts, Flow Charts, bar diagrams, line graph etc. Statistical tools such as frequency distribution and cross-tabulation were used in the process of presenting and analyzing data from the field. Arc GIS 10.2.2 software (GIS Software) is also used for the map making. Qualitatively, information gathered from the interviews, observations and key informants were summarized into statements and analyzed manually. A triangulation of

both quantitative and qualitative methods was used in order to give the research statistical and conceptual significance.

Result and Discussion

The word development is used for the development and transformation of a particular society. The process of human environment depends on the traditional technology, while the technique and organization have helped in enhancing human environment relations. Thus, development is a multi-directional ideology and changing the economy poses in a positive value. Sustainable development is the new concept of development. There is an arrangement for meeting the needs of current and future generations in sustainable development. Development is also what is done without affecting the present generation. In this, special emphasis is placed on the protection of the natural environment. This means do not use valuable resources like forest at this pace so that they can't be reproduced or re-instantly reproduced at the same speed. In order to preserve earth's reaches, we need to work in harmony with nature.

Urban agriculture, although often overlooked in policy development and by city planners, is vital to enhance the health and well-being of its citizens. The potential for food production in cities is great and the benefits to cities are many. Dozens of municipalities are demonstrating that urban agriculture is a necessary and viable urban land use. Urban agriculture and the food system more broadly, is an integral part of the physical, economic, social and spiritual well-being of places that planners care about. Urban agriculture can support the sustainable management of vacant and risk-prone land and water areas by applying specific production techniques and optimizing productive use of lands not suitable for construction (steep slopes, roadsides, and water harvesting areas).



Source: Prepared by Researcher

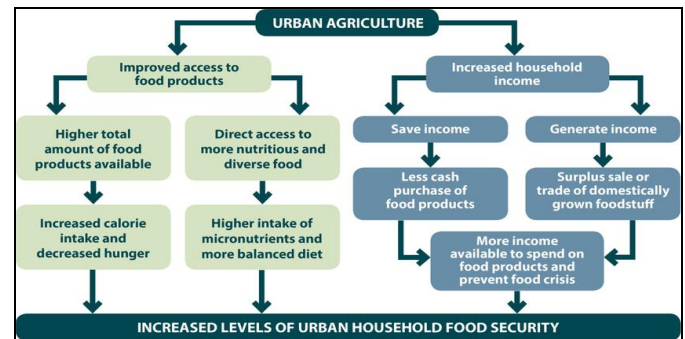
Fig 2: Urban Agriculture as a holistic approach

Sustainable aspects of Urban Agriculture

i) Economic Sustainability

Food Security is a situation means that all people at all times have physical and economic access to adequate amounts of nutrition, safe and culturally appropriate foods. It means the availability, accessibility and affordability of food to all people at all times. It also means that the people who produce our food are able to earn a decent, living wage, growing,

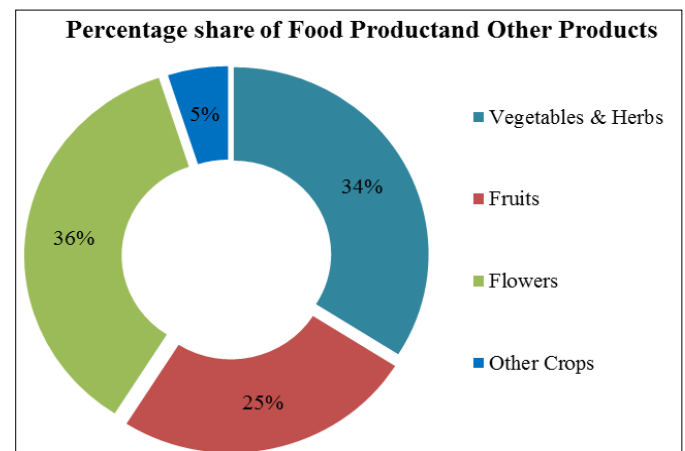
catching, producer, processing, transporting, retailing and serving food. Access to healthy food and optimal nutrition for all comes at the core of food security. Urban agriculture produces food security by providing direct access to home-produced food to households. Urbanization brings major changes in demand for agricultural products both from increases in urban populations and from changes in their diets and demands. This has brought and continues to bring major changes in how demands are met and in the farmers, companies, corporations, and local and national economies that benefit. It can also bring major challenges for urban food security. This includes more scope for urban and peri-urban agriculture.



Source: www.researchgate.net

Fig 3: Urban Agriculture: Two way path to increased food security

Almost 95 percent of households agreed that urban agriculture is a better aid to food security. 90 percent of households agree that they grow food for themselves which shows the subsistence level of urban agriculture as well as the growing food security to the region.



Source: Primary Survey, 2016

Fig 4: Percentage shares of food products

Most of the household cultivate different variety of food product. The multiple cultivation of food products provide different food to eat. Vegetables and herbs (34 percentages) are the most cultivated food product in study area followed by different fruit products. The production of flowers in every household is easily available as they are used for the beautification.

Table 1: Different Food Products

Different types of food product grown in Dehradun	
Category	Food Product
Vegetables	Amaranths, Bitter Gourd, Bottle Gourd, Beans, Cabbage, Carrot, Cauliflower, Chilly, Eggplant, Garlic, Green Vegetables (<i>Sarso, Bathua</i>), Jack fruit, Lady-finger, Lemon, Luffa Gourd, Onion, Peas, Potato, Pumpkin, Radish, Silk-Cotton, Spinach, Sugar-beet, Sweet Potato, Tomato and Turnip.
Fruits	Banana, Citron, Guava, Litchi, Mango, Papaya, Peach, Pear, Plum, Pomegranate, Pyrus Malus and Orange.
Flowers	Marigold, Rose, and Sunflower.
Herbs	Basil (Tulsi), Cassia (Tejpatta), Coriander and Mint.
Crops and Plantation	Cotton, Maize, Mustard, Pulses, Rice, Sugarcane and Wheat
Others	Aloe-vera, Bakule, Cactus, Ficus-virena, Groundnut, Hibiscus, Mehndi, Money Plant, Phyllanthus emblica (Aawla), Popler, and Sevchana.

Source: Primary Survey, 2016

Most of the household has practicing farming activities from past 4 to 7 years and some more than that. The duration of food cultivating time clearly indicated the duration of food availability in a cheaper rate. This shows the level of food security that provides, afford, and make accessible to everyone to get healthy and fresh food.

ii) Social Sustainability

Effectiveness of UA is not limited to poverty reduction at the household level, since it also creates economic employment. After all, not only family members of farming households are set to work to produce goods, but numerous other people are involved and employed in the farming, marketing and processing activities. Food composes a substantial part of urban household expenditures (almost 70-80% of total budget) and the lack of cash income translates more directly into food shortages and malnutrition in the context of city. Urban Agriculture benefit economically as the production activities help to saving on food expenditure. These savings can be used for other livelihood essentials like water, medicines, rent,

schooling and clothing. It also spends for the sales of surplus crop in addition from production and sales of processed products and agricultural inputs. Instead for paying or expand on crops, fruits and vegetable, the amount can be expand on other activities.

Urban Agriculture can easily control poverty alleviation which directly and indirectly affects each and every household. This can put an expeditious curb to cities that are quickly becoming the principal territories for intervention and planning of strategies that aim to eradicate hunger and poverty and improve livelihoods, requiring innovative ways to stimulate local economic development in combination with enhancing food security and nutrition. Most of the farmers produce for themselves but some of them also participate in commercial form of Urban Agriculture. The farmers earn almost 8,000-10,000 per month after selling their food product to Niranjapur and nearby market. This income is used in the fulfillment of basic facilities except the food product because whatever they grow almost half of the amount (commercial farmers) they store or use for themselves only.



Source: Primary Survey, 2016

Fig 5: Niranjapur market

Health issues in urban environment can relate to pollution, both chemical and biological, asthma, chronic respiratory diseases, unhealthy diets, heart diseases, cancer, diabetes, etc. with the rapid increase in population of the city due to the natural growth and migration; city is unable to provide the services needed to particular low income and poor group.

Urban Agriculture also anecdotal increased in fruit and vegetable consumption. It provides different vitamin, nutrients to our body which directly increase the health. The following list shows the different vitamins and nutrients from vegetables, fruits and food grains grown in Dehradun.

Table 2: Vitamins and nutrient from food products

Vitamins and Nutrients from Different Fruits/Vegetables/Grain Grown in Study Area	
Vitamins & Nutrients	Fruits and Vegetables
Vitamin A	Guava, Mango, Papaya, Amaranth leaves, Carrots, Peas, Pumpkin, Spinach, Sweet Potato, Banana, Litchi
Vitamin B1	Guava, Mango, Orange, Pomegranate, Beans, Corn, Peas, Potatoes, Sweet Potato, Rice, Wheat, Banana, Litchi, Eggplant,
Vitamin B2	Banana, Litchi, Pomegranate, Amaranth leaves, Peas, Pumpkin, Beans
Vitamin C	Litchi, Mango, Papaya, Orange, Lime, Lemon, Banana, Peach, Luffa Gourd, Tomato, Cabbage, Plum, Pear, Peach,
Vitamin E	Guava, Mango, Peach, Papaya, Potatoes, Pumpkin
Vitamin K	Pear, Plums, Pomegranate, Mango, Tomatoes, Carrot, Cabbage, Cauliflower, Peas, Spinach,
Folic Acid	Beans,
Iron	Beans, Peas, Potato, Spinach, Amaranth,
Potassium	Cabbage, Carrot, Eggplant, Peas, Banana, Sweet Potatoes
Fiber	Cabbage, Eggplant, Spinach, Bottle Gourd,
Calcium	Papaya, Pumpkin, Sweet Potato, Spinach

Source: prepared by researcher

Plants have been used for medicinal purpose form primitive time. Treatment with medicinal plants is considered very safe as there are no harmful side effects. Medicinal plants such as Aloe-vera, Tulsi, Neem, Turmeric, Mint and Ginger cure several common ailments. These are considered as home remedies in many parts of the country. It is known fact that lots of consumers are using Basil for making medicines, tea, in Pooja and other activities in their day to day life. The papaya leaves also used as the remedies of dengue fever. The leaves of guava help to control the diabetes. Most of the households have grown Basil (Tulsi) because of its multiple advantages followed by aloe-vera and neem.

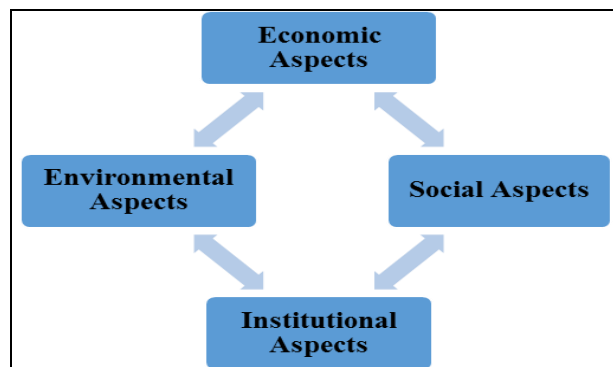
iii) Environmental Sustainability

Besides food security, there’s an aesthetic aspect to urban farming which is environmental benefits. When crops are grown in yards, they create green spaces, which give the environment a pleasant appearance. They also purify the air

by absorbing carbon dioxide from the air through photosynthesis and producing oxygen in return. Urban Agriculture contributes to environmental change in several ways by encouraging the use of partially processed solid and liquid biodegradable waste and by assimilating air pollution with the help of trees. Temperature tends to reduce with the growth of trees and plants. Urban Agriculture also takes care of public health concerns. It also provides the better socio-economic condition that lead to a better quality of life. Other components like assimilation of waste, aesthetics, and regulating micro-climate plays major role in environmental sustainability.

iv) Institutional Sustainability

Government support is very important for the fulfillment of institutional related initiative. Government and institutional body regulate, manifest, coordinate and facilitate the decision making on sustainability polices. In dehradun there is no as such government policy and program for the enhancement for the provision of Urban Agriculture. In urban agriculture government should create separate institution and regulating body for urban agriculture under urban city planning.



Source: Prepared by Researcher

Fig 6: Pillars of Sustainability

Sustainable Development Goals and Urban Agriculture

The Sustainable Development Goals are a set of 17 global targeted goals and indicators that 193 UN members states will be expected to use to frame their agendas and political polices from 2015-2030. The urban agriculture somewhat can helps to get these development goals. The 17 SDGs are listed below;



Source: www.un.org

Fig 7: Sustainable Development Goals

Goal 1: No Poverty- Reduction in poverty can achieve with the help of urban agriculture as it supports the income generation to the urban poor. The Urban Agriculture indirectly and directly creating a job opportunity. Directly; a farmer can sell their product to market and indirectly; the saving of money can spend on buying food product is not less than a job.

Goal 2: Zero Hunger- Urban households involved in Urban Agriculture are generally more food secure and benefit from a more diverse diet. Increasing food security in an urban environment through urban agriculture has the potential to offer greater nutrition to residents of that urban area. If one were to use urban agriculture to achieve food security they could potentially grow enough food to feed local populations and increase the nutritional value of the local diet.

Goal 3: Good Health and Well-being- Urban agriculture provides the better quality food which has organic base and provides important nutrition's. Improved access to fresh food and nutrition's from these food products are directly relates to improved health. The different unaffordable fruits and vegetables provide individual a good no. of nutrient which can increase in better health.

Goal 5: Gender Equality- The dominance of (poor) women has been explained by higher levels of unemployment amongst women and the fact that it meshes well with their other domestic type of duties. Research shows that women dominated urban farming activities. In Dehradun city, women constituted 80 percent of the urban farmers. Women are the main beneficiaries of Urban Agriculture and therefore, UA contributes to the reduction of gender inequalities. One of the reasons mentioned for women to dominate the Urban Agriculture sector is that farming meshes well with women's other household activities.

Goal 8: Decent Work and Economic Growth- Food production, processing and marketing also contributes to generating income and employment for many poor urban households. The role of gardening as perceived by gardeners was that it removed hunger by feeding the households, and sometimes generated a cash income.

Goal 10: Reduced Inequality- Urban agriculture may function as an important strategy for poverty alleviation and social integration of disadvantaged groups (such as immigrants, HIV-AIDS affected households, disabled people, female-headed households with children, elderly people without pension, youngsters without a job) by integrating them more strongly into the urban network, providing them with a decent livelihood and preventing social problems.

Goal 11: Sustainable Cities and Communities- As increasing the farming or agriculture activities in urban/peri-urban/city which leads to the Sustainable city is very much important. Urban agriculture is an important source of income for a substantial number of urban households, recreational facilities, food security, environmental effects, land-use planning, food security, poverty alleviation, and employment generation which holistically leads to sustainable city characteristics.

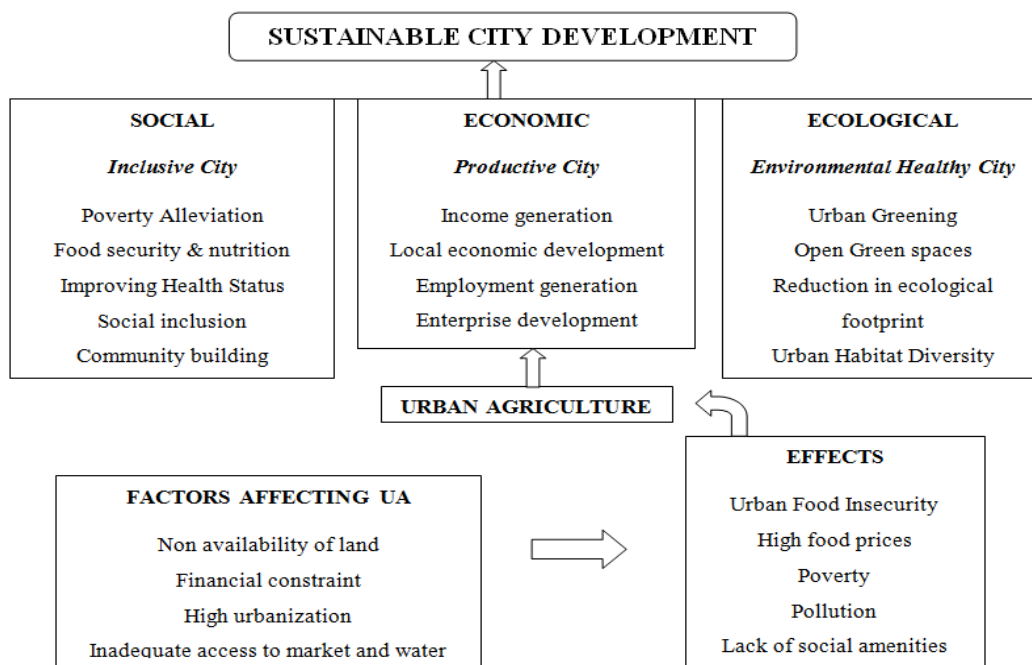
Goal 13: Climate Action- Urban agriculture reduces pollution in two obvious ways: first, through the reduction in fossil-fuel emissions associated with the transport of food and non-food products into urban environments, and second, through reduces the amount of pollution in an urban area because of the increased presence of plants in the urban environment. Growing plants in the urban environment reduces pollution because of the photosynthetic properties of plants, which absorb carbon dioxide and release oxygen. Introducing more plants into an urban environment, using urban agriculture, can also reduce pollution. The production of trees, shrubs, flowers, and ornamental plants and food crops can beautify the city, cool its climate, curb erosion and absorb air pollution.

Goal 16: Life on Land- Urban agriculture is in other cases part of an integrated environmental policy, with its main benefit being the greening of the city, increasing citizen's access to nature, recreation and leisure and their awareness of their environment. Urban agriculture can also positively increase biodiversity through ecological and verdant greenery.

Sustainable City Development and Urban Agriculture

With the rapid urbanization going on, it means cities must be conscious of the fact that they need to feed themselves given their sensitivity to food shortages. Food planning has therefore become an important and legitimate part of the planning agenda now in both developed and developing economies. A study of the definition, concept, characteristics, practices and the possible benefits of Urban Agriculture lead to envisaging a multi-dimensional role of Urban Agriculture In city management As mentioned earlier, the different sectors of development that can be promoted by Urban Agriculture are: food security, poverty alleviation, employment, economic development community participation and social upliftment, land-use planning regeneration, assimilation of solid, liquid and gaseous waste, environmental change including microclimate and aesthetics and recreation. However, the potential of Urban Agriculture to improve the city's economy and environment, as also the socio-economic status of the citizens from employment in Urban Agriculture and better access to food and nutrition and thereby a good quality of life, is intimately connected to the process and extent of urbanization, its impacts and the methods used for city management. Effective practice of Urban Agriculture will

depend upon factors like the nature of city growth and administration, plan-provisions for urban expansions that influence land-use and activity zones, the institutional support available, the city's economy including the extent of poverty and unemployment, the quantity and quality of infrastructure support and so on. To consider all these, a systematic approach will have to be adopted to integrate them into an efficient city management plan, including an environment management system. Urban agriculture may also contribute to cleaning of the city by turning derelict open spaces and vacant land areas into productive and green zones. Urban agriculture contributes to reduction of the ecological foot print of the city and reduction of energy use for transport, packaging, cooling, etcetera, by producing fresh foods close to the consumers. Urban agriculture has been practiced throughout the world for thousands of years and is an integrated urban form in many places. It is practiced in many areas that city planning is concerned with: on city streets, in public gardens, parks and schools, and in community gardens and offers many benefits to city life. The sustainability of urban agriculture is related to its contributions to the development of a sustainable city as an inclusive, food-secure, productive and environmentally healthy city.



Source: Prepared by Researcher

Fig 8: Conceptual Framework on in UA into sustainable city development

S.W.O.T. Analysis of Dehradun city in terms of Urban Agriculture

Study to identify internal strengths and weaknesses as well as external opportunities and threats are very important to understand urban agriculture in terms of city development. The city has several strengths related to the urban agriculture. The favorable climatic conditions, fertile soil, water resources, fair amount of rainfall makes better agriculture conditions. The major areas of weakness for the city includes infrastructural facilities, poverty, high no. of urban poor, rapid urban growth, fragmented landholdings and lack of

government policies for urban agriculture. Dehradun has several potential and existing opportunities for urban agriculture. The availability of favorable climate, water sources, land resources and provision towards city planning with the smart city concept could be the primarily opportunities for the sustainable development. Opportunity majorly divided into three major parts;

i) Environmental Opportunity

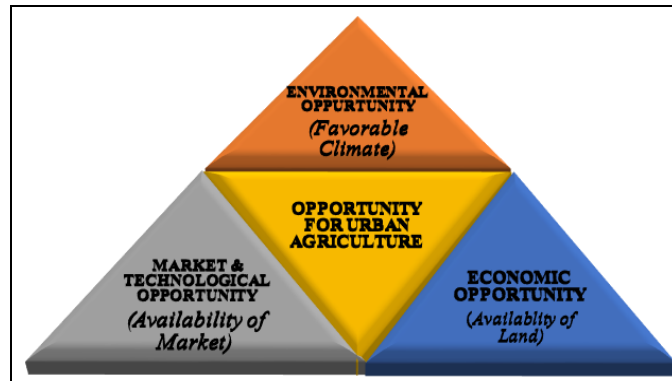
Dehradun climate is Humid Subtropical Climate which generally has a wet summer with associated high

temperatures, and mild, dry winters. The availability of river tones, Yamuna, and Bindal provides the loamy alluvial soil to this region. The distribution of vegetation communities is closely related to soil differences, primarily soil structure and moisture retention characteristics. Dehradun soils are closely related to the climatic influences especially continental effect of high rainfall and high summer temperatures which have promoted weathering and mineral leaching. Dehradun has the advantage of favorable climatic and soil characteristics and when combined with the converging influences described earlier make a strong case for the development of urban agriculture. The climate provides the opportunity from which

more and more crops and plantation can be grown.

ii) Techniques and marketing opportunities

This section describes the opportunity that exists by growing high value crops for local direct markets. The urban farmer has to think creatively when considering getting more and more profit with the help of suitable techniques. Various vegetables like Green vegetable, Spinach, Potato, Chilly, Onion, and Amaranths are easily available in market any time. The nearest market is Niranjanpur market where farmer can easily sell their products.



Source: Prepared by Researcher

Fig 9: Opportunity for Urban Agriculture

iii) Economic Opportunity

The most of the population of Dehradun lives a lower middle class lifestyle. Population doesn't have an advanced technical assists but they have a moderate size of land holdings. With the help of suitable techniques they can earn a good amount of profit. The availability of land gives them upper hand to

cultivate their land by subsistence approach or with the commercial approach. Threats majorly exist weakness, which if not addressed soon might pose as threats in future for the development of city. The SWOT analysis of dehradun city in terms of urban agriculture is given below;

<p style="text-align: center;">Helpful</p> <p>Strengths</p> <ul style="list-style-type: none"> • Suitable Agriculture Conditions • Institutional Hub • Citizens involvement in city affairs • Green Space • Variety of food production 	<p style="text-align: center;">Harmful</p> <p>Weaknesses</p> <ul style="list-style-type: none"> • Poverty • Lack of Local Markets • Fragmented landholdings • Lack of infrastructural facility • Lack of government policies for Urban Agriculture
<p>Opportunities</p> <ul style="list-style-type: none"> • Availability of whole sale market • Availability of water resources • City planning to Smart city • Availability of land for agriculture • Provision of policies for urban poor's 	<p>Threats</p> <ul style="list-style-type: none"> • Immigration • Increasing Population • Rapid Urbanization • Incline towards tourism economy • Water pollution

Source: Prepared by Researcher

Fig 10: SWOT analysis of city in terms of Urban Agriculture

Cities Farming for the Future

A growing number of cities are designing policies and programmes for urban agriculture, applying holocoenotic

planning approaches to identify effective ways to integrate urban agriculture into urban sector policies, urban land use planning and sustainable urban agriculture. There is a need to

explore the relationship between multi-dimensional concepts and sustainability of urban agriculture. Areas for further research and development includes land tenure, legislation and urban land use planning; gender; methodologies in working with stakeholders, such as action research with urban farmers or with planners to include agriculture in environmental planning, as a part of green belts, city parks and open spaces; development of new institutions or institutional arrangements such as urban and peri-urban markets and support to (commercial and subsistence) horticulture, aquaculture and livestock systems. Facilitating such research and development requires the creation of adequate institutional frameworks that give urban agriculture an institutional home and ensure the active participation of direct and indirect stakeholders in the formulation and implementation of urban agriculture policies and action programmes. Urban agriculture will be sustainable, maintaining its dynamism and flexibility, adapting to changing urban conditions and demands, intensifying its productivity and diversifying its functions for the city, reducing associated health and environmental risks and by doing so gaining more social and political acceptability. In certain parts of a city, the existing forms of urban agriculture may fade away or change its form and functions drastically, while new forms of urban agriculture may develop in other parts of that same city. On the longer term, urban agriculture will be sustainable especially if its potential for multi-functional land use is recognized and peoples active involvement in sustainable approaches.

Suggestion and Conclusion

Urban Gardening is a multi-sector, comprehensive, integrated intervention in Dehradun. By developing high quality food produce and improving access to markets we can also help vulnerable groups such as unemployed youth to increase their income and improve food security in the long term. Sustainable Urban Agriculture supports community members to include environmental conservation techniques and smart agricultural practice in their urban agricultural systems. By promoting Urban Agriculture in urban gardens for community groups and school, including rainwater harvesting systems, greenhouses and sacrificial wells and drip irrigation system will help urban agriculture with environment friendly approach. We can also include livestock, training in organic farming practices, and access to new markets and micro-enterprises to boost incomes and food security and Sustainable City. Some suggestions are mentioned below for boosting urban agriculture;

- Urban A farmers need a strong support on a range of issues such as training, extension services and financial support from government and non-governmental sides.
- To improve food production, urban farmers need access to inputs markets which required access to credit facilities and financial institutions that accommodates their needs.
- Government should give provision to infrastructure facilities which involves irrigation facilities, fencing and cold storage.
- Provide sufficient support services to the urban small scale agricultural sector.
- Encourage teaching of agriculture as a subject in urban schools.
- Encourage national and international investment on infrastructure and technology development required for Urban Agriculture development e.g. food parks and agro parks.
- Promotion of ecological farming methods to reduce risks related to intensive use of agrochemicals and nano-technology.
- Government and NGO can educate and aware farmer for the management of health risks, proper choice of crops and irrigation methods, hygiene, and management of animal wastes.
- Establish urban agriculture based institutions to promote and regulate urban agriculture activities.

The results of the study confirm that Urban Agriculture production has a significant contribution to food security for those who practice it. Urban agriculture is examined in the context of poverty alleviation. A descriptive and quantitative assessment of the salient variables of the practice in the area is attempted in order to give an insight of the potential role the sector can play in eliminating poverty, environmental benefits, enhancing incomes and creating employment. The study shows that participation in urban farming can impact significantly on poverty conditions and improve livelihoods. Planning as the framework within which urban agriculture occurs, can and should play a major role in helping to ensure sustainable city development. The results from this study indicate that food security can be derived from urban agriculture since it provides sufficient quantities of food, appropriate nutrition, cost-effective food supplies and reduction in food bills. It also shows that the declining pattern of Urban Agriculture increasing the environmental problems such as increasing rate of pollution day by day in Dehradun. Therefore, we can say the Urban Agriculture helps city and city resident in multi-dimensional ways.

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