Urban Agriculture: Ecological Functions for Urban Landscape

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Abstract

Urban agriculture is a pivotal landscape concept in many urban areas, especially in a developing country. It is one significant strategy for food security in both urban poverty and the loss of biodiversity from urbanization. Urban agriculture does not only play an important part in creating a sustainable city but also affects the spatial structure of the urban landscape and its dwellers.

Bangkok is one of the rapidly growing metropolitans with a critical problem of urban poverty. A lot of green urban spaces have been replacing by urban structures. Many urban farms that played an important role in urban nutrients flow are also disappeared. Although the food security problem is not yet obviously seen today, the loss of productive lands in the city certainly causes urban environmental problems and quality of life of inhabitants.

This study reveals the influence of the old agriculture pattern on food culture in Bangkok and directions of urban landscape in the future. With examples of some existing and adaptive urban farms, this study explores different alternative methods to bring agricultural land back into urban landscape.

Keywords: urban agriculture, urban farm, ecological function, food security, productive land, Edible landscape

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1 Introduction
History of Urban Agriculture in Thailand

Bangkok, the capital city of Thailand, was once called 'The Venice of the East' because of its canals systems. These canals were not only served as the major transportation of the city but also used as irrigation systems of the old orchards and vegetable gardens in Bangkok and vicinity areas. Because most of the areas in Bangkok were agricultural lands, we had fresh, local grown, and cultural relevant food. There were less air and water pollutions because food was not travelled very far from the producers to the consumers. Communities and families were engaged through the cultural cuisine and food sharing, therefore, we knew where our food came from.

Even though Thai economy evolves from agriculture based to industrial and services based economy, agricultural areas are still important as we have urban planning policies to promoted Thailand as the world's kitchen during the next five to 15 years.[1] At the same time, according to a UN report, more than 50 percents of world population will reside in the urban areas, including Bangkok.[2] Today Bangkok has over 10 millions population with the area of 7,761.50 sq.km.[3] The city used to have enough productive lands to sustainably produce ample food for its citizens. However, because of the growth of urban development and the loss of urban agriculture, the city could not supply enough food for people and leads to food security problems. The quantity of food is not the food security concerned issue in Bangkok since we can easily access to local cheap street food. The critical problems are the quality of food, cultural loss, loss of biodiversity, and social impacts.

Low cost and low quality food productions are imported from farther away and it impacts our local agriculturists. The changes of these nutrient flows cause bad agricultural systems and worsen economic situation. Food has to transport from far distances. Consequently, there will be more problems pertaining food security, urban poverty, and cultural and environmental effects.

2 Food security and urban ecology

> *" Urban agriculture is the practice of growing and distributing food locally, and is, by nature, a practice that connects people with each other and their environment in a way that is participatory, democratic, and just. Local food production leads to increased food security and sustainable community practices that benefit communities…."*
>
> Urban Agriculture at Peseo Boricua. Dr.Pedro Albizu. Campos High school.
> (Construct an eco-friendly greenhouse on the cafeteria's roof as an extended science lab)

Urban agriculture has more benefits than urban food productions. Besides the food security, urban agriculture helps re-engaged the communities, enhances urban environment, contributes to local economic development, helps poverty alleviation, reuses grey water and solid waste, and provides green areas in the city.[4]

According to Resource Centres on Urban Agriculture & food Security foundation (RUAF), there are eight urban agriculture production systems:

1. Micro-farming in and around the house
2. Community gardening
3. Institutional urban agriculture
4. Small-scale commercial horticulture

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1 http://www.ghb.co.th/en/Journal/Vol2/15.pdf
2 http://www.unis.unvienna.org/unis/pressrels/2004/pop899.html
3 http://en.wikipedia.org/wiki/Bangkok_Metropolitan_Area
4 Resource Centres on Urban Agriculture & food Security foundation

5. Small-scale commercial livestock and aquatic farming
6. Specialized urban agriculture and forestry production
7. Large-scale agro-enterprises
8. Multifunctional farms

RUAF also categorized types of urban agriculture locations. Urban agriculture can take place inside the cities or in the peri-urban areas including:

- Homestead (on-plot)
- Vacant land away from the residences
- Private land
- Public land such as parks, roadside, railways
- Semi-public land such as schoolyards, hospitals or other institutions

Types of products grow in urban agriculture can be edible products such as vegetables, fruits, herbs, or animals and non-food products such as medicinal herbs, aromatic plants, or other tree products.

Bangkok's urban agriculture

The story of Bangkok and urban agriculture starts from the city's name. While the city's name 'Bangkok' is still unclear where it came from, one of the derivations of the name is the Java plum (*Spondias mombin*) which, in Thai, called Ma-kok (olive-like fruit trees). *Bang* is the central Thai name for town. And because there was abundant of Makok trees in this area, the city was called Bang Makok which has eventually changed to Bangkok.[5] In addition to the city's name that put us on view of the orchard city, the location of Bangkok is suitable for agriculture. Bangkok is on the Chao Phraya river basin where the sediment accumulated in the estuarine and makes this area fertility for agriculture. For that reason, Thai gardens are edible landscapes. Vegetations in Thai gardens serve not only visual purpose but also as a food for the family. There are four types of traditional Thai gardens:

Potted plants

The traditional Thai house is elevated house in order to live with water. We have our customs and our way of life according to weather and tides. Potted plants in Thai house are flexible that we could move it up on the terrace during the high tide. These potted plants gardens are also similar to roof gardens because we normally grow edible micro landscape in these containers on the large terrace of the Thai house.

Vegetable gardens

Every Thai house grows vegetable. We reuse household solid waste to make fertilizers for our vegetable gardens. This type of Thai garden is multi functional garden that grows various species of plants and vegetables where we can find almost everything we need in the kitchen.

Rice field

Rice fields are found in most of the central floodplain area of Thailand. There are also varieties of rice species in different parts of the country. Rice is not only the major component in Thai cuisine but also Thailand's major industrial drop.[6]

Orchard

In many areas of Bangkok were once orchards because it had a perfect weather and plenty of water resources for irrigations. The pattern of the old orchards in Bangkok shaped the pattern of the city. The streets were built over the canals and represent the grid of the old irrigation systems of the orchards in the old Bangkok.

Every type of Thai gardens associate with variations of edible vegetations. In addition to these private gardens, public landscapes in Thailand are also related to edible plants. Since Sukhothai period (1279-1298), the ancient capital of Thailand, the first public space in the city was filled with sugar palm trees (*Borassus flabellifer*). The sugar palm was chosen to plant by the king because of its long life and several advantages. People can made sugar from the palm, its fruits can be used in Thai desserts, many parts of the trees were ingredients in many dishes, and other parts of the trees can be used in many households products.

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[5] http://en.wikipedia.org/wiki/Bangkok_Metropolitan_Area

[6] Postharvest Technology Innovation Center. http://www.phtnet.org/news52/view-news.asp?nID=255

In Rattanakosin period, Many old streets in Bangkok are shaded by fruit trees such as Tamarind, Jackfruit, and Mango. These fruit trees served as urban green, shading for pedestrian, represent the cultural of ample city, and also food supply for urbanites.

Tamarind streets: edible urban street
Over a hundred years ago, during the reign of King Rama V, Tamarind trees were planted along Ratchadamnoen Nok Road, the road that inspired from Champs Elysees, and Sanam Luang, the royal ground in front of the Grand Palace in Bangkok. Today Sanam Luang, which is still fringed with 365 Tamarind trees, is an important landmark of the city, the largest open space in central old Bangkok. This large oval-shaped urban open space is multi-purposed area. It is a new kind of urban space that has function as a royal ground, a public park, an activities plaza, and an agricultural field in urban area. (Dovey, 2001) Even though the Bangkok municipality does not manage to harvest and distribute the fruits, these tamarinds are free fresh local fruits for everyone.

3 The Rebirth of Urban Agriculture

3.1 Why food security should be considered in Bangkok:

Bangkok has proper climate for agriculture. The city was filled with productive lands and provided fresh local food for people. However, with the fast economic growing, the urban developments replace the old urban agriculture lands. The city food supply is decreasing as well as the senses of community in the city.

Thai edible landscape
Urban nutrient flow
People from fruitful landscape of the rural Thailand have to face the problems of natural food scarcity when they moved in the cities. Although there are varieties of cheap accessible food on the street, many of them are not clean and do not have enough nutrients. Thai gardens are edible landscapes. Tamarind, Jackfruits, Mangoes were once street trees. We can pick our food from the nature. However, today urban landscape in Bangkok does not provide food for its dwellers.
People search for affordable fresh food and hunger for consume safe and locally grown food as we use to have in rural and also in the old Bangkok.

Economic crisis
We are facing economic crisis all over the world. Numbers of urban migrants face poverty problems in the cities. Growing urban farm makes urban life more resilience. The productivity of urban landscape can sustain the city and its dwellers in long terms.

Health concern
Another reason for urban agriculture in Bangkok is the health concern. People are more concerned on what they consume. We prefer to see whether our food came from the safe and reliable sources. In addition, the urban poverty, loss of cultural and biodiversity, and inequity access to the fresh, affordable food, brought the urban agriculture concept reestablished in urban landscape.

3.2 Urban agriculture opportunities in Bangkok

Urban agriculture in theory --support the slow food concept and natural biodiversity by its productivity. These productive urban areas in forms of small green patches can be very flexible and applicable. One important way to build productive lands is to plants more productive trees. Edible urban landscape can be crested in every urban open space such as street corner, street median, or attach to urban structures. Besides, using fruit trees along the streets is an original concept for the streets in Bangkok. Another opportunity of urban agriculture in Bangkok can start with the local government. The institutions such as district offices or other government work places are inspiring precedents for people to start their own vegetable gardens at home. In the smaller but more efficiency scale, private vegetable gardens are most practical for urban agriculture. City dweller can grow their own food at any small corners in the houses. With the productions from urban agriculture, the social ecology in Bangkok can be re-engaged and sustain.

Streetscape and public urban spaces

Productive urban street trees as an urban green infrastructure

One possibility for urban agricultures in Bangkok is urban street trees. This includes urban public space such as public parks and vegetations in any vacant lots, bus stops, riverside, and residue spaces under elevated roads. Since there are already some uses of fruit trees in some streets and public spaces in Bangkok, the selection of plants species in these urban public areas could be more concerns on history of the city, food security, and urban poverty. Instead of using only ornamental plants, fruits trees, herbs, or vegetables can be installed in these locations. As well as visual quality, the fruit trees can be served an ecological function for the city. These fruits and herbs can decrease the urban poverty, provide natural habitat, and guarantee the food supply for the city's dwellers.

Mango Festival

Mango trees along the street of Yitian Cun, in front of the Shenzhen apartment complex in China, provide shade for pedestrians all year round. Every June, plentiful of mangoes is harvested and gave away to tenants and neighborhoods. People can pick any mangoes and share with their friends. There are affordable mangoes in the stores but people prefer the fresh free mangoes that they can pick themselves. The products from these urban street trees are beneficial than just its fruit.

Institutional urban agriculture

Government buildings, schools, temples, and other semi-public offices can be community centers for urban agriculture in Bangkok. In addition to private residences, temples and schools are the gathering place of the community. In Thailand, we have many customs and activities related to temples. Temple is the central of the community, education center, a gathering place for people, and meditation retreats for everyone. There are more than 400 temples, 50 District offices, and hundreds of government schools in Bangkok which can be abundant sites for urban farms. Furthermore, the urban agriculture can rebuild the community, recreate social ecology, and reconnect people.

Urban agriculture builds on the existing structure of the city.

Lak si District office, one of 50 districts of Bangkok, is located in the Northern area of Bangkok. In 1999, the staffs of the district office started a nursery on a vacant abandon land next to the government building. At the beginning, they planted flowers and ornamental plants for streetscape. Then they grew more varieties of plants, including herbs and vegetables. A few years later, in year 2002, after they turned the barren site into a tidy nursery, the property's owner requested the rental fee of using his premise. As a matter of fact that they had no budget for any land rental, the nursery had to move out.

Today the vegetable roof garden located on the 10th floor, on the rooftop of the District office, with the area of 440 sq.m. Growing vegetables on the roof may have many limitations but it also has many benefits. The districts staffs turn many unused boards, signage, and street furniture into planting containers and create this urban agriculture on the roof. Besides the production of the gardens, the district office arranges a community meeting, activities, and workshops pertaining urban agriculture twice a month. The fresh vegetables from this project may not be enough for everyone but this is a great example that inspires other to create more urban agriculture sites by themselves. This project helps raise awareness and demonstrate the practical yet efficiency ways of urban agriculture.

Tropical fruits in urban forest

Fairchild Tropical Botanic Garden in Florida uses economically important trees and crops in the urban forestry and estate gardening. This urban forest consists of three components; crops, fruit trees, and tropical fruit trees. The first part is economic crops such as pomegranate, pineapple, pineapple, peppers, and papaya. The fruit trees section consists of shading trees which are avocado, tamarind, persimmon, and jackfruit. The tropical fruit trees which specific horticultural controls are mango, lychee, guava, carambola, and sapodilla. The benefits from this urban agriculture are a public display, funding seed money for other urban

forest projects, and also response to hurricanes and other natural occurrences. (Campbell, Ledesma, and Valls, 2006)

Private garden

Residential vegetable and fruits gardens can be installed in private houses, residential complexes, low-rise or high-rise housing projects. In addition to family's fresh food supply, edible gardens in many houses can served as urban greens and enhance the microclimate in urban areas. Another type of residential in Bangkok is urban poor residents and slum areas. There is a large number of poor migrants reside in central Bangkok. Urban agriculture can alleviate their economic stress and poverty. With urban agriculture, these low-income residents can have a better household food security, reduce economic frustration, have better nutrient consumptions, and be able share food productions with their neighbor for community building.

Agro-housing

China has the world largest population and is one of the fastest urban growing countries. More than 50 percent of its population will reside in the cities within the next decade.[7] Agro-housing in Wuhan is a new concept housing that combines the high-rise apartment with a vertical vegetable garden. The project will be complete in 2011 to support the increasing population in urban areas of China. The agro-housing's idea is to create a home feeling for migrants who move from rural. The tenants can grow their own food supply in the vertical garden. The advantages of this vertical farm are not only fresh vegetables, but also create a sense of community, make extra income, preserve rural traditions, improve the building's microclimate, and help the environment by reusing greywater and reducing soil and air pollutions.

The major participants who should involve in Bangkok urban agriculture are urban migrant and urban poor.[8] Low-income urban residents can get a lot of benefits from urban agriculture which includes providing fresh food productions and creating sense of community. Another group of people partake in urban agriculture is urban habitants with health concerns. Because they can grow their own food and be able to see the whole process of food production without using pesticide or adding any chemical that might pollute the food quality and our environment. Bangkok urban agriculture also needs supports from local government. The government officers play an important part in urban agriculture. Local government can set a good example of urban food production, support community with agricultural knowledge and new technology, and provide equipments for people who would like to start growing their own food.

3.3 Constrains on Bangkok urban agriculture

Although urban agriculture has a lot of benefits for urbanites, there are several constraints and limitations growing fruits and vegetables in urban areas of Bangkok. Lack of vacant lands, land use control regulations, and microclimate conditions are physical stresses. There is also the urban way of living that make people disconnect with their own communities. Besides, the availability of cheaper food does not encourage people to grow their own vegetables. Even though the low-price imported foods threat our local grow food productions.

Lack of available land in urban areas

The first constrain on urban agriculture in Bangkok is the lack of large open spaces. The cost of vacant spaces and necessary resources for agricultures in Bangkok could make the cost of urban agricultural productions higher than the one in rural areas. However, there are possibilities for efficiency urban agriculture.

Urban agriculture overlay on existing structure

Since buildings and paved areas are filled up the city, roof areas, interior and basements of the buildings can also be potential locations for urban agriculture. Urban agriculture can be

[7] Knafo Klimor Architects. http://www.kkarc.com/images/Publications/34.pdf

[8] Resource Centres on Urban Agriculture & food Security Foundation

on top of buildings and other urban infrastructures. Many large abandoned rooftops of public buildings such as industrial buildings, shopping malls, gymnasiums, or school buildings, can be sites for urban farm. Roof space is a major residue space in urban area. (Lawrence, 1996) The vacant roof spaces of large public buildings such as industrial, commercial, or community buildings are potential sites for urban agriculture --rooftop vegetable gardens. Although there are some difficulties such as moving the vegetations, finding the access to roof areas, or maintaining vegetations on the roof's windy conditions, the all-day exposure to sunlight is suitable for vegetable growing.

Maintenance

Fruits and vegetables may required more maintenance than other hardy street trees. During fruit seasons, harvest arrangements have to be managed otherwise the fruits could fall off and make streets dirty. However, the productions from these local fruit trees are worthy. In addition to enhance the local economics, contribute these fresh fruits to people and to share with animals, the food productions from these urban street trees can help re-engage the community to participate and be part of the urban harvest.

Horticulture control

Although Bangkok's climate is suitable for agriculture, microclimate in the city can sometimes difficult for vegetations to grow. The urban heat, glare, and pollutions can affect the plants growing conditions. Because there is no access to natural water resources, urban agriculture also has extra expense on irrigations. However, to solve this problem, urban agriculture can be designed as a stormwater retention to reduce the cost of water uses in urban agriculture and enhance the urban environments.

Land use control and policy support

In order to encourage people to grow their own vegetable gardens, the government needs to put these issues in the land use control regulations. It is important that urban farmers receive incentives from growing food. Because the urban agriculture provide not only local fresh food for urbanites, but also reduce the cost of transportation which include the environmental cost that city has to absorb. Additionally, the imported low-cost food productions have to be controlled to reduce the impact on local agriculture economics.

4 Conclusions

The New Pattern of Urban Agriculture

> *A great many things happen when you plant a vegetable garden, some of them, directly related to climate change, other indirect but related nevertheless…*
>
> *One planted from seed, nourished by compost from the kitchen and involving not too many drives to the garden center, you can grow the proverbial free lunch—CO2 free and dollar-free.*
>
> *Michael Pollen. Why Bother?*
> *New York times Magazine April 20, 2008*

Most people think about food as a past not the future. However, how we feed ourselves, the impact from our food productions on our health, our environment, and our future are important concerns today. (Pollen, 2009) Modern agriculture techniques help agriculture to produce more productions than ever but the quality of the food, the impact on the environment, and the loss of cultural agriculture are critical issues.

In conclusion, urban agriculture is a new efficiency concept for sustainable and livable city. The alternative solution for poverty alleviation is productive urban green. With optimal spatial arrangement the productive urban green patches can be valuable food resources for urban habitat. The rebirth of urban agriculture is important to create a resilient city. A new pattern of urban agriculture should not limited to the size, shape, location, altitude, slope, or surrounding. These productive urban green patches can penetrate and interweave into urban space. Scatter yet related green open spaces create continuous urban green, which provide a habitat corridor for urban living. Although there are constraints and some limitations in growing food in the cities, the benefits of urban agriculture are tremendously more than the city food supply. Social, cultural, environmental, and economic improvement, which are critical issues in urban areas, are advantages from urban agriculture as well.

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