Development Concept of Productive Landscape with Urban Agriculture Based on Potential Green Open Space and Community Preference in Bogor City

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Abstract. Bogor City is one of the closest cities to capital city. This is the main reason for the rapid development of Bogor City. Rapid development causes land to be built in Bogor City increasing accompanied by population growth which is directly proportional. This rapid development has an impact on the reduction in green open space which incidentally can be used as a land for people to do agricultural activities for their food needs. This study aimed to find the location of potential green open space for the development of productive landscape with urban agriculture and make it applicable with a community preference approach. The method used in determining potential locations is GIS analysis. Using the spatial map of Bogor City, by overlaying hydrological maps, groundwater map, poverty map, land use map and slope map. Then a ground check is made to ensure the accuracy of the GIS results. The result is a thematic map of the potential for developing urban agriculture in Bogor City. Determination of community preferences is obtained using a questionnaire conducted using the snowball method around the potential area. Respondents who were sampled were limited to 30 people with each with diverse characteristics. The method used to determine communities preferences is the Chi Square statistical method. The result is there are 14 potential location that spread in 3 region of Bogor City. The 3 region are 7 location in South Bogor, 5 location in West Bogor, and 2 location in Tanah Sareal. There is also find a significant relationship between urban agriculture preferences and landscape types around potential green open space points. The concept of green open space development will be adjusted to the preferences of the community by considering factors type of plant that has a significant different of three region. The concept of productive green open space development is expected to be able to support the economic growth of the poverty area in Bogor City.

Keyword: Bogor City, green open space, poverty area, preferences, urban agriculture.

1. Introduction
Bogor City has a history as a green city. The face of the green city is still visible today with large trees surrounding the city. Bogor Botanical Gardens also supports the face of a green city as an icon as well as a green open space that provides fresh air in the city. However, Bogor itself which is currently the capital's buffer zone has high growth. This rapid growth has a significantly increased impact on built up land. Automatically reduced green land causes the face of a green city like never before.

Development or conversion land, especially agricultural land, uncontrolled will greatly affect independence in fulfil of food needs. This problem can have a direct impact on the urban poor in case of effort to access available food. Bogor City is one of the cities that are close to the
center of the national capital, but the number of poverty still reaches 71,314 heads of households out of 307,730 households or about 23% of the total population of Bogor City [1]. Community food security must be a concentration of urban development. The most appropriate concept to keep making a green city and supporting food security is urban agriculture. Urban agriculture (UA) is defined as any agricultural activity that grows, increases, processes and distributes agricultural products regardless of the size of the land and the amount of human resources of city and cities [2]. UA contributes to increasing sustainability in cities by improving the quality of building environments [3]. UA in Bogor City has been carried out since the last few years. Some programs have been applied such as KRPL (Kawasan Rumah Pangan Lestari) namely urban farming in the yard, demonstration garden or known as a demplot that uses public land, toga gardens or medicinal plant gardens, and several other programs. The development of urban farming in Bogor City is initiated by the city government through related agencies such as the Agriculture Office and the Food Security Office. However, one of problem that occurs according to develop urban agriculture is lack of green open space so that it requires identification of potential green open space for its sustainability [4].

This study aims to identify the potential of GOS to implement urban agriculture. Not just finding the potential of GOS, but this research considers how to make urban agriculture applicable to city residents. Researchers also found citizen preferences about UA. Preferences make clear the choice of food crops, techniques, and also what the citizens of the city want to develop in the future. All of these results can be explained in the concept of developing productive landscapes through urban agriculture in Bogor City.

2. Method
2.1. Study Site
This research was carried out in Bogor City. This research was conducted in the area of Bogor City, West Java. The Bogor City is located between 106 '48' E longitude and 6 '26' S latitude, the geographical position of the Bogor City in the middle of the Bogor Regency area and its location is very close to the National Capital. The location of the study was conducted in the Bogor City area, covering six sub-districts, namely North Bogor District, South Bogor, Central Bogor, East Bogor, West Bogor, and Tanah Sareal (Figure 1).

![Figure 1. Research Location, Map of Bogor City](image)

2.2. Geographic Information System analysis
GIS is a computer system used to collect, examine, integrate, and analyze information relating to the surface of the earth [5]. Basically, the term geographic information system is a combination of three main elements, namely system, information, and geography. Thus, understanding the three main elements will be very helpful in understanding GIS. By looking
at the main elements, it is clear that GIS is an information system. GIS is a system that emphasizes geographic information elements. Data processing can be seen in Figure 2.

![Flow Chart of Analysis](image)

**Figure 2. Flow Chart of Analysis**

2.3. Statistics analysis
Data on urban farming preferences were obtained from distributing questionnaires to respondents both residents and activists. The questionnaire calculation method uses a Likert scale which is a measurement method used to measure the attitudes, opinions and perceptions of a person or group of people about social phenomena [6]. The Likert scale used is five scales and gives the value of each answer question. The score on the highest scale is 5 (five) until the lowest score is 1 (one). Data also processed by Pearson Chi-Square correlation analysis using the Statistical Product and Service Solution (SPSS) program with $\alpha = 0.05$. This test serves to measure the strength of the linear relationship between two variables.

3. Result and discussion
Departing from the poverty rate of Bogor City which is considered quite significant, which is 23% of the total number of families there, making a direction to support food security is very much needed by the government. One alternative that can be done by the government is to make productive land from green open spaces in urban areas. Urban agriculture is a way to activate productive land in the city. To make it more applicable, it requires knowledge of community preferences as UA actors. The concept of urban farming landscape that can support this resilience is made aware of 2 things, namely the potential location point and the people’s preference as actors.

3.1. Urban Agriculture in Bogor City
The vision and mission of developing urban farming in the Bogor City is to develop a food security system based on regional characteristics. This is supported by the food resources of 168 farmer groups consisting of: Kelompok Wanita Tani/ Women Farmers Group (KWT), Kelompok Tani Dewasa/Adult Farmers ’Groups (KTD) and Kelompok Tani Ternak / Livestock Farmers’ Groups (KTT), and has forty-one Gabungan Kelompok Tani/ Joint Farmer Group (Gapoktan) which are spread in Bogor City [4].

For the overall program of urban farming according to the Agriculture Office of the Bogor City, among others: (1) development of nurseries, (2) development of demonstration plots or
sample gardens, (3) development of farmer member yards, (4) development of school gardens, and (5) supporting healthy food consumption patterns, B2SA or Diverse, Nutritious, Balanced and Safe Food. To support B2SA, urban farming can be a part of providing local food from upstream to downstream in order to support food security.

3.2. A potential location for developing urban agriculture

Water is a very important factor in efforts to increase agricultural production. Water is an absolute requirement for plant life and growth. Water for farmers is a basic resource that supports agricultural activities. [7]. To determine a good agricultural location, the location of water is a major consideration in terms of potential locations.

Bogor City is currently crossed by two major rivers, the Ciliwung River and the Cisadane River. Besides the two main rivers, Bogor City also has quite a number of tributaries. Bogor also have a lake name Danau Situ Gede in West Bogor. Besides water bodies, groundwater potential is also a consideration in potential locations in UA. There are 3 criteria for groundwater potential in Bogor City, which are 10 l/s/km²; 2.5 l/s/km²; and water critical. So, from groundwater potential criteria, only 2 that can be take in the overlay process. Poverty also one of consideration in terms of potential locations. The poverty map explains the distribution of the welfare status of the people from very high to very low poverty [8].

3.2.1. Suitability Analysis Map

In determining the level of land suitability carried out by the scoring method. The land suitability classification was carried out following the FAO 1993 classification [9], where suitability follows a level of suitability for certain uses. According to FAO (1993) the suitability classification standard is famous for land suitability analysis. The standard establishes whether a land is highly suitable or not suitable. This case study used three of the important ratings of land suitability ratings to generate the results. The three ratings are high suitability, moderate suitability, and low suitability (Table 1). The first scoring was carried out on the green space distribution map that based on the function factors stated in the Bogor City spatial plan (2011-2031) [10].

| Table 1. Explanation of the land suitability ratings used in the study [9] |
|-----------------|-----------------|-----------------|
| **Low Suitability** | **Moderate Suitability** | **High Suitability** |
| S3 | S2 | S1 |
| Land with limitations so severe that benefits are reduced and/or the inputs needed to sustain production are increased so that this cost is only marginally justified | Land that is clearly suitable but which has limitations that either reduce productivity or increase the inputs needed to sustain productivity compared with those needed on highly suitable land | The land can support the land use indefinitely and benefits justify input |

The second stage of the scoring was carried out on the overall land slope map of the Bogor City. Land Slope map is needed in consideration of applying the UA. Scoring value is based on slope 0-15% for S1, 15-45 for S2, and >45% for S3.

3.2.2. Thematic Map of potential location for UA

Based on the results of land suitability analysis using the scoring method, the map overlayed, so that the thematic maps are needed. Thematic maps of potential locations for the development of UA are generated from the overlay of the identification results which are equated with the unit values. Then on this thematic map potential points of location will be
used to develop UA. To test the truth on a map produced from spatial analysis with GIS, a
groundcheck process was carried out. Observation at location points is done by looking at and
documenting it. There were 14 potential locations for the development of UA (Figure 3). This
potential point is in Tanah Sareal District (2 locations), West Bogor District (5 locations), and
South Bogor District (7 locations) (Table 2).

Table 2. Location of potential point in 3 region of Bogor City

| Location Potential | Name of Village | Region/District |
|--------------------|----------------|-----------------|
| 1                  | Kertamaya      | South Bogor     |
| 2                  | Genteng        | West Bogor      |
| 3                  | Genteng        |                 |
| 4                  | Genteng        |                 |
| 5                  | Cipaku         |                 |
| 6                  | Rangga Mekar   |                 |
| 7                  | Cikaret         |                 |
| 8                  | Pasir Jaya     |                 |
| 9                  | Pasir Kuda     |                 |
| 10                 | Gunung Batu    | West Bogor      |
| 11                 | Gunung Batu    |                 |
| 12                 | Menteng        |                 |
| 13                 | Kayu Manis     | Tanah Sareal    |
| 14                 | Kayu Manis     |                 |

Figure 3. Tematic Map of Potential location for UA development

3.3. Community preferences for urban farming
The social conditions of the community at the fourteen points spread in West Bogor, Tanah
Sareal, and South Bogor are known through the results of distributing questionnaires to 420
respondents. Each potential location has 30 samples. The majority of respondents were
women (26-60 years old) with a level of education equivalent to high school and entrepreneurial profession, private and housewives (Figure 4). This relates to the location of research that focuses on areas with high poverty rates.

![Figure 4. Educational and Profession Status of Respondent](image)

Community preferences are based on 3 regions based on the potential point of urban farming. In the preferences found the choice of aspects of motivation to do agriculture, choice of land, planting techniques, and types of plants. For the aspect of motivation to do farming the highest preference value or significant value is in economic motivation, that is they do agriculture to increase income with agricultural products intended for sale. Planting location preference has a fairly balanced value, but it is slightly different from the number of choosing higher public land. This may be due to discretion if the land is its territory. For planting techniques that have significant value are conventional planting techniques, namely planting directly in the soil. Community preference for plant species is one that can be used as the main concept for developing urban farming in each potential area.

Community preferences for the three regions in Bogor City based on potential locations have different results (Figure 5). South Bogor has a preference of ornamental plants with beautiful flower types. This corresponds to the adjacent landscape at a potential point, namely the public cemetery landscape. People often plant flowers especially during the rainy season because of requests from grave visitors. West Bogor has a preference for vegetable crops. Landscapes close to potential points in West Bogor are settlements and one of them is an office area for vegetable seed breeding. The last region, Tanah Sareal, has a preference for fruit plants. Residents around the potential point in Tanah Sareal have leased land to produce fruit gardens. One of the farm that they manage is guava farm.

![Figure 5. Preference Plant of Urban Agriculture](image)

### 3.4 Concept development of landscape productive
Landscape always being appreciated for its aesthetic value but its offer more than just an aesthetic pleasure. To bring landscape back in the urban life; it is important to think about
what can a landscape offer for the betterment of human living and can be a part of our daily contemporary life [11]. Productive Landscapes” is an emerging strategy of 20th century that is integrating productivity in cities via landscape and planning tools. It redefines urban open space and supports the resiliency by developing a sustainable infrastructure. Design of space for urban agriculture must compliment both the needs of urban farmers and the desirable characteristics of open space as desired [12].

Implementation of UA to increase community income by producing food for themselves and the surrounding community, as well as income from other agriculture-based businesses. In addition, it is also fun to do for the purpose of city beauty, recreation and relaxation for the community, including for the need to increase tourist destinations in the city of Bogor. Because basically, agricultural activities, the environment, and access to food directly and indirectly to the welfare of the community [13]. Departing from potential locations and community preferences and needs in the region, concepts that can be developed urban agriculture based on type of plant. The concept is ‘One Region One Theme of Plant’. To apply this theme also need to considerate commodity that farmer of group has running, so it can be combine the plant with each theme of region (Table 3). UA development can involve cultivation practices, implementation, as well as food distribution, as well as other supporting activities, to tourism practices (Table 4).

| Table 3. Concept of Plant for UA in 3 region |
|-----------------|-----------------|-----------------|-----------------|
| **Location** | **Region/District** | **Theme Of Plant** | **Commodity of Farmer Group** | **Combining of Plant** | **Sample of Plant** |
| 1 | South Bogor | Decorative Plant (Flower) | Vegetable plant | Edible flower plant | Torch ginger, sunflower, crysanthemum, etc. |
| 2 | South Bogor | Decorative Plant (Flower) | Decorative plant | Flower plant | Rose red/white, jasmine, cananga, vinca flower, etc. |
| 3 | South Bogor | Decorative Plant (Flower) | Decorative plant | Flower plant | Malay apple, peach fruit, fashion fruit, etc. |
| 4 | South Bogor | Decorative Plant (Flower) | Fruit plant | Fruiting and Flowering plant | Adenium, spathiphyllum, rose, soka, etc. |
| 5 | West Bogor | Vegetable Plant | Decorative plant | Flowering ornamental plant | Water spinach, mustard greens, spinach, cucumber, beans, etc. |
| 6 | West Bogor | Vegetable Plant | Vegetable plant | Vegetable plant | Guava, papaya, banana, etc. |
Table 4. Concept of Program for UA

| No | Type of Treatment/ Program | Function | Executor |
|----|---------------------------|----------|----------|
| 1  | Cultivation               | means cultivation and household consumption | surrounding communities and agricultural activist |
| 2  | Agricultural training     | enhance agricultural education | surrounding communities, activist, and related services |
| 3  | Agricultural tourism      | educational and relaxation facilities | surrounding communities and agricultural activist |
| 4  | Farmers market            | means of selling agricultural products | surrounding communities and agricultural activist |

4. Conclusion

This study produced the concept of development through the map of potential points and preferences community. Thematic map required 14 locations found which is divided into 3 regions. Community preference shows that the landscape around a potential point significantly influences community preferences on the type of plant. This research is expected to contribute to the development of the city by making urban green spaces like vacants optimally utilized for the welfare of society. Green open space that is used as an agricultural area will increase the area of productive green space for the city, and also produce a 'city face' that is green with a neatly arranged and beautiful environment. The problems involved are in the process of transforming activities, where the community needs to be the world of agriculture is promised a pretty good socially economic future.

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