Abstract. The rapid conversion of agricultural land into a built space has an impact on the quality of the city landscape. Urban farming is agricultural practice efforts in urban areas by using narrow land to produce food to fulfill the needs of urban agricultural products, while providing the benefits of landscape services especially in improving the quality of urban landscapes. This study aims to identify the potency of urban farming in the district of South Bogor to support landscape quality of Bogor city including ecological quality, aesthetic quality, and social quality of the community. From the research identified areas of agriculture covering 1.609,19 ha and agricultural activities in 49 farmer groups at district of South Bogor. In addition, a total of 164 plant were identified with a plant diversity index value of 2,774 classified as moderate. The results of the descriptive analysis of the landscape aesthetics at district of South Bogor show that urban farming and borrowing landscape from Mount Salak and Mount Gede Pangrango are able to present an attractive aesthetics of the city landscape. The results of the chi-square test showed that the respondent's background in the form of profession and education had a significant influence on the social interaction of the community in the farmer group. Landscape management recommendations consist of a basic concept to maintain agricultural land and urban agricultural activities with 7 landscape management strategies that can be through development actions in macro by Bogor city government and micro through agricultural activities by farmer groups at district of South Bogor.

Keywords: farmer groups, landscape quality, land use change, South Bogor District, urban farming

1. Introduction

Bogor City Planning leads to sustainable city planning. One of the city concepts applied in Bogor City is the Green City which promotes ecological development. Ecological development can be done because it is supported by city landscape conditions and agricultural areas in the city. According to the 2015-2019 Bogor City RPJMD [1], the largest agricultural area in Bogor City is located in the South Bogor District. Bogor City District has an area of of 3,081 hectares with agricultural land consisting of 104,7 hectares of paddy land and 786,5 hectares of non-paddy land in 2017.[2]

The population in the South Bogor District continues to increase within a period of 1 year from 2016-2017 experienced an increase of 2,370 people with a population growth of 1.19 percent.[2] This population cause an increasing need for residential land and that agricultural land is threatened with land conversion, so this is will threaten the sustainability of agricultural activities.
If this condition is not resolved, the quality of the city landscape will decline and have implications for the decline in the quality of people’s lives. Therefore, one efforts that can be done by urban farming. Urban farming is strategy in urban areas that is used to produce food and fully supply urban food by shortening the distribution process [3]. Urban farming activities have the potential to be carried out in the South Bogor District because there is still potential land as agricultural land and activities through farmer groups. The aims of this study is to identify the potential areas and urban farming activities in Bogor City and to analyze the quality of the landscape in the South Bogor District from urban farming activities. The final results of this study is landscape management recommendations through urban farming activities to support landscape quality in Bogor City.

2. Method
2.1 Study site
The study was conducted in the South Bogor District, Bogor City (Figure 1). This location was chosen because the district has the largest agricultural land in Bogor City based on the map of Bogor City land cover in 2015, namely Mulyaharja Village, Kertamaya Village, Bojongkerta Village, and Genteng Village. The research was conducted in October 2018 until June 2019.

![Research Location Map](image)

Figure 1 Research Location Map

2.2 Research methods
2.2.1. Ecology quality analysis
a. Analysis of Plant Biodiversity
Data of plant biodiversity was obtained using purposive sampling technique with the criteria used are agricultural land located in a sample villages and agricultural land owners belonging to a farmer group in the related villages. Farmland sampling for plant biodiversity data was consisting of 12 paddy fields, 12 forest gardens, and 12 home gardens. Data analyzed by calculating the diversity of plant biodiversity from agricultural land using the Shannon-Wiener (1963) Species Diversity Index which can be calculated using the formula:
The 4th International Symposium of Sustainable Landscape Development
IOP Conf. Series: Earth and Environmental Science 501 (2020) 012009
doi:10.1088/1755-1315/501/1/012009

\[ H = - \sum \Pi_i \ln \Pi_i \text{ dengan } \Pi_i = N_i/N_{ \text{total} } \]

b. Water analysis
Water analysis refers to the quality standards for clean water in ministry of health regulation Republic of Indonesian No. 416 of 1990 concerning Requirements and Supervision of Water Quality and Republic of Indonesia regulation No. 82 of 2001 concerning Management of Water Quality and Water Pollution Control. The parameters of clean water can be seen from the physical parameters is turbidity and color, the chemical parameters are BOD, COD, and DO levels, and the biological parameters are the total levels of coliform. The analytical method used is simple descriptive through literature study.

c. Air analysis
Air analysis refers to the air quality standards in Government Regulation No. 44 of 1999 concerning air pollution control. Substances that affect air quality in the form of SO2, CO, NO2, O3, dust, HC, and Pb. The analytical method used is simple descriptive through literature study.

2.2.2 Aesthetic quality analysis
Landscape visual data was collected by random sampling technique in the sample villages based on the form of agricultural land. Then, the data were analyzed with a simple descriptive method.

2.2.3 Social quality analysis
Analysis of social quality is carried out to see social interaction through the role and participation by farmer groups in South Bogor District. Data sample collected by interviewing 15 key persons consisting from the head of sample villages, agriculture instructor, and the head of the farmer group. In addition, data sample collected by questionnaires to 32 respondents consisting from members of the farmer group in the sample villages. Data were analyzed by Chi-Square test to see the relationship of social interaction with community background [4]. The mathematical analysis of the Chi-Square test is formulated as follows:

\[ \chi^2 = \sum_{j=1}^{k} \frac{(O_j - E_j)^2}{E_j} \]

Information: \( \chi^2 \) = chi-square \( E_j \) = expected frequency \( O_j \) = frequency of observations

3. Result and Discussion
3.1 General condition
South Bogor District is one of the sub-districts in Bogor City has an area of 3,081 ha with 16 villages.[5] The South Bogor District area is at an altitude of 200 - 330 masl. This area has a reddish brown latosol type having an area of 1,860.67 ha.[4] The climatic conditions are classified as tropical tropic types, average temperature of 27.3 °C, air humidity of 82%, average rainfall from
3500-4500 mm/year. The hydrology of South Bogor District is fed by the Cisadane River and flows through the area from Rancamaya Village for about 31.04 km with an average annual discharge of around 2.4 m³/s. South Bogor District has the largest population in Bogor City. Based on BPS Bogor City (2018)[2], the population of South Bogor District in 2017 there were 201,618 people. This is indicated by the rate of population growth in 2017 recorded at 1.19%. The peoples who work on agriculture have the smallest number of 335 peoples.

3.2 Land Use Pattern

South Bogor District experiences physical development that goes rapidly along with population growth. This is indicated by the increasing amount of land that has been built in the South Bogor District as a result of the change of function of the unbuilt land. Land use is classified as built and un builtland.[6] Land use patterns and specification of land not developed in the South Bogor District can be seen in Figure 2.

![Figure 2 Land use patterns and specification Land use in South Bogor District](image)

Unbuilt land in South Bogor District reaches 54.49% of the total area of South Bogor District. The amount of agricultural land in the South Bogor District has a 14.5% of the total land area of Bogor City. This number shows the great potential for the sustainability of agricultural activities are identified in the form of 846.88 hectares of forest gardens and 133.58 hectares of paddy land. In addition, it is also known that there is potential for land to be developed into agricultural land in urban agricultural activities on shrub land area of 475.81 hectares and vacant land area of 26.25 hectares.

3.3 Implementation of Urban Farming in the City of Bogor

The implementation of agricultural activities in the South Bogor District depends on the amount of agricultural land. Agricultural land used for agricultural activities in the sample villages is shown in Table 1. Meanwhile, the area of agricultural land in the form of home gardens is shown in Table 2. Urban agricultural activities in the South Bogor District are shown in Figure 3.
Table 1 Potential agricultural land in sample villages

| District   | Area (ha) | Agricultural land | Land that can be developed |
|------------|-----------|-------------------|---------------------------|
|            |           | Paddy fields (ha) | Forest gardens fields (ha) | Scrub land (ha) | Vacant land (ha) |
| Mulyaharja | 479       | 80.57             | 197.83                    | 83.77          | 3.43            |
| Kertamaya  | 360       | 0.00              | 280.63                    | 52.55          | 5.49            |
| Bojongkerta| 276       | 18.17             | 215.75                    | 73.89          | 5.77            |
| Genteng    | 173       | 1.18              | 137.01                    | 65.64          | 0.12            |
| Total      | 99.92     | 831.22            | 275.85                    | 14.81          |

* source: Bogor City Bappeda in 2015

Table 2 Potential home gardens in sample villages

| Sample number | District   | Mulyaharja (m²) | Kertamaya (m²) | Bojongkerta (m²) | Genteng (m²) |
|---------------|------------|-----------------|----------------|------------------|--------------|
| 1             | Mulyaharja | 33.0            | 31.5           | 6.0              | 15.0         |
| 2             | Mulyaharja | 16.5            | 25.0           | 12.0             | 6.0          |
| 3             | Mulyaharja | 50.0            | 28.5           | 0.9              | 65.0         |
| Avarage       |            | 66.17           | 28.33          | 6.3              | 28.67        |
| Total Avarage |            | 32.37           |                |                  |              |

Figure 3 Urban agriculture in the South Bogor District

Bogor South District mostly cultivates food crops, horticulture, ornamental plants, and medicinal plants. Agricultural cultivation techniques carried out in South Bogor District consist of conventional and modern cultivation techniques. The Government of the City of Bogor continues to develop various urban agricultural activities in the South Bogor District through urban farming activities by farmer groups. However, the implementation of urban farming in South Bogor District was threatened by a drastic reduction of agricultural land, which has implications for the reduction activities of farmer groups. The farmer groups in South Bogor District was recorded of 49 active groups in 2018. Various efforts to maintain agricultural activities in the South Bogor District including various training, counseling, and assistance. In addition, it is also cooperates with several stakeholders such as Bintang Toedjoe herbal medicine company in the red ginger planting program and the community of Hidroponik Bogor Raya in Bogor City hydroponics program. According to interviews, the most common obstacles encountered in urban farming activities in the South Bogor District are land availability, land ownership status, lack of profitable marketing sites and high costs for urban farming technology innovation.
3.4 Landscape Quality Data Analysis

3.4.1 Ecology quality analysis

a. Analysis of Plant Biodiversity

Plant diversity analysis influenced by the number and dominance of these plant types on agricultural land. The higher level of diversity, then a community can fulfill food needs and implications for avoiding the threat of food insecurity and malnutrition. An agricultural land has the highest diversity value if it is composed of many types of plants with relatively uniform amounts. The lower diversity value occurs if the plant consists of a few types of plants or certain types of plants whose numbers are dominant to an agricultural land. The results, 164 species of plants were planted in urban farming in South Bogor District. The average value of plant diversity on agricultural land in South Bogor District is 2,774 or classified as moderate with stratification of vertical diversity dominated by grass and horizontal diversity by herbs plant. The study area that has the highest diversity value from home gardens of 3,947 which is classified as a high diversity category. This is because the aim planting in home gardens is not for production but fulfill of daily needs. Therefore, urban farming can be done through the use of home gardens so that the diversity of plant biodiversity urban farming in South Bogor District is maintained.

b. Water analysis

The upstream and middle sections of Cisadane watershed are located in the South Bogor District. The flow that belongs to the South Bogor District area starts from Rancamaya Village with one tributary, the Cipakancilan River.[7] Physical parameters can be seen from the physical condition of the river is identified by the land use around the flow which is dominated by the undeveloped area in the upstream area and the developed area in the middle section. Land use around the flow can determine the color and turbidity of river water. The physical condition of the river can be seen in Figure 4.

![Figure 4 Physical condition of the rivers](image)

The most of the river water in the South Bogor District is murky brown in color. This is thought to be due to erosion in the upper Cisadane watershed. Erosion can occur by land conversion and utilization of riverbanks for built up land. Ananda's research [8] states that agricultural land changes increased on the upstream Cisadane watershed in 1987-1995. This condition can be seen with the color of river water in the rivers in Bojongkerta and Kertamaya villages which are still part of the upstream Cisadane watershed. The survey identified the physical
condition of the river influenced by rubbish. The results chemical parameters and biology by the Departement of Environment Bogor City in 2009 and 2015 stated that some of content water quality in the Cisadane River did not fulfill the quality standard for class II utilization. Details of water quality can be seen in Table 3.

Table 3 Water quality of the Cisadane River in 2009 and 2015

| Location                  | Measurement results | 2009 | 2015 | 2015 |
|---------------------------|---------------------|------|------|------|
|                           | BOD (mg/l) | DO (mg/l) | COD (mg/l) | Coliform (jlh/100m l) | BOD (mg/l) | DO (mg/l) | COD (mg/l) | Coliform (jlh/100m l) |
| Upstream (Rancamaya housing) | 2.4       | -          | 18.000     | 8,5             | 13,5      | 2.100     |
| Midstream (Cipaku bridge) | 3.8      | 5.9        | 14.4       | 60.000          | 11,5      | 4         | 18,5       | 2.600             |
| Quality standards (class II) | 3        | 4          | 25         | 5.000           | 3         | 4        | 25         | 5.000             |

*a source: 1DLH Bogor City 2009, 2DLH Bogor City 2015

Air quality monitoring location in the South Bogor District is Empang T-junction. The emission levels in 2016 showed that NO2 levels had exceeded the quality standards and dustfall was higher than other observation points. This is thought to be caused by the combustion of motorized and industrial machinery. Details of air quality are seen in Table 4. Conversion of agricultural land into other function can causes Bogor City experiences climate change. [9] Faced with this, the Bogor City government participated in the Climate Village Program. The efforts have been made by the Bogor City government in fact encourage Bogor City to be chosen as the pilot project for the clean air quality development program of Clean Air Asia in 2019. The statement was supported by the results of research conducted by the Center for Disaster Study of IPB which revealed that the air quality of the City of Bogor is still fairly good and comfortable. The air quality index shows 85.3 in 2017. [10]

Table 4 Air quality in Bogor City

| Location      | SO2 (μg/Nm³) | CO (μg/Nm³) | NO2 (μg/Nm³) | O3 (μg/Nm³) | HC (μg/Nm³) | Pb (μg/Nm³) | Dustfall (μg/Nm³) |
|---------------|--------------|-------------|--------------|------------|-------------|-------------|------------------|
| Empang T-junction | 92.75        | 294.4       | 252.6        | 108.3      | 8.63        | <0.05       | 70.16            |
| Quality standards | 365         | 10.000      | 150          | 235        | 160         | 2           | 230              |

*a source: DLH Bogor City 2016

3.4.2 Aesthetic quality analysis

Landscape aesthetics can shaping the character and identity by physical elements that support the quality of the city landscape is open space including agricultural land which is one of the form of green open space.[3] Green open space in South Bogor District is dominated by agricultural land covering 1,609.19 ha or contributing 14.50% of open space for the City of Bogor. Based on this, agricultural land is one of the contributors to a significant proportion of urban green open space. Based on the field survey, the interesting aesthetic of the landscape in the South Bogor District is not only influenced by agricultural land but also due to the borrowing
landscape of Mount Salak and Mount Gede Pangrango. A map of examples of landscape aesthetics through agricultural land in Bogor Selatan District is shown in Figure 5.

![Map of aesthetic examples of agricultural land in South Bogor District](image)

Figure 5 Map of aesthetic examples of agricultural land in South Bogor District

3.4.3 Social quality analysis
Urban farming activities are believed to be able to overcome social problems that are generally found in urban communities. One of the social problems encountered in urban communities is a decrease in social interaction between communities.[11] The role of farmer groups is very important in improving and maintaining social interaction between communities. Social interaction can be achieved through the role and participation of the community in activities in farmer groups. The role and participation of the community in urban agricultural activities in farmer groups are formed by the number of activities, the intensity of attendance in the activities, participation, contributions, and motivation to participate. Based on the results using the chi-square test, it can be seen that between variables have a reciprocal relationship that significantly influences community social interaction and respondents' backgrounds through profession and education in farmers groups.

3.5 Landscape management recommendations
Landscape management through urban agriculture programs is directed not only to meet the needs of agricultural products for the community, but also to maintain agricultural land and agricultural activities in Bogor City, especially in the South Bogor District in supporting the quality
of the city landscape. South Bogor District was identified as having the potential to develop urban farming through rice fields, forest gardens, and home gardens. The forest garden have the largest area with 846,88 ha. Urban farming in South Bogor District has the potential to be developed on shrub land area of 475,81 ha and vacant land area of 26,25 ha, there are also have 49 active farmer groups. Meanwhile, obstacles are also known to threaten city landscape quality and sustainability of urban farming activities consisting of land availability, land ownership status, lack of marketing places, high costs of technological, and water pollution. Therefore, action is needed through landscape management.

The Strategy landscape management is based on the grand design of urban farming in Bogor City. Landscape management have 7 strategies such as enduring agricultural land, land use policies, household waste management, agricultural agro-tourism development, creative economy, sustainable urban agriculture, and monitoring. This strategy can be achieved with the proposed 13 landscape management actions by government and farmer groups. Landscape management actions by government such as incentives and disincentives, household waste management, integrating urban agriculture with tourism, make market for agriculture product, ‘gang hijau’, and monitoring. Besides, landscape management by farmer groups such as make cooperation agreements, integrated TPS 3R with urban farming, involving the community in the arrangement of agricultural agro-tourism areas, Innovation for agricultural products, simple urban farming technology, and socializing agricultural technology to farmer groups.

4. Conclusion
South Bogor District has a potential of 1,609,19 ha of agricultural land or 14.5% of the total area of Bogor City. This agricultural land covers a paddy fields of 133,58 ha, a forest gardens fields of 846,88 ha, and a home gardens with an average area of 32,37 m². South Bogor District also has potential land to be developed into urban agricultural land in a shrub area of 475,81 ha and vacant land area of 26,25 ha. Agricultural activities are carried out by the community through 49 active farmer groups in the South Bogor District. In addition, the analysis of landscape quality in South Bogor District is dominated by ecologically good quality in the form of plant diversity which identifies 164 plant species with a diversity index of 2.774 which belongs to the moderate class. Water and air quality is still classified as good with the assessment indicators mostly below the quality standard, but it is necessary to take measures to improve quality. The visual landscape of the South Bogor District on agricultural land also shows the attractive aesthetic quality of the landscape. This is supported by borrowing landscape from Mount Salak and Mount Gede Pangrango. Agricultural activities through the farmer groups are believed by the community as a forum for people to interact with each other. This statement is supported by the results of the chi-square test conducted revealed that the existence of community background relationships that are members of farmer groups can affect social interaction. Social interaction that is still maintained through farmer groups shows a good social quality of the community. Based on the analysis it can be seen that each indicator presented proves that urban agriculture has the potential to support landscape quality. The recommendations given consist of the basic concepts for maintaining land and urban agricultural activities by proposing 7 landscape management strategies that can be carried out with macro management by the Bogor City government and micro management by the South Bogor District farmer groups.

References
[1] Bogor City Government. 2014. Bogor City Regulation Number 6 of 2014 concerning the Medium-Term Regional Development Plan of Bogor City in 2015-2019. Jakarta (ID): State Secretariat. Adit SZ. 2019. Bogor City pilot project clean air action plan. http://kotabogor.go.id [downloaded 20 Apr 19].
[2] [BPS] Bogor City Statistics Agency in Figures 2018. Bogor (ID): BPS Kota Bogor.
[3] Anggrayni, Andrias, Andriani .2015. Food security and coping strategies of urban farming and fisheries in Surabaya. Indonesian Journal of Nutrition Media. 10 (2): 173-178.
[4] Tanty H, Bekti RD, Rahayu A. 2013. Nonparametric methods for analyzing the relationship of behavior and public knowledge about plastic codes. Journal of Statistics Mathematics. 13 (2): 97-104.
[5] [BPS] Central Statistics Agency of South Bogor District in Figures 2018. Bogor (ID): BPS Kota Bogor.
[6] [BSN] National Standardization Agency. 2010. Land Closure Classification. Jakarta (ID): BSN.
[7] [DLH] Environmental Agency. 2017. 2017 Bogor City Regional Environmental Management Performance Information Document. Bogor (ID): DLH Bogor City.
[8] Ananda RD. 2010. Estimation of Erosion and Sedimentation in the Cisadane Hulu Cipopokol Sub-Watershed using the AGNPS (Agricultural Non Point Source Pollution Model) Model. [Thesis]. Bogor (ID): Bogor Agricultural University.
[9] Paragoan W. 2010. Climate change City of Bogor is being studied by BMKG. https://www.republika.co.id [downloaded 13 Jul 19].
[10] Fauzi AR, Ichniarsyah AN, Agustin H. 2016. Urban agriculture: urgency, role and best practices. Journal of Agrotechnology. 10 (1): 49-62.