

## Study Green Open Space Model As Element Smart Green City Permata Jingga in City Of Malang

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### Abstract

Green open space area smart green city is developed to function as Food function, health function, philosophy function, shade function, aesthetic function and protective function which is the main function and support function to optimize the function of a green city. Green open space model management as the main element of green city Permata Jingga. a concept of green open city, green space city vegetation type can also serve as a habitat of various types of fauna that interact with each other to build ecosystem environment in the residential area Permata Jingga. Growing number of residence results in decreasing amount of green open space, and consequently, reducing amount of oxygen production. Land conservation from green open space to residence prevents trees and plants from growing well. Green open space refers to area around certain neighborhood or in the city where trees and plants can grow. Smart green city is solution towards lacking green open space in the cities. The era of globalization and modernization require people to live more prosperous lives and fulfill their basic needs. Government should facilitate those using concept of smart city. Prior to solving their environmental issues, cities may not be able to have sustainable development. Smart city visions are to build sustainable, environmental-friendly and disaster-proof smart green cities as well as to improve government's ability to support the life of its people.

**Keywords:** onvenience Permata jingga, green open space, Smart green city

### INTRODUCTION

Improve In order to provide public services, Malang government added the function of GOS was also functioned as a playground. Of course, this very friendly action was concerned with public policy analysis. The needs to the public space was taken into account to be very serious needs. In the procurement of public spaces, the government meets the minimum service standard of public works and spatially based on the Regulation of the Minister of Public Works No. 14 / PRT / M / 2010 [1]

Green open space can control growth of development and maintains green area, recreational or absorption areas. When implemented effectively, green living concept can help eliminating effects of global warming and climate change in Indonesia. Concept of green living resident developer offers is many times not more than marketing strategy. The developers frequently associated green living concept with trees, plants or the color green.

The most fundamental element of Green City ecosystem is vegetation more particularly especially trees; vegetation keeps balance of ecosystem in residential areas. Elements of ecosystem that should remain in good balance are hydrological function, microclimate, clean air and absorption of carbon dioxide. Ensure environmental health, and synergize natural and artificial environments. Cultivation of plants on median roads not only serves as aesthetic only, but also has functional value that can improve the function of median road as shade, protector for road users. Therefore, the selection of species and the arrangement of plants on the median road must be in accordance with the criteria of physical properties, ecology of landscape crops of the road, and its arrangement on the median road [2].

Smart green city initiative is combination between the concept of smart and green city in certain strategic areas. Underlying backgrounds of this initiative are rapid growth of the city and various urban issues such as traffic congestion, flood, landslide, slum, social inequality, and reducing amount of green open space. In recent years, these urban issues have become more severe due to climate change demanding

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people living in the cities to think more carefully. It is important to develop this initiative into policies and more realistic, comprehensive programs as response towards climate change. The realization of smart and green cities as a metaphor of sustainable cities, based on the application of sustainable development principles, as well as being able to address actual urban / urban needs and problems, as well as respond to the challenges of climate change.

The mission of the green city is not limited to turning a city green and planting more trees. Its broader, more holistic and comprehensive vision of green city is environmentally friendly city that is able to use its water and energy resource effectively and efficiently, reduce waste, develop integrated transportation system, maintain healthy environment and create synergy between natural and man-made environment. Concept of planning and development (Masterplan) green open space smart green city Permata Jingga has been developed horizontally in front of the use of open area specifically for RTH on flat area, another characteristic described by Occupancy Developer such as vegetation composition and park supporting element that most the owner of the residence wants the park in the form of horizontal [3].

Components of protective trees, ornamental plants in the form of flowering plants, colorful leaves, unique and distinctive leaf shape, medicinal plants, other herbal plants as filler vegetation. This model of governance suggests that the developers of residential areas still think that building relationships between humans and nature in the form of plants is a dream for comfort that most still have a philosophy of life directly related to nature is a gift of God, which means that immediate perceived benefits can be instantaneous because plants and plants with green leaves, colorful flowers and a fragrant smell that creates something beautiful.

The concept of green open space development (RTH) in Permata Jingga residential area is a representative of the spatial plan of the region which put forward the concept of smart area in the view of the mix between the concept of built area by 70% and 30% in designation for green open space covering the median area of the road and the area of vegetation cover of the 75 Ha residential area.

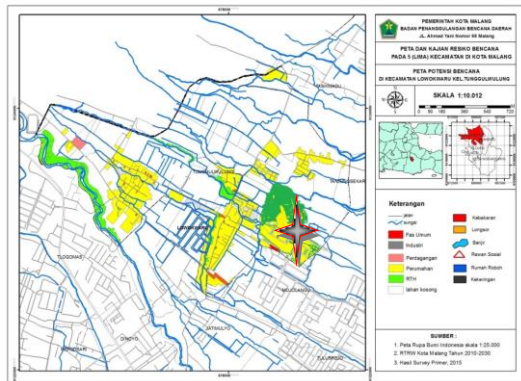
The objective of analyzing the study of landscape model, green open space, vegetation and vegetation cover index in Permata Jingga residential area as the main element of smart green city in Malang city.

## **METHODOLOGY**

### **Research sites**

Permata Jingga residential area development is a beautiful and strategic area in the middle of Malang city. Permata Jingga residential area developed to meet the needs of residential housing for people living in the city of Malang or people who come from outside the city of Malang. Jingga develops the concept of the governance of the residential area by emphasizing the comfortable environment, beautiful, and the expanse of green plants gives the feel of beautiful natural scenery. Permata Jingga is a residential area that applies the concept of underground power network so as to enable the development of green open space area with the concept of smart green city in Permata Jingga residential area by applying a balanced model of housing development based on the protection of environmentally sound ecosystem resources and regional development model formal and informal housing as a safe, comfortable and productive shelter with the support of infrastructure, facilities, infrastructure, support the needs of well-resourced settlement communities.

It is located between 7.06 0° - 8.02° South Latitude and 112.06° - 112.07° East Longitude and between 440 and 667 meters above sea level. Located in mountainous area, average temperature is between 22.0 °C and 24.8 °C. Maximum temperature is 31.4°C and minimum temperature is 17.2°C. Average humidity is between 66% and 83% with maximum humidity is 98% and minimum temperature is 19%. The highest rainfall is 385 millimeters. Permata Jingga green open space located between 7.9292° South Latitude and 112.6169° East Longitude. Figure 1 described green open space map of Smart Green City Permata Jingga in Malang in 2017.



Source Permata Jingga management

**Figure 1.** Smart Green City Permata Jingga Green Open Space Map

### 1. Vegetation Composition Index Analysis

The study would conduct comprehensive evaluation and analysis towards the following aspects, namely types and composition of vegetation, convenience index, landscape vegetation cover index, and green open space ecosystem. The study used mixed method The logic model method for analyzing vegetation composition using quantitative method is used to run statistical analysis on type and composition of vegetation, vegetation cover index towards objects found in smart green city green open space which involves green open space ecosystem (landscape). This analysis would result in relationship between type of vegetation, green open space landscape model and green open space ecosystem as the elements of smart green city.

### 2. Vegetation Cover Index Analysis

Another method was conducted for running vegetation cover index analysis. The basis for this analysis The appendices consist of information on planning, performance aspects and indicators, and effects of the analysis. The following formula was used to obtain data on vegetation cover index

$$VCI = \frac{VCA}{LTA}$$

Description:

VCI : Vegetation Cover Index;

VCA : Vegetation Cover Area;

LTA : Large Total Area

### Temperature Humidity Index (THI) Analysis

Quantitative level of convenience is represented by Temperature Humidity Index (THI), an index to describe effects of temperature towards human (convenience) [4].

$$THI = 0.8 Ta + \frac{RH \times Ta}{500}$$

Description:

THI: (Temperature Humidity Index);

Ta : (Temperature/ °C);

RH : (Relative Humidity/ %)

conducted empirical analysis on the relationship between THI and convenience [5].

### Research data:

#### Collecting Data on Temperature Humidity Index

Field research was conducted in the form of observation and situational analysis of landscape model, field observation, documentation, field data collection, and interview, survey. Temperature Humanity Index consisted on perceptions of smart green city open green space experts. To obtain these data, questionnaires were distributed to the technical and management team of Permata Jingga Estate, teaching asistens. Faculty of Forestry of *Institut Pertanian Malang*, technical team from USAID United States Agency for International Development)

Table 1. Respondent identification data of green open space appraiser smart green city Permata Jingga.

Respondent	Age	Education	Work
Mr. Agus Sokarno	58	Doctor	lecturer
Mr.M.A.Ferdian	28	Master	lecturer
Mr. Poeguh P.R	35	Master	lecturer
Mrs. Anisa Z	35	Master	lecturer
Mrs. Diena W	35	Master	lecturer
Mr. Dwi Prianto	51	Bachelor	USAID
Mr. M. Rizal	37	Bachelor	USAID
Mr. Muhamad S	52	Bachelor	USAID
Mr. Yovianus S	37	Bachelor	USAID
Mrs. Ristianan A	37	Bachelor	USAID
Mrs. Khusnul H	51	Bachelor	USAID

The sampling technique was Purposive Sampling or Purposive Sampling Definition is a sample determination technique with certain considerations. Example Purposive Sampling, will conduct research on the quality of food, the sample data source is a person who is a food expert. This sample is more suitable for Qualitative Research or research that does not generalize [6]. The number of sample was 15 respondents. Responses from the questionnaires were analyzed into percentage using tabulation method and factorial impact test.

Collecting data on Temperature Human Index (THI) which emphasized on environmental issues and components of green opening space of Smart Green City Permata Jingga was conducted on November, 2017. Shape of and vegetation in green open space are two important components affecting Environmental Quality Index or and ecology in Permata Jingga Residence.

## RESULTS AND DISCUSSION

### Vegetation Index in Green Open Space of Smart Green City Permata Jingga

In order to run analysis on vegetation in green open space, the researchers took some samples from one of the housing units in Permata Jingga called "The Cordoba B-20." The size of this private green open space was 4 m x 3 m x 1.5 m of median road. This housing unit aimed at making connecting between human and nature through ecological, humane and tropical private garden. In the green vegetable, garden composition of smart green city in the design of the garden layout, closely related to the layout adjusted the color of leaves and flowers, leaf texture, and the shape, size of the plant combined well will produce good aesthetic quality. Beautiful color composition is a form of blend of natural colors with the color of the landscape elements are diverse. Green open space public model in the development of Permata Jingga area is influenced by design design that prioritizes the blend of green open space governance, social activities, culture, community economy and which provide comfort and attraction for the community especially with the availability of green open space private smart green city built smart green city is a manifestation of mutual relationship between all community activities in Permata Jingga housing that interact directly with the open nature model [7].

As supporting data, the researchers also provided map showing exact location of "The Cordoba B-20 housing." Table 1 described type and composition of vegetation in private green open space in smart green city Permata Jingga.

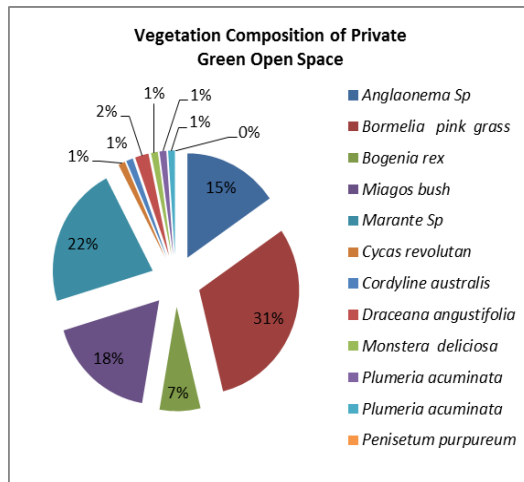
Table 2. Composition of Vegetation in Private Green Open Space in Smart Green City Permata Jingga

Latin	$\Sigma$	Type	Function		%
			E	CO2	
<i>Anglaonema Sp</i>	14	Shrubs	√	√	15
<i>Bormelia pink grass</i>	28	Shrubs	√	√	31
<i>Bogenia rex</i>	6	Shrubs	√	√	7
<i>Miagos bush</i>	16	Shrubs	√	√	18
<i>Marante Sp</i>	20	Shrubs	√	√	22
<i>Cycas revolutan</i>	1	Tree	√	√	1
<i>Cordyline australis</i>	1	Tree	√	√	1
<i>Draceana angustifolia</i>	2	Tree	√	√	2
<i>Monstera deliciosa</i>	1	Tree	√	√	1
<i>Plumeria acuminata</i>	1	Tree	√	√	1
<i>Plumeria acuminata</i>	1	Tree	√	√	1
<i>Penisetum purpureum</i>	0	Shrubs	√	√	0

Source: Data Research 2017

Based on the data analysis, the private green open space consisted of 31 % of *Bormelia pink grass*, 22.0% of *Marante sp*, 18 % of *Miagos bush*, 15 % of *Anglaonema commutatum*, 7 % of *Bogenia rex*, 2 % of *Draceana angustifolia*, and 1 % of *Monstera deliciosa*, *Cycas revolutan*, *Cordyline australis*, *Plumeria acuminata* and red *Plumeria acuminata*. Indicates that the owner of the occupancy prefers the esetetic value by infusing the composition of the type, Marante sp serves as an element that serves as a garnet of deep red to strengthen the characteristic limits of the elements of green open space and more tree plants to add shades of green and serve as a protector by prioritizing the concept of the park personal minimalist model and tropical nature feel.

Figure 2 described percentage of vegetation grown in private green open space in smart green city Permata Jingga in the from of diagram.



Source: Data Research 2017

**Figure 2** Vegetation in Private Green Open Space Smart Green City Permata Jingga Malang.



Source: Data Research 2017.

**Figure 3.** Green green private open space model with green composition of vegetation in Permata Jingga Malang.

### Green Open Space Model in Smart Green City Permata Jingga

Based on the Masterplan, green open space in Smart Green City Permata Jingga was in the form of horizontal area making use of flat open space for developing green open space. The technical and management team explained that most of the house owners preferred horizontal garden in which shade plants, flower, uniquely-shaped, colorful shrubs and herbs were grown. It showed that both the developers and home owners associated plants as connection between human being and nature and as indicator of convenience and comfort. The median roads observed had a total width of

0.8m with a width of 0.5m and a height of soil in the median of 80cm. There are 16 types of ornamental plants of bush grown on the median road. As many as 87.5% of ornamental plants grown on median roads were observed dominated by annual shrubs and the remaining 12.5% were seasonal bush crops. As many as 37.5% of beautiful flowering ornamental plants and as much as 62.5% of beautiful leafy plants. [8].

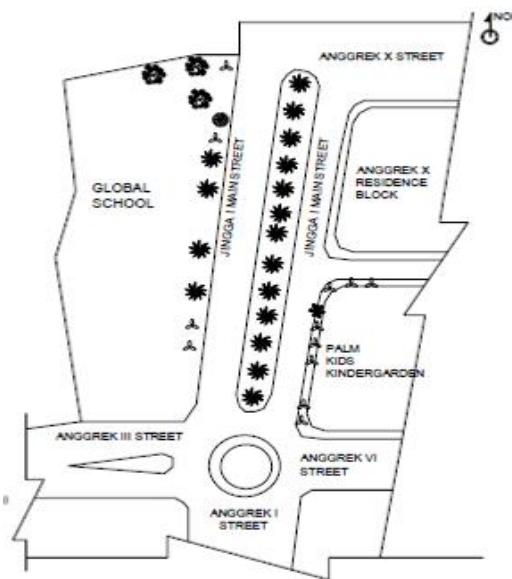
Beautiful leafy ornamental plants are *Syzygium oleina*, *Cordyline fruticosa*, *Iresine herbstii*, *Tabernaemontana corymbosa*, *Tabernaemontana corymbosa* var., *Codiaeum variegatum*, *Excoecaria cochinchinensis*, *Dracaena marginata*, *Osmoxylum lineare*, *Dracaena reflexa*, 'song of india'. While that includes beautiful flowering ornamental plant is *Rhododendron obtusum*, *Bougainvillea* sp, *Pachystachys lutea*, *Pseuderanthemum reticulatum*, *Jasminum multiflorum*, dan *Plumbago auriculata* [9].

Development of green open space (RTH) of private smart green city in Permata Jingga housing developed various types of vegetation that is very dominant is shoot red (*Zizigium* sp.) About 68%. The colors of leaves and flowers that can be found in private RTH dominated by red, green, yellow, and brown. In a private landscape landscape element, the color becomes one of the park's determinants, so the color composition is good so it can be enjoyed by the people in the dwelling [10]. Beautiful color composition is a form of blend of natural colors with the color of the landscape elements are diverse. The value of its utilization on the fruits produced by the vegetation for the fulfillment of the needs of the community itself, for the type of ornamental plants more functioned as a mascot of social status or serve as a function of the distribution of preferred activities (hobby) such as *Piper crocatum*, *Monstera deliciosa* sp, *Phalaenopsis amabilis*, *Anglonema* sp, *Epiphyllum angulinger*, *Jasminum sambac*, *Hibiscus rosa sinensis* L) type that grows in residential neighborhood of Permata Jingga residential community [9]. Concept of planning and development (Masterplan) green open space smart green city Permata Jingga has been developed horizontally in front of the use of open area specifically for RTH on flat area, another characteristic described by Occupancy Developer such as vegetation composition and park supporting element that most the owner of the residence wants the park in the form of



horizontal. Components of protective trees, ornamental plants in the form of flowering plants, colorful leaves, unique and distinctive leaf shape, medicinal plants, other herbal plants as filler vegetation. This model of governance suggests that the developers of residential areas still think that building relationships between humans and nature in the form of plants is a dream for comfort that most still have a philosophy of life directly related to nature is a gift of God, which means that immediate perceived benefits can be instantaneous because plants and plants with green leaves, colorful flowers and a fragrant smell that creates something beautiful [11].

In general, smart city was the underlying concept of open green space in Permata Jingga. The total area of the residence was 75 hectares; 70% of its total area consisted of buildings (houses) while the remaining 30% was green space. Figure 3 described open green space model applied in Permata Jingga as representation of smart green city.



Source: Data Research 2017

**Figure 4.** Model Green Open Space in Smart Green City Permata Jingga

#### Open Green Space Vegetation Cover Index in Smart Green City Permata Jingga Malang

Shape of open green space in the residence is similar to an island. The open green space functioned as area of the road that is utilized to be planted with various types of vegetation which is the element of green open space landscapeit divided 6.5 meter-road into two 2-meter-width roads. Its size is 3 meters x

15 meters. Shade plants were types of plants grown in the road dividers. Nowadays, it has been common to use road dividers as green open space. Since Permata Jingga has spacious landscape, the technical team has started to build green canopy as another alternative of green open space. The plants grown in the open green space were 4 *Samanea saman* trees, 150 *Elaeis guineensi* trees, 8 *Phoenix silvestris* trees and 10 *Erythrina crista galli* trees. Green open space model in smart green city combines elements of human and nature. Road dividers in the residential area functions as both safety instrument and green open space.



Source: Data Research 2017

**Figure 5.** Green green private open space model with green composition of vegetation in Permata Jingga Malang

The rotective function, aesthetic function in the environment. So the total for the sample of vegetation type analysis data as the main constituent of RTH smart green city Permata Jingga consists of tree vegetation type there are 511 trees of the total species in the primary data for the analysis or about 46.9% species of trees with shade function and protective functions. Including shrubs and shrubs 267 horticultural trees or 37.3%. For ornamental plants (herbs) flowering beautiful as many as 146 herbs from 12 types of ornamental plants as much as 15.8% in the form of ornamental plants leafy and beautiful flowering. For the type of tree vegetation and shrubs is RTH vegetation developed by the Management of Jeweled Housing developers and residents.

Permata Jingga technical staffs planted 3 *Durio zibethinus* trees, 1 *Artocarpus altilis* tree, 7 *Mangifera indica* SP trees, 2 *Syzygium polyanthum* trees, 4 *Annona muricata* trees, 1 *Averrhoa bilimbi* tree, 2 *Artocarpus heterophyllus* trees, 4 *Dimocarpus longan* trees, and 3 *Averrhoa carambola* L trees in the river banks near the residential area. Furthermore, the staffs also planted 2 *Furcrea gigantea* trees, 3 *Furcrea gigantea*, 8 *Sansevieria trifasciata*, 4 *Draceana angustifolia*, 6 *Oliana* sp, 7 *Cidiaun variegatum* trees, 2 *Anthurium araceae*, 4 *Cycas revolutan* and 1 *Cycas* Sp tree. These trees and shrubs has ecological, aesthetic, social and safety function. Vegetation Cover Index of Permata Jingga green open space was 31.2%. The green open space consisted of 7.0% *Samanea saman*, 1.8% *Mangifera indica* L gadung, 6.7% *Bauhinia purpurea*, 4.7% *Casuarina equisetifolia*, 4.7% *Cordyline australis*, 2.0%, *Dimocarpus longan* L, 2.0% *Artocarpus heterophyllus*, 3.9%, *Mangifera indica* L manalagi, 12.0% *Elaeis guineensi*, 9.0% *Phoenix silvestris*, 1.4% *Durio zibethinus*, 1.8% *Annona muricata* L, 1.8% *Artocarpus altilis*, 3.1% *Averrhoa carambola* L, 2.7% *Syzygium polyanthum*, 3.3% *Manilkara zapota*, 6.8% *Nephelium lappaceum*, 0.2% *Tectona grandis*, 2.5% *Pometia pinnata*, *Erythrina crista galli*, 5.5% *Roystonea* Sp, and 6.7% *Tabebuia rosea*. Figure 7 and 8 described a graph showing Permata Jingga Open Green Space Vegetation Cover Index.



Source: Data Research 2017

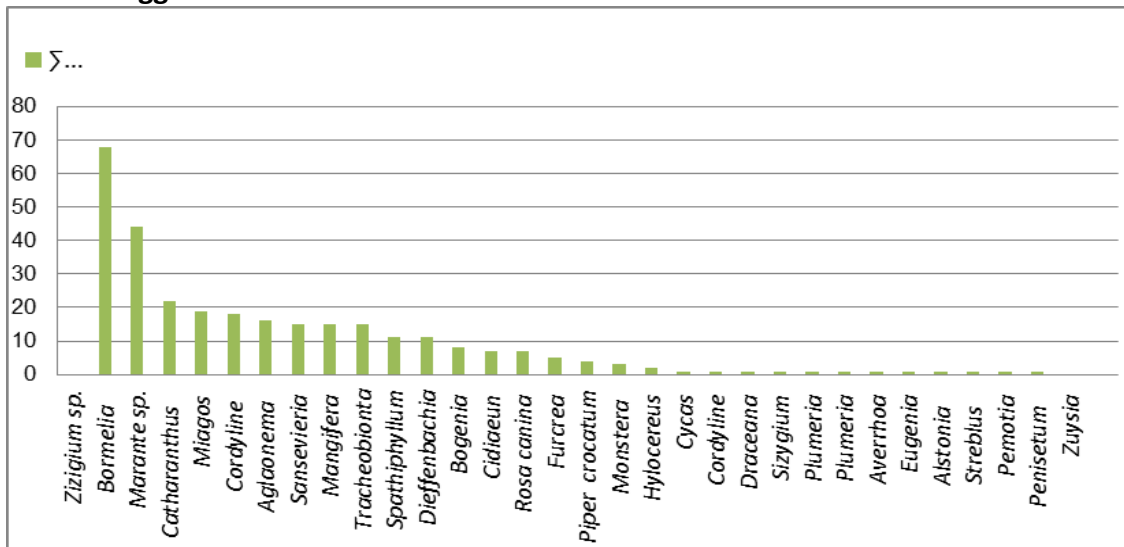
Figure 6. Green public open space model of smart green city with the composition of vegetatio Permata Jingga Malang.

### Convenience Index in Smart Green City Permata Jingga.

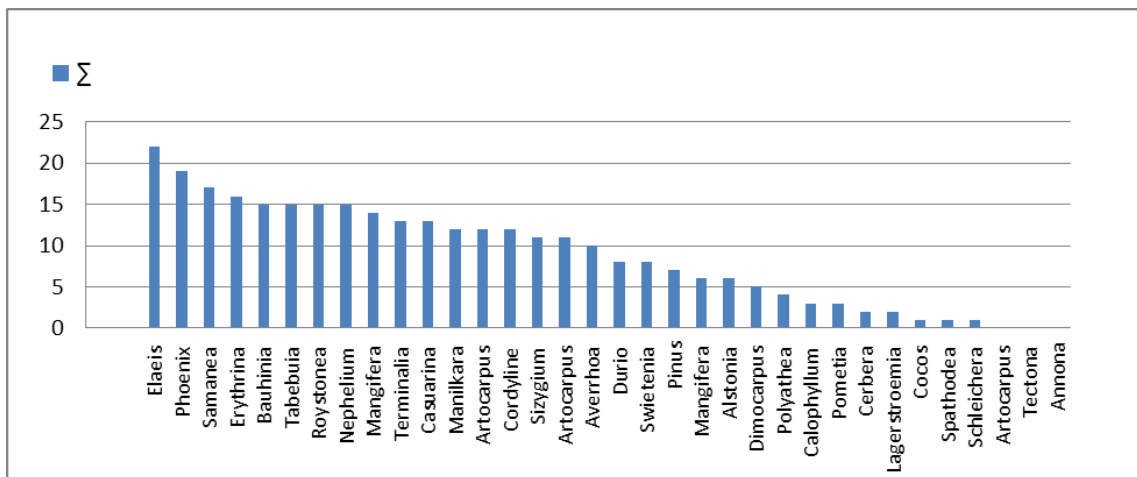
Convenience Index evaluated as a sampling of the research was conducted on 4 points of sampling of green open spaces personally fluence the green open space had towards daily activities and mobility of Permata Jingga residents. To obtain these information, questionnaires were distributed to 15 respondents that consisted of environmental and forestry experts, USAID (United States Agency For International) technical team members and dan Permata Jingga technical team members. They evaluated green open space model in smart green city Permata Jingga. Table 2 described number of respondents involved in the study. Based on "Likert-scale Impact Factor" score, convenience index of Permata Jingga was 3.9. It showed that the green open space and smart green city concept had positive impact towards the environment surrounding the residential area.

Based on Laurie's Temperature Humidity Index, temperature in Permata Jingga was categorized as cool. The average temperature was 26.91°C and average humidity was 75.

# 1. Chart of Index vegetation green open speace smart green city in Permata Jingga.



Vegetation Cover Index of Green Open Space Private in Smart Green City Permata Jingga Malang



Vegetation Cover Index of Green Open Space Private in Smart Green City Permata Jingga Malang

## CONCLUSION

Green Open Space as Smart Green City Components in Permata Jingga Malang residential area in Malang. Home yard is a private green open space become an important part for the conservation of biological resources of local ecosystem also developed for green open space sting good to maintain environmental conservation of ecosystem so Permata Jingga residential area is in accordance with the determination of smart area by local government of Malang City. the yard of the house as a private green space area indicates the social status of homeowners and also many describes the "mascot" social status and social interactivity of the community. Open space

green smart green city in residential neighborhood Permata Jingga with the development of vegetation composition as an element of green open space support describes the composition of a balanced vegetationMost of green open space in the area also functions as park or road divider. *Elaeis guineensi* (12%) and *Bormelia pink grass* (30.8%) are two types of plants commonly found in those parks and road dividers. Based on the data analysis, out of 75 hectares land Permata Jingga has, 31.2% consists of green open space. The average monthly temperature is 26.91°C and average humidity is 75.58 %. These show that Permata Jingga has implemented smart green city concept well.



## SUGGESTION

- 1). Future researchers should involve environmental factors should involve environmental factors (quality of oxygen) as variables in studies focusing on green open space in smart green city. Another alternative is to conduct study of which objective is to describe effects of green open space towards oxygen production or environments in general.
- 2). Housing developers should pay careful attention on which types of plants to grown in green open space. *Elaeis guineensis* and *Roystonea regia* are two types of plants known for reducing quality of the environment.

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