Preservation of Nutmeg Tree (*Myristica fragrans* Houtt) used as Bogor’s Local Culinary Ingredient for the Strengthness of Urban Landscape Identity

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**Abstract.** Nutmeg tree (*Myristica fragrans*) is Indonesian native tree species originating from Maluku Island, especially Ambon and Banda. The spread of nutmeg in Bogor area can be traced back to the Dutch colonial period when different kinds of spices were traded across the Indonesian archipelago and beyond. Having this long history, nutmeg is now widely used in Bogor’s culinary. At the national level, it has high economic value and become one of Indonesia’s main export products. However, there is little research on nutmeg tree spatial distribution. The objectives of the study were: (1) identify the nutmeg trees spatial distribution in Bogor city (2) mapping the existence and identification of nutmeg trees conditions and growing environment. This research was conducted Bogor City from February - May 2018. The data was obtained through direct interview, study field, and study literature. Data collection is determined based on the distribution of nutmeg trees in Bogor City, and extinct status based on study literature. Furthermore, the existence of nutmeg trees in Bogor collected used purposive and snowball technique. The results showed that a total of 108 nutmeg trees were found in all sub-districts of Bogor city. These trees grow in a variety of areas such as green corridor, public park, agriculture farm, riverbanks, yard, office park, and cemetery. The results of this study can be used as the basis for determining the preservation strategy and area for nutmeg conservation in Bogor city.

**Keywords:** Nutmeg tree; Native tree; spatial distribution, sustainability, urban landscape identity

1. Introduction

Nutmeg (*Myristica fragrans* Houtt) or King of Spices is native to Indonesia [1]. This plant was originally found in the eastern part of Maluku Island, Indonesia especially Ambon and Banda [2]. It has been traded since the 18th century and nutmeg is, therefore, one of the oldest traded commodities in the world [3, 4]. At the present time, nutmeg is widely used as spices in cooking and numerous traditional medicines [5]. Nutmeg plant has also economic value. The most valuable parts are mace and seed which are used to produce nutmeg oil.

Nutmeg plant was first introduced into Java during Marco Polo’s trip to China that passed through the island of Java between 1271 and 1295. Nutmeg cultivation later extended to Sumatra and now it has spread to other parts of Indonesia as well [2]. The introduction and spread of nutmeg in Bogor city were in particular, occurred during the Dutch colonial period. During that time, the Dutch colonial government brought nutmeg from Maluku to be planted in the resting place so-called “Buitenzorg”, the
old name of Bogor city. The local people used this tree as one of their culinary ingredients. Because of this long history and the indigenous knowledge that has been passed through generations, nutmeg is now widely used in Bogor’s local culinary. Indeed, nutmeg has been acknowledged by Bogor people as the local fruit, thus part of Bogor’s local identity.

A high level of urbanization in Bogor city (and in other big cities in Indonesia) has encouraged land conversion, including agricultural land. The decreasing agricultural land has had direct implications for the number of nutmeg being planted. This decreasing number of native plants being cultivated, such as nutmeg, has altered the traditional food consumption of the local community. Relatedly, it has also affected the local knowledge of the local community on different kinds of native plants that have been circulated through generations. The use of introduced plants, such as ornamental and shading tree in urban area currently spreading across the Indonesian archipelago is increasingly becoming a threat to the sustainability of the native plants. According to The National Museum of Indonesia History’s data, almost 80% of the plants supporting human life are introduced plant and not native to Indonesia. Relatedly, Bogor’s landscape elements tend to use the same type of vegetation trend in several green open spaces [6].

Native plant can be generally defined as a plant that has evolved naturally under the local environmental conditions [7]. In natural landscaping, such kinds of plants can be utilized for sustainable landscaping because they can better adapt to the local environmental conditions [8]. These native plants have long been recognized as important and valuable natural resources that provide many vital ecosystem services, including agricultural production, cultural benefits, and supporting services [9]. Sustainable landscape can be achieved by using native plants for landscape and it enhancing the quality of the environment. Urban biodiversity conservation theory and practice generally assumes that only native plants can effectively support native animal biodiversity [10].

Against the above background, research is needed to map the use of nutmeg as Bogor’s one of the main culinary ingredients in the context of local cultural heritage that should be preserved. From the perspective of sustainable urban landscape, it is important to value nutmeg trees as one of Bogor's landscape identity plants. Due to the continuous urbanization process, efforts should be made to preserve nutmeg trees in Bogor city. This study, therefore, aims to map the distribution of nutmeg in Bogor city. It is expected that there will much stronger concern on the existence of nutmeg, not only as a native plant but also as an identity for the urban landscape.

2. Materials and methods

The study was conducted in Bogor city area in Java Island, Indonesia from February - May 2018 which administratively covers 6 sub-districts i.e., West Bogor district, South Bogor district, Middle Bogor district, East Bogor district, North Bogor District and Tanah Sareal district. Geographically, Bogor city is located between E 106°48' and S 6°26', with a total area of 118.50 km. Bogor is located at an altitude of 190 to 330 meters above sea level. The air is relatively cool with the average air temperature every month is 26 °C and the air humidity is about 70%. The lowest average temperature in Bogor is 21.8 °Celsius.

This study uses a descriptive qualitative method by providing an explanation of nutmeg tree distribution, growing requirement, and strategy of preservation. The spatial distribution of the nutmeg tree was observed with the selection of observation locations by purposive sampling and snowball sampling. Observation by purposive sampling was carried out by selecting 3 sub-districts located in the northern, central and southern parts of all sub-district in Bogor. The snowball sampling was carried out to get the potential location of localized trees based on information obtained from direct interviews with Bogor’s culinary sellers, local fruit sellers, the instructor of the Bogor Department of Agricultural staff, and Bogor community. Field observation was carried out to ascertain the existence of the tree and put it using GPS Garmin. The data is then inputted using ArcGIS 10.5. Secondary data collection is done by collecting information through literature study, and relevant data obtained through government agencies and the results of previous studies. The purpose of this study was generated by using spatial and
descriptive analysis to explain nutmeg conservation strategies in Bogor city to support the conservation of urban landscape identity.

3. Result

3.1. Nutmeg utilization for Bogor’s culinary

Bogor community has known nutmeg as a local fruit that is widely used for various purposes, especially as a culinary ingredient. There are 3 types of Bogor local culinary that utilize parts of nutmeg, namely: pickled nutmeg, candied nutmeg, and nutmeg (Table 1). The main part mostly used is nutmeg fruit flesh.

| Local culinary | Figure | Nutmeg part |
|----------------|--------|-------------|
| Pickled nutmeg | ![Pickled nutmeg](image1) | Flesh |
| Candied nutmeg | ![Candied nutmeg](image2) | Flesh |
| Nutmeg ice     | ![Nutmeg ice](image3)    | Flesh |

3.2. Nutmeg distribution in Bogor city

A total of 108 nutmeg trees were found in the Bogor region in all sub-districts (Figure 1). The highest nutmeg plant tree was observed in the Middle Bogor district (35 trees), while the lowest population was observed in North Bogor District (1 tree). Nutmeg were found in several locations: 43 trees (39.81 %) on the roadside; 26 trees (24.07 %) in the yard; 28 trees (25.93 %) in the field; 10 trees (9.26 %) on the office park, and 1 tree (0.93 %) on public park (Figure 2).
Figure 1. Nutmeg distribution in Bogor city.

Figure 2. Nutmeg's location discovery in Bogor.

Nutmegs were found in all categories of soil slope, but most findings were on sloping slopes (8-15%) and are rather steep (15-25%). The discovery of nutmeg trees in the city of Bogor in various types of land height is 150 - 450 above sea level (Table 2). Based on soil types analysis, the discovery of nutmeg trees divided into three types namely: latosol soil, brown latosol, and red latosol.
### Table 2. The land height of the location nutmeg tree discovery.

| Sub-district     | Amount | Sea level (mdpl) | Soil types |
|------------------|--------|------------------|------------|
| West Bogor       | 25     | 197 - 274        | BL         |
| South Bogor      | 28     | 338 – 351        | BL, L, RL  |
| Middle Bogor     | 35     | 248 – 261        | BL         |
| East Bogor       | 10     | 280 – 424        | BL, L      |
| North Bogor      | 1      | 197 – 294        | BL, L      |
| Tanah Sareal     | 9      | 214 - 249        | RL, L      |
| **Total**        | 108    |                  |            |

Notes: BL = Brown latosol; L = Latosol; RL = Red latosol

### 4. Discussions

#### 4.1. Characteristics of the nutmeg tree

Nutmeg belongs to the family of Myristicaceae. Nutmeg is included in the medium tree category because it can grow to reach 10-20 meters high [11]. The nutmeg leaves are shiny green and dark. Nutmeg leaves are shiny and dark green, alternate on petioles 5-14 cm long, 3-7 cm wide and 0.4-1.5 cm long petiole. Early sex determination can be expected from the shape of the leaf blade. The flowers are dioecious and small, male flowers are three to five on a peduncle. The shape of the more drooping leaves is a characteristic of female nutmeg. While the shape of the leaf blade is relatively smaller with a more upright leaf location. Nutmeg tree is 20-25 feet high, having a greyish brown smooth bark. Nutmeg trees are usually dioecious, female flowers produced by female plants are different from male plants which only produce male flowers. It has a beautiful looking tree with towering up and to the edge, the crown of the tree is tapered, conical, oval and round with a relatively regular branching [12]. In several locations was found the composition of nutmeg trees that have female and male species especially in the green corridor, because trees are planted linearly. In landscapes, nutmeg can be used as a directional and shade tree.

#### 4.2. Growth requirements of nutmeg tree

All types of plants can grow under certain conditions. Growth requirements of plants include climate, temperature, nutrients, drainage and aeration, soil type and structure, and land height. Nutmeg needs a hot climate with high and rather even rainfall. The appropriate environmental air temperature is around 20-30°C. Around from air temperature. According to Ruhnayat and Martini [4], nutmeg will grow well at an altitude of about 0-700 meters above sea level. Therefore, nutmeg is suitable to grow in the Bogor because it is at an altitude range of 190-330 meters above sea level [13].

Nutmeg is very sensitive to wind, so this plant is recommended to be planted with a protective plant that serves to resist the wind. The protective tree is also useful as nutmeg protection from excessive sunlight especially when the plant is young. Young nutmeg will grow easier to fall when it becomes fruit. However, nutmeg is not recommended to be planted too tightly because it will cause nutrient competition and decrease fruit production. Nutmeg is very sensitive to water availability. Nutmeg needs enough water but not too much. If the area has a lot of water, it is necessary to make drains that can overcome this problem. This is in accordance with the nutmeg tree data obtained, only found two nutmeg trees that grow around the water flow, especially the river.

#### 4.3. Landscape identity by using native plant

Urban identity is a mental picture of a city in accordance with the average view of the community. Images can make it easier to find out the position of someone or someone who can find out where they are. Therefore, the image is closely related to identity. Identity is the image of people who will demand
an introduction to an object in it so that people easily recognize it. Place identity also an important dimension of social and cultural life in urban areas and continuity of place identity is strongly linked to place attachment and sense of belonging [14].

Nowadays, cities are considerably multi-cultural and heterogeneous. The influence of neoliberalism and globalization is very prominent in the development of urban areas and this consequently affects the identity of urban environments. Hence, the management and conservation of local heritage and values have become an important aspect of urban design and planning. The way that can be done is to preserve natural resources biodiversity especially native by planting in urban green open spaces. It can improve urban identity and sustainability. Planting is carried out in public and private green open spaces. Therefore, an analysis is needed to consider the suitability of the landscape for planting a nutmeg tree.

4.4. Strategy for preservation
Preservation of native trees is closely related to landscape sustainability refers to the local or regional scale. Turner et al. [15] defined landscape sustainability as the capacity of socio-ecological systems to provide a desired set of landscape sustainability for current and future generations in the face of human land use and a fluctuating environment. In some analyses, the ecological branch of sustainability is also regarded as ecological integrity [16, 17]. Urban spatial planning uses regional strategic values to develop, preserve, protect and coordinate the integration of strategic value development in an area to realize high utilization and sustainable use. According to the Convention in Biological Diversity [18], sustainable use of renewable natural resources to ensure that these resources can meet the needs of present and future generations.

Several ways can be done to preserve the nutmeg in the Bogor area. Conservation can be done by developing the potential of the sub-district with the highest number of nutmeg discoveries such as the Middle Bogor and Bogor district. The government can develop thematic villages with the aim of increasing the potential of local community wisdom, improving the economy, and supporting the sustainability of nutmeg tree utilization in Bogor communities. Bogor Agricultural Department already plans a program of the Specific Fruit Thematic Village. It is expected that each urban village in Bogor City has one particular fruit tree species agreed upon by residents through community consultation, to be planted en masse, in several locations, namely yards, green lanes, and in gardens and fields.

Another way to preserve the nutmeg is to develop the city seed banks. It utilizes as storage of preserved nutmeg tree seeds. This city seed bank can be developed in collaboration with relevant agencies, especially the Environmental Services and Settlement Services and Parks Department of Bogor City. The government also can cooperate with several nurseries in the city of Bogor to support the implementation of the city seed bank program.

Preservation of nutmeg tree planting can be done in several green open spaces in Bogor city, such as:

1. **Roadside**

   Nutmeg trees are found quite a lot in the green lane of the road. Planting nutmeg trees can be done on the green road and toll road. In the green lane of the road, nutmeg serves as a shade tree, directional and ornamental tree. In the green lane, planting nutmeg must co-exist with a protective tree which larger than the size of a nutmeg tree. It protects nutmeg from wind exposure and excessive sunlight (Figure 3). While on the toll road, nutmeg cultivation can be done in groups planting type. According to [19], the recommended nutmeg trees composition according to male to female ratio was 1:10, meaning that in each row of female trees there is 1 male tree.
2. Public park

Columnar nutmeg tree headings are very suitable as accents on the landscape. Nutmeg can be planted in large green open spaces in groups and strata. Whereas in a small park with a small area can use tree species with ornamental functions.

3. Urban forest

Urban forests are plants or woody vegetation in urban areas that provide environmental benefits such as protection, aesthetics, recreation, and other special uses. The type of plant used in this area must be a symbol or symbol of a city [20]. Urban forests plants are various heights, leafy canopy root systems and strong branching, able to keep the soil from landslides, tolerant of limited sunlight and water, absorb air pollution, and bring birds, plants grow long and belong to plants evergreen. In urban forests, nutmeg can be planted in a group or mass.

4. Home yard

Planting nutmeg in home yards can support local food availability. Yard empowerment based on local wisdom, local culture, and local ecological knowledge is estimated to be reliable as a functional land, which is produced both for subsistence food needs fulfillment and economical scale [21].

5. Conclusion

A total of 108 nutmeg trees were found in the Bogor region which found in four sub-districts. A total of 59% of nutmeg trees are found on the green corridor, 27% in the yard, 11% in the garden, and 3% in the office garden. It was at an average height of 200 meters above sea level. Preservation of nutmeg trees in several green open spaces in Bogor city can be done in the public and private sectors. This effort is carried out by taking into account the spatial aspects of the existence of nutmeg trees, growth requirements, local wisdom, and the development of thematic villages.

References

[1] Kristen L, Olsen, J, Weiner J 2008. Crop density, sowing pattern and nitrogen fertilization effects on wed supression and yield in spring whaet. Weed Sci 56 97.

[2] Deryanti T, Ervizal A M Z, Rinekso S 2014. Conservation of Nutmeg (Myristica fragrans Houtt) An Analysis Three Stimulus Amar (Natural, Use, Willing) Pro-Conservation cases in Bogor Regency. Med Conserv 19 47.

[3] Periasamy G, Aman K, Mebrahtom G, Gerezihir G, Anwar H. Nutmeg (Myristica frgrans Houtt) Oils. 2008. Essential Oils in Food Preservation, Flavor and Safety. 69 607.

[4] Ruhnayat A, Endri M. 2015. Pedoman Budidaya Pala pada Kebun Campuran.
[5] Dorman H J D, Figueriredo A C, Barroso J G, Deans S G 2000. In vitro evaluation of antioxidant activity of essential oils and their components. Flavour Fragrance Journal 15 12-16.

[6] Budiarti, T. 2015. Native Trees Improve The Quality of Urban Green Open Space. Jabodetabek Study Forum 5 683.

[7] Miller F 2005. Indicating ecosystem and landscape organisation. Ecol. Ind. 5 280.

[8] Kermath B 2007. Why go native? Landscaping for biodiversity and sustainability education. Int. J. Sust 8 210.

[9] Yapp G, Walker J, Thackway R 2010. Linking vegetation type and condition to ecosystem goods and services. Ecol. Complex. 7 292.

[10] DEFRA 2008. The Invasive Non-Native Species Framework Strategy for Great Britain. Department of Environment, Food and Rural Affairs, London.

[11] Lestari G, Kencana I p. 2008. Galeri Tanaman Hias Lanskap (Edisi Revisi). Penebar Swadaya Grup: Jakarta.

[12] Thangaselvabai T, Sudha K R, Selvakumar T, Balakumbahan R 2011. Nutmeg (Myristica fragrans Houtt)- The Twin Spice – A Review. Agri. Review 32 283-93.

[13] Ramdhan M, Hadi S A, Yuli S, Suria D. 2017. Towards Water Sensitive City: Lesson Learned From Bogor Flood Hazard in 2017. Proceeding of the 2nd International Conference on Energy

[14] Kaymaz I. 2013. Urban Landscapes and Identity. Intech Open Science: Department of Landscape Architecture.

[15] Phondani P C, Arvind B, Elsarrag E, Horr Y A 2015. Criteria and indicator approach of global sustainability assessment system for sustainable landscaping using native plants in Qatar. Ecol. Ind. 69 381-89.

[16] Miller F 2005. Indicating ecosystem and landscape organisation. Ecol. Ind. 5 280.

[17] Kandziora M, Burkhard B, Müller F 2013. Interactions of ecosystem properties, ecosystem integrity and ecosystem service indicators: a theoretical matrix exercise. Ecol. Ind. 28 54.

[18] Muhtaman D R, Siregar C A, Hopmans P 2000. Criteria and Indicators for Sustainable Plantation Forestry in Indonesia. Center for International Forestry Research, Bogor, Indonesia 72.

[19] Musaad I, Irmanda A F D, Noval A 2016. Land Characteristics and Their Relationship to Papua Nutmeg (Myristica argentea Warb.) Population in Fakfak Regency. J. Appl Env Sci 4 957.

[20] Bramasto Y, Nurhasybi, Danu, Dida S, M Zanzibar, Endang P, Safrudin M. 2015. Trees of the City: Profil Tanaman Hutan Untuk Perkotaan Wilayah Jawa Barat, Banten. Dan DKI Jakarta. Balai Penelitian Teknologi Perbenihan Tanaman Hutan: Bogor.

[21] Arifin H S. 2013. Pekarangan Kampung untuk Konservasi Agro-Biodiversitas Dalam Mendukung Penganeka Ragaman dan Ketahanan Pangan di Indonesia. Media Conference.