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Management of Green Open Space (RTH) in Kendari to Reduce Air Pollution

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Abstract
The existence of green open space (RTH) is very important in any urban area so that the government issued a policy to regulate the presence of green open space. Based on Law No. 26 Year 2007 on Spatial Planning, which then poured in Local Regulation in Kendari No. 10 of 2011 on the Management of green open space, its requiring green open space at least 30% of the area of the city, while the proportion of green open space public at least 20% and private green open space 10% of the area of the city. Along with a number of city dwellers is increasing, natural resources and environment in the city more and more utilized. This resulted in forest resources more widely utilized and the rate of decline RTH getting faster and the increased activity of urban communities that use fossil fuels leads to high air pollution. This study aims to (1) evaluate the suitability of tree species making up RTH, and (2) make referrals election suitability of tree species that have a growing and effective in controlling air pollution. This study uses survey and identification to determine the constituent tree species. Rate suitability of tree species based site and literature. The results showed that the tree species in Kendari city RTH Region consists of 51 species, 33 species of which in accordance with the requirements of silvicultural, management and aesthetics, while there are 18 species of trees that were considered suitable place to grow and be effective in controlling air pollution.

Keywords: *green open space, the selection of tree species, air pollution*

1. Introduction

Green Open Space (RTH) is an area dominated by woody plants or trees that serve as a buffer urban areas, such as water management regulator and ability to absorb carbon in the air. The existence of the green open space is very important in any urban area so that the government issued a policy to regulate the presence of green open space. Based on Law No. 26 Year 2007 on Spatial Planning, which was then poured into Regional Regulation Kendari No. 10 of 2011 on the Management of green open space, its requiring green open space at least 30% of the area of the city, while the proportion of public green open space 20% and private green open space 10% of the area of the city.

Along with a number of city dwellers more and more, natural resources and environment in the city more and more utilized. This resulted in water resources increasingly depleted , forest resources more widely used and the rate of decrease in the extent RTH getting faster and the increased activity of urban communities that use fossil fuels lead to high air pollution that occurred , especially the rich content of CO2 released from burning so that the amount of CO2 in the air is increasing. Burning fossil fuels and changes in land use , continues to disrupt the carbon cycle and increase the concentration of CO2 in the

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atmosphere . Currently the rising CO2 concentration of about 370 ppm / year (Falkowski et al. , 2000) .
Kendari city as an urban area is a center of education , office , industrial , trade services , housing and community activities. As contained in the Spatial Plan 2010-2030 Kendari , Kendari city urban centers scattered in several administrative regions , including the central government department , department of education , trade , and industrial port area , district and provincial governments as well as regional colleges terminal / transport . As a result of these activities lead to increased concentration of carbon in the air in the city of Kendari. In addition to more densely populated, generally air pollution in urban areas is higher than in rural areas because the majority of urban air pollution is caused by emissions of carbon dioxide (CO2) emissions from human activities in various sectors. Air quality and the environment can be decreased due to increased human activity utilizing fuel oil (BBM), transport, industry, development of infrastructure and trash. The resulting CO2 can be absorbed by vegetation contained in the RTH. Carbon emissions from the conversion or changes in land cover and use its own 12.5% of the total emissions generated in 2000-2009 (Friedlingstein et al., 2010; Houghton et al., 2012), while the greatest emissions come from the energy sector (Ministry of Environment 2009; Pratiwi & Hermana 2013). So we need an alternative efforts to control CO2 emissions and increase CO2 uptake in the city.
The purpose of this study was to determine the types of trees making up the green space , evaluate the suitability of trees making up the green space and determine the direction of the selection of tree species that have compatibility with a growing and effective in the control of air pollution in the city of Kendari and to know the potential of biomass and carbon stocks in the green space in the city of Kendari,
This research is expected to provide information on the types of trees making the appropriate RTH as a basis for consideration in the management of RTH Kendari. In addition, information regarding the suitability of tree species making up the green space would be beneficial for the development of forestry science, especially urban forest science.

2. Research Methods

The research was conducted from January to April 2016 held in the city of Kendari. The research object in the form of neighborhood green space in Kendari on three areas of green space, including office area, settlement, and business.
The materials used in this study are Map of RTRW 2010-2030 Kendari, Kendari city administration maps and land use maps for the city of Kendari and Kendari RTH Region Map. The tools required are a compass, tape meter, christenhypsometer, rope or plastic rope, tallysheet, GPS, stationary, cameras and a set of computers.
This research was conducted by means of field surveys were conducted to determine the type of trees making the city green space at each location . The survey was conducted by census method. Tree species identification results are used to evaluate the suitability of tree species making up a green open space . Studies conducted to determine the growing requirements and characteristics of tree species making up the green space at the sites. According Indriyanto (2006) , analysis of the suitability of tree species making up the

urban forest is done with the data processing and tabulation , and then analyzed descriptively . At each RTH classified into three classes , namely appropriate , quite appropriate , and not in accordance with the determination of the class interval.
Component scoring for vegetation RTH based on the theory of Indriyanto (2006) and Saebo et al (2005) as follows :
1. Terms of silvicultural
According Indriyanto (2006) , to fulfill the functions of urban forests optimally , then the type of forest tree city must meet the requirements of silvicultural , which are located to the site that fits the needs of growth (climatic conditions and edaphic) , can be grown on poor soil nutrients , capable restoring soil fertility , resistant to pests and diseases , plant species are evergreen , strong main stem and branches that are not easily uprooted and broken , the roots do not damage roads, concrete , and existing buildings in the vicinity. While Saebo et al . (2005), adding that this type of tree for the urban forest should be tolerant of high temperatures and strong solar irradiation and tolerant to water shortage .
2. Requirements management
According Indriyanto (2006) , planting of plant species chosen should be easy , convenient and inexpensive maintenance , security and easy utilization . Meanwhile, according to Saebo et al . (2005), the tree species selected for the development of urban forests should have expected functions in accordance with the purpose of construction of the urban forest , which is entitled thick and dense so it can function as a shade plant , entitled strong and tightly so that it can function as cover crops wind , and capable high in the reduction of urban environmental pollution (air, water, land) .
3. Terms aesthetics
According Indriyanto (2006) , the type of trees to be planted in the urban forest should have habitus which reveal conformity with the purpose of beauty. Meanwhile, according to Saebo et al. (2005), in addition to the aesthetic function / beauty, trees that have in the development of the urban forest should support the function of education / education and the health and comfort of the surrounding communities , including:
a. has a canopy, branches, leaves and / or flowers are beautiful so as to serve as an addition to aesthetics or beauty of the urban environment ,
b . has a function as a means of education ,
c . has a relatively small -sized pieces so that when the fall does not harm humans or damaging facilities / buildings around
d . does not produce sap that is poisonous or harmful to living things ,
e . do not produce pollen potentially allergenic to humans.

To determine the suitability criteria were calculated on the score of each type of tree that is obtained from the field survey. After that, every kind of tree sorted by highest to the lowest score, then classified into three classes as follows suitability criteria.
Conformance criteria:
a. does not match (score 23 to 30.33)
b. quite appropriate (score> 30.33 to 38.33)
c. appropriate (score> 38.33 to 46)

To find out the types of trees that grow in accordance with the terms conditions and tolerant of air pollution do with literature. The tree species are considered appropriate in the development of the urban forest is a tree species that have a high ability to absorb pollutants and have high durability (tolerant) against exposure to pollutants at the sites.
Selection of forest tree species making up the city proper place to grow must consider factors, economic factors and social factors (Miller, 1997). Selection of tree species in each RTH will vary given the green space management objectives in each region are also diverse.

3. Results And Discussion

Selection of Tree Species for RTH

One of the early stages of green space management is the selection of tree species . Selection of these species should consider the requirements of silvicultural , management and aesthetics in order to function optimally trees making appropriate RTH development goals . Based on this study , it was found 51 species with the appropriate criteria and 33 species of trees with sufficient criteria accordingly. Thus, all kinds of trees found in the green space in Kendari Urban Area in general can be selected for the development of green space .
Selection of tree species directed to the appropriate tree species with a growing and effective in the control of air pollution or to have a high durability against exposure to pollutants . Selection is based on the potential of tree species in the control of air pollution in urban areas is also important to consider in addition to the consideration of the requirements of silvicultural , management and aesthetics .
According Sulistijorini (2009), the type of tree that is effective in the absorption of nitrogen dioxide (NO2) from the air is a flamboyant (*Delonix regia*), tanjung (*Mimusops elengi*), Angsana (*Pterocarpus indicus*), cinnamon (*Cinnamomum burmanii*), mahoni (*Swietenia macrophylla*) , bungur (*Lagerstroemia speciosa*), and melina (*Gmelina arborea*). While the type of tree that effectively absorb carbon monoxide (CO) by Kusminingrum (2008) is Genitri (*Elaeocarpus sphaericus*), bungur (*Lagerstroemia flos-reginae*), cempaka (*Michelia champaca*), bunga merak (*Caesalpinia pulcherrima*), sapu tangan (*Maniltoa grandiflora*) , tanjung (*Mimusops elengi*), kupu-kupu (*Bauhiniapurpurea*), and kecrutan (*Spathodea campanulata*). According to Dahlan (2008), plants that have absorption of carbon dioxide (CO2) very high is beringin (Ficus benjamina), kopal (*Trachylobium verrucossum*), pingku (Dysoxylum excelsum), kenanga (*Canangium odoratum*). Type absorbent is bungur (*Lagerstroemia speciosa*), segawe (*Adenanthera pavonina*), selasihan (*Cinnamomum parthenoxylon*), mahoni (*Swietenia mahagoni*), matoa (Pometia pinnata), kiara payung (*Filicium decipiens*), medang (*Beilschmiedia roxburghiana*). Type absorbent medium is puspa (*Schima wallichii*), sirsak (*Annona muricata*), khaya (*Khaya senegalensis*), mahoni (*Swietenia macrophylla*), johar (*Cassia grandis*), nangka (*Artocarpus heterophyllus*), jati (*Tectona grandis*). Type absorbent low is: Angsana (Pterocarpus indicus), pacira (Pachira affinis), mangium (*Acacia mangium*), maya-maya (Sapium indicum), merbau (Instia bijuga), mahoni Africa (*Khaya anthotheca*), pelahlar (*Dipterocarpus retusa*) , kembang merak (*Caesalpinia pulcherrima*), Carapa (*Carapa guinensis*). Type absorbent so low is kedundung (*Koompasia excelsa*), merawan (*Hopea mengarawan*), asam jawa (*Tamarindus indica*), rambutan (*Nephelium lappaceum*), merawan (*Hopea odorata*), dadap

merah (*Erythrina crista-galli*), sapu tangan (*Maniltoa grandiflora*), and asam keranji (*Pithecelobium dulce*).

According to Dahlan et al. (1989), the type of trees that have the ability to absorb and adsorb lead (Pb) very high is jambu biji (*Psidium guajava*), Ketapang (*Terminalia catappa*), and bungur (*Lagerstroemia speciosa*). While this type of high caliber is mahony (*Swietenia macrophylla*); ability medium is mangga (*Mangifera indica*), cemara gunung (*Casuarina junghuhniana*), and Angsana (*Pterocarpus indicus*): low capacity are kupu-kupu (*Bauhinia purpurea*), and kenanga (*canarium odoratum*): as well as very low ability is kiara payung (*Filicium decipiens*), kenari (*Canarium commune*), fikus (*Ficus hirta*), dadap (*Erythrina variegata*) and acacia (*Acacia auriculiformis*). Meanwhile, according to Siringoringo (2000), the type of trees that have the ability to adsorb particulate lead (Pb) with a high capacity is johar (*Cassia multijuga*), the ability of being is acacia (*Acacia auriculiformis*) and kayu manis (*Cinnamomum subavenium*), while low capacity, namely mangium (*Acacia mangium*) and kupu-kupu (*Bauhinia purpurea*).

Vegetation to controll air polution

Based on several studies about the ability of trees in air pollution control, 18 kinds of trees in the study site is effective in controlling air pollution. Some types of trees producing fruit that is consumed by humans, such as mango (*Mangifera indica*), guava (*Psidium guajava*) and Ketapang (*Terminalia catappa*) also has the ability to be effective in controlling air pollution, especially particles of lead (Pb) are normally produced from gas vehicles motorized. The resulting fruit of the tree of contaminated particles of lead when consumed by humans can be detrimental to health. Lead particles that enter the plant tissue will also be spread to all parts of the plant, including the fruit. If the fruit is consumed by humans, then the contamination of lead contained in the fruit will enter the human body and damage the health. Therefore, these species can be selected as a constituent tree species RTH but its placement would be more appropriate if the lead away from sources of pollution.

Conclusion

Based on the research results , it can be concluded as follows :

1. There are 51 species of trees making green space in the city of Kendari, 33 of which have the appropriate criteria based on the requirements of silvicultural, management and aesthetics.
2. Types of trees making the green space in the city of Kendari in accordance with a growing and effective in air pollution control, there are 18 types, such as bungur (*Lagerstroemia speciosa*), angsana (*Pterocarpus indicus*) and mahoni (*Swietenia macrophylla*).

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