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# SUSTAINABLE MEGACITIES: vulnerability, diversity, and livability

IPB INTERNATIONAL CONVENTION CENTER  
Bogor, 17 - 18 March 2015



Center for Regional System Analysis, Planning and Development  
Bogor Agricultural University

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**Proceeding Book**

**THE 5<sup>th</sup> INTERNATIONAL CONFERENCE OF  
JABODETABEK STUDY FORUM**

**“SUSTAINABLE MEGACITIES:  
VULNERABILITY, DIVERSITY AND LIVABILITY”**



IPB International Convention Center (IICC)  
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# Foreword

More than half of the world's population now lives in urban areas. Rapid urbanization in Asian developing countries over the past half century has been followed by excessive urban population concentration in very large urban agglomerations, so called as megacities. The UN defined megacity as a metropolitan area urban agglomeration complex with more than 10 million inhabitants. The number of megacities in the world has increased from 10 megacities in 1990 with 153 million of population or 7 percent urban population of the world to become 28 megacities in 2014 with 453 million populations or 12 percent urban population of the world. The United Nations expected that by 2050 about 66 percent of the world's population will live in cities (UN, 2014).

The rapid growth, high population density and high consumption rate of residents in megacities has led to wide range of local and global socioeconomic and environmental impacts which requires attention from the global community. Therefore, it will significantly affect the future prosperity and sustainability of the world. The Greater Jakarta or Jabodetabek is experiencing continuous growth that seems to be an unstoppable phenomenon and at the same is facing various problems that may not have been experienced by other major cities in the world. The result of many studies showed that the carrying capacity of the environment, especially land and water in Java Island where Jabodetabek lies, is already overshoot. However, given the relatively rapid growth of Mega Urban Jakarta, it is possible that Jakarta will grow to be the world's largest megacity.

Amid the global concern on the negative impacts of the continuing megacities' growth on global environment, the Center for Regional System Analysis Planning and Development (CRESTPENT/P4W), Bogor Agricultural University (IPB) has established Jabodetabek Study Forum since 2001. This Study Forum has conducted biennial international seminar on complex mega-urban issues on Asian megacities as well as urbanization and urban-rural linkages in Asian countries. The biennial conference has a tradition of organizing two types of paper presentations, namely scientific papers and community papers. This year's conference will also open a session for local government officials. This proceeding book covers papers from nearly all the presentations delivered during the conference.

We hope that this proceeding book will be able deliver the aims of the conference: to recognize multi-dimensional aspects, perspectives and knowledge on megacities; to communicate and facilitate experiences, policies, and studies related to challenges of continuing development of Jabodetabek and Asian Megacities, as well as solutions to address these challenges; and to bring up common understanding on the development of Jabodetabek and Asian Megacities.

Bogor, April 2015

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# Native Trees Improve The Quality Of Urban Green Open Space

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## ABSTRACT

The use of trees species in several cities tend to be the same, as well as Jakarta, Bogor, Depok, Tangerang and Bekasi, so there is no character and distinctiveness of the city. Indonesia has many native trees but have not used optimally. The purpose of this study is to present the change of green open space in some major cities, trees species that are widely used in some cities, and the benefit of native plants for urban greenery. Literature studies from various research was used in this study. The results of this study indicate that green open space in several cities are decline gradually and there are only limited species of trees for urban greenery. Some of the benefits of using native trees are: preserving the original trees, increasing the diversity, creating characteristic of the city, increasing comfort, supporting the preservation of wildlife, useful for education and research. Native trees species can be used for various forms of urban green open space, such as in parks, green lane road, city forest, public facilities, and housing area. There are some important factors should be considered for improving of urban greenery with native trees: information and dissemination to stake holders, collaboration of landscape designers, contractors, supply of native trees seedling, and government policy.

**Keywords :** *native trees, green open space, urban*

## INTRODUCTION

Developments in urban are characterized by the increasing population and built area so that affect the environmental balance and comfort in urban areas. Green open space is an important component of the urban system where there are herbs and plants to support the ecological, social, cultural, economic, and aesthetic. According to the Regulation of the Minister of Public Works No. 05/PRT/M/2008, the function of green open space are divided into 1). The main function (intrinsic) : ecological functions; such as the lungs of the city, affect the micro-climate, shading, absorbing rain water, wildlife habitat, absorbing pollutants, and windbreaks; and 2). Additional functions (extrinsic) those are functions of socio-cultural, economics, and aesthetics.

The trees have very important role to support the natural environment system, and sustainability of urban areas those are requiring proper management for the benefit of present and future. Some informations were found that the kind of trees in several cities tend to be the same, such as in Jakarta, Bandung, Bogor [1], [2], [3], [4]. Some researchs were informed that native trees are beneficial for urban greenery. There are a lot of native trees in Indonesia that may be used for urban greenery.

Green open space in several cities seems to decline due to lack of attention from the development of the city of ecological aspects. This study aims to describe the changes in urban green open space in several cities, the information some kind of trees that are widely used in some cities, the potencies and benefits of local trees for urban greenery, and the possibilities to increase the use of native trees for urban green open space. The preparation of this article using literature study from various researches. Information from this article would be useful for the development and improvement the quality of urban green open space.





## GREEN OPEN SPACE CHANGES IN SOME CITIES

Based on the Regulation of the Minister of Public Works No. 05/PRT/M/2008 on Guidelines for the Provision and Use of Green Open Space In Urban Area, the definition of green open space is an elongated area, lines, and groups, that use is more open, a place to grow plants, both of which grow naturally or intentionally planted. The public green open space is green space owned and managed by local government city/country that is used for the benefit of society in general. Physically, green open space can be divided into natural green open space in the form of natural wildlife habitats, protected areas and national parks as well as non-natural green open space or auxiliaries such as parks, sports fields, cemeteries or green-lane road.

The development of cities, especially large cities had changed the landscape, which dominates the built area and open green space continue to decline. There are the result of the study in several major cities; the rate of reduction of green open space per year in some major cities as follows : Jakarta by 0.74 percent (from 1984 - to 2013), Bandung 0.539 percent (1991 - 2013), Semarang by 0.565 percent (1973 - 2013), Yogyakarta 0.342 percent (1972-2013), and Surabaya 0.106 percent (1994-2013) [5]. Development of Jakarta has influenced the development of the surrounding towns, such as Bogor, Depok, Tangerang, and Bekasi; so that the green open spaces also decline gradually.

Declining of green open space cause environmental quality of urban areas decreased, so that the efforts of developing and improving the quality of urban green space is very necessary in order to overcome environmental problems. Several attempts to do is improving the quality of urban green space with the addition of vegetation that meets the criteria to improve the ecological and aesthetic city. Some part of the cities may be built specific parks such as "pocket park", boulevard, median road, also create vertical garden structure, and roof garden as the way to improve the quality of the urban environment.

### ROLE OF TREES IN URBAN GREEN OPEN SPACE

Trees in urban green open space has create very important role include : 1) improve the environment and the comfort, 2) healthy environment, 3) improve the economy of local communities, 4) make conservation and land reclamation, 5) produce useful products (fruit, wood, and other products), 6) enrich and support the wildlife, 7) enhance the beauty of the urban landscape, and 8) to support community sustainability [6].

Some of the important functions of the trees are : improve the environment and increase comfort by making the lower temperatures, reduce air pollution, hold rain water, reduce flooding, improve groundwater reserves, absorbe CO<sub>2</sub> and store it in the trunk, thereby reducing global warming [6]. The result of study at Taman Langsat, Taman Anggrek, and Taman Menteng in Jakarta, obtained information that the air temperature under the canopy of trees in city park area in daylight is lower 3 - 4 ° C than the temperature outside garden area. Trees and shrubs in the garden can also reduce noise up to 15 db [3]. In another study obtained a close correlation between tree cover in an area with air temperature. The higher the tree cover, air temperature is lower. Similarly canopy shape affects the temperature under the canopy of trees. Temperature under a tree with a rounded crown, dome, spreads and meeting leafy lower than under a tree with oval canopy and less dense leafy canopy [7].

Other benefits of trees in urban areas is to enrich and support the wildlife, trees provide habitat and food for wildlife that is fun for the urban community. Some information was found that trees produce flowers, fruits, and nectar is more likely to the bird. Canopy shape and branching does not affect the presence of bird directly, but there is a tendency that small leave trees are preferred the birds [8]. Besides that, trees can enhance the beauty of the urban landscape, softening the rigid building mass becomes more harmonious, and became the character of local areas and can give the impression or the dimensions of the past, present and future [6].

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The uses of trees for urban green space are relatively few species and tend to the same trend in the various cities. From various studies indicate that there are similarities use of trees in various cities causes the city does not have a distinctive characteristic that distinguishes it from other cities. Based on the results of several studies obtained information that there are similarities plant species of mostly planted on some green open space in the cities such as : Jakarta, Bandung, Bogor, Batam [1], [9], [10], [2], [3], [4], [11], [12]; many tree species found in some green open space in several cities including : *Swietenia mahogany*, *Pterocarpus indicus*, *Ficus benyamina*, *Mimushop elengi*, *Acasia mangium*, *Samanea saman*, *Bauhinia blakeana*, *Cerbera odolan*, *Polyalthia longifolia*, *Erytrina cristagali*, *Ficus lyrata*, *Delonix regia*, *Plumeria rubra*, *Cassia fistula*, *Leucaena glauca*, *Terminalia catapa*, *Felicium decipiens*, *Roystonea regia*, *Mutingia calabura*, *Syzigium campanulatum*.

Government provision related plant species have existed, for example Jakarta Governor Decree No. 2359 of 1987 about a Protected Plant in Jakarta, there are 26 species of plants (Table 1).

Table 1. Jakarta Governor Decree No. 2359 of 1987 about Protected Plant in Jakarta

|   |                                      |    |                               |    |                               |
|---|--------------------------------------|----|-------------------------------|----|-------------------------------|
| 1 | <i>Diospyros philipensis</i>         | 10 | <i>Eugenia cuminii</i>        | 19 | <i>Morinda citrifolia</i>     |
| 2 | <i>Annona reticulata</i>             | 11 | <i>Feronica lucida</i>        | 20 | <i>Baccuria racemosa</i>      |
| 3 | <i>Antidesma reticulata</i>          | 12 | <i>Nepheium mutabile</i>      | 21 | <i>Garcinia dulcis</i>        |
| 4 | <i>Lansium domesticum var Condet</i> | 13 | <i>Mangifera caesia</i>       | 22 | <i>Cynometra cauliflora</i>   |
| 5 | <i>Durio zibhetinus Cipaku</i>       | 14 | <i>Stelechocarpus burahol</i> | 23 | <i>Falcourtia rukam</i>       |
| 6 | <i>Durio zibhetinus Sitokong</i>     | 15 | <i>Mangifera odorata</i>      | 24 | <i>Salacca edulis cainato</i> |
| 7 | <i>Bouea macrophila</i>              | 16 | <i>Floacourtia inermis</i>    | 25 | <i>Manilkara kauki</i>        |
| 8 | <i>Syzygium polycephalum</i>         | 17 | <i>Leachi chinensis</i>       | 26 | <i>Annona squamosa</i>        |
| 9 | <i>Eugenia jambos</i>                | 18 | <i>Phyantus emblica</i>       |    |                               |

Source : [13]

Similarly identity plants of the region defined by the category of provincial, city/district. Each region has a identity plant with a specific background, for example, a plant of Jakarta is *Salacca edulis*, West Java is *Bouea macrophylla*, Central Java is *Michelia alba*, Jogjakarta is *Stelechocarpus burahol* [14]; Bogor is *Canarium vulgare*, Cianjur is *Diospyros blancoi*, Cirebon is *Mangifera indica* L. kultivar 'Gedong gincu', Bandung is *Caesalpinia pulcherrima*, Bekasi is *Sandoricum koetjape*, Depok is *Garciana mangostana* [15].

From the twenty-six rare plant species based on Jakarta Governor Decree No. 2359/1987 which is also a typical plant at Betawi, only seven types that can still be found at the pekarangan (home garden) sample with a limited number, among which *Psidium guajava*, *Syzygium malaccensis*, *Pometia pinnata*, *Morinda citrifolia*, *Falcourtia rukam*, *Manilkara zapota*, and *Annona muricata* [16].

Development of identity plant of the region and local plants (native) can be used as the character of the city while preserving the local plant and animal species. The results were obtained from a variety of information on various benefits of using native plants for urban green space are: improving environmental quality through improved comfort (temperature, humidity), reducing pollutants, support wildlife, provide useful products, provide beauty while preserving native plant species. Development of urban green space, especially in the big cities that have been limited in number plant species, can be done by adding the number of trees species especially the native trees, increase the participation of stakeholders to build and maintain, and increase the utilization of green space. The use of the type and number of trees, especially native plants need to be upgraded and can be done in areas that have not been many plants or new green space areas. Increased participation of stakeholders is needed to raise awareness and contribute to environmental improvement.





## THE BENEFITS OF NATIVE TREES FOR URBAN GREEN OPEN SPACE

Some advantages of using native trees for urban green space are: 1) more a lot of **wildlife**, 2) low maintenance level, 3) reduce the invasion of exotic species, 4) preserve endangered habitats, 5) avoid the common mistakes that only a few species planted in the area broad. Based on the **research results** in Mexico City, show that total, native, and exotic tree densities were the highest in areas where **large green spaces** are considered for greening purposes. Conversely, total, native, and exotic tree **species richness** were highest in land uses with intermediate levels of urban development (residential, residential-commercial areas). Not finding highest tree species richness in less developed urban. Thus, **that results** suggest that, to increase of the ecological quality of cities, residents and managers should be **encouraged** to select a greater variety of trees to promote heterogeneous green areas [17]

In order to reduce the further loss of native plants and animals from our Cities and towns in the future, we need to develop management actions that mitigate the negative impacts of small reserves, as well as the detrimental chemical, physical and biotic conditions that occur in urban environments. There are some key issues related to the creation of future management actions to reduce local extinctions of plants and animals in our Cities and towns: 1) link management actions with ecological knowledge, 2) **protect** existing natural habitats, 3) restore degraded habitats, and 4) integrate remnant patches into the urban landscape [8]. The study in Singapore informed that since independence in the 1960s, the policy to green Singapore was implemented with dedicated effort and political will. It has resulted in an island almost 50 percent vegetated with its existing biodiversity managed and conserved and increasingly made accessible and interpreted. Its key botanical institution, the Singapore Botanic Gardens, has played leading role in plant diversity conservation since its establishment almost 150 years ago [19].

### IMPROVE URBAN GREEN OPEN SPACE WITH NATIVE TREES

Increased use of native trees in urban green space provides many benefits; both ecologically, support increased biodiversity of plants and wildlife, enhance the beauty, and provide social function for urban communities. Some efforts to increase of native trees can be done by giving information about the role and importance of native trees for the urban environment to various groups include to the younger generation. These activities need to be followed by several programs, the use of native trees in the design and implementation of green space development. Development of native tree planting material supply is also very necessary in industry-provider landscape plants. The program needs to be supported by government policy or related agencies and their dissemination to various parties.

Information about the benefits of native plants and their functions in the urban landscape needs to be improved through several research, publications, and more explanation to the people and stakeholders who have authority in the development of green space. Good cooperation between landscape designer and implementer of construction and industrial landscape plants is needed for developing of native plants, especially those that are increasingly rare or endangered.

### CONCLUSION

The trees have very important role supporting natural environment system and sustainability of urban areas. Increasing of native trees in green open space provides many benefits; both ecologically, increase biodiversity of plants and wildlife, enhance the beauty, and provide social function for urban communities.

Developing of native trees is important for urban greenery; it needs more information and dissemination to the stakeholders; collaboration among landscape designers, contractors, and nurseries, also supports by government policy.

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The plenary lectures were delivered by four keynote speakers, which include the Minister of Agrarian and Spatial Planning, Deputy Governor of Jakarta Province, Head of Megacities and Global Environment Project RIHN Japan and Scientific Director of Future Cities Laboratory Singapore ETH Centre. This conference was attended by 92 presenters and 150 participants.

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