



PROCEEDING

The International Symposium of



“THE FUTURE CHALLENGE”

AUGUST 10-11, 2009

IPB INTERNATIONAL CONVENTION CENTER - BOGOR INDONESIA

ISBN 978-979-19795-4-2

**Proceeding " The International Symposium of Green City"
The Future Challenge**

Copyright © 2009 by Department of Landscape Architecture,
Faculty of Agriculture, Bogor Agricultural University (IPB),
Jl. Meranti Kampus IPB Darmaga, Bogor, INDONESIA 16680.

Editor : Dr. Ir. Alinda F.M Zain, MSi.
Dr. Syartinilia, SP, MSi.

Cover Design : Dewi Rezalini Anwar, SP, MAdes

Layout : Yuni Pujirahayu
Wondo Hendratmo
Annisa Hasanah

Sponsored by:

Institut Pertanian Bogor (IPB)

International Federation of Landscape Architecture (IFLA)

Form Pendidikan Arsitektur Lanskap Indonesia (FPALI)

Ikatan Arsitektur Lanskap Indonesia (IALI)

Sentul City

ISBN: 978-979-19795-4-2



EDITORIAL

Proceeding of The International Symposium of Green City is concerned with conceptual, scientific, and design approaches toward urban sustainability. The papers were presented on The International Symposium of Green City, August 10-11th 2009, held by Dept of Landscape Architecture Department at IPB Bogor, Indonesia. It emphasizes ecological understanding and a multi-disciplinary approach to analysis, planning and design of urban area. The paper also attempts to draw attention to ecological processes interacting within urban areas, and between these areas and the surrounding natural systems with specific problems such as social and cultural approaches to urban landscape issues.

Proceeding consists of papers dealing with Green City, Eco-City and Sustainable City; Green Infrastructure and Green Architecture; and Urban Rural Linkage. The topics might include but are not limited to landscape ecology, landscape planning and landscape design. Landscape ecology examines how heterogeneous combinations of ecosystems are structured, how they function and how they change. Landscape planning examines the various ways humans structure their land use changes. Landscape design involves the physical strategies and forms by which land use change is actually directed. The papers is based on the premise that research linked to practice will ultimately improve the urban landscape.

We wish this proceeding to be a useful for increasing our understanding toward urban sustainability and we also sincerely thank for sponsors, steering committee, organizing committee and paper contributors.

Bogor, November 2009

EDITOR



Opening Address

International Symposium of Green City

“The Future Challenge”

Assalamu'alaikum Warahmatullahi Wabarakatuh

Good Morning, Ladies and Gentlements. First of all, please allow me on behalf of Bogor Agricultural University or IPB to welcome you all to IPB Campus. It is an honour for IPB to be a host of this very important event to discuss the future challenge of green city. I thank you very much, especially for the keynote speaker, the honorable Minister of Public Eork Republic of Indonesia visit to IPB campus to day. This visit is very important for IPB; because IPB has a long history in environment and agricultural studies related to publuc works. I thank you very much for invited speakers and participants from Indonesia and overseas to share their research progress related to green city in this symposium. This symposium is an initial meeting to develop understanding the context of problem sollution to address the future of green city. However, I am sure that this symposium will conclude very valuable results.

Dear Participants, Distinguished Guests,

Since December 2000, IPB has become an autonomous university. As a legal entity, IPB has been more independent in term of academic program, as well as resource management. IPB is the only state university in Indonesia that is focusing on tropical agriculture and bio-science as its core competence. Internationally, IPB is well recognized. IPB has been in a long standing cooperation with national as well as international institutions. IPB has nine faculties, one Postgraduate School, and one Vocational School. IPB has 36 departments and 16 research centers. Student body of IPB is around 25,000 students, 15,000 of which undergraduate students, 5,000 graduate students and the rest are vocational school students. IPB has 133 professors, IPB is capable of offering innovative programs including activities on green city research and development. There are some opportunities to develop research collaboration between IPB and national/overseas Universities, as well as other institutions, like Sentul City, Sampoerna Group on green city research and development.

Dear Participants, Distinguished Guests,

This symposium is aimed to be an exchange information event on research results related to green city and the implementation of green city concept in several housing area such as Sentul City. As we know that Sentul City introduce a new cluster with green building and green wall as a part of green infrastructure concept. The collaboration project between IPB and Sentul City was just signed by two parties on last month to show that IPB is very concerned to develop an integrated spatial plan for green city.



Dear Participants, Distinguished Guests,

Through this symposium we do hope that the green city concept could be widely adopted by the government and the housing developer to prevent and even to increase green space in urban area. I thank you very much for all the participants and wish you a very succesful symposium. Finally, I hope this symposium will be very fruitful and be a significant step in realizing green city concept. Thank you very much for your attention.

Wassalamualaikum Warahmatullahi Wabarakatuh

Bogor, August 10th, 2009

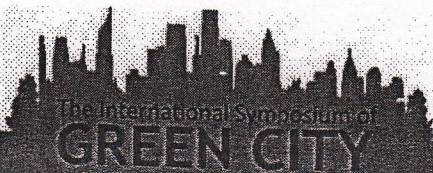
Rector,

Prof. Dr. Ir. Herry Suhardiyanto, MSc.

of
an
re
er,
to
in
ch
ir
an
ss
ry

y,
ce
al
ll
is
ie
of
0
s,
y
h
r
d

s
g
h
e
1
1



Welcoming Speech

Dean of Faculty of Agriculture

Ladies and gentlemen,

First of all we would like to express our gratefulness to Allah for all the blessings have received. It is our pleasure to welcome you all to this global awareness symposium. Will our city be chaos or controlled? We believe our city should be controlled. Our future city should be a green city, eco-city, and sustainable city. We invite our colleagues representing academicians, professionals, government and community members to give enhancement and to share their experiences on three sub themes of our discussion i.e. (1) green city, eco-city and sustainable city (2) green infrastructure and green architecture; and (3) urban-rural linkage. Therefore we would like to thank to Prof Yoritaka Tashiro from Chiba University; Diane Wildsmith, MSc Arch Visiting Assistant Professor of University of Indonesia, Prof Joerg Rekittke Director of MLA Program, National University of Singapore; Deni Ruchiyat from Ministry of Public Work; invited speakers and practitioners and developers who had pioneered local and community based sustainable development and management in the city.

Our landscape architecture competencies, originating from horticultural and environmental sciences that later will be developing into green and aesthetic spatial engineering competencies that will inspire our colleagues from Department of Landscape Architecture to develop concept of green city. We believe such competencies will be complementary and needed in our complex future.

I intend my address on how city as living and dynamic entity, should be developed in sustainable ways. As an analogy to a biological organism, a metabolic process in which material is consumed and transformed, complex growth and development occurs in a city. Therefore as generically outlined by Sarosa (2004) green city development and management is subject and in respect of (1) intergeneration orientation, (2) spatial dynamic (3) sosio-economic viability, (4) political and policy power and arena, (5) interspecies interaction, and (6) intermedium transformation. Moreover, benefits of such development and management for its inhabitants not only socio-economic and environmental benefits, but also cultural vibrancy in which the community inclusively participates. Starting by this symposium we invite you all to engage in efforts of "green" enhancement in respect to Lynch's (1980) fundamental criteria: (1) vitality of the infrastructure and function; (2) sense of place; (3) fit or sense of competence; (4) competence; (5) control; and (6) meta criteria (equality, justice) to create a better livable city.

Have a success symposium. Thank you.

Prof. Dr. Ir. Didy Sopandie, M. Agr.
Dean of Faculty of Agriculture
Bogor Agricultural University



Welcoming Speech

Head of Landscape Architecture Department

Distinguished Ladies and Gentlemen, all participants of Green City International Symposium,

The rapidly growing world population is exerting great pressure on the land, waters, and energy resources that are essential to productive tropical agriculture-rural communities and its bio-resources. By 2030, more than 60 percent of the world population will live in cities, up from almost half now and just a third in 1950. The growth poses huge problems ranging from clean water supplies to trash collection. Already, one of every three urban dwellers lives in a slum in the present time. Let us create green cities. Adding the United Nation goal of halving poverty by 2015 would not be met unless city planning was less haphazard.

Green city (*kota hijau*) is a term used for sustainable city or ecological city. Activists mark June 5, the date of the first environmental summit in Stockholm in 1972, as the UN World Environment Day. The 2005 theme is Greener planning for cities, many of them hit by air pollution, fouled rivers and poor sanitation. In San Fransisco, the main host of the 2005 event, mayors from more than 50 cities including Shanghai, Kabul, Buenos Aires, Sydney, Phnom Penh, Jakarta, Rome and Istanbul planned to sign up for a scheme setting new green standards for cities. Cities would be ranked from zero to four stars according to compliance with a set of 21 targets. And around the world, from Australia to Zimbabwe, activists staged rallies, cleaned up litter, organized poetry competitions or planted trees.

Green City is related to Urban Enviromental Management and ISO 14001 at the level of a City. The development and implementation of the EMS at the level of a city is a complex task involving a myriad range of tasks and actors. UNEP's International Environmental Technology Centre recommends three steps in extrapolating the ISO 14001 to the level of city:

- **Step 1 (Promotion of Eco-office):** Reduction of energy use; Reduction of water use; Reduction of solid wastes; Promotion of recycling; Green Procurement;
- **Step 2 (Promotion of Eco-Project):** Using e-friendly materials; Using e-friendly equipment; Accelerate use of recycled materials; Green public engineering works; Develop green technology; Promote greening
- **Step 3 (Green City Planning):** Set green guidelines for public works; Set green guidelines for housing; Enhance public transportation; Capacity building; Apply EMS to the whole city

Through the Green City International Symposium that is being conducted in IPB International Convention Center (IICC), Bogor, Indonesia on 10-11 August 2009, we wish all the stake-holders from academic institution, professionals, companies, government, and communities can sit together to have excursion in the second day in the objects of Sentul City, Puncak Highland, Taman Bunga Nusantara, and Kota Bunga.

After the symposium, you could enjoy Bogor City and its vicinity by yourself. We suggest to visit Bogor Botanical Garden, Ethno-botany Museum, Zoology Museum, culinary tour, etc.

Finally, welcome to Bogor and have a good and fruitful time attending this symposium.

Prof. Dr. Ir. Hadi Susilo Arifin, MS
Head of Landscape Architecture Department
Faculty of Agriculture-IPB

Green city (kota hijau) is a term used for sustainable city or ecological city. Activists mark June 5, the date of the first environmental summit in Stockholm in 1972, as the UN World Environment Day. The 2002 theme is Greening the Planet for cities, many of them hit by air pollution, flooded rivers and poor sanitation. In San Francisco, the main host of the 2002 event, more than 50 cities including Singapore, Kuala Lumpur, Sydney, Perth, Perth, Jakarta, Korea and Istanbul plan to sign up for a solemn setting new green standards for cities. Cities would be ranked from zero to four stars according to compliance with a set of 21 targets. And around the world, from Australia to Zimbabwe, activists staged rallies, cleaned up litter, organized poetry competitions or planted trees.

Green City is related to Urban Environmental Management and ISO 14001 at the level of a city. The development and implementation of the EMS at the level of a city is a complex task involving a myriad range of tasks and actors. UNEP's International Environmental Technology Centre recommends three steps in attaining the ISO 14001 to the level of city:

- Step 1 (Promotion of Eco-efficiency): Reduction of energy use; Reduction of water use; Reduction of solid waste; Transition of recycling; Green Procurement;
- Step 2 (Promotion of Eco-friendly): Using eco-friendly materials; Using eco-friendly equipment; Accelerate use of recycled materials; Green public organizing work; Develop green technology; Promote greening;
- Step 3 (Green City Planning): Set green guidelines for public work; Set green guidelines for housing; Finance public transportation; Capacity building; Apply EMS to the whole city.

Through the Green City International Symposium that is being conducted in IPB International Convention Center (ICC), Bogor, Indonesia on 10-11 August 2009, we wish all the stakeholders from academic institutions, professionals, companies, government, and communities can sit together to have excursion in the second day in the objects of Sentul City, Puncak Hillland, Taman Bungas Nusantara, and Kota Bogor.



Ve
m,
is

Welcoming Speech Chairperson of Organizing Committee

Assalamu'Alaikum Warahmatullahi Wabarakatuh

Good Morning, Ladies and Gentlemen.

First of all, welcome to distinguished guest Rector IPB, Keynote Speaker, Dean Faculty of Agriculture and other Faculties, Invited Speakers, Head of Department Landscape Architecture and other Departments, and all participants in this Symposium of Green City organized by Department Landscape Architecture, IPB. It is a great honor for me to explain a brief report about these two days symposium with the theme.

Dear Participants, Distinguished Guests,

As we all know the loss of urban green space became a trend of urban development in all over the world. However, global warming, high pollution, flooding, etc. have become hot issues recently in big cities, including in Indonesia. We need to give our energy to revitalize the existence of urban green space to reduce these problems. Urban green space strongly plays an important role to improve ecological sustainability of urban landscape, beside increase the aesthetics of the city.

The new Spatial Planning Act 26/2007 gives us a bright future for urban sustainability commitment. One of the important provisions of the Spatial Planning Law 26/2007 is the requirement of at least 30% of urban areas for open spaces. The open spaces can be public and private open spaces. More specifically, public open spaces account for at least 20% urban areas. In addition, this law stipulates that forest areas must be account for at least 30% of river stream areas. Such provisions were not included in the previous spatial planning law.

Dear Participants, Distinguished Guests,

With these all in mind, we selected "The Future Challenge of Greencity" to become a theme of this symposium. The symposium will be held on two days. On first day, we will learn deeply about greencity concept from honorable invited speakers, and experience learning from private sectors in the morning; and after lunch time we will share our research progress related to green city which is divided into 3 parallel sessions: Green city, Eco-city and Sustainable city; Green Infrastructure; and Green Architecture and Urban-Rural linkages. For these parallel sessions, we grateful all to 30 oral presenters and 9 poster presenters. It is great honor for us as an academic society to share our research experience through this Symposium.

On second day, we will hold a field excursion. We will visit Sentul City, the beautiful satellite city within Jabotabek area with excellent MURI awards of 2009 for their streetscape design, and Kota Bunga Nusantara, one of well designed flowers city in Puncak Area. Through this field excursion, we do hope that we could learn how to realize a greencity not only based on theory based but also from real practice.



Dear Participants, Distinguished Guests,

Finally, we do hope that this symposium become a valuable time for our learning process to reach our dream: "Greencity". Many thanks to head of Landscape Architect Department, Steering Committee, and Organizing Committee, without you all, we could not hold a big event. Also highly appreciation for all studentd, with their big effort to spend the time and energy for symposium preparation.

On behalf of organizing committee, we kindly ask your apology for some any weaknesses during these two days event and symposium preparation.

I do hope that ALLAH SWT bless all of us

Thank You

Wassalamualaikum Warahmatullahi Wabarakatuh

Dr. Ir. Alinda F.M Zain, MSi.
Chairperson of Organizing Committee



CONTENTS

Page

EDITORIAL ii

OPENING ADDRESS iii

WELCOMING SPEECH

Dean of Faculty of agriculture (Prof. Dr. Didy Sopandie) v

Head of Landscape Architecture Department (Prof. Dr. Ir. Hadi Susilo Arifin) vi

Chairperson of Organizing Committee (Dr. Alinda F.M Zain) viii

CONTENTS x

KEYNOTE SPEECH

Green Cities: Challenges Towards Sustainable Urban Development
(Djoko Kirmanto: Minister of Public Works of Republik Indonesia) 1

PLENARY SESSION: "The Future Challenge" 5

Green Cities, Eco-Architecture
(Diane Wildsmith, MSc.Arch (Visiting Assistant Professor Dept Architecture, University of Indonesia - Commissioner PT IDC) 7

Green Networking As An Appropriate Urban Greening Method To The Green City
Prof. Dr. Yoritaka Tashiro (Chiba University - Japan) 19

From Green City to Urban Jungle
Prof. Dr. Joerg Rekitke (Director of MLA Program, National University of Singapore) 20

Green Cities Policy in Indonesia
Dr. Deny Ruchyat, M.Eng (Directorate General of Spatial Planning, Ministry of Public Works) 28

PLENARY SESSION : "Experience Learning" 29

The Largest Street Garden
Andrian Budi Utama (Director of PT Sentul City, Tbk) 31

Community Based Participation Towards Green City: Practice Learning from
"Kotaku Hijau" (Green City) Competition
Prof. Dr. Hadi Susilo Arifin (Head of Department of Landscape Architecture) 33

The International Symposium of
GREEN CITY

AUGUST 10-11, 2005, IPB INTERNATIONAL CONVENTION CENTER (IGGOR) IN DONDELAH

| | |
|---|------------|
| PARALLEL SESSIONS: Green city, Eco-city and Sustainable City | 41 |
| Eco-city Development, A Challenge for Tomorrow (<i>Ning Purnomo Hadi</i>) | 43 |
| The Role of System Dynamic in Future City Landscape Development Planning (<i>Aris Munandar, AC Achsan, Setia Hadi, Alinda F. M. Zain</i>) ✓ | 57 |
| Historical Public Open Space Analysis in The Old City Revitalization (<i>Euis Puspita Dewi, Nurhayati H.S. Arifin, Aris Munandar</i>) | 65 |
| Urban Greenways Assesment: Providing Suitable Space for Wildlife (Lesson from City of Onkaparinga, South australia) (<i>Cynthia Wuisang</i>) | 76 |
| Towards Green City Through Green Architecture Movement (<i>Budi Faisal, Putrikinasih, Ria Asyurani</i>) | 91 |
| Eco City and Urban Sustainability (<i>Quintarina Uniaty</i>) | 119 |
| Eco-Architectural and Eco-Landscape Management Concepts for Repararian Landscape in Lebak Kantin, Sempur-Bogor (<i>Ni Wayan Febriana, Setia Hadi</i>) | 132 |
| Environmental Strategy as an action plan toward sustainable city (or ecocity) (<i>Nana Fitriana Firman</i>) | 137 |
| Internalizing Water Literacy Among Students in Semarang Through Participatory Film-making A Lay Person Approach (<i>Dwi Prabowo, Rahmad Djati Winarno, Tjahjono Rahardjo</i>) | 142 |
| Internalizing Water Literacy Among Students in Semarang Through Participatory Film-making Water Sustainability Aspects (<i>Vina Oktiviani, Wiyanto Hadipuro, Budi Widianarko</i>) | 147 |
| Internalizing Water Literacy Among Students in Semarang Through Participatory Film-making Water Access Aspects (<i>Juwanto, Tjahjono Rahardjo, Budi Widianarko</i>) | 152 |
| PARALLEL SESSION: Green Infrastructure and Green Architecture | 157 |
| The Changing Roles of Public Spaces in Malaysia (<i>Nor Zalina Harun, Ismail Said, Hamidah Ahmad</i>) | 159 |
| Green Architecture in Indonesia: Challenging for Practitioners, Regulations and Local Governments (<i>M. Syarif Hidayat</i>) | 170 |
| The Trees Diversity of Roadside Greenbelt in Jakarta (<i>Nizar Nasrullah, Chatarine Suryowati</i>) | 174 |
| Study of Development Model for Settlement Improvement and Urban Infrastructure at Kali Banger Project in Semarang City (<i>Budi Susetyo</i>) | 186 |
| Ornamental Shrubs Palettes on Streetscape Greening and Their Potency As Bioindicator of Surabaya City Air Quality (<i>Pangesti Nugrahani</i>) | 193 |
| Modelling of temperature, pressure, air flow distribution on Eco-house's inner room using Computational Fluid Dynamic (CFD, Flovent V7.2.) (<i>Sri Muhiastuti, A. Indra S., Kudang B.S., H. Armansyah T., Suryono S.</i>) | 199 |
| Trees Carbon Reserve Estimation of City Greenery Open Spaces (GOS) in East | 209 |

Jakarta Municipality Using Landsat Imagery (*Bambang Sulistyantara, Nizar Nasrullah, Isdiyantor*)

Landscape Structure Analysis to Develop Green Infrastructure Network in Depok City (*F.X. Herwirawan, Alinda F.M. Zain, Dwi Putro Tejo Baskoro*) 216

PARALLEL SESSION: Urban-Rural linkages (Ecological Network) 217

Adoption Patterns of Communal Waste Water Treatment Facilities in Kricak Kidul and Sukunan Neighborhoods, Jogjakarta (*Juliana Luminto, Tjahjono Rahardjo, Budi Widianarko*) 219

Industrial Areas Management Strategy Towards Eco-Industrial Park (Study Case : Industrial Areas in Cilegon, Banten Province) (*Fatah Sulaiman, Asep Saefuddin, Rizal Syarif,, Alinda FM Zain*) 220

The Typhology of Real Estat Physical Boundary at Jakarta Periphery (*Tin Budi Utami*) 228

Urban Ecotourism Development Planning Area at Ciliwung Corridor (*Dini Rosmalia, Siti Nurisjah*) 238

Environmental Management System (EMS) in An Eco-living Community (Case Study: Jambangan Kampong, City of Surabaya) (*Mayrianti Annisa Anwar, Aris, Munandar, Asep Saefuddin*) 247

Ecological Legal Aspects for Sustainable Riparian Landscape Management in Sempur Area, Bogor City, Indonesia (*Yuni Prihayati, Hadi Susilo Arifin*) 254

Landscape Planning Base on Bioregion Approach (Case Study: Ciliwung Settlement Corridor) (*Arin Ningsih Setiawan, Qodarian Pramukanto*) 259

Payment for Environmental Services (PES) Scheme Implementation in Upstream and Downstream Areas as an Alternative for Sustainable Ecological Network (*Christine Wulandari, Hadi Susilo Arifin, Qodarian Pramukanto, Kaswanto, Hermayani Putra*) 272

Dynamic Model for Settlement Area Management in The Upper Stream of Ciliwung Watershed, Bogor District, Indonesia (*Indarti Komala Dewi, Surjono Hadi Sutjahjo, Kholil, Hadi Susilo Arifin*) 281



POSTER PRESENTATION

- Dealing With Climate Change Disaster With Green and Low-Cost Innovations (Ariya Aruninta) 289
- Evaluation of Healthy and Environmentally Sound Housing in The Upper Stream of Ciliwung Watershed, West Java (Dwi ariyanti, Hadi Susilo Arifin, Nurhayati.HS.Arifin, Aris Munandar) 306
- The Study of The Comfortness Aspect at Pedestrian Space in Order to Increase The Use Effectiveness on M.H. Thamrin-Jend. Sudirman Street Jakarta (Mimi Rahmiati) 314
- Greenery Open Space as Ecological Features of The City (Imawan Wahyu Hidayat) 322
- Influence of Surface Material and Trees Density on Thermal Environment and Comfort for Pedestrian in Tropical and Humid Climate (Sangkertadi, Cynthia V Wuisang, Reny Syafriny) 327
- Building the Tree Inventory Application for the city of East Jakarta (Bambang Sulistyantara, Imawan, Nasirudin, Hendrawan) 342



Building The Tree Inventory Application for City of East Jakarta

Bambang Sulistyantara¹, Imawan², Nasirudin³, Hendrawan⁴

¹Lecturer at Dept. Landscape Architecture Bogor Agricultural University

^{2,3}Graduate Student Bogor Agricultural University

⁴Application Programmer

Email: bbsulistyantara@yahoo.co.id

ABSTRACT

Trees are essential elements of an urban space. The presence of trees in urban areas is not only appreciated as physical attribute, but beyond this, it serves a fundamental function in balancing and conserving urban ecosystem. Especially in tropical countries like Indonesia which receive high levels of solar radiation, trees contribute to the protection of urban areas from the impact of excessive micro-climatic conditions. But, the presence of trees sometimes resulted in the accidents for the residences because of broken branches and human injuries. This situation leads the city to prepare a tree inventory system, which is beneficial in giving the information about tree conditions and thus the information that would be useful for tree maintenance activities. The tree inventory on application for the city of East Jakarta was built for this purpose, comprising a tree inventory and easy access to the database. The application connects the database source with the GIS map, so that the users could retrieve information for each kind of data.

1. INTRODUCTION

a. Background

The development of urban areas that is focused on physical construction has much more neglected urban greenery, especially on greenery of road. This is in turn affecting on the physical condition of trees, indicated by the trees injury. The lack of trees health will become a serious problem for comfort and safety of traffic users. In rainy season with storm and hurricane, this will induce stem breaking and tree fallen down. This is why we want to monitore physical condition of trees, especially of urban roadtrees. The monitoring of trees condition involves the checking of trees indurries, both caused by pest and diseases, and by mechanical indurries.

In order to know the intensity of trees monitoring, it would be known some data including trees inventory, greenery facilities inventory, and the intcnsity of trees maintenance programs, and other related data. The problem faced by the municipal government of East Jakarta City in management of road-trees and greenery open spaces, is the lack of information of trees maintenance. The information management system for tree maintenance is the fundamental guidance which is essential for the judgement of development management of road-trees and greenery open space, due to earn the more efficient maintenance management.

b. The Purposes

The purpose of this study is to build information management system of trees and greenery open space for the area of East Jakarta City. This information would be usefull for some reasons: (1) the availability of information of trees and greenery management which is accessible and accurate, (2) the increasing of efficiency in budget and time for monitoring and maintenance, and (3) the increasing of communication between municipal government and citizen of Jakarta.

2. METHODOLOGY

a. Time and Location

This study was conducted by observation of trees at road and some park of East Jakarta during October 2006. The study areas comprises ca. 187.77 km² or about 28,37% of the area of Jakarta Metropolitan. The study location was limited for five protocol roads and two parks. The protocol roads includes: (1) Jalan Raya Bogor, (2) Jalan Mayjen Sutoyo, (3) Jalan Jenderal Ahmad Yani, (4) Jalan Raya Kalimalang, (5) Jalan Kayu Putih Raya. While the parks includes: (1) Taman Hutan Kota at Pondok Kelapa, (2) Taman Dermaga, at Duren Sawit.

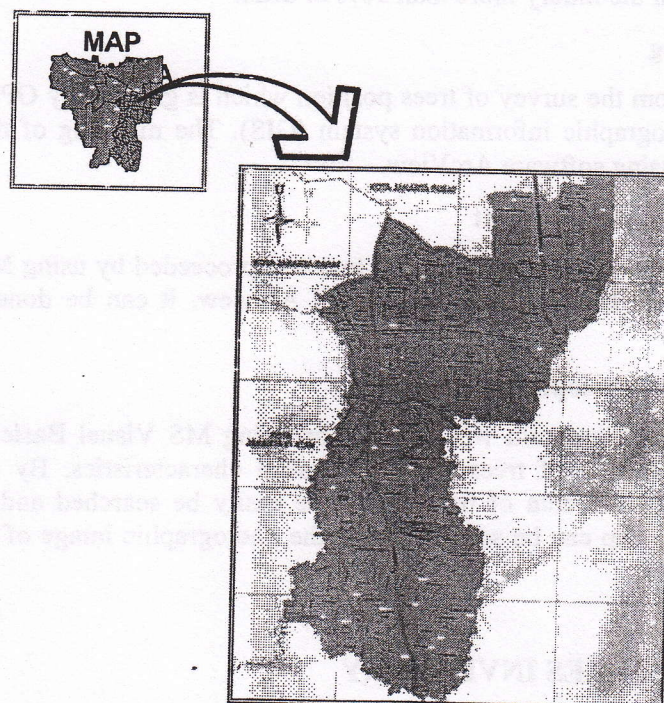


Figure 1. Study Location at East Jakarta City, Indonesia

b. Facilities

Materials. The materials needed for the study includes: (1) Topographic map of East Jakarta, (2) Landsat TM-7, (3) Data of management of trees and greeneries, and (4) Trees at sites.

Tools. Some softwares were used for the study, includes: (1) Arc View GIS v 3.2 3D *Spatial Analyst Extensions*; (2) Microsoft Access; (3) Visual Basic 6. While the hardware used includes: PC Pentium P4 1800 MHz SSE Ready, DDR RAM 256 MB. The tools needed for survey includes: (1) GPS Garmin Etrex Vista, (2) Compas of Suunto, (3) Digital camera, (4) Abney level, and (5) Roll-meter.

c. Data Collecting

The method for data collection conducted for this study comprises of survey and reference study. The survey of tree condition was conducted by suveying along the tree condition at study location, while the reference study was conducted due to find the information of trees maintenance standard applied at East Jakarta. In general, the study was conducted into four steps: (1) trees data and management data collection (2) mapping of trees data, (3) management of trees database, (4) user interface development.

- **Trees data and management data collecting**

- **Tree Physical Inventory.** Inventory on trees includes 5 aspects: (1) diameter at breast height (DBH), (2) tree height, (3) canopy width, (4) canopy form (symmetrical of canopy), and (5) location of trees (UTM).
- **Trees Health Valuation.** Tree health valuation was done based on three kinds of injury factors, i.e. (1) pest and disease, (2) mechanic, (3) technique. Then the value of trees injury was classified into four categories (modification of Grey and Deneke, 1978): (1) Category 1 (best) with the injury up to 15%, (2) Category 2 (good) with the injury 15 – 30%, (3) Category 3 (bad) with the injury 30 – 50%, and (4) Category 4 (worse) with the injury more than 50% or dead.

- **Trees Mapping**

Data earned from the survey of trees position which is grasped by GPS, was inputted for program of geographic information system (GIS). The mapping of this UTM data was conducted by using software ArcView.

- **Trees Database Management**

Data of trees including the number and text was proceeded by using MS Access. And, to make a link data between MS Access and Arcview, it can be done by operating MS Visual Basic 6.

- **User Interface Development**

The user interface program was built up by using MS Visual Basic 6, comprising the geographical position of trees and its physical characteristics. By operating the user interface project, the data of trees would be easily be searched and retrieved, and the location on the map can be seen. Besides, the photographic image of individual tree can also be seen.

3. RESULT OF TREES INVENTORY

Based on the field survey, the result showed that there was the data of trees population along the location of study comprised of 4227 trees. The trees were composted of 42 species, which was distributed unevenly. Among those trees, there was 14.9% of trees that is in bad to worse condition, or the trees in good to best condition was about 85.1%. The trees were distributed in seven location (of five roads and two parks). The location at Jl. Mayjen Sutoyo and Jl. Kali Malang contributed large sumber of trees with bad condition. The injury of trees usually was mostly caused by vandalism activity. The form of vandalism involved by painting, push the trees with nails, for hanging commercial items, and some by cutting branches in order to build kiost behind. This situation leads to have to strengthen the regulation to maintain trees against vandalism, especially for all trees located near commercial activities.

The distribution of trees at seven location and those health condition is described as below:

a. Jl. Raya Bogor

Trees were distributed along west and east sides of road, making a line of trees with the north-south orientation, from the point of Pasar Rebo fly-over to Cililitan Shopping Center. The number of trees is 436 composted of 19 species, involving at west-side 348 trees and at east-side 88 trees. Among the trees, there was 92 trees in bad condition and 4 trees worse.

b. Jl. Mayjen Sutoyo

Trees were distributed along west and east sides of road, road median, and at viaduct with the north-south orientation from the point of Cililitan Shopping Center to Cawang

fly-over. The number of trees is 485 composting from 17 species, comprising 90 trees at west-side, 123 trees at road-median, 181 trees at east-side, and 91 trees at viaduct lot. Almost one-third of those trees were in bad condition.

Table 1. Trees Condition at Study Area of East Jakarta City

| No. | Location | Number of Tree Condition | | | | |
|--|---------------------|--------------------------|-------|-------|-------|-------|
| | | total | best | good | bad | worse |
| 1 | Jl. Raya Bogor | 436 | 143 | 197 | 92 | 4 |
| 2 | Jl. Mayjen Sutoyo | 495 | 192 | 126 | 167 | - |
| 3 | Jl.A. Yani | 826 | 513 | 244 | 48 | 21 |
| 4 | Jl. Kali Malang | 842 | 605 | 21 | 216 | - |
| 5 | Jl. Raya Kayu Putih | 427 | 225 | 167 | 34 | 1 |
| 6 | Taman Darmaga | 213 | 169 | 39 | 2 | 3 |
| 7 | Taman Hutan Kota | 988 | 975 | 13 | - | - |
| | Grand Total | 4227 | 2822 | 807 | 559 | 29 |
| | | | 66,8% | 19,1% | 13,2% | 0,7% |
| Indury: best: 0-15%; good: 15-30%; bad: 30-50; worse: >50% | | | | | | |

c. A. Yani Street

Trees were distributed along west -sides of road in the north-south orientation from the point of Jatinegara fly-over to Pramuka intersection, and at east-side running to Jl Suprpto intersection. The number of trees is 882 composting from 15 species, comprising 359 trees at west-side and 523 trees at east-side. Almost one-third of those trees were in bad condition. Lest than 10% of trees at this site was in bad – worse condition.

d. Kalimalang Street

Trees were distributed along north and south sides of road, with the west-east orientation from the point of Cipinang Muara to Pasar Sumber Artha. The number of trees is 842 composting from 12 species, comprising 255 trees at north-side and 587 trees at south-side. Among the trees, there was about one fourth in bad condition.

e. Kayu Putih Raya Street

Trees were distributed along west and east sides of road, road median, and west separator and east separator, with the north-south orientation from the point of Tanah Mas Kayu Putih intersection to Perintis Kemerdekaan intersection. The number of trees is 427 composting from 13 species, comprising 51 trees at west-side, 42 trees at west separator, 131 trees at road-median, 168 trees at east separator and 35 trees at east side. Almost one-third of those trees were in bad condition. Among the trees, lest than 10% was in bad condition.

d. Dermaga Park

The location of Dermaga Park is at Jl. Duren Sawit Raya. The Dermaga park was consisted of 11 lots, the lots varied in the size of area of 200 to 500 m². The number of trees at Dermaga park is 213 involving 21 species. Most of the trees were in a best condition, and only a little was in bad to worse condition.

e. Hutan Kota Park

The location of Dermaga Park is at Jl. Dogol, Pondok Kelapa. The Dermaga park was consisted of 3 lots, the total area consisting 2 ha. The number of trees at Dermaga park is 988 involving 18 species, distributed as 381 trees at Lot-1, 317 trees at Lot-2, and 290 trees at Lot-3. All of the trees were in a good to best condition.

4. THE BUILDING OF GEOGRAPHIC INFORMATION MANAGEMENT

a. Geographic Information Management

The GIS of trees resulted from the observation was built up by using ArcView. User can retrieve the location and condition of individual tree by opening this program. In order to get operation of this program, the user should proceed some steps:

- (1) Open the program of ArcView
- (2) Activate all available extension tools
- (3) From File menu/ Open Project/ select the project with the extension format *.apr.

Figure 2 below shows the view of the project of GIS in retrieving trees located at specific road. User can also look up the directory of trees at specific location, including the information of trees health condition.

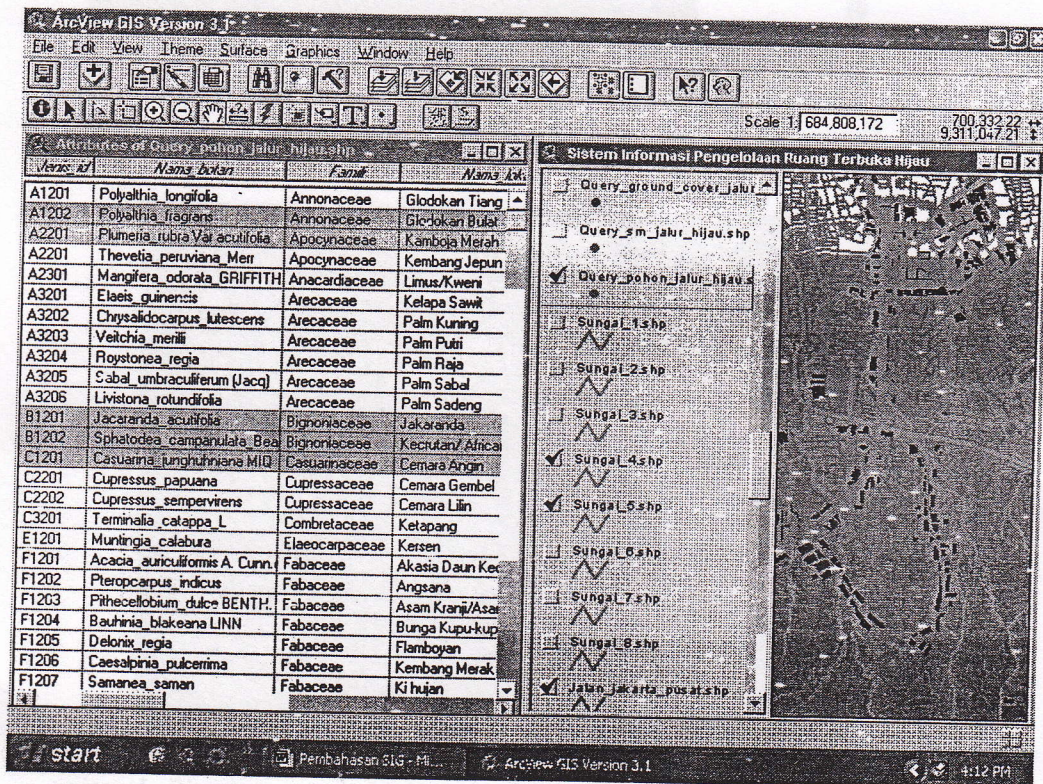


Figure 2. GIS for Trees Inventory Database of East Jakarta City, Indonesia

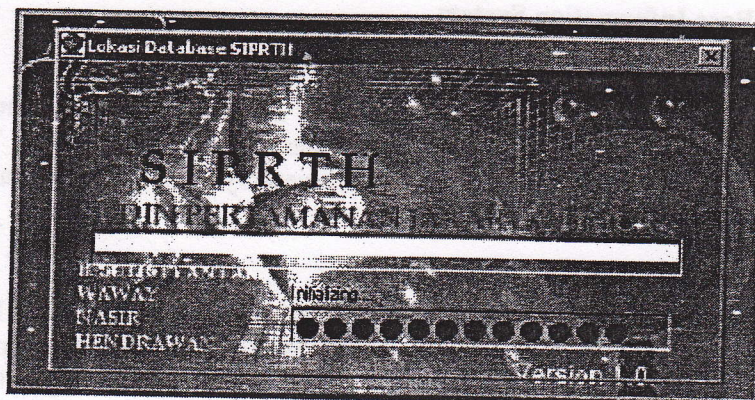


Figure 3. Opening View of Trees Inventory Application

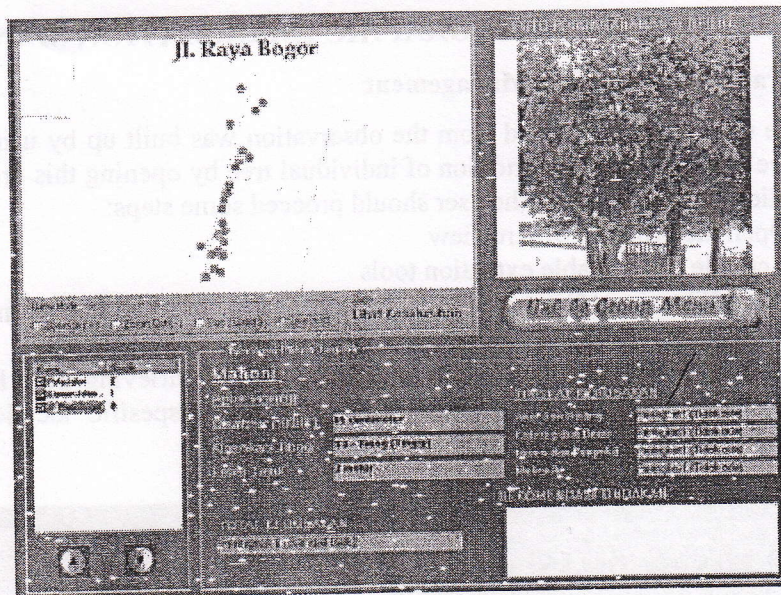


Figure 4. User interface for urban trees mangement



Figure 5. Retrieving information of individual tree at spesific location

b. Object-Base Information System

- **Database and Database Management System**

The database was designed in esay way for retrieving data. The information was divided into some tables, and every table stores specific entity. This was done by dividing the table for data of trees inventory and table for data of trees health valuation

- **Access 2000 DBMS For Windows**

MS Access is one of a good database application, was very useful for trees database management, because it contains of DBMS (database management system) which is facilitated with query. The query is very important for building a statement to look up the information.

- **Application of Database Management with MS Visual Basic 6.0**

MS Visual Basic is a programming language working in the area of MS Windows, that is why MS Visual Basic can optimize MS Windows. This language was successfully building up the application for trees database management. Even, the application can be built to retrieve image data in form of GIS. By making a user interface project using MS Visual Basic, a user can easily retrieve the data and information within it. The illustrations below show views of user interface built up as MS Visual Basic project.

5. CONCLUSION

Urban trees condition in a form of database that comprises of huge number of trees can managed in a simple way, and can easily retrieve by user. By using the capacity of MS Visual Basic 6, the database of urban trees condition even can be retrieved as an information in form of GIS. This capacity could be used worldwide for all urban areas, due to evaluate the natural resources in the cities.

REFERENCES

- Alam, MAJ. 2005. Mengolah Database dengan SQL dan Microsoft Query dalam Microsoft Excel. Elex Media Komputindo Gramedia. Jakarta.
- Arnold, H. F. 1980. Tree In Urban Design. Vand Nostrand Reinhold Co. Inc. New York. 168p
- Carpenter, P.L., T.D. Walker dan F.O. Lanphear. 1975. Plants in the Landscape. W.H. Freeman and Co. San Fransisco. 481p.
- Davis, G., 1995. Kerangka Dasar Sistem Informasi Manajemen. PT. Pustaka Binama Pressindo. Jakarta. 68 p.
- Grey, G.W. dan F.I. Deneke. 1986. Urban Forestry. John Wiley and Sons, Inc. New York.
- Miller, R. W. 1988. Urban Forestry : Planning and Managing Urban Greenspace. Prentice Hall, Inc. New Jersey. 404 p
- Pirone, P. P. 1972. Tree Maintenance. Oxford University Press. New York. 574 p.
- Prahasta, E. 2002. Konsep-konsep Dasar Sistem Informasi Geografi. Penerbit Informatika. Bandung.