PUBLIC GREEN SPACE IN BANGKOK: A CASE STUDY OF LUMPHINI PARK

Mr. Chieh-ming Lai

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Arts Program in Southeast Asian Studies
(Interdisciplinary Program)
Graduate School
Chulalongkorn University
Academic Year 2015

พื้นที่สาธารณะสีเขียวในกรุงเทพฯ: กรณีศึกษาสวนลุมพินี

นายเจีย หมิง ไล่

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาศิลปศาสตรมหาบัณฑิต
สาขาวิชาเอเชียตะวันออกเฉียงใต้ศึกษา (สหสาขาวิชา)
บัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2558

Thesis Title	PUBLIC GREEN SPACE IN BANGKOK: A CASE STUDY OF LUMPHINI PARK
By	Mr. Chieh-ming Lai
Field of Study	Southeast Asian Studies
Thesis Advisor	Associate Professor Montira Rato, Ph.D.
Thesis Co-Advisor	Bharat Dahiya, Ph.D.

Accepted by the Graduate School, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master's Degree

.....Dean of the Graduate School

(Associate Professor Sunait Chutintaranond, Ph.D.)

THESIS COMMITTEE

.....Chairman

(Saikaew Thipakorn, Ph.D.)

.....Thesis Advisor

(Associate Professor Montira Rato, Ph.D.)

.....Thesis Co-Advisor

(Bharat Dahiya, Ph.D.)

.....External Examiner

(Associate Professor Banasopit Mekvichai, Ph.D.)

เจีย หมิง ไล่ : พื้นที่สาธารณะสีเขียวในกรุงเทพฯ: กรณีศึกษาสวนลุมพินี (PUBLIC GREEN SPACE IN BANGKOK: A CASE STUDY OF LUMPHINI PARK) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: รศ. ดร. มนธิรา ราโท, อ.ที่ปรึกษาวิทยานิพนธ์ร่วม: ดร. บารัต ดาหิยา, 138 หน้า.

พื้นที่สาธารณะสีเขียวมีความจำเป็นอย่างยิ่งสำหรับการพัฒนาพื้นที่เขตเมืองอย่างยั่งยืนและคุณภาพชีวิตของผู้พักอาศัย แม้ว่ากรุงเทพมหานครได้จัดสรรพื้นที่สาธารณะสีเขียวเพิ่มมากขึ้นแล้วก็ตาม แต่ปัจจัยด้านกายภาพของพื้นที่สาธารณะสีเขียวของกรุงเทพมหานครยังไม่ได้รับการสำรวจอย่างทั่วถึง ซึ่งนี่คือปัจจัยสำคัญในการการบริหารจัดการพื้นที่สีเขียวในเขตเมืองอย่างมีประสิทธิภาพ จากการสำรวจนโยบายด้านพื้นที่สาธารณะสีเขียวของกรุงเทพมหานคร การย้อนกลับไปศึกษาประวัติศาสตร์ของพื้นที่กรณีศึกษา การวิเคราะห์สัดส่วนต้นไม้ในพื้นที่กรณีศึกษา การสัมภาษณ์เจ้าหน้าที่ในหน่วยงานที่เกี่ยวข้อง และการสำรวจภาคสนาม ผู้วิจัยพบว่าวิวัฒนาการของการคัดสรรพันธุ์ไม้ในสวนลุมพินีนั้นสามารถแบ่งออกเป็น 4 ยุค ดังนี้

ก่อนทศวรรษที่ 1970 ให้ความสำคัญกับพันธุ์ไม้ที่ให้ร่มเงาเป็นอันดับแรก ตั้งแต่ก่อนทศวรรษที่ 1970 เป็นต้นมา พันธุ์ไม้ประดับได้รับความสนใจมากยิ่งขึ้น ตั้งแต่ทศวรรษที่ 1990 ถึงต้นทศวรรษที่ 2000 พันธุ์ไม้ที่ใช้สำหรับการแบ่งโซนพื้นที่ได้รับความสนใจเป็นพิเศษ และในปัจจุบันกรุงเทพมหานครให้ความสำคัญกับพันธุ์ไม้ที่มีคุณสมบัติในการดูดซับสารคาร์บอน การค้นพบดังกล่าวแสดงให้เห็นถึงการปรับเปลี่ยนมุมมองของเจ้าหน้าที่เกี่ยวกับต้นไม้และภูมิทัศน์ในพื้นที่สาธารณะ รวมถึงหน้าที่อันหลากหลายของต้นไม้เพื่อสภาพแวดล้อมของกรุงเทพมหานคร ความสำคัญของประวัติความเป็นมาและบทบาทของเจ้าหน้าที่สวนสาธารณะต่องานด้านพื้นที่สาธารณะสีเขียวได้ถูกสะท้อนออกมาจากกรณีศึกษานี้ด้วยเช่นกัน ผู้วิจัยเสนอแนะต่อกรุงเทพมหานครให้ใช้ต้นไม้ในพื้นที่สาธารณะในการส่งเสริมนโยบายด้านสิ่งแวดล้อม ซึ่งสามารถเชื่อมโยงผู้คนกับต้นไม้ให้ใกล้ชิดกันมากยิ่งขึ้น และยังเป็นการขานรับต่อนโยบายในการส่งเสริมสำนึกด้านสิ่งแวดล้อมของผู้คนอีกด้วย

สาขาวิชา เอเชียตะวันออกเฉียงใต้ศึกษา ลายมือชื่อนิสิต .....

ปีการศึกษา 2558 ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

ลายมือชื่อ อ.ที่ปรึกษาร่วม .....

5787557720 : MAJOR SOUTHEAST ASIAN STUDIES
KEYWORDS: PUBLIC GREEN SPACE / BANGKOK / LUMPHINI PARK / TREESCAPE / URBANIZATION / UN'S SUSTAINABLE DEVELOPMENT GOALS

CHIEH-MING LAI: PUBLIC GREEN SPACE IN BANGKOK: A CASE STUDY OF LUMPHINI PARK. ADVISOR: ASSOC. PROF. MONTIRA RATO, Ph.D., CO-ADVISOR: BHARAT DAHIYA, Ph.D., 138 pp.

Public green spaces are essential for a sustainable city and urban dwellers' life quality. Although the Bangkok government (BMA) has already begun to seek for more public green spaces, the physical elements of Bangkok's public green spaces have not been fully explored, which is the key to good management of urban greenery. By reviewing BMA's policies on public green spaces, tracing back the history of the sampled site, analyzing the tree composition, interviewing government officials, and conducting field observations, the author reveals the policy evolution on tree selection in Lumphini Park, which can be delineated as four main phases.

Before the 1970s, shade trees were priorities. Since the 1970s, ornamental trees have become the emphasis. From 1990s to early 2000s, trees' spatial functions gained a distinct highlight. Nowadays, BMA focuses on trees' capability of carbon absorption. Such finding reflects not only the authorities' shifting perceptions of trees and landscape in public spaces but also trees' multiple functions for Bangkok's environment. The importance of the history and the role of park officers on public green spaces are also reflected in this case study. The author recommends BMA to use trees in public spaces to publicize its environmental policy, which can bind people with trees more tightly and corresponds to BMA's policy of raising the public's environmental awareness.

Field of Study: Southeast Asian Studies Student's Signature .....
Academic Year: 2015 Advisor's Signature .....
Co-Advisor's Signature .....

ACKNOWLEDGEMENTS

A pair of keen eyes found a sleeping seed. “You have unique flowers. Wake up!” Ajarn Bharat’s bright voice dispelled the darkness, making this seed germinate. “Anchor your roots firmly to this land. It is called Suvarnabhumi.” Ajarn Montira’s warm voice accompanied this bud when it kept growing. Two careful gardeners looked after this seedling together.

Mr. Somsak, my Ajarn in Lumphini Park, patiently shared his knowledge and experience of trees with me. Mr. Itsara sees friends’ difficulties more urgent than his own, and selflessly helps friends with his excellent language command. Ajarn Banasopit brought along the severest storm, which turned to be the best nutrients.

Miss Thipawan, Mrs. Waridtha, and Miss Sasiwan helped and encouraged me at different BMA offices. Miss Krongkarn, Mr. Bancha, Ms. Piangpanor, Mr. Pira, Mr. Saket, Mr. Naphat, Mr. Tanut, Mr. Surapon, Mr. Nguyễn Tuấn Anh and Mr. Pawel offered lots of assistance. Ajarn Bart, Ajarn Amara, Ajarn Saikaew, and Ajarn Lowell gave me advice on research methods. My parents sent unchanged supports from home.

This is an unexpected but rewarding journey. I have immense gratitude for every name mentioned above.

CONTENTS

Page

Page

Page

LIST OF TABLES

LIST OF FIGURES

- Unless other stated, all figures are provided by author.

CHAPTER 1

Introduction

1.0 Outline of Chapter 1

1.1 Statement of the Problem

1.1.1 Public Green Spaces and Sustainable City

1.2 Literature Review

1.2.1 Public Green Spaces in Southeast Asian Cities

1.2.2 Bangkok's Urbanization and Diminishing Green Spaces

1.2.3 Trees Cultivated in Southeast Asia

1.2.4 Trees in Bangkok

1.2.5 Urban Treescape

1.3 Conceptual Framework

1.4 Research Objectives

1.5 Methodological Framework

1.5.1 Study Area and Sampled Site

1.5.2 Data Collection

1.5.3 Data Analysis

1.6 Research Significance

1.7 Research Map

1.0 Outline of Chapter 1

Public green space is an indispensable element for a good and livable city. However, little of public green spaces in Southeast Asian cities, is known, and this research is aimed to explore this burgeoning topic. This chapter explains the issue background, reviews relevant works, illustrates the conceptual framework, specifies the research objectives, elaborates the author's methodological framework, and outlines the following chapters.

1.1 Statement of the Problem

Cities, the highest form of human sociocultural achievement in human civilization (Dahiya 2014) , attract and blend people, resources, intelligence, and finance to boost creativity and productivity. However, urbanization also brings various urban issues, including the shortage of infrastructure, traffic congestion, slums, and environmental deterioration. Water, air and noise pollution seem unavoidable in the cities. Apart from ubiquitous pollution, another issue of urban environment—public green spaces—has emerged as an indicator of urban dwellers' life quality.

Public green spaces, the spaces people can have least distance with the nature in the cities, provide urban dwellers with a wide range of personal and societal benefits, including the improvement of people's physical and psychological health, urban

regeneration, economic gain, sense of community and environmental awareness (Fuller and Irvine 2010, 134). However, the benefits of urban green spaces are much more than these. Urban vegetation also provides lots of environmental functions and ecological services to harmonize cities with the nature. To exemplify, plants have great importance in cooling down the city by reducing the urban heat island effects, in purifying the city air by trapping atmospheric pollutants, in baffling traffic and construction noise (Detwyler 1972, 230), and in reducing the intensity of storm runoff in the city by absorbing the water (Harris et al. 2004, 102-114) . For lives other than human being, plants in the cities provide habitats for numerous insects, birds, fungus, and microorganisms to maintain the urban ecosystem (Sadler et al. 2010, 243). Street trees impose shades on the pavements to make urban travel less uncomfortable in hot weather, contributing to a city's walkability (UN-HABITAT 2015). Park trees provide the visitors with pleasant shades for outdoor exercise, quiet contemplation, and social activities. A variety of trees, shrubs, and flowers in the cities greatly improve the urban landscape. Considering such abundant benefits urban vegetation can generate for the cities and city dwellers, deeper understanding of the urban vegetation and public green spaces in our cities is necessary to improve the urban environment and life quality. On the other hand, trees exist in cities because of human selection rather than natural succession, which is totally different from trees in the wild and forests. Exploring urban trees, accordingly, is a way to understand the urban dwellers' perceptions of the

nature in a city and a necessity for a city to harmonize itself with the nature. The trees in public green spaces, however, are often taken for granted, and thus need more research to address this topic.

1.1.1 Public Green Spaces and Sustainable City

To improve the city environment and urban residents' life quality, the United Nations (UN) has set a series of Sustainable Development Goals (SDGs), one of which is "Sustainable Cities and Communities: Making Cities inclusive, safe, resilient and sustainable." Under this SDG, eleven more concrete targets have been formulated, and one of them is:

> "Target 11.7: By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities." (United Nations 2015)

This target makes it clear that inclusive and accessible green and public spaces are an essential part of a sustainable city. A green space can be public, private, and in-between. For a public one, a city park is a typical example; for a private one, a balcony garden fits this type; for a semi-public (or semi-private) one, a golf course exemplifies this sort for the fact that only those who can afford the entrance fee can enjoy the

greenery of a golf course. As a result, only the public green spaces are inclusive to everyone, which is the SDG target mentioned above.

Many European and North American cities have strived much for their public green spaces, while most of the developing countries are trying to catch up with the front-runners. The Economist Intelligence Unit's *The Green City Index* (2012) indicates that in Latin American cities, everyone has 255 square meters of green space; in African cities, 74 m^2; in Asian cities, 39 m^2. UN-HABITAT's *State of the World's Cities 2012/2013: Prosperity of Cities* (2012) also points out that the new parks built in last five years has increased 31 percent in Africa; 70 percent in Arab states; 77 percent in Asia, and 60 percent in Latin America and Caribbean. These numbers reveals that although the public green spaces provided currently are not sufficient for the urban residents, Asian cities have begun to make themselves greener. Accordingly, public green spaces have become an important part for Asian cities to pursue sustainable development.

1.2 Literature Review

The issues of public green spaces come up at an intersection of urban studies and plant science, making it necessary to review works on urban development and arboriculture. In addition, a comparison of public green spaces among adjacent cities facilitates the understanding of public green spaces in a wider viewpoint.

1.2.1 Public Green Spaces in Southeast Asian Cities

According to the Economist Intelligence Unit's report *The Asian Green City Index* (2011), the area data of public green space from six Southeast Asian cities are available, shown in Table1. As the public green spaces highly correlate with a city's development level, it is of no surprise that all data focus on the capital cities, which are the driving hubs of industrial production and commercial activities of Thailand, Vietnam, Indonesia, Malaysia, the Philippines, and Singapore. So far, no statistics of public green space from any city of Cambodia, Laos, Myanmar, and Brunei are available.

Table 1. Public Green Space Areas in Southeast Asian Cities (Unit: m^2/person)

City	Green space area (m^2/person)	Data year	Data source
Bangkok	3.3	2007	Bangkok Metropolitan Administration (BMA)
Hanoi	11.2	2008	Graduate School, Hiroshima University
Jakarta	2.3	2008	Statistics Jakarta
Kuala Lumpur	43.9	2004	Kuala Lumpur Master Plan
Manila	4.5	2007	Metro Manila Development Authority
Singapore	66.2	2009	Singapore Government Statistics

(Source: Economist Intelligence Unit (EIU) 2011)

In terms of maritime Southeast Asia, the four cities distribute as two groups on the two ends of the spectrum—Jakarta and Manila are at one end, while Singapore

and Kuala Lumpur are at another one. On the same spectrum, the two mainland Southeast Asians cities—Bangkok and Hanoi—are located at the same side with Jakarta and Manila. Although lacking the data of Phnom Penh, Vientiane, Yangon and Nai Pyi Daw, it is undoubted that the development level of Bangkok is much higher than all of these cities. Laos and Myanmar (Burma) had been long-term self-enclosed until recently, while Cambodian society underwent Khmer Rouge's destruction and brutal mass killing, leading to devastating regression on Phnom Penh. Therefore, Bangkok arguably has the least public green spaces among mainland Southeast Asian cities, urging more attention on this important urban issue.

1.2.2 Bangkok's Urbanization and Diminishing Green Spaces

The Siamese established Bangkok on the eastern bank of the Chao Phraya River in 1782 (Wyatt 2003, 313). Located in tropical Asia, receiving abundant monsoon rain, Bangkok was once a green city for more than one century. In the guidebook written for the Royal State Railways of Siam (Seidenfaden 1984), the verdant image is repeated in various parts of Bangkok in the 1920s. Some depictions are excerpted as follows:

> "This district is cut through by several roads running roughly from west to east between New Road[1] and Rama IV Road, namely, in order from north to south,

[1] 'New Road' is another name of Charoen Krung Road.

> the *Si Phya*, the *Suriwongse*, the *Silom* or *Windmill* and the *Sathorn* Roads....The roads are well kept and in part shady being lined on both sides by cozy cottages and bungalows each standing inside its own garden plot shaded by the foliage of the big trees or almost hidden behind a wealth of flowering shrubs and creepers, while every afternoon the fresh sea breeze makes life in this quarter more than bearable, in fact, quite enjoyable." (77-78)

The above description reveals the pleasant greenery in Silom, a highly westernized commercial district near the center of Bangkok, in the 1920s. Away from the hustle-bustle, people in the 1920s Thonburi could see the following verdant view:

> "The West Bank of the Menam[2], though rather densely populated along its banks, has few or no roads, most of the traffic being by boat through the network of klongs[3] with which the hinterland of this district is intersected. The land stretching behind and away from the river bank is in fact one huge garden with many kinds of fruit trees, a delightfully idyllic district to roam about." (87)

[2] 'Menam' means the Chao Phraya River; the west bank of Chao Phraya River is Thonburi.

[3] 'Klong' means canal.

When he climbed the Golden Mountain[4] and had a bird eye's view on Bangkok from Wat Saket, Seidenfaden praised the extensive greenery as:

> "Looking to the south the horizon is closed as by a mighty forest, the vast and idyllic garden-land on the west bank of the river, from which here and there, some white prang or pointed chedi peep up out of all the greenery. On this side of the river, towards the south and south-east, the newer part of the capital extends with its throng of streets and houses, presenting a view which however, is not that of a desert of stones like so many American or European cities because here in Bangkok the trees and the verdure dominate. Seen from a high position, the town resembles one huge park…" (245)

The Great Depression spread to Siam, striking the kingdom's economy in the early 1930s; meanwhile, the coup d'état occurred in 1932 replaced the absolute monarchy with constitutional monarchy (Wyatt 2003, 227-230). Precarious economy and politics were then followed by the World War Two in the 1940s, decelerating the development of Bangkok in this period. After the end of the World War II in 1947, more population migrated to the capital city, reviving the growth of the Bangkok (Thadaniti 1995, 263).

[4] A 76.5 meters high artificial hill, on the east bank of Chao Phraya River. It is near the Giant Swing.

The real urbanization of Bangkok, as the result of Field Marshal Sarit's intention to modernize the kingdom's capital city, has started since the 1960s (Askew 1994, 100) and fully accelerated in the 1970s (Warren 2002, 94). The area of Bangkok expanded rapidly from 96.4 square kilometers in 1958, 290 square kilometers in 1968, and 1,568 square kilometers in 1994 (Thadaniti 1995, 263). The watery network was transformed to roads for motorized *tuk-tuk* and automobiles, and new western-styled buildings grew one by one among the traditional wooden houses. The fast-spreading and never-ending constructions had removed numerous trees which once stretched branches along old streets and canals as described below,

> "[In 1960s]... the placid tree-lined Bangkok which had charmed the well-heeled tourists of earlier years gave way to the concrete and air-conditioned business city of the modernist period." (Askew 1994, 100)

The scene of plentiful trees being removed when Bangkok expanded is repeated in Smithies' work as follows:

> "Most of the old streets with canals on either side and huge shady rain trees[5] above have gone in the name of modernization. With a great deal of imagination

[5] *Samanea saman*, alternative common names include East Indian walnut and Monkey pod.

one can picture how Wireless Road looked twenty-five years ago, for many of its trees remain[ed], and the parallel side roads were once klongs. It is impossible now to conjure up a similar picture of Ploenchit, though less than thirty years ago it was the same." (Smithies 1986, 75)

As the building boom continued, the green spaces in Bangkok kept diminishing. The plants inside private gardens and yards are still growing, but they are not readily reachable for the public due to privacy and security reasons.

"...most of the city's trees are hidden when you are sitting in one of Bangkok's endless traffic jams, surrounded by clouds of smog and all manner of noisy vehicles... Head off the main streets into a small soi (side street), however, and the situation is often completely different... Stroll around these back streets and you'll catch glimpses not just of majestic trees but of manicured lawns and magnificent tropical garden. Glimpses, however, are all you'll get. Because throughout Bangkok, affectionately known as the Big Mango, greenery is hoarded within private compounds, hidden behind walls designed to keep out prying eyes and would-be burglars." (Fahn 2004, 14-15)

The garden-like Bangkok, after its trees were chopped down in the name of urbanization and modernization, has become a concrete jungle. Increasing pollution and rising housing prices pushed people to the city's fringes for greener and cheaper living places (Poungsomlee and Ross 1992, 47).

In 2001, the area of Bangkok's public green space ranged from 1.8 to 2.8 square meters per capita, or 4.2% of Bangkok's total area (Thaiutsa et al. 2008). Since 2007, the Bangkok Metropolitan Administration (BMA) has undertaken an action plan on mitigating global warming, one objective of which is to expand the park area in the city and increase the number of trees for the absorption of carbon dioxide (Bangkok Metropolitan Administration (BMA) 2007).

In 2015, the Department of Environment, BMA, announced the green area has increased to 5.44 m^2 in 2014 (Bangkok Metropolitan Administration (BMA) and JICA 2015). However, Halkic (2014) argues this growth is dubious because some 'increased' public green spaces are existing green areas in Bangkok's outskirt, which were not included in previous years but are included in latest calculation. On the other hand, the uneven distribution and outlying location of public green spaces make it uneasy for Bangkok dwellers to access them (Unakul 2013, 197-198).

Although Bangkok dwellers' and city government's awareness of preserving and expanding public green spaces has been growing, the physical elements of public green spaces in Bangkok have not received much attention yet. The size, shape, structure,

composition, location and spatial configuration of green spaces have great influences on their ecological functions (Pauleit and Duhme 2000). Furthermore, the biodiversity, history, design and management of a public green space also play decisive role in its functions (Uy and Nakagoshi 2008). As a result, it is necessary to analyze the plant composition of Bangkok's public green spaces so that Bangkok residents can better understand their cityscape and (re)connect themselves with the nature in Bangkok, a famous Asian city.

1.2.3 Trees cultivated in Southeast Asia

Jensen's work (1999) records 94 tree species, including conifers, casuarinas, bamboos, palms, bananas, and lots of broadleaved trees, which are all commonly cultivated in Southeast Asia around farms, in plantations, and along roads and canals. For each species, Jensen provides its local names in each Southeast Asian country[6] (if available), scientific name, morphological description, major uses for human, ecological traits, distribution map in Southeast Asia, and data references. For most tree species, as Jensen notes in the preface, it is only possible to know that a species appears at a certain part of a country; whether this tree can be found within the whole country is little known because the data is very limited. In insular countries like Indonesia and the Philippines, it might be relatively easy to specify a species' distribution to certain

[6] The tree species' name in each national language. Names in dialects are not included.

islands. On the contrary, confirming a tree species' distribution in mainland Southeast Asia is more difficult. A few tree species' geographical origin is also mentioned if there is data.

1.2.4 Trees in Bangkok

Thaiutsa et al. (2008) recorded 127 tree species with 22 most dominant tree species (count≥1000 trees) from 189,409 street trees in Bangkok. An excerpt is shown as Table 2.

Table 2. Dominant Street Trees in Bangkok 2001

Scientific name	Total number	Percentage of total (%)	Geographical provenance
Pterocarpus indicus	79,365	41.9	SE Asia
Tabebuia rosea	12,792	6.8	Cent, S America
Cassia fistula	12,731	6.7	SE Asia
Swietenia macropjylla	9026	4.8	Cent, S America
Lagerstroemia speciosa	8293	4.4	SE Asia
Mimusops elengi	7841	4.1	SE Asia
Polyalthia longifolia	5829	3.1	S Asia
Calophyllum inophyllum	5484	2.9	Africa, Asia
Lagerstroemia loudonii	5270	2.8	SE Asia
Lagerstroemia floribunda	4908	2.6	SE Asia
Peltophorum pterocarpum	4901	2.6	SE Asia
Delonix regia	4736	2.5	Africa
Lagerstroemia macrocarpa	3714	2.0	SE Asia
Azadirachta indica	3444	1.8	Asia

Scientific name	Total number	Percentage of total (%)	Geographical provenance
Tamarindus indica	3348	1.8	Africa
Millingtonia hortensis	2455	1.3	SE Asia
Terminalia catappa	1961	1.0	Asia
Cassia spectabilis	1917	1.0	Cent, S America
Ficus benjamina	1757	0.9	Asia
Alstonia scholaris	1399	0.7	Asia
Casuarina junghuhniana	1251	0.7	SE Asia
Acacia auriculiformis	1157	0.6	Australia

(Source: Thaiutsa et al. (2008))

Table 2 clearly indicates *Pterocarpus indicus* is the most numerous tree species along Bangkok's roads and streets. The top three tree species, including *Pterocarpus indicus, Tabebuia rosea,* and *Cassia fistula,* sum up more than half of the surveyed street trees. As for the geographical provenance, 16 dominant tree species included in Table 2 are native to Asia, including Southeast Asia. What should be noted here is the authors carefully describe the trees' geographical provenance with the continent parts rather than country names. Such objective and flexible definition of species origins is followed in this research.

The Forestry Research Center, Kasetsart University (2004) recorded 61 tree species planted in Rommaneenart Park with descriptions of the tree species' botanical characteristics and landscape values. The top seven most numerous tree species in

Rommaneenart Park are *Pterocarpus indicus* (128 trees), *Millingtonia hortensis* (75 trees), *Mimusops elengi* (53 trees), *Polyalthia longifolia* (48 trees), *Peltophorum pterocarpum* (31 trees), *Lagerstroemia loudonii* (29 trees), and *Lagerstroemia speciosa* (23 trees). It is interesting that all the tree individuals of these seven species are medium or small size trees, and big-sized trees are relatively small even they have already reached mature phase, which might be attributed to the relatively short history of Rommaneenart Park[7]. This tree survey also indicates that flowering period is an important criterion for urban tree planting, and identifies 18 tree species flowering only in winter (December and January), 12 species in hottest month (March and April), and 6 species during rainy season (from June to October). Covering the site history and trees' flowering periods, this survey report presents a reader-friendly tree profile of Rommaneenart Park.

The above works greatly facilitate the understanding of the trees in Bangkok's public spaces. However, urban trees vary a lot according to the types of public spaces. Street trees, for example, encounter the severest environmental constraints among urban trees because of air pollution and space limit, while open spaces such as large parks, are friendlier for urban trees. On the other hand, the tree composition in a large and old public green space might be much more complicated than in a small and

[7] The site of Rommaneenart Park had been a prison for 103 years until 1992. The construction of this park was finished in July 1993 and has been open for the public.

young one. Currently, there is little research on trees in Bangkok's large public green space. Therefore, this research, as an explanatory investigation, is aimed to fill in this gap and expand the understanding scope of these previous work.

1.2.5 Urban Treescape

'Treescape' is 'a landscape including many trees or groups of trees' (Merriam-Webster 2016). That is to say, 'treescape' focus on the trees in a specific landscape. Treescape comprises at least three aspects—tree species composition, tree dimension and tree performance (Chen and Jim 2003). Tree species composition can be understood as the tree diversity of a specific flora; tree dimension involves a tree's measurements such as its height and form; tree performance is decided by the tree species' biological clock and other physiological features. For example, *Cassia fistula*, an ornamental tree widely cultivated in Thailand, blooms with bright golden flowers from February to May (Veesommai et al. 2013, 90-91), and is thus called 'Golden shower.' after the flowering period, the bright golden color disappears and the long brown legumes keep dangling beneath the branches, presenting different visual effects. The above three aspects jointly affect the way we see trees and perceive the treescape. Besides, Halprin (1972, 163) indicates landscape designers have two different attitudes towards the creation of urban treescape. One is to employ trees for space delineation such as planting trees in precise rows along irrigation channels. The other one regards

trees as organic forms, which should be left unpruned and grow naturally in clumps, simulating as much as possible the trees in natural woodlands. This dimension of treescape is also discussed in following chapters.

1.3 Conceptual Framework

The conceptual framework of this research is shown as Figure 1. Firstly, the tree composition in Lumphini Park, the sampled site, is the accumulation result of a series of policies on tree selection from past until present. Therefore, the author tries to understand the current tree composition, and then the reasons behind. However, the lack of documents makes it difficult to know the policies implemented in the past. As a result, with the great help of the park team's leading arborist, the author attempts to reconstruct a chronicle of tree introduction with trees' estimated ages. By doing so, the author approaches the questions "what trees are planted in Lumphini Park" and "why are these trees planted in Lumphini Park." In addition, the tree performance is also depicted after each tree species' ecological trait was revealed. Secondly, the landscape design and maintenance practices of trees have enormous influence on the tree dimension. Combining all the three aspects—tree composition, tree performance, and tree dimension, the author represents the treescape of Lumphini Park, the core element of this sampled public green space.

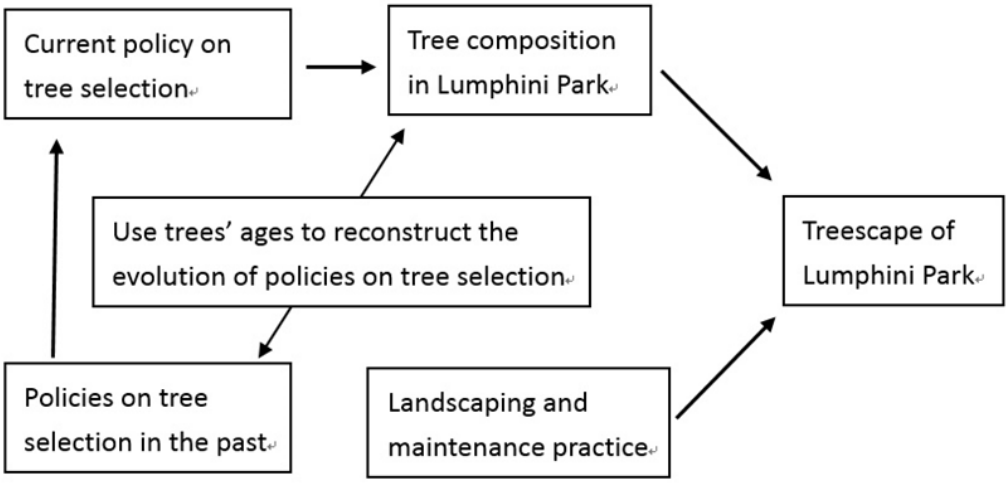

Figure 1. Conceptual Framework

1.4 Research objectives

On the basis of conceptual framework, three interrelated research objectives are designed to conduct this research. The three objectives are:

(1) To trace the historical development, and understand the current geography and landscape of Lumphini Park.

(2) To review the Bangkok government's policy on public green spaces and the implementation of such policy in Lumphini Park.

(3) To investigate the tree composition in Lumphini Park and find out the dominant tree species to present the treescape.

1.5 Methodological Framework

1.5.1 Study Area and Sampled Site

As Table1 reveals, Bangkok is arguably the last one in terms of the area of public green spaces in mainland Southeast Asian cities. Accordingly, Bangkok is an indicative city to understand the current state of public green spaces in Southeast Asia. On the other hand, not much of the tree composition and the policies which formed Bangkok's public green spaces is known. Accordingly, selecting an iconic public green space to conduct an integrated research will help to approach the research questions.

Accessibility, as UN's Sustainable Development Goals suggests, is the key for urban residents to enjoy the public green spaces. This essential prerequisite makes Lumphini Park[8] as a suitable case to be studied. Lumphini Park, located at the center of Bangkok, is close to several convenient public transportation systems, including 2 subway stations, 2 sky train stations, and many bus routes. As a result, Lumphini Park is highly accessible for Bangkok dwellers to reach. As for area, Lumphini Park occupies 576,000 m^2, only second to the 800,000 m^2 of Suan Luang Rama IX Public Park and 600,000 m^2 of Wachirabenchatat Park (Rotfai Park) in Bangkok. However, Suan Luang Rama IX Public Park is located in the southeastern outskirt of Bangkok, making its vast green space uneasy to enjoy. Therefore, being indicative in both accessibility and area,

[8] There are different English translations of Lumphini Park's name. The author follows the official spelling in the publication of Public Park Office (2013).

Lumphini Park is selected to study the tree composition and the policy behind for this research.

1.5.2 Data Collection

1.5.2.1 Secondary Data Collection

The secondary data and sources are:

(1) Historical material, which were collected from books, documents and the authority explanations acquired from the sample site.

(2) Public policies, meaning written government policies, were acquired via Internet access from the official website of Environment Department, BMA, and direct contact with officials at City Planning Department, BMA.

(3) Data of public parks in Bangkok, which were obtained via Internet access from the official website of Environment Department, and the official publication of Public Park Office (2013).

(4) Tree survey data, which was acquired from the leading arborist of Lumphini Park after the author contacted Lumphini Park Office.

1.5.2.2 Primary Data Collection

The primary data and sources are:

(1) To understand the policies on tree selection, interviews were conducted with the

director and leading arborist of Lumphini Park Office. For the park director, the questions were very simple; for the latter, a series of questions were designed, but the interview remained semi-structured, namely the arborist talked as much as possible freely without following the question order strictly. For more detailed content, the author's interpreter translated simultaneously, and the arborist also drew and consulted reference books to facilitate explanation. The interview content was rearranged in the same day, and let the arborist review whether there is any mistake during next interview. The interview information is shown in Table 3.

Table 3. Interview Information

No.	Interviewee Name and Occupation	Date	Place	Talk Topics
a	Mr. Somsak Intarmart (นาย สมศักดิ์ อินทมาตร์), Leading Arborist of Lumphini Park	15 Feb, 2016	Lumphini Park Office	Tree composition, criterion of tree selection
b		4 Apr, 2016	Lumphini Park Office	Maintenance practices of trees, disambiguation of surveyed data
c		26 Apr, 2016	Lumphini Park	Introduction tour of trees in Lumphini Park
d	Miss Sasiwan Wongsiriprasert (นางสาว ศศิวรรณ วงศ์ศิริประเสริฐ), Director of Lumphini Park	3 May, 2016	Lumphini Park Office	Overall policy on environment and trees of Lumphini Park

Table 4 shows the questions designed for the first interview (a) with the leading arborist of Lumphini Park Office. Question No.1 to 8 are factors involving tree functions, and No. 9 to 17 are concerned with tree maintenance. However, the arborist spoke very freely without strict following the question order.

Table 4. Questions for the First Interview with the Arborist

No.	Idea behind	Real Questions
1	Multiple flower colors	Is flower color important when you select tree species? Any flower color is preferred?
2	Tree forms	How tall a tree should be? What kind of tree form is good?
3	Seasonal performance	Did you select trees having flowers in different months?
4	Exotic species	Did you select trees from other countries? What exotic trees we can see in Lumphini Park? Can these exotic trees grow well here? Do you plan to plant more exotic trees?
5	Wide shade area	What trees can give us many shades in Lumphini Park?
6	Tree height	How tall is good for a shade tree?
7	Foliage density	What trees have dense crown and thick shade?
8	Evergreen or deciduous	If a tree sheds many leaves, is it not good like trees that sheds few leaves?
9	Environment tolerance	What factors are important for trees to survive in Bangkok?
10	Resistance to pests and diseases	Any tree here having serious issues of pest and disease?

No.	Idea behind	Real Questions
11	Transplanting & Establishing	Is it important that a tree is easy to transplant or establish so that you want to choose it?
12	Minimal litter	Did you choose trees that having few fallen leaves, flowers or fruits so that it is easier to clean?
13	Long life span	The longer a tree can live, the better?
14	Recovery ability from pruning	How often you prune trees? What trees need most pruning? How were the trees after pruning? Easy to die?
15	Non-invasive tree species	Any exotic trees here can propagate very fast? Can you control it if it spreads or propagate too fast?
16	Non-allergic	Any tree's flower pollen can make people allergic?
17	Space feeling (landscaping)	Did you consider whether a tree can match other plants or facilities in Lumphini Park? Any trees are very important in space control or define?
18	(Others)	

(2) Field observation in Lumphini Park, which enabled the author to obtain much information, including seasonal performance, maintenance practices, and so on, which can hardly be gained from the tree survey data. The author visited Lumphini Park for more than twenty times during December 2015 to June 2016, and has begun to learn tree identification since February 2016. Photos were densely taken during April to June 2016 before 6 pm each time to make sure the hues of each photo keep close among each other.

1.5.3 Data Analysis

1.5.3.1 Analysis of Secondary Data

All of the secondary data were utilized straightforward except the tree survey data. The tree survey of Lumphini Park is conducted every 6 years. In the latest tree inventory (Lumphini Park Office 2010), which was done by 5 arborists for one month, 6,105 woody plants of 136 species were recorded. A perennial tree, which generally can grow up to 20 meters, is counted in when it reaches 10 meters. A shrub, usually not taller than 6 meters in height, is counted in when it reaches 2 to 3 meters. Groundcovers, vines, epiphytes and plants in the nursery are not the survey targets.

The tree list was handled with the following steps before analysis. First, some tree names on the list were abbreviations or misspelt, so the author asked the arborist to disambiguate the unclear terms. Second, the author consulted plant reference books to find out the trees' scientific names from their Thai names. Third, the tree list was cross-examined with the author's field observation to check whether there is any difference. Although the author was not able to check the whole 6,105 trees, some differences, being mistake or update, were found and discussed with the arborist to confirm the reason. After this step, the tree inventory was analyzed statistically.

To find out the dominant tree species and represent the holistic treescape in Lumphini Park simultaneously, the tree species whose percentage is higher or equal to 0.25 percent of all surveyed trees, namely the individual number is greater than 15,

are included in this research. Consequently, 50 of the 136 tree species that reach this threshold have been found, accounting for 93.9 percent, or 5,731 tree individuals in Lumphini Park. The other 429 trees accounting for only 7 percent of the total trees in Lumphini Park. As a result, the 5,731 trees from 50 most dominant tree species are abundant enough to represent the main treescape in Lumphini Park, and are the focus of chapter 4.

The information of tree species is collected and compared from several reference books, including Amranand and Warren (1996), Jensen (1999), Gardner et al. (2000), Forestry Research Center (2004), Simpson (2006), Veesommai (2013) and other online databases because there is no single reference source covering all the 50 most dominant tree species in Lumphini Park. Among the various information sources, Amranand and Warren (1996), Forestry Research Center (2004) and Veesommai et al (2013) are the three major sources the author follows for their focus on landscape plants used in Thailand, which is highly relevant and proper for the analysis on the trees in Lumphini Park.

1.5.3.2 Analysis of Primary Data

The answers obtained from the semi-structured interviews with the arborist were compared with the examples from Arnold (1993) and Harris et al. (2004), and then the author discussed the differences with the arborist. Some questions gained

ample discussions while some were little answered, which is also an indicator to know a factor's weight in the criterion of tree selection. Answers that exceeded listed questions were also integrated into the analysis.

1.6 Research Significance

This research will be helpful to understand the urban treescape in Bangkok's public green spaces and the policies shaping such urban landscape. In addition, this research is expected to provide some information for further research on environment and ecology in Southeast Asian cities.

1.7 Research Map

Chapter 2 presents the history, geography, landscape of Lumphini Park, and people's activities in Lumphini Park. This chapter is aimed to introduce the background of Lumphini Park as an iconic public green space in Bangkok for following analysis on Lumphini Park's treescape.

Chapter 3 presents the Bangkok Metropolitan Administration (BMA)'s policies on public green spaces, including the holistic policies of City Planning Department and Environment Department as well as Lumphini Park Office's specific policy on trees. This chapter explains the implementations of the policies on Lumphini Park's trees and reveals the structure of next chapter.

Chapter 4 presents various trees planted in Lumphini Park. Firstly, major trees are introduced with their main functions on the bases of interview result and field observation. Secondly, the trees are illustrated spatially to represent a dynamic treescape. This chapter aims to integrate everything mentioned forehand to depict a dynamic treescape.

Chapter 5 concludes this research by reviewing the research findings, providing recommendations, and suggesting the directions for further research.

CHAPTER 2

Lumphini Park: Human-place Relations

2.0 Outline of Chapter 2

This chapter aims to provide the background of Lumphini Park by tracing its history, mapping its geography, and depicting its landscape. Subsequently, the author represents people's and the authorities' activities in Lumphini Park with pictures to visualize the various functions of this iconic public green space. Assembling these four dimensions of Lumphini Park, the human-place relations are illustrated to facilitate the discussions in following chapters.

2.1 The History of Lumphini Park

Prior to the construction of Lumphini Park, this land was a property of King Rama VI (1910-1925) and was called Saladaeng Field. In the beginning of 1920s, the King planned to hold an international trade fair named Siamese Kingdom Exhibition (งานสยามรัฐพิพิธภัณฑ์, literally means Siam Kingdom Museum), and Saladaeng Field, a site within easy access to the city, was chosen to be the venue for this grand event (Changkwanyuen 2006, 1), where all sorts of products and natural resources around the Kingdom were supposed to be displayed to attract domestic and international buyers.

King Rama VI's initial idea of this site after the exhibition was to turn it as a botanical garden for people's recreation and education (Public Park Office 2013, 13). Prior to the exhibition, the construction of this site was completed in 1925, and the King named this site 'Lumphini,' meaning the birthplace of Lord Buddha. However, the

sudden passing-away of King Rama VI in November 1925 made this exhibition cancelled. Afterwards, King Rama VII rented 14.4 hectares of land in the south of the original site, and created this part of Lumphini Park as an amusement park. As the recreational significance of Lumphini Park continued to grow, King Rama VII transferred the ownership of this land to the government, and commanded that this site can be utilized for public use only. During World War II, Lumphini Park was a camping site of the Japanese troops. After World War II, Lumphini Park was used as the site for constitution celebration and Siamese Beauty Pageant (Public Park Office 2013, 13).

2.2 The Geography of Lumphini Park

Lumphini Park is located in Rama IV Road, Lumphini Sub-District, Pathumwan District, Bangkok, Thailand (Figure 2). This quadrangle walled enclosure is defined by Ratchdamri Road in the western side, Rama IV Road in the southern side, Witthayu Road in eastern side, and Sarasin Alley in the northern side. There are 8 entrances in total (Figure 3). Entrance 4 (13.734210, 100.537890)[9](Figure 4), at the intersection corner of Ratchadamri Road and Rama IV Road, is the frontal gate, in front of which a statue of King Rama VI's is erected in memory of his foundation of Lumphini Park (Figure 5).

[9] The source of coordinate: http://www.latlong.net/ (Accessed on 30 Jun 2016)

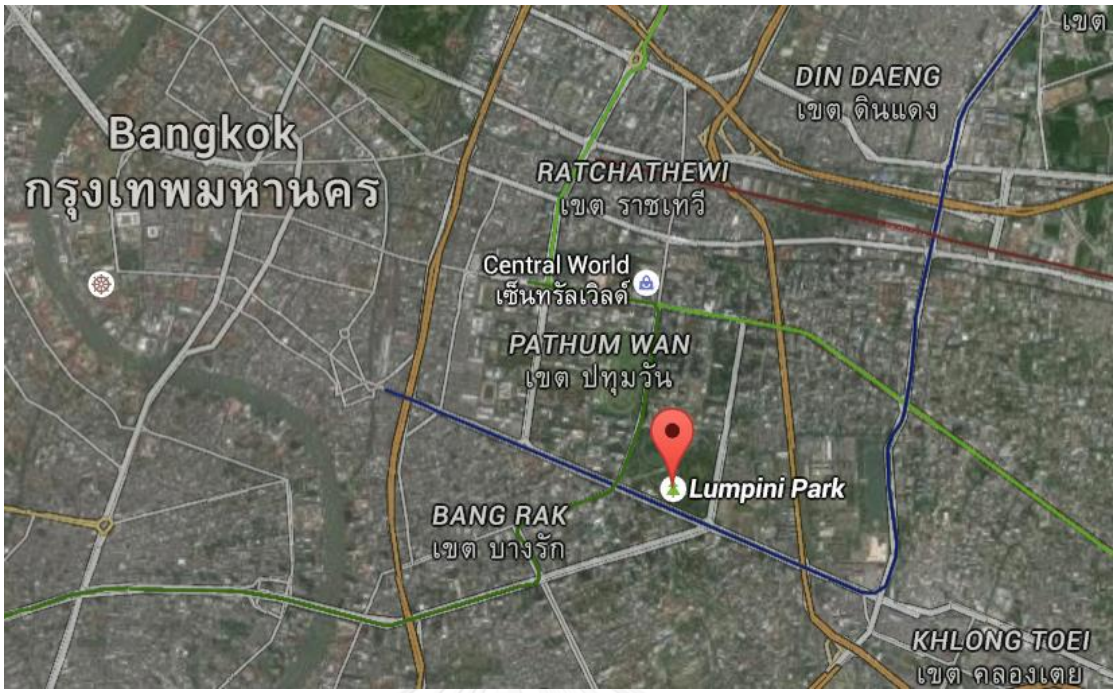

Figure 2. Location of Lumphini Park in Bangkok (Source: Google Maps)

Figure 3. Map of Lumphini Park I (Source: Google Maps, Adapted by Author)

Figure 4. Frontal Gate (Entrance 4) of Lumphini Park

Figure 5. Statue of King Rama VI

The frontal gate (Entrance 4) is adjacent to subway Silom Station and sky train Sala Daeng Station. Outside Entrance 3 is a busy bus station, where 8 bus routes and local truck bus (Songthaew) pass. Entrance 2 is near subway Lumphini Station, while Entrance 5 and 6 are both around 600 meters away from sky train Ratchadamri Station. Many buses also drop passengers along Witthayu Road, Sarasin Alley and Ratchadamri Road. Such convenient traffic connection ensures the accessibility of Lumphini Park for Bangkok dwellers. Along the Sarasin Alley side, Entrance 6 (Sarasin Minor), 7 (Sarasin) and 8 (Lumphini Training Center[10]) are less used by general park visitors, but outside these three entrances are some street food vendors, where many motorcycle taxi drivers and park workers such as guards, gardeners, etc. buy their lunches.

The lengths of the four straight walls are approximately 950 meters along Rama 4 Road, 600 meters along Ratchadamri Road, 800 meters along Sarasin Alley, and 900 meters along Witthayu Road[11]. The four boundaries cover approximately 57.6 hectares (Public Park Office 2013, 16). The afternoon downpour in rainy season, if at a large intensity, might inundate the tarmac paths up to 5 centimeters high (Figure 6) due to the low terrain of Lumphini Park. However, according to the author's field observation, the water is usually drained out within one hour.

[10] Lumphini Training Center (ศูนย์ฝึกอาชีพสวนลุมพินี) is a BMA institution. It offers vocational trainings for Thai citizens. This center is inside Lumphini Park but not under the jurisdiction of Lumphini Park Office.

[11] The lengths were calculated by the author with the scale on Google's map.

Figure 6. Inundated paths during downpour (20th Jun 2016)

2.3 The Landscape of Lumphini Park

Plants and animals make the landscape of a public green space look more natural than that of other urban or built environment. However, these 'natural' elements actually involve a lot of human processes. To exemplify, the trees in a park were selected and planted by the authorities. This 'natural' dimension of Lumphini Park, addressed in chapter 4, is the focus of this research, while some artificial features in Lumphini Park's landscape are briefly introduced in this section, which includes two parts. The first part analyzes the spatial configuration of Lumphini Park, and the second one examines the meanings of the sculptures and monuments of Lumphini Park.

2.3.1 Spatial Configuration of Lumphini Park

On Figure 3, Entrance 4 (Frontal Gate), Entrance 5 (Ratchadamri), Entrance 2 (Clock Tower), and Entrance 1 (Witthayu) are main entrances at the four corners of Lumphini Park[12]. At the center of this quadrangle site, where the two diagonals meet, is the palm garden, a distinct landscape design in Lumphini Park. The palm garden and the four entrances, connected with walking paths, roughly divide Lumphini Park into four triangles. Such fourfold dividing of a square space is a typical design pattern shared by many early European botanical gardens[13]. Considering the founder's initiative of turning Lumphini Park into a botanical garden after the Siamese Kingdom Exhibition, this design is not surprising. However, the interior of Lumphini Park is far an imitation of the early European botanical gardens; instead, it seems to be inspired by the English natural landscape. For example, riverine walking paths meander along the ponds rather than straight lines. Besides, the trees are not cultivated in rigid specimen beds like plants in a botanic garden. Instead, major shade trees planted along walking trails to cast shades for visitors, and more trees are clumped on lawns (Figure 7), a typical feature of English "natural" landscape (Lowenthal and Prince 1964, Halprin 1972, 163).

[12] Except Entrance 5, which is approximately 160 m south of the Ratchdamri-Sarasin corner.

[13] The early European botanical gardens built in 16th to 17th century were made after the discovery of the New World, in the age of discovery and colonial expansion. In this period, botanical gardens were a means of attaining the knowledge of God. The four paths symbolize the four rivers flowing out of paradise, and the four quarters are miniatures of the four continents—Europe, Asia, Africa, and America (Moore, Mitchell, and Turnbull 1988, 111).

Figure 7. Trees clumped on Lawns

There are four ponds in Figure 3 (W1-W4), but all the water bodies are linked with each other by canals so that the park maintenance team can keep the water level more adjustable and provide aquatic animals with larger habitats. Boat rental for paddling (Figure 8) is available at three ponds W1, W2, and W4.

Some important recreational or socializing spaces in Lumphini Park, including Lanna Thai Pavilion, Chinese Pavilion, Youth Center, Elderly Center, etc. can be found in Figure 3. Entertainment Building (an outdoor theater) and Octagonal Pavilion are frequently chosen to be the venue when BMA or Lumphini Park Office plan to hold large activities (Figure 9). At the middle of frontal gate and octagonal pavilion is Lumphini Public Library, the first public library in Thailand.

Figure 8. Boat Paddling at the Pond

Figure 9. Octagonal Pavilion on World Environment Day (6th Jun 2016)

2.3.2 Sculptures and Statues in Lumphini Park

Sculptures are often created to express the artists' thoughts on the society, and sculptures, statues or monuments chosen or even created by the authorities to be placed in public spaces are expected to convey specific information to the public. The most apparent one in Lumphini Park is, as Figure 5 shows, the statue of King Rama VI. However, there are still lots of statues and sculptures in Lumphini Park, enriching the meanings and purposes of this public green space.

At the middle of the frontal gate and Lumphini public library is a waterwheel sculpture (S1 in Figure 3), which is a real-sized model of the Chaipattana Aerator, an invention of King Bhumibol. More than twenty Chaipattana aerators are in using in Lumphini Park to facilitate oxygen gas to dissolve in the water for aquatic organisms.

In front of Lumphini Hall, visitors can see a man statue holding a violin, which is erected to memorize the famous Thai composer and musician Euah Suntornsanan (เอื้อ สุนทรสนาน, 1910-1981) for his great contribution of creating the prototype of modern Western-Thai music (Siamstamp 2010). His music influence in Cambodia, Laos, and China is stressed on the statue text to make him a regional idol. Not far from this statue, a sculpture of a man and a woman, standing back to back, is placed on the lawn (S2 in Figure 3) without any text interpretation. Another sculpture nearby (S3 in Figure 3), entitled 'Youth preserving Environment,' is two teenagers surrounded by

flying birds (Figure 13), expressing direct expectations on the young generation's environmental awareness and movements.

Figure 10. Sculpture 'Youth Preserving Environment'

Opposite to the Clock Tower, near Entrance 2, is an interesting sculpture of turtle shell (Figure 11, S4 in Figure 3), entitled ‘Sagittarius.’ This name, according to the sculpture text, was inspired by the same zodiac shared by King Bhumibol Adulyadej of Thailand and Emperor Akihito of Japan, and this sculpture was placed to celebrate His Majesty the King’s 80 Birthday and the 120th anniversary of Japan-Thailand diplomatic relations. This sculpture, however, is not the only diplomatic installation. The sundial (Figure 12), near the library, was a gift from the Swiss government to congratulate His Majesty the King’s Sixth Cycle Birthday. Considering the King’s deep relationship with Switzerland, placing this sculpture in Lumphini Park embedded very strong diplomatic meaning in this public space.

Figure 11. Sculpture ‘Sagittarius’

Figure 12. Sundial

Two sculptures were placed along the walking trail paralleled to Witthayu Road. The first one, entitled 'A Mother's Love,' is a woman and a child sitting on her shoulder (Figure 13, S5 in Figure 3), expressing strong parental affection and family ethic. Another sculpture, entitled 'Women in the Next Three Decades,' is a human-shaped figure, having no clear face but exaggerated body shape (Figure 14, S6 in Figure 3). On one hand, this female figure's body seems to imply the women will be more overweighed in the next three decades, involving health and diet issues; on the other hand, her dynamic posture emanates positive energy and self-confidence, suggesting her control and freedom over her own body without worrying about others' judging. These two

close sculptures present entirely different female images and imaginations, forming an intriguing and thought-provoking contrast.

Figure 13. Sculpture 'Mother's Love'

Figure 14. Sculpture 'Women in the Next Three Decades'

In the palm garden is another sculpture entitled 'Unity, Growth, & Peace,' (S7 in Figure 3) transmitting clear messages of achieving cohesion, development, and stability for Thai society.

Among the above sculptures, 'Unity, Growth, & Peace,' 'Mother's Love,' 'Youth Preserving Environment' are the winners' works from sculpture competitions held by the National Youth Bureau in 1985, 1992, and 1993 respectively, and 'Women in the

Next Three Decades' was a winner's work from a magazine's competition in 2007. This background indicates some connotations. First, such selection indicates the authorities' trend of encouraging and conveying harmonious and positive images to the public. Second, although not much and filtered by the authorities, the public's art expressions can be seen in Lumphini Park.

2.4 Lumphini Park, People, and Activities

Bangkok residents of all ages and backgrounds come to Lumphini Park and build tight bindings with this public green space through various activities, including:

(1) Physical exercises: jogging, working out with facilities, biking, exercising Tai Chi martial arts, doing aerobics (Figure 15), paddling, and so on.

(2) Recreational activities: enjoying picnics, watching birds, dating, fish-feeding, feeding pigeons, practicing photography, playing chess, taking graduation photos, club-gathering, watching outdoor movies[14], etc.

(3) Festival and public activities. Lumphini Park is an ideal open space for the authorities to organize large activities. For example, the Busker's Festival has since 2008 annually held every December, when a great number of free and enjoyable street shows such as music, theater, dances and circus juggle are performed (Figure 16) to 'provide happiness for everyone' (Bangkok Street Show 2015). Thailand Tourism

[14] For example, German film 'Wings of Desire' was screened in Lumphini Park on 25 Feb 2016 (Coconuts Bangkok 2016).

Festival 2016 was held in 13th-17th January, when kaleidoscopic local customs, famous landmarks, featured products, and folk performances from every region of the kingdom were represented (Figure 17), turning Lumphini Park a vibrant microcosm of Thailand, reminding people of King Rama VI's initiative of this public space. On 5th-6th June 2016, BMA arranged a series of activities to honor the World Environment Day (Figure 18) and manifest its effort to improve Bangkok's environment. At the activity climax, the BMA governor, embassy delegates and UN representatives jointly planted around twenty *Cassia fistula* trees, the national flower of Thailand (Center for International Affairs), in Lumphini Park, embedding another layer of environmental, diplomatic and political meaning in this public green space (Figure 19).

Figure 15. People Doing Aerobics around Palm Garden

Figure 16. Street Performance on Busker's Festival (6th Dec 2015)

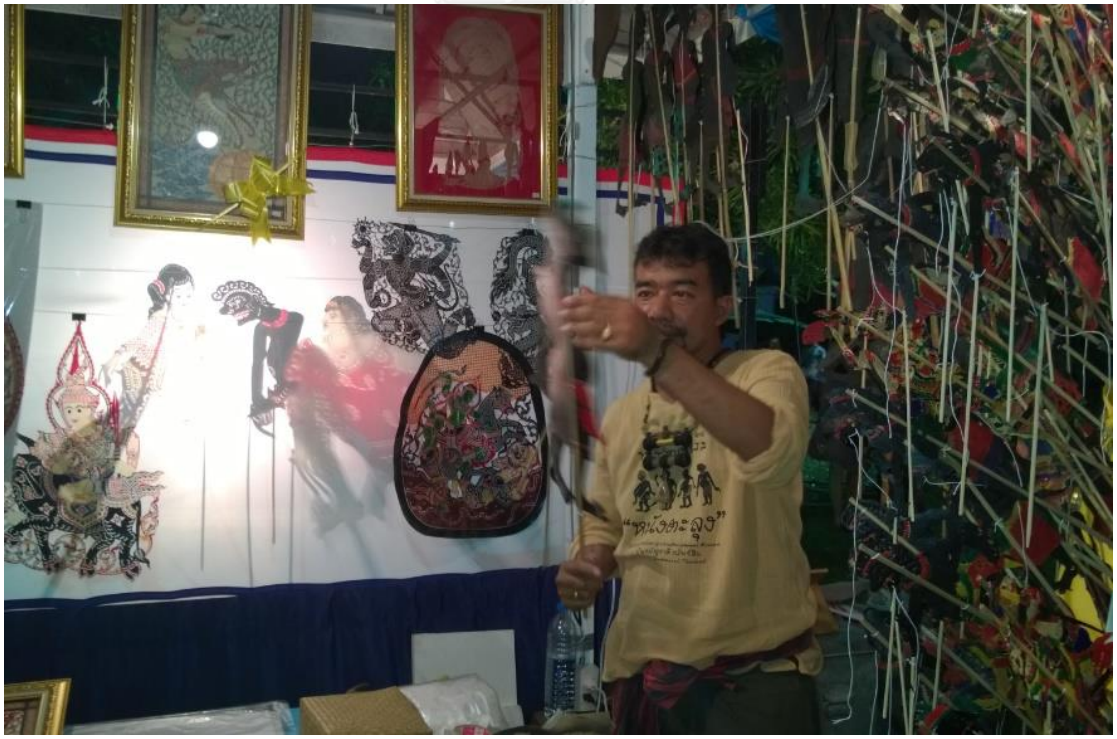

Figure 17. Shadow Puppet Play from Nakhon Si Thammarat, Southern Thailand, Performed in Lumphini Park (14th Jan 2016)

Figure 18. BMA Gave Free Seedlings on the World Environment Day (6th Jun 2016)

Figure 19. Trees Planted on World Environment Day (8th Jun 2016)

(4) Political activities. Lumphini Park is an important public place for Thais to articulate their political demands and opinions for public policy. For example, the PAD (People's Alliance for Democracy) leader Sondhi Limthongkul gave speeches to stir public resentment against former PM Taksin Shinawatra in Lumphini Park during 2005-2006 (Waites 2014, 256). In the demonstration against Yinluck government in 2014, Lumphini Park was one of PDRC (People's Democratic Reform Committee)'s major protest and camping site (Sinlapavan 2014). Earlier In May 2013, an open concert was held in Lumphini Park to invite more people to sign the petition of maintaining the vast open space Makkasan as public green space rather than being developed to another shopping mall (Coconuts Bangkok 2013).

All the above functions bind Bangkok residents tightly with Lumphini Park, and make them harbor a strong sense of ownership of this public space. In October 2003, the Bangkok government attempted to close Lumphini Park to ensure safety for visiting Australian PM John Howard's morning jogging, but the outraged public protested, forcing the authorities to open Lumphini Park as usual (Ziv and Sharett 2005, 80).

Lumphini Park, the first and most time-honored park of Bangkok, has become Bangkok's icon of public spaces for multiple recreational, social, and political purposes, and is therefore deeply rooted into Bangkok residents' life memory and city identity.

2.5 Summary of Chapter 2

Lumphini Park came into being because of its accessible location. The design of Lumphini Park featured both early European botanical garden and English natural landscape. Multilayered social, artistic and political meanings are embedded in this public space through the landscaping process and materials such as statues and sculptures. The Bangkok government's and residents' recreational, political, social, and environmental activities in Lumphini Park confirm the multiple and robust functions of this public space and its importance for Bangkok.

CHAPTER 3

Bangkok Government's Policy on Public Green Spaces

3.0 Outline of Chapter 3

3.1 Public Parks in Bangkok: An Overview

3.2 The Policy of City Planning Department, BMA

3.3 The Policy of Environment Department and Public Park Office, BMA

3.4 Policy on Trees in Lumphini Park

3.5 Summary of Chapter 3

3.0 Outline of Chapter 3

This chapter attempts to review the Bangkok government's policy on public green spaces and the implementation of such policy in Lumphini Park. Firstly, an overview on Bangkok's public parks is given. Secondly, relevant policies on public green spaces from City Planning Department, Environment Department, and Public Park Office are discussed. Thirdly, the interview content from Lumphini Park's arborist will be examined to reconstruct a possible chronicle of tree introduction and reveals the policy development on tree selection in Lumphini Park.

3.1 Public Parks in Bangkok: An Overview

All the public parks of Bangkok are defined and categorized by the Public Park Office into seven types as follows:

(1) Pocket Park: area is not over 2 rai (3,200 m^2).

(2) Neighborhood Park: area ranges from 2-25 rai (3,200-40,000 m^2).

(3) Community Park: area ranges from 25-125 rai (40,000-200,000 m^2).

(4) District Park: area ranges from 125-500 rai (200,000-800,000 m^2).

(5) City Park: area is larger than 500 rai (800,000 m^2).

(6) Street Park: an area with at least 5-meter-long width and unlimited length, including side walk park, street isle park, and road-intersection park.

(7) Special Purpose Park: a park which contains special historic or social

meaning. There is no fixed size for this kind of park.

Currently, there are 31 public parks around the whole Bangkok metropolitan. Their opening year, areas, and types according to area size are shown in Table 5

Table 5. Public Parks in Bangkok

No.	Park name	Opening year	Area size (m^2)	Type*
1	Lumphini Park	1926	576,000	D
2	Saranrom Park	1960	36,800	B
3	Thon Burirom Park	1968	101,280	C
4	Phra Nakhon Park (Lat Krabang Park)	1974	80,000	C
5	Suan Luang Rama IX Park	1980	800,000	E
6	Chatuchak Park	1980	248,226	D
7	Nong Chok Park	1987	56,800	C
8	Benchasiri Park	1992	46,400	B
9	Rommaninart Park	1993	47,888	B
10	Queen Sirikit Park	1996	315,060	D
11	Serithai Park	1997	560,000	D
12	Santiphap Park	1998	32,320	B
13	Wachirabenchatat Park	1999	600,000	D
14	Public Park in Commemoration of H. M. the King's 6^{th} Cycle Birthday	2000	46,400	C
15	Santi Chai Prakan Park	2000	13,600	B
16	Benchakitti Park	2004	208,000	D
17	Chaloem Phrakiat Kiakkai Public Park	2005	16,000	B
18	Rommanee Thungsikan Park	2005	25,096	B

No.	Park name	Opening year	Area size (m^2)	Type*
19	Thawiwanarom Park	2005	86,400	C
20	Ram Indra Sport Park	2005	94,544	C
21	Suan Luang Rama VIII Park	2005	38,400	B
22	Phanphirom Park	2006	22,400	B
23	Maha Chakri Sirindhorn's 50th Birthday Park	2008	32,196	B
24	Her Majesty the Queen's 60th Birthday Park	2008	83,876	C
25	Wanadharm Park	2009	61,212	B
26	Nawaminpirom Park	2010	121,757	C
27	Nakharapirom Park	2010	6,280	B
28	Bueng Nam Latphrao 71 Park	2011	33,600	B
29	Sirintorapusapan Park	2011	4,864	B
30	Public Park for the 80th Anniversary of H. M. the King	2012	33,600	B
31	Public Park of King Bhumbol Adulyadej on the Auspicious Occasion of 80th Birthday Anniversary	2012	28,064	B

* A=Pocket Park, B=Neighborhood Park, C=Community Park, D=District Park, E=City Park

(Source: Public Park Office, 2013)

Eighteen among the current 31 parks, as Table 2-2 shows, were constructed after 2000. Nine parks came into being from 1980 to 1999. Before 1980, there were only four public parks in Bangkok. Namely, Bangkok residents did have very few parks for recreation a few decades ago. In terms of park area, Suan Luang Rama IX Park is

the only one that reaches the size of a city park. However, Suan Luang Rama IX Park was opened in 1980; prior to this city park, Lumphini Park, opened in 1926, has served to be the largest public green space in Bangkok for more than half century. Nowadays, even Suan Luang Rama 9 Park and Wachirabenchatat Park (Rotfai Park) occupy larger areas, Lumphini Park's size still stands out among other newly constructed parks.

3.2 The Policy of City Planning Department, BMA

The aim of this research is to study the tree composition in Lumphini Park, which is highly relevant to Public Park Office's and Lumphini Park Office's policy as well as implementation in Lumphini Park. However, the policy of City Planning Department provides a holistic guideline on Bangkok's future way of development. Therefore, it is necessary to state the policy in this section. In the latest Bangkok Comprehensive Plan (City Planning Department 2013), five visions are pictured to make Bangkok:

1. A metropolis with attractive national arts and culture identities.
2. A metropolis of convenience with the comprehensive transportation networks.
3. A metropolis that is the economic and technological center of Southeast Asian Region.
4. A metropolis that is the center of administration, major social institutions,

and international organizations.

5. A healthy metropolis that promote conservation of natural environment.

In order to achieve the above five visions, twelve more detailed objectives are planned as follow:

1. To promote better quality of life of Bangkok residents by providing adequate and standardized social services, public utilities and amenities.
2. To promote Bangkok as an important business, commercial, and service center of the country and of Southeast Asian Region by providing appropriate facilities to increase Bangkok's competitiveness against other metropolises.
3. To promote Bangkok as a tourism center; a gateway to Thailand, and to other ASEAN countries by developing tourism resources and services.
4. To promote Bangkok as an administrative center and the location of major national and international institutes by developing a gorgeous zone of the governmental institutes and international organizations.
5. To promote convenient, fast and secure modes of travelling by developing efficient mass transit system and comprehensive transportation networks.
6. To ensure jobs and housing balance for commute trip reduction by promoting development, improvement, and restoration of Bangkok

residential areas and suburban community centers.

7. To enhance environment quality by promoting risk and pollution-free, skilled labor and high technology oriented manufacturing industries in Bangkok.
8. To preserve the productivity of the existing agricultural areas in Bangkok by controlling urbanization in accordance with the concept of compact city development.
9. To promote the identity of the Bangkok and Thailand by preserving and restoring indigenous arts and culture including those of significant architectural, historical, and anthropological values.
10. To conserve environment and natural resources by promoting conservation, maintenance and restoration.
11. To strengthen personal and asset safety by preventing and mitigating distress from either natural or man-made disasters.
12. To promote solution against global warming by expanding green area in order to reduce greenhouse gases.

Vision 5 aims at the improvement of Bangkok's environment, and objective 10 and 12 are tightly connected with the issue of urban green areas. Objective 10 underlines the importance of conserving urban environment and ecology, while

objective 12 highlights the role urban green spaces play in mitigating the impact of global warming. Actually, the severe flooding in 2011 and the large emission of greenhouse gas (GHG)[15] have already put a warning spotlight on Bangkok's vulnerable environment and pushed BMA to accelerate the pace of raising environmental resilience to cope with climate change and global warming. Consequently, a series of strategy, covering mitigation measures in transportation, energy consumption, waste and wastewater treatment, and green urban development, have been formulated to reduce the emission of GHG (Bangkok Metropolitan Administration (BMA) and JICA 2015). The measures of green urban development in public domains are listed in Table 6.

Table 6. Measures of Green Urban Development in Public Domains

No.	Measure	Measure details for year 2016-2018	Measure details for year 2019-2023
1	Increasing new green areas (public parks)	To build 5 middle/large scale new public parks (200 rai)	To build 10 middle/large scale new public parks (400 rai)
2	Increasing new green areas (public areas)*	1. To plant new trees at public area at least 2,000 rai	1. To plant new trees at public area at least 4,000 rai
		2. It is based on "One community, one park" project and "One school, one park" project.	

[15] In 2013, the Carbon dioxide (CO_2) emission in Bangkok is 13.76 million ton from transport source, 25.6 million ton from energy consumption, 4.55 million ton from waste and wastewater treatment, while 0.045 million ton was absorbed by Bangkok's trees, so the emission sum was 43.87 million ton in total (Bangkok Metropolitan Administration (BMA) and JICA 2015).

		3. To encourage the involved district offices to build pocket parks	
3	Planting new trees along roadside areas	1. To plant 100 new trees per year along 40 roadside that set back 2m including increasing new young trees between existing trees 2. To establish the competition on the concept of “Green Road” among district office	
4	Mangrove reforestation	1. To plant 50 rai mangrove trees in 2018	1. To plant mangrove trees up to 250 rai in 2023
		2. To promote increase of new mangrove areas with cooperation with major companies	
		3. To promote the campaign for tree distribution (1 time per year, 10,000 trees per time)	
		4. To seed, nurse and produce mangrove trees	
5	Well-managing & maintaining of planted trees	1. To maintain 100% of existing trees in public parks and public area (government office, public schools, public hospitals, temples)	
		2. To look after and maintain planted trees in routine job done by Public Park Office*	
		3. To train the involved staff on “how to correctly look after maintain planted trees”	
6	Rooftop greening and wall greening	To promote rooftop greening and wall greening on government and private area, with pilot project on “Rooftop and wall greening” by Public Park Office	
7	Public awareness campaign	1. To promote the public awareness campaign to children, students, and citizens with tree distribution (300,000 trees/year)	
		2. To recruit and train volunteers (50 persons/year) to look after, preserve, and maintain the green areas	

		3. To encourage the citizens, communities and land owners to preserve any huge trees in their areas

*Public areas include government office, public schools, public hospitals, and temples

Measure 5 'Well-managing and maintaining of planted trees' is most relevant to the current policy on the trees in Lumphini Park. Namely, every tree which has been planted in Lumphini Park should be preserved well and receive good maintenance.

3.3 The Policy of Environment Department and Public Park Office, BMA

The Environment Department, BMA, has the following vision[16]:

"Department of Environment is the key organization on environment and energy conservation in order to create Bangkok as a green and clean city with good environment."

Under this vision, five more detailed missions are developed as follow:

(1) To manage environment with exploration, analysis and research for solving, supporting and conserving the quality of environment.

(2) To increase green space, improve urban landscape, and strive for greenery conservation and development.

[16] The vision, missions, and goals of Environment Department, written in both Thai and English, were acquired from the bulletin board in Lumphini Park Office in April, 2016. A few words of the English translation were slightly modified, with minimal rewriting or self-interpretation, in order to make the sentences grammatically correct in English.

(3) To reduce air and noise pollution by controlling pollution from vehicles and other resources with the air quality monitoring support.

(4) To improve efficiency in solid waste, night soil, and hazardous waste management by promoting waste reduction and classification; to improve efficiency in solid waste management using appropriate technology; to provide regular service of waste collection and the service of night soil transport and disposal.

(5) To lead energy conservation, renewable energy promotion, and global warming mitigation.

The following goals were added as supplement to above missions:

1. To make green space in appropriate ratio with the population number.
2. To make BMA's management of solid waste, hazardous waste and night soil efficient without environmental impacts.
3. To make air and noise quality in Bangkok meet the standard criteria.
4. To make all parties in the society take part in environment preservation and energy conservation.
5. To make administration system transparent and efficient.

Mission 2 states that Environment Department has to increase green space, improve urban landscape, and strive for greenery conservation and development. “To increase green space” corresponds to City Planning Department’s policy on “increasing new green areas” (see No.1 & 2 in Table 6)[17]. The latter part of Mission 2 “improve urban landscape, and strive for greenery conservation and development” correlates with all tasks of tree maintenance in Bangkok’s public green spaces. In order to provide a procedure guideline for arborists and gardeners, Public Park Office (2004) published a book titled ‘An Operational Manual for Tree Cultivation and Maintenance (คู่มือการปฏิบัติงานปลูกและดูแลรักษาต้นไม้),’ involving all relevant arboricultural practices for urban trees such as tree selection, planting, watering, fertilizing, pruning, transplanting, pest and disease controlling, as well as some general concepts of landscape design and management regulations. This manual has since 2004 functioned to be a reference for the management of public green spaces in Bangkok. However, the practices vary a lot in different types of public green space. For instance, the trees with surface roots cannot be planted along roads for traffic safety, but this is acceptable for large public parks. In terms of parks, different sizes, designs, and purposes also lead to different practices. Accordingly, the real maintenance practices vary from place to place. The

[17] According to the Public Park Office, ‘green area’ means any area which has not ever been developed into a garden or a park, so it can be ‘vacant area, street isle, way side, canal side, (spaces) under expressway, building walls, fence, and garden inside tall buildings, rooftop, and so on’ .

latest policy of Public Park Office on tree selection is to recommend trees which are highly capable of carbon absorption.

3.4 Policy on Trees in Lumphini Park

Selecting plants for landscape design requires both artistic sense and botanical expertise. Carpenter et al. (1975, 8) indicates:

> "The selection of plants is both an art and a science. It is art because it requires sensitivity to elements of design, such as color, form, and texture, and the ability to judge these elements in each plant. And herein lies the primary difficulty, for in describing the design qualities of a plant, the designer must remember that the plant is not static but changes in texture, form, color, and so forth, with seasons as well as age. It is science because it requires knowing the plant's environmental requirements before its health can be maintained. The proper selection of plants is dependent on the fulfilment of both artistic and scientific considerations."

The most decisive factor of selecting trees for the cities, Trowbridge and Bassuk (2004) argues, is a plant's adaptability to the urban environment rather than its original site because the urbanization process greatly changes a city's environment. Even a

plant species was native to the site of today's New York City in the sixteenth century, it does not mean that this species is still fitting for New York City today because the environment has changed a lot. Arnold (1993) indicates different disciplines often provide conflicting views for tree selection so that the landscape designers have to weigh different elements before making choice. In real practice, the characteristics of each tree species would be listed and rated according to a series of selection criteria. Arnold (1993, 82) provided an example of selection criteria for urban shade trees, which contains three major criteria groups and eighteen sub-criteria in total. An excerpt of this list is shown in Table 7.

Table 7. Arnold's Sample of Tree Selection Criteria

Criteria	WEIGHTED VALUE	Red Maple	Japanese Pagoda Tree	White Ash
AESTHETIC/ FUNCTIONAL CRITERIA				
Scale at maturity	5	■	■	■
Density of foliage	5	■		
Growth rate	3	■		■
Seasonal attribute	1	■		■
CULTURAL CRITERIA				
City tolerance	5	■	■	
Resistance to pests	3			
Salt tolerance	2			■
OPERATIONAL CRITERIA				
Client requirements	5	■	■	■
Transplanting limitations	3	■	■	

Criteria	WEIGHTED VALUE	Red Maple	Japanese Pagoda Tree	White Ash
Maintenance requirements	2	■	■	
RANKING (out of 17 tree species)		6	9	13

(Source: Arnold (1993))

Arnold's criterion of tree selection was utilized in Philadelphia, the United States of America. Taking into account the great difference of physical geography and cultural contexts between North America and mainland Southeast Asia, it is not appropriate to apply such criterion in Thailand directly. However, criterion examples of tree selection from Arnold above and Harris et al. (2004, 119-123) are two major references for the author to design questions (Table 4 in section 1.5.2.2) for the first interview with the arborist of Lumphini Park.

Due to the fact that Lumphini is the first and oldest public park in Bangkok, the trees in Lumphini Park has already reached saturation level since twenty to thirty years ago, and only a few trees were replaced in recent two decades (Interview, 2016a). Therefore, most of the author's questions can only be answered with current ideas or principles. However, the arborist indicated that the most critical function of trees, and accordingly the decisive criterion of tree selection is whether a tree can provide wide shade for park visitors. Lumphini Park, a construction for all Bangkok residents to do

outdoor exercise and recreational activities, need plentiful trees to provide shades to prevent people from heat stroke. If there were no sufficient shade trees, people would not be willing to walk into Lumphini Park, especially in hot season (Interview, 2016a). Therefore, abundant shade trees were planted to cast cooling shades for park visitors.

As for the selection of shade tree, many factors are involved, including a tree's form, foliage density, growth rate, availability, and so on. An umbrella-shaped crown and spreading branches is the most ideal form of a shade tree, while a palm' shade is often relatively limited. Arnold (1993) suggested the appropriate size of a shade tree should be 45 to 60 feet (13.8-18.3 meter) in height, and the major shade tree species, including *Pterocarpus indicus, Samanea saman, Tamarindus indica, Peltophorum pterocarpum,* and so on, are all able to reach this height in Lumphini Park. As a matter of fact, many of these shade trees, planted at least 60 to 70 years ago, are the earliest habitants of Lumphini Park and have already exceeded this size.

Whether the foliage density was an important concern for shade trees in Lumphini Park is uncertain. In the past, people might simply try to find nearest big trees and transplant them to Lumphini Park. A tree species' capability of surviving Bangkok's hot sunlight was, and still is, the essential factor of selection for the maintenance team (Interview, 2016a). That is to say, environment tolerance is the essential concern of tree selection.

Shade trees in large parks are expected to provide wide shades within shortest time. Therefore, a fast-growing tree is better than a slow-growing one in terms of shade giving. However, a fast-growing tree tends to have weaker structure and cannot live as long as slower-growing ones (Harris et al 2004, 20). Growth rate might be preferred in an opposite way for ornamental plants because slow-growing trees need less pruning and cleaning than fast-growing ones. On the other hand, how long a tree can live seems not an issue. All in all, growth rate is an important factor for Lumphini Park when selecting shade trees while long life span is not.

An interesting coincidence is all the major shade trees in Lumphini Park are all species of the Leguminosae family, a vast plant group for its nitrogen-fixing mechanism (please see section 4.5). When these majestic shade trees were planted at least 60 to 70 years ago, people were not very likely to understand such intricate bio-chemical relationship among plants, bacteria and soil, but people knew some big trees can grow very well and fast even the soil is infertile (Interview, 2016b), which is an advantage for tree maintenance and might be an unintentional reason for the selection of these leguminous trees for shades.

All the foregoing factors might affect the selection of shade trees more or less, but availability prevails over other factors. In the past, a big tree which was easy to obtain and can survive easily might be good enough to be planted in Lumphini Park. If a tree dies, it should be, ideally, replaced with another one of the same species for

the visual uniformity and known suitability. The practice, however, is the same tree species is not always available. A compromise way is to choose another tree species from the same plant family or has similar form and habit from the available trees (Interview, 2016b). For example, there are no seedling of any major shade trees in the nursery, but some *Crydia chrysantha,* a rare and native tree species of Leguminosae family, are kept there. This tree species can reach the appropriate size of a shade tree fast and be substitutes for big leguminous shade trees if necessary.

Although shade trees are indispensable components of the treescape in Lumphini Park, abundant ornamental trees from a great variety of species are cultivated everywhere. The lack of document makes it difficult to know when the ornamental trees were introduced into Lumphini Park. Despite such insufficiency, the age of trees might help reveal this process. The logic of this method is that most trees come to a park through human operation rather than natural succession, and human plant trees as a whole batch within a short time in each phases. When trees are purchased and sold as a batch, it is easier to set the price if most of the tree individuals are at a similar age or size. Therefore, the trees of the same species in a park, if introduced by human, usually have the close size and similar age, making it possible to trace back the time when a tree species was introduced to a park (Interview, 2016b). Table 8 is a rough chronicle reconstruction of dominant trees with estimated average age of each tree species. For example, the arborist estimated the average age of *Cassia*

fistula (Golden shower/Rajapruek, Khun) is between 40 to 50 years old, so this tree species might appear in Lumphini Park during 1966 to 1976, and is included in both sections of year 1960-1970 and 1970-1980 in Table 8.

Table 8. Estimated Chronicle of Tree Introduced Period of Dominant Trees

Time period	Shade trees	Ornamental trees
Before 1950	*Pterocarpus indicus* (946)* *Samanea saman* (220) *Ficus religiosa*	*Corypha lecomtei* (palm)
1950-1960	Pithecellobium dulce	*Phyllocarpus septrentrionalis* (palm) *Streblus asper* *Borassus flabellifer* (palm)
1960-1970	*Peltophorum pterocarpum* (310) *Acacia auriculaeformis* (114) *Tamarindus indica* (137)	*Cassia fistula* *Lagerstroemia loudonii*
1970-1980	*(Albizia lebbeck)*** *(Caesalpinia coriaria)* *(Millingtonia hortensis)*	*Casuarina junghuhniana* (146) *Cassia fistula* *Albizia lebbeck* *Caesalpinia coriaria* *Swietenia macrophylla* (111) *Millingtonia hortensis* (109)
1980-1990	*(Delonix regia,* 189*)* *(Mimusops elengi)* *(Syzygium cumini)* *(Dolichandrone serrulata)*	*Delonix regia* (189) *Mimusops elengi* *Callistemon viminalis* *Elaeis guineensis* (palm) *Lagerstroemia floribunda*

		Lagerstroemia speciosa *Livistona chinensis* (palm) *Tabebuia rosea* (134) *Plumeria spp.* (117) *Alstonia scholaris* (105) *Dipterocarpus alatus* *Syzygium cumini* *Dolichandrone serrulata* *Jacaranda filicifolia*
1990-2000	*Ficus benjamina* (121) *Mangifera indica* *(Gliricidia sepium)* *Terminalia catappa* *Azadirachta indica*	*Phoenix roebelenii* (palm, 184) *Roystonea regia* (palm, 182) *Nypa fruticans* (palm) *Cocos nucifera* (palm, 129) *Gliricidia sepium* *Cerbera odollam* *Senna siamea* *Amherstia nobilis*
After 2000	*(Murraya paniculata)*	*Polyalthia longifolia* (151) *Wrightia religiosa* (758) *Murraya paniculata* (427) *Phyllanthus acidus* *Wodyetia bifurcate* (palm) *Ptychosperma macarthurii* (palm) *Adonidia merrillii* (palm)

* Trees having more than 100 individuals are marked with number in the brackets.

** If a trees' main function is ornamentation but can also provide shade when reaching considerable size, it is listed in both 'Ornamental Trees' and 'Shade Trees' but with brackets in the latter. Actually, every tree can provide shade more or less, so this grouping is based mainly on the author's field observation in current Lumphini Park.

Table 8 suggests some points. First, most shade trees were planted in Lumphini Park before 1970, and more than half of them were even earlier than 1950. This estimation can correspond to the shade need for outdoor activities, the main purpose of Lumphini Park. Second, the 1970s is a transition period. When the shade trees became saturated, more and more ornamental tree species have been introduced to Lumphini Park since this period. Third, only a few enormous palms planted at very early phase, namely *Corypha lecomtei* and *Phyllocarpus septrentrionalis,* serve to be the visual focus before the 1980s, but various and numerous palms have come to Lumphini Park since the 1980s. Fourth, the abundant use of *Cocos nucifera* to mark water edge since the 1990s and three important trees/shrubs utilized for space-defining or space-dividing, namely *Polyalthia longifolia, Wrightia religiosa,* and *Murraya paniculata*, arrived after the 2000s, indicating the recent enhancement of plants' landscaping functions.

Consequently, the tree selection underwent some major phases. First, the 1970s can be seen as a dividing period. Before the 1970s, shade trees were priorities; afterwards, more attentions have been paid to ornamental trees, which can be confirmed with abundant palms. Second, the trees' landscaping functions have existed for a long time, but gained another highlights since the 1990s. Today, BMA emphasizes trees' value of carbon absorption although this aspect actually has no impact on the tree selection in Lumphini Park. Such evolving trend of tree selection reveals the

government officials' shifting perceptions of trees and trees' multiple roles and functions for the city.

3.5 Summary of Chapter 3

Lumphini Park prevails over all Bangkok's public parks in history length, and ranks 3rd in terms of area, making it an intriguing case to examine how public policies were implemented on this public green space.

The City Planning Department focus on the expansion of Bangkok's green area. For trees, preserving every tree in public spaces is its main concern. Environment Department is in charge of improving Bangkok's landscape. To approach this target, Public Park Office provides operational manual for arborists and gardeners. However, real practices vary in different urban spaces.

In Lumphini Park, shade trees were the priorities from the 1920s and 1970s. The importance of ornamental trees has since the 1970s increased. Trees' spatial functions gained a highlight from the 1990s to early 2000s. The Bangkok government's current policy on public trees is to emphasize their capabilities of carbon absorption as a means to mitigate the impact of global warming on Bangkok. This policy does not affect the trees in Lumphini Park currently.

CHAPTER 4

Trees in Lumphini Park

4.0 Outline of Chapter 4

4.1 Dominant Trees

4.2 Exotic Trees

4.3 Shade Trees

4.4 Ornamental Trees

4.5 Carbon-absorbing Trees

4.6 Nitrogen-fixing Trees

4.7 Serendipitous Trees: Nature and Thai Culture

4.8 A Dynamic Treescape: Human-tree Interactions

4.9 Summary of Chapter 4

4.0 Outline of Chapter 4

This chapter finds out the tree composition in Lumphini Park, and presents the 50 dominant tree species with multiple interrelated lenses, including their botanical taxonomy, geographical origins, shade and ornamentation functions, soil chemistry, the authorities' current policy, introduction agents, and Thai culture. After discussing the above dimensions of trees separately, the author integrates all content of trees with basic practices of tree maintenance to present a dynamic treescape and human-tree interactions in Lumphini Park on the map.

4.1 Dominant Trees

In plant science, family[18] is a highly suitable unit for study (Jaques 1984, iii). The 50 dominant tree species, therefore, are analyzed with their botanical families in this section, shown as Table 9.

Table 9. Fifty Most Dominant Tree Species and Their Botanical Families

Rank	Scientific Name	Number	Percentage (%)[19]
Family	Leguminosae (Fabaceae)		
Subfamily	Papilionoideae		

[18] The primary taxonomic ranks accepted by the International Code of Botanical Nomenclature (ICBN), from highest downwards, are Kingdom, Phylum/Division, Class, Order, Family, Genus, and Species. These ranks are hierarchical, meaning that each rank is inclusive of all other ranks beneath it (Simpson, 2006: 12-13).

[19] The number percentage of 5,731 trees from the 50 most individual-numerous tree species

Species	*Pterocarpus indicus*	946	16.51
	Gliricidia sepium	19	0.33
Subfamily	Mimosoideae		
Species	*Samanea saman*	220	3.84
	Acacia auriculaeformis	114	1.99
	Pithecellobium dulce	44	0.77
	Albizia lebbeck	32	0.56
Subfamily	Caesalpinioideae		
Species	*Peltophorum pterocarpum*	310	5.41
	Delonix regia	189	3.30
	Tamarindus indica	137	2.39
	Cassia fistula	89	1.55
	Caesalpinia coriaria	29	0.51
	Phyllocarpus septrentrionalis	19	0.33
	Senna siamea	16	0.28
	Amherstia nobilis	16	0.28
Sum of Leguminosae tree species		2180	38.04
Family	Apocynaceae		
Species	*Wrightia religiosa*	758	13.23
	Plumeria spp.[20]	117	2.04
	Alstonia scholaris	105	1.83
	Cerbera odollam	18	0.31
Sum of Apocynaceae tree species		998	17.41
Family	Rubiaceae		
Species	*Murraya paniculata*	427	7.45
Family	Annonaceae		
Species	*Polyalthia longifolia*	151	2.63

[20] *Plumeria spp.* contains many varieties because plumeria has long been crossbred for its ornamental value. In the tree inventory, all the varieties are regarded as the same species.

Family	Palmae (Arecaceae)		
Species	*Phoenix roebelenii*	184	3.21
	Roystonea regia	182	3.18
	Cocos nucifera	129	2.25
	Adonidia merrillii	92	1.61
	Elaeis guineensis	51	0.89
	Ptychosperma macarthurii	31	0.54
	Wodyetia bifurcate	28	0.49
	Nypa fruticans	20	0.35
	Livistona chinensis	20	0.35
Sum of Palmae (Arecaceae) tree species		737	12.86
Family	Bignoniaceae		
Species	*Tabebuia rosea*	134	2.34
	Millingtonia hortensis	109	1.90
	Dolichandrone serrulata	20	0.35
	Jacaranda filicifolia	19	0.33
	Crescentia cujete	15	0.26
Sum of Bignoniaceae tree species		297	5.18
Family	Casuarinaceae		
Species	*Casuarina junghuhniana*	146	2.55
Family	Moraceae		
Species	*Ficus benjamina*	121	2.11
	Ficus religiosa	33	0.58
	Streblus asper	25	0.44
Sum of Moraceae tree species		179	3.13
Family	Lythraceae		
Species	*Lagerstroemia loudonii*	83	1.49
	Lagerstroemia floribunda	40	0.70
	Lagerstroemia speciosa	35	0.61
Sum of Lythraceae tree species		158	2.8

Family	Meliaceae		
Species	*Swietenia macrophylla*	111	1.94
	Azadirachta indica	15	0.26
Sum of Meliaceae tree species		126	2.20
Family	Myrtaceae		
Species	Callistemon viminalis	80	1.40
	Syzygium cumini	44	0.77
Sum of Myrtaceae tree species		124	2.17
Family	Sapotaceae		
Species	*Mimusops elengi*	86	1.50
Family	Dipterocarpaceae		
Species	*Dipterocarpus alatus*	47	0.82
Family	Combretaceae		
Species	*Terminalia catappa*	16	0.28
Family	Euphorbiaceae		
Species	*Phyllanthus acidus*	17	0.29
Family	Anacardiaceae		
Species	*Mangifera indica*	42	0.73

In Lumphini Park, the tree species of Leguminosae (Fabaceae) family, including all species of three subfamilies—Papilionoideae, Mimosoideae, and Caesalpinioideae, consist of the majority of all trees in both individual number and species number. Such dominance, in terms of the sum of individual numbers, is then followed by family Apocynaceae, Palmae (Arecaceae), Rubiaceae, Bignoniaceae, Moraceae, Lythraceae, Annonaceae, Casuarinaceae, Meliaceae, Myrtaceae, etc. shown as Figure 20.

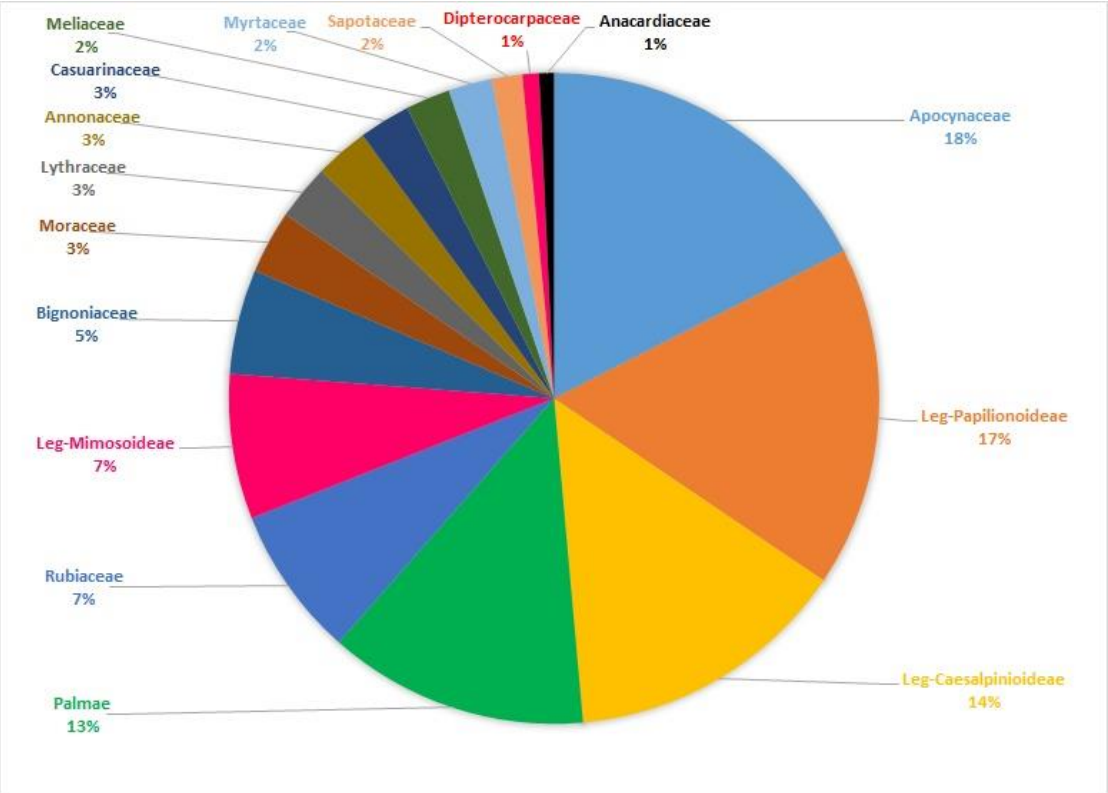

Figure 20. Pie Chart of Families of the 50 Most Dominant Tree Species

The dominant tree species of the above families, thriving mainly or even exclusively in tropical regions worldwide, share similar physiological characteristics. That is, warm environment and strong sunlight are required for these trees' growth. Some tree species, such as *Murraya paniculata* (Veesommai et al. 2013, 132) and *Delonix regia* (Amranand and Warren 1996, 42), even cannot bloom or flower very little if sunlight is not sufficient. As for moisture, moderate watering is preferred by almost all tree species, while some are more drought-tolerant, such as *Lagerstroemia floribunda*, or flood-tolerant, such as *Samanea saman*. Accordingly, such physiological traits reflect these dominant tree species' fitness to the tropical monsoon climate of

central Thailand—high temperature through whole year, little precipitation in dry season from December to April, and almost daily afternoon thunderstorms in raining season from May through October (Thaiutsa et al, 2008)[21]. For the landscape architects, selecting plant species highly adapted to the landscape environment can reduce the cost and minimize the possibility of planting failure (Harris et al. 2004, 118-119). In Lumphini Park, this concept is also a prerequisite of tree selection before assessing a tree's functions (Interview, 2016a).

4.2 Exotic Trees

Exotic Species, or non-native species, are species that originate from certain areas but have been introduced to some other places because of human activity. Some exotic species cannot establish in new places where they were introduced because these species do not fit in the new environments, while some introduced species may survive or even thrive in the new environments. If an introduced species prevails over the native species in competing limited resources, this species may displace the native species or even have serious impacts on the ecosystem in the new place where it was introduced, and might be considered as an invasive species[22].

[21] For more recent climate statistics, please refer to Thai Meteorological Department via http://www.tmd.go.th/en/climate.php?FileID=7 (website accessed on 5 May 2016)

[22] This definition of 'exotic species' and 'invasive species' is very primary. The definitions of 'exotic species,' 'native species,' 'naturalized species,' 'indigenous species,' 'weeds,' and more terms among others have evolved a lot during the past two centuries. However, all the debates involve arbitrarily bounded places

In terms of plants, agricultural and horticultural utilization are two important causes of introducing exotic plant species. (Primack 2002, 276) Namely, exotic plant species are often found at gardens and parks, the places where ornamentation is greatly emphasized. For landscape architect, as mentioned in section 1.7.2, whether a plant species is native or non-native is not an important concern. What really matters is how to assemble plants to create living and dynamic 'structures' in the landscape design such as creating and dividing spaces, hiding unwanted objects, softening the rigid and 'cold' feeling of buildings, ornamenting the environment as well as this plant's adaptability to the built environment. Bradshaw et al. (1995, 109) argues,

> "If we restrict our choice to native species, we will miss species which could be very valuable to us. At the same time, some of our native species [which] are adapted to such specialized natural conditions that they are unsuitable for towns."

The above argument highlights two points. First, the practical functions of plants is more important than their origins. Second, a city's environment is different from this site's natural environment so that a native species might not grow well in the city even

---

and times. If the evolution mechanism is taken into account, a species' fitness might be the only criterion of 'belonging to a place.' For a brief review of the paradigm shift in invasion ecology, please refer to Chew (2013).

this species has existed in this site before it became the current city for centuries. Harris et al. (2004, 123) share the same point of view, indicating that native species often do not perform as well as non-native species because most urban sites are no longer 'native.' However, Harris et al. (2004, 122) also emphasized some exotic species have potential to displace the native species; if such potential impact is confirmed, such species should be limited on their use despite their desirable characteristics for landscaping.

In Lumphini Park, abundant exotic tree species are also planted, forming a great part of the treescape the park visitors perceive. The arborist indicated that the tree species' origin is a factor before new trees are purchased in order to avoid an exotic tree becomes invasive, but none of the exotic tree species thriving in Lumphini Park has been reported to be invasive in all Bangkok's parks (Interview, 2016a)[23]. The director of Lumphini Park Office pointed out that tree species 'native to Thailand but rarely seen' will be prioritized in the selection list because such tree-selecting can be beneficial for the public to know more native tree species and for academic people to study Thailand's flora (Interview, 2016d). That is, the educational function also plays an unspoken role in tree selection. Therefore, native species and exotic species, with

[23] Such situation is, to a high level, applied with the following definition of 'naturalized plants': Alien plants that reproduce consistently and sustain populations over many life cycles without direct intervention by humans or in spite of human intervention; they often recruit offspring freely, usually close to adult plants, and do not necessarily invade natural, semi-natural or human-made ecosystems.

different reasons, were both introduced to Lumphini Park, creating the interwoven treescape.

The geographical provenances of the 50 dominant tree species, by referring to various sources, are listed as Appendix 2. However, most of the origins are speculated with limited scientific evidence and can only be reference accordingly. As section 1.2.4 and Table 2 noted, a species' origin should not be described with political boundaries, while country names are still utilized in some reference books to indicate more precise or specific areas. In order to keep the information in Appendix 2 less arbitrary and more objective, the geographical provenance is described as 'part-continent' and is followed with more specific area names in brackets if information is available.

Exotic tree species were introduced for some specific purposes, not because they were perfect. Some exotic tree species also have obvious drawbacks, but these drawbacks are acceptable if their functions are highly desired. On the other hand, the unfavorable traits of some introduced tree species were unknown when they were introduced, but were found afterwards. *Acacia auriculaeformis* (Australian wattle, Krathin Narong) is an example of this case. This tree was introduced to Thailand in the 1970s. By that time, gardeners were enthusiastic about its fast growth rate and shade-providing function. A few years later, arborists found this tree's non-stop leaf-shedding is a real nuisance because it requires frequent cleaning (Amranand and Warren 1996, 38); besides, its pollens are allergic to some people (Veesommai et al. 2013, 21). Not

proved to have apparent negative impacts on other native species, Australian Wattle is not regarded as 'invasive species,' but the finding of its unfavorable traits in maintenance practices has made it much less popular. This example shows that the perception and popularity of an introduced exotic tree species can also be changed.

Seven dominant and exotic tree species, whose geographic origins are outside Asia, are presented with their numbers, main uses and drawbacks in Table 10.

Table 10. Some Dominant Exotic Species' Main Uses and Drawbacks

Scientific Name	Number	Main uses*	Drawbacks
Samanea saman	220	S, O	Brittle twigs
Delonix regia	189	S, O	Few flowers if too much water
Plumeria spp.	117	O	Allergic latex
Tabebuia rosea	134	O	
Acacia auriculaeformis	114	S	Numerous shed leaves are not easy to clean, allergic pollens
Roystonea regia	182	SC	Falling leaves are dangerous for people
Polyalthia longifolia	151	SC	

*S=Shade-providing, O=Ornamentation with flowers, SC=Screening

4.3 Shade Trees

The dominant trees present two major functions for Lumphini Park's visitors. One group, consisting of only a few tree species, comprises the green canopy of Lumphini Park, which buffers the park visitors from Bangkok's frenetic sunlight; another

group, embracing abundant tree species, is cultivated and maintained to ornament Lumphini Park like a colorful tapestry. However, this grouping is not rigid but very flexible instead. The majestic shade trees spread striking visual effects with their forms or when they are in full bloom, while many ornamental trees also cast cooling shades if reaching considerable size. A few examples of this dynamic function are given below.

Samanea saman (Rain Tree, Chamchuri)[24], a huge and fast-growing tree, is one of the most important shade trees in Lumphini Park. When reaching 10-20 meters tall, its distinct umbrella-shaped crown casts wide and large shade on the ground (Figure 21). Rain tree is native to Central and South America (Forestry Research Center 2004, 45) but is now popular in Thailand for its shade-providing function. Nevertheless, Rain tree is not very common along streets or roads in Bangkok because its huge size, surface roots, brittle twigs, and fallen leaves are inappropriate for traffic safety, road cleaning and maintenance (Public Park Office 2004, 114). Instead, this tree species is mainly planted to provide shade in Bangkok's large open spaces such as Lumphini Park, where more than two hundreds individuals are cultivated. Except for its shades, Rain tree also spreads stunning visual effects with its form and when its crown is fully dotted with pinkish tuft-like florets. Excellent in both shade-giving and ornamentation, *S. saman* is accordingly a welcomed tree species and a good example of the dynamic roles trees play in Bangkok's public green spaces.

[24] The first name is the common name in English, and the second one in Thai.

Figure 21. A Big Rain Tree, Its Shade, and Park Visitors

Except for rain tree, *Pterocarpus indicus* (Angsana, Pratu), *Peltophorum pterocarpum* (Yellow Flame, Non Si), and *Tamarindus indica* (Tamarind, Makham), *Acacia auriculaeformis* (Australian wattle, Krathin Narong) are all dominant shade trees introduced to Lumphini Park around fifty to seventy years ago. *Delonix regia* (Flame Tree, Hang Nok Yung Farang), native to Madagascar, creates great ornamental effect from April to June when it blooms with most eye-catching red and orange flowers; after this period, it also provide shades although less dense because its leaflets are thin and small. From November to March, however, this tree sheds all of its leaves.

Therefore, *D. regia* provides no shade nor flowers for around four months (Amranand and Warren 1996, 42).

D. regia exemplifies the annual or seasonal dynamics of a tree's physiological characteristics, shade function and ornamental value. A similar example is *Terminalia catappa* (Sea almond, Hu Kwang). The large and bright green leaves of Sea almond in Lumphini Park, though not numerous, give thick shades for most time of one year, but turn red and then carpet the ground usually in February[25], leaving the branches bare for around one week (Amranand and Warren 1996, 34) , presenting seasonal change.

The leaf-shedding is controlled by a tree's physiological mechanism to respond the periodic change or occasional stresses in the environment. Except leaf-shedding, many other factors such as a tree's form, maturity height, crown size, and foliage density, and so on, also influence on its shade function. The form or shape of trees and shrubs is that of the crown and its supporting trunk (Harris et al, 2004)[26]. Besides, a fast-growing tree is much more preferred than a slow-growing one to be a shade tree. Table 11, based on Amranand and Warren (1996) as well as Veesommai et al. (2013), lists some dominant trees for their shade function in Lumphini Park. However, not all tree species in Table 11 are planted as shade trees for the main purpose but are

[25] *T. catappa*'s leaves' turning red and shedding was also observed in March, April, and May 2016.

[26] To be more detailed, A tree's form can be determined by (1) the location of leaf and flower buds (terminal or lateral), (2) the pattern of bud break along the trunk and branches, (3) the angle at which branches grow, and (4) the differential elongation of buds and branches (Harris et al 2004, 20). The terms utilized to describe tree forms in Table 9 follow that of Veesommai et al (2013).

included to present the favorable features of a shade tree by comparing and contrasting various tree species. For example, *Mimusops elengi* (Bullet Wood, Phikun), a medium-sized tree, grows very slowly, which is not an advantage for a shade tree, but its round and dense crown casts deep shade on the ground and is excellent for screening 'if you can wait for it' (Amranand and Warren 1996, 33) . *M. elengi* produces low-key but sweet-smelling flowers[27] and beautiful reddish-orange fruits all year round. Besides, this tree's slow growing rate makes it require little maintenance. As a result, young *M. elengi* is more ideal for ornamentation than its shade function, which needs patience.

Despite the fact that tree shade surely depends on the foliage, it is interesting that the majority of shady trees in Lumphini Park are composed of (semi-)deciduous trees rather than evergreen trees. It is a general trend that deciduous trees shed leaves in dry season, which begins from November until April or May in Thailand, to reduce their own water-losing from transpiration. Consequently, the tree shade in Lumphini Park also shrinks more or less in this hot period.

[27] Old-fashioned Siamese people use Phikun's small but fragrant flowers to scent clothes in the way lavender flowers are used in England. Such deep connection between a plant and people's traditional way of life may also play a tacit role when Phikun trees were selected and planted in Lumphini Park.

Table 11. Selected Dominant Trees in Shading Function

Deciduous tree species					
Tree species*	**Tree Form**	**Crown Size (m)**	**Growth rate**	**Maturity height (m)**	**Seasonal change****
Pterocarpus indicus (945)	Spreading	5-8	Fast	10-20 m	D. Feb-Apr F. May
Samanea saman (220)	Umbrella	10-25	Fast	15-30	D. very short F. Aug-Feb
Delonix regia (189)	Spreading	8-15	Fast	10-15	D. Dec-Mar F. Apr-Jun
Tamarindus indica (137)	Round	5-20	Slow	5-25	D.*** F. Mar-May
Terminalia catappa (16)	Spreading in layers	8-10	Fast	8-35	D. Feb F. Feb-Apr
Evergreen tree species					
Peltophorum pterocarpum (310)	Round	5-10	Fast	8-20	F. Mar-May
Ficus benjamina (121)	Spreading, Weeping	10 up	Fast	10-30	F. Dec-Feb
Acacia auriculaeformis (114)	Round/ Spreading	4-5	Fast	7-30	F. year-round
Mimusops elengi (86)	Round	4-8	Slow	5-18	F. year-round
Crescentia cujete (15)	Weeping	4-6	Slow	3-10	F. year-round

* Numbers in brackets are the tree number in Lumphini Park

** D=Defoliating period, F=Flowering period

*** Defoliating is not apparent; depends on the moisture

4.4 Ornamental Trees

Abundant ornamental tree species are selected and planted in Lumphini Park. However, whether a plant species, or which part of a plant, is ornamental, is quite subjective. To analyze trees' ornamental effects in this section, three elements are involved. First, trees of the 50 dominant tree species are grouped according to having showy or apparent flowers or not. Trees having showy or apparent flowers are then grouped with flower colors with approximate blooming season and durations. More detailed descriptions of flower morphology are available from plant reference books such as Gardner et al. (2000). The analysis of dominant trees' flower performances are presented as Table12.

Table 12. Dominant Trees with Ornamental Flowers in Lumphini Park

Tree species	Number	Blooming season	Blooming duration	Other functions or remarks
Trees producing yellow or golden flowers				
Pterocarpus indicus	946	May-Jun	3-5 days	Major shade tree
Peltophorum pterocarpum	310	Mar-May	8-10 weeks	Major shade tree
Cassia fistula	89	Mar-May	8-10 weeks	National flower of Thailand
Albizia lebbeck	32	Mar-Apr	6-8 weeks	Shade tree

Tree species	Number	Blooming season	Blooming duration	Other functions or remarks
Senna siamea	16	Year-round	--	Edible with healthy benefits
Trees producing white or creamy-colored flowers				
Wrightia arborea	758	Year-round	--	Screening
Murraya paniculata	427	Year-round, full sunlight needed	--	Screening, shady tree if tall enough
Millingtonia hortensis	109	Sep-Nov, flowers in the evening	12-15 weeks	Shady tree
Mimusops elengi	86	Year-round	--	Shady tree if tall enough, screening
Dolichandrone serrulata[28]	20	Mainly Feb-Mar, flowers at night	12-16 weeks	Flowers are edible, shade tree
Cerbera odollam	18	All year round	--	Allergic latex
Trees producing orange or red flowers				
Delonix regia	189	Apr-Jun	10-12 weeks	Seasonal shade tree
Callistemon viminalis	80	Year-round	--	
Phyllocarpus septrentrionalis	19	Nov-Dec	4-6 weeks	Seasonal shade tree
Amherstia nobilis[29]	16	Jan-Feb	6-8 weeks	

[28] Source: http://tplant.web.fc2.com/3nouzen_mangurobutrumpet.html (accessed on 23 May 2016)

[29] Source: http://tplant.web.fc2.com/3jaketu_youraku.html (accessed on 23 May 2016)

Tree species	Number	Blooming season	Blooming duration	Other functions or remarks
Trees producing pink or purple flowers				
Samanea saman	220	Year-round, mainly Aug-Feb	Longer than 6 months	Major shade tree
Tabebuia rosea	134	Feb-Apr	8-12 weeks	(Semi) shade tree
Lagerstroemia loudonii	83	Year-round, densely Dec-Mar	--	(Semi) Shade tree
Lagerstroemia floribunda	40	Year-round, densely Jul-Sep	--	(Semi) Shade tree
Lagerstroemia speciosa	35	Year-round, densely Mar-Jun	--	(Semi) Shade tree
Jacaranda filicifolia	19	Jan-Mar	10-12 weeks	(Semi) shade tree
Trees producing flowers in other/more colors				
Tamarindus indica	137	Mar-May	6-8 weeks	Orange-yellow with red dots
Plumeria spp.	117	Year-round	--	White, pink, red, yellow
Caesalpinia coriaria	29	Jun-Jul	6-8 weeks	White with yellow and green

Some species listed in Table 12 are worthy of further introduction. *Tabebuia rosea* (Pink Trumpet, Chomphu phanthip), *Millingtonia hortensis* (Indian Cork tree, Pip), *Dolichandrone serrulata* (No English common name, Khae Na), and *Jacaranda filicifolia* (Jacaranda, Si Trang) are all members of family Bignoniaceae. The species of this family

are characterized with tubular flowers, which are fused by four or five petals and resemble a trumpet. Bignoniaceae contains some of the world's most spectacular ornamental trees, making these species widely introduced to overseas gardens and parks (Gardner et al. 2000, 265). Pink Trumpet and Jacaranda are exotic species originating from Central and South America. Another two exotic tree species of Bignoniaceae family, *Crescentia alata* (Tecomate, Tinpet Farang) and *Crescentia cujete* (Calabash, Namtao Ton, Figure 22), giving beautiful silhouette and shades with unique weeping branches, are also introduced to Lumphini Park. Although their trumpet-like flowers are small and less attractive, their big round fruits and striking tree form are of much ornamental effects.

Figure 22. A Calabash Tree and a Man Taking a Nap

The planting of these showy exotic Bignoniaceae tree species highlights the fact that exotic tree species are accepted in Lumphini Park. Abundant *Plumeria spp.*[30], a vast group of frangipani trees native to Central America, are also planted in Lumphini Park for their year-round beautiful flowers, reconfirming the utilization of exotic species.

Even a tree has no showy flowers, its form still can be highly ornamental like Tecomate and Calabash. Palms, the members of family Palmae (Areaceae), are a symbolic group of such ornamental plants. Palms can give strong tropical feeling to the surroundings because palms are almost exclusive in tropical regions (Gardner et al. 2000, 367). Most palms have distinct features—single stem, no branch, evergreen large leaves arranged at the stem top, enlarged stalks form a sheath around the stem, and clustered flowers below the leaves. In addition, two more features make palms very different from other trees. The first one is that a palm enlarges its stem before elongation; once a stem reaches its max diameter, it will no longer increase. This feature makes it convenient for arborist to calculate the spacing when planting palms. The second one is that palms' roots branch out but do not thicken, making it relatively easy to transplant a palm (Harris et al 2004, 38-39; Amranand and Warren 1996, 58). A variety of palm species are cultivated in Lumphini Park (Figure 23 & 24) for their

[30] Plumeria is a genius name, and *Plumeria spp.* contains abundant varieties, including *P. rubra* (red flowers), *P. acutifolia* (yellow flowers), *P. obtuse* (white flowers), and so on . In the tree inventory, all the varieties were counted as *Plumeria spp.*

ornamental and space-defining functions. Besides, right at the center of the whole Lumphini Park is a palm garden, highlighting palms' importance in Lumphini Park.

Figure 23. Foxtail Palm

Figure 24. Fiji Fan Palm

Table 13 are the palm species, their common names and possible origins, suggesting how 'exotic' they are, and their space-defining functions in Lumphini Park.

Table 13. Palms in Lumphini Park

Palm species	Common name (and suggested origin)	Space-defining functions/ distribution in Lumphini Park
Roystonea regia	Royal Palm (Central America)	Planted straight along roads; palm garden
Cocos nucifera	Coconut Palm (Southeast Asia)	Planted along water edge all over park; palm garden

Palm species	Common name (and suggested origin)	Space-defining functions/ distribution in Lumphini Park
Adonidia merrillii	Manila Palm (The Philippines)	Planted straight along trails; arranged with other plants
Elaeis guineensis	Oil Palm (Western Africa)	Along the wall of Witthayu Road and Lumphini Park; palm garden
Wodyetia bifurcate	Foxtail Palm (Australia)	Mixed with others at palm garden; new ones near outdoor theatre
Nypa fruticans	Nipa Palm (S & SE Asia, Pacific islands)	Assembled at palm garden swamp
Livistona chinensis	Chinese Fan Palm (East Asia)	Mixed with others at palm garden
Livistona rotundifolia	Java Palm (Southeast Asia, Java)	Mixed with others at palm garden
Phoenix roebelenii	Pigmy Date Palm (SW China, N Laos)	Screening, in row close to front gate; arranged with other plants
Caryota mitis	Fishtail Palm (Southeast Asia)	Opposite to Lanna Pavilion, on pond edge near frontal gate
Pritchardia pacifica	Fiji Fan Palm (Pacific island, Fiji, Tonga)	Sparsely distributed; palm garden
Licuala spinosa	Mangrove Fan Palm (Southeast Asia)	Near palm garden swamp and mix-grouped with others
Chrysalidocarpus lutescens	Madagascar Palm, Yellow Bamboo Palm	Screening, arranged with other plans
Ptychosperma macarthurii	McArthur Palm (New Guinea, Australia)	Screening, arranged with other plants
Syagrus romanzofflana	Queen Palm, Giriba Palm (South America)	Mixed with others at palm garden
Corypha lecomtei	Talipot Palm (Mainland Southeast Asia)	Striking visual focus of palm garden

Palm species	Common name (and suggested origin)	Space-defining functions/ distribution in Lumphini Park
Borassus flabellifer	Paimyra Palm, Brab Palm (South Asia)	Striking visual focus of palm garden
Phoenix dactylifera	Date Palm (West Asia)	Planted near the Lanna Pavilion
Dypsis decaryi	Triangle Palm (Madagascar, Africa)	Sparsely distributed; palm garden

Coconut Palm and Oil Palm are two outstanding members of the Palmae family utilized to define the spaces of Lumphini Park. Excluding the individuals in the palm garden, the former can be found along water edge all around the park, while the latter is planted along the wall in Witthayu Road side as boundary markers. Except for palms, *Casuarina junghuhniana* (No English common name, Son Pradiphat, 146 trees), *Polyalthia longifolia* (Cemetery tree, Asok India, 151 trees), *Wrightia religiosa* (Water Jasmine, Mok, 758 trees), and *Murraya paniculata* (Orange jessamine, 427 trees) are also important boundary markers. *C. junghuhniana* (Figure 25), distinct for its pine-like leaves, is always visible for the joggers because this tree is planted as rows along many trails and water channels to mark the boundary. *P. longifolia* (Figure 26) is a popular tree as screens or windbreaks for its unique tall and straight trunk, tower shape, and dense weeping branches.

Water Jasmine and Orange Jessamine are not distinct like *C. junghuhniana* or *P. longifolia*, but these two tree species actually play important supporting roles in

defining Lumphini Park's space. Water Jasmine's soft twigs can be easily pruned and controlled at needed height. Alternatively, it can grow up to 2.5 meters high to provide some shade. As a result, Water Jasmine is an ideal landscape plant (Interview, 2016b). It is plentifully planted not only inside Lumphini Park but also outside the park to soften the rigid feeling of the railings (Figure 27). Orange Jessamine is abundantly used to screen rest sites. The elegant scent of Orange jessamin's flowers is especially a refreshing delight for park visitors. However, Orange jessamine needs full-day sunlight for its flowering. If it is under big trees' thick shade, it can hardly bloom (Veesommai et al 2013, 132). In Lumphini Park, such phenomenon is also observed. Some tall Orange Jessamine trees have full blooms while some short ones bear very few flowers.

Figure 25. *Casuarina junghuhniana* Planted along Walking Trails

Figure 26. Asok India Planted along Canal

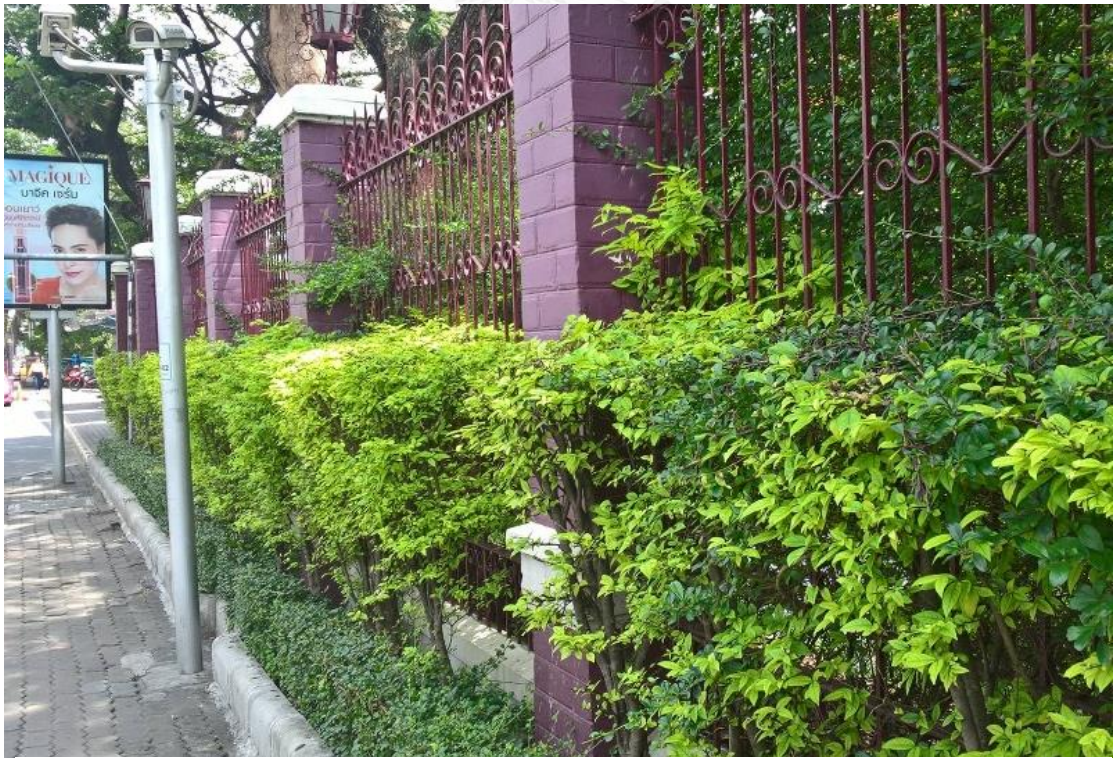

Figure 27. Water Jasmine Planted along the Railings

4.5 Carbon-absorbing Trees

Since the beginning of industrial age, the concentration of carbon dioxide (CO_2), the prime greenhouse gas, has been consistently rising in the atmosphere, leading to the warming of global temperature (Harris et al, 2004). Around 85% of the human-produced CO_2 is generated in or near urban areas (Forman 2014, 147). While cities are facing growing risks of global warming and climate change, various measures are needed to reduce the concentration of CO_2. One of the possible ways is to utilize plants. Carbon dioxide and water are absorbed by plants to synthesize carbohydrate and other forms of energy in photosynthesis. That is, carbon is stored inside plants naturally until the plants are eaten by animals, burned, or decomposed by microorganisms. Trees, as the majority of biomass, accumulate plentiful CO_2 in their bodies. Therefore, planting trees (back to the earth) is a possible way to balance the CO_2 emission and decelerate the temperature rising.

In order to cope with the challenge of global warming and make Bangkok as a resilient city, Bangkok Metropolitan Administration (BMA) has started a series of measures, one of which is to increase the area of green spaces and the number of trees in Bangkok. Meanwhile, to better understand and manage Bangkok's public green spaces, BMA has also lunched survey of park trees. Based on the data collected from trees planted at four sampled parks[31], 189,409 trees along roads and streets in Bangkok,

[31] The four parks and tree numbers are Santiphap Park (720 trees), Saranrom Park (356 trees),

and statistics from some Asian countries, invited foreign scholars calculated the carbon storage capacity of some dominant tree species to further recommend tree species for each park office to purchase and plant new trees (Interview, 2016b).

Lumphini Park, the oldest public park of Bangkok, has already survived for 90 years and its tree density has already reached saturation level. Within the past ten years, only a few trees were planted to replace the dead ones (Interview, 2016b). Accordingly, BMA's recommendation list done in 2015 serves to be a reference for newly constructed parks and has little impact on the tree selection of Lumphini Park. However, most of the tree species recommended by BMA, though account for only a small part of all tree species, can be found in Lumphini Park, making it a possible way to estimate Lumphini Park's capacity of carbon absorption[32]. The absorption factor of BMA-provided tree species and calculation result are shown as Table 14.

Table 14. Carbon Absorption Factor and Amount in Lumphini Park

Tree Species	Absorption Factor (ton carbon/ tree/ year)	Tree number in Lumphini Park	Absorption amount (ton carbon/ year)
Delonix regia	0.026	189	4.914
Acacia auriculiformis	0.025	114	2.850
Peltophorum pterocarpum	0.021	310	6.510

Rommaneenart Park (700 trees) and Chatuchak Park (845 trees).

[32] Carbon Absorption factor * Tree Number = Carbon Absorption Amount

Tree Species	Absorption Factor (ton carbon/ tree/ year)	Tree number in Lumphini Park	Absorption amount (ton carbon/ year)
Syzygium cumini	0.019	44	0.836
Samanea Saman	0.017	220	3.740
Pterocarpus indicus	0.013	946	12.298
Tabebuia rosea	0.0124	134	1.662
Mimusops elengi	0.010	86	0.860
Millingtonia hortensis	0.009	109	0.981
Tabebuia argentea	0.007	4	0.028
Cerbera odollam	0.006	18	0.108
Streblus asper	0.005	25	0.125
Lagerstroemia speciosa	0.005	35	0.175
Lagerstroemia loudonii	0.005	83	0.415
Ptychosperma marcarthurii	0.004	31	0.124
Polyalthia longifolia	0.003	151	0.453
Plumeria spp.	0.003	117	0.351
Lagerstroemia floribunda	0.003	40	0.12
Melaleuca bracteata	0.002	0	0
Sesbania grandiflora	0.001	0	0
Hopea odorata	0.001	0	0
Sum		2,656	36.5496

Table 14 shows the estimated amount of carbon absorption from 2,656 trees, or 43.5 percent of all tree individuals in Lumphini Park, is 36.55 ton per year.

Alternatively, when the average absorption factor (0.008 ton carbon/tree/year) is multiplied by the total tree number of Lumphini Park (6,105), the product is 48.84 ton carbon per year.

Although the absorption factor provided by BMA is just a rough estimation and requires research on more tree species, it is undeniable that Lumphini Park's capacity of carbon absorption is very tiny compared to the 43.87 million ton greenhouse gas emission in 2013 (Bangkok Metropolitan Administration (BMA) and JICA 2015). This calculation result indicates the long way ahead of sustainable urban environment and megacity Bangkok's desperate demand of more trees and green spaces.

On the other hand, the absorption factor of selected tree species provided by BMA suggests the potential of a variety of major shade and ornamental trees planted and commonly seen in Lumphini Park, including *Delonix regia, Acacia auriculiformis, Peltophorum pterocarpum, Samanea Saman, Pterocarpus indicus, Tabebuia rosea*, etc. As a result, these numerous tree species in Lumphini Park can be employed as excellent explanation source for the public to understand the concepts of greenhouse gas emission and global warming as well as trees' important role in mitigating Bangkok's fever. By doing so, Lumphini Park and more public parks in Bangkok can exert greater influence of environmental education on urban residents, which can respond to BMA's plan of raising the public awareness of sustainable environment (Bangkok Metropolitan Administration (BMA) and JICA 2015).

4.6 Nitrogen-fixing Trees

As mentioned in section 4.1, the tree species of Leguminosae (Fabaceae) family consists of the majority of all trees in both individual number and species number in Lumphini Park. The other reason that leguminous trees are preferred as landscape plants might be the leguminous trees' nitrogen-fixing mechanism (Interview, 2016b). Nitrogen-fixing, the process by which the nitrogen gas (N_2) becomes ammonium (NH_4^+) to further produce amino acids and other organic compounds, is a stage of nitrogen cycle and indispensable for all living organisms but can be carried out by certain bacteria only. Some of such nitrogen-fixing bacteria establish symbiotic association with certain vascular plants by invading these plants' roots. By doing so, the bacteria provide the plants with a form of nitrogen to make protein while the plants give carbon-containing molecules to the bacteria in return, so this relationship is mutually beneficial (Evert and Eichhorn 2013, 653-657). The Leguminosae family, accounting for the majority of such type of nitrogen-fixing plants, has evolved to be able to survive in soils where the nitrogen nutrients are poor. Therefore, leguminous plants have become highly competitive and have wide distribution thanks to this nitrogen-fixing mechanism. In addition, the plant tissue of leguminous plants contain abundant nitrogen nutrients, which can be good fertilizers by releasing nitrogen nutrients back to the soil after the fallen leaves and twigs are burned or decomposed. It is widely known

among gardeners, for example, the leaves of *Samanea saman* can be excellent compost (Amranand and Warren 1996, 48).

The members of family Leguminosae (Fabaceae) are generally classified into three subfamilies: Papilionaceae, Caesalpiniaceae, and Mimosaceae (Simpson 2006, 262), all of which are found in dominant tree species in Lumphini Park. However, the species of these three subfamilies are reported to differ a lot in the nitrogen-fixing percentage. Up to 80 to 90% of the Papilionaceae species perform nitrogen-fixing, but only around 25% of the Mimosaceae and even fewer of the Caesalpiniaceae species have been found having this mechanism (Postgate 1998). So far, very few of Lumphini Park's major leguminous trees such as *Pterocarpus indicus*, *Samanea saman, Delonix regia, Peltophorum pterocarpum*, etc., have been well researched with their nitrogen-fixing performance. Besides, leguminous plants perform less nitrogen-fixing when the soil is rich in nitrogen nutrients (Postgate 1998, 76). The fact that fertilizers are given on a monthly basis at Lumphini Park nowadays (Interview, 2016b) might decrease the leguminous trees' nitrogen-fixing performance. Accordingly, leguminous trees might be highly preferred half century ago for their physiological competitiveness, but such trait today might not be as important as in the past.

4.7 Serendipitous Trees: Nature and Thai Culture

In spite of the fact that trees in parks are selected and planted by human, on the basis of a tree species' the ecological fitness and landscape functions, a few tree species have different stories. In Lumphini Park, tree species containing 10 or more individuals were most likely planted by the park team. On the contrary, apart from some very clear exceptions, tree species having less than 10 individuals might be brought into Lumphini Park by the park visitors (Interview, 2016a).

Numerous fruit tree species are found in Lumphini Park. However, most of them were not very possible planted by the park maintenance team (Interview, 2016c). Considering the park regulation that plucking flower or any part of plants is regarded as vandalism and will be punished, planting fruit tree seems to discourage the park visitors from complying the regulation.

Table 15 clearly shows that Tamarind tree (*Tamarindus indica*) and Coconut palms (*Cocos nucifera*) are two outstanding exceptions among other fruit trees. Tamarind trees are one of the major shade trees along walking trail, and coconut trees are highly ornamental and planted along water edge. Mango trees (*Mangifera indica*), a popular choice in Thai gardens to provide shades, are also planted in Lumphini Park but not apparent because they are utilized as screen behind Lumphini Park Office. Similarly, Date palms (*Phoenix dactylifera*) were cultivated behind the Lanna Pavilion, near the main entrance, for their beautiful form; Nipa palms (*Nypa fruticans*), one of

the few mangrove palm species and where the dessert ingredient Attap Chee[33] comes from (Palm Pedia 2016), are clustered in the palm garden, where a small swamp was dug to accommodate this plant. Therefore, these fruit trees were chosen and planted by the park maintenance team for their shade or ornamental functions.

Table 15. Fruit Tree Species in Lumphini Park

Thai name	Scientific Name	English name	Number	Remark*
มะขาม	*Tamarindus indica*	Tamarind	137	S
มะพร้าว	*Cocos nucifera*	Coconut	129	O
มะขามเทศ	*Pithecellobium dulce*	--	44	S
มะม่วง	*Mangifera indica*	Mango	42	S, SC
จาก	*Nypa fruticans*	Nipa Palm	20	O
มะยม	*Phyllanthus acidus*	Tahitian Gooseberry	17	S
อินทผลัม	*Phoenix dactylifera*	Date, Date Palm	11	O
ขนุน	*Artocarpus heterophyllus*	Jackfruit	9	
ละมุดสีดา	*Madhuca esculenta*	--	8	
ลูกน้ำนม (สตาร์แอปเปิ้ล)	*Chrysophyllum cainito*	Star Apple	3	
ระกำ	*Salacca wallichiana*	Snakefruit	3	
มะตูม	*Aegle marmelos*	Bengal Quince, Bael, Bhel	2	
กระท้อน	*Sandoricum koetjape*	--	2	

[33] Attap Chee is the immature fruit of Nipa palm. This translucent, sweet and sticky fruit is commonly used for iced dessert in Thailand, Malaysia, and Singapore.

Thai name	Scientific Name	English name	Number	Remark*
มะปราง	*Bouea macrophylla*	Marian Plum, Plum Mango	1	
ชมพู่	*Syzygium spp.*	Rose Apple	1	
ลำไย	*Dimocarpus longan*	Longan	1	
ส้ม	*Citrus spp.*	Orange	1	
สาเก	*Artocarpus altilis*	Breadfruit	1	O

*S: Shade tree, O: Ornamental tree, SC: Screen tree

The other fruit trees such as rose apple (*Syzygium spp.*), longan (*Dimocarpus longan*), orange (*Citrus spp.*), and so on, were most likely brought in by park visitors when the seeds of these fruit trees were thrown onto the soil after the visitors enjoyed their own fruits in Lumphini Park (Interview, 2016c). Such point of view is supported by the small number and scattered distribution of these fruit trees. Snakefruit (*Salacca wallichiana*) is usually kept away to prevent people from getting hurt by its dangerous sharp spines. Breadfruit (*Artocarpus altilis*) is an exception. This fruit tree grows slowly and its fruits are not of much taste, but it is a welcomed tree thanks to its large and deeply indented leaves, which provide wide shade, attractive form, and much convenience for gardeners to clean (Amranand and Warren 1996, 52). Some potted seedlings of breadfruit trees have been introduced to Lumphini Park recently.

The regular weeding removes most unplanned plants, but some lucky seeds, brought in by human, other animals or even wind, might have chances to grow up if

they sprouted at some neglected corners of Lumphini Park, where gardeners paid less attention. When a young unplanned tree is found, it might be transplanted to some other corner in Lumphini Park if it is assessed as jeopardizing to landscape design or other trees nearby. Alternatively, it would also be kept on the spot if the arborist sees no negative impact from this unplanned tree to its surroundings. Either the former or the latter case, an unexpected tree, generally speaking, can keep surviving in Lumphini Park, because 'it is not easy to plant a tree. Keeping one is easier' (Interview, 2016b).

Another interesting case is *Ficus religiosa* (Bodhi tree/ Pipal tree, Pho), the tree under which Prince Gautama Siddhartha meditated, and received enlightenment to become Lord Buddha (Tudge, 2006: 194). This tree is a unique tree in the whole Buddhist world, including Thailand, a Buddhist-dominant society. Because of its deep connection with Buddhism, a Bodhi tree is usually planted in the yard of a Buddhist temple only. Thai people rarely plant this tree outside the temples[34]. In Lumphini Park, there are not plentiful Bodhi trees, but most of them, being very old, "maybe 70, 80 years old, or even older" (Interview, 2016c), have already reached considerable size. Moreover, these grand Bodhi trees are not arranged into any landscape pattern. The reason behind is a mixture of Bodhi tree's ecological trait[35] and Thais' perception of

[34] Except for religious reason, the author argues that it might be Bodhi trees' botanical trait that makes Thais rarely plant this tree near their homes—Bodhi trees' roots are destructive to other plants and buildings.

[35] *F. religiosa* is a member of Genus Ficus, Family Moraceae. Ficus trees produce juicy berry-like fruits, which are important food source for many birds and small mammals. The sticky seeds are dispersed everywhere with birds' droppings, making the wide distribution of ficus trees. Bodhi trees are no exception and can be found

this tree—the Bodhi tree's seeds were delivered by birds, rather than human being, from somewhere to Lumphini Park, or this site even before it became Lumphini Park. After one young Bodhi tree was identified with its unmistakable heart-shaped leaves, it is very likely to be 'protected' by the park maintenance team because of its sacred status in Buddhism (Interview, 2016c). Such perception and protection may even enhanced in Lumphini Park because the word 'Lumphini' is a place name in Nepal, where Prince Siddhartha Gautama was born (Harris et al. 2011, 14). Therefore, this name 'Lumphini,' full of Buddhist meaning and given by King Rama VI, tightly connects this public green space with most Thais' believes. This special cultural context might enhance Bodhi trees' importance and make them well-preserved in Lumphini Park.

The arrival and existence of Bodhi trees and a variety of sparse tree species, including some fruit trees, suggest the maintenance team's control intensity on tree introduction in Lumphini Park is not high. Besides, the park maintenance team is not the only agent of tree introduction in Lumphini Park. Instead, park visitors and animals also exert influence on forming the treescape in this public green space although their 'contributions' are at a much lesser extent[36]. The arborist's tolerant attitude on tree introduction, however, might facilitate to form a tree diversity higher than planned, which might be potential to provide more food and habitats choices to accommodate

---

everywhere.

[36] For a more in-depth discussion of the active role of non-human agents in creating places, please see Whatmore (2006) and Horton & Kraftl (2014).

more insects, birds, or even small mammals, contributing to higher biodiversity in Lumphini Park.

4.8 A Dynamic Treescape: Human-tree interactions

Except for tree composition, the treescape in Lumphini Park is also influenced by tree maintenance and landscape design, which are highly interconnected with each other. This section turns the foregoing focus on tree species to the whole park space, integrating all the above dimensions to present a dynamic treescape and human-tree interactions on the map, shown as Figure 28.

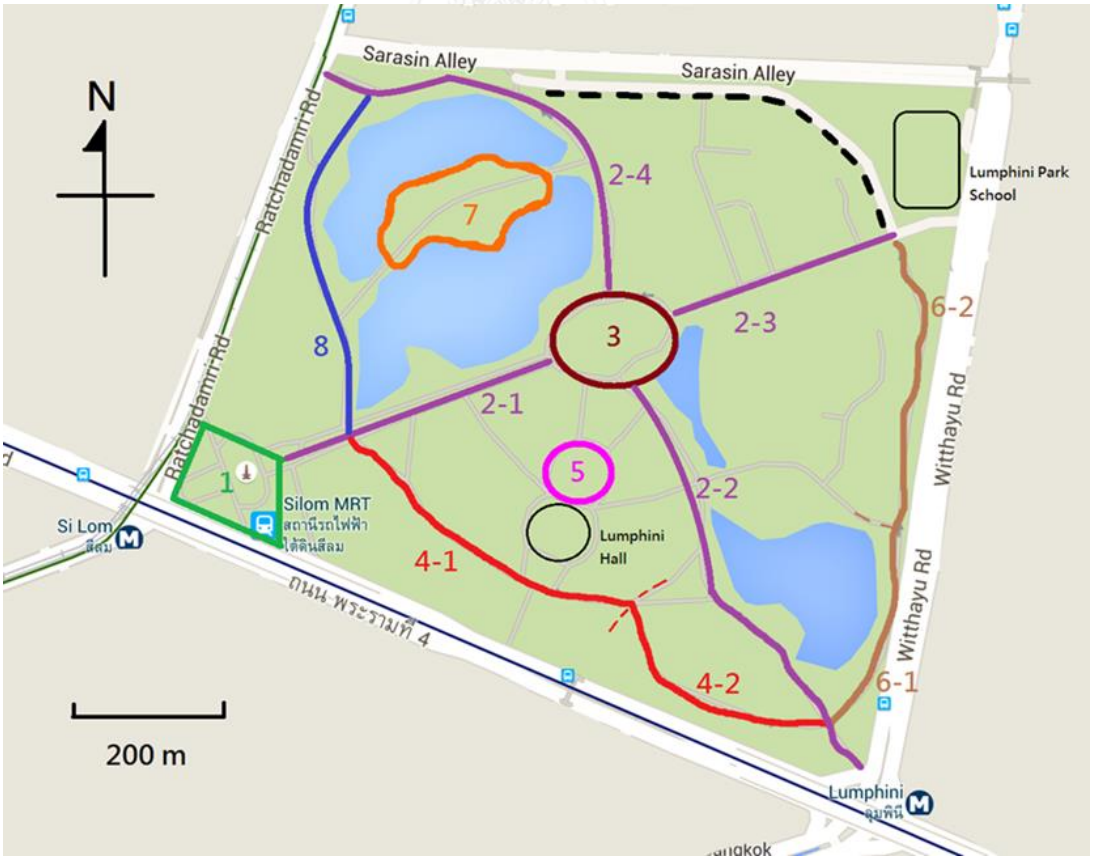

Figure 28. Path Map of Lumphini Park (Source: Google Maps, adapted by Author)

Approaching the frontal gate (code 1), one can start to see some dominant trees, including *Pterocarpus indicus, Alstonia scholaris, Dolichandrone serrulata*, *Mimusops elengi,* etc. An interesting phenomenon is that some people come to Lumphini Park to collect the white edible flowers of *Dolichandrone serrulata* (Khae Na, Figure 29 & 30), which open in the evening at high branches and drop down in early morning (Gardner et al. 2000, 268). This might be the only case that plants in Lumphini Park provide food for people. Although the taste of Khae Na flowers is quite bitter, some Thais from Northern and North-eastern provinces like to boil this flower and eat it with chili dipping.

Figure 29. Khae Na Flower

Figure 30. A Woman Collecting Khae Na Flower

After entering the frontal gate, visitors can see a huge Rain tree case wide shade on the beverage booth and information desk with its umbrella crown. Walking along

trail 4-1, one can find *Delonix regia* and *Pterocarpus indicus*, *Cerbera odollam* etc., on left hand side, while T*amarindus indica* (Tamarind, Makham) and *Roystonea regia* (Royal Palm, Pam Khuad) on right hand side. Looking towards Rama IV Road from Lumphini Hall, one can see a few tall *Terminalia catappa* (Hu Kwang) casting thick shades with their distinct multi-layered crowns. Behind these *Terminalia catappa* is a group of *Tabebuia rosea* (Chomphu phanthip), which carpet the lawn with trumpet-shaped pink flowers during April to May. If taking a rest at the beverage booths a few steps away, visitors can find a row of sturdy *Mimusops elengi* behind the booths.

A few steps ahead Lumphini Hall, a tall Bodhi tree stands solely on the grass among a group of *Pterocarpus indicus* and *Tabebuia rosea* (Figure 31). It is unknown who tied the colorful cloths on its trunk for what reason, but it would be too arbitrary if we reckon this scene as a Buddhist practice. Traditional Thais believe trees are inhabited by spirits or have their own souls (Welty 2004, 120) . Some Thais even believe the spirits can bring good or bad lucks. Such animistic belief of trees is presented with colorful cloths wrapped on big tree's trunks and is still widely seen across Thailand. However, if the cloths wrapped on a tree is yellow-orange color, this tree might be an 'ordained tree.' This tree ordination ritual, originating from northern Thailand in the 1980s and having spread widely, is a practice of Buddhist environmentalism (Darlington 2012). Both the animistic and Buddhist practices of wrapping cloths on tree trunks are aimed to remind people to keep harmony with trees.

Figure 31. A Tall Bodhi Tree Wrapped with Colourful Cloths

Entering trail 4-2, one can see the trees on left hand side are planted as two rows. On the outer side, *Peltophorum pterocarpum* (Yellow flame, Non Si) and *Pterocarpus indicus* (Angsana, Pratu) cast shades for joggers and bikers; on the inter side, untrained tall Orange Jessamine and banyan trees mark the lawn boundary. Many Non Si trees were pruned because their branches were too low and dangerous to visitors (Figure 32). To assure visitors' safety, pruning was conducted on branches lower than four meters high. Big shade trees along jogging routes are checked every year; branches to which park visitors might bump will be pruned (Interview, 2016b). On the right hand side are lots of majestic Rain tree before the wall dividing Lumphini Park and Rama IV Road.

Even Non Si trees intersperse over the whole park, one will find a large number of this tree on the lawns alongside route 6-1 to 6-2, with *Delonix regia* and *Samanea saman* dotted among them. Staking Non Si trees (Figure 33) is sometimes seen because its trunk is not strong enough before it reaches 6"- 8" in diameter (Veesommai et al 2013, 61).[37] On left hand side is the lake, where Coconuts are planted along the water edge. On the right hand side is the wall dividing Lumphini Park and Witthayu Road; *Elaeis guineensis* (Oil Palm) and *Wrightia religiosa* (Water Jasmine) are planted along the railings, which can soften the railings' rigid (and prison-like) feeling and reduce the traffic noise from outside.

[37] Young trees of *Alstonia scholaris* and *Cassia fistula* also require stick supporting.

Figure 32. Pruning on Non Si Tree

Figure 33. Staking Non Si Tree

Near the exit to Witthayu Road, the very tall *Roystonea regia* (Royal Palm, Pam Khuad) are planted in straight lines along the path (Figure 34). Standing at the middle of the path, visitors can see the Royal palms are aligned in both sides, forming a bilateral symmetry, which conveys a feeling of order and formality. Such landscape design might attribute to Lumphini Park School and Lumphini Park Office, the buildings at the end of trail 6-2. Compared with other recreational spaces and exercise facilities in Lumphini Park, these two buildings are less casual, and Royal palms are employed properly to shift the spatial feeling. However, the large and heavy frond leaves of Royal palm is dangerous to visitors when falling down, making it necessary to check and prune Royal palms regularly.

Figure 34. Royal Palms along Two Sides of the Trail to Shift Spatial Feeling

Behind the end of trail 6-2 are the parking lot of Lumphini Park School as well as the warehouse and work field of Lumphini Park Office (the section along the black dotted line in Figure 28), both of which are not for park visitors' recreation. Therefore, park visitors need to turn left to proceed the walking tour to trail 2-3. More Non Si, Pratu and Rain trees come to the visitors' sight, but a turn into the vast section among trail 2-3 and 6-2 will be more interesting for tree lovers. Away from the main jogging route, one can find abundant *Swietenia macrophylla* (Mahogany, Mahogany), *Acacia auriculaeformis* (Australian Wattle, Krathin Narong), *Caesalpinia coriaria* (Divi-divi, Tan Yong), *Adonidia merrillii* (Manila palm, Mak Kho Nuan), *Mimusops elengi* (Bullet wood, Phikun), Crescentia cujete (Calabash, Namtao Ton), Dipterocarpus alatus (No English

common name, Yang Na), *Plumeria spp.* (Frangipani, Lilawadhi/ Lanthom) and so on. Along the canal, *Casuarina junghuhniana* (No English common name, Son Pradiphat) and *Albizia lebbeck* (Lebbeck, Chamchuri Si Thong) mark the water edge. The farer away from the main trail, the fewer trees are planted. Except a few huge Rain trees, this open space is kept cleared for large activities.

Leaving the bridge at the end of trail 2-3, visitors will arrive at the palm garden. *Nypa fruticans* (Nipa palm, Chak, Figure 35), grouped in a swamp, and *Licuala spinosa* (Ka Pho, Mangrove fan palm) clustered nearby, are two rarely seen mangrove palms in Bangkok. A few steps away, stunning *Corypha lecomtei* (Talipot Palm, Lan, Figure 36) and *Borassus flabellifer* (Paimyra Palm, Tan) are the visual focus of palm garden for visitors coming from every direction. Considering their size, these impressive palms are very likely the earliest habitants of palm garden (Interview, 2016c). A Talipot palm blooms only one time over its life span, which usually happens after its age of 40. After the spectacular blooming for a few month, the whole palm will die (Amrarand and Warren 1996). The huge Talipot palms in palm garden are all over 50 or even 60 years old, so the days are counting.

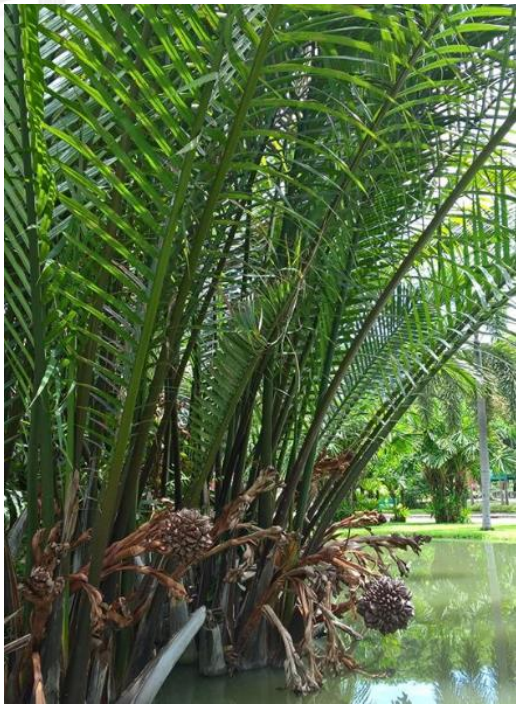

Figure 35. Nipa Palm

Figure 36. Talipot Palms, Visual Focus of Palm Garden

After seeing the highly ornamental palm garden, visitors can find *Lagerstroemia loudonii* (No English common name, Salao) and other dominant trees along trail 2-4 and 8. A flock of white herons often skim the water and perch on the Divi-divi trees (*Caesalpinia corlaria*, Figure 37) on Floating Island, the other side of the pond. Floating Island (code 7) is an interesting place for tree lovers. Except all the major shade trees and coconuts marking the water edge, some less common tree species can be found here, such as *Pithecellobium dulce* (No English common name, Makham Thep), *Streblus asper* (Siamese toothbrush tree, Khoi), *Thespesia populnea* (Rosewood of Seychelles, Pho Thale), *Pterospermum littorale* (No English common name, Cham Pathet), *Diospyros mollis* (Ebony, Ma Kleua), etc.

Figure 37. A Flock of White Herons Perching on Divi-divi Trees

Walking back to the starting point of trail 4-1, visitors can turn left to trail 2-1, where Tamarind trees, Rain trees and Non Si cast shades on left hand side. Along the water edge, some tall *Plumeria spp.* (Frangipani, Lilawadhi/ Lanthom) are planted at a triangle corner. They often carpet the grass with slim, red and fragrant petals. Crossing the trail, visitors may be awed by the golden shower of *Cassia fistula* if coming at the right time. Passing by the public library and the Sundial, one will reach the fountain and find it look like a pinkish-purple wreath during March to May because the fountain is encircled by *Lagerstroemia speciosa* (Queen's flower, Inthanin, Figure 38 & 39).

Figure 38. Flowers of Inthanin

Figure 39. Capsules of Inthanin

The lawn between trail 2-2 and 4-2 is where some very rare trees can be found. *Butea monosperma* (Flame of the forest, Thong Kuau), *Saraca indica* (Saraca, Sok Nam), and *Nauclea orientalis* (Cheesewood, Krathum Nam) all consist of not more than 5 trees in Lumphini Park. Tree enthusiasts will find much to be explored in this section.

4.9 Summary of the Chapter

Trees of Leguminosae family, excel in both shade-giving and ornamentation, are the most dominant group in Lumphini Park in terms of both tree species and number among the top 50 dominant tree species. Nitrogen-fixing mechanism might be an important reason to select these leguminous trees even people did not understand this mechanism in the past.

Abundant exotic tree species have been utilized to ornament Lumphini Park as none of these species is proved as invasive species. Carbon-absorbing capability is the authorities' latest policy on public trees, which does not affect the tree selection in current Lumphini Park. However, the carbon-absorbing capacity of Lumphini Park's trees points out Bangkok need more trees urgently.

The non-authority agents of tree introduction to Lumphini Park reveals the complexity of the landscape formation of public green spaces. The arborist's tolerant attitude might play an intriguing role to interact with the non-authority agents to make tree diversity higher than planned.

A few tree species are abundantly utilized to create or shift the spatial feelings in Lumphini Park. Tree maintenance is regularly conducted not only for landscaping but also for visitors' safety. In addition, the history of Lumphini Park and Thai culture exert unspoken yet important influence on the treescape of Lumphini Park.

CHAPTER 5

Conclusions

5.1 Summary of Research Findings

5.1.1 Lumphini Park

5.1.2 Policies on Bangkok's Public Green Spaces

5.1.3 Seeing Treescape in Lumphini Park

5.2 Reflections and Recommendations

5.2.1 Trees: Natural Medium of Environmental Policies

5.2.2 Staff, History, and Policies of Public Green Spaces

5.1 Summary of Research Findings

This research spans three major parts. In chapter 2, the author introduced the background of Lumphini Park by tracing its history, locating its geography, and depicting its landscape. In chapter 3, the author reviewed the Bangkok government's policies on public green spaces from several engaged units, including City Planning Department, Environment Department, Public Park Office, and Lumphini Park Office. In chapter 4, the author analyzed the trees in Lumphini Park, the principal element of this public green space, and discussed their functions and reasons behind their existence.

5.1.1 Lumphini Park

Lumphini Park, the most time-honored public park of Bangkok, has already survived ninety years since 1926. It has witnessed all the gradual and dramatic changes of this kingdom, from past Siam to present Thailand. The accessible location made this land chosen to become Lumphini Park, and still makes it highly reachable for Bangkok dwellers today. The design of Lumphini Park featured both early botanical garden and English natural landscape. Except for its robust recreational functions, various social, environmental, and political meanings are embedded through the long-running landscaping process and Bangkok residents' multiple activities. Such versatility makes Lumphini Park an iconic public place of Bangkok.

5.1.2 Policies on Bangkok's Public Green Spaces

The units of BMA engaged with issues of Bangkok's public green spaces include City Planning Department, Environment Department, Public Park Office, and offices of each public park. City Planning Department focuses on the expansion of Bangkok's green area, but it also stresses trees' capabilities of carbon absorption as an effective way to mitigate the impact of global warming on Bangkok. Therefore, the main concern of City Planning Department on trees is to preserve every tree in public spaces.

Environment Department strives for improving urban landscape and conserve greenery. To achieve these targets, Public Park Office, one affiliation of Environment Department, provides an operational manual as reference for arborists and gardeners. However, real practices vary in different places because of different spatial constraints and purposes, and accordingly have to be acquired from each public green space.

5.1.3 Seeing Treescape in Lumphini Park

In Lumphini Park, shade trees were the priorities from the 1920s to 1970s, corresponding to the demand of outdoor recreation. The importance of ornamental trees has kept growing since the 1970s. Some tree species' spatial functions gained a highlight from the 1990s to early 2000s. Such focus change reflects the park officials' shifting perceptions of the way trees integrated into the landscape of Lumphini Park.

At least 136 tree species from more than 6,100 trees are found in Lumphini Park. Trees of Leguminosae family, excel in both shade-giving and ornamentation, are the most dominant group in terms of both tree species number and individual number among the top 50 dominant tree species. Besides, nitrogen-fixing mechanism might be a vital reason for these majestic leguminous trees to be selected even people did not understand this complicated mechanism in the past. Abundant exotic tree species have been utilized to ornament Lumphini Park as none of these species is proved as invasive species. The roles of shade trees and ornamental trees are highly overlapping because of Lumphini Park's long history.

Carbon-absorbing capability is the authorities' latest policy on public trees, which does not affect the tree selection in current Lumphini Park. However, the carbon-absorbing capacity of Lumphini Park's trees warns Bangkok of its urgent need of more trees. The non-authority agents of tree introduction to Lumphini Park reveals the complexity of the landscape formation of public green spaces, while the tolerant attitude of the arborist and maintenance team play an intriguing role to interact with the non-authority agents. This interaction might help create high tree diversity in Lumphini Park, tacitly echoing the founder's initiative of 'turning Lumphini Park a botanical garden.' The history of Lumphini Park and Thai culture exert unspoken yet important influence on the treescape of Lumphini Park.

5.2. Reflections and Recommendations

This research started with two very simple questions 'What trees are there in Lumphini Park' and 'Why are these trees here.' Surprisingly, a series of policy evolution and human-tree interaction are found in this iconic and versatile public green space. However, more than ten millions are living in this megacity, and other thirty public parks and other types of public green spaces also provide their recreational, social, environmental and other functions for this city. Based on the findings of this research, the author has following reflections and recommendations.

5.2.1 Trees: Natural Medium for Environmental Policies

Bangkok government's latest policy on public trees is to emphasize the trees' capability of carbon absorption to mitigate the impact of global warming on Bangkok. As more scientific data of trees' carbon absorption have become available, the author recommends the authorities utilize the trees in public green spaces as an ideal and off-the-shelf medium to make Bangkok residents understand this policy. Although boards in parks to introduce tree species' scientific names, botanical taxonomy and morphological characteristics are common, these information are very difficult for non-academic visitors and can hardly make people feel linked with trees. However, as long as the authorities add some board-texts beside trees to explain trees' capability of carbon absorption and other functions for the city, park visitors can understand BMA's

environmental policies and trees' importance easily. In addition, this recommendation corresponds to BMA's policy of raising the public's environmental awareness so that more people living in this city can be engaged in improving the environment of Bangkok.

5.2.2 Staff, History, and Policies of Public Green Spaces

Even the landscape of a public green space looks more 'natural' than other cityscapes, it is still highly artificial, including its treescape. This research reflects the importance of the connection between a public park and people—not just park visitors but also the administrative staff, especially the founder, the landscape architect, and the arborist. Besides, tracing the often taken-for-granted history and maintenance practices can greatly help unveil the formation of a public green space.

For example, Wachirabenchatat Park, also known as Rotfai Park, meaning 'Train Park,' was a land owned by the State Railway of Thailand in northern Bangkok (Public Park Office 2013, 61). The spatial configuration and landscape features of Rotfai Park are obvious different from that of Lumphini Park. To exemplify, Rotfai Park's terrain is distinctly undulating, sparse trees are only planted along walking trails, and the tree performance is much less ornamental than that of Lumphini Park. Adjacent to Rotfai Park, Queen Sirikit Park presents an entirely different treescape—abundant plant species are cultivated in well-designed sections with clear board texts to explain their botanical taxonomy, ecology in the wild, and cultural meanings for Thai society. Queen

Sirikit Park, namely, resembles a botanical garden because it was created for the purposes of plant collection and conservation (Public Park Office 2013, 47). Different backgrounds and purposes of public green spaces, therefore, lead to different designs, and more research on the history, policy, arborists, and landscape architect is needed for better management of Bangkok's parks and other public green spaces.

The above reflections and recommendations for Bangkok's public green spaces are also appropriate for other cities in Thailand and Southeast Asia. However, some famous public green spaces in Southeast Asian cities, excluding Bangkok or other cities in Thailand, were founded by western colonizers. Singapore botanical Garden, built by the British governor and amateur botanist Thomas Stamford Raffles in 1822, is arguably the most well-known example for its inscription as a UNESCO Heritage Site in 2015 (Singapore Botanical Gardens 2015). Bogor Botanical Garden (Kebun Raya Bogor) in Java, Indonesia, was also initiated by Thomas Stamford Raffles during the British occupation in Java (1811-1816), and then expanded by the Dutch. By the end of 19th century, Bogor Botanical Garden has become one of the world's foremost tropical plant collections (Warren 1997, 41-42). In Vietnam, Bach Thao Park (Vườn bách thảo Hà Nội), established by French in 1890, has long been praised as 'lung of Hanoi' for more than 100 years even the current area is only one-third of the original park (Viet Nam Government Web Portal 2014).

These colonizer-built parks or botanical gardens were firstly built to collect commercial and exotic plants as well as offer the colonial elites recreational spaces (Warren 1997, 42). Today, their roles have transformed as places for plant conservation, and are accessible for everyone. The importance of studying the background of public green spaces are reconfirmed with these examples. However, little of their policy development as well as arborists' attitudes and real practices, as the case of Lumphini Park reveals, is known. Accordingly, more research in this human aspect is needed to enhance these public green spaces' functions for more cities in Southeast Asia.

A city's image is framed with its public spaces. Good public spaces embrace all walks of life to exchange their ideas, express artistic works, and participate in political affairs. The greenery, especially trees, turns public spaces as sanctuaries for urbanites to relax and refresh from everyday hustle-bustle and reconnect themselves with the nature in the city. Although this research is merely a small step for more understanding on our daily cityscape and better management on public green spaces, the information provided in this research is expected to be a stepping-stone to inspire more studies on public green spaces and urban trees.

REFERENCES

Amranand, Pimsai, and William Warren. 1996. *Gardening in Bangkok*. Bangkok: The Siam Society.

Askew, Marc. 1994. "Bangkok: transformation of the Thai city." In *Cultural Identity and Urban Change in Southeast Asia: Interpretative Essays*, edited by Marc Askew and William S. Logan, 85-115. Australia: Deakin University Press.

Bangkok Metropolitan Administration (BMA). 2007. BMA Action Plan on Global Warming Mitigation 2007-2012.

Bangkok Metropolitan Administration (BMA), and JICA. 2015. Executive Summary of the Bangkok Master Plan on Climate Change 2013-2023.

Bangkok Street Show. 2015. "About Bangkok Street Show." Accessed 7 Jul 2016. http://www.bangkokstreetshow.com/en2015/about.shtml.

Carpenter, Philip L., Theodore D. Walker, and Frederick O. Lanphear. 1975. *Plants in the Landscape*. USA: W. H. Freeman.

Center for International Affairs, Suranaree University of Technology. "ASEAN National Flowers." Accessed 30 Jun 2016. http://cia.sut.ac.th/ASEANInformation/AseanNationalFlowers.htm.

Changkwanyuen, Preecha. 2006. *The Souvenir of the Siamese Kingdom Exhibition at Lumbini Park B.E. 2468*. Bangkok: Chulalongkorn University Press.

Chen, Sophia S., and C. Y. Jim. 2003. "Quantitative Assessment of the Treescape and Cityscape of Nanjing, China." *Landscape Ecology* 18:395-412.

City Planning Department. 2013. The Bangkok Comprehensive Plan 2013 (B.E. 2556).

Bangkok: Bangkok Metropolitan Administration (BMA).

Coconuts Bangkok. 2013. "Makkasan Hope Throws Free Concert Before Sending Petition to SRT." Accessed 3 Jul 2016. http://bangkok.coconuts.co/2013/05/15/makkasan-hope-throws-free-concert-sending-petition-srt.

Coconuts Bangkok. 2016. "Goethe-Institut to host outdoor screening of German romance 'Wings of Desire'." Accessed 1 Jul 2016. http://bangkok.coconuts.co/2016/02/15/goethe-institut-host-outdoor-screening-german-romance-wings-desire.

Dahiya, Bharat. 2014. "Southeast Asia and Sustainable Urbanization." *Global Asia* 9 (3):84-91.

Darlington, Susan M. 2012. *The Ordination of a Tree: The Thai Buddhist Environmental Movement*. USA: State University of New York.

Detwyler, Thomas R. 1972. "Vegetation of the City." In *Urbanization and Environment: The Physical Geography of the City*, edited by Thomas R. Detwyler and Melvin G. Marcus. United States of America: Duxbury Press.

Economist Intelligence Unit (EIU). 2011. The Asian Green City Index: Assessing the environmental performance of Asia's major cities. Munich: Siemens AG.

Economist Intelligence Unit (EIU). 2012. The Green City Index: A summary of the Green City Index research series. Munich: Siemens AG.

Evert, Ray F., and Susan E. Eichhorn. 2013. *Raven Biology of Plants*. New York: W. H. Freeman.

Fahn, James David. 2004. *A Land on Fire: The Environmental Consequences of the*

Southeast Asian Boom. Thailand: Silkworm Books.

Forestry Research Center. 2004. *Trees in Bangkok: Rommaneenart Park* (ต้นไม้ในกรุงเทพมหานคร สวนรมณีนาถ). Bangkok: Kasetsart University.

Forman, Richard T. T. 2014. *Urban Ecology: Science of Cities*. UK: Cambridge University Press.

Fuller, Richard A., and Katherine N. Irvine. 2010. "Interactions between People and Nature in Urban Environments." In *Urban Ecology*, edited by Kevin J. Gaston. New York: Cambridge University Press.

Halkic, Sabrina. 2014. "The Impact of Urban Governance Structures and Practices on Public Green Space Provision: Exploring Barriers to Urban Sustainability from an Urban Governance Perspective through the Lens of the Public Green Space Provision in Bangkok." Master Thesis, University of Amsterdam.

Halprin, Lawrence. 1972. *Cities*. Cambridge MA: MIT Press.

Harris, Ian, Helen Varley, Peter Connolly, and Stefania Travagnin, eds. 2011. *The Complete Illustrated Encyclopedia of Buddhism*. London: Hermes House.

Harris, Richard W., James R. Clark, and Nelda P. Matheny. 2004. *Arboriculture: Integrated Management of Landscape Trees, Shrubs, and Vines*. United States of America: Pearson Education.

Jensen, Michael. 1999. *Trees Commonly Cultivated in Southeast Asia: An Illustrated Field Guide*. Bangkok: FAO Regional Office for Asia and the Pacific.

Lowenthal, David, and Hugh C. Prince. 1964. "The English Landscape." *Geographical Review* 54 (3):309-346.

Lumphini Park Office. 2010. รายการต้นไม้ในสวนลุมพินี (*List of Trees in Lumpini Park*).

Merriam-Webster. 2016. "treescape." Accessed 30 Jun 2016. http://www.merriam-webster.com/dictionary/treescape.

Moore, Charles W., William J. Mitchell, and William Jr. Turnbull. 1988. *The Poetics of Gardens*. Cambridge MA: The MIT Press.

Palm Pedia. 2016. "Nypa fruticans." Last Modified 8 Jun 2016 Accessed 30 Jun 2016. http://www.palmpedia.net/wiki/Nypa_fruticans.

Pauleit, Stephan, and Friedrich Duhme. 2000. "Assessing the Environmental Performance of Land Cover Types for Urban Planning." *Landscape and Urban Planning* 52 (1):1-20.

Postgate, John. 1998. *Nitrogen Fixation*. United Kingdom: Cambridge University Press.

Poungsomlee, Anuchat, and Helen Ross. 1992. *Impacts of Modernisation and Urbanization in Bangkok: An Integrative Ecological And Biosocial Study*. Nakhon Pathom: Mahidon University.

Public Park Office. 2004. คู่มือการปฏิบัติงานปลูกและดูแลรักษาต้นไม้ (*An Operational Manual for Tree Cultivation and Maintenance*). Bangkok: Bangkok Metropolitan Administration (BMA).

Public Park Office. 2013. *Paradise Parks of Bangkok* (สวนสวรรค์ของชาวกรุง). Bangkok: Bangkok Metropolitan Administration (BMA).

Sadler, Jon, Adam Bates, James Hale, and Philip James. 2010. "Bringing cities alive: the importance of urban green spaces for people and biodiversity." In *Urban Ecology*, edited by Kevin J. Gaston. New York: Cambridge University Press.

Seidenfaden, Erik. 1984. *Guide to Bangkok with Notes on Siam*. Malaysia: Oxford University Press.

Siamstamp. 2010. "Euah Suntornsanan's Centenary Commemorative Stamp." Accessed 2 July 2016. http://www.siamstamp.com/catalogue/index.php?id=893.

Simpson, Michael G. 2006. *Plant Systematics*. Canada: Elsevier Academic Press.

Singapore Botanical Gardens. 2015. "The History of Singapore Botanical Gardens." Accessed 11 Jul 2016. https://www.sbg.org.sg/index.php?option=com_k2&view=item&layout=item&id=15&Itemid=9.

Sinlapavan, Budsarakham. 2014. "BMA concerned about state of Lumpini Park's ecosystem since occupation by antigovt PDRC protesters." *The Nation*. Accessed 3 July 2016. http://www.nationmultimedia.com/national/BMA-concerned-about-state-of-Lumpini-Parks-ecosyst-30232710.html.

Smithies, Michael. 1986. *Old Bangkok*. Singapore: Oxford University Press.

Thadaniti, Suwattana. 1995. New Directions in Thailand's Urban Environment Policy. In *Towards a Sustainable Urban Environment in Southeast Asia*, edited by Azman Awang, Mahbob Salim and John F. Halldane. Johor: Institute Sultan Iskandar of Urban Habitat and Highrise.

Thaiutsa, Bunvong, Ladawan Puangchit, Roger Kjelgren, and Wanchai Arunpraparut. 2008. "Urban Green Space, Street Tree and Heritage Large Tree Assessment in Bangkok, Thailand." *Urban Forestry & Urban Greening* 7:219-229.

UN-HABITAT. 2012. State of the World's Cities 2012/2013: Prosperity of Cities. United Nations (UN).

UN-HABITAT. 2015. "HABITAT III Issue Papers 11: Public Space." United Nations (UN), Last Modified 31 May 2015 Accessed 30 Jun 2016. http://unhabitat.org/wp-content/uploads/2015/04/Habitat-III-Issue-Paper-11_Public-Space-2.0.compressed.pdf.

Unakul, Montira Horayangura. 2013. "Reconnecting Bangkok's Heritage Landscape: Urban Waterways and the Modern City." In *Protecting Siam's Heritage*, edited by Chris Baker. Bangkok: The Siam Society & Silkworm Books.

United Nations. 2015. "Sustainable Development Goals." Accessed 27 Jun 2016. http://www.un.org/sustainabledevelopment/cities/.

Uy, Pham Duc, and Nobukazu Nakagoshi. 2008. "Application of Land Suitability Analysis and Landscape Ecology to Urban Greenspace Planning in Hanoi, Vietnam." *Urban Forestry & Urban Greening* 7:25-40.

Veesommai, Uamporn, Sasiya Siriphanich, Alisara Menakanit, and Nath Pichakum. 2013. พรรณไม้ในงานภูมิสถาปัตยกรรม 1 (*Plants for Landscape Architectural Uses in Thailand 1*). Bangkok: H. N. Group.

Viet Nam Government Web Portal. 2014. "Bach Thao park." Accessed 11 Jul 2016. http://hanoi1000yrs.vietnam.gov.vn/Home/Bach-Thao-park/201412/7747.vgp.

Waites, Dan. 2014. *Cultural Shock! Bangkok: A Survival Guide to Customs and Etiquette*. Singapore: Marshall Cavendish Editions.

Warren, William. 1997. *The Tropical Garden: Gardens in Thailand Southeast Asia and the Pacific*. Singapore: Asia Books.

Warren, William. 2002. *Bangkok*. Singapore: Talisman.

Welty, Roger. 2004. *Thai Culture and Society*. Thailand: Asia Books.

Wyatt, David K. 2003. *Thailand: A Short History*. 2nd ed. Bangkok: Silkworm Books.

Ziv, Daniel, and Guy Sharett. 2005. *Bangkok Inside Out*. Thailand: Equinox Publishing.

APPENDIX

Appendix 1. The 50 Most Dominant Tree Species in Lumphini Park

Scientific name	Number	Number percentage (%)	Accumulated number	Accumulated percentage (%)
Pterocarpus indicus	946	15.50	946	15.5
Wrightia religiosa	758	12.42	1,704	27.9
Murraya paniculata	427	6.99	2,131	34.9
Peltophorum pterocarpum	310	5.08	2,441	40.0
Samanea saman	220	3.60	2,661	43.6
Delonix regia	189	3.10	2,850	46.7
Phoenix roebelenii	184	3.01	3,034	49.7
Roystonea regia	182	2.98	3,216	52.7
Polyalthia longifolia	151	2.47	3,367	55.2
Casuarina junghuhniana	146	2.39	3,513	57.5
Tamarindus indica	137	2.24	3,650	59.8
Tabebuia rosea	134	2.19	3,784	62.0
Cocos nucifera	129	2.11	3,913	64.1
Ficus benjamina	121	1.98	4,034	66.1
Plumeria spp.	117	1.92	4,151	68.0
Acacia auriculaeformis	114	1.87	4,265	69.9
Swietenia macrophylla	111	1.82	4,376	71.7
Millingtonia hortensis	109	1.79	4,485	73.5
Alstonia scholaris	105	1.72	4,590	75.2

Scientific name	Number	Number percentage (%)	Accumulated number	Accumulated percentage (%)
Adonidia merrillii	92	1.51	4,682	76.7
Cassia fistula	89	1.46	4,771	78.1
Mimusops elengi	86	1.41	4,857	79.6
Lagerstroemia loudonii	83	1.36	4,940	80.9
Callistemon viminalis	80	1.31	5,020	82.2
Elaeis guineensis	51	0.84	5,071	83.1
Dipterocarpus alatus	47	0.77	5,118	83.8
Syzygium cumini	44	0.72	5,162	84.6
Pithecellobium dulce	44	0.72	5,206	85.3
Mangifera indica	42	0.69	5,248	86.0
Lagerstroemia floribunda	40	0.66	5,288	86.6
Lagerstroemia speciosa	35	0.57	5,323	87.2
Ficus religiosa	33	0.54	5,356	87.7
Albizia lebbeck	32	0.52	5,388	88.3
Ptychosperma macarthurii	31	0.51	5,419	88.8
Caesalpinia coriaria	29	0.48	5,448	89.2
Wodyetia bifurcata	28	0.46	5,476	89.7
Streblus asper	25	0.41	5,501	90.1
Dolichandrone serrulata	20	0.33	5,521	90.4
Nypa fruticans	20	0.33	5,541	90.8
Livistona chinensis	20	0.33	5,561	91.1
Gliricidia sepium	19	0.31	5,580	91.4

Scientific name	Number	Number percentage (%)	Accumulated number	Accumulated percentage (%)
Phyllocarpus septrentrionalis	19	0.31	5,599	91.7
Jacaranda filicifolia	19	0.31	5,618	92.0
Cerbera odollam	18	0.29	5,636	92.3
Phyllanthus acidus	17	0.28	5,653	92.6
Senna siamea	16	0.26	5,669	92.9
Amherstia nobilis	16	0.26	5,685	93.1
Terminalia catappa	16	0.26	5,701	93.4
Crescentia cujete	15	0.25	5,716	93.6
Azadirachta indica	15	0.25	5,731	93.9

Appendix 2. Geographical Origins of the 50 Dominant Tree Species

Thai name	Scientific name	Origin place	Common English name
ประดู่	*Pterocarpus indicus*	Borneo, Philippines, Malay Archipelago, Myanmar	Padauk, Angsana, Andaman Redwood, Burmese Redwood
โมก	*Wrightia religiosa*	Tropical Asia	
ต้นแก้ว	*Murraya paniculata*	(Widely found)	Andaman Satinwood, Chinese Box tree, Orange Jessamine
นนทรี	*Peltophorum pterocarpum*	Southeast Asia, North Australia	Copper Pod, Yellow Flame, Yellow Poinciana
จามจุรี	*Samanea saman*	Central and South America	Rain tree, Monkey Pod, East Indian walnut
หางนกยูงฝรั่ง	*Delonix regia*	Madagascar	Flame tree, Flamboyant, Royal Poinciana, Peacock flower
สิบสองปันนา	*Phoenix roebelenii*	Yunnan, Northern Laos and Vietnam	Pigmy Date Palm
ปาลม์ขวด	*Roystonea regia*	Central America, Caribbean	Royal Palm
อโศก	*Polyalthia longifolia*	India, Sri Lanka	Cemetery tree

Thai name	Scientific name	Origin place	Common English name
สนประดิพัทธิ์	*Casuarina junghuhniana*	Indonesia	
มะขาม	*Tamarindus indica*	Tropical Africa	Tamarind
ชมพูพันทิพย์	*Tabebuia rosea*	Central America	Pink Tecoma, New World trumpet tree
มะพร้าว	*Cocos nucifera*	Southeast Asia	Coconut Palm
ไทรใหญ่	*Ficus benjamina*	South Asia (India)	Weeping Fig
ลีลาวดี	*Plumeria*	Central America	Temple tree, Pagoda tree
กระถินณรงค์	*Acacia auriculaeformis*	Australia, Papua New Guinea	Wattle
มะฮอกกานี ใบใหญ่	*Swietenia macrophylla King*	Central America	Bay Wood, Honduras Mahogany
ปีบ	*Millingtonia hortensis*	(Widely found)	Indian Cork tree
พญาสัตบรรณ	*Alstonia scholaris*	India, Southeast Asia	White Cheesewood, Devil tree
หมากนวล	*Adonidia merrillii*	The Philippines	Manila Palm, Christmas Palm
ราชพฤกษ์ คูณ	*Cassia fistula*	India	Indian Laburnum, Pudding Pipe tree
พิกุล	*Mimusops elengi*	(Widely found)	Bullet Wood, Tanjong tree
เสลา ใบใหญ่	*Lagerstroemia loudonii*	Southeast Asia (Thailand)	
แปรงล้างขวด	*Callistemon viminalis*	Australia	Weeping Bottle Brush

Thai name	Scientific name	Origin place	Common English name
ปาล์มน้ำมัน	*Elaeis guineensis*	Western Africa	Oil Palm
ยางนา	*Dipterocarpus alatus*	Southeast Asia	
หว้า	*Syzygium cumini*	South Asia, Myanmar, Thailand	Jambolan, Black plum
มะขามเทศ	*Pithecellobium dulce*	Central and South America	(Makhamthet)
มะม่วง	*Mangifera indica*	South Asia, Myanmar	Mango
ตะแบกนา	*Lagerstroemia floribunda*	Southeast Asia (Myanmar, Thailand, Malaysia)	Queen's flower
อินทนิลน้ำ	*Lagerstroemia speciosa*	Southeast Asia (Thailand)	Queen's flower, Queen's Crape Myrtle, Pride of India
โพธิ์	*Ficus religiosa*	South Asia	Bodhi tree
จามจุรีสีทอง	*Albizia lebbeck*	Southeast Asia, India	Lebbeck tree
หมากเขียว	*Ptychosperma macarthurii*	Oceania, Pacific islands	MacArthur Palm
ตันหยง	*Caesalpinia coriaria*	Tropical America	Divi-divi tree
ฟอกเทล	*Wodyetia bifurcata*	Australia	Foxtail Palm
ข่อย	*Streblus asper*	Tropical Asia	(Siamese) Toothbrush tree

Thai name	Scientific name	Origin place	Common English name
แคนา	*Dolichandrone serrulata*	Northern and Central Thailand, Laos, Myanmar	
จาก	*Nypa fruticans*	Indian ocean and Pacific islands	Nipa Palm
ปาล์มจีน	*Livistona chinensis*	Ryukyu, Taiwan, China	Chinese Fan Palm, Fountain Palm
แคฝรั่ง	*Gliricidia sepium*	Central America	Gliricidia, Mata Raton (Spanish)
ประดู่แดง	*Phyllocarpus septentrionalis*	Central America	Fire of Pakistan, Monkey flower tree
ศรีตรัง	*Jacaranda filicifolia*	Central and South America	Jacaranda
ตีนเป็ดน้ำ	*Cerbera odollam*	South Asia	Pong Pong
มะยม	*Phyllanthus acidus*	(Uncertain, Madagascar maybe)	Gooseberry tree
ขี้เหล็ก	*Senna siamea*	Southeast Asia	Cassod tree
โสกระย้า	*Amherstia nobilis*	Myanmar	Pride of Burma
หูกวาง	*Terminalia catappa*	Asia	Indian Almond, Singapore Almond
น้ำเต้าอินเดีย	*Crescentia cujete*	Central and South America	Calabash tree
สะเดา	*Azadirachta indica*	South Asia	Siamese Neem tree

VITA

Chieh-Ming Lai was born in Kaohsiung City, Taiwan, 1985. He received B.Sc in Geography from National Taiwan University. He has fallen in love with Southeast Asia since his first backpacking trip in 2010. He is glad he combined urban geography, current major Southeast Asian Studies, and personal interest in plants in this Master thesis, and completed it in Bangkok, one of his beloved city.