

論文の内容の要旨

論文題目 A Study of Planning and Its Transition of Urban Street Trees in Taiwan
(台湾における街路樹計画の歴史的変遷と現状及び今後の展開に関する研究)

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1. Introduction

This study focuses on the urban street trees in Taiwan while considering modern-day street trees planning so as to reveal a comprehensive understanding of the variation. As the mitigation of heat-island effect becomes important, the street trees are included among the important factors that contribute to the relief of this phenomenon. In Taiwan, where the tropical landscape enriches the environment, green spaces on roads are being reduced due to the development of cities. As a result, with the large-scale urban construction that is being undertaken for the expansion of cities, the protection of urban street trees that mitigate the urban warming effect is highly recommended. Studies concerning street trees in Taiwan were mostly analyzed from the perspective of urban planning rather than from the planting of street trees itself. Recently, with the rising interest in the street trees of Taiwan, the insufficient knowledge and skill in the cultivation of street trees has been noted. Also, with the deep influence of the Japanese colonial period, it is a matter of common observation that this influence still has great impact on various aspects of Taiwanese cities. For this reason, this study will take into account the variation of historic street tree planning from the Japanese colonial period to modern-day plans, so as to obtain a comprehensive understanding of the planning of Taiwanese street trees and to propose recommendations for future plans.

The purpose of this study is to obtain a comprehensive understanding of the historic variation of street-trees planning, and related concepts, in Taiwanese cities. Also, considering their historic background, an analysis on the transpiration change and the healthiness of street trees will be conducted to propose a suitable design for street trees in Taiwan. Further, the selection of street-trees species will be suggested via database.

The following is an overview of the content of each of the subsequent chapters of this work:

2. Characteristics of adoption of foreign culture on street trees in Taiwan cities: Roads developed in ancient China were designed for a military defensive purpose, which provided a possibility for street-trees planning. In China, the street-trees planting concepts started in ancient times, since all imperial capitals throughout history have been in north China. As a result, in tree-species selection, the northern climate and environment were considered. The Chinese Scholar tree and willows were typical examples of the species that were widely planted for five thousand years. Together with the individual significance of style in different times, street-trees planting and the species of trees are explained based on the cultural background.

With a demonstration of the historic change of street-trees planting in China, the history of street-trees planting in China is further reviewed and organized. The Qing government did not pay much attention to the road system in Taiwan, and thus, all roads and street trees were practically underdeveloped. The “Roads” at that time that meet present-day standards were mainly streets that only provided one-way or two-way paths for bullock carts or sedan chairs. After Japanese colonization, the Japanese, for military purposes, mobilized the troops to build roads in order to amplify their control over Taiwan.

In the mid-era of Japanese colonization, with an expanded population, urban planning for the purpose of decentralizing the population to the suburban areas was therefore introduced. In this plan, in order to establish shelters for disaster and also to mitigate the summer heat, parks were equally distributed in the city of Taipei and the park system that connects the parks was thus introduced. Also, this plan incorporated urban-disaster-prevention concepts from Japan. During this trend of design, in the early colonial era, the street trees served an aesthetic function and, in the latter colonial era, the focus of planning was shifted to a disaster-prevention function. After World War II, the nationalist government brought in the boulevard design for the purpose of beautification of the city and the mitigation of warming effect. By this historic transition, Taiwanese street-trees planning affairs were developed with multiple purposes and function being taken into consideration. After the war, the nationalist government not only inherited the plans for street trees made by the Japanese colonial government, but also advanced the plans for beautification.

3. Regulation of and changes in street tree planning Taiwan: The main characteristics of Taiwanese street-trees planning are that during Japanese rule, it started from nursing seedlings and took into consideration foreign planting styles and techniques. Those foreign styles introduced into Taiwan influenced profoundly street-trees planning affairs. Despite Taiwan’s colony status, street-trees planning were enthusiastically promoted and the three-lined roads in Taipei even earned a reputation as “the Paris of the East.” After the war, as the nationalist government of the Republic of China took over the management of Japanese nursery gardens of street-trees seedlings, the forestry bureau was put in charge of street-trees planting affairs and it also supervised local officials in carrying out the planting of street trees. Hence, with this clear division of work responsibility, street-trees planning affairs after the war, thus, saw good progress and even matched some goals for a greener environment.

4. Design and concepts of street trees (Taipei and Tainan city): Overall, progress regarding urban street trees during the period of Japanese occupation faced many obstacles with respect to the urban planning progress. Firstly, during the colonization, the design and outcome of the urban plan was inefficient and incomplete. Budget limitations after the establishment of the nationalist government also hindered development. Meanwhile, under authoritarian rule, a lack of information about the environment and inadequate knowledge about management in the urban street-trees planning program have thwarted urban street-trees management and development. Planning management was the main problem that had to be overcome if people wanted to develop an urban main-street-trees career. The urban street-trees planning

evolution has influenced the boulevard system in Taipei city. The landscape has been gradually changed into an ecological urban greening system. The urban street-trees planning management was about not only the plantation management, the theory and knowledge application were also necessary.

5. The Present Situation of the Street Tree in Taiwan Cities: Since the end of the war, urbanization has limited open spaces in cities. In order to solve this problem, the government promoted the development of an urban greening program. This chapter focuses on the management and maintenance of the urban street-trees in Taiwan. Through the research on tree-vigor condition, the concept of urban street-trees planning has been promoted. Recently, because of the growing importance of issues, such as global warming and the heat island effect, the maintenance of trees and the design of planting on green land are becoming more and more significant. This study focuses on variation in sap flow in, and transpiration of, street trees along Tainan Parkway. In order to understand the relationship between the allocation of plantings and the physiological functions of trees, the influence of cover conditions and meteorological conditions related to insolation were taken into consideration. All above, the chapter specifically focuses on the tree survey of urban street-trees in Taipei and Tainan, and it is proven that there have been failures of tree allocation and selection of plants in many aspects. For instance, center islands are planted with *Terminalia boivinii* Tul and *Alstonia scholaris*, both of which have a larger tree-crown. In addition, due to improper pruning techniques, the trunks are seriously rotted. Besides, due to a smaller planting hole, banyans planted on the pavements have problems with unhealthy root systems. As for the injury to trees caused by parking on the pavement, this practice further leads serious decaying of the bark and the trunks. Recently, each municipal government has promoted the urban street trees as having ecological functions and processes of planting based on the idea of biodiversity. However, urban street trees program in Taipei, the planning of which was designed during the Japanese occupation, has simplex tree species, compared to that of Tainan, which was planned after the 1990s and has a variety of tree species. As a result, the number of tree species and the number of street trees in Tainan is more than that of Taipei; and in Tainan most trees are exotic species.

Besides this, the Granier method experiment showed the influence of the differences of transpiration amount in each vegetation pattern of street trees on the surrounding microclimate. In the multiple-layer style, rising ground temperatures and suppressed transpiration rate form a wind tunnel between trees. Further, the reduction of watering rate can be advantageous to the management of trees, and the multiple-layer style created an overall aesthetic beauty and serves to create rich biodiversity in the environment. Based on the scientific research data, future street-trees planning can thus be proposed.

6. Conclusion

Through the review of historic variation of urban boulevard planning, we are deeply inspired by the following aspects:

First, the beginning of the street trees planting started from the military paths when the colonial government

first settled in Taiwan. After replacing military administration with civil administration, the street trees planning affairs was incorporated into the Temporal Civic Engineering Division, which was in charge of the road related affairs. Yasusada Tashiro as a civil engineer in the Governor-General of Taiwan proposed a plan regarding the establishment of street trees with a particular focus on Taiwan urban street trees. During the city reform, Tashiro gave a detailed description on the species of trees and their planting methodology in his famous work—Essentials of Street Trees in Taiwan and Tree Planting. According to this book, the street trees planting project was established while considering Taiwan's unique climate and culture. This work proposed detailed ideas regarding the street trees planting affairs, including the invitation of experts specialized in landscaping, installation spots for planting street trees, selection of tree species and tree protection. Based on the plan by Tashiro, the first western style pattern was introduced into Taiwan's urban planning. The street trees planting plan established in Japanese Rule serves as an important part of the development of the current planting pattern in Taiwan.

Second, through the survey of street trees vitality in Taipei and Tainan city, in total there are 10218 trees in our tree vigor prediction. The overall predictions of the trees will be included 10 items as follows: Tree Virgo, Tree form, Branch extension, Top-dieback, Foliage density, Wrap around, Wood-Decay. As a result, the most important problem that urban street trees in Taiwan are facing is the insufficient vegetation design and poor pruning techniques make the quality of landscape degenerate, thereby causing problems with cityscapes.

Third, according to the experimental results the planting design of street trees on broad roads has much to do with the transpiration effect. Furthermore, a green belt can also provide shade that counteracts temperature increases around roads. Therefore, planting conditions could infer a relationship between the amount of transpiration and variations in ground vegetation.

Proposal for urban street tree design: In order to make recommendation for street-trees planning for Taiwan, the characteristics of each street-tree species introduced will be categorized in detail with a picture reference for the street trees. With the hope of providing a correct and suitable reference for future street-trees species selection, this study will propose this picture reference after a careful review.

Selecting three typical patterns of urban street trees in Taiwan, a design proposal will thus be generated. Based on the historic conditions reviewed in this study, the characteristics of street trees introduced and their vegetation allocation, their cultural significance, and their adaptation to the local environment will be taken into consideration in the design of the most suitable street-trees planning for modern Taiwanese cities in graphic analysis.