IDENTIFICATION OF SUITABLE TREES FOR URBAN PARKS AND ROADSIDE IN JOHOR BAHRU AND PASIR GUDANG

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Abstract – *Trees can be harmful to both properties and human lives. Trees planted at roadsides with low endurance rate and general unhealthiness increase the risk of tree fracture and fall which are dangerous to motorists and pedestrians. Meanwhile, overhanging limbs can obscure streetlights, signs and traffic signals and affect road users' vision. Therefore, identification of suitable trees for urban parks and roadsides according to their maintenance level is important. Trees field data from two local authorities in the Iskandar Malaysia region were obtained to achieve the objective of this study. Questionnaire survey was conducted to gain detailed information about the maintenance level of existing trees and their suitable locations from professionals. A simple scoring method was applied; the scores were ranged between 0 and 300 with the highest value indicating less maintenance is required by the trees concerned. Results showed the Mimosup elengi tree species obtained the highest score (300) followed by Cinnamomum verum (297) and Hopea odorata (283). In contrast, Khaya senegalensis with the score of 212 was found to require high levels of maintenance. The results also indicated that maintenance level and suitable location for planting varied depending on the features of the tree species. Strongest trees or limbs tend to cause less problem thereby requiring less maintenance. Trees found in nature (forests) are more resilient and tolerant to a wide range of conditions and locations. To sum up, this study can help provide insights to decision makers in crafting better management plans for urban forest in the future.*

1.0 INTRODUCTION

Trees serve a **number of benefits**, mainly for environment, community and economy. Every tree species are vary in their ability to provide these different benefits.

1. Air quality enhancement
2. Carbon storage and sequestration
3. Aesthetics
4. Climate modification (shade cooling/wind shelter
5. Moderate storm water runoff
6. Wildlife habitat
7. Privacy screening
8. Food production

However, trees can also be **harmful to both property and human lives**. Trees planted at roadsides with low endurance rate and general unhealthiness increase the risk of tree fracture and fall which is dangerous to motorists and pedestrians. Meanwhile, overhanging limbs can obscure streetlights, signs and traffic signals and affect road users' vision in vicinity.

Literature review

ISA, 2011
Urban tree fracture and fall directly **creating a hazard** for motorists and pedestrians as well as **causing damage** to property.

Churkina et al., 2015
Lead to **other problems** including shorter-survival and production of secondary air pollutants.

ISA, 2011
Poorly maintained trees can contribute to **the cumulative maintenance burden** and be a significant liability.

Haaften et., 2015
Maintenance can be **costly, time consuming** and involve lots of works.

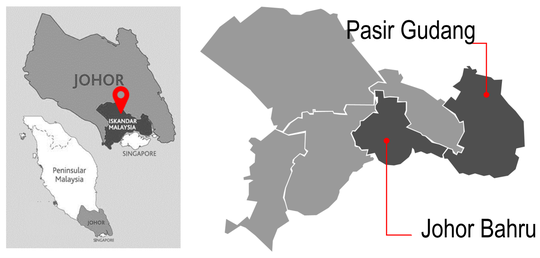
Unfortunately, any official documents or guidelines informing about tree maintenance is still **unavailable** in Malaysia.

Selection of site or location to plant trees also should be appropriate according to tree species (City of London Urban Forestry Strategy, 2014). This helps to assure trees become healthy, resilient and survive for long-term, thereby reducing maintenance burden.

Thereby, identification of suitable trees for urban parks and roadside according to their maintenance level is important.

2.0 STUDY AREA

The study area comprises of 2 districts, which are Johor Bahru and Pasir Gudang.



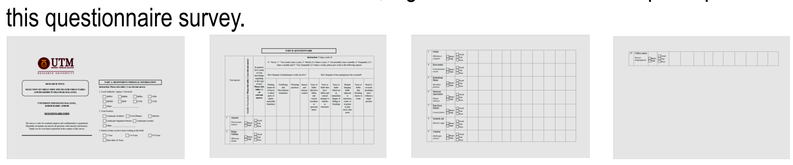
Johor Bahru		Pasir Gudang
Johor Bahru City Council (MBJB)	Administration	Pasir Gudang Municipal Council (MPPG)
454,310 (2005 census)	Population	152,564 (2005 census)
51,820 hectares	Area	33,937 hectares
Residential, commercial, industry	Land use	Residential, commercial, industry, mangrove and agriculture (oil palm and rubber)
Johor Bahru City Centre, Plentong and Tebrau.	Sub-district	Sungai Tiram and part of Plentong
Commercial and leisure values to locals/non-locals	Economy	Industry (Johor port and Tanjung Langsat Port)
Temperature : 21°C - 32°C /Annual rainfall : 2,000 mm - 2,500 mm	Climate	Temperature : 21°C - 32°C / Annual rainfall : 2,000 mm - 2,500 mm

3.0 METHOD

3.1 Data collection

Questionnaire survey

A number of respondents or experts including arborist, landscape architects, landscape lecturers, landscape organiser/plant nursery and technical landscape assistant from various local authorities, agencies and universities participated in this questionnaire survey.



The **questionnaire** is designed for respondents to give appropriate scale for maintenance levels for each type of tree currently found in the cities.

0	1	2	3	4	5
Never	Very rarely (once a year)	Rarely (2-3 times a year)	Occasionally (once a month)	Frequently (2-3 times a month)	Very frequently (2-3 times a week)

Meanwhile, according to the Tree Maintenance Guidelines by the Department of Recreation and Parks, City of Los Angeles (2003), maintenance works are categorised into 2 types; regular work and tree emergencies.

Regular work	Tree emergencies
Pruning or removal of leaves or dead parts of plants especially branches	Trees or limbs that have fallen and caused accidents or personal injury
Fertilizing and mycorrhizae treatments	Trees or limbs that have fallen and caused damage to vehicles or structures
Watering practices	Trees or limbs which are in immediate danger of falling or breaking
Insects and disease control	Broken hanging limbs adjacent to structures, roads, or in picnic or play areas
	Trees or limbs that blocking streets or roads
	Sudden dead or severely declining trees

3.2 Data analysis

Simple weighted scoring method

Scale given	0	1	2	3	4	5
Score allocated	5	4	3	2	1	0

⇨ Single score: The highest value means less maintenance is required by trees

4.0 RESULT

Table 1 : Total score of maintenance for every trees species and comparison between existing location and suitable location for tree planting

No.	Family	Specific name	Local name	Total score	Current location	Suitable/Proposed location
1.	*Sapotaceae*	*Mimosup elengi*	*Bunga tanjung*	300	Park	Park/roadside
2.	*Lauraceae*	*Cinnamomum verum*	*Kayu manis*	297	Park/roadside	Park/roadside
3.	*Dipterocarpaceae*	*Hopea odorata*	*Merawan siput jantan*	283	Park/roadside	Park/roadside
4.	*Myrtaceae*	*Melaleuca cajaputi*	*Gelam*	277	Park/roadside	Park/roadside
5.	*Fabaceae*	*Dalbergia oliverii*	*Tamalan*	273	Park	Park
6.	*Fabaceae*	*Spondias pinnata*	*Mempari*	269	Park	Park
7.	*Fabaceae*	*Cassia fistula*	*Rajah kayu*	268	Roadside	Park/roadside
8.	*Fabaceae*	*Delonix regia*	*Semarak api*	265	Roadside	Park
9.	*Fabaceae*	*Saraca thaipingensis*	*Yellow saraca*	262	Park	Park
10.	*Meliaceae*	*Khaya grandifolia*	*African mahogany*	262	Park/roadside	Park
11.	*Gentianaceae*	*Fagraea fragrans*	*Tembusu*	262	Park/roadside	Park
12.	*Myrtaceae*	*Syzgium polyanthum*	*Salam*	259	Park/roadside	Roadside
13.	*Apocynaceae*	*Dyera costulata*	*Jelutong*	257	Park	Park
14.	*Annonaceae*	*Polyalthia longifolia*	*Asoka*	256	Roadside	Roadside
15.	*Fabaceae*	*Acacia auriculiformis*	*Aksia*	253	Roadside	Park
16.	*Fabaceae*	*Peltrophorum pterocorpum*	*Yellow flame*	252	Park/roadside	Park/roadside
17	*Fabaceae*	*Samanea saman*	*Hujan-hujan*	251	Park/roadside	Park/roadside
18.	*Apocynaceae*	*Alstonia angustifolia*	*Pulai*	249	Park/roadside	Park
19.	*Meliaceae*	*Sweitenia macrophylla*	*Mahogany*	247	Roadside	Park
20.	Fabaceae	*Pterocarpus indicus*	*Angsana*	245	Park/roadside	Park
21.	Moraceae	*Artocarpus elasticus*	*Terap*	243	Park	Park
22	Lecythidaceae	*Couroupita guianensis*	*Cannon ball*	241	Roadside	Park
23	*Bignoniaceae*	*Tabebuia rosea*	*Tecoma*	241	Roadside	Park/roadside
24	Pinaceae	Pinus	*Pokok pine*	240	Park	Roadside
25	Meliaceae	Azadirachta excelsa	*Sentang*	239	Park	Park
26	Apocynaceae	Alstonia angustiloba	*P.Pulai*	238	Park/roadside	Park
27	Clusiaceae	Garcinia nitida	*Manggis hutan*	236	Park	Park
28	Myrtaceae	Syzygium grande	*Jambu laut*	236	Park/roadside	Park/roadside
29	Dipterocarpaceae	Shorea leprosula	*Meranti tembaga*	235	Park	Park
30	Casuarinaceae	Casuarina nobilis	*Borneo Rhu*	233	Park	Park
31	*Meliaceae*	*Khaya senegalensis*	*Khaya*	212	Roadside	Park

4.1. Tree maintenance level

The results demonstrate that urban trees such as *Mimosup elengi* from the family *Sapotaceae* obtained highest score of 300 (Table 1). High score indicates less maintenance is required by trees species, thus *Mimosup elengi* is considered as urban tree species requiring least maintenance followed by *Cinnamomum verum* (297) and *Hopea odorata* (283). *Saraca thaipingensis*, *Khaya grandifolia* and *Fagraea fragrans* recorded the same total score of 262. *Khaya senegalensis* scored lowest values (212), indicating it requirement for high maintenance.

4.2. Suitable location for tree planting

Table 1 also shows the existing tree species in parks and roadsides in Johor Bahru and Pasir Gudang, their current location, and proposed new location. Proposed locations are obtained from survey conducted in this study. One section in questionnaire asked respondent to choose suitable location for planting each tree species. Analysis of the questionnaire shows that only 16 tree species are located at right or suitable locations. The rest of the tree species are found to be located at inappropriate locations and suggested to be planted at new location; 10 trees for park, 3 for both park and roadside and 2 for roadside only.

5.0 DISCUSSION

The results indicate that;

5.1 Tree maintenance level

i. Maintenance level is **varied depending on the features** of the tree species.
ii. **Strongest trees or limbs** tend to cause less problem thereby require less maintenance.
iii. Tree species found in the **nature (forest)** or wild including Mimosup elengi, Cinnamomum verum and Hopea odorata are usually **more resilient and can tolerate a wide range of conditions** including poor soils and climate (World agroforestry.org, 2016) - require less regular maintenance including watering and pest control compared to cultivated tree species in order to survive and grow.

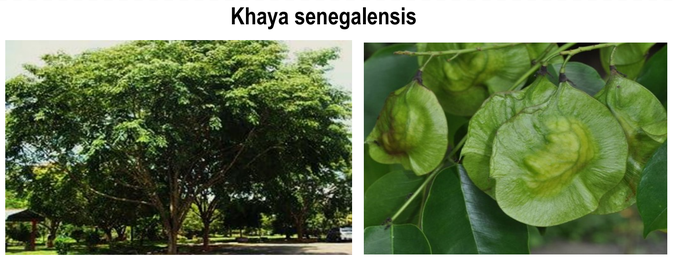
5.2 Suitable location for tree planting

i. The **feature and maintenance of trees affect location** for tree planting
ii. The feature of tree species such as deciduous, large spreading crown, broad and big leaf, shallow surface roots cause problem to roadsides including vehicle, pavement, signage, utilities line as well as building.
iii. Several tree species are pressing to be planted at different areas, mostly in parks due to sufficient space. **Trees planted in parks require less maintenance and have more space.**
iv. Some landscape architects declared most of the fallen trees at roadsides in Johor Bahru are caused by narrow space planting especially median strip - town planner **often overlooked** this space problem.

Mimusop elengi

- Requires less maintenance
- One of the popular wayside trees- attractive shape and fragrant flowers
- Wood is reputed to be the strongest of Indian timbers

Khaya senegalensis



- Requires high maintenance
- Foreign species to Malaysia
- Deciduous tree that sheds leaves- clog drains and triggers flash flood
- Beautiful flower-attract birds, however creates noise and nuisance (their droppings on cars parked below the trees)

6.0 CONCLUSION

This study was conducted to list types of urban tree species suitable for urban parks and roadsides based on their maintenance in Johor Bahru and Pasir Gudang. This study can also help to reduce the risk of tree fracture and fallings, cutting maintenance burden for local authority and prolonging the life of trees to get maximum benefits by providing insights of maintenance level and suitable location for tree planting for decision makers. They can understand the actual and potential role of urban trees and make better management plans for urban forest in future. This conclusion was based on the analysis of limited number of trees (31) from 2 local authorities; MBJB and MPPG .

REFERENCES

Ayram, C. C. A., Mendoza, M. E., Etter, A., & Salicrup, D. R. P. (2016). Habitat connectivity in biodiversity conservation: A review of recent studies and applications. Progress in Physical Geography, 40 (1), 7-37.

Chin, W. Y., (2003). Tropical Trees and Shrubs: A Seleection for Urban Plantings, Sun Tree Publishing Limited, USA.

Churkina, G., Grote, R., Butler, T. M., & Lawrence, M. (2015). Natural selection? Picking the right trees for urban greening. Environmental Science & Policy, 47, 12–17. https://doi.org/10.1016/j.envsci.2014.10.014 [Accessed December 1, 2015].

City of London Urban Forest Strategy (2014). Enhancing the Forest City. Retrieved from City of London official website:https://www.london.ca/residents/Environment/TreesForests/Documents/London%20Urban%20Forestry%20Strategy%20Final.pdf

Conway, T. M., & Vander Vecht, J. (2015). Growing a diverse urban forest: Species selection decisions by practitioners planting and supplying trees. Landscape and Urban Planning, 138, 1–10. https://doi.org/10.1016/j.landurbplan.2015.01.007 [Accessed December 1, 2015].

Corners, E. J. H., 1997. Wayside Trees of Malaya: in two volumes. Fourth edition, Malayan Nature Society, Kuala Lumpur. Volume 1: 1-476 pp, plates 1-38; volume 2: 477-861 pp., plates 139-236.

Garis Panduan Landskap Negara Edisi 2 (2008). Jabatan Landskap Negara Kementerian Perumahan Dan Kerajaan Tempatan Malaysia

Gogate, N. G., Kalbar, P. P., & Raval, P. M., (2017). Assessment of stormwater management options in urban contexts using Multiple Attribute Decision Making. Journal of Cleaner Production, 142, 2046-2059.

Ho, C.S., Chau L.W., Teh B.T., Matsuoka Y., Gomi K., Rohayu A., Nadzirah J., Nur Syazwani S., Muhammad Akmal Hakim H. and Lv Y. (eds.) (2015) Low Carbon Society Action Plan for Johor Bahru 2025: Vibrant World Class Cosmopolis of the South. Johor Bahru: UTM-Low Carbon Asia Research Centre.

Ho, C.S., Chau L.W., Teh B.T., Matsuoka Y., Gomi K., Rohayu A., Nadzirah J., Nur Syazwani S., Muhammad Akmal Hakim H. and Lv Y. (Eds.) 2015, Low Carbon Society Action Plan for Pasir Gudang 2025: Green & Clean Industrial City. Johor Bahru: UTM-Low Carbon Asia Research Centre.

Karuppannam, S., Baharuddin, Z. M., Sivam, A., & Daniels, C. B. (2014). Urban Green Space and Urban Biodiversity: Urban Green Space and Urban Biodiversity: Kuala Lumpur, Malaysia, (April 2016). https://doi.org/10.5539/jsd.v7n1p1

Kelaine, E., Vargas, E., gregory McPherson, J. R., Simpson, P. J., Peper, S. L., Gardner, & Xiao, Q. (2006). Temperate Interior West Community Tree Guide - Benefits, Costs and Strategic Planting. United States Department of Agriculture

City of Los Angeles, Department of Recreation and Parks (2003). Tree Maintenance Guidelines, 1–15

Samuel A. Cushman, Brad McRae, Frank Adrianensen, Paul Beier, Mark Shirley and Kathy Zeller, (2013). Biological corridors and connectivity, Key Topics in Conservation Biology 2, First Edition. Edited by David W. Macdonald and Katherine J. Willis. John Wiley & Sons, Ltd. Published by John Wiley & Sons, Ltd.

Saraswat, C., Kumar, P., & Mishra, B. K., (2016). Assessment of storm water runoff management practices and governance under climate change and urbanisation: An analysis of Bangkok, Hanoi and Tokyo. Environmental Science & Policy, 64, 101-117

Sinar Harian, 2014. Gerai, Motosikal Dihempap Pokok, Sinar Harian e- newspaper 7th November 2014.

World Agroforestry Centre (2016). Retrieved June 8th, 2016 from http://www.worldagroforestry.org.