

10. 結論

隨著城市繼續快速都市化和密集化，街道樹木成為社區願景的焦點：增強生態效益和與自然聯繫。香港擁有世上人煙最為稠密的城市環境⁶⁴，要面對逐步發展、變幻莫測的氣候，還有年老的街道樹木種植的資產，又要促進街道樹木種植，特別具挑戰性。的而且確，氣候變化已經為香港帶來可見的影響－酷熱天氣的頻率和雨量⁶⁵增加，有些數十年前種下的年老樹木，將可能無法適應這些變化。因都市熱效應和氣候變化而引致的氣溫上升，在其他經濟體⁶⁶已證實了會對某些樹種造成威脅。香港需要做好準備，確保在面對這些變化時，城市林木能夠更具抗禦力，適應環境和可持續發展。

研究建議以「植樹有方，因地制宜」為原則，來挑選和栽種路旁樹木，締造城市林木，以應付因未來變化帶來的挑戰。為進一步證明這一寶貴資產的未來發展，本港應盡可能考慮採用 10-20-30 的植物多樣性法則，廣泛用於栽種新樹和更替樹木的規劃。

藉着增加有「互補植物群落組合」支持的樹種多樣性，研究的地面成果有助降低與上游生命周期規劃不足和街道樹木資產設計不足的相關風險。很多國際都市在城市種植方面均採用植物多樣性，還有新興的園境設計重新構想了傳統的街道環境。研究還建議制定和發展全區城市林木區域或總綱計劃，以更好闡明園境設計主題，而更重要的是，可以提供整體園境策略，凝聚香港。創新設計大有可為，因為複雜設計需要創新方案。研究為香港園境師提供了獨特的機會，為稠密的帶形園境創作嶄新的街景設計。

政府應尋求園境師、合資格樹藝師、園藝家和其他相關從業員的專業意見，就街道種類和設計，進一步研究樹種的合適程度，在更替年老樹資產時尤應注意。正式的街景建築設計和園境設計，建議在所有工作階段都尋求園境師的意見。這包括但不限於下列各項：在設計階段之初分配足夠的種植空間；在設計階段設計合適的「互補植物群落組合」和輔助園林建築要素，如：樹坑詳情、結構土壤或模組、排水系統和灌溉要求，以及合適的栽種方法標準等；在落實階段挑選優質苗木和監督種植工作，以確保工藝合適等。

為了鞏固穩健的生命周期資料庫，研究強烈建議開發全面的城市林木資料庫，記錄樹木的栽種日期、健康狀況、形態、大小和都市有效預期壽命等，以確保可就不同街道類型的樹種表現進行持續評估和檢視；亦建議就樹木和互補植物群落組品種（特別是原生品種）的繁殖、採購、生長特性和表現進行進一步研究。隨着名單內的樹種的應用和試種，將累積更多經驗，有助更新和豐富指引內的品種名單，以持續改善香港的城市林木情況。想要減少下游樹木管理和保養風險，則需要支持使種植狀況更現代化，包括樹坑詳情、城市土壤的規格選項、排水系統和種植方法。在市區沿行車道和行人道栽種樹木，能有效將園境連接。然而，其他未有載入研究的合適城市林木栽種點亦同樣重要，例如：人工斜坡、公園、政府用地內的綠化空間等。除了路旁種植，研究亦鼓勵於項目計劃階段探索更多種植機會，以連接周邊地區組成備有生態走廊的「藍綠系統」網絡，符合《香港 2030+》的設想，大大增加園境的好處。

我們每日都會在街道行走，而且街道環境佔了室外環境的 75%，其適應能力、舒適和安全程度均非常影響我們對於優質城市的看法，讓社區留下和享用。能應對變化和有利植物生

⁶⁴ Wendell Cox 顧問服務公司（2018 年 4 月）。Demographia World Urban Areas 14th Annual Edition: 201804。檢索自 www.demographia.com/db-worldua.pdf。

⁶⁵ 香港天文台。（沒有標註日期）香港氣候變化。極端天氣事件。2018 年 1 月 18 日檢索自 https://www.hko.gov.hk/climate_change/obs_hk_extreme_weather_e.htm。

⁶⁶ Kendal, Dave 及其他（2017 年 11 月）Risks to Australia's Urban Forest from Climate Change and Urban Heat。墨爾本大學國家環境科學課程純淨空氣及都市園境中心。檢索自 www.nesurban.edu.au/publications-resources/research-reports/CAULRR07_RisksAustralianUrbanForest_Oct2017.pdf。

長的城市林木是一項重要的投資，其好處和重要性應受到更多人認同。隨着更多人使用此研究和指引，願這項城市林木投資能守護珍貴的樹木資產，繼續傳承後代。

參考書目

- Agriculture, Fisheries and Conservation Department, HKSAR Government. (2016). Hong Kong Herbarium. Retrieved from <http://www.herbarium.gov.hk/home.aspx>
- Ann, P. J., Chang, T. T., & Ko, W. H. (2002). *Phellinus noxius* brown root rot of fruit and ornamental trees in Taiwan. *Plant Disease*, 86(8), 820-826.
- Architectural Services Department, HKSAR Government. (2017). General specification for building.
- Architectural Services Department, HKSAR Government. (2007). Guide on Green Roof Application in Hong Kong - Final Report. Retrieved from https://www.archsd.gov.hk/media/11630/green_roof_study_final_report.pdf
- Berghöfer, A., Mader, A., Patrickson, S., Calcaterra, E., Smit, J., Blignaut, J., ... & van Zyl, H. (2011). TEEB Manual for cities: Ecosystem services in urban management. *The Economics of Ecosystems and Biodiversity*, Suiza.
- Bolund, Per, and Sven Hunhammar. (1999). Ecosystem Services in Urban Areas. *Ecological Economics* 29.2: 293-301.
- Byrne, L. B., & Grewal, P. (2008). Introduction to ecological landscaping: a holistic description and framework to guide the study and management of urban landscape parcels. *Urban Horticulture*. 2016, 10.1201/b21180-3, pp. 3-32
- Chan, Y. L. (2015). The History of Landscape Profession of Hong Kong: A Collection of Interviews 1978-2015. The Hong Kong Institute of Landscape Architects, 2015.
- Cheung, M. S., Chan, H. S., & Tong, H. W. Rainfall Projection for Southern China in the 21st Century using CMIP5 Models.
- City of Melbourne. (2011). Urban Forest Diversity Guidelines. Retrieved from <https://www.melbourne.vic.gov.au/SiteCollectionDocuments/urban-forest-diversity-guidelines.pdf>
- Planning Development, HKSAR Government (n.d). The Diverse Landscapes of Hong Kong. Hong Kong Landscape. Retrieved Apr, 2016 from http://www.pland.gov.hk/pland_en/p_study/prog_s/landscape/e_executive_summary_hp/e_ch2.htm
- Development Bureau, HKSAR Government. (2012). Development Bureau Technical Circular (Works) No. 2/2012 Allocation of Space for Quality Greening on Roads.
- Development Bureau & Planning Department, HKSAR Government. (2016) Hong Kong 2030+ Towards a Planning Vision and Strategy Transcending 2030.
- Department of Conservation and Natural Resources, Pennsylvania Government. (2018). Plant Communities. Retrieved from www.dcnr.pa.gov/Conservation/WildPlants/PlantCommunities/Pages/default.aspx.
- Drainage Services Department, HKSAR Government. (2018) Stormwater Drainage Manual, Planning Design and Management, 5th Ed.
- Dumroese RK, Wenny DL, Barkley YC. (2001). Plant your seedlings right. Retrieved from <http://www.lri-lb.org/sites/default/files/Plant%20Your%20Seedling%20Right.pdf>
- Fern, K. (1996).
- Environment Bureau, HKSAR Government. (2016). Hong Kong Biodiversity and Strategy Action Plan 2016-2021.
- Environment Bureau, HKSAR Government. (2017). Hong Kong's Climate Action Plan 2030+.

- Environment Bureau, HKSAR Government. (2015). Hong Kong Climate Change Report 2015. Environment Bureau:2015. Retrieved Apr. 2016 from <http://www.enb.gov.hk/sites/default/files/pdf/ClimateChangeEng.pdf>
- Fern, K. (2014). Useful Tropical Plants. Retrieved from <http://tropical.theferns.info/>
- Fini, Alessio, and Cecilia Brunetti (2017). Irrigation of Urban Trees. Routledge Handbook of Urban Forestry, Taylor and Francis Group, pp. 419–432.
- Food and Agriculture Organization of the United Nations. (n.d.). “Planning a Tree Nursery”. Retrieved from <http://www.fao.org/docrep/006/AD228E/AD228E03.htm>
- Gilman, E. (2013). 680 Tree Fact Sheets: Trees by Scientific Name. Retrieved from http://hort.ufl.edu/database/trees/trees_scientific.shtml
- Gilman, E. F. (2011). An illustrated guide to pruning. Cengage Learning.
- Gilman, E. F., Masters, F., & Grabosky, J. C. (2008). Pruning affects tree movement in hurricane force wind. *Arboriculture and Urban Forestry*, 34(1), 20.
- Gillman, J. & Rosen, C. (2017). Tree Fertilization: A guide for fertilizing new and established trees in the landscape, University of Minnesota Extension. Retrieved from <https://www.extension.umn.edu/garden/yard-garden/trees-shrubs/tree-fertilization-guide/>
- Gómez-Baggethun, Erik, Åsa Gren, David N. Barton, Johannes Langemeyer, Timon McPhearson, Patrick O’Farrell, Erik Andersson, Zoé Hamstead, and Peleg Kremer. (2013). Urban Ecosystem Services. *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities*:175-251.
- Greening, Landscape and Tree Management Section, HKSAR Government. (2012). List of Potential Suitable Plant Species for Skyrise Greening in Hong Kong, Greening and Landscape Office; Greening, Landscape and Tree Management Section; Development Bureau. HKSAR Government.
- Greening, Landscape and Tree Management Section, HKSAR Government. (2015). Guidelines for Tree Risk Assessment and Management Arrangement. Hong Kong: Greening, Landscape and Tree Management Section, Development Bureau.
- Greening, Landscape and Tree Management Section, HKSAR Government. (2013). Skyrise Greenery - Pictorial Guide to Plant Resources for Skyrise Greenery in Hong Kong. Retrieved from http://www.greening.gov.hk/en/green_technologies/skyrise_guide.html
- Greening, Landscape and Tree Management Section, HKSAR Government. (2016). Handbook on Tree Management. Hong Kong: Greening, Landscape and Tree Management Section, Development Bureau.
- Greening, Landscape and Tree Management Section, HKSAR Government. (2015). Guidelines for Tree Risk Assessment and Management Arrangement. Hong Kong: Greening, Landscape and Tree Management Section, Development Bureau.
- Greening, Landscape and Tree Management Section, HKSAR Government. (2016). Knowledge Sharing (Special Topics). Hong Kong: Greening, Landscape and Tree Management Section, Development Bureau. Retrieved on Feb 2017 from www.greening.gov.hk/en/knowledge_database/special_topics.html
- Godfrey, Nick, and Roger Savage. (2012). Future Proofing Cities: Risks and Opportunities for Inclusive Urban Growth in Developing Countries. Epsom, Surrey, U.K: Atkins.
- Harris, J. R., Day, S. D., & Kane, B. (2008). Nitrogen fertilization during planting and establishment of the urban forest: a collection of five studies. *Urban Forestry & Urban Greening*, 7(3), 195-206.

- Hartman, J. R., Pirone, T. P., & Sall, M. A. (2000). *Pirone's tree maintenance*. Oxford University Press.
- Highways Department, HKSAR Government. (2006). *Public Lighting Design Manual*. Hong Kong: Highways Dept., Govt. of the H.K.S.A.R. Print.
- Highways Department, HKSAR Government. (2013). *Structures Design Manual for Highways and Railways*. Hong Kong: Highways Department. Print.
- Hitchmough, J., & Fieldhouse, K. (Eds.). (2008). *Plant user handbook: a guide to effective specifying*. John Wiley & Sons.
- Hong Kong Observatory. (n.d.). *Climate Change in Hong Kong: Extreme weather events*. Retrieved 21 Mar 2016 from http://www.hko.gov.hk/climate_change/obs_hk_extreme_weather_e.htm
- Hong Kong Observatory. (n.d.). *Climate Change in Hong Kong. What Is UV Radiation*. Retrieved 18 Jan. 2018 from www.hko.gov.hk/climate_change/obs_hk_temp_e.htm.
- Huang, Q., Swatantran, A., Dubayah, R., & Goetz, S. J. (2014). The influence of vegetation height heterogeneity on forest and woodland bird species richness across the United States. *PLoS One*, 9(8), e103236.
- H.Y. Mok, M.C. Wu and C.Y. Cheng. (2010). *Spatial Variation of the Characteristics of Urban Heat Island Effect in Hong Kong*. Hong Kong: Hong Kong Observatory, 2010.
- IH, A. E. S., Koriesh, E. M., Moghazy, E. I., & Hefni, M. M. (2013). Comparison Between Two Methods of Fertilizer Applications and Fertilizer Rates for Young Urban Tree *Ficus retusa*, Linn. Implanted in Sandy Soil. *Hortscience Journal of Suez Canal University, Hort. Dep. Suez Canal University*, 2013.
- Jeff, C. & Carl, R. (2000). *Tree fertilization: A guide for fertilizing new and established trees in the landscape*. United States: University of Minnesota Extension. Retrieved from <https://www.extension.umn.edu/garden/yard-garden/trees-shrubs/tree-fertilization-guide>
- Jim, C. Y. (2008). Multipurpose census methodology to assess urban forest structure in Hong Kong. *Arboriculture and Urban Forestry*, 34(6), 366-378.
- Jim, C. Y. (2000). *Trees in Major Urban Parks in Hong Kong - Volume 1-4*. Hong Kong: Leisure and Culture Services Department.
- Jin, S., Guo, J., Wheeler, S., Kan, L., & Che, S. (2014). Evaluation of impacts of trees on PM_{2.5} dispersion in urban streets. *Atmospheric Environment*, 99, 277-287.
- Kendal, Dave, et al. (Nov. 2017) *Risks to Australia's Urban Forest from Climate Change and Urban Heat*. Clear Air and Urban Landscapes Hub, National Environmental Science Programme, The University of Melbourne. Retrieved from www.nesurban.edu.au/publications-resources/research-reports/CAULRR07_RisksAustralianUrbanForest_Oct2017.pdf.
- Koeser, A. K., Gilman, E. F., Paz, M., & Harchick, C. (2014). Factors influencing urban tree planting program growth and survival in Florida, United States. *Urban forestry & urban greening*, 13(4), 655-661.
- Krishnan, P. R., Kalia, R. K., Tewari, J. C., & Roy, M. M. (2014). *Plant Nursery Management: Principles and Practices*.
- Kurn, D. M., Bretz, S. E., Huang, B., & Akbari, H. (1994). *The potential for reducing urban air temperatures and energy consumption through vegetative cooling* (No. LBL--35320). Lawrence Berkeley Lab., CA (United States).

- Magurran, Anne E. (2011). *Measuring biological diversity*. Blackwell.
- Mbora, Anne, et al. (2013). "Good Nursery Practices: A Simple Guide". Establishing a tree nursery | TECA, World Agroforestry Center. Retrieved from teca.fao.org/read/7808.
- Morel, J. L., Chenu, C., & Lorenz, K. (2015). Ecosystem services provided by soils of urban, industrial, traffic, mining, and military areas (SUITMAs). *Journal of Soils and Sediments*, 15(8), 1659-1666.
- Penn State College of Agricultural Sciences. (2017). *Herbicides (Introduction to Weeds and Herbicides)*. Retrieved from <http://extension.psu.edu/pests/weeds/control/introduction-to-weeds-and-herbicides/herbicides>
- Planning Development, HKSAR Government. (n.d). *Analysis of the Hong Kong Landscape*. Hong Kong Landscape. Retrieved Apr, 2016 from http://www.pland.gov.hk/pland_en/p_study/prog_s/landscape/tech_report/ch5.htm
- Planning Department, HKSAR Government. (2015). *Hong Kong Planning Standards and Guidelines*. Hong Kong: Planning Department, 2015. Print.
- Plants for a future. (2012). Retrieved from <http://www.pfaf.org/user/Default.aspx>
- Roddick, C., & Hanson, B. (2007). *The Tree Care Primer* (No. 186). Brooklyn Botanic Garden.
- Roloff, A. (Ed.). (2016). *Urban tree management: for the sustainable development of green cities*. John Wiley & Sons.
- Salmond, J. A., Tadaki, M., Vardoulakis, S., Arbuthnott, K., Coutts, A., Demuzere, M., ... & McInnes, R. N. (2016). Health and climate related ecosystem services provided by street trees in the urban environment. *Environmental Health*, 15(1), S36.
- Santamour, F.S., Jr. (1990). Trees for urban planting: diversity uniformity, and common sense. *Proceedings of the 7th Conference of the Metropolitan Tree Improvement Alliance*, pp.57 – 65.
- Starbuck, C. J. (1999). *Fertilizing shade trees*.
- Tallis, M., Taylor, G., Sinnett, D., & Freer-Smith, P. (2011, September 01). Estimating the removal of atmospheric particulate pollution by the urban tree canopy of London, under current and future environments. Retrieved April 25, 2018, from <https://www.sciencedirect.com/science/article/pii/S0169204611002349>
- Transport Department. (2001). *Transport Planning and Design Manual*. Hong Kong: Transport Department. Print.
- Transport Department, HKSAR Government. (2013). *Transport Planning & Design Manual*.
- Tree Care Industry Association, inc., & American National Standards Institute. (2004). *American national standard for tree care operations: Tree, shrub and other woody plant maintenance--standard practices (fertilization)*. Manchester, N.H: Tree Care Industry Association, Inc., Secretariat.
- "Tree Planting and Maintenance in Hong Kong", Standing Interdepartmental Landscape Technical Group, Hong Kong Government, Editor: Richard Webb, Design: Government Information Services, Print: The Government Printer, 1991 Edition
- Urban Forest Ecosystems Institute at California Polytechnic State University. (1995). *SelecTree: A Tree Selection Guide*. Retrieved from <https://selecttree.calpoly.edu/>
- Vince, S. W., Duryea, M. L., Macie, E. A., & Hermansen, A. (Eds.). (2004). *Forests at the wildland-urban interface: conservation and management*. CRC Press.

- Vogt, J., Hauer, R. J., & Fischer, B. C. (2015). The costs of maintaining and not maintaining the urban forest: a review of the urban forestry and arboriculture literature. *Arboriculture & Urban Forestry*, 41(6), 293-323.
- Wendell Cox Consultancy (Apr. 2018). *Demographia World Urban Areas 14th Annual Edition: 201804*. Retrieved from www.demographia.com/db-worldua.pdf.
- William, E. (2005). *Pruning Landscape Trees*. Retrieved from <http://extension.psu.edu/natural-resources/forests/urban-community/publications/pruning-landscape-trees>
- Williams, K. (2014). *A Dozen "Must Have" Plants for Backyard Habitat*. New Jersey Audubon. Retrieved from www.njaudubon.org/SectionBackyardHabitat/ADozenMustHavePlantsforBackyardHabitat.aspx
- Wu, Z., Raven, P., & Hong, D. (2013). *Flora of China*. Beijing: Science Press Ltd.
- Zavestoski, Stephen and Julian Agyeman. (2015). *Incomplete Streets: Processes, Practices and Possibilities*. s.l.: Routledge.
- Zhang, H., & Jim, C. Y. (2014). Contributions of landscape trees in public housing estates to urban biodiversity in Hong Kong. *Urban forestry & urban greening*, 13(2), 272-284.
- 蔡福貴 (1995). *臺灣自然觀察圖鑑 3 - 木本觀賞植物(一)*. 臺北: 渡假出版社
- 蔡福貴 (1997). *臺灣自然觀察圖鑑 8 - 木本觀賞植物(二)*. 臺北: 渡假出版社
- 薛聰賢 (2001). *景觀植物實用圖鑑第 7 輯 - 精選木本花卉 196 種*. 北京: 北京科學技術出版社
- 薛聰賢 (2004). *景觀植物實用圖鑑第 14 輯 - 補遺. 新品種 178 種*. 北京: 北京科學技術出版社
- 香港園藝學會、中國科學院華南植物園 (2006). *香港古樹名木*. 香港: 天地圖書.
- 廣州市園林科學研究所 (2008). *華南園林植物 (喬木卷)*. 貴陽: 貴州科技出版社
- 呂福原、歐辰雄 (1997). *臺灣樹木解說*. 臺北: 行政院農業委員會
- 周琳潔 (2010). *華南鄉土樹種與應用*. 北京: 中國建築工業出版