Attachment – Cooling and Greening Melbourne

Purpose

Appendix A provides background on the Cooling and Greening Melbourne work and speaks to the study's use of the Urban Monitor approach and the results of that study. In summary, the appendix discusses the likely reasons for the difference in the 2018 measurement of canopy between the Cooling and Greening Melbourne approach and Council's approach.

It is important to note that the intermediate datasets on which the Cooling and Greening Melbourne reporting is based have not been published and are not available for benchmarking. Due to the difference in source data and methodologies between Council's adopted approach and the Cooling and Greening Melbourne work outlined below, it is not possible for Council to report on canopy cover change as a logical progression of that study.

Cooling and Greening Melbourne

In 2019, as part of Plan Melbourne 2017-2050, the Victorian Government's long-term planning strategy, the Cooling and Greening Melbourne work reported on canopy change across Metropolitan Melbourne between 2014 and 2018.

Note: In early 2025, Plan Melbourne was superseded by Plan for Victoria.

The Cooling and Greening Melbourne work was a collaboration between RMIT University, The University of Western Australia, The Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Victorian Government Department of Environment, Land, Water and Planning.

The Cooling and Greening Melbourne work utilised the CSIRO's Urban Monitor approach (Caccetta et al, 2016) to produce vegetation structure across the project area. The Urban Monitor methodology for measuring vegetation data *'uses proprietary techniques derived by the CSIRO to identify the presence or absence of reticulated vegetation within any given cell'* and is based in part on the use of lidar and multispectral aerial photography[1].

Unlike Council's approach, the Urban Monitor approach does not exclusively utilise lidar to directly measure vegetation height.

Findings

Amongst other findings relating to Urban Heat Islands and Heat Vulnerability Indices, the Cooling and Greening Melbourne work reported a measurement of an 18.4% tree canopy for the full extent of the City of Whitehorse in 2018 for vegetation above a height of three metres, which represented a 2.28% decrease from their measurement of a 2014 canopy.

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[1] https://nespurban.edu.au/wp-content/uploads/2019/07/urban-vegetation-cover-change.pdf

For reference purposes, the Cooling and Greening Melbourne work reported a 20.69% canopy cover in 2014, and an 18.4% canopy cover in 2018 across the full extent of the City of Whitehorse.

$$percentage\ point\ difference = 2018\ canopy\ \% - 2014\ canopy\ \%$$

- The Cooling and Greening Melbourne measurement reported that across the full extent of the City of Whitehorse, canopy decreased by 2.28% over the four-year study period (average annual reduction of 0.56% per year).
- Note: Percentage point difference is an **arithmetic difference** between two percentages and is used to directly compare the canopy cover between two periods.

$$percentage\ change = \frac{2018\ canopy\ area - 2014\ canopy\ area}{2014\ canopy\ area} * 100\%$$

- The Cooling and Greening Melbourne measurement reported that across the full extent of the City of Whitehorse, canopy decreased at a rate of change of 10.91% over the four-year study period (average annual rate of change of 2.73% per year).
- Note: Percentage change is a measure of the **proportional change** relative to the initial value and is used to emphasize the rate or magnitude of change relative to the starting point. A percentage change of 10.91% over the study period does not mean that the canopy reduced by 10.91%. It means that the total canopy area lost as a proportion to its starting value is 10.91%.

Based on the 2018 lidar and Council's adopted approach, a canopy measurement was assessed with a total area of 13.889km^2, which represents a canopy cover of 21.62% for the City of Whitehorse.

Differences

There are three areas of differentiation between Council's work and the Cooling and Greening Melbourne work which will likely result in differences: Methodology, Data Source, and Data Currency.

1. Methodology (software and workflow):
    a. The Cooling and Greening Melbourne work was based on the CSIRO's Urban Monitor approach, which uses proprietary software and techniques. The full workflow utilised by the Urban Monitor software is not known.
    b. Council's workflow is aligned to best practice for the generation of Canopy Height Models and is based on a lidar point cloud classified to the ICSM lidar standard. This is a widely adopted approach across industry including government agencies.

2. Data Sources:
    a. Council's adopted workflow is based on classified lidar point clouds. The lidar classification for vegetation classes has been improved to a 98% confidence interval[2].
    b. The Cooling and Greening Melbourne work utilised remote sensing techniques that utilised lidar and multispectral aerial photography. The lidar classification for vegetation classes used by this workflow has not been improved to a 98% confidence interval, and the lidar is likely solely utilised to determine the ground surface.
    c. Both workflows will result in canopy extents being represented by a staggered bounding box around vegetation with heights greater than three metres, similar to Figure 4 in the main report.
3. Data Currency:
    a. The reporting of canopy cover is reliant on the extent of canopy detected at the time of acquisition of both the lidar and multispectral aerial photography datasets. Optimal conditions are when foliage is at a maximum, and consistency between acquisition dates is key. Council's lidar has been acquired over the summer months, but the acquisition date of the multispectral aerial photography utilised by the Cooling and Greening Melbourne work is unknown. If the multispectral imagery was captured in early or late summer, or even late spring or early autumn, this could affect the canopy extents reported through the Cooling and Greening Melbourne work.

[2] A 98% confidence interval means that our expectation is that 98 out of every 100 lidar points in this data will correctly represent the real-world features they depict (like ground, buildings, or trees), with a defined level of precision.