DSM GEODATA
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Urban tree canopy and built environment data analysis and reporting 2018-2019

Survey Area

Technical Report

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Prepared for

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Contents

Abbreviations

CHM – Canopy height model
LGA – Local government area
LiDAR – Light detection and ranging

Glossary

Building footprints – A vector dataset displaying horizontal extent of classified buildings within LiDAR point cloud.

Digital canopy model – A discontinuous raster that describes the horizontal extent and vertical height of tree canopy across an area of interest.

Digital terrain model – A continuous raster which shows the bare-earth elevation above sea level with buildings and trees removed.

Land ownership classes – Below is a list of all land ownership classes used in this analysis based on cadastral data current as of 2018. Community land includes land parcels held for the benefit of the community, this includes land held by trusts and public institutions. Not specified includes land parcels missing ownership information in the cadastral data. State and local government roads were classified based on a roads (polygon) dataset supplied by DIT, which differentiates between roads maintained by local and state governments.

- Private
- Company
- Community
- Federal government
- Local government
- Local government (road)
- State government
- State government (road)
- Not specified

Land use classes – Below is a list of all land use classes used in this analysis. The list of classes is based on the 2018 generalised land use categories.

- Commercial
- Education
- Forestry
- Industrial / utilities
- Mining / quarrying
- Non private residential
- Primary production
- Public institution
- Recreation
- Reserve
- Residential
- Roads
- Vacant
- Not specified

Mid storey vegetation cover – Describes the horizontal extent of the tree canopy within between 2 to 3 m height showing the vertical structure and distribution of the canopy.

Percentage canopy cover – The percentage of canopy cover in each 100 m x 100 m grid cell.

Tree canopy cover – A vector showing the precise horizontal extent of tree canopy cover ≥3 m in height. Allows for the percentage of tree canopy cover to be calculated across a range of areas of interest (e.g. LGA or unit area).

Tree canopy cover classification – Classification of the canopy cover for each type of land use category, land ownership category and DIT land types.

Tree canopy stratification – Describes the horizontal extent of the tree canopy within defined height intervals showing the vertical structure and distribution of the canopy.

1. Survey summary

1.1. Survey area

The survey area for the project consisted of areas within metropolitan Adelaide that were included in 2018 and 2019 LiDAR data captures. The following LGAs fall within the survey area:

Council	Capture Coverage	Capture Year	Council	Capture Coverage	Capture Year
City of Adelaide	Complete	2018	City of Onkaparinga	Complete	2018-2019
City of Burnside	Complete	2018-2019	City of Playford	Partial	2018-2019
Campbelltown City Council	Complete	2018-2019	City of Port Adelaide Enfield	Complete	2018
City of Charles Sturt	Complete	2018	City of Prospect	Complete	2018
Town of Gawler	Partial	2018	City of Salisbury	Complete	2018-2019
City of Holdfast Bay	Complete	2018	City of Tea Tree Gully	Complete	2018-2019
City of Marion	Complete	2018	City of Unley	Complete	2018
City of Mitcham	Complete	2018-2019	Town of Walkerville	Complete	2018
City of Norwood Payneham & St. Peters	Complete	2018	City of West Torrens	Complete	2018

This report provides information specific to the Survey area.

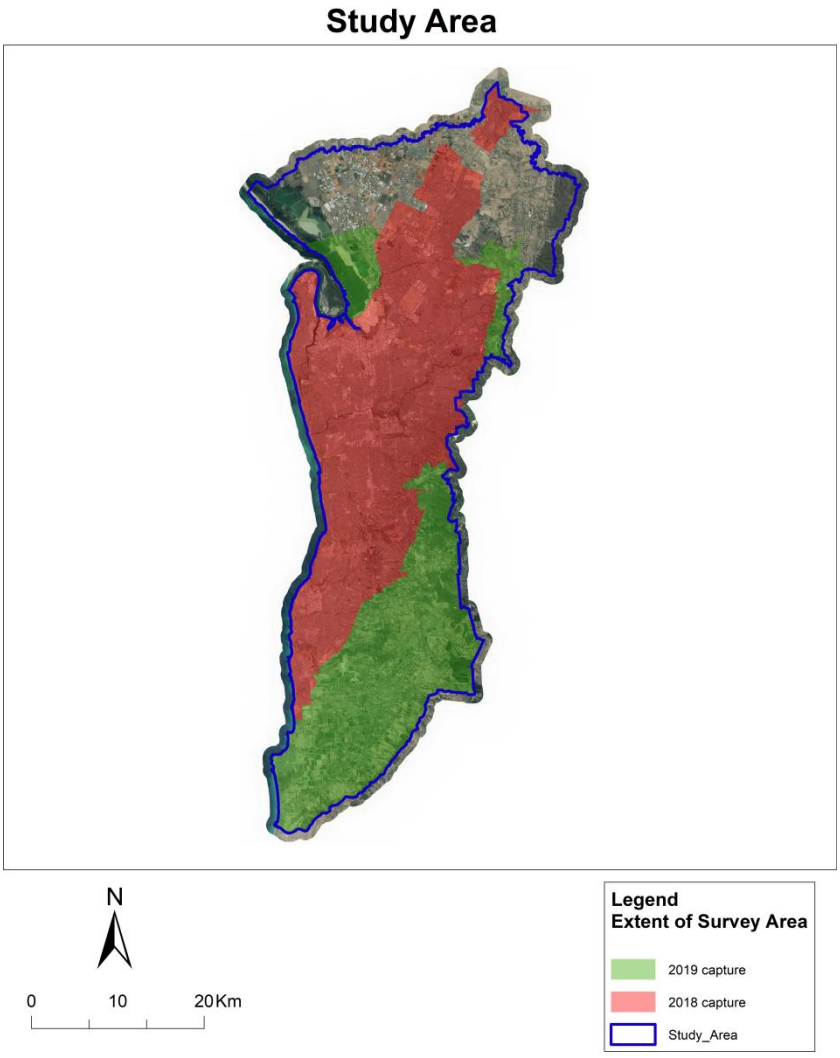

Figure 1: Extent of survey area

1.2. Survey methodology

In 2018 and 2019, LiDAR data was captured over the majority of metropolitan Adelaide and subsequently analysed to investigate tree canopy cover (extent, height stratification, differences across different land use and ownership categories), and to derive a number of additional products including building footprints and permeable and impermeable surfaces.

1.3. Processing methodology

Using Python, a custom application was developed for pixel value manipulation of each of the data analysis products.

Tree canopy cover by land use:
Tree canopy cover (≥3 m in height) and land use polygons were the inputs. Numerical codes (DNs) were assigned for each tree canopy cover pixel within land use polygons with respect to land use categories.

Tree canopy cover by land ownership:
Tree canopy cover (≥3 m in height) and land ownership polygons were the inputs. Numerical codes (DNs) were assigned for each tree canopy cover pixel within land ownership polygons with respect to land ownership category.

Tree canopy cover by DIT land types:
Tree canopy cover (≥3 m in height) and DIT land types polygons were the inputs. Numerical codes (DNs) were assigned for each tree canopy cover pixel within DIT land types polygons with respect to DIT land categories.

Tree canopy cover by unit area:
Tree canopy cover (≥3 m in height) was the input. A 100 m resolution raster grid (100 m x 100 m) was created representing the percentage of canopy cover within each 100 m unit area.

Stratified tree canopy height:
CHM was the input. Input height model was reclassified at 5 m intervals from 3 m to maximum height present in the datasets.

Mid-storey vegetation cover (2 to 3 m):
CHM was the input. Pixel values in the range between ≥2 m to <3 m in the input height model were extracted.

2. Summary of deliverables

Outlined below is a summary of each deliverable presented within this report. Each of the deliverables was generated at the following scales:

- Entire survey area
- Green Adelaide region
- Each LGA within the survey area
- DIT owned and managed land

2.1. Summary of spatial datasets derived from the 2018-2019 data capture

Table 1: Summary of datasets derived from 2018-2019 data capture

Section	2018-2019 derived spatial datasets
3.1	Tree canopy cover (≥3 m in height)
3.2	Tree canopy cover by land use
3.3	Tree canopy cover by land ownership
3.4	Stratified tree canopy height
3.5	Tree canopy cover by unit area
4.1	Building footprints

3. Tree canopy cover

3.1. Tree canopy cover horizontal extents

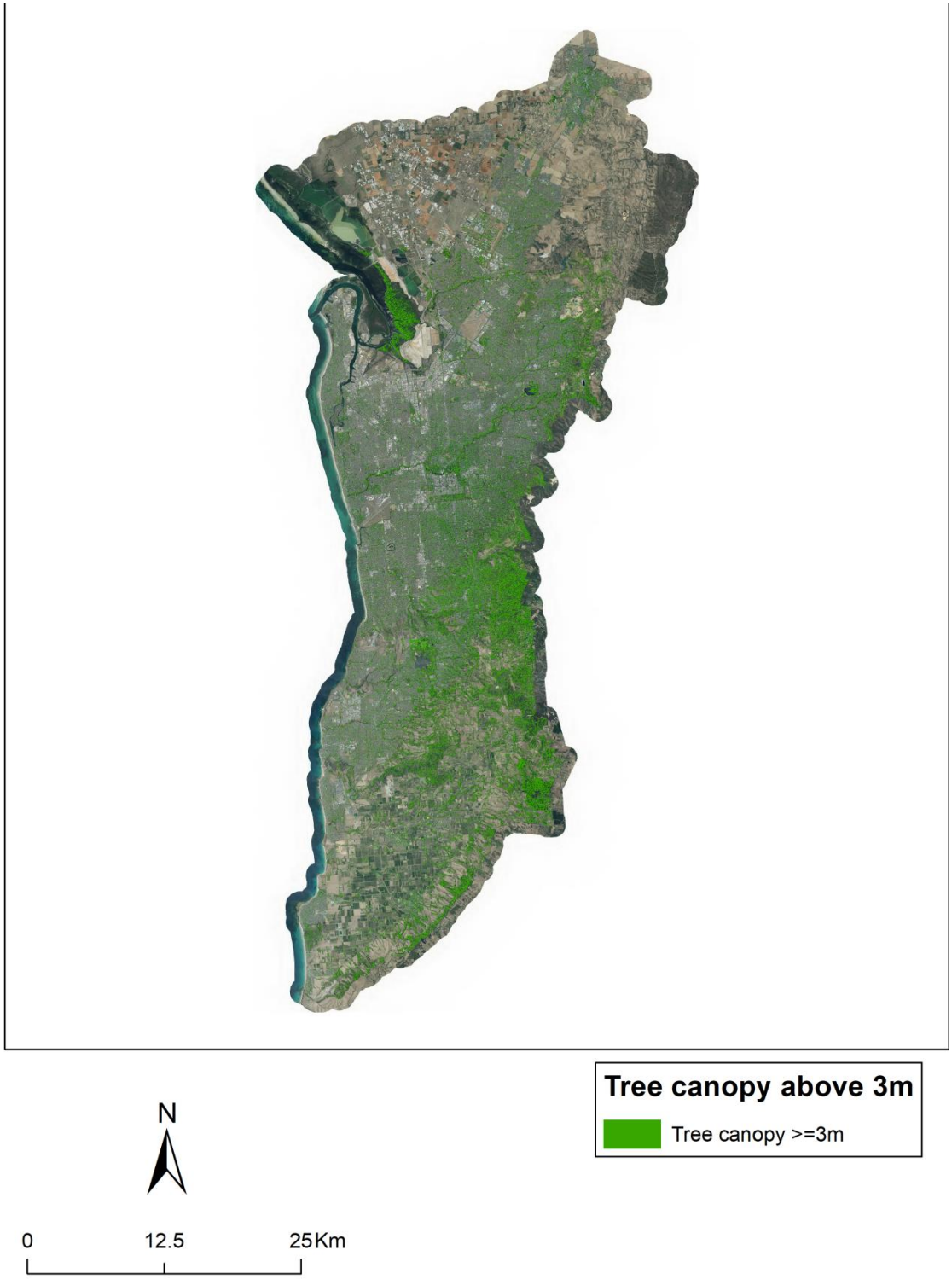

Figure 2: Tree canopy cover (≥3 m in height) horizontal extents

In the below pie chart, green indicates the percentage of tree canopy cover (≥3 m in height) and grey indicates the percentage of non-canopy area within the Survey Area.

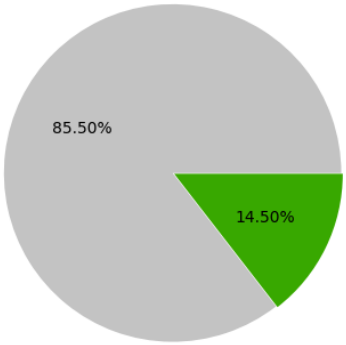

Figure 3: Percentage of tree canopy cover (≥3 m in height)

Table 2: Total area and % of total area covered by tree canopy (≥3 m in height)

Total area (m^2)	Tree canopy area (m^2)	% of tree canopy	% of non-canopy
1,310,758,482	190,017,054	14.50%	85.50%

Description:
The horizontal extent of tree canopy cover (≥3 m in height) across the Survey Area. This data was derived from the CHM and depicts the exact area that is covered by tree canopy. Total tree canopy cover (≥3 m in height) has been calculated at 14.50% within the Survey Area (Figure 2).

3.2. Tree canopy cover by land use

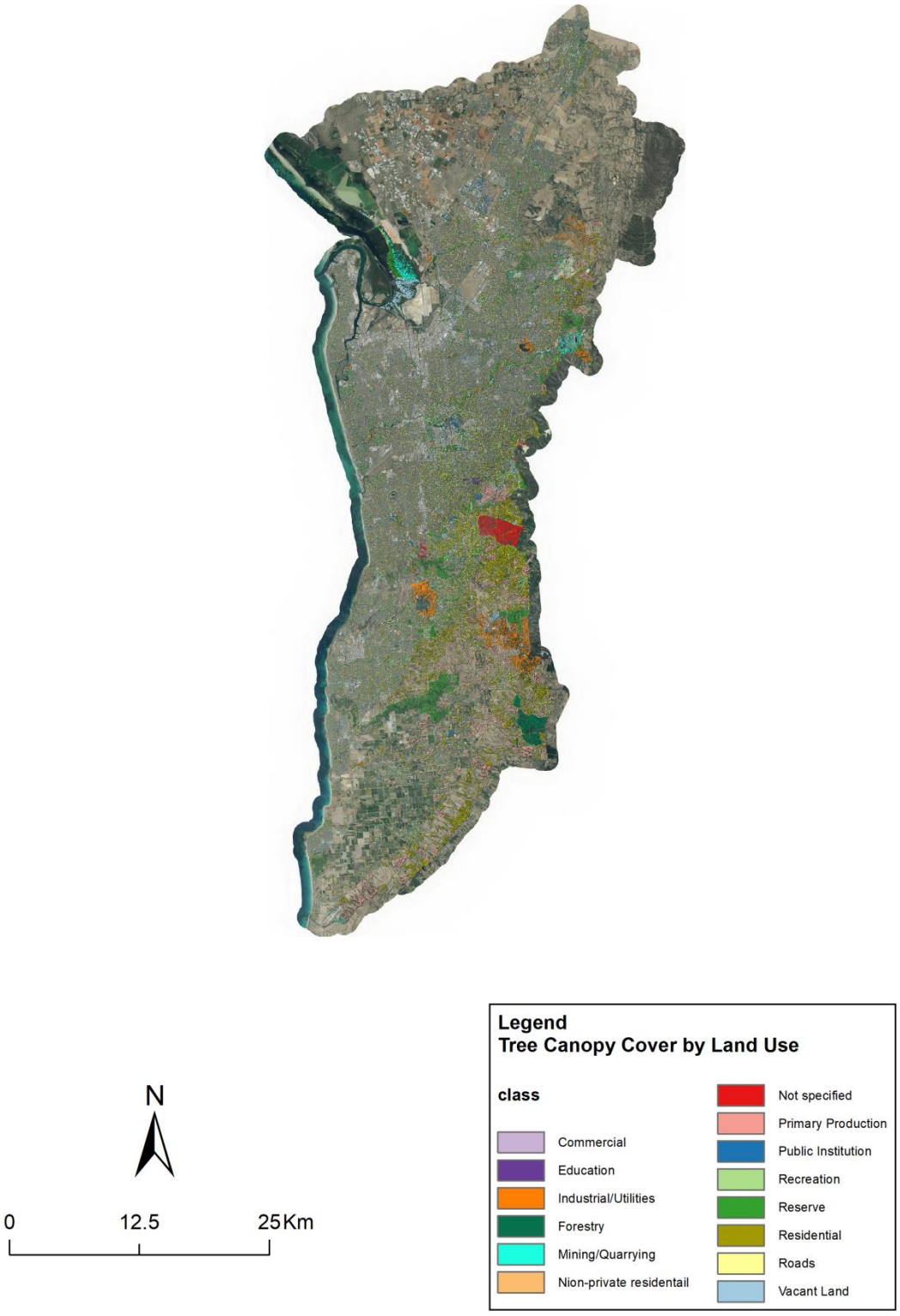

Figure 4: Tree canopy cover (≥3 m in height) classified by land use

Table 3: Total area (m²) and percentage cover of tree canopy (≥3 m in height) by land use type

Class	Land use type	Total area (m2)	Canopy area (m2)	% of land use type covered by canopy
1	Commercial	41,710,660	1,841,083	4.41%
2	Education	19,033,135	2,540,618	13.35%
3	Industrial / utilities	92,892,424	12,597,409	13.56%
4	Forestry	6,972,051	3,975,150	57.02%
5	Mining / quarrying	32,060,232	3,068,028	9.57%
6	Non-private residential	5,867,918	493,849	8.42%
7	Not specified	17,595,862	5,649,165	32.11%
8	Primary production	230,677,766	19,354,160	8.39%
9	Public institution	26,567,579	2,629,789	9.90%
10	Recreation	39,015,140	6,896,576	17.68%
11	Reserve	92,556,009	23,098,920	24.96%
12	Residential	470,245,586	71,597,665	15.23%
13	Roads	168,541,344	26,113,878	15.49%
14	Vacant	66,152,956	10,147,162	15.34%

Description:
The total area of tree canopy cover (≥ 3 m in height) divided into areas that correspond to different land use types (Figure 4), and the area and percentage of tree canopy cover that covers each land use type (Table 3). For example, tree canopy cover is 15.23% over all land with land use classified as residential within the Survey Area.

3.3. Tree canopy cover by land ownership

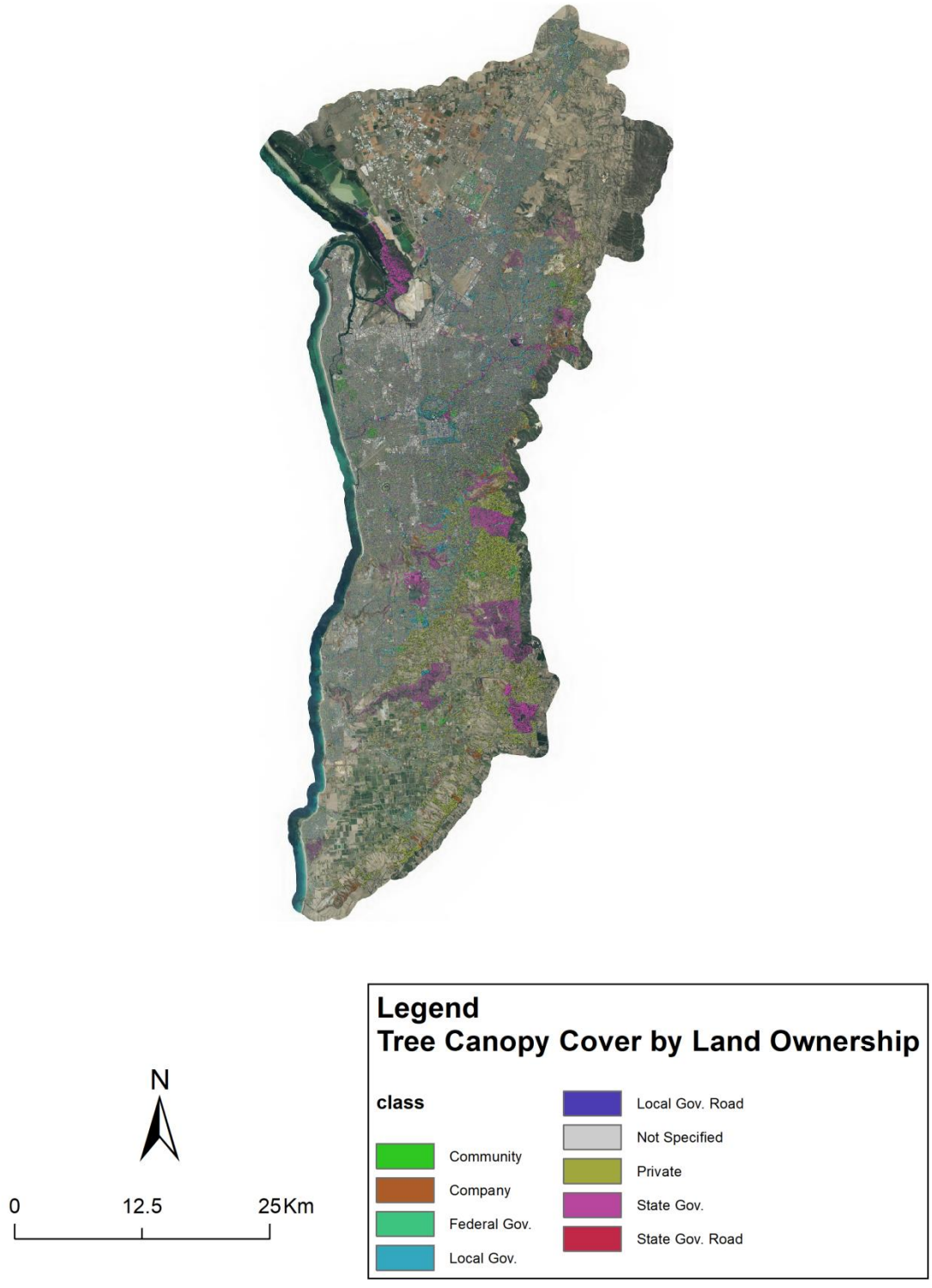

Figure 5: Tree canopy cover (≥3 m in height) classified by land ownership

Table 4: Total area (m²) and percentage cover of tree canopy (≥3 m in height) by land ownership type

Class	Land ownership type	Total area (m²)	Canopy area (m²)	% of land ownership type covered by canopy
1	Community	33,525,377	4,066,866	12.13%
2	Company	198,849,370	13,427,175	6.75%
3	Federal government	28,936,743	1,276,852	4.41%
4	Local government	85,295,518	19,401,735	22.75%
5	Local government (road)	135,243,493	20,835,593	15.41%
6	Not specified	3,297,263	605,933	18.38%
7	Private	564,921,669	81,951,310	14.51%
8	State government	231,361,951	44,855,723	19.39%
9	State government (road)	28,480,347	3,583,554	12.58%

Description:
The total area of tree canopy cover (≥3 m in height) divided into areas that correspond to different land ownership types (Figure 5), and the area and percentage of tree canopy cover that covers each land ownership type (Table 4). For example, tree canopy cover is 22.75% over all land with land ownership classified as local government within the Survey Area.

3.4. Tree canopy height stratification

Figure 6: Tree canopy height stratification

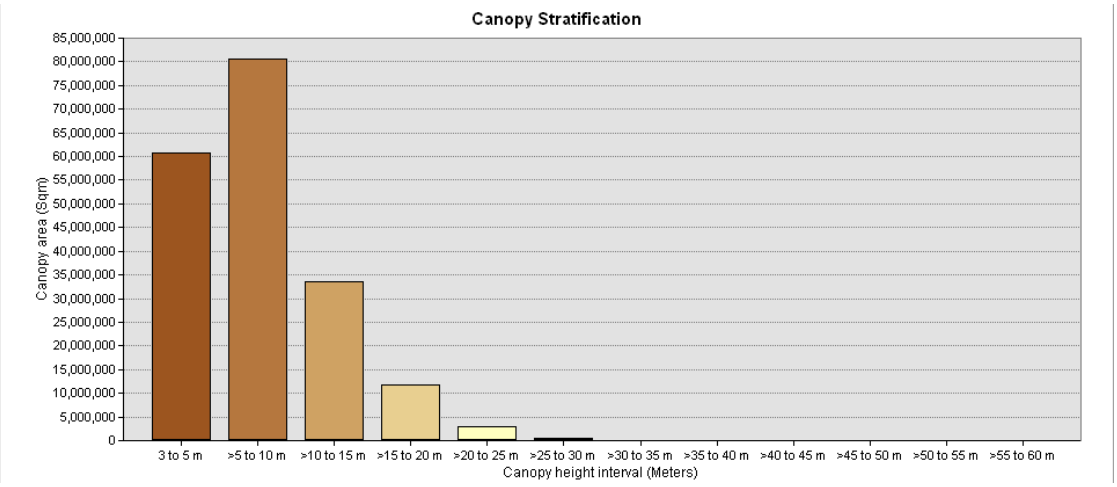

Figure 7: Tree canopy height stratification displayed by 5 m intervals

Table 5: Total area (m²) and % of total tree canopy cover for each canopy stratification level

Class	Stratification interval	Area (m²)	Percent of total canopy cover
1	3 to 5 m	60,712,176	31.95%
2	>5 to 10 m	80,669,564	42.45%
3	>10 to 15 m	33,514,396	17.64%
4	>15 to 20 m	11,679,960	6.15%
5	>20 to 25 m	2,844,792	1.50%
6	>25 to 30 m	501,700	0.26%
7	>30 to 35 m	77,060	0.04%
8	>35 to 40 m	15,546	0.01%
9	>40 to 45 m	1,788	0.00%
10	>45 to 50 m	56	0.00%
11	>50 to 55 m	11	0.00%
12	>55 to 60 m	4	0.00%

Description:

The area that is covered by tree canopy within defined height above ground intervals, ranging from 3 m up to the maximum canopy height (Figure 6). All tree canopy areas are classified at 5 m interval ranging from 3 to 5 m, >5 to 10 m, >10 to 15 m, >15 to 20 m, etc. to maximum tree canopy height in that tile. From this classification, the percentage of the total tree canopy cover in each height range within the Survey Area is listed (Figure 7). For example, total tree canopy is dominated by canopy within the height range of 5 to 10 m within the Survey Area.

3.5. Tree canopy cover by unit area

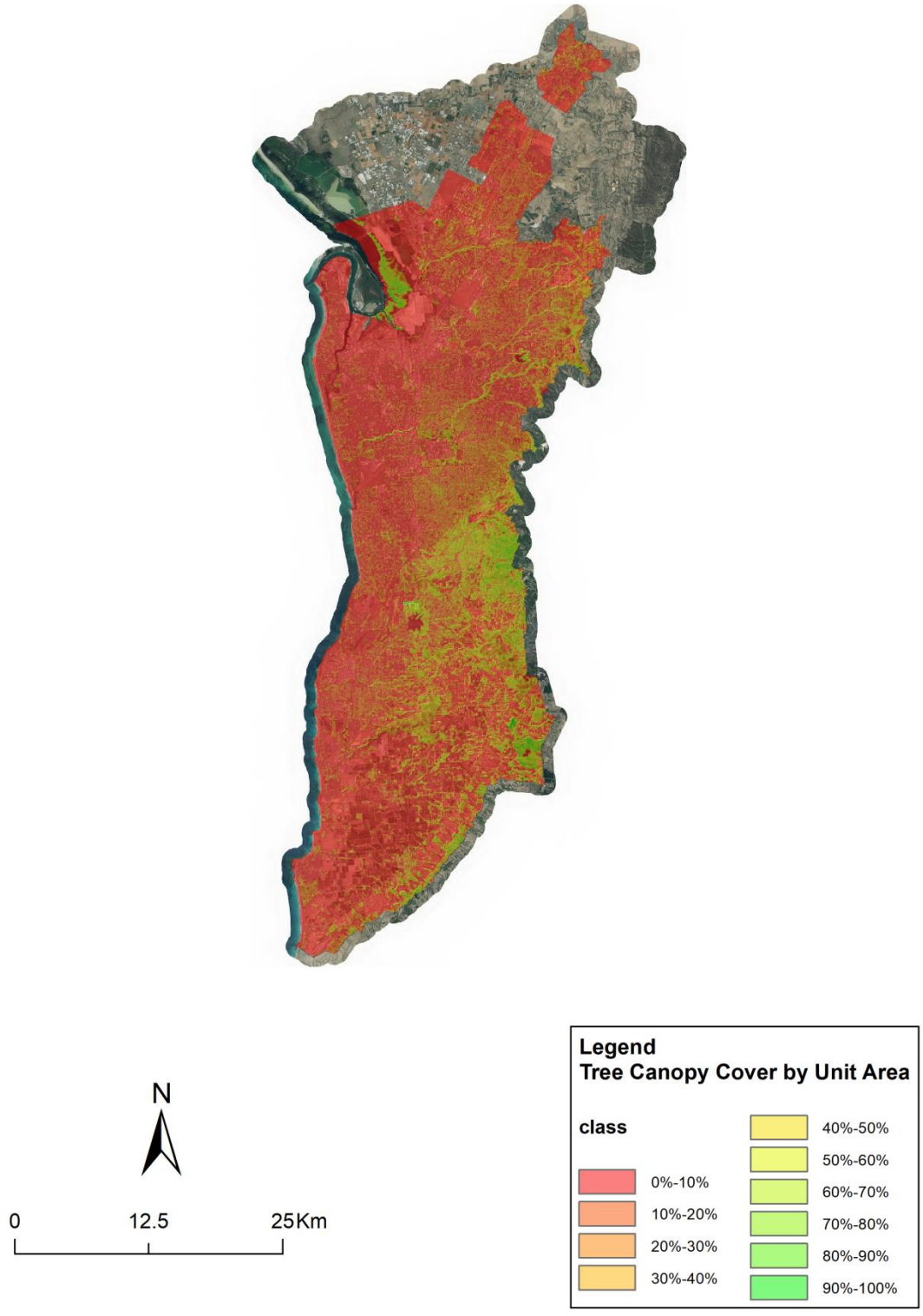

Figure 8: Tree canopy cover displayed by percentage canopy cover in 100 m x 100 m units

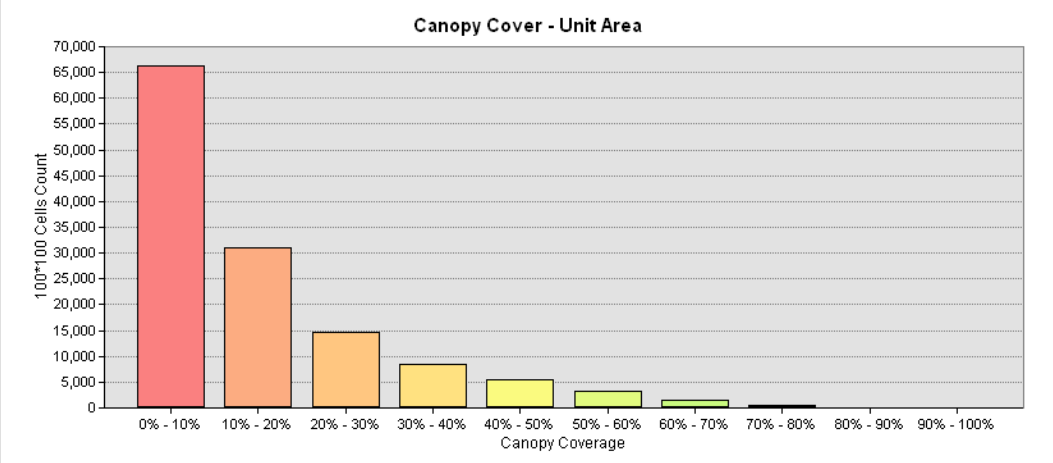

Figure 9: Bar graph of total number of 100 m x 100 m units within each canopy cover % interval

Table 6: Number of 100 m x 100 m cells at each percentage canopy cover interval

Percentage canopy coverage	Number of 100 m x 100 m cells	Percent of total canopy cover
0% - 10%	66,183	50.43%
10% - 20%	31,117	23.71%
20% - 30%	14,533	11.07%
30% - 40%	8,437	6.43%
40% - 50%	5,540	4.22%
50% - 60%	3,242	2.47%
60% - 70%	1,542	1.17%
70% - 80%	530	0.40%
80% - 90%	104	0.08%
90% - 100%	17	0.01%

Description:

Tree canopy cover by unit area was generated by dividing the area of interest into uniform 100 m by 100 m cells and then calculating the percentage of tree canopy cover within each individual cell. All cells are then colour coded by percentage canopy cover (Figure 8). From this classification, we have calculated the tree canopy coverage (≥ 3 m in height) percentage in each 100 m grid cell within the Survey Area. For example, areas with 10% - 20% of tree canopy cover 31,117 (100 m x 100 m) cells within the Survey Area.

4. Built environment

4.1. Building footprints

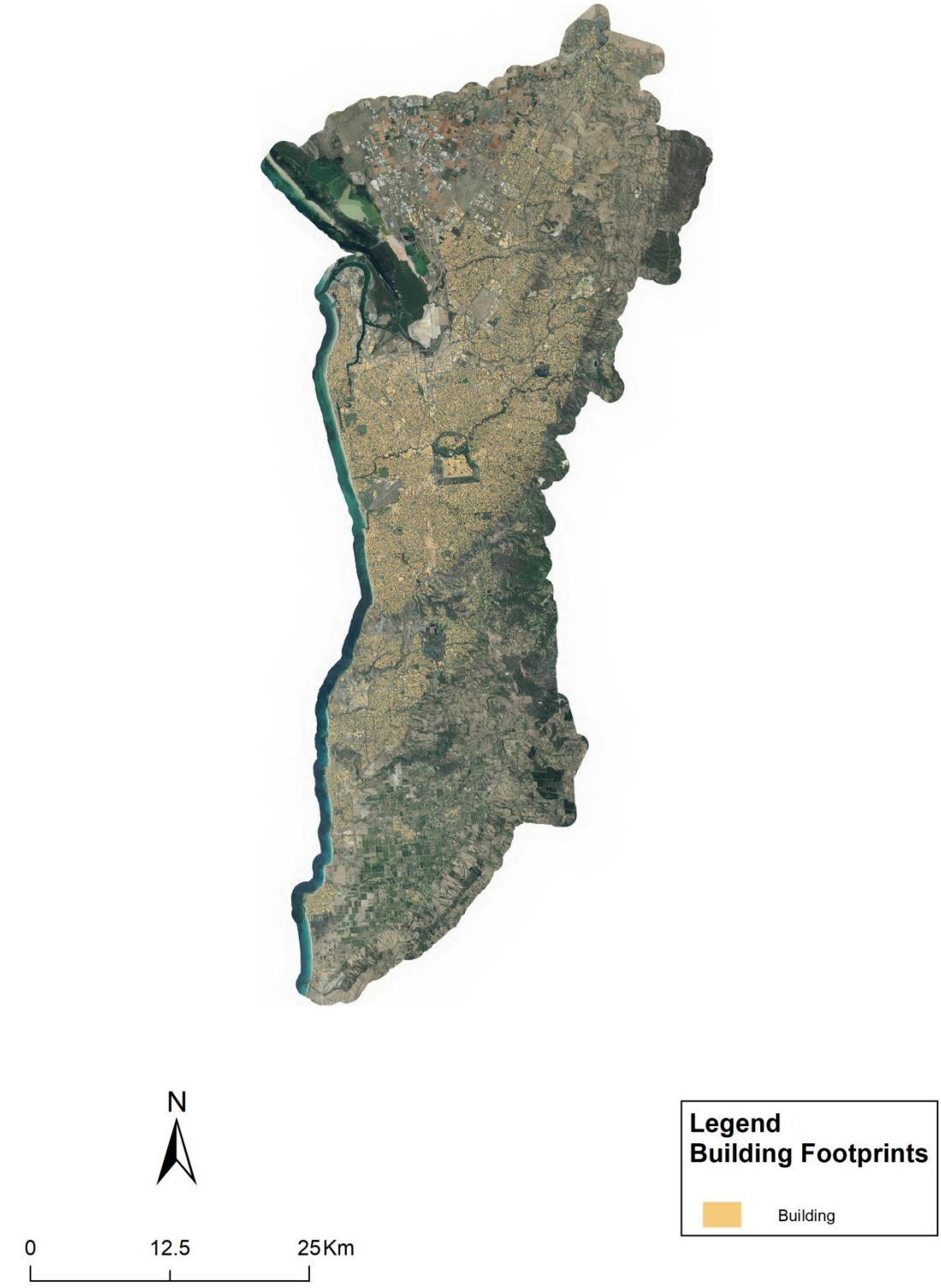

Figure 100: Extent of building footprints

In the below pie chart, light ochre indicates the percentage of building footprints and grey indicates the percentage of non-building area within the Survey Area.

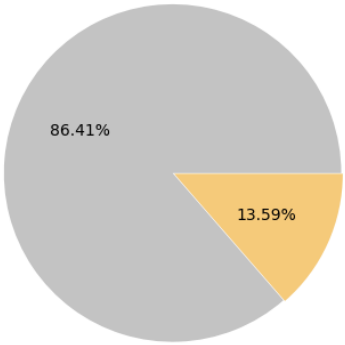

Figure 111: Percentage of survey area covered by buildings

Table 27: Total area (m^2) and percentage of area covered by building footprints

Class	Total area (m^2)	Building area (m^2)	% of building	% of non-building area
1	1,310,758,482	178,128,026	13.59%	86.41%

Description:
Building footprints for the Survey Area. Building outlines are generated using the error fixed LiDAR dataset (Figure 10). From this classification, the percentage of building footprints within the Survey area has been calculated (Table 7).

5. Disclaimer and data limitations

Disclaimer: This report has been produced for Green Adelaide using the data originally presented in *LiDAR derived tree canopy coverage metrics across Adelaide, South Australia – Report 2: Metropolitan Adelaide* (Aerometrex, 2020). While the previous report is based on analysis of a 2018-2019 LiDAR derived Canopy Height Model (CHM) and horizontal extents at 1m x 1m resolution, this report is based on analysis of a 2018-2019 LiDAR derived CHM and horizontal extents at 0.5m x 0.5m resolution. The same LiDAR point cloud was used for the derivation of products at both resolutions. The analysis documented in this report was also an input to the change detection analysis section of *Urban tree canopy data analysis and reporting 2022 – Survey Area Technical Report* (DSM GeoData, 2024).

5.1. Minor rounding and methodological differences

Minor differences may be present in area calculations in some tables in this report. These are due to rounding of figures during calculation and differences in calculation methods between raster and vector spatial layers. The differences are minor and typically equate to <0.01% of the area of interest.