



# **Tree Canopy Cover in the City of Burnside**

## **Benchmark Assessment**

23 September 2016

# Tree Canopy Cover in the City of Burnside – Benchmark Assessment

A report prepared for the City of Burnside

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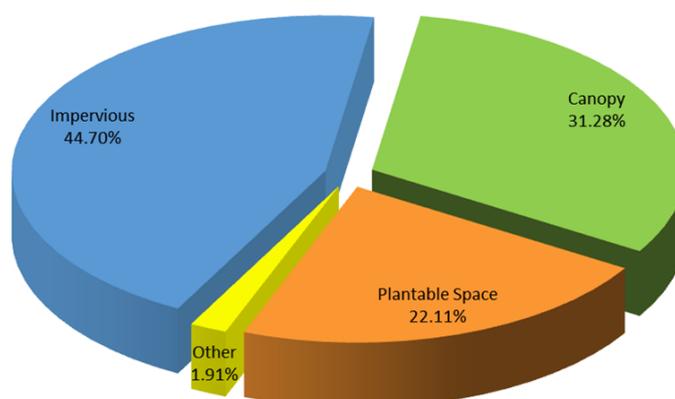
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# Executive Summary

Green infrastructure, in particular tree canopy cover, is an increasing priority in urban areas nationally and internationally. Despite a well-recognised suite of benefits provided by urban trees on human and environmental health and well-being, climate change mitigation and adaptation, infrastructure lifetimes, and economic prosperity, a number of barriers to increasing tree canopy cover in urban areas still persist. Being able to measure and monitor changes (trends) in land cover, particularly canopy cover, within suburbs will be important for informing decision-making, assessing the success of greening objectives and activities, and prioritising the type and location of activities to best promote desired outcomes.

Seed Consulting Services (Seed) was contracted by the City of Burnside (Council) to undertake an assessment of land cover within the City's 28 suburbs using the i-Tree Canopy software. In addition, three suburbs were selected by Council to investigate historical land cover and assess trends in land cover change over time. With a focus on canopy cover and plantable space opportunities, the assessment aimed to establish canopy cover benchmarks which may be used to monitor future change over time and provide information to underpin decision-making regarding green infrastructure. Key findings from the assessment were:

- 10,780 points were assessed within the City of Burnside (385 points per suburb);
- 10 of the 14 land cover categories considered were identified occurring within the City;
- current land cover across the City is dominated by impervious surfaces, followed by canopy cover, plantable space, and other land covers (e.g. water) (see pie chart below)
  - the current estimated canopy cover of 31.28% across the city is slightly higher than the 30.2% reported in the National Benchmarking Report<sup>1</sup> for the year 2013;
- just over 22% (~ 6km<sup>2</sup>) of the City area (public + private tenure) provides opportunities for planting additional trees (see pie chart below);
- land cover proportions amongst suburbs varied:
  - percent impervious cover is highest in Eastwood and lowest in Waterfall Gully;
  - percent tree/canopy cover is highest in Waterfall Gully and lowest in Glenside;
  - percent plantable space is highest in Leawood Gardens and lowest in Eastwood;
- in Burnside, Glenside and Magill impervious cover has increased and tree cover has decreased since 2010, indicative of urban in-fill processes;



<sup>1</sup> Jacobs, B et al. 2014. *Benchmarking Australia's Urban Tree Canopy: An i-Tree Assessment, prepared for Horticulture Australia Limited by the Institute for Sustainable Futures*, NSW: University of Technology Sydney.

Land cover change over time, as assessed initially in three trial suburbs (Burnside, Glenside, Magill), showed an increase in impervious and plantable space cover and a decline in canopy cover between 2010 and 2015; indicative of urban in-fill processes. If these trends in were found to be consistent across the City, this would highlight a substantial loss of canopy cover. Such declines in canopy cover would present a major challenge for Council meeting future goals around recreation and open space and climate change adaptation, especially given projected rates and extents of on-going urban in-fill. Mitigating future tree loss and moving towards overall canopy cover gain across the City will require complementary greening actions on public and private land.

The implications of on-going declining tree cover will be wide and varied, with substantial negative impacts on the liveability, prosperity, and long-term resilience of the City. Examples of specific impacts include, but are not limited to: lower air quality; hotter average day and night temperatures; decreased shading; increased winds; increased localised flooding; decreased water quality; decreased biodiversity; decreased amenity and liveability.

The information derived from this assessment can be used as a benchmark for monitoring future land cover change. In addition, the findings from this project will help to rationalise the need to prioritise on-going understanding, mapping, monitoring, and valuing of the urban forest. Building and refining such information will help to inform a range of Council decision-making, such as:

- what green infrastructure actions to take and where to prioritise their application to achieve the most effective and efficient desired outcomes;
- how local policies and strategies may be amended in order to facilitate urban greening objectives; and,
- understanding and addressing interactions with other urban challenges such as urban heat island effects, climate change adaptation, and community health and well-being.

# 1 Introduction

## 1.1 Background

Urban green infrastructure<sup>2</sup> cover, in particular tree canopy cover, is receiving increasing attention from urban land planners and managers nationally and internationally. This is due in large part to trees now being widely recognised for providing multiple benefits, including: climate change mitigation and adaptation; improved air and water quality; enhanced biodiversity conservation; increased local economic prosperity and property values; decreased energy requirements of buildings, crime rates, and infrastructure maintenance; and, improved human health and well-being. Recent developments within Australia<sup>3</sup> further promote the importance of trees in our urban areas and underpin the growing momentum of local governments to understand, maintain, and enhance their urban forests.

Despite the recognition of the multiple benefits offered by trees, and the recent drive to increase canopy cover in urban areas, two key barriers to increasing tree cover in urban areas persist:

- competition for space from opposing land-uses (e.g. residential in-fill development, sporting fields); and
- the difficulty in valuing tree worth as an urban asset and so justify their business-case, such as may be done for built infrastructure (e.g. roads, buildings).

The i-Tree<sup>4</sup> Canopy software was chosen as it provides a freely available, user-friendly, and repeatable way to measure and monitor land cover, including canopy cover, and provide high level valuations of certain ecosystem service benefits provided by trees.

Seed Consulting Services (Seed) was engaged by the City of Burnside to assess land cover across the City area using the i-Tree Canopy software. Covering a land area of approximately 27km<sup>2</sup> the City of Burnside extends from the Adelaide parklands into the foothills of the Mount Lofty Ranges (Figure 1). It is bounded by six other local government areas: Adelaide, Norwood Payneham and St Peters, Campbelltown, Adelaide Hills, Mitcham, and Unley.

## 1.2 Objectives

The objectives of this project were to:

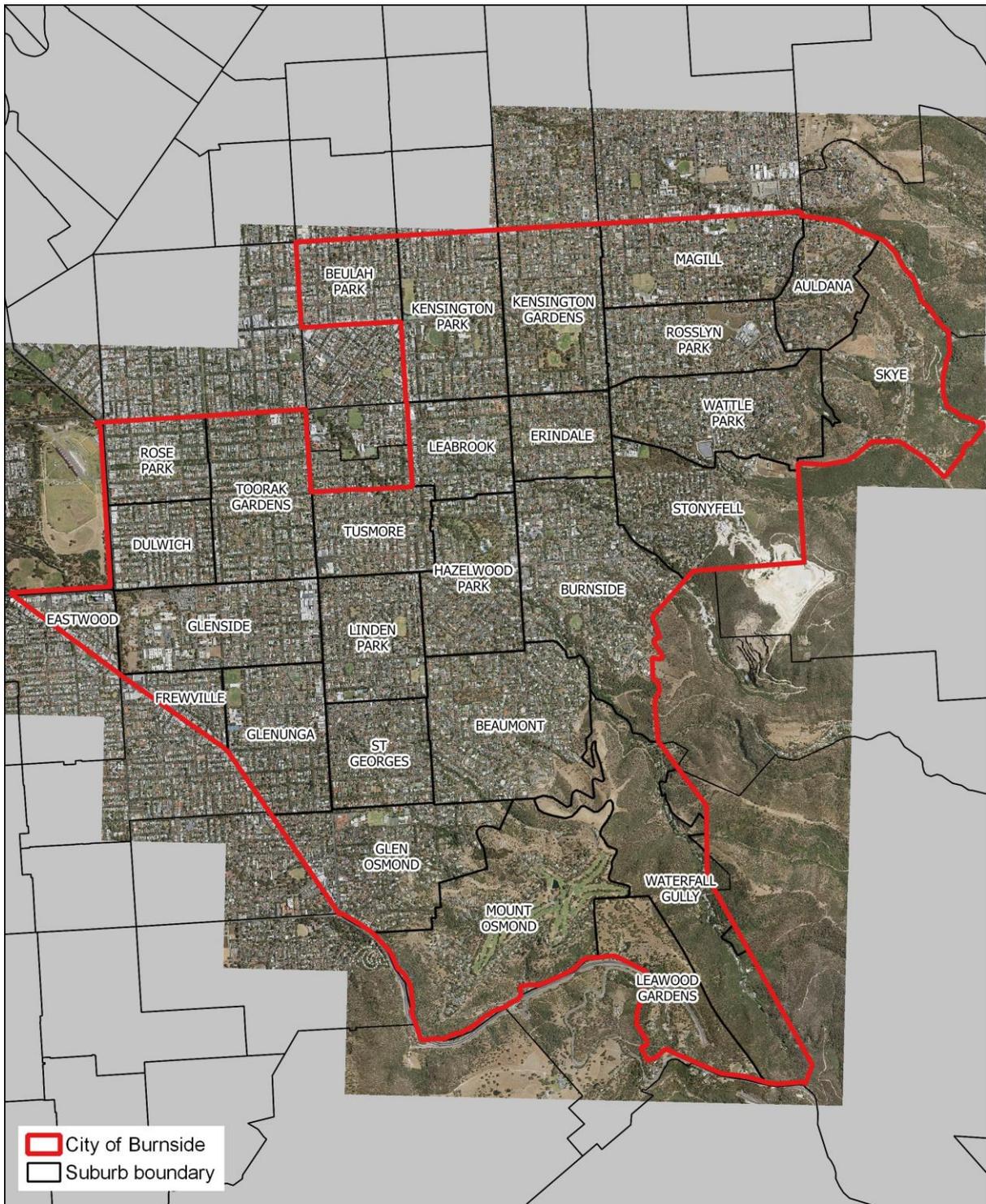
- assess current (2015) land cover in the City's 28 suburbs using i-Tree Canopy;
- assess change in land cover between 2010 and 2015 for three suburbs selected by the City of Burnside as trial suburbs; and
- provide a high level report of findings and recommendations for future opportunities.

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<sup>2</sup> living green and blue elements (e.g. trees, grass, shrubs, green walls/roofs, waterways, and wetlands)

<sup>3</sup> such as national actions by 2020 Vision and the Federal Government's Minister for the Environment.

<sup>4</sup> [www.itreetools.org](http://www.itreetools.org)



**Figure 1. Suburbs assessed within the City of Burnside.**

Created: 23/65/2016      Drawn: J. Garden  
 Ref.: 657\_F1v1          Datum: GDA94  
 Data Sources: <http://www.sa.gov.au>  
 Aerial Imagery: City of Burnside 2015

  
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Important notes: (i) This map is not guaranteed to be free from error or omissions, and has been produced for the exclusive use of the Client and Seed Consulting Services (ii) Any contours are suitable only for the purpose of this plan; their accuracy has not been verified and no reliance should be placed upon them for any purpose other than the original purpose of this map (iii) Aerial photos and imagery have been overlaid as best fit on the boundaries shown and precision is approximate only (iv) Scale shown is correct for original plan and any copies of this plan should be verified by checking against the scale bar (v) This figure may not be copied unless this note is included.

# 2 Approach and Methodology

## 2.1 Survey area

The 28 suburbs contained entirely, or in their majority, within the City boundary formed the study area for this assessment (Table 1, Figure 1).

**Table 1.** The 28 suburbs and their areas (ha) assessed for this project.

SUBURB	AREA (ha)	SUBURB	AREA (ha)
Auldana	61.2	Leabrook	62.8
Beaumont	157.1	Leawood Gardens	82.2
Beulah Park	56.6	Linden Park	83.7
Burnside	170.6	Magill	107.4
Dulwich	56.9	Mount Osmond	207.3
Eastwood	28.4	Rose Park	56.1
Erindale	55.9	Roslyn Park	82.8
Frewville	27.4	Skye	136.3
Glen Osmond	126.6	St Georges	70.1
Glenside	112.1	Stonyfell	129.4
Glenunga	89.1	Toorak Gardens	110.7
Hazelwood Park	94.8	Tusmore	66.4
Kensington Gardens	109.6	Waterfall Gully	173.9
Kensington Park	110.6	Wattle Park	115.5

## 2.2 Selection of points

Each suburb was assessed using 385 points. The number of points assessed was based on a power analysis conducted *a priori* with a confidence level set at 95% and a confidence interval set at 5%. Further details about the power analysis and i-Tree Canopy's process of allocating and classifying points are provided in Attachment A.

## 2.3 Land-cover categories

Fourteen land-cover categories (Table 2; Plate 1) were defined for this project. When defining land cover categories, consideration was given to:

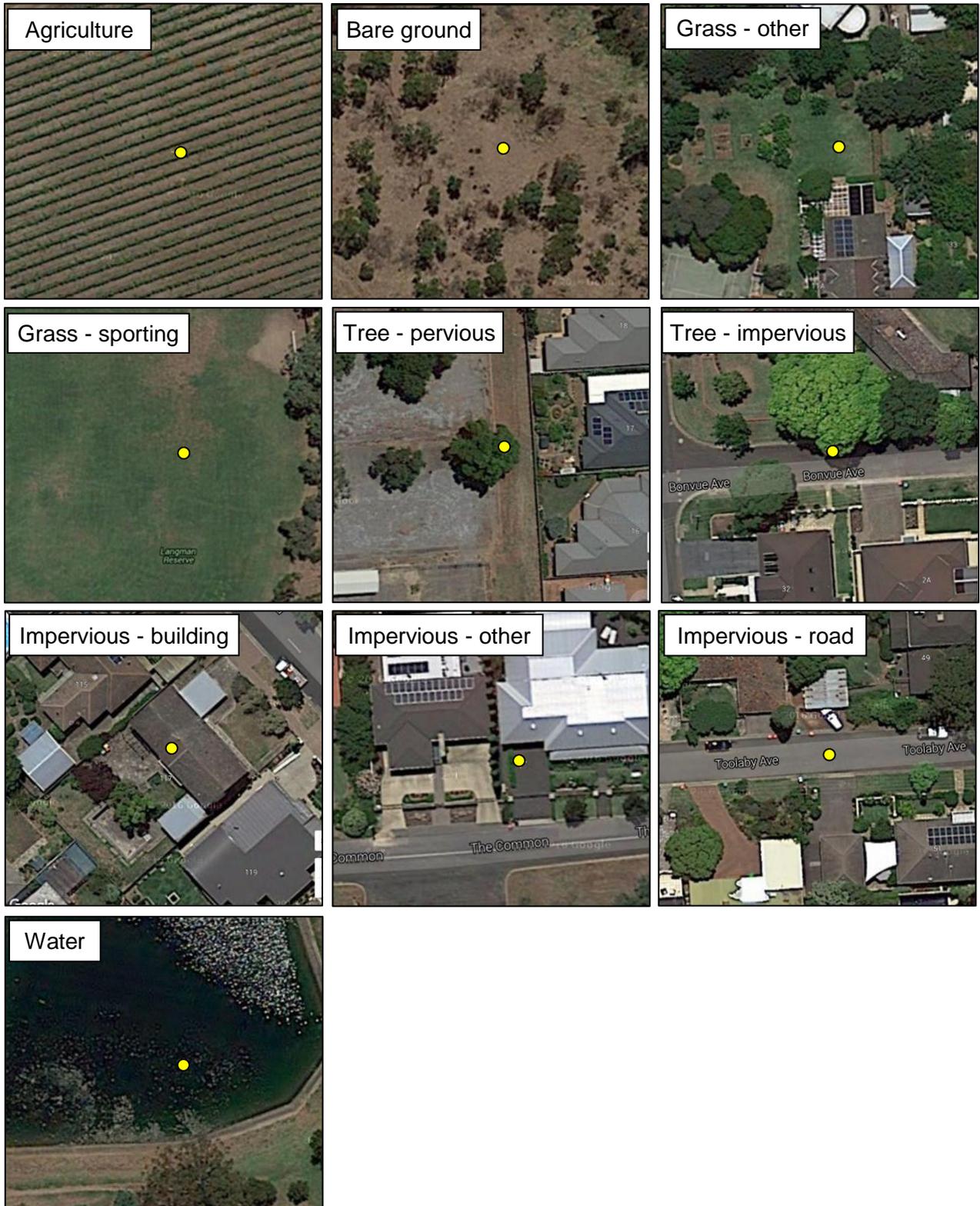
- realistic representation of key land uses and relevance to on-ground planning and management;
- flexibility for future refined analyses; and
- consistency with similar assessments conducted for other local government areas.

For example, the two “grass” categories differentiated between grassed sporting fields and non-sporting grassed areas, as it is highly unlikely that sporting grounds would be viewed as opportunities for planting trees. Noting that grass areas surrounding the actively used area of sporting fields was classified as non-sporting grassed areas as they may have space for shade tree plantings. In addition, the tree category was classified as being over pervious or impervious surfaces, based on the surrounding land use. This allows for future refinement of impervious surfaces and plantable space if so desired.

**Table 2.** Land cover categories used for analyses. Categories shown with an asterisk (\*) are those that were found to occur in the City area.

CATEGORY	CODE	DESCRIPTION
<b>IMPERVIOUS</b>		
*Impervious – building	ImpBld	A permanent built structure (e.g. house, carport).
*Impervious – other	ImpOth	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.
*Impervious – road	ImpRd	A sealed road.
<b>TREE/CANOPY</b>		
*Tree – impervious	TrImp	Tree canopy over perceived impervious surface.
*Tree – pervious	TrPer	Tree canopy over perceived pervious surface.
<b>PLANTABLE SPACE</b>		
*Bare ground	BG	Non-vegetated pervious surface. Includes sand traps in golf courses.
*Grass - other	GrOth	Grassed areas not included in Grass-sporting cover class. Includes public parks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).
<b>OTHER</b>		
*Agriculture	A	Active cropping or other agricultural activity.
Beach	B	Non-vegetated portion of coastal sandy beaches, to low tide mark.
Dune vegetation	DV	Vegetation growing on coastal sand dunes.
*Grass - sporting	GrSpo	Grassed areas used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.
Salt	S	Salt fields with or without water covering the pans.
*Water	W	Aquatic or marine waterbodies. Does not include pools.
Wetland vegetation	WV	Fringing or aquatic vegetation (not trees) associated with waterbodies.

**Plate 1.** Screen shot examples from the i-Tree Canopy assessment of the different land cover categories occurring in the City of Burnside (N.B. a yellow dot has been used to better show the location of the yellow cross-hair used in i-Tree Canopy).



## 2.4 i-Tree Canopy settings

Each suburb was assessed as a separate i-Tree Canopy project. For each project, i-Tree Canopy project settings were as follows:

- **project location:** the i-Tree Canopy software calculates approximate ecosystem service benefits provided by trees as part of the output. These calculations are based on USA-specific metrics related to weather, pollution and tree species. In order to run an i-Tree Canopy project a USA location must be selected. For the purposes of this project, 'California – urban' was selected, as this is considered the closest USA climatic analogue to the study area in South Australia;
- **land cover categories:** these are user-defined categories entered in to the i-Tree Canopy settings (see Section 2.3, Table 2);
- **benefit options:** this setting identifies which of the land-cover categories represents "tree/canopy cover", which for the purposes of this project were "Tree – impervious" and "Tree – pervious" (see Table 2);
- **currency:** AUD \$; and
- **units:** metric.

## 2.5 Land cover assessment time periods

Land-cover in each suburb was assessed for the "current" time period, which was set at December 2015. This was the default Google Earth imagery linked with the i-Tree Canopy software at the time of assessment.

A trial of assessing historical land cover was also undertaken for this project in three suburbs selected by the City of Burnside: Burnside, Glenside, and Magill. These historical assessments were undertaken using the "change survey" function in i-Tree Canopy together with 2010 aerial imagery provided by City of Burnside and the QGIS software. Change in percent land cover over time was quantified by comparing the difference in percent land cover between 2010 and 2015. This trial historical assessment demonstrates how trends in land cover change over time can be documented and used to inform land planning and management decisions.

## 2.6 Calculating statistical significance

Statistical significance of changes in percent land cover over time were calculated using two-tailed t-tests, which is a statistical hypothesis test used to determine if two data sets differ significantly from each other.

Differences were considered statistically significant if p-values were less than or equal to the 0.05 critical alpha level. A p-value (or probability value, "p"), is one output from a t-test which indicates whether the differences between data being compared is occurring due to chance (i.e. not significantly different) or is a real phenomenon (i.e. is significantly different). The critical alpha value sets the standard to which the p-value is compared and is usually set to 0.05. Therefore, a p-value less than or equal to 0.05 indicates the observed difference between the data is so unusual that it would only have happened by chance, at most, 5% of

the time and so the difference is considered statistically significant. If a p-value is greater than 0.05, this indicates that the observed difference between data could have happened by chance more than 5% of the time and so the difference is considered statistically insignificant.

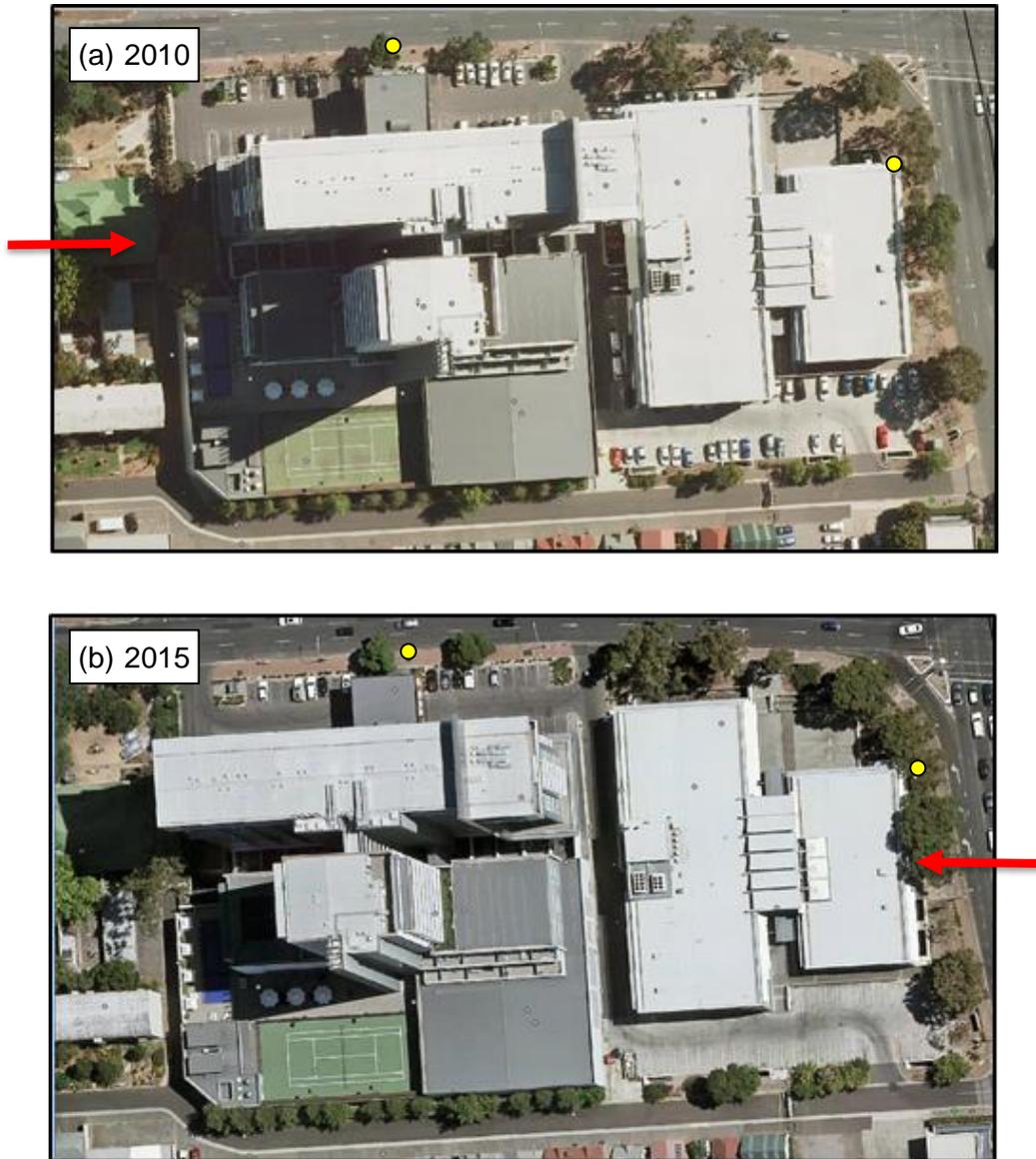
For the purposes of these analyses, we assumed no spatial autocorrelation between points. Meaning that it was assumed that the data points are independent and land-use category of one point does not influence the land-use category of nearby points.

## 2.7 Potential assessment errors and considerations

The classification of land cover types based on satellite imagery and aerial photos is open to interpretation by the user, which may lead to an inherent level of error in the classification, particularly if the quality of the imagery/photo is poor. Such error was minimized as much as possible by considering the surrounding land-cover context and comparing images in other time periods. Key interpretation issues faced and decisions made were as follows:

- Seasonal and weather variation:
  - when comparing points between time periods, weather and climatic conditions, particularly pertaining to rainfall, may vary how a particular point is classified and potentially result in a point's land cover category changing between different assessment dates. This is particularly the case for grass and bare ground categories. For example, a point classified as grass-other in one year/month may be classified as bare ground in another year/month due to changes only caused by seasonal rain influences;
- Inferred points:
  - user-rationale was used to interpret land-cover under points where shadows impeded a clear view; where necessary, comparison with imagery from other time periods and Google street view were also assessed;
  - where a point fell over a temporary cover (e.g. cars, junkyard debris), the more permanent land cover was classified. For example, a point falling over a car parked on bare ground would be classified as "bare ground" not "impervious – other"; and,
- Photo skew:
  - aerial photos can appear displaced or skewed due to variation in the capture angles of the aircraft/satellite relative to the feature. This displacement increases as the look angle moves away from a vertical capture angle, and so features at the edge of an image will have more displacement than those directly below the sensor at the time of acquisition. When these photos are georeferenced, this skew can impact on where certain classification points appear to fall. User interpretation was required in these cases to infer how the photo would appear if not displaced/skewed (Plate 2).

**Plate 2.** Examples of photo skew between aerial images taken in (a) 2010 and (b) 2015. Yellow dots indicate georeferenced classification points that would be classified differently if photo skew were not considered. Red arrows indicate the direction of skew.



*The 2010 imagery is skewed right whereas the 2015 imagery is skewed left. Two land cover classification points are shown over each image. These points are georeferenced in the same location between years, yet due to the distortion of the aerial imagery the points appear to represent different land covers between the two years despite land cover being unchanged. Careful user interpretation of this displacement/skew is required to infer the land-cover under the points in 2010 to be the same as in 2015.*

# 3 Results

A total of 10,780 points were assessed within the City of Burnside (i.e. 385 points in each of 28 suburbs) (Figure 2). Of the 14 land cover categories considered, 10 were found to occur in the City (Plate 1). The following sections present the key findings from across the City as a whole and also at the suburb level.

## 3.1 Current land cover across the City of Burnside

Current land cover across the City was calculated by combining the assessments for each suburb. Further details relative to the City, regarding the number of points and associated percent cover for each land cover category in each time period, is provided in Attachment B.

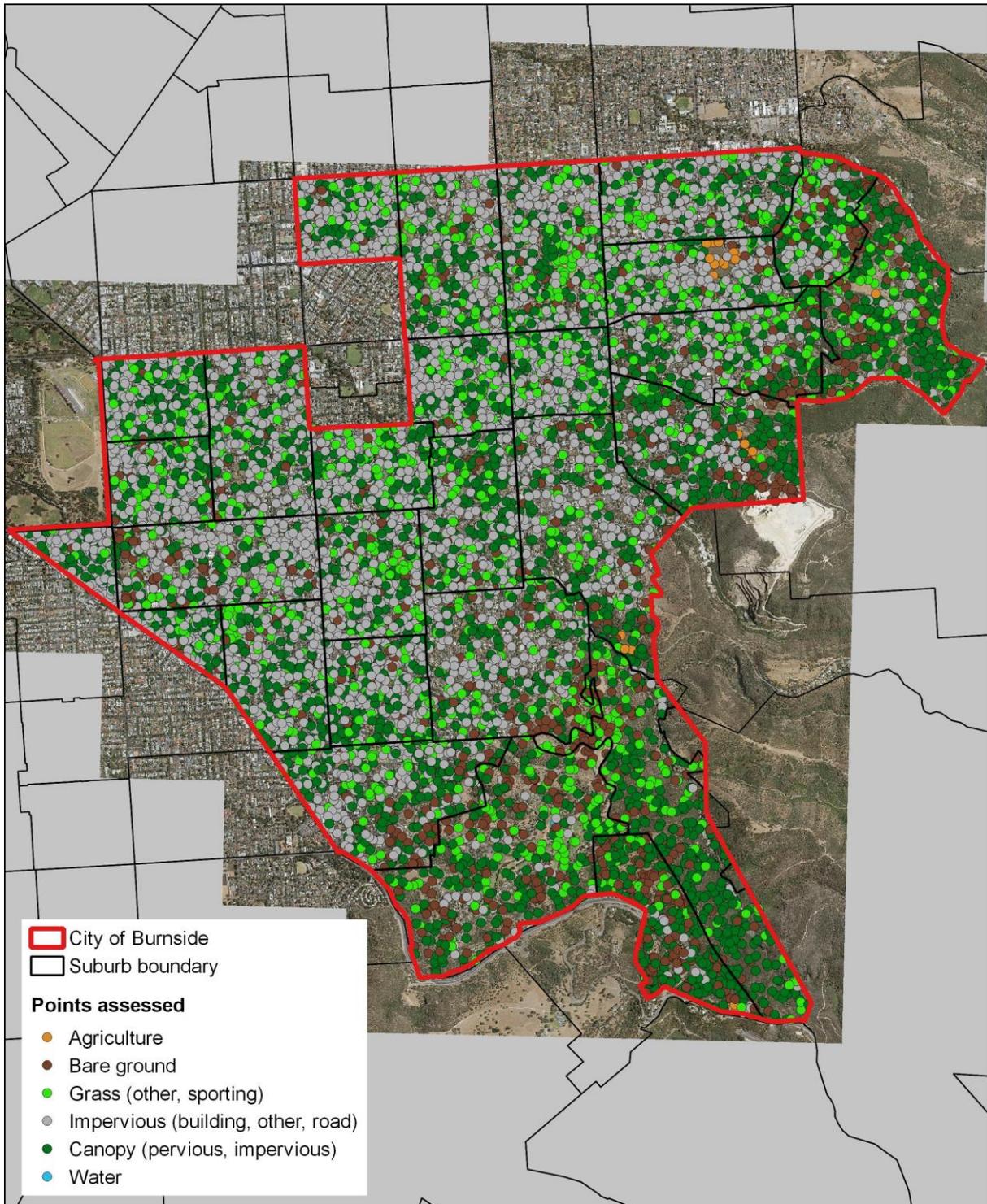
Nearly 45% of the City area was classified as impervious surfaces (Figure 3). Buildings comprised over half of these surfaces, and there was approximately twice as much other impervious surfaces than roads. Just over 31% of the City was covered by tree canopy, with most of this occurring over impervious surfaces (Figure 3). Approximately 22% of the City was classified as plantable space, with non-sporting grassed areas comprising more of this space than bare ground (Figure 3). The remaining small proportion (1.91%) of the City area was comprised of a combination of grassed sporting areas, agriculture, and water (Figure 3). With regard to water cover, it should be noted that given Second Creek traverses the City area, more water is considered to occur in the City than is represented in these findings. The lack of points classified as water is likely an artefact of: (1) exposed water representing a very small percentage of overall land cover in the City; and (2) much of Second Creek being well treed which would mean points which spatially coincide with the creek would likely be classified as tree-impervious, rather than water.

The current estimated canopy cover of 31.28% across the city is slightly higher than the 30.2% reported in the National Benchmarking Report<sup>5</sup> for the year 2013; though this difference is not statistically significant<sup>6</sup>. Key differences between the National Benchmarking Report and this analysis which may account for the difference observed, include the years assessed (2013 versus 2015), and the number of points assessed (1,000 versus 10,780).

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<sup>5</sup> Jacobs, B., Mikhailovich, N. & Delaney, C., 2014. *Benchmarking Australia's Urban Tree Canopy: An i-Tree Assessment, prepared for Horticulture Australia Limited by the Institute for Sustainable Futures*, NSW: University of Technology Sydney.

<sup>6</sup> ( $p = 0.4777$ )



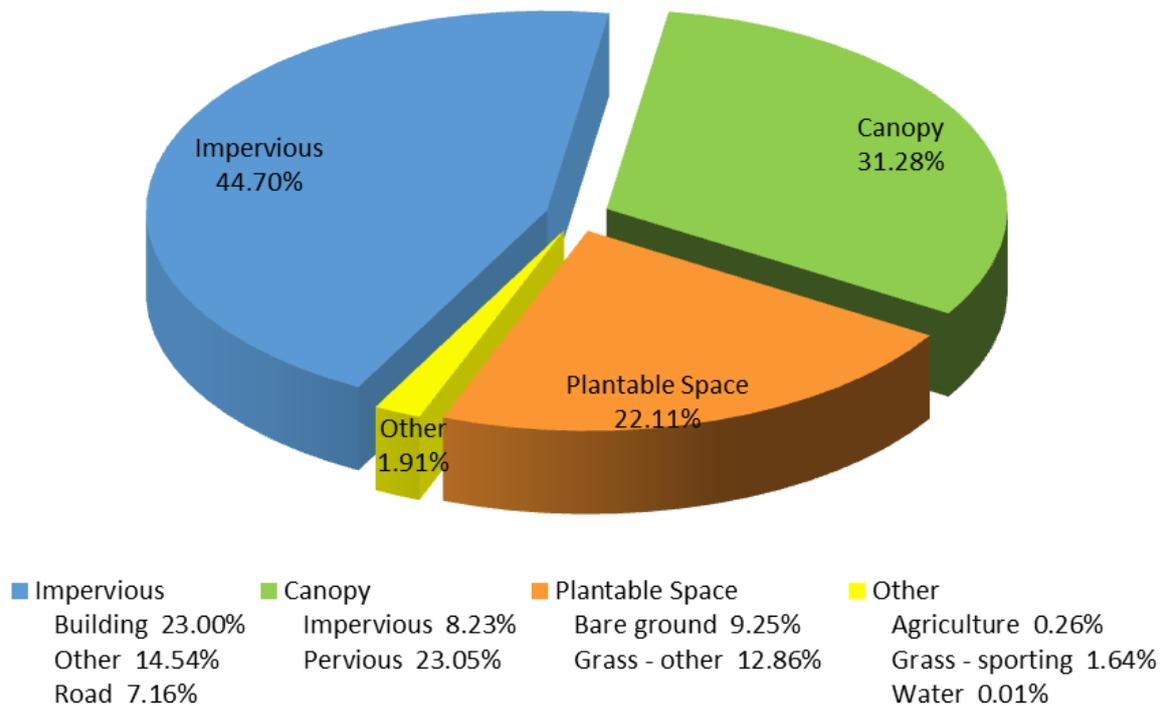
- City of Burnside
  - Suburb boundary
- Points assessed**
- Agriculture
  - Bare ground
  - Grass (other, sporting)
  - Impervious (building, other, road)
  - Canopy (pervious, impervious)
  - Water

**Figure 2. Points classified within the City of Burnside.**

Created: 24/65/2016      Drawn: J. Garden  
 Ref.: 657\_F2v1          Datum: GDA94  
 Data Sources: <http://www.sa.gov.au>  
 Aerial Imagery: City of Burnside 2015

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 1:46,000

Important notes: (i) This map is not guaranteed to be free from error or omissions, and has been produced for the exclusive use of the Client and Seed Consulting Services (ii) Any contours are suitable only for the purpose of this plan; their accuracy has not been verified and no reliance should be placed upon them for any purpose other than the original purpose of this map (iii) Aerial photos and imagery have been overlaid as best fit on the boundaries shown and precision is approximate only (iv) Scale shown is correct for original plan and any copies of this plan should be verified by checking against the scale bar (v) This figure may not be copied unless this note is included.



**Figure 3.** Estimated land cover across the City of Burnside in 2015.

### 3.2 Current land cover across each suburb

All suburbs contained a mixture of impervious, canopy, and plantable space cover, though the proportions varied (Table 3; Figure 2). “Other” cover was classified in 22 of the suburbs. The i-Tree Canopy reports for 2015 land cover in each suburb are provided in Attachment C. A broad land cover trend was apparent, with suburbs tending to be differentiated along a northeast-southwest divide; those suburbs on the southeast side of the divide tended to have higher canopy and plantable space cover and lower impervious cover than suburbs on the northwest side of the divide (Figures 4-6). All land cover percent calculations have a standard error of 2.55 or less (Attachment C).

**Percent impervious cover increases moving east to west** and ranged from 1.82% in Waterfall Gully to 70.39% in Eastwood (Table 3; Figure 4). This difference in cover reflects the geographical locations of Waterfall Gully at the well-vegetated foothills in the southeastern region of the City, compared to Eastwood at the more urbanised and developed western edge. More than half the City’s suburbs were comprised of over 50% impervious cover, whilst four suburbs (all containing substantial areas of the foothills) contained less than 10% impervious cover (Table 3).

**Canopy cover decreases moving east to west** and ranged from 57.4% in Waterfall Gully to 19.74% in Glenside (Table 3; Figure 5). The difference again tends to reflect geographical locations of suburbs either closer to the less developed foothills or the more developed suburban and retail districts. Although visually not the most densely developed suburb,

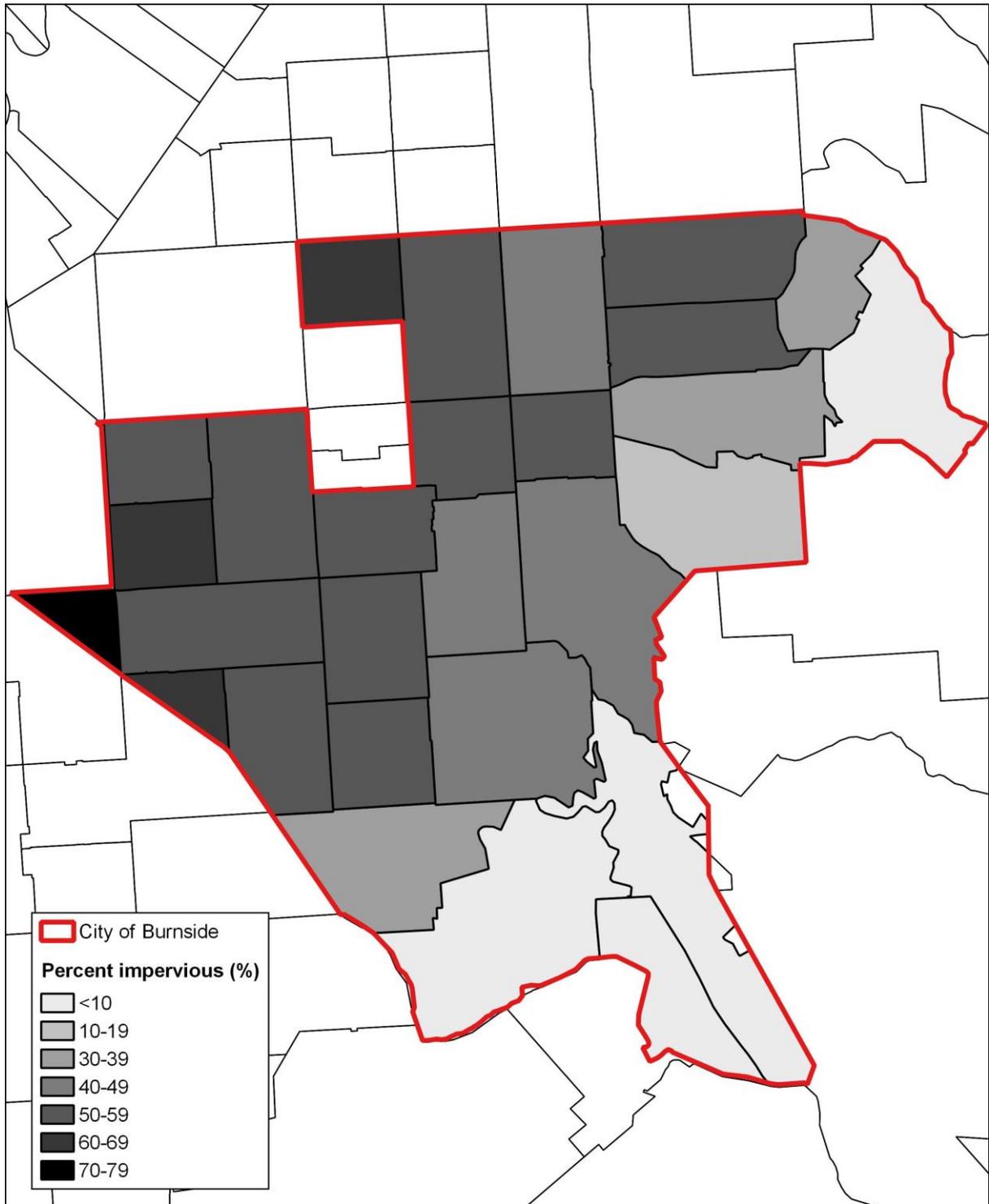
approximately one-third of Glenside comprises the mental health campus of the Royal Adelaide Hospital. Visual assessment of this campus noted a large amount of relatively un-treed open space area, which is likely to be a primary reason for the low canopy cover across the suburb. The three suburbs with the highest canopy cover all occurred at the foothills and contained more than 50% canopy cover (Table 3).

**Percent plantable space cover decreases moving east to west** and ranged from 42.6% in Leawood Gardens to 7.01% in Eastwood (Table 3; Figure 6). The very low plantable space available in Eastwood is due to the highly developed nature of this suburb, as reflected by its highest ranking for impervious cover. Comparatively, Leawood Gardens provides substantial opportunities for increasing total canopy cover across the City through tree plantings, despite already being ranked as having the third highest level of canopy cover. The level of planting opportunities on private versus public land will need to be carefully considered, but was outside the scope of this project. Six suburbs provide planting opportunities in more than 30% of their area (Figure 6).

**Other cover** was less than 10% in all suburbs, with Mount Osmond and Kensington Gardens having the highest percent covers (8.05% and 6.23%, respectively) due to the grassed sporting areas associated with Mount Osmond golf course and Kensington Gardens Reserve (Table 3).

**Table 3.** Land cover in each suburb, ordered by increasing canopy cover. For each suburb, land cover is shown as percent cover (%) and equivalent land area (km<sup>2</sup>). The total cover across the City of Burnside is also shown in bold in the bottom row. Imp. = impervious cover; Can. = canopy cover; Pla. = plantable space cover; Oth. = other cover.

Suburb	Percent cover (%)				Land cover (km <sup>2</sup> )			
	Imp.	Can.	Pla.	Oth.	Imp.	Can.	Pla.	Oth.
Glenside	56.88	19.74	23.12	0.26	0.64	0.22	0.26	0.00
Rossllyn Park	52.73	20.52	21.82	4.94	0.44	0.17	0.18	0.04
Frewville	64.42	21.82	13.77	0.00	0.18	0.06	0.04	0.00
Dulwich	60.00	22.34	16.88	0.78	0.34	0.13	0.10	0.00
Beulah Park	65.19	22.34	12.47	0.00	0.37	0.13	0.07	0.00
Eastwood	70.39	22.60	7.01	0.00	0.20	0.06	0.02	0.00
Erindale	55.32	23.38	18.70	2.60	0.31	0.13	0.10	0.01
Linden Park	55.06	24.42	16.88	3.64	0.46	0.20	0.14	0.03
Kensington Park	52.73	25.19	20.00	2.08	0.58	0.28	0.22	0.02
Magill	54.55	25.19	17.66	2.60	0.59	0.27	0.19	0.03
Toorak Gardens	57.66	26.23	14.29	1.82	0.64	0.29	0.16	0.02
Tusmore	53.25	26.23	18.96	1.56	0.35	0.17	0.13	0.01
Leabrook	55.06	26.49	14.29	4.16	0.35	0.17	0.09	0.03
Rose Park	57.66	27.79	14.55	0.00	0.32	0.16	0.08	0.00
Kensington Gardens	47.27	28.31	18.18	6.23	0.52	0.31	0.20	0.07
Glenunga	52.73	29.09	13.25	4.94	0.47	0.26	0.12	0.04
Beaumont	41.30	29.61	28.57	0.52	0.65	0.47	0.45	0.01
St Georges	51.69	30.39	16.88	1.04	0.36	0.21	0.12	0.01
Auldana	31.43	30.65	36.88	1.04	0.19	0.19	0.23	0.01
Wattle Park	37.40	32.21	30.13	0.26	0.43	0.37	0.35	0.00
Hazelwood Park	46.23	33.51	20.26	0.00	0.44	0.32	0.19	0.00
Glen Osmond	39.74	36.36	22.60	1.30	0.50	0.46	0.29	0.02
Burnside	40.26	36.62	21.04	2.08	0.69	0.62	0.36	0.04
Stonyfell	27.01	44.68	25.45	2.86	0.35	0.58	0.33	0.04
Mount Osmond	8.31	45.19	38.44	8.05	0.17	0.94	0.80	0.17
Leawood Gardens	6.49	50.39	42.60	0.52	0.05	0.41	0.35	0.00
Skye	9.09	57.14	33.51	0.26	0.12	0.78	0.46	0.00
Waterfall Gully	1.82	57.40	40.78	0.00	0.03	1.00	0.71	0.00
<b>City of Burnside (total)</b>	<b>44.70</b>	<b>31.28</b>	<b>22.11</b>	<b>1.91</b>	<b>12.26</b>	<b>8.58</b>	<b>6.06</b>	<b>0.52</b>



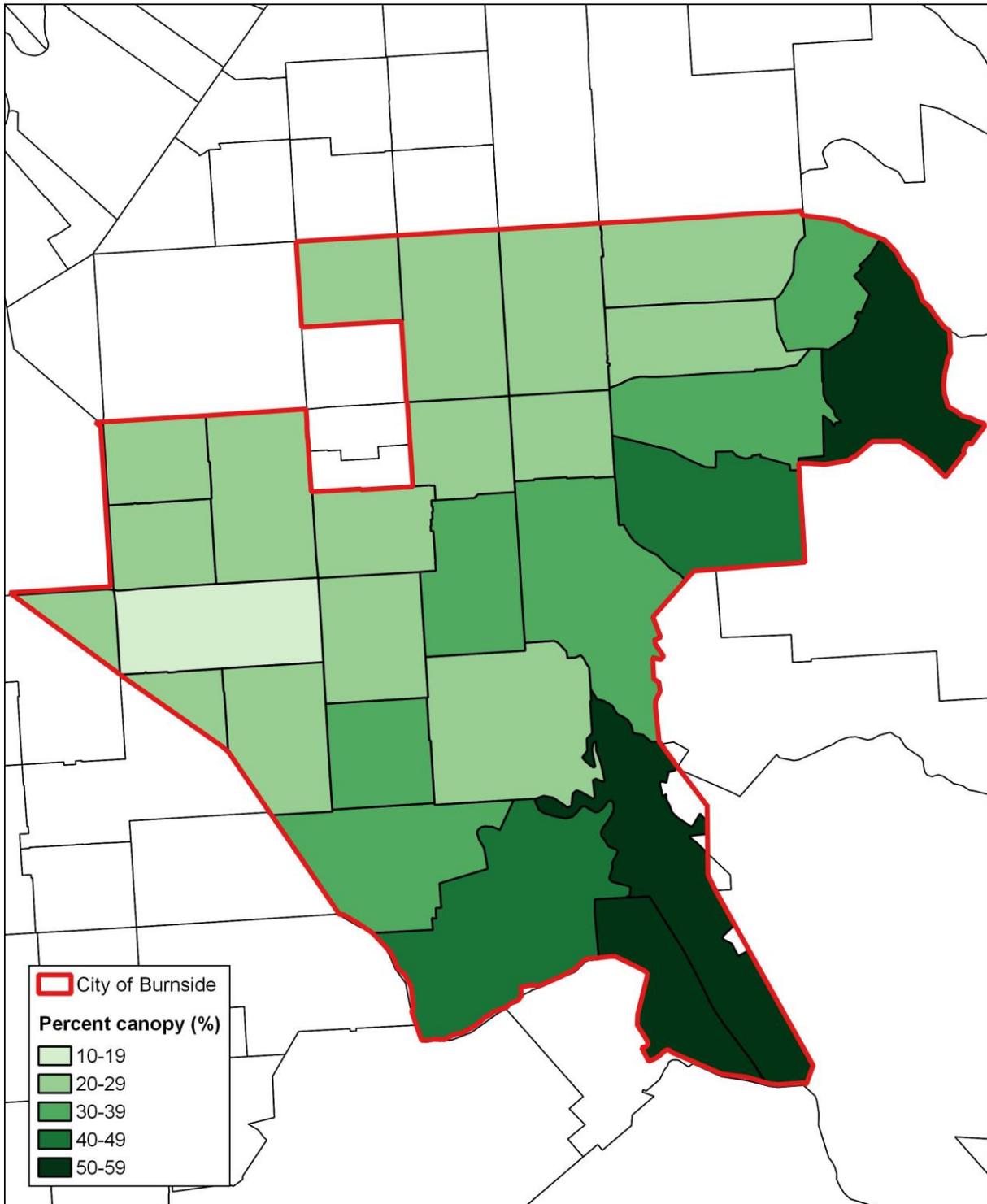
**Figure 4. Percent impervious cover by suburb in 2015**

Created: 24/65/2016  
 Ref.: 657\_F4v1  
 Data Sources: <http://www.sa.gov.au>

Drawn: J. Garden  
 Datum: GDA94

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Important notes: (i) This map is not guaranteed to be free from error or omissions, and has been produced for the exclusive use of the Client and Seed Consulting Services (ii) Any contours are suitable only for the purpose of this plan; their accuracy has not been verified and no reliance should be placed upon them for any purpose other than the original purpose of this map (iii) Aerial photos and imagery have been overlaid as best fit on the boundaries shown and precision is approximate only (iv) Scale shown is correct for original plan and any copies of this plan should be verified by checking against the scale bar (v) This figure may not be copied unless this note is included.



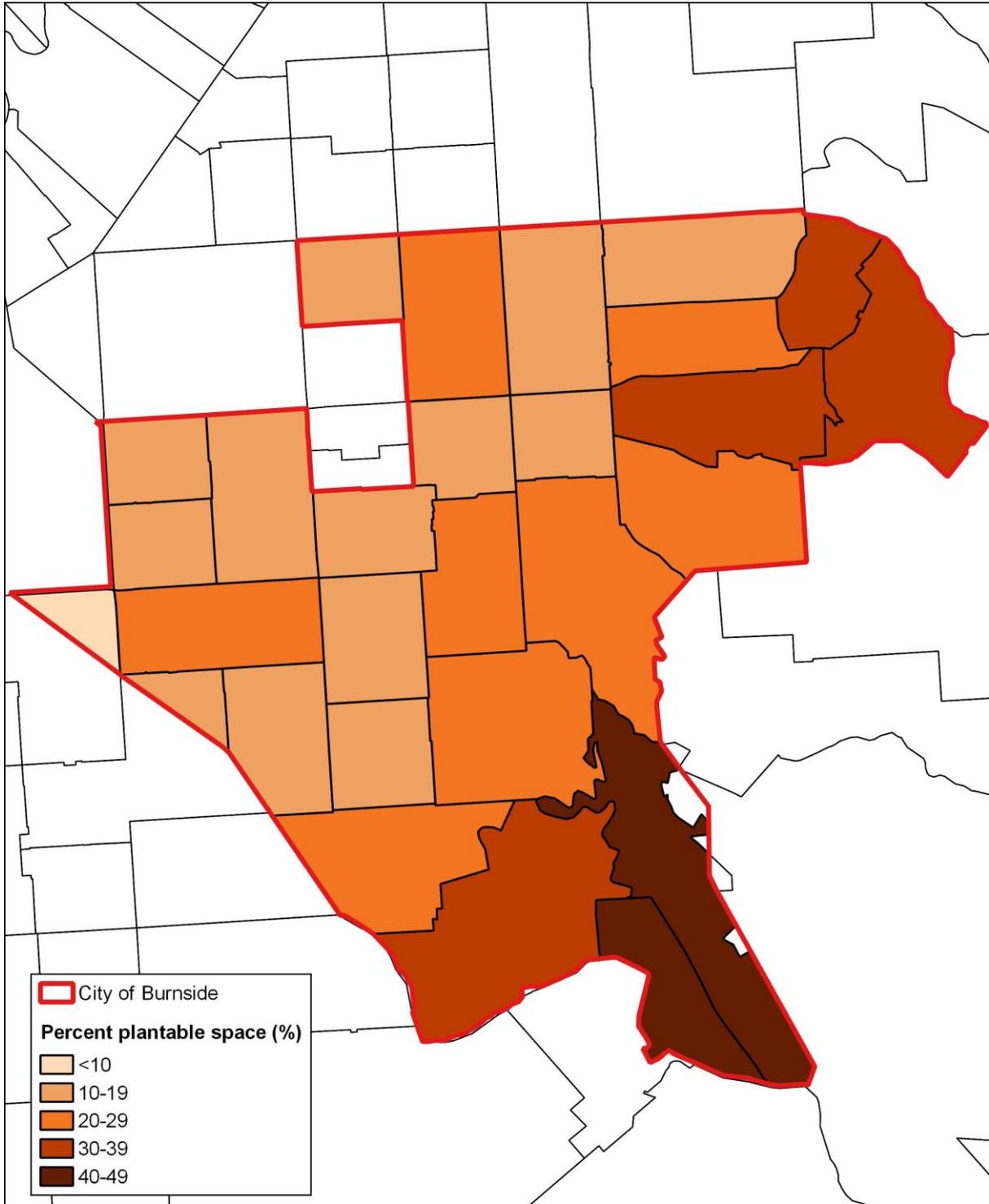
**Figure 5. Percent canopy cover by suburb in 2015**

Created: 24/65/2016  
 Ref.: 657\_F5v1  
 Data Sources: <http://www.sa.gov.au>

Drawn: J. Garden  
 Datum: GDA94

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Important notes: (i) This map is not guaranteed to be free from error or omissions, and has been produced for the exclusive use of the Client and Seed Consulting Services (ii) Any contours are suitable only for the purpose of this plan; their accuracy has not been verified and no reliance should be placed upon them for any purpose other than the original purpose of this map (iii) Aerial photos and imagery have been overlaid as best fit on the boundaries shown and precision is approximate only (iv) Scale shown is correct for original plan and any copies of this plan should be verified by checking against the scale bar (v) This figure may not be copied unless this note is included.



**Figure 6. Percent plantable space cover by suburb in 2015**

Created: 24/65/2016  
 Ref.: 657\_F6v1  
 Data Sources: <http://www.sa.gov.au>

Drawn: J. Garden  
 Datum: GDA94

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Important notes: (i) This map is not guaranteed to be free from error or omissions, and has been produced for the exclusive use of the Client and Seed Consulting Services (ii) Any contours are suitable only for the purpose of this plan; their accuracy has not been verified and no reliance should be placed upon them for any purpose other than the original purpose of this map (iii) Aerial photos and imagery have been overlaid as best fit on the boundaries shown and precision is approximate only (iv) Scale shown is correct for original plan and any copies of this plan should be verified by checking against the scale bar (v) This figure may not be copied unless this note is included.

### 3.3 Land cover change over time

As requested by the City of Burnside, changes in land cover between 2010 and 2015 were assessed for Burnside, Glenside, and Magill; with these three suburbs acting as trial suburbs for this assessment. The ensuing section reports on the key trends in impervious, canopy, plantable space, and other cover in each of the trial suburbs. The i-Tree Canopy reports for 2010 land cover in the trial suburbs are provided in Attachment D.

**Impervious cover** across all three suburbs increased by 9.09% between 2010 and 2015. Although increasing trends occurred in each suburb, the increases were not statistically significant<sup>7</sup> (Figure 7; Table 4). The greatest increase occurred in Magill (3.9%) and the least in Glenside (2.3%). The increasing trends were driven primarily by increased building cover in all suburbs, most likely as a result of urban in-fill. Other impervious surfaces also increased in Burnside and Magill, but decreased in Glenside, and road cover decreased in each suburb, though not significantly (Table 4).

**Canopy cover** across all three suburbs declined by 9.87% between 2010 and 2015. Although declining trends occurred in each suburb, none were statistically significant<sup>7</sup> (Figure 7; Table 4). The greatest decline occurred in Burnside (5.7%), and was driven primarily by a decline in canopy cover over pervious surfaces. Magill and Glenside both showed a 2.1% decline in canopy cover. In Magill, this was driven by a loss of canopy over pervious surfaces, whereas canopy loss over pervious and impervious surfaces occurred equally in Glenside.

**Plantable space cover** across all three suburbs increased by 0.52%. Trends varied among suburbs, with cover increasing in Burnside, decreasing in Magill, and remaining constant in Glenside (Figure 7; Table 4). None of these changes were statistically significant<sup>7</sup>. The increase in cover in Burnside was driven by increases in bare ground and non-sporting grass areas. Many bare ground points were observed to coincide with new building sites which suggests a reassessment of land cover in the future will result in these points changing to impervious cover.

Although the amount of plantable space remained constant in Glenside, changes in land cover were observed with the decline in bare ground (due largely to urban in-fill) being countered by an equal, and statistically significant<sup>7</sup>, increase in grass-other (Table 4). Some of this increase in grass cover was observed to be due to lawns being established at new residential developments.

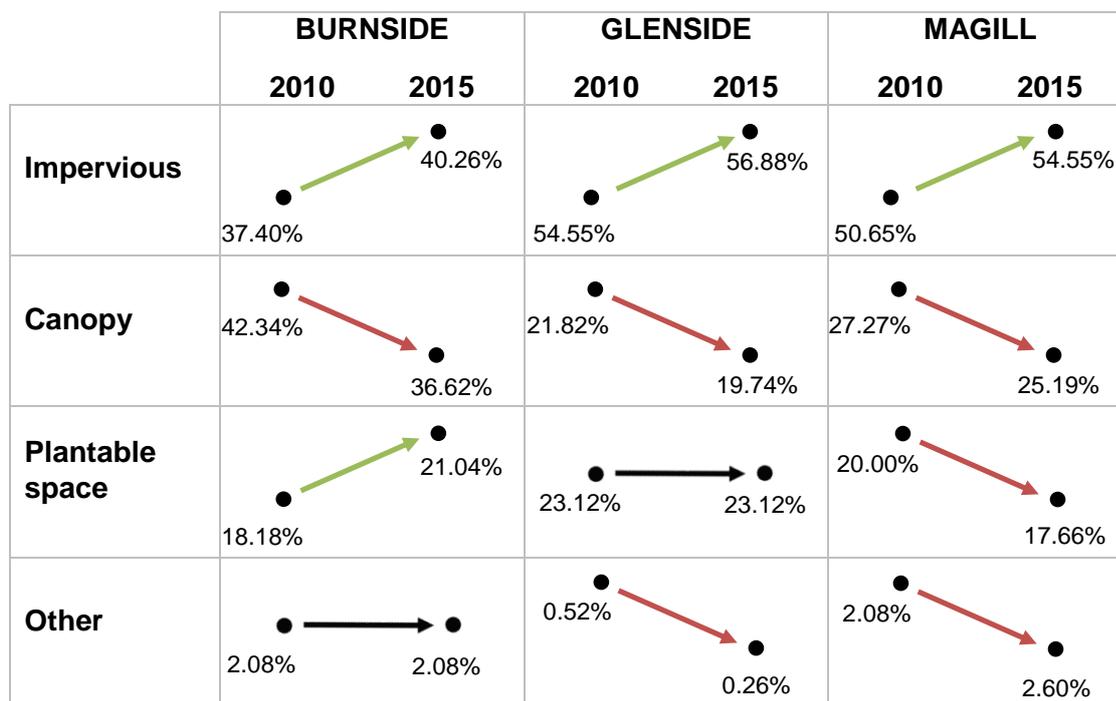
The decrease in plantable space in Magill is driven primarily by a statistically significant<sup>7</sup> decline in bare ground due largely to urban in-fill. Similarly, a statistically significant<sup>7</sup> increase in grass-other also was observed, though the amount of change was less than that calculated for bare ground (Table 4).

**Other cover** changed little over time across the three suburbs (Table 4). A slight increase occurred in Magill due to an increase in grass-sporting; a slight decline occurred in Glenside due to a decrease in grass-sporting; and, no change was found in Burnside. None of the changes calculated were statistically significant<sup>7</sup>.

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<sup>7</sup> at  $p < 0.05$

**Figure 7.** Trends in land cover change between 2010 and 2015 for the suburbs of Burnside, Glenside and Magill. Refer to Table 4 for further details.



**Table 4.** Changes in land cover between 2010 and 2015 for the suburbs of Burnside, Glenside and Magill. Change in percent cover marked with an asterisk (\*) indicates statistically significant changes at p = 0.05.

Land Cover Category	BURNSIDE			GLENSIDE			MAGILL		
	Percent Cover (%)			Percent Cover (%)			Percent Cover (%)		
	2010	2015	Change	2010	2015	Change	2010	2015	Change
<b>Impervious</b>	<b>37.40</b>	<b>40.26</b>	<b>2.86</b>	<b>54.55</b>	<b>56.88</b>	<b>2.34</b>	<b>50.65</b>	<b>54.55</b>	<b>3.90</b>
Impervious - building	18.96	21.30	2.34	28.05	31.95	3.90	25.71	28.57	2.86
Impervious - other	12.99	13.77	0.78	15.58	14.29	-1.30	15.84	17.40	1.56
Impervious - road	5.45	5.19	-0.26	10.91	10.65	-0.26	9.09	8.57	-0.52
<b>Tree</b>	<b>42.34</b>	<b>36.62</b>	<b>-5.71</b>	<b>21.82</b>	<b>19.74</b>	<b>-2.08</b>	<b>27.27</b>	<b>25.19</b>	<b>-2.08</b>
Tree - impervious	10.13	9.09	-1.04	9.35	8.31	-1.04	7.27	7.01	-0.26
Tree - pervious	32.21	27.53	-4.67	12.47	11.43	-1.04	20.00	18.18	-1.82
<b>Plantable space</b>	<b>18.18</b>	<b>21.04</b>	<b>2.86</b>	<b>23.12</b>	<b>23.12</b>	<b>0</b>	<b>20.00</b>	<b>17.66</b>	<b>-2.34</b>
Bare ground	8.83	9.87	1.04	16.62	12.47	-4.16	14.55	6.49	-8.05*
Grass - other	9.35	11.17	1.82	6.49	10.65	4.16*	5.45	11.17	5.71*
<b>Other</b>	<b>2.08</b>	<b>2.08</b>	<b>0</b>	<b>0.52</b>	<b>0.26</b>	<b>-0.26</b>	<b>2.08</b>	<b>2.60</b>	<b>0.52</b>
Agriculture	0.78	0.78	0	0	0	0	0	0	0
Grass - sporting	1.30	1.30	0	0.52	0.26	-0.26	2.08	2.60	0.52

# 4 Discussion

Trees are a critical element of the urban environment, not only because they contribute significantly to a city's character and liveability and help create a unique "sense of place", but also because they provide a suite of other beneficial services for the environment, biodiversity, and people. Under increasing urbanisation pressures and competition of space, being able to effectively and efficiently quantify land cover and change over time in a transparent and repeatable manner will equip urban land managers with tools and information necessary to justify the need for trees, monitor the success of greening objectives, and prioritise locations for targeting specific programs and actions in order to achieve the desired outcomes for the City.

i-Tree Canopy was used to measure current (2015) land cover (including canopy cover) across the City of Burnside. In addition, the software was also used to demonstrate how trends in land cover change could be assessed over time. The i-Tree Canopy software provides a rapid, consistent, user-friendly and transparent approach to measuring and monitoring land cover and land cover change. In addition, the land cover metrics established in this project provide a benchmark of tree canopy cover and inform future decision-making regarding tree management, the efficacy of tree planting programs, and action prioritisation.

## 4.1 Key findings

The key findings from the project are summarised below:

- The City is comprised primarily of impervious surfaces (44.7%), followed by canopy cover (31.28%), plantable space (22.11%), and other cover (1.91%);
- There is a clear demarcation of suburbs with regard to land cover proportions, with those suburbs closest to the foothills in the southeast of the City having higher canopy and plantable space cover and lower impervious cover than suburbs further from the foothills in the northwest of the City;
  - Following this general pattern from southeast to northwest, impervious cover ranged from 1.82% to 70.39%; canopy cover ranged from 57.4% to 19.74%, and plantable space cover ranged from 42.6% to 7.01%; and
- Across the three suburbs assessed for land cover change over a five-year period (2010-2015), impervious cover increased by 9.1% (particularly buildings), canopy cover decreased by 9.87% (particularly over pervious surfaces), and plantable space increased by 0.52%. The direction of change for impervious and canopy cover were consistent within each suburb, though plantable space varied among suburbs;
  - These trends are indicative of urban in-fill processes which lead to a replacement of canopy and plantable space as properties are sub-divided and houses built. There is likely to be an observable time lag in land cover proportions as urban in-fill continues, with canopy loss and increased plantable space likely to be observed initially (as properties are cleared in preparation for development), followed by a subsequent increase in impervious cover as buildings are constructed. This lag also explains the variation in plantable space trends across the suburbs assessed.

## 4.2 Implications of tree declines

If land cover change trends quantified for Burnside, Glenside and Magill are representative of City-wide trends, then ongoing losses of canopy cover over time is likely as urban development continues. Loss of canopy cover will also occur from other processes such as natural senescence, storm damage, and climate change. Without considered and targeted tree planting actions, these processes will result in a significant loss of canopy cover across the City over the next 5-10 years and beyond. Such declines present a major challenge for Council in meeting future goals around canopy cover protection, recreation and open space, and climate change adaptation, especially given projected rates and extents of on-going urban in-fill. Mitigating future tree loss and moving towards overall canopy cover maintenance or gain across the City will require complimentary greening actions on public and private land.

The implications of on-going declining tree cover will be wide and varied, with substantial negative impacts on the liveability, prosperity, and long-term resilience of the City. Specific examples include<sup>8</sup>:

- decreased resilience to climate change impacts, particularly increased temperatures, and exposure to wind and rainfall intensity associated with storms;
- increased urban heat island effects (i.e. increased ambient temperatures), which will be exacerbated by climate change-induced temperature rises;
  - increased temperatures will have substantial negative implications for: human health and well-being (particularly vulnerable members of the community); the wear and maintenance of built assets (e.g. roads); water availability; building energy efficiency; and, the survival and maintenance costs associated with existing green infrastructure elements;
- decreased shading will affect community connectedness by people being less inclined to spend leisure time outdoors in hot parks and gardens. Where shading is lost near buildings, increased energy costs associated with cooling the building may occur;
- lower air quality (e.g. dust and pollutants), which will impact human health and well-being, particularly vulnerable members of the community (e.g. very young or elderly, and those with compromised respiratory systems);
- increased winds, with this exacerbating decreased air quality and community health, as well as decreasing the liveability and attractiveness of the City;
- increased localised flooding and destabilised waterway/coastal banks and margins, which will directly impact infrastructure and communities and decrease water quality;

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<sup>8</sup> e.g. Bolund P., Hunhammar S. (1999) Ecosystem services in urban areas. *Ecological Economics*, 29, 293-301.

Hastie C. (2003) The benefits of urban trees. A summary prepared for Warwick District Council, Leamington Spa, UK. Available from: <http://www.naturewithin.info/UF/TreeBenefitsUK.pdf>

Shanahan D., et al. (2016) Health benefits from nature experiences depend on dose. *Nature Scientific Reports*, doi:10.1038/srep28551.

- increased amount and velocity, and decreased quality, of stormwater run-off, which will have negative ramifications for aquatic and marine environments;
- decreased human physical and mental health resulting from a loss of interactions with “natural” landscape elements such as trees, and a loss of ecosystem services provided by trees (e.g. oxygen production, carbon storage and sequestration, and air pollution removal);
- decreased biodiversity benefits, such as wildlife foraging and shelter opportunities, and landscape connectivity (which will become particularly important for conserving wildlife species in the plains regions by facilitating range shifts in response to climate change)
  - such impacts may compromise the functioning of whole ecosystems, and potentially have flow-on effects to other systems reliant on natural ecosystem functioning (e.g. nearby horticultural systems may be impacted if natural pest predators and pollinators no longer occur in the region); and
- decreased amenity, which will decrease property values and the desire for people to live, work and visit the City, with flow-on effects to local economic prosperity and crime rates; and
- decreased local economic prosperity and real estate values due to a loss of trees, with trees having been shown to produce more “attractive” places to live and work and treed areas commanding higher property values than non-treed counterparts.

### 4.3 Future opportunities

The information derived from this project will likely have immediate applications for informing management decisions and target-setting, including responding to Target 5 of the recently released draft 30 Year Plan for Greater Adelaide<sup>9</sup>. A number of additional opportunities exist to further inform decisions and prioritise actions, such as:

- completing land cover change analyses for the other 25 suburbs to generate a consistent and comprehensive City-wide understanding of trends over time;
- investigating and understanding land cover trends between private and public land in each suburb;
  - a key barrier for local councils aiming to protect and increase canopy cover is their limited influence on activities occurring on private land. This is particularly problematic in higher density residential suburbs and suburbs with high levels of urban in-fill occurring. Enacting programs (e.g. incentives, education, and behavioural change) which encourage tree plantings on private land and elicit support for additional plantings on public land will be important for councils wishing to maintain or increase tree (canopy) cover across their City area;

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<sup>9</sup> <https://livingadelaide.sa.gov.au/>

- identifying and spatially mapping key climatic indicators that may benefit from increased tree plantings, such as thermal hotspots. Such information could be used to investigate spatial congruence with planting opportunities; and
- identifying and spatially mapping key demographic indicators that may benefit from increased tree plantings, such as: socio-economic classes, age classes, and health classes. Such information could be used to investigate spatial congruence with planting opportunities;
- conducting virtual forecasting of change in impervious cover and canopy cover into the future, based on approved and proposed development applications and planting programs; and
- valuing the urban forest as an urban asset;
  - whilst i-Tree Canopy can provide some high-level benchmarking valuations of trees (See reports in Attachments C and D), applying i-Tree Eco will enable the direct value of certain ecosystem services provided by urban trees to be calculated which can then be used to view trees as urban assets and justify the business-case for trees.

# 5 Attachments

**Attachment A.** Power analysis and allocation of survey points.

**Attachment B.** Number of points, percent cover, and equivalent land area for each land cover category in 2015 in City of Burnside.

**Attachment C.** i-Tree Canopy reports for the 28 suburbs assessed in 2015.

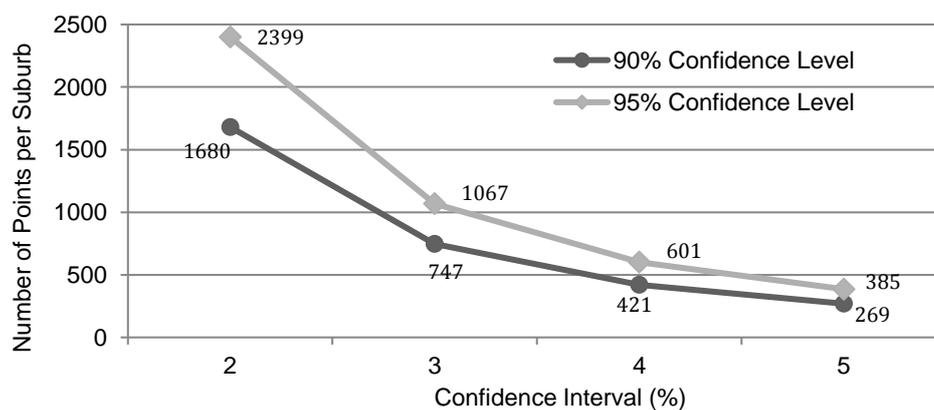
**Attachment D.** i-Tree Canopy reports for the 3 suburbs assessed in 2010.

**Attachment A.** Power analysis and process used by i-Tree Canopy to allocate and classify points

The study area, number of points, and land cover categories are all user-defined. The i-Tree Canopy software randomly allocates points within a study area overlaid on Google Earth imagery and the user classifies the land cover beneath each point to a category. As each point is classified, an automated statistical estimate for land cover (area, km<sup>2</sup>, and percent, %) in the study area, as well as an uncertainty estimate (i.e. standard error, SE) is provided. The more points classified, the lower the standard error and the more precise the estimated cover should be. However, the more land-cover categories defined the more points that need to be classified in order to achieve statistical stabilisation of estimates<sup>10</sup>.

i-Tree Canopy suggests surveying 500-1000 points per sample area, though the difference in resources required to survey 500 points versus 1000 points can be substantial when multiple areas are involved, with potentially little gain in precision and varying levels of confidence in the outputs. The authors of Australia’s national canopy benchmarking report undertook further evaluations and found that between 600-1000 points would tend to provide a standard error of less than three percent<sup>5</sup>. However, this again would result in varying confidence levels in outputs given the varying sampling intensity among larger and smaller areas (i.e. likely lower confidence levels for larger areas, and higher for smaller areas).

For this project, a power analysis based on a confidence level (CL) of 95% and a confidence interval (CI) of 5% (as selected by the City of Burnside) identified 385 points would achieve statistically acceptable levels of error (Figure A1) among suburbs of varying sizes whilst limiting the potential for surveying more points than necessary to produce fit-for-purpose outputs. That is, surveying 385 points provides at least a 95% confidence level that the estimated outputs of land cover percentages are within 5% of actual cover percentages in each suburb. In order to greatly improve on these confidence levels and intervals, 600 or more points would need to be surveyed (Figure A1).



**Figure A1.** Power analysis showing the number of points required to achieve confidence levels of 90% or 95% and confidence intervals of 2-5%.

<sup>10</sup> Jacobs, B., Mikhailovich, N. & Delaney, C., 2014. *Benchmarking Australia's Urban Tree Canopy: An i-Tree Assessment, prepared for Horticulture Australia Limited by the Institute for Sustainable Futures*, NSW: University of Technology Sydney.

**Attachment B.** Number of points, percent cover (%), and equivalent land area for each land cover category in 2015 relative to the 10,780 points sampled across the City of Burnside.

<b>LAND COVER CATEGORY</b>	<b>No. Points</b>	<b>Percent Cover (%)</b>	<b>Land Area (km<sup>2</sup>)</b>
<b>IMPERVIOUS</b>	<b>4819</b>	<b>44.70</b>	<b>12.25</b>
Impervious – building	2480	23.01	6.31
Impervious – other	1567	14.54	3.99
Impervious – road	772	7.16	1.96
<b>TREE/CANOPY</b>	<b>3372</b>	<b>31.28</b>	<b>8.57</b>
Tree – impervious	887	8.23	2.26
Tree – pervious	2485	23.05	6.32
<b>PLANTABLE SPACE</b>	<b>2383</b>	<b>22.11</b>	<b>6.06</b>
Bare ground	997	9.25	2.54
Grass – other	1386	12.86	3.53
<b>OTHER</b>	<b>206</b>	<b>1.91</b>	<b>0.52</b>
Agriculture	28	0.26	0.07
Grass – sporting	177	1.64	0.45
Water	1	0.01	0.002

**Attachment C.** i-Tree Canopy reports for the 28 suburbs assessed in 2015.



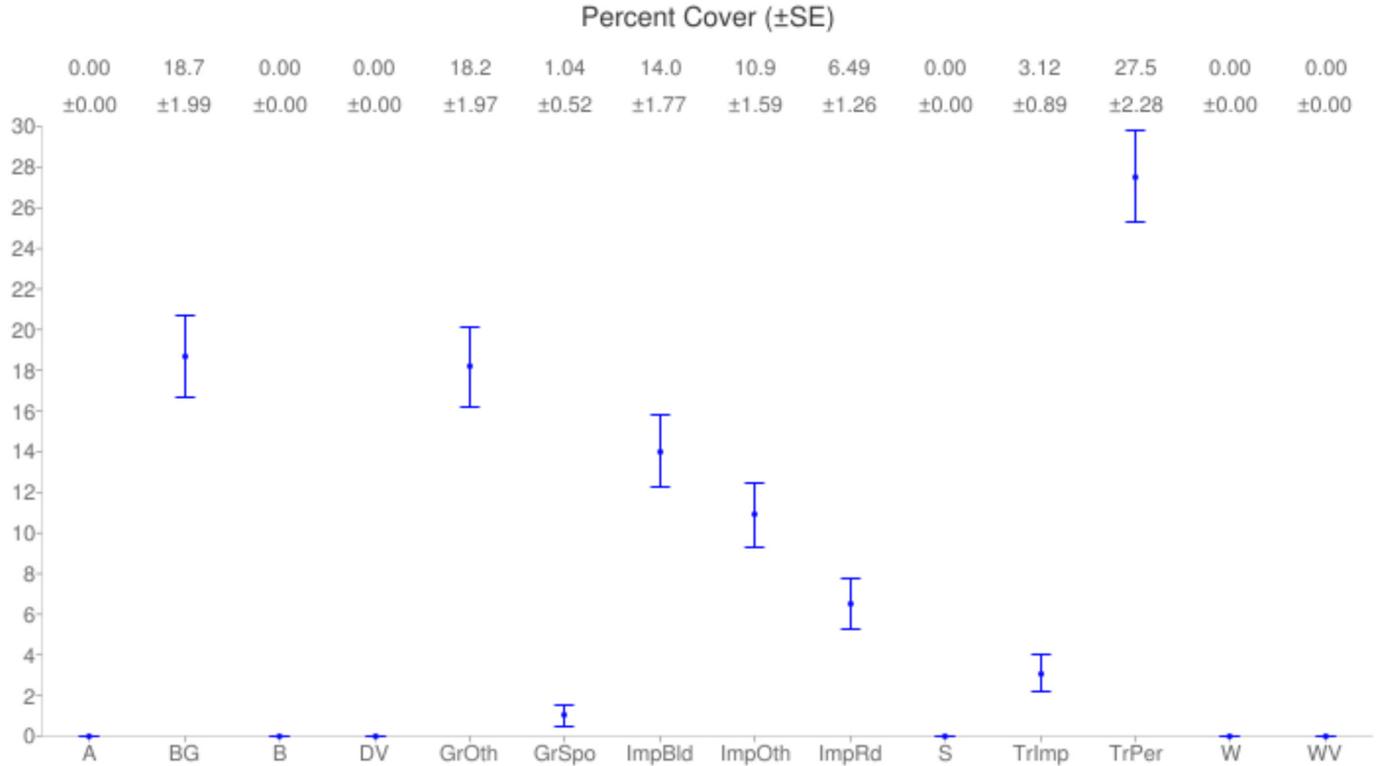
AULDANA - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/12/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	72	18.7 ±1.99
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	70	18.2 ±1.97
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	4	1.04 ±0.52
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	54	14.0 ±1.77
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	42	10.9 ±1.59
Impervious - road	A sealed road.	ImpRd	25	6.49 ±1.26
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	12	3.12 ±0.89
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	106	27.5 ±2.28

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

**Tree Benefit Estimates**

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$71.34	±5.47	36.14 kg	±2.77
NO2	Nitrogen Dioxide removed annually	\$253.32	±19.42	210.40 kg	±16.13
O3	Ozone removed annually	\$12,355.14	±947.18	1.30 t	±0.10
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$10,973.03	±841.22	34.02 kg	±2.61
SO2	Sulfur Dioxide removed annually	\$15.88	±1.22	42.61 kg	±3.27
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$3,608.51	±276.64	388.85 kg	±29.81
CO2seq	Carbon Dioxide sequestered annually in trees	\$14,329.39	±1,098.53	266.57 t	±20.44
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$210,946.22	±16,171.71	5.27 kt	±0.40

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,974.16 | NO2 1.125 @ \$1,203.96 | O3 6.934 @ \$9,527.83 | PM2.5 0.182 @ \$322,514.19 | SO2 0.228 @ \$372.58 | PM10\* 2.079 @ \$9,280.01 | CO2seq 1,425.370 @ \$53.75 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

**About i-Tree Canopy**

The concept and prototype of this program were developed by David J. Nowak, Jeffery T. Walton and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company).

**Limitations of i-Tree Canopy**

The accuracy of the analysis depends upon the ability of the user to correctly classify each point into its correct class. As the number of points increase, the precision of the estimate will increase as the standard error of the estimate will decrease. If too few points are classified, the standard error will be too high to have any real certainty of the estimate.

**A Cooperative Initiative Between:**



www.itreetools.org



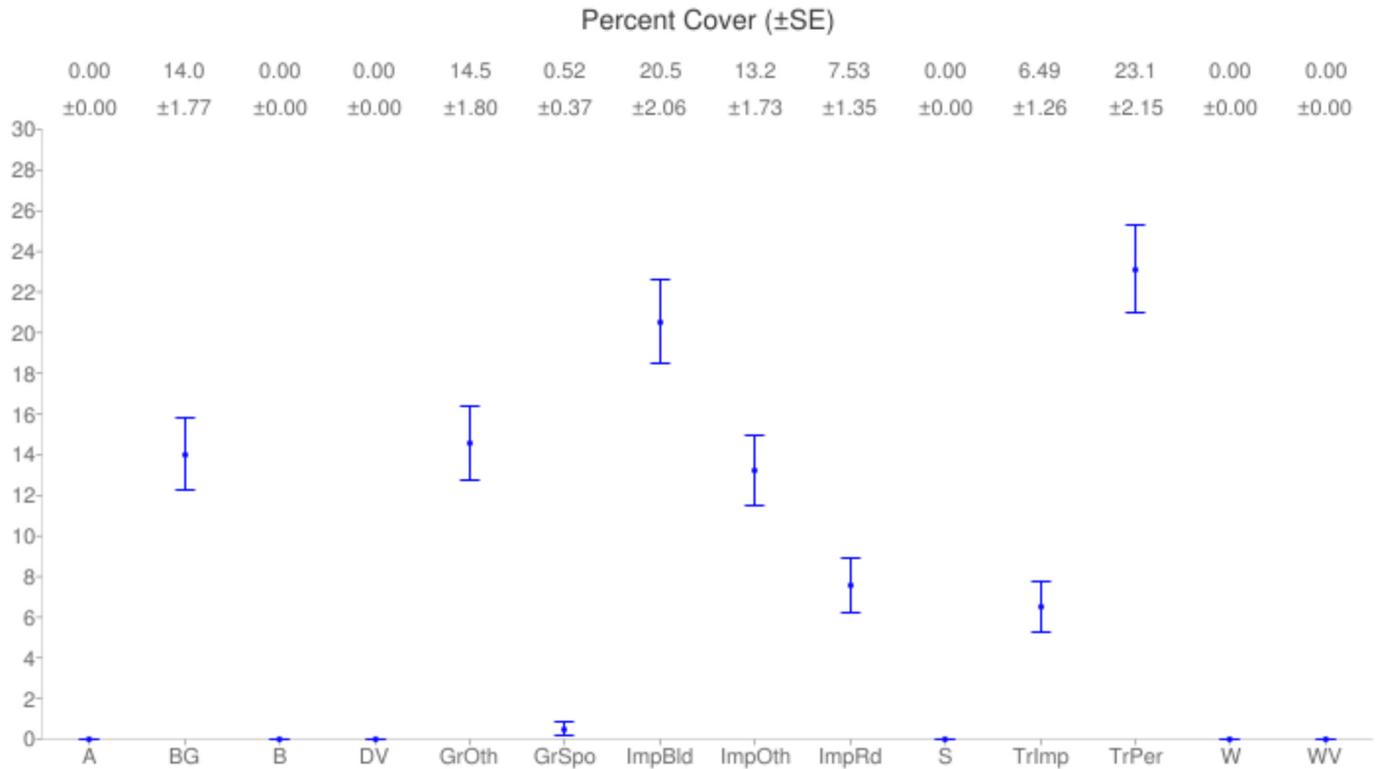
BEAUMONT - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/21/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	54	14.0 ±1.77
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	56	14.5 ±1.80
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	2	0.52 ±0.37
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	79	20.5 ±2.06
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	51	13.2 ±1.73
Impervious - road	A sealed road.	ImpRd	29	7.53 ±1.35
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	25	6.49 ±1.26
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	89	23.1 ±2.15

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

**Tree Benefit Estimates**

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$177.04	±13.91	89.68 kg	±7.05
NO2	Nitrogen Dioxide removed annually	\$628.59	±49.39	522.10 kg	±41.03
O3	Ozone removed annually	\$30,658.73	±2,409.11	3.22 t	±0.25
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$27,229.11	±2,139.61	84.43 kg	±6.63
SO2	Sulfur Dioxide removed annually	\$39.39	±3.10	105.73 kg	±8.31
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$8,954.37	±703.62	964.91 kg	±75.82
CO2seq	Carbon Dioxide sequestered annually in trees	\$35,557.76	±2,794.06	661.48 t	±51.98
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$523,453.89	±41,132.04	13.08 kt	±1.03

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,974.16 | NO2 1.125 @ \$1,203.96 | O3 6.934 @ \$9,527.83 | PM2.5 0.182 @ \$322,514.19 | SO2 0.228 @ \$372.58 | PM10\* 2.079 @ \$9,280.01 | CO2seq 1,425.370 @ \$53.75 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

**About i-Tree Canopy**

The concept and prototype of this program were developed by David J. Nowak, Jeffery T. Walton and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company).

**Limitations of i-Tree Canopy**

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**A Cooperative Initiative Between:**



www.itreetools.org



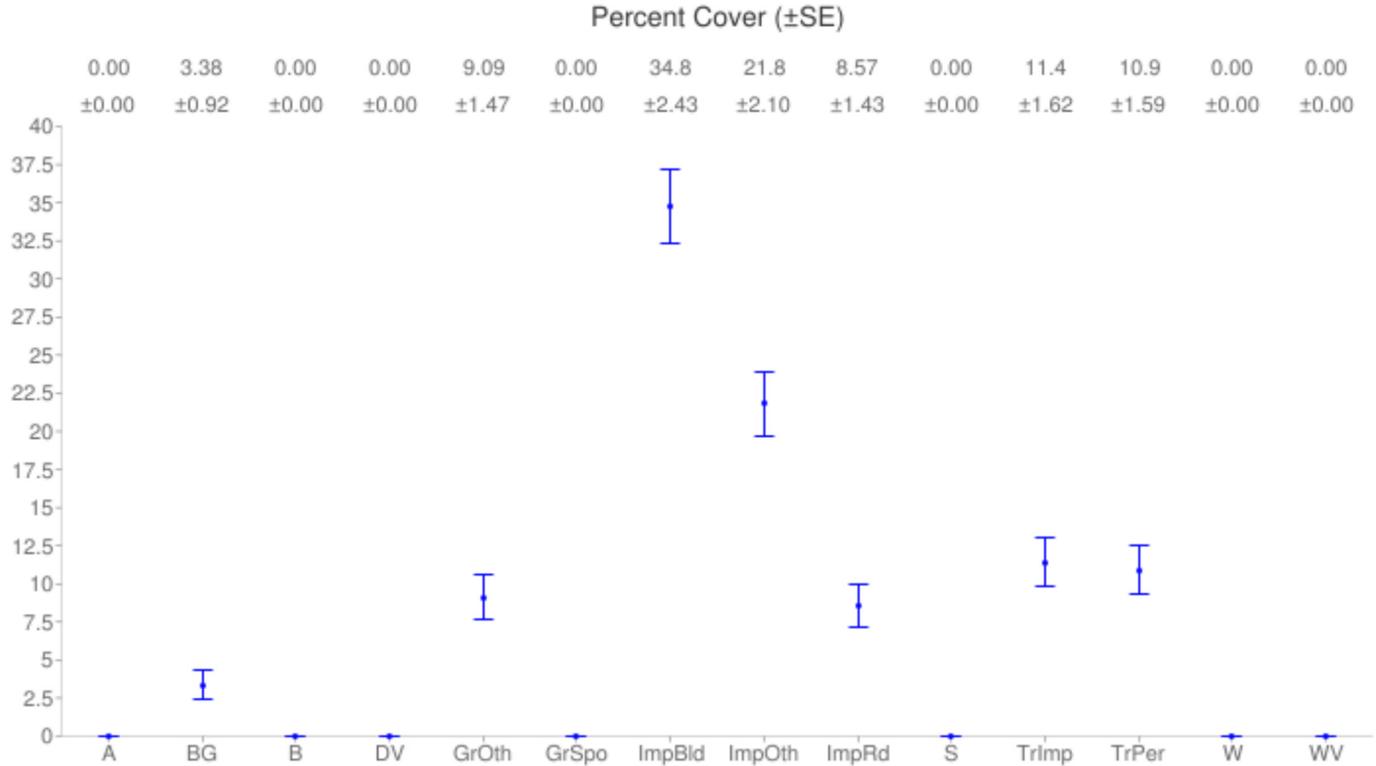
BEULAH PARK - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/12/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	13	3.38 ±0.92
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	35	9.09 ±1.47
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	0	0.00 ±0.00
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	134	34.8 ±2.43
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	84	21.8 ±2.10
Impervious - road	A sealed road.	ImpRd	33	8.57 ±1.43
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	44	11.4 ±1.62
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	42	10.9 ±1.59

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$47.78	±4.54	24.36 kg	±2.32
NO2	Nitrogen Dioxide removed annually	\$169.63	±16.12	141.84 kg	±13.48
O3	Ozone removed annually	\$8,273.72	±786.24	874.17 kg	±83.07
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$7,348.18	±698.29	22.94 kg	±2.18
SO2	Sulfur Dioxide removed annually	\$10.63	±1.01	28.72 kg	±2.73
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$2,416.47	±229.63	262.13 kg	±24.91
CO2seq	Carbon Dioxide sequestered annually in trees	\$9,595.79	±911.88	179.70 t	±17.08
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$142,204.60	±13,513.56	3.55 kt	±0.34

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,961.08 | NO2 1.125 @ \$1,195.98 | O3 6.934 @ \$9,464.66 | PM2.5 0.182 @ \$320,375.99 | SO2 0.228 @ \$370.11 | PM10\* 2.079 @ \$9,218.49 | CO2seq 1,425.370 @ \$53.40 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

#### About i-Tree Canopy

The concept and prototype of this program were developed by David J. Nowak, Jeffery T. Walton and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company).

#### Limitations of i-Tree Canopy

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#### A Cooperative Initiative Between:



[www.itreetools.org](http://www.itreetools.org)



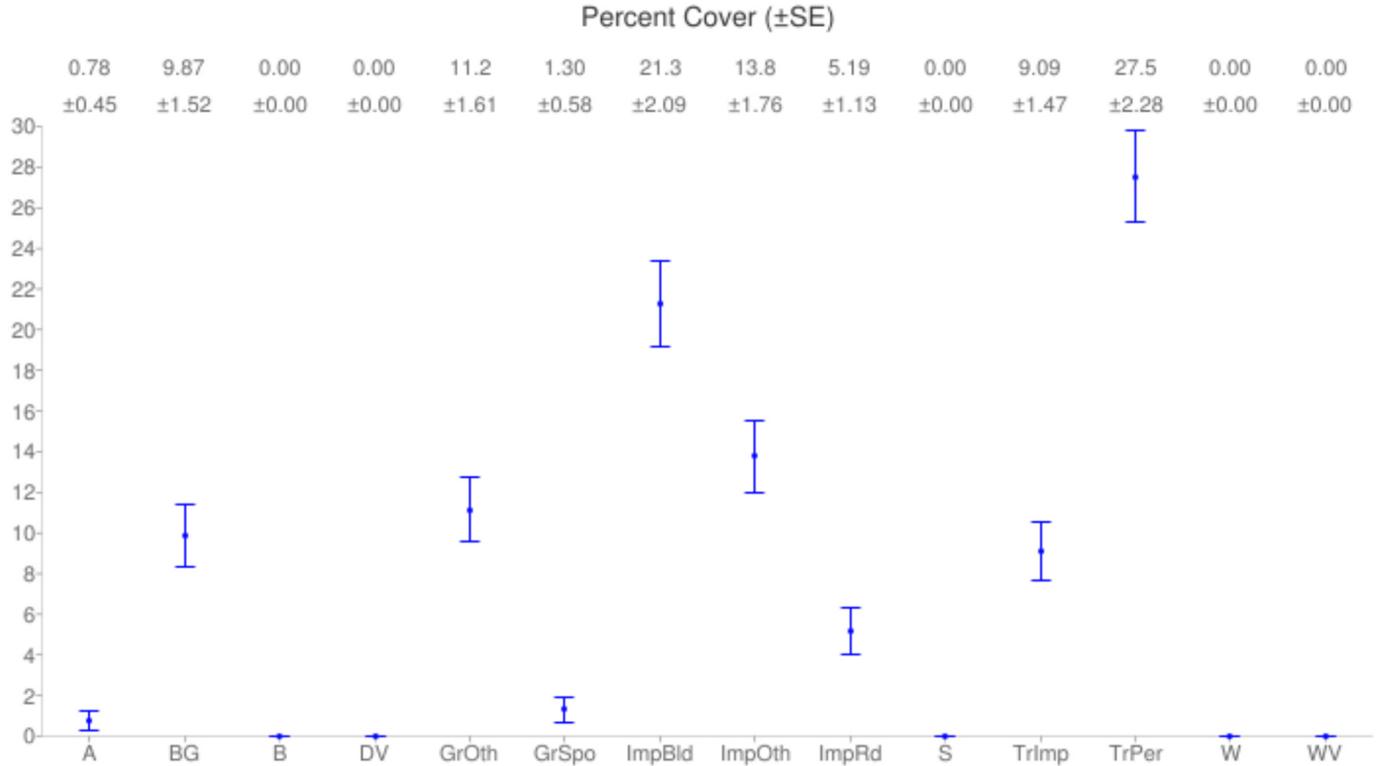
BURNSIDE - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/12/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	3	0.78 ±0.45
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	38	9.87 ±1.52
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	43	11.2 ±1.61
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	5	1.30 ±0.58
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	82	21.3 ±2.09
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	53	13.8 ±1.76
Impervious - road	A sealed road.	ImpRd	20	5.19 ±1.13
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	35	9.09 ±1.47
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	106	27.5 ±2.28

Cover Class	Description	Abbr.	Points	% Cover
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$239.13	±16.03	120.45 kg	±8.08
NO2	Nitrogen Dioxide removed annually	\$849.06	±56.92	701.29 kg	±47.02
O3	Ozone removed annually	\$41,411.69	±2,776.37	4.32 t	±0.29
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$36,779.18	±2,465.80	113.40 kg	±7.60
SO2	Sulfur Dioxide removed annually	\$53.21	±3.57	142.02 kg	±9.52
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$12,094.94	±810.88	1.30 t	±0.09
CO2seq	Carbon Dioxide sequestered annually in trees	\$48,028.95	±3,220.02	888.51 t	±59.57
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$703,108.70	±47,138.68	17.56 kt	±1.18

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,985.22 | NO2 1.125 @ \$1,210.70 | O3 6.934 @ \$9,581.17 | PM2.5 0.182 @ \$324,319.80 | SO2 0.228 @ \$374.66 | PM10\* 2.079 @ \$9,331.97 | CO2seq 1,425.370 @ \$54.06 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

#### About i-Tree Canopy

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#### Limitations of i-Tree Canopy

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#### A Cooperative Initiative Between:



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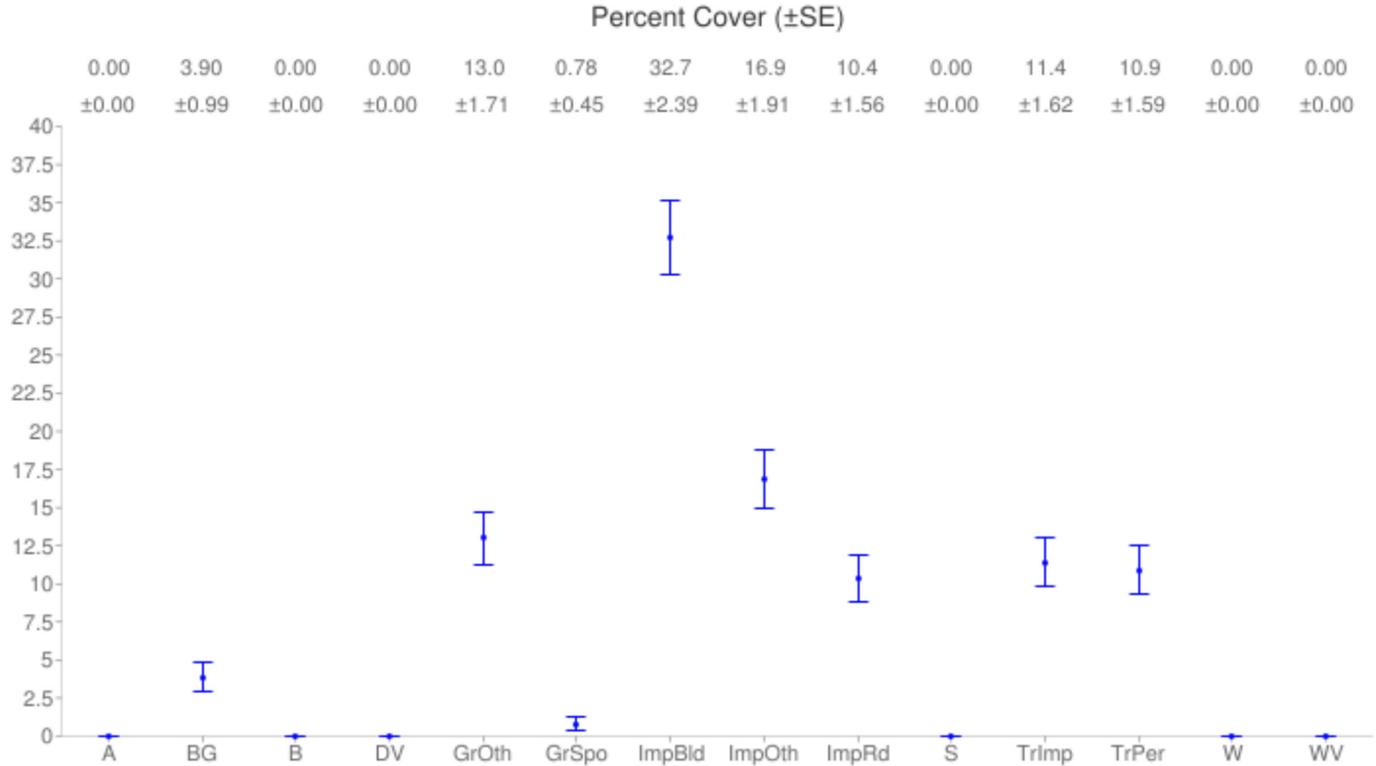
DULWICH - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/12/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	15	3.90 ±0.99
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	50	13.0 ±1.71
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	3	0.78 ±0.45
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	126	32.7 ±2.39
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	65	16.9 ±1.91
Impervious - road	A sealed road.	ImpRd	40	10.4 ±1.56
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	44	11.4 ±1.62
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	42	10.9 ±1.59

Cover Class	Description	Abbr.	Points	% Cover
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

**Tree Benefit Estimates**

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$48.58	±4.62	24.52 kg	±2.33
NO2	Nitrogen Dioxide removed annually	\$172.50	±16.39	142.78 kg	±13.57
O3	Ozone removed annually	\$8,413.51	±799.53	879.98 kg	±83.62
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$7,472.33	±710.09	23.09 kg	±2.19
SO2	Sulfur Dioxide removed annually	\$10.81	±1.03	28.91 kg	±2.75
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$2,457.30	±233.51	263.88 kg	±25.08
CO2seq	Carbon Dioxide sequestered annually in trees	\$9,757.92	±927.28	180.90 t	±17.19
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$143,150.12	±13,603.41	3.58 kt	±0.34

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,981.04 | NO2 1.125 @ \$1,208.15 | O3 6.934 @ \$9,561.00 | PM2.5 0.182 @ \$323,637.09 | SO2 0.228 @ \$373.87 | PM10\* 2.079 @ \$9,312.32 | CO2seq 1,425.370 @ \$53.94 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

**About i-Tree Canopy**

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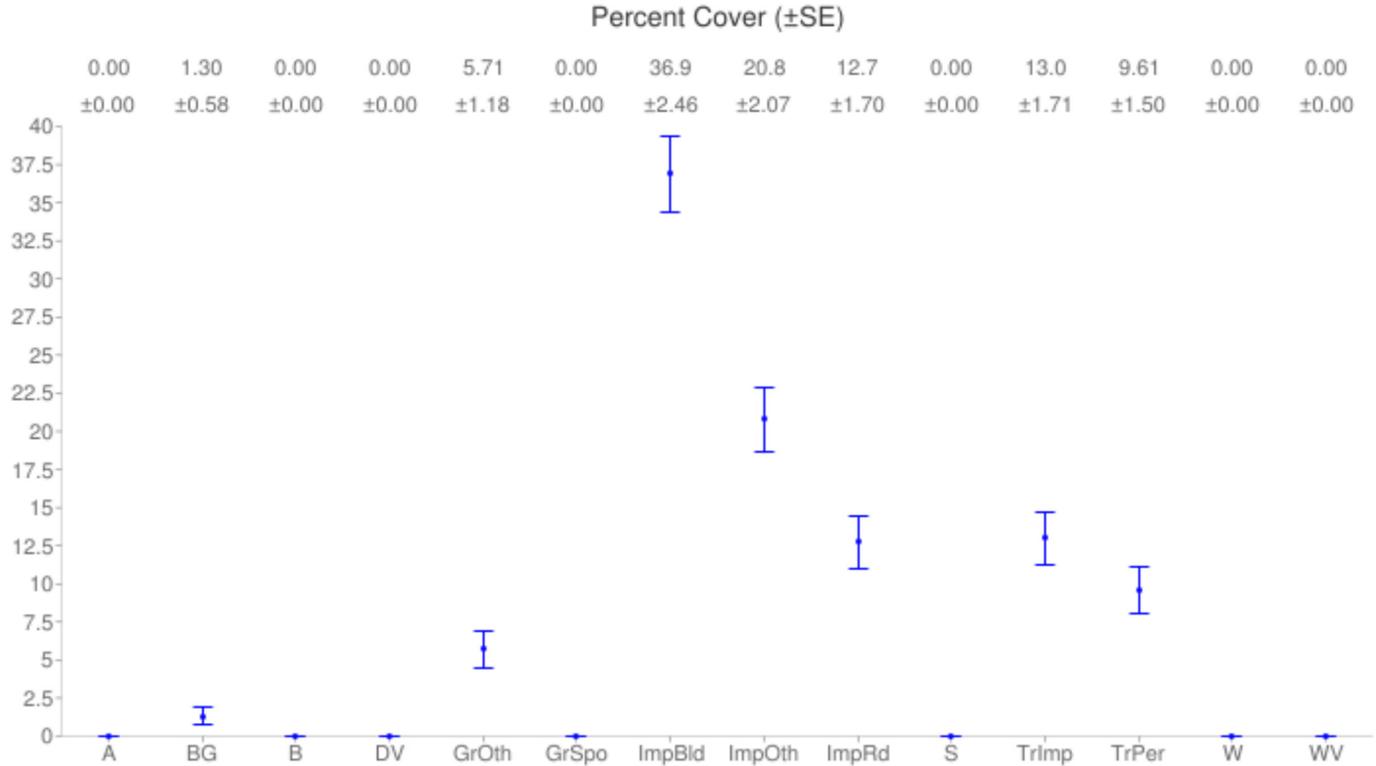
EASTWOOD - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/12/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	5	1.30 ±0.58
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	22	5.71 ±1.18
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	0	0.00 ±0.00
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	142	36.9 ±2.46
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	80	20.8 ±2.07
Impervious - road	A sealed road.	ImpRd	49	12.7 ±1.70
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	50	13.0 ±1.71
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	37	9.61 ±1.50

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$24.64	±2.32	12.36 kg	±1.17
NO2	Nitrogen Dioxide removed annually	\$87.48	±8.25	71.96 kg	±6.79
O3	Ozone removed annually	\$4,266.85	±402.46	443.49 kg	±41.83
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$3,789.54	±357.44	11.64 kg	±1.10
SO2	Sulfur Dioxide removed annually	\$5.48	±0.52	14.57 kg	±1.37
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$1,246.20	±117.55	132.99 kg	±12.54
CO2seq	Carbon Dioxide sequestered annually in trees	\$4,948.66	±466.77	91.17 t	±8.60
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$72,144.00	±6,804.85	1.80 kt	±0.17

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,993.49 | NO2 1.125 @ \$1,215.75 | O3 6.934 @ \$9,621.12 | PM2.5 0.182 @ \$325,672.03 | SO2 0.228 @ \$376.23 | PM10\* 2.079 @ \$9,370.87 | CO2seq 1,425.370 @ \$54.28 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

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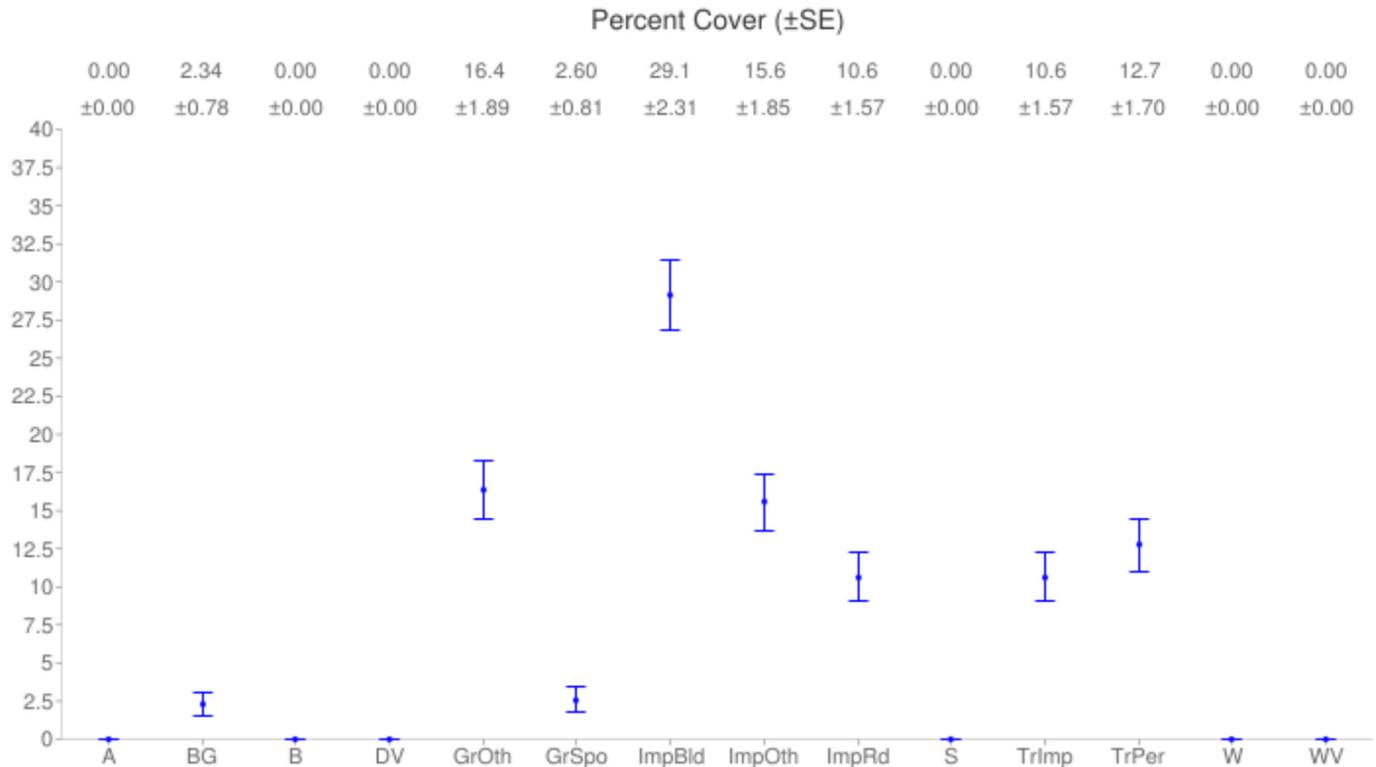
ERINDALE - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/12/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	9	2.34 ±0.78
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	63	16.4 ±1.89
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	10	2.60 ±0.81
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	112	29.1 ±2.31
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	60	15.6 ±1.85
Impervious - road	A sealed road.	ImpRd	41	10.6 ±1.57
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	41	10.6 ±1.57
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	49	12.7 ±1.70

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$50.21	±4.63	25.18 kg	±2.32
NO2	Nitrogen Dioxide removed annually	\$178.26	±16.45	146.63 kg	±13.53
O3	Ozone removed annually	\$8,694.46	±802.24	903.68 kg	±83.38
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$7,721.86	±712.49	23.71 kg	±2.19
SO2	Sulfur Dioxide removed annually	\$11.17	±1.03	29.69 kg	±2.74
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$2,539.36	±234.31	270.98 kg	±25.00
CO2seq	Carbon Dioxide sequestered annually in trees	\$10,083.76	±930.43	185.77 t	±17.14
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$147,006.00	±13,564.21	3.67 kt	±0.34

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,993.49 | NO2 1.125 @ \$1,215.75 | O3 6.934 @ \$9,621.12 | PM2.5 0.182 @ \$325,672.03 | SO2 0.228 @ \$376.23 | PM10\* 2.079 @ \$9,370.87 | CO2seq 1,425.370 @ \$54.28 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

#### About i-Tree Canopy

The concept and prototype of this program were developed by David J. Nowak, Jeffery T. Walton and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company).

#### Limitations of i-Tree Canopy

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#### A Cooperative Initiative Between:



[www.itreetools.org](http://www.itreetools.org)



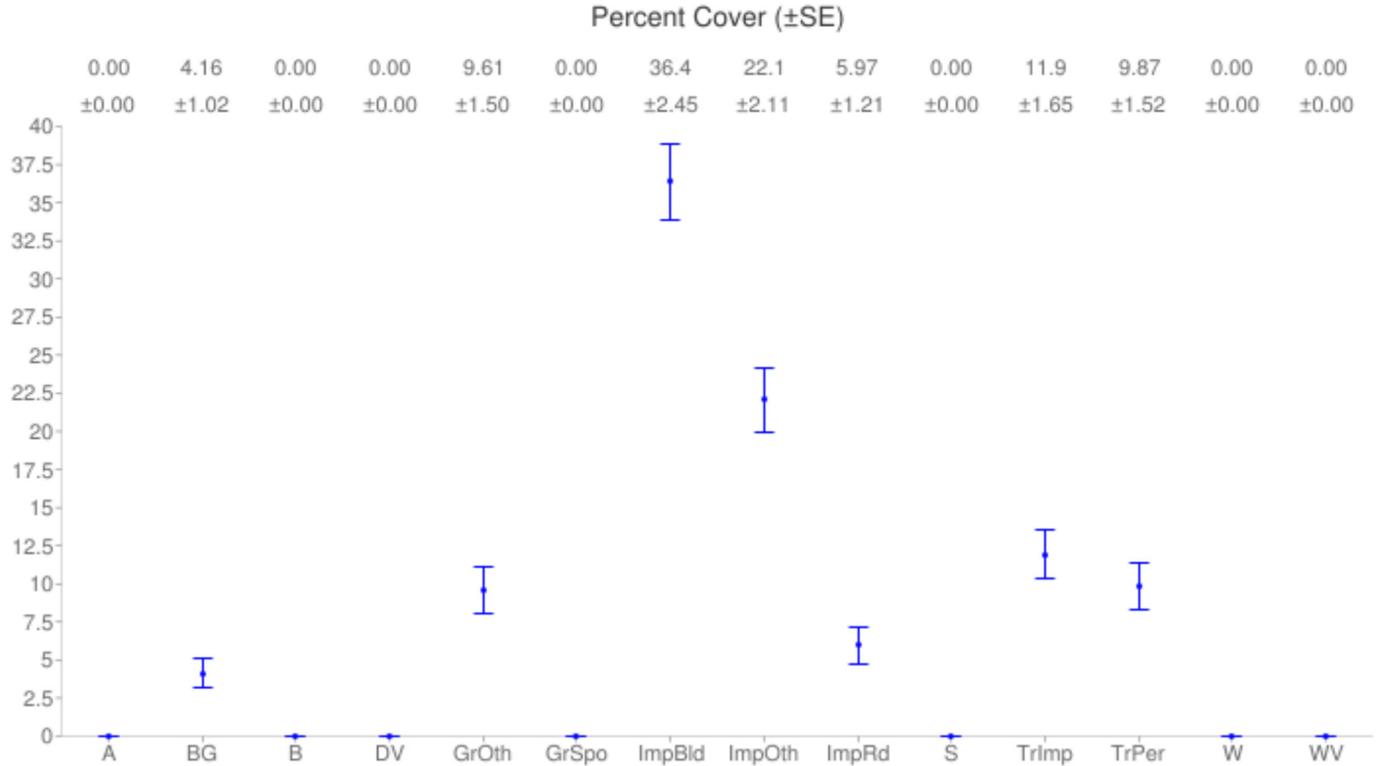
FREWVILLE - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/12/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	16	4.16 ±1.02
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	37	9.61 ±1.50
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	0	0.00 ±0.00
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	140	36.4 ±2.45
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	85	22.1 ±2.11
Impervious - road	A sealed road.	ImpRd	23	5.97 ±1.21
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	46	11.9 ±1.65
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	38	9.87 ±1.52

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$23.02	±2.22	11.55 kg	±1.11
NO2	Nitrogen Dioxide removed annually	\$81.73	±7.88	67.22 kg	±6.49
O3	Ozone removed annually	\$3,986.14	±384.56	414.31 kg	±39.97
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$3,540.24	±341.54	10.87 kg	±1.05
SO2	Sulfur Dioxide removed annually	\$5.12	±0.49	13.61 kg	±1.31
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$1,164.22	±112.32	124.24 kg	±11.99
CO2seq	Carbon Dioxide sequestered annually in trees	\$4,623.10	±446.01	85.17 t	±8.22
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$67,397.77	±6,502.18	1.68 kt	±0.16

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,993.49 | NO2 1.125 @ \$1,215.75 | O3 6.934 @ \$9,621.12 | PM2.5 0.182 @ \$325,672.03 | SO2 0.228 @ \$376.23 | PM10\* 2.079 @ \$9,370.87 | CO2seq 1,425.370 @ \$54.28 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

#### About i-Tree Canopy

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#### A Cooperative Initiative Between:



[www.itreetools.org](http://www.itreetools.org)



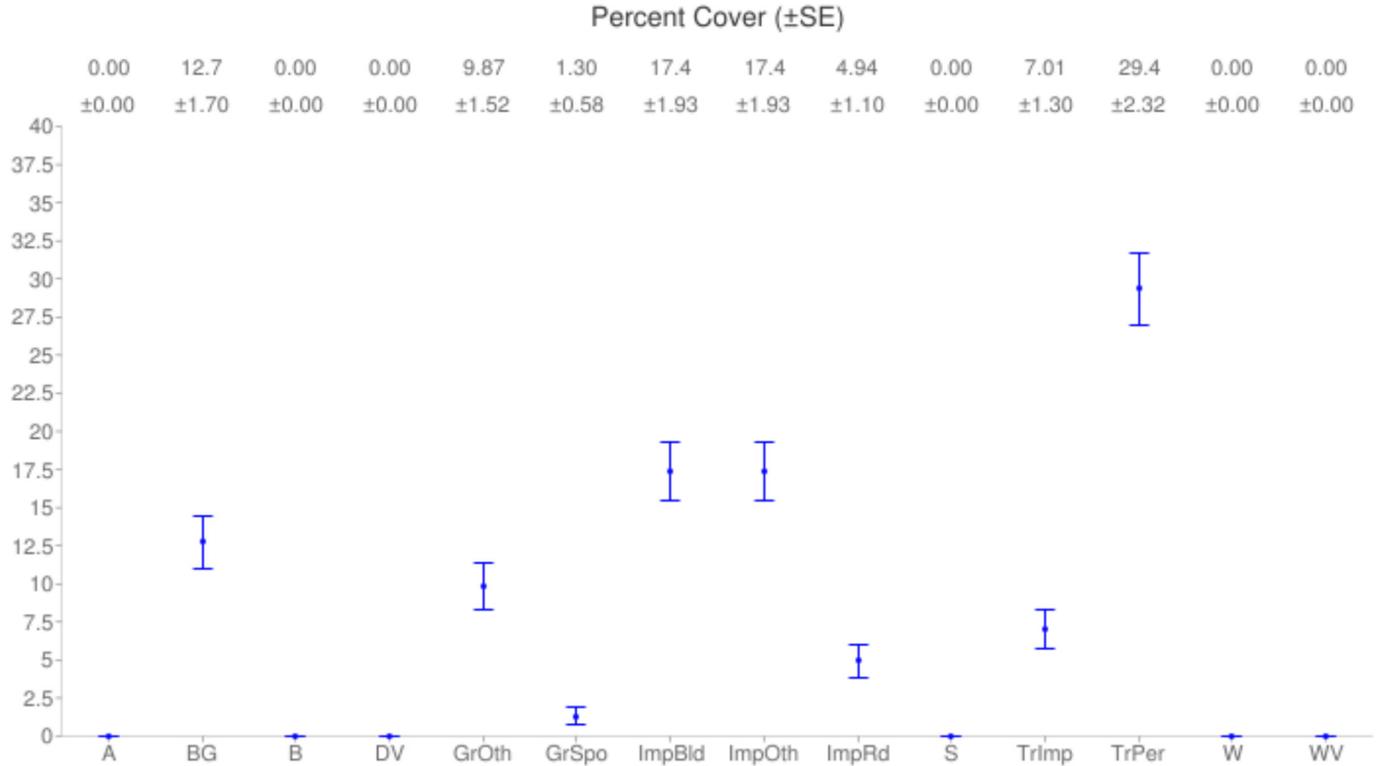
GLEN OSMOND - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/12/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	49	12.7 ±1.70
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	38	9.87 ±1.52
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	5	1.30 ±0.58
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	67	17.4 ±1.93
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	67	17.4 ±1.93
Impervious - road	A sealed road.	ImpRd	19	4.94 ±1.10
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	27	7.01 ±1.30
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	113	29.4 ±2.32

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

**Tree Benefit Estimates**

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$176.98	±11.93	88.78 kg	±5.99
NO2	Nitrogen Dioxide removed annually	\$628.38	±42.37	516.87 kg	±34.85
O3	Ozone removed annually	\$30,648.50	±2,066.32	3.19 t	±0.21
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$27,220.01	±1,835.17	83.58 kg	±5.64
SO2	Sulfur Dioxide removed annually	\$39.38	±2.66	104.67 kg	±7.06
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$8,951.38	±603.50	955.23 kg	±64.40
CO2seq	Carbon Dioxide sequestered annually in trees	\$35,545.89	±2,396.50	654.85 t	±44.15
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$518,205.16	±34,937.38	12.95 kt	±0.87

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,993.49 | NO2 1.125 @ \$1,215.75 | O3 6.934 @ \$9,621.12 | PM2.5 0.182 @ \$325,672.03 | SO2 0.228 @ \$376.23 | PM10\* 2.079 @ \$9,370.87 | CO2seq 1,425.370 @ \$54.28 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

**About i-Tree Canopy**

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**A Cooperative Initiative Between:**



www.itreetools.org



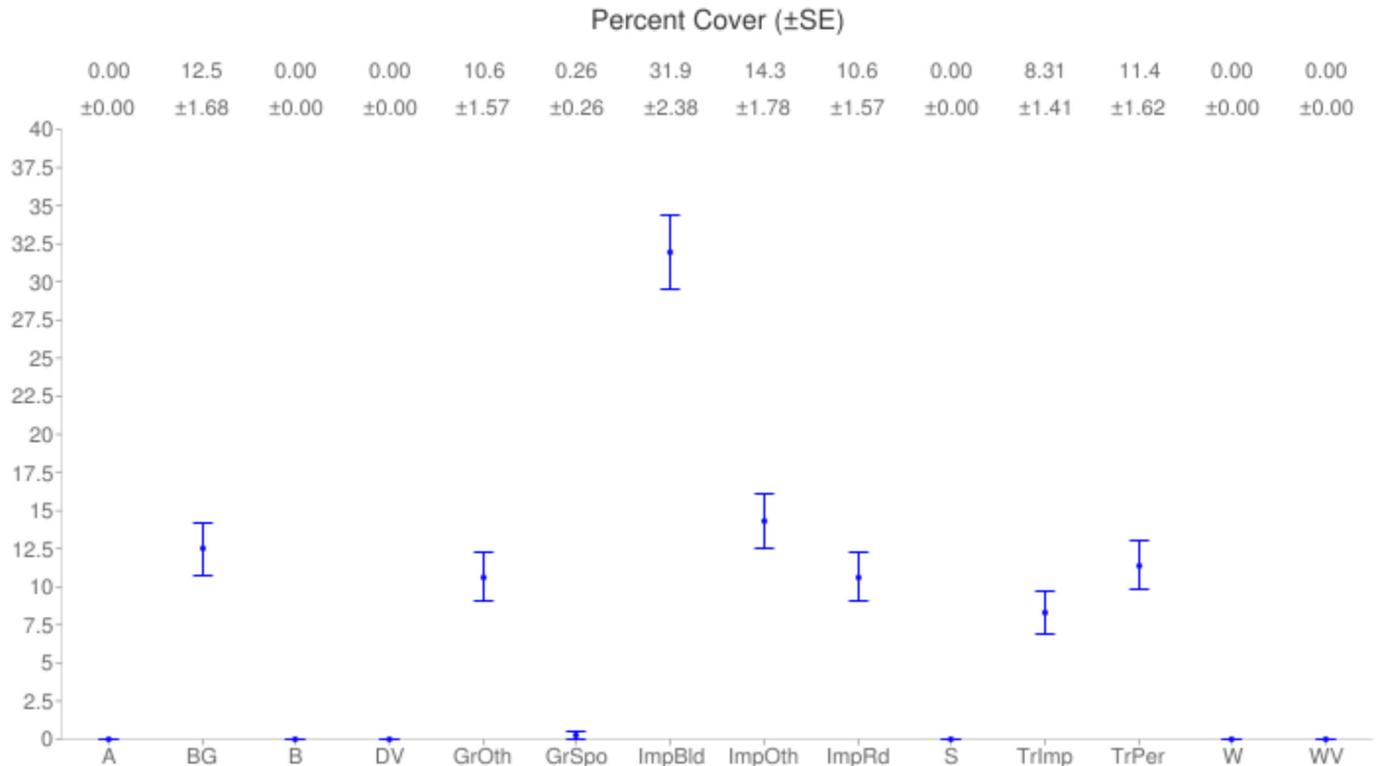
GLENSIDE - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/16/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	48	12.5 ±1.68
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	41	10.6 ±1.57
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	1	0.26 ±0.26
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	123	31.9 ±2.38
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	55	14.3 ±1.78
Impervious - road	A sealed road.	ImpRd	41	10.6 ±1.57
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	32	8.31 ±1.41
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	44	11.4 ±1.62

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$85.03	±8.74	42.65 kg	±4.38
NO2	Nitrogen Dioxide removed annually	\$301.90	±31.02	248.33 kg	±25.52
O3	Ozone removed annually	\$14,724.86	±1,513.19	1.53 t	±0.16
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$13,077.67	±1,343.92	40.16 kg	±4.13
SO2	Sulfur Dioxide removed annually	\$18.92	±1.94	50.29 kg	±5.17
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$4,300.63	±441.95	458.94 kg	±47.16
CO2seq	Carbon Dioxide sequestered annually in trees	\$17,077.77	±1,754.98	314.62 t	±32.33
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$248,968.07	±25,585.02	6.22 kt	±0.64

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,993.49 | NO2 1.125 @ \$1,215.75 | O3 6.934 @ \$9,621.12 | PM2.5 0.182 @ \$325,672.03 | SO2 0.228 @ \$376.23 | PM10\* 2.079 @ \$9,370.87 | CO2seq 1,425.370 @ \$54.28 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

#### About i-Tree Canopy

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#### A Cooperative Initiative Between:



[www.itreetools.org](http://www.itreetools.org)



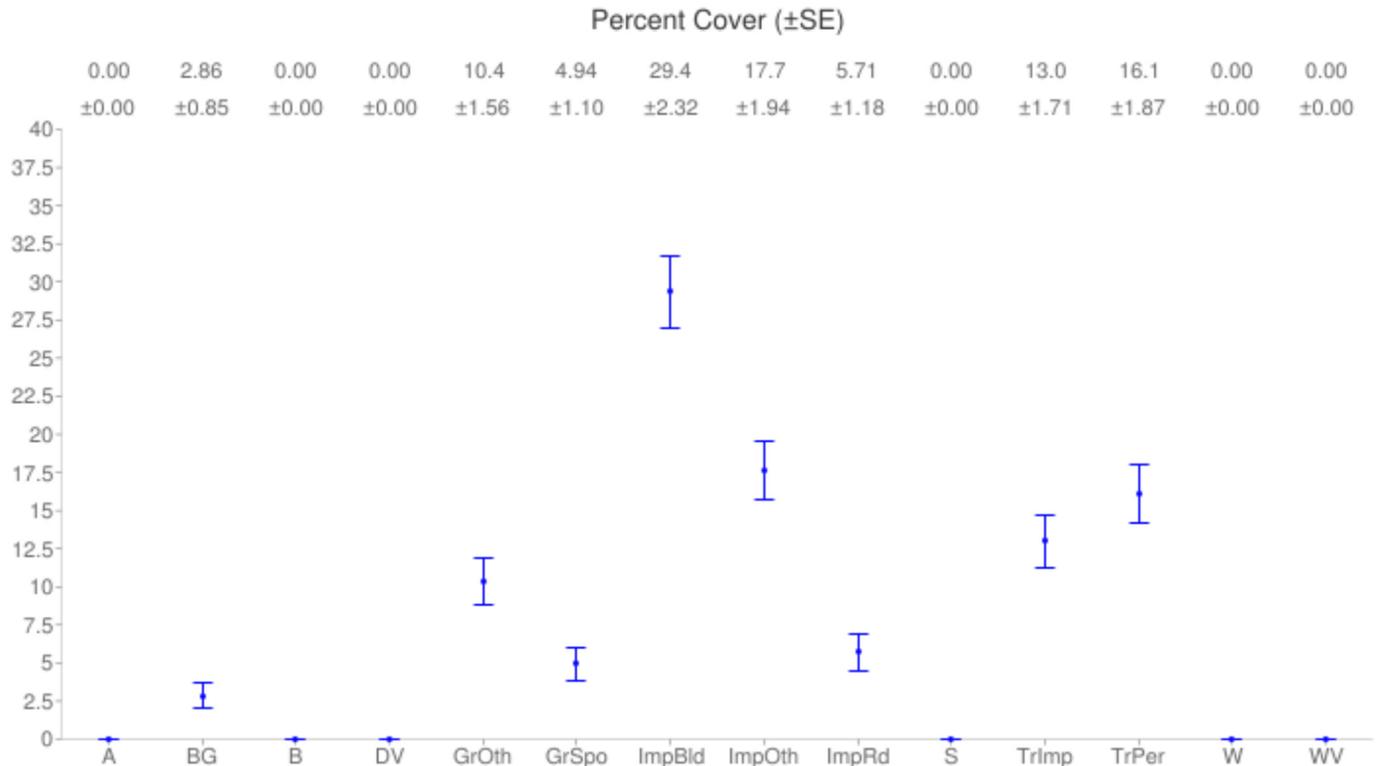
GLENUNGA - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/13/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	11	2.86 ±0.85
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	40	10.4 ±1.56
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	19	4.94 ±1.10
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	113	29.4 ±2.32
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	68	17.7 ±1.94
Impervious - road	A sealed road.	ImpRd	22	5.71 ±1.18
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	50	13.0 ±1.71
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	62	16.1 ±1.87

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$99.59	±7.92	49.96 kg	±3.98
NO2	Nitrogen Dioxide removed annually	\$353.62	±28.14	290.87 kg	±23.14
O3	Ozone removed annually	\$17,247.58	±1,372.37	1.79 t	±0.14
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$15,318.18	±1,218.85	47.04 kg	±3.74
SO2	Sulfur Dioxide removed annually	\$22.16	±1.76	58.90 kg	±4.69
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$5,037.43	±400.82	537.56 kg	±42.77
CO2seq	Carbon Dioxide sequestered annually in trees	\$20,003.60	±1,591.66	368.52 t	±29.32
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$291,622.23	±23,203.98	7.29 kt	±0.58

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,993.49 | NO2 1.125 @ \$1,215.75 | O3 6.934 @ \$9,621.12 | PM2.5 0.182 @ \$325,672.03 | SO2 0.228 @ \$376.23 | PM10\* 2.079 @ \$9,370.87 | CO2seq 1,425.370 @ \$54.28 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

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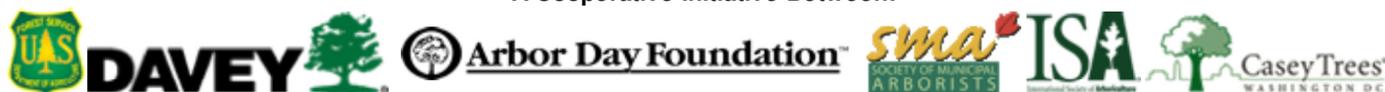
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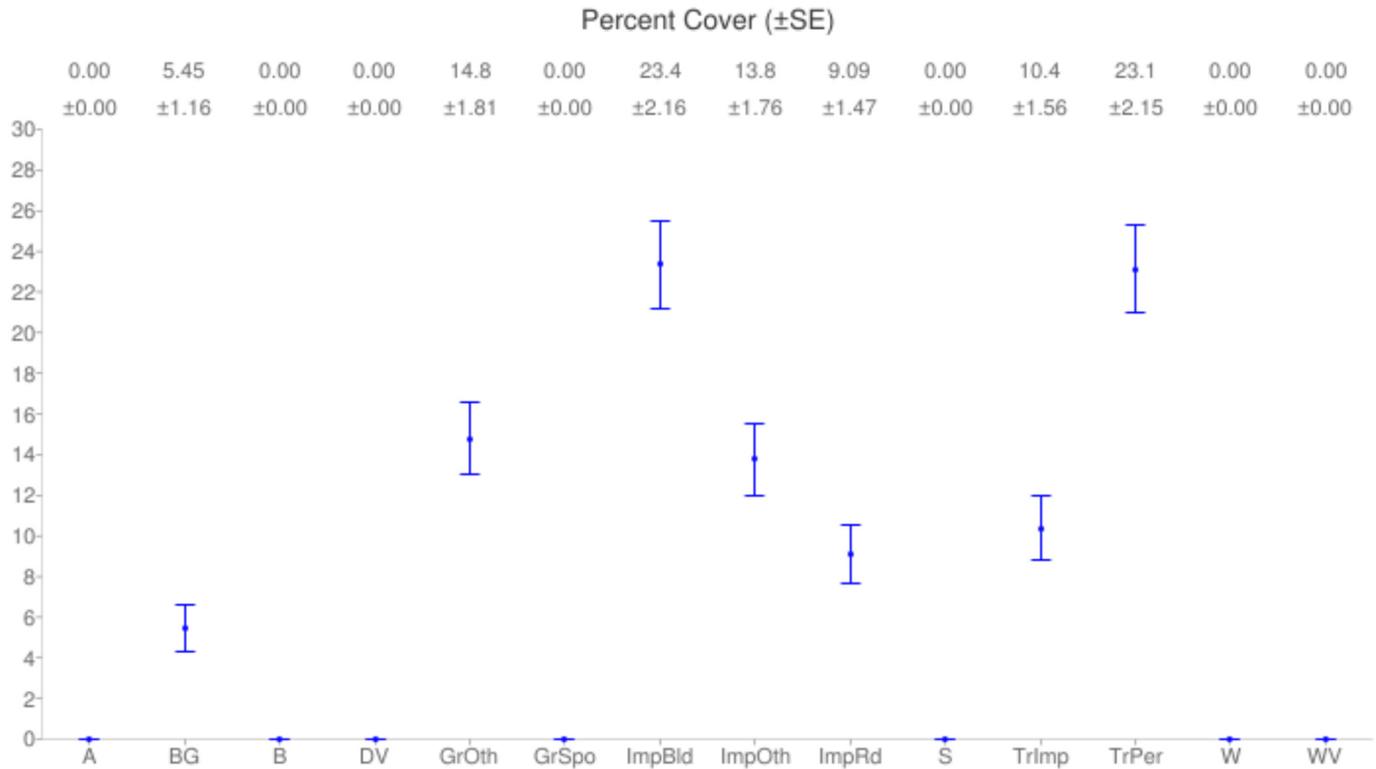
HAZELWOOD PARK - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/13/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	21	5.45 ±1.16
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	57	14.8 ±1.81
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	0	0.00 ±0.00
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	90	23.4 ±2.16
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	53	13.8 ±1.76
Impervious - road	A sealed road.	ImpRd	35	9.09 ±1.47
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	40	10.4 ±1.56
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	89	23.1 ±2.15

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$122.10	±8.77	61.25 kg	±4.40
NO2	Nitrogen Dioxide removed annually	\$433.52	±31.12	356.59 kg	±25.60
O3	Ozone removed annually	\$21,144.59	±1,518.08	2.20 t	±0.16
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$18,779.26	±1,348.26	57.66 kg	±4.14
SO2	Sulfur Dioxide removed annually	\$27.17	±1.95	72.21 kg	±5.18
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$6,175.62	±443.38	659.02 kg	±47.31
CO2seq	Carbon Dioxide sequestered annually in trees	\$24,523.33	±1,760.66	451.78 t	±32.44
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$357,513.07	±25,667.68	8.93 kt	±0.64

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,993.49 | NO2 1.125 @ \$1,215.75 | O3 6.934 @ \$9,621.12 | PM2.5 0.182 @ \$325,672.03 | SO2 0.228 @ \$376.23 | PM10\* 2.079 @ \$9,370.87 | CO2seq 1,425.370 @ \$54.28 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

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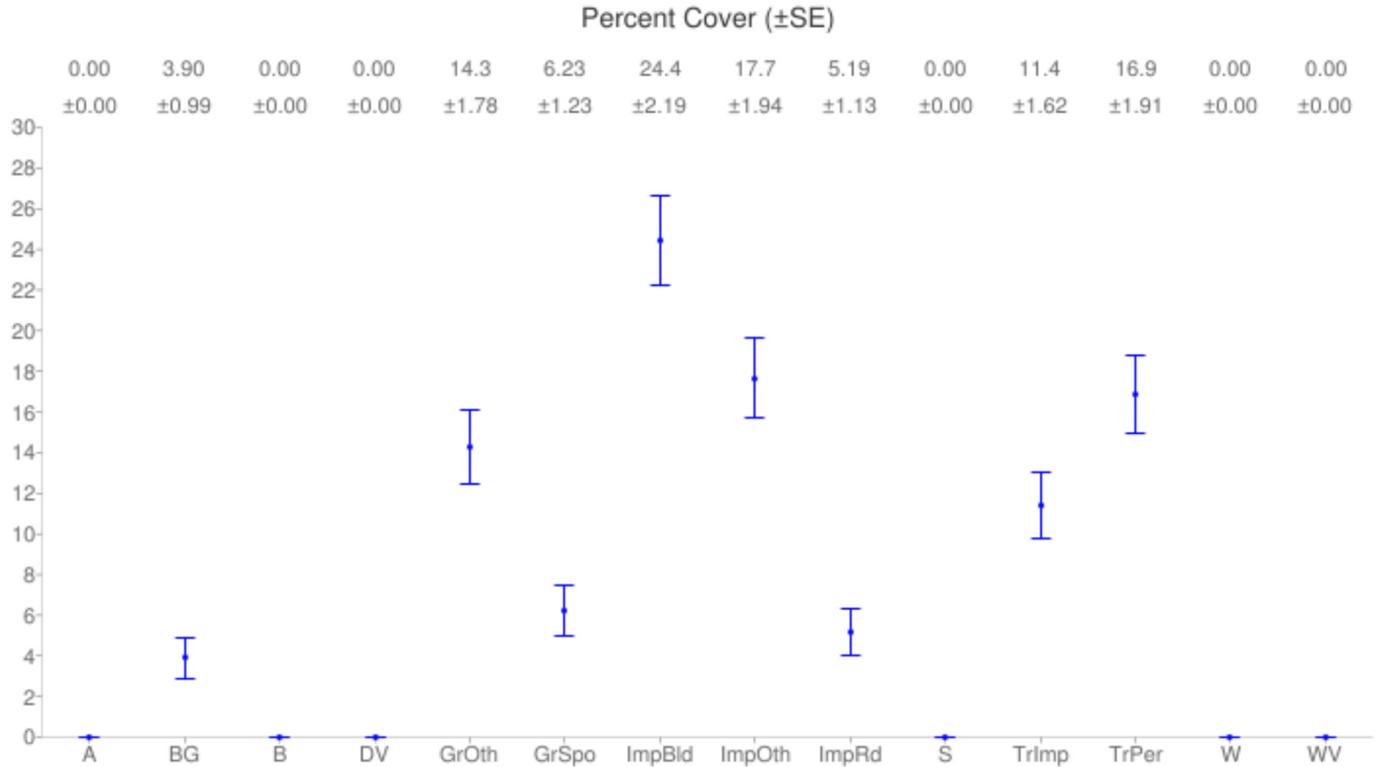
KENSINGTON GARDENS - 2015

Tools for Assessing and Managing  
**Community Trees and Forests**

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/13/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 $\pm 0.00$
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	15	3.90 $\pm 0.99$
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 $\pm 0.00$
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 $\pm 0.00$
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	55	14.3 $\pm 1.78$
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	24	6.23 $\pm 1.23$
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	94	24.4 $\pm 2.19$
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	68	17.7 $\pm 1.94$
Impervious - road	A sealed road.	ImpRd	20	5.19 $\pm 1.13$
Salt	Saltfields with or without water covering the pans.	S	0	0.00 $\pm 0.00$
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	44	11.4 $\pm 1.62$
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	65	16.9 $\pm 1.91$

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$119.31	±9.68	59.85 kg	±4.85
NO2	Nitrogen Dioxide removed annually	\$423.62	±34.36	348.45 kg	±28.26
O3	Ozone removed annually	\$20,661.75	±1,675.63	2.15 t	±0.17
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$18,350.43	±1,488.19	56.35 kg	±4.57
SO2	Sulfur Dioxide removed annually	\$26.55	±2.15	70.56 kg	±5.72
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$6,034.59	±489.39	643.97 kg	±52.23
CO2seq	Carbon Dioxide sequestered annually in trees	\$23,963.34	±1,943.38	441.47 t	±35.80
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$349,349.15	±28,331.57	8.73 kt	±0.71

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,993.49 | NO2 1.125 @ \$1,215.75 | O3 6.934 @ \$9,621.12 | PM2.5 0.182 @ \$325,672.03 | SO2 0.228 @ \$376.23 | PM10\* 2.079 @ \$9,370.87 | CO2seq 1,425.370 @ \$54.28 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

#### About i-Tree Canopy

The concept and prototype of this program were developed by David J. Nowak, Jeffery T. Walton and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company).

#### Limitations of i-Tree Canopy

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#### A Cooperative Initiative Between:



[www.itreetools.org](http://www.itreetools.org)



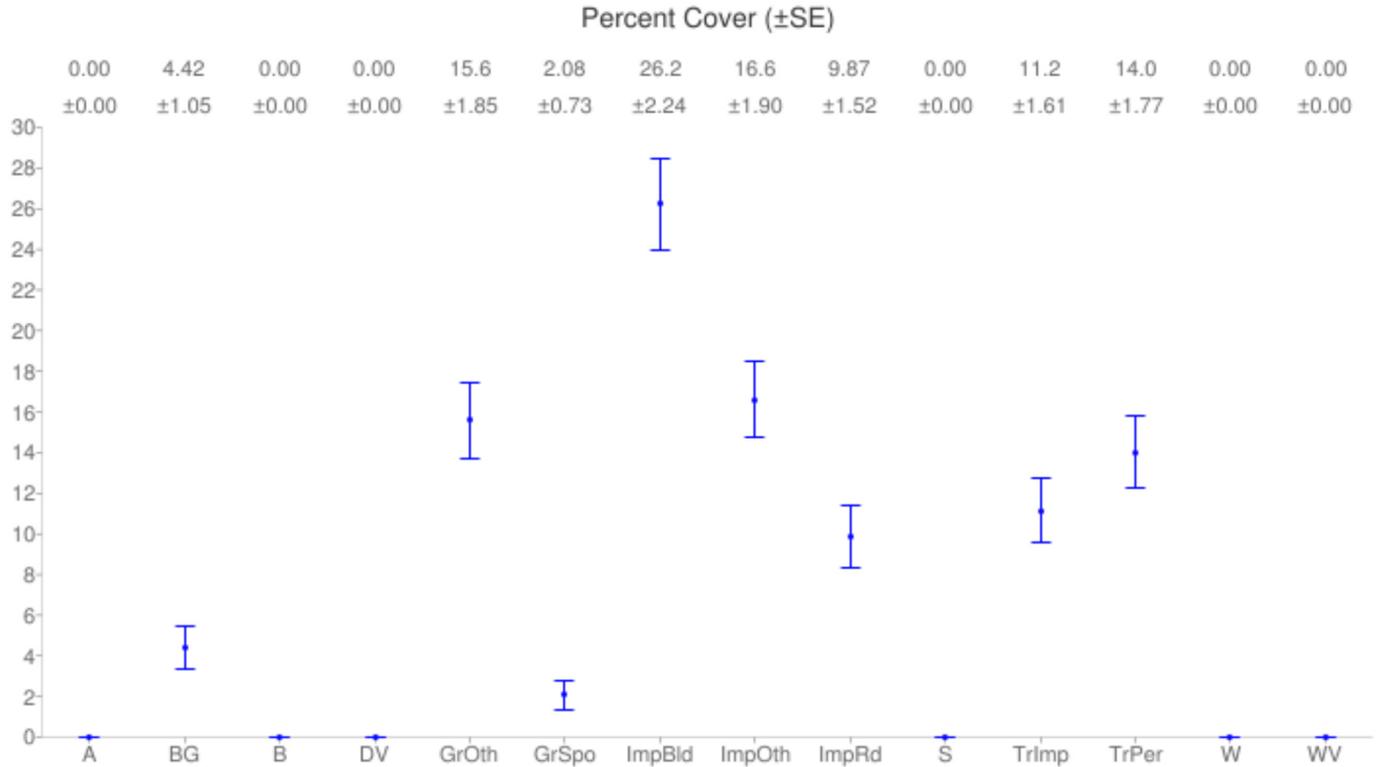
KENSINGTON PARK - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/13/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 $\pm$ 0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	17	4.42 $\pm$ 1.05
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 $\pm$ 0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 $\pm$ 0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	60	15.6 $\pm$ 1.85
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	8	2.08 $\pm$ 0.73
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	101	26.2 $\pm$ 2.24
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	64	16.6 $\pm$ 1.90
Impervious - road	A sealed road.	ImpRd	38	9.87 $\pm$ 1.52
Salt	Saltfields with or without water covering the pans.	S	0	0.00 $\pm$ 0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	43	11.2 $\pm$ 1.61
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	54	14.0 $\pm$ 1.77

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$107.11	±9.41	53.73 kg	±4.72
NO2	Nitrogen Dioxide removed annually	\$380.29	±33.40	312.81 kg	±27.47
O3	Ozone removed annually	\$18,548.40	±1,628.87	1.93 t	±0.17
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$16,473.49	±1,446.66	50.58 kg	±4.44
SO2	Sulfur Dioxide removed annually	\$23.83	±2.09	63.35 kg	±5.56
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$5,417.36	±475.74	578.11 kg	±50.77
CO2seq	Carbon Dioxide sequestered annually in trees	\$21,512.29	±1,889.15	396.31 t	±34.80
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$313,616.57	±27,540.96	7.83 kt	±0.69

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,993.49 | NO2 1.125 @ \$1,215.75 | O3 6.934 @ \$9,621.12 | PM2.5 0.182 @ \$325,672.03 | SO2 0.228 @ \$376.23 | PM10\* 2.079 @ \$9,370.87 | CO2seq 1,425.370 @ \$54.28 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

#### About i-Tree Canopy

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#### A Cooperative Initiative Between:



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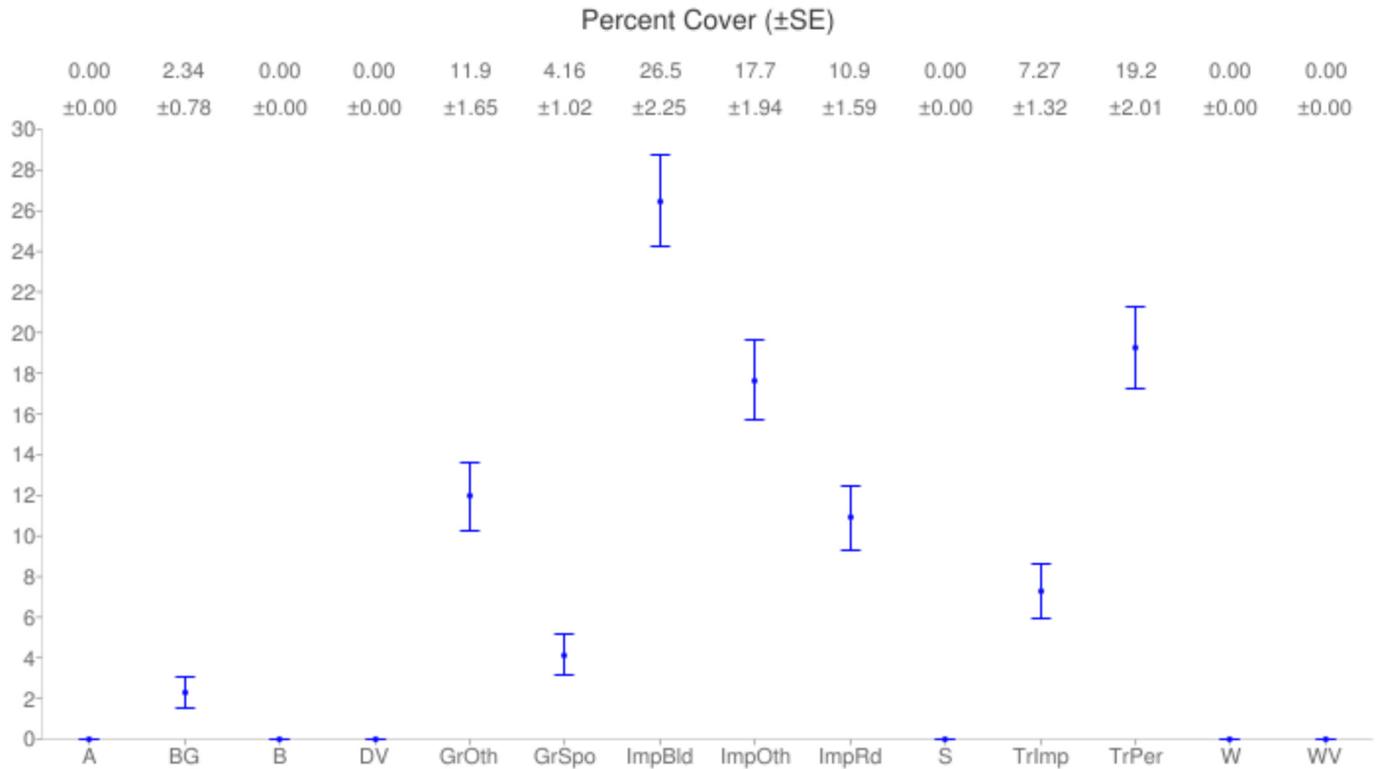
LEABROOK - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/13/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 $\pm 0.00$
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	9	2.34 $\pm 0.78$
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 $\pm 0.00$
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 $\pm 0.00$
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	46	11.9 $\pm 1.65$
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	16	4.16 $\pm 1.02$
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	102	26.5 $\pm 2.25$
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	68	17.7 $\pm 1.94$
Impervious - road	A sealed road.	ImpRd	42	10.9 $\pm 1.59$
Salt	Saltfields with or without water covering the pans.	S	0	0.00 $\pm 0.00$
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	28	7.27 $\pm 1.32$
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	74	19.2 $\pm 2.01$

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$63.97	±5.43	32.09 kg	±2.72
NO2	Nitrogen Dioxide removed annually	\$227.15	±19.28	186.84 kg	±15.86
O3	Ozone removed annually	\$11,078.74	±940.49	1.15 t	±0.10
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$9,839.42	±835.28	30.21 kg	±2.56
SO2	Sulfur Dioxide removed annually	\$14.24	±1.21	37.84 kg	±3.21
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$3,235.72	±274.68	345.30 kg	±29.31
CO2seq	Carbon Dioxide sequestered annually in trees	\$12,849.04	±1,090.77	236.71 t	±20.09
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$187,319.55	±15,901.78	4.68 kt	±0.40

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,993.49 | NO2 1.125 @ \$1,215.75 | O3 6.934 @ \$9,621.12 | PM2.5 0.182 @ \$325,672.03 | SO2 0.228 @ \$376.23 | PM10\* 2.079 @ \$9,370.87 | CO2seq 1,425.370 @ \$54.28 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

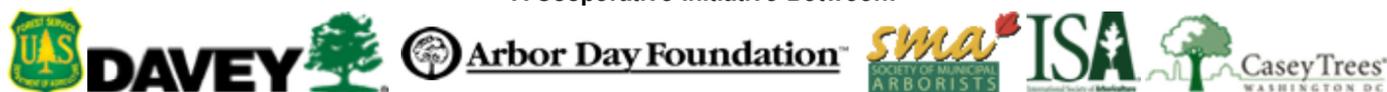
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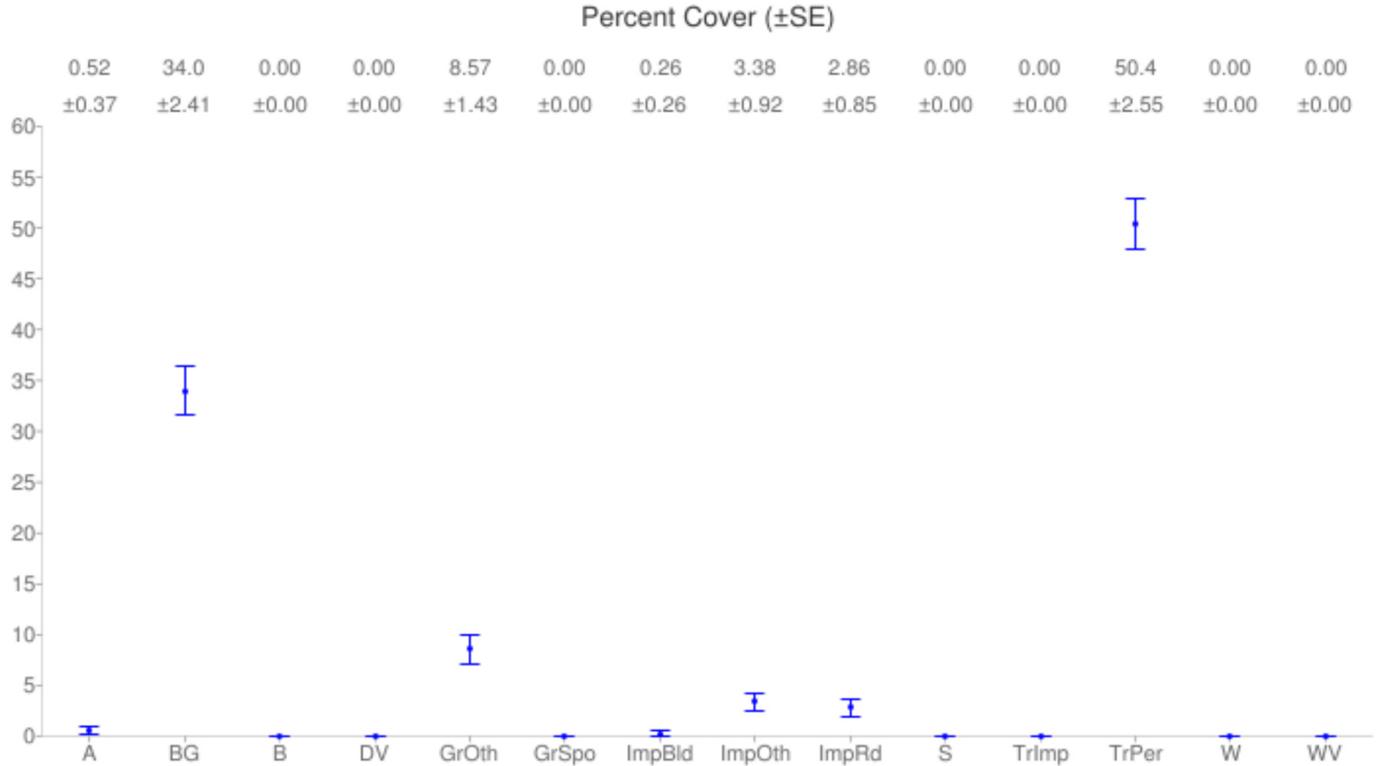
LEAWOOD GARDENS - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/12/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	2	0.52 ±0.37
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	131	34.0 ±2.41
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	33	8.57 ±1.43
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	0	0.00 ±0.00
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	1	0.26 ±0.26
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	13	3.38 ±0.92
Impervious - road	A sealed road.	ImpRd	11	2.86 ±0.85
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	0	0.00 ±0.00
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	194	50.4 ±2.55

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

**Tree Benefit Estimates**

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$159.17	±8.05	79.85 kg	±4.04
NO2	Nitrogen Dioxide removed annually	\$565.16	±28.58	464.89 kg	±23.51
O3	Ozone removed annually	\$27,565.11	±1,393.94	2.87 t	±0.14
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$24,481.55	±1,238.01	75.18 kg	±3.80
SO2	Sulfur Dioxide removed annually	\$35.42	±1.79	94.15 kg	±4.76
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$8,050.83	±407.12	859.18 kg	±43.45
CO2seq	Carbon Dioxide sequestered annually in trees	\$31,969.80	±1,616.68	589.00 t	±29.79
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$632,075.10	±31,963.49	11.64 kt	±0.59

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,993.38 | NO2 1.125 @ \$1,215.68 | O3 6.934 @ \$9,620.57 | PM2.5 0.182 @ \$325,653.54 | SO2 0.228 @ \$376.20 | PM10\* 2.079 @ \$9,370.34 | CO2seq 1,425.370 @ \$54.28 | CO2stor is a total biomass amount of 28,177.630 @ \$54.28*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

**About i-Tree Canopy**

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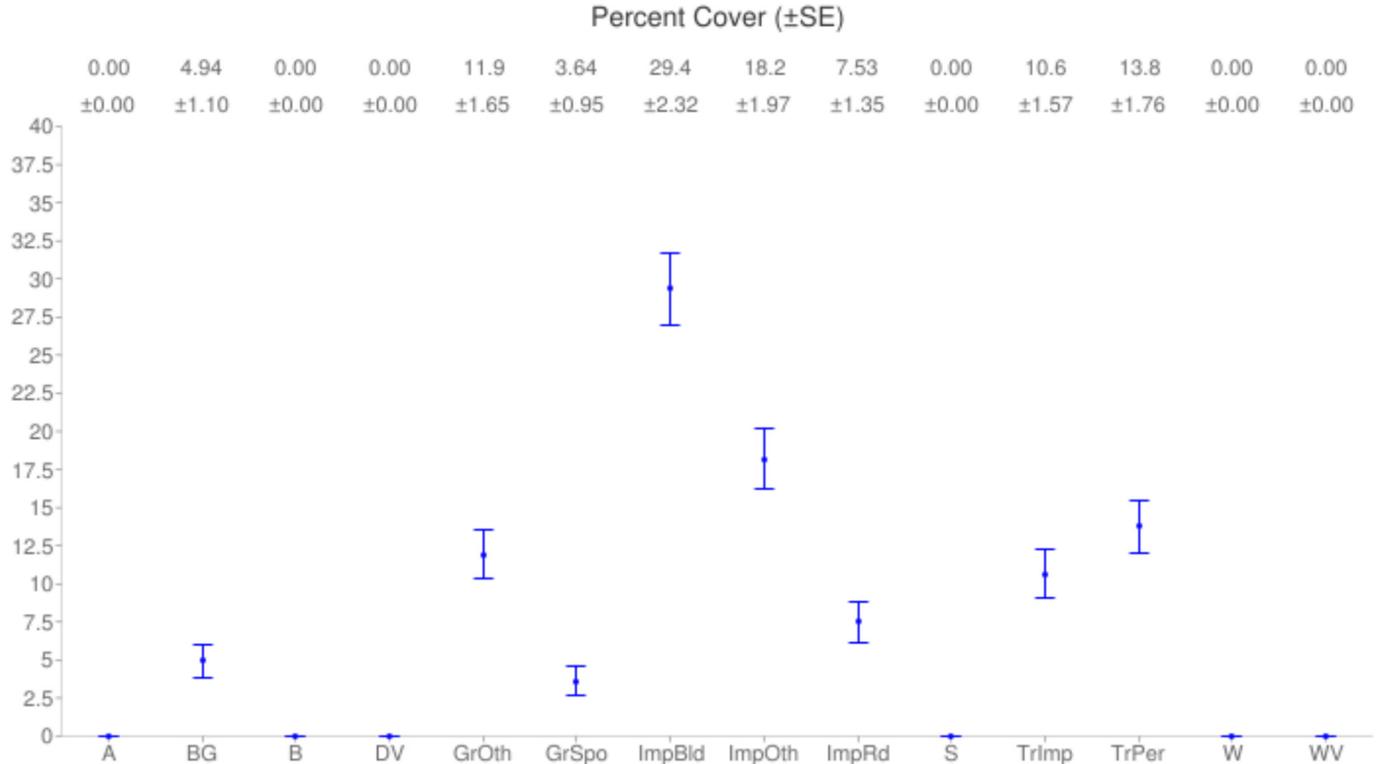
LINDEN PARK - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/12/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	19	4.94 ±1.10
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	46	11.9 ±1.65
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	14	3.64 ±0.95
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	113	29.4 ±2.32
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	70	18.2 ±1.97
Impervious - road	A sealed road.	ImpRd	29	7.53 ±1.35
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	41	10.6 ±1.57
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	53	13.8 ±1.76

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

**Tree Benefit Estimates**

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$78.57	±7.05	39.39 kg	±3.53
NO2	Nitrogen Dioxide removed annually	\$278.97	±25.02	229.31 kg	±20.56
O3	Ozone removed annually	\$13,606.34	±1,220.09	1.41 t	±0.13
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$12,084.27	±1,083.61	37.08 kg	±3.33
SO2	Sulfur Dioxide removed annually	\$17.48	±1.57	46.44 kg	±4.16
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$3,973.95	±356.35	423.80 kg	±38.00
CO2seq	Carbon Dioxide sequestered annually in trees	\$15,780.53	±1,415.06	290.53 t	±26.05
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$311,996.86	±27,977.08	5.74 kt	±0.52

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,994.80 | NO2 1.125 @ \$1,216.55 | O3 6.934 @ \$9,627.45 | PM2.5 0.182 @ \$325,886.24 | SO2 0.228 @ \$376.47 | PM10\* 2.079 @ \$9,377.04 | CO2seq 1,425.370 @ \$54.32 | CO2stor is a total biomass amount of 28,177.630 @ \$54.32*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

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**A Cooperative Initiative Between:**



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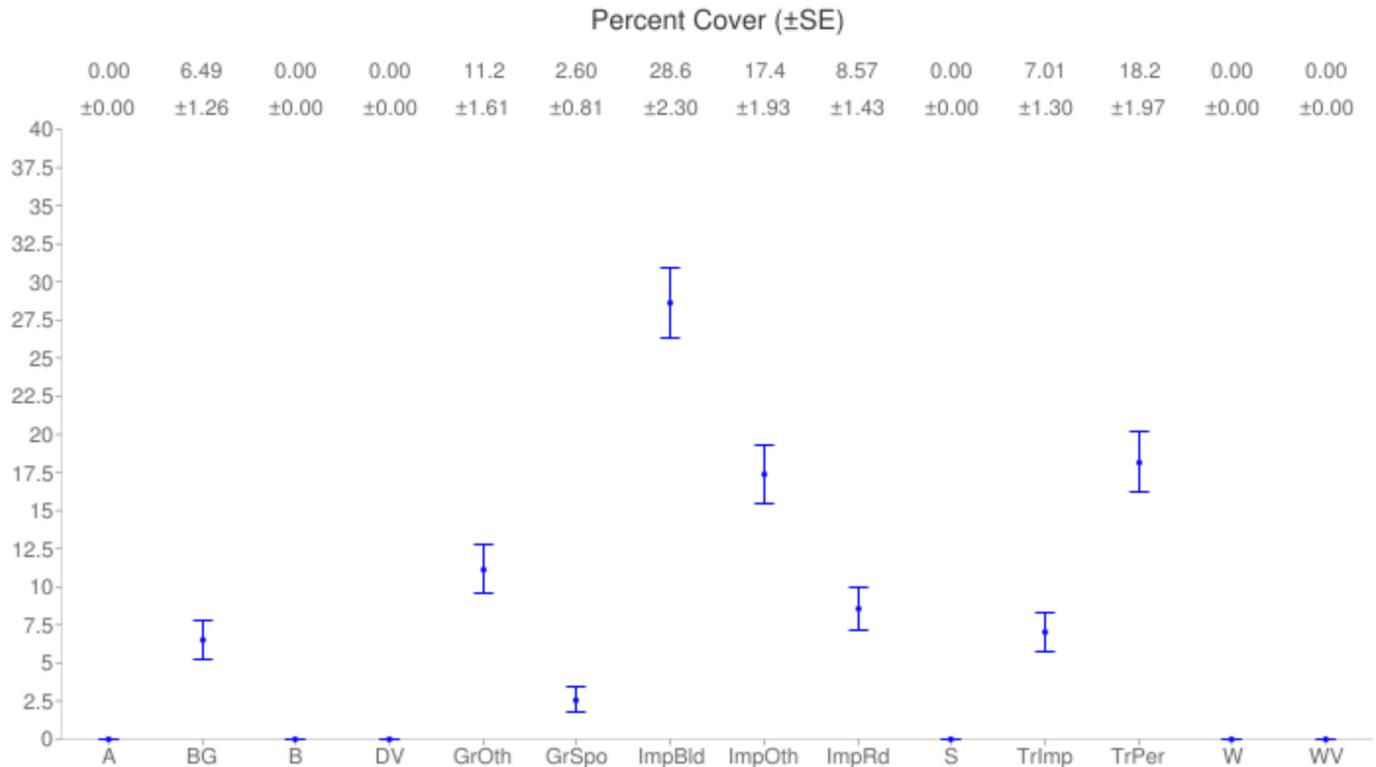
MAGILL - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/20/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	25	6.49 ±1.26
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	43	11.2 ±1.61
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	10	2.60 ±0.81
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	110	28.6 ±2.30
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	67	17.4 ±1.93
Impervious - road	A sealed road.	ImpRd	33	8.57 ±1.43
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	27	7.01 ±1.30
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	70	18.2 ±1.97

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$103.87	±9.12	52.15 kg	±4.58
NO2	Nitrogen Dioxide removed annually	\$368.81	±32.39	303.62 kg	±26.66
O3	Ozone removed annually	\$17,988.06	±1,579.66	1.87 t	±0.16
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$15,975.83	±1,402.95	49.10 kg	±4.31
SO2	Sulfur Dioxide removed annually	\$23.11	±2.03	61.49 kg	±5.40
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$5,253.70	±461.37	561.12 kg	±49.28
CO2seq	Carbon Dioxide sequestered annually in trees	\$20,862.41	±1,832.08	384.67 t	±33.78
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$304,403.62	±26,731.90	7.60 kt	±0.67

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,991.78 | NO2 1.125 @ \$1,214.71 | O3 6.934 @ \$9,612.86 | PM2.5 0.182 @ \$325,392.51 | SO2 0.228 @ \$375.90 | PM10\* 2.079 @ \$9,362.83 | CO2seq 1,425.370 @ \$54.23 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

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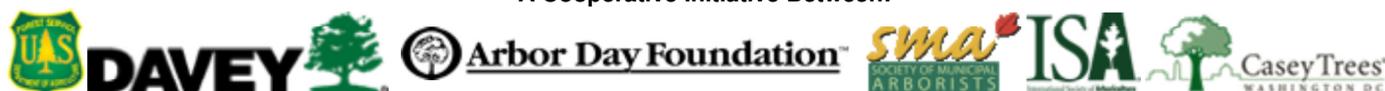
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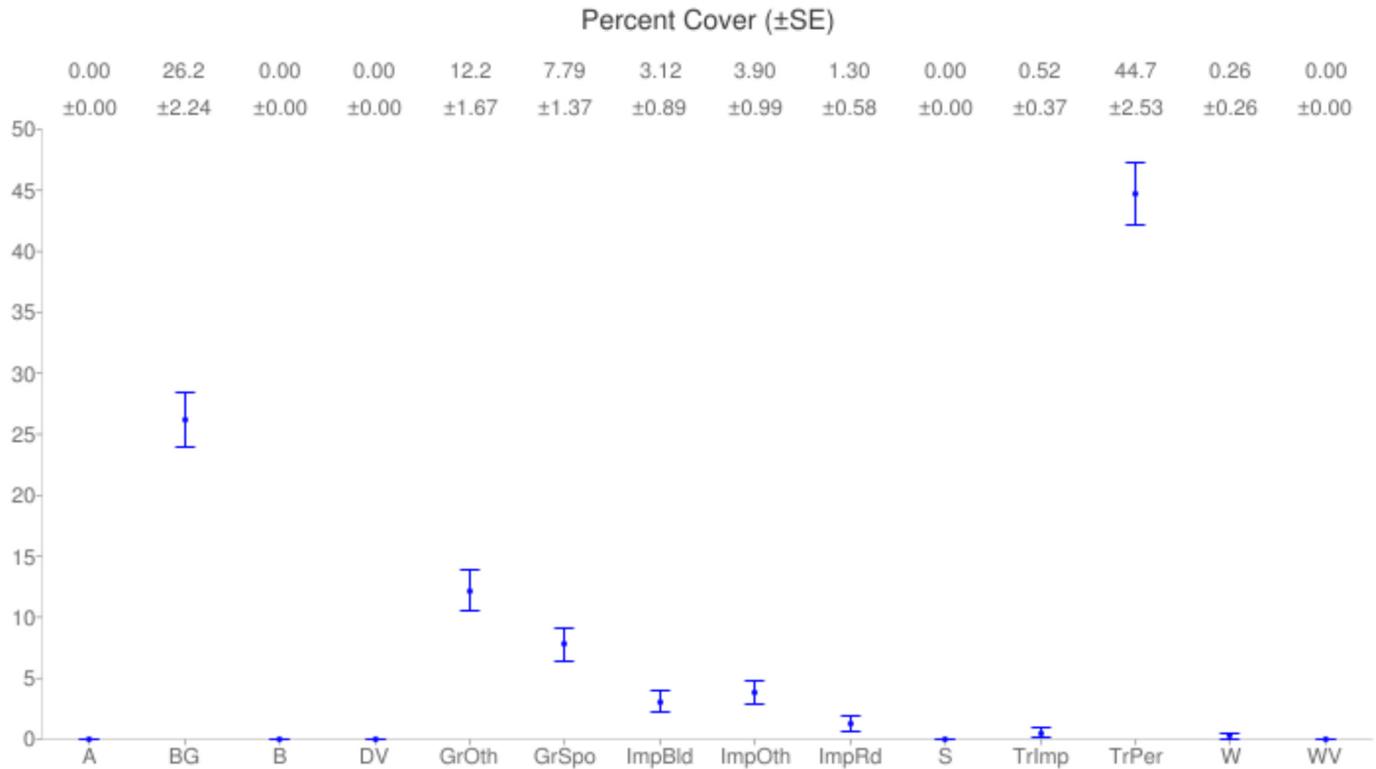
MOUNT OSMOND - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

*Estimated using random sampling statistics on 6/23/16*



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 $\pm 0.00$
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	101	26.2 $\pm 2.24$
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 $\pm 0.00$
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 $\pm 0.00$
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	47	12.2 $\pm 1.67$
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	30	7.79 $\pm 1.37$
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	12	3.12 $\pm 0.89$
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	15	3.90 $\pm 0.99$
Impervious - road	A sealed road.	ImpRd	5	1.30 $\pm 0.58$
Salt	Saltfields with or without water covering the pans.	S	0	0.00 $\pm 0.00$
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	2	0.52 $\pm 0.37$
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	172	44.7 $\pm 2.53$

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	1	0.26 ±0.26
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$359.79	±20.19	180.59 kg	±10.14
NO2	Nitrogen Dioxide removed annually	\$1,277.48	±71.70	1.05 t	±0.06
O3	Ozone removed annually	\$62,307.49	±3,496.85	6.48 t	±0.36
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$55,337.48	±3,105.67	170.02 kg	±9.54
SO2	Sulfur Dioxide removed annually	\$80.06	±4.49	212.93 kg	±11.95
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$18,197.90	±1,021.31	1.94 t	±0.11
CO2seq	Carbon Dioxide sequestered annually in trees	\$72,263.74	±4,055.61	1.33 kt	±0.07
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$1,054,142.53	±59,161.01	26.33 kt	±1.48

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,992.27 | NO2 1.125 @ \$1,215.00 | O3 6.934 @ \$9,615.22 | PM2.5 0.182 @ \$325,472.23 | SO2 0.228 @ \$375.99 | PM10\* 2.079 @ \$9,365.13 | CO2seq 1,425.370 @ \$54.25 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

#### About i-Tree Canopy

The concept and prototype of this program were developed by David J. Nowak, Jeffery T. Walton and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company).

#### Limitations of i-Tree Canopy

The accuracy of the analysis depends upon the ability of the user to correctly classify each point into its correct class. As the number of points increase, the precision of the estimate will increase as the standard error of the estimate will decrease. If too few points are classified, the standard error will be too high to have any real certainty of the estimate.

#### A Cooperative Initiative Between:



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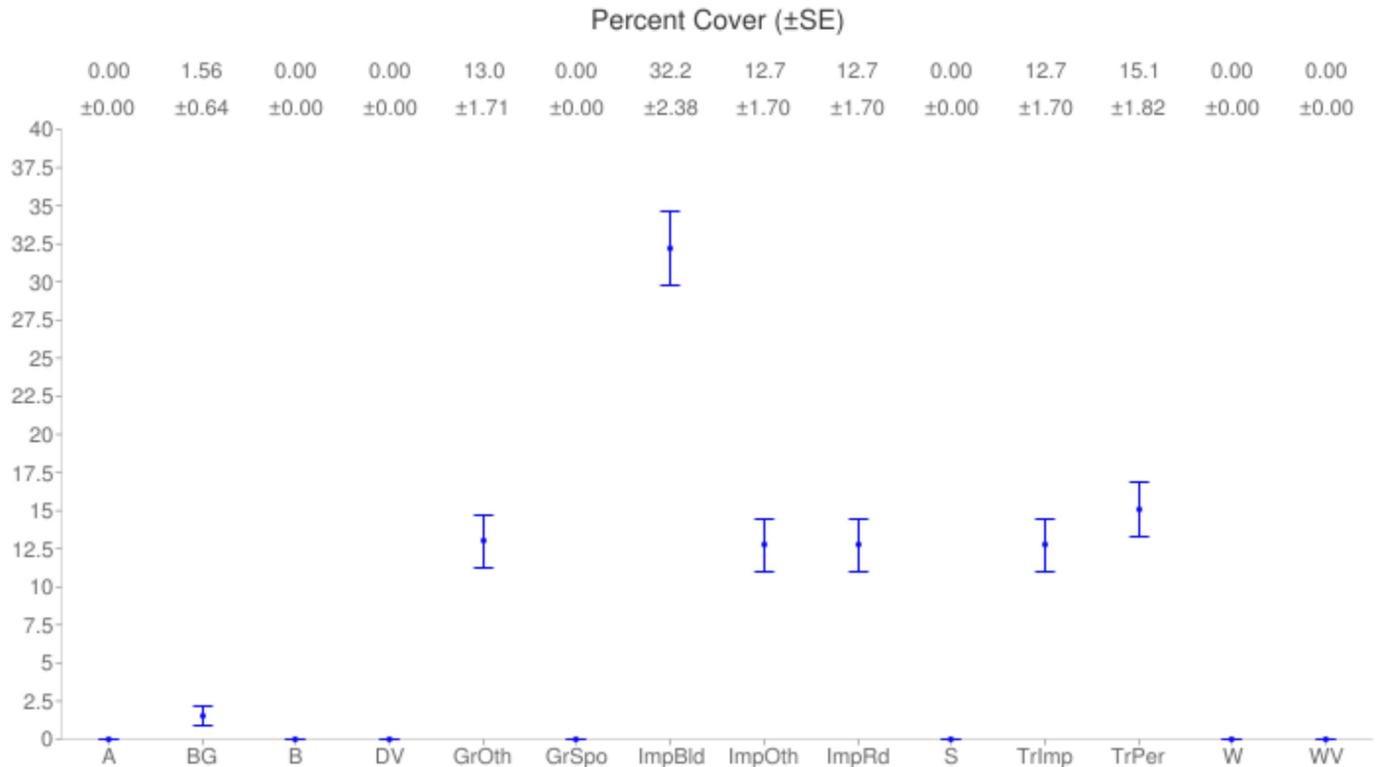
ROSE PARK - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/13/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	6	1.56 ±0.64
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	50	13.0 ±1.71
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	0	0.00 ±0.00
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	124	32.2 ±2.38
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	49	12.7 ±1.70
Impervious - road	A sealed road.	ImpRd	49	12.7 ±1.70
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	49	12.7 ±1.70
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	58	15.1 ±1.82

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$59.82	±4.91	30.06 kg	±2.47
NO2	Nitrogen Dioxide removed annually	\$212.39	±17.45	174.99 kg	±14.38
O3	Ozone removed annually	\$10,359.28	±851.00	1.08 t	±0.09
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$9,200.44	±755.80	28.30 kg	±2.32
SO2	Sulfur Dioxide removed annually	\$13.31	±1.09	35.44 kg	±2.91
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$3,025.59	±248.55	323.41 kg	±26.57
CO2seq	Carbon Dioxide sequestered annually in trees	\$12,014.61	±986.98	221.71 t	±18.21
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$237,540.96	±19,513.66	4.38 kt	±0.36

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,990.20 | NO2 1.125 @ \$1,213.74 | O3 6.934 @ \$9,605.24 | PM2.5 0.182 @ \$325,134.36 | SO2 0.228 @ \$375.60 | PM10\* 2.079 @ \$9,355.40 | CO2seq 1,425.370 @ \$54.19 | CO2stor is a total biomass amount of 28,177.630 @ \$54.20*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

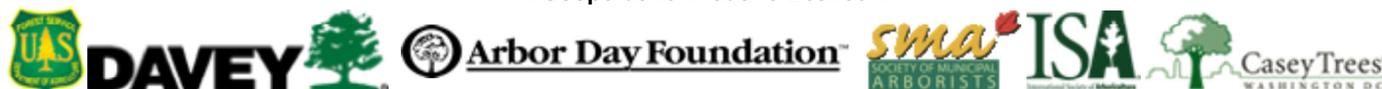
#### About i-Tree Canopy

The concept and prototype of this program were developed by David J. Nowak, Jeffery T. Walton and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company).

#### Limitations of i-Tree Canopy

The accuracy of the analysis depends upon the ability of the user to correctly classify each point into its correct class. As the number of points increase, the precision of the estimate will increase as the standard error of the estimate will decrease. If too few points are classified, the standard error will be too high to have any real certainty of the estimate.

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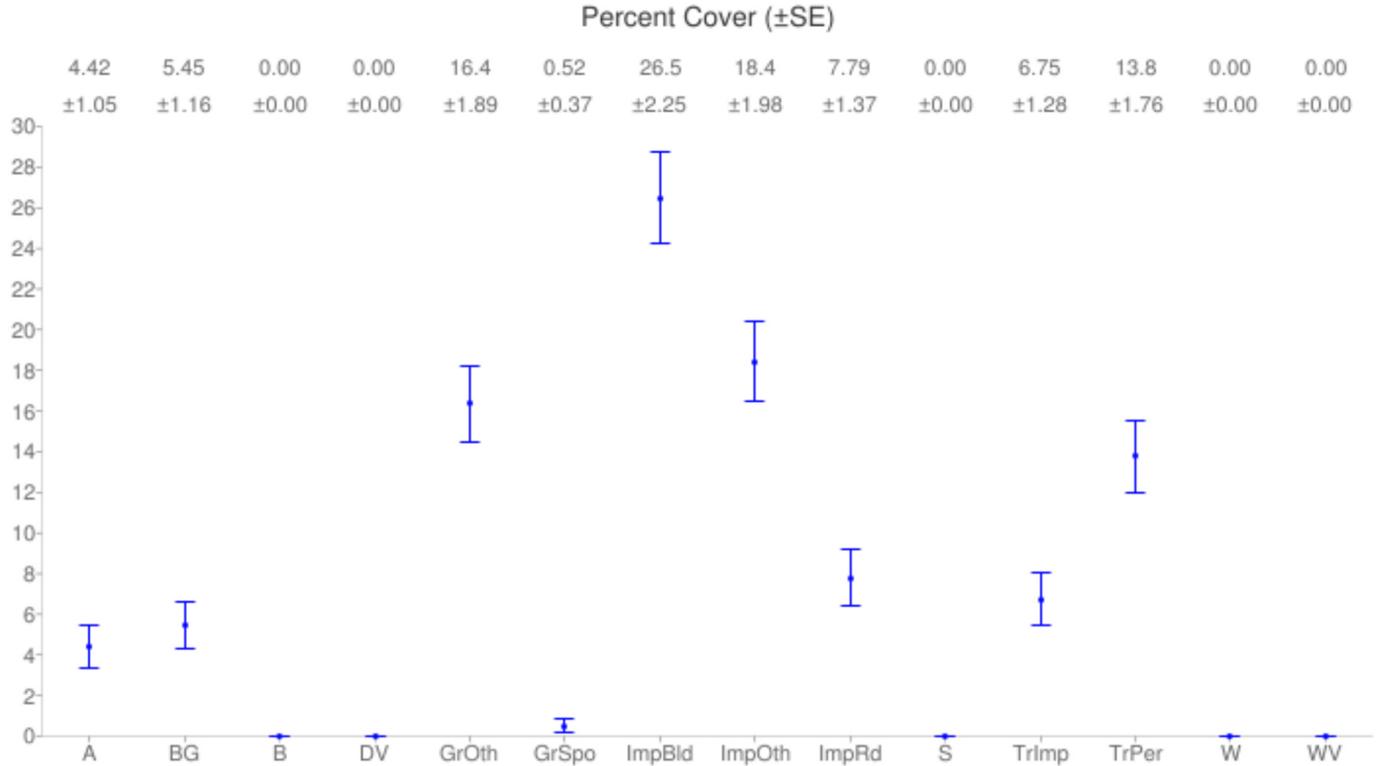
ROSSLYN PARK - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/13/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	17	4.42 ±1.05
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	21	5.45 ±1.16
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	63	16.4 ±1.89
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	2	0.52 ±0.37
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	102	26.5 ±2.25
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	71	18.4 ±1.98
Impervious - road	A sealed road.	ImpRd	30	7.79 ±1.37
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	26	6.75 ±1.28
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	53	13.8 ±1.76

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

**Tree Benefit Estimates**

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$65.12	±6.53	32.77 kg	±3.29
NO2	Nitrogen Dioxide removed annually	\$231.21	±23.19	190.77 kg	±19.14
O3	Ozone removed annually	\$11,276.86	±1,131.11	1.18 t	±0.12
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$10,015.38	±1,004.58	30.85 kg	±3.09
SO2	Sulfur Dioxide removed annually	\$14.49	±1.45	38.63 kg	±3.88
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$3,293.59	±330.36	352.58 kg	±35.36
CO2seq	Carbon Dioxide sequestered annually in trees	\$13,078.82	±1,311.85	241.70 t	±24.24
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$258,581.35	±25,936.66	4.78 kt	±0.48

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,987.25 | NO2 1.125 @ \$1,211.94 | O3 6.934 @ \$9,590.97 | PM2.5 0.182 @ \$324,651.44 | SO2 0.228 @ \$375.05 | PM10\* 2.079 @ \$9,341.51 | CO2seq 1,425.370 @ \$54.11 | CO2stor is a total biomass amount of 28,177.630 @ \$54.12*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

**About i-Tree Canopy**

The concept and prototype of this program were developed by David J. Nowak, Jeffery T. Walton and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company).

**Limitations of i-Tree Canopy**

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**A Cooperative Initiative Between:**



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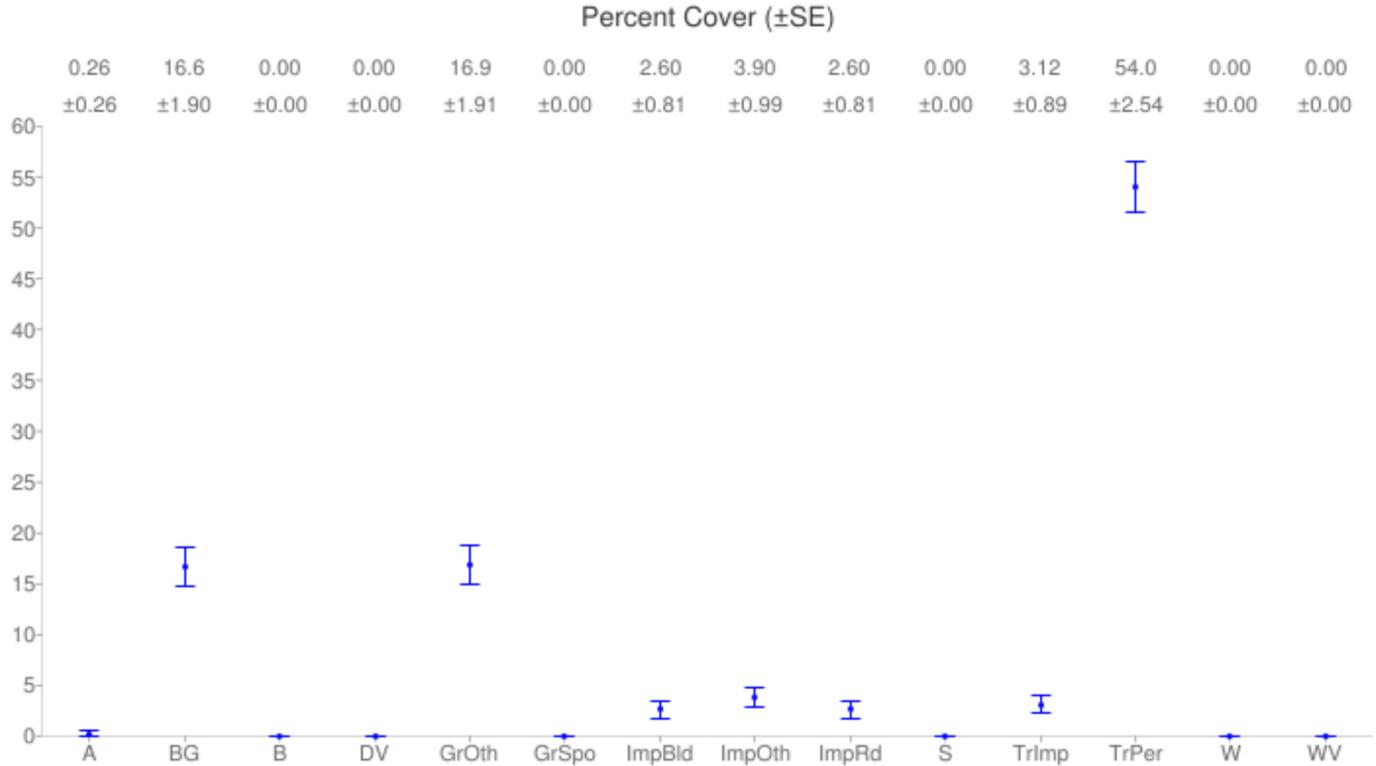
SKYE- 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

*Estimated using random sampling statistics on 6/13/16*



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	1	0.26 ±0.26
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	64	16.6 ±1.90
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	65	16.9 ±1.91
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	0	0.00 ±0.00
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	10	2.60 ±0.81
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	15	3.90 ±0.99
Impervious - road	A sealed road.	ImpRd	10	2.60 ±0.81
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	12	3.12 ±0.89
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	208	54.0 ±2.54

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$298.17	±13.16	150.19 kg	±6.63
NO2	Nitrogen Dioxide removed annually	\$1,058.70	±46.73	874.40 kg	±38.59
O3	Ozone removed annually	\$51,637.03	±2,279.09	5.39 t	±0.24
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$45,860.67	±2,024.14	141.40 kg	±6.24
SO2	Sulfur Dioxide removed annually	\$66.35	±2.93	177.08 kg	±7.82
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$15,081.42	±665.64	1.62 t	±0.07
CO2seq	Carbon Dioxide sequestered annually in trees	\$59,888.22	±2,643.27	1.11 kt	±0.05
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$1,184,050.36	±52,260.12	21.90 kt	±0.97

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,985.34 | NO2 1.125 @ \$1,210.78 | O3 6.934 @ \$9,581.79 | PM2.5 0.182 @ \$324,340.70 | SO2 0.228 @ \$374.69 | PM10\* 2.079 @ \$9,332.57 | CO2seq 1,425.370 @ \$54.06 | CO2stor is a total biomass amount of 28,177.630 @ \$54.07*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

#### About i-Tree Canopy

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#### Limitations of i-Tree Canopy

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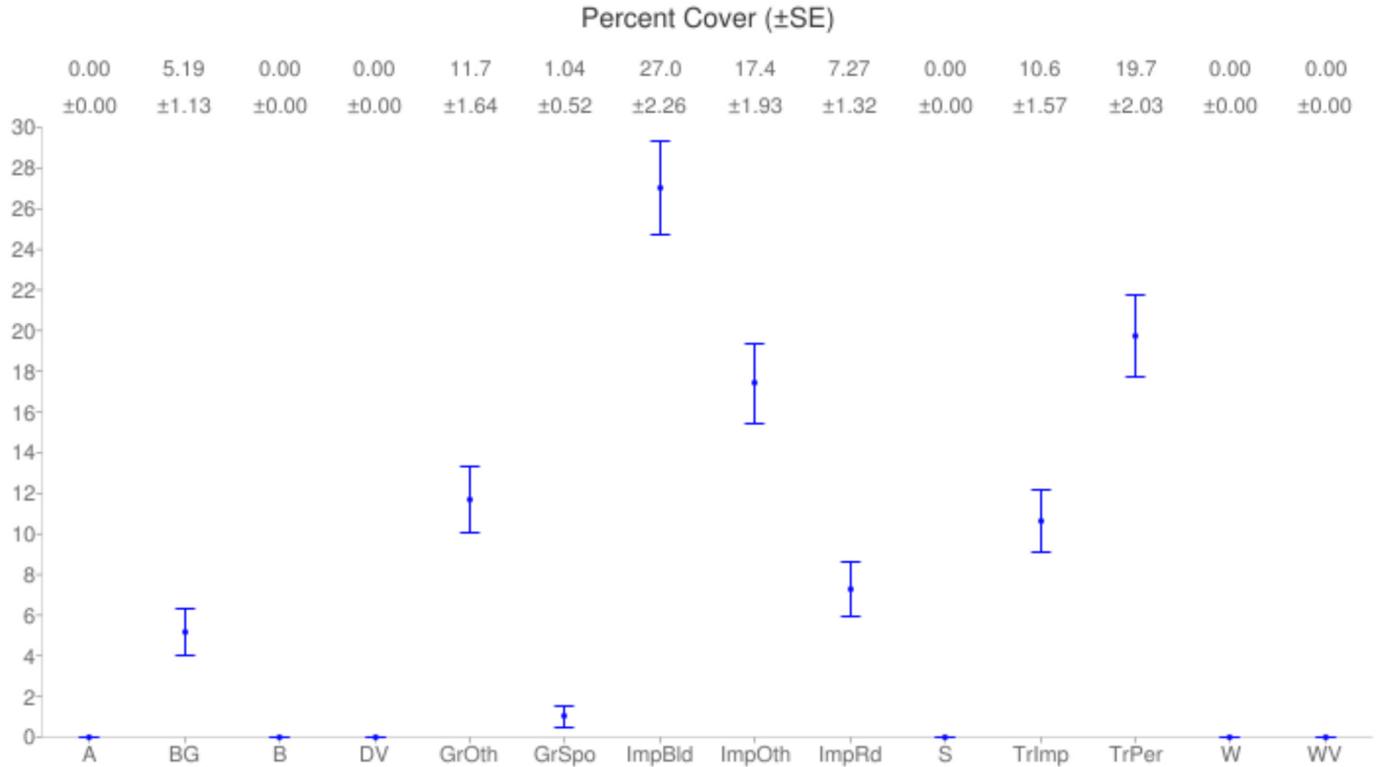
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ST GEORGES - 2015

Tools for Assessing and Managing  
Community Trees and Forests

**i-Tree Canopy** v6.1  
Cover Assessment and Tree Benefits Report  
*Estimated using random sampling statistics on 6/13/16*



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	20	5.19 ±1.13
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	45	11.7 ±1.64
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	4	1.04 ±0.52
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	104	27.0 ±2.26
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	67	17.4 ±1.93
Impervious - road	A sealed road.	ImpRd	28	7.27 ±1.32
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	41	10.6 ±1.57
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	76	19.7 ±2.03

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$81.74	±6.30	41.09 kg	±3.17
NO2	Nitrogen Dioxide removed annually	\$290.23	±22.39	239.21 kg	±18.45
O3	Ozone removed annually	\$14,155.65	±1,091.88	1.47 t	±0.11
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$12,572.14	±969.74	38.68 kg	±2.98
SO2	Sulfur Dioxide removed annually	\$18.19	±1.40	48.44 kg	±3.74
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$4,134.38	±318.90	442.10 kg	±34.10
CO2seq	Carbon Dioxide sequestered annually in trees	\$16,417.62	±1,266.35	303.07 t	±23.38
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$324,592.81	±25,037.04	5.99 kt	±0.46

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,989.42 | NO2 1.125 @ \$1,213.27 | O3 6.934 @ \$9,601.47 | PM2.5 0.182 @ \$325,006.84 | SO2 0.228 @ \$375.46 | PM10\* 2.079 @ \$9,351.73 | CO2seq 1,425.370 @ \$54.17 | CO2stor is a total biomass amount of 28,177.630 @ \$54.18*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

#### About i-Tree Canopy

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#### Limitations of i-Tree Canopy

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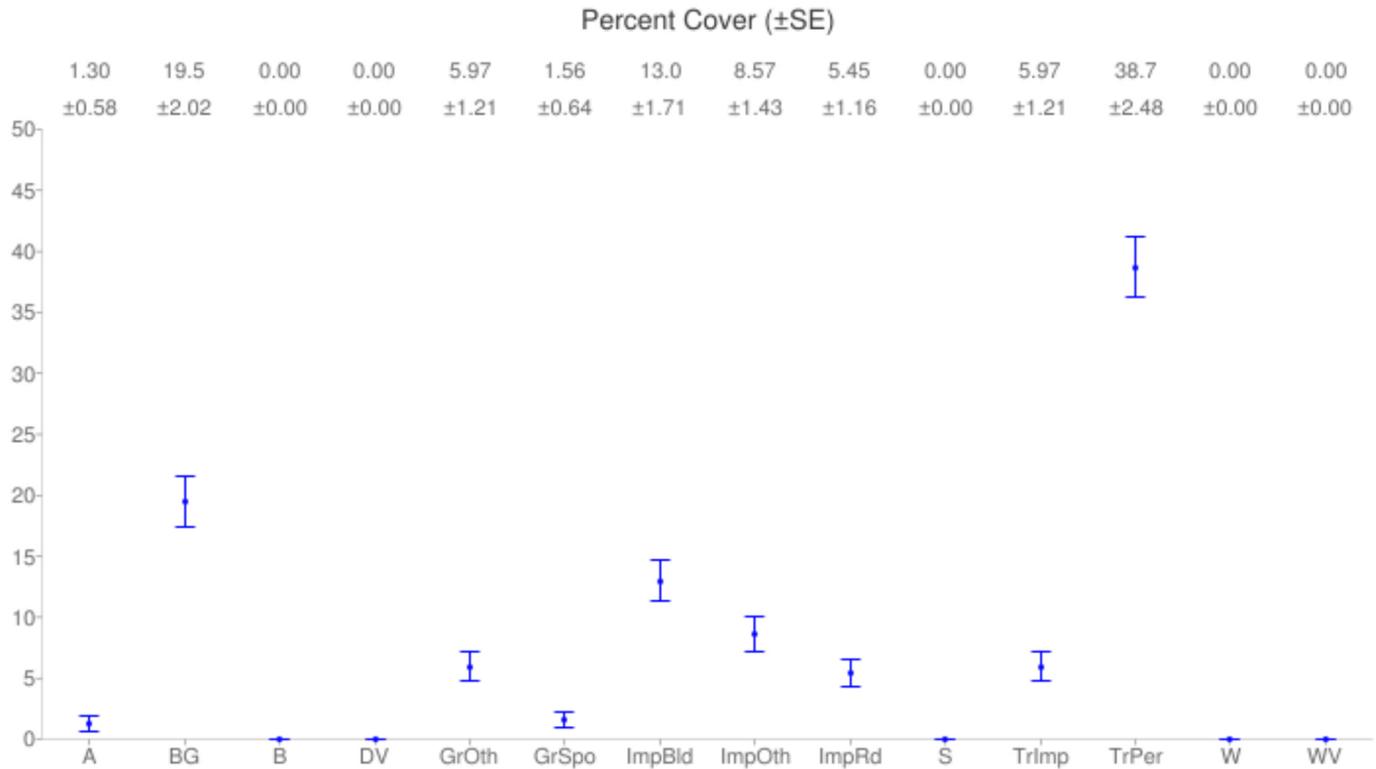
STONYFELL - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/21/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	5	1.30 ±0.58
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	75	19.5 ±2.02
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	23	5.97 ±1.21
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	6	1.56 ±0.64
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	50	13.0 ±1.71
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	33	8.57 ±1.43
Impervious - road	A sealed road.	ImpRd	21	5.45 ±1.16
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	23	5.97 ±1.21
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	149	38.7 ±2.48

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$219.96	±12.48	111.44 kg	±6.32
NO2	Nitrogen Dioxide removed annually	\$781.01	±44.29	648.79 kg	±36.80
O3	Ozone removed annually	\$38,092.80	±2,160.42	4.00 t	±0.23
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$33,831.56	±1,918.74	104.91 kg	±5.95
SO2	Sulfur Dioxide removed annually	\$48.95	±2.78	131.39 kg	±7.45
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$11,125.61	±630.98	1.20 t	±0.07
CO2seq	Carbon Dioxide sequestered annually in trees	\$44,179.73	±2,505.64	821.99 t	±46.62
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$873,477.68	±49,538.98	16.25 kt	±0.92

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,973.88 | NO2 1.125 @ \$1,203.79 | O3 6.934 @ \$9,526.47 | PM2.5 0.182 @ \$322,468.09 | SO2 0.228 @ \$372.52 | PM10\* 2.079 @ \$9,278.68 | CO2seq 1,425.370 @ \$53.75 | CO2stor is a total biomass amount of 28,177.630 @ \$53.75*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

#### About i-Tree Canopy

The concept and prototype of this program were developed by David J. Nowak, Jeffery T. Walton and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company).

#### Limitations of i-Tree Canopy

The accuracy of the analysis depends upon the ability of the user to correctly classify each point into its correct class. As the number of points increase, the precision of the estimate will increase as the standard error of the estimate will decrease. If too few points are classified, the standard error will be too high to have any real certainty of the estimate.

#### A Cooperative Initiative Between:



[www.itreetools.org](http://www.itreetools.org)



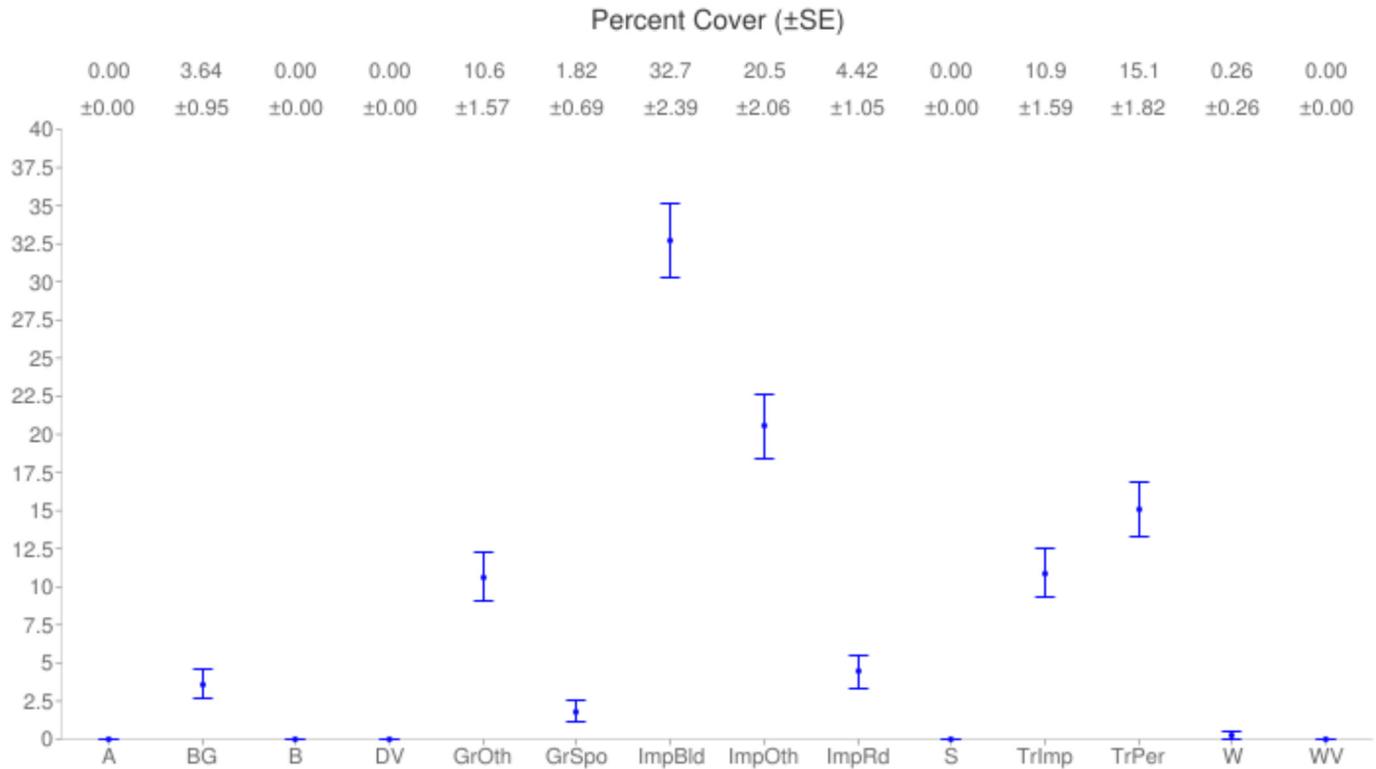
TOORAK GARDENS - 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/14/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	14	3.64 ±0.95
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	41	10.6 ±1.57
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	7	1.82 ±0.69
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	126	32.7 ±2.39
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	79	20.5 ±2.06
Impervious - road	A sealed road.	ImpRd	17	4.42 ±1.05
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	42	10.9 ±1.59
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	58	15.1 ±1.82

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	1	0.26 ±0.26
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$110.37	±9.50	55.45 kg	±4.77
NO2	Nitrogen Dioxide removed annually	\$391.90	±33.72	322.86 kg	±27.78
O3	Ozone removed annually	\$19,114.41	±1,644.57	1.99 t	±0.17
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$16,976.19	±1,460.60	52.21 kg	±4.49
SO2	Sulfur Dioxide removed annually	\$24.56	±2.11	65.38 kg	±5.63
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$5,582.67	±480.32	596.68 kg	±51.34
CO2seq	Carbon Dioxide sequestered annually in trees	\$22,168.75	±1,907.36	409.05 t	±35.19
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$323,694.69	±27,850.16	8.09 kt	±0.70

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,990.37 | NO2 1.125 @ \$1,213.84 | O3 6.934 @ \$9,606.02 | PM2.5 0.182 @ \$325,161.01 | SO2 0.228 @ \$375.63 | PM10\* 2.079 @ \$9,356.17 | CO2seq 1,425.370 @ \$54.20 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

#### About i-Tree Canopy

The concept and prototype of this program were developed by David J. Nowak, Jeffery T. Walton and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company).

#### Limitations of i-Tree Canopy

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#### A Cooperative Initiative Between:



[www.itreetools.org](http://www.itreetools.org)



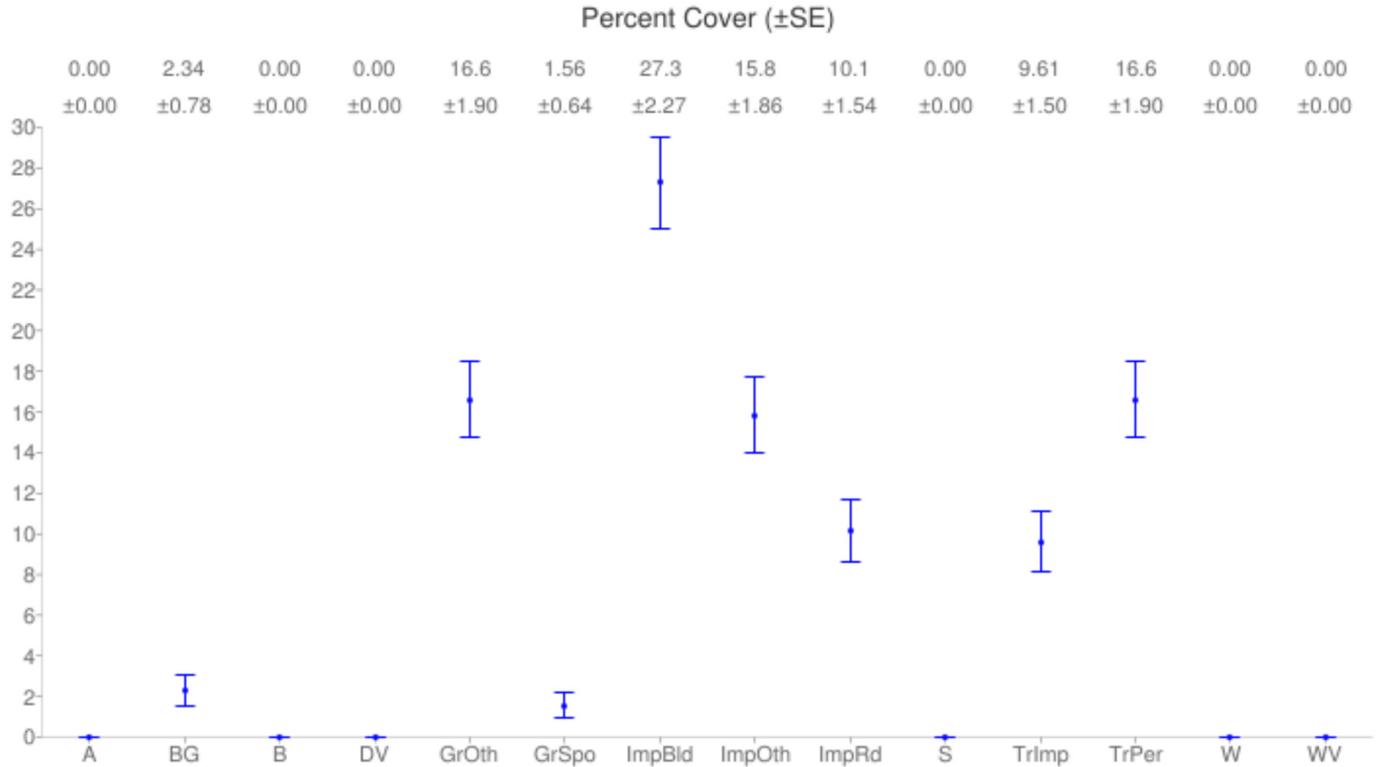
TUSMORE- 2015

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/14/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	9	2.34 ±0.78
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	64	16.6 ±1.90
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	6	1.56 ±0.64
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	105	27.3 ±2.27
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	61	15.8 ±1.86
Impervious - road	A sealed road.	ImpRd	39	10.1 ±1.54
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	37	9.61 ±1.50
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	64	16.6 ±1.90

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$66.72	±5.70	33.58 kg	±2.87
NO2	Nitrogen Dioxide removed annually	\$236.89	±20.25	195.52 kg	±16.71
O3	Ozone removed annually	\$11,554.21	±987.43	1.21 t	±0.10
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$10,261.71	±876.98	31.62 kg	±2.70
SO2	Sulfur Dioxide removed annually	\$14.85	±1.27	39.60 kg	±3.38
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$3,374.59	±288.40	361.34 kg	±30.88
CO2seq	Carbon Dioxide sequestered annually in trees	\$13,400.49	±1,145.22	247.71 t	±21.17
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$264,941.09	±22,642.14	4.90 kt	±0.42

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,986.71 | NO2 1.125 @ \$1,211.61 | O3 6.934 @ \$9,588.38 | PM2.5 0.182 @ \$324,563.79 | SO2 0.228 @ \$374.94 | PM10\* 2.079 @ \$9,338.99 | CO2seq 1,425.370 @ \$54.10 | CO2stor is a total biomass amount of 28,177.630 @ \$54.10*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

#### About i-Tree Canopy

The concept and prototype of this program were developed by David J. Nowak, Jeffery T. Walton and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company).

#### Limitations of i-Tree Canopy

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#### A Cooperative Initiative Between:



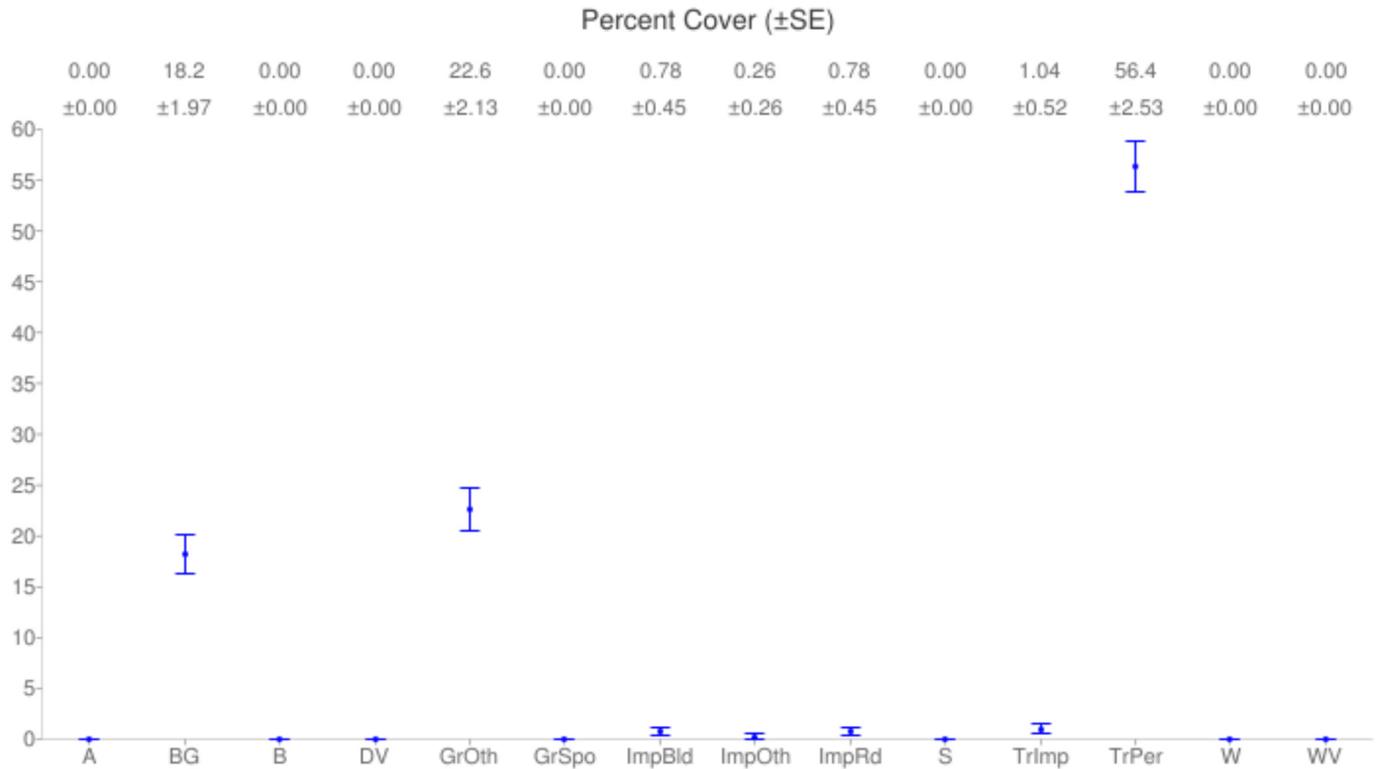
[www.itreetools.org](http://www.itreetools.org)



WATERFALL GULLY - 2015

Tools for Assessing and Managing  
Community Trees and Forests

**i-Tree Canopy** v6.1  
Cover Assessment and Tree Benefits Report  
*Estimated using random sampling statistics on 6/14/16*



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	70	18.2 ±1.97
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	87	22.6 ±2.13
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	0	0.00 ±0.00
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	3	0.78 ±0.45
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	1	0.26 ±0.26
Impervious - road	A sealed road.	ImpRd	3	0.78 ±0.45
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	4	1.04 ±0.52
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	217	56.4 ±2.53

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$382.25	±16.78	192.40 kg	±8.45
NO2	Nitrogen Dioxide removed annually	\$1,357.24	±59.59	1.12 t	±0.05
O3	Ozone removed annually	\$66,197.73	±2,906.29	6.90 t	±0.30
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$58,792.54	±2,581.18	181.14 kg	±7.95
SO2	Sulfur Dioxide removed annually	\$85.06	±3.73	226.85 kg	±9.96
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$19,334.10	±848.83	2.07 t	±0.09
CO2seq	Carbon Dioxide sequestered annually in trees	\$76,775.61	±3,370.69	1.42 kt	±0.06
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$1,123,093.90	±49,307.33	28.06 kt	±1.23

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,986.71 | NO2 1.125 @ \$1,211.61 | O3 6.934 @ \$9,588.38 | PM2.5 0.182 @ \$324,563.79 | SO2 0.228 @ \$374.94 | PM10\* 2.079 @ \$9,338.99 | CO2seq 1,425.370 @ \$54.10 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

#### About i-Tree Canopy

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#### A Cooperative Initiative Between:



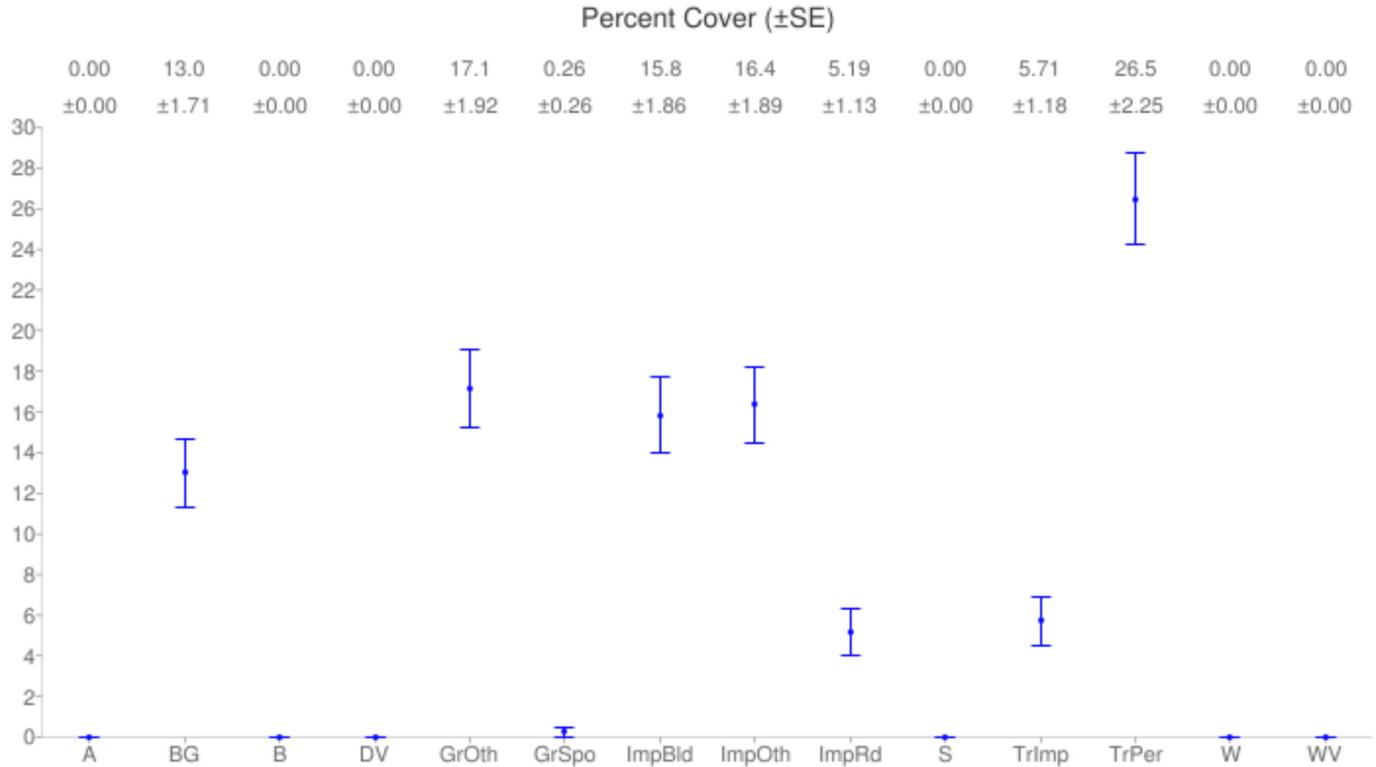
[www.itreetools.org](http://www.itreetools.org)



WATTLE PARK - 2015

Tools for Assessing and Managing  
Community Trees and Forests

**i-Tree Canopy** v6.1  
Cover Assessment and Tree Benefits Report  
*Estimated using random sampling statistics on 6/14/16*



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	50	13.0 ±1.71
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	66	17.1 ±1.92
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	1	0.26 ±0.26
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	61	15.8 ±1.86
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	63	16.4 ±1.89
Impervious - road	A sealed road.	ImpRd	20	5.19 ±1.13
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	22	5.71 ±1.18
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	102	26.5 ±2.25

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$143.43	±10.61	71.73 kg	±5.30
NO2	Nitrogen Dioxide removed annually	\$509.28	±37.66	417.64 kg	±30.88
O3	Ozone removed annually	\$24,839.53	±1,836.63	2.57 t	±0.19
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$22,060.87	±1,631.18	67.53 kg	±4.99
SO2	Sulfur Dioxide removed annually	\$31.92	±2.36	84.58 kg	±6.25
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$7,254.78	±536.42	771.85 kg	±57.07
CO2seq	Carbon Dioxide sequestered annually in trees	\$28,808.70	±2,130.11	529.13 t	±39.12
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$418,718.22	±30,960.00	10.46 kt	±0.77

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,999.53 | NO2 1.125 @ \$1,219.43 | O3 6.934 @ \$9,650.28 | PM2.5 0.182 @ \$326,659.01 | SO2 0.228 @ \$377.37 | PM10\* 2.079 @ \$9,399.27 | CO2seq 1,425.370 @ \$54.45 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

#### About i-Tree Canopy

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#### Limitations of i-Tree Canopy

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#### A Cooperative Initiative Between:



[www.itreetools.org](http://www.itreetools.org)

**Attachment D. i-Tree Canopy reports for the 28 suburbs assessed in 2010**



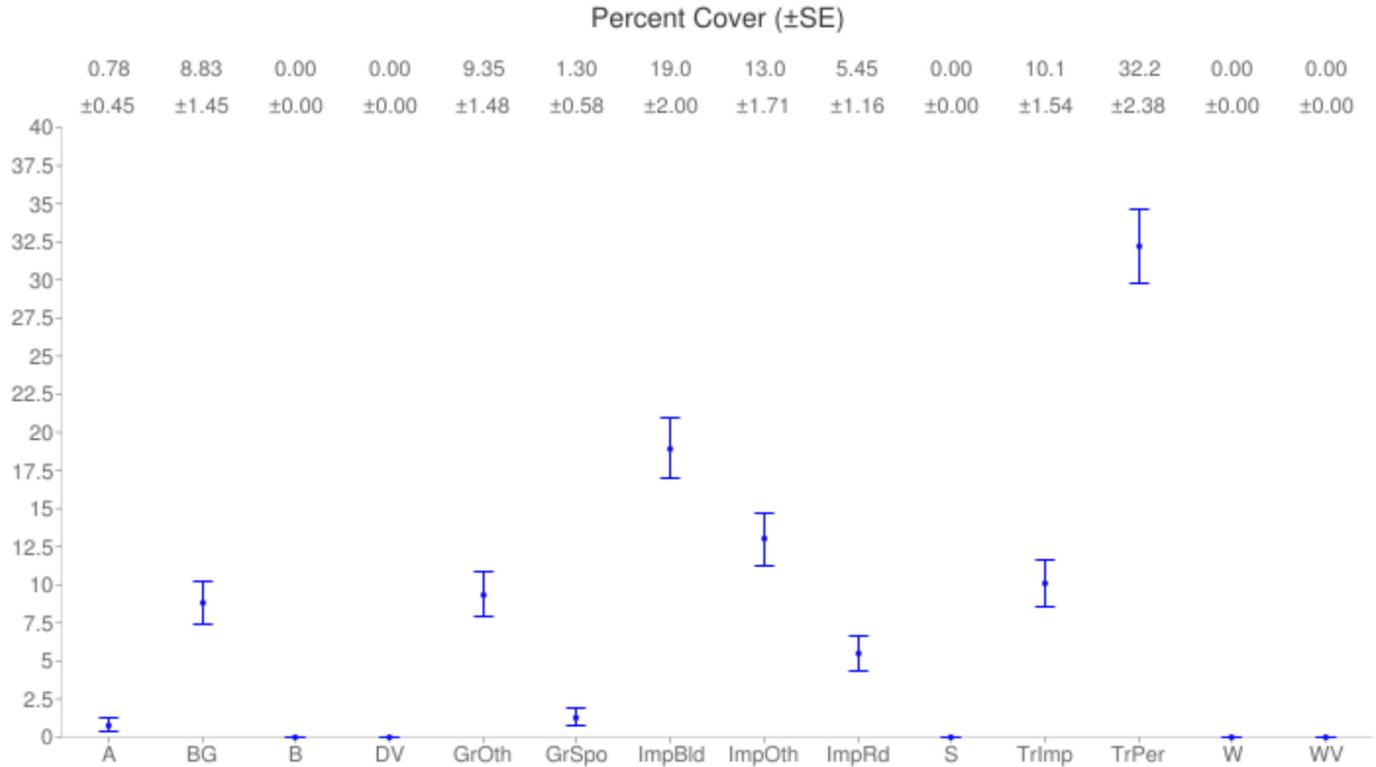
BURNSIDE - 2010

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/15/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	3	0.78 ±0.45
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	34	8.83 ±1.45
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	36	9.35 ±1.48
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	5	1.30 ±0.58
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	73	19.0 ±2.00
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	50	13.0 ±1.71
Impervious - road	A sealed road.	ImpRd	21	5.45 ±1.16
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	39	10.1 ±1.54
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	124	32.2 ±2.38

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$276.44	±16.44	139.25 kg	±8.28
NO2	Nitrogen Dioxide removed annually	\$981.53	±58.38	810.71 kg	±48.22
O3	Ozone removed annually	\$47,873.08	±2,847.37	5.00 t	±0.30
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$42,517.78	±2,528.85	131.10 kg	±7.80
SO2	Sulfur Dioxide removed annually	\$61.51	±3.66	164.18 kg	±9.76
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$13,982.10	±831.62	1.50 t	±0.09
CO2seq	Carbon Dioxide sequestered annually in trees	\$55,522.83	±3,302.36	1.03 kt	±0.06
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$812,813.60	±48,344.08	20.31 kt	±1.21

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,985.22 | NO2 1.125 @ \$1,210.70 | O3 6.934 @ \$9,581.17 | PM2.5 0.182 @ \$324,319.80 | SO2 0.228 @ \$374.66 | PM10\* 2.079 @ \$9,331.97 | CO2seq 1,425.370 @ \$54.06 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

#### About i-Tree Canopy

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#### Limitations of i-Tree Canopy

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#### A Cooperative Initiative Between:



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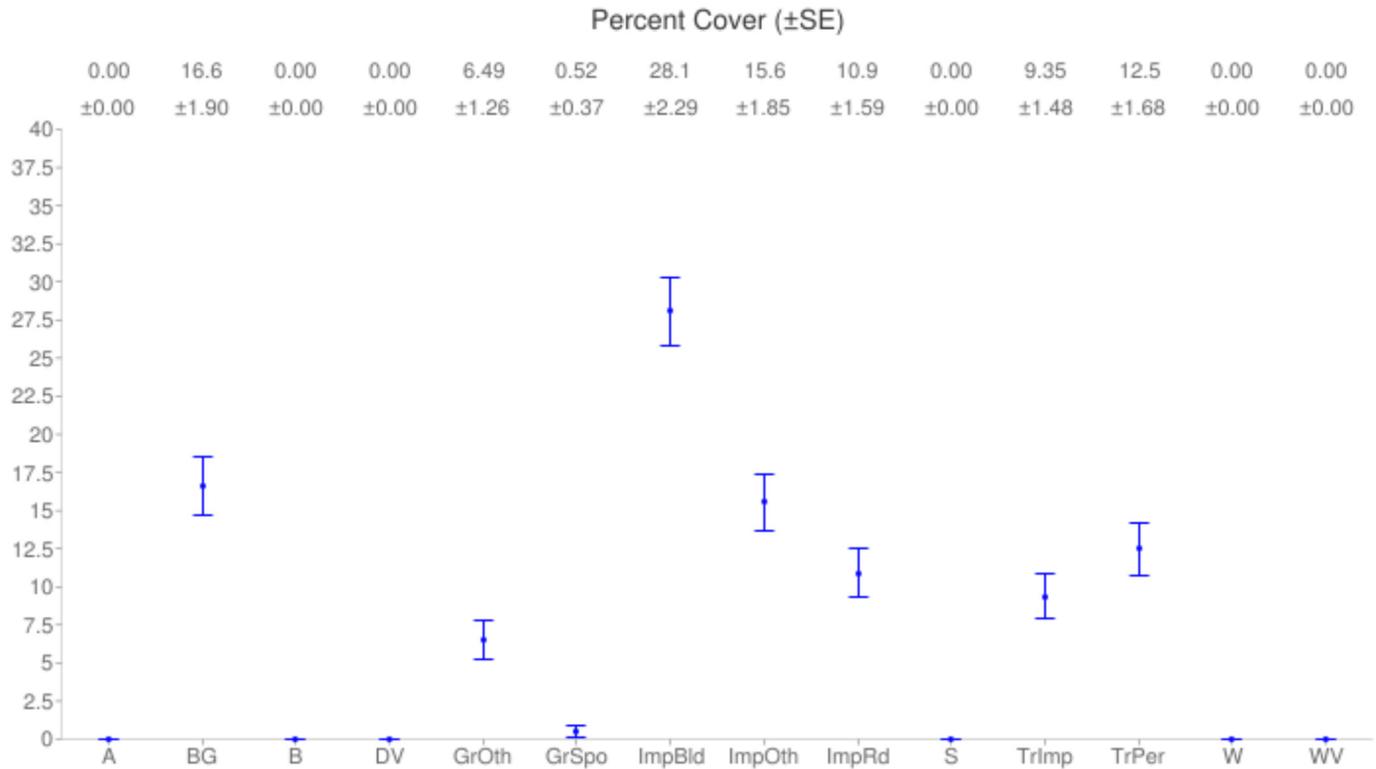
GLENSIDE - 2010

Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/16/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 ±0.00
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	64	16.6 ±1.90
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 ±0.00
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 ±0.00
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	25	6.49 ±1.26
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	2	0.52 ±0.37
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	108	28.1 ±2.29
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	60	15.6 ±1.85
Impervious - road	A sealed road.	ImpRd	42	10.9 ±1.59
Salt	Saltfields with or without water covering the pans.	S	0	0.00 ±0.00
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	36	9.35 ±1.48
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	48	12.5 ±1.68

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$93.98	±9.07	47.14 kg	±4.55
NO2	Nitrogen Dioxide removed annually	\$333.68	±32.19	274.46 kg	±26.48
O3	Ozone removed annually	\$16,274.84	±1,570.11	1.69 t	±0.16
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$14,454.26	±1,394.47	44.38 kg	±4.28
SO2	Sulfur Dioxide removed annually	\$20.91	±2.02	55.58 kg	±5.36
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$4,753.33	±458.58	507.24 kg	±48.94
CO2seq	Carbon Dioxide sequestered annually in trees	\$18,875.43	±1,821.00	347.73 t	±33.55
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$275,175.23	±26,547.44	6.87 kt	±0.66

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,993.49 | NO2 1.125 @ \$1,215.75 | O3 6.934 @ \$9,621.12 | PM2.5 0.182 @ \$325,672.03 | SO2 0.228 @ \$376.23 | PM10\* 2.079 @ \$9,370.87 | CO2seq 1,425.370 @ \$54.28 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

#### About i-Tree Canopy

The concept and prototype of this program were developed by David J. Nowak, Jeffery T. Walton and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company).

#### Limitations of i-Tree Canopy

The accuracy of the analysis depends upon the ability of the user to correctly classify each point into its correct class. As the number of points increase, the precision of the estimate will increase as the standard error of the estimate will decrease. If too few points are classified, the standard error will be too high to have any real certainty of the estimate.

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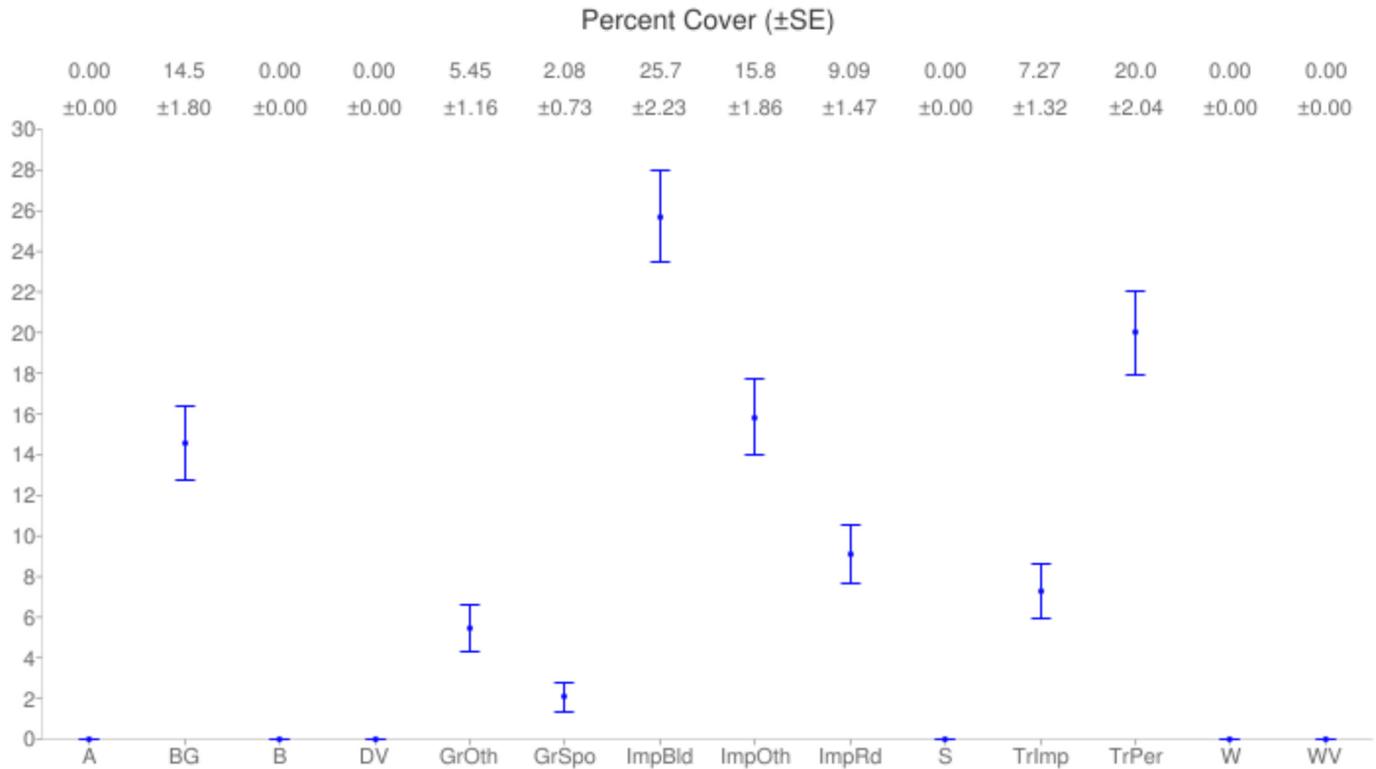
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Tools for Assessing and Managing  
Community Trees and Forests

# i-Tree Canopy v6.1

## Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 6/20/16



Cover Class	Description	Abbr.	Points	% Cover
Agriculture	Active cropping or other agricultural activity.	A	0	0.00 $\pm 0.00$
Bare ground	Non-vegetation pervious surface. Includes sand traps in golf courses.	BG	56	14.5 $\pm 1.80$
Beach	Non-vegetated portion of coastal sandy beaches, to low tide mark.	B	0	0.00 $\pm 0.00$
Dune vegetation	Vegetation growing on coastal sand dunes.	DV	0	0.00 $\pm 0.00$
Grass - other	Grassed areas not included in Grass-sporting cover class. Includes public paks, private lawns, areas beside sporting fields, and non-tree plants (e.g. shrubs and short hedges).	GrOth	21	5.45 $\pm 1.16$
Grass - sporting	Grassed areas primarily used as sporting fields. Includes school ovals, sports fields, golf fairways and putting greens, and airport runways.	GrSpo	8	2.08 $\pm 0.73$
Impervious - building	A permanent built structure (e.g. house, carport).	ImpBld	99	25.7 $\pm 2.23$
Impervious - other	Impervious surfaces not included in building and road cover classes. Includes footpaths, driveways, parking lots, railway lines, airport runways, and pools.	ImpOth	61	15.8 $\pm 1.86$
Impervious - road	A sealed road.	ImpRd	35	9.09 $\pm 1.47$
Salt	Saltfields with or without water covering the pans.	S	0	0.00 $\pm 0.00$
Tree - impervious	Tree canopy over perceived impervious surface.	TrImp	28	7.27 $\pm 1.32$
Tree - pervious	Tree canopy over perceived pervious surface.	TrPer	77	20.0 $\pm 2.04$

<b>Cover Class</b>	<b>Description</b>	<b>Abbr.</b>	<b>Points</b>	<b>% Cover</b>
Water	Aquatic or marine waterbodies. Does not include pools.	W	0	0.00 ±0.00
Wetland vegetation	Fringing or aquatic vegetation (not trees) associated with waterbodies.	WV	0	0.00 ±0.00

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	\$112.44	±9.36	56.45 kg	±4.70
NO2	Nitrogen Dioxide removed annually	\$399.22	±33.23	328.66 kg	±27.35
O3	Ozone removed annually	\$19,471.61	±1,620.53	2.03 t	±0.17
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$17,293.43	±1,439.25	53.15 kg	±4.42
SO2	Sulfur Dioxide removed annually	\$25.02	±2.08	66.56 kg	±5.54
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	\$5,686.99	±473.30	607.40 kg	±50.55
CO2seq	Carbon Dioxide sequestered annually in trees	\$22,583.02	±1,879.47	416.39 t	±34.65
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	\$329,509.07	±27,423.40	8.23 kt	±0.69

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in g/m<sup>2</sup>/yr and \$/t/yr: CO 0.193 @ \$1,991.78 | NO2 1.125 @ \$1,214.71 | O3 6.934 @ \$9,612.86 | PM2.5 0.182 @ \$325,392.51 | SO2 0.228 @ \$375.90 | PM10\* 2.079 @ \$9,362.83 | CO2seq 1,425.370 @ \$54.23 | CO2stor is a total biomass amount of 28,177.630 @ \$40.03*

*Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.*

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