WHERE SHOULD ALL THE TREES GO?

GREENER SPACES BETTER PLACES

GREENER SPACES BETTER PLACES™

is a national initiative that brings together state and local government, universities, business and industry to make our urban areas greener.

We're on a mission to make sure our green spaces grow as our urban places grow and, in doing so, make Australia's cities the greenest in the world.

The program first launched under the name 202020 Vision in 2013 and is evolving in order to keep meeting the needs of our network, through 2020 and beyond.

For more information please visit greenerspacesbetterplaces.com.au/faqs

Nursery & Garden Industry Australia | Hort Innovation

Greener Spaces Better Places is funded by Hort Innovation using the nursery marketing levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

WHAT IS THIS REPORT?

In 2013, the 202020 Vision released 'Where are all the trees?', Australia's first national benchmark of urban canopy cover.

This is the next generation of that report.

Like the original, it maps 139 local governments, providing updated snapshots of urban canopy cover.

Download it from **202020vision.com.au**

2013 ● ● ●

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NATIONAL OVERVIEW

Australia, it's a big place.

7.692 million km²

Habitable land:

768,685 km²

But most people live in a small part of it.

89.5%
people live in around
10%
of the country

That's

21.6 million
people in cities and surrounding suburbs.

We need to put green space where it's most needed.

We do this by understanding where it's being lost, where it's hot and where people will benefit most.

But where should all the trees go?

We asked RMIT to identify the urban areas that would most benefit from more green space. Here's what they told us...

Canberra Nara Peace Park

Our method:

THE VHHEDA VULNERABILITY INDEX

(Vulnerability to Heat, poor Health, Economic Disadvantage and Access to green spaces)

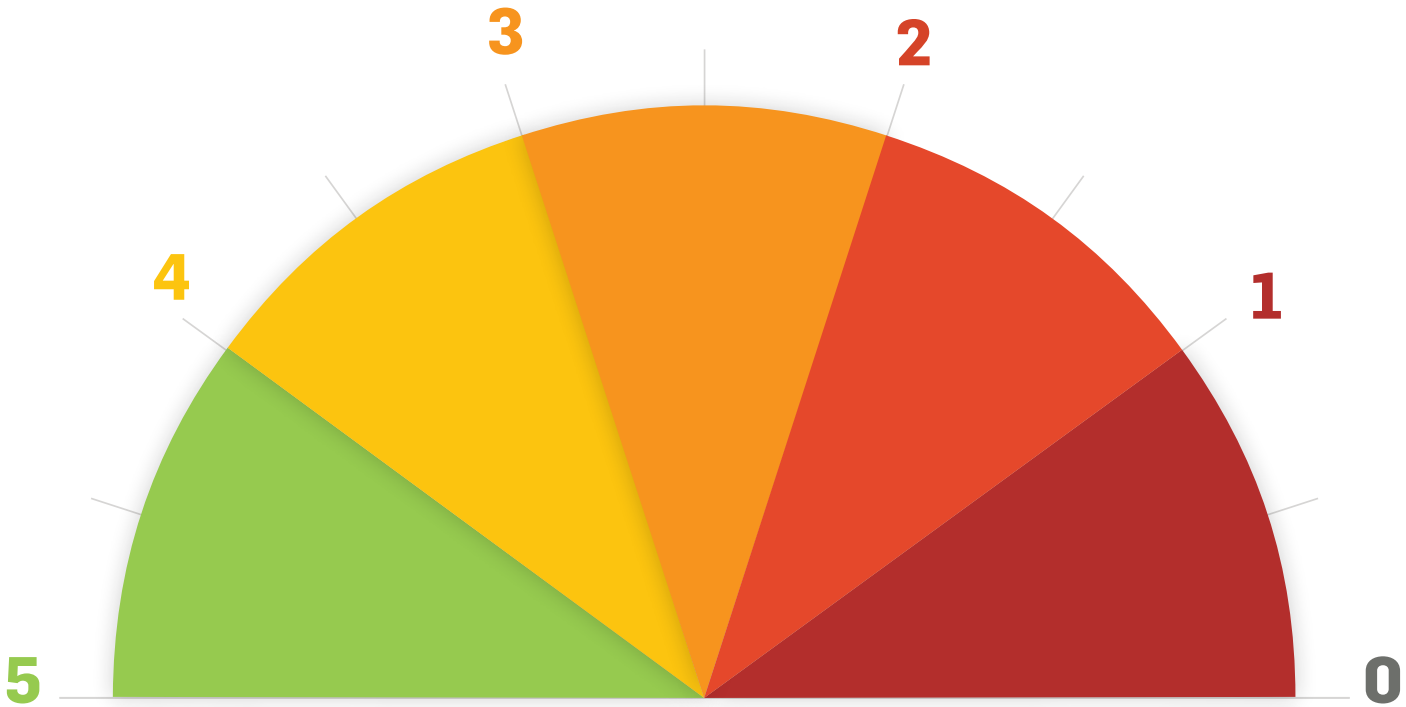
A brand new tool that measures the vulnerability of an area based on:

Heat: *On the hottest days, how hot does this area get?*

Health: *Are people in the area healthy and able to cope with prolonged, increased heat?*

Trends: *Is the area currently losing, gaining or retaining its green space?*

WANT TO KNOW HOW THIS WAS DEVELOPED?
Head to our Methodology chapter.

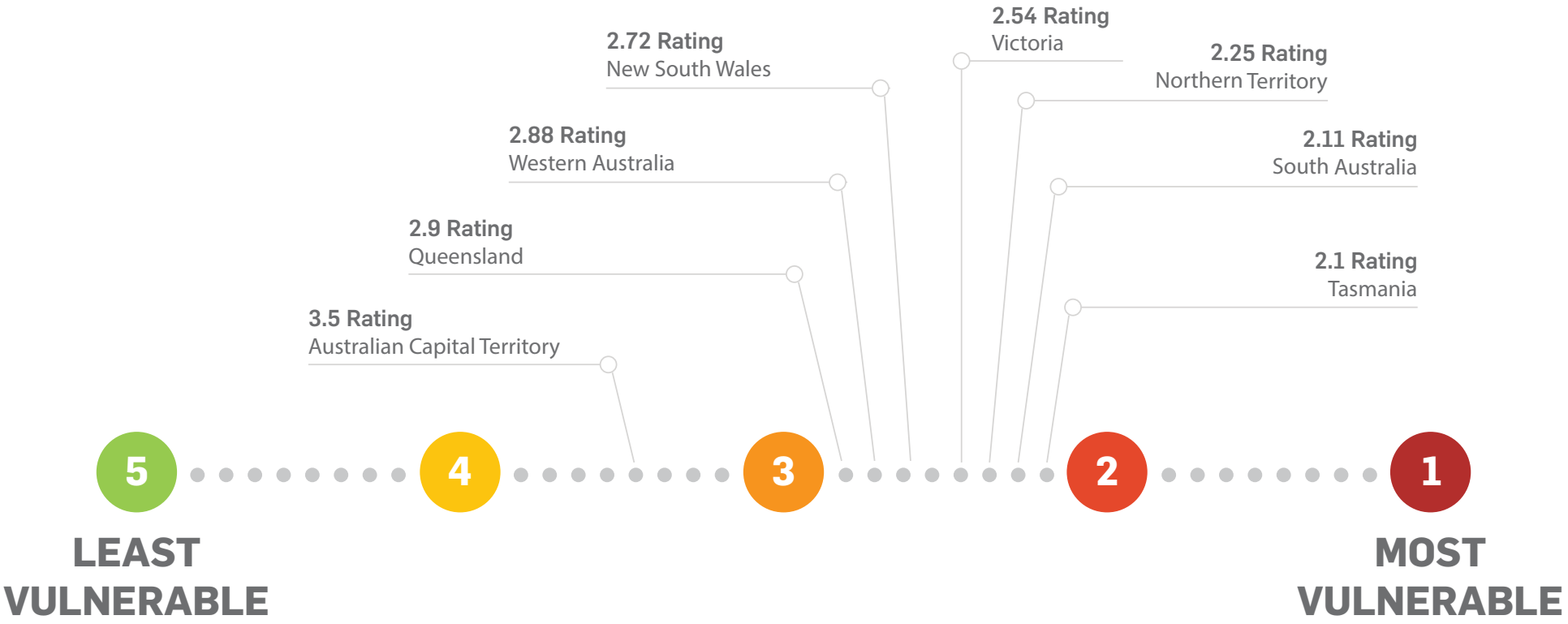


The higher an area's vulnerability rating, the better able it is to cope.

The lower the number, the more vulnerable.

So where should all the trees go?
In the most vulnerable places first.

VULNERABILITY BY STATE



VULNERABILITY BY LGA

4.5 Rating

Hornsby Shire
Ku-ring-gai Council
Municipality of Mosman
Municipality of Woollahra
City of Bayside (VIC)
City of Knox
Shire of Nillumbik
Shire of Yarra Ranges
City of Adelaide
City of Mitcham
City of Tea Tree Gully
Town of Claremont

4.0 Rating

Municipality of Lane Cove
Municipality of Leichhardt
North Sydney Council
Sutherland Shire
City of Willoughby
City of Manningham
City of Whitehorse
City of Yarra
City of Brisbane
City of Burnside
City of Canning
Town of Cottesloe
Shire of Kalamunda
Shire of Mundaring
Shire of Peppermint Grove

3.5 Rating

Municipality of Hunter's Hill
City of Kogarah
Manly Council
Pittwater Council
City of Ryde
The Hills Shire
Warringah Council
Waverley Council
City of Boroondara
Shire of Cardinia
City of Melbourne
City of Monash
Shire of Mornington Peninsula
Gold Coast City
Redland City
Townsville City Council
City of Joondalup
Town of Mosman Park
City of Nedlands
City of South Perth
City of Subiaco
City of Vincent
City of Hobart
ACT

3.0 Rating

Camden Council
City of Sydney
City of Banyule
City of Casey
City of Maroondah
City of Port Phillip
Moreton Bay Region
Sunshine Coast
City of Unley
Town of Walkerville
City of Bayswater
Town of Cambridge
Town of East Fremantle
City of Melville
City of Stirling
Kingborough Council

2.5 Rating

City of Hurstville
City of Penrith
City of Randwick
City of Glen Eira
City of Kingston
City of Stonnington
Cairns Regional Council
City of Norwood Payneham & St Peters
City of Prospect
City of Armadale
City of Fremantle
City of Gosnells
City of Perth
City of Rockingham
City of Palmerston

2.0 Rating

Municipality of Ashfield
Burwood Council
City of Canada Bay
Marrickville Council
City of Newcastle
City of Parramatta
Municipality of Strathfield
City of Moonee Valley
City of Whittlesea
City of Wyndham
City of Ipswich
Logan City
Toowoomba Regional Council
City of Campbelltown (SA)
City of Holdfast Bay
Town of Bassendean
Town of Swan
City of Wanneroo
City of Darwin

1.5 Rating

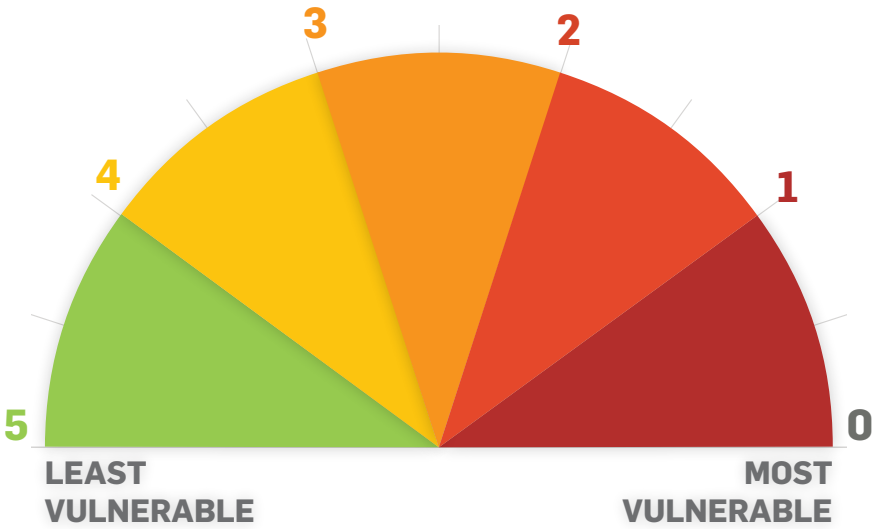
Auburn City
Bankstown City
City of Campbelltown (NSW)
Fairfield City
City of Liverpool
City of Frankston
City of Greater Bendigo
City of Greater Dandenong
City of Greater Geelong
City of Hobsons Bay
City of Melton
Adelaide Hills Council
City of Onkaparinga
City of Cockburn
Town of Victoria Park
City of Clarence
City of Glenorchy

1.0 Rating

City of Blacktown
City of Botany Bay
City of Canterbury
City of Holroyd
Rockdale City
City of Brimbank
City of Maribyrnong
City of Moreland
City of Marion
City of Salisbury
City of Kwinana
City of Launceston

0.5 Rating

City of Ballarat
City of Darebin
City of Hume
City of Charles Sturt
Town of Gawler
City of Playford
City of Port Adelaide Enfield
City of West Torrens
City of Belmont



TOP 50 GREENING OPPORTUNITIES IN AUSTRALIA

(BASED ON THE VHHEDA INDEX)

City of Darwin

City of Belmont,
City of Kwinana,
City of Cockburn,
The Town of Victoria Park,
Town of Bassendean,
City of Swan,
City of Wanneroo

Toowoomba
Regional Council,
Logan City Council,
Ipswich City Council

Blacktown City Council,
City of Botany Bay,
City of Canterbury Bankstown,
Holroyd City Council,
Rockdale City Council,
City of Auburn,
Bankstown City Council,
Campbelltown City Council,
Fairfield City Council,
Liverpool City Council

City of Greater Bendigo

City of Ballarat

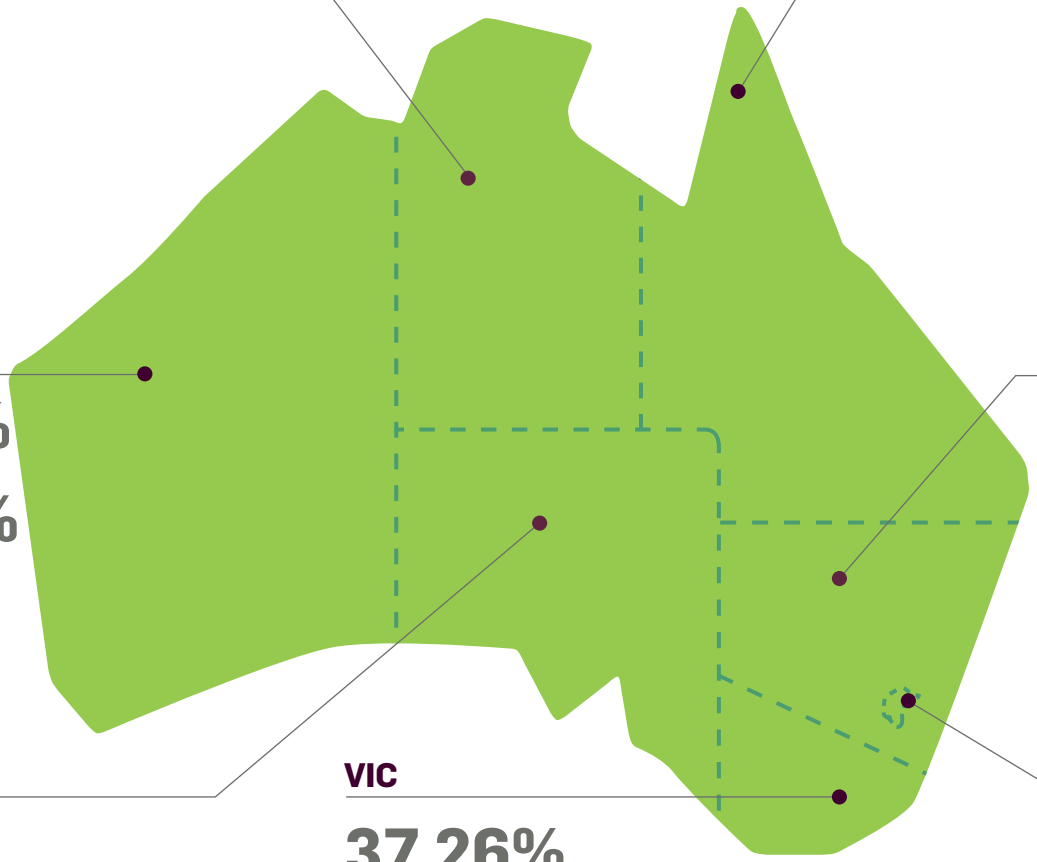
City of Greater Geelong

City of Darebin,
City of Brimbank,
Maribyrnong City Council,
Moreland City Council,
Frankston City Council,
City of Greater Dandenong,
Hobsons Bay City Council,
Moonee Valley City Council,
Whittlesea Council,
Wyndham City Council

City of Launceston

Clarence City Council,
Glenorchy City Council

CURRENT GREEN COVER



NT

24.4%
hard surface cover
75.5%
green cover

*+ 6.35% increase in hard surface**

QLD

9.9%
hard surface cover
90.1%
green cover

*+ 1.79% increase in hard surface**

WA

41.22%
hard surface cover
58.78%
green cover

*+ 2.09% increase in hard surface**

NSW

42.79%
hard surface cover
57.21%
green cover

*+ 3.01% increase in hard surface**

SA

43.2%
hard surface cover
56.8%
green cover

*+ 2.57% increase in hard surface**

VIC

37.26%
hard surface cover
62.74%
green cover

*+ 3.01% increase in hard surface**

TAS

9.96%
hard surface cover
90.04%
green cover

*+ 0.82% increase in hard surface**

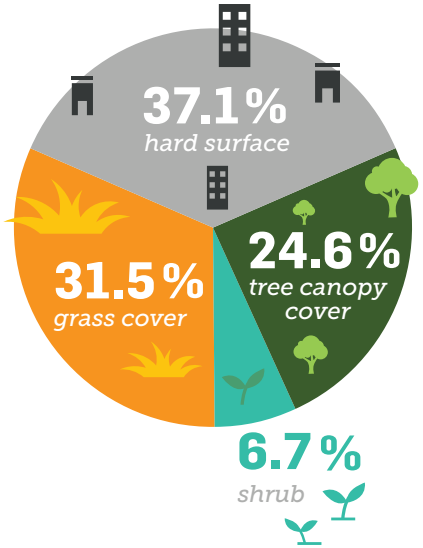
ACT

7.4%
hard surface cover
92.6%
green cover

*+ 2.2% increase in hard surface**

**changes represented since 2009*

National urban average comparison



In 'Where are all the trees', the national average was calculated by averaging the state averages. In this report we have chosen to update the methodology to make the national average an average of all LGAs, as we believe it more accurately represents the true figure.

79%
Highest tree canopy

3.2%
Lowest tree canopy

WHAT'S CHANGED?
2009 TO 2017

CANOPY COVER

35%
of councils have undergone a significant decline.

61%
of councils have had no significant change.

4%
of councils have undergone a significant increase.

SHRUB COVER

16%
of councils have undergone a significant decline.

67%
of councils have had no significant change.

17%
of councils have undergone a significant increase.

HARD SURFACES

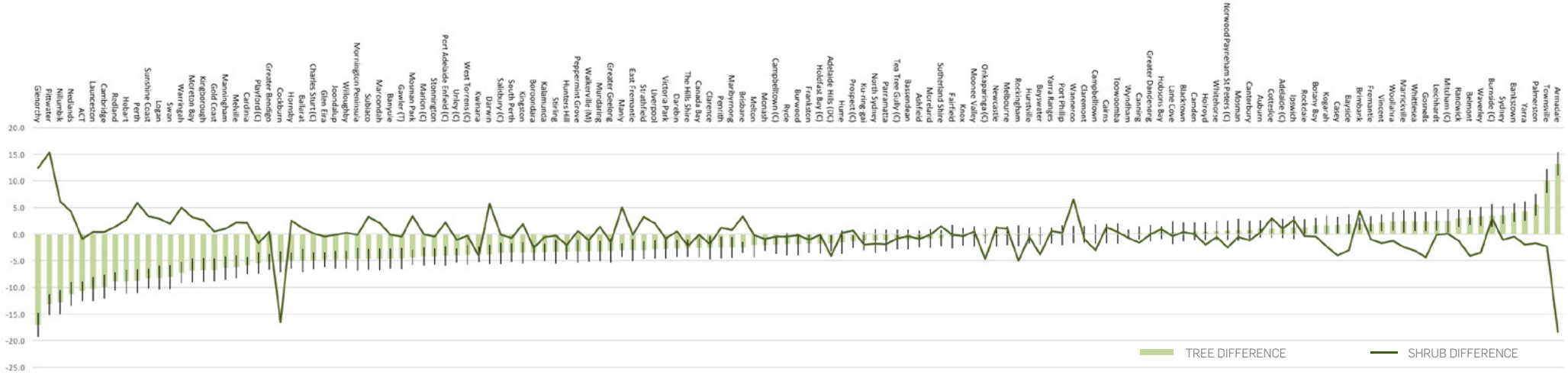
ZERO
councils have seen a significant decline.

34%
of councils have undergone a significant increase.

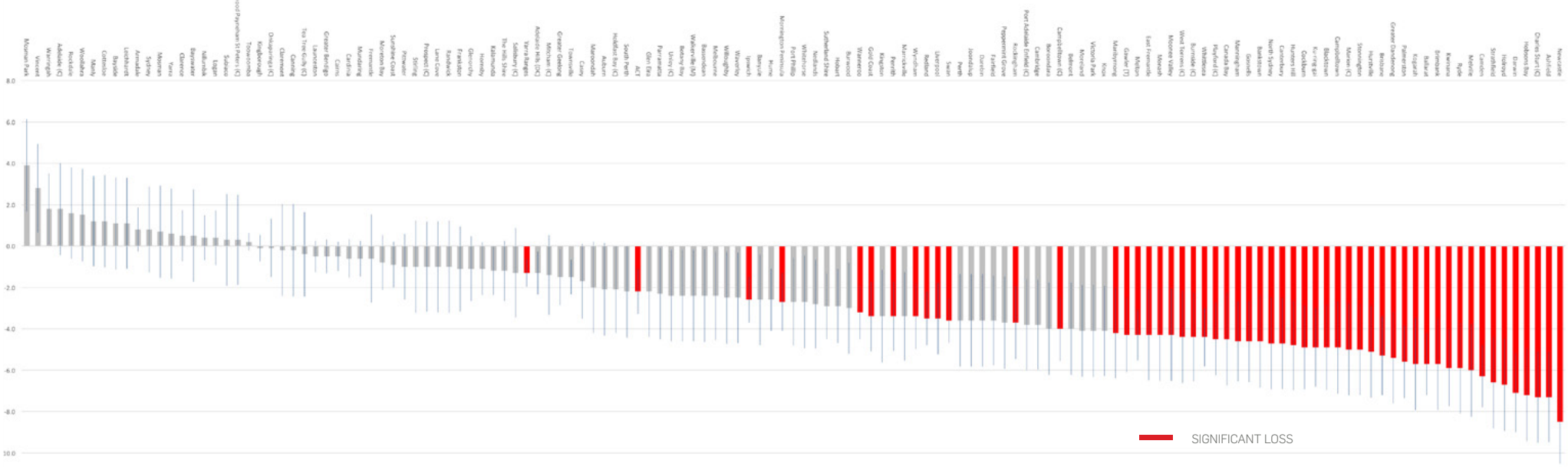
COUNCIL BY COUNCIL

HI-RESOLUTION
Zoom for detail.

NATIONAL CHANGE IN URBAN FOREST AND SHRUB CANOPY COVER 2008-2013 TO 2016



NATIONAL GAIN AND LOSS IN GREEN COVER IN AUSTRALIA METROPOLITAN AREAS 2008-2013 TO 2016



KEY TAKE-AWAYS

THE GOOD NEWS:

A majority of councils have not experienced a significant increase in hard surface cover or loss of tree canopy and shrubbery.

Nationally, shrubbery decline is only half of tree canopy decline. As shrubs grow, they may compensate some canopy loss.

Councils that have gained the most significant tree canopy have lost shrubbery. This suggests that the gain in canopy may be the legacy of past plantings of small trees (shrubs) maturing into trees.

In many cases, a decline in canopy is matched by an equivalent increase in shrubbery. This suggests that canopy loss is being compensated for by re-planting.

THE BAD NEWS:

Nationally, tree canopy and shrub cover has dropped by 2.1% over the past four years.

That's 4,041 km², or 161,860 Melbourne Cricket Grounds of urban green space.

In many cases a decline in canopy and shrubbery is matched by an increase in hard surface and grassed areas. This suggests that development and clearing is replacing green spaces.

The rate of canopy loss is generally higher in LGAs which have the most canopy cover.

NEW SOUTH WALES

Wendy's Secret Garden

NSW WHAT'S HAPPENING?

Average canopy cover for urban NSW is

26.64%

down 0.83% from

27.47%

in 2009.

The highest canopy cover in an urban LGA is

54%

in Hornsby Shire.

The lowest canopy cover in an urban LGA is

13.7%

in both the City of Botany Bay and Rockdale City Council.

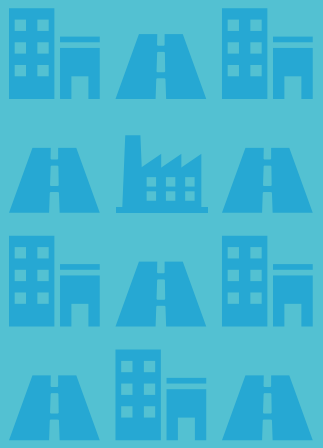
The most significant and beneficial gains could be made in the Bayside City Council, Cumberland Council, Inner West Council and Liverpool City Council.

Now that Bankstown City Council has merged with Canterbury City Council, the canopy figure across the amalgamated LGA will be reduced, as Canterbury City Council has

2% LESS CANOPY.

Despite the canopy gains in Bankstown City Councils there has been a

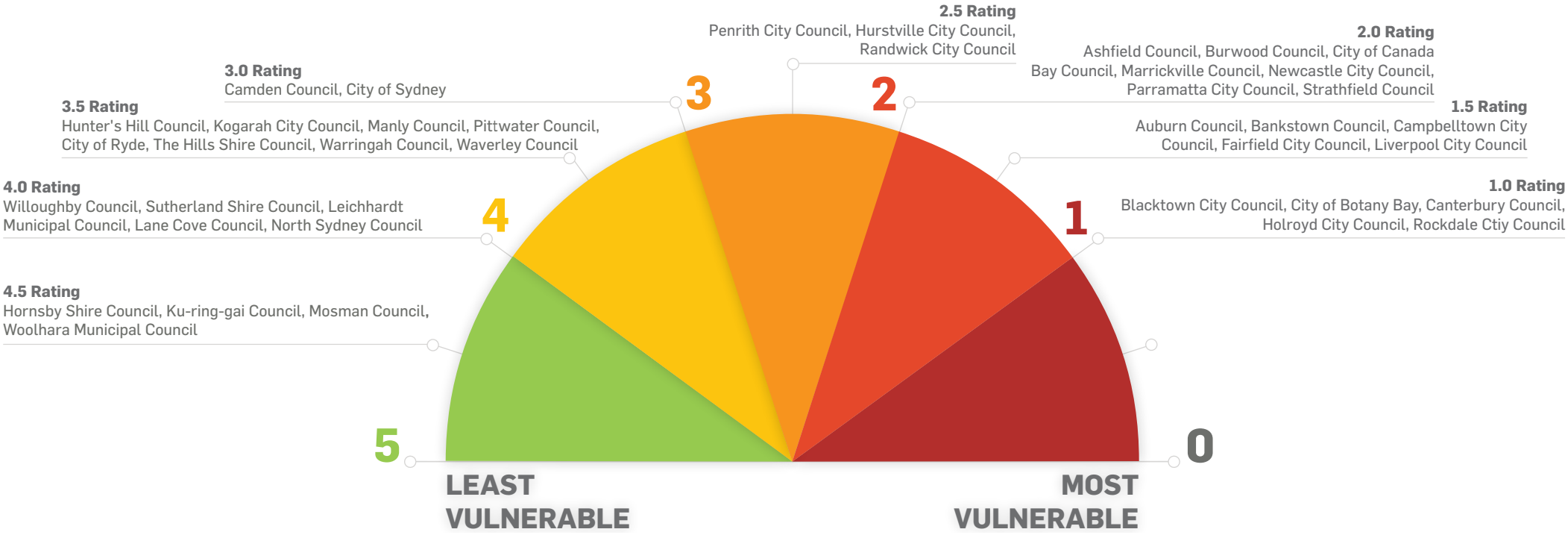
SIGNIFICANT INCREASE IN HARD SURFACES.



The most significant canopy loss was in Pittwater Council.

▼ 13.2%

NSW THE MOST & LEAST VULNERABLE



TOP URBAN GREENING OPPORTUNITIES:

Blacktown, Botany, Canterbury, Holroyd & Rockdale (which have all been affected by council amalgamations).

- Blacktown City Council, City of Botany Bay, Canterbury Council, Holroyd City Council, Rockdale City Council (1)
- Cumberland Council - Auburn Council (1.5), Holroyd City Council (1)
- Amalgamations between Canterbury (1) and Bankstown Councils (1.5)
- City of Parramatta Council - Auburn Council (1.5), Parramatta City Council (2)
- Holroyd City Council (1), Hornsby Shire Council (4.5)
- Inner West Council - Ashfield Council (2), Leichhardt Municipal Council (4) Marrickville Council (2)
- Northern Beaches Council - Manly Council, Pittwater Council, Warringah Council (3.5)

NSW SNAPSHOT

THE GREEN KEY

In technical terms, a tree is a plant over six metres, while a shrub is under six metres. However, for an accurate comparison to our previous mapping report, 'Where are all the trees?', we have used the following definitions:

Trees
Anything that looks like a tree from above, distinguished from shrubs by the shadows cast.

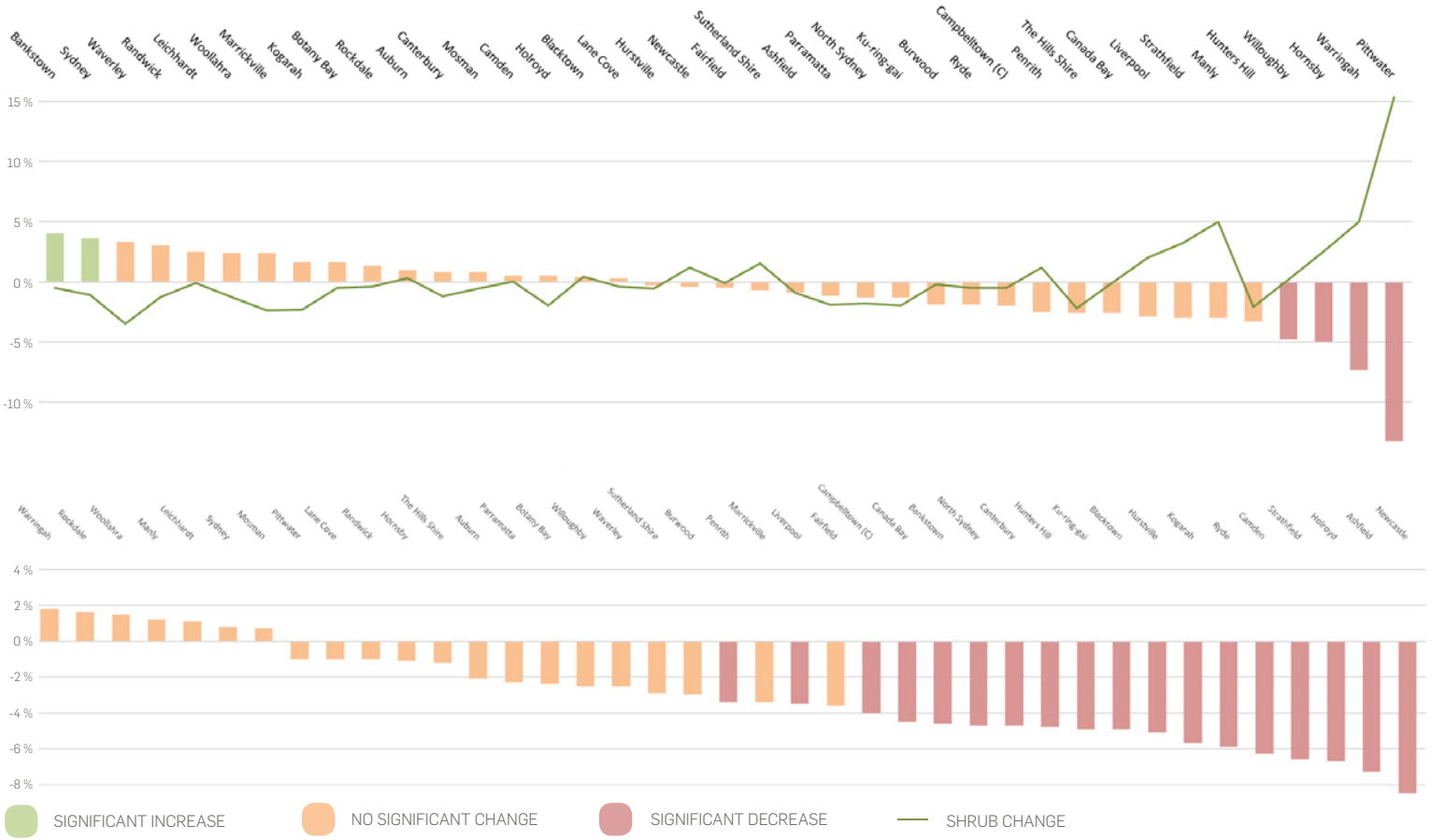
Shrub
Landscaped vegetation as well as bushland shrubs, crops and grapevines.

Grass
Cleared road sides, lawns, pastures, sites cleared for development and sporting grounds.

Hard surfaces
Asphalt, buildings, car parks, footpaths, sandy beaches, train lines, rocky coastlines and water.

KEY STATISTICS	2009*	2016	
Tree Canopy Cover	27.47%	26.64%	0.83% Loss
Shrub Cover	7.01%	7.2%	0.19% Gain
Grass Cover	25.73%	23.36%	2.37% Loss
Hard Surface	39.8%	42.8%	3.0% Increase

SHRUB & TREE CANOPY COVER CHANGES IN NSW LGAs 2009-2016

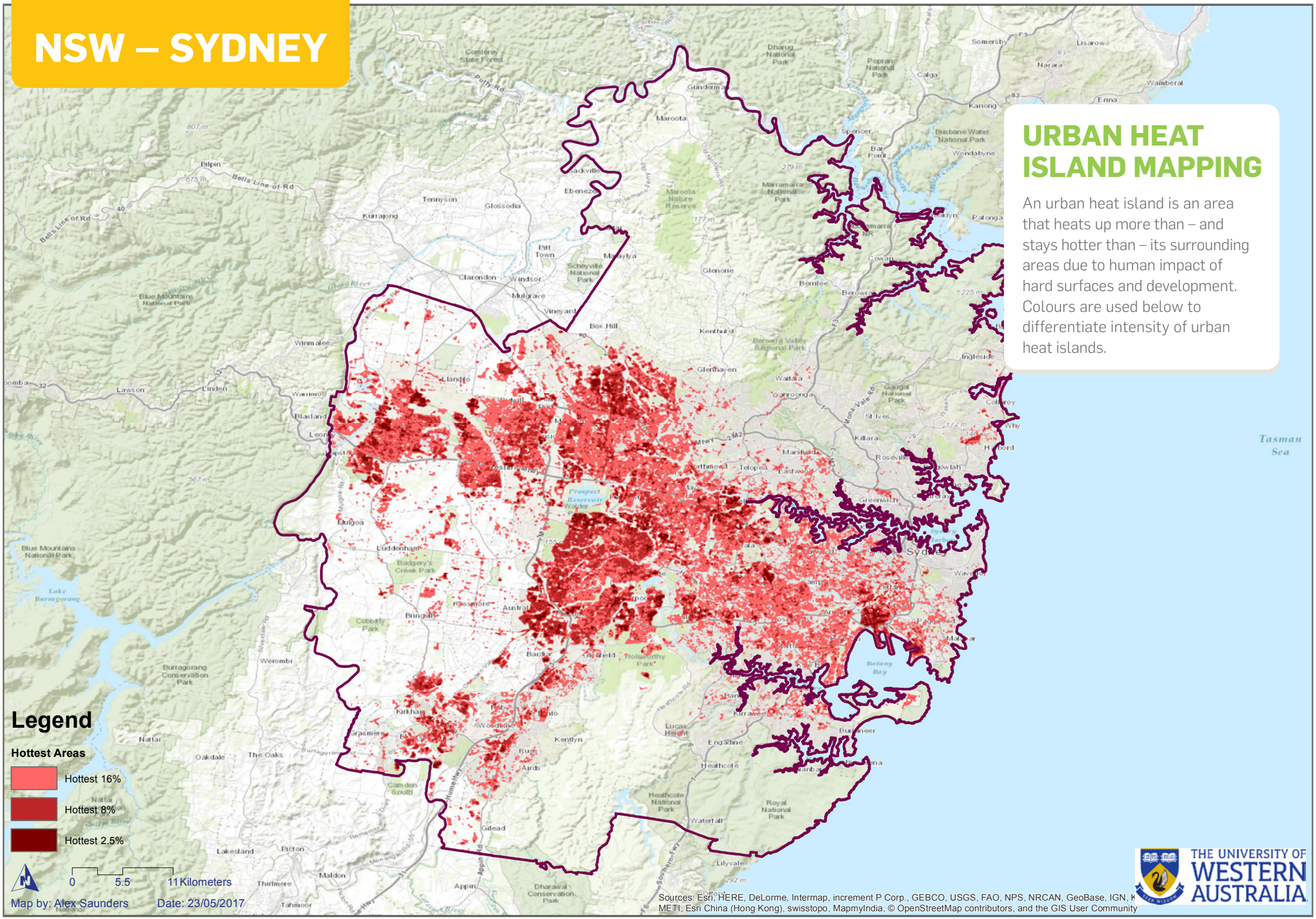


** From 'Benchmarking Australia's Urban Tree Canopy: An i-Tree Assessment', Final Report (2014)*

NSW – SYDNEY

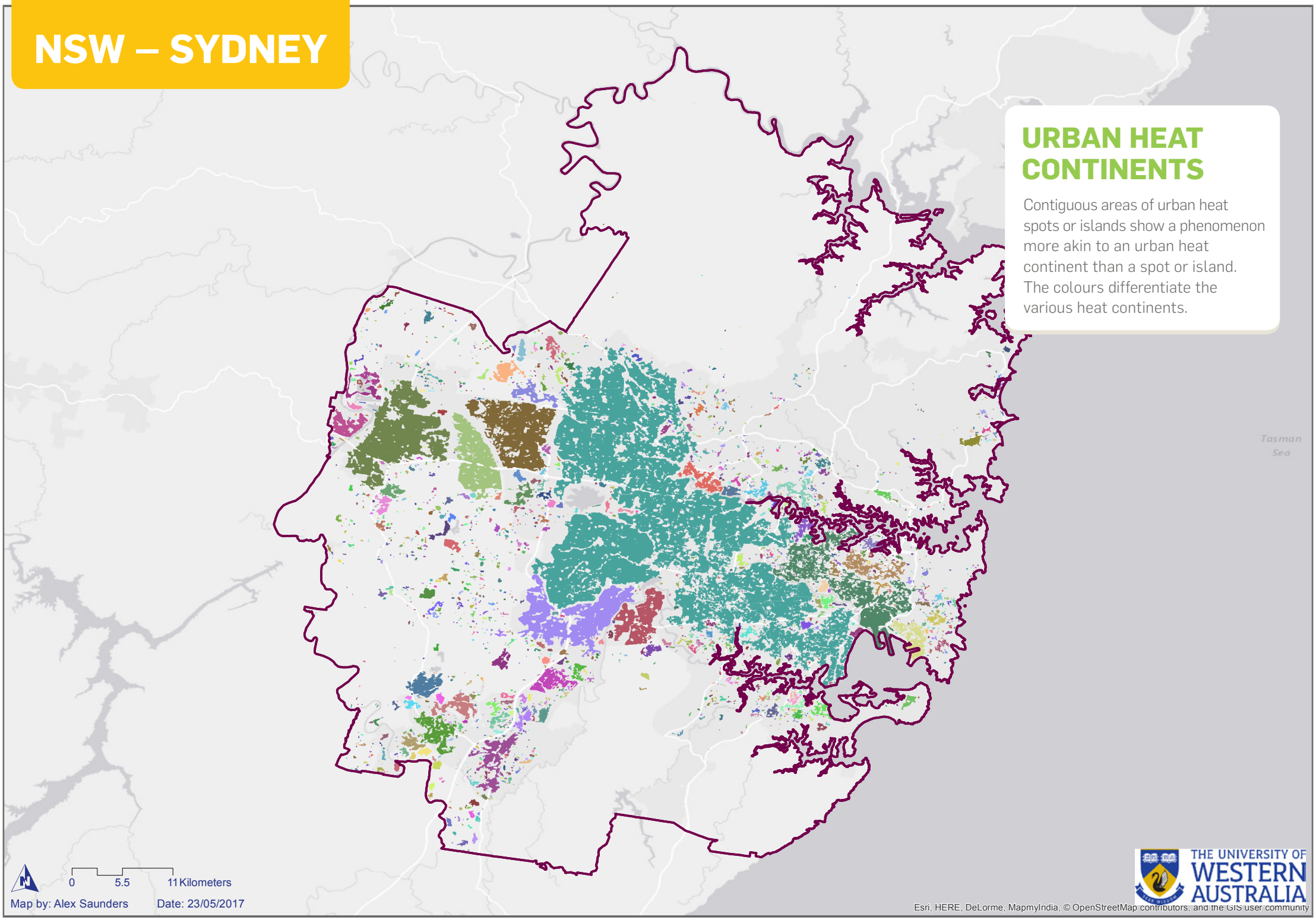
URBAN HEAT ISLAND MAPPING

An urban heat island is an area that heats up more than – and stays hotter than – its surrounding areas due to human impact of hard surfaces and development. Colours are used below to differentiate intensity of urban heat islands.



THE UNIVERSITY OF WESTERN AUSTRALIA

NSW – SYDNEY



URBAN HEAT CONTINENTS

Contiguous areas of urban heat spots or islands show a phenomenon more akin to an urban heat continent than a spot or island. The colours differentiate the various heat continents.

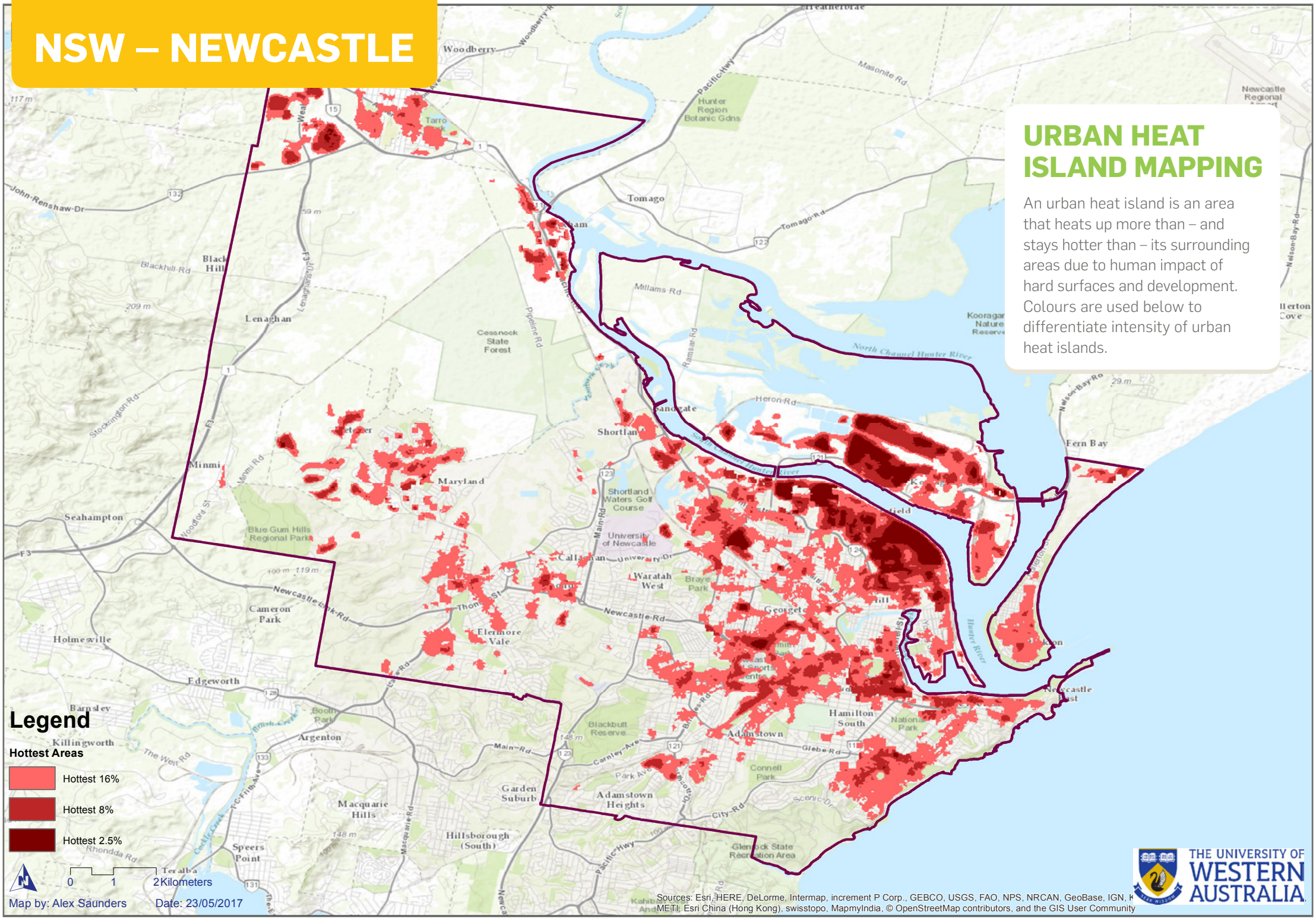
0 5.5 11 Kilometers

Map by: Alex Saunders Date: 23/05/2017

THE UNIVERSITY OF WESTERN AUSTRALIA

Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

NSW – NEWCASTLE



URBAN HEAT ISLAND MAPPING

An urban heat island is an area that heats up more than – and stays hotter than – its surrounding areas due to human impact of hard surfaces and development. Colours are used below to differentiate intensity of urban heat islands.

Legend

Hottest Areas

- Hottest 16%
- Hottest 8%
- Hottest 2.5%

Map by: Alex Saunders

Date: 23/05/2017

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, K
METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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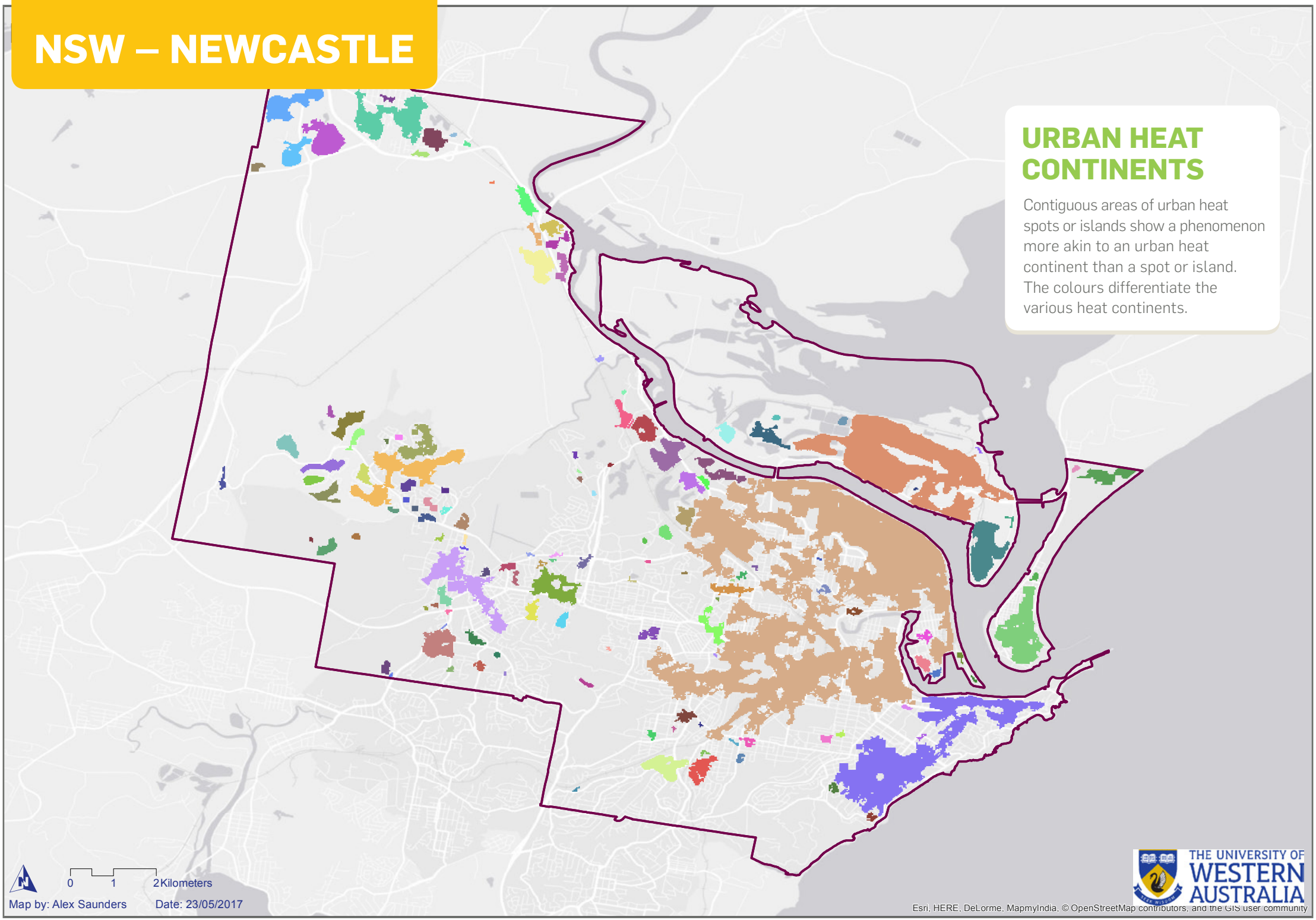
NSW – NEWCASTLE



URBAN HEAT CONTINENTS

Contiguous areas of urban heat spots or islands show a phenomenon more akin to an urban heat continent than a spot or island. The colours differentiate the various heat continents.

0 1 2Kilometers

Map by: Alex Saunders Date: 23/05/2017

THE UNIVERSITY OF WESTERN AUSTRALIA

Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

NSW THE GOOD NEWS

The best tree canopy gains have been made in Bankstown Council (4% gain) and the City of Sydney (3.6% gain).

NSW COUNCIL COMMENTS

PENRITH CITY COUNCIL

Using data from 2011 Penrith City Council undertook an in-depth study across the Penrith LGA. This analysis allowed us to identify priority areas to focus future urban greening and cooling projects. These areas are St Marys, Penrith, Kingswood, Cranebrook and Glenmore Park.

CARMEL HAMILTON
SUSTAINABILITY COORDINATOR

NORTH SYDNEY COUNCIL

MELISSA MCMANUS
PARKS DEPARTMENT TECHNICAL OFFICE

Since 1997, North Sydney Council has strived to undertake regular detailed canopy analysis. LIDAR assessment in 2008 reported 34% canopy cover and in 2014, 31% canopy cover. There was no analysis in 2016 due to bad weather but the next round of measurement is due to be conducted in Spring 2017 and will be carried out in conjunction with City of Sydney. Once this additional data has been measured it will be incorporated into a review of the Urban Forestry Strategy which has been in place since 2011.

Currently, key greening opportunities are aligned with the snapshot findings and are focused in and around St Leonards – an area identified as a hotspot. North Sydney Council has been actively planting out carparks over the past five years, and has experienced good rates of tree growth. The North Sydney Council Urban Forest Strategy is accessible to the public via the website.

SUTHERLAND SHIRE COUNCIL

MARK CARLON
MANAGER STRATEGIC PLANNING

The snapshot should be read within a broader context to refine future action. For example, the intersection as a priority area is in fact quite treed in its local context. The heat detected is likely to be coming from the Miranda centre and large Westfield shopping centre on Kiora Road. Council has an active Green Streets Program designed to maintain tree canopy in the future in the face of increased densification.

The Green Streets Program seeks to grow the next generation of canopy trees in the public domain to offset those lost from private land with four new trees being planted for each tree removed in Sutherland Shire. Since 2012, over 7,000 trees have been planted in the public domain through this project. In Miranda centre, Syncarpia glomulifera have been planted in the Kingsway and species from the Sydney Turpentine Iron Bark Forest planted in surrounding streets.

NSW COUNCIL COMMENTS

KARENNE JURD
ASSET PROGRAM COORDINATOR, ENVIRONMENT INFRASTRUCTURE PLANNING

NEWCASTLE CITY COUNCIL

Overall, there is general alignment between the City of Newcastle's (Council) understanding of hotspots and what the RMIT mapping has identified. However, it should be noted that the analysis of hard sand that includes 'water' needs to moderated in areas such as the Newcastle LGA, which comprises a substantial area of small and large wetlands. For example, the substantial constructed wetland at Sandgate needs to be incorporated in such analysis when projecting the performance of this light industrial area. As major hotspots identified in industrial areas are on private land, Council is working to build partnerships to address these hotspots through proactively targeting street tree planting such as the recent planting of the Beresfield light industrial areas.

Each year, as part of the annual Street and Park Tree Renewal Program, Council plants on average 1,100 trees. Approximately 90% of these are street trees, with the remaining planted within park open space. Council's approach to tree planting is a strategic one that takes into account our GIS tree asset inventory of 113,377 new and established urban trees, our Urban Forest Policy (2008), Development Control Plans and Technical Guidance Manuals, maintenance schedules, community requests, water sensitive urban design, microclimate modifications and the location of tree vacancy sites across the LGA.

Council's potential planting areas include:

Merewether, The Junction – Corlette, Frederick, Kemp, Kilgour, Patrick and Buchanan Streets.

Mayfield East – whole suburb retrofit, and Stevenson Park, Mayfield West.

Kotara – Parkway Avenue and Howell Street, Kulliabah Reserve

Beresfield – Local Centre, Beresford and Landor Street.

Wallsend – Local Centre, Wallsend Reserve and road rehabilitation sites.

Hamilton – Denison and Samdon Streets.

VICTORIA

Royal Botanic Gardens, Melbourne

VIC

WHAT'S HAPPENING?

Average canopy cover for urban VIC is

18.83%

down 2.06% from

20.89%

in 2013.

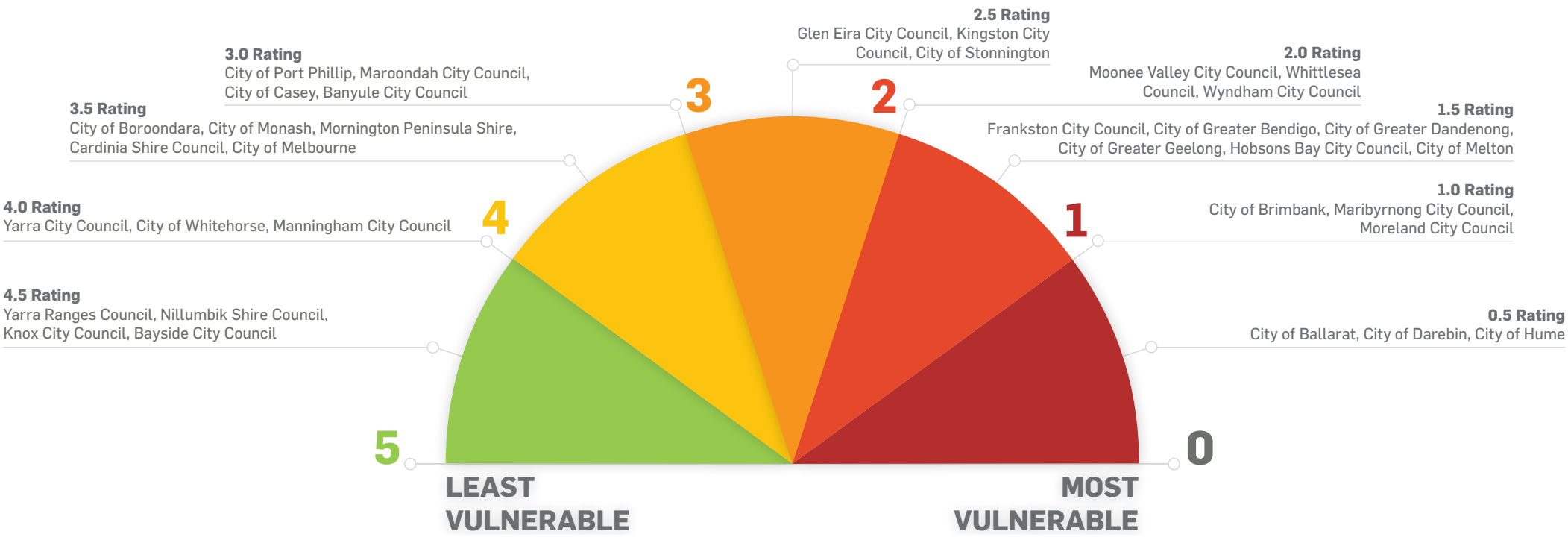
There has been an overall increase of **3%** *in hard surfaces, which is exactly the same rate of increase as NSW, but overall VIC has around* **5%** *less hard surfaces than NSW.*

In VIC, **44%** *of urban LGAs have undergone a significant loss of tree canopy, with only* **8%** *having had a significant increase in shrubbery.*

THERE HAVE BEEN QUITE A FEW SIGNIFICANT CANOPY LOSSES.

– Notably in the City of Ballarat (5%), Banyule City Council (4.6%), Cardinia Shire Council (5.9%), Nillumbik Shire Council (12.8%), Maroondah City Council (4.7%), Mornington Peninsula Shire (4.7%) and Eira City Council (4.8%).

VIC THE MOST & LEAST VULNERABLE



TOP URBAN GREENING OPPORTUNITIES:

- City of Ballarat, City of Darebin, City of Hume (0.5)
- City of Brimbank, Maribyrnong City Council, Moreland City Council (1)
- Frankston City Council, City of Greater Bendigo, City of Greater Dandenong, City of Greater Geelong, Hobsons Bay City Council, City of Melton (1.5)
- Moonee Valley City Council, Whittlesea Council, Wyndham City Council (2)

VIC SNAPSHOT

THE GREEN KEY

In technical terms, a tree is a plant over six metres, while a shrub is under six metres. However, for an accurate comparison to our previous mapping report, 'Where are all the trees?', we have used the following definitions:

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Anything that looks like a tree from above, distinguished from shrubs by the shadows cast.

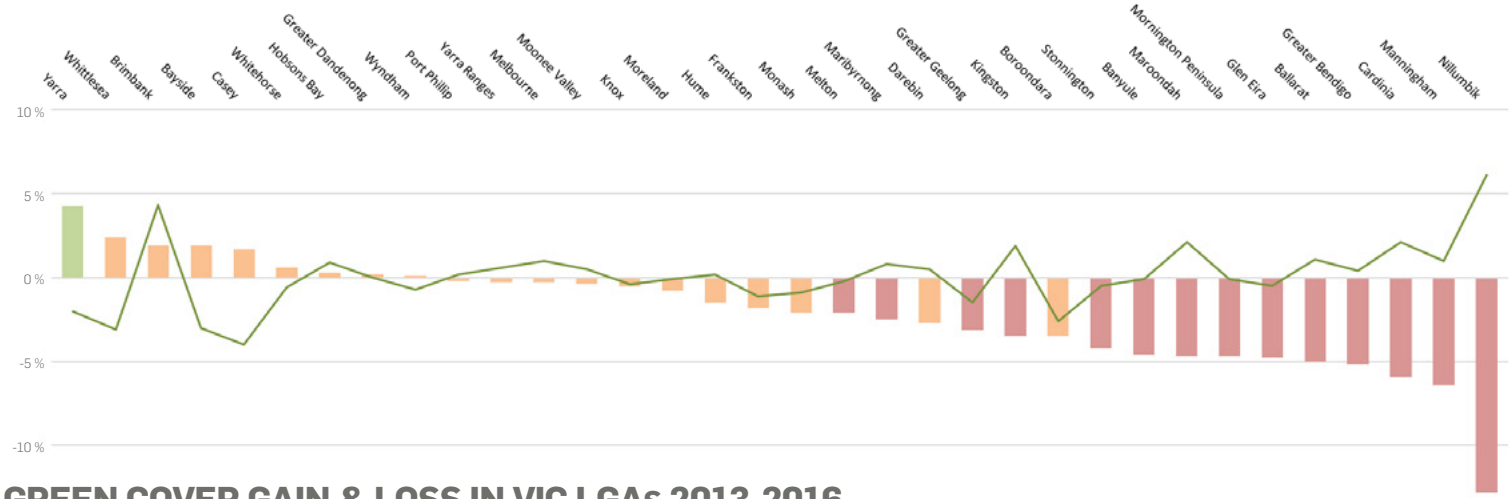
Shrub
Landscaped vegetation as well as bushland shrubs, crops and grapevines.

Grass
Cleared road sides, lawns, pastures, sites cleared for development and sporting grounds.

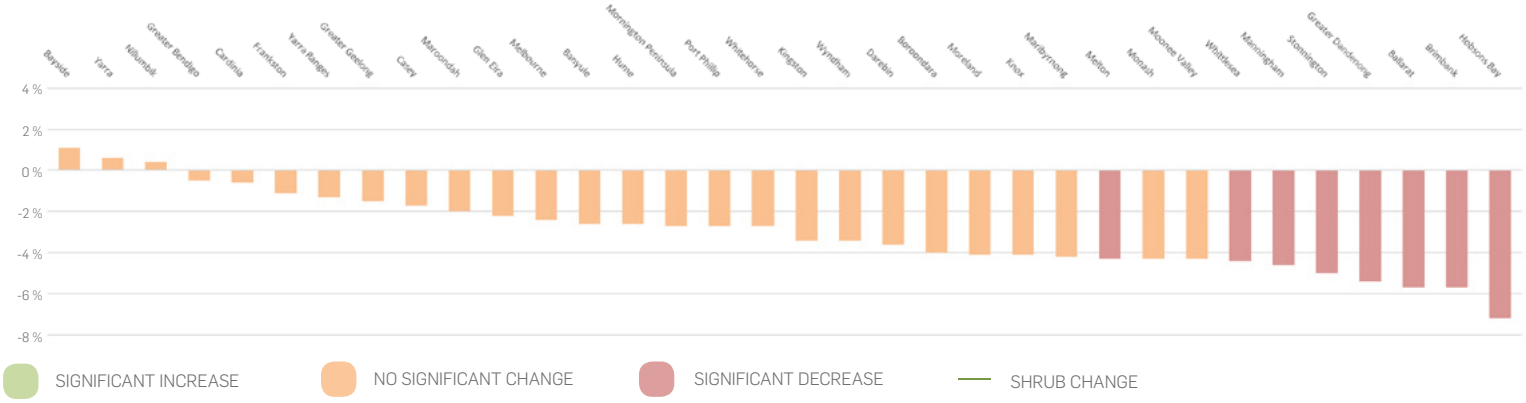
Hard surfaces
Asphalt, buildings, car parks, footpaths, sandy beaches, train lines, rocky coastlines and water.

KEY STATISTICS	2013*	2016	
Tree Canopy Cover	20.89%	18.83%	2.06% Loss
Shrub Cover	4.82%	4.89%	0.07% Gain
Grass Cover	40.04%	39.03%	1.01% Loss
Hard Surface	34.25%	37.26%	3.01% Increase

SHRUB & TREE CANOPY COVER CHANGES IN VIC LGAs 2013-2016



GREEN COVER GAIN & LOSS IN VIC LGAs 2013-2016

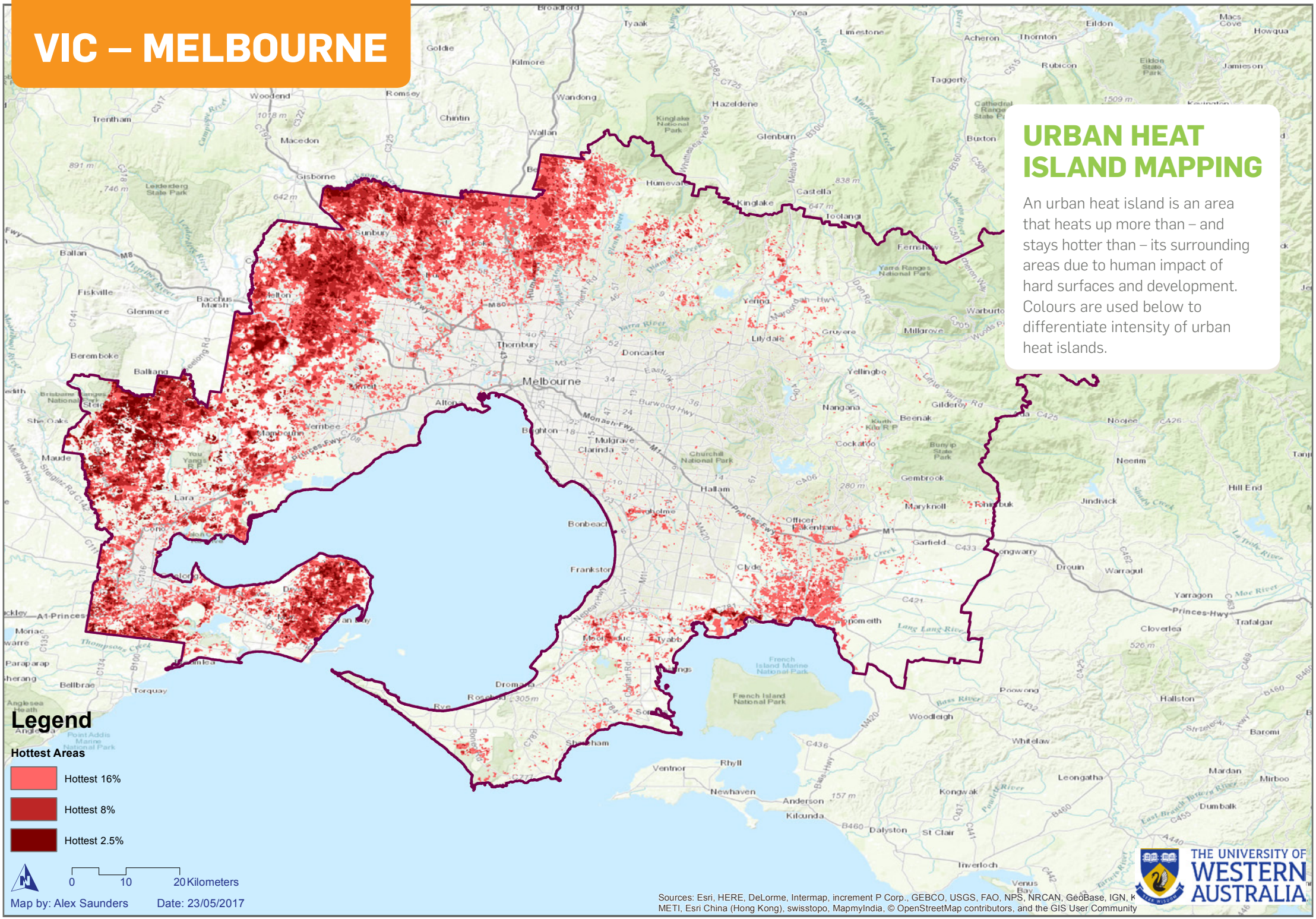


** From 'Benchmarking Australia's Urban Tree Canopy: An i-Tree Assessment', Final Report (2014)*

VIC – MELBOURNE

URBAN HEAT ISLAND MAPPING

An urban heat island is an area that heats up more than – and stays hotter than – its surrounding areas due to human impact of hard surfaces and development. Colours are used below to differentiate intensity of urban heat islands.



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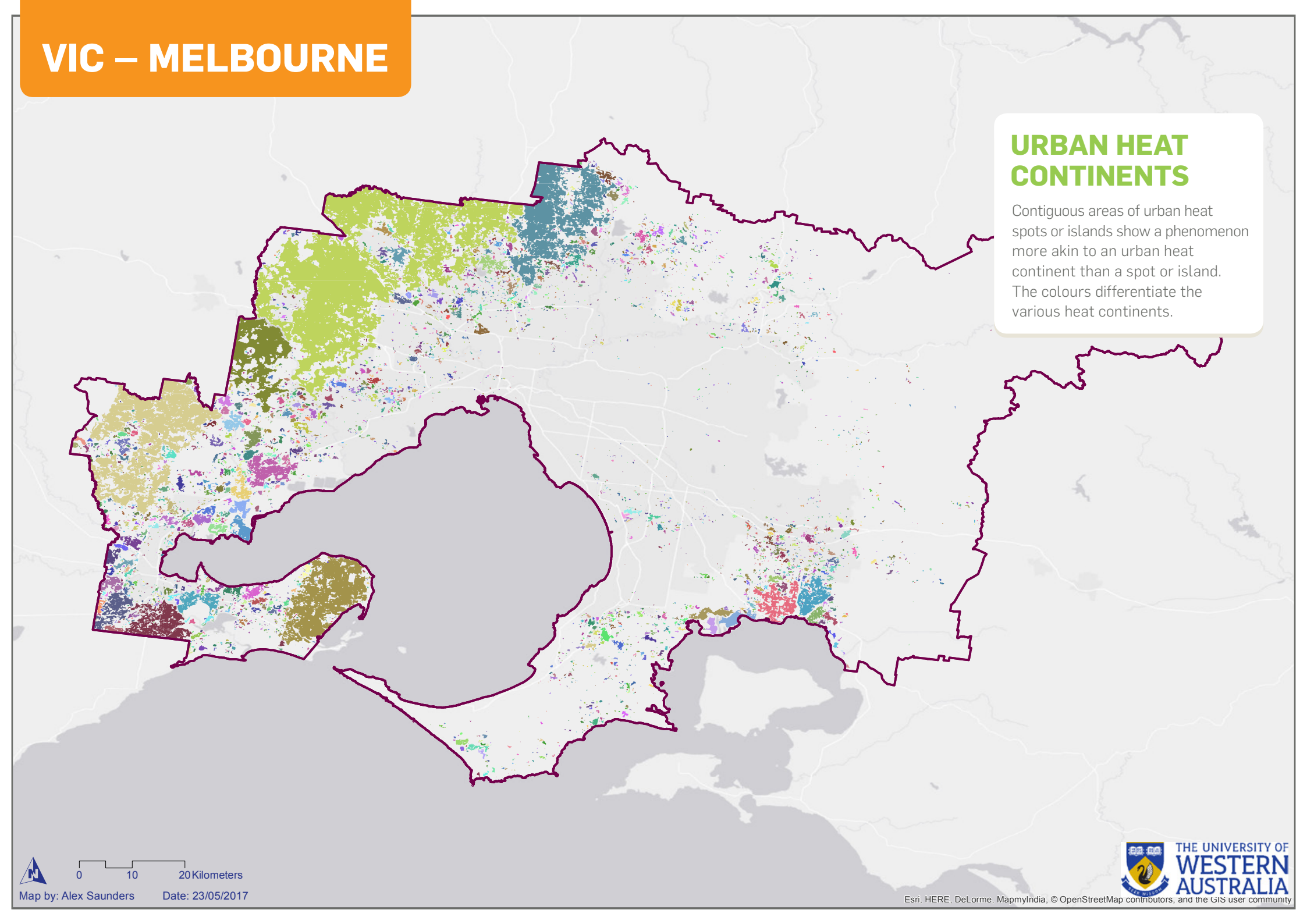
VIC – MELBOURNE



URBAN HEAT CONTINENTS

Contiguous areas of urban heat spots or islands show a phenomenon more akin to an urban heat continent than a spot or island. The colours differentiate the various heat continents.

0 10 20 Kilometers

Map by: Alex Saunders Date: 23/05/2017

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VIC – BALLARAT

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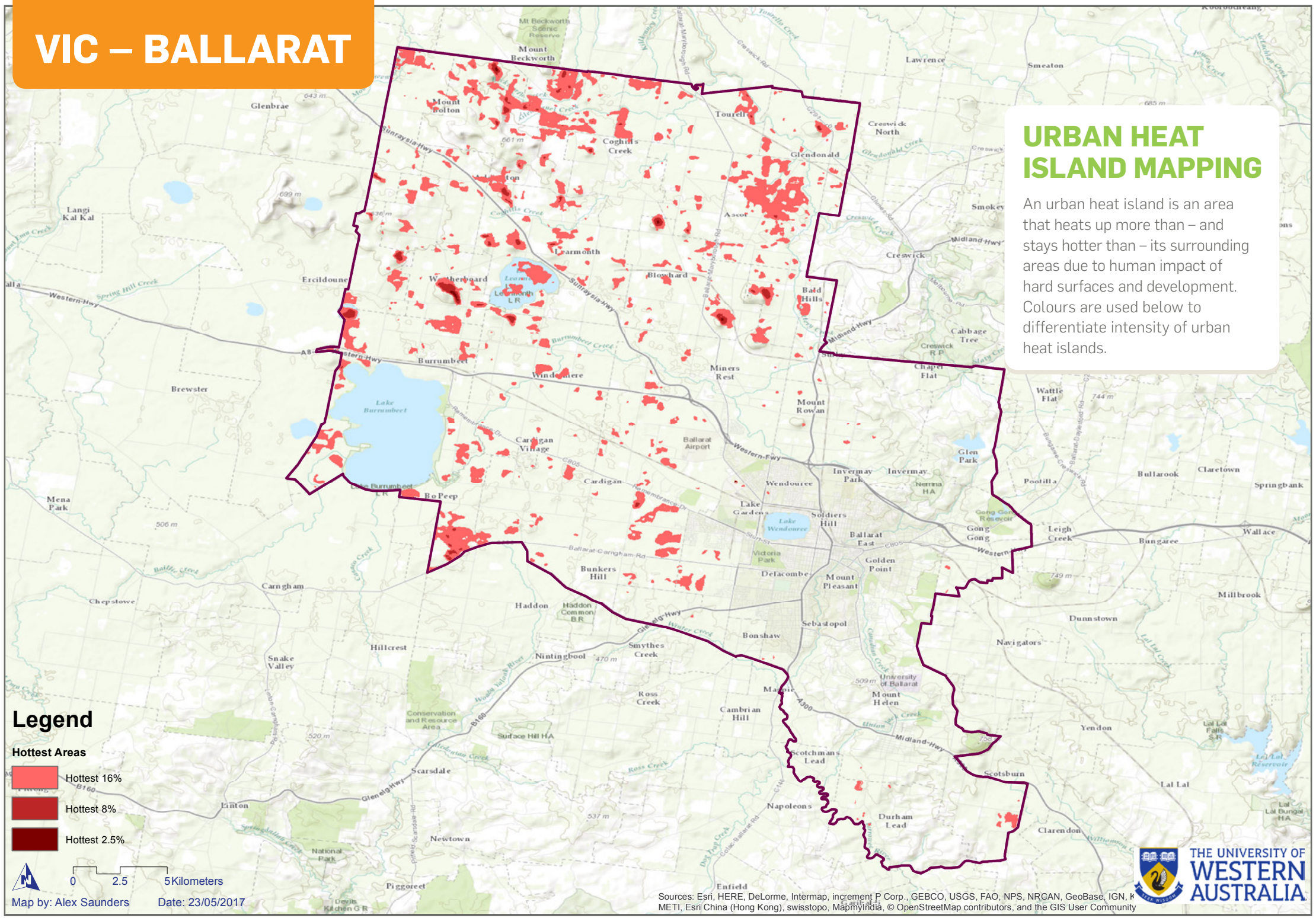
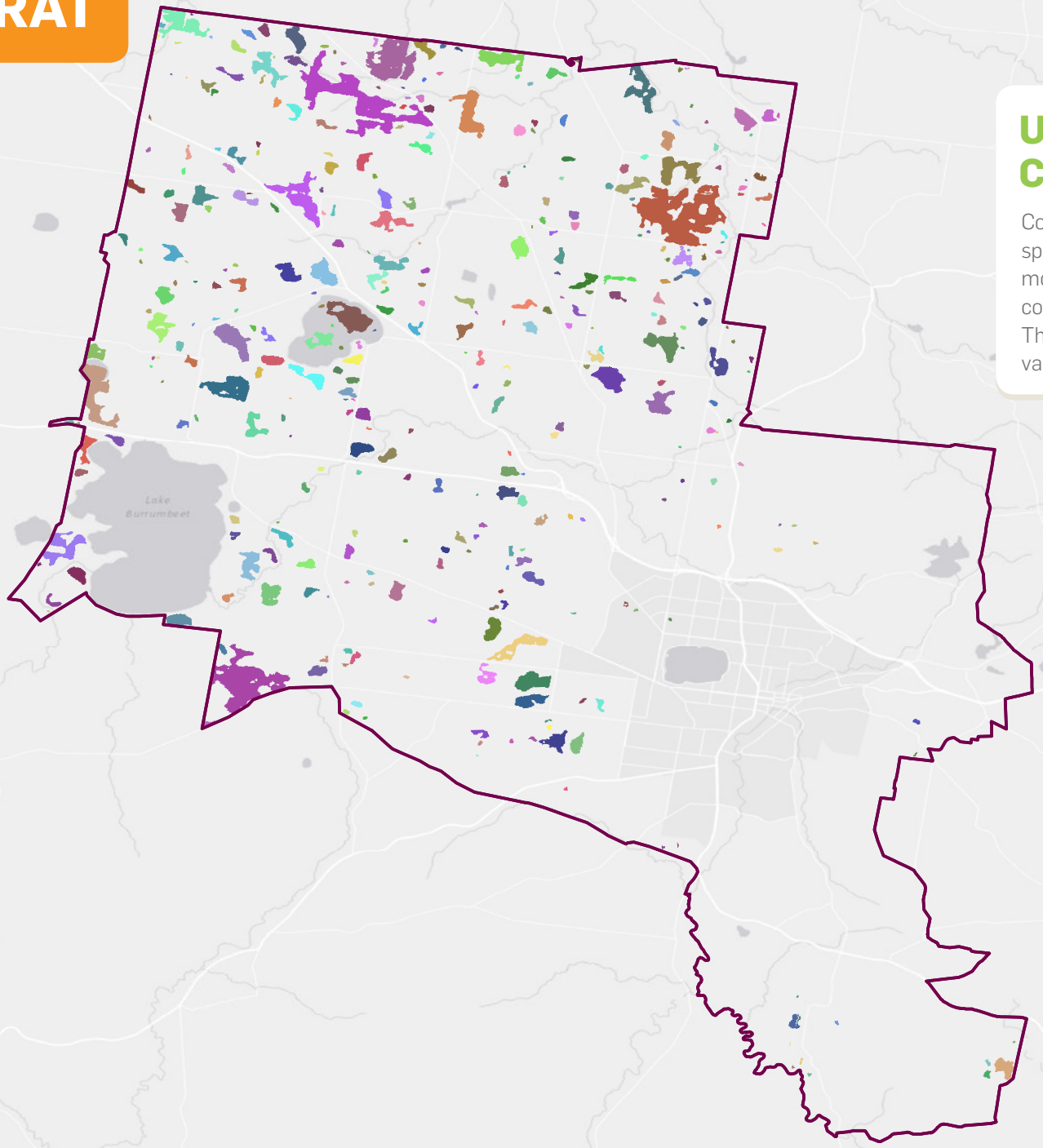


VIC – BALLARAT



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0 2.5 5 Kilometers

Map by: Alex Saunders Date: 23/05/2017

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VIC – BENDIGO

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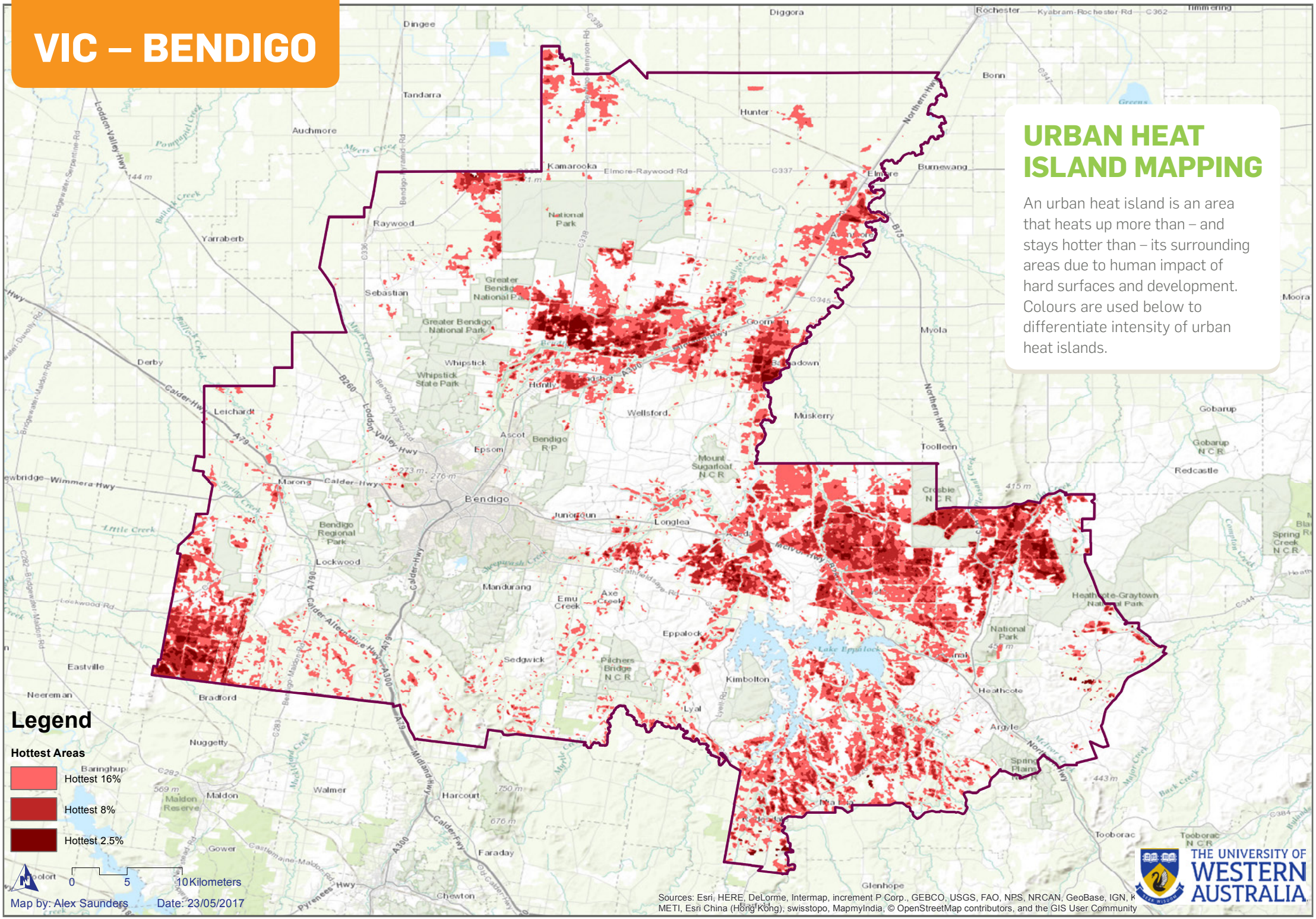

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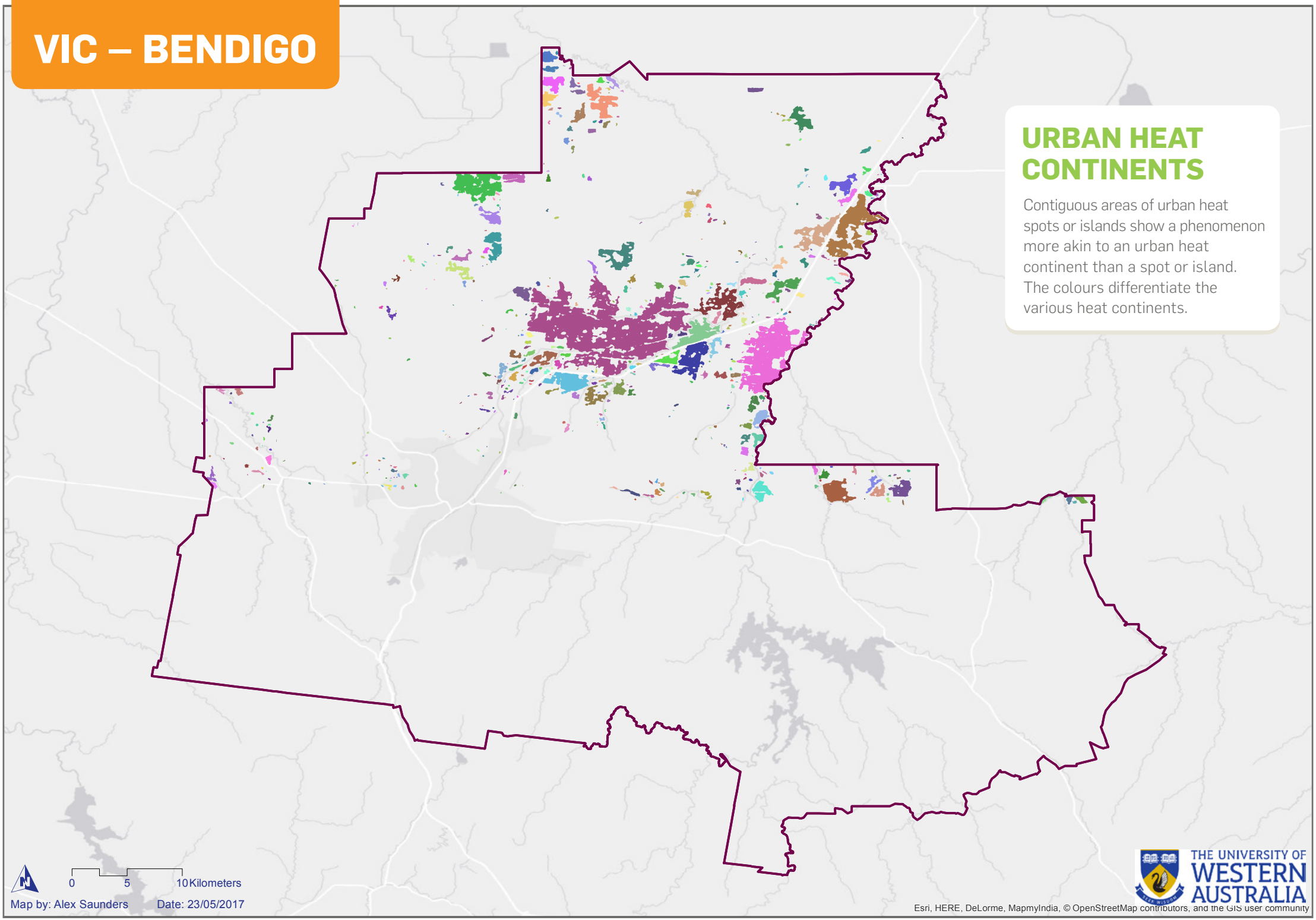
VIC – BENDIGO



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0 5 10 Kilometers

Map by: Alex Saunders Date: 23/05/2017

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VIC THE GOOD NEWS

Despite population growth and an increase in hard surface areas, the City of Melbourne has managed to maintain its canopy levels – there has been no significant loss of canopy.

Given Ballarat's vulnerability and overall loss of canopy there is a significant urban greening opportunity there. However it is likely that these results are somewhat of an anomaly given that Ballarat has higher than average areas of pastoral land and is somewhat atypical of other urban LGAs.

The City of Yarra has gained 4.3% in canopy cover and has a longstanding commitment to urban forestry.

VIC COUNCIL COMMENTS

MORNINGTON PENINSULA SHIRE

The Mornington Peninsula Shire is located Southeast of Melbourne and is surrounded by the coast on three sides. We note that the hotspots and areas of vulnerability are generally outside of our urban growth boundary or not located in our most heavily populated areas. One interpretation of these results is that the lack of or change in vegetation may be due to horticultural or recreational development.

JESSICA WINGAD
MANAGER CLIMATE CHANGE, ENERGY AND WATER

FRANKSTON CITY COUNCIL

The City of Frankston has limited data on canopy cover and this is the first we've seen about hotspots and heat, so it is of great interest to us. Interestingly, the heat mapping showed that the hotspots were in our rural, not urban areas, so there was limited overlap between where vulnerable people live and where it is hottest.

We would be interested in learning more about where our canopy cover is being lost.

NATHALIE NUNN
ENVIRONMENTAL PLANNER

WYNDHAM CITY COUNCIL

Roughly 58% of the Wyndham municipality is outside the Urban Growth Boundary.

Rural areas are dominated by market gardens and the Western Grassland Reserve which protects natural temperate grasslands of the volcanic plains, a critically endangered ecosystem where trees are naturally scarce.

The low tree canopy percentage of the entire municipality reflects this and there are very few locations where dense tree planting is appropriate within the rural area. Urban Wyndham has a much higher tree canopy cover however due to tree planting within the urban growth zone. The rapid population growth means there is a large portion of young trees, as well as many vacant sites where additional trees can be planted within streets and parks.

BENJAMIN DE KLEPPER
URBAN FOREST PLANNER

VIC COUNCIL COMMENTS

CITY OF GREATER BENDIGO

TANIA MACLEOD
PROJECT OFFICER ARBORICULTURE

Bendigo's urban growth boundary covers only 4.2% (126 km^2) of the Greater Bendigo Local Government area (3000 km^2), therefore canopy cover statistics for the urban area are quite different than those for the entire LGA, with large proportions of agricultural land and national, state and regional parks. Bendigo is often referred to as the 'City in a Forest,' attributed to the ring of Box Ironbark forest (Greater Bendigo National Park) which almost encircles the urban area.

A canopy cover analysis (using iTree canopy) of Bendigo's urban area (defined by the urban growth boundary) paints a very different picture than the statistics supplied in your report for the entire Greater Bendigo area. Tree canopy here is 19% compared to 28% from the 2014 assessment. Impermeable surfaces cover over a quarter of all land compared to only 3% over all of Greater Bendigo.

This is predicted to get worse as Bendigo develops, expands into new growth areas and infill existing urban areas. We are also predicted to lose 44% of all city trees over the next 10 years as our ageing European trees come to the end of their natural lives.

MAROONDAH CITY COUNCIL

RICHARD PHILLIPS
TREE MANAGEMENT OFFICER

We realise that this is a broad brush analysis, but observe that the areas identified as greening opportunities due to the high temperatures are mostly intensively developed industrial areas, shopping centre car parks and the like. In terms of public greening, our current opportunities are limited to areas that council has control of, such as nature strips. Although it may seem challenging, the real opportunity is for there to be more green infrastructure such as green roofs and walls within private locations, which we would encourage.

QUEENSLAND

7th Brigade

QLD WHAT'S HAPPENING?

Average canopy cover in urban QLD is the highest in the country at

47.2%

down 3% from

50.2%

in 2009.

The rate of loss in QLD is almost

DOUBLE

that of any other state.

40%

of urban LGAs have had no significant loss or increase in canopy.

The increase in hard cover is most pronounced in the City of Brisbane where that gain seems to have come largely at the expense of grassed areas. However there is a significant increase of

3.3% *in shrubbery which, based on trends seen in other QLD LGAs, would predict a canopy increase over time.*

There has been a

1.65%

increase in shrub cover and a small

0.49%

reduction in grass. Hard surface areas have increased by

1.79%

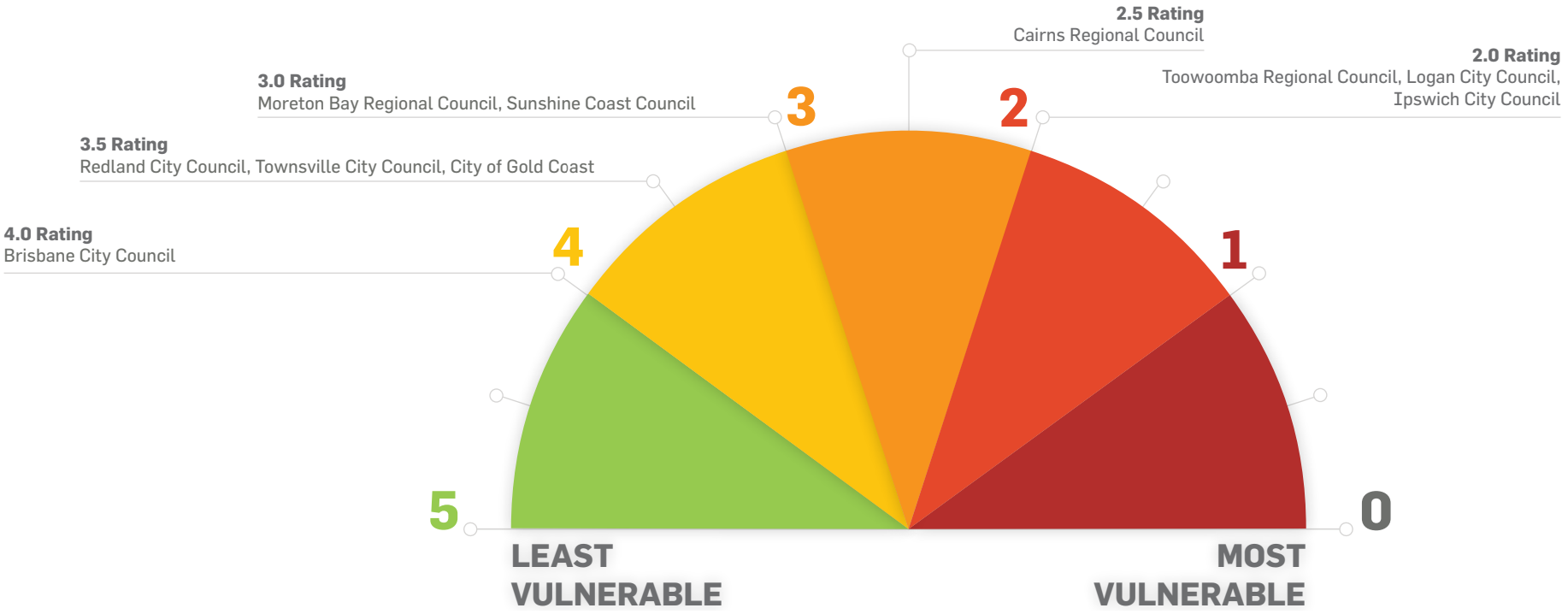
The **8.9%** *loss in canopy in Redland City Council should be watched because at the same time there has been a*

3.5% *increase in hard surfaces and a*

4% *increase in grassed areas.*

There has not, however, been a significant increase in shrubbery, indicating that there may not be enough small saplings and trees being planted to compensate for the loss of canopy.

QLD THE MOST & LEAST VULNERABLE



TOP URBAN GREENING OPPORTUNITIES:

- Toowoomba Regional Council, Logan City Council, Ipswich City Council (2)
- Cairns Regional Council (2.5)
- Moreton Bay Regional Council, Sunshine Coast Council (3)

QLD SNAPSHOT

THE GREEN KEY

In technical terms, a tree is a plant over six metres, while a shrub is under six metres. However, for an accurate comparison to our previous mapping report, 'Where are all the trees?', we have used the following definitions:

Trees
Anything that looks like a tree from above, distinguished from shrubs by the shadows cast.

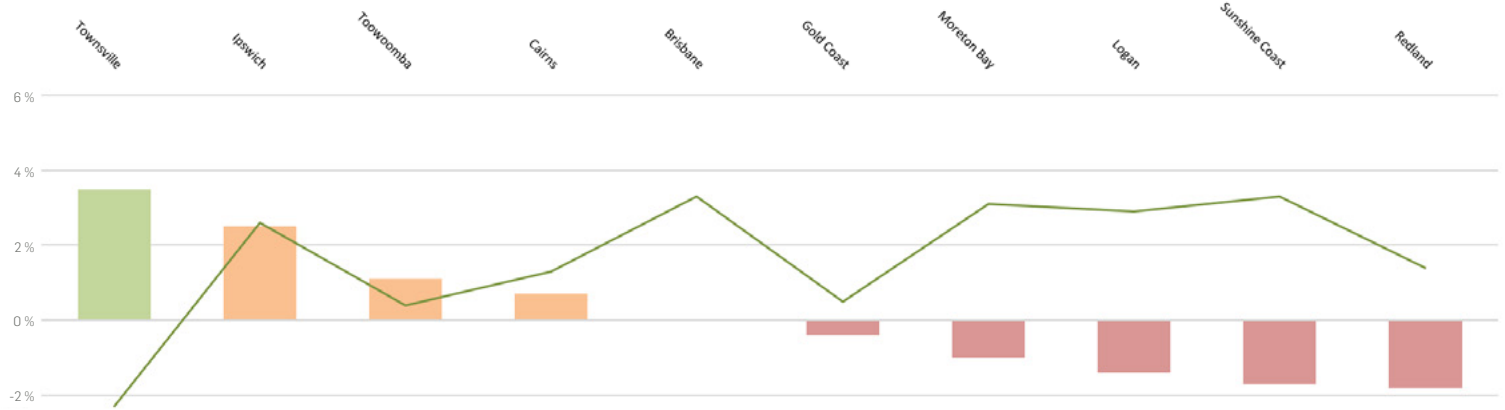
Shrub
Landscaped vegetation as well as bushland shrubs, crops and grapevines.

Grass
Cleared road sides, lawns, pastures, sites cleared for development and sporting grounds.

Hard surfaces
Asphalt, buildings, car parks, footpaths, sandy beaches, train lines, rocky coastlines and water.

KEY STATISTICS	2009*	2016	
Tree Canopy Cover	50.2%	47.2%	3% Loss
Shrub Cover	6.69%	8.34%	1.65% Gain
Grass Cover	35%	34.51%	0.49% Loss
Hard Surface	8.11%	9.9%	1.79% Increase

SHRUB & TREE CANOPY COVER CHANGES IN QLD LGAs 2009-2016



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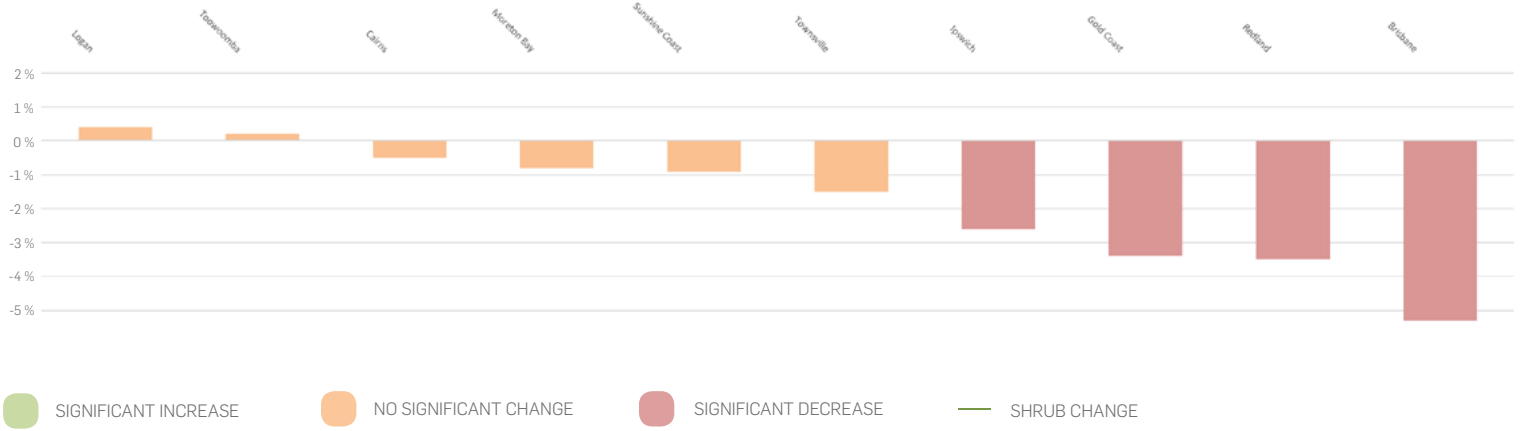

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QLD – SOUTH-EAST QUEENSLAND

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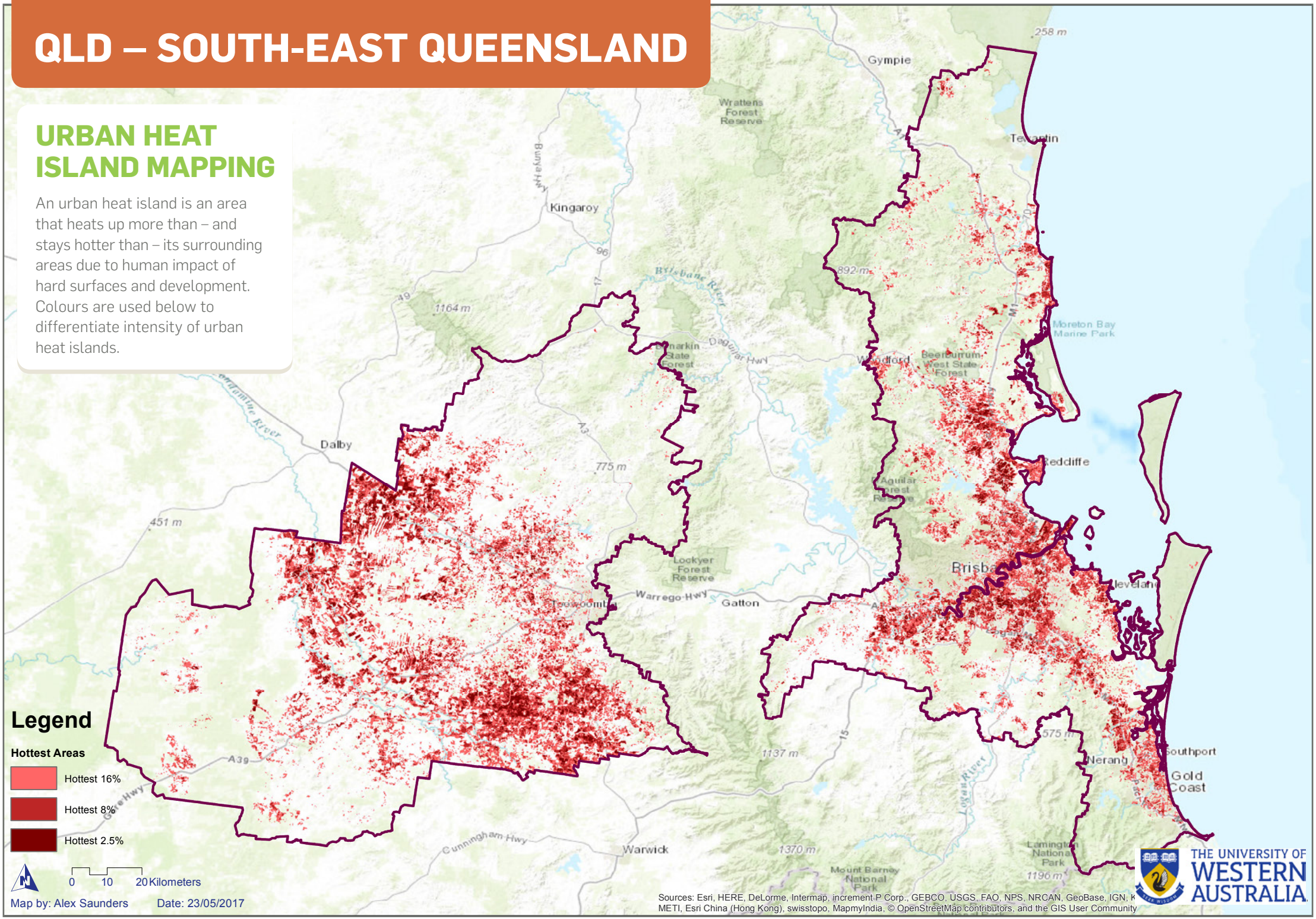

Legend

Hottest Areas

- Hottest 16%
- Hottest 8%
- Hottest 2.5%

0 10 20 Kilometers

Map by: Alex Saunders Date: 23/05/2017

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, K
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QLD – SOUTH-EAST QUEENSLAND

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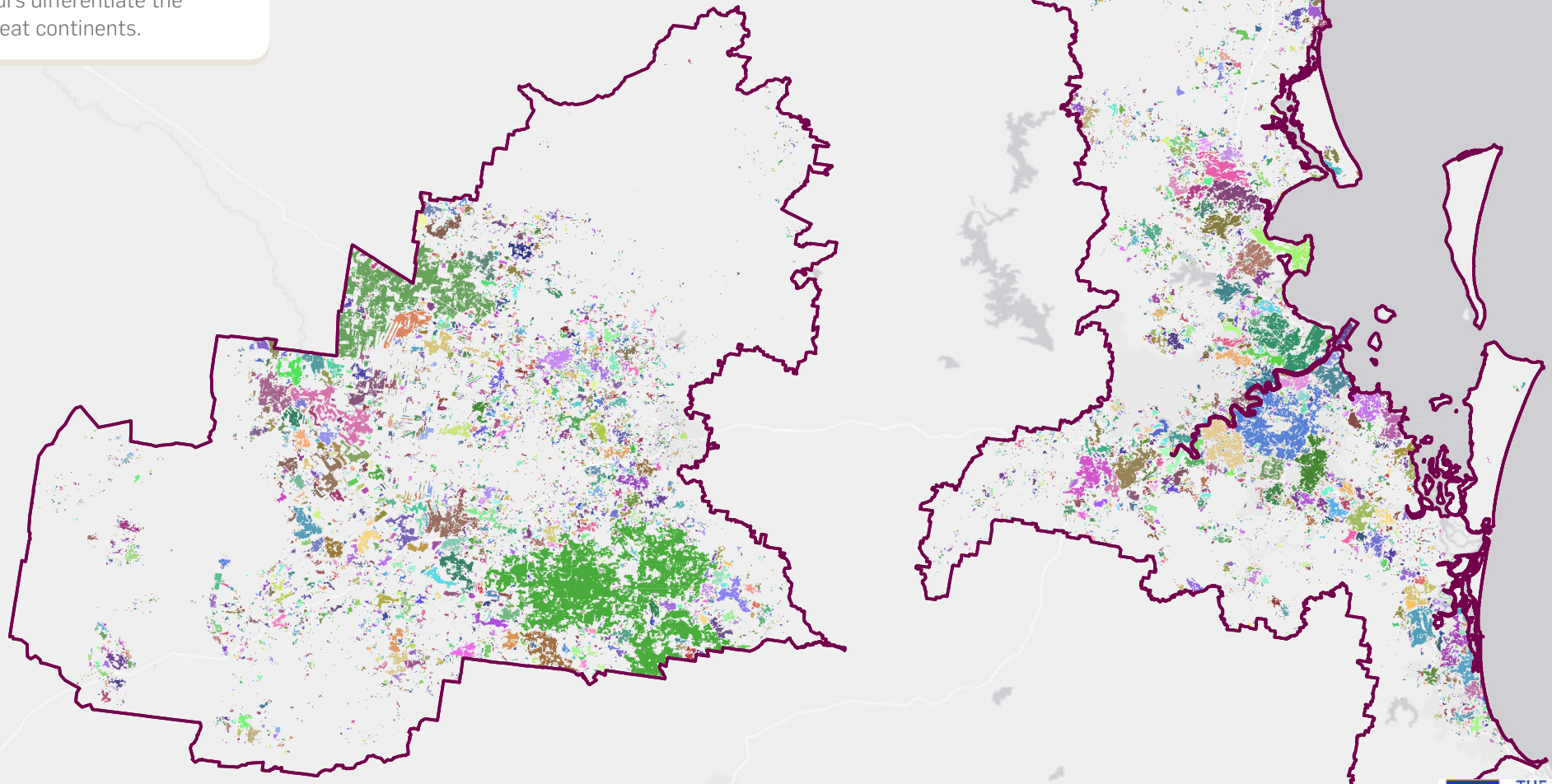

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QLD – CAIRNS

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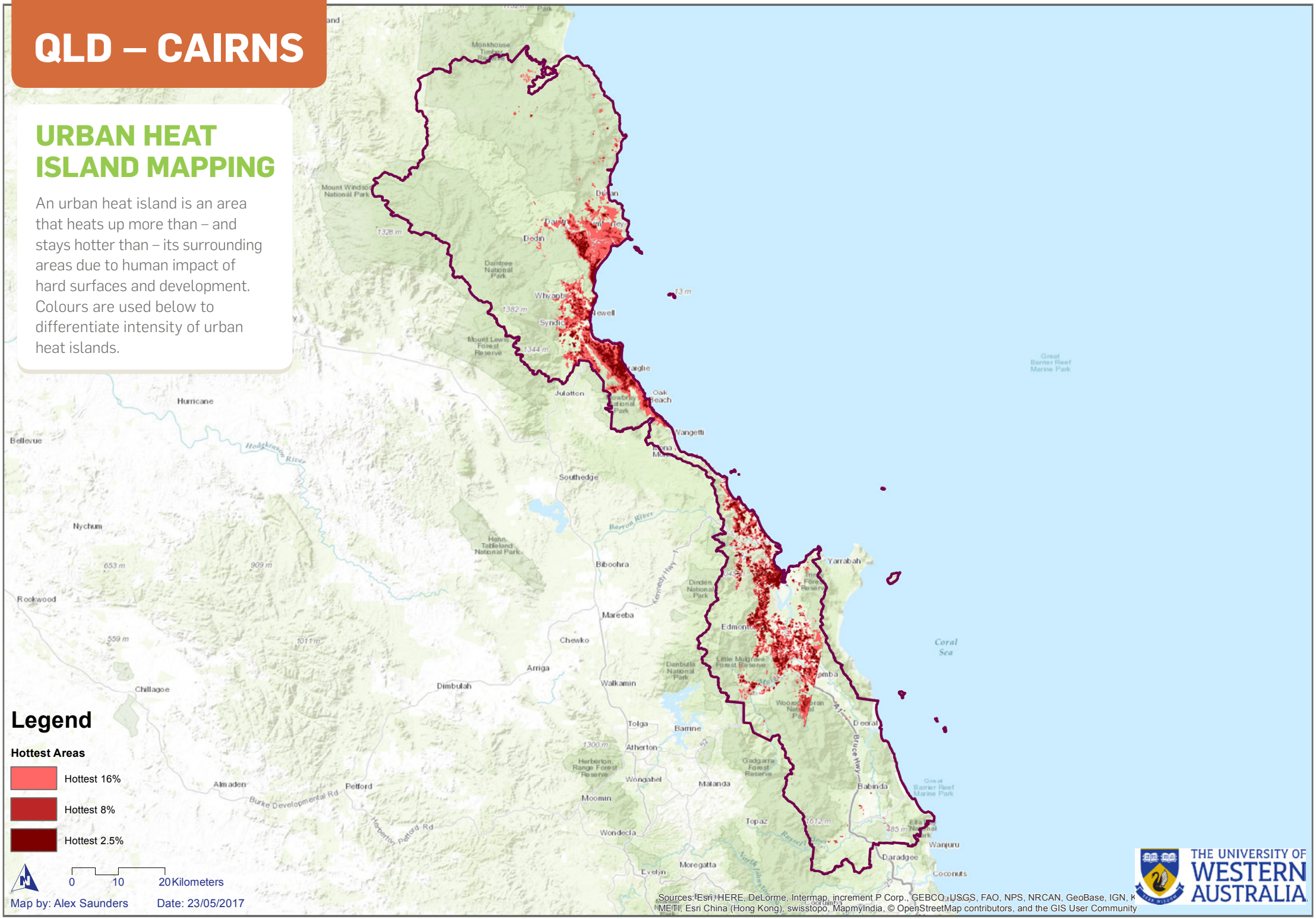

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QLD – CAIRNS

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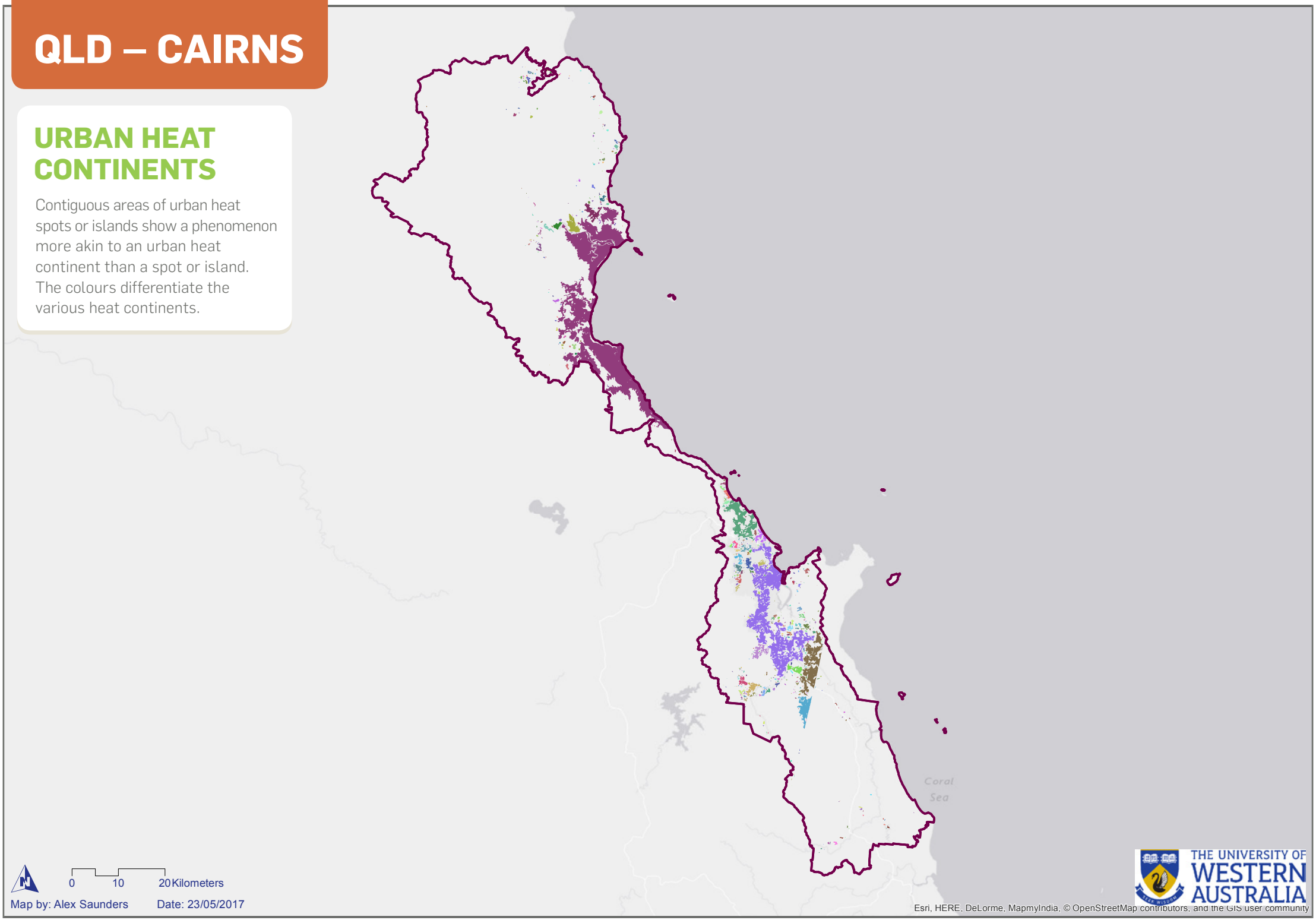

0 10 20 Kilometers

Map by: Alex Saunders Date: 23/05/2017

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QLD – TOWNSVILLE

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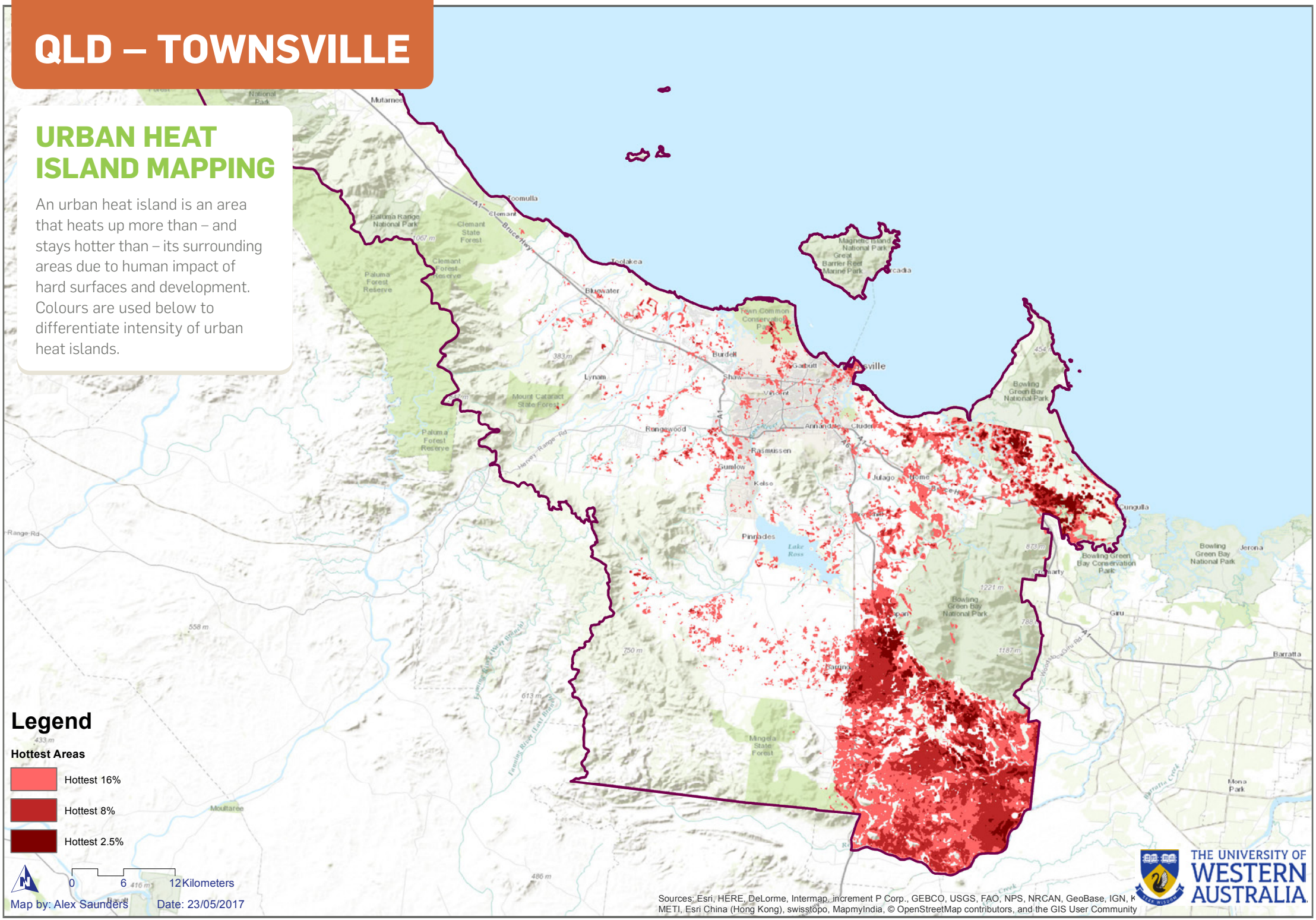

QLD – TOWNSVILLE

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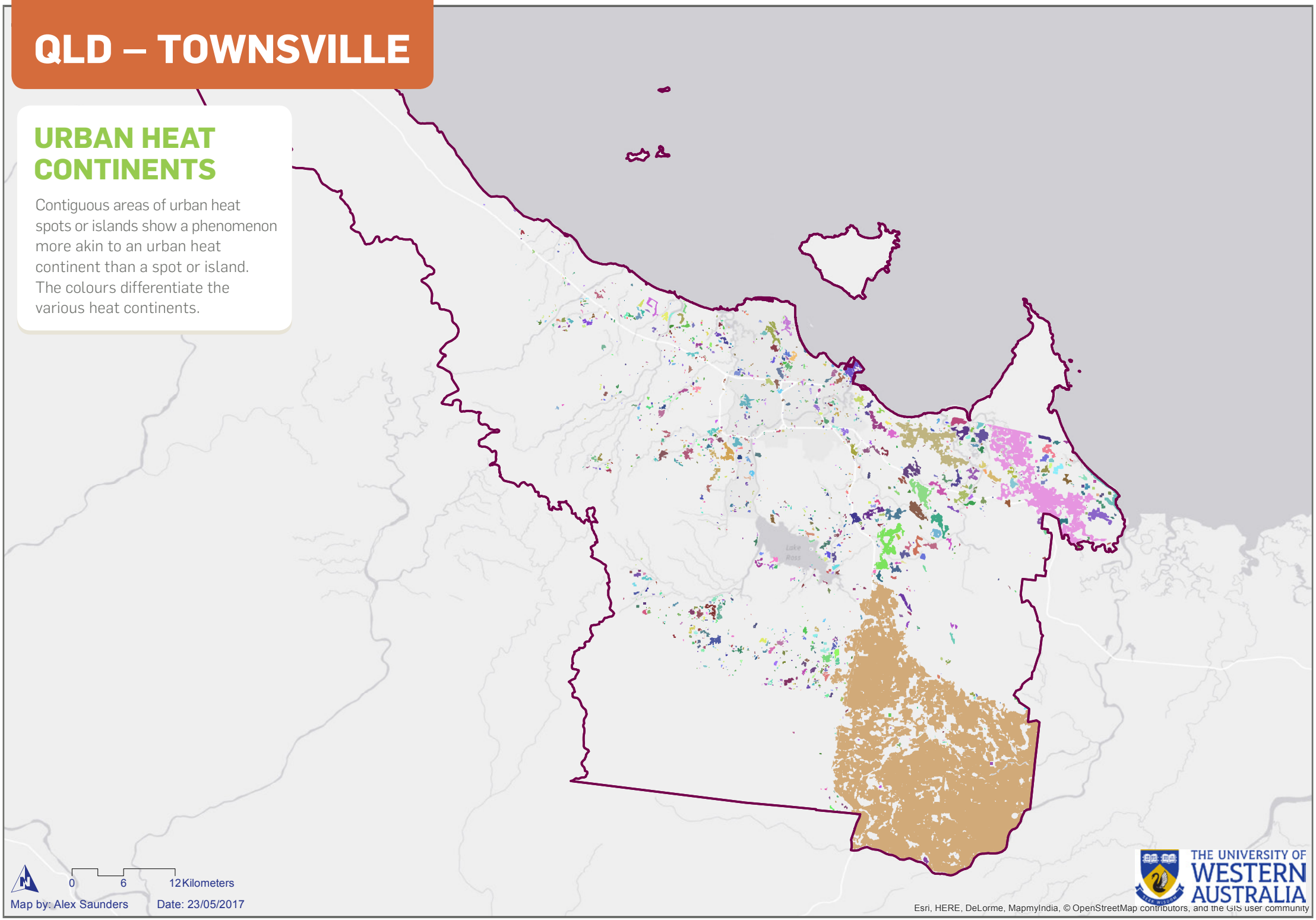

0 6 12 Kilometers

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QLD THE GOOD NEWS

Overall, the state's VHHEDA Index rating is 2.9%, making it one of the least vulnerable states to health risks associated with urban heat incidences.

Townsville has undergone a 10% gain in canopy, much of which seems to be a result of grassed (down 9.4%) and shrub-covered (down 2.3%) surfaces maturing and being recognised by analysts as canopy.

In the City of Brisbane, there is a significant increase of 3.3% in shrubbery which, based on trends seen in other LGAs, would predict a canopy increase over time.

In Logan City, the 8.2% loss in canopy appears not to have been to hard surfaces but instead to a combination of grassed and shrub-covered surfaces.

Based on trends elsewhere in QLD, this would likely signify that over time this grassed area might convert to shrubs and the 2.9% shrubbery cover to convert into canopy to compensate for the 8.2% loss.

QLD COUNCIL COMMENTS

TOOWOOMBA REGIONAL COUNCIL

CALLUM EDWARDS
SENIOR ARBORIST

The urban heat island mapping for a rural local government (like Toowoomba Regional Council) is somewhat misleading and hard to apply. Land mapped in the Toowoomba LGA and shown as hotspots is either natural grasslands or agricultural land.

I agree these land types need to be mapped and considered when discussing vegetation cover. However, it may be best to have two different maps (in a perfect world) – one showing the extent of the LGA (including the agricultural and grassland) and associated hotspots, and the other showing urban areas (as defined by planning schemes/instruments). From a management viewpoint, this would provide more useable information for strategy and policy development. I do understand this would be a time consuming process.

REDLAND CITY COUNCIL

It is important to acknowledge that this report includes data from both the mainland and the islands, specifically North Stradbroke Island, a forested area that is in fact larger than its mainland counterpart and is currently in the process of becoming a National Park. This inclusion skews the data in a positive way, not necessarily reflecting the reality of our Redlands urban areas.

CANDY DAUNT
SENIOR ADVISOR, ENVIRONMENT POLICY AND PLANNING

BRISBANE CITY COUNCIL

Brisbane City Council has recently released 'Brisbane: Clean, Green, Sustainable 2017-2031'. Chapter 8 (the Urban Forest) outlines Council's goal to value, nurture and protect its urban forest. Council is committed to identifying the hot parts of the City with low tree cover in order to target tree plantings in areas that require shade and cooling. Council will consider the locations and opportunities identified in 'Where should all the trees go?' and their suitability for planting. The strategy also identifies two landmark projects including urban cooling and a memorial ring of green.

KRISTEN DANGERFIELD
URBAN FOREST PROGRAM OFFICER

CITY OF GOLD COAST

Generally speaking the identified hotspot areas seem to correspond to the urban footprint, with some of the hottest areas aligning with suburbs we expect would be subject to additional urban heat i.e. the City's northern suburbs.

Unfortunately at this mapping scale it is difficult to confirm and ideally we would overlay the outputs with our urban footprint and other GIS layers to provide a true comparison. To date we have not produced heat mapping for the City so are unable to compare with a similar dataset.

SAMANTHA BONNEY
SUPERVISOR OF NATURAL HAZARDS

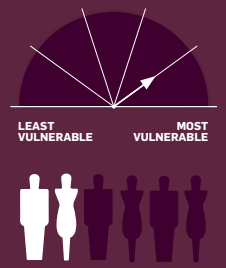
SOUTH AUSTRALIA

Adelaide Botanic Gardens

SA WHAT'S HAPPENING?

Average canopy cover for urban SA is
19.45%
down 1.92% from
21.37%
in 2013.

79% *of the urban LGAs in SA are rated as vulnerable on our VHHEDA Index.*



NO COUNCIL
has had a significant gain in urban tree canopy cover.

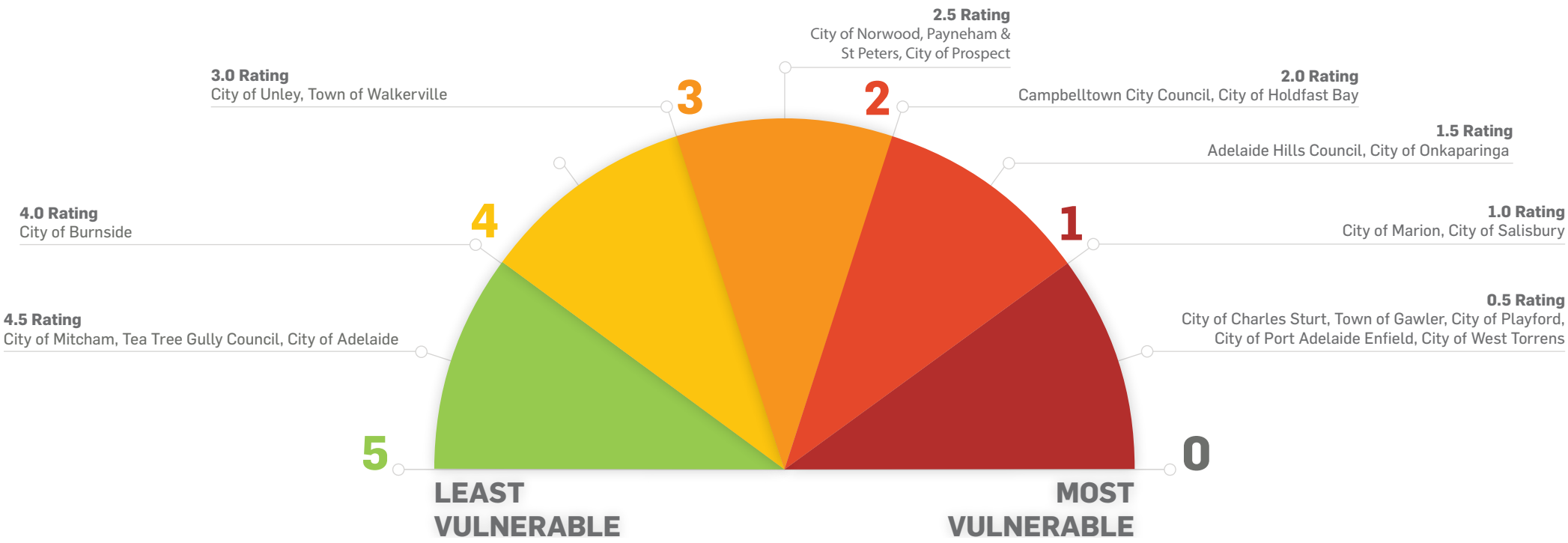
43% *of urban LGAs have had a significant loss in tree canopy cover.*

The City of Playford appears to be the most vulnerable LGA in the state. It only has **9.4%** *canopy cover and has undergone a loss of* **5.4%** *since 2009, in combination with a loss of shrubbery and a* **4.5%** *increase in hard surfaces. It is rated as one of the most vulnerable LGAs in the country.*

36% *of urban LGAs have had a significant increase in hard surfaces, on average this increase has been by* **5%**

The loss of grassed surfaces by **10.9%** *in the City of Burnside, and the gain in shrubbery would suggest some greening.*

SA THE MOST & LEAST VULNERABLE



TOP URBAN GREENING OPPORTUNITIES:

- City of Charles Sturt, Town of Gawler, City of Playford, City of Port Adelaide Enfield, City of West Torrens (0.5)
- City of Marion, City of Salisbury (1)
- Adelaide Hills Council, City of Onkaparinga (1.5)
- Campbelltown City Council, City of Holdfast Bay (2)
- City of Norwood, Payneham & St Peters, City of Prospect (2.5)
- City of Unley, Town of Walkerville (3)

SA SNAPSHOT

THE GREEN KEY

In technical terms, a tree is a plant over six metres, while a shrub is under six metres. However, for an accurate comparison to our previous mapping report, 'Where are all the trees?', we have used the following definitions:

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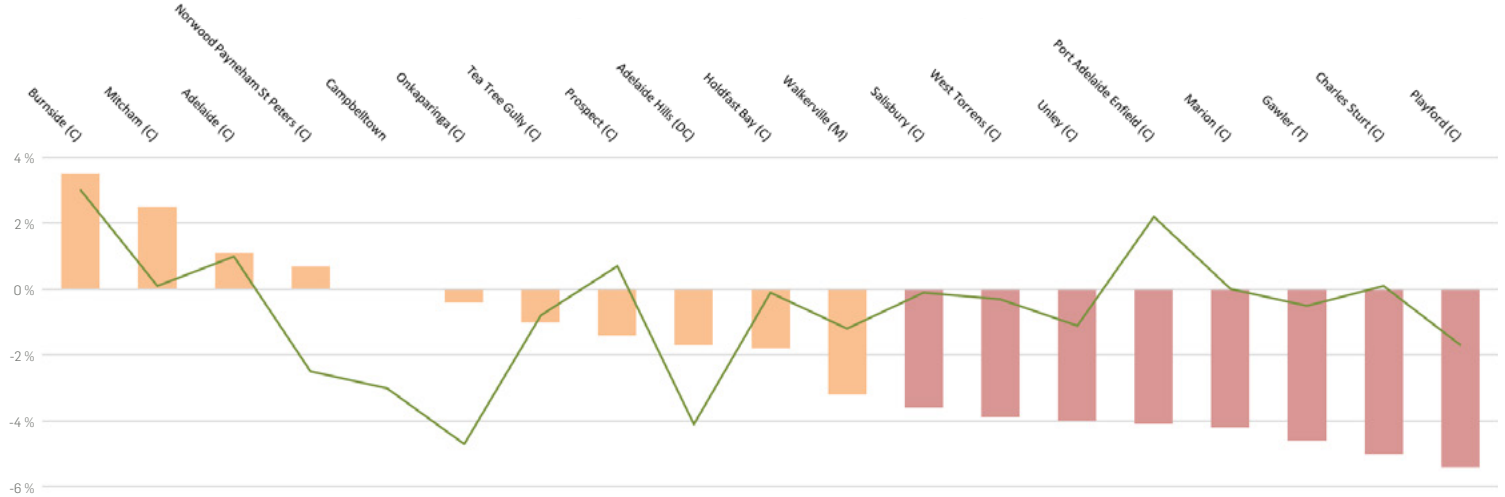
Cleared road sides, lawns, pastures, sites cleared for development and sporting grounds.

Hard surfaces
Asphalt, buildings, car parks, footpaths, sandy beaches, train lines, rocky coastlines and water.

KEY STATISTICS	2013*	2016	
Tree Canopy Cover	21.37%	19.45%	1.92% Loss
Shrub Cover	5.92%	5.23%	0.69% Loss
Grass Cover	32.08%	32.1%	0.02% Gain
Hard Surface	40.63%	43.2%	2.57% Increase

SHRUB & TREE CANOPY COVER CHANGES IN SA LGAs 2013-2016



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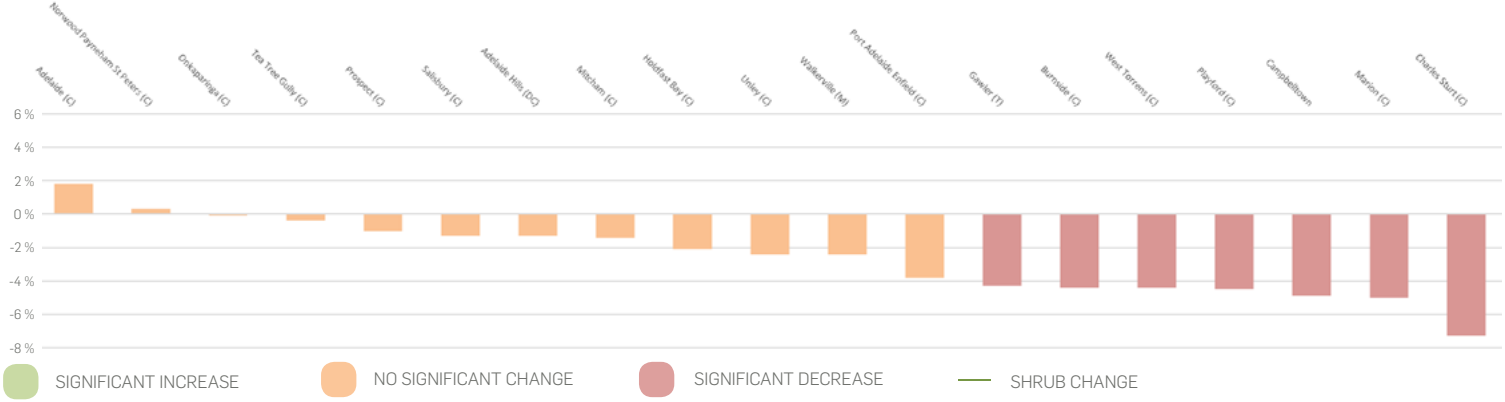

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SA – ADELAIDE

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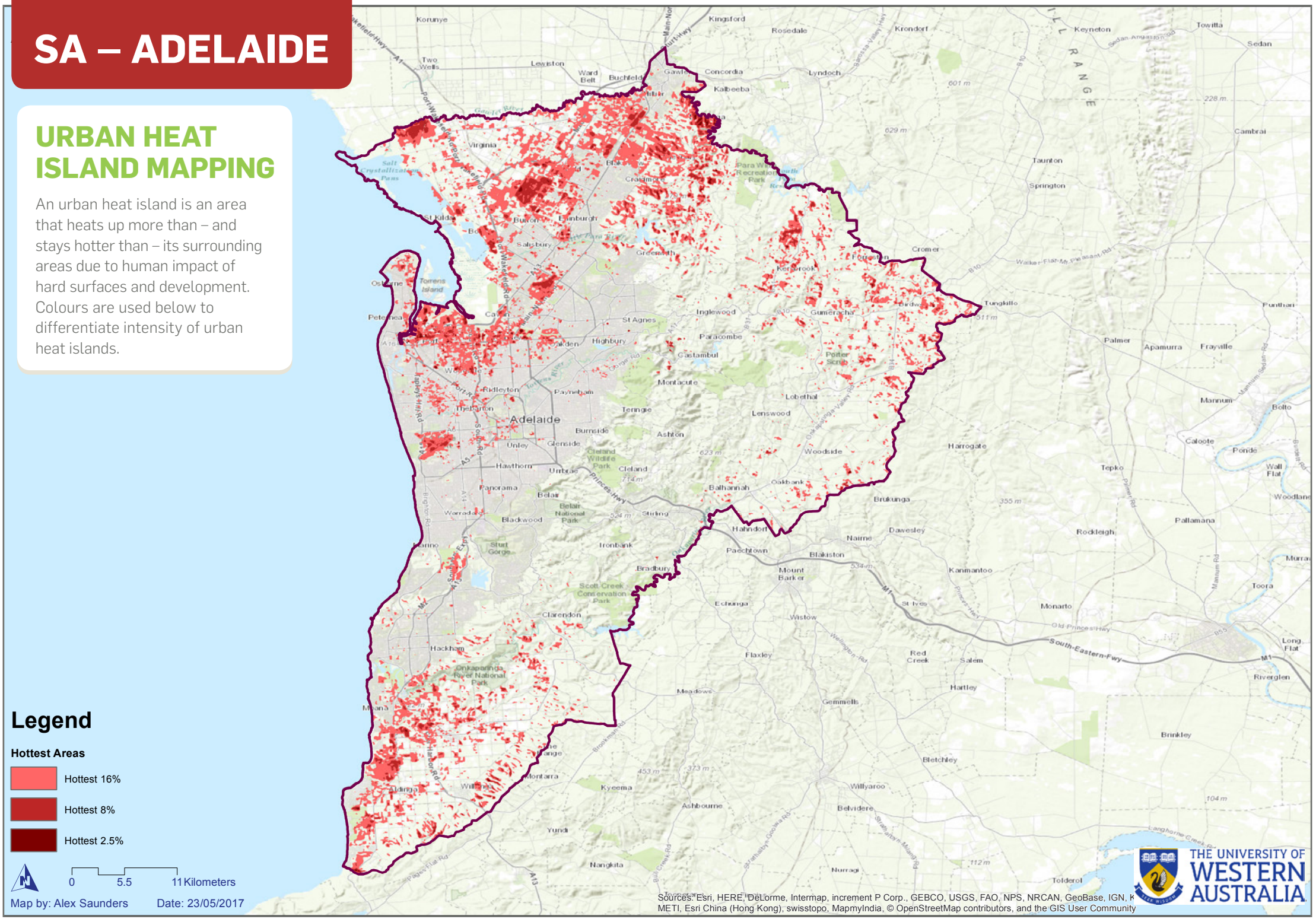

Legend

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0 5.5 11 Kilometers

Map by: Alex Saunders

Date: 23/05/2017

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, K
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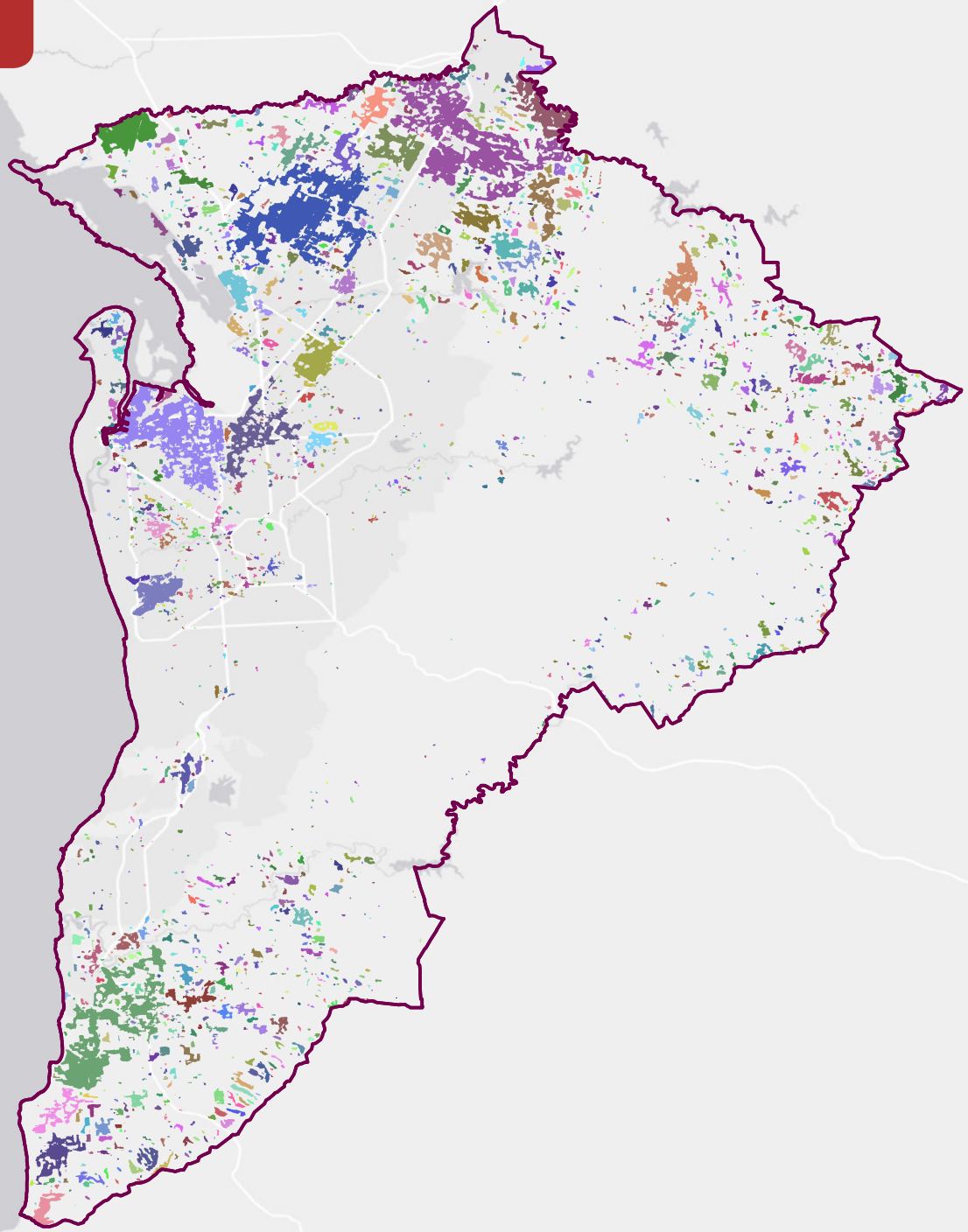
SA – ADELAIDE

URBAN HEAT CONTINENTS

Contiguous areas of urban heat spots or islands show a phenomenon more akin to an urban heat continent than a spot or island. The colours differentiate the various heat continents.



0 5.5 11 Kilometers

Map by: Alex Saunders Date: 23/05/2017

THE UNIVERSITY OF WESTERN AUSTRALIA

Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

SA THE GOOD NEWS

Despite being the most densely populated part of SA, the City of Adelaide's canopy cover of 21.4% (up by 1.1% from 2009 figures), has the 8th best canopy cover of the 19 urban LGAs.

Despite a significant loss of grassed surfaces, the City of Burnside has gained 3% shrub cover.

SA COUNCIL COMMENTS

CITY OF WEST TORRENS

NICKY O'BROIN
SUSTAINABILITY PLANNER

The City of West Torrens (with the University of South Australia) undertook an i-tree Canopy assessment in 2017 and came up with slightly different results to those in the RMIT report. Notably a 2.3% loss of canopy, compared to the 3.9% on the snapshot and a 1.6% increase in impervious surfaces, compared to the 4.9% increase reported by RMIT. Based on our sample we would be in the 'no significant change' category.

We are currently undertaking detailed heat mapping which will be available in due course.

CAMPBELLTOWN CITY COUNCIL

HENRY HAAVISTO
TREE MANAGEMENT OFFICE

The snapshot seems in keeping with our observations. The City has experienced a notable increase in subdivisions since the baseline data. In 2016, there were 340 new allotments created and in 2015 there were 329. This compares to only 179 new allotments in 2014.

Much of the loss in green cover is on private land and unfortunately this is something we have little control over. Across all of Campbelltown's suburbs, Council data suggests an average 6% decrease in tree canopy cover from 2006 to 2016.

Therefore the key statistic for tree canopy cover that says "no change" in the snapshot appears misleading – it doesn't seem to align with the VHHEDA Index rating of 2 (a figure that does seem in keeping with our observations).

CITY OF ONKAPARINGA

JENNI MCGLENNON
SUSTAINABILITY COORDINATOR, STRATEGIC FUTURES

The City of Onkaparinga undertook high-resolution multispectral airborne image collection for heat and canopy in February 2016, however this was for our urban area only.

Our urban canopy cover varied from the RMIT snapshot, and instead we recorded tree canopy cover of 12.5% and overall vegetation cover of 24.8%. Our definition of a tree was over three metres as this is the height at which cooling can begin to be attributed.

The heat mapping is difficult to compare as our focus was on urban areas only and not the entire LGA. In terms of vulnerability this would appear to us to be consistent with our understanding of the area, particularly considering that the 12.5% tree canopy cover is one of the lowest rates I've encountered.

One of the key challenges is that our LGA is peri-urban and consequently the rural areas skew findings for tree canopy – this would happen favourably or unfavourably depending on land use. In our LGA, land is used for vineyards, cropping and horticulture whereas in others there may be mainly national parks.

SA COUNCIL COMMENTS

CITY OF PORT ADELAIDE ENFIELD

MAGGIE HINE
ACTING MANAGER CITY DEVELOPMENT

Since the data was collected for this snapshot, the City of Port Adelaide Enfield, along with their partners in the Adapt West Climate Change Adaptation Program (Cities of West Torrens and Charles Sturt with the support of the Adelaide Mount Lofty Ranges Natural Resources Management Board), have undertaken urban heat mapping of the region. The councils have also undertaken further i-tree assessments. The findings from Adapt West's more localised assessment are due to be released in late 2017. These localised assessments will provide more detailed information to help identify where green infrastructure might be placed.

CITY OF PROSPECT

NINA PHILLIPS
LANDSCAPE ARCHITECT

The areas that have been identified in the heat map are consistent with our data because they are either areas with a shopping centre or vacant land. Currently, the land on the north-west corner of our council area is being developed and will most definitely include vegetation and street tree planting.

We have also increased our budget for our Street Tree Planting program in the last year and this is consistent with the Council Strategic Plan indicating increased tree canopy cover. We have a Green Neighbourhoods program running that is specifically looking at streets of poor tree canopy cover as we aim to achieve a 'green tunnel' canopy cover for all streets. Currently this has been captured through looking at a minimum of 70% tree canopy cover. We have identified that the laneways do not achieve this and will be difficult to achieve as they are so narrow.

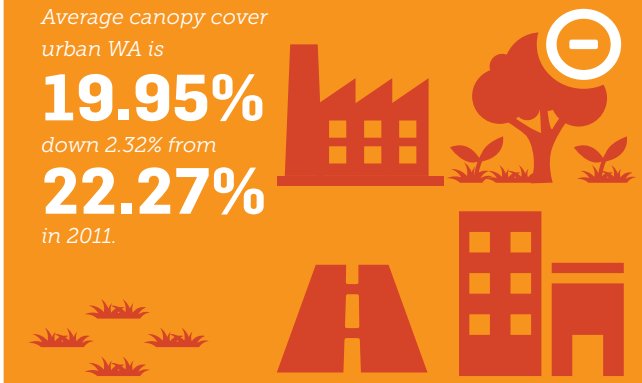
WESTERN AUSTRALIA

Kings Park, Perth

WA

WHAT'S HAPPENING?

Average canopy cover urban WA is
19.95%
down 2.32% from
22.27%
in 2011.



51% *of urban LGAs in WA have seen a decrease in shrubs.*

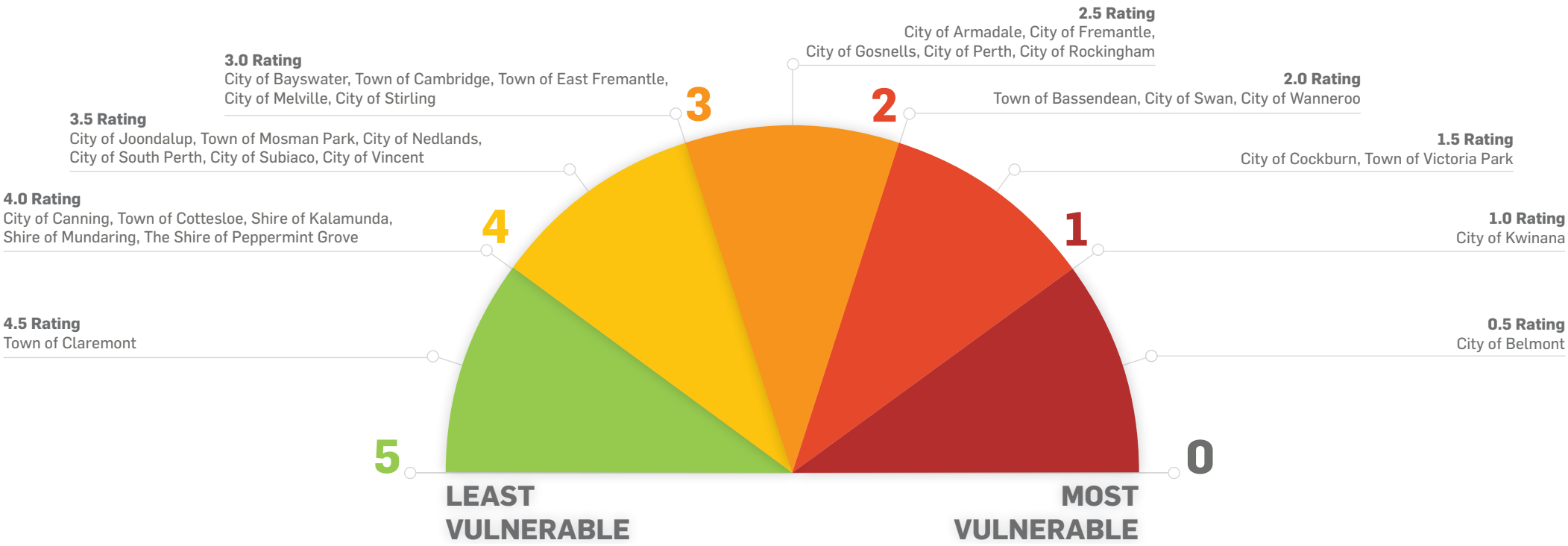
The City of Cockburn is of concern given that there has been a
16.6% *loss in shrubbery and an almost equivalent gain in grass surfaces, suggesting that clearing may have taken place.*

The **5%** *loss of canopy in the City of Cockburn is almost equivalent to that of the hard surface increase.*

41% *of urban LGAs in WA have experienced a significant loss in canopy.*

24% *of LGAs in WA have seen an increase in hard surfaces.*

WA THE MOST & LEAST VULNERABLE



TOP URBAN GREENING OPPORTUNITIES:

- City of Belmont (0.5)
- City of Kwinana (1)
- City of Cockburn, Town of Victoria Park (1.5)
- Town of Bassendean, City of Swan, City of Wanneroo (2)
- City of Armadale, City of Fremantle, City of Gosnells, City of Perth, City of Rockingham (2.5)
- City of Bayswater, Town of Cambridge, Town of East Fremantle, City of Melville, City of Stirling (3)

WA SNAPSHOT

THE GREEN KEY

In technical terms, a tree is a plant over six metres, while a shrub is under six metres. However, for an accurate comparison to our previous mapping report, 'Where are all the trees?', we have used the following definitions:

Trees
Anything that looks like a tree from above, distinguished from shrubs by the shadows cast.

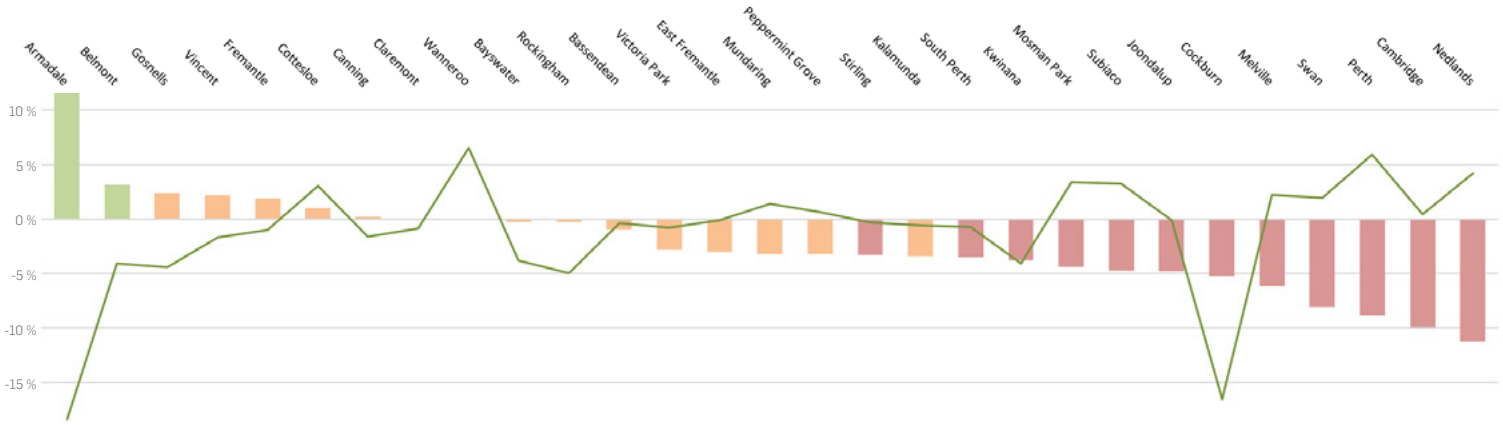
Shrub
Landscaped vegetation as well as bushland shrubs, crops and grapevines.

Grass
Cleared road sides, lawns, pastures, sites cleared for development and sporting grounds.

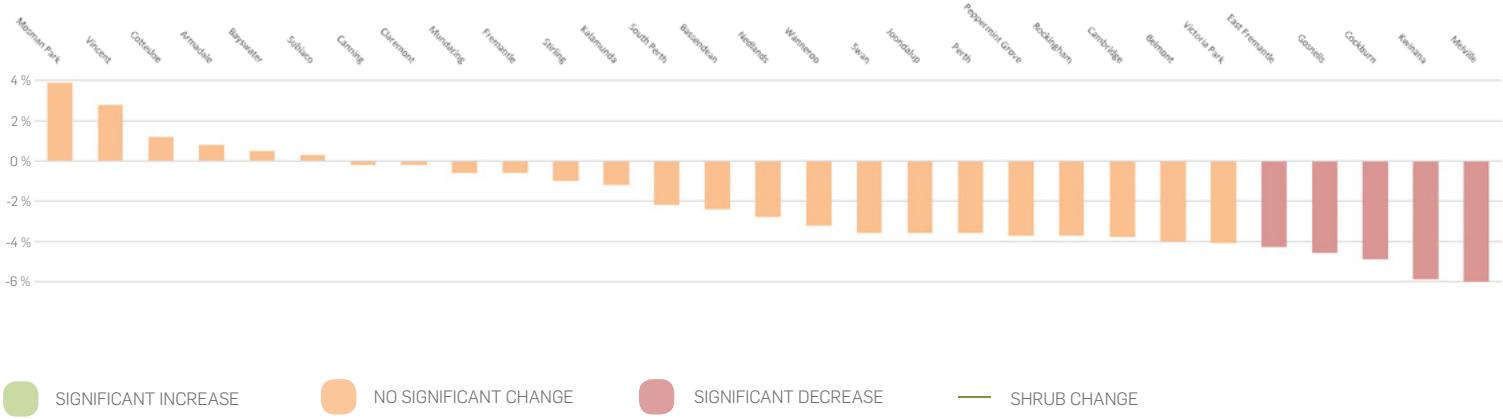
Hard surfaces
Asphalt, buildings, car parks, footpaths, sandy beaches, train lines, rocky coastlines and water.

KEY STATISTICS	2011*	2016	
Tree Canopy Cover	22.27%	19.95%	2.32% Loss
Shrub Cover	8.73%	7.63%	1.1% Loss
Grass Cover	29.87%	31.19%	1.32% Gain
Hard Surface	39.13%	41.22%	2.09% Increase

SHRUB & TREE CANOPY COVER CHANGES IN WA LGAs 2011-2016



GREEN COVER GAIN & LOSS IN WA LGAs 2011-2016

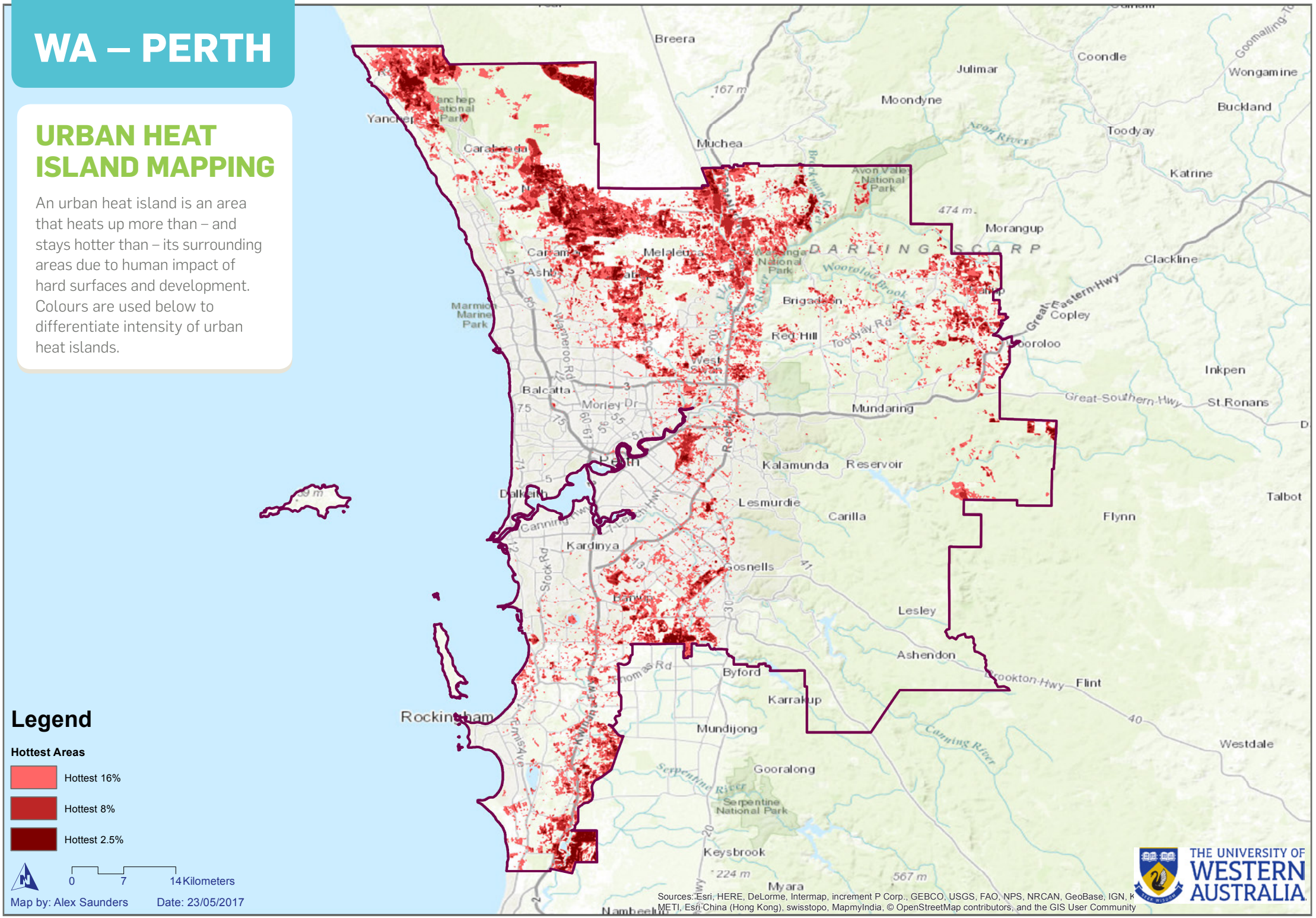


** From 'Benchmarking Australia's Urban Tree Canopy: An i-Tree Assessment', Final Report (2014)*

WA – PERTH

URBAN HEAT ISLAND MAPPING

An urban heat island is an area that heats up more than – and stays hotter than – its surrounding areas due to human impact of hard surfaces and development. Colours are used below to differentiate intensity of urban heat islands.



Legend

Hottest Areas

- Hottest 16%
- Hottest 8%
- Hottest 2.5%

0 7 14 Kilometers

Map by: Alex Saunders Date: 23/05/2017

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, K
METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

THE UNIVERSITY OF WESTERN AUSTRALIA

WA – PERTH

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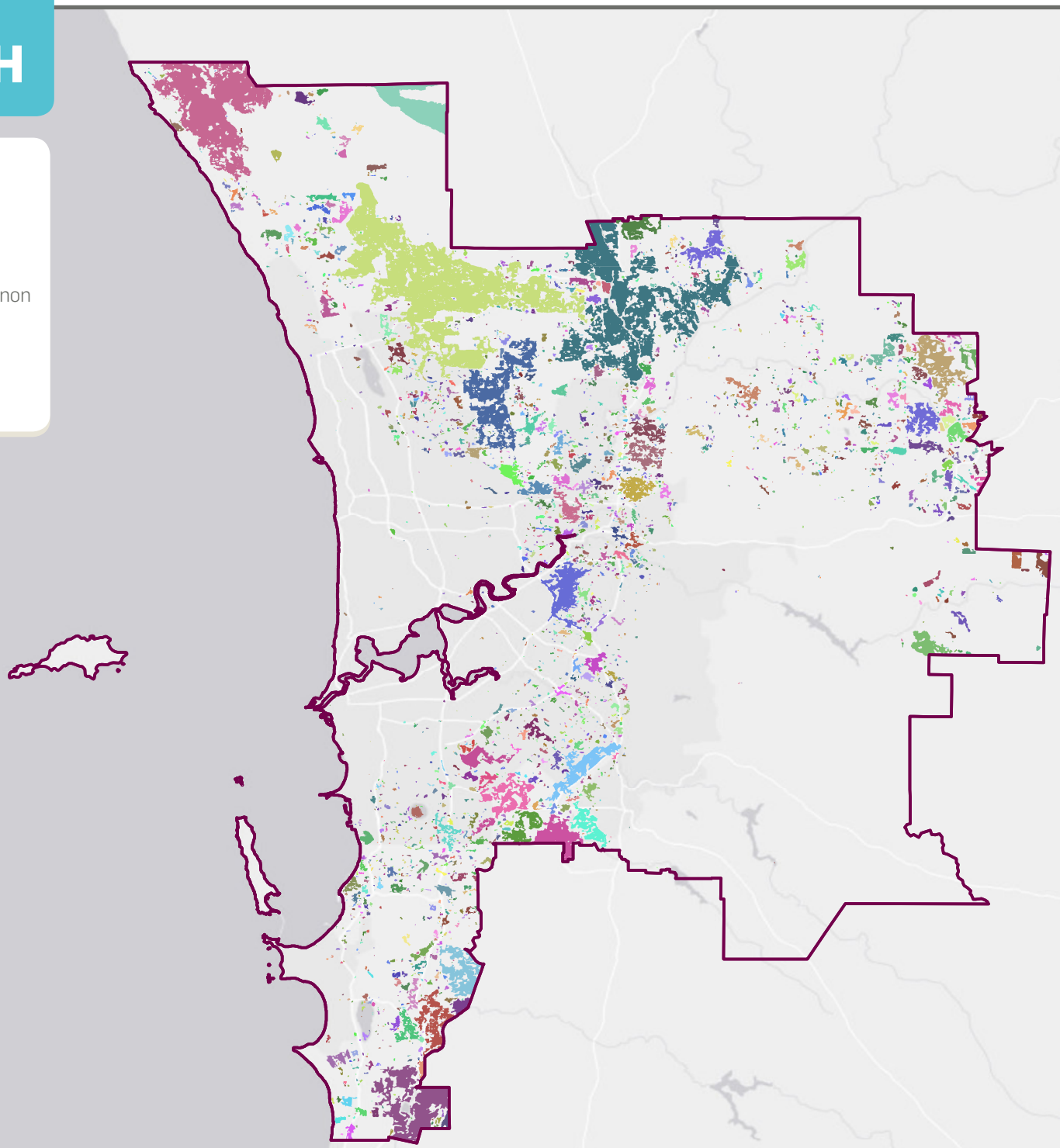

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Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

WA THE GOOD NEWS

The City of Armadale currently has

46% URBAN TREE CANOPY COVER

– the second highest cover among urban LGAs in WA.

The City of Armadale has undergone a

13.2% INCREASE IN CANOPY.

Hard surfaces have had no significant increase.

Grassed surfaces have increased by

6%

Shrub-covered areas have decreased by

18.4%

This low incidence of shrubbery is most likely due to smaller plantings maturing and now being identified as tree canopy.

The City of Belmont has also undergone an

INCREASE IN TREE CANOPY BY 3.1%

This is particularly important as it has happened at the most vulnerable end of the scale (0.5).

Both the City of Belmont and the City of Armadale are two of

THE MOST DEDICATED COUNCILS TO URBAN FORESTRY,

with strong targets and committed urban forestry teams.

WA COUNCIL COMMENTS

CITY OF SUBIACO

The City of Subiaco has more detailed thermal imagery to identify heat islands and future planting areas that relates to its new town planning scheme. A more detailed strategy will be outlined in their new urban forest strategy by the end of 2017.

GRAY STEAD
MANAGER OPERATIONS AND ENVIRONMENT

CITY OF VINCENT

Our team has looked at the RMIT report for our LGA and we have found nothing that contradicts our expectations. We are yet to receive our own set of canopy data for the period in question, which means that we have not had the opportunity to compare RMIT's findings to our own dataset.

By way of comment, we found it interesting that all the areas of heat vulnerability and greening opportunity identified in the RMIT report for our LGA are on State Government controlled land, where we have little if any influence on plantings. We can however use the information to advocate to State Government, particularly as we had already identified those areas as a priority for greening.

ANITA MARRIOTT
SUSTAINABILITY OFFICER, POLICY & PLACE

CITY OF KWINANA

This is the first heat mapping data the City has had access to for our Local Government area. It will be useful for an upcoming review of our Climate Change Mitigation and Adaptation Strategy.

We feel the map is broadly accurate given our experience on the ground. It was noted that there are a few vegetated areas that are classified as hotspots. One large one in particular we noted had been burnt recently and wondered if this had affected the results. There is also another spot that is adjacent to Bollard Bulrush wetland and we wondered if the black soil may have affected this.

There is a large suburb (Bertram) that is undergoing a street tree planting program as it has very little vegetation. Given the lack of street trees in this suburb, it was surprising that this was not a hotspot. Belgravia is noted as a hotspot which matches our understanding of street tree coverage. There are other areas that are noted as hotspots that were recently cleared. It would be interesting to see how they change after urban development.

SARAH MCCABE
SUSTAINABILITY OFFICER

TASMANIA

Royal Tasmanian Botanical Gardens

TAS WHAT'S HAPPENING?

Average canopy cover for urban TAS is

44.7%

down 9.1% from

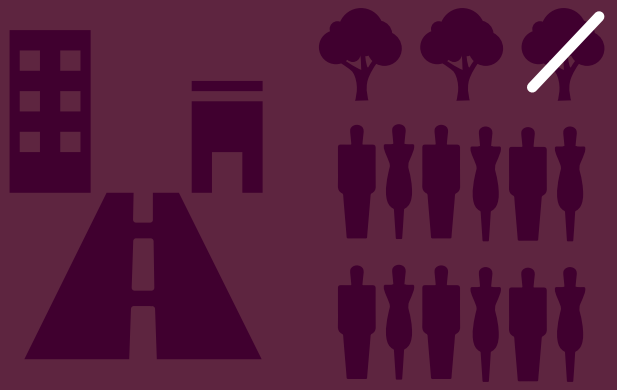
53.8%

in 2008.

Despite having the highest canopy cover, Tasmania has the highest average rate of canopy loss in the country, with the average loss across all urban LGAs being

9.1%

This is particularly pronounced in the denser urban areas of Launceston and Hobart.



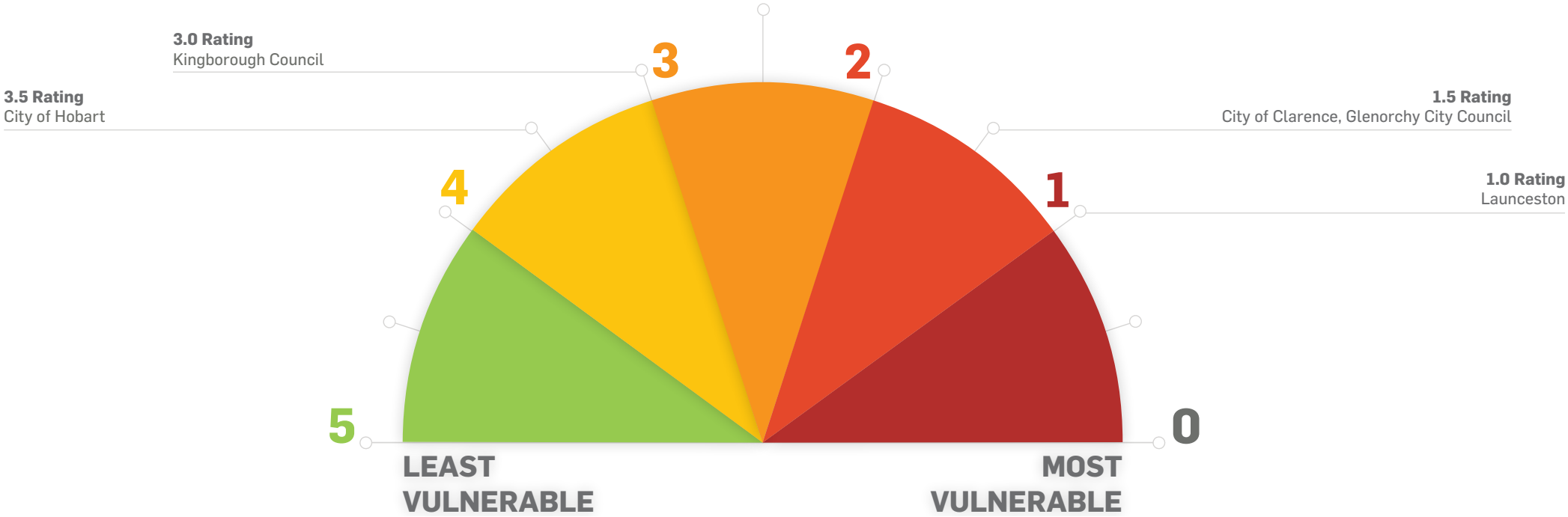
The biggest loss has been in Glenorchy City Council with

17%

lost. This is the most significant loss of canopy in the country but is largely thought to be due to the 2013 and 2016 Tasmanian bushfires.

The **12.4%** *increase in shrubbery has in part compensated for this loss of canopy.*

TAS THE MOST & LEAST VULNERABLE



TOP URBAN GREENING OPPORTUNITIES:

- City of Launceston (1)
- City of Clarence, Glenorchy City Council (1.5)

TAS SNAPSHOT

THE GREEN KEY

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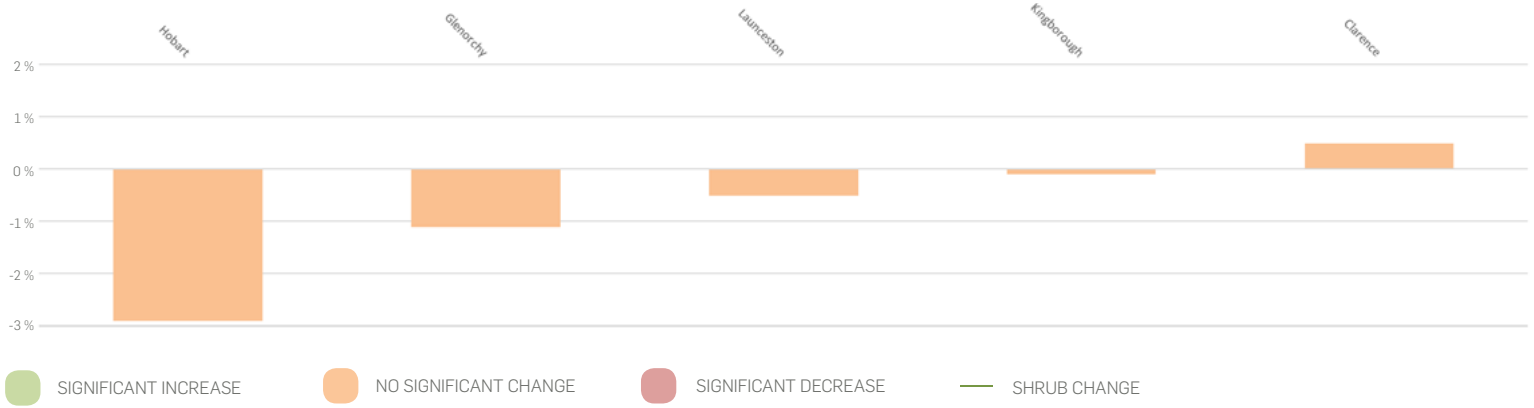
Hard surfaces
Asphalt, buildings, car parks, footpaths, sandy beaches, train lines, rocky coastlines and water.

KEY STATISTICS	2008*	2016	
Tree Canopy Cover	53.8%	44.7%	9.1% Loss
Shrub Cover	8.66%	11.9%	3.24% Gain
Grass Cover	28.4%	33.42%	5.02% Gain
Hard Surface	9.14%	9.96%	0.82% Increase

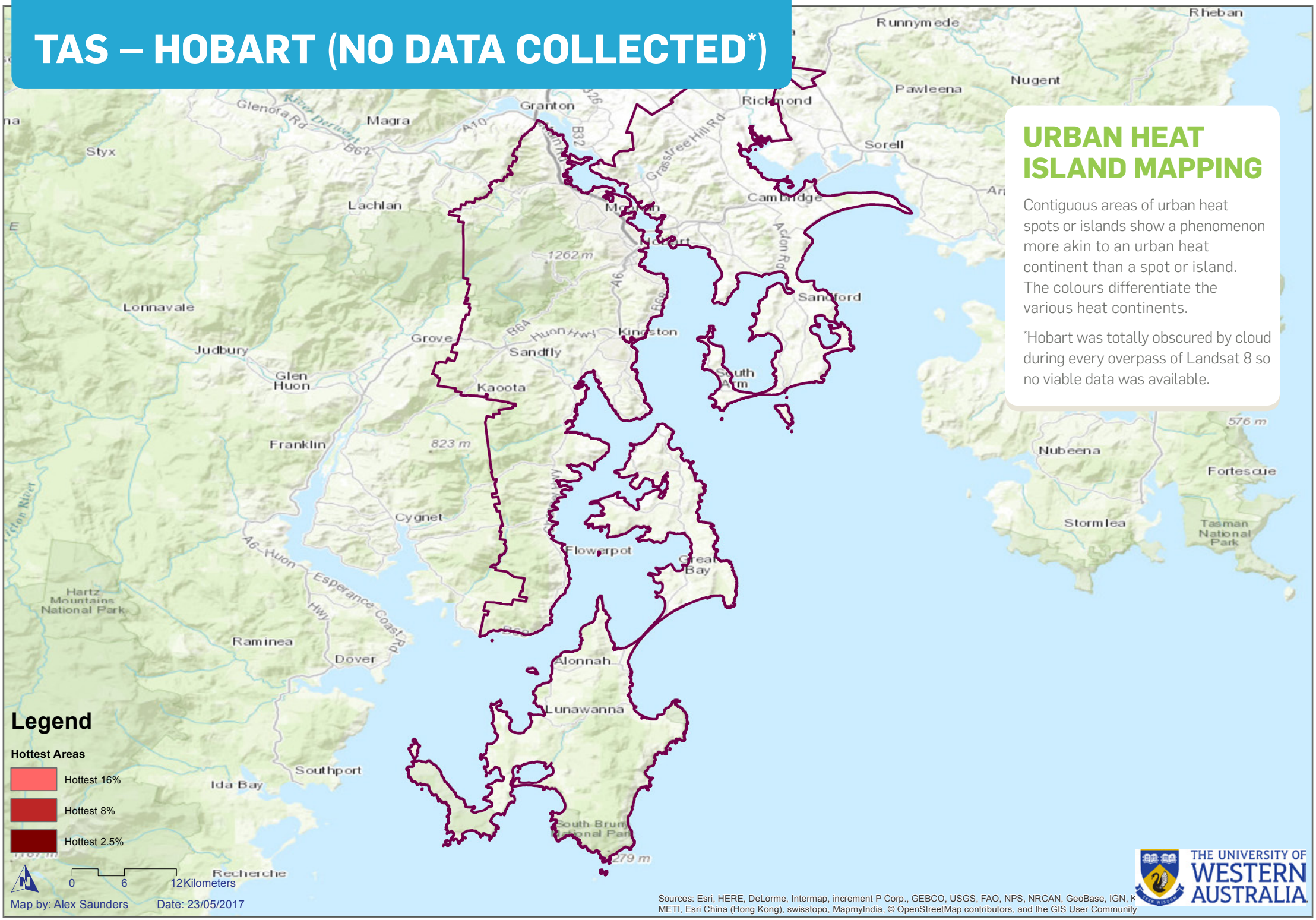
SHRUB & TREE CANOPY COVER CHANGES IN TAS LGAs 2008-2016

GREEN COVER GAIN & LOSS IN TAS LGAs 2008-2016



** From 'Benchmarking Australia's Urban Tree Canopy: An i-Tree Assessment', Final Report (2014)*

TAS – HOBART (NO DATA COLLECTED*)



URBAN HEAT ISLAND MAPPING

Contiguous areas of urban heat spots or islands show a phenomenon more akin to an urban heat continent than a spot or island. The colours differentiate the various heat continents.

*Hobart was totally obscured by cloud during every overpass of Landsat 8 so no viable data was available.

Legend

Hottest Areas

- Hottest 16%
- Hottest 8%
- Hottest 2.5%

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, K
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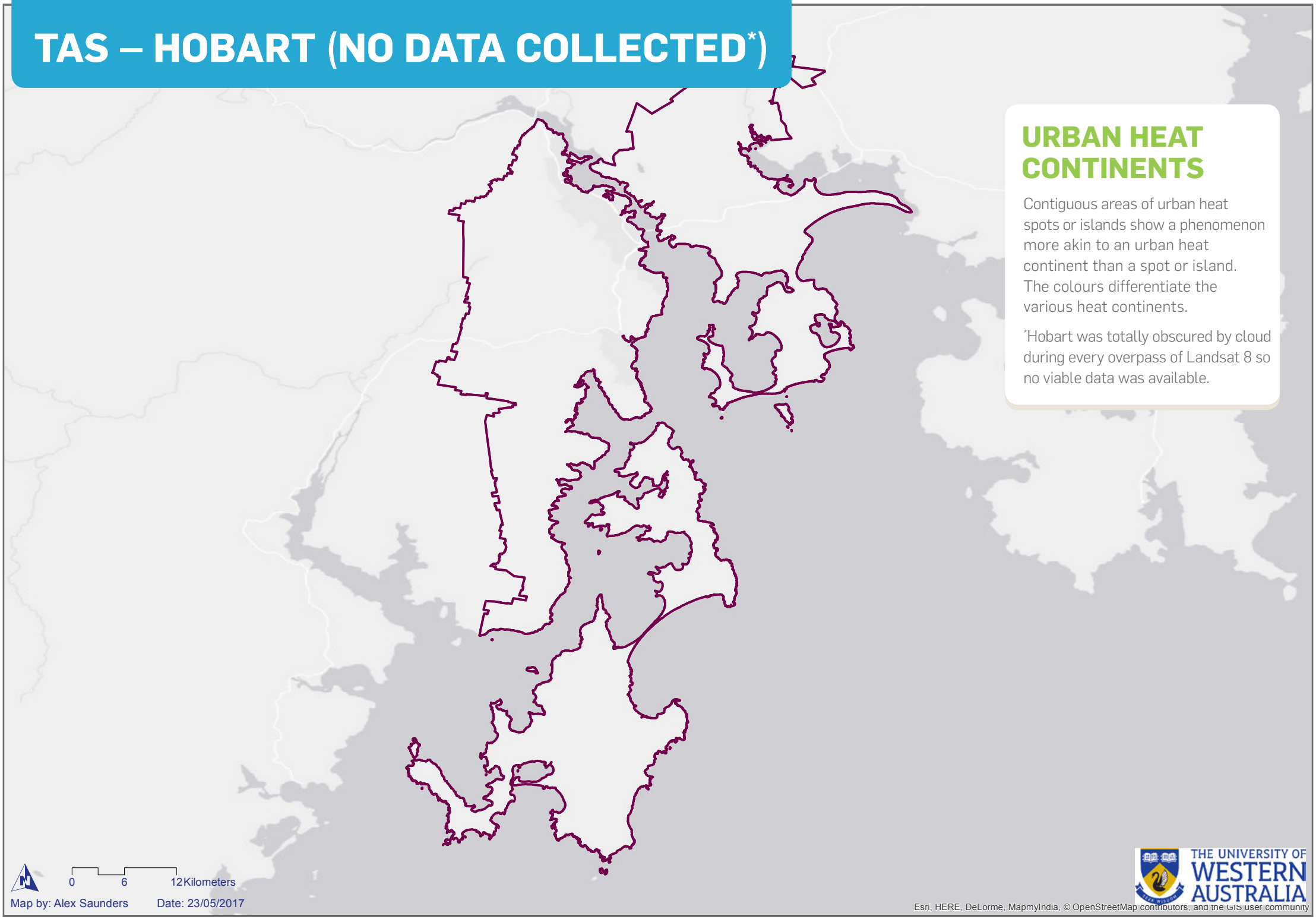

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0 6 12 Kilometers

Map by: Alex Saunders Date: 23/05/2017

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TAS – LAUNCESTON

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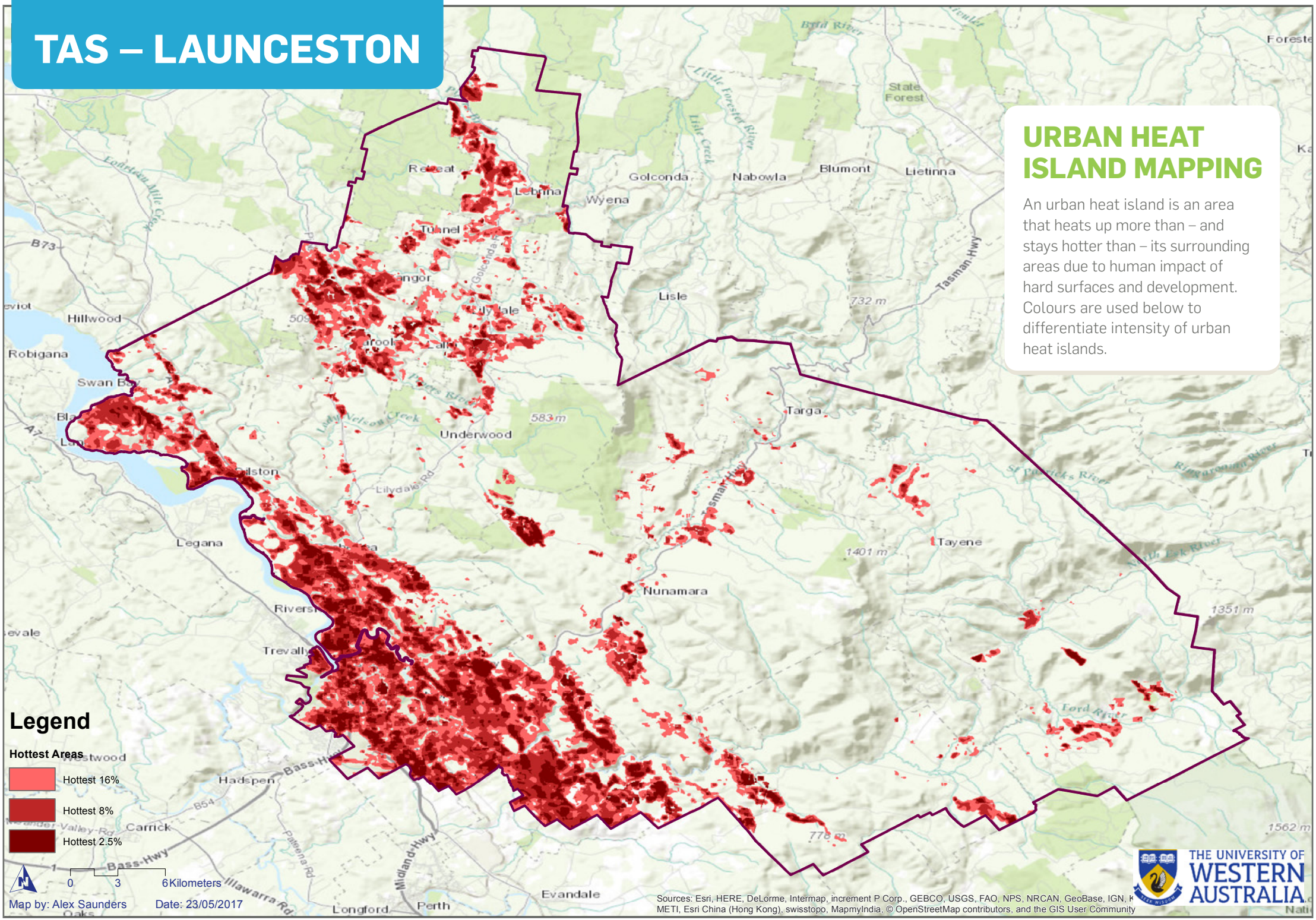
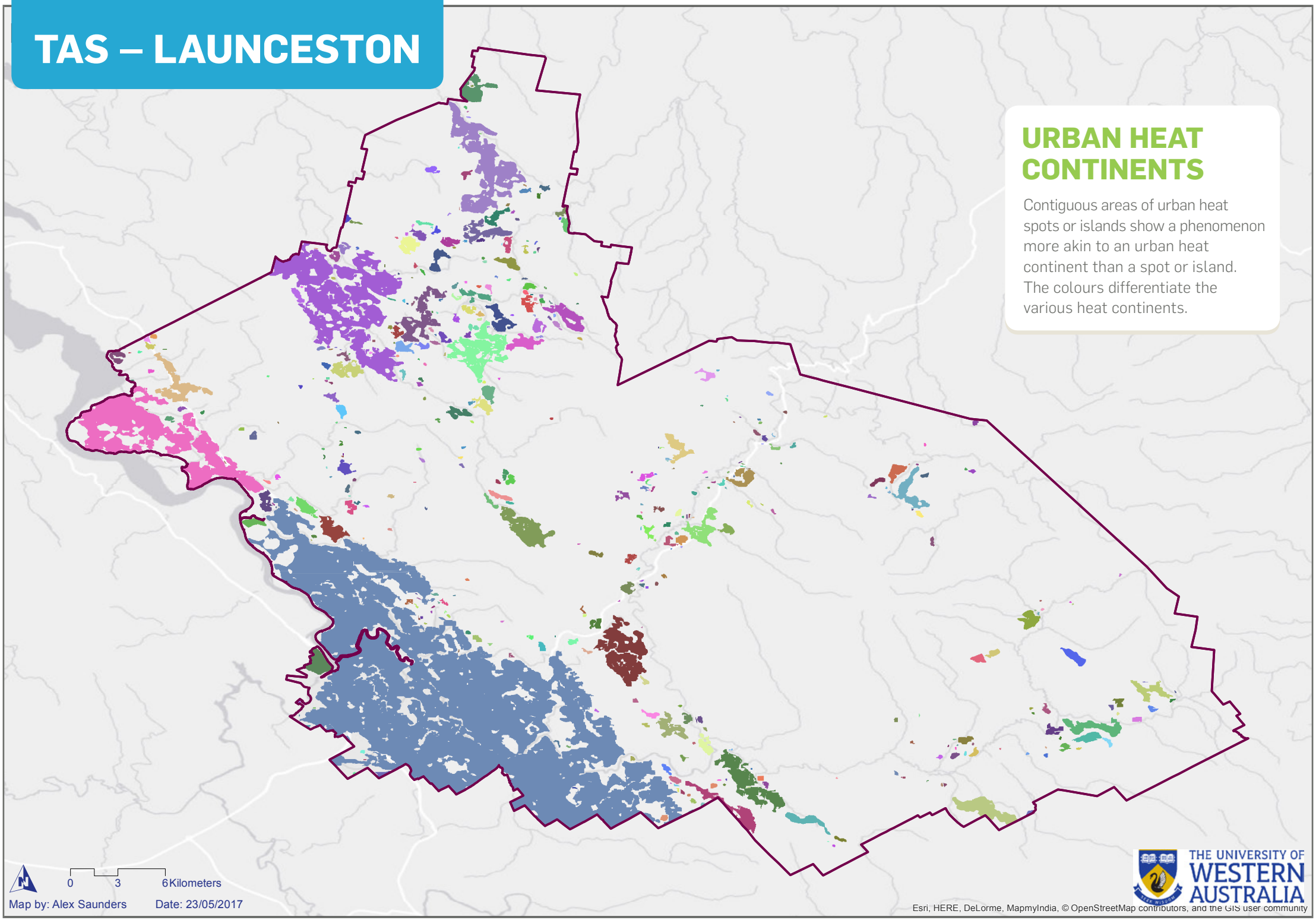


TAS – LAUNCESTON



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TAS THE GOOD NEWS

The rates of shrubbery cover in Glenorchy City Council will in time compensate for the loss of canopy, assuming that they can grow into healthy, mature trees.

Despite having some of the most vulnerable communities, the tree canopy cover on places like Launceston is much higher (44.5%) than other vulnerable communities in the country. It would appear in Tasmania that urban heat is not as much of a major issue – although the risk of bushfire with elevated temperatures may pose a threat.

Despite the 8.9% decrease in canopy in Hobart, there has been a 2.7% increase in shrubs and a 3.2% increase in grass, which in time may lead to higher levels of canopy cover.

NORTHERN TERRITORY

Darwin Waterfront

NT WHAT'S HAPPENING?

Average canopy cover for urban NT is

28.9%

up 0.85% from

28.05%

in 2009.

In the City of Palmerstone there has been a

5.5%

increase in tree canopy, whereas in the City of Darwin, there has been a

3.8%

decline in canopy.

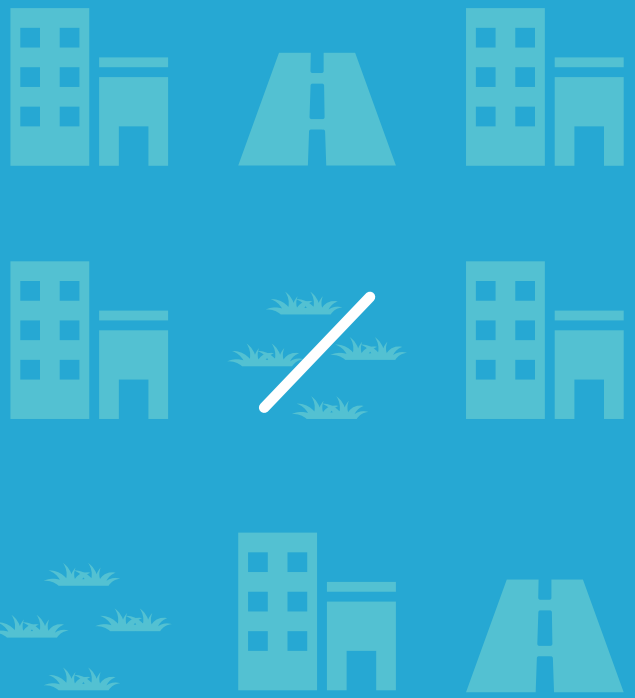
In the City of Darwin, there has been a

7.1%

increase in hard surfaces and a consequent

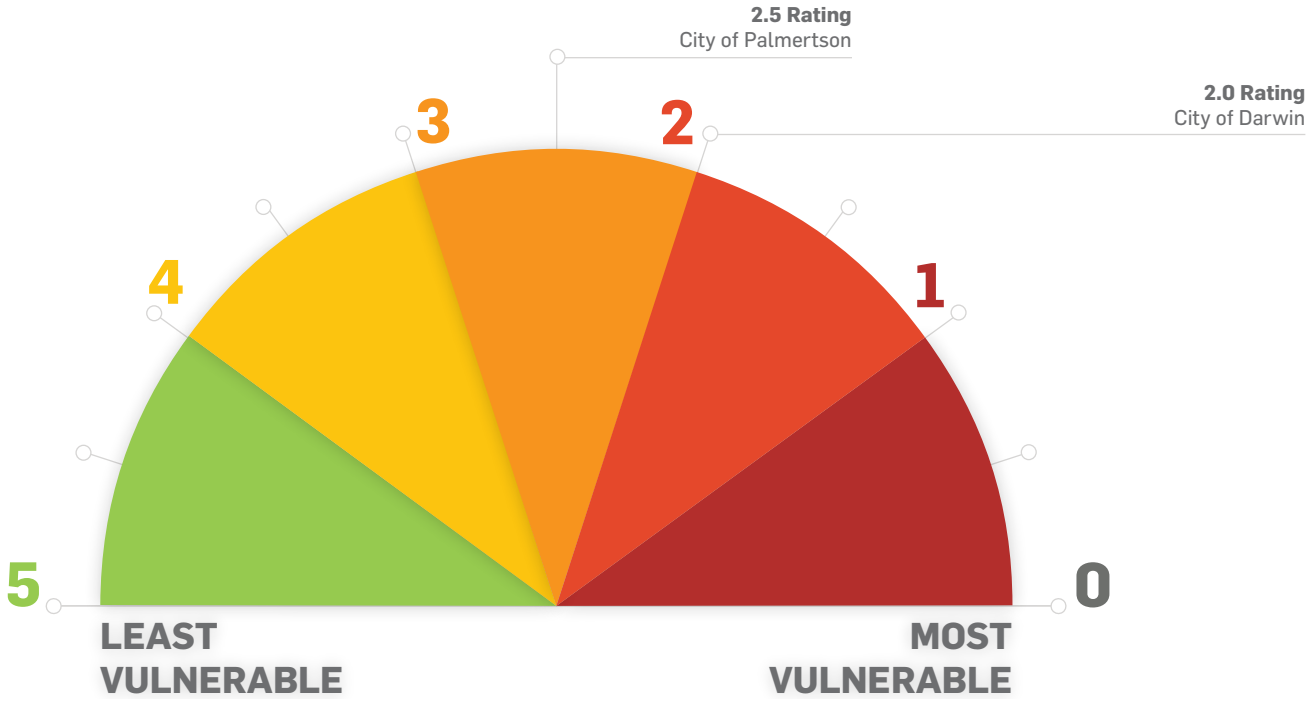
9.1%

loss in grassed areas. This may signify an overall increase in hard surface infrastructure at the cost of green spaces.



NT

THE MOST & LEAST VULNERABLE



TOP URBAN GREENING OPPORTUNITIES:

Both the City of Darwin and the City of Palmerston, the only two urban parts of the Northern Territory, would benefit from urban greening.

NT SNAPSHOT

THE GREEN KEY

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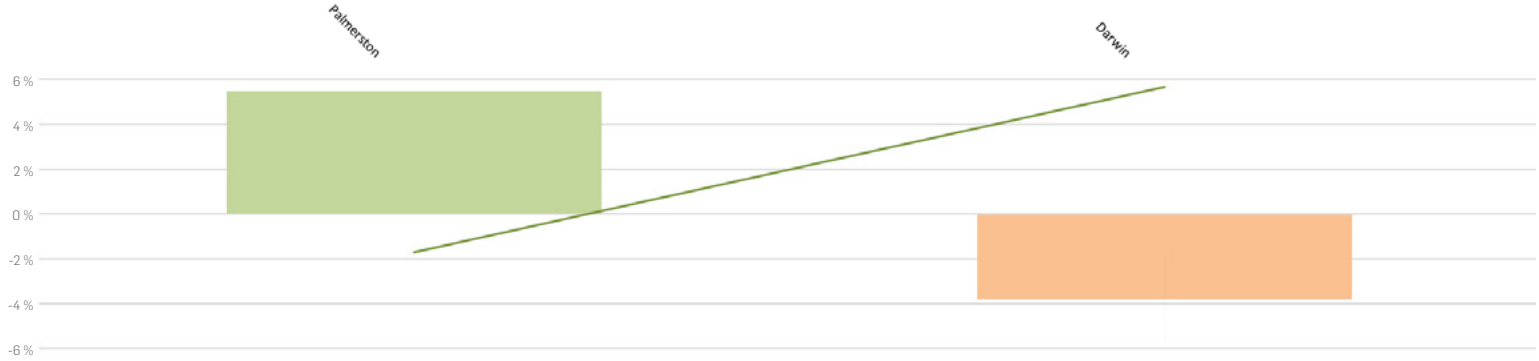
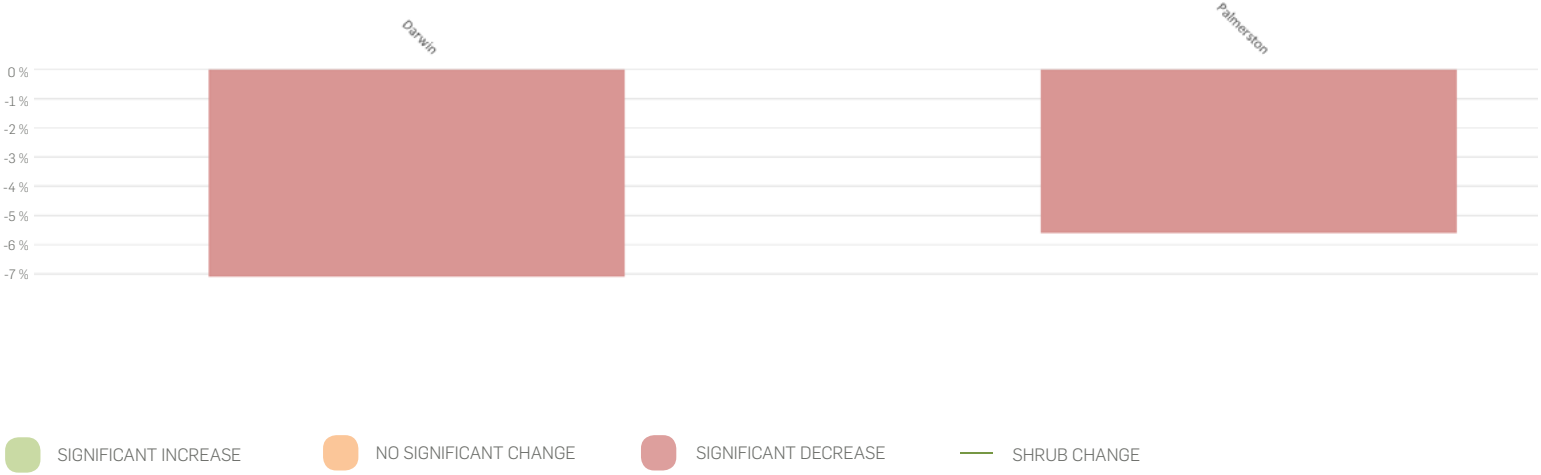
KEY STATISTICS	2009*	2016	
Tree Canopy Cover	28.05%	28.9%	0.85% Gain
Shrub Cover	8.91%	10.9%	2% Gain
Grass Cover	44.95%	35.7%	9.25% Loss
Hard Surface	18.05%	24.4%	6.35% Increase

SHRUB & TREE CANOPY COVER CHANGES IN NT LGAs 2009-2016



GREEN COVER GAIN & LOSS IN NT LGAs 2009-2016



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NT – DARWIN

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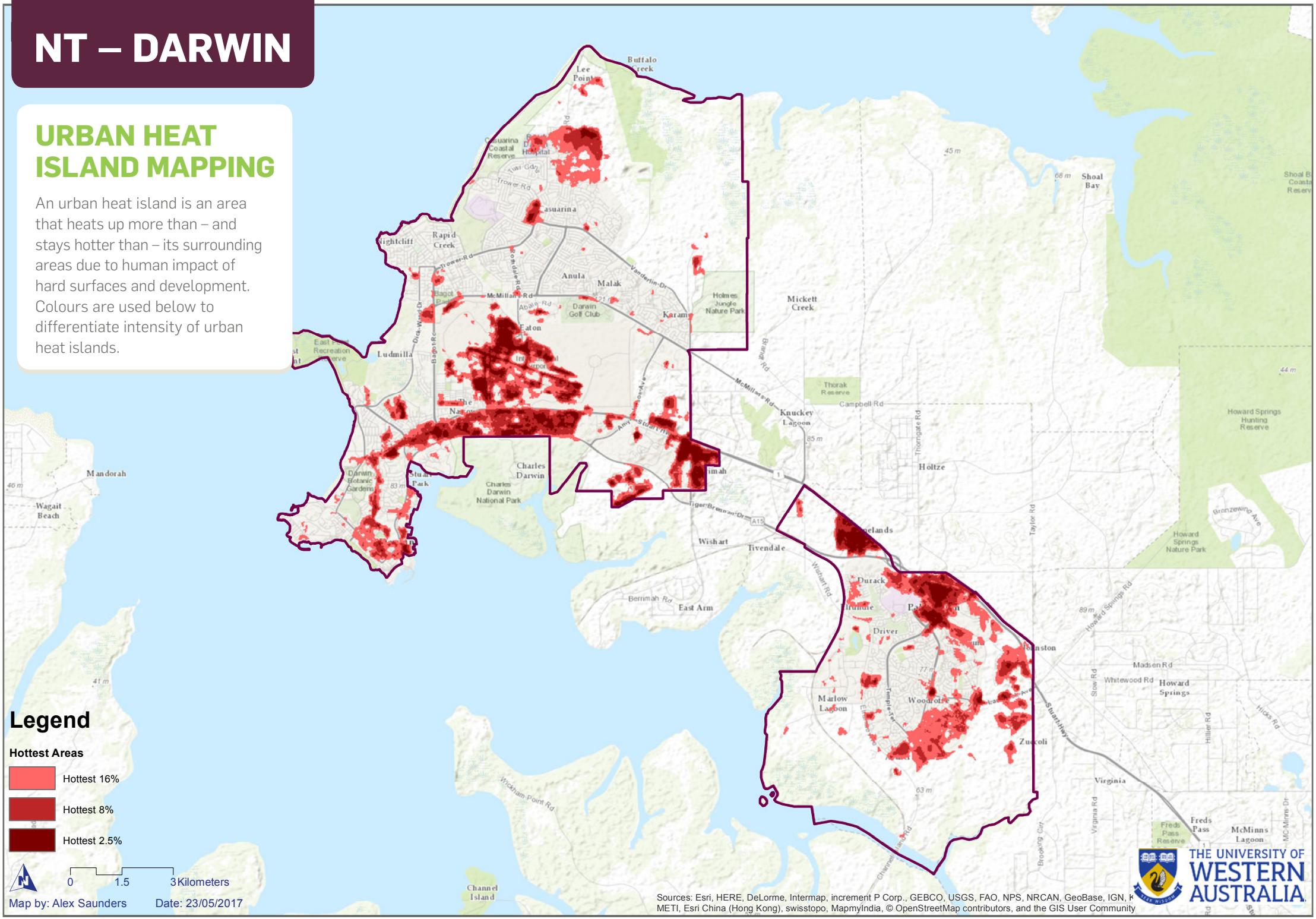

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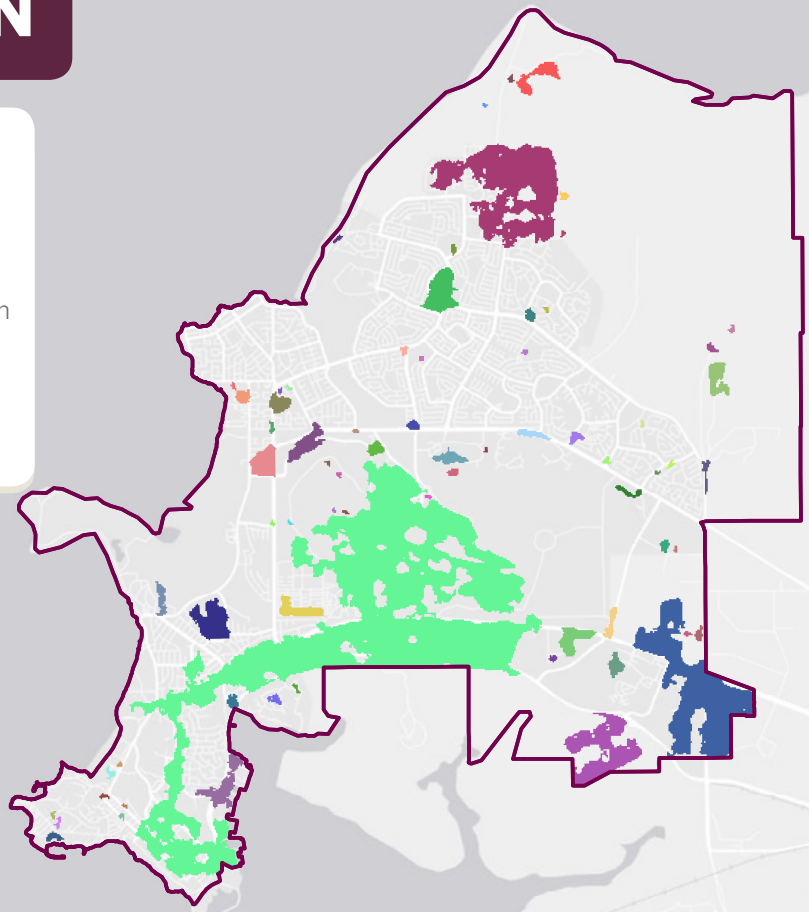

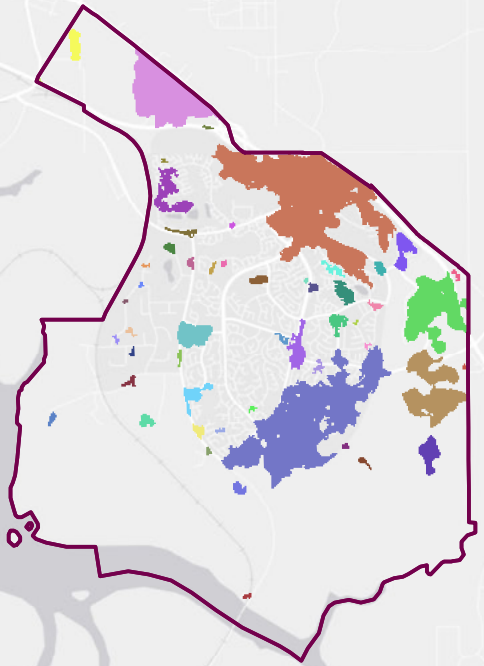

0 1.5 3 Kilometers

Map by: Alex Saunders Date: 23/05/2017

THE UNIVERSITY OF WESTERN AUSTRALIA

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NT THE GOOD NEWS

Despite the 3.8% decline in canopy in the City of Darwin, there has been a 5.69% increase in shrubbery, which according to trends elsewhere in the country, would suggest an increase in canopy over time.

In the City of Palmerston, the 5.6% increase in hard spaces has been balanced out by an almost equivalent increase in canopy cover.

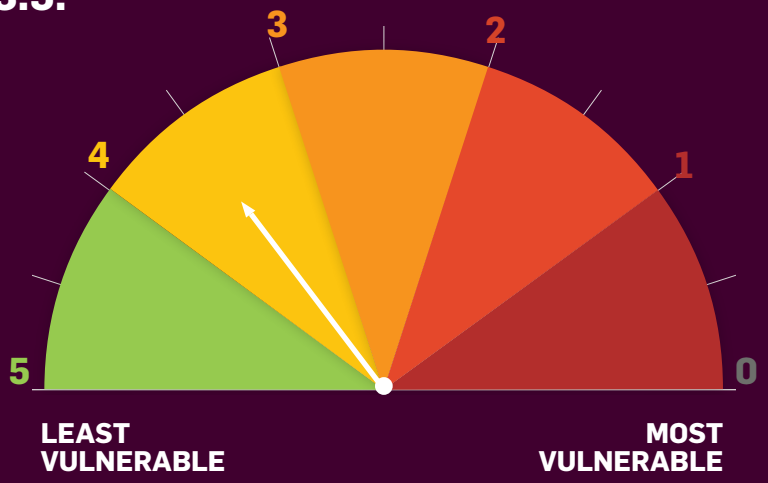
THE AUSTRALIAN CAPITAL TERRITORY

Canberra Nara Peace Park

ACT WHAT'S HAPPENING?

Given that the ACT does not have delineated local government areas, the vulnerability indexation has occurred as an overall measure of the territory and

IS RATED AT THE LEAST VULNERABLE END OF THE SCALE AT 3.5.



The ACT has very high canopy coverage overall, however like in other places with high levels of canopy cover it is declining at a very high rate. In the ACT there has

BEEN A 10.7% CANOPY LOSS SINCE 2008.

ACT SNAPSHOT

THE GREEN KEY

In technical terms, a tree is a plant over six metres, while a shrub is under six metres. However, for an accurate comparison to our previous mapping report, 'Where are all the trees?', we have used the following definitions:

Trees
Anything that looks like a tree from above, distinguished from shrubs by the shadows cast.

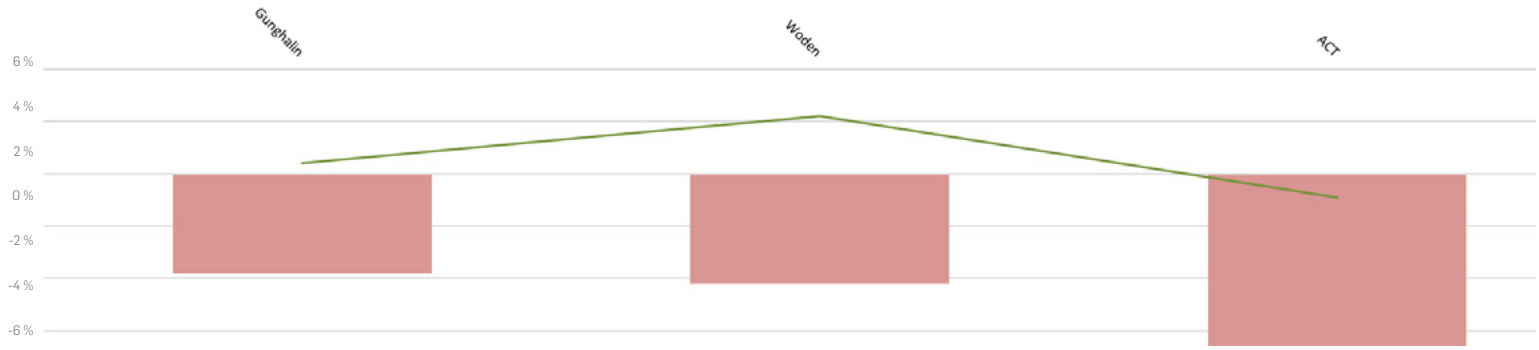
Shrub
Landscaped vegetation as well as bushland shrubs, crops and grapevines.

Grass
Cleared road sides, lawns, pastures, sites cleared for development and sporting grounds.

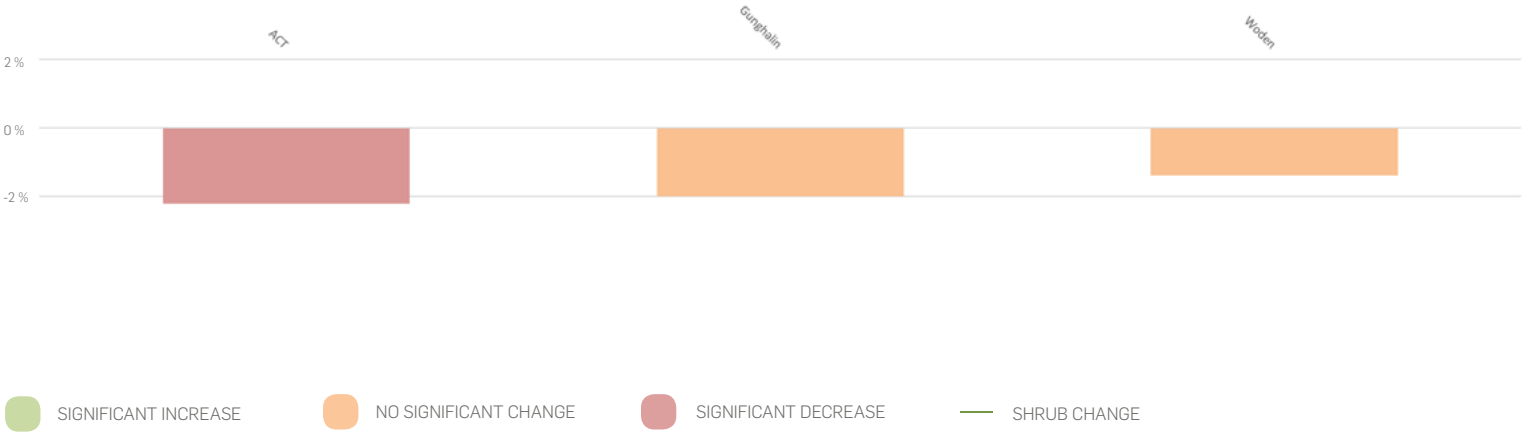
Hard surfaces
Asphalt, buildings, car parks, footpaths, sandy beaches, train lines, rocky coastlines and water.

KEY STATISTICS	2008*	2016	
Tree Canopy Cover	56.3%	45.6%	10.7% Loss
Shrub Cover	5.4%	4.5%	0.9% Loss
Grass Cover	33.1%	42.5%	9.4% Gain
Hard Surface	5.2%	7.4%	2.2% Increase

SHRUB & TREE CANOPY COVER CHANGES IN ACT LGAs 2008-2016



GREEN COVER GAIN & LOSS IN ACT LGAs 2008-2016

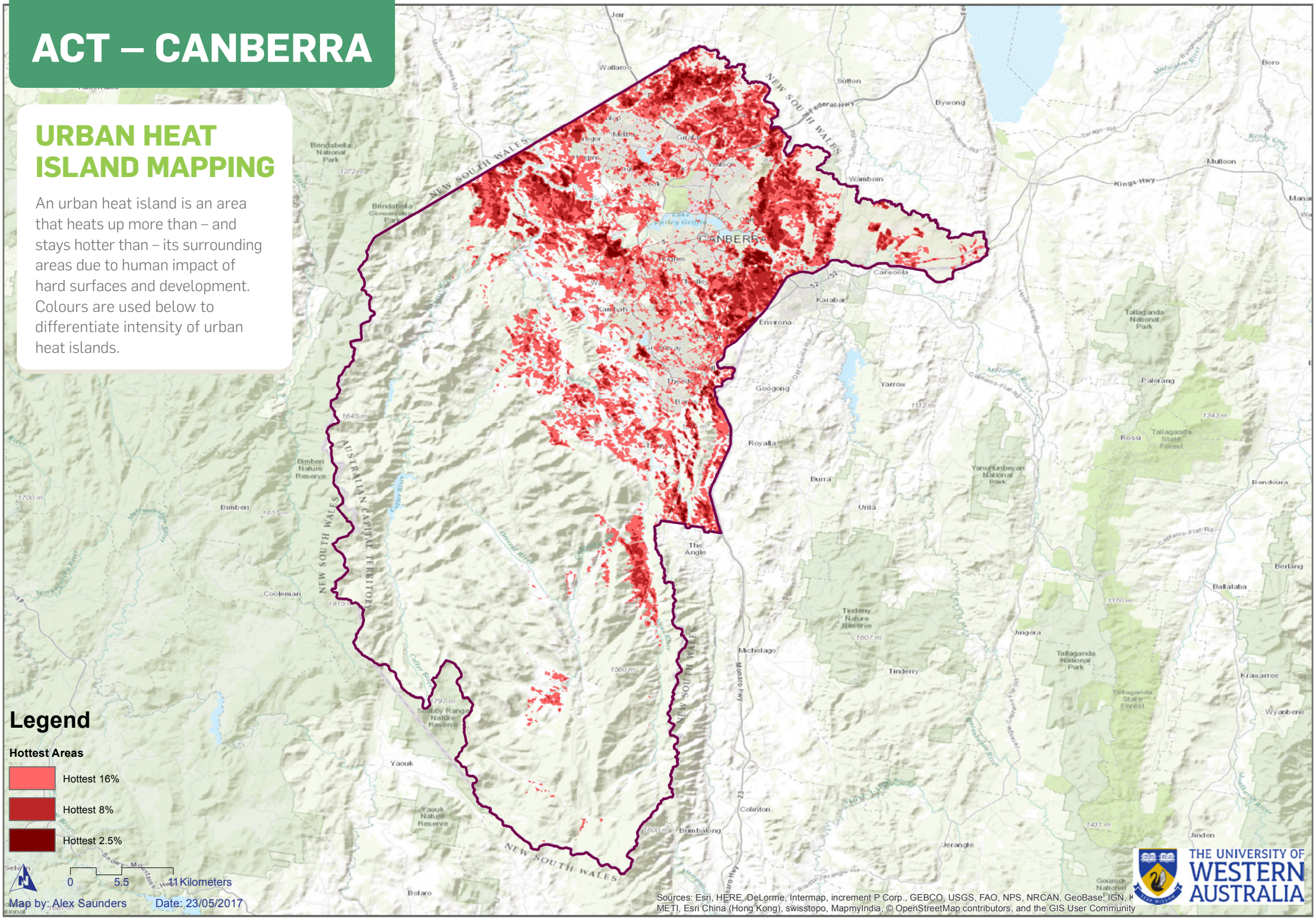


** From 'Benchmarking Australia's Urban Tree Canopy: An i-Tree Assessment', Final Report (2014)*

ACT – CANBERRA

URBAN HEAT ISLAND MAPPING

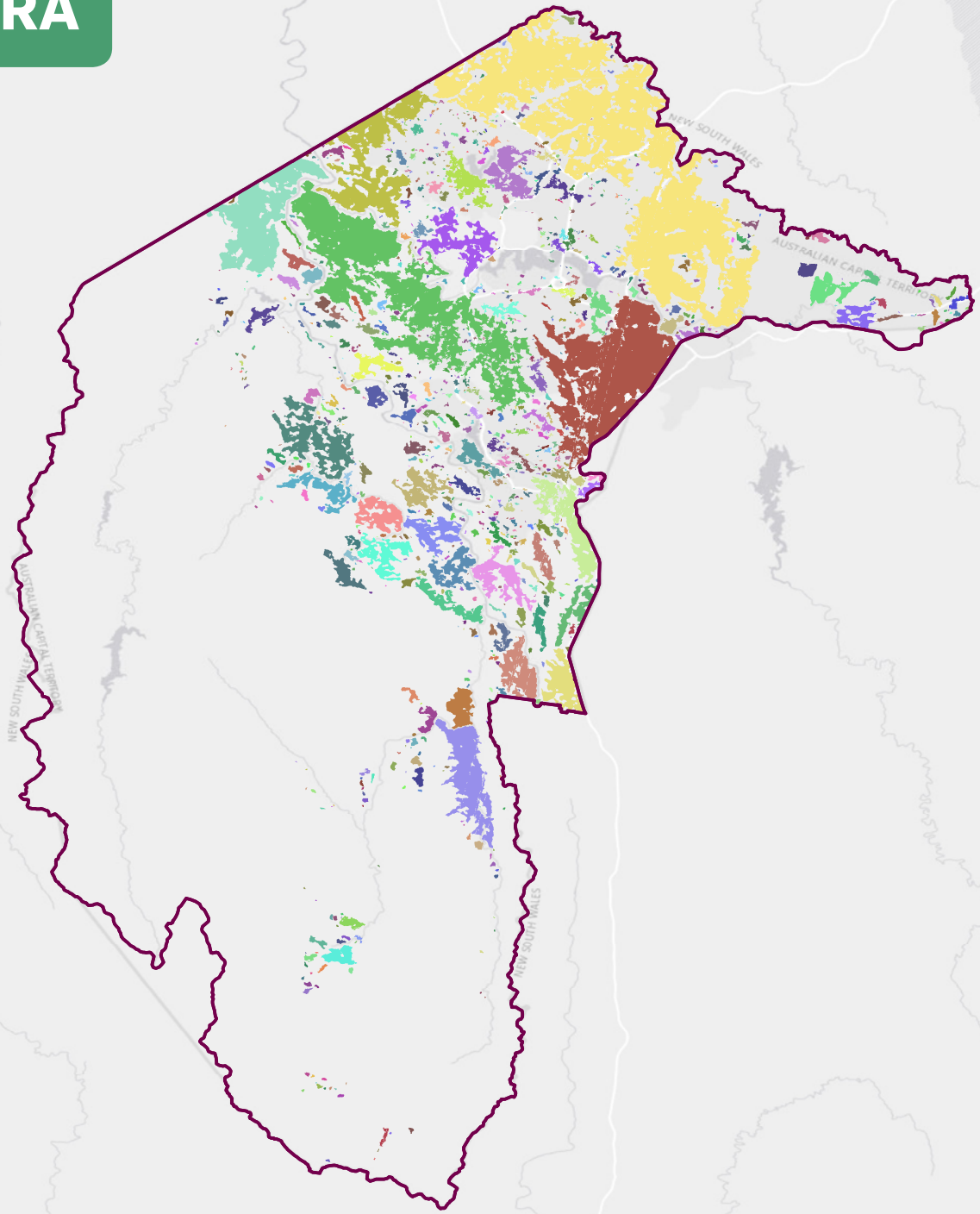
An urban heat island is an area that heats up more than – and stays hotter than – its surrounding areas due to human impact of hard surfaces and development. Colours are used below to differentiate intensity of urban heat islands.



ACT – CANBERRA

URBAN HEAT CONTINENTS

Contiguous areas of urban heat spots or islands show a phenomenon more akin to an urban heat continent than a spot or island. The colours differentiate the various heat continents.



0 5.5 11 Kilometers

Map by: Alex Saunders Date: 23/05/2017

THE UNIVERSITY OF WESTERN AUSTRALIA

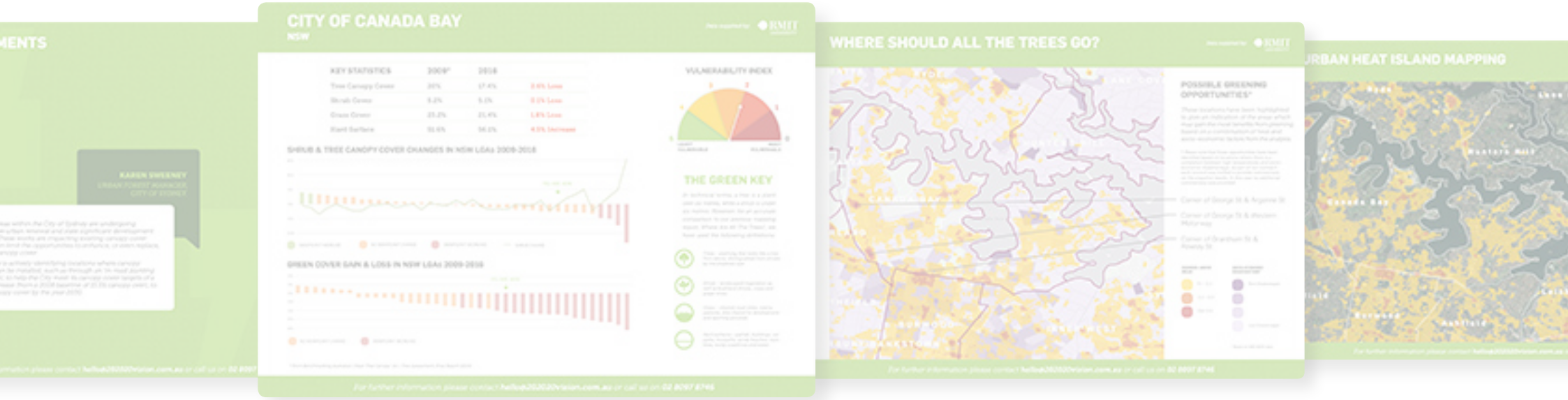
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

ACT THE GOOD NEWS

Hard surfaces have only increased by 2.2% overall, whereas grassed areas have increased by 9.4%. It is unclear as to whether the increase of grassed surfaces has come at the cost of canopy. However it would appear so given the close correlation of numbers –
9.4% increase in grass and 10.7% loss in canopy.

NEED MORE DETAIL?

AN INDIVIDUAL SNAPSHOT IS AVAILABLE FOR YOUR LGA ON REQUEST.



Contact hello@202020vision.com.au to request yours.

METHODOLOGY
AT A GLANCE

155,436 km²
of urban area has been measured.

=

0.8%
of Australia's land mass.

More than of population live within the LGAS assessed.

researchers on the team.

139
LGAs assessed

LGA's per state		
19 *SA*	**01** *ACT*	
02 *NT*	**34** *VIC*	**05** *TAS*
29 *WA*	**10** *QLD*	**39** *NSW*

random points samples taken in each LGA.

Royal Botanic Gardens, Melbourne

THE VULNERABILITY INDEX

Where should all the trees go? In simple terms, where they can create the greatest health, cooling and liveability benefit to urban communities.

To determine where trees and plants will have the most benefit, the researchers at RMIT developed the VHHEDA Vulnerability Index.

The Index brings together three factors to paint a holistic, numerical rating of an area's vulnerability:

1. CHANGES IN TREE CANOPY

over time using i-Tree canopy analysis.

2. URBAN HEAT

to identify hotspots and patches.

3. SOCIO-DEMOGRAPHIC INDICATORS

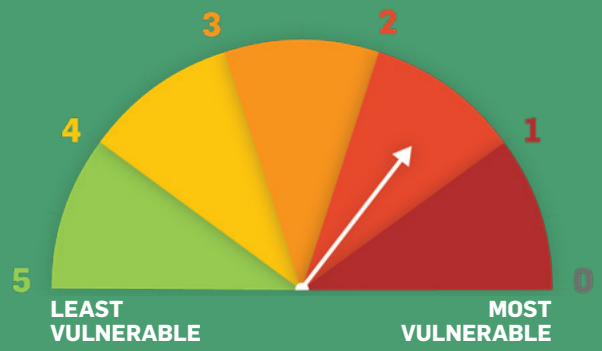
including self-assessed health, diabetes, the age of the population and economic situation.

Once the Index was established for each LGA, The 202020 Vision team surveyed a representative from each Local Government to provide available additional information and data to better understand the results.

The combination of mapping and local council insight then enabled us to understand where the biggest economic, social, health, cooling and ecological gains might be made through the investment in more and better urban green spaces.

THE VHHEDA INDEX:

Vulnerability to **H**eat, poor **H**ealth, **E**conomic **D**isadvantage and **A**ccess to green spaces.



The Index provides a simple benchmark to identify trends, areas of concern and where gains might best be made.

It is intended to help inform local, metropolitan and state decisions and investment in urban green space.

WANT ALL THE RESEARCH DETAILS?

Access the full report online at
202020vision.com.au/research

MEASURING CHANGES IN TREE CANOPY:

Given that data to create an urban canopy benchmark happened in 2013 ('*Where are all the Trees?*') the research team used the same methodology to understand how things had changed over time – this ensured an 'apples with apples' comparison.

When it comes to measuring tree canopy cover and other land uses there are a range of tools that can be used. The reason our researchers chose i-Tree was because they believed it to be robust, cost effective and its limitations are well understood. [3] [4]

THE PROCESS:

1

Researchers used Nearmap aerial images for each LGA because they offer much better clarity than Google Maps.

2

Images used were taken during summer to ensure that maximum leaf coverage was captured.

3

1,000 random points were generated and scattered throughout the LGA boundary.

4

Analysts within the team were trained to use i-Tree to interpret and obtain reliable data from the maps.

5

The analysts' job was to identify each of the 1,000 random point samples within each LGA as either a tree, shrub, bare ground/ grass or hard surface – the same categories that were used in the 2013 report.

6

Then, big deviations were checked again by different analysts. The standard errors were calculated and used to identify which changes were significant to 95% certainty.

WHAT TYPES OF SURFACES WERE WE LOOKING FOR?

Tree *– anything that looks like a tree from above, distinguished from shrubs by the shadows cast.*

Shrub *– landscaped vegetation as well as bushland shrubs, crops and grapevines.*

Grass *– cleared road sides, lawns, pastures, sites cleared for development and sporting grounds.*

Hard surface *– asphalt, buildings, car parks, footpaths, sandy beaches, train lines, rocky coastlines and water.*

3. Parmehr EG, Amati M, Taylor EJ and Livesley SJ (2016) Estimation of urban tree canopy cover using random point sampling and remote sensing methods, Urban Forest Urban Greening, 20, 160-171.

4. Kaspar, J Kendal, D Sore, R and Livesley, SJ (2017) Random point sampling to detect gain and loss in tree canopy cover in response to urban densification, Urban Forest Urban Greening, 24, 26-34.

MEASURING URBAN HEAT

Generating heat maps for specific regions requires stitching a range of individual datasets and equations together. The most important thing is to be able to measure the difference in temperature between an urbanised and a non-urbanised area.

To measure urban heat, researchers calculated a temperature gradient that took into account not only the heat differences in urbanised areas, but also the contribution of forest boundaries, high slopes, elevation and distances from the coast as factors that contribute to urban heat.

Researchers also took into account that in different places the temperature range varies considerably, for example, in the tropics, temperature might only oscillate between 28 – 35 degrees, whereas down south, temperatures can range from between 0 – 40 degrees.

THE PROCESS

If you are really keen to get into the nitty gritty of the methodology, you should go and check out page 7 of the *RMIT* report[5], but if you're just after the 'gist', the main things you need to know are that:

Our study window was October 2015 – April 2016, during this time a satellite called Landsat 8 passed over each location taking high resolution thermal images every 16 days.

These images were processed in a way that took into account thermal infrared data, atmospheric water vapour and reflections, and came up with an average temperature range.

The images and the layers of data were stitched together to provide a composite map of temperature with those temperatures that deviate considerably from the vegetated areas identified as heat spots.

5. Amati, M. Boruff, B. Caccetta, P. Devereux, D. Kaspar, J. Phelan K. and Saunders, A. (2017) 'Where should all the trees go?' Investigating the impact of tree canopy cover on socio-economic status and wellbeing in LGA's prepared for Hort Innovation by the Centre for Urban Research, RMIT University

Hyde Park, Perth

THE URBAN HEAT CONTINENT:

The conventional academic wisdom defines a Heat Island as the difference in temperature of an urbanised area compared to a geographically-equivalent non-urbanised baseline.

As most of us trying to sleep on a hot summer night will agree, the Heat Island effect is most pronounced once the sun goes down. Urban areas take longer to cool down compared to surrounding rural areas. This is because the built form (buildings, roads, bridges etc.) in cities and urban areas store more heat than green spaces. Urban areas also produce heat through air conditioning and wind speed is slower, which again means that cooling takes longer. In contrast, tree canopies produce shade which reduces the amount of solar radiation that hard surfaces receive and absorb.

The heat mapping indicated that there are large temperature fluctuations within Australian cities where a hotspot can be understood as approximately 10 degrees Celsius warmer than the norm. These hotspots can cover large areas of the city, and are found to be associated with areas of socio-economic disadvantage.

While many people are familiar with the concept of urban heat 'spots' or 'islands' to describe urban heat throughout summer, the largely uninterrupted and contiguous heat patches shown by this research, shows that large areas of metropolitan areas are covered by a single hotspot that it mire akin to a heat continent than a heat island.

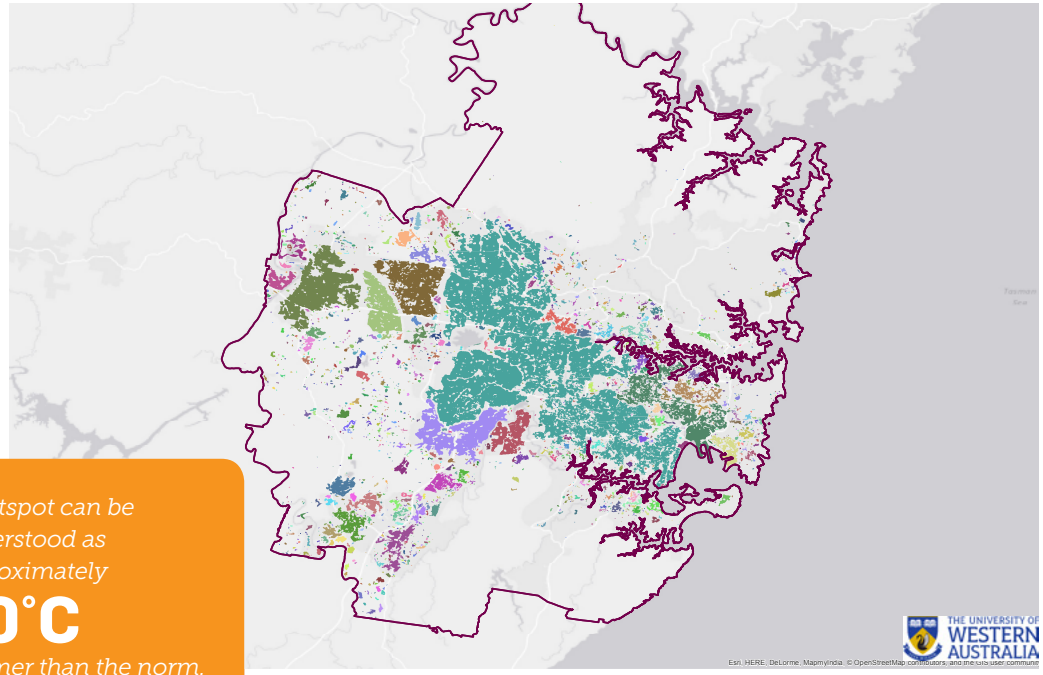
In contrast, cooler parts of Melbourne and Sydney tend to be located within proximity to national parks and socio-economic affluence as measured by the SEIFA Index. Melbourne's eastern areas are generally cooler than those in the West. In Sydney, the upper North Shore is cooler compared to areas to the South and West. Even in highly urbanised contexts, river corridors and large areas of green space such as golf courses have clear cooling effects on heat patterns. This highlights the importance of corridors of native bush, in both urban and rural areas.

6. Amati, M. Boruff, B. Caccetta, P. Devereux, D. Kaspar, J. Phelan K. and Saunders, A. (2017) 'Where should all the trees go?' Investigating the impact of tree canopy cover on socio-economic status and wellbeing in LGA's prepared for Hort Innovation by the Centre for Urban Research, RMIT University.

"A key task for strategic planning of green infrastructure in large metropolitan areas will be to invest resources in planting corridors and attempting to break up patches of high heat anomalies. These large patches form a stable area of heat in a city and may resist mitigating effects of wind when compared to smaller patches. Some areas of extreme heat anomalies exist in areas of relative socio-economic disadvantage, for example in Sydney's West." [6]

- Dr Peter Cacceta, CSIRO Data 61

This map shows that in Australian cities a single patch of heat island (or 'continent') can occupy large areas of the city.



Contiguous areas of Urban Heat Island in Sydney coloured differently for each contiguous area.

A hotspot can be understood as approximately
10°C
warmer than the norm.

MEASURING THE RISK & VULNERABILITY BASED ON PEOPLES' HEALTH, AGE & ECONOMIC SITUATION

One of the major barriers encountered by researchers was the availability of social and economic datasets.

While all of the canopy and heat measurements were made in 2016, the socio-economic data it is compared to comes from the 2011 Census – the only census information available at the time of the research.

One of the other things researchers were very careful to consider was the extent to which they could draw statistical conclusions. This was due to the availability of socio-economic and health data that was quite detailed – down to a street level, and canopy mapping data being taken at the broader LGA level.

To overcome these limitations the research team developed the VHHEDA Index. The purpose of the Index was to rank LGAs across Australia in a way that could be used by decision-makers to reach conclusions about the vulnerability of their residents. The Index is a relative estimate of risk as opposed to an absolute measurement.

THE PROCESS BEHIND THE VHHEDA INDEX:

A range of datasets were combined and overlaid so that researchers were able to gain a sense of which LGAs were most vulnerable. For example, a specific LGA may have lost a great deal of canopy and have heat spots, but if the population was wealthy enough to be able to move to another area, they would be rated as less vulnerable. In contrast, a LGA that was really hot, had undergone relatively little canopy loss (but the overall percentage was low) but whose population had limited economic choices, would be rated as much more vulnerable.

To that end, the VHHEDA Index was based on the following:

Population of under 5s and over 65s who live alone.

The percentage of canopy the LGA had versus the percentage of hotspots.

Peoples' self-assed health compared to actual incidences of diabetes (Health ASR 100).

Socio-Economic Indexes for Areas (SEIFA) Index of Relative Socio-Economic Disadvantage versus SEIFA Index of Economic Resources – how much money people had which included assets they had.

The rate at which canopy had increased/decreased as a percentage versus the overall percentage of canopy cover (so, how many trees you had lost/gain as a proportion of how many you had to begin with, so if an LGA began with lots of trees and lost a fair amount, that would be indexed differently to an LGA that had few to begin with and lost a similar amount).

All of these factors were combined and then divided into a five-point scale.

RESEARCH LIMITATIONS

- The research methodology was based on i-Tree which is a sample-based study. A sample approach is relatively cheap and useful for a benchmarking exercise. It doesn't tell you where all the trees are at a scale less than the LGA.
- Many of the metropolitan LGAs that were studied contain national parks. Trees and shrubs are subject to dieback and leave new opportunities for new vegetation to grow.
- There is a natural exchange between tree canopy cover and shrubs. In LGAs where there has been a significant loss in tree canopy over a five-year period (2009- 2016) these losses are offset by gains in shrub cover (which would also include saplings) during the same period.
- Bushfire or drought can reduce tree canopy but allow shrubs or juvenile trees to take their place.
- Our team members are only human, so there is an unavoidable chance that some misclassification of a tree as a shrub may have occurred.

Rocks Riverside Park

BENCHMARKING FOR URBAN GREENING

The project reaffirms that i-Tree is a useful methodology for measuring and monitoring urban green space, but it isn't without its limitations – namely, the ability to understand what is happening with green space at the street level.

For future consideration, researchers suggest:

- If you're going to use tree canopy levels as a benchmark for urban greening, you also need to consider shrubbery.
- Benchmarking has to happen at the sub-LGA level so that we can go beyond understanding canopy cover as a percentage of an LGA and instead consider what's happening at a street level – you would have more detailed and accurate comparisons if heat and socio-economic data was taken at this more detailed level.
- It is possible to benchmark not only canopy but also urban heat island for Australian cities.

UNDERSTANDING URBAN HEAT

The study shows that it is possible to capture Landsat 8 images and understand urban heat. Researchers say that it would be quite possible and relatively cost-effective to collect this data at regular intervals as opposed to LGAs having to pay significant amounts of money for aerial heat photography.

The resolution of the photography also means that it is possible to identify the location of heat sources and potentially identify possible greening locations such as large areas of railway land, roads and alongside major highways.

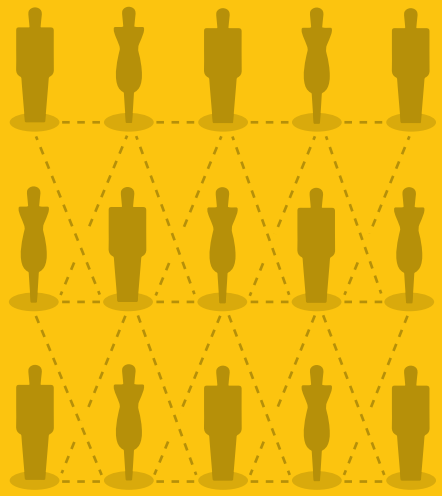
Kings Park, Perth

WHAT IS THE 202020 VISION?

The 202020 Vision is a mass collaboration of organisations working together to create 20% more and better green space in urban areas in Australia by 2020.

Since 2013, it has grown into a network of more than 400 member organisations and individuals and collaborated on a range of projects that provide the tools, resources and networks necessary to achieve this common vision.

The 202020 Vision is commissioned by Hort Innovation for the Australian nursery industry using levy contributions.



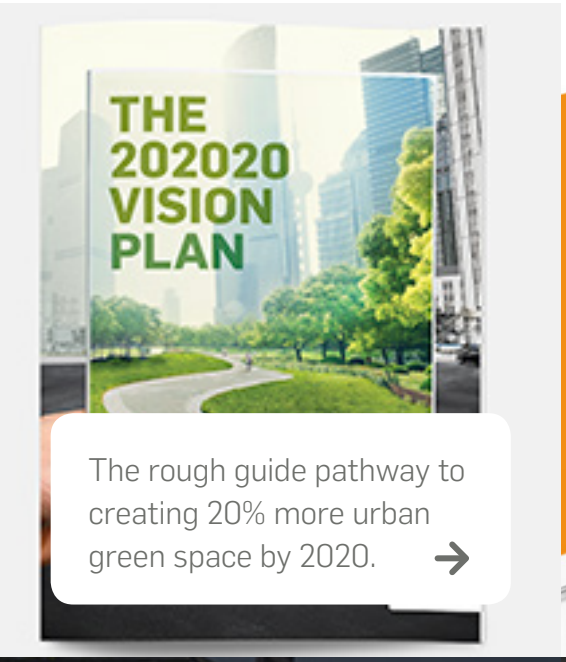
More than
7,000
collaborators, the world's biggest network of green space advocates.

408
organisational network members

More than **68**
topic experts

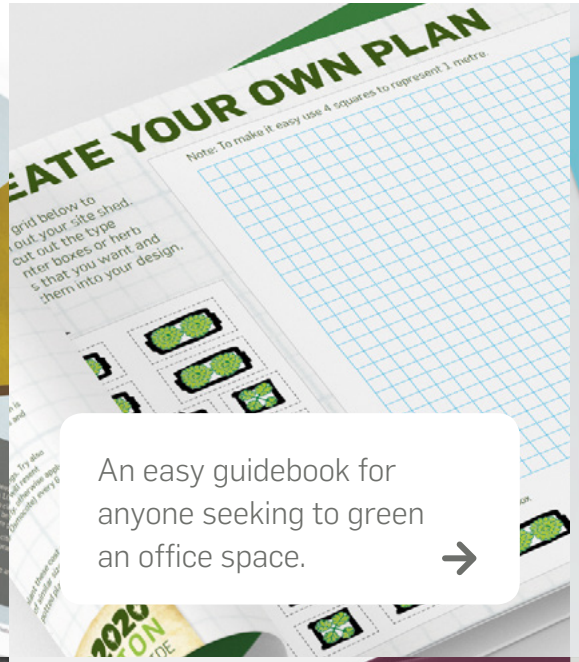
ALSO FROM THE 202020 VISION

All available at **greenerspacesbetterplaces.com.au**



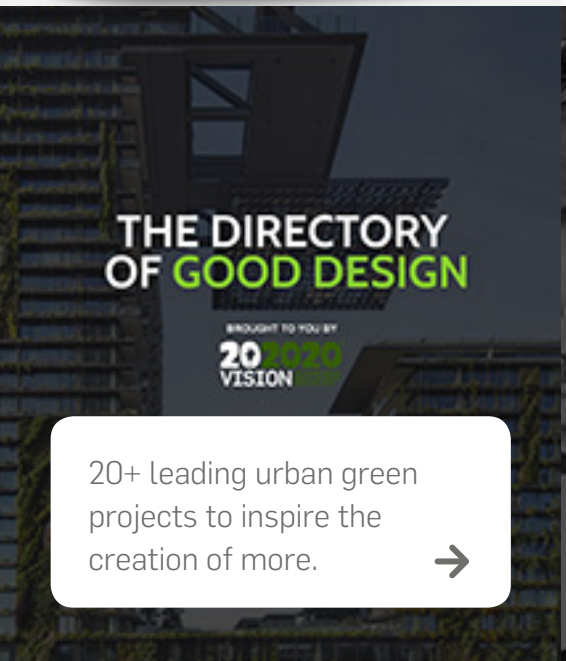
The rough guide pathway to creating 20% more urban green space by 2020.

Australia's first national benchmark of urban canopy cover.

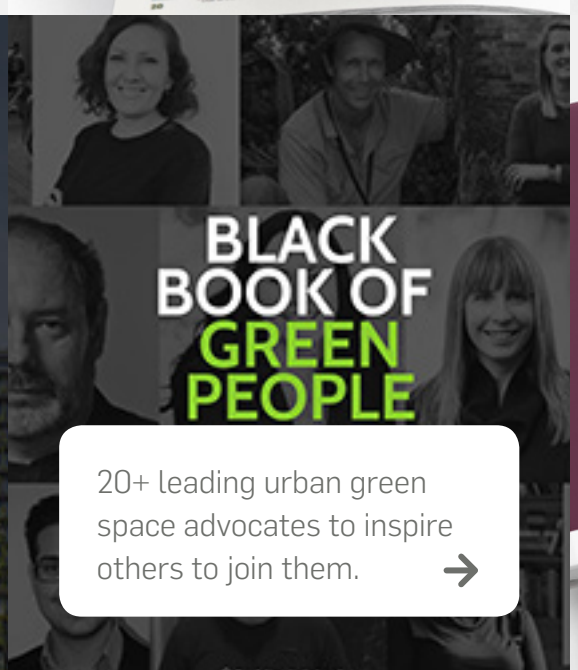


An easy guidebook for anyone seeking to green an office space.

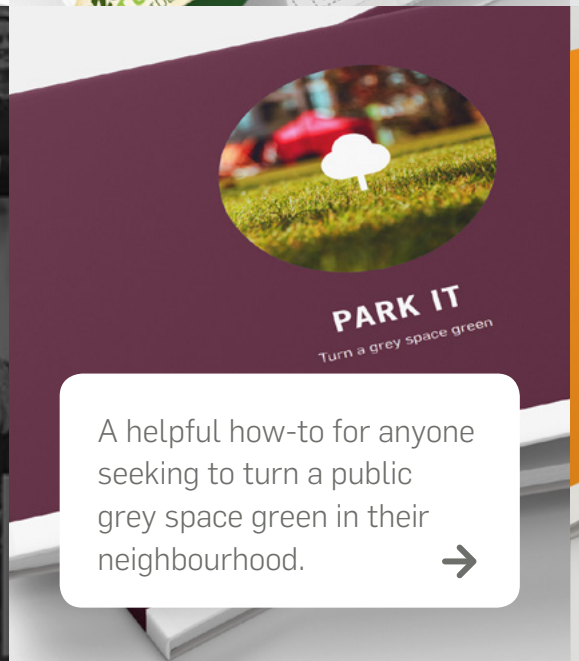
The definitive step-by-step guide to establishing an urban forest strategy.



20+ leading urban green projects to inspire the creation of more.



20+ leading urban green space advocates to inspire others to join them.



A helpful how-to for anyone seeking to turn a public grey space green in their neighbourhood.

A discussion guide to make it easier for green space people and engineers to work together in creating better public spaces.

GREENER SPACES BETTER PLACES™

WANT TO KNOW MORE?

greenerspacesbetterplaces.com.au