Water Sensitive Cities Scenario Tool

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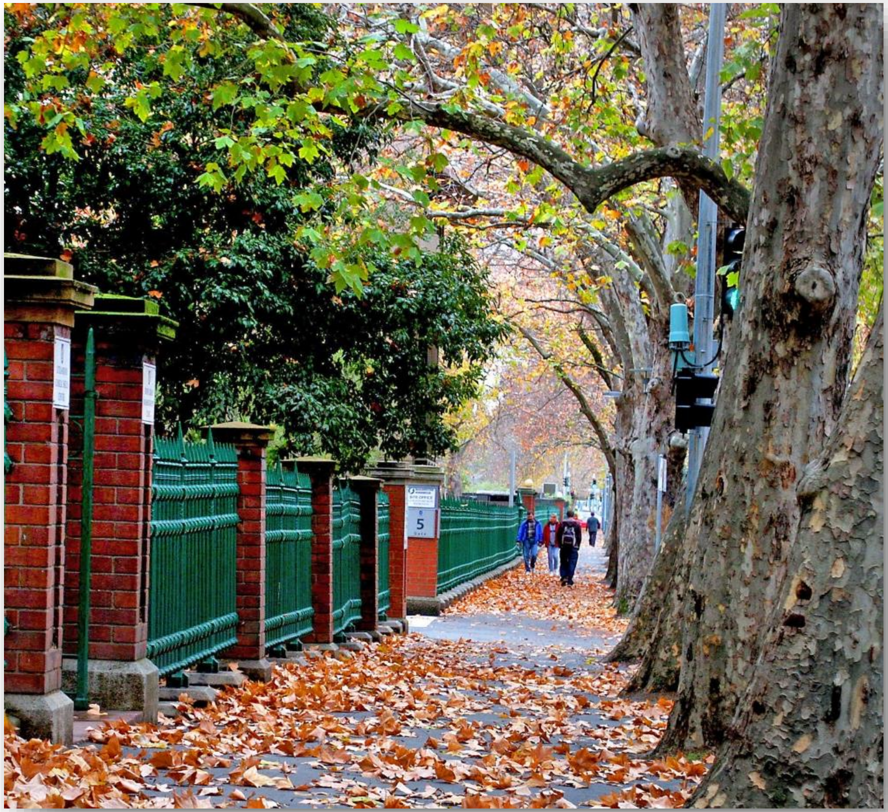
An introduction to the Scenario Tool

- Background
- What is it?
- How can it be used?
- What are the limitations?



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In the news

Australia news

This article is more than **8 months old**

Adelaide breaks its all-time heat record, hitting 46.6C, in extreme Australia heatwave

Seventeen records broken in South Australia amid animal culls and mass fish deaths in other parts of the country

- **25 January - Australia extreme heatwave: Victoria and Tasmania face bushfire threat - live updates**
- **Extreme heat Melbourne: city expecting 44C as Victoria faces hottest day since Black Saturday**

Naaman Zhou
@naamanzhou
Thu 24 Jan 2019 20.51 AEDT

1232

People in Adelaide head to the beach to escape Thursday's record-breaking Australia heatwave. Photograph: Kelly Barnes/AAP

Temperature records have tumbled across South Australia, with the city of Adelaide experiencing its hottest day on record, as the second heatwave in as many weeks hit southern parts of Australia.

Adelaide hit 46.6C on Thursday afternoon, the hottest temperature recording in any Australian state capital city since records began 80 years ago.

weatherzone°

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Home › Weather News › Halloween heat hits southern Australia

Weather News

Halloween heat hits southern Australia

Ben Domensino, Thursday October 31, 2019 - 13:18 EDT

October heat records are being challenged in parts of southern Australia today.

Hot air from central Australia will be pushed across the nation's southern states on Thursday and Friday ahead of an approaching cold front.

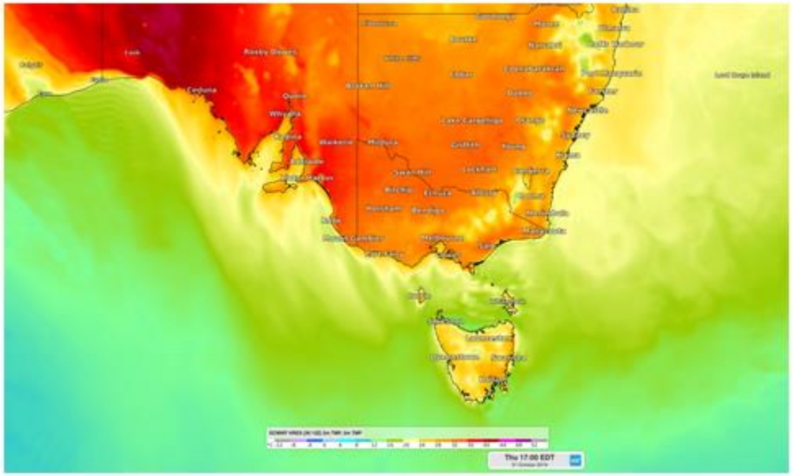

Image: Forecast surface temperature on Thursday, Ocotber 31.

Being at what is usually the hotter end of the month, some October heat records could be challenged on Thursday.

Adelaide had already hit 35 degrees by 1pm and could reach the high thirties during the afternoon. Prior to today, Adelaide's highest October temperature on record was 39.0 degrees in 1987. Friday could get to the low thirties, although cloud and showers accompanying a cool change should limit heating later in the day.

Melbourne climbed above 30 degrees shortly after midday and is forecast to reach 35 degrees on Thursday afternoon. This would be the city's hottest day since March, but a couple of degrees below the October record of 36.9 degrees from 1914. Friday could get almost as warm, with a top of 34 degrees forecast in the city.

Hobart could edge above 30 degrees on Thursday and 31 degrees on Friday, which would be the city's warmest pair of days on record this early in spring.

The timing of this hot weather could also make this the hottest halloween on record for some areas. These were the heat records for October 31 prior to 2019:

- Adelaide 39.0C in 1987
- Melbourne 33.1C in 2009
- Hobart 34.6C in 1987

37.6°

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What is the Urban Heat Island?

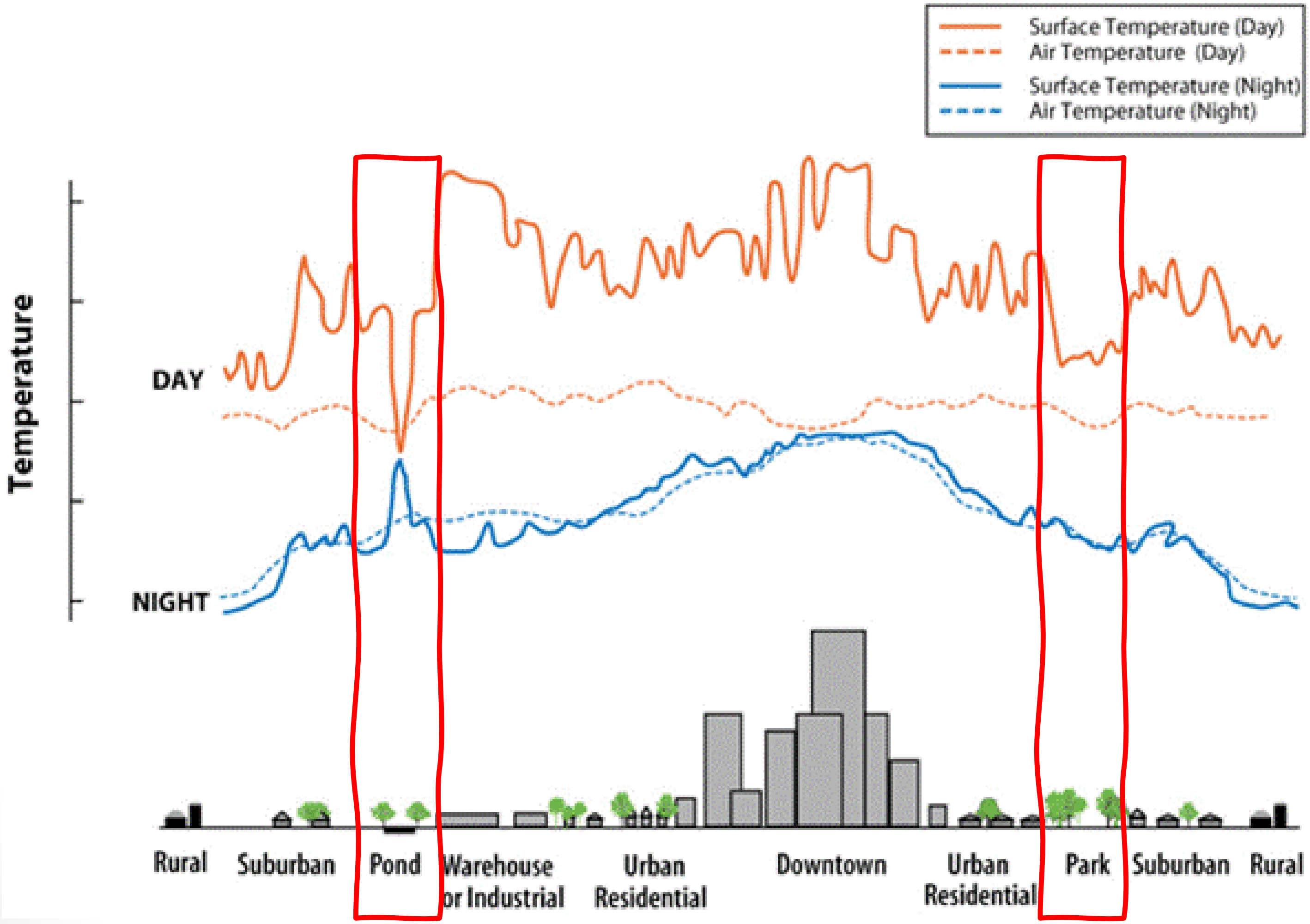

Image Source: US EPA (2012)

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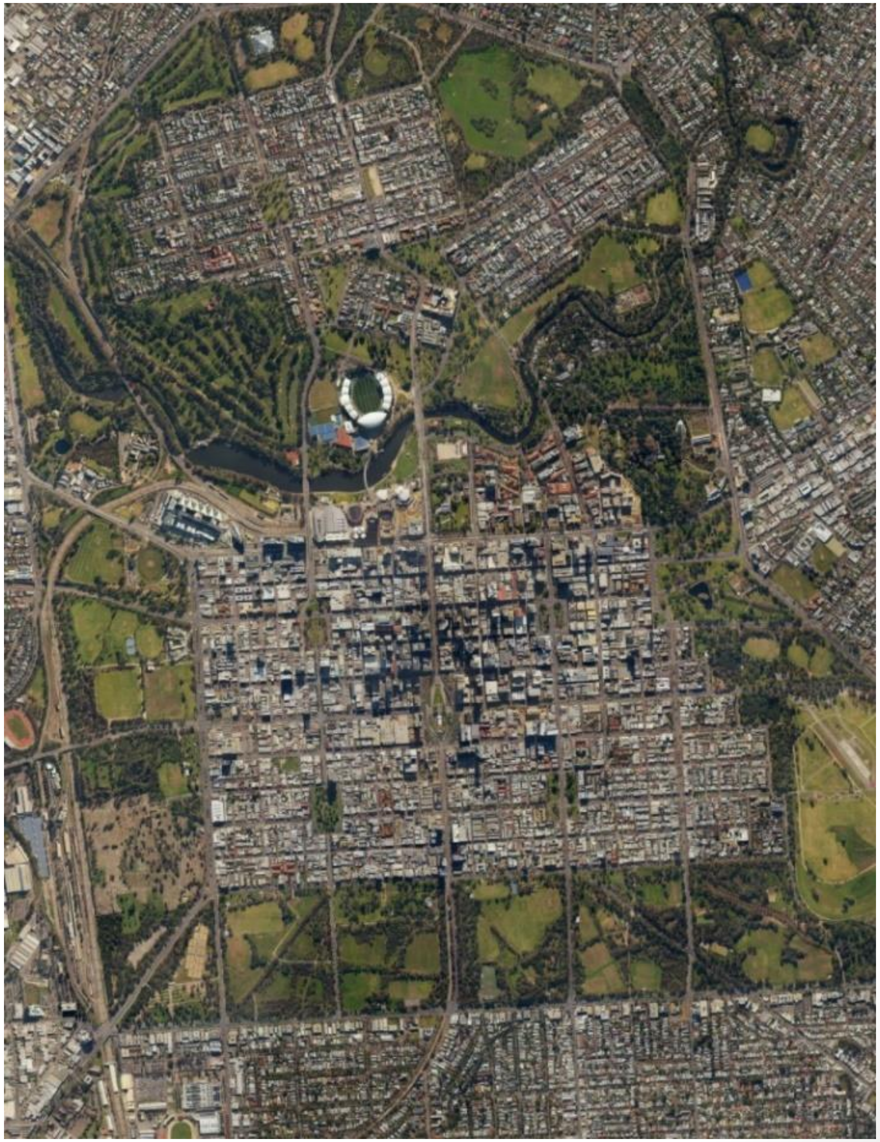
Urban Heat Island

- Size
- Density
- Surface types
- Shade
- Airflow
- Vegetation
- Blue-green infrastructure



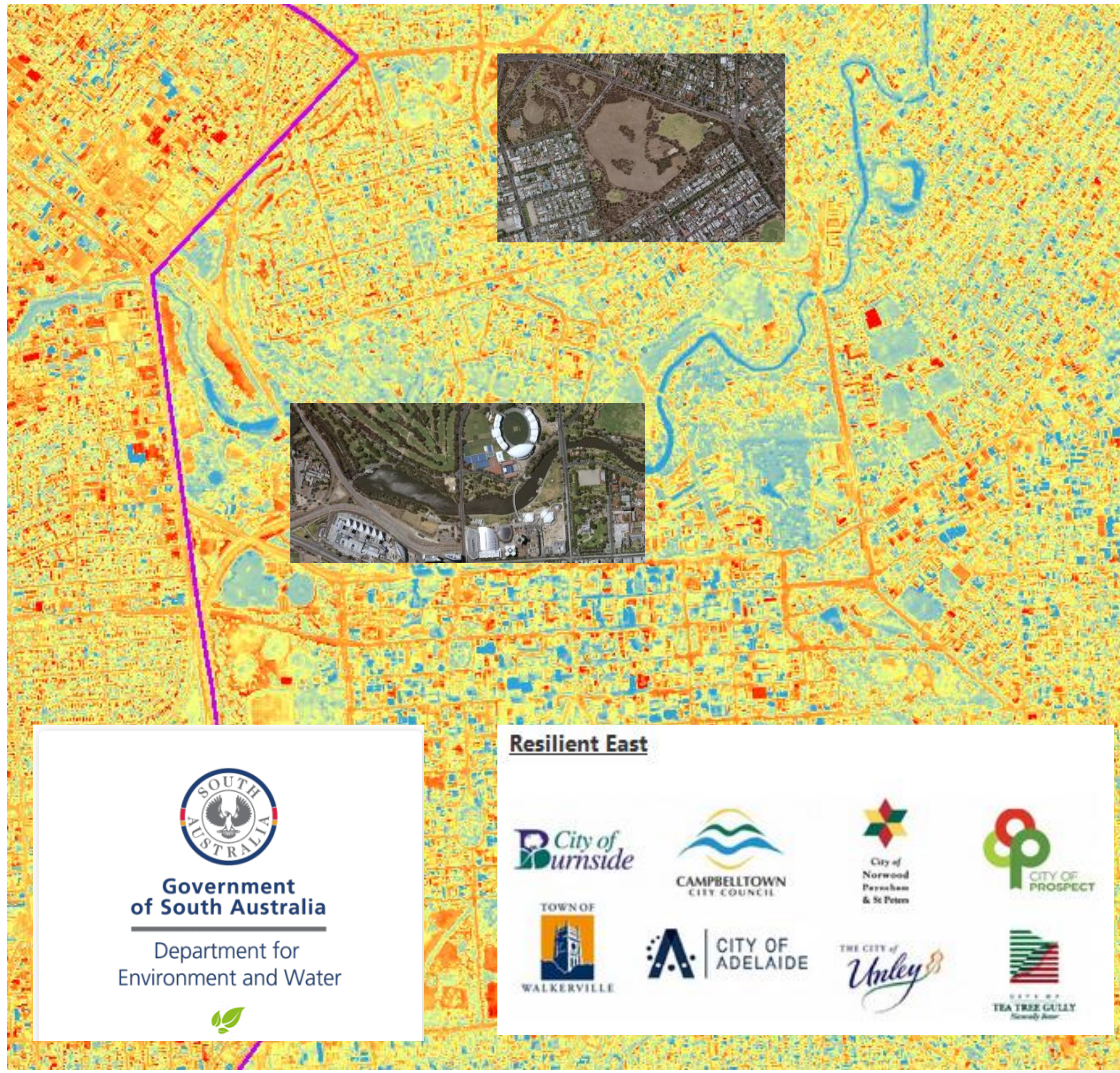
Urban Heat Map Viewer

- Surface Temperature
  - Where are hotspots?

- A point in time

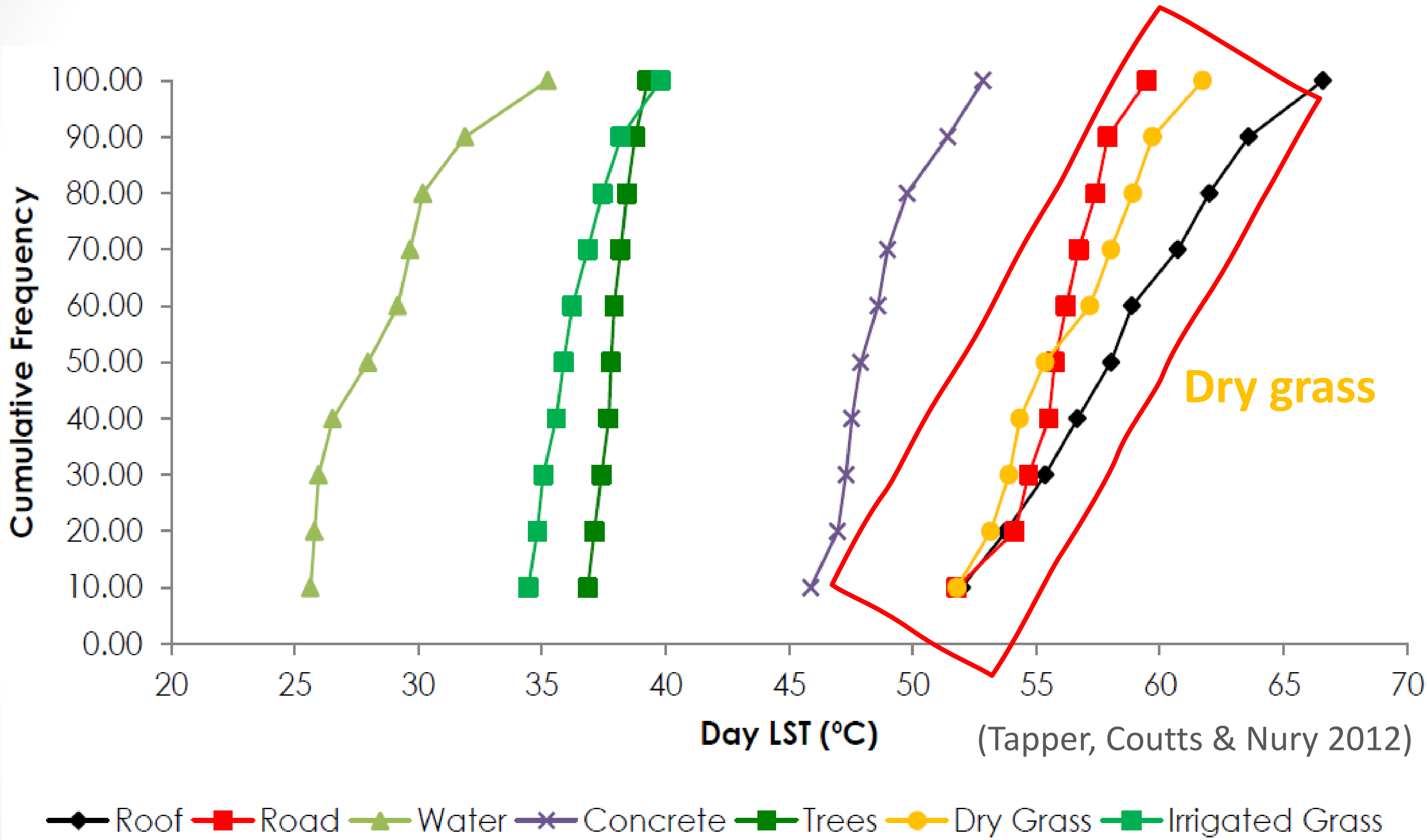
23rd March 2018

- Not modelled data



http://spatialwebapps.environment.sa.gov.au/urbanheat

Land use temperatures



Extreme heat day land surface temperature data

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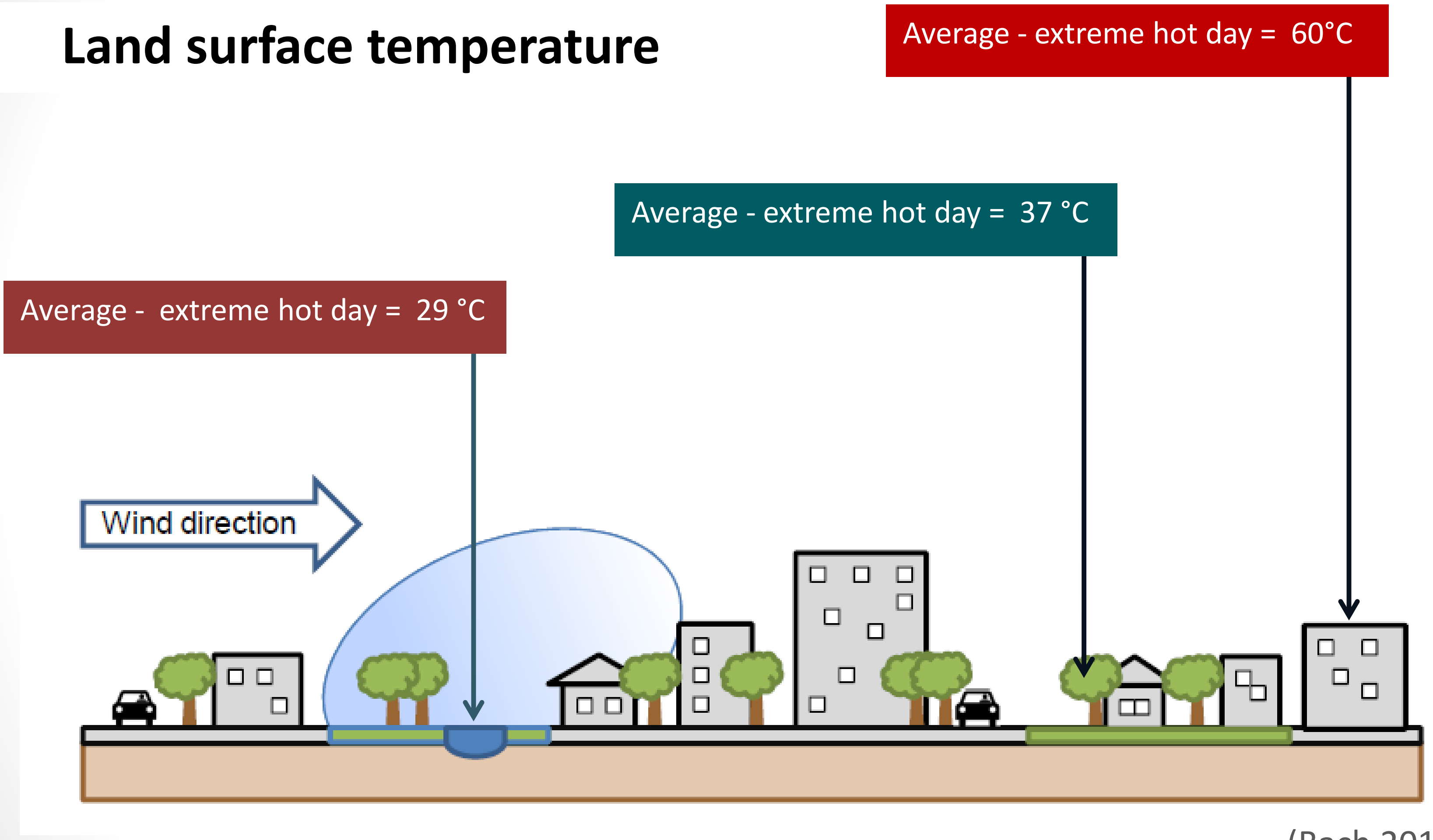
Theoretical basis

Land surface temperature



(Bach 2017)

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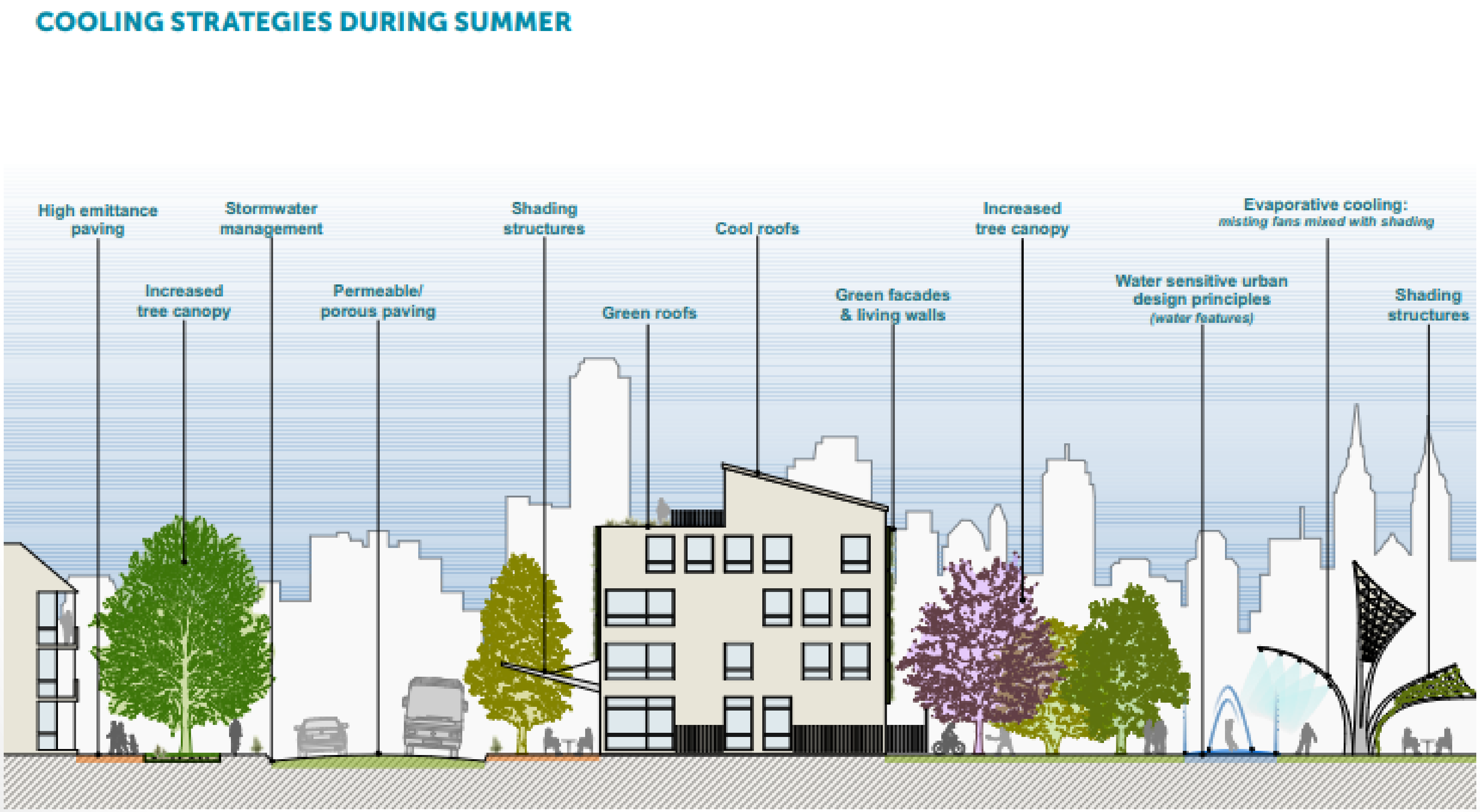
Urban Heat Mitigation



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Further reading

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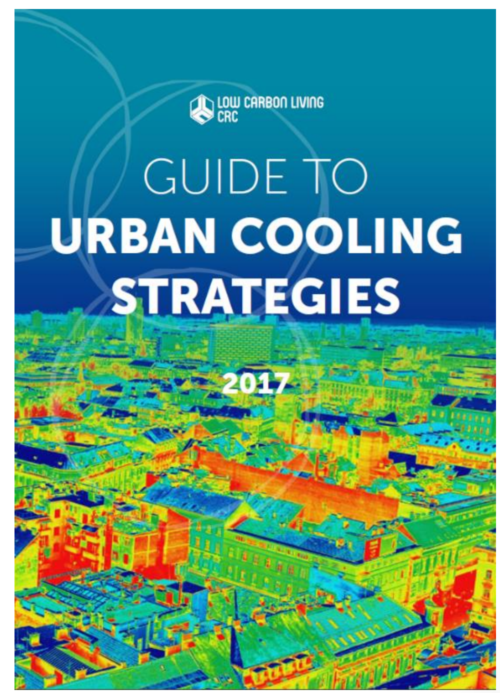
LOW CARBON LIVING
CRC



watersensitivecities.org.au

lowcarbonlivingcrc.com.au

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Trees for a Cool City

The cooling effect:

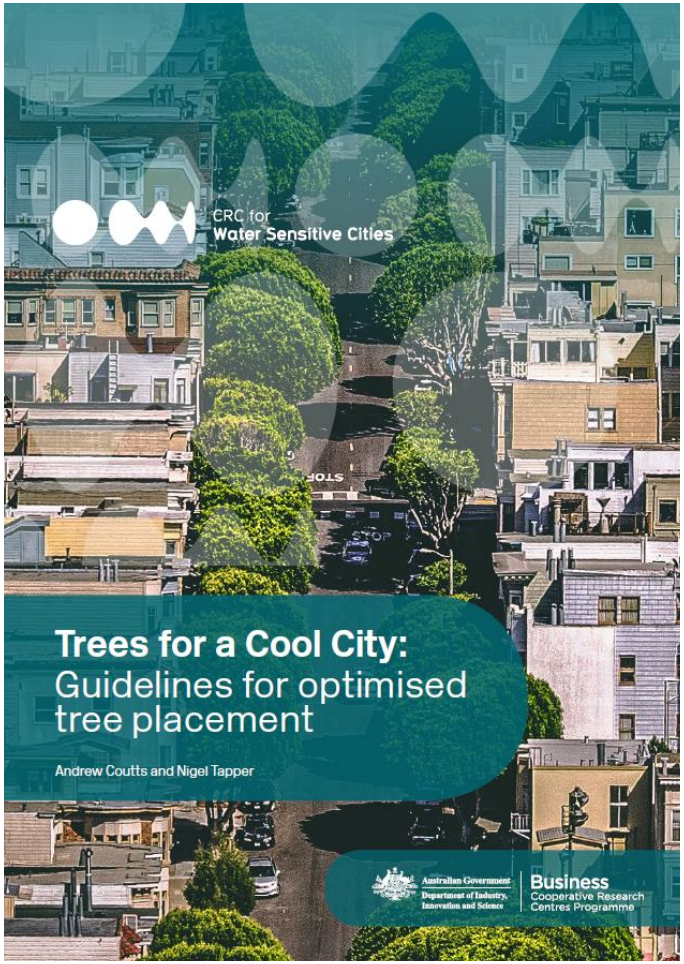
- Transpiration
- Shade

Additional benefits:

- Economic
- Comfort and Wellbeing

Challenges:

- Plant selection
- Maintenance
- Water
- Infrastructure
- Safety



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The WSC Scenario Tool

- Planning-support tool
- Assess urban development changes
- Models
- Scenarios
- Comparison

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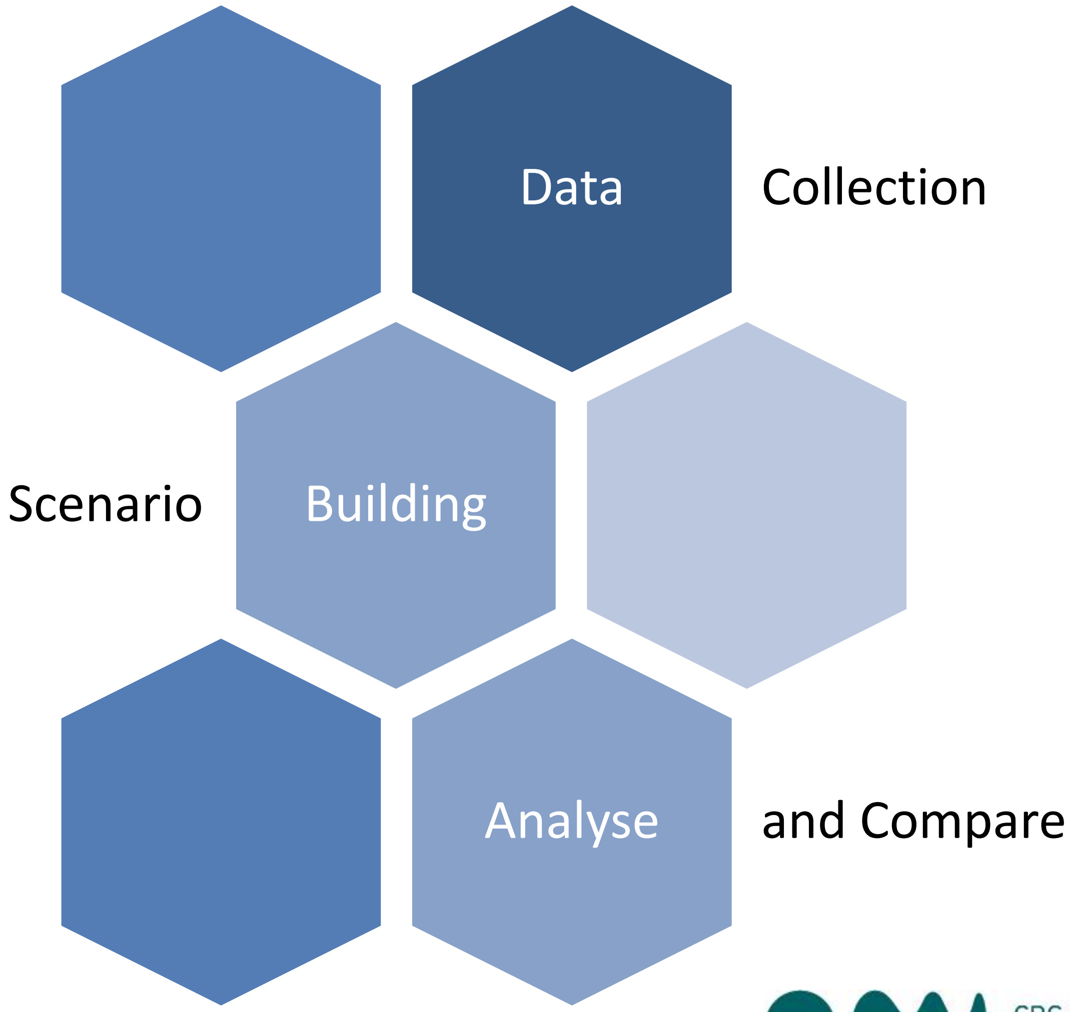
Extreme Heat Module

- **Understand** how blue-green infrastructure can **influence** urban heat and thermal comfort
- **Quantify** the urban **microclimate benefits**
- **Investigate** potential strategies for **urban heat mitigation**
- **Planning** and **Design**

The process



Caveats and limitations

- Cell size – 30 m x 30 m
- It is NOT a detailed design tool
- Data quality – rubbish in – rubbish out
- It does not incorporate all WSUD scenarios at this stage
- One tool to be used amongst many for urban design

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Data

Census data

Map polygons

Building footprints

Landcover

24 hr rainfall &
Evapotranspiration

Geoscape

User defined

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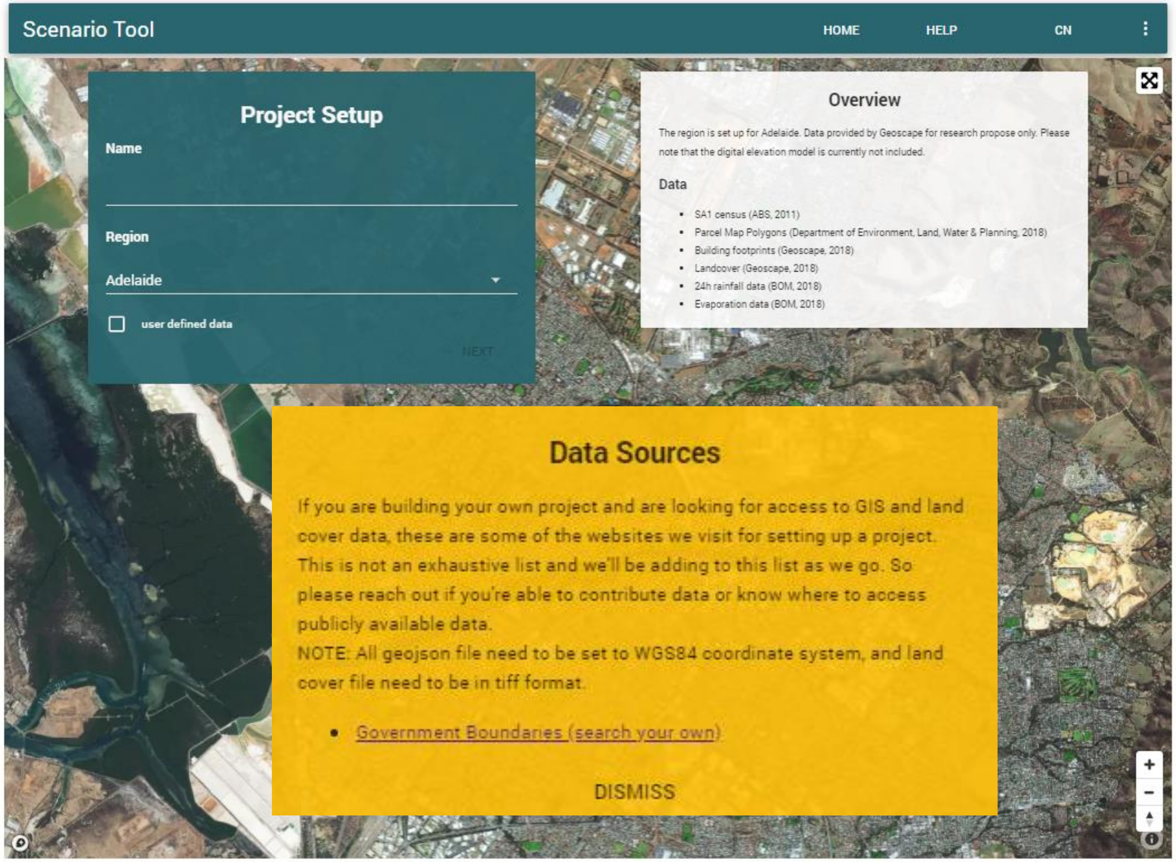
Setup

- Step through wizard
- Define location
- Own data
  - i.e. LGA
- GeoJSON – WGS84 coordinates



https://data.gov.au/search?q=psma

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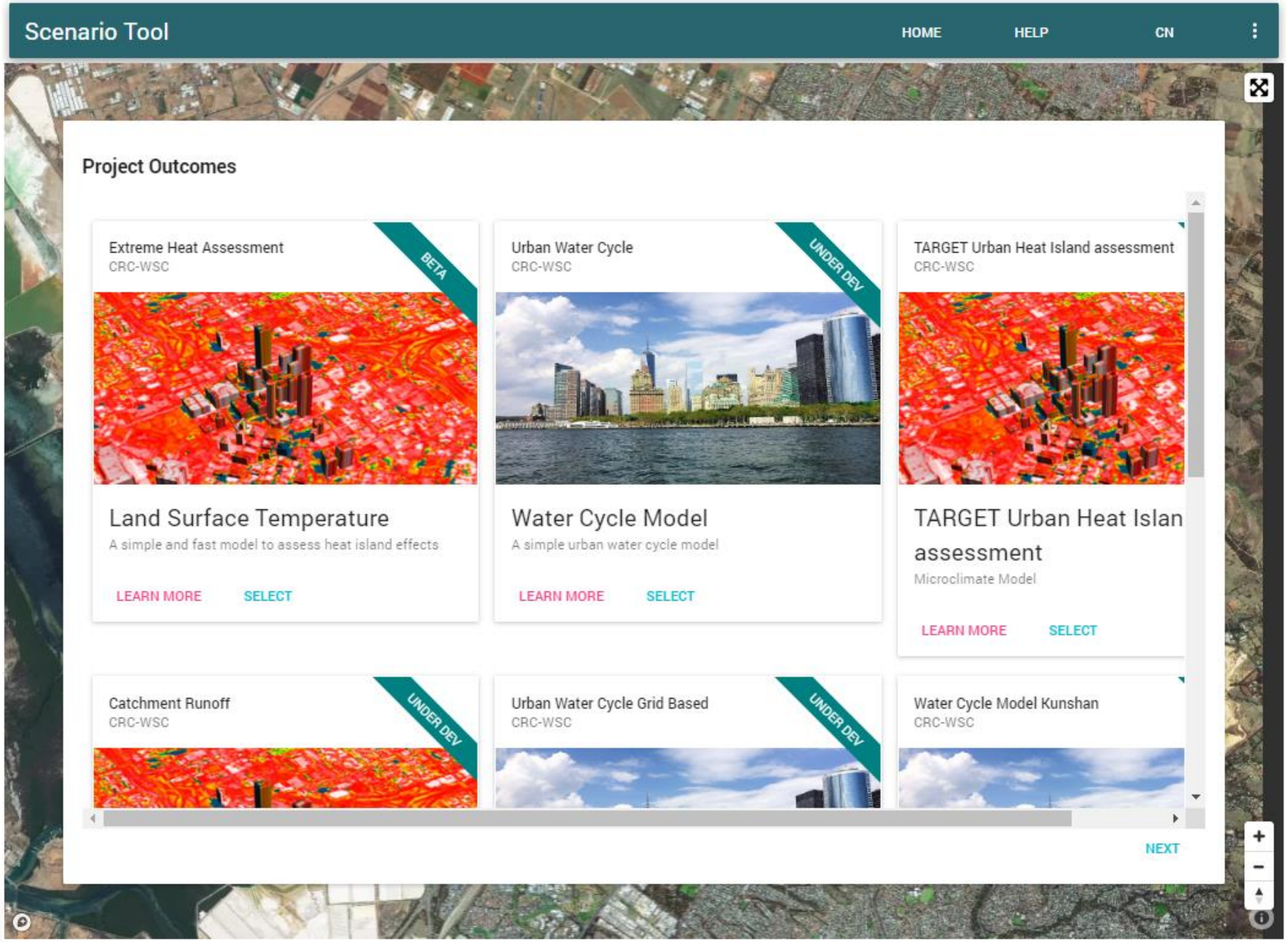
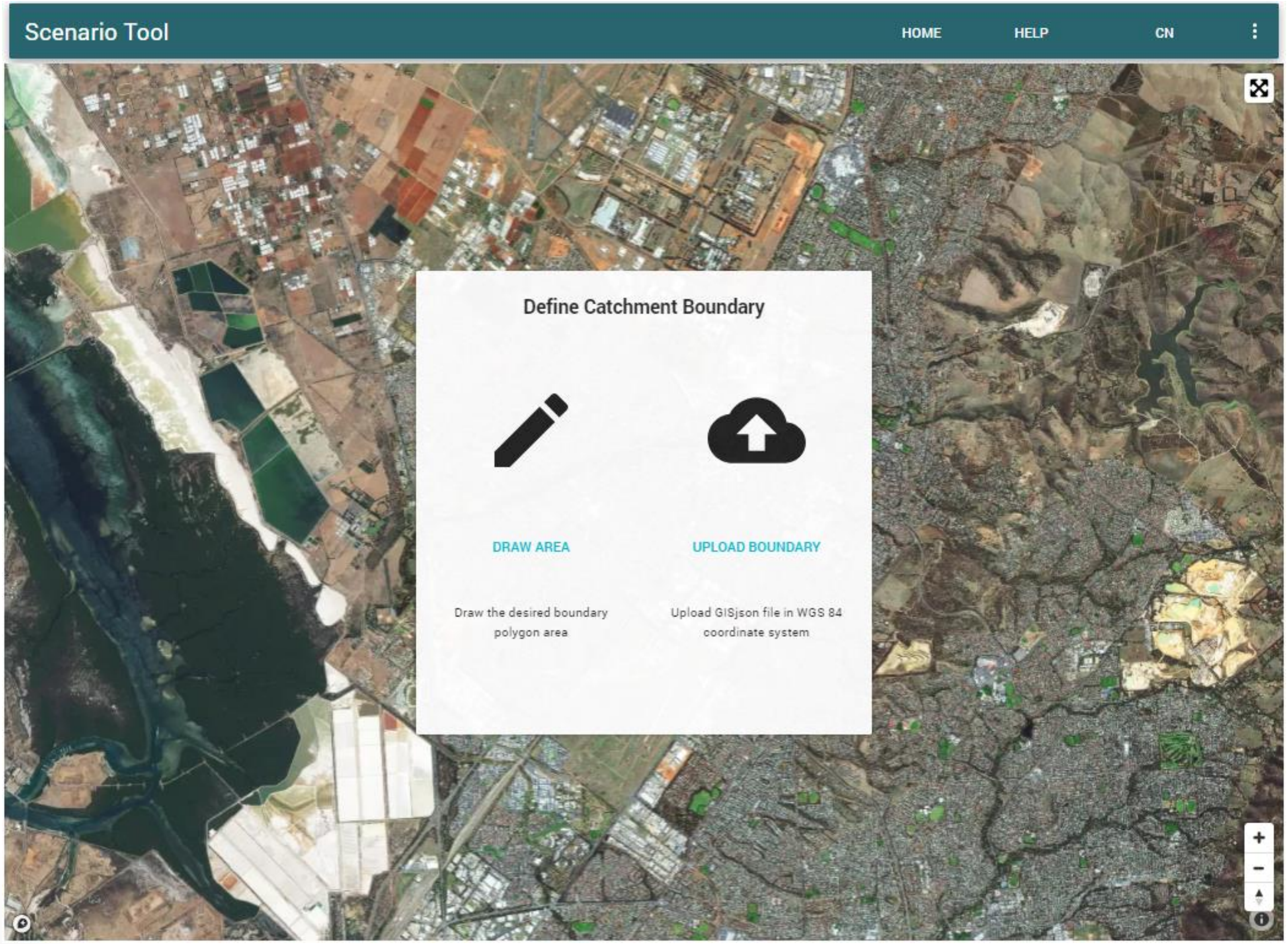
Module selection



Define the catchment



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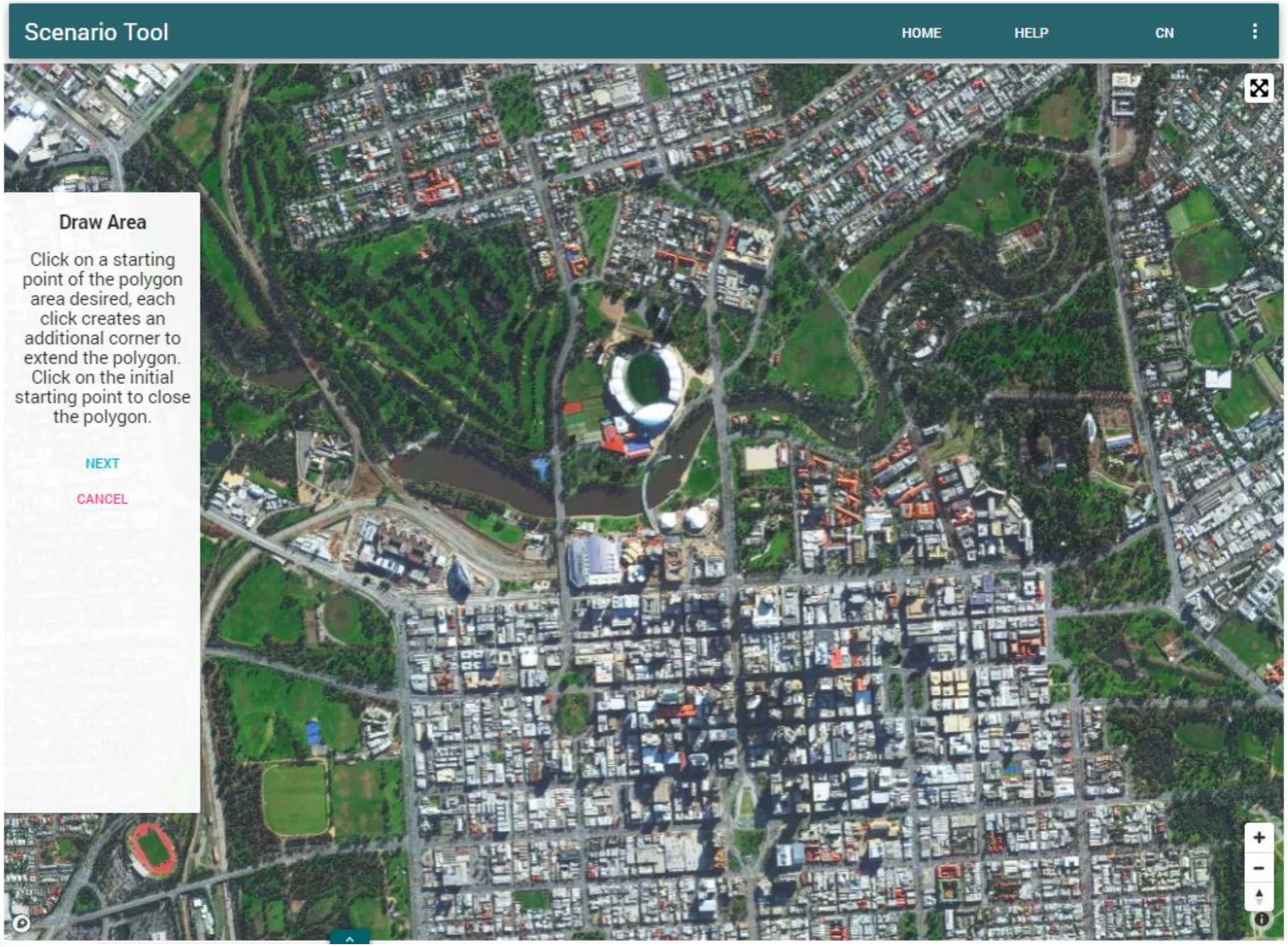
Define model area



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Define model area

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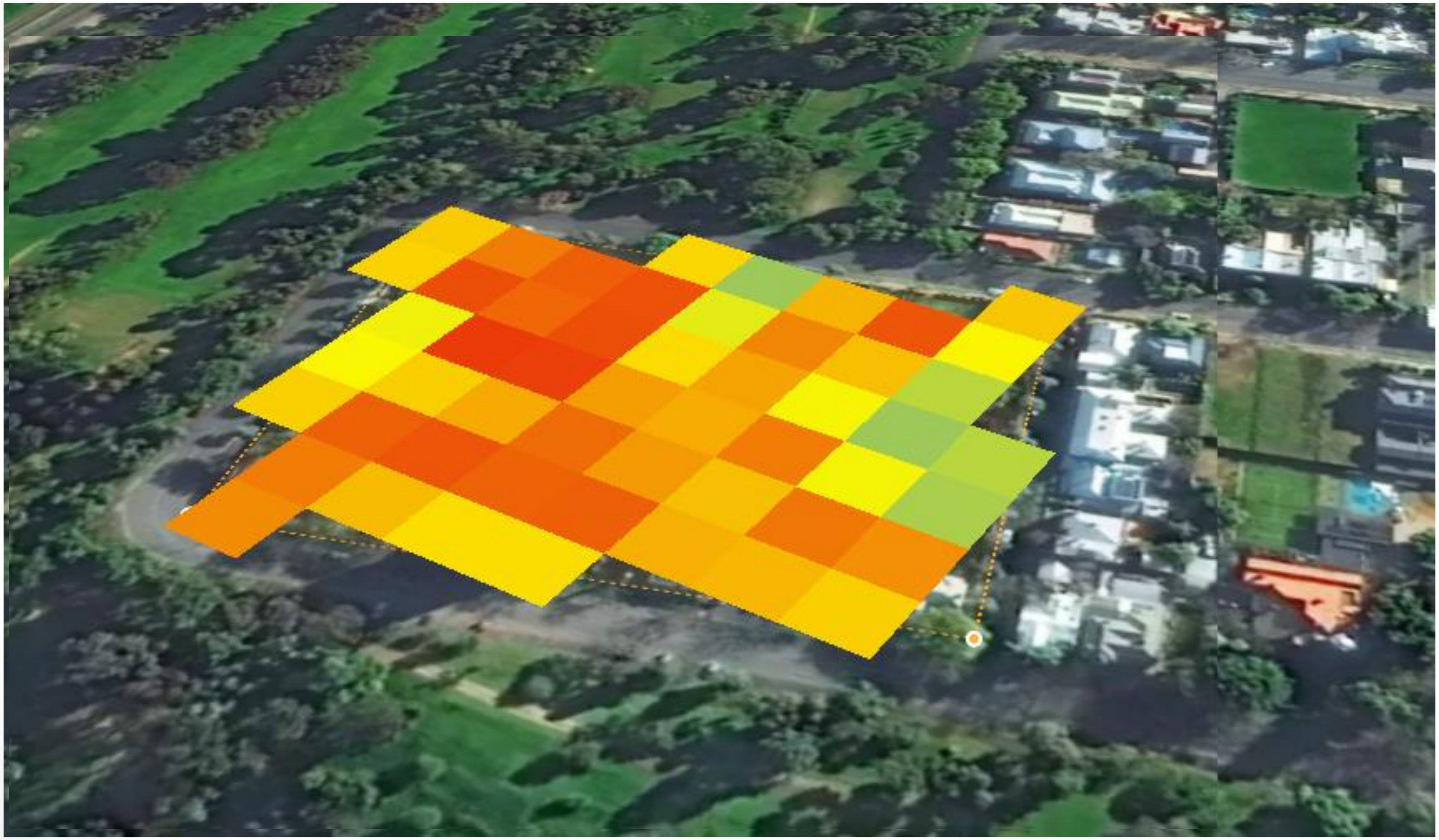
Initialisation

Initialising Base Data

The model is currently set up for you. This might take a couple of minutes.

- ✓ Initialise Simulation
- ✓ Import Urban From
- ✓ Load Census Data
- Build City Database
- Sample Households
- Export Database

Baseline scenario



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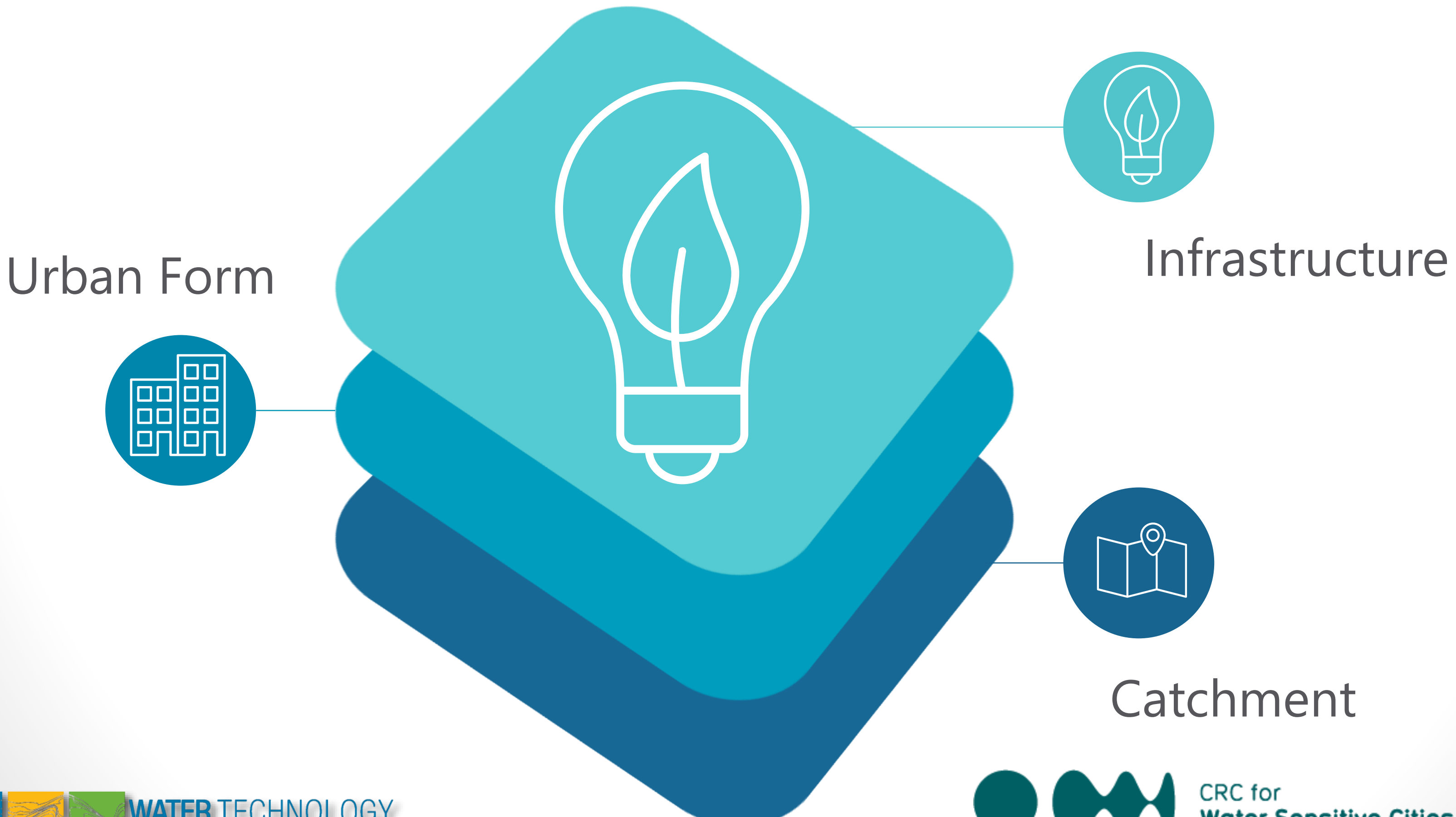
Create a scenario

Design layers

30 adaptation nodes



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Create a scenario

Urban form - residential

Select Node Type

Categories

All

Urban Form

Green Infrastructure

Polder Infrastructure

Land Cover

Site Analysis

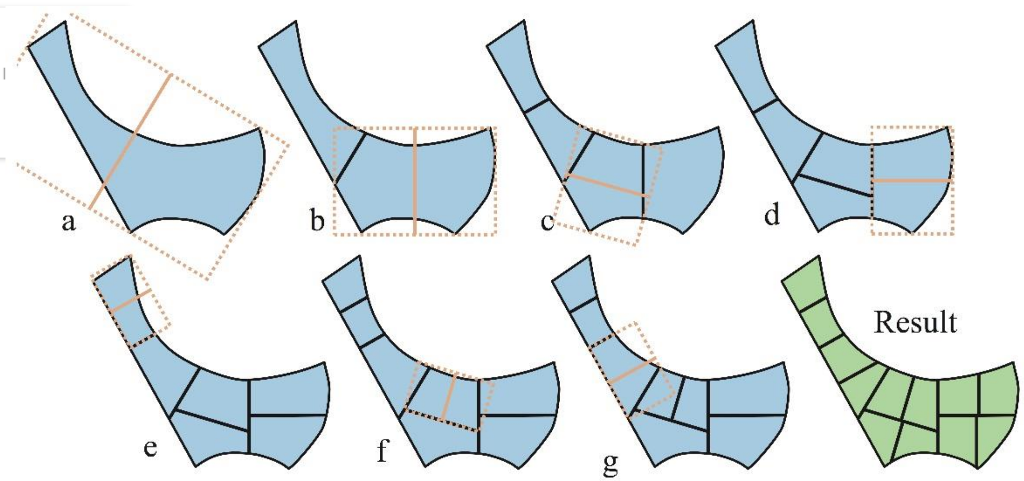
Category Urban Form

Clear area
Removes buildings and parcels within the boundary
LEARN MORE SELECT

Subdivision
Subdivides existing residential lots and adds new buildings
LEARN MORE SELECT

Residential
Add residential precinct
LEARN MORE SELECT

Create roadway
Create a roadway with trees and different l
LEARN MORE SELECT



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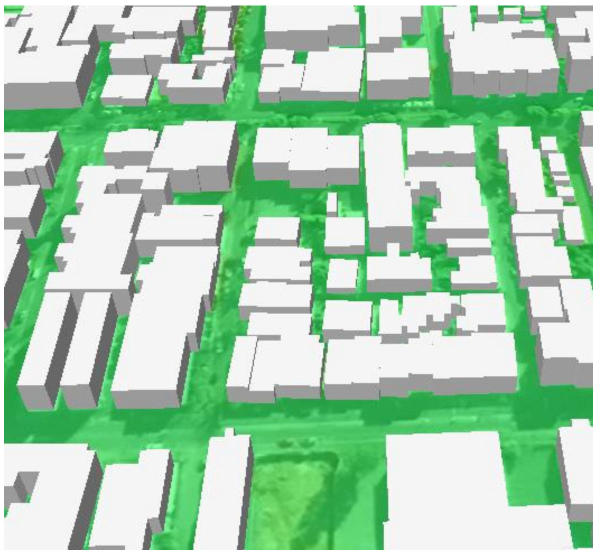
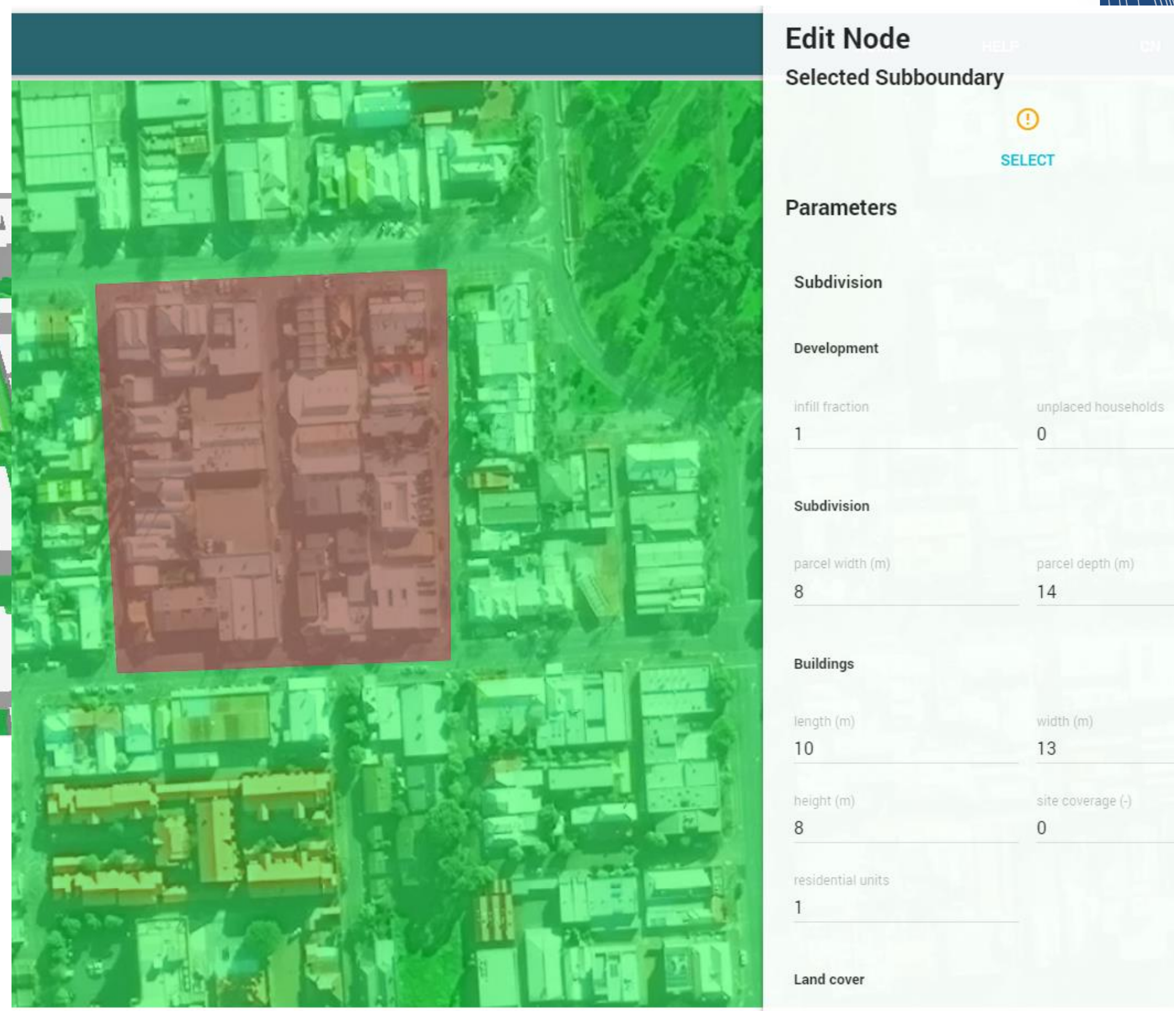
Create a scenario

Node setup





Create a scenario

Infrastructure – blue / green

Category Green Infrastructure

Trees on lot
Adds are tree on residential lots
LEARN MORE SELECT

Rainwater harvesting tanks
Add rainwater harvesting tanks to residential buildings
LEARN MORE SELECT

Swales
Places swales as fraction of roads
LEARN MORE SELECT

Category Land Cover

Micro climate query
Assign land cover fraction to grid cell
LEARN MORE SELECT

Assign fractions
Assign land cover fraction to grid cell
LEARN MORE SELECT

Tree cover change
Increase or decrease tree cover percentage
LEARN MORE SELECT

Open space irrigation
Irrigate dry grass within the catchment
LEARN MORE SELECT

Generate trees along a road or other sub-area boundary
LEARN MORE SELECT

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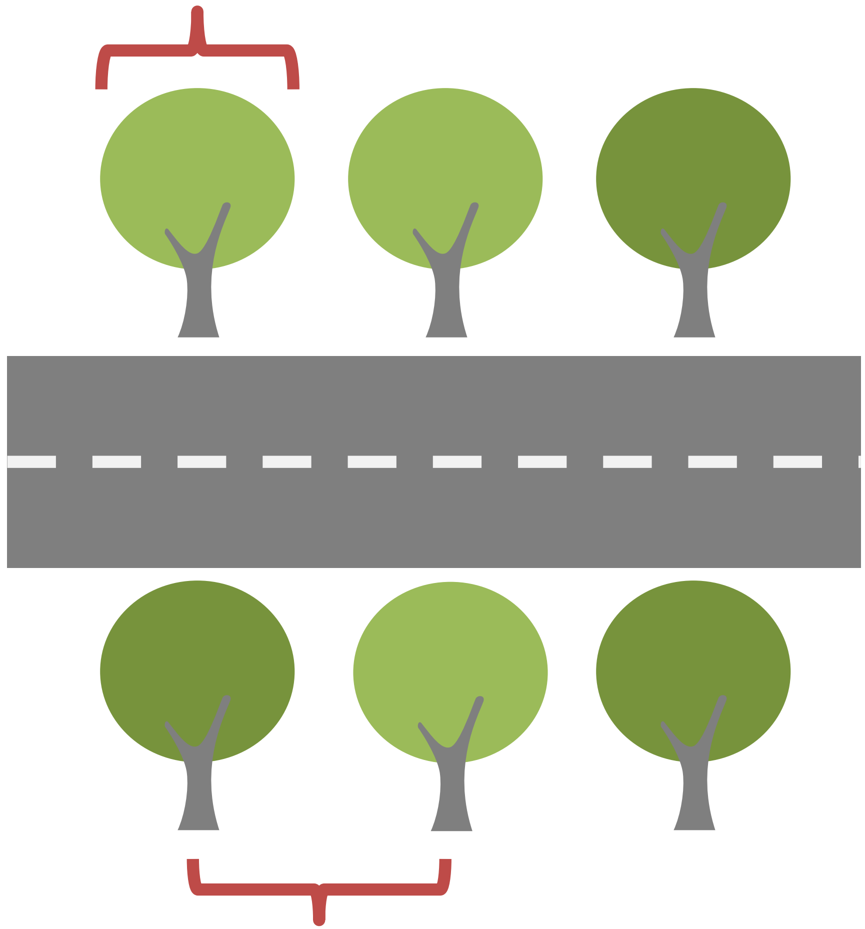
Increasing tree cover

Canopy diameter



Tree spacing

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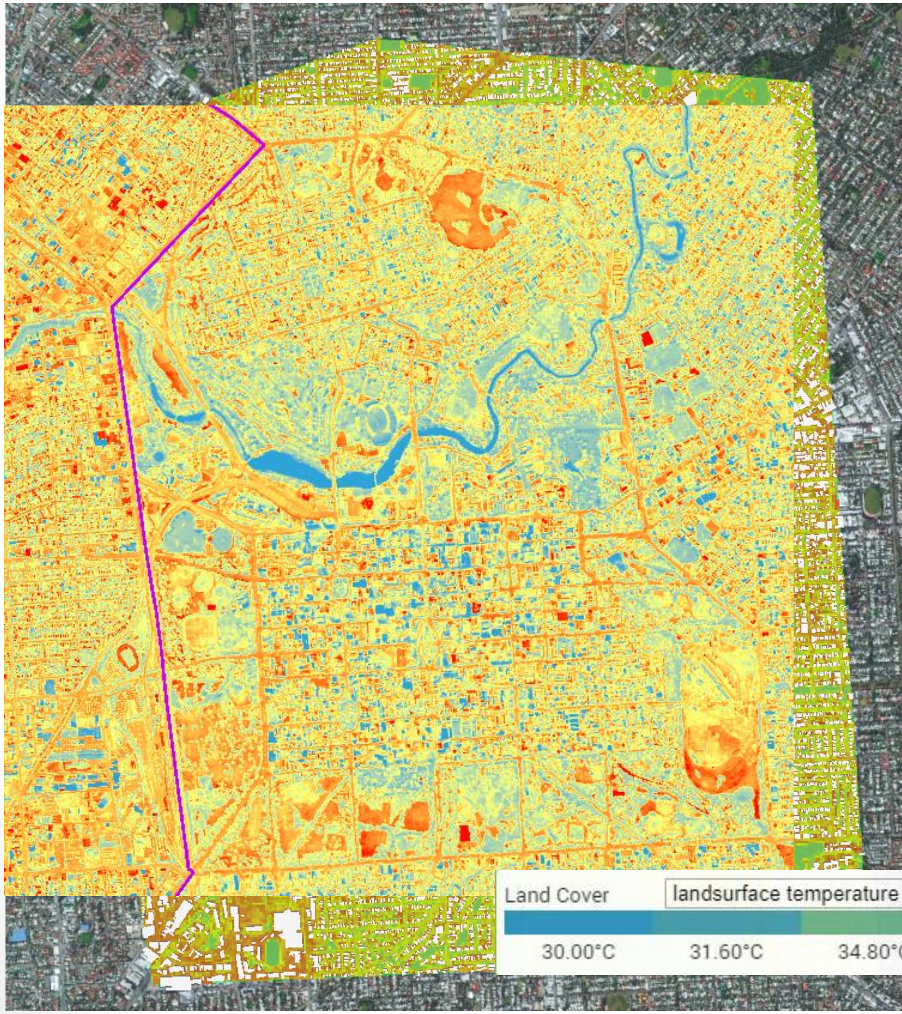
Demonstration

www.wsc-scenario.org.au

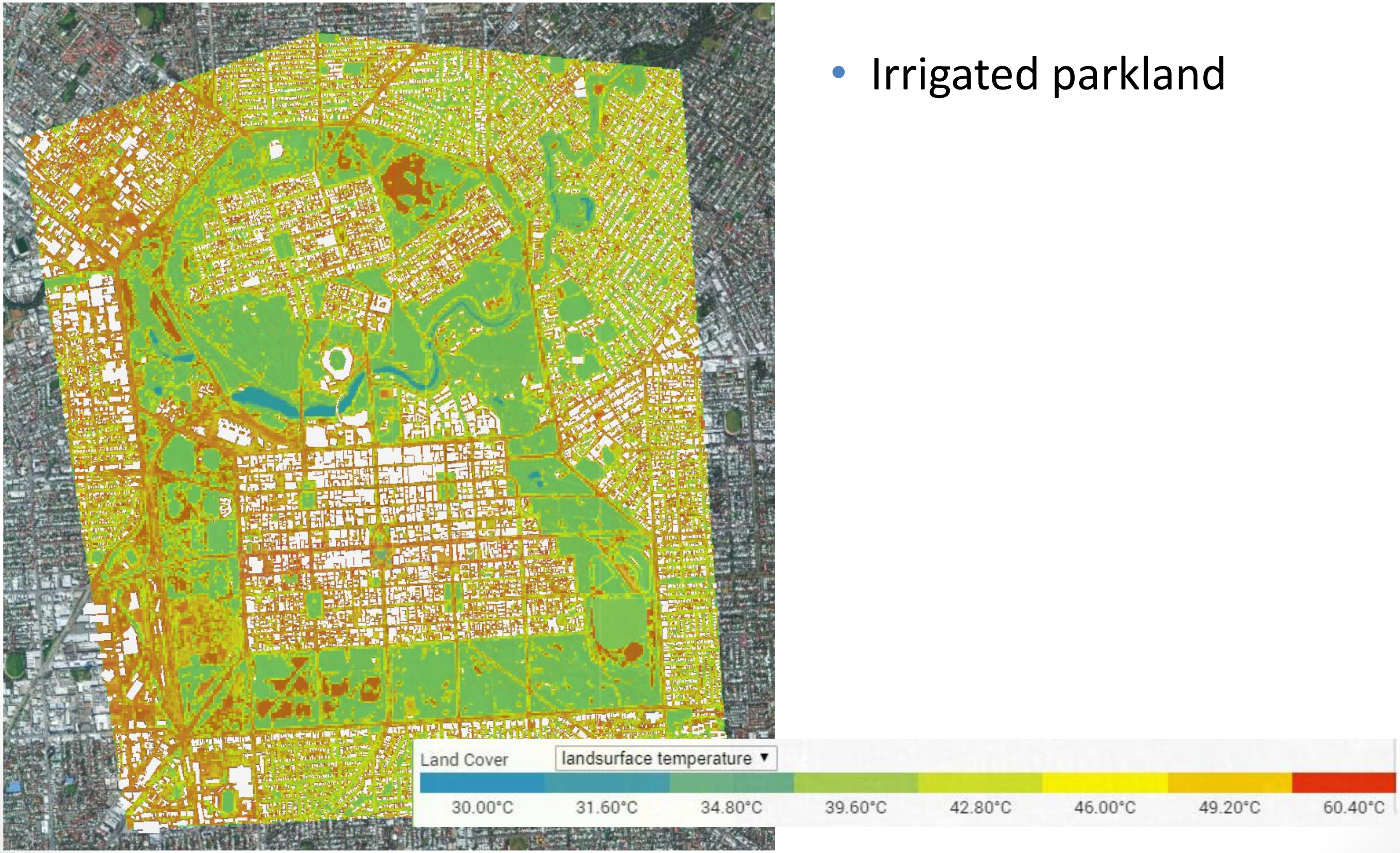
Base case



- Building footprint
- Extreme heat map

Comparing to mapped to modelled

Reduced bare earth



- Irrigated parkland

Increased street trees

- 50% increase in trees

Note:

- Reduced max temp.

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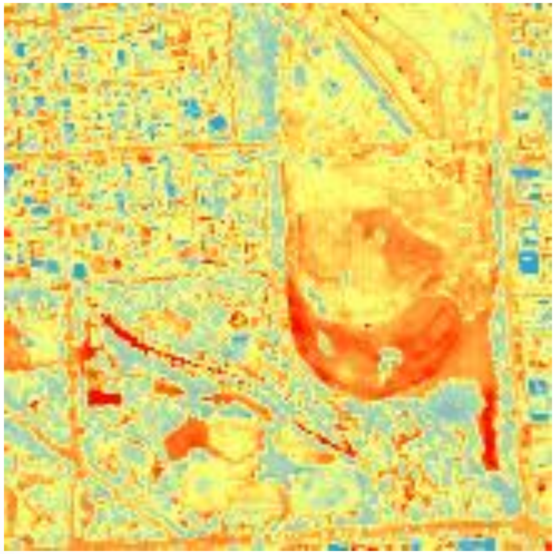
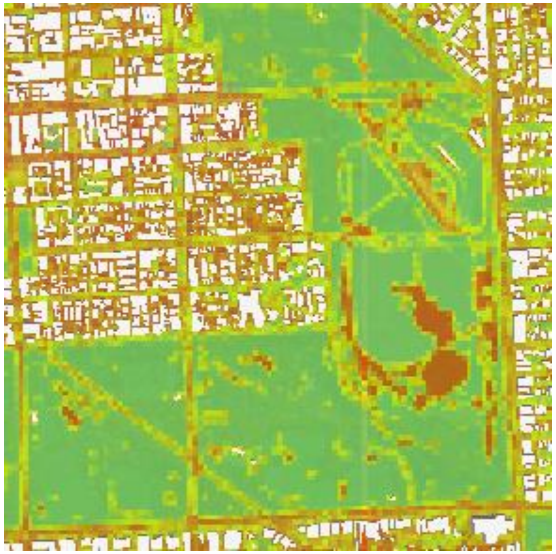
Side by side

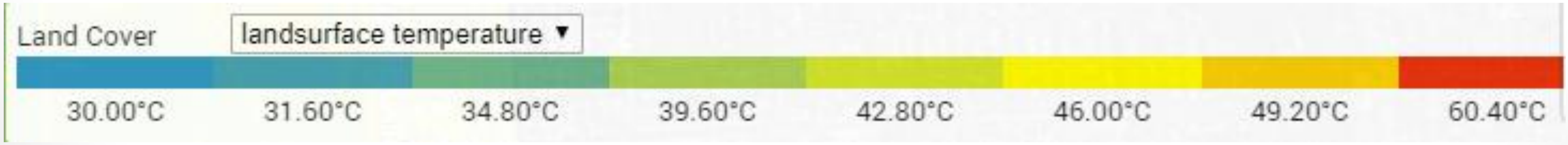
Areal image



Modelled – base case



Modelled – 50% increase in trees



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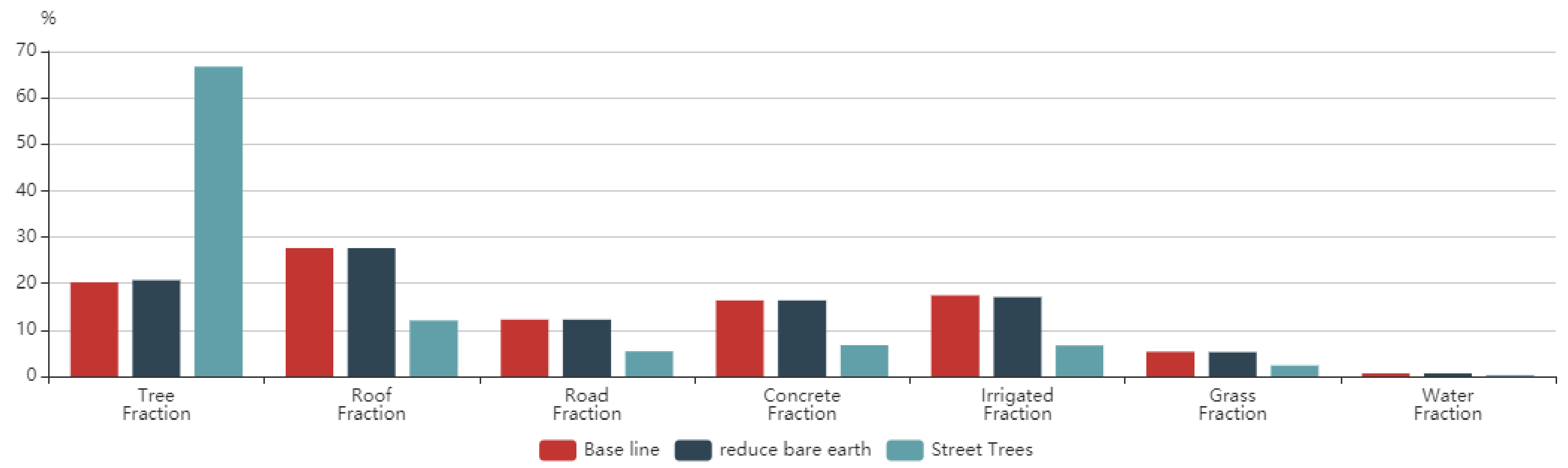
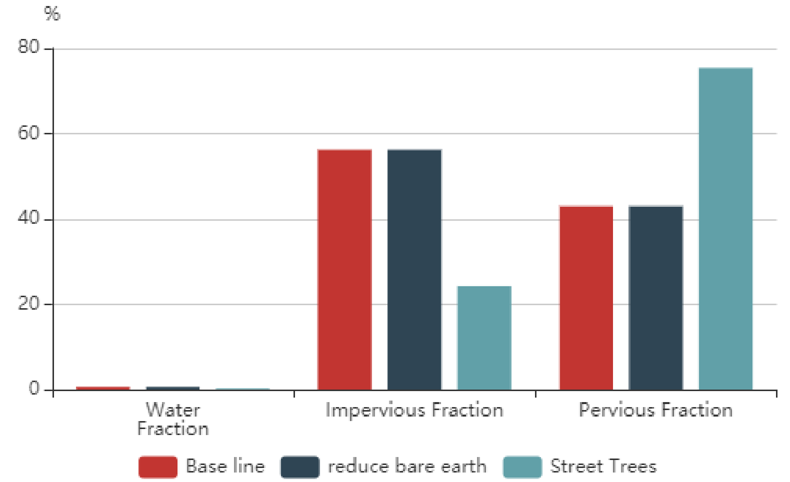
Land cover



Impervious fraction



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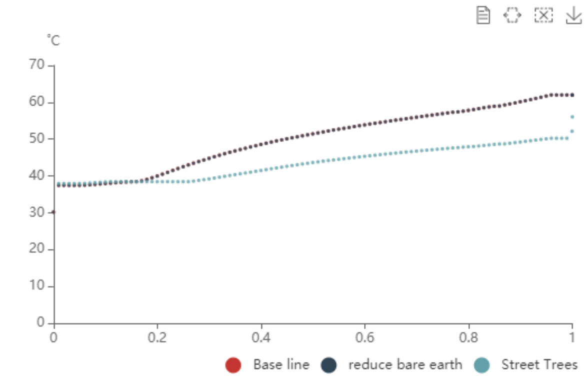
Results

Land Surface Temperature

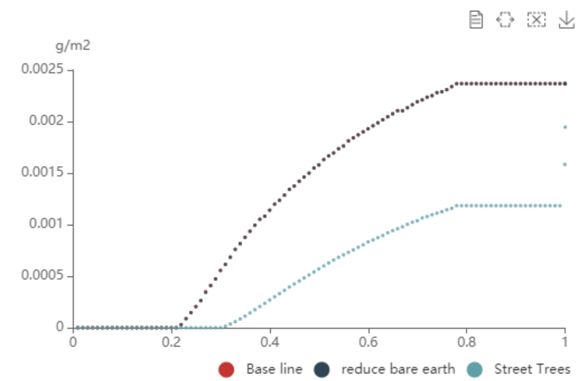
Scenario	Average Surface Temperature °C
Base line	50.00
reduce bare earth	49.98
Street Trees	43.43

Scenario	Population -
Base line	46318.00
reduce bare earth	46318.00
Street Trees	46318.00

Land Surface Temperature



Total Nitrogen Generation



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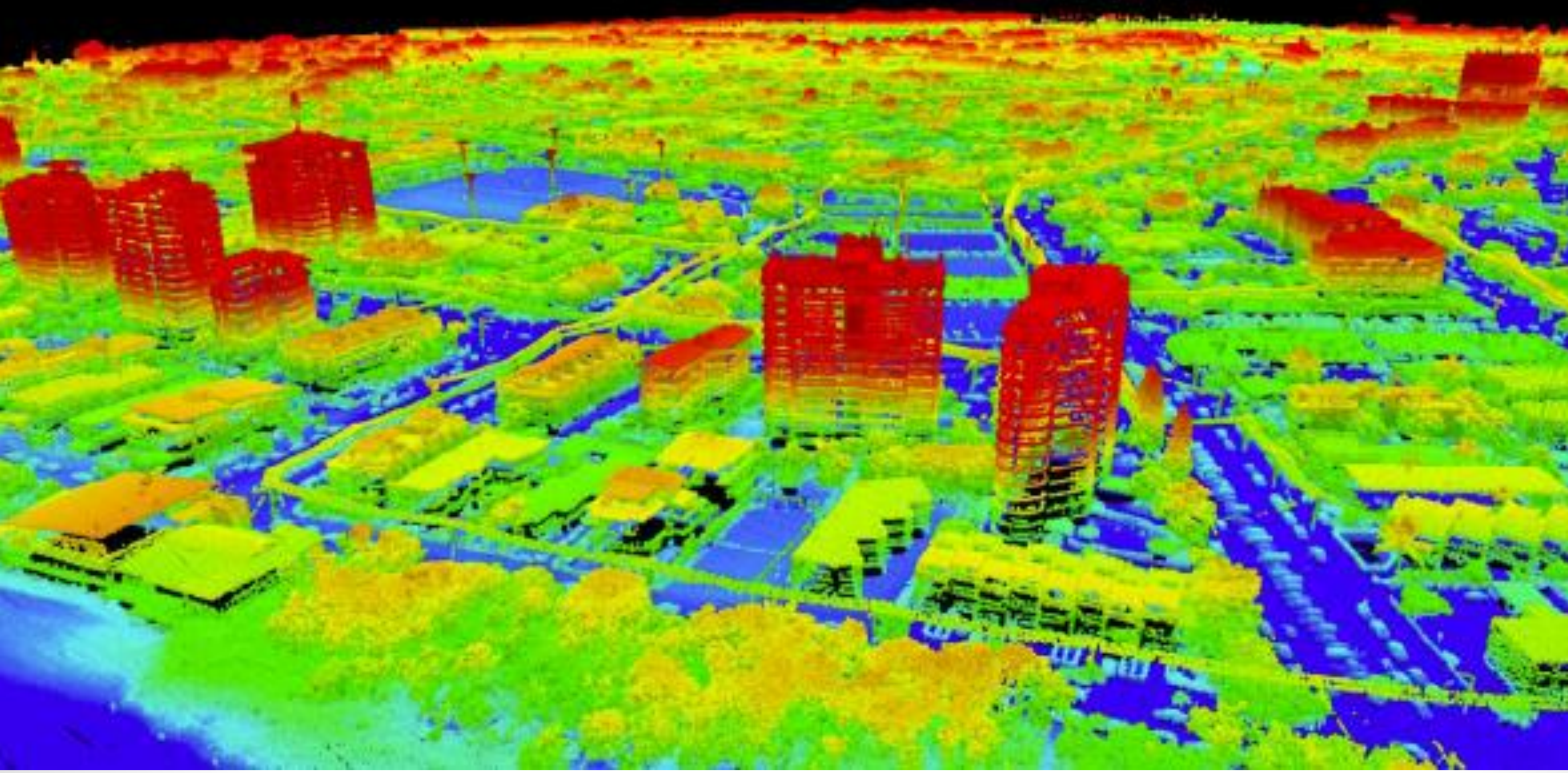
Yarrabilba



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A WATER SENSITIVE CITIES APPROACH

Yarrabilba Community – Lend Lease

Master planned community

Over 2,800 ha

Completion ~ 2042

~ 15,000 homes

~ 40,000 people

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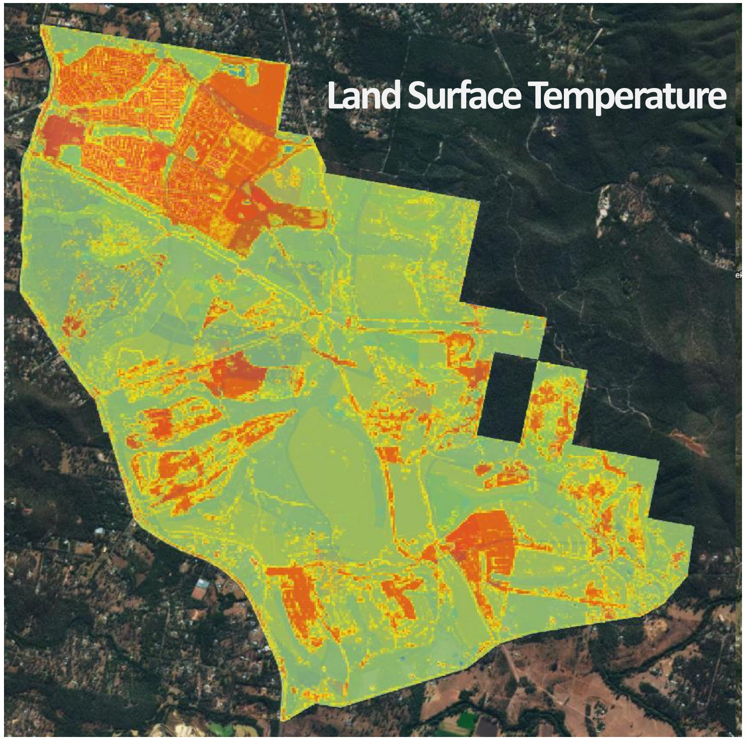
Current Development Case

- Initial Development
- Clear plantation forest
  (note heat map of bare soil)

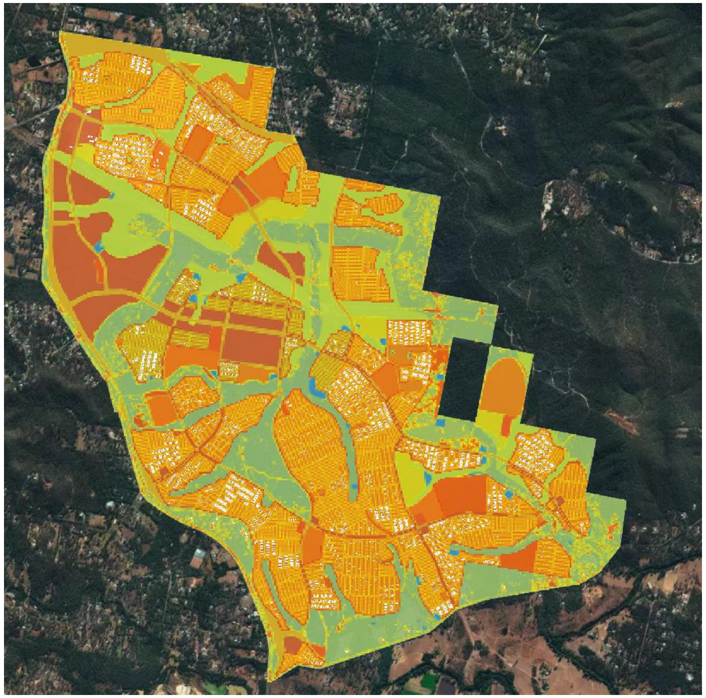
Population	-
Av. Surface Temp	43.6 °C
Stormwater Load (TN)	11 gm/Ha



Business as Usual Case

- Extension of initial stages of Development

Population	38,500
Av. Surface Temp	49.7 °C
Stormwater Load (TN)	16 gm/Ha



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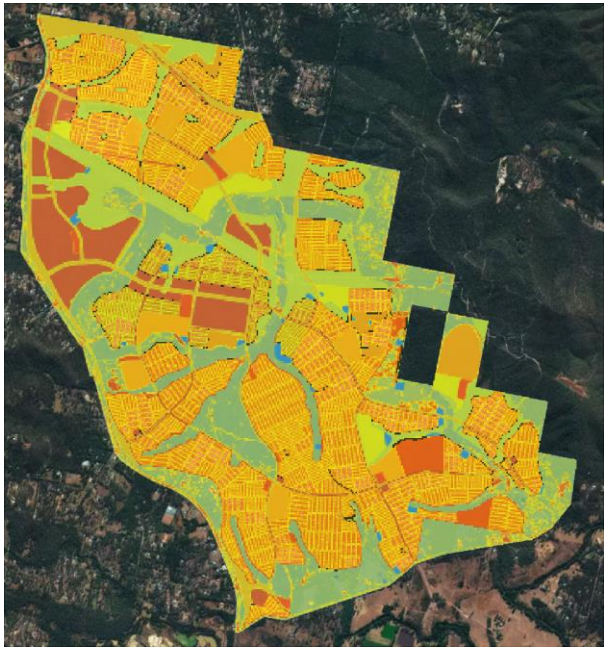
Water Sensitive City Lite

- Open space irrigation – 50%
- Street Trees – 22m spacing
- Trees on 15% of lots
- Wetland Water Reuse
- Rainwater Harvesting – 25% uptake

Population	38,600
Av. Surface Temp	48.0 °C
Stormwater Load (TN)	14 gm/Ha



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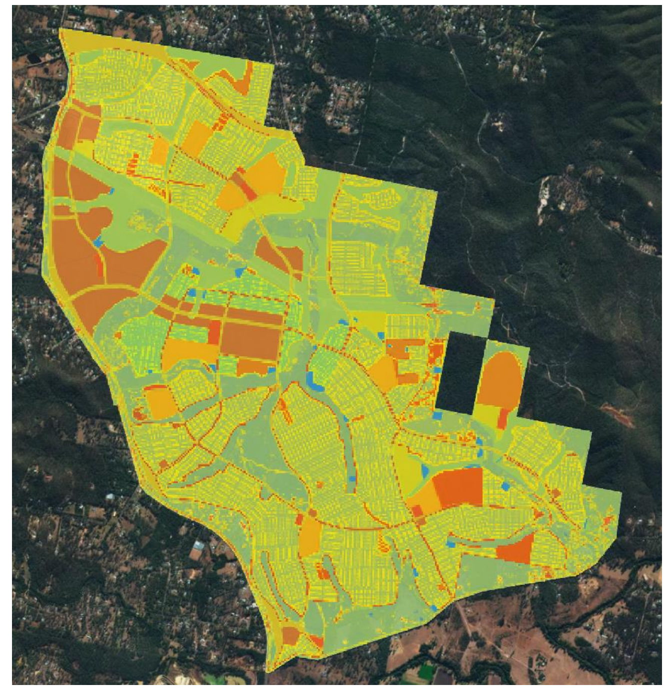
Water Sensitive City

- Open space irrigation – 75%
- Street Trees – 17.5m spacing
- Trees on 25% of lots
- Wetland Water Reuse
- Rainwater Harvesting – 75% uptake
- Swales & Tree Pits
- *Increased population – higher density infill areas*



Population	49,000
Av. Surface Temp	43.8 °C
Stormwater Load (TN)	8 gm/Ha

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