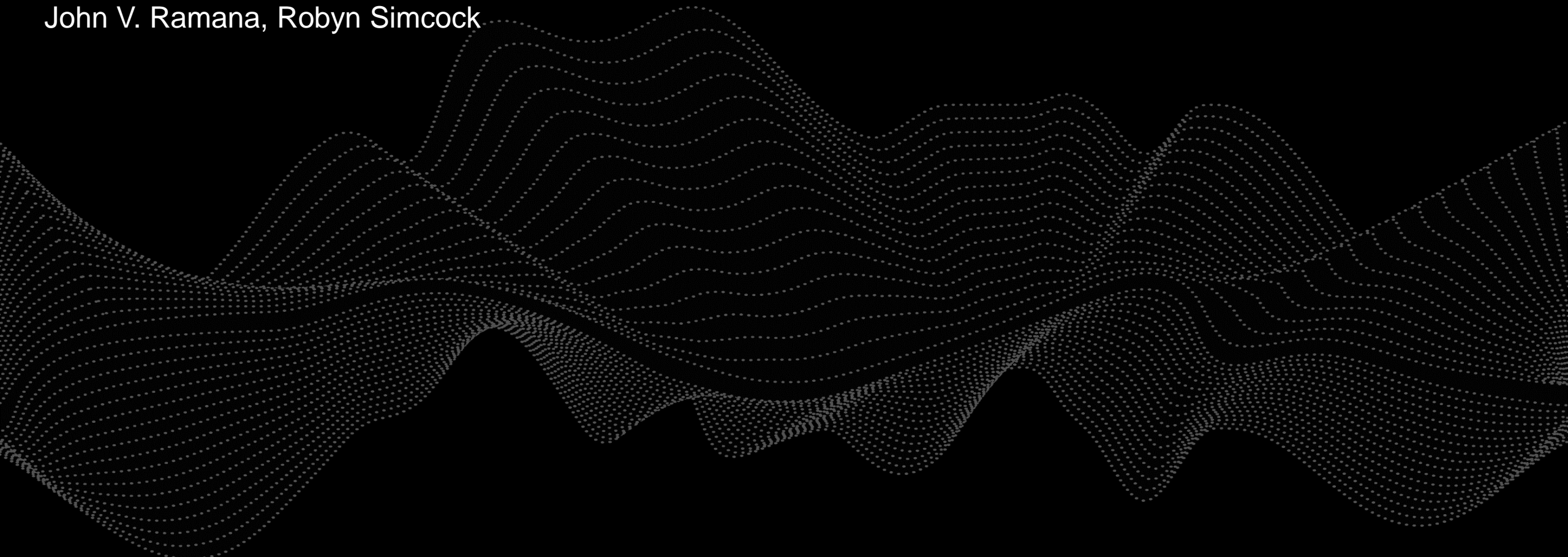


# Benefits of urban ecosystems in Ōtautahi/ Christchurch



Manaaki Whenua  
Landcare Research

Daniel Richards, Maksym Polyakov, Angela J. Brandt, Jo Cavanagh, Gradon Diprose, Grace Milner,  
John V. Ramana, Robyn Simcock



# Benefits of urban ecosystems



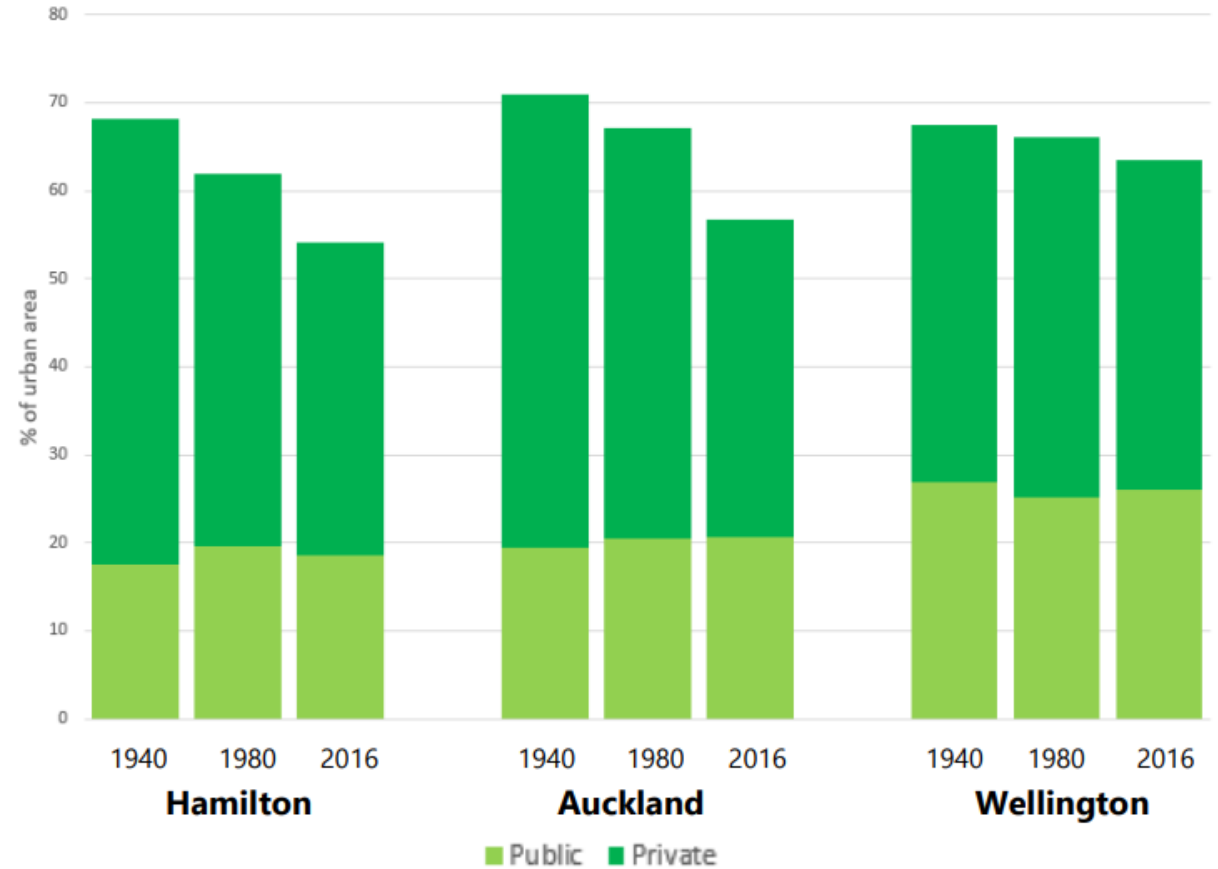
Margaret Mahy Garden. Photo by Robyn Simcock

# Urban ecosystems are under pressure

## Are we building harder, hotter cities?

The vital importance of urban green spaces

March 2023



**Figure 4. Public and private green space summary (% of urban area).**

# Benefits of urban ecosystems



Biodiversity



Carbon stock



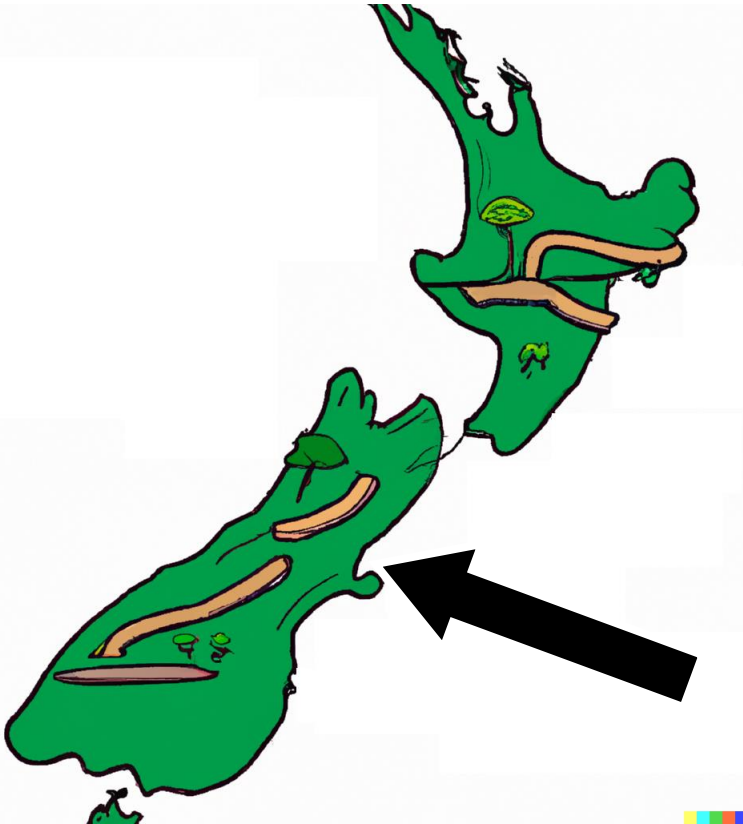
Runoff retention



Shade



Recreation

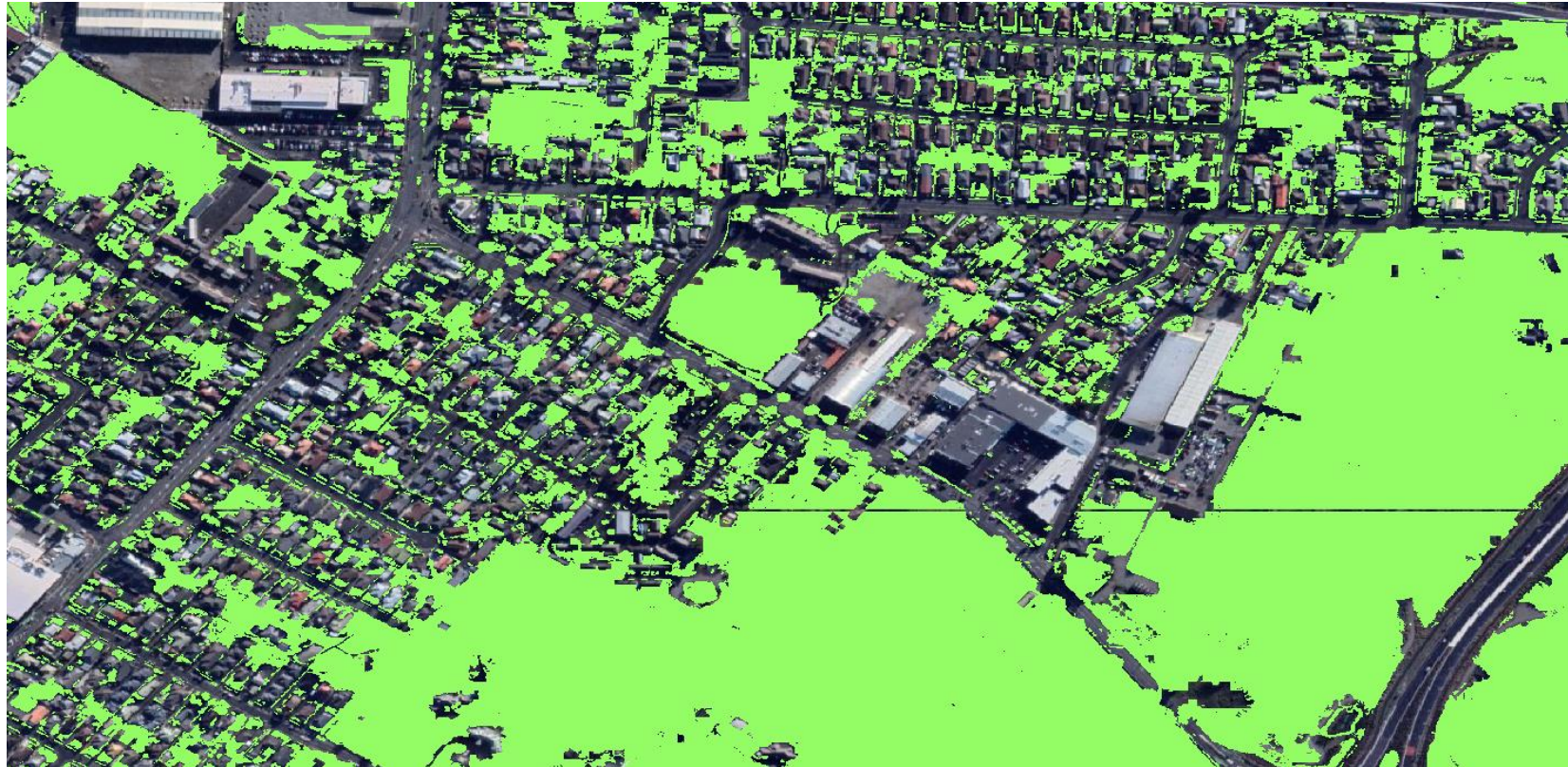


# Methods



Papanui

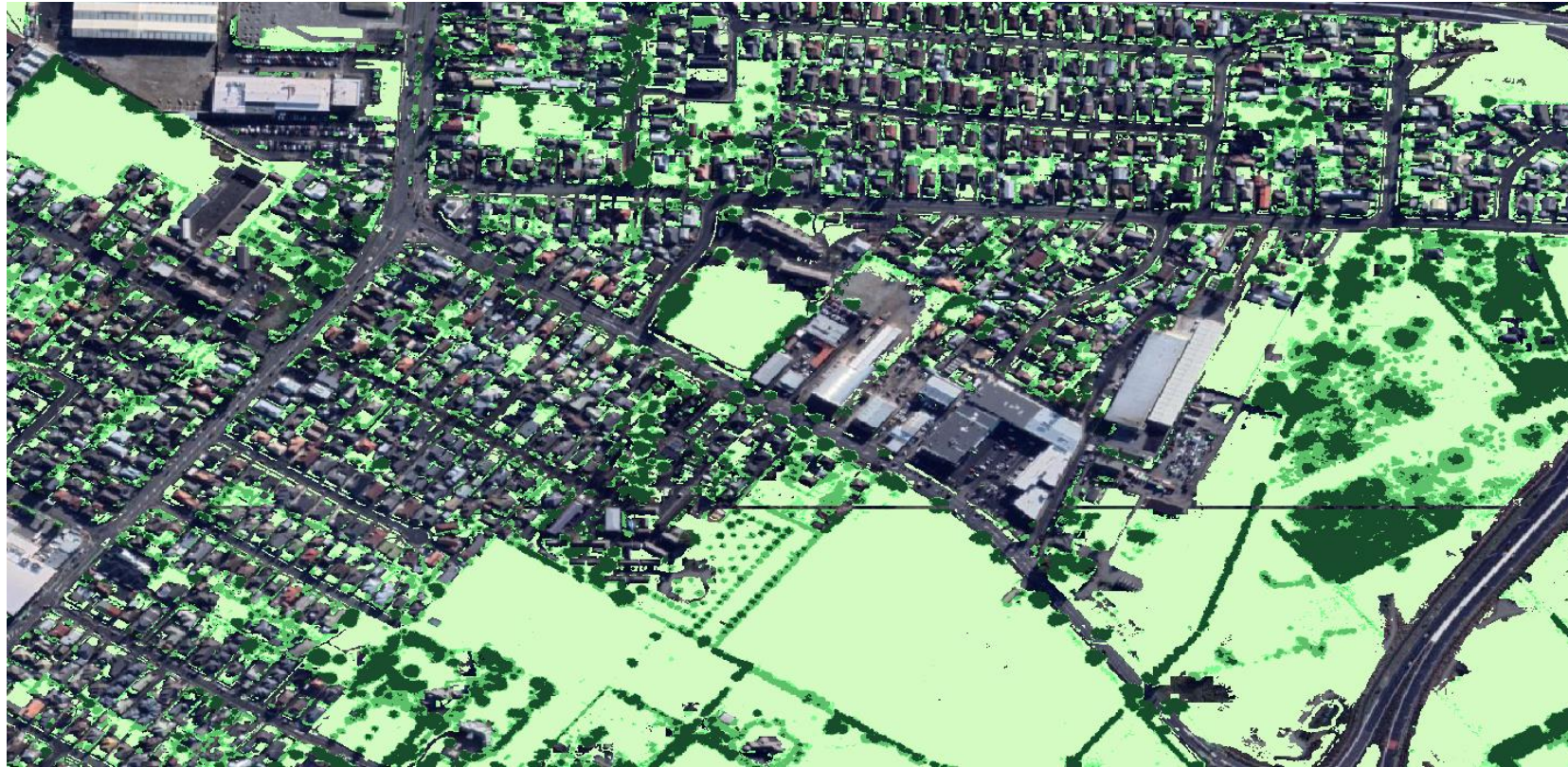
# Methods







Vegetation

Papanui

# Methods



	Grass
	Scrub/ shrub
	Tree < 5m
	Tree > 5m

Papanui

# Methods

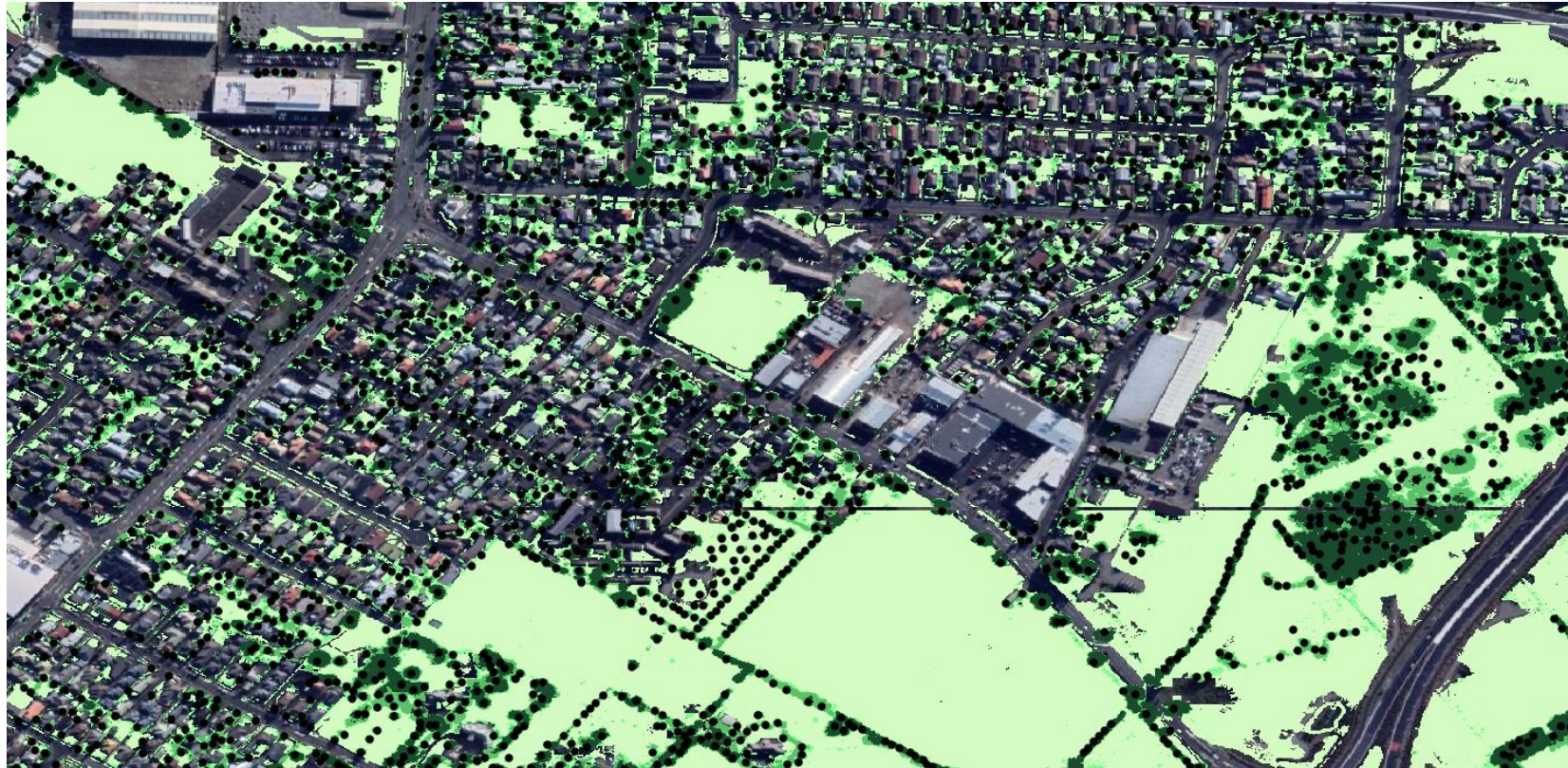


	0 m
	1 m
	5 m
	10 m
	20 m

Papanui



# Methods



●	Tree location
Light Green	Grass
Medium Green	Scrub/ shrub
Dark Green	Tree < 5m
Very Dark Green	Tree > 5m

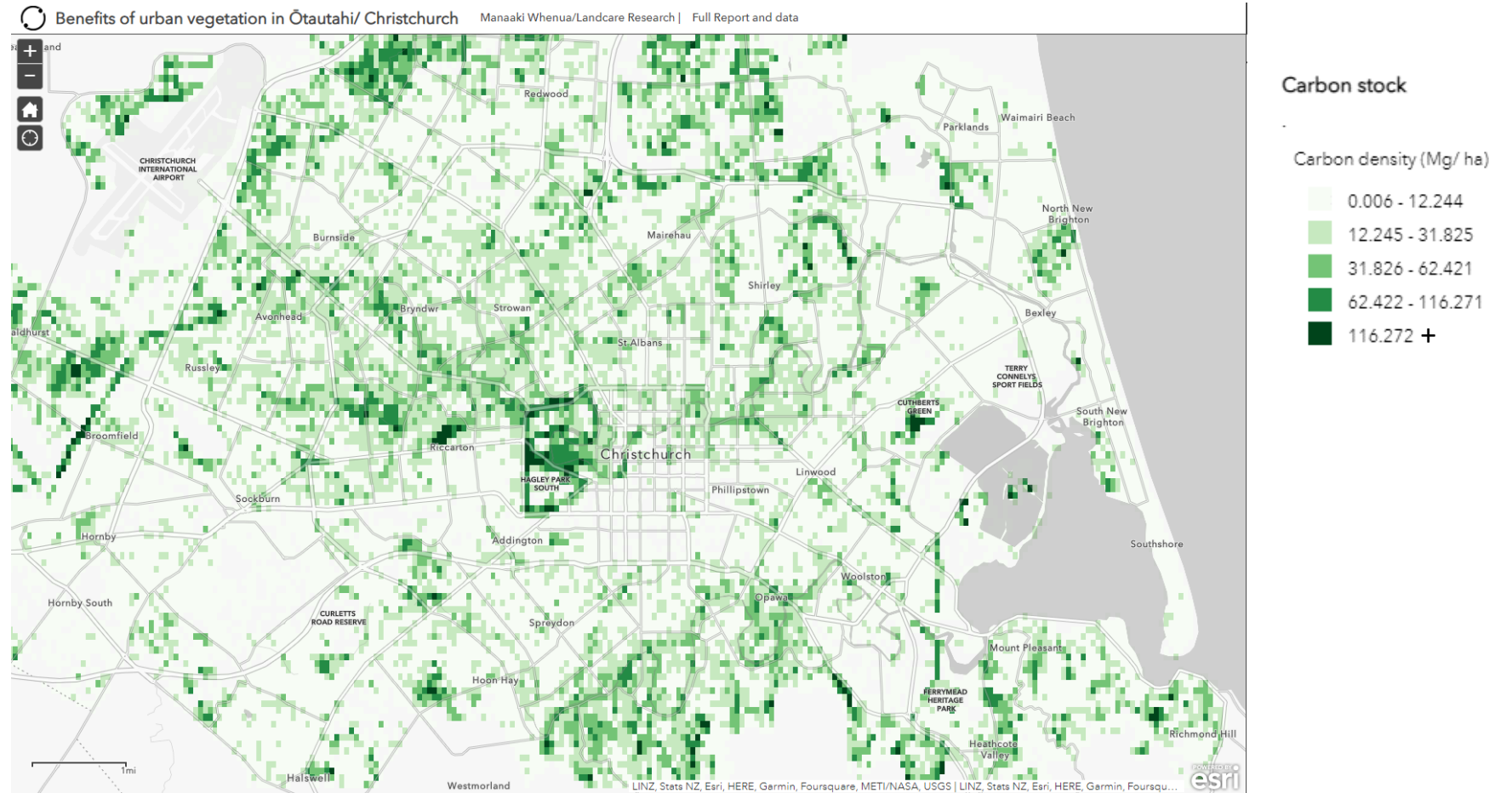
Papanui

# Carbon stocks



Tree biomass carbon stock

Modelled from tree height using allometric equations



Total stock estimated at ~380,000 tonnes C

= 1.4 million tonnes CO<sub>2</sub> equivalent

≈ 50% of the annual emissions from the city

# Shade



Shade between 8 am and 6 pm on 1<sup>st</sup> February 2019

Modelled using rayshading of a 3D model



At an average location, shade was provided 5% of the time

Overall, 14% of shade was provided by trees

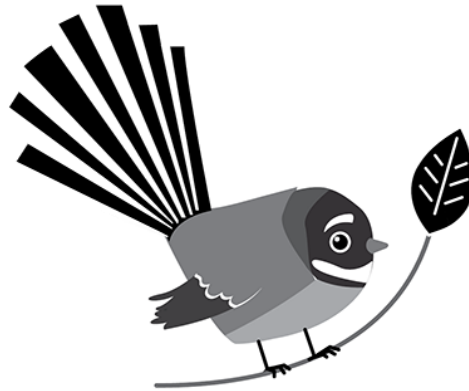
# Biodiversity



Bird species  
observed in 1 hour

Modelled using NZ  
Garden Bird Survey  
data from 2018,  
2019, 2020

Total n = 936



**New Zealand**

---

**GARDEN BIRD  
SURVEY**

# Biodiversity



Bird species  
observed in 1 hour

Modelled using NZ  
Garden Bird Survey  
data



Most common:

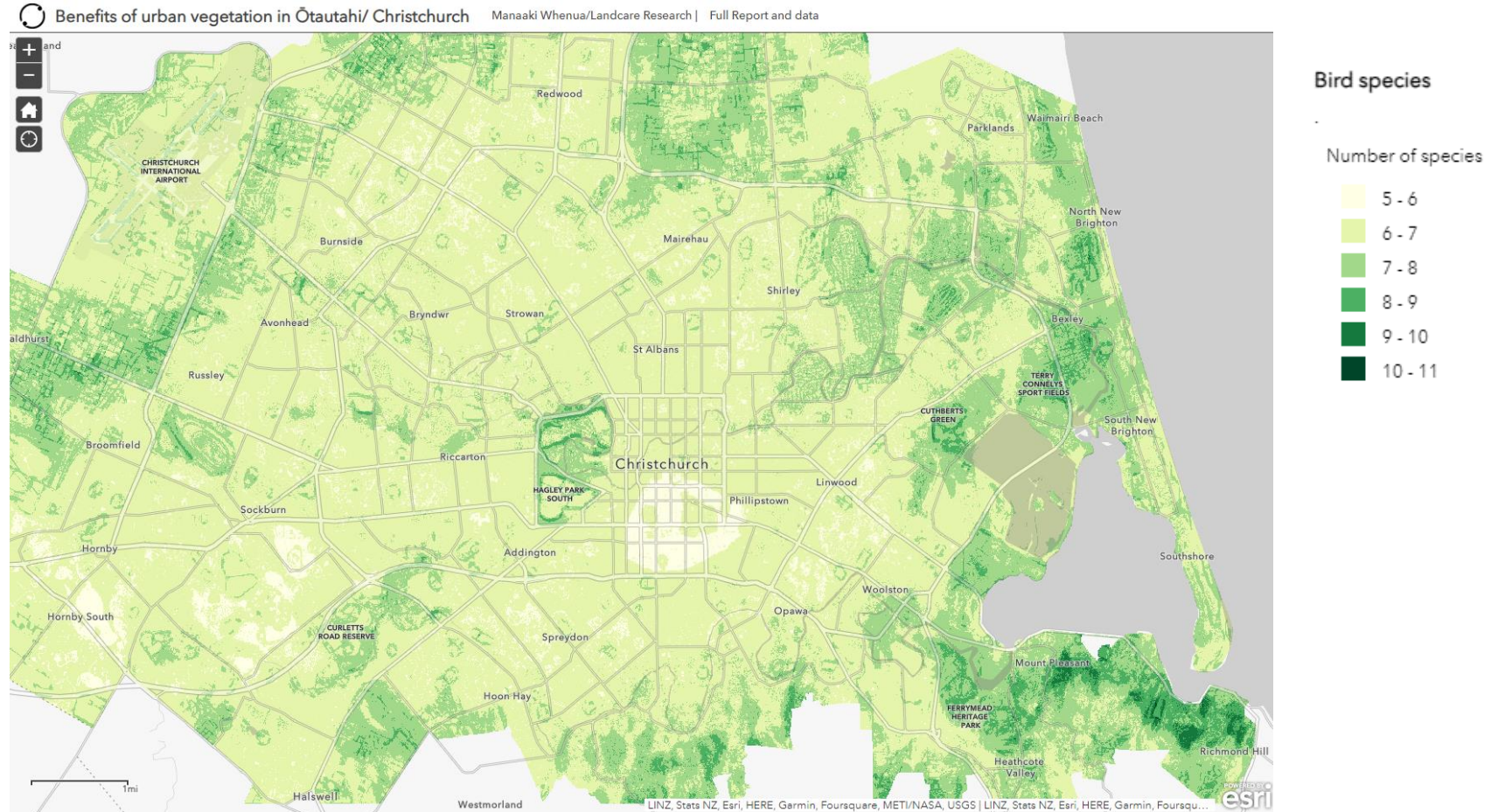
1. House Sparrow
2. Blackbird
3. Silvereye/ tauhou
4. Starling
5. Fantail
6. Greenfinch
7. Gull black backed
8. Chaffinch
9. Thrush
10. Dunnock
- ... 21. Kererū

# Biodiversity



Bird species  
observed in 1 hour

Modelled using NZ  
Garden Bird Survey  
data



Some common species  
everywhere, others only in  
some neighbourhoods

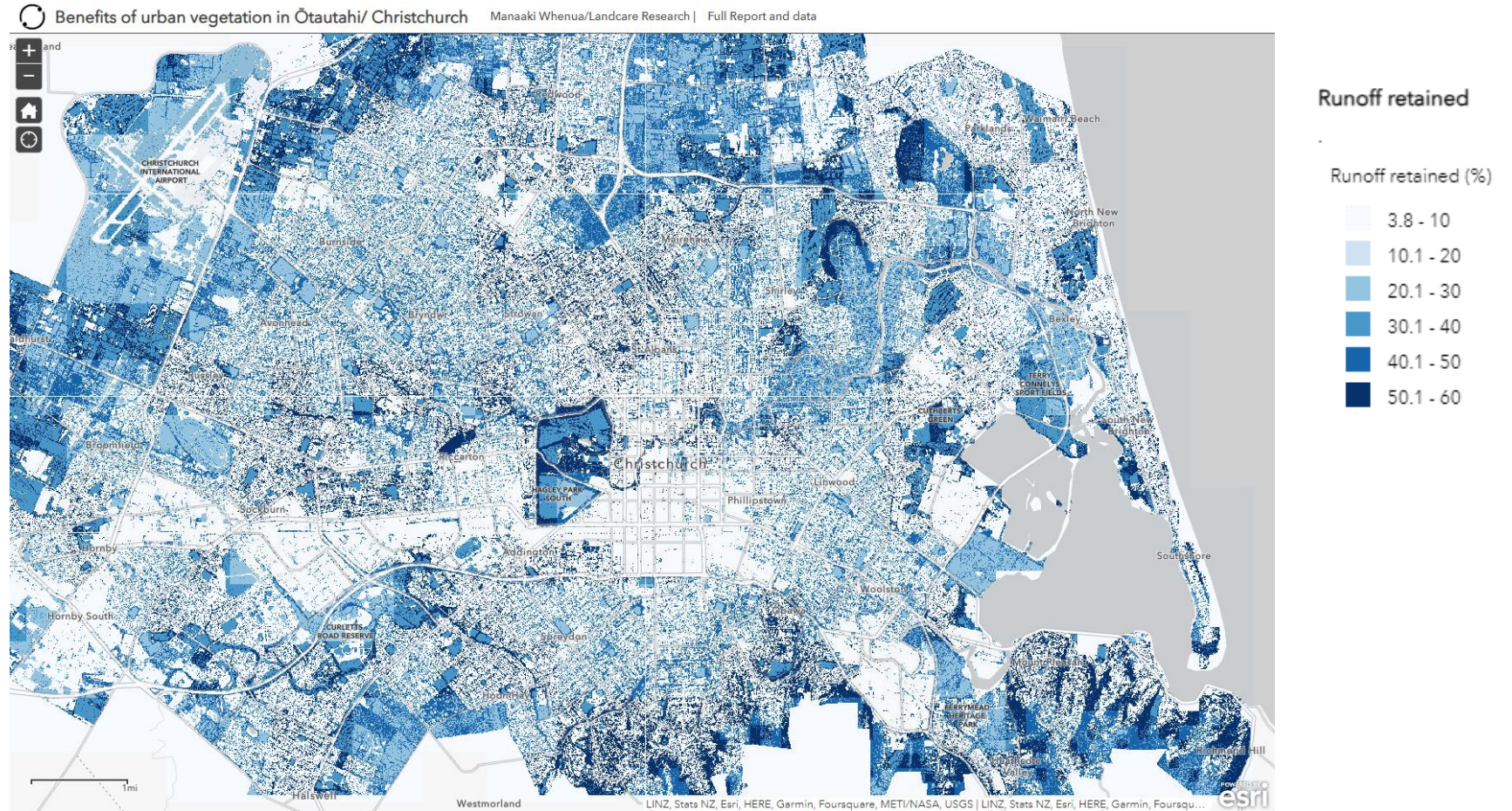
Bird species richness heavily  
influenced by grass and tree  
cover, surrounding scrub and  
tree, water

# Runoff



Runoff retained under a high rainfall event (137 mm)

Modelled using Curve Number approach



Across the city, 22% of incoming rainfall was retained

Within neighbourhoods, between 5% and 43% retained

# Access to outdoor spaces

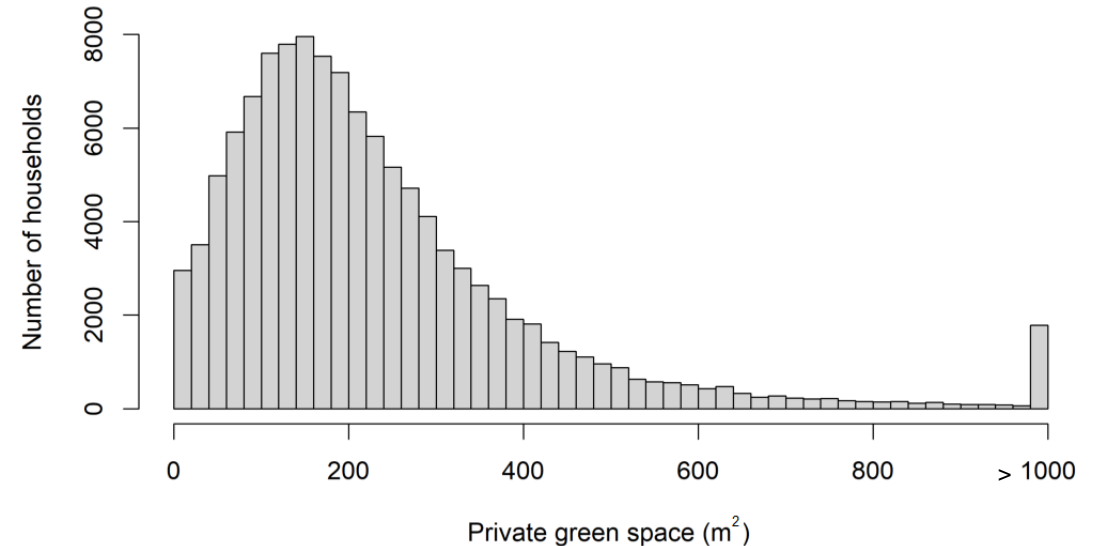
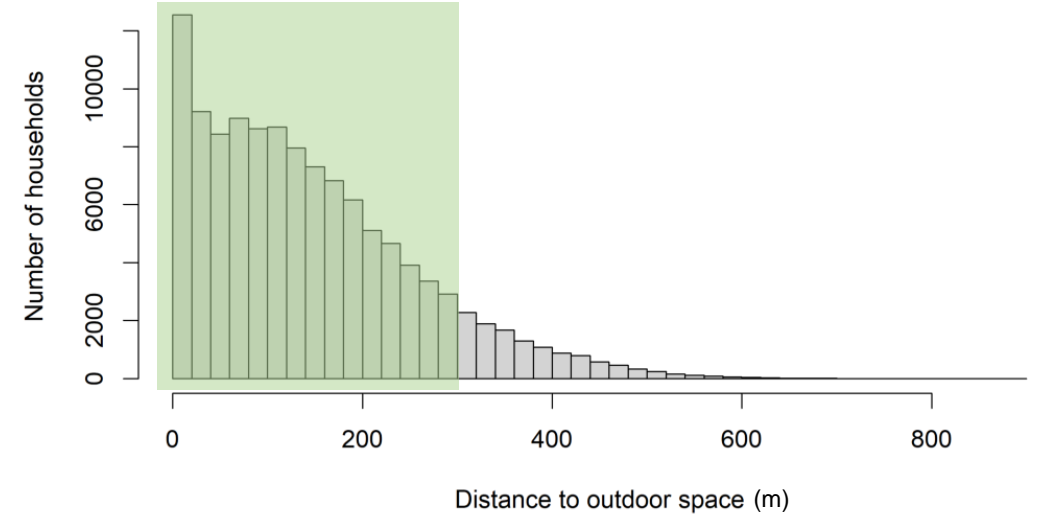


Distance from outdoor recreation space

89% meet the WHO 300 m recommendation

Private green space within land parcel

Mean household has 246 m<sup>2</sup> private green space



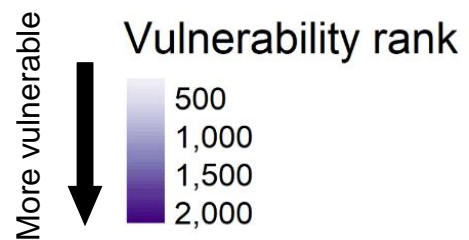


# Applications of these data

- How equitable are people's experiences of urban ecosystems?
- Interactive tool to inform planning and the public

# Equity in the benefits of urban ecosystems

- The “vulnerability” of communities is indicated by the Economic and Social Vulnerability Index, based on census data. Ranked from least vulnerable to most vulnerable



# Access to the benefits of urban ecosystems?

More vulnerable mesh blocks:

- have less urban ecosystem cover (45%)
- have less tree cover (44%)
- have lower performance for 8 out of 9 types of ecosystem benefit

**Low vulnerability**



Styx Mill

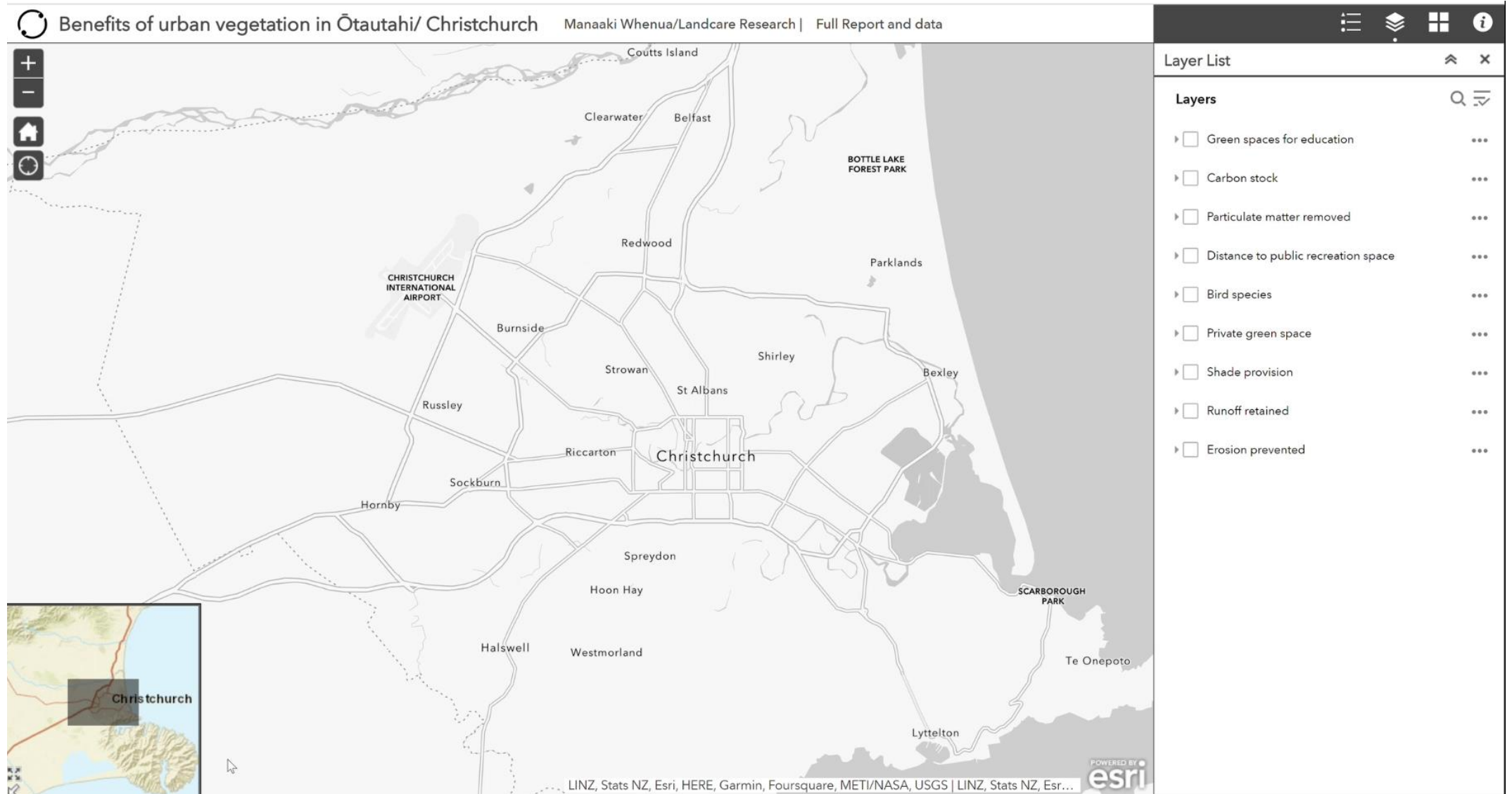
**High vulnerability**



Addington. Images from Google Street View

# Tools and data

<https://mwlr.nz/ncp-christchurch>



# Tools and data

<https://datastore.landcareresearch.co.nz/dataset/ncp-christchurch>

The screenshot shows the Datastore website interface. At the top, there is a navigation bar with the Datastore logo, Manaaki Whenua Landcare Research name, and links for Data, Collections, Groups, and Terms of Use. A search bar is also present. Below the navigation bar, the breadcrumb trail reads: Home / Collections / Manaaki Whenua - Landcare ... / Benefits of urban ...

The main content area is titled "Benefits of urban vegetation in Ōtautahi/ Christchurch". It features a "Dataset" tab, "Groups" icon, and "Activity Stream" link. The description states: "This dataset contains map layers describing different benefits that urban ecosystems provide to people in Christchurch/ Ōtautahi. The nine map layers use different datasets and models developed by Dan Richards and a team from Manaaki Whenua - Landcare Research."

On the left side, there is a sidebar with the following information:

- Followers: 0
- Collection icon and label
- Manaaki Whenua Landcare Research logo and name

The "Data and Resources" section lists the following items, each with a "Data" icon and an "Explore" button:

- Methods summary**: Overview of methods used to generate the datasets.
- Carbon stocks**: Above-ground tree biomass carbon stocks. Carbon stocks were estimated using...
- Runoff retention**: The proportion of incoming rainfall retained by vegetation. Runoff retention...
- Removal or particulate matter air pollution (PM10)**: The contribution of vegetation to removing particulate matter pollution from...
- Erosion control**: The proportion of potential soil erosion prevented by vegetation. A soil loss...
- Shade provision**: The proportion of time that vegetation was providing shade at ground level...
- Green spaces for education**

# Summary

- Urban ecosystems in Ōtautahi provide benefits to people
- High-resolution spatial datasets allow us to see variability across a city
- Tools to view and download these datasets are available
- Future work will look at how urban ecosystems and their benefits may change in future

