

# Ecosystem services (seed funding)



Manaaki Whenua  
Landcare Research

Dan Richards

Senior Researcher

[richardsd@landcareresearch.co.nz](mailto:richardsd@landcareresearch.co.nz)

# Ecosystem Services (Seed Funding)



## Aims:

- Develop a framework to fuse LiDAR with other available datasets to parameterize ecosystem service models
- Write this up as a set of software functions (R language) to make ecosystem service analysis easier, repeatable, comparable across time and space

## Outputs:

- R package and documentation
- Some model runs for test region (Wairoa)

# Ecosystem services scope



Nutrient retention



Air pollution removal



Carbon stock



Runoff retention



Shade



Ultraviolet protection



Landscape aesthetics

# R package



The screenshot displays the GitHub interface for the repository `manaakiwhenua/hbrc`. At the top, there is a navigation bar with links for Product, Solutions, Resources, Open Source, Enterprise, and Pricing. A search bar is located on the right. Below the navigation bar, the repository name and a 'Public' badge are visible. A secondary navigation bar includes links for Code, Issues, Pull requests, Actions, Projects, Security, and Insights. The main content area is divided into two columns. The left column shows the repository structure with a table of files and folders, including `R`, `data`, `man`, `.Rbuildignore`, `.gitignore`, `DESCRIPTION`, `LICENSE.md`, `NAMESPACE`, `README.md`, `hbrc.Rproj`, and `intro-hbrc-v3.pdf`. The right column contains an 'About' section with a description: 'Functions for estimating ecosystem services indicators using high-resolution spatial datasets.' It also lists repository statistics: 0 stars, 3 watching, and 0 forks. Below the 'About' section are sections for 'Releases' (No releases published) and 'Packages' (No packages published). At the bottom, there is a 'Languages' section showing 'R 100.0%'. The repository's README is partially visible at the bottom of the page, starting with the title 'hbrc: Quantifying ecosystem services'.

File/Folder	Description	Commit Date
R	Minor error in cn.e1	8 months ago
data	Removed datasets from data since they do not travel well. T...	8 months ago
man	Updated to match Beets et al 2012 Table 2	9 months ago
.Rbuildignore	Initial	9 months ago
.gitignore	Initial commit	9 months ago
DESCRIPTION	Addition of pdf guide version	9 months ago
LICENSE.md	Initial	9 months ago
NAMESPACE	Initial commit	9 months ago
README.md	Update README.md	8 months ago
hbrc.Rproj	Initial commit	9 months ago
intro-hbrc-v3.pdf	Updated documentation after fixing biomass	9 months ago

<https://github.com/manaakiwhenua/hbrc>

# R package guide



## Introduction to the HBRC package

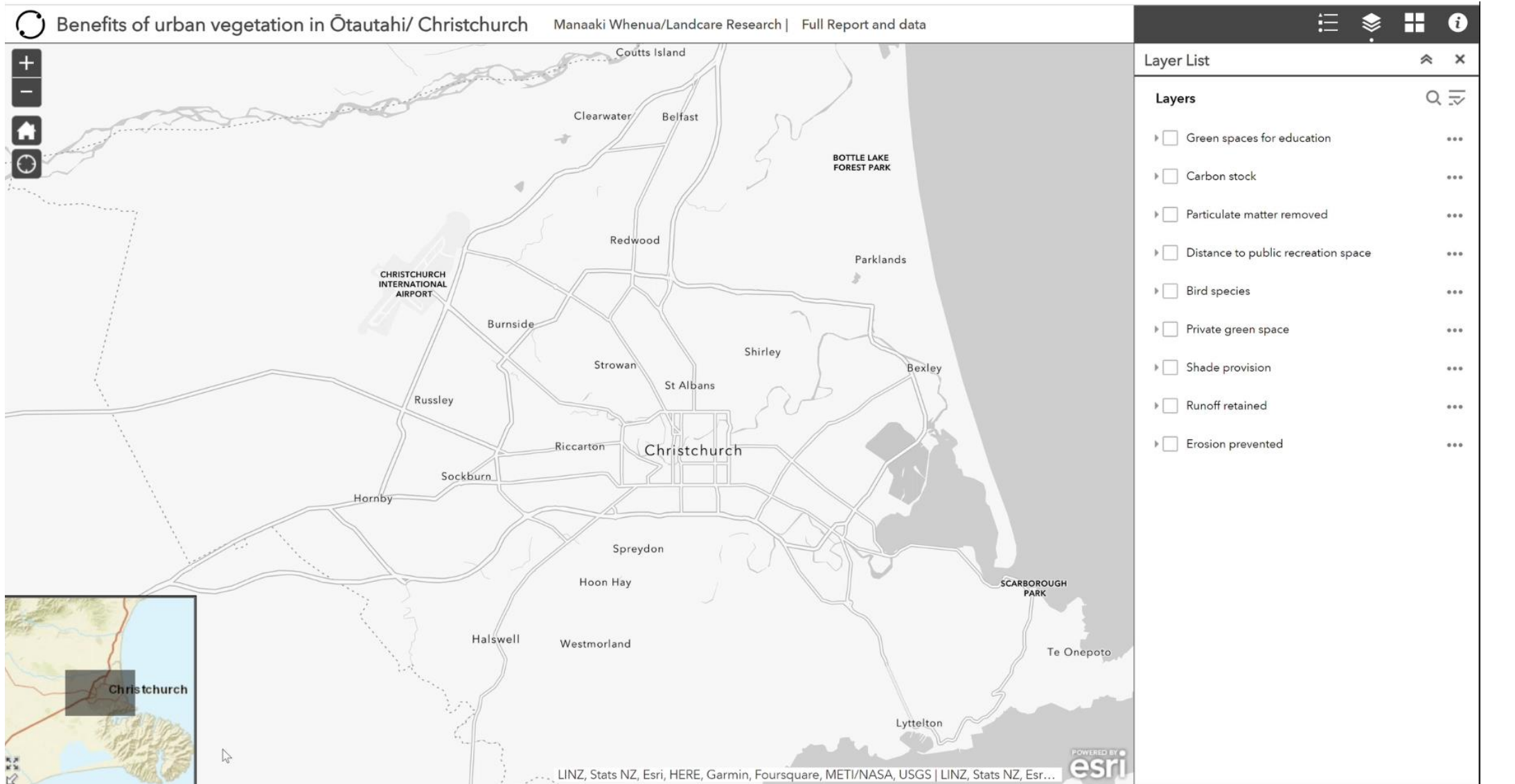
Dan Richards

2023-12-04

### Contents

- Overview** 2
- Package installation and set-up** 2
- Package functions summary** 2
  - Runoff retention . . . . . 2
  - Carbon stocks . . . . . 2
  - Air pollution removal . . . . . 3
  - Landscape aesthetics . . . . . 3
  - Ultraviolet (UV) protection . . . . . 3
  - Shade . . . . . 3
  - Nutrient retention . . . . . 3
- Example usage** 4
  - Test case study region . . . . . 4
  - Runoff retention . . . . . 6
  - Aboveground biomass carbon stocks . . . . . 8
  - Air pollution removal . . . . . 10
  - Ultraviolet (UV) protection . . . . . 12
  - Shade . . . . . 13
  - Landscape aesthetics . . . . . 15
  - Nutrient retention . . . . . 17
- Uncertainty propagation** 18
- Saving output maps** 20
- Acknowledgements** 21

# Other applications





## Rolleston Ecosystem Services Case Study



The case study is part of a broader research programme on the Waikirikiri Ki Tua Future Selwyn Blue-Green Network

# Other applications

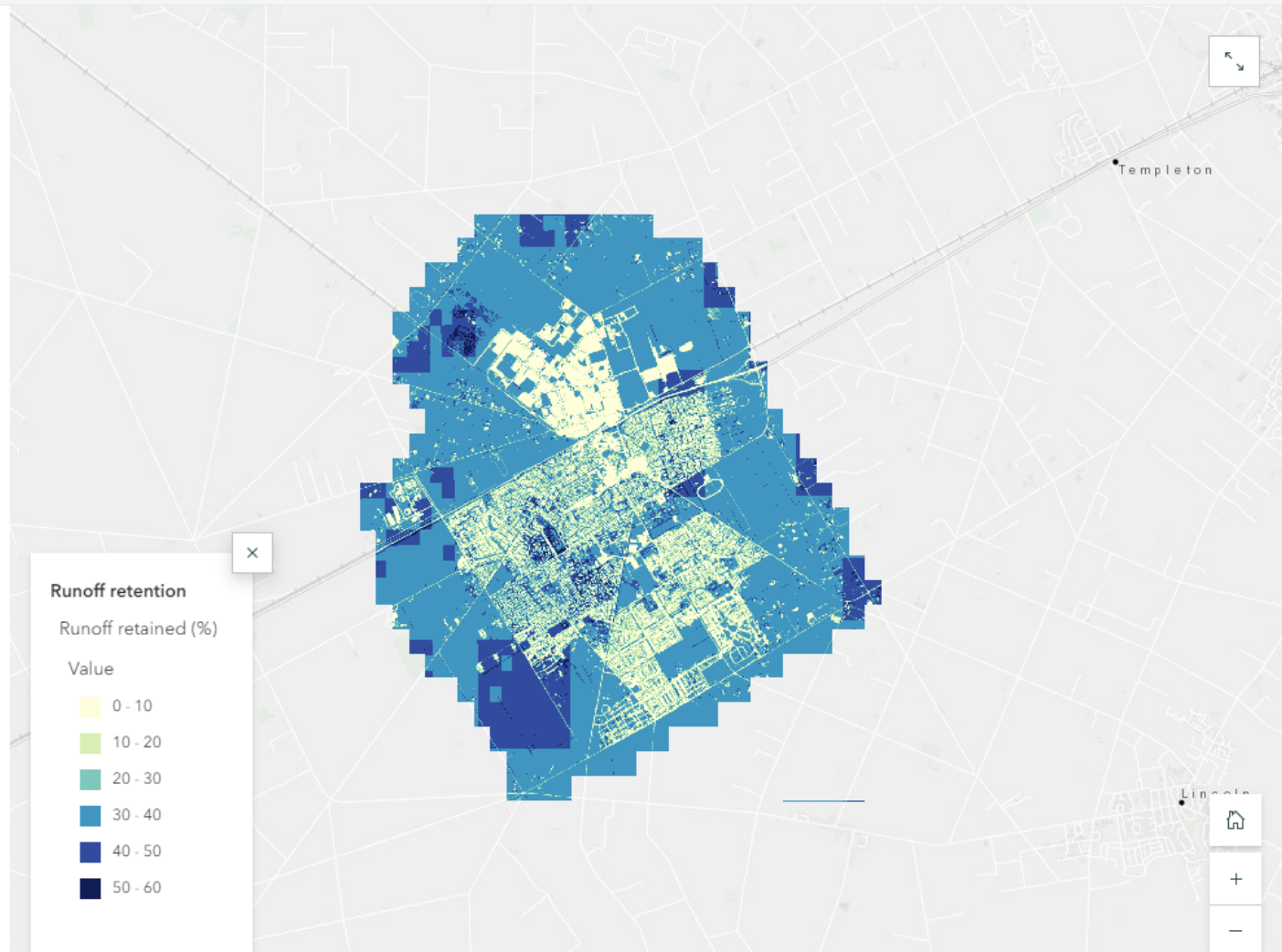


## Runoff retention

Development results in an increase of impervious surfaces which impacts on the natural water cycle, causing water to flow over the surface of land more quickly and more frequently even from smaller events. This is having an increasing impact as we move towards intensification and reduction in private green space.

Stormwater systems are designed and engineered to cope with rain, however systems can become overwhelmed, and this can result in various problems. Pollutants can find their way into stormwater systems and have negative impacts on downstream ecosystems and on urban infrastructure.

Green spaces have a number of positive





# Other applications



## Daytime shade provision

Urban trees provide daytime shade and are a key tool in helping us meet the challenges of climate change and the biodiversity crisis. Trees have many benefits and are central to enhancing our wellbeing and the amenity of our urban areas as well as providing a network of habitat for wildlife. Trees can cool their surrounding environment through shading and transpiration (releasing water from their leaves into the air) which reduces the surface and air temperature.

Evidence suggests that shading provided by trees can even extend the life of infrastructure such as asphalt. With a warming climate that will exacerbate the urban heat island effect in many urban areas, shading from trees will become increasingly



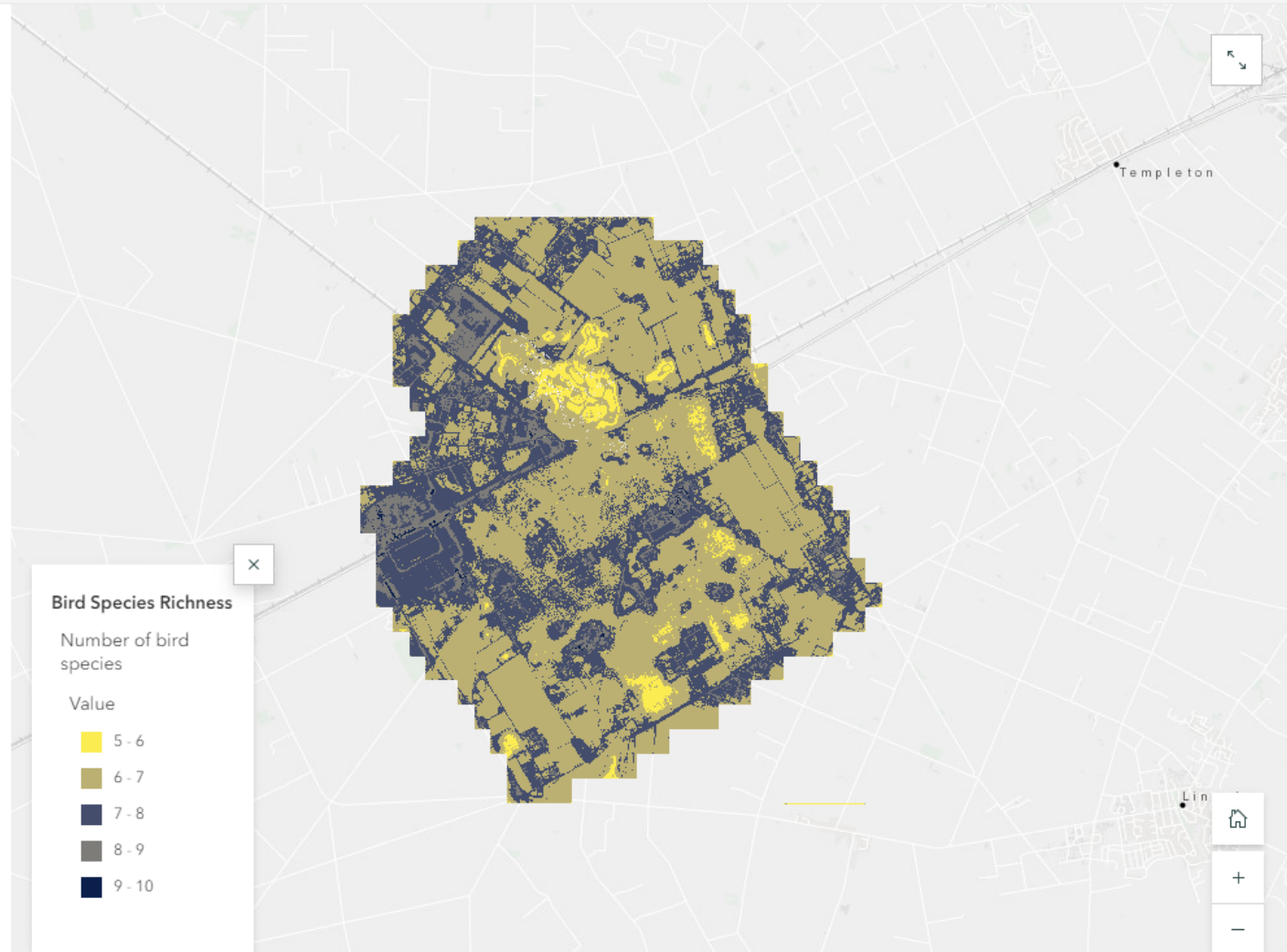
# Other applications



## Number of bird species

Human activity has significantly impacted Aotearoa New Zealand's bird diversity over the last few centuries. Aotearoa New Zealand's biodiversity is unique due to its evolution with many native species found nowhere else in the world. Protecting Aotearoa New Zealand's unique bird species is vital for maintaining ecosystem integrity and overall biodiversity.

Understanding the presence and richness of bird communities is an important indicator of the state of biodiversity. Changes in bird populations can signal changes in the environment such as pollution levels or habitat quality. The diversity of bird species is important for ecosystem



# Other applications



Trees in landscapes  
Te Kapunipunitanga a Tāne Mahuta