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Short webinars for environmental policy-makers and practitioners

The benefits of urban ecosystems in Ōtautahi Christchurch

The following questions were asked during our live webinar with Dan Richards but due to time restrictions, we were unable to answer these in the session.

Questions about geospatial methodologies

Is there a write-up of this case study where other local authorities can apply the methodology using their own data inputs and similar models?

This work is now published and available online here:

<https://www.sciencedirect.com/science/article/pii/S1618866723002157>

Kia ora, Kiri Joy Wallace from the People, Cities & Nature research programme here. Re Methods: When you said you ran an algorithm over the remote sensing data to identify trees, is it a machine learning algorithm or something else? Would love to hear a bit more please.

Kia ora, great to hear from that great research programme. We used ForestTools to identify individual trees, using a segmentation based on canopy height. We used the R version of the software available here: <https://github.com/andrew-plowright/ForestTools>

Yes access to the methodologies would be great thanks, particularly the calculations used for biomass estimation, as I've recently performed canopy modelling.

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Hamilton is 12.5% I did the modelling - greater than 3.5m crown height.

Great to know, thanks for the information.

The particulate matter removed layer - does it differentiate between grass and trees? As areas of grass show up clearly?

Particulate matter is estimated based on leaf area, which can be relatively high in grassy areas. Also, the resolution of that dataset is quite low so most pixels would have a mix of vegetation types.

How can spatial planning support an increased carbon stock?

It may be possible to identify locations suitable for planting trees, which would support an increased carbon stock. For example, overlaying with soil data and showing where there is enough 'above ground' space for tree canopies.

I note the pylons running across Charlesworth Reserve are being caught as Carbon Stock...

Yes this is a minor error in the dataset.

Questions about wellbeing

Kia ora this was really interesting thank you. I was wondering whether this data can be used to support planning under the Local Government (Community Well-being) Amendment Act? i.e. reducing some of the inequities you have shown.

This is a great suggestion and we hope that the analysis shows how and where investment in say nature based solutions and/or water sensitive urban design could be targeted to address interconnected environmental and socio-economic inequities. Local Government could adapt the information and associated indicators we have used to suit their respective contexts, communities, and priorities.

What has the WHO got to do with us in Aotearoa?

We used the WHO recommendation as an example of a recommended distance from outdoor space that has been shown to have benefits for health and well-being. From the graph provided, you can compare any other threshold to see how many people live within that distance from an outdoor space. We would be very interested to hear other recommendations for outdoor space requirements that are tailored to Aotearoa.

Questions about vegetation details / natural features

What is the ratio of exotic to native trees in Christchurch relative to other NZ cities?

At this point, we do not know the answer to this question. You may be interested in this study of tree inventory data from the Red Zone: <https://peerj.com/articles/10588/>

Impact of streams and rivers on this analysis?- nice work!

Unfortunately freshwater ecosystems do not feature strongly in this analysis. It would be interesting to work on this in future.

How much shade is provided by trees/vegetation compared to the shade provided by the buildings?

Of the total shade provided by topography, vegetation, and buildings modelled over the time period of this study, 14% was provided by trees.

Has any work been done to assess the benefits of shelter provided by vegetation? It might perhaps be more important in windy, temperate NZ, than cooling from shade?

We are not aware of any work in this area in NZ for urban landscapes, although the impact of, and design of shelterbelts for livestock and horticulture (especially wind-sensitive crops such as kiwifruit, avocados and stonefruit) have been investigated.

Application in planning and other outcomes

Is there any plan to link the visualisation platform you've created to the Christchurch District Plan?

There is no plan to make this link at present.

When I was in Amsterdam, new urban development was planned with med density (similar to our townhouse style) 3 level walk ups with narrow road frontages. This did allow for contiguous connected front yards which were able to be 'greened' in a bio-corridor style for biodiversity to travel / thrive in urban areas. Any thoughts on how to get our government agencies to collaborate on this kind of holistic outcome for any of our cities?

A space where a comparable approach can be delivered is along 'green' stormwater infrastructure, especially along riparian corridors, overland flow paths, and transport infrastructure (mainly roads, cycle paths). Perhaps one way to collaborate is through specifying standards for tree cover (30%) and natural cover in spatial plans. However, bio-corridors need to be supplemented with larger areas as 'nodes' or 'cores' that have low edge effects (especially low artificial light, noise and low fluctuations in temperature and humidity).

Would it be better for people to have smaller gardens so there is dedicated wild spaces to give flora and fauna a better chance?

There are strategies such as 'connected gardens' (see comment above) that make effective green space larger, because larger areas as 'nodes' or 'cores' are needed that have low edge effects (especially low artificial light, noise and low fluctuations in temperature and humidity). This can be achieved by having carefully designed spaces that may not need to be exclusively 'wild'.

How do you propose to have different mix vegetation in Christchurch, i.e. which area is suitable for more big trees and some area is more to shrubs? Based on what guidelines/concept this could be done?

At the larger spatial scale this can be started by identifying areas that have space for big trees (above ground and below ground), and aren't formal playing fields, and spaces where shrubs are prevented by requirements for 'sight lines' and 'clear zones' that are required along parts of roads, where there are above-ground power-lines/cables' and in public spaces with CiPTED controls (Crime Prevention through landscape design). In riparian and flood detention areas trees, not shrubs are wanted because shrubs are considered to occupy flood volume.

Could someone please refer me to where I might find the mana whenua response/contribution to Ōtautahi urban ecosystems?

Iwi Management Plans are a useful resource to broadly understand how mana whenua express kaitiakitanga and rangatiratanga. They can provide a helpful starting point to identify the priorities mana whenua may have for urban ecosystems (although Iwi Management Plans may not categorise land as 'urban' and 'rural').

I'm interested in how you plan to ensure there is enough water for new trees. Especially with drought/ heat increasing in coming years.

Yes this is an important consideration. We do not dig into species-level selection in this study, but it may be advisable to a) choose drought-tolerant species in some areas, to give better resilience to future climate change; b) establish trees so that they receive runoff from adjacent impervious surfaces such as footpaths, roads and roofs (this increases the accessible water from even very small events of 2-5 mm rain); c) reduce tree stress by ensuring large root volumes, planting in clusters so they are self-sheltering, and ensuring the surface is permeable and preferably planted and/or mulched (not paved); d) ensuring soils into which trees are planted can infiltrate and store water (e.g. adding organic amendments, and protecting from compaction e) using buildings to help shade trees.

The *private* green space is not actually a positive thing, because it directly contradicts the need for urban densification, and does not reflect an emphasis on the common good (i.e., shared facilities). Your comments?

While we agree there is potential for conflict here between the known benefits of private green spaces for well-being, and the benefits of densification for many other urban parameters. We also note that private green space that is visible from public areas (e.g. front yards) has been shown to provide common benefits such as wellbeing, as well as benefits from cooling/shade/air quality. If public green spaces can be well-designed to support well-being equitably, it may be more socially and environmentally acceptable to remove or reduce the size of private green spaces.

Other councils

I'd be keen to see how this aligns with Wellington. Keen to look at a similar study in Wellington with its increasing biodiversity and green spaces

Perhaps see the spatial webinar by Jan Schindler earlier this year that had a segment mapping Wellington's tree canopy (https://youtu.be/q_gdOcpWmPo); Wellington was also included as a case study in the Parliamentary Commissioner for the Environment's report on urban green space.

Keen on adding Tāmaki Makaurau Auckland too - they used LiDAR to map tree canopy cover so have some analysis and have a some plan to increase, but sometimes this can be decoupled from the urban areas rather than integrated.

The Tāmaki Makaurau tree canopy analysis is a great dataset, and could be used to do a similar modelling of tree benefits as we have presented here. In addition to trees, other types of vegetation are also important, so it would be good to include them too. Auckland was included in the PCE report on urban green space.

Which other cities in NZ can be viewed using this technology?

No other cities are available at present.

Great mahi - loved the comparison of cities in NZ. Would love to see where Tauranga City ranks!

This would be very interesting, unfortunately we are not aware of any similar analyses for Tauranga yet.

Fantastic! How do we get this done for our other cities?

We are keen to explore working in other cities. Please get in touch if you would be interested in collaborating.

Questions about birds and wetlands

Have wetland birds been considered in this example? Christchurch in particular is a nationally and internationally important site for wetland birds, and naturally does not have the same forest vegetation of cities like Dunedin and Wellington.

No, the current analysis does not have good coverage of wetlands due to reliance on the NZ Garden Bird Survey dataset. We agree it would be valuable to better include wetland birds, for example by using other citizen science or other datasets.

Could eBird be used as well as the NZ Garden Bird survey as that might take into account some of the bird species?

Thank you for the great suggestion, it might be a good way to broaden the scope of the analysis. We will bear this suggestion in mind for future work.

The NZ Garden Bird Survey is great, but it doesn't take into account that some of the most important areas for birds in wetlands and many of these are in public parks and reserves, such as Travis Wetland, Avon-Heathcote Estuary. How does this research take into consideration that wetlands and wetland species are significant for communities in Christchurch.

The current analysis does not have good coverage of wetlands due to reliance on the NZ Garden Bird Survey dataset. We agree it would be valuable to better include wetland birds, for example by using other citizen science or other datasets.

Other resources and comments shared

- **Thanks for the presentation. I note that the parliamentary commission also did a report on the vital importance of urban green spaces:**
<https://pce.parliament.nz/publications/are-we-building-harder-hotter-cities-the-vital-importance-of-urban-green-spaces/>.

The PCE report is important and complementary work.

- **I'm putting together a symposium on Urban Forests - date TBD, but likely mid-March 2024 in Christchurch. Would be keen to chat to anyone else interested:**
Tom.Carlin@scionresearch.com.
- **Is the team aware of the Stockholm Project that was initiated by Bloomberg Philanthropies with the model now be progressed in other cities.**
- **See Christchurch Urban Forest Plan.**