UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha

Analysing urban systems

Accessibility, Sustainability, and Resilience

Presented By:
Dr Tom Logan

Date:
14/04/2022

Introduction

Tom Logan, PhD

Lecturer, Civil Systems Engineering
Co-Director, Cluster of Community & Urban Resilience (CURe)

- Risk and urban science
- Climate change mitigation and adaptation
- Operations Research
  - Data analysis
  - Geospatial Analysis
  - Simulation

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Collaborators

RESILIENCE TO NATURE'S CHALLENGES | Kia manawaroa – Ngā Ākina o Te Ao Tūroa | National Science Challenges

THE DEEP SOUTH | Te Kōmata o Te Tonga | National Science Challenges

QuakeCoRE
NZ Centre for Earthquake Resilience

UC GEO HEALTH

UC CURE
cluster for community and urban resilience

THE CENTER FOR SPATIAL DATA SCIENCE
THE UNIVERSITY OF CHICAGO

Urban Hub Objectives

01

To provide a forum for presentations about **relevant research, projects** and policies.

02

To provide networking, relationship-building and **collaboration opportunities** for members and interested parties.

03

To help **drive the quality of policy development, research and data analysis** related to transport and urban areas.

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Opportunities to work together

Research

Do you have questions that are broader/nebulous?

Would you be interested in joining steering committees for existing projects?

Consulting

Applying these tools and techniques

Creating dashboards for specific areas/analysis

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01

Accessibility

X-Minute-City
Measuring Inequality

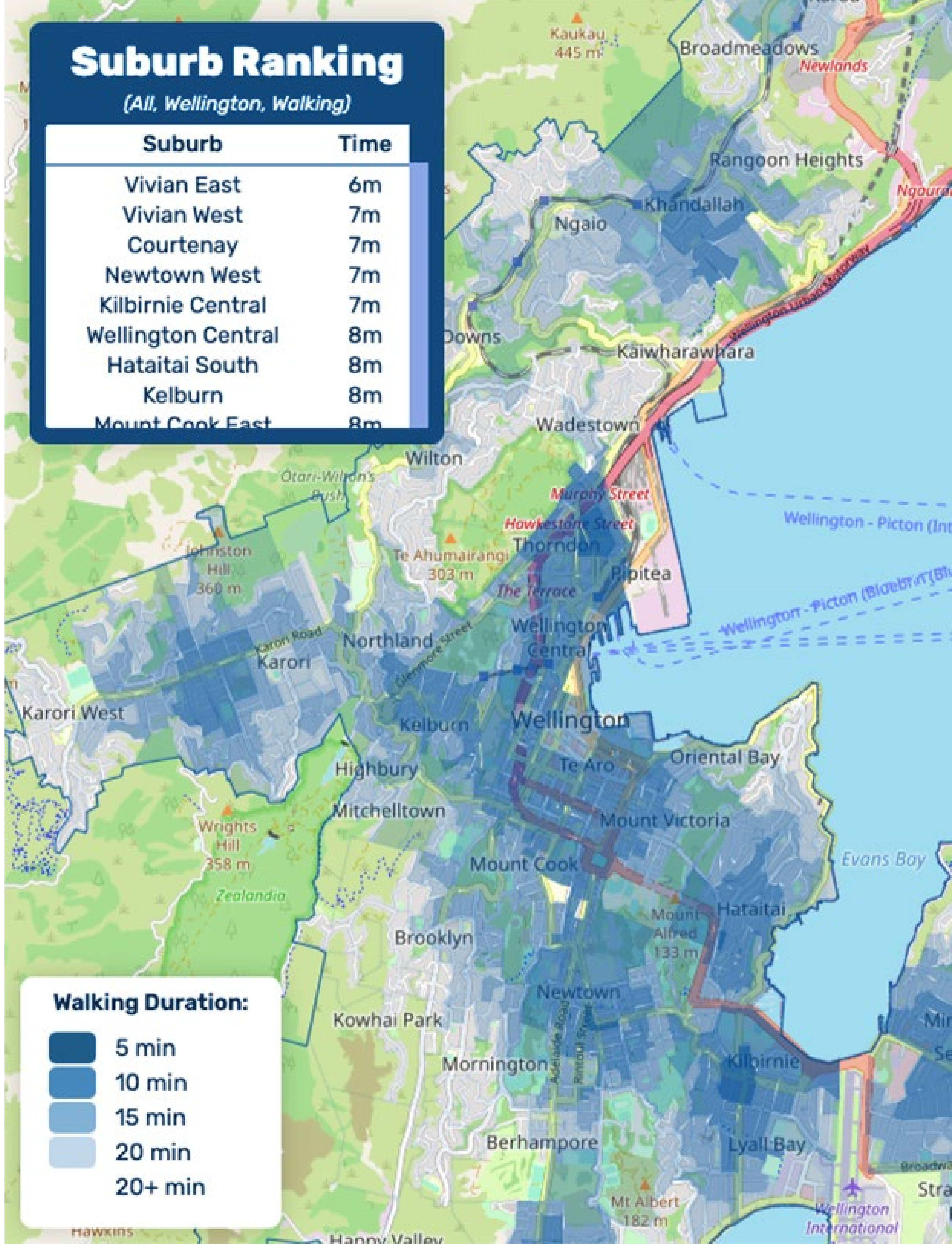
X-MINUTE-CITY

10/15/20/… minute city

Objective:

- How do measure the x-minute city
- What are the strengths and weaknesses of this concept?

Team:
UC Engineering, Health, and Geography collaboration



X-MINUTE-CITY

Challenges with approaches:

- Different measurement approaches can exclude people with poor access
- Are based on arbitrary thresholds

Approach:

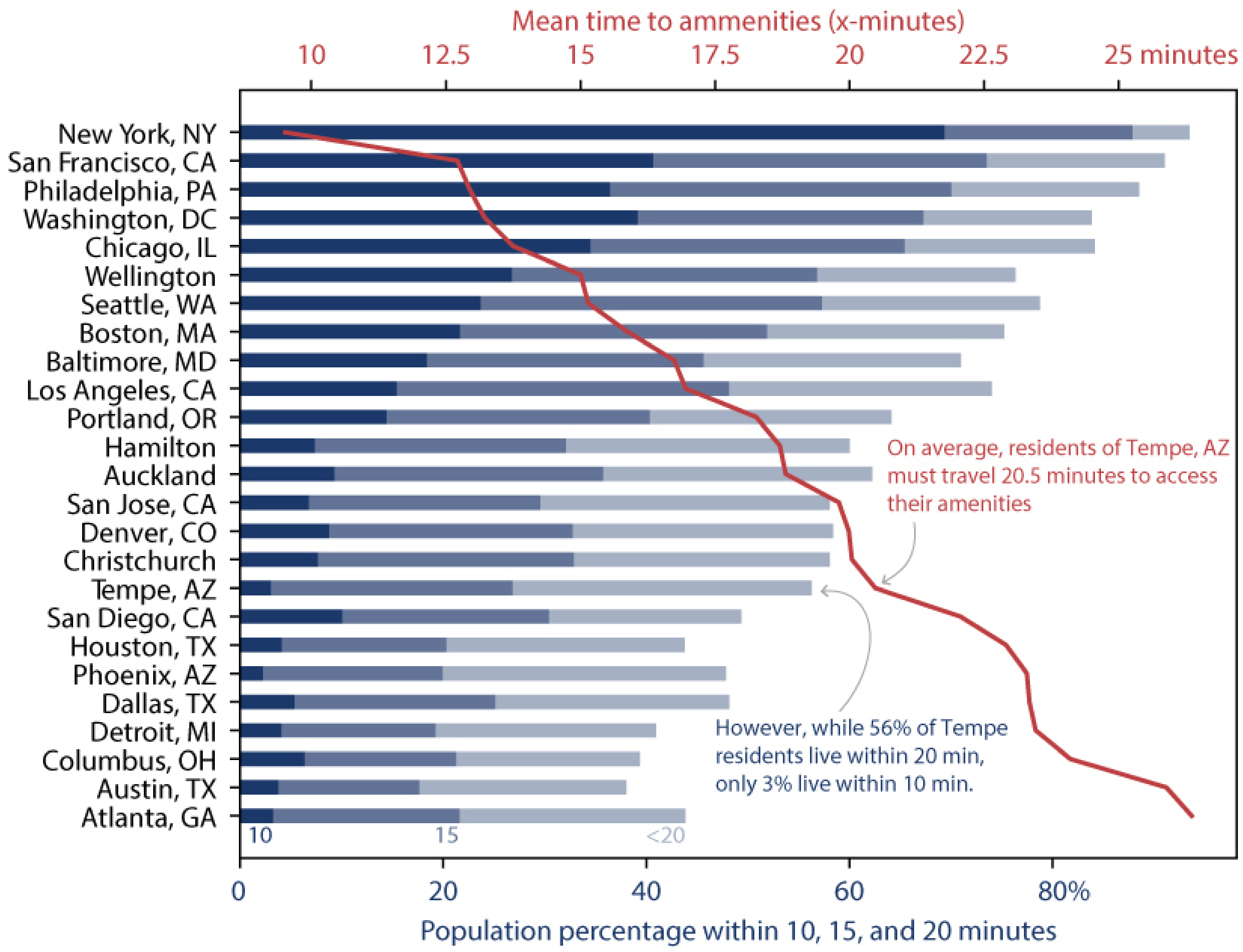
- We measured the access in all of NZ's urban areas and 500 cities in the USA

Output:

- Paper under 2nd review with *Cities*

How do the cities compare?

Ranking several well known cities in the USA and NZ against their access to amenities



The 10 Minute City

Wellington

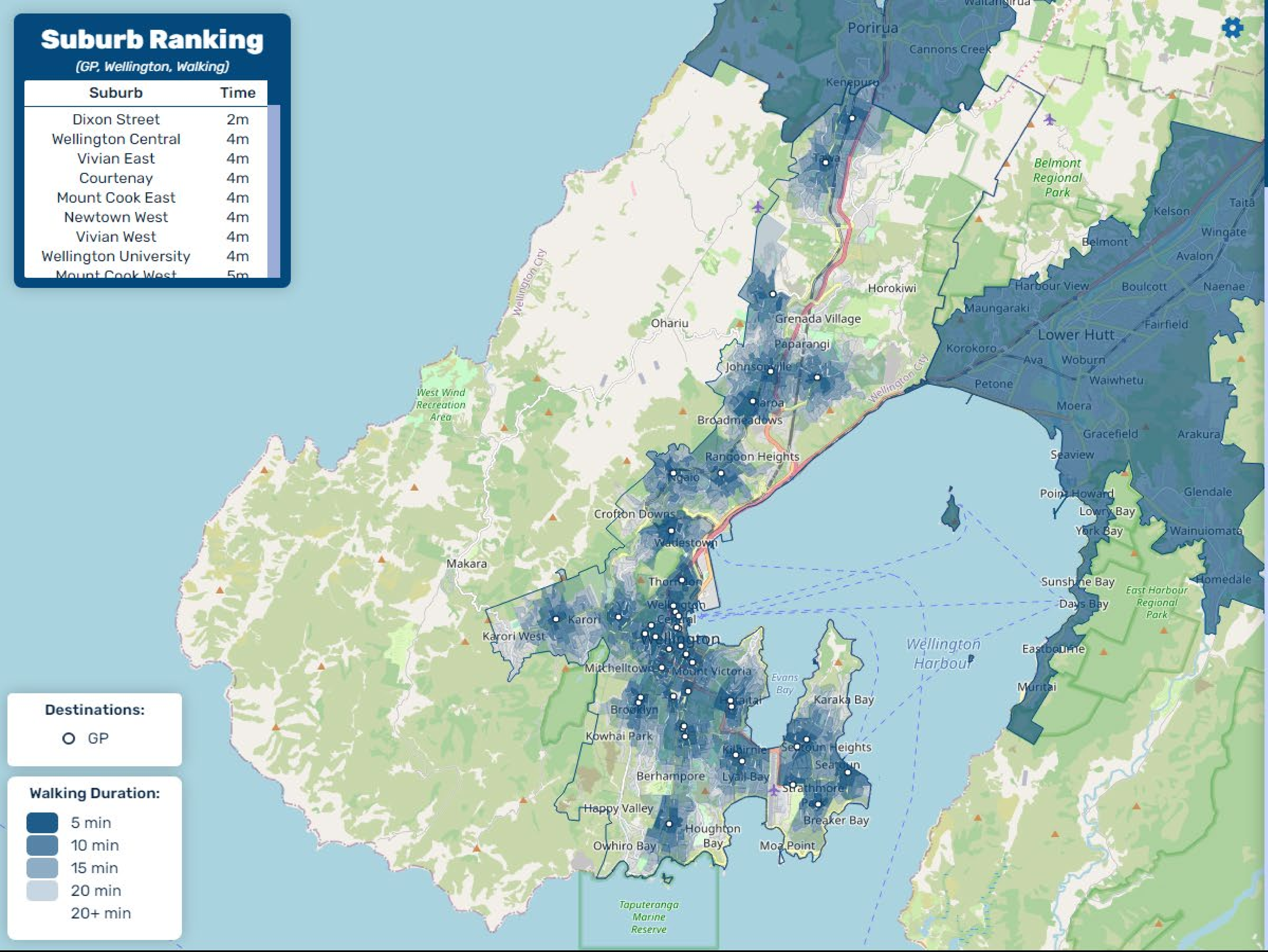
Amenity/Service: GP

Mode: Walking

Suburb Ranking

(GP, Wellington, Walking)

Suburb	Time
Dixon Street	2m
Wellington Central	4m
Vivian East	4m
Courtenay	4m
Mount Cook East	4m
Newtown West	4m
Vivian West	4m
Wellington University	4m
Mount Cook West	5m



Destinations:

GP

Walking Duration:

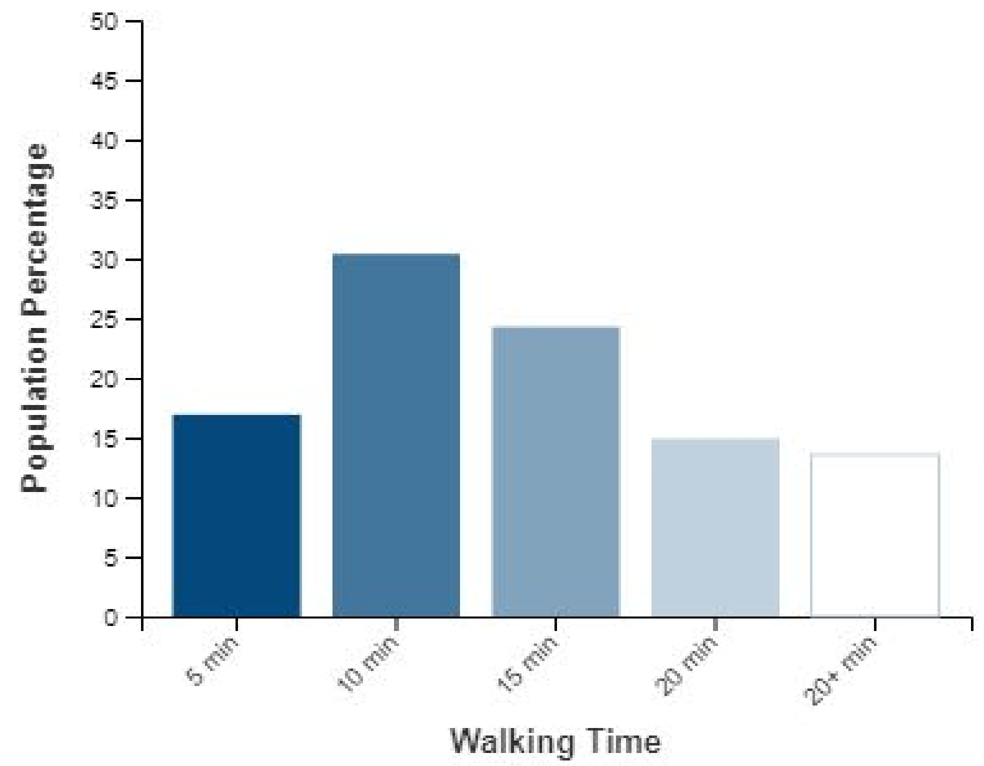
- 5 min
- 10 min
- 15 min
- 20 min
- 20+ min

On average, for walking to a GP, Wellington is a **12 minute city.**

53% of residents live within a 10 minute walk of a GP.

Wellington's least accessible amenity by walking is **a supermarket.**

Wellington Travel Time | Population Distribution



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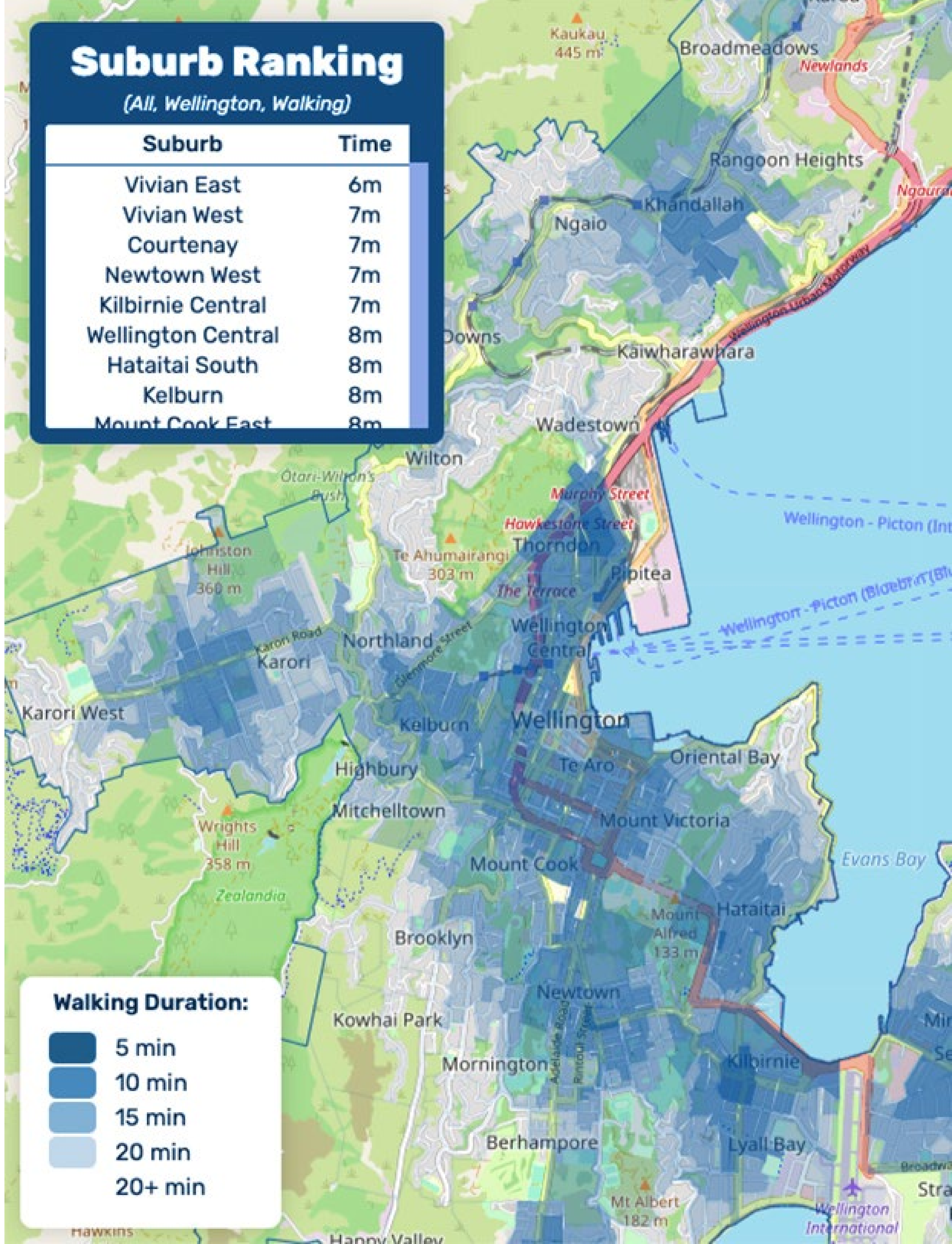
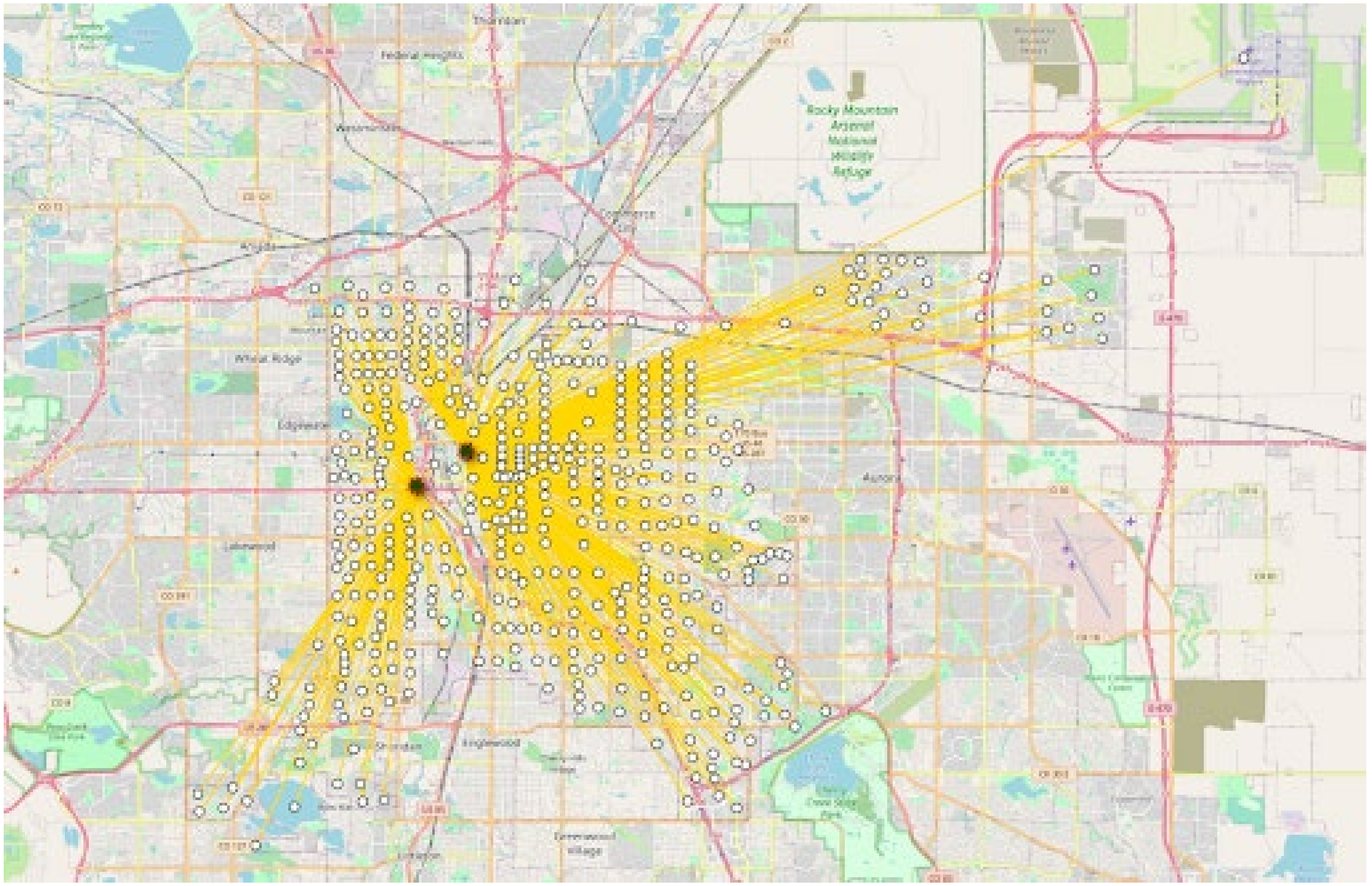
X-MINUTE-CITY

Explore our dashboard:
https://projects.urbanintelligence.co.nz/x-minute-city/

Further steps:

- Data updating – input from councils
- Public transport





*Network distance is used, even though depicted with straight lines

Optimising facility locations

How do we improve?

Objective:

- Where should we build/add another facility (e.g., supermarket)?
- If we want to achieve some level of access how many facilities and where should they go?

Team:

- University of Canterbury
- University of Colorado, Denver
- US Naval Academy, Annapolis

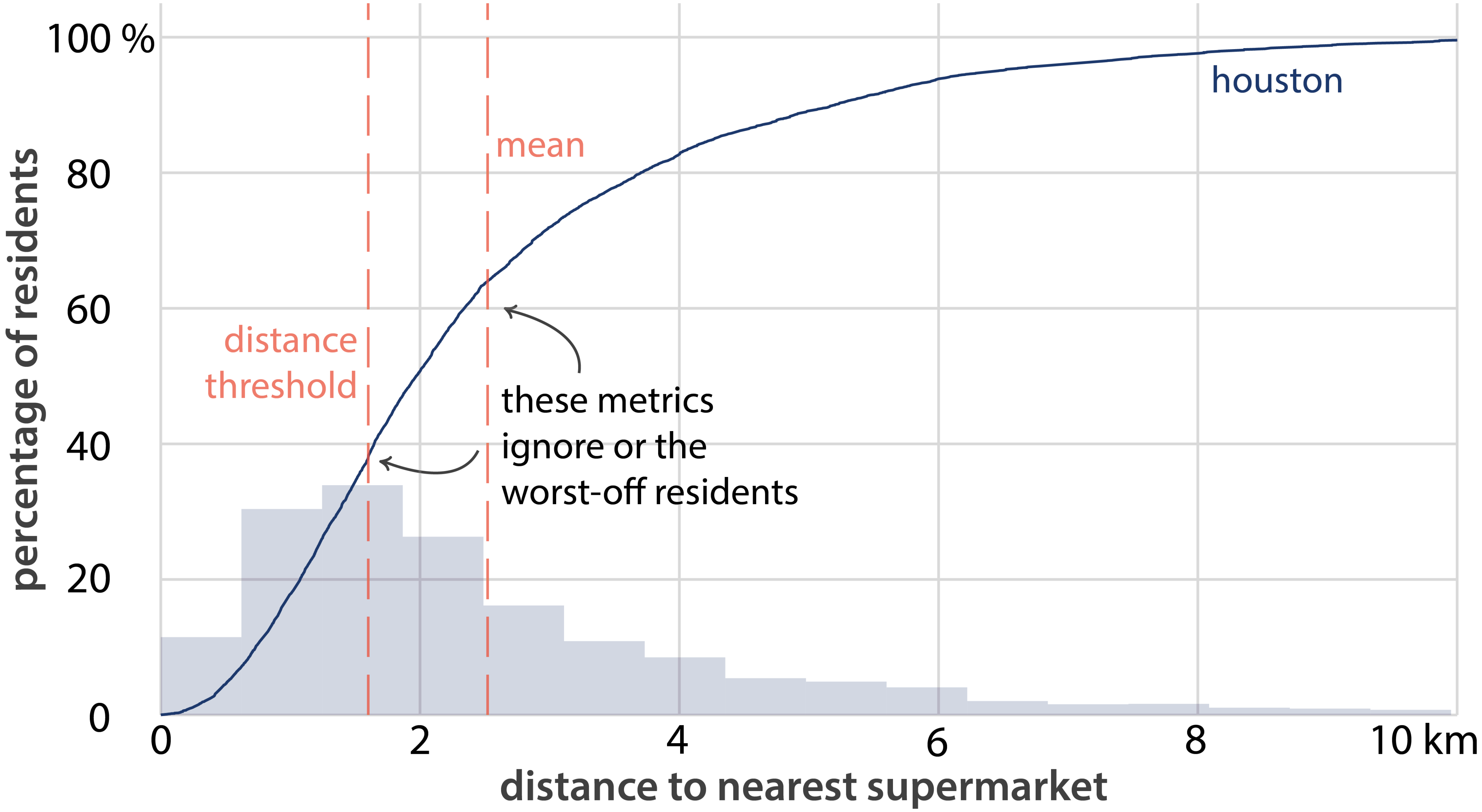
Measuring Inequality

Objective: Find a measure that
- can represent the tail of the distribution
- can show if there are differences between the groups

Team:
- UC Engineering and Geography
- University of Colorado, Denver

Traditional measures of distributions are insufficient for indicating inequality

Residents' distance to their nearest supermarket in Houston, TX, showing the histogram, cumulative distribution, mean, and 1-mile threshold.



Logan, T. M., Anderson, M. J., Williams, T. G., & Conrow, L. (2021). Measuring inequalities in urban systems: An approach for evaluating the distribution of amenities and burdens. *Computers, Environment and Urban Systems*

Measuring Inequality

Approach:

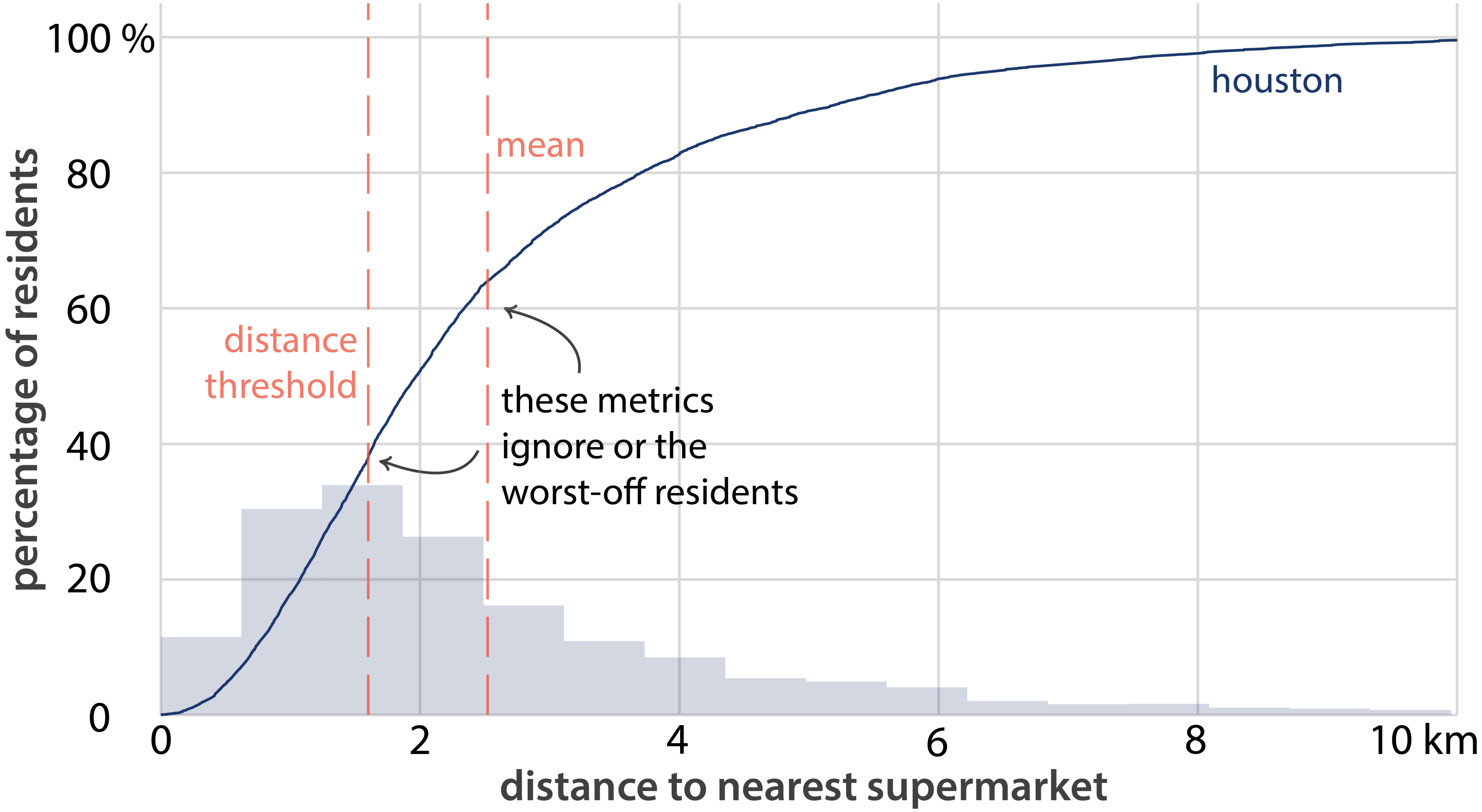
- Similar to an income inequality measure
- Evaluates how any quantity is distributed (access, risk exposure…)
- Considers different demographic groups

Further work:

- Developing an approach that can factor in multiple variables (e.g., access and house price) – to represent compounding inequalities

Traditional measures of distributions are insufficient for indicating inequality

Residents' distance to their nearest supermarket in Houston, TX, showing the histogram, cumulative distribution, mean, and 1-mile threshold.



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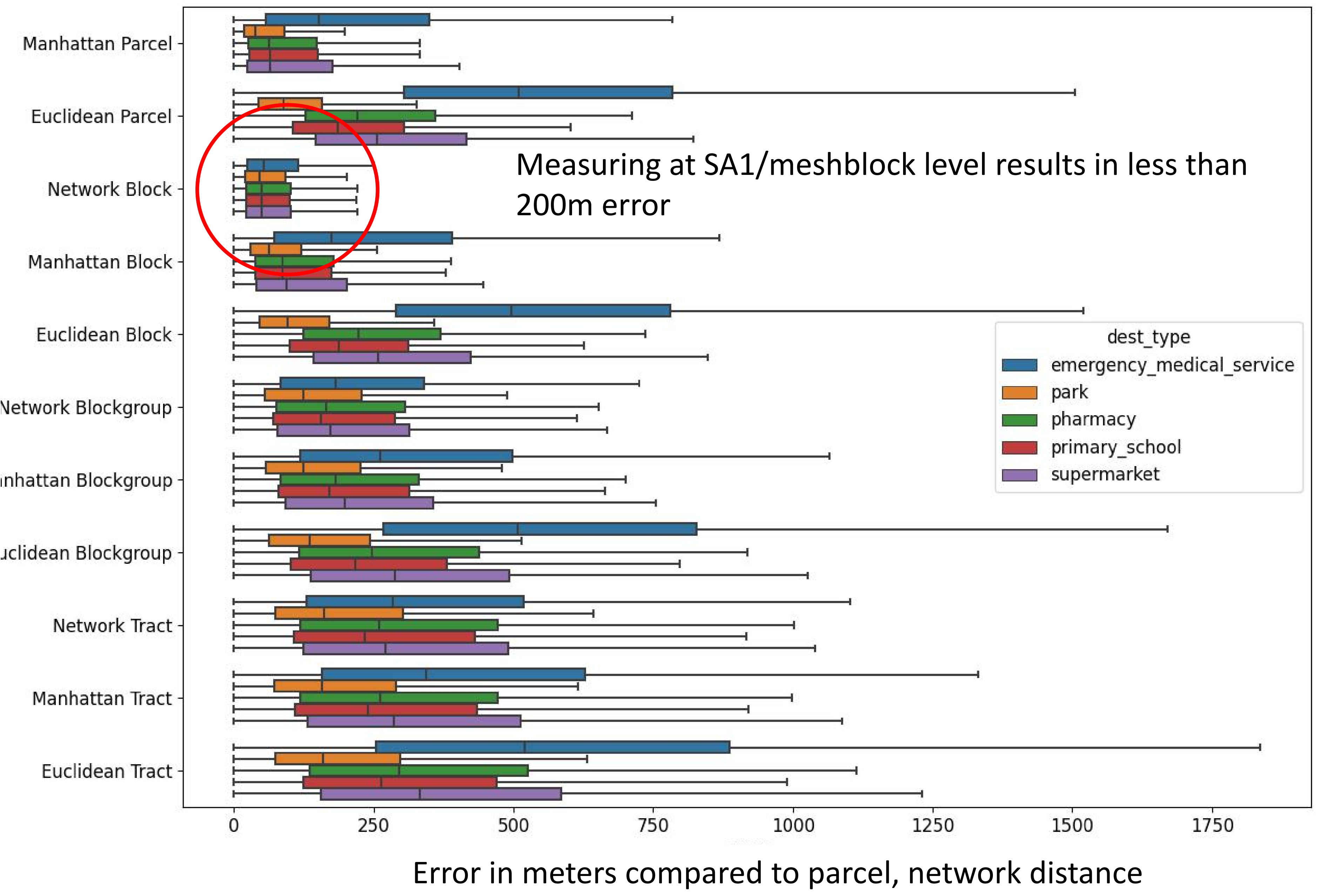
Errors in access measures

Spatial resolution, distance measure, accessibility measure



Objective:

- How much error is introduced because of resolution or distance measures

Team:

- University of Canterbury (Engineering, Health, Geography)
- Chicago Spatial Data Center

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02

Sustainability

Urban Form, Emissions

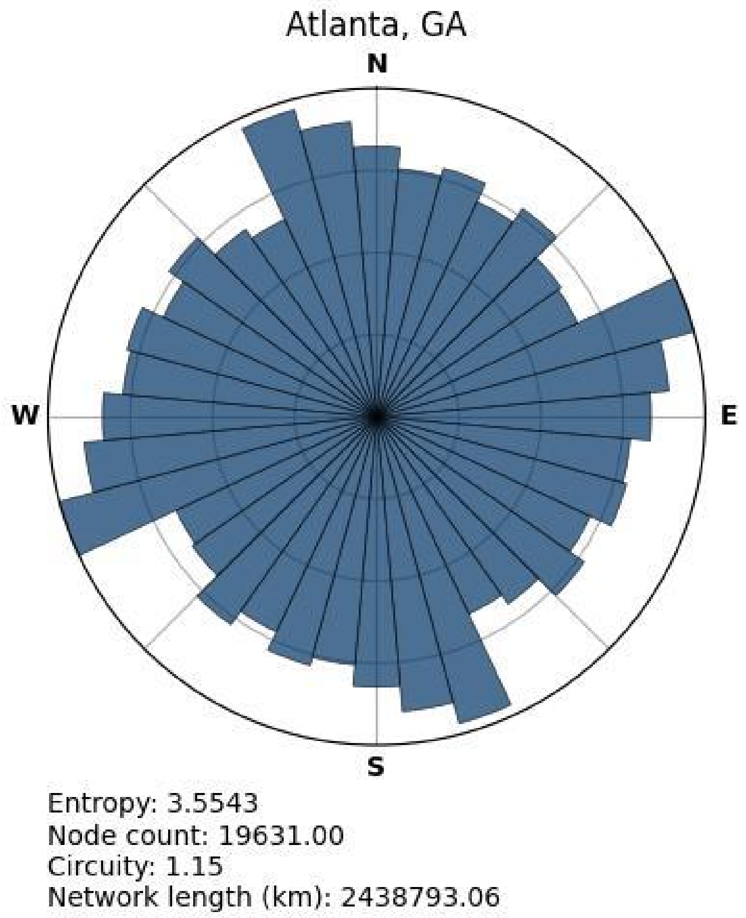
Urban Form

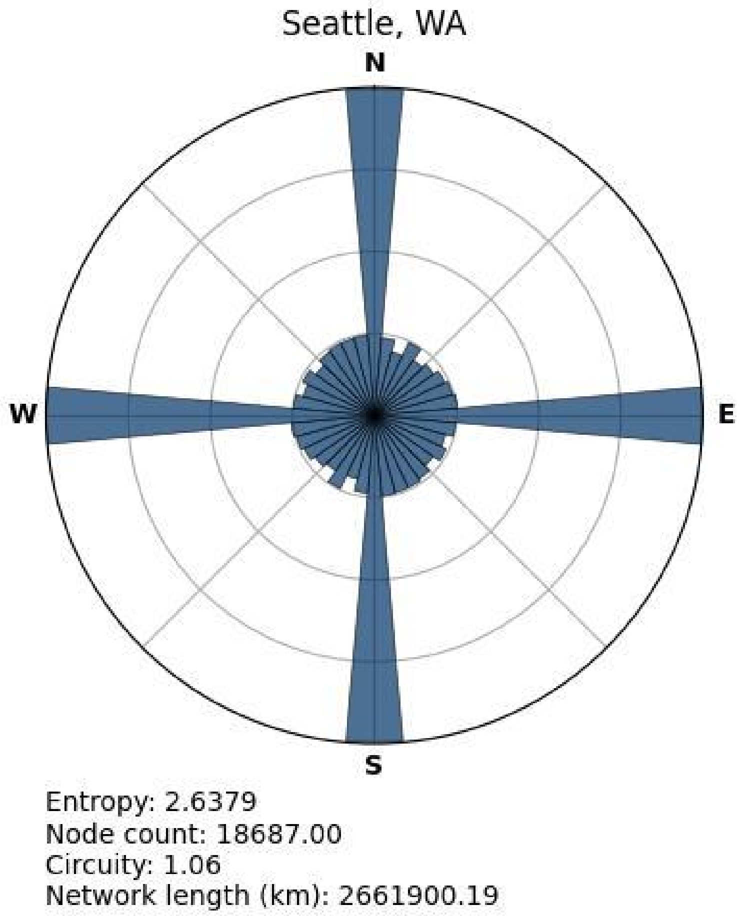
Promoting walkability and car independence

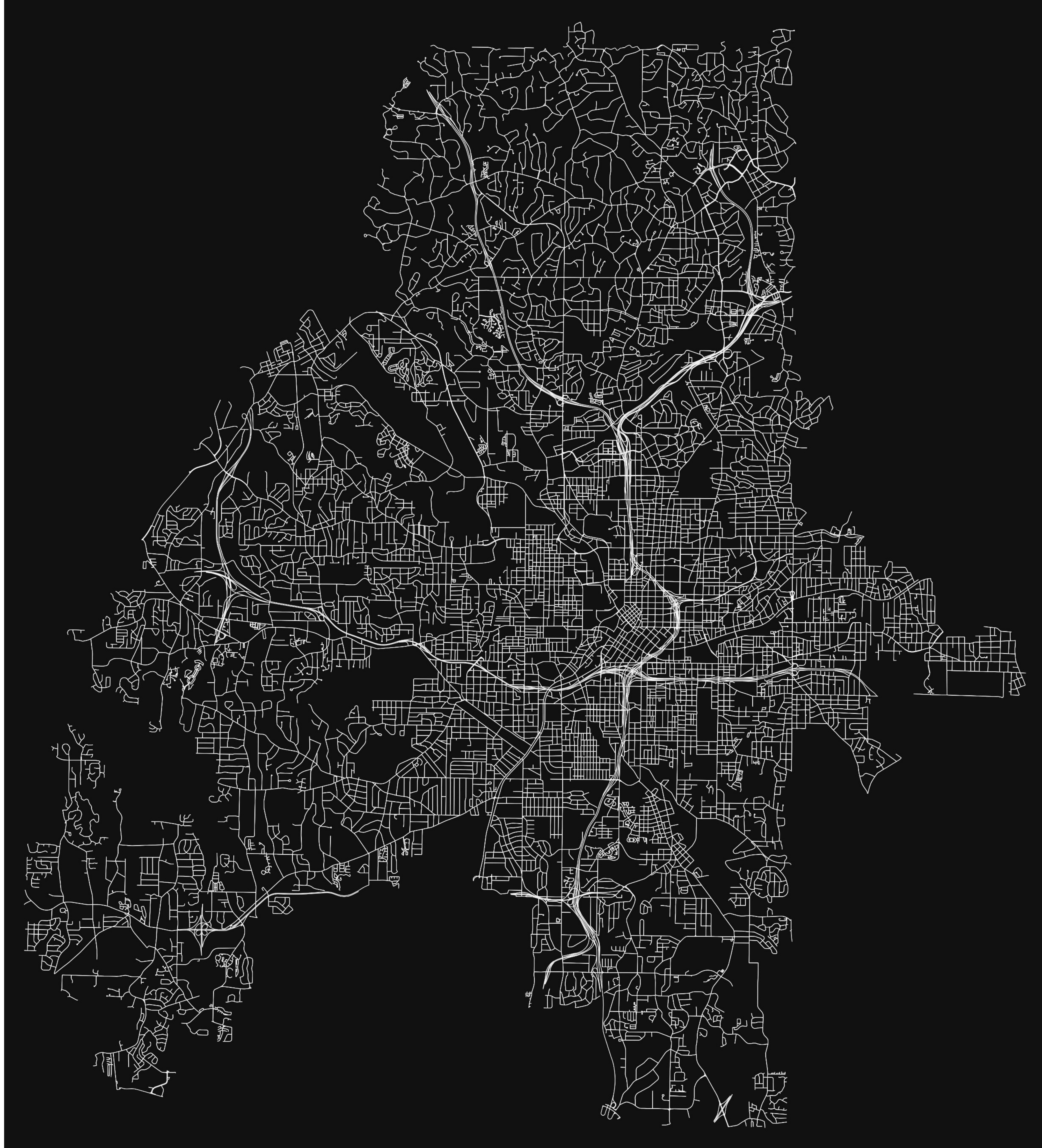
Objective:

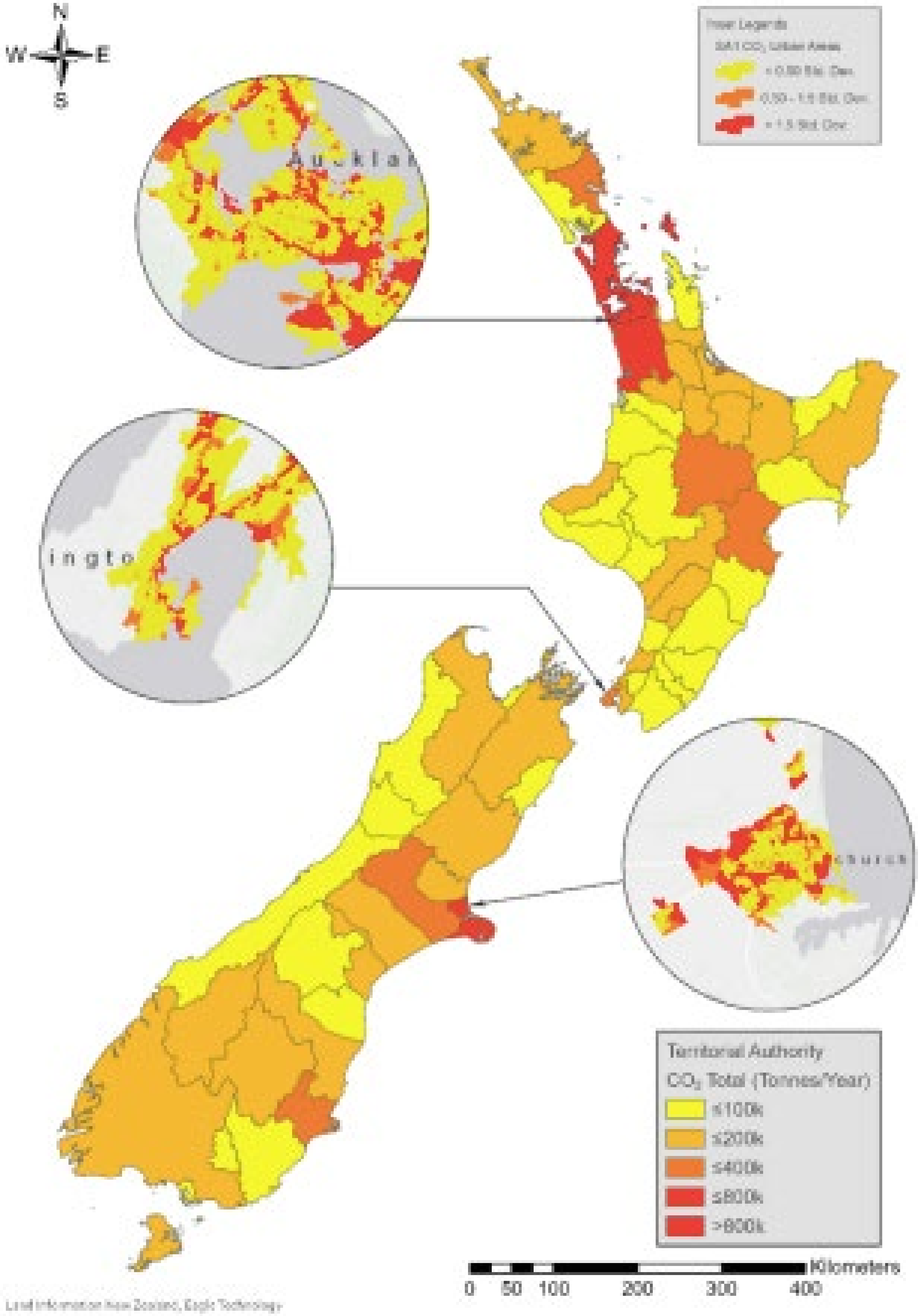
- What is the relationship between urban typologies and accessibility, car dependence, etc.

Machine Learning with 500 cities in the USA









Urban Form and Emissions

Reducing emissions through urban design

Objective:

- Understand the relationship between urban form and emissions
- Provide best practice guidance for NZ towns and cities

Provisionally funded through BRANZ:

Identifying best-practice in urban form for emission reduction in NZ towns and cities

Team:

- UC Engineering and Geography
- Steering committee of stakeholders – let us know if you're interested. Currently includes HUD, MoT, KO

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03

Resilience

Transport Resilience
Climate Risk & Adaptation

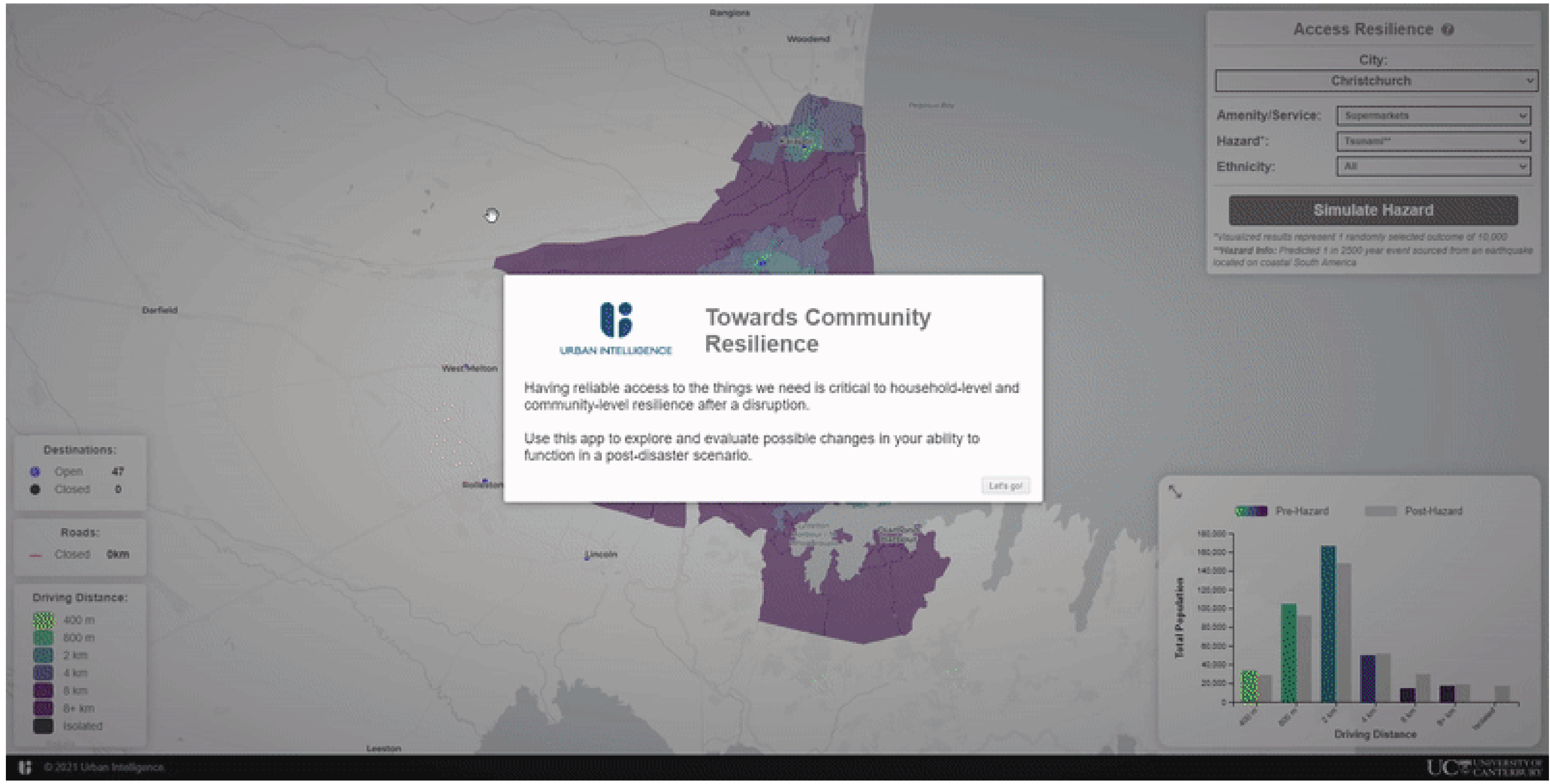
Access Resilience

What happens in a disaster?

Objective:

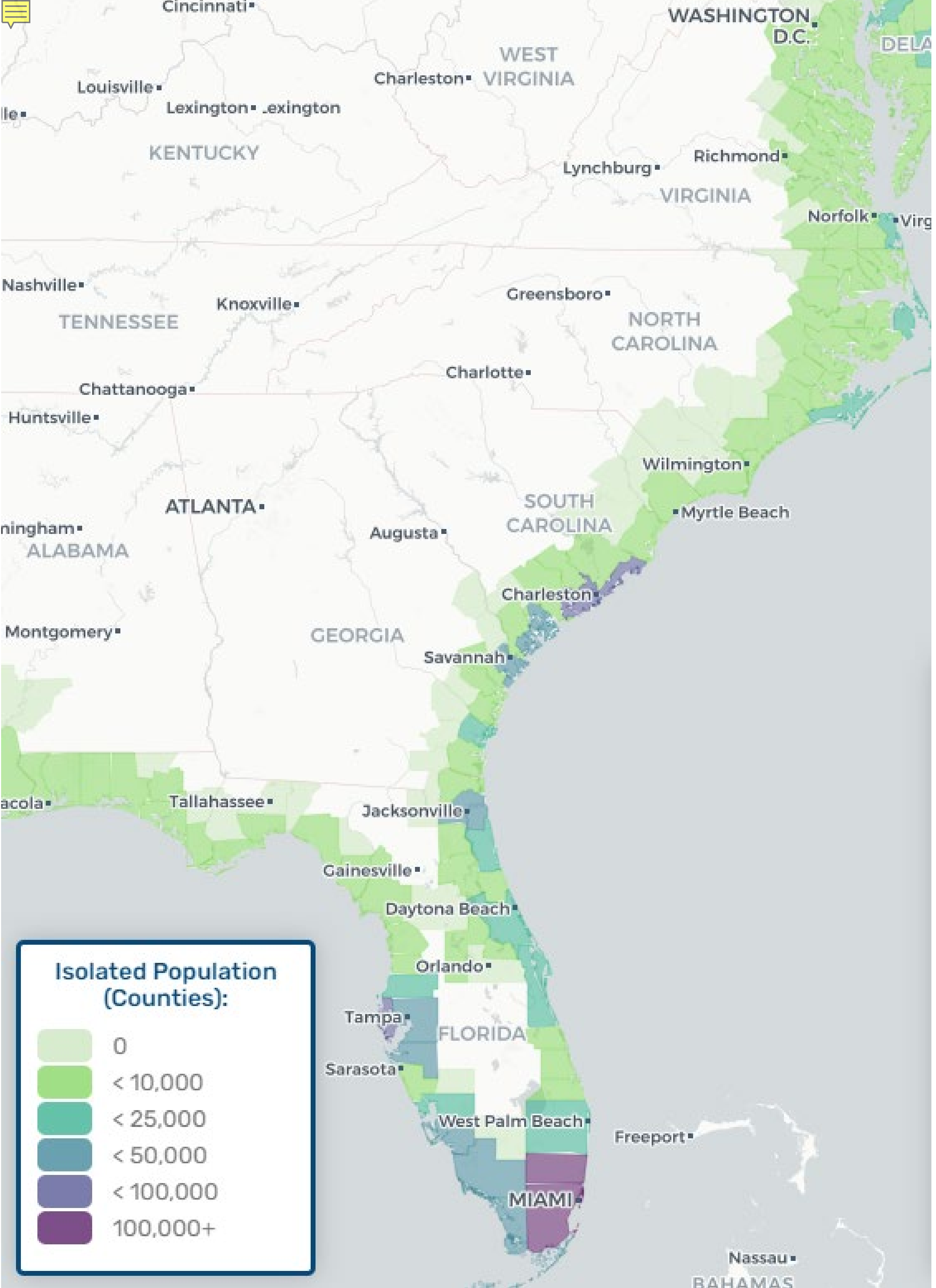
- How do disruptions (road and facility closures) affect communities?
- Are the impacts equitably distributed?

Additionally:
Working with the Wellington Lifelines Group on levels of service



Check it out:
https://urbanintelligence.co.nz/research/the-resilience-of-access/

Anderson, M. J., Kiddle, D. A. F., & Logan, T. M. (2022). The underestimated role of the transportation network: Improving disaster & community resilience. *Transportation Research Part D: Transport and Environment*, *106*(103218), 103218. https://doi.org/10.1016/j.trd.2022.103218



Isolation from sea-level rise

Objective:

- Understand the magnitude of isolation risk
- Compare this with direct inundation risk
  - Number of people
  - Timing of risk
- Understand inequalities

Team:

- UC Engineering
- University of Maryland, College Park
- NIWA
- University of Auckland

Explore the results:
https://projects.urbanintelligence.co.nz/slr-usa/

Currently doing this analysis for all of NZ and looking at inequalities in access loss

Climate Risk

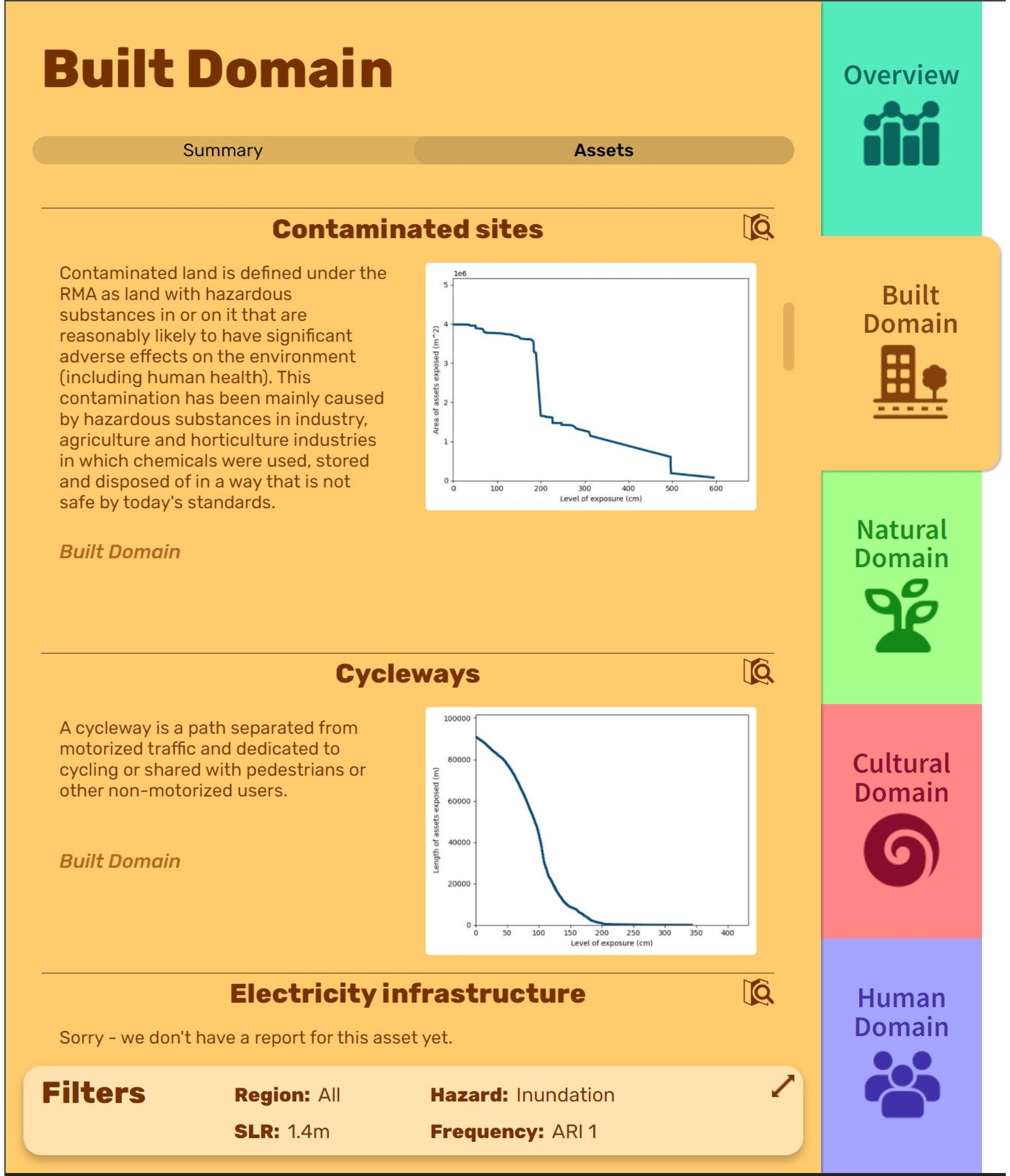
Christchurch City Council

Objective:

- Leading the climate risk assessment for CCC
- Capturing the risk on the built, natural, social, cultural domains
- Enable council to understand the risk to their assets and what that means
- Will be used in community engagement

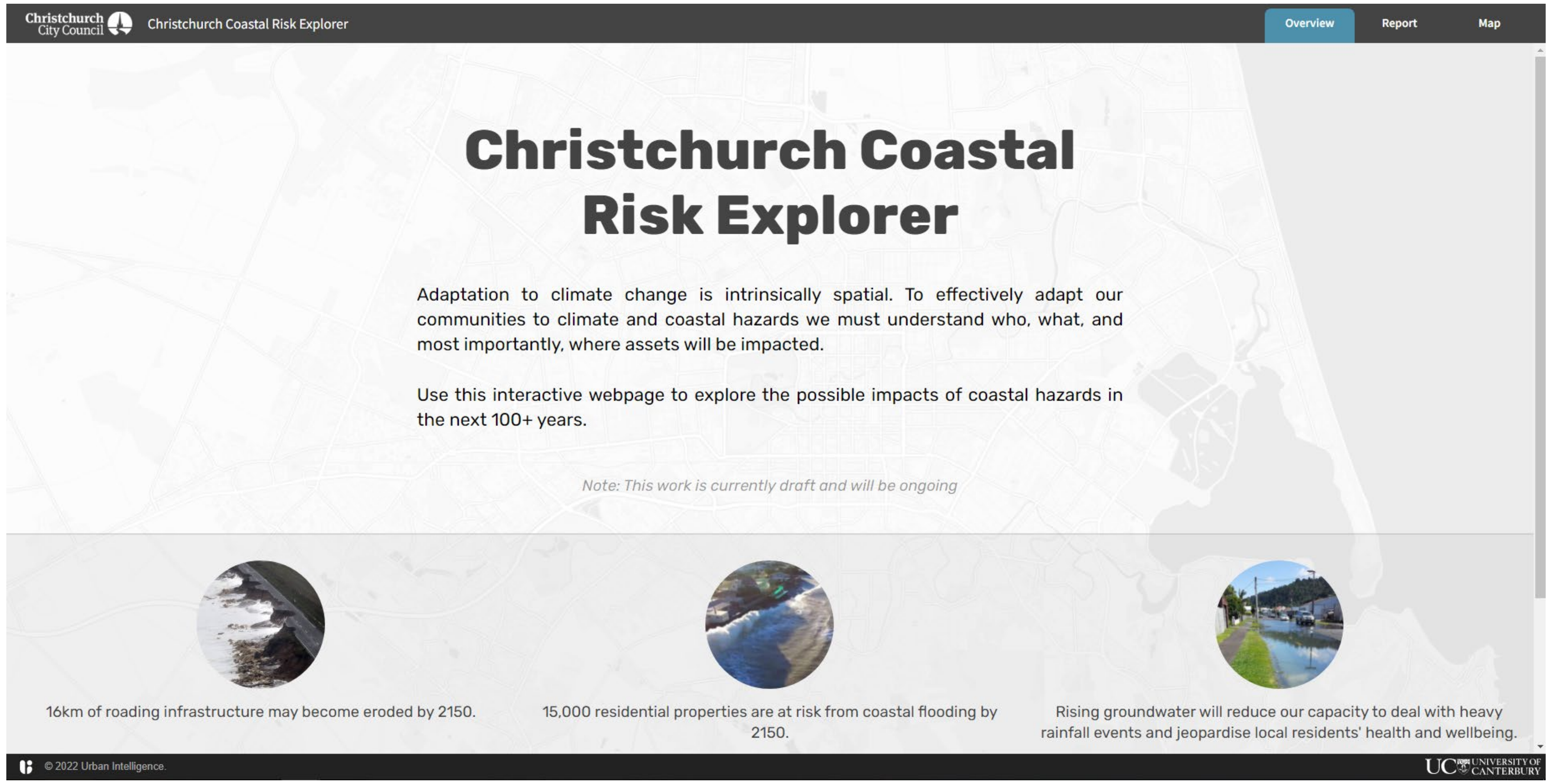
Team:

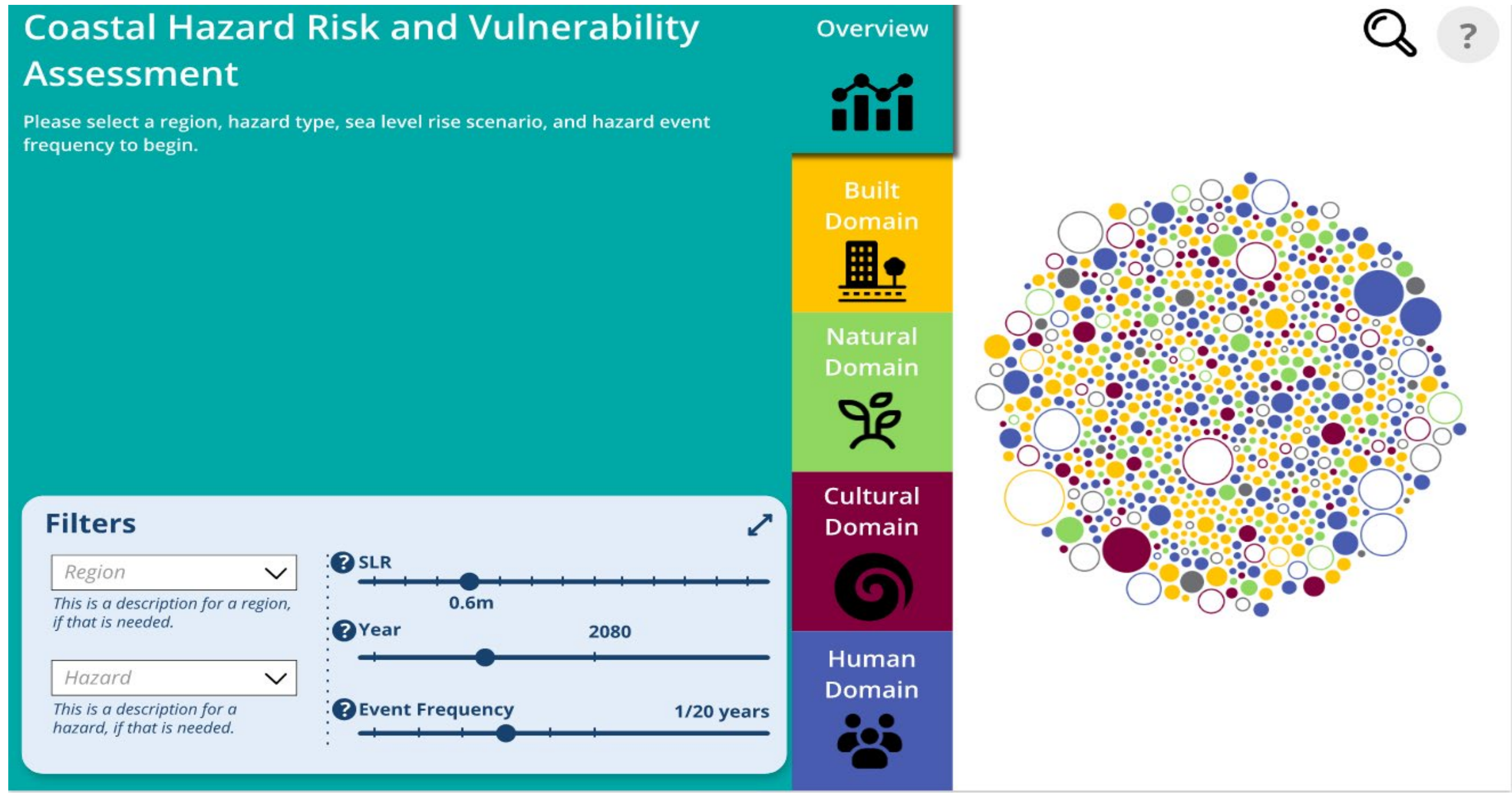
- UC Engineering
- Christchurch City Council Coastal Hazards Adaptation Team

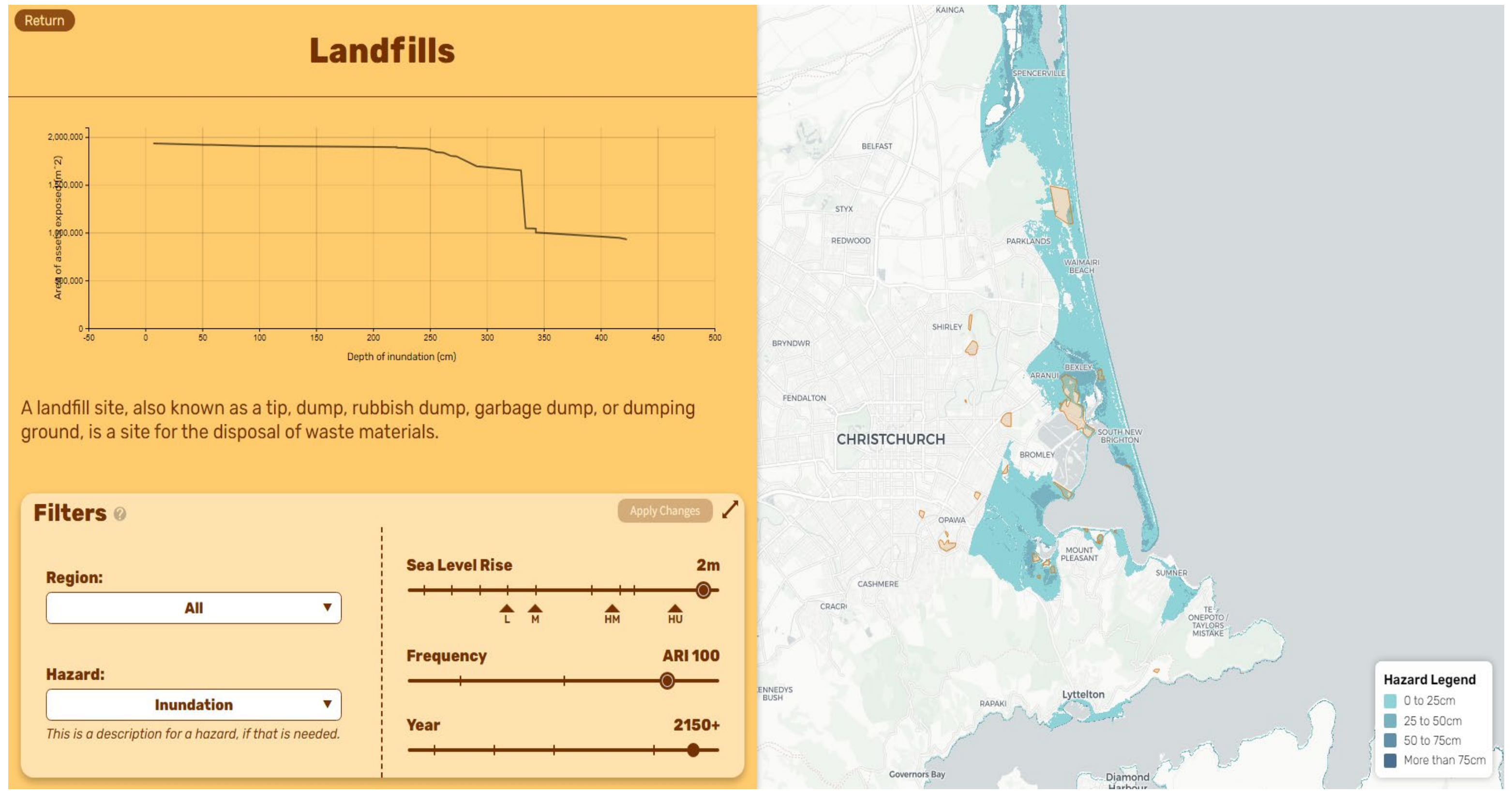


Climate Risk

With Christchurch City Council







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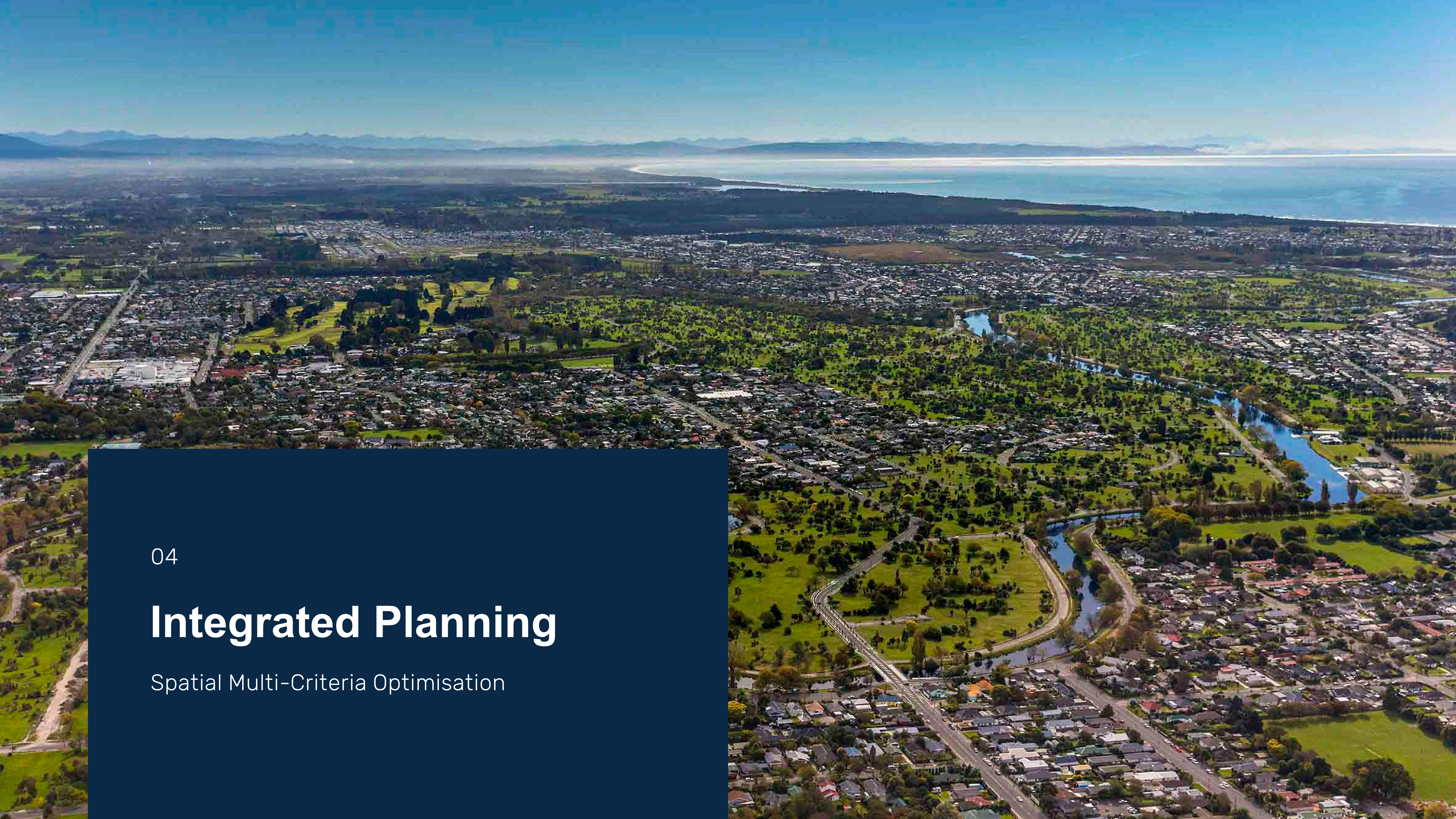


04

Integrated Planning

Spatial Multi-Criteria Optimisation

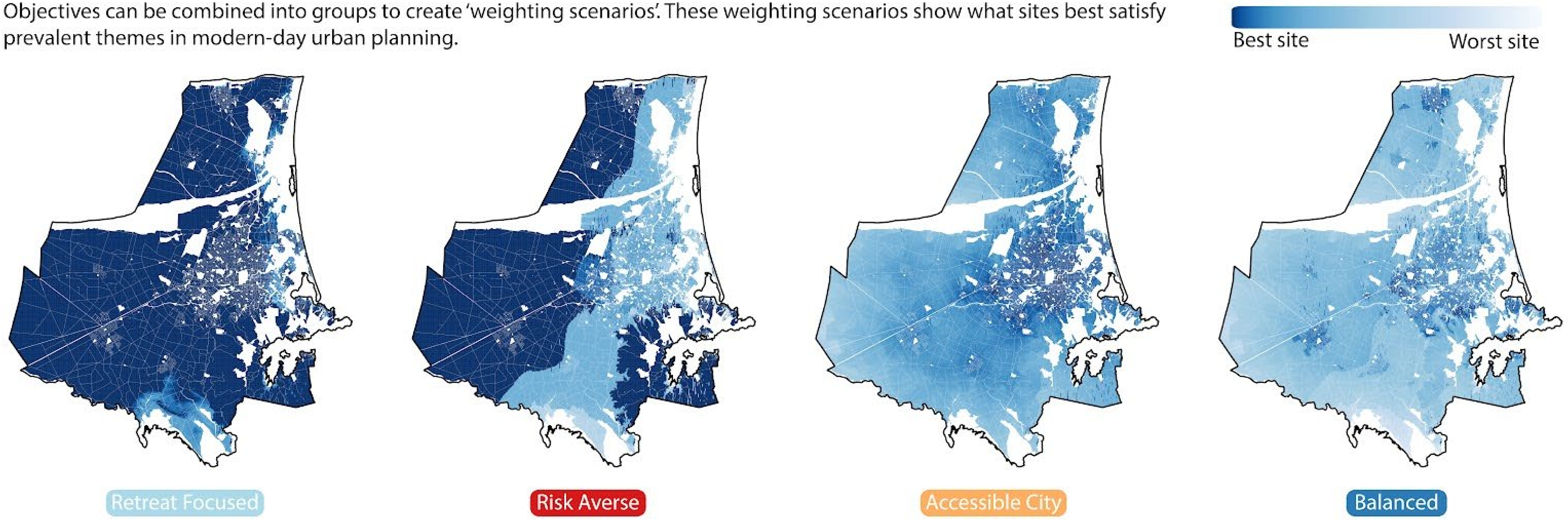
Guiding strategic land-use planning

Capturing multiple objectives/criteria

Objective:

- Where should future development be encouraged?
- Avoid maladaptation
- Consider sustainability, accessibility, risk

Objectives can be combined into groups to create 'weighting scenarios'. These weighting scenarios show what sites best satisfy prevalent themes in modern-day urban planning.



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Thank you.

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