5th International Conference 'Urban e-Planning' (Virtual)

Institute of Geography and Spatial Planning, University of Lisbon & International Journal of E-Planning Research
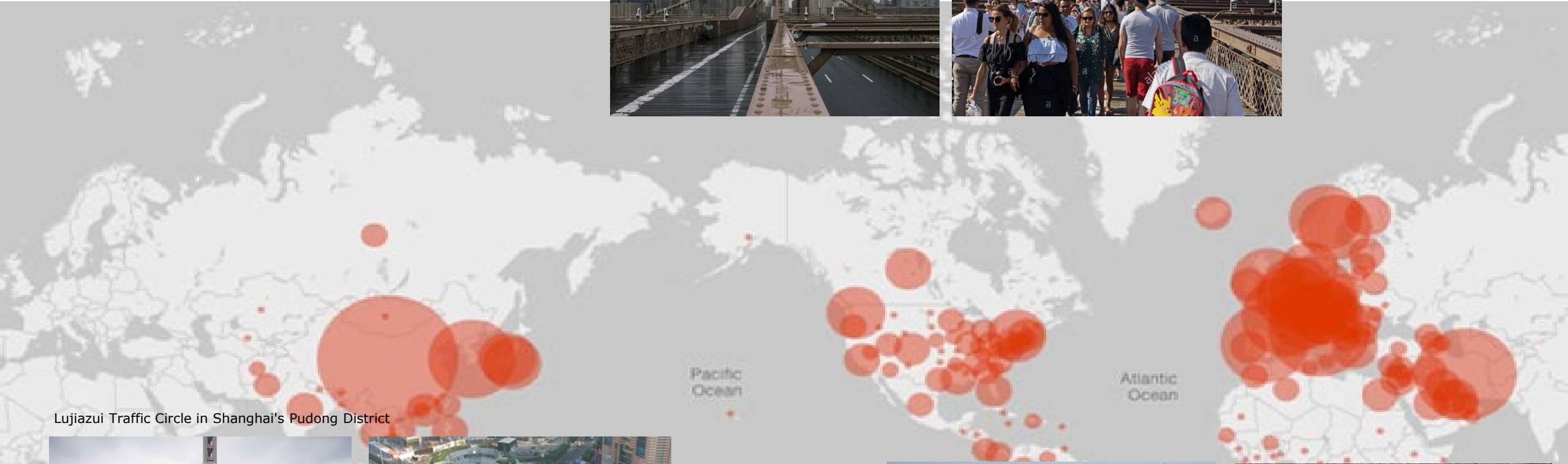
Lisbon, Portugal

7-10 September 2021

Re-assess meaningful urban spaces:
sensing Auckland social 'hotspots' with mobile location data under the COVID-19 impact

Presenters: *I-Ting Chuang - University of Auckland*
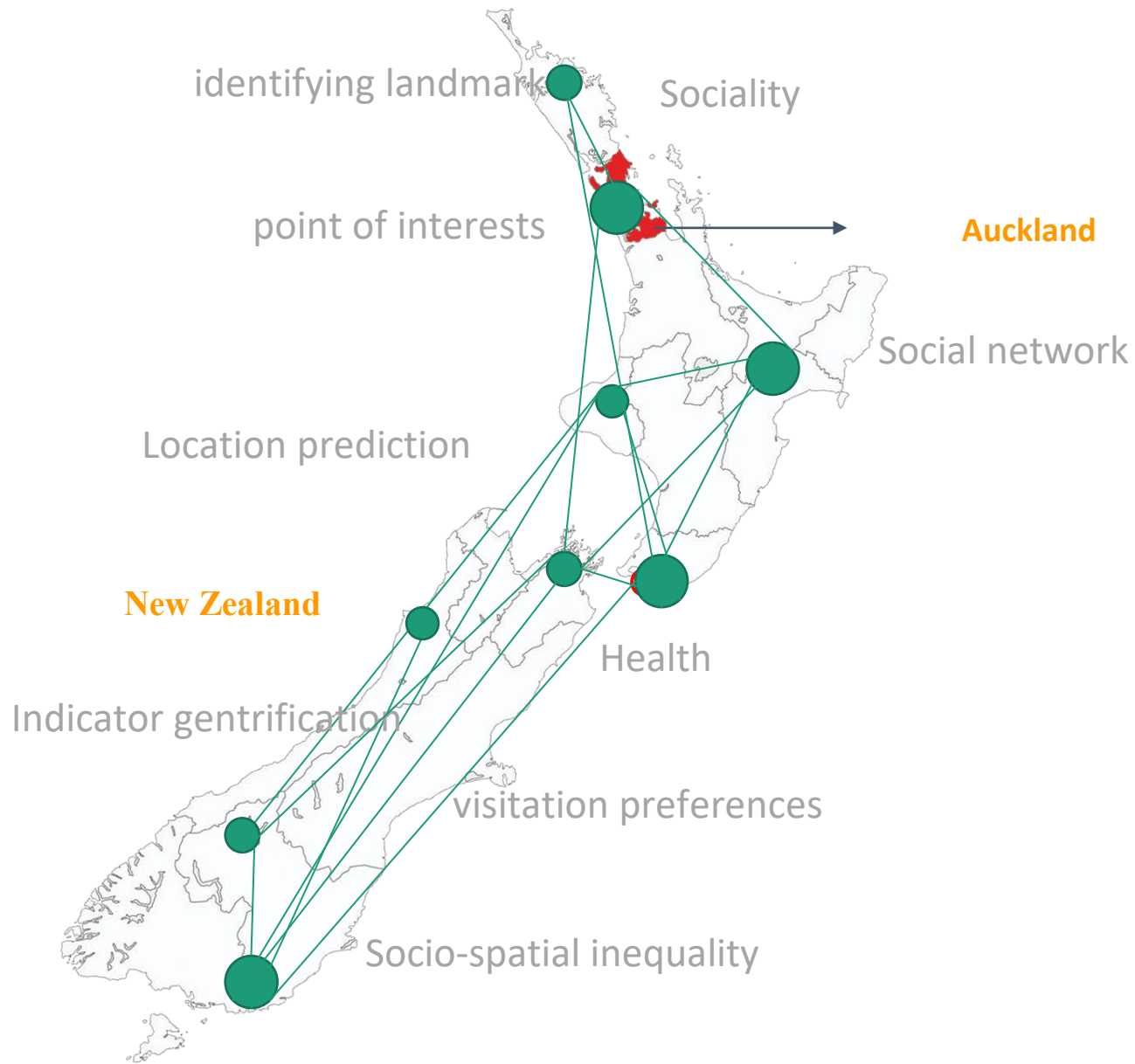*Qingqing Chen - University at Buffalo*
Sep 10 2021

THE UNIVERSITY OF AUCKLAND
Te Whare Wānanga o Tāmaki Makaurau
NEW ZEALAND

UB University at Buffalo
The State University of New York

Background: *COVID-19 impact*

Lujiazui Traffic Circle in Shanghai's Pudong District

Pacific Ocean

Atlantic Ocean

identifying landmark

Sociality

point of interests

Auckland

Social network

Location prediction

New Zealand

Health

Indicator gentrification

visitation preferences

Socio-spatial inequality

Where are the urban "HOT SPOTS" under the impact of COVI-19?

https://www.newsroom.co.nz/the-new-zealand-strains-how-the-coronavirus-got-here

Current Research:

- Support decisions and inform public health actions *(Oliver et al., 2020)*
- Human mobility pattern change *(Linka et al., 2020)*
- Socioeconomic effects of pandemic *(Nicola et al., 2020)*

Locating **"HOT SPOTS"**

Refers to **user-defined** *urban spaces with crowded human mobility and intensive social and economic activities regardless of their designated urban programs.*
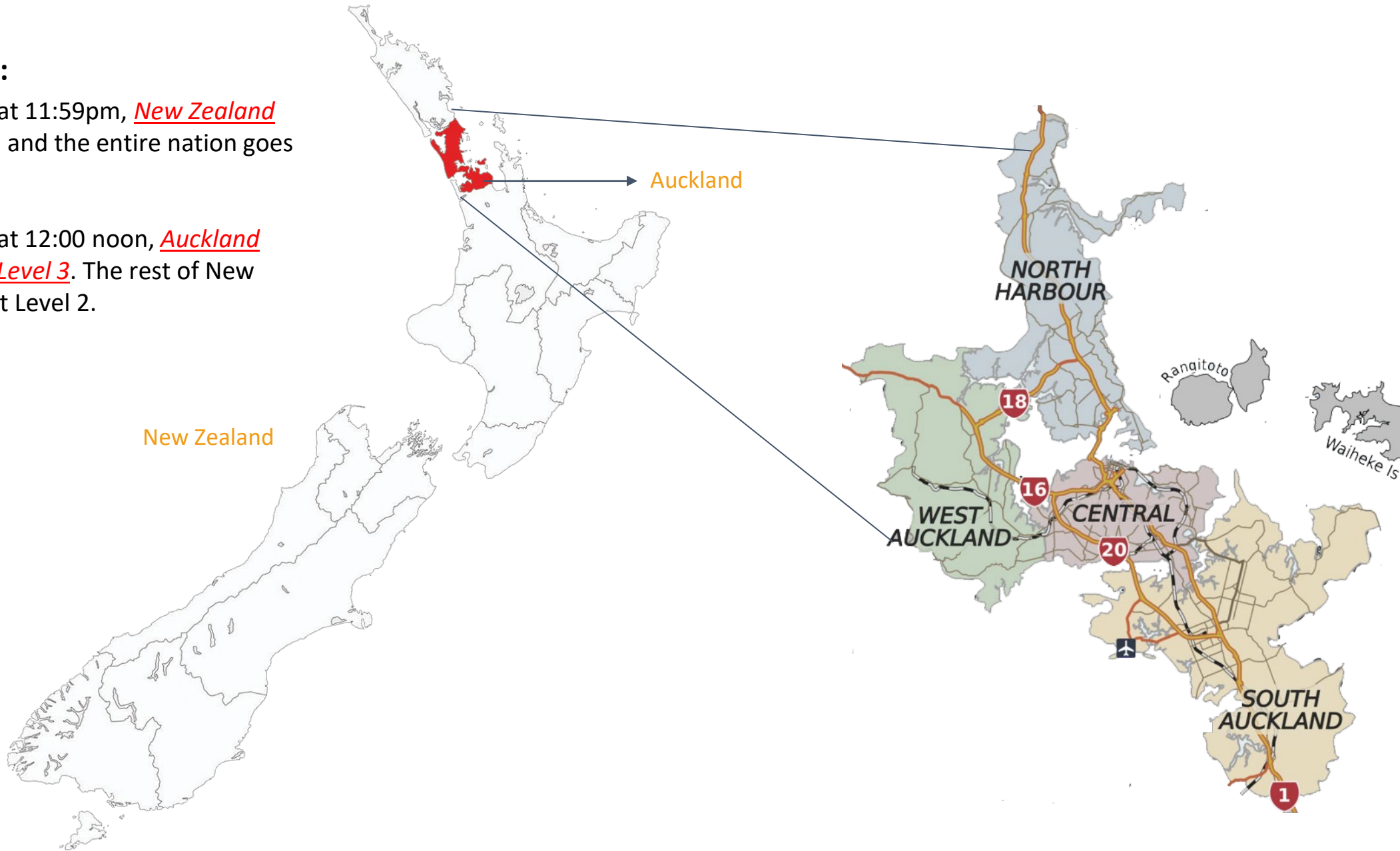

City is a place of diversity

Social hubs

a space that serves as an important site of social interactions.

Lockdown Periods:

Period 1: 03/25/2020 at 11:59pm, *New Zealand moves to Alert Level 4*, and the entire nation goes into self-isolation.

Period 2: 08/12/2020 at 12:00 noon, *Auckland region moves to Alert Level 3*. The rest of New Zealand moves to Alert Level 2.
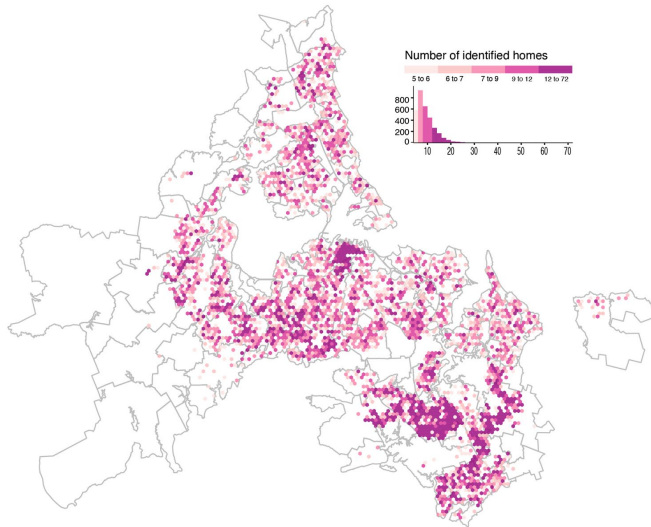
Auckland

New Zealand

NORTH HARBOUR

Rangitoto

18

16

WEST AUCKLAND

CENTRAL

20

Waiheke Is

SOUTH AUCKLAND

1

Methodology: Key Analyses

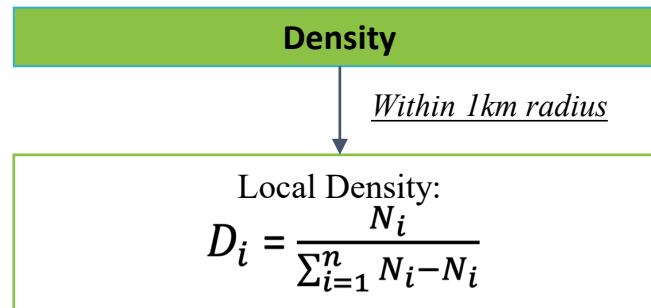| **Construct Human-geographical Networks**	**Analysis Local Density**	**Analysis Social Diversity**

- Customize the size of a place (i.e. a 300m grid cell)
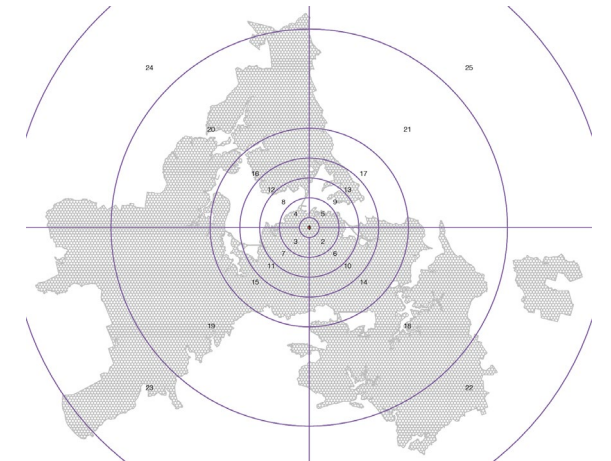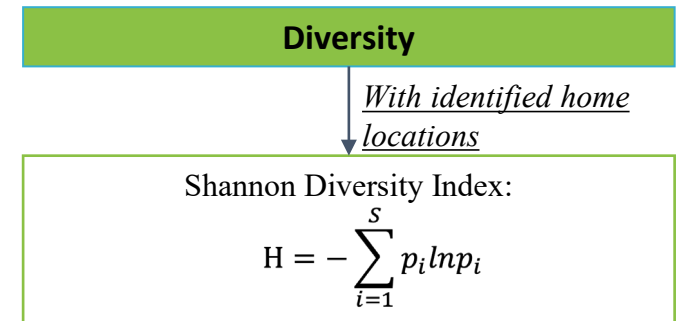- Identify home locations *(Chen and Poorthuis, 2021)*
- Construct home-to-destination networks

Density: visitor density in a local context of 1km radius derived from the geo-location to people's presence in a particular place.
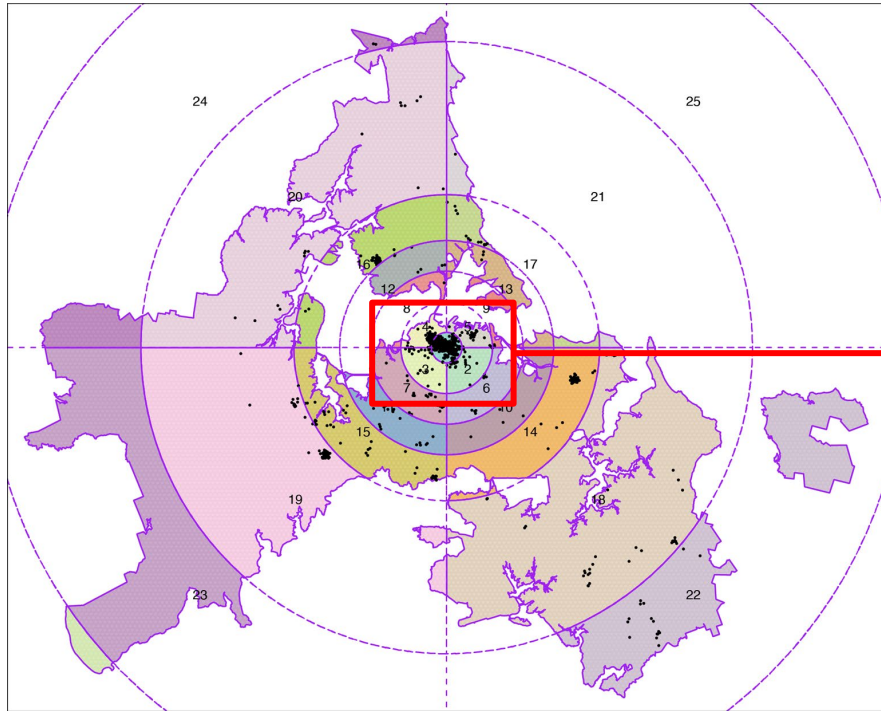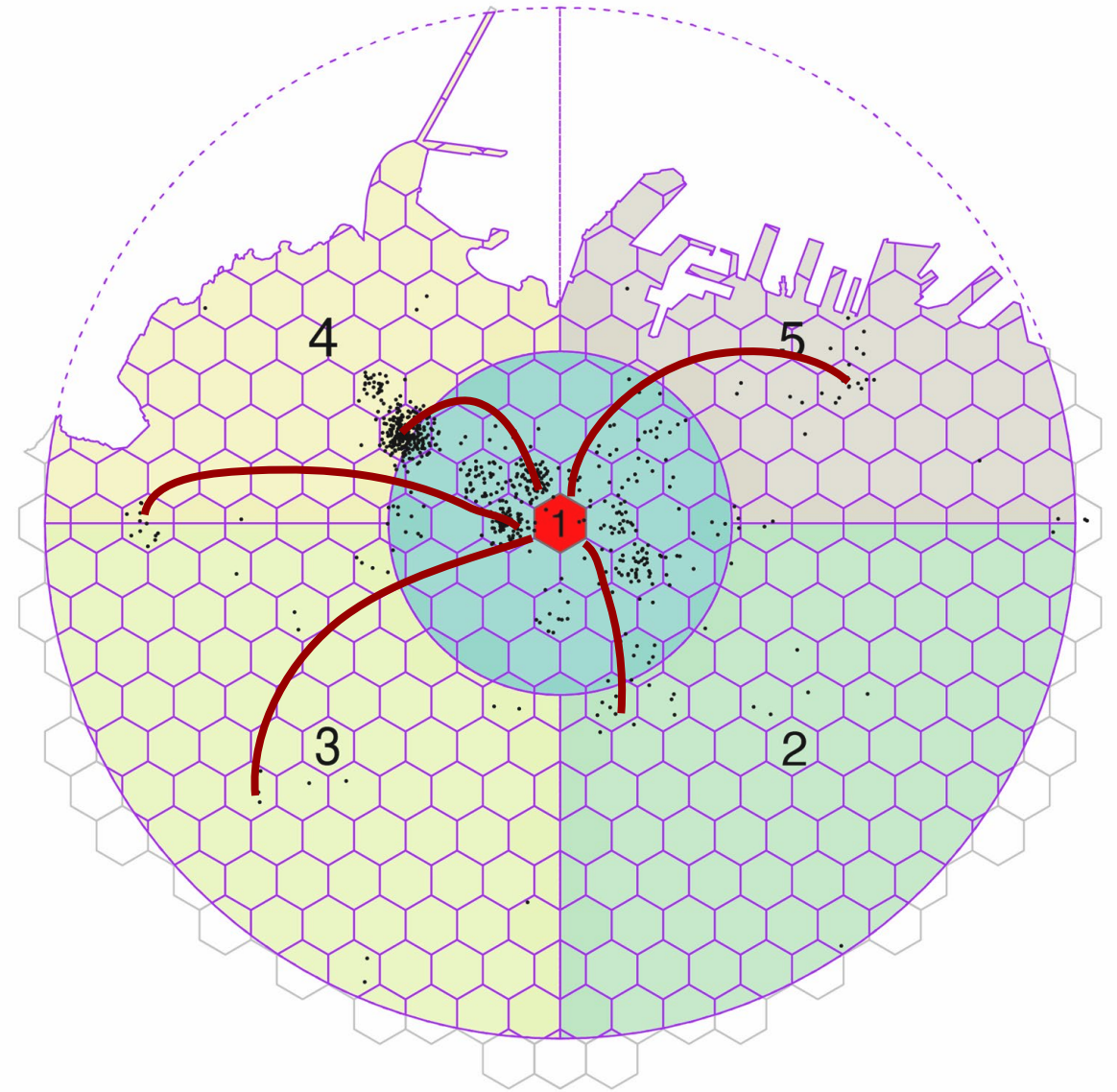
Diversity: variety of home locations of mobile phone users visit to each geographical location across the city (Chen et al., 2021).

Spatial Distribution of Identified Home Locations

Density

Within 1km radius

Local Density:
$$D_i = \frac{N_i}{\sum_{i=1}^{n} N_i - N_i}$$

Diversity

With identified home locations

Shannon Diversity Index:
$$H = -\sum_{i=1}^{S} p_i \ln p_i$$

Diversity Analysis

Diversity

With identified home locations

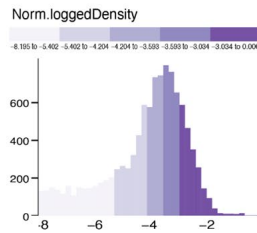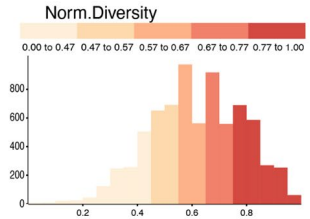Shannon Diversity Index:

$$H = -\sum_{i=1}^{S} p_i \, ln p_i$$

Zoom in

https://www.landscapearchitecture.nz/

https://www.geoplastglobal.com/en/

Spatial distribution of logged global density (year 2020)

Norm.loggedDensity

-8.185 to -5.402 | -5.402 to -4.204 | -4.204 to -3.593 | -3.593 to -3.034 | -3.034 to 0.000

Auckland CBD

Manukau

Density

Spatial distribution of normalized diversity (year 2020)

Norm.Diversity

0.00 to 0.47 | 0.47 to 0.57 | 0.57 to 0.67 | 0.67 to 0.77 | 0.77 to 1.00

Diversity

Spatial distribution of logged global density (year 2020)

Norm.loggedDensity

-8.195 to -5.402 | -5.402 to -4.204 | -4.204 to -3.593 | -3.593 to -3.034 | -3.034 to 0.000
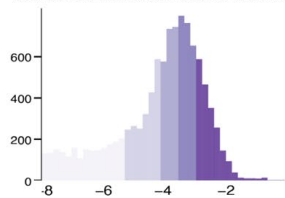
Auckland CBD

Manukau

Spatial distribution of normalized diversity (year 2020)

Norm.Diversity

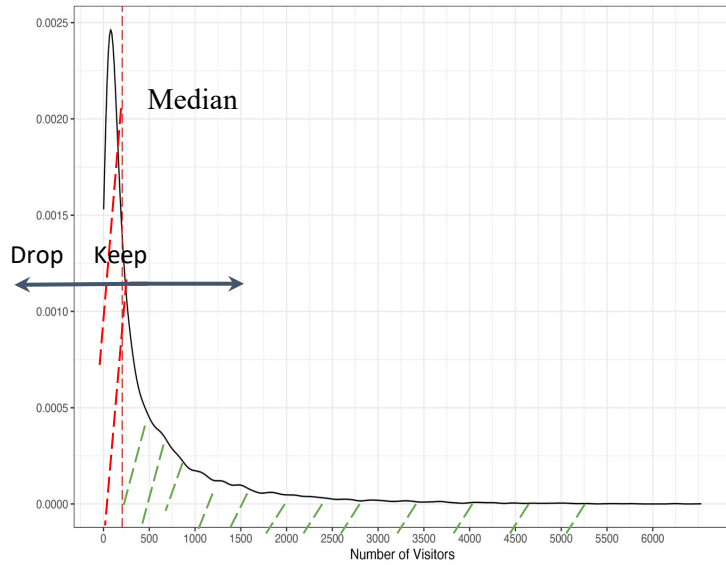0.00 to 0.47 | 0.47 to 0.57 | 0.57 to 0.67 | 0.67 to 0.77 | 0.77 to 1.00

Albany

Southdown Inland Port

East Tāmaki
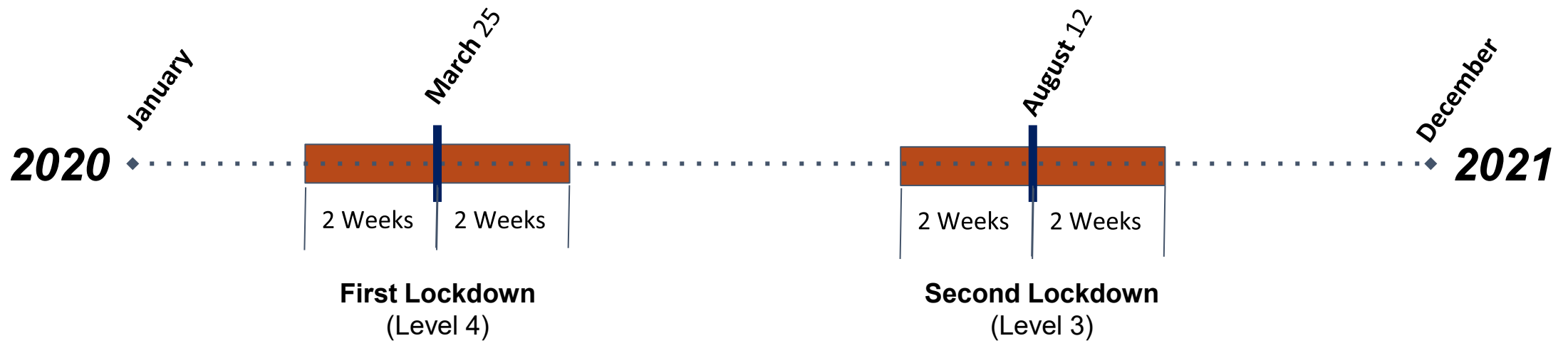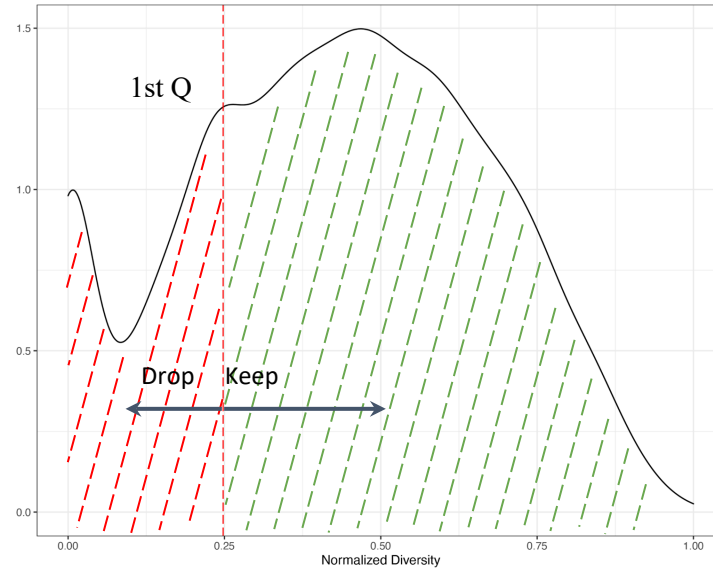
Manukau

Filter above median density grid locations

Median

Drop | Keep

Number of Visitors

Filter exclude lowest quantile dense grid locations

1st Q

Drop | Keep

Normalized Diversity

2020 — January — March 25 — First Lockdown (Level 4) — 2 Weeks | 2 Weeks — August 12 — Second Lockdown (Level 3) — 2 Weeks | 2 Weeks — December — 2021
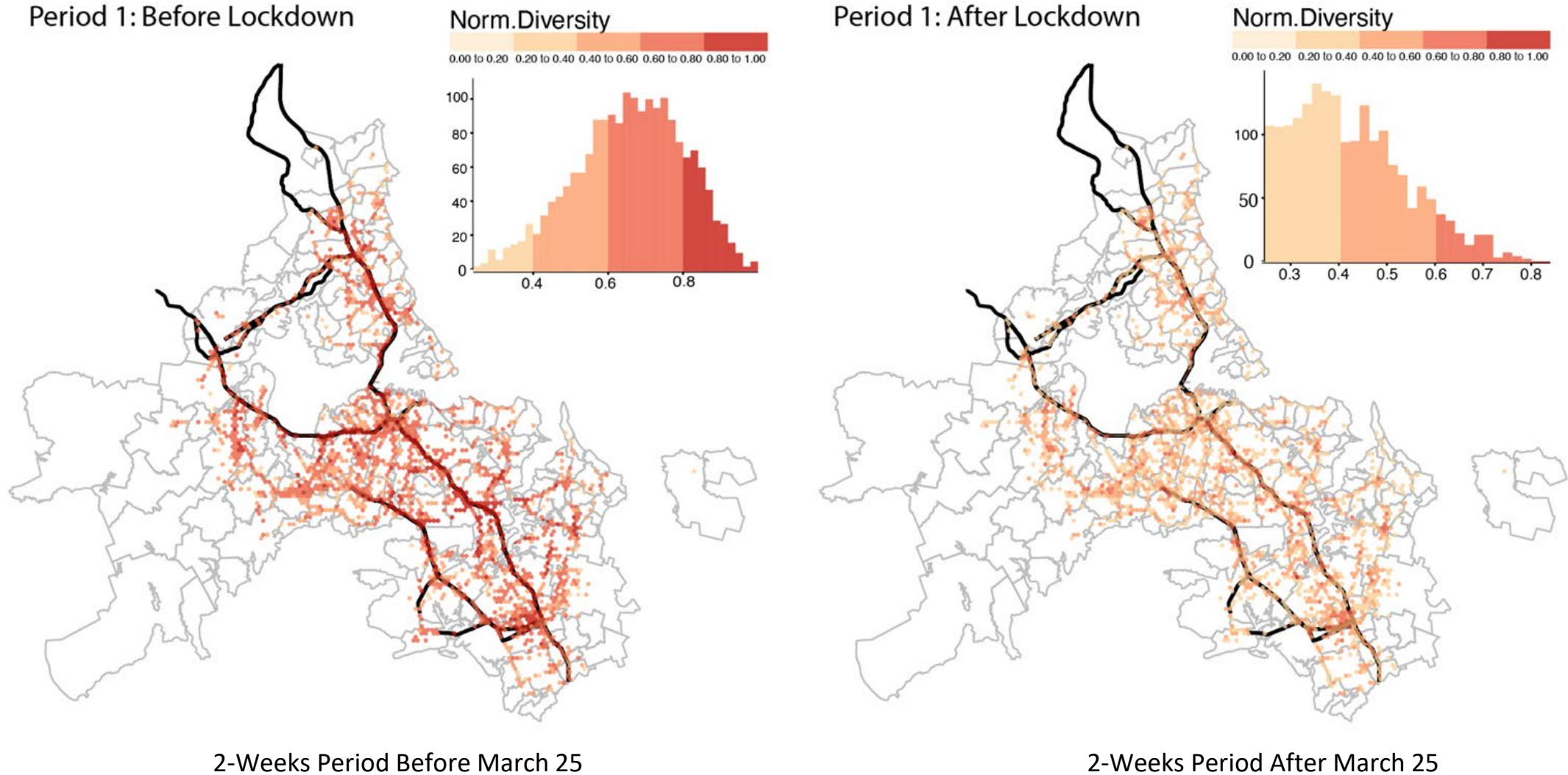
Period 1

Comparison of Nomalized Diversity Before and After Lockdown

Period 1: Before Lockdown

Norm.Diversity
0.00 to 0.20 0.20 to 0.40 0.40 to 0.60 0.60 to 0.80 0.80 to 1.00

Period 1: After Lockdown

Norm.Diversity
0.00 to 0.20 0.20 to 0.40 0.40 to 0.60 0.60 to 0.80 0.80 to 1.00

2-Weeks Period Before March 25

2-Weeks Period After March 25

Period 2

Comparison of Nomalized Diversity Before and After Lockdown
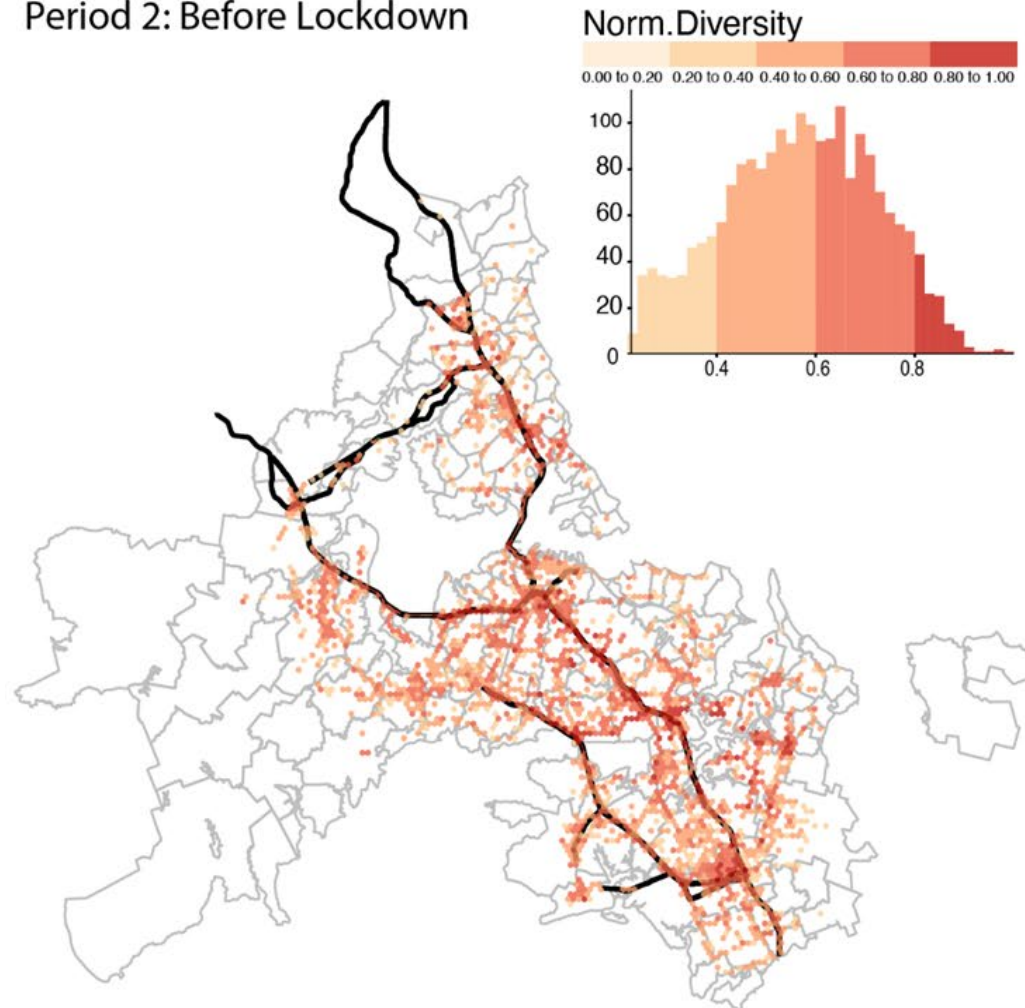
2-Weeks Period Before August 12

2-Weeks Period After August 12
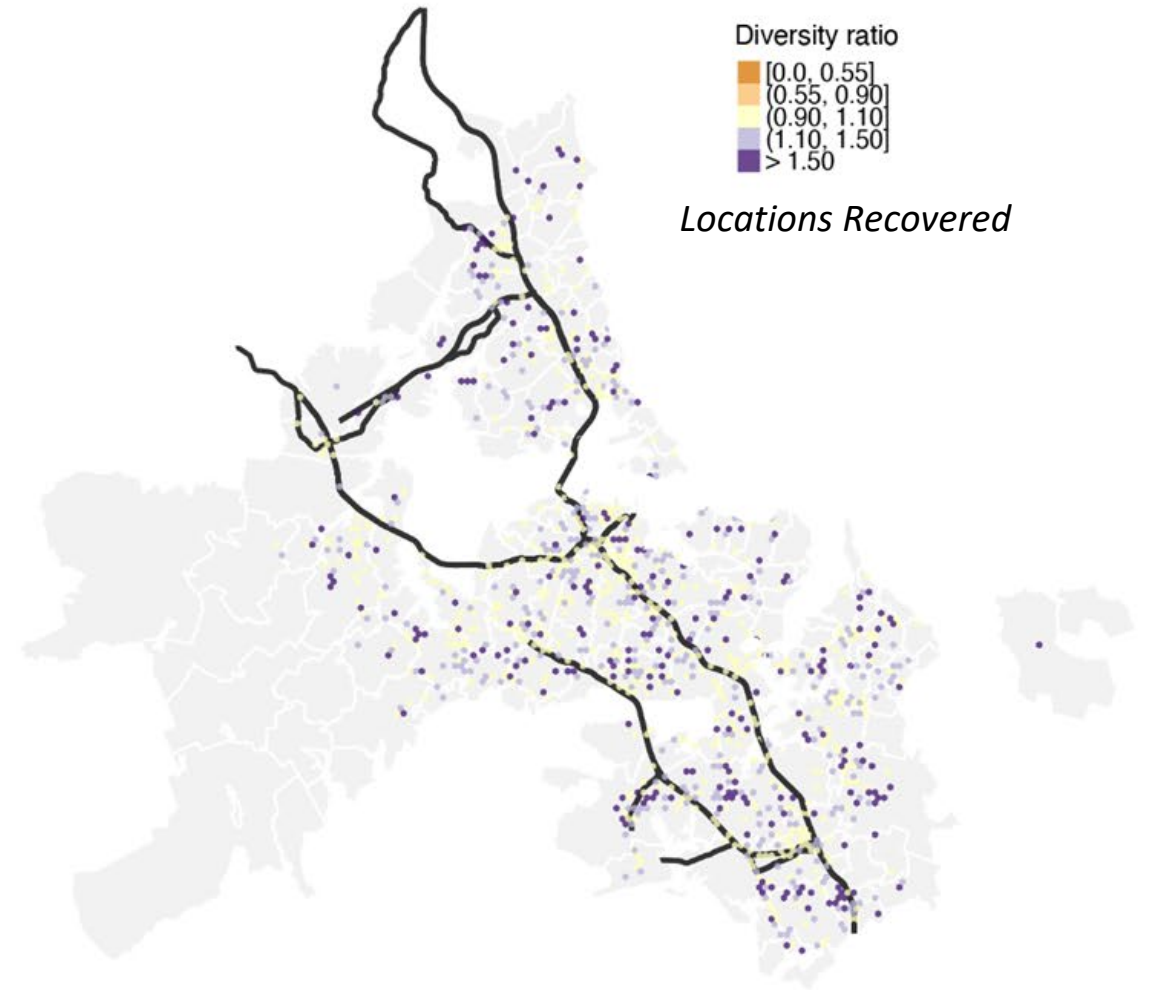
Ratio Analysis

After 1st lockdown

Before 2nd lockdown

Spatial Distribution of Diversity Ratio:
Before second lockdown compared to after first lockdown

Diversity ratio
- [0.0, 0.55]
- (0.55, 0.90]
- (0.90, 1.10]
- (1.10, 1.50]
- > 1.50
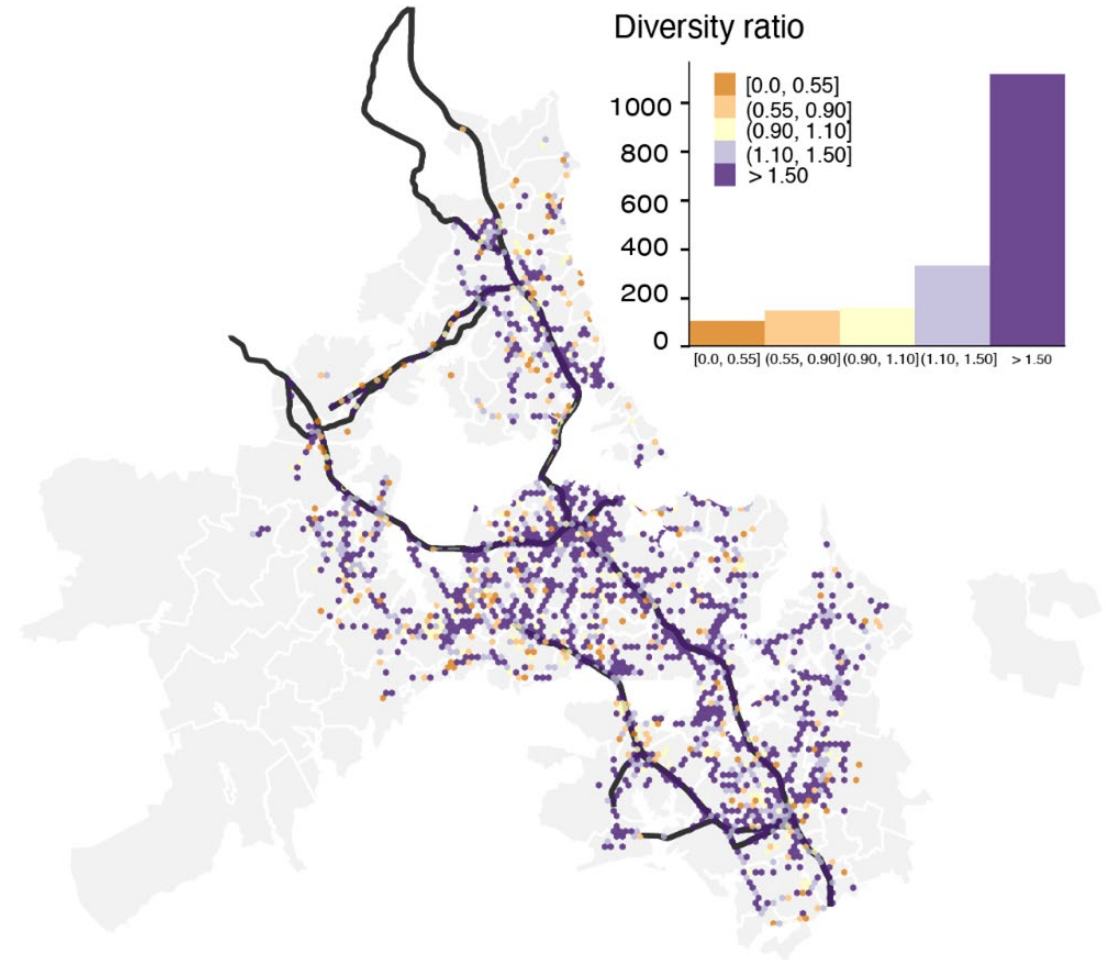
Diversity Before 2nd Lockdown / Before 1st Lockdown

Diversity ratio
- [0.0, 0.55]
- (0.55, 0.90]
- (0.90, 1.10]
- (1.10, 1.50]
- > 1.50

Locations Not Recovered

Locations Recovered
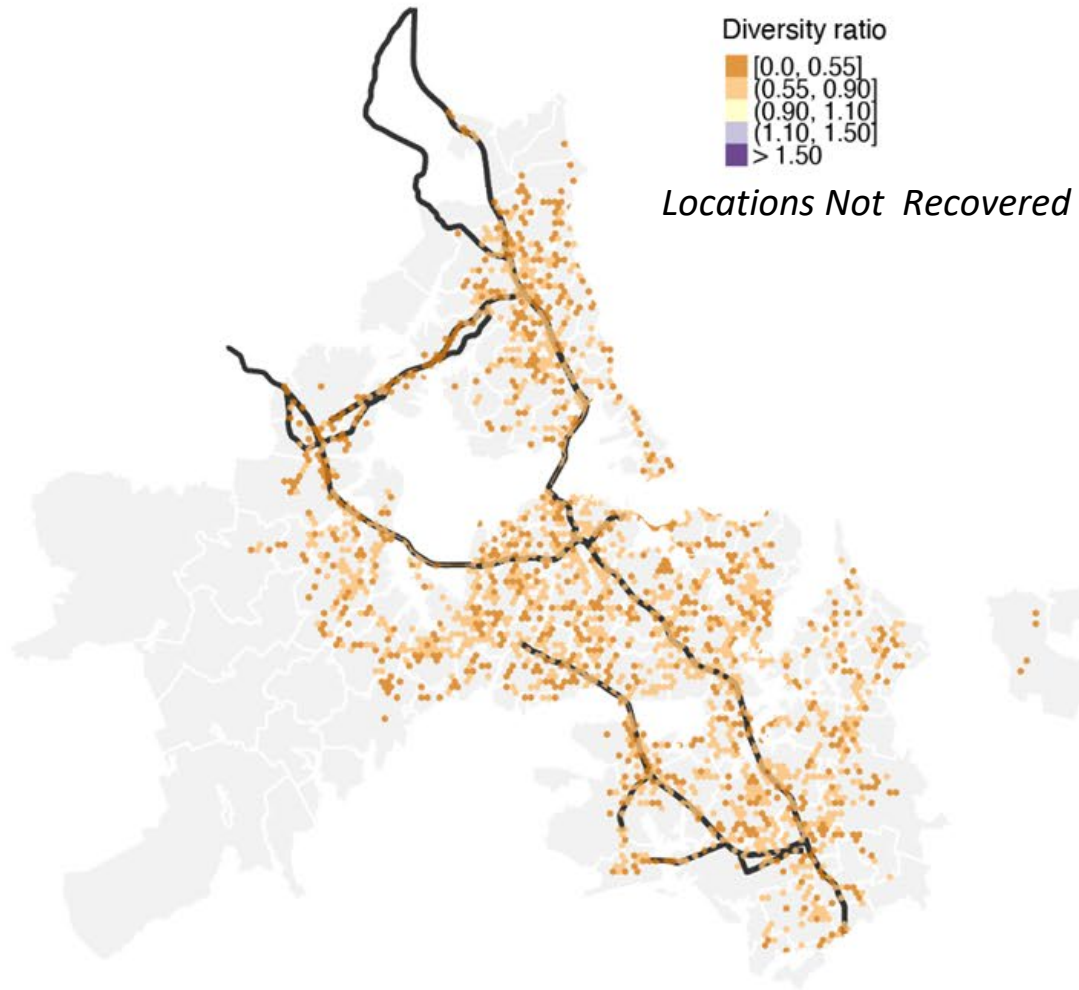
Measure against the normal life pattern allows us to provide insights on the recovery of the urban places.

"Urban Hot Spots"

https://heartofthecity.co.nz/attractions/parks/albert-park

https://www.totstoteens.co.nz/event/ellen-melville-centre-community-open-day/

https://www.aucklandmuseum.com/

Highway on ramp

Auckland Hospital

https://www.mphsfoundation.org/

http://www.stuff.co.nz/auckland/
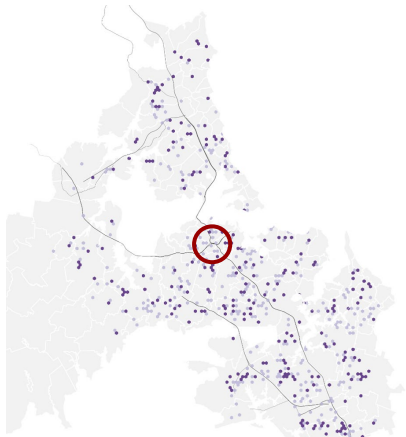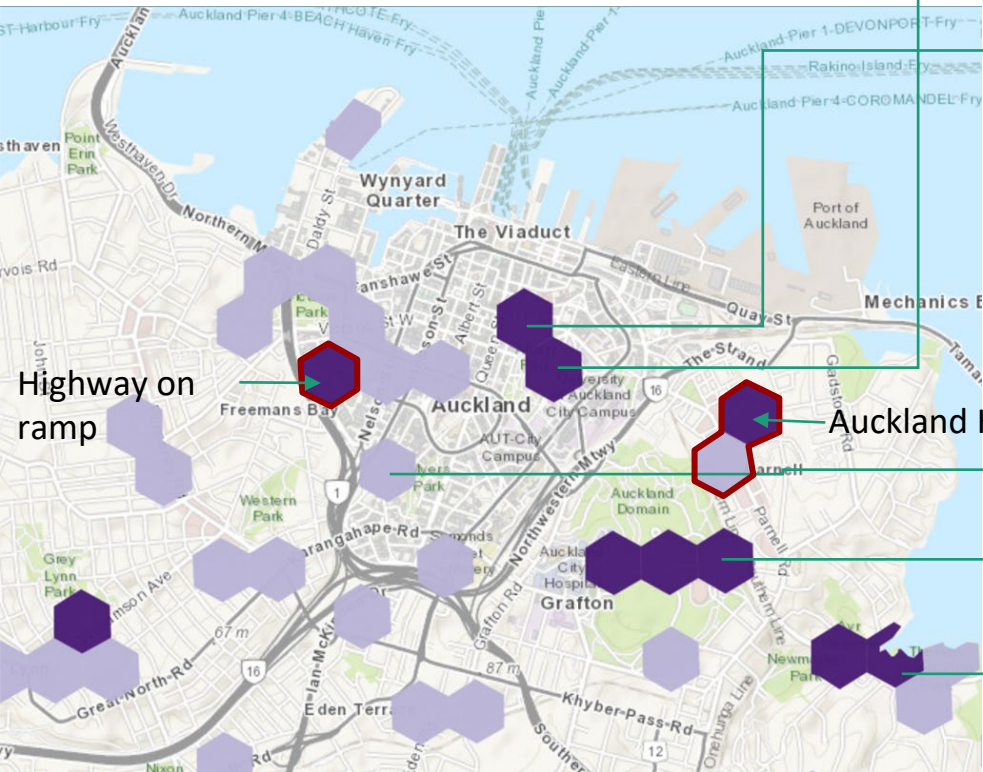
Auckland CBD

Essential Urban Programs
(Schools/ Hospital/Highway Ramp)

Green Open Space/ Leisure Places

Albany Domain

Shepherds Park

Devonport Park

Memorial Park

One Tree Hill

Highland Park

Macleans Park

Albany Senior High School

North Shore Hospital

https://www.nzia.co.nz/awards/national/award-detail/3859#Albany%20Senior%20High%20School

Auckland Hospital

Western Heights School

Kelston Primary School

Al Madinah School

Ormiston Senior/Junior College/Primary School

Manurewa Central Primary School

https://lp-cms-production.imgix.net/2019-06/GettyImages-472339930_super.jpg?auto=compress&crop=center&fit=crop&format=auto&h=832&w=1920

Kohuora Park

Botanic Garden

https://www.aucklandbotanicgardens.co.nz/media/1395/autumn-julylake.jpg?crop=0,0.2200550964187328,0,0.16123329228211217&cropmode=percentage&quality=100&width=970&height=400&rnd=130816032580000000

Conclusion

Urban "hot-spots" under the impact of Covid are not only the popular places in the city, but are the "essential" spaces that recover quickly to support the changing dynamics of urban living.

https://cdn.auckland.ac.nz/aem/content/auckland/en/news/2020/06/17/crisis-of-public-spaces/jcr:content/leftpar/imagecomponent/image.img.1024.medium.jpg/1592349130896.jpg

Contribution:

- Insights to contribute for design and planning of the post-pandemic urban landscape
- Adoptable methodology to other urban context

Future Work:

- Explore further on human mobility pattern under the impact of Covid-19 policy (eg. different temporal frames or recovery rate)
- Spatial Correlation with various urban programs
- Spatial characteristic factors of the urban "hot-spots"
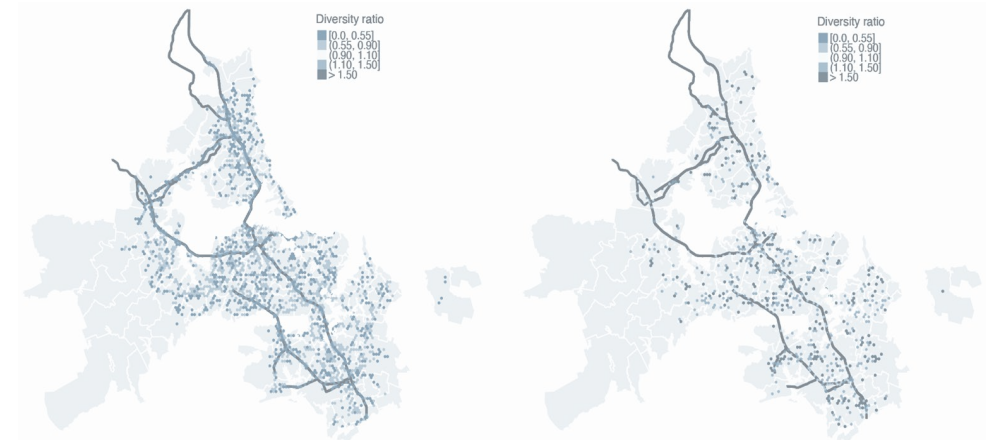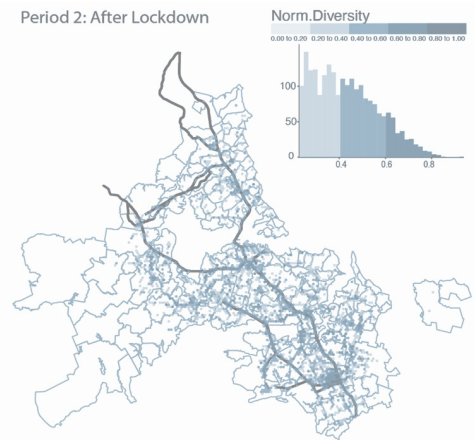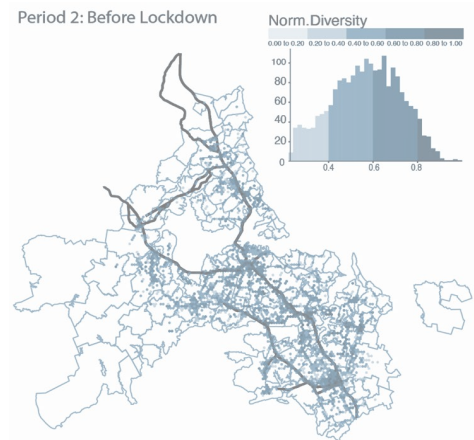
THANK YOU FOR YOUR ATTENTION

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qchen47@buffalo.edu