Social vulnerability indicators for natural hazards and other emergencies in Aotearoa

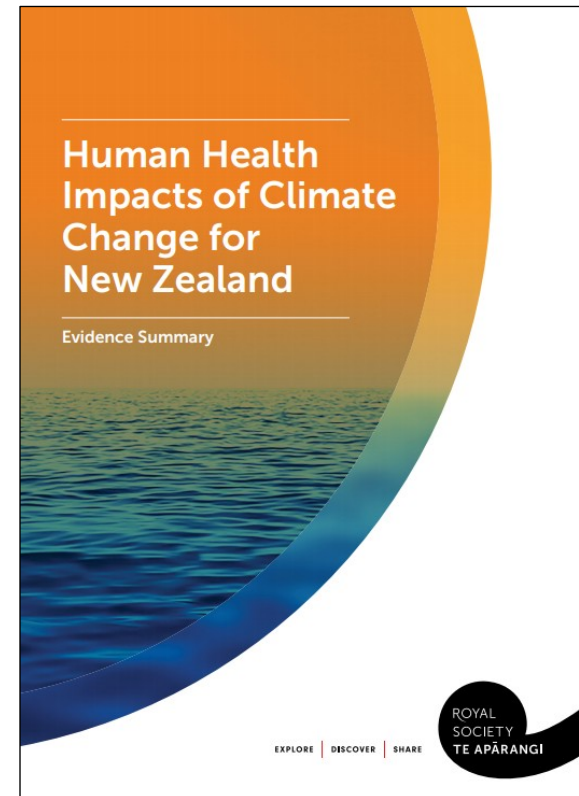Edgecumbe floods, NZ, March 2017

Kylie Mason
Principal Analyst, EHINZ
Massey University (Wellington)

NZ Population Conference, 29 August 2023
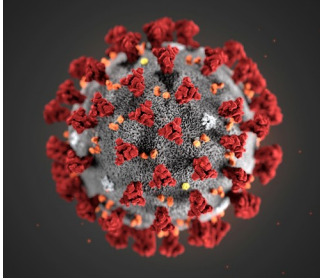
Climate change will affect human health

- Increased frequency and/or severity of
  - **flooding, extreme storm events**
  - **wildfires**
  - **heatwaves**
  - **droughts**
- Sea-level rise
- Environmental changes, eg
  - **air quality**
  - **water quality**
  - **food security**
- Potential infrastructure damage, displacement
- Social and economic changes

Human Health
Impacts of Climate
Change for
New Zealand

Evidence Summary

EXPLORE | DISCOVER | SHARE

ROYAL
SOCIETY
TE APĀRANGI

MASSEY
UNIVERSITY
TE KUNENGA KI PŪREHUROA

UNIVERSITY OF NEW ZEALAND

ehinz

Environmental Health
Intelligence New Zealand
Rapu Mātauranga
Hauora mo te Taiao – Aotearoa

Not everyone is affected equally in disasters

Social vulnerability refers to:

characteristics of people and their situation that influence their capacity to anticipate, cope with, and recover from the impacts of hazards

(Cutter et al 2003)

Aotearoa New Zealand's first national adaptation plan for climate change:

"New Zealanders are already feeling the impacts of climate change.

These impacts affect people and communities differently because they have varying degrees of exposure, or different capacity to prepare for and respond to climate impacts.

We need to understand these different vulnerabilities to enable future actions to be targeted to support those most vulnerable to the impacts of climate change." (Ministry for the Environment 2022)

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Outline

1. Method for developing the indicators

2. Social vulnerability indicators and data visualisations

3. Uses of SVIs and future work

Method for developing the indicators

Developing social vulnerability indicators

- Research project funded by Natural Hazards Research Platform, that aimed to:

    - Develop a set of social vulnerability indicators for flooding in New Zealand, using 2013 Census data

    - Test the indicators using a case study of Porirua City Council area

    - Implement the indicators into RiskScape

    - Develop guidelines on how to incorporate the indicators into emergency management and land use planning

    - *Project team included EHINZ, Rawiri Faulkner (Tūtaiao Ltd), GNS Science, NIWA, Urban Edge Planning Ltd; partnered with Ngāti Toa Rangatira for the project; key stakeholder group consulted throughout*

- Indicators since updated with 2018 Census data, and expanded for other hazards

Methods for developing the indicators

Scoping stage

Understand the issue

(how flooding affects health and wellbeing, who is more vulnerable, and why)

Review previous research and indicator sets

Understand end-users and their needs

Selection stage

Create a conceptual framework

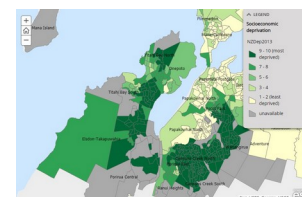**Identify potential indicators** to reflect the conceptual framework

Evaluate indicators

Design stage

Design the indicators (e.g. technical aspects)
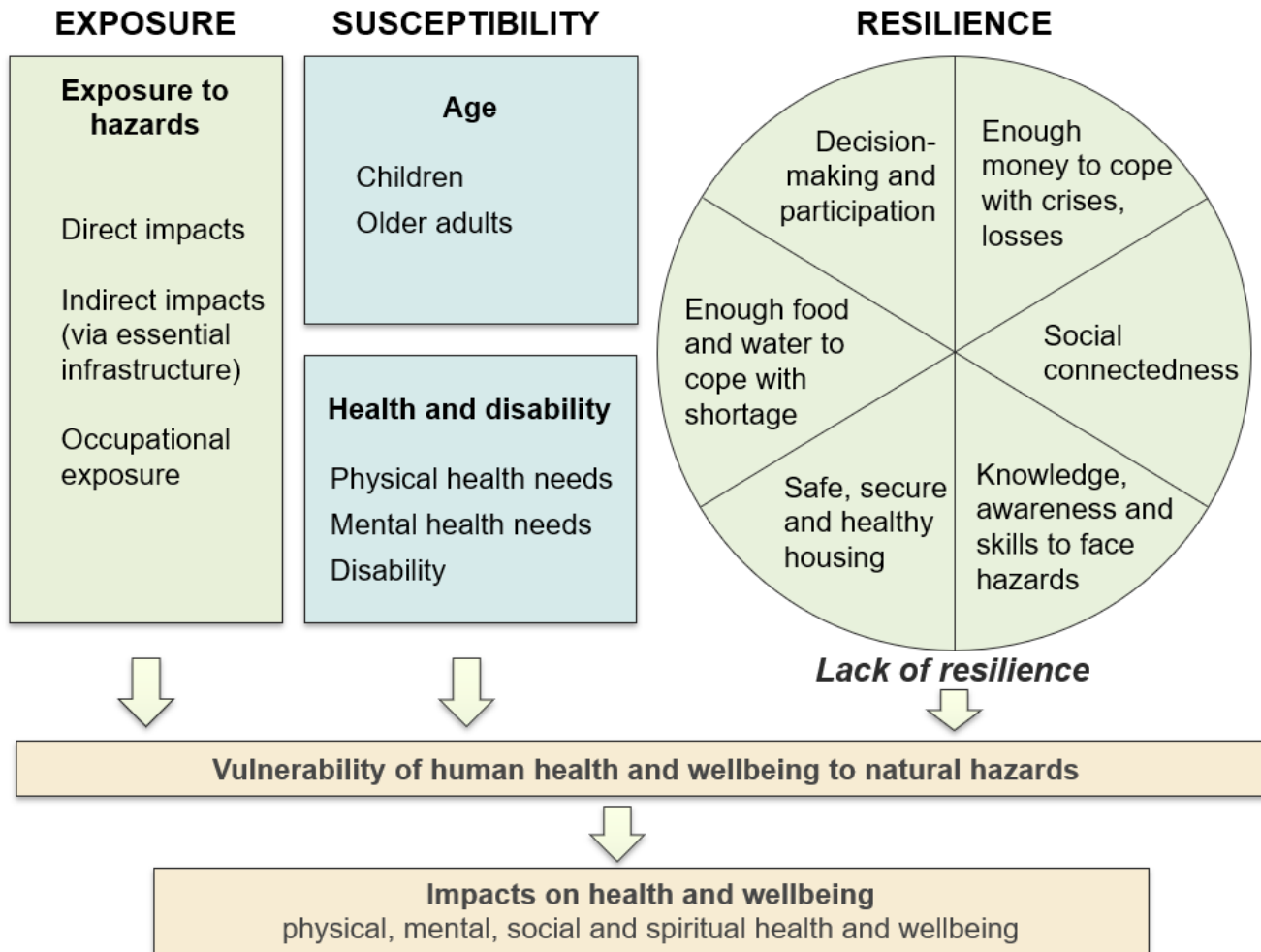
Feedback from end users

Produce and publish the indicators

Indicators used by end-users

Stakeholder and end user input

Conceptual framework for social vulnerability

Conceptual framework adapted from:

- MOVE framework (Methods for Improving Assessment of Vulnerability in Europe) (Birkmann et al 2013)

- Circle of capacities (Wisner et al 2012)

- Te whare tapa whā – Māori model of health and wellbeing (Durie 1985)

Social vulnerability indicators and data visualisations

Social vulnerability indicators for 2018

Dimension	Indicators (with Census-type data for NZ)
Exposure	Usually resident population Number of households Urban/rural classification Ethnic group (total response): European, Māori, Pacific peoples, Asian, MELAA
Exposure (occupational)	Health care and social assistance workers Primary industry workers
Children	Children aged 0-4 years Children aged 0-14 years School-aged children (5-14 years) Households with at least one child aged 0-4 years Households with at least one child aged 0-14 years
Older adults	People aged 65+ years People aged 75+ years People aged 85+ years Households with an older adult (65+ years) living alone
Health and disability	Pregnant women (proxy)

Dimension	Indicators (with Census-type data for NZ)
Having enough money to cope with crises/losses	Socioeconomic deprivation (NZDep2018) Unemployed people People who are not in the labour force Single parent households Households with no access to a car
Social connectedness	Households living in rental housing Recent immigrants (less than 1 year; 0-1 years) One person households
Knowledge, skills and awareness to face hazards	People who do not speak English Households with no access to a mobile phone Households with no access to the internet
Safe, secure and healthy housing	Crowded households People living in crowded households Damp dwellings (always; always or sometimes) Mouldy dwellings (always; always or sometimes)
Enough food and water to survive	Households living in rental housing Socioeconomic deprivation (NZDep2018) Dwellings with no access to safe drinking water Dwellings with no access to fridge Dwellings with no electricity
Decision-making and participation	Voter turnout in 2019 Local Authority Elections

Point locations relating to social vulnerability and resilience

- Schools and ECEs
- Rest homes and retirement villages

- Hospitals
- Primary health care centres
- Pharmacies
- Residential and respite care facilities for people with disabilities

- Emergency services facilities
- Civil Defence Centres

- Marae

- Houses and buildings on Māori land

- Visitor accommodation
- Temporary housing (such as boarding houses)
- Social housing

- Emergency water supplies
- Food stores and food banks

- Child-care and protection facilities
- Justice facilities and youth justice facilities

Creating indicator dataset and visualisations

- Created indicators using Census data, including requesting customised data tables
- We output indicator data at SA2, territorial authority and DHB level
- For 2018 Census variables with missing data, we calculated logical bounds for percents to show uncertainty
- Heatmaps provide a visual summary of social vulnerability for areas (%s)

An example for Porirua City Council area, by SA2 (2018 data)

SA2 name	Urban/rural	Usually resident population	Number of households	European	Māori	Pacific peoples	Asian	MELAA	0-4 years	0-14 years	5-14 years	65+ years	75+ years	85+ years	0 years	NZDep2018 deciles	Unemployed	Not in labour force	Households with no car	Living in rented dwelling	Immigrant arrived in past year	Immigrant arrived in past 0-1 years	Don't speak English	Households with no cellphone	Households with no Internet	Crowded households	People living in crowded households	Dwelling damp (always/sometimes)	Dwelling damp (always)	Dwelling mouldy (always/sometimes)	Dwelling mouldy (always)	NZDep2018 deciles	Living in rented dwelling	Dwellings with no access to safe running water	Dwellings with no access to a fridge	Dwellings with no access to electricity
Pukerua Bay	Large urban area	1962	705	91.9	14.1	3.7	2.3	1.2	6.4	21.7	15.1	11.9	3.1	0.6	1.4	2	3.1	22.5	2.2	15.7	0.6	1.4	0.2	2.7	5.3	1.4	2.8	19.8	1.8	16.1	3.1	2	15.7	1.8	1.3	0.4
Paekakariki Hill	Rural	375	135	93.6	10.4	1.6	4.0	0.8	4.0	20.0	16.0	16.0	5.6	0.8	..C	1	3.0	25.0	0.0	13.6	0.0	0.0	0.8	10.0	5.0	..C	2.9	17.9	0.0	10.3	0.0	1	13.6	5.0	0.0	0.0
Plimmerton	Large urban area	2142	840	90.2	13.4	3.1	3.2	0.7	5.0	18.6	13.4	17.6	5.9	1.4	1.3	2	2.4	27.5	5.2	23.5	1.0	1.5	0.1	3.3	7.4	2.5	3.7	17.9	1.5	12.4	3.0	2	23.5	0.4	3.0	0.4
Titahi Bay North	Large urban area	2688	981	69.9	35.8	16.9	7.9	0.6	7.3	22.9	15.6	11.0	4.2	0.9	1.5	8	6.8	27.1	11.0	43.3	0.7	1.2	1.0	6.5	15.4	7.4	13.7	30.0	6.0	23.5	6.6	8	43.3	3.1	4.8	1.1
Titahi Bay South	Large urban area	3744	1266	65.8	36.3	21.6	8.0	1.8	8.3	24.6	16.2	12.3	5.1	1.9	1.7	9	6.7	30.4	12.9	48.9	0.6	1.4	1.3	7.9	19.1	8.2	14.7	28.5	4.1	24.6	5.9	9	48.9	2.4	4.2	1.1
Elsdon-Takapuwahia	Large urban area	2418	696	47.8	52.9	28.7	10.0	0.7	8.6	24.9	16.4	9.9	3.6	0.9	1.6	9	7.4	32.2	13.0	49.8	0.7	1.9	3.4	9.5	17.9	13.6	24.4	43.1	8.7	34.2	10.4	9	49.8	3.5	4.0	3.1
Pauatahanui	Rural	966	312	95.3	7.1	2.2	0.9	0.6	4.3	20.2	15.8	10.6	3.4	0.6	0.6	1	2.7	19.5	0.0	14.4	0.9	1.6	3.3	6.0	5.0	3.3	5.7	8.2	1.0	8.2	1.0	1	14.4	2.0	1.0	0.0
Onepoto	Large urban area	1917	624	70.1	32.2	18.0	4.5	1.4	7.8	24.4	16.6	11.6	3.9	0.9	1.6	5	4.3	25.9	4.7	26.0	0.7	2.0	1.1	5.7	9.9	5.0	8.9	30.6	4.3	22.9	6.4	5	26.0	1.6	1.7	0.3
Camborne	Large urban area	2013	726	89.4	9.5	2.8	6.7	1.2	6.4	21.6	15.1	12.4	4.0	0.7	1.8	1	2.9	23.0	3.0	16.9	1.0	2.1	0.8	1.7	4.2	1.4	1.6	14.5	1.7	10.3	2.1	1	16.9	1.3	0.6	0.3
Paremata	Large urban area	2463	972	89.6	11.9	5.8	4.1	0.9	4.9	16.7	11.8	19.2	6.8	1.2	1.2	2	3.2	27.2	3.9	22.8	1.6	2.6	0.2	3.9	7.8	2.1	4.1	15.7	2.6	11.0	3.6	2	22.8	1.3	1.9	1.1
Porirua Central	Large urban area	261	33	57.5	28.7	13.8	11.5	2.3	2.3	4.6	3.4	8.0	3.4	1.1	..C	10	1.2	48.8	25.0	63.6	3.5	5.8	1.1	12.5	25.0	..C	..C	50.0	12.5	14.3	0.0	10	63.6	0.0	0.0	0.0
Papakowhai	Large urban area	2268	759	83.6	13.6	6.9	8.7	0.5	5.6	18.1	12.7	17.2	7.3	2.4	0.8	1	3.1	26.8	1.6	14.6	0.7	2.0	1.1	3.3	4.5	2.7	4.5	14.1	1.2	12.0	2.1	1	14.6	1.2	0.6	0.3
Aotea	Large urban area	3138	1062	70.6	8.2	7.2	22.0	1.3	8.0	24.4	16.3	14.4	7.4	2.6	1.7	1	2.5	28.1	4.1	17.8	1.2	2.4	2.2	4.4	4.7	1.9	2.8	1.8	0.3	2.6	0.6	1	17.8	0.9	0.6	0.0
Postgate	Large urban area	2754	927	77.6	14.9	13.6	6.5	0.5	8.4	22.1	13.9	9.9	3.2	0.3	1.3	2	3.9	21.7	1.7	23.0	0.8	1.9	0.9	2.3	4.3	4.4	8.4	19.0	1.7	15.4	3.1	2	23.0	0.7	1.7	1.1
Ascot Park	Large urban area	2862	804	45.1	29.4	42.6	12.1	1.5	8.7	25.2	16.5	9.4	2.5	0.2	2.1	9	6.2	30.8	6.0	39.9	0.5	1.2	2.9	4.8	13.2	14.1	22.8	36.6	8.2	31.1	9.4	9	39.9	1.2	2.4	2.2
Whitby	Large urban area	3042	1059	86.7	10.6	6.2	6.8	0.9	6.7	21.4	14.7	15.7	7.0	1.9	1.2	1	2.6	26.6	2.9	19.5	0.8	1.7	1.2	4.0	4.8	1.9	3.2	15.7	1.2	13.0	2.9	1	19.5	0.6	0.6	0.0
Porirua East	Large urban area	2235	681	38.9	31.1	44.6	12.2	1.3	9.0	24.0	15.0	8.6	2.3	0.3	1.7	10	7.4	31.6	16.0	59.9	1.1	2.3	4.3	8.6	20.7	14.3	24.0	38.5	11.2	31.6	11.8	10	59.9	4.1	5.6	5.2
Endeavour	Large urban area	4617	1482	85.7	7.4	3.0	9.7	1.4	7.3	22.6	15.3	12.1	4.2	1.0	1.4	1	2.9	23.9	1.2	12.3	1.8	3.2	0.9	2.3	2.1	1.4	1.9	5.4	0.4	5.1	1.0	1	12.3	0.4	1.2	0.0
Cannons Creek North	Large urban area	3474	915	28.1	28.8	58.0	10.4	3.3	10.4	29.8	19.3	7.2	2.4	0.5	2.0	10	10.3	35.6	23.2	75.4	1.1	3.1	6.4	12.9	27.3	23.5	38.3	52.4	13.1	44.5	16.3	10	75.4	7.3	8.5	7.1
Waitangirua	Large urban area	4398	1044	22.0	28.8	66.0	8.3	1.4	9.8	30.1	20.3	7.8	2.5	0.3	1.7	10	9.7	37.5	14.6	72.8	1.2	2.1	6.9	10.8	24.9	25.5	39.6	53.4	13.7	46.4	18.4	10	72.8	5.1	5.4	4.0
Ranui Heights	Large urban area	1326	465	62.4	24.2	26.2	9.7	1.4	7.7	18.3	10.9	13.3	4.5	0.9	2.0	5	4.7	27.7	6.2	30.1	0.5	0.7	2.1	5.5	13.8	4.4	8.3	25.4	3.5	19.1	4.3	5	30.1	2.7	4.1	0.4
Cannons Creek East	Large urban area	3879	933	19.9	23.8	68.1	7.1	2.2	9.4	28.5	18.9	8.6	2.9	0.3	1.8	10	9.9	37.5	17.0	64.6	0.3	1.0	5.2	11.9	26.5	25.0	39.5	52.5	13.2	44.6	16.5	10	64.6	5.9	6.3	5.1
Cannons Creek South	Large urban area	1620	414	26.7	26.7	59.6	8.1	2.6	8.3	27.8	19.4	7.0	2.2	0.2	2.4	10	9.7	40.0	10.6	64.0	0.4	0.9	5.9	8.8	22.8	21.1	33.3	45.3	15.9	45.8	15.9	10	64.0	4.5	5.9	2.6

Porirua interactive map

Social vulnerability indicators for flooding in Aotearoa/New Zealand: Porirua case study

Overview | About Porirua | **Exposure** | Children | Older adults | Health & disability | Enough money | Social connectedness | Knowledge & awareness | Safe housing | Food & water | ☰

Exposure

A Story Map

People in flood hazard zones

The maps in this application show you aspects of social vulnerability for Porirua.

Explore these interactive maps by zooming in and out. Click on an area to find out more. Select other indicators (in the tabs below, and also those highlighted in red).

Exposure to flooding

Exposure to flooding is an important part of social vulnerability.

People who live in flood hazard zones are more likely to come in contact with floodwaters. Floodwaters may also damage their home and/or belongings, put their life in danger, and increase the risk of injury or health impacts.

Social vulnerability indicators include:

- Flood hazard zones (1-in-100 year) include stream corridors, overland flow paths, and inundation zones.

People likely to be affected by disruptions to transportation network

People likely to experience outages to water, electricity or telecommunications services during a flood

People living in an area likely to be contaminated during a flood

LEGEND

Stream corridor

Inundation

Overland flow

Porirua City Council, Maxar | LINZ, Stats NZ, Esri, HERE, Garmin
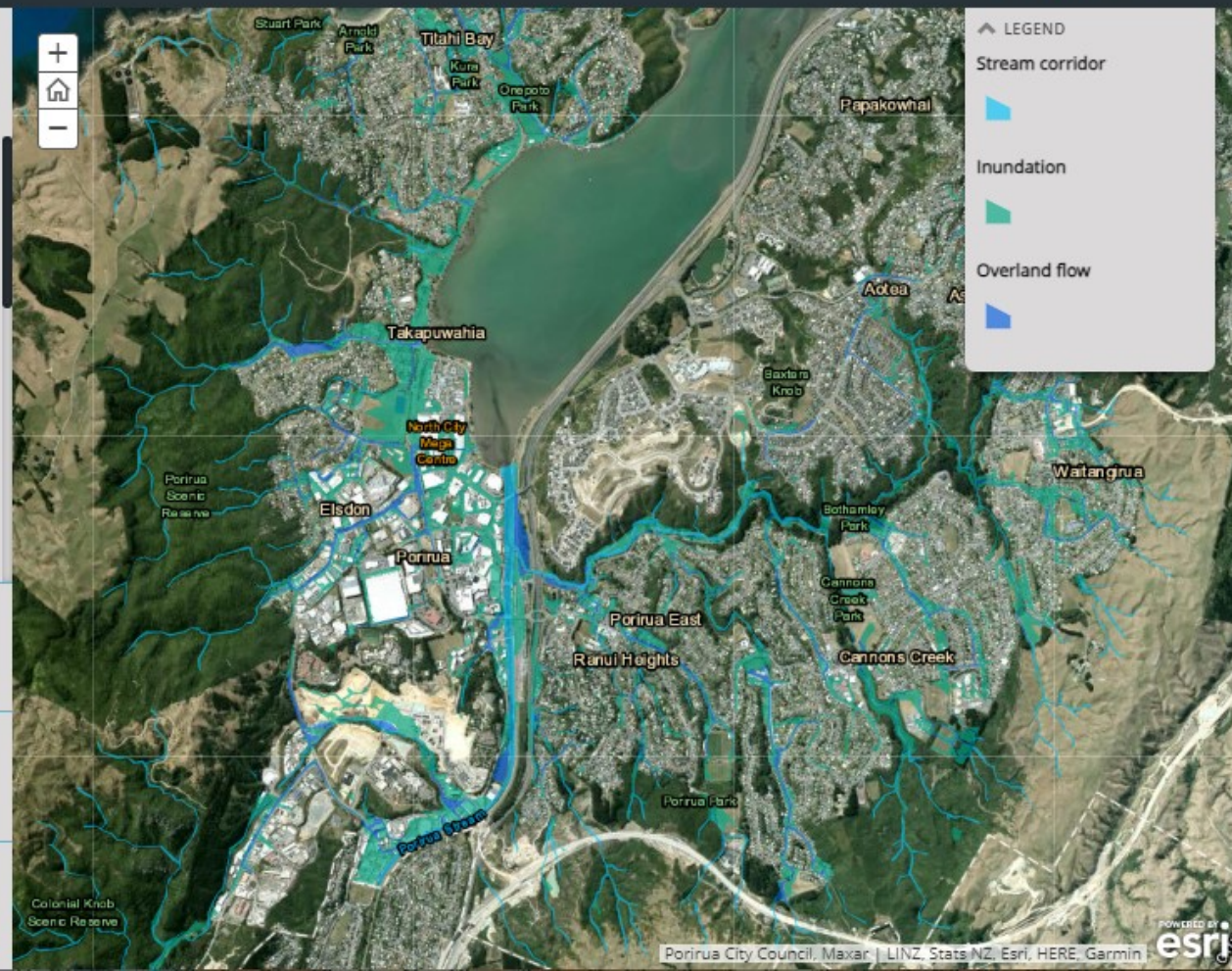
StoryMap for the 2018 Social Vulnerability Indicators for NZ

Online data visualization tool of 2018 SVIs available for New Zealand
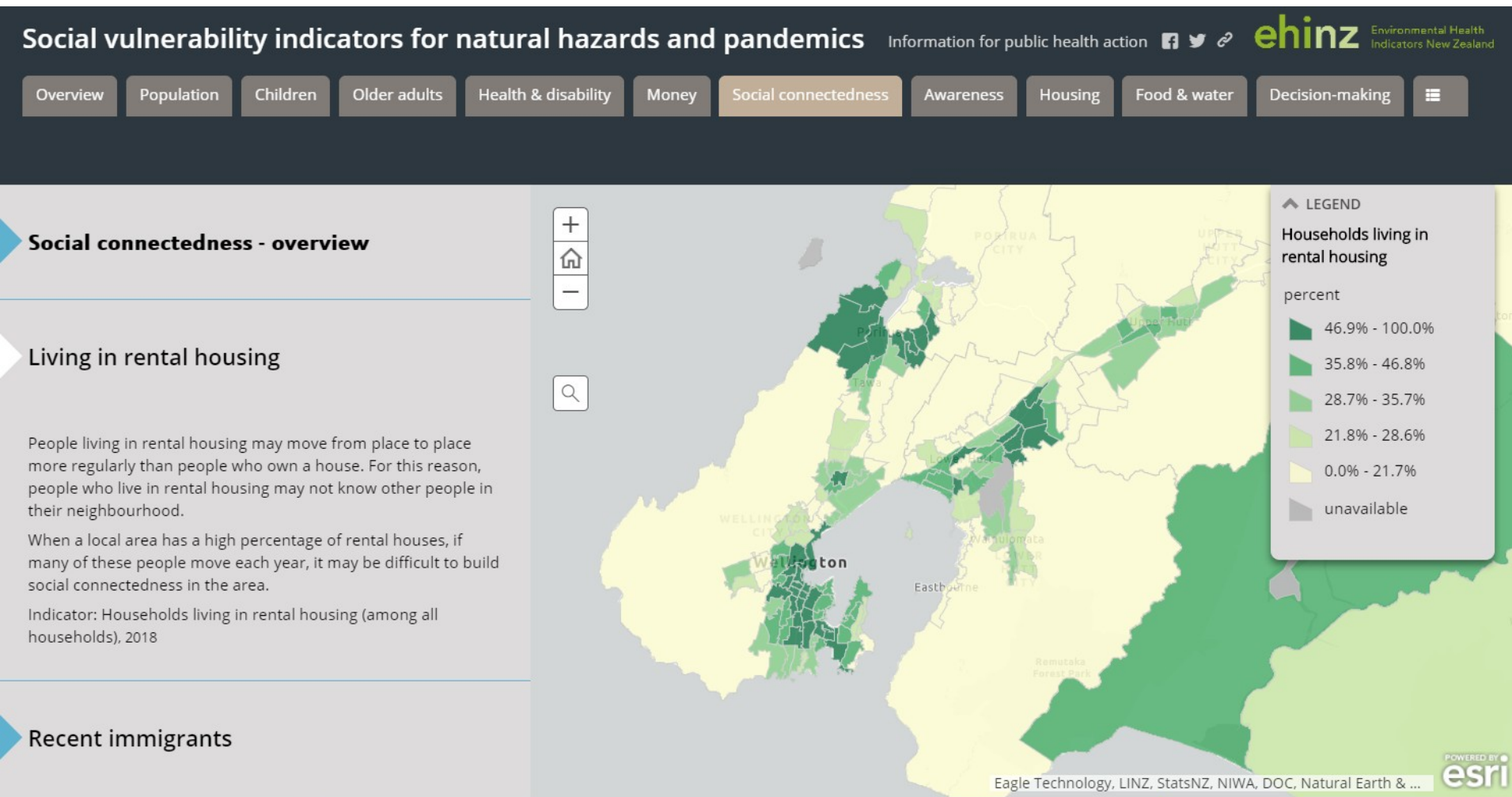
Uses of SVIs and future work

Extreme Climate Index and SVIs

EHINZ has partnered with Heather McLeod on her work with James Renwick (VUW), to produce:

- Climate summary reports
- Dashboards of ECI and SVIs

www.ehinz.ac.nz/projects/ECI

Uses of the SVIs across sectors

- CDEM planning and response during floods, and recovery

- Local councils
    - District Plan provisions for natural hazards – limit development of 'sensitive activities' in hazard zones
    - Informing climate change vulnerability assessments
    - Infrastructure upgrades – having objective data to help consider vulnerable populations

- Health needs assessments for health localities

Future work for SVIs

- Update the indicators with 2023 Census data

- Consider new indicators to fill gaps
  - disability indicators
  - health indicators (eg prevalence of chronic disease, mental health, people relying on medications) using linked health datasets

- Investigate 'point locations' in hazard zones

- Monitor social vulnerability over time
  - Adaptation to climate change = transforming systems + **reducing vulnerability**

Conclusions

- Unequal impacts of natural hazards and climate change

- Social vulnerability indicators help us to understand who is most vulnerable, and where they live

- It is vitally important to understand people's vulnerability
  - ➢ to help prioritise and target efforts, in order to support more vulnerable populations
  - ➢ to ultimately reduce the risk of harm to people's health and wellbeing

Social vulnerability indicators

www.ehinz.ac.nz

EHI website → Population vulnerability → Social vulnerability indicators

Extreme Climate Index
www.ehinz.ac.nz/projects/eci

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Environmental Health
Intelligence New Zealand
Rapu Mātauranga
Hauora mo te Taiao – Aotearoa

Understanding hazards, vulnerability and risk
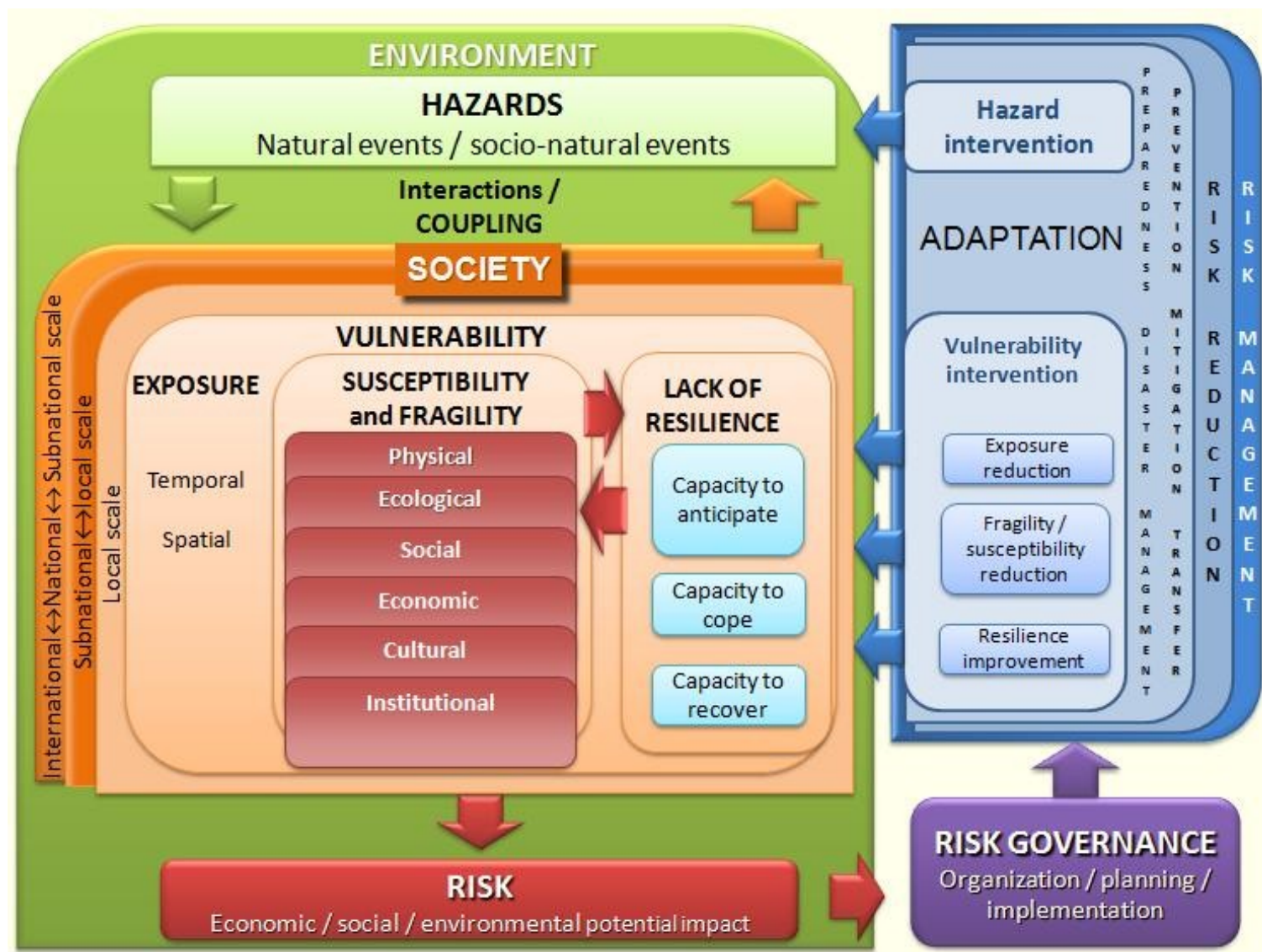
The MOVE framework

Methods for the Improvement of Vulnerability Assessments in Europe

Birkmann J, Cardona OD, Carreno ML, Barbat AH, Pelling M et al. 2013. Framing vulnerability, risk and societal responses: the MOVE framework. *Natural Hazards* 67: 193-211.

Understanding resilience

The 'Circle of Capacities'
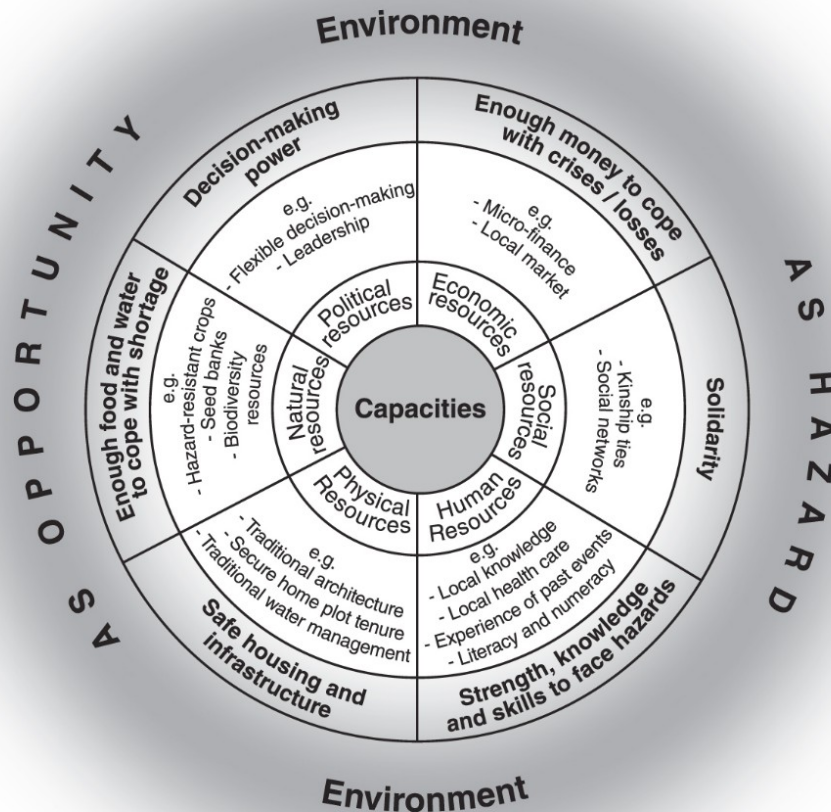
- Enough money to cope with crises/losses

- Social connectedness

- Knowledge, awareness and skills to face hazards

- Safe, secure and healthy housing

- Enough food and water to cope with shortage

- Decision-making and participation

Wisner B, Gaillard J, and Kelman I. 2012. "Framing disaster: Theories and stories seeking to understand hazards, vulnerability and risk," in *Handbook of Hazards and Disaster Risk Reduction*, B. Wisner, J. Gaillard, and I. Kelman Eds. London: Routledge.

Summary - DHB heatmap

DHB code	District Health Board	Usually resident population	Number of households	Population density	Population living in rural areas	European	Māori	Pacific peoples	Asian	Middle Eastern, Latin American, or African (MELAA)	0-4 years	0-14 years	5-14 years	65+ years	75+ years	85+ years	0 years	Living in NZDep2018 quintile 5 (most deprived areas)	Unemployed	Not in labour force	Households with no car	Living in rented dwelling	Immigrant arrived in past year	Immigrant arrived in past 0-1 years	Don't speak English	Households with no cellphone	Households with no Internet	Crowded households	People living in crowded households	Dwelling damp (always/sometimes)	Dwelling damp (always)	Dwelling mouldy (always/sometimes)	Dwelling mouldy (always)	Living in NZDep2018 quintile 5 (most deprived areas)	Living in rented dwelling	Dwellings with no access to safe running water	Dwellings with no access to a fridge	Dwellings with no access to electricity
01	Northland	179,076	64,251	14.1	51.3	73.1	36.0	4.2	3.9	0.5	6.5	21.0	14.5	19.6	7.7	2.0	1.3	42.8	5.2	37.1	5.4	32.1	0.6	1.2	0.9	10.0	19.9	5.9	11.7	27.6	4.5	22.4	6.2	42.8	32.1	4.0	3.0	1.9
02	Waitemata	586,335	193,440	201.2	11.1	65.3	10.1	8.6	24.3	2.2	6.6	19.8	13.3	13.5	5.7	1.6	1.3	9.6	3.6	30.3	4.2	33.7	1.8	3.9	4.2	6.5	9.0	5.8	10.3	23.1	3.1	19.3	4.6	9.6	33.7	3.5	3.2	1.6
03	Auckland	467,604	159,009	746.6	6.3	53.5	8.2	12.5	32.1	3.1	5.4	16.8	11.4	11.4	4.8	1.4	1.1	17.8	4.0	29.0	11.1	48.0	3.6	7.1	4.8	8.4	10.1	9.6	16.4	26.2	4.4	22.0	6.1	17.8	48.0	4.0	3.9	2.4
04	Counties Manukau	537,633	150,702	189.0	8.1	41.7	16.3	25.3	28.2	1.6	7.5	23.0	15.5	11.0	4.4	1.1	1.5	36.6	4.7	31.4	4.8	41.0	1.4	3.1	5.7	7.5	13.0	12.1	21.3	25.6	4.6	22.8	6.5	36.6	41.0	5.0	4.5	2.9
05	Waikato	405,558	144,243	19.1	27.2	73.7	23.9	4.6	10.0	1.2	6.8	21.1	14.3	15.9	6.7	1.8	1.3	27.6	4.5	32.3	5.5	37.1	1.1	2.3	1.6	8.5	16.5	5.1	9.6	23.4	3.2	18.7	4.8	27.6	37.1	3.2	3.5	1.6
06	Lakes	109,080	38,886	12.3	21.0	67.8	36.6	4.7	7.9	0.5	6.8	21.8	14.9	16.0	6.5	1.7	1.3	34.5	5.1	30.6	5.6	36.4	1.2	2.4	1.4	7.7	16.9	6.0	11.7	23.5	3.8	18.9	5.1	34.5	36.4	2.2	3.5	1.6
07	Bay of Plenty	240,183	87,105	24.9	20.7	76.8	25.7	3.0	6.4	0.8	6.4	20.4	14.0	19.6	8.6	2.3	1.3	21.5	4.0	34.2	4.5	31.9	1.0	2.1	1.3	7.8	14.6	4.7	9.4	18.8	2.5	15.2	3.8	21.5	31.9	1.9	2.6	1.4
08	Tairawhiti	47,517	16,410	5.7	27.3	58.1	52.9	4.5	2.8	0.4	7.5	23.7	16.2	15.5	6.3	1.8	1.4	49.3	5.2	32.7	7.8	40.6	0.5	1.0	1.4	12.7	21.9	7.7	14.9	26.4	4.1	21.3	5.8	49.3	40.6	3.8	3.5	1.8
09	Taranaki	117,684	45,306	14.8	26.8	84.8	19.8	2.1	4.5	0.6	6.6	21.0	14.4	17.4	7.6	2.3	1.2	23.5	4.0	32.7	6.1	31.4	0.7	1.3	0.6	9.0	18.1	3.1	5.9	21.5	2.7	18.4	4.6	23.5	31.4	2.3	2.9	1.2
10	Hawke's Bay	166,287	60,204	13.1	19.0	75.0	27.0	5.6	5.0	0.6	6.5	21.0	14.5	18.3	7.7	2.1	1.3	28.2	3.6	32.8	6.2	33.5	1.0	1.8	1.3	9.8	17.2	5.4	10.8	18.3	2.5	14.1	3.6	28.2	33.5	6.1	3.2	1.6
11	Whanganui	64,599	25,281	6.7	21.3	78.5	27.4	4.0	3.7	0.4	6.4	20.2	13.8	19.5	8.5	2.4	1.3	40.9	4.7	35.9	7.8	33.2	0.6	1.1	0.9	11.4	22.2	3.9	8.3	23.4	3.3	17.7	4.5	40.9	33.2	3.8	3.3	1.5
12	MidCentral	174,993	65,580	19.8	22.8	80.1	20.6	4.4	7.5	0.9	6.3	19.8	13.5	17.8	7.7	2.1	1.2	26.6	4.4	34.4	7.0	33.0	0.9	1.7	1.3	9.1	17.2	3.8	7.6	20.4	2.4	15.9	3.8	26.6	33.0	3.6	3.1	1.2
13	Hutt Valley	148,509	53,034	162.3	2.5	71.6	17.6	9.8	13.2	1.4	6.6	20.0	13.4	14.0	6.1	1.7	1.3	20.2	4.6	29.8	8.5	32.0	1.0	2.1	2.1	7.1	13.2	5.7	10.3	22.8	2.9	17.3	4.3	20.2	32.0	2.5	2.9	1.5
14	Capital and Coast	303,987	110,802	409.6	1.2	74.1	11.6	8.7	14.5	2.4	5.6	17.7	12.2	13.1	5.6	1.6	1.1	11.5	4.6	27.3	12.1	37.8	1.9	3.8	1.9	6.0	8.9	5.1	9.1	22.2	3.1	17.3	4.6	11.5	37.8	1.7	2.4	1.2
15	Wairarapa	45,327	17,913	7.7	29.7	87.5	18.0	3.1	4.6	0.3	5.9	19.0	13.1	21.5	8.9	2.3	1.2	15.5	3.2	33.8	5.9	27.9	0.4	1.1	0.5	10.0	17.2	2.9	6.0	16.8	1.8	12.0	2.7	15.5	27.9	2.9	2.4	1.2
16	Nelson Marlborough	150,612	58,041	7.3	25.7	89.1	10.8	2.3	4.6	0.7	5.2	17.8	12.6	20.8	8.5	2.3	1.0	10.1	2.6	32.9	4.7	27.8	1.3	2.3	0.8	8.3	14.4	3.2	6.1	14.4	1.3	10.2	2.1	10.1	27.8	2.4	2.4	1.3
17	West Coast	31,575	13,503	1.3	45.0	90.5	11.7	1.5	3.4	0.5	5.5	17.7	12.2	19.6	7.7	1.9	1.2	25.0	3.2	33.0	7.1	32.0	0.9	1.6	0.4	14.9	23.5	2.2	4.4	23.2	3.0	15.3	3.9	25.0	32.0	6.1	3.7	2.1
18	Canterbury	539,631	200,694	19.4	14.3	81.6	9.5	3.3	11.8	1.3	5.8	18.3	12.4	15.4	6.7	2.0	1.2	11.0	3.3	29.8	5.8	32.7	1.5	3.2	1.6	7.4	12.9	3.8	7.0	16.3	1.8	10.5	2.4	11.0	32.7	2.0	3.0	1.5
19	South Canterbury	58,977	24,270	4.3	30.5	90.1	8.7	1.7	4.8	0.7	5.5	17.7	12.2	21.5	9.5	2.6	1.1	12.5	2.4	33.0	5.7	29.0	1.0	1.9	0.5	9.5	18.8	2.2	4.2	17.1	1.8	11.0	2.3	12.5	29.0	3.5	2.3	1.2
22	Southern	324,405	125,028	4.8	25.0	86.8	10.5	2.7	6.6	1.4	5.5	17.6	12.1	16.6	7.2	2.1	1.1	14.0	3.2	30.6	6.9	31.6	1.8	3.4	0.7	8.4	15.8	2.9	5.5	18.1	1.9	12.1	2.8	14.0	31.6	2.5	2.5	1.4
total	Total NZ	4,699,755	1,653,792	17.6	16.3	70.2	16.5	8.1	15.1	1.5	6.3	19.6	13.4	15.2	6.4	1.8	1.2	21.1	4.0	31.3	6.6	35.5	1.6	3.2	2.5	8.1	13.9	5.7	10.8	21.5	3.0	16.9	4.3	21.1	35.5	3.2	3.2	1.7

Link between environmental health indicators and SVIs

		Exposure to hot days								Population context (2018)				Social vulnerability indicators 2018 (percentages, %)													
	Geographic area	Average number of hot days over 25°C per year								Population (counts)	Urban areas	Ethnic group (total response) (% of population)		Children	Older adults	Having enough money			Social connectedness		Awareness, knowledge and skills to cope with hazards		Safe, secure and healthy housing		Decision-making	Occupation
CDEM region	Territorial Authority (TA2018)	Significant increase over time period (*)	2002–2004	2005–2007	2008–2010	2011–2013	2014–2016	2017–2019	2020–2022	Usually resident population	Population living in urban areas (%)	Māori	Pacific peoples	0–4 years	65+ years	Living in areas of high socioeconomic deprivation (NZDep2018 deciles 9–10)	Single parent households	Households with no car	One-person households	Households with an older adult (65+ years) living alone	Doesn't speak English	Households with no Internet	Living in rented dwelling	People living in crowded households	Residential voter turnout in 2019 local body elections	Primary industry workers (among 15+ years)
Northland region	Far North District	*	21	35	43	35	47	57	52	65,250	35.6	48.3	4.8	6.5	19.3	58.1	9.5	5.3	25.5	13.4	1.1	22.8	32.7	15.5	47.3	7.0
	Whangarei District	*	28	31	46	38	48	60	58	90,960	62.9	30.1	3.9	6.6	19.1	34.3	9.5	5.8	24.7	12.9	0.9	17.7	32.4	10.3	44.9	4.2
	Kaipara District									22,869	29.7	24.6	3.8	6.2	22.2	32.9	7.4	4.2	27.3	14.5	0.7	21.1	29.1	7.5	44.9	13.2
Auckland	Auckland	*	18	31	31	29	36	42	51	1,571,718	93.7	11.5	15.5	6.5	12.0	21.2	8.9	6.6	18.0	8.0	4.9	10.5	40.6	15.8	34.8	0.7
Waikato region	Thames-Coromandel District		26	40	53	20	43	65	48	29,895	67.2	18.3	2.1	4.4	31.0	18.6	6.5	5.4	29.7	17.6	0.4	20.3	26.6	5.7	53.2	3.9
	Hauraki District		26	40	53	20	43	65	48	20,022	55.6	22.9	3.0	5.7	23.6	40.1	8.3	4.7	28.5	15.7	0.7	23.5	31.3	7.2	48.6	9.7
	Waikato District	*	14	23	36	33	59	51	57	75,618	35.6	26.4	4.2	7.1	12.6	22.2	8.3	3.3	17.8	7.4	1.0	15.3	29.5	9.9	34.5	8.1
	Matamata-Piako District	*	29	38	49	39	51	61	75	34,404	58.5	16.7	2.1	6.6	19.7	14.3	7.2	4.2	24.6	13.2	0.9	19.0	33.8	6.6	51.8	13.4
	Hamilton City	*	27	32	49	43	53	54	61	160,911	100.0	23.7	6.1	7.2	11.8	32.4	10.4	7.0	22.2	9.3	2.9	12.9	46.2	11.9	39.3	1.2
	Waipa District	*	27	32	49	43	53	54	61	53,241	63.2	14.9	1.8	6.3	17.8	6.7	7.7	3.7	21.8	11.6	0.6	13.8	29.1	5.1	38.3	7.9
	Ōtorohanga District	*	28	38	52	42	48	65	77	10,104	30.0	30.0	2.2	7.6	14.6	19.9	6.9	3.4	23.1	9.5	1.0	21.6	36.6	8.7	47.2	22.2
	South Waikato District				0	1	5	2		24,042	74.4	35.3	12.8	7.8	16.5	53.8	10.1	6.6	26.8	12.6	0.9	22.6	36.8	12.3	37.2	11.4
	Waitomo District		28	38	52	42	48	65	10	9,303	49.2	44.8	3.7	7.0	15.5	47.8	9.8	6.4	27.3	11.5	1.2	28.4	40.4	13.3	52.2	17.2
	Taupō District	*	10	12	21	18	22	24	28	37,203	72.8	29.9	3.2	6.5	19.0	22.4	8.0	4.4	25.4	12.8	0.9	16.3	33.6	7.6	53.9	6.7
Bay of Plenty region	Western Bay of Plenty District	*	20	27	41	32	35	49	43	51,321	37.8	19.2	2.7	5.4	21.0	11.6	6.4	2.5	20.3	11.2	1.3	13.8	25.3	9.2	38.9	11.5
	Tauranga City	*	20	27	41	32	35	49	43	136,713	100.0	18.2	2.9	6.4	19.7	13.1	8.6	4.6	23.3	13.5	1.3	12.2	33.3	7.5	41.2	1.9
	Rotorua District	*	6	10	15	16	19	25	26	71,877	82.2	40.1	5.4	7.0	14.4	40.8	10.2	6.2	24.1	11.2	1.7	17.2	38.0	13.8	46.3	5.3
	Whakatāne District	*	18	29	32	32	33	44	41	35,700	62.8	46.8	3.0	7.1	17.4	42.1	9.7	5.9	24.3	12.4	1.2	20.3	33.8	13.3	52.0	8.3
	Kawerau District				78	63	82	90	81	7,146	100.0	61.7	4.6	8.0	19.9	89.3	12.2	8.2	28.4	14.7	1.4	24.5	34.9	18.5	48.9	3.6
	Ōpōtiki District		10	24	27	26				9,276	51.8	63.7	3.5	7.7	17.9	69.4	10.8	7.1	26.7	13.2	1.5	27.9	37.8	18.8	53.8	15.2
Tairāwhiti	Gisborne District		41	51	57	48	57	65	54	47,517	72.7	52.9	4.5	7.5	15.5	49.3	12.6	7.8	25.6	12.7	1.4	21.9	40.6	14.9	50.1	11.6
Hawke's Bay region	Wairoa District	*	46	61	61	57	64	87	89	8,367	54.1	65.7	3.3	7.6	17.1	76.5	11.6	8.7	28.4	13.9	1.1	29.5	39.0	17.3	51.3	13.4
	Hastings District			59	59	49	59	68	60	81,537	75.5	27.3	8.0	6.6	16.8	28.6	10.0	6.0	23.6	12.3	1.6	16.6	33.6	12.9	44.1	9.2
	Napier City		36	39	42	40	47	57	45	62,241	100.0	22.2	3.4	6.1	20.0	24.1	10.4	6.7	27.5	15.0	1.0	16.0	33.9	8.4	50.7	3.5
	Central Hawke's Bay District			46	42	52	64	70		14,142	45.8	23.7	2.9	6.7	19.8	15.5	7.1	3.6	24.5	12.2	0.6	19.5	28.0	6.5	56.5	17.7