

# Modelling post-disaster habitability and population displacement

## Finn Scheele

Risk Scientist (GNS Science)

PhD Candidate (University of Canterbury)

### PhD supervisors:

Thomas Wilson (UC)

Julia Becker (Massey)

Nick Horspool (GNS)



# 1. Previous work:

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Modelling residential habitability and human displacement for tsunami scenarios in Christchurch, New Zealand

Finn Scheele<sup>a,\*</sup>, Thomas Wilson<sup>b</sup>, Emily M. Lane<sup>c</sup>, Kate Crowley<sup>d</sup>, Matthew W. Hughes<sup>e</sup>, Tim Davies<sup>b</sup>, Nick Horspool<sup>a</sup>, James H. Williams<sup>b</sup>, Lina Le<sup>b</sup>, S.R. Uma<sup>a</sup>, Biljana Lukovic<sup>a</sup>, Marion Schoenfeld<sup>f</sup>, James Thompson<sup>g</sup>



## 2. PhD

## Assess:

- Number of people displaced – and how long
- Number of people requiring shelter

## Physical factors:

- Building damage
- Infrastructure outage
- Access disruption

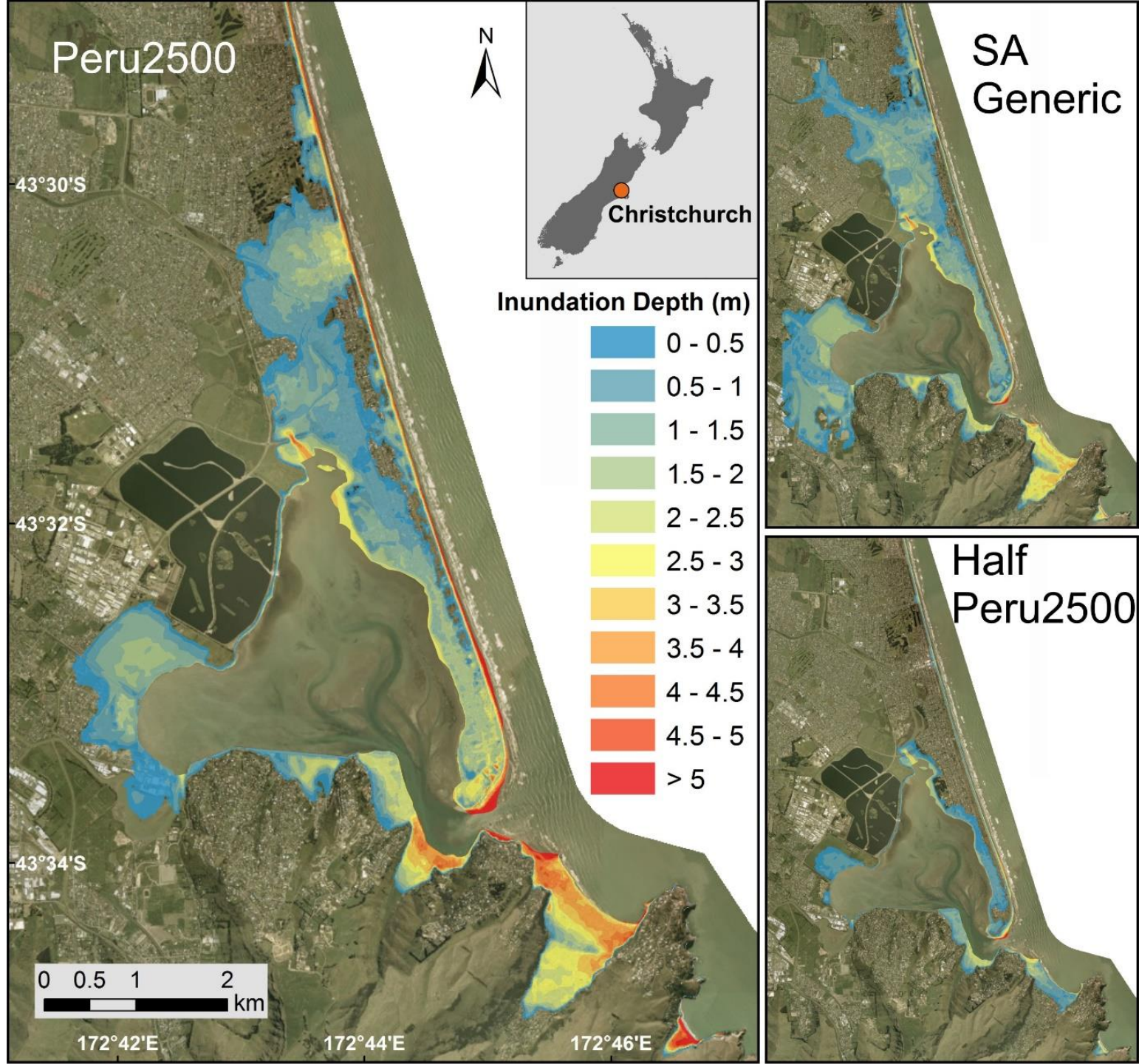
## Demographic factors (household decision-making):

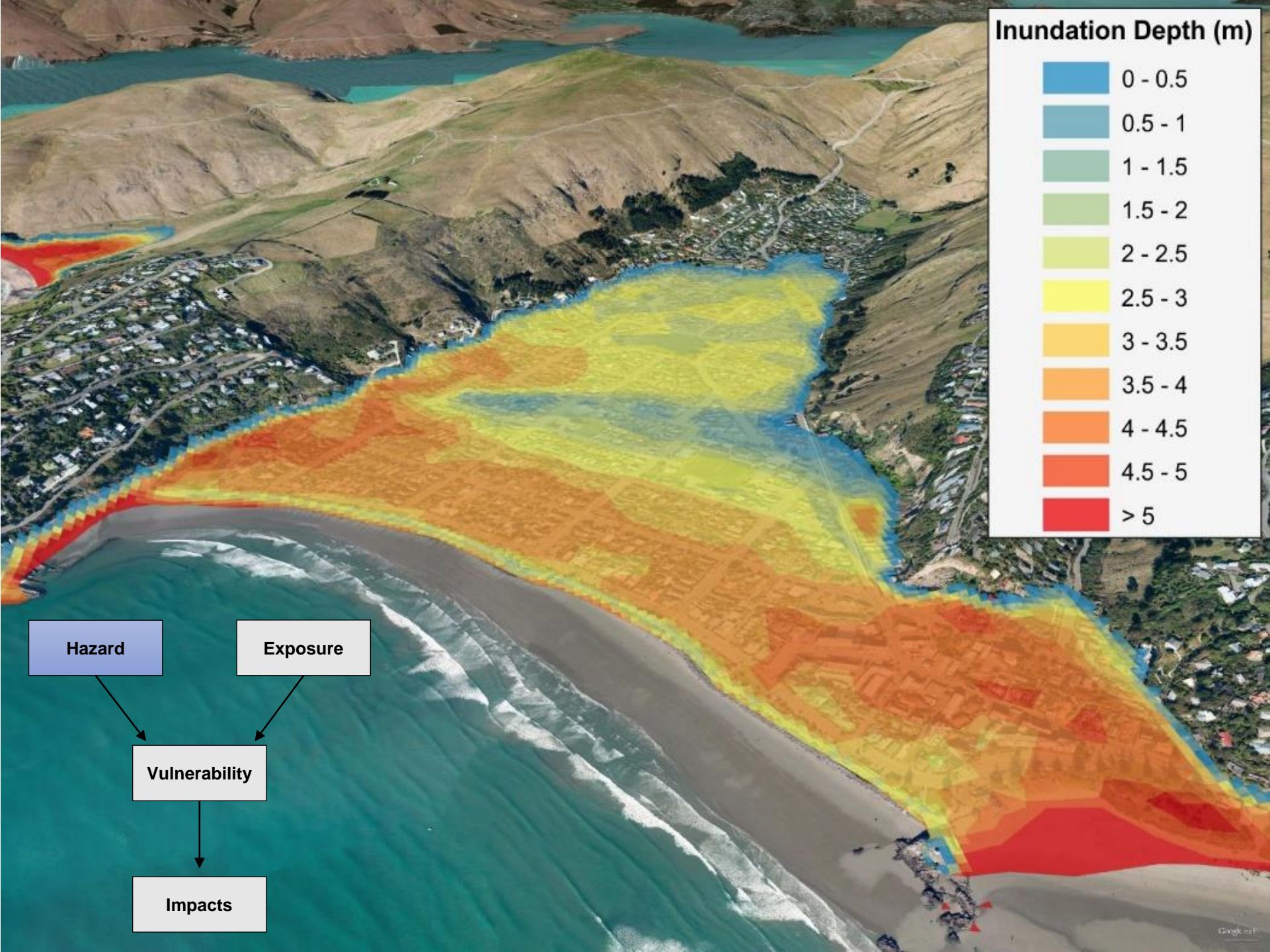
- Income
- Home ownership
- Age
- Years resident

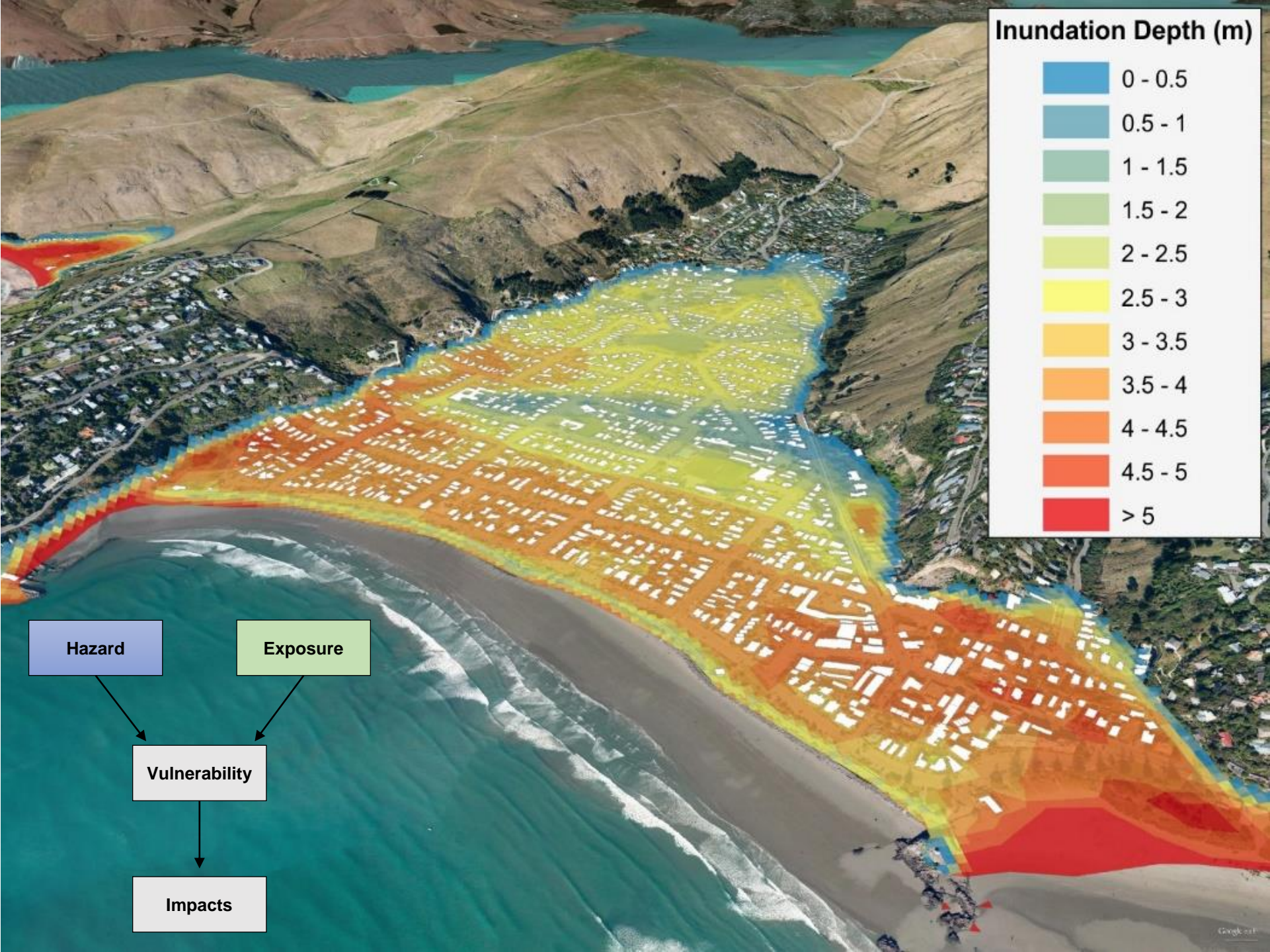


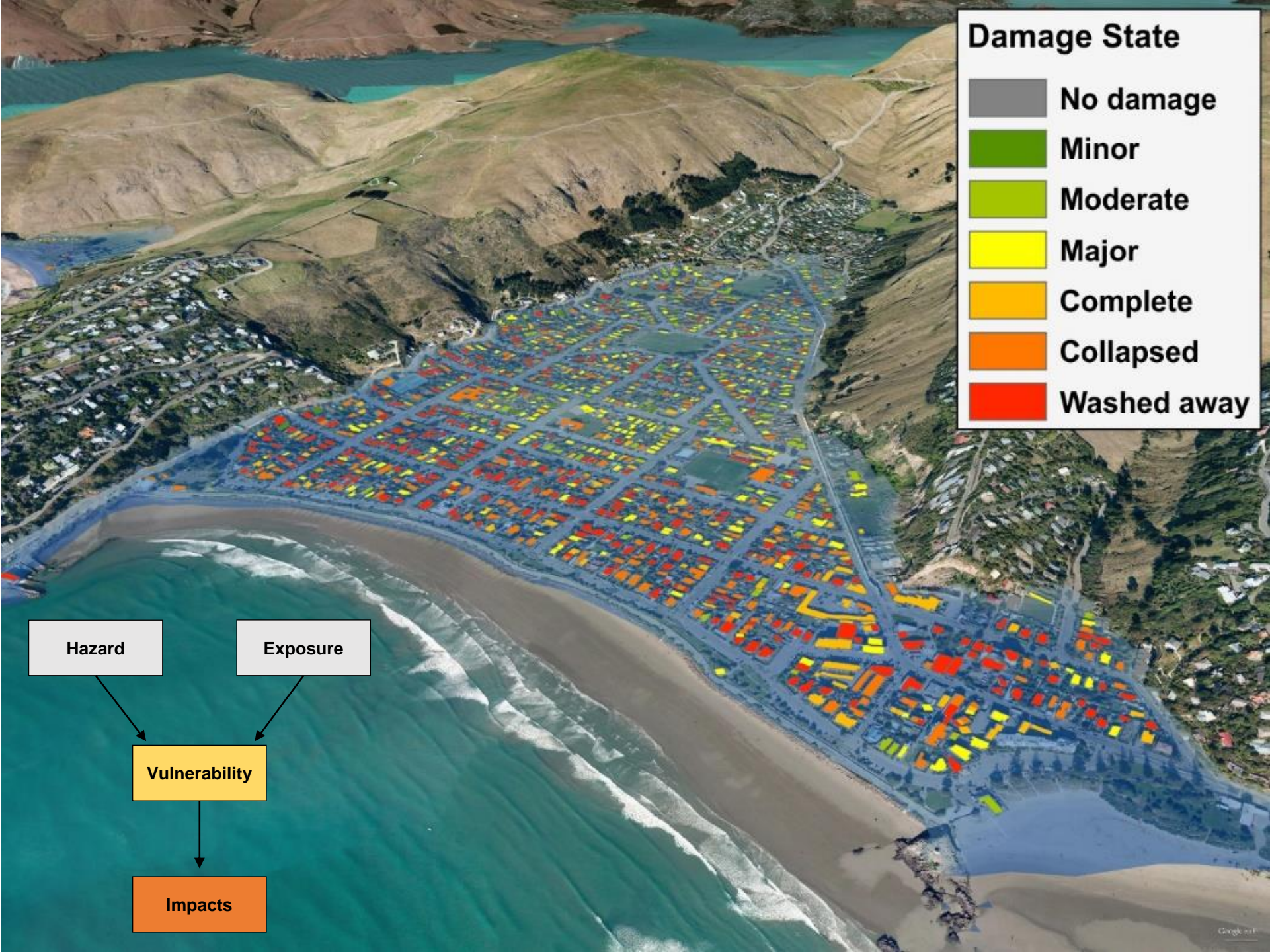
# Tsunami scenarios: South American sources

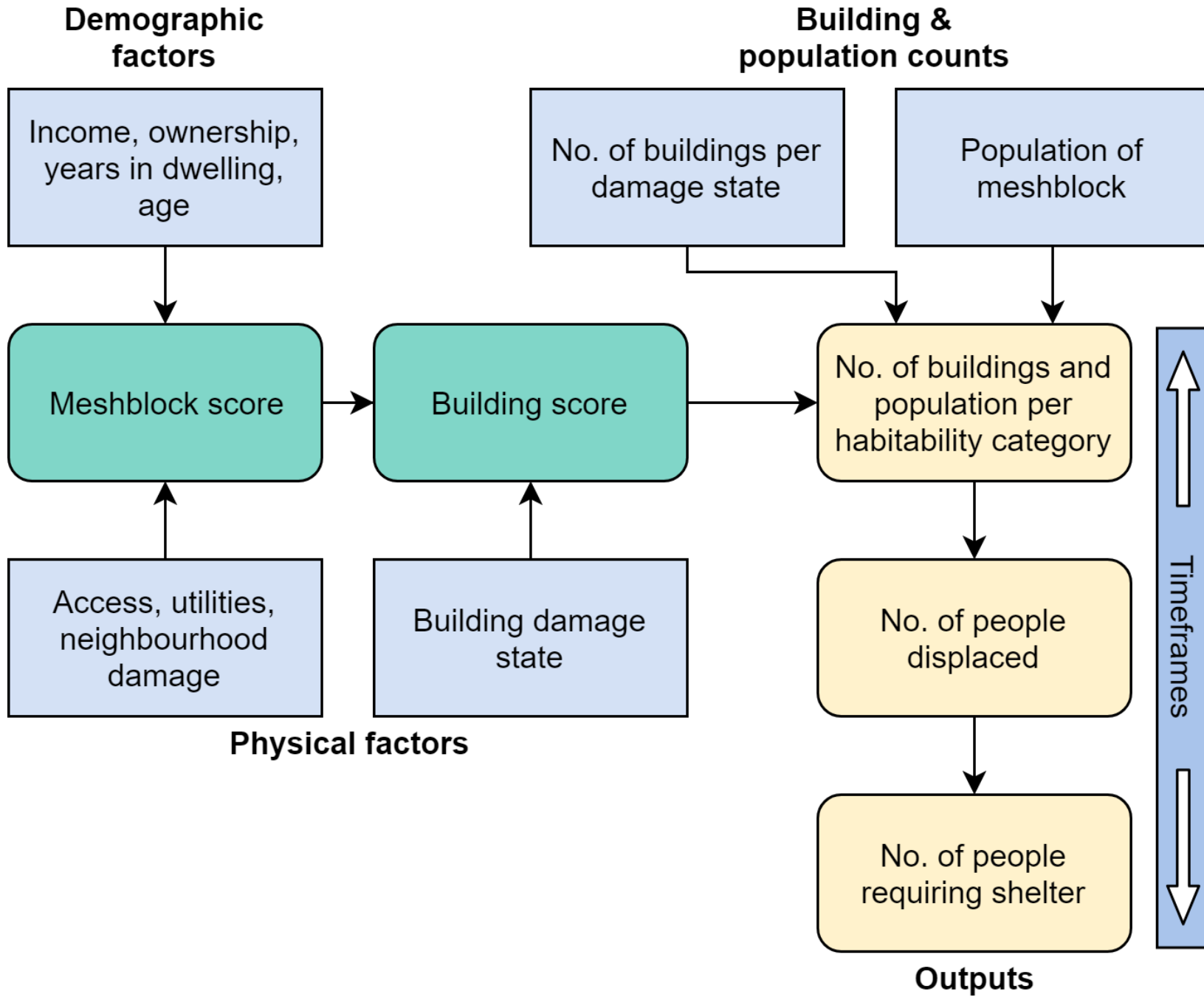
Assumed enough time for  
complete evacuation









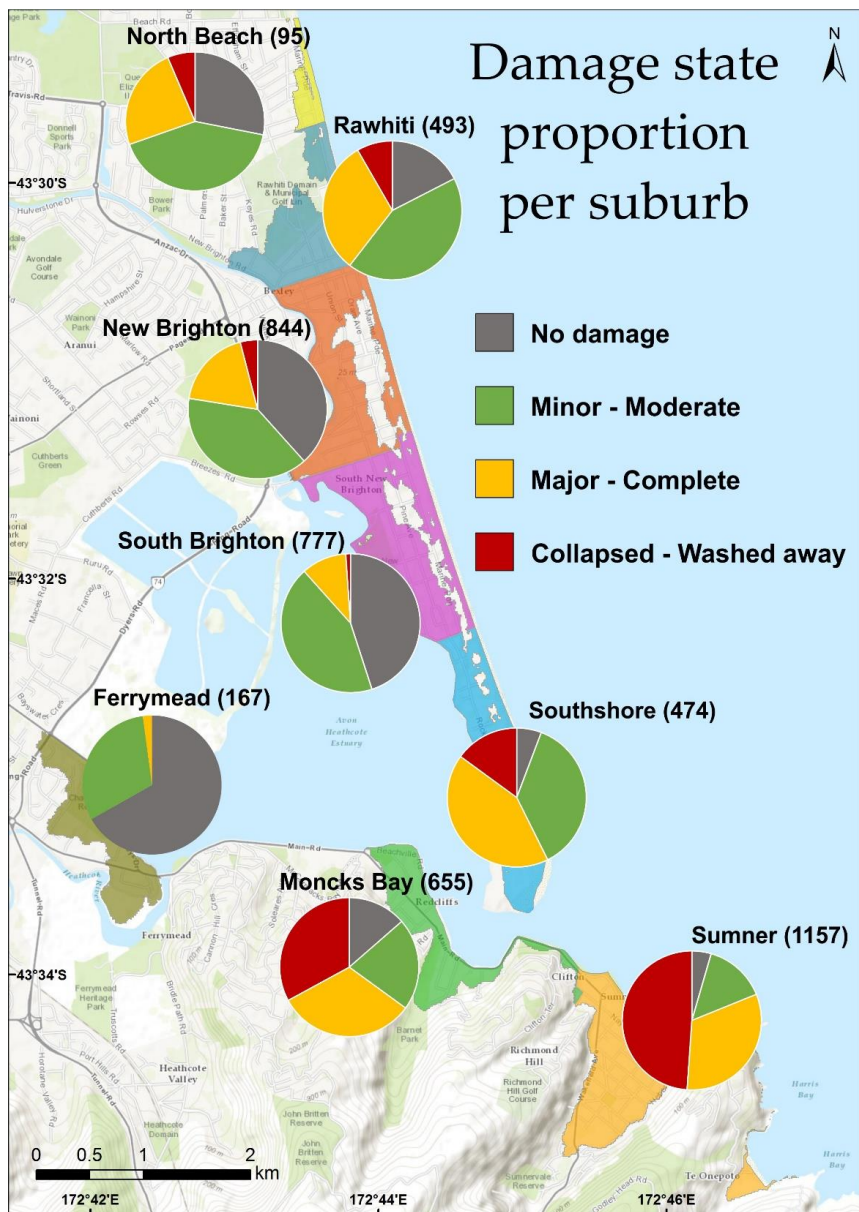




# Habitability/liveability categories for residential dwellings

Habitability/liveability	Score	Description
<b>No disruption</b>	0	Fully habitable and liveable
<b>Minor disruption</b>	0.1 – 0.4	Residents experience minor disruption to household routines
<b>Compromised liveability</b>	0.5 – 0.9	Difficulty undertaking household routines, residents may require assistance
<b>Uninhabitable</b>	$\geq 1.0$	Residents will be displaced

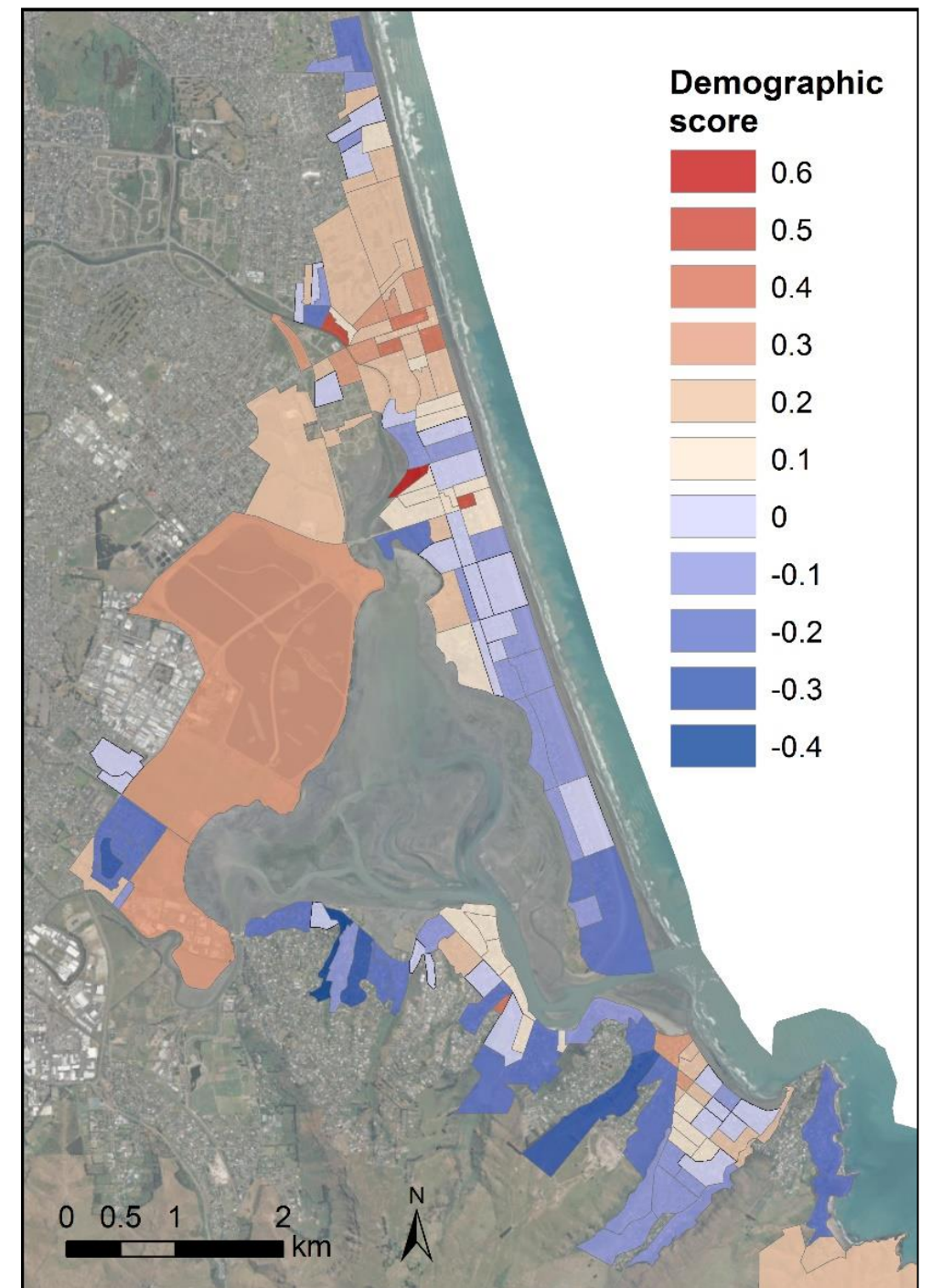
# Physical scores



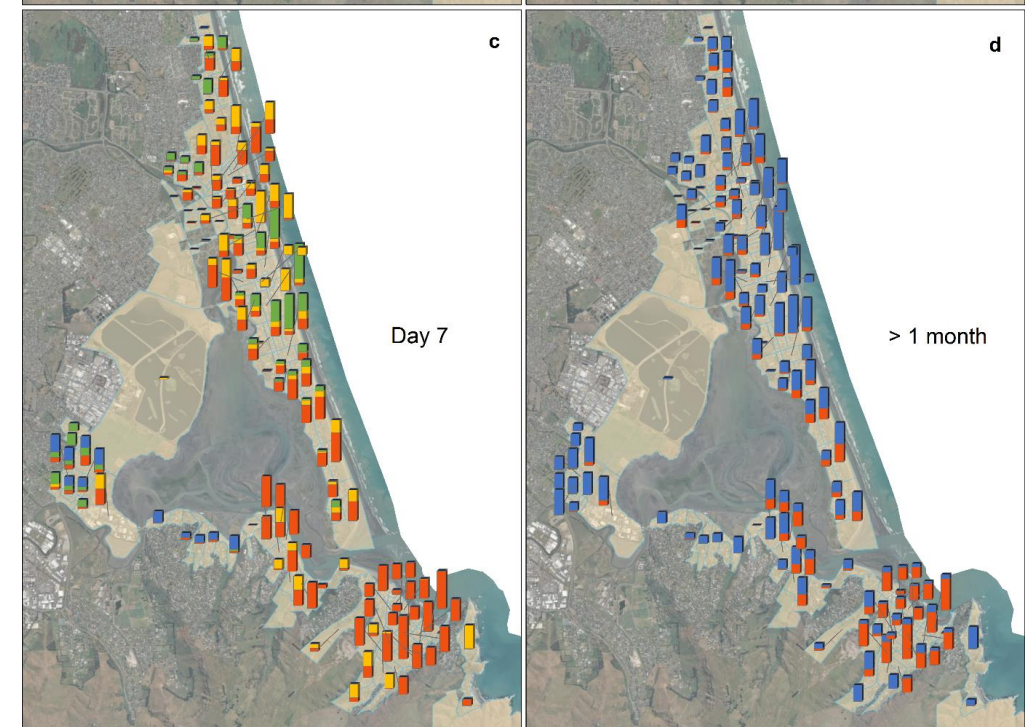
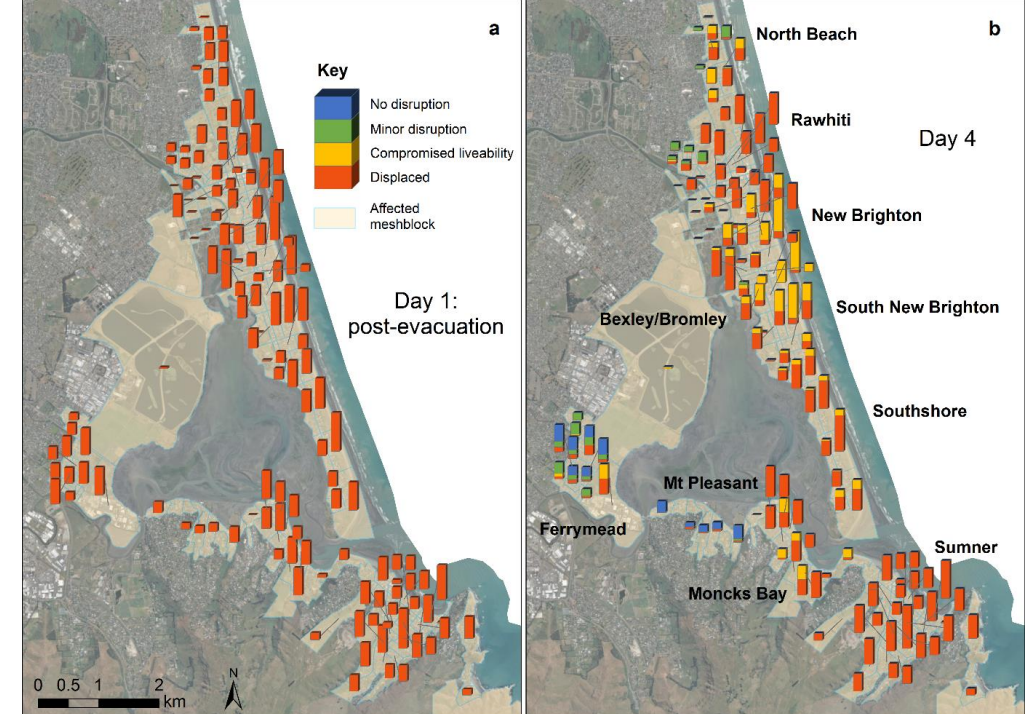
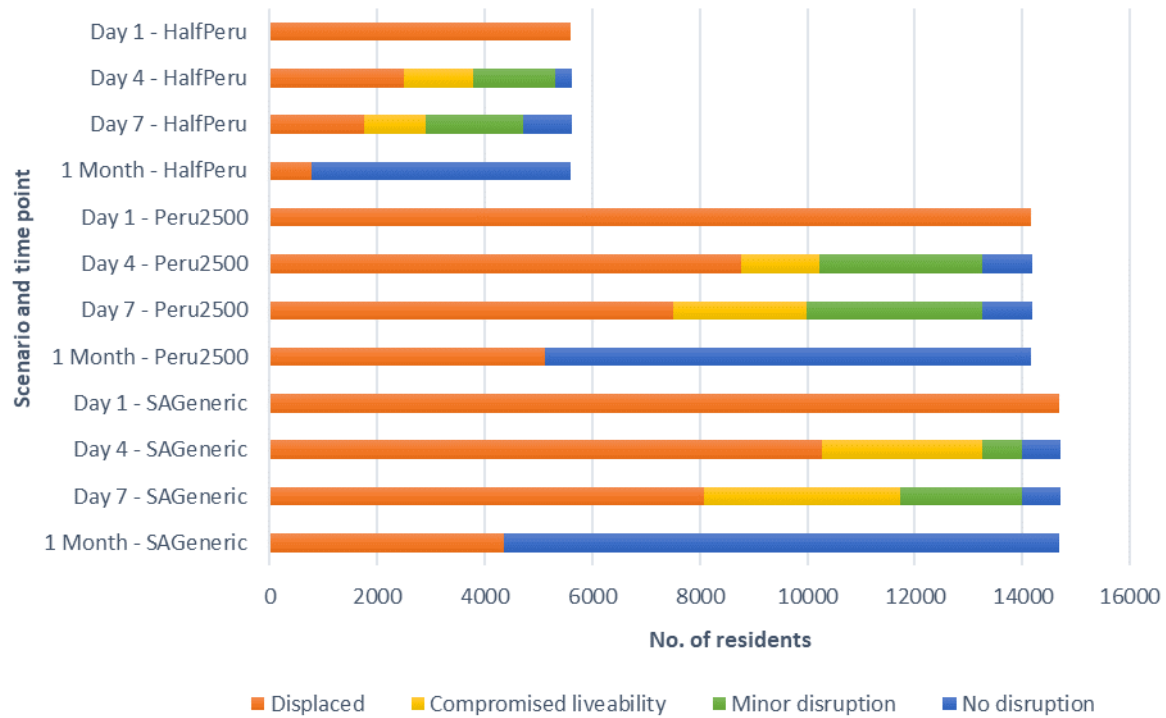
Physical factor	Default score
<b>Access (AC)</b>	
Resident access to property available	0
No access to property for residents	1
<b>Building damage (BD)</b>	
DS0: No damage	0
DS1: Minor damage	0.3
DS2 – DS6: Moderate damage – washed away	1
<b>Electricity (E)</b>	
Electricity available	0
Electricity unavailable	0.2 (summer), 0.4 (winter)
<b>Water (W)</b>	
Water available	0
Water unavailable	0.2
<b>Wastewater (WW)</b>	
Wastewater available	0
Wastewater unavailable	0.2
<b>Neighbourhood damage (ND)</b>	
Less than 5% of buildings in DS2 or above	0
5 – 20 % of buildings in DS2 or above	0.1
>20% – 50% of buildings in DS2 or above	0.2
>50% of buildings in DS2 or above	0.3

# Demographic scores

Demographic factor	Code	Default score
<b>Household income (HI)</b>		
< NZ\$30,000 (US\$20,600)	HI1	0.5
NZ\$30,000 – \$70,000 (US\$20,600-\$48,100)	HI2	0.1
> NZ\$70,000 (US\$48,100)	HI3	-0.1
<b>Ownership (O)</b>		
Own home	O1	-0.3
Renting	O2	0.3
<b>Years resident (YR)</b>		
<1 year	YR1	0.3
1 – 4 years	YR2	0.2
5 – 9 years	YR3	-0.2
≥10 years	YR4	-0.3
<b>Age (AG)</b>		
15 – 65 years old	AG1	-0.1
<15 or >65 years old	AG2	0.2



# Results



# PhD

## Agent-based modelling

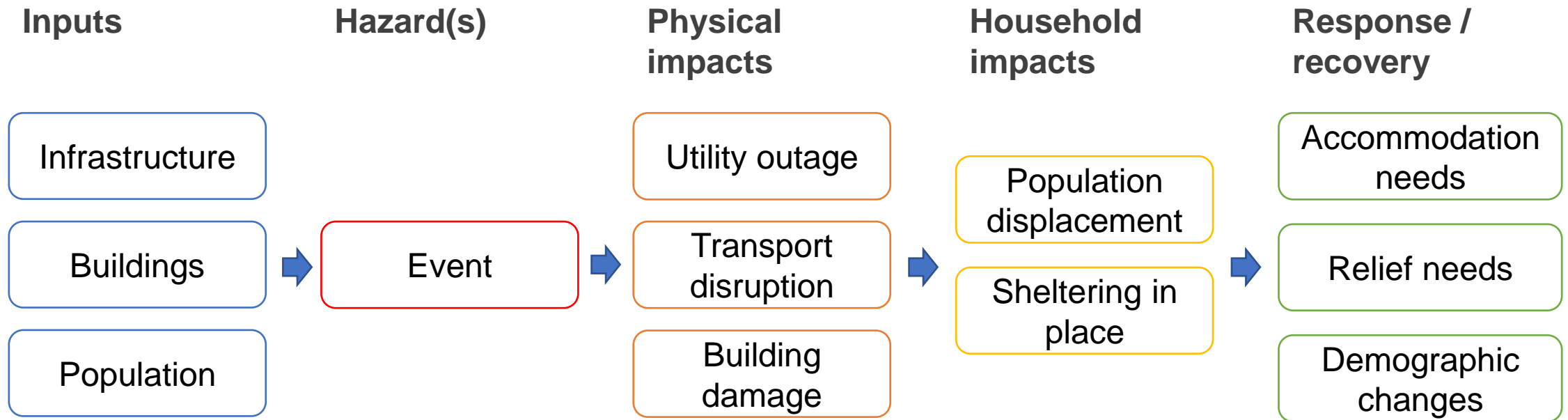
### Potential scenarios:

- Wellington Fault
- AF8
- Hikurangi EQ + tsunami
- Taranaki volcanic event

### Contributing data / projects:

- Updating building data
- Population exposure model
- Chch/Kaikoura Eqs
- Flooding surveys: Southland & Edgecumbe

# Modelling framework



# Population exposure model

## Individuals

- Age
- Sex
- Ethnicity
- Income

Also time-varying  
population  
distribution

## Households



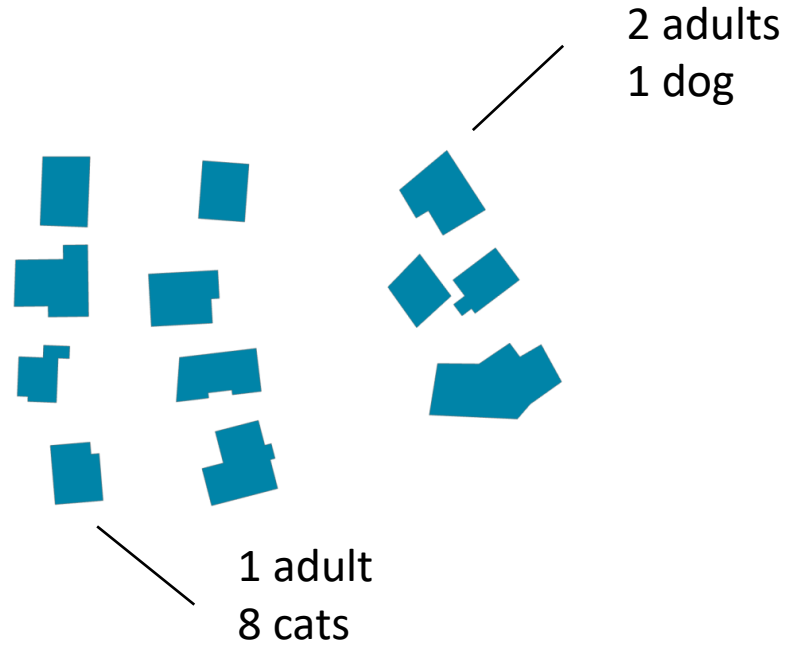
3 adults - unrelated  
2 Māori & 1 NZ European  
1 year resident  
Renting  
Different incomes

2 adults  
NZ European  
2 years resident  
Renting  
Household income:  
\$80k

2 adults  
2 children  
Māori  
5 years resident  
Own house  
Household income:  
\$120k



# Pets



**Thanks for  
listening**

