# Climate change impacts on erosion and suspended sediment loads in New Zealand

**Andrew Neverman**, Hugh Smith, Mitchell Donovan, Anne-Gaelle Ausseil, Christian Zammit

Manaaki Whenua – Landcare Research

AgResearch

NIWA

# Background

- Accelerated erosion and excess fine sediment loads have adverse environmental, social, cultural, and economic impacts throughout catchments, which may include:
  - Loss of productive capacity for food and fibre
  - Impacted water and energy infrastructure
  - Ecological degradation
  - Loss of culturally and socially significant sites
- Regional councils now required to manage fine sediment under the NPS-FM following the 2020 amendment

CLIMATE

**Why the global soil shortage threatens food, medicine and the climate**

PUBLISHED SUN, JUN 5 2022•7:45 AM EDT | UPDATED SUN, JUN 5 2022•7:45 AM EDT

NEWS

**Landslides affect water supply lakes in storm-hit Auckland**

07 SEPTEMBER, 2021 | BY GREG PITCHER

NEW ZEALAND

**State of the Gulf: Auckland Council report finds estuaries choking in sediment, shellfish dying**

By Michael Neilson

Save | Share

**Historical Māori kōiwi bones unearthed by erosion in Nūhaka**

8:52 pm on 28 January 2021

Share this

Alice Angeloni, Local Democracy Reporter
aliceangeloni alice.angeloni@gisborneherald.co.nz

Historical Māori remains have been unearthed as banks of the Nūhaka River erode away.

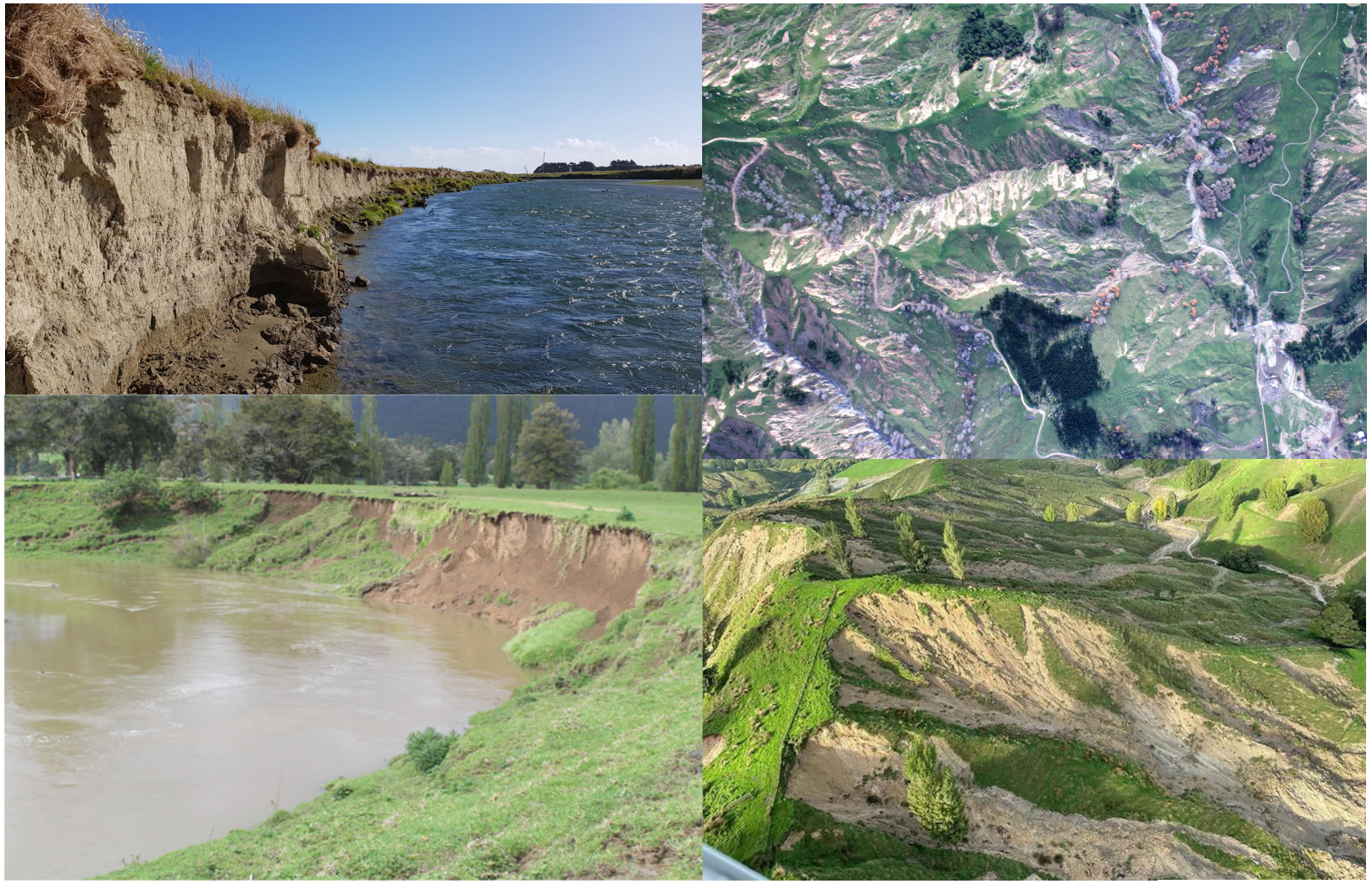
## What about the future?

- How will erosion rates and sediment loads change in the future?
- Will there be a change in the relative contribution of erosion processes and sources?
- What mitigation approaches will be most beneficial in the future?
- Will present environmental objectives be feasible?
- Will communities be able to achieve their aspirations?

## Project Aims:

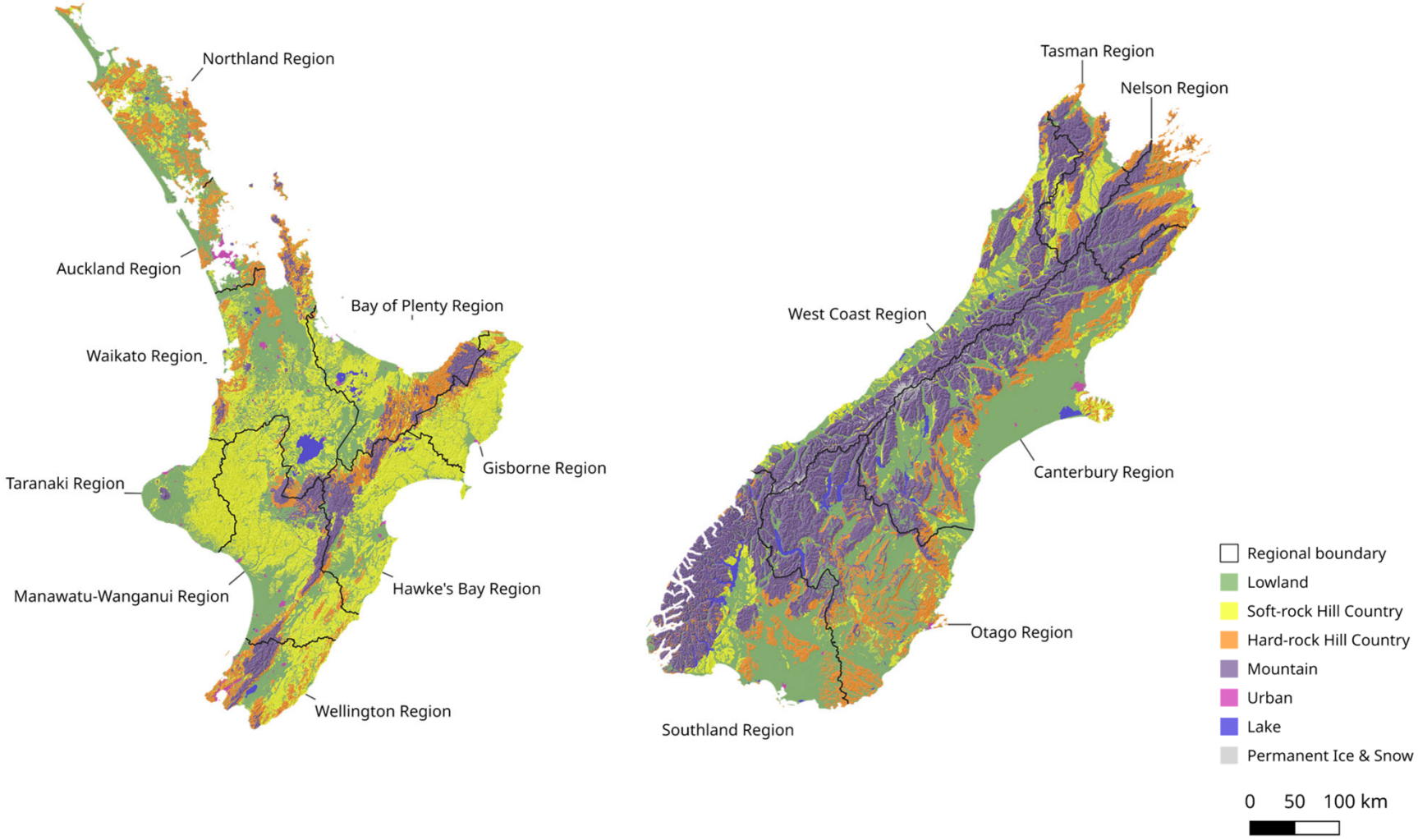
- Aotearoa's first national assessment of climate change effects on catchment suspended sediment loads
- Projections for mid- and late century (2040 and 2090)
- Develop a national-scale model framework that:
    a) better recognises the contribution of erosion processes to instream sediment loads and their spatial variation nationally
    b) represents the differences in how these erosion processes are affected by climate change

# Where is the sediment coming from?

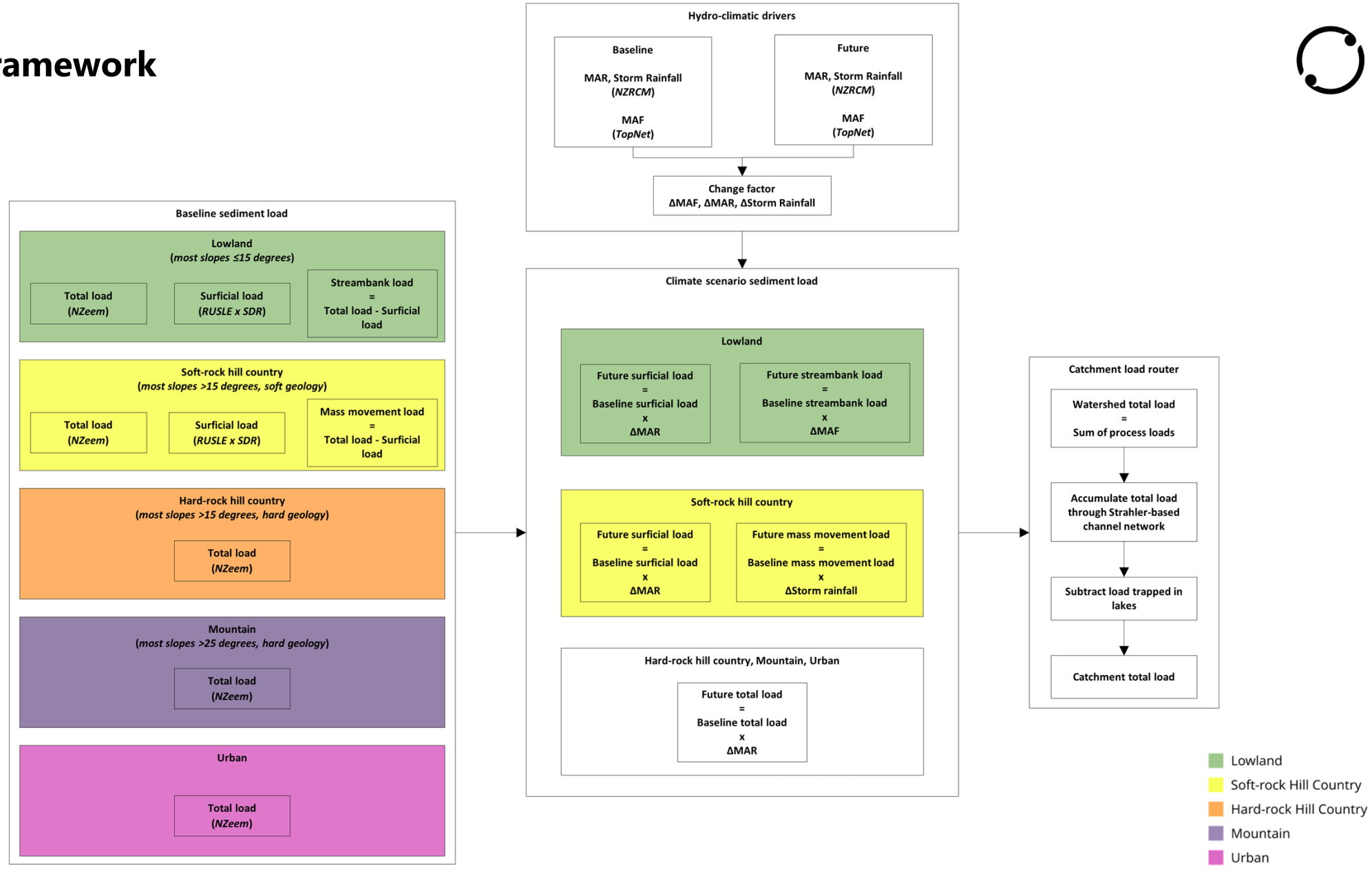


Source: Wairoa Helicopters

# Erosion domains



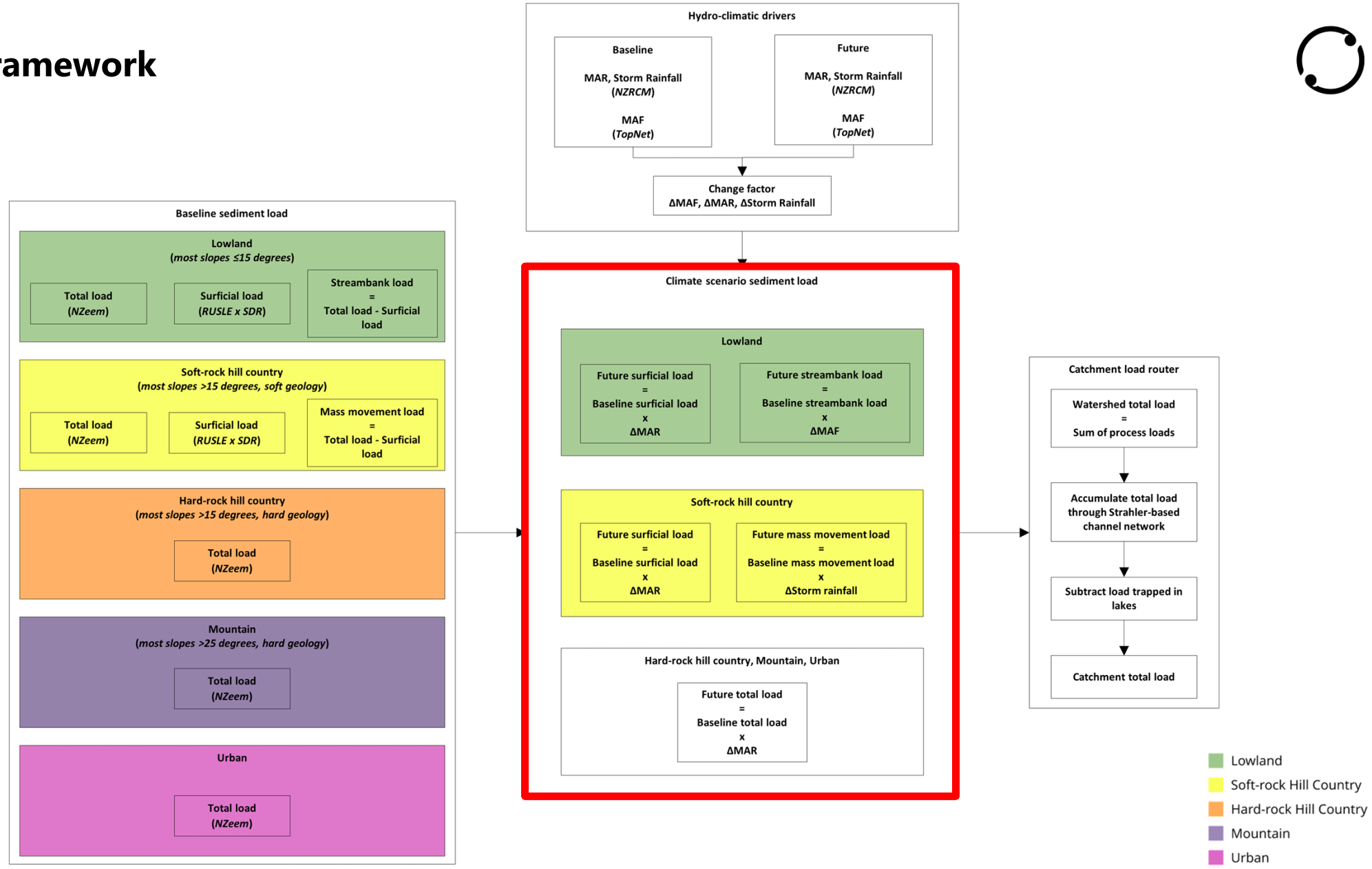
# Model framework



# Model framework

# Model framework

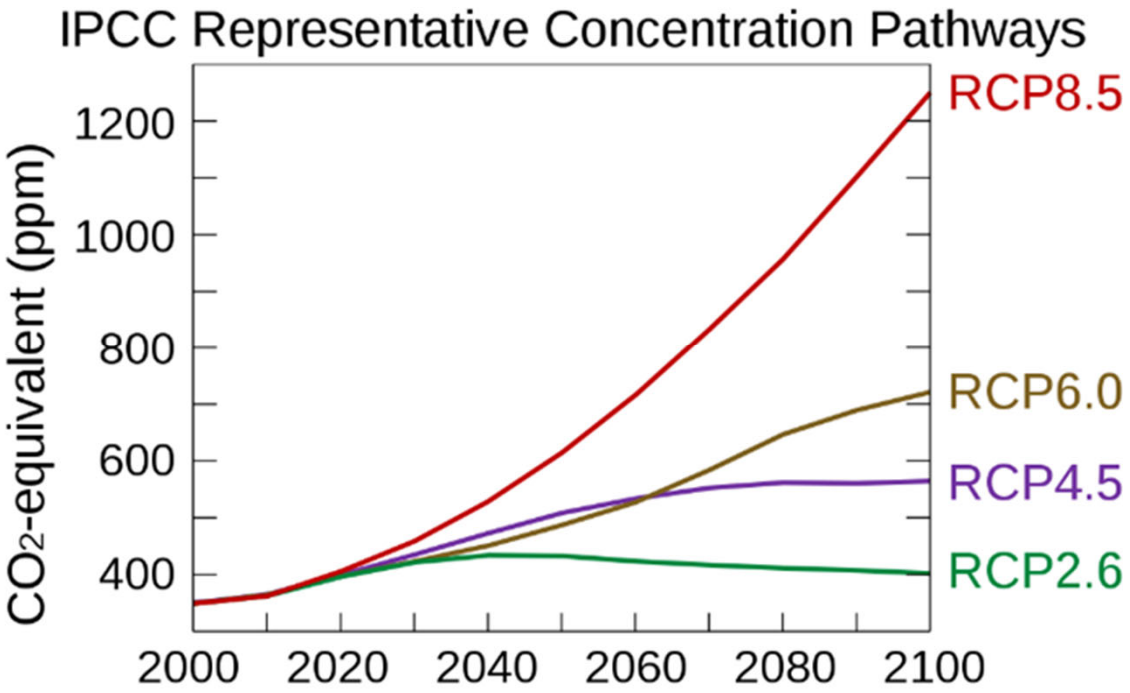
# Model framework



# Model framework

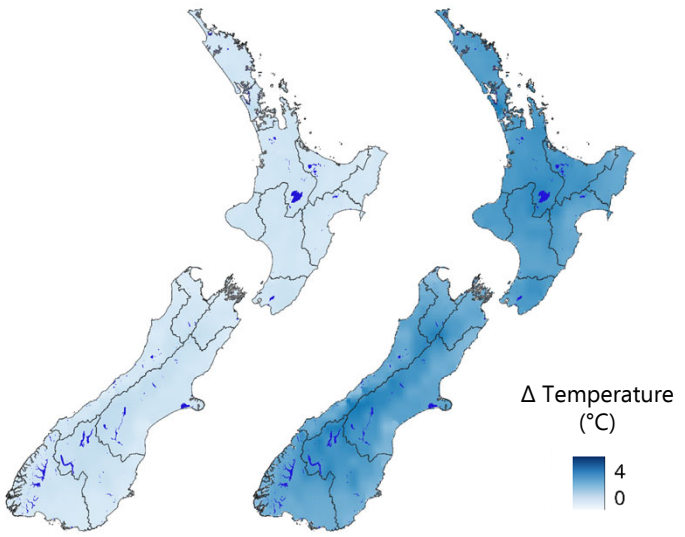
# Climate scenarios

- Four forcing scenarios (RCPs) from the IPCC 5th Assessment Report
- Six global climate models (GCMs) dynamically downscaled using the NZ Regional Climate Model (MfE 2018, Sood 2014), referred to as RCMs.
- Climate projections for 2040 & 2090 relative to 1995

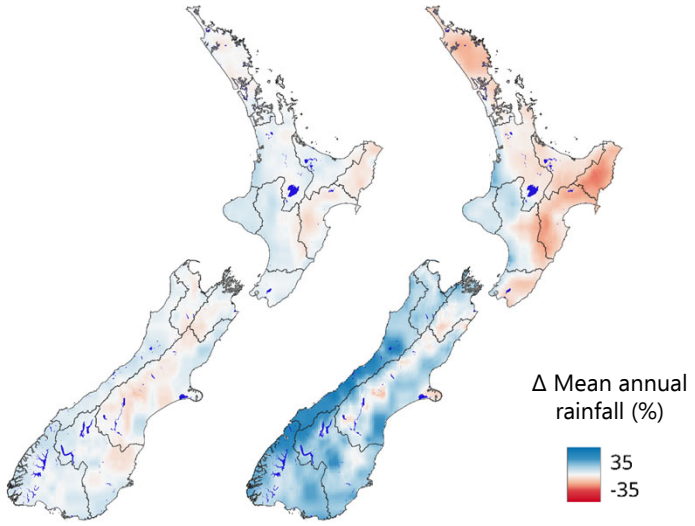


# Hydroclimatic Drivers

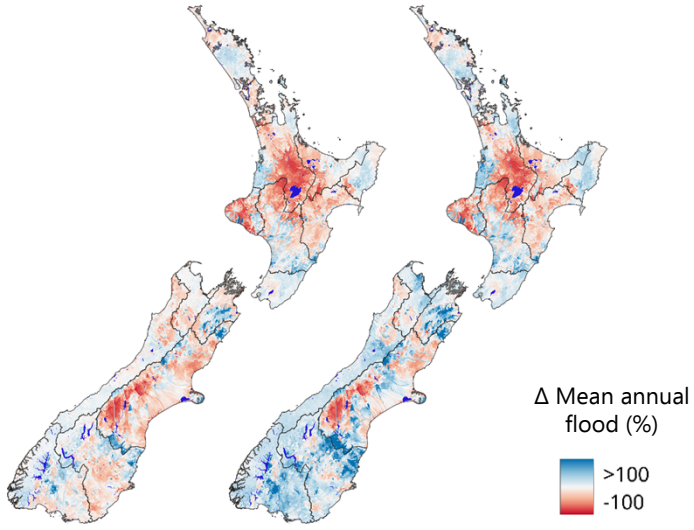
- Changes in temperature and mean annual rainfall from the New Zealand Regional Climate Model (NZRCM) (MfE 2018, Sood 2014)
- Changes in mean annual flood from TopNet (Collins et al., 2018; Collins, 2020)
- Changes in storminess driven by change in temperature (Carey-Smith 2018, MfE 2018)




RCP 2.6 RCP 8.5




RCP 2.6 RCP 8.5

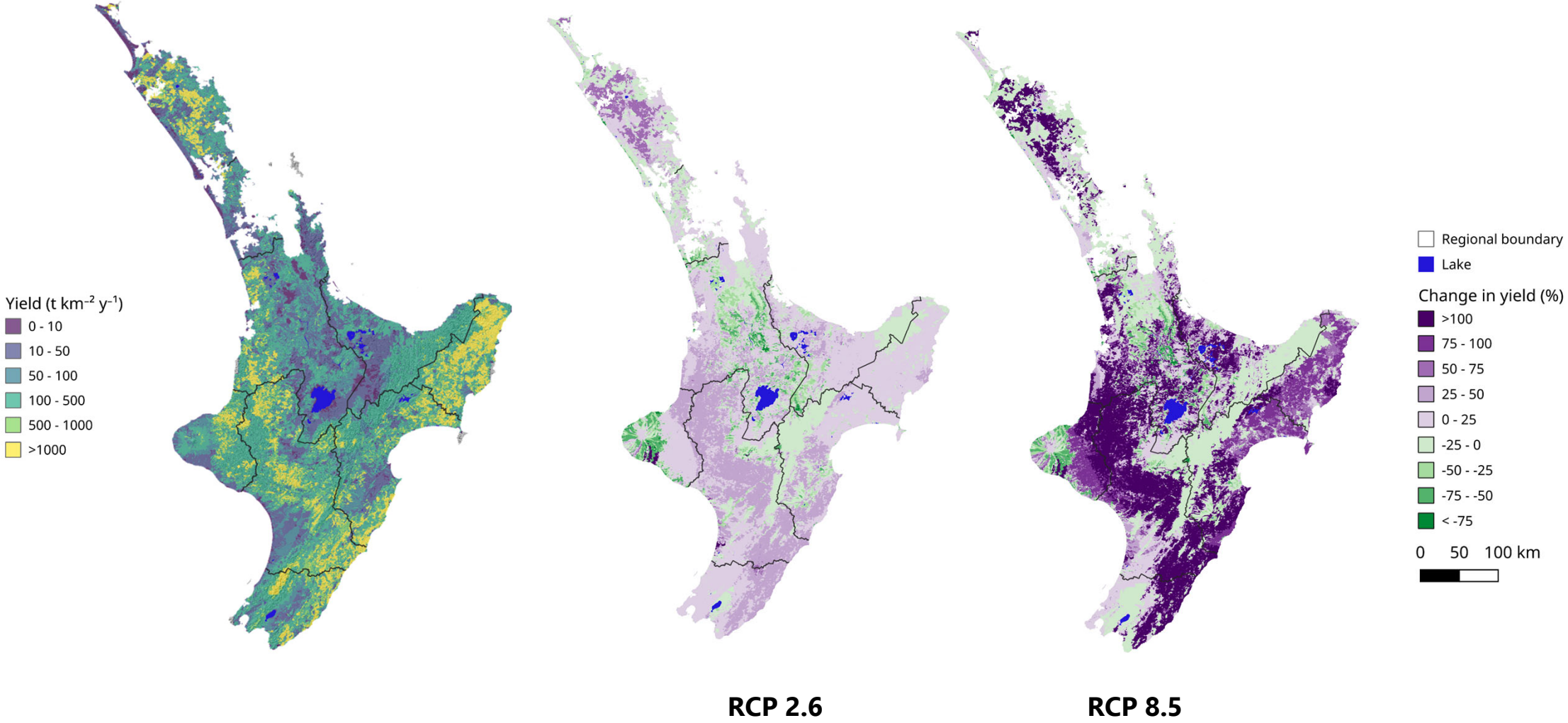



RCP 2.6 RCP 8.5

# Suspended sediment yields

## Contemporary erosion

## Percent change in erosion – 2090 (2081-2100)



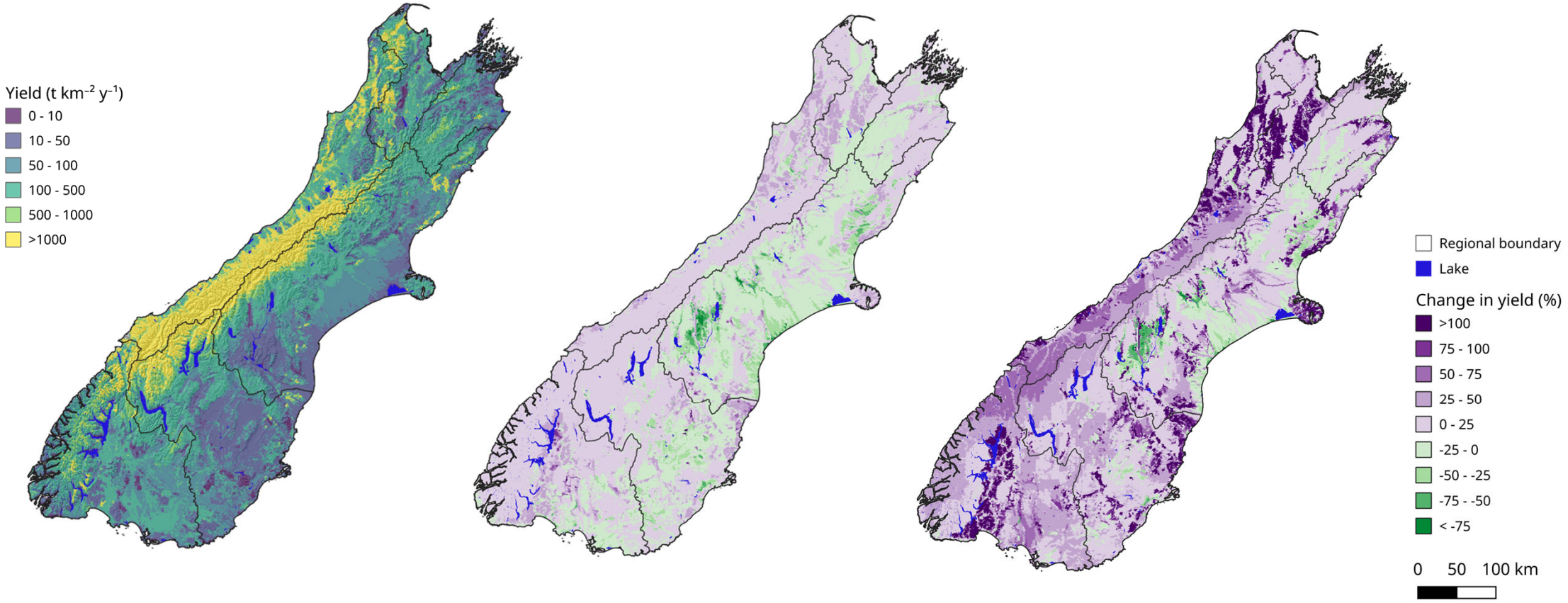

RCP 2.6

RCP 8.5

# Suspended sediment yields

## Contemporary erosion

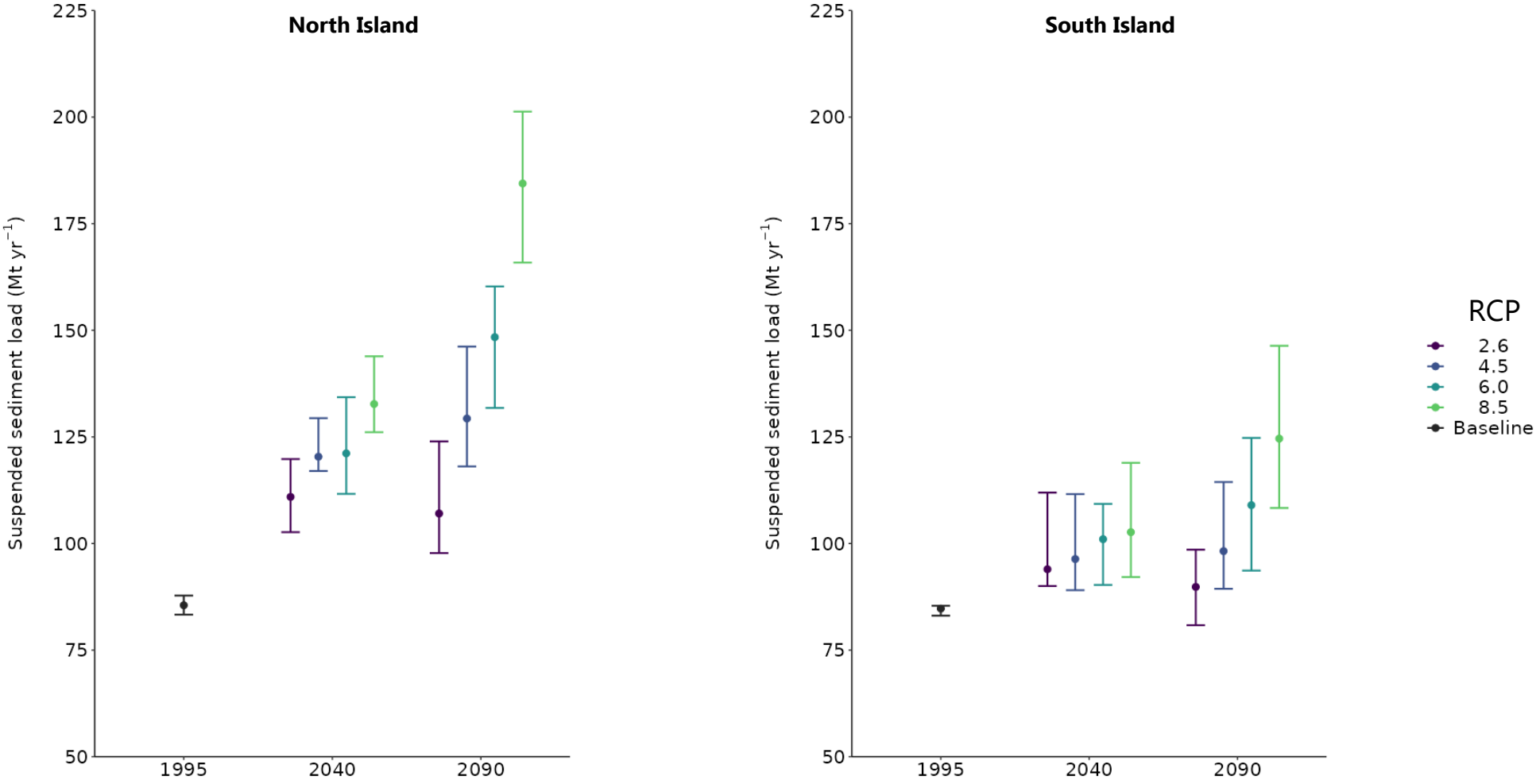
## Percent change in erosion – 2090 (2081-2100)




**RCP 2.6**

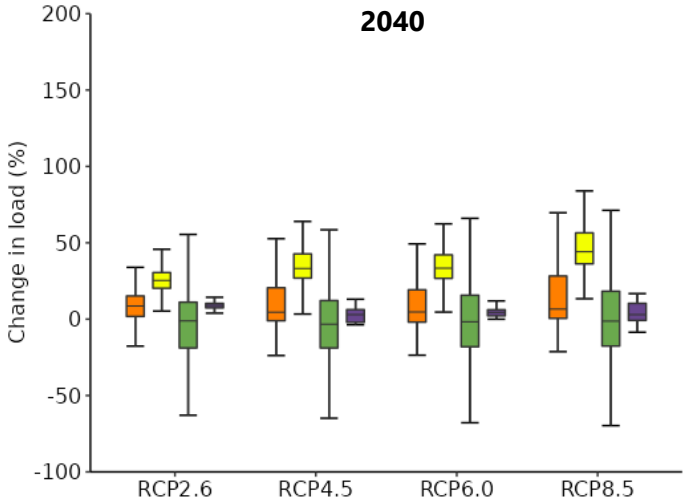
**RCP 8.5**

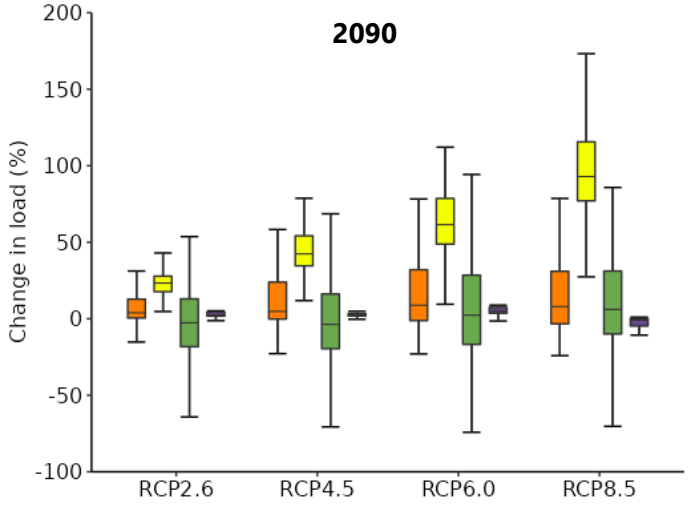
# Total suspended sediment loads



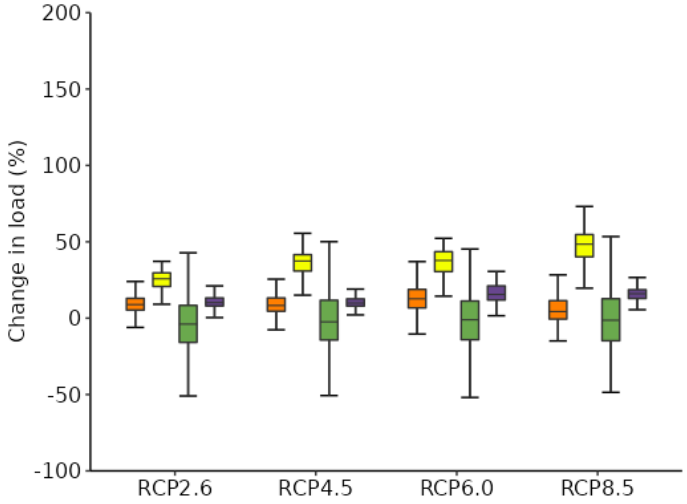
# Change in end-of-catchment loads by dominant domain

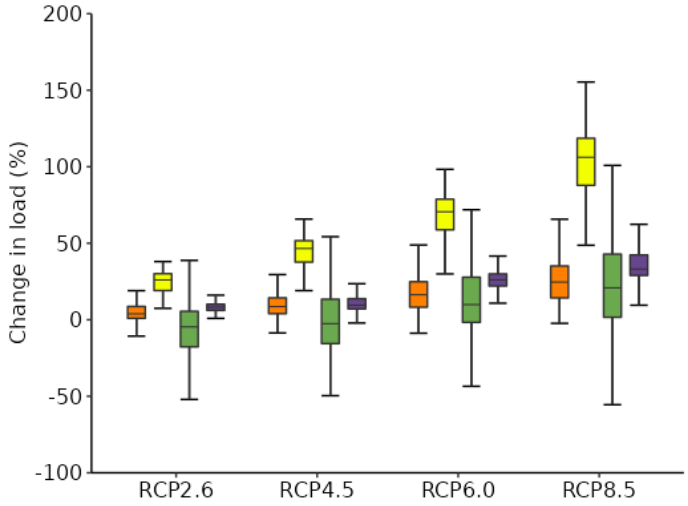
**North Island**




**South Island**




# Key findings

- Catchment characteristics play an important role in erosion and sediment load response to climate change
- Divergence in catchment responses increases with warmer scenarios
- Relative contribution of erosion sources is likely to shift under projected climate change
    - Soft-rock hill country is particularly prone to increased erosion under warmer climate scenarios
    - Lowland catchments show varied responses due to divergence in hydroclimatic drivers both spatially and between climate scenarios.
- Coastal receiving environments in the North Island may see a larger relative impact than in the South Island

Manaaki Whenua
Landcare Research

This work has been published Open Access in *Geomorphology* as:

Neverman AJ, Donovan M, Smith HG, Ausseil A-G, Zammit C. 2023. Climate change impacts on erosion and suspended sediment loads in New Zealand. *Geomorphology*. 427:108607. https://doi.org/10.1016/j.geomorph.2023.108607

Dr. Andrew Neverman – nevermana@landcareresearch.co.nz