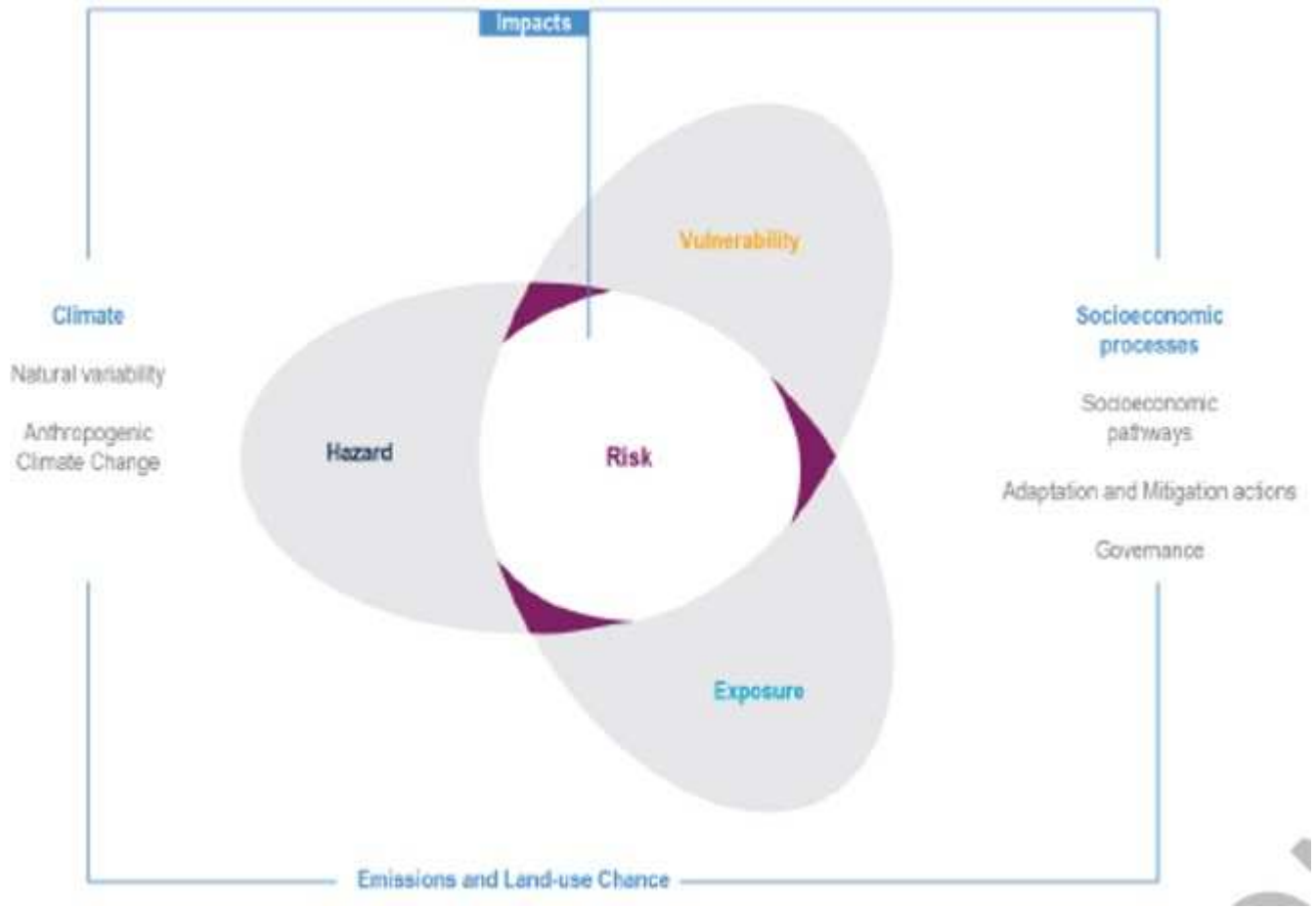
Climate change impacts on the New Zealand agricultural sector

Anita Wreford
AERU
Lincoln University

Impacts and Implications
Programme Lead
Deep South National Science Challenge

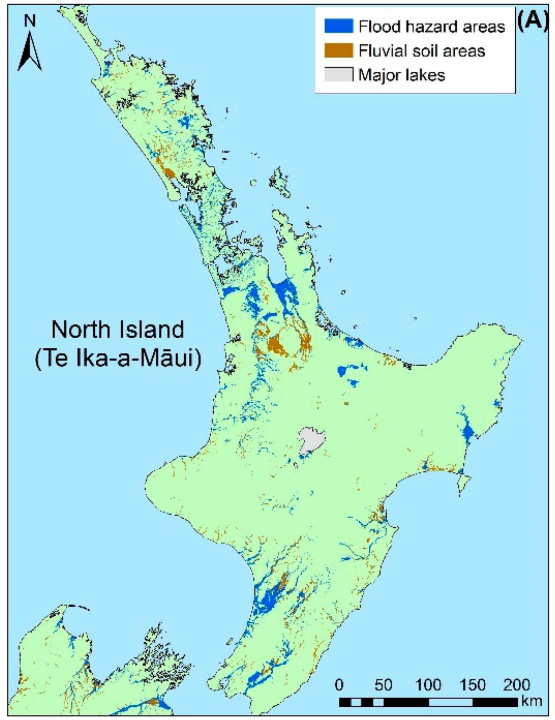
NZAGRC Agricultural Climate Change Conference
Wellington, 28th February 2023

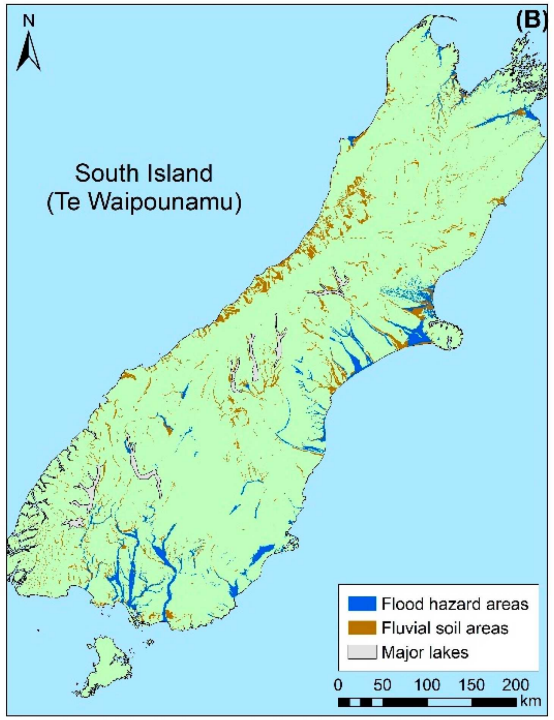
“Impacts”?

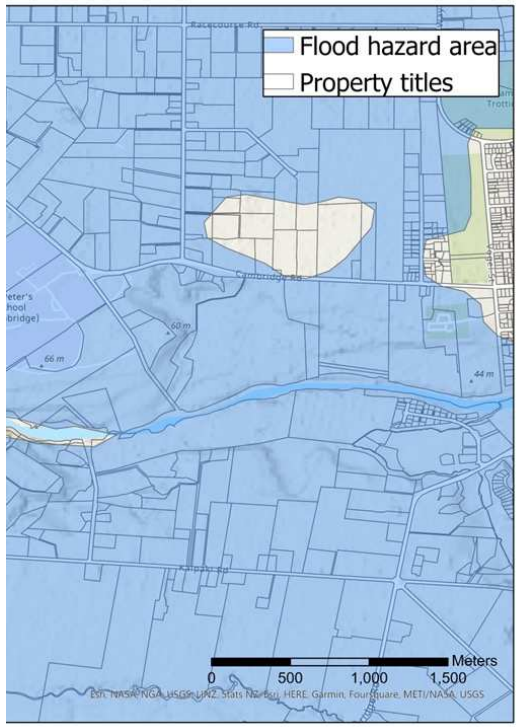


Risk as framed by the IPCC

Exposure







Craig, H., Paulik, R., Djanibekov, U., Walsh, P., Wild, A., & Popovich, B. (2021). Quantifying national-scale changes in agricultural land exposure to fluvial flooding. *Sustainability (Switzerland)*, *13*(22). https://doi.org/10.3390/su132212495

Vulnerability

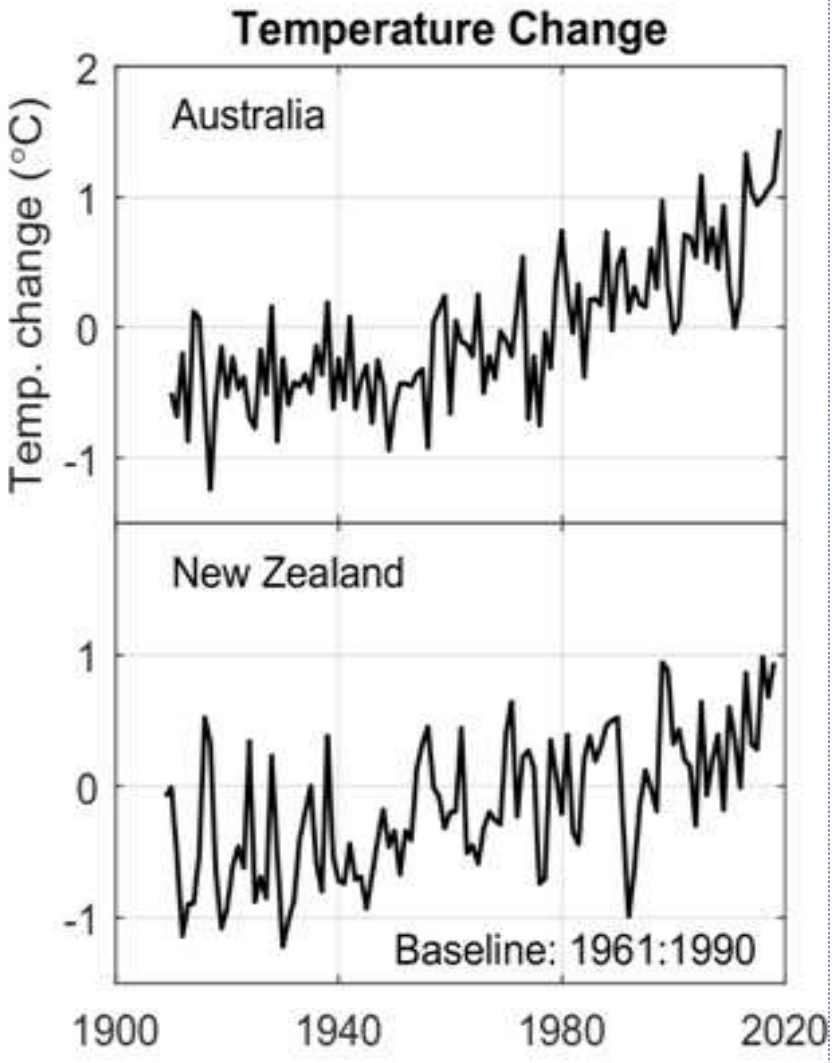
Sensitivity of the land and assets:

- Soil type
- Soil quality
- Topography
- Vegetation
- Characteristics of assets and livestock

Adaptive capacity of the farmer or grower:

- Farm size
- Farm system and intensity
- Demographic factors (Education, Age, Gender)
- Income
- Debt
- Access to markets

Key findings for New Zealand – observed impacts



Ongoing climate trends have exacerbated many extreme events

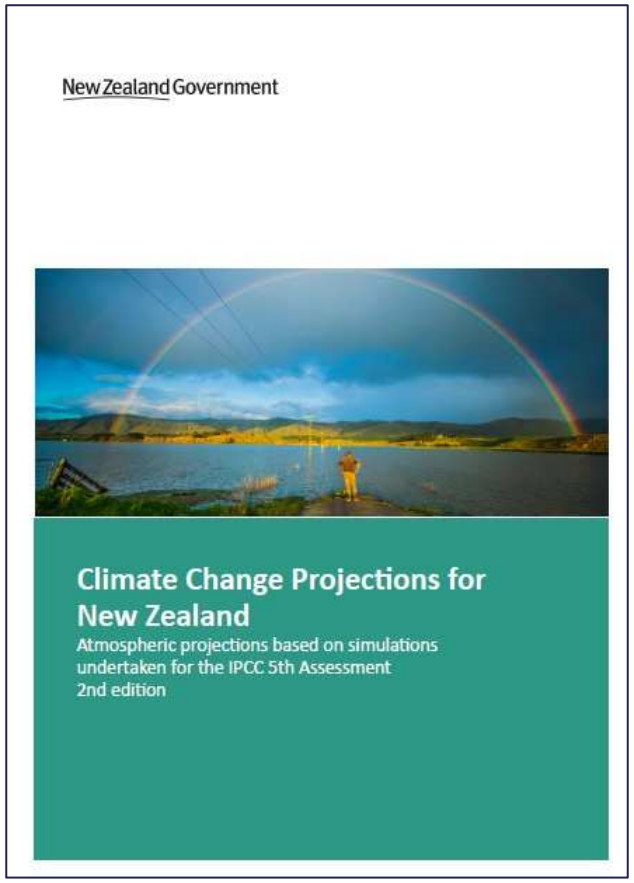
Trends

- Warming of 1.1°C since 1910
- Sea level rise of 2.4 mm/year since 1961
- More rainfall in the south, less in the north
- Less snow

Extreme events

- Warmest year in 2016
- Increasing frequency and intensity of droughts in several sites
- More extreme fire weather in the east
- Changing seasonality

Key findings for New Zealand – projections

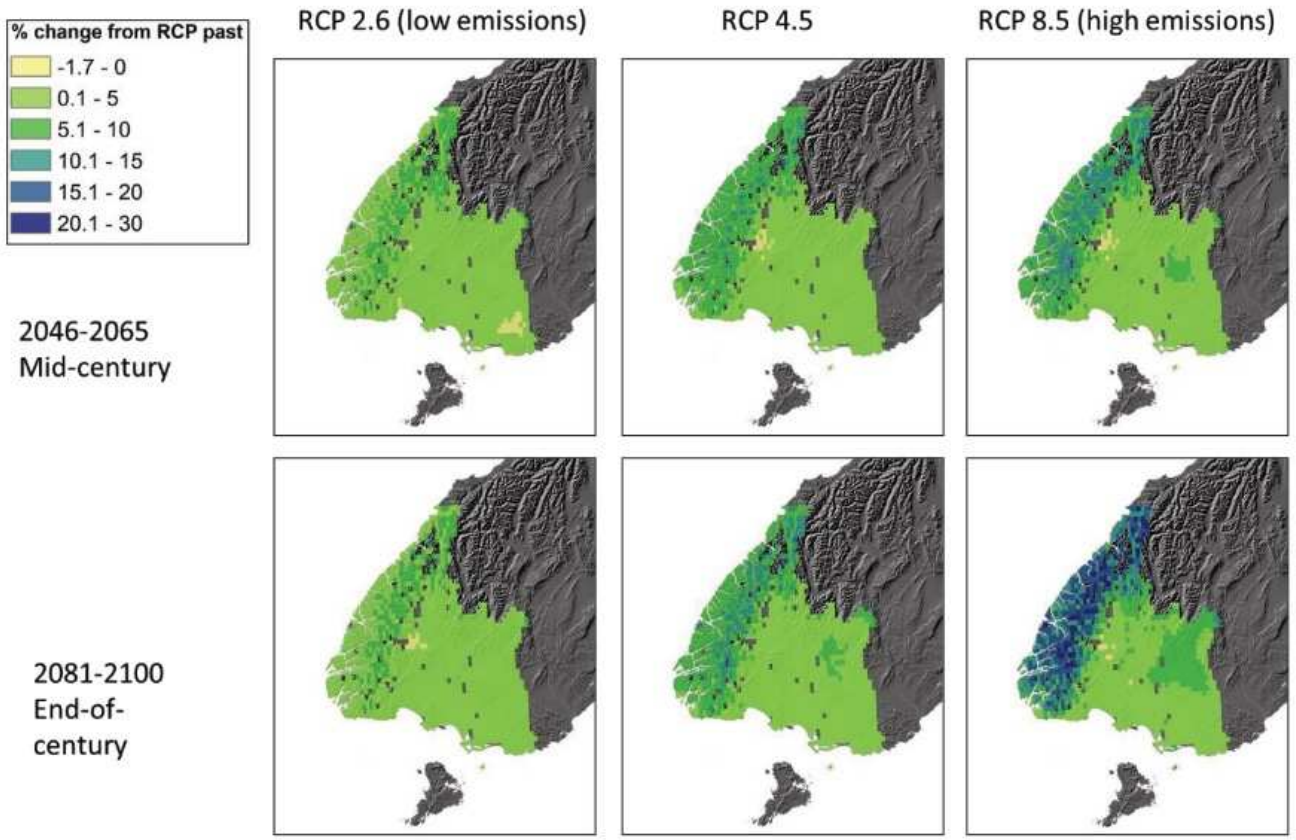


Climate projections

- Further warming, with more hot days, fewer cold days and less snow
- Sea-level rise and ocean acidification
- Changes in rainfall patterns
- Increased heavy rainfall intensity
- More extreme fire weather in the north and east
- Increasing frequency of drought in the north

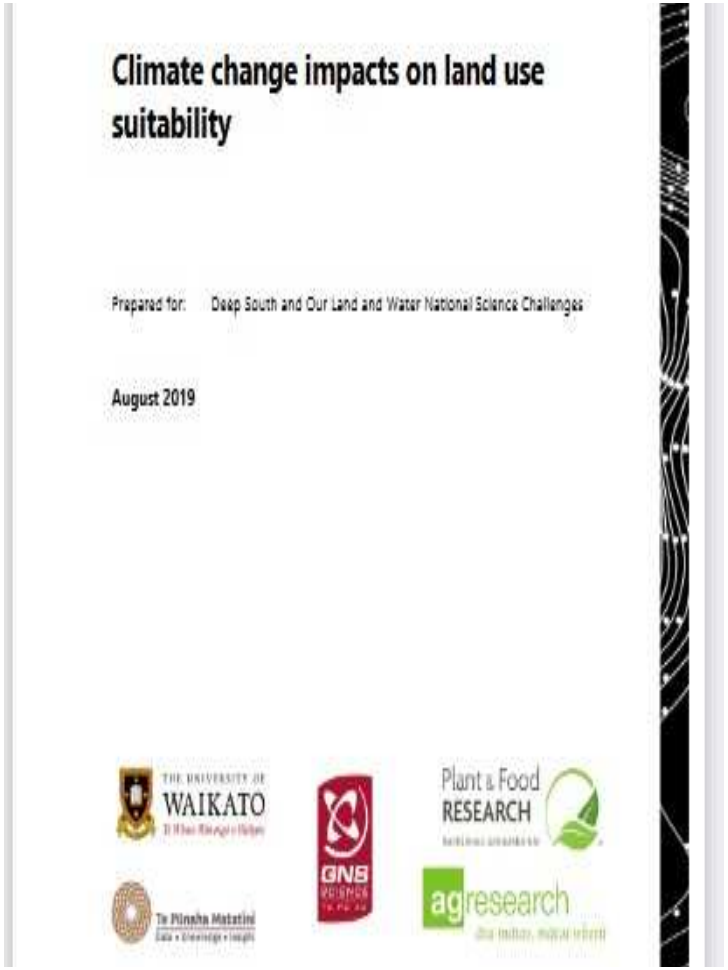
Pasture growth

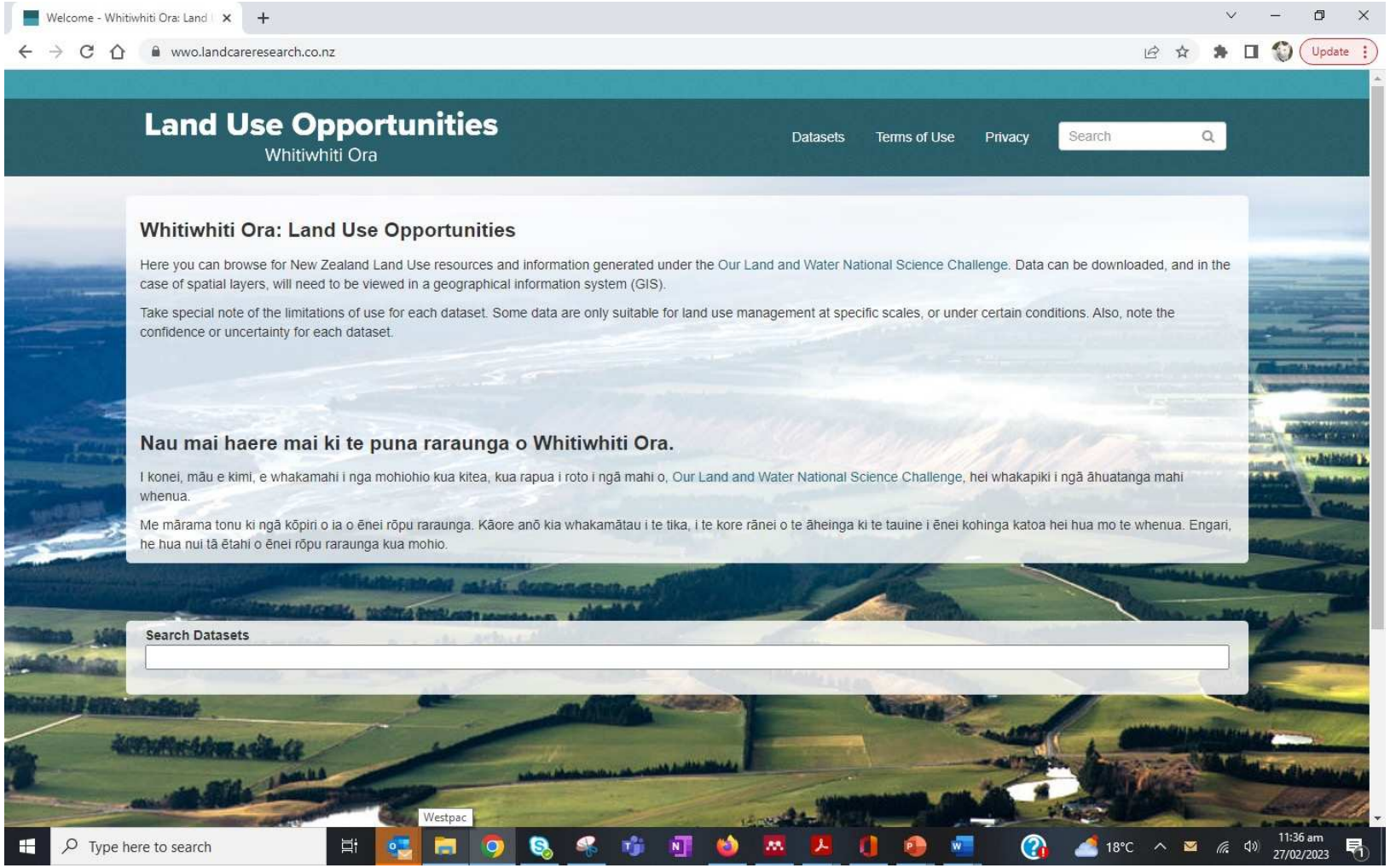
e.g. mean annual pasture yield (Southland)



Keller, E. D., Lieffering, M., Guo, J., Baisden, W. T., & Ausseil, A. (2021). Climatic factors influencing New Zealand pasture resilience under scenarios of future climate change. *Resilient Pastures - Grassland Research and Practice Series 17*, 105–122.

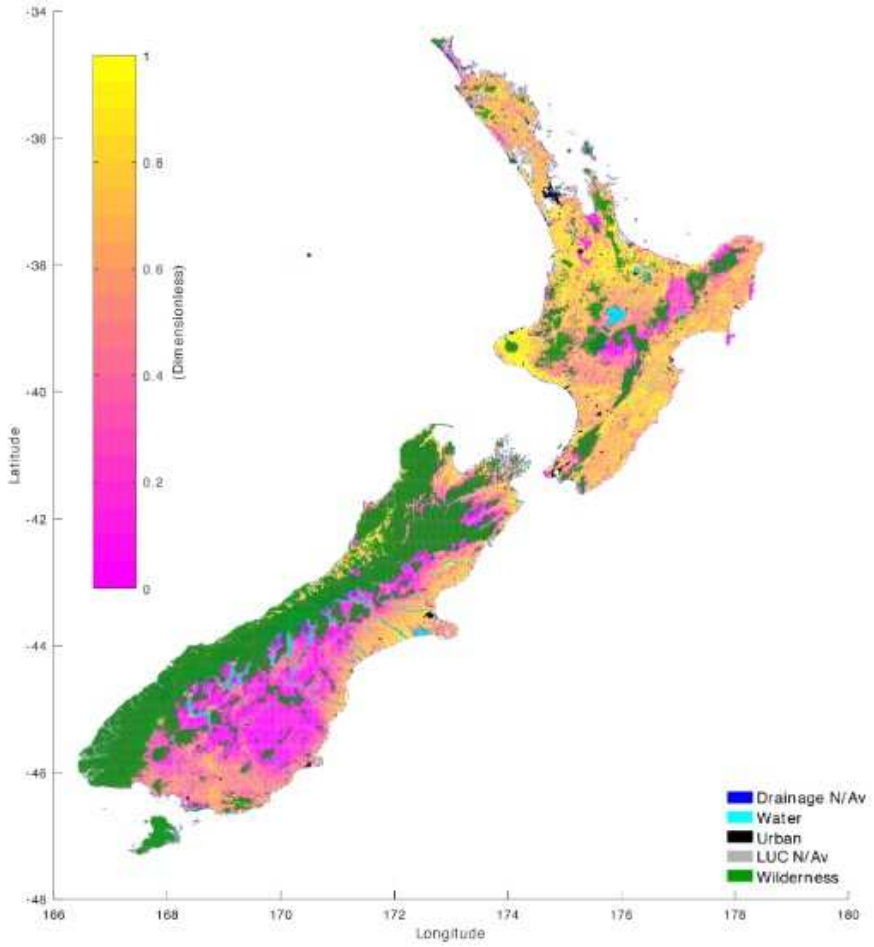
Land-use suitability and opportunities





Suitability: e.g. kiwifruit

Mid-century forecast for kiwifruit under the high GHG concentration pathway (RCP 8.5)



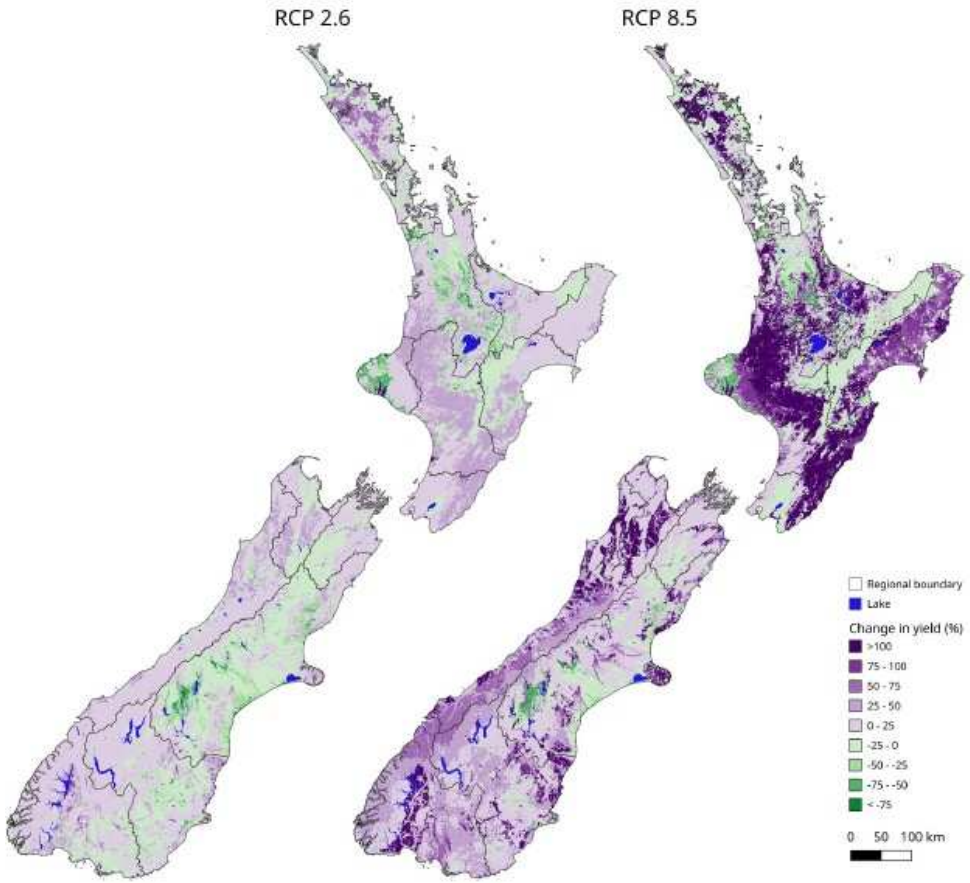
Criteria considered	Importance	
Climate related		
Cold damage	High	●
Growing degree days	Moderate	●
Frost risk	Moderate	●
Winter chill	Moderate	●
Soil or land related		
Drainage	High	●
Potential rooting depth	Moderate	●
Land use capability class (LUC)	Moderate	●
Slope of land	Moderate	●

Please note irrigation is assumed to be available if needed and rainfall is not evaluated.

https://www.plantandfood.com/en-nz/article/climate-change-impacts-on-kiwifruit

Erosion and sediment load

Mean proportional change in sediment yield by 2090



Geomorphology 427 (2023) 108607

Contents lists available at ScienceDirect

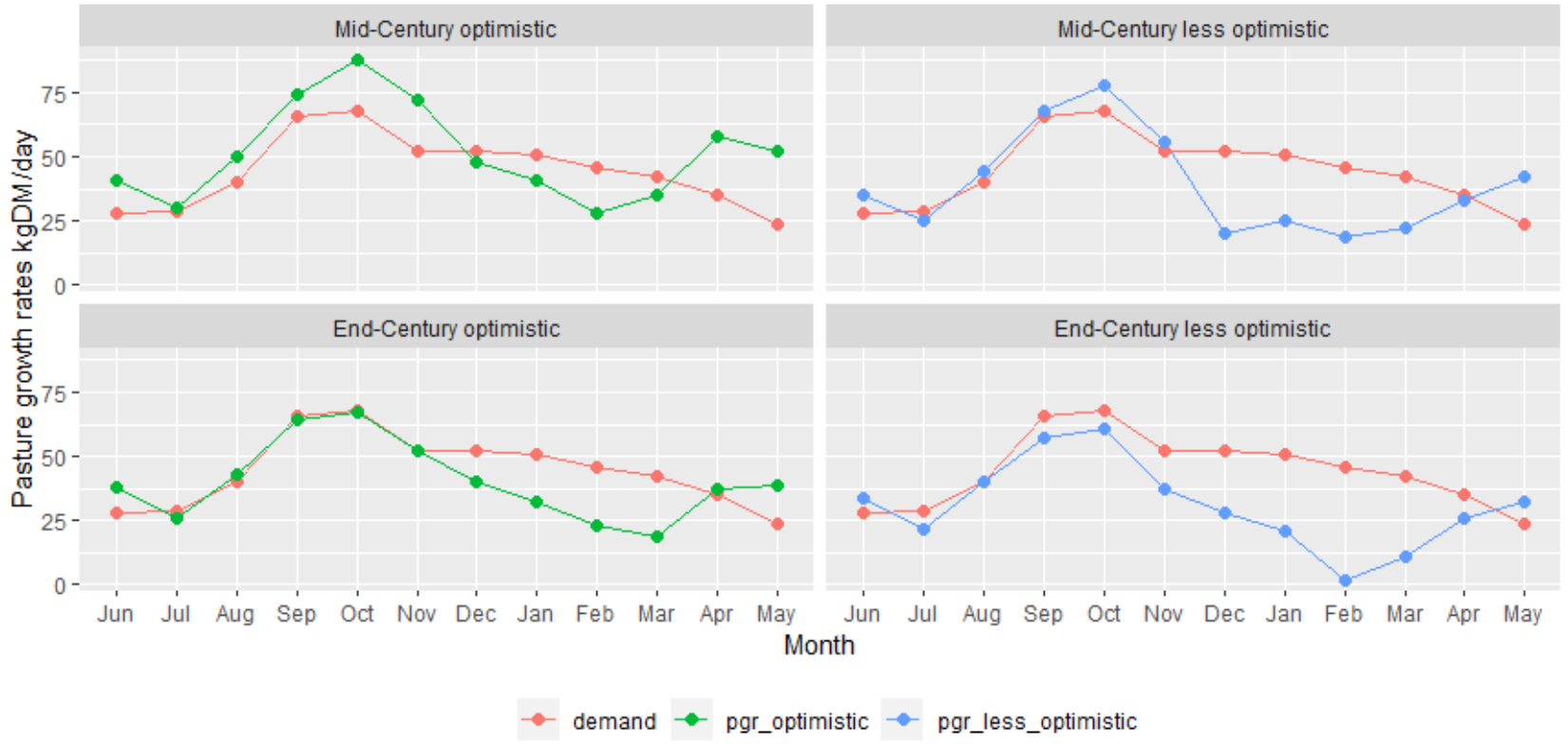
Geomorphology

journal homepage: www.journals.elsevier.com/geomorphology

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

Andrew J. Neverman [a,*], Mitchell Donovan [b], Hugh G. Smith [a], Anne-Gaelle Ausseil [c], Christian Zammit [d]

Pasture growth together with feed demand (RCP 4.5)

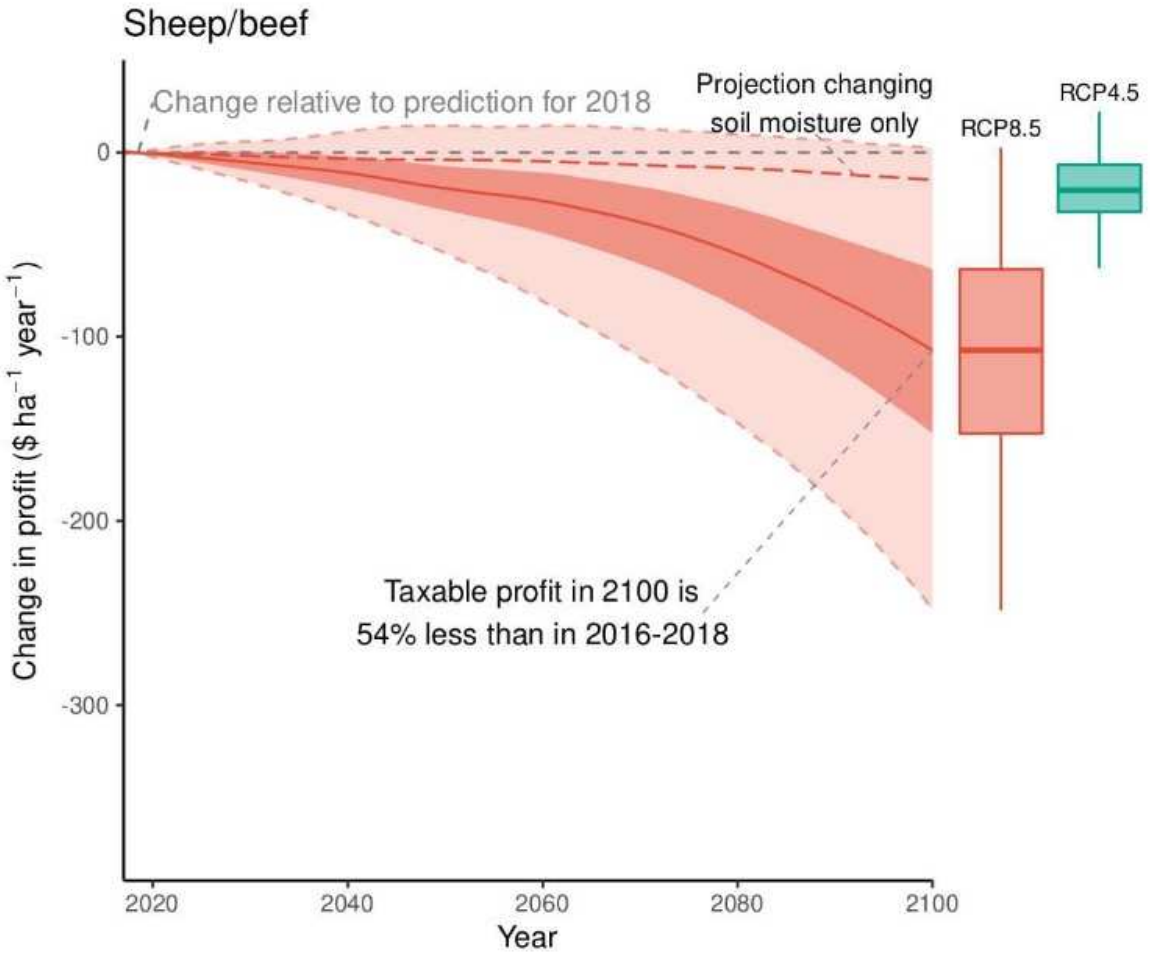


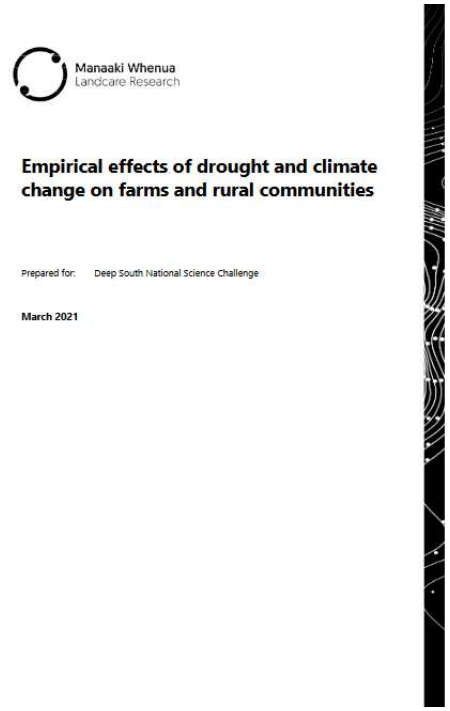
Pierre Beukes, Andrea Babylon, Taisekwa Chikazhe & Hemda Levy

Dairy NZ

(Deep South NSC)

Impacts of drought and climate change on farm profits

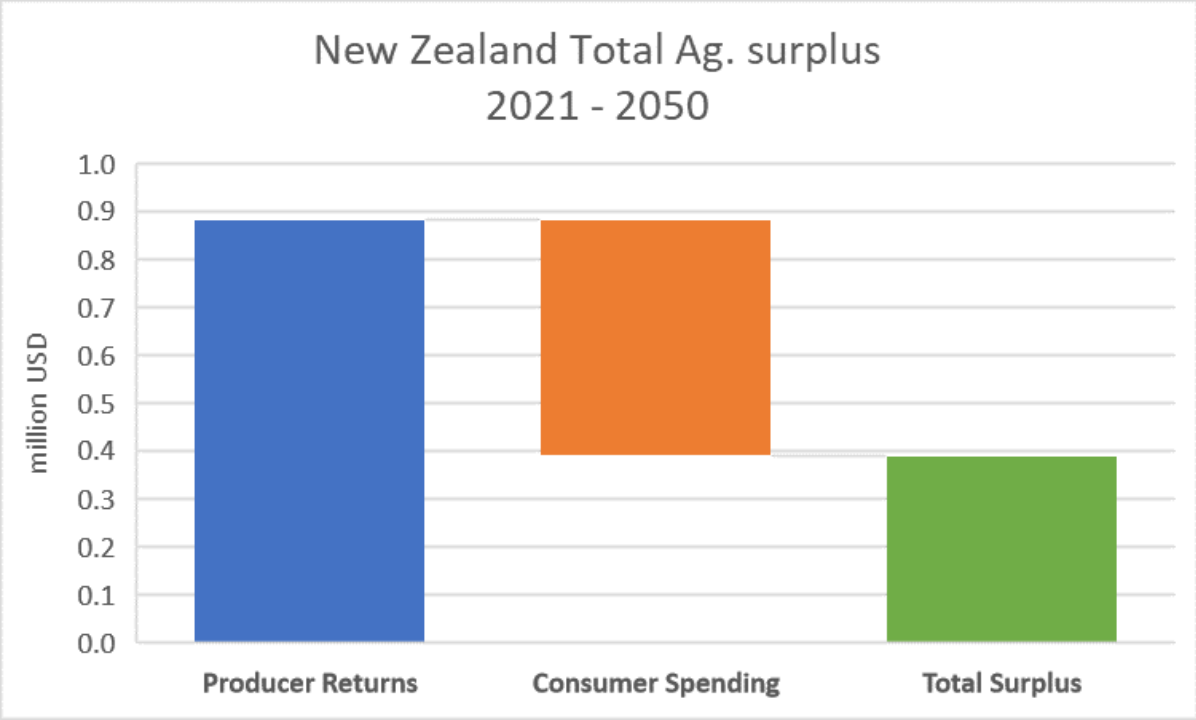




Bell et al. (2021)

https://deepsouthchallenge.co.nz/resource/empirical-effects-of-drought-and-climate/

NZ drought impacts combined with “global breadbasket failure”



Wreford, A, Saunders, J., Renwick, A (2022). Economic implications of global and domestic extreme weather events on New Zealand’s agricultural producers. Client report to MPI, Contract Number 40631. Lincoln University: Agribusiness and Economics Research Unit.

Impacts on farmers – social impacts

Journal of Rural Studies 98 (2023) 147–158

Contents lists available at ScienceDirect

Journal of Rural Studies

journal homepage: www.elsevier.com/locate/jrurstud

'As a farmer you've just got to learn to cope': Understanding dairy farmers' perceptions of climate change and adaptation decisions in the lower south Island of Aotearoa-New Zealand

Christina Griffin [a,1,*], Anita Wreford [b], Nicholas A. Cradock-Henry [c]

[a] GHC Consulting, Dunedin, New Zealand
[b] AERU, Lincoln University, Lincoln 7647, Canterbury, New Zealand
[c] GNS Science Te Pū Ao, 1 Fairway Drive, Avalon 5010, PO Box 30368, Lower Hutt, 5040, New Zealand

Reg Environ Change (2017) 17:245–259
DOI 10.1007/s10113-016-1000-9

ORIGINAL ARTICLE

New Zealand kiwifruit growers' vulnerability to climate and other stressors

Nicholas A. Cradock-Henry[1]

Developing better understanding of impacts

But impacts are complex!

- Concurrent
- Interacting
- Cascading

Climate Risk Management 29 (2020) 100234

Contents lists available at ScienceDirect

Climate Risk Management

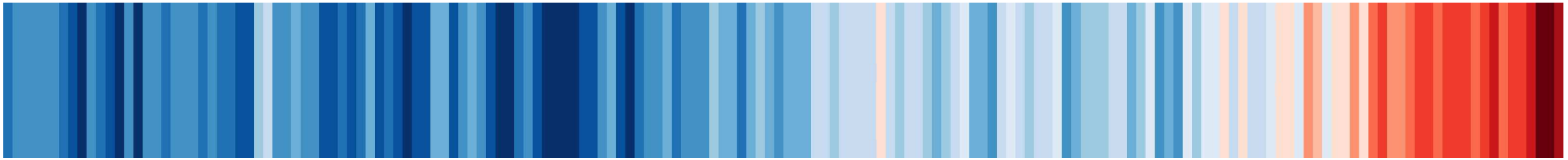
journal homepage: www.elsevier.com/locate/crm

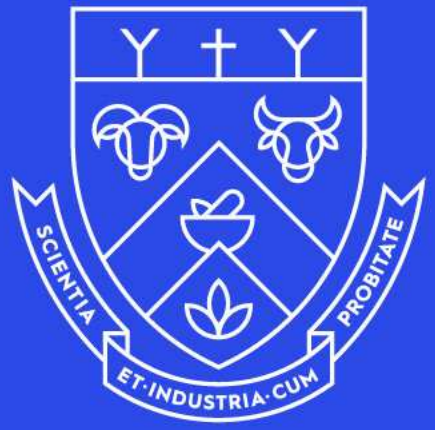
Cascading climate change impacts and implications

Judy Lawrence[a,*], Paula Blackett[b], Nicholas A. Cradock-Henry[c]

[a] Climate Change Research Institute, Victoria University of Wellington, PO Box 600, Wellington 6140, New Zealand
[b] National Institute of Water and Atmospheric Research, PO Box 11115, Hillcrest, Hamilton 3251, New Zealand
[c] Manaaki Whenua – Landcare Research, Lincoln, New Zealand

- Need much better knowledge and understanding of **adaptation:**
  - Effectiveness
  - Limits to effectiveness
  - Monitoring
  - Transformation





LINCOLN

UNIVERSITY

TE WHARE WĀNAKA O AORAKI