Global Climate Change and New Zealand Forests

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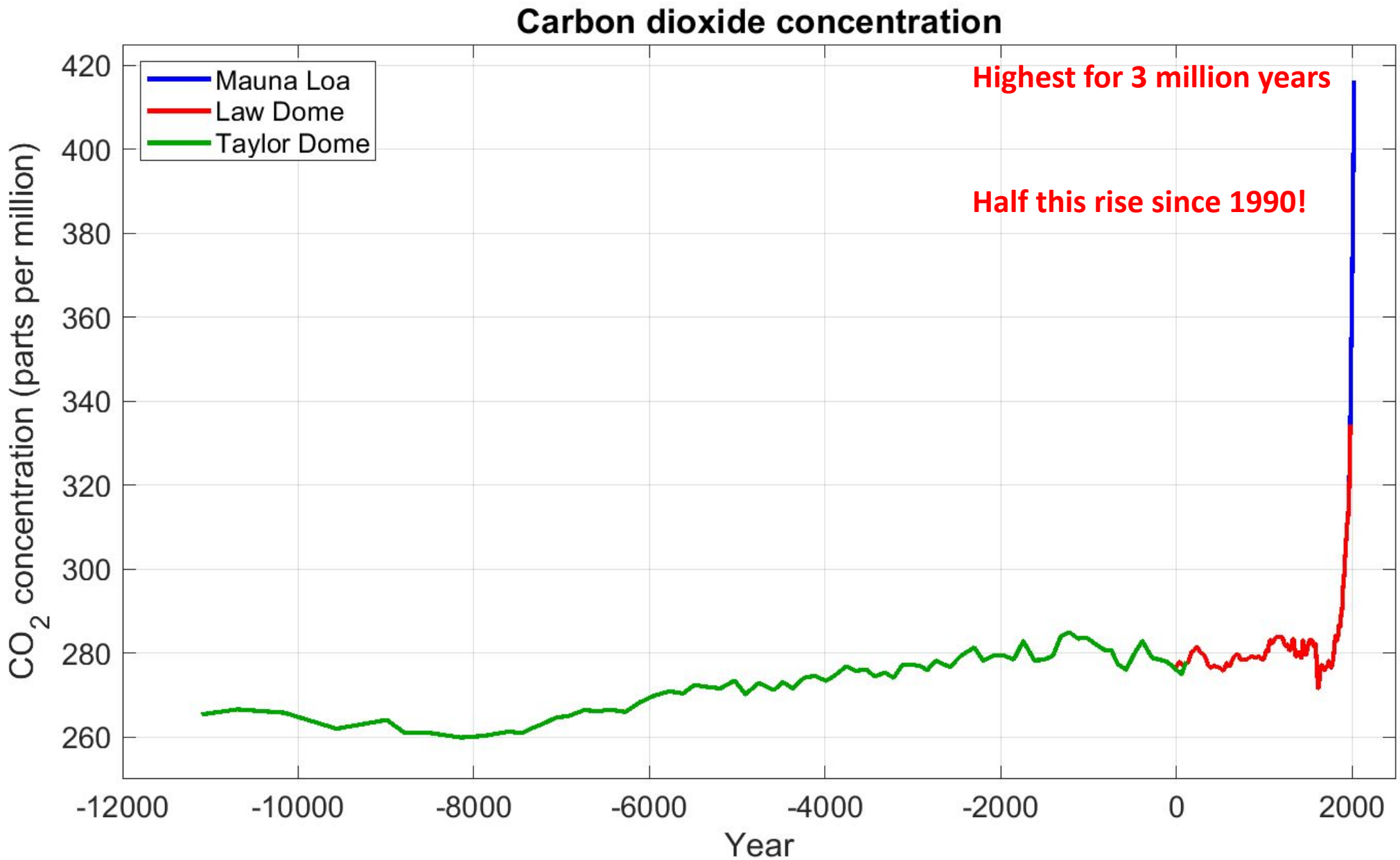
The problem:


Carbon dioxide concentration
Mauna Loa
Law Dome
Taylor Dome
Highest for 3 million years
Half this rise since 1990!
CO_2 concentration (parts per million)
420
400
380
360
340
320
300
280
260
-12000
-10000
-8000
-6000
-4000
-2000
0
2000
Year

[Credit: NASA]

"Recent changes in the climate are widespread, rapid, and intensifying, and unprecedented in thousands of years.

ipcc
INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

[Credit: Hong Nguyen | Unsplash]

Climate change is already affecting every region on Earth, in multiple ways.

The changes we experience will increase with further warming.

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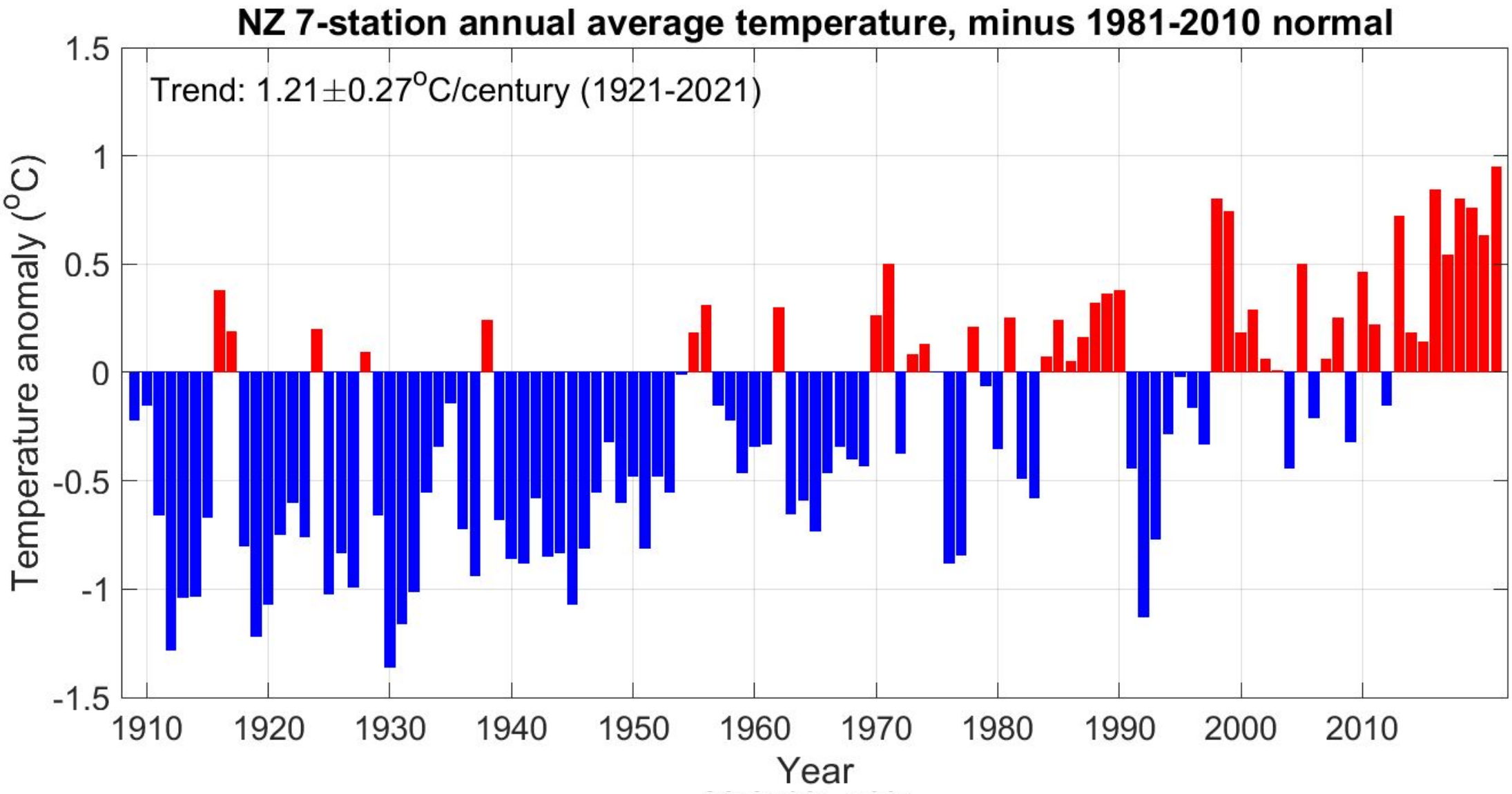
Temperature Change



[Credit: Yoda Adaman | Unsplash]

“It is indisputable that human activities are causing climate change, making extreme climate events, including heat waves, heavy rainfall, and droughts, more frequent and severe.

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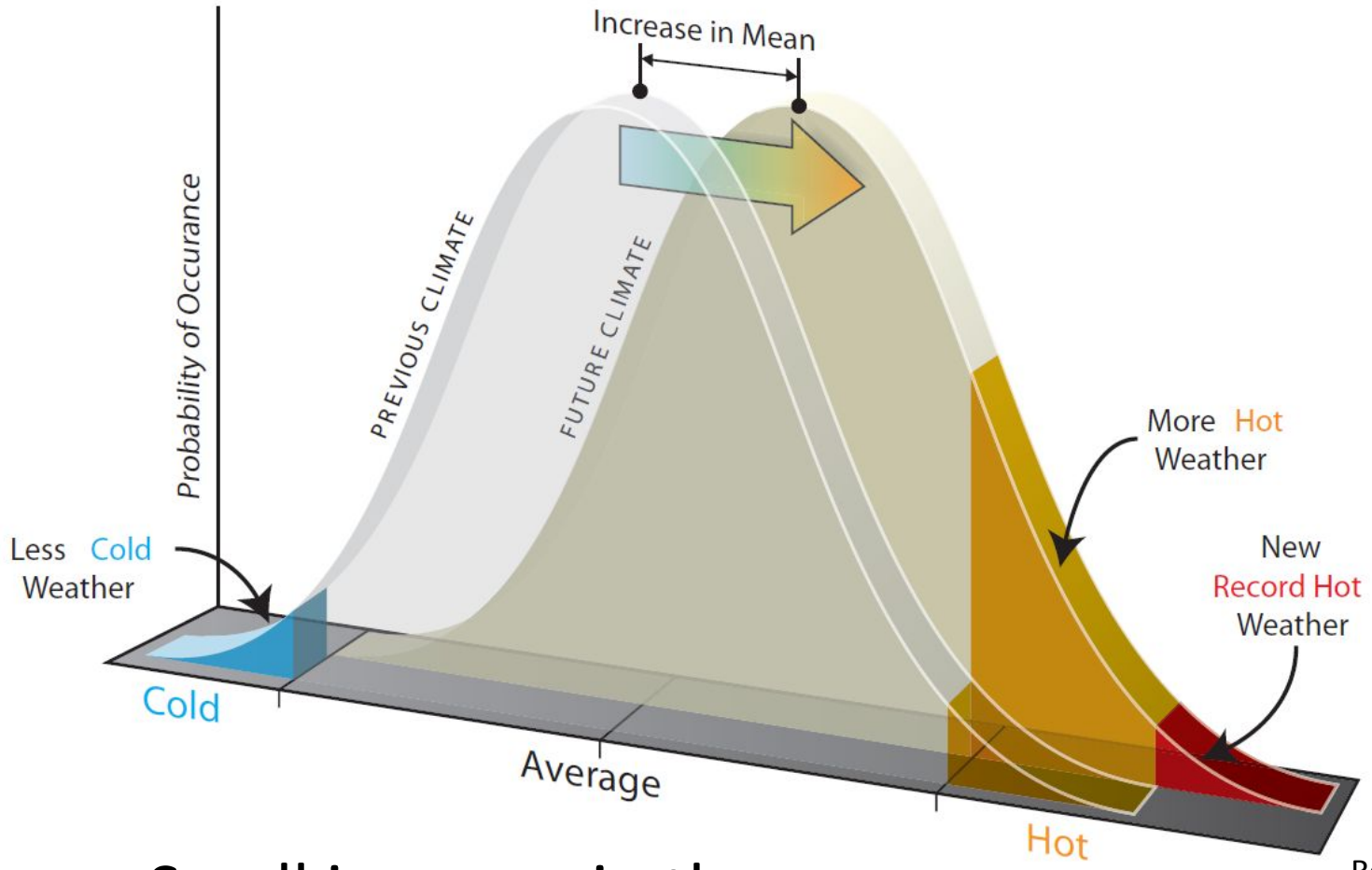
Changes in extremes:temperature



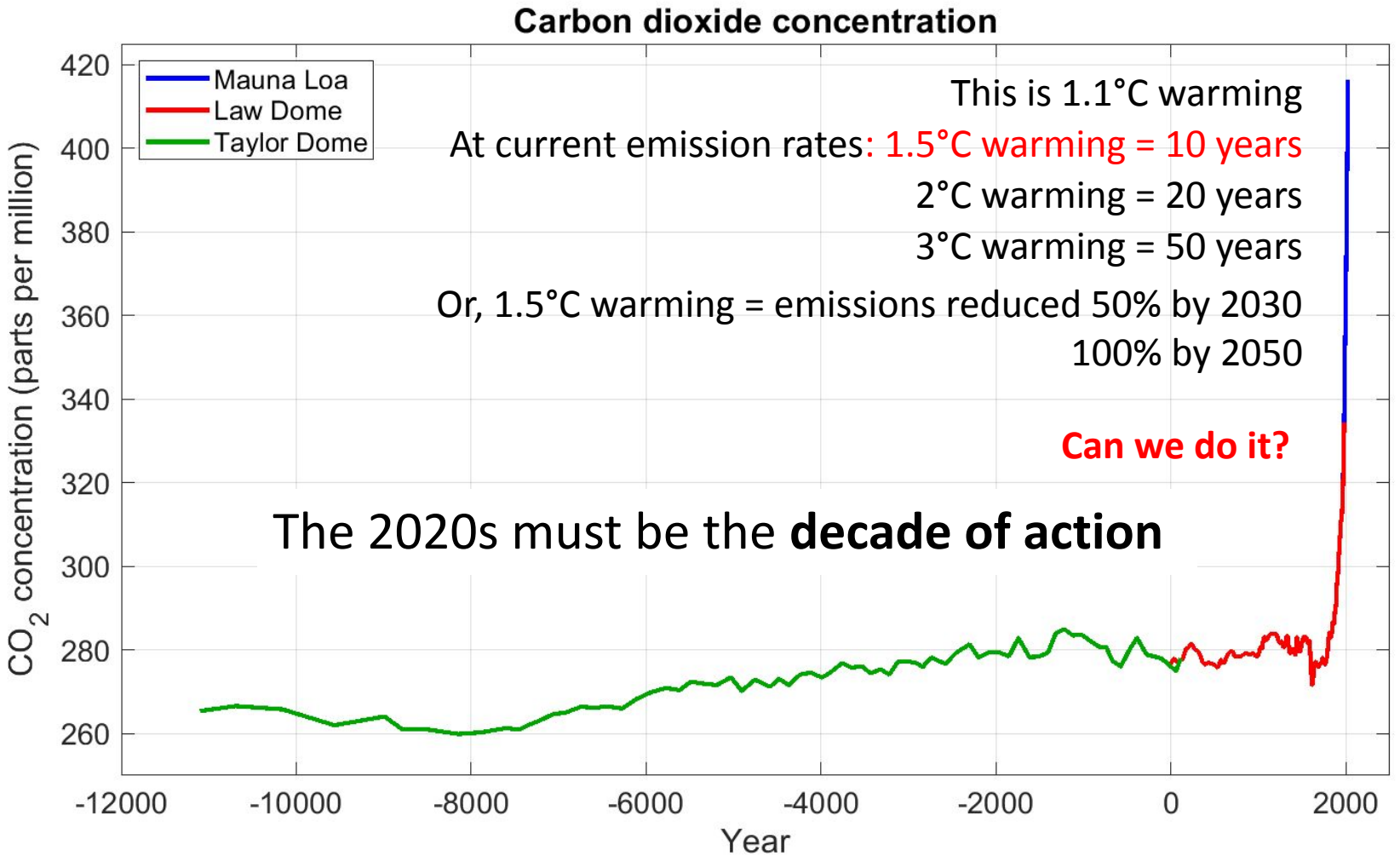
Reisinger (2009)

- Small increase in the average
  - Big increase in risk of extremes
    - Including new, unprecedented extreme values

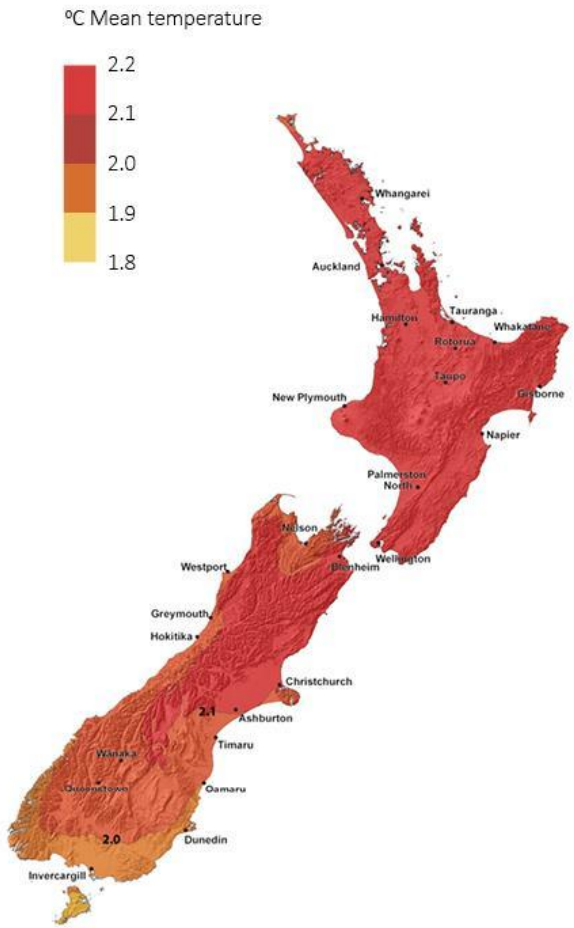
Changes in extremes: rainfall

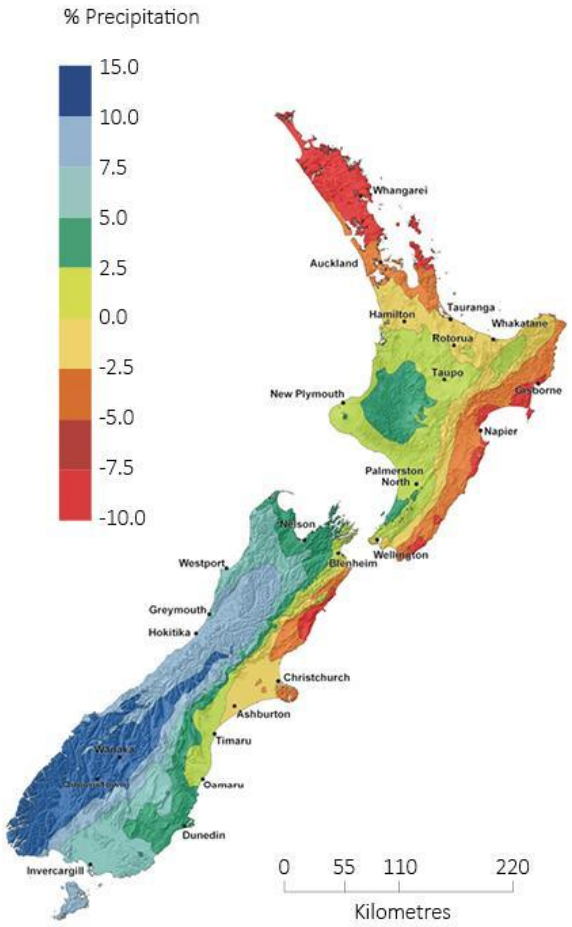
- More complex…
  - Half the total annual rainfall happens on 12 days
    - Averaged across the world
    - That will happen on even fewer days as temperatures rise
- Amount of moisture in the air increases with temp
  - More heavy rainfalls and floods
- Evaporation works better in warmer conditions
  - Droughts can develop faster
- Days of “moderate rain” get squeezed out
  - Heavier rain, when it rains
  - Longer dry spells and more droughts in between
  - More variability

Where to from here?



Aotearoa New Zealand





https://environment.govt.nz/publications/climate-change-projections-for-new-zealand/

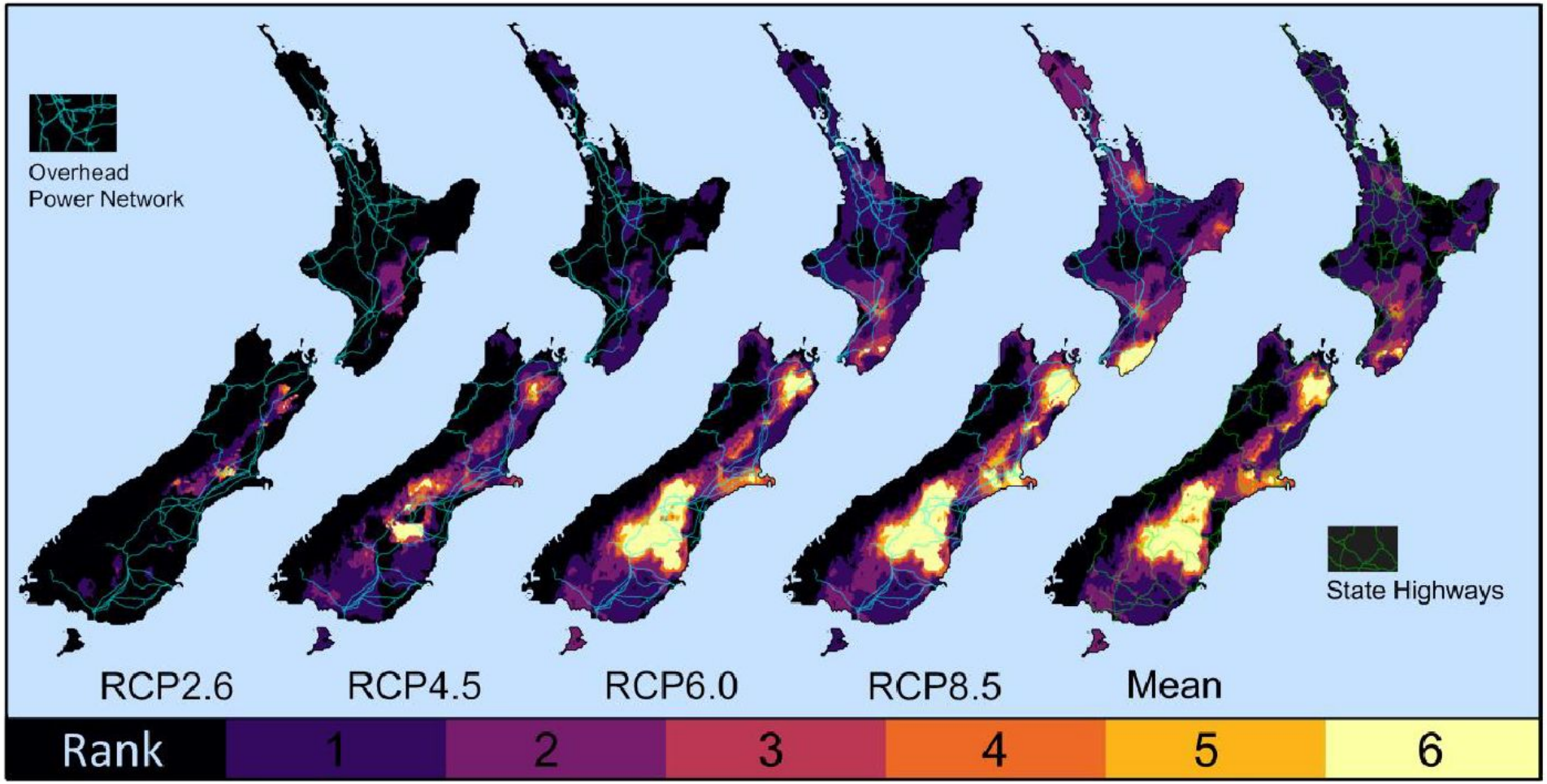
- ~100-year changes, for a mid-range scenario
  - The wet get wetter, the dry get drier
  - Relatively uniform temperature rise
  - Rapid increases in extremes

NZ Extremes

- 2°C warming…
  - Tripling number of hot days
- Plus 5-10% less rain…
  - Tripling drought occurrence
  - 2-3 x longer fire season

Forest Fire Danger:2100

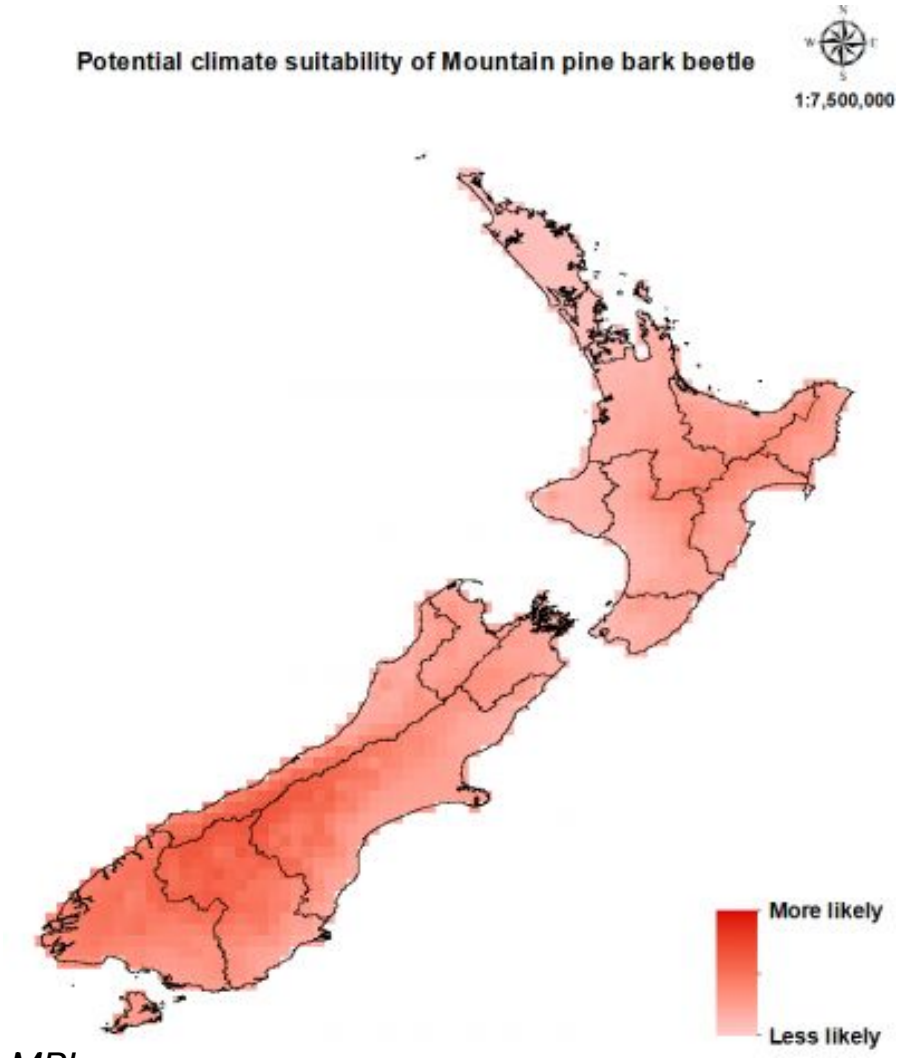
2°C 3°C 4°C



Melia et al (2022)

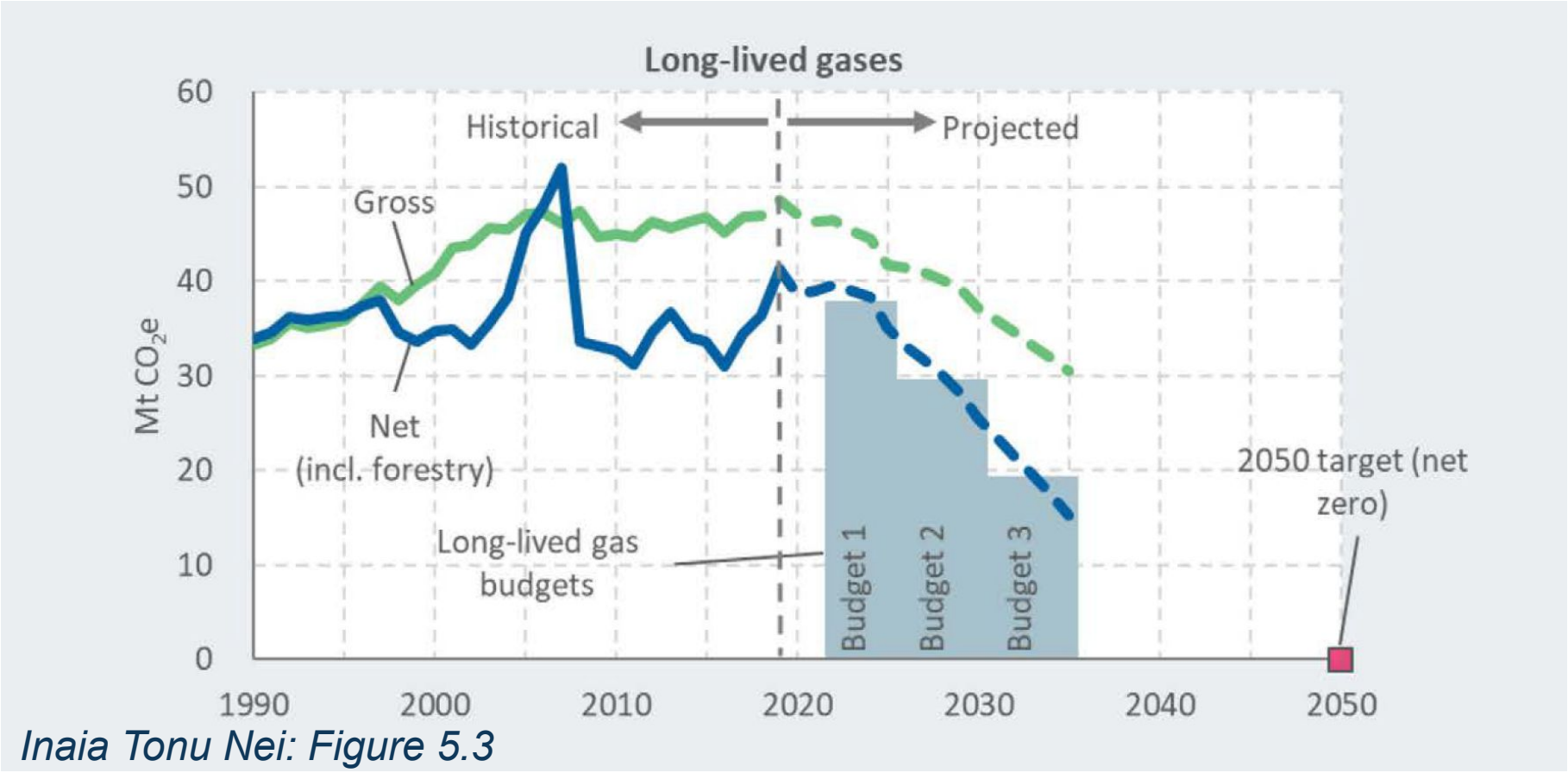
Pests?

Pine Bark Beetle, North America



MPI

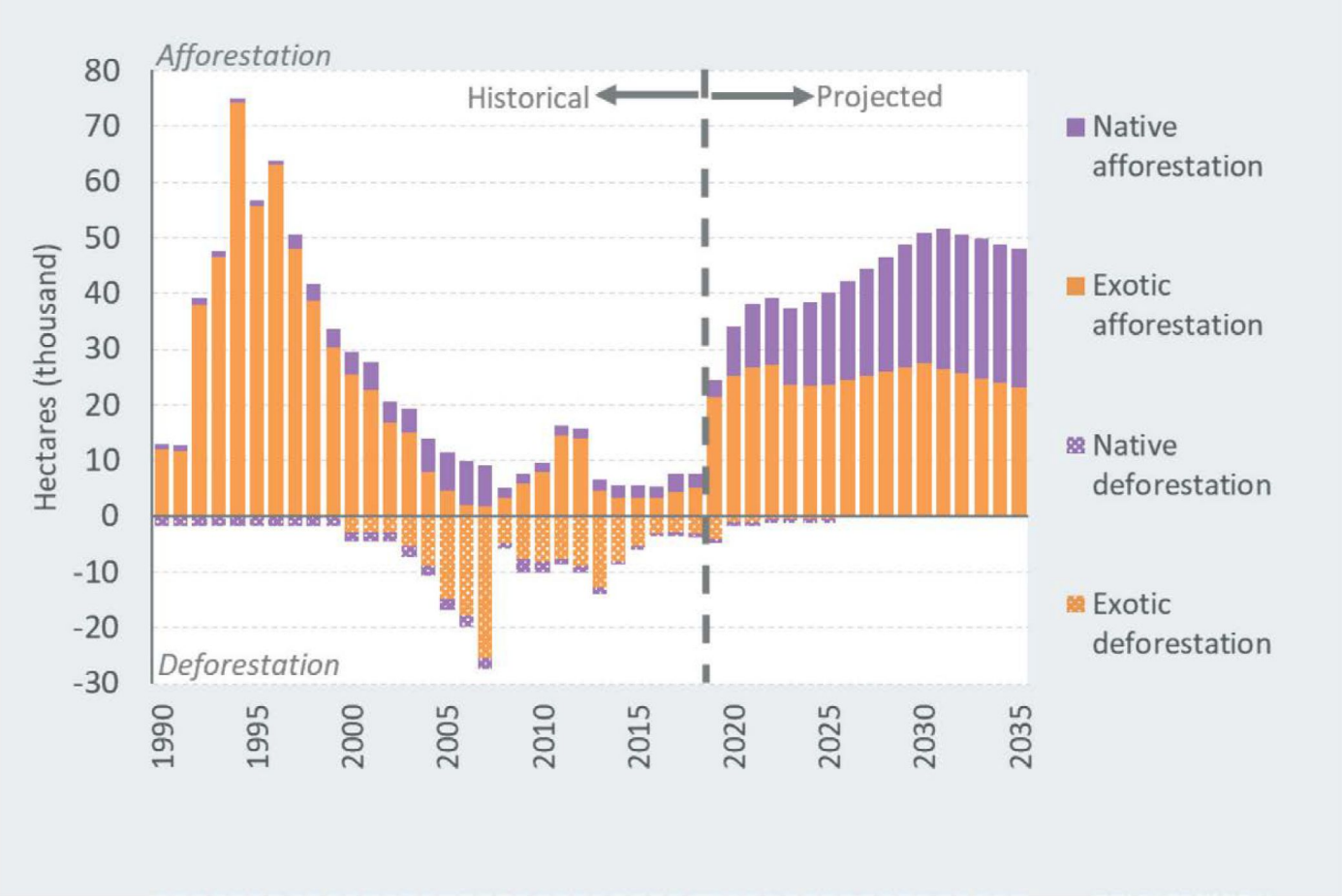
Trees and GHG emissions (CCC)



Inaia Tonu Nei: Figure 5.3

- Net-zero CO_2 by 2050
  - Mostly via reducing gross emissions, but…
  - Need forestry offsets over the next few decades at least

Trees and GHG emissions (CCC)



- Exotic forest planting now
- Native forest planting later

- Reduction of gross emissions
  - In the longer term
  - Must get to zero gross CO_2
    - Cannot plant our way out of this

Figure 7.15: Afforestation and deforestation by year in the demonstration path

Summary

- Climate is changing fast it's all down to human activity
  - Rapid and deep cuts in emissions needed to stop at ~1.5°C
  - Many extremes becoming much more common
  - **We have all the power to stop the change**
- New Zealand change is near the global average rate
  - High temperature extremes becoming more common
  - West becoming wetter, east dryer, extreme rainfalls becoming more intense
- Afforestation can help offset greenhouse gas emissions
  - Transition to native plantings, stop all gross CO_2 emissions this century
  - Increasing risks from fire danger, and (probably) pests
- Need **urgent** reductions in emissions to stop warming at 1.5-2°C