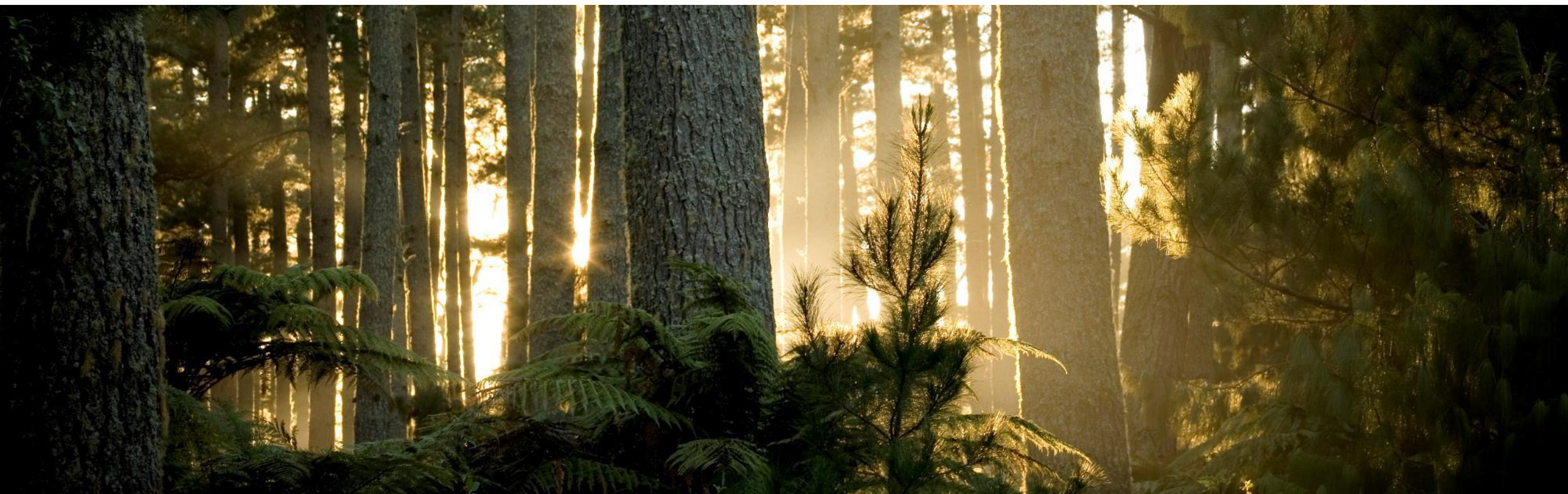


Native and exotic trees – carbon, afforestation, and research needs

Simeon Smail, Team Lead Microbial Ecology • Soil Systems
August 2022



Our climate crisis response is largely based on planting trees

- 2020 MfE data
 - Gross CO₂ equivalent emissions of 82.8 MT
 - Offset of 8.3 MT from forestry activity
 - Emissions of 74.4 MT

- 2050 MfE Projections (AR5 scenario)
 - Gross CO₂ equivalent emissions of 69.4 MT (16% reduction)
 - Offset of 24.8 MT from forestry activity (199% increase)
 - Emissions of 44.7 MT

So that's a lot of trees – what should they be?

- Although radiata pine captures carbon much faster than any native tree, it has a bit of a PR problem

ENVIRONMENT

The unpopular tree sucking carbon from our air

**PLANTING FARMS IN
PINE TREES FOR
CARBON**

**WRONG TREE. WRONG PLACE.
FULL STOP.**



They can live for thousands of years.
Unlike pine, they don't need to be
clear-felled and replanted—they keep
thriving.

Lots of reasons why people want native afforestation – and not just carbon

- Cultural drivers
- Provision of diverse habitats
- Support for economic activities
- Potential for greater carbon storage over time than exotics
- Mistrust / lack of understanding of exotics

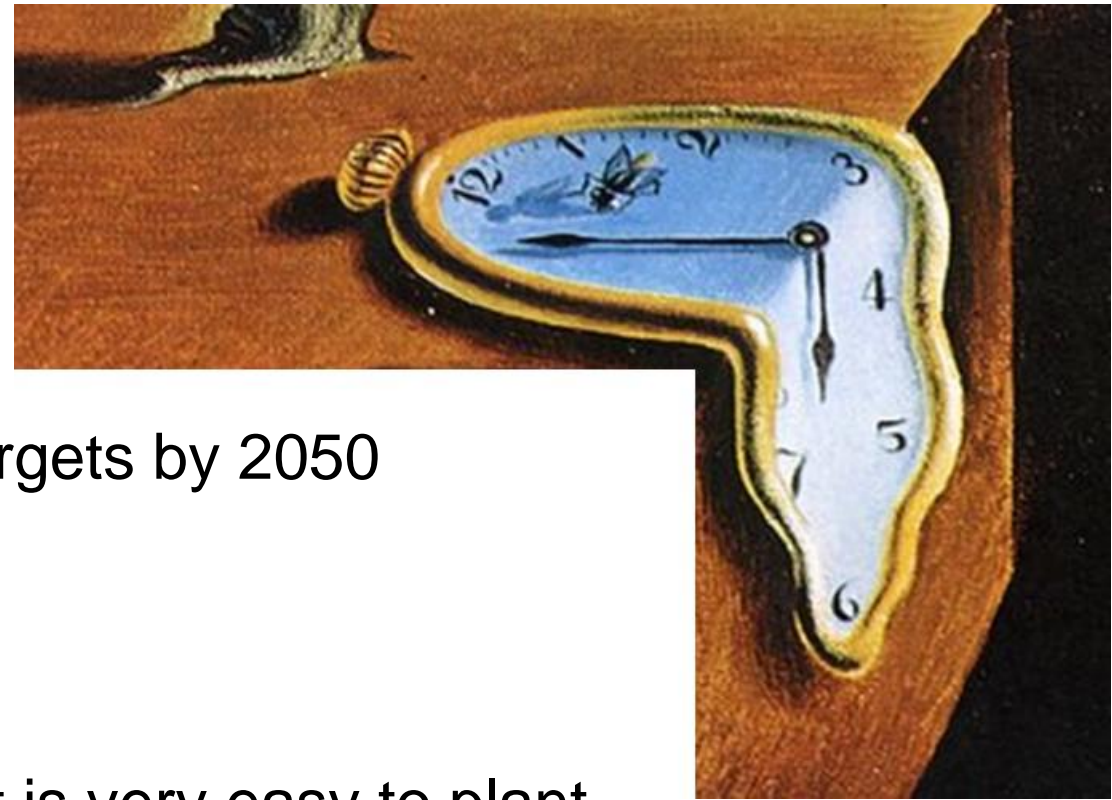


So what about radiata pine?

- Can plant it just about anywhere and it will grow
 - Captures carbon 25% faster than ETS tables, based on national mean MfE data
- Supported by decades of research and a reliable supply chain
- Can deal with the current and future climate
- It's a boring but safe bet... and that matters



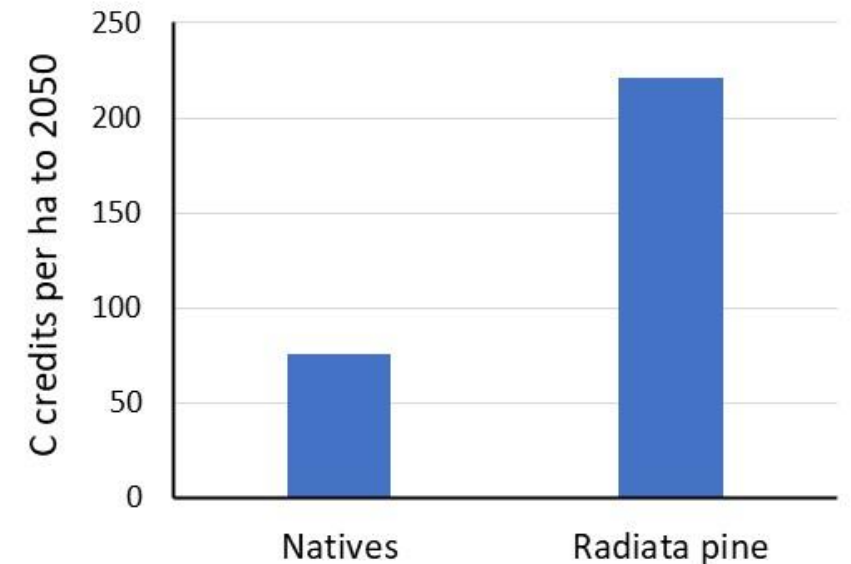
Unfortunately, our time is running out



- We need a safe bet to even approach our targets by 2050
 - Adaptable genetics
 - Availability and standards
 - Simple establishment – by comparison, it is very easy to plant natives, but very hard to turn them into forests
- We do not have this capability for native tree species at suitable scales – we needed to start this work **40 years ago**

Afforestation with natives

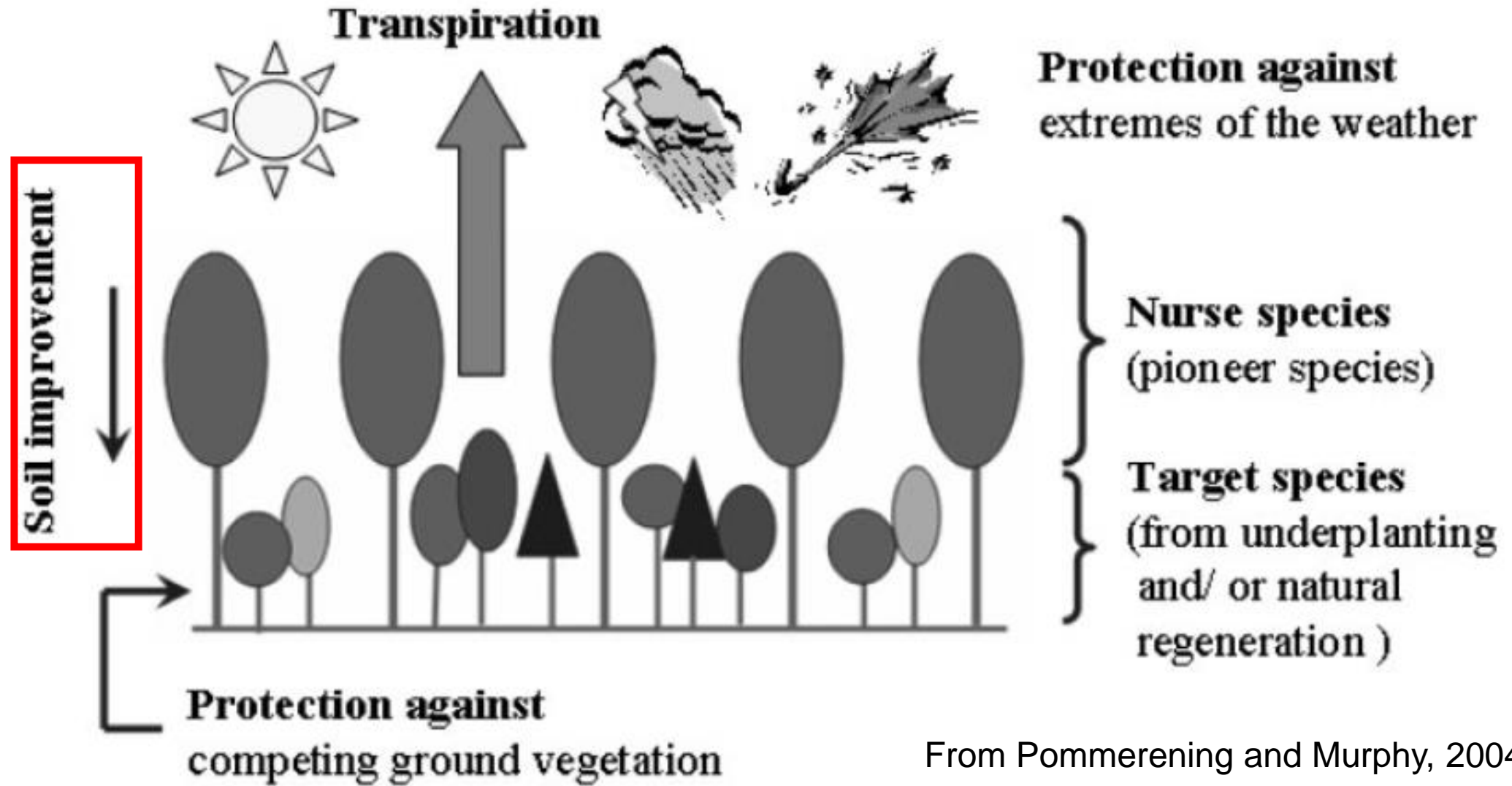
- Do mature planted native forests actually achieve the carbon storage of natural native forests?
- Where native afforestation has worked, often a special case – e.g. huge volunteer input
- Slower rates of native growth will require at least triple the pasture area to be afforested



This does not mean we should not afforest with natives at all

- Lots of other reasons why people want to convert pasture into native forests, and we should embrace that
- It's not a competition – planted exotic forests exist to provide a reliable source of fibre, energy, and now increasingly a store of carbon – pine buys space and time for native forests to be planted for other reasons (including long term carbon)
- Sequential planting (pine or other exotics gradually replaced by natives) is another option

Exotics as nurse crops



From Pommerening and Murphy, 2004.

Exotics as nurse crops – natural regeneration

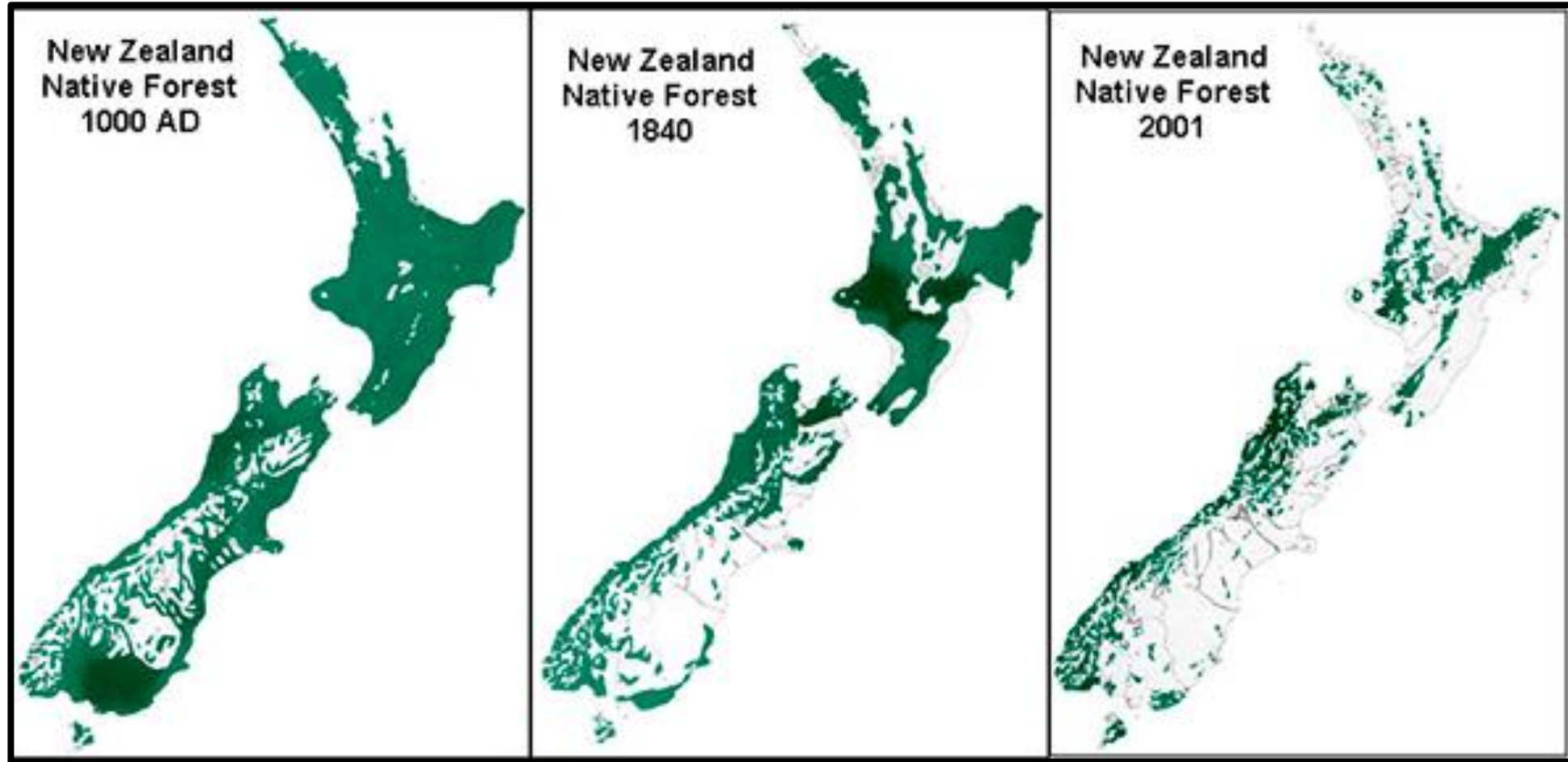


Dr Adam
Forbes

Exotics as nurse crops – planted natives



Despite our best efforts, we still have a lot of native forest



Represents a huge carbon store
that we need to protect

and a lot of gradually regenerating native plant communities



Risks to regenerating and existing natural forests

British Columbia

Vancouver trees dry out as heat wave continues to take its toll

VANCOUVER

Western red cedars are dying of drought in Vancouver and scientists say it's one more portent of climate change

How B.C.'s forests became a carbon-spewing liability

The more timely research focus?

- Supporting enhanced native forest regeneration **and** protection of the carbon stored in existing native forests could bring more reward for efforts with natives
- Evaluate the rationale for research into afforestation, regeneration and protection
 - need to create a comprehensive evidence base to quantify the trade-offs
- Need input into policy and policy enforcement at regional and national levels

The elephant in the room

- Forests represent stores, not sinks – the carbon is still in the biological cycle, and still at risk of loss from fire or disease or other disturbances
- Forests buy time until emissions reduce... but there are some potential sinks
 - Increased soil carbon residence time through fungal biomass
 - Pyrolysis – lose 50% of the carbon immediately, but the remainder can last for centuries
 - Methane – forest soils support methanotrophic activity, which is a key sink on a global scale

Thanks for your attention, and to the Symposium organisers for this opportunity to speak today.

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Prosperity from trees *Mai i te ngahere oranga*

Volatile Organic Compounds

- Released by pine needles into the atmosphere
- Can interact with hydroxyl radicals, slowing methane oxidation

Low



Stem methane emissions

- Produced by microbes living in the tree
- Soil methane can be transported to the stem for release



Mod

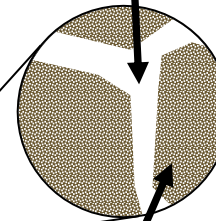
Tree litter

- Litter decomposition processes can produce methane
- Woody debris can act as a sink

Mod



Macropore



Micropores

Methane oxidation by soil bacteria

- Consume methane for energy in well aerated soil
- Pine roots create macropores in forest soils, enhancing aeration

High

