Landcare Research
Manaaki Whenua

Forecasts of masts and ‘mega-masts’ that generate pest outbreaks

Roger Pech & Mandy Barron

THE PRESS

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Helping hand for endangered parakeets

Rachel Young
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It's like lacrosse with birds.

Six players are spread throughout an enclosure – each with a specific role – with nets in hand, waiting for a critically endangered native orange-fronted parakeet to make a dash for it. The nets swoop and a bird is nabbed.

Yesterday, a team caught 18 of the parakeets to send to predator-free Tuhua Island, near Tauranga, in a bid to build a self-supporting population there.

Department of Conservation ranger Simon Elkington said there only between 200 and 400 of the birds, found in three alpine valleys in the wild, left.

Six captive breeding pairs are kept at Isaac Conservation and Wildlife Trust at Peacock Springs with their chicks kept in enclosures replicating Tuhua Island's environment.

When the chicks are about three months old they are captured and sent to the island.

Elkington said parakeets nested in tree holes and were easy prey for tree-climbing predators, including rats.

Predator levels in the valleys are at low levels currently, but are expected to climb in late autumn as the seed falls from the trees.

A beech mast 14 years ago drove rat and stoat levels to plague proportions and savaged the South Island populations of orange-fronted parakeet.

Elkington said creating populations on predator-free islands saved the bird from extinction.

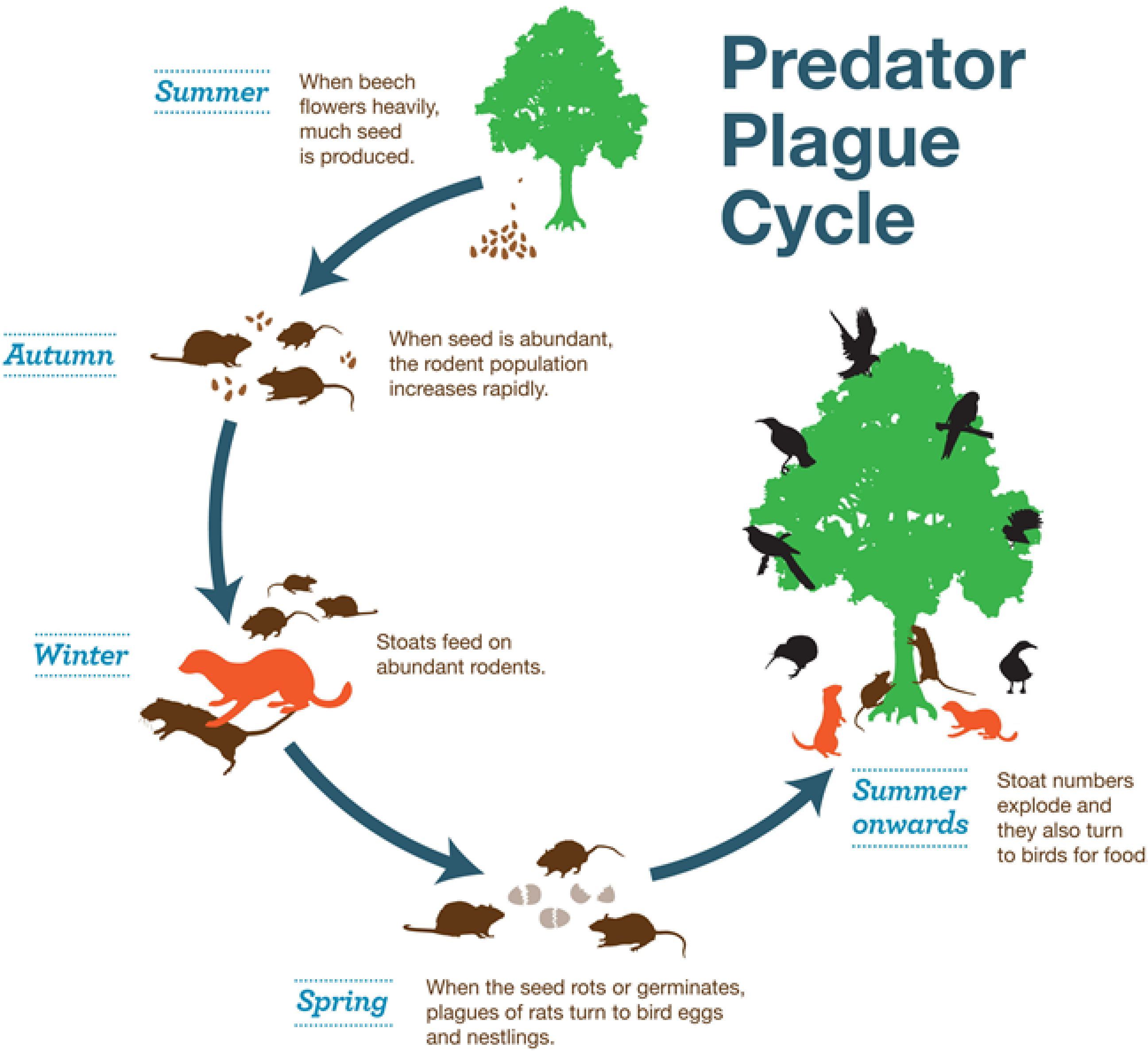
Since 2009, the trust and DOC have sent 130 birds to Tuhua Island, including the 18 that arrived late yesterday.

Birds bred at the centre supply "insurance" populations on four predator-free islands; Chalky Island in Fiordland, Blumine and Maud islands in the Marlborough Sounds and Tuhua.

A bird in the hand: Simon Elkington, a Department of Conservation ranger, catches orange-fronted parakeets at Peacock Springs for transfer to a predator-free island in the North Island. Photos: DANIEL TOBIN/FAIRFAX NZ

"A beech mast 14 years ago drove rat and stoat levels to plague proportions and savaged the South Island populations of orange-fronted parakeets."

Department of Conservation
Te Papa Atawhai



Battle for our BIRDS
BEECH MAST 2014

www.doc.govt.nz/battleforourbirds

Department of Conservation
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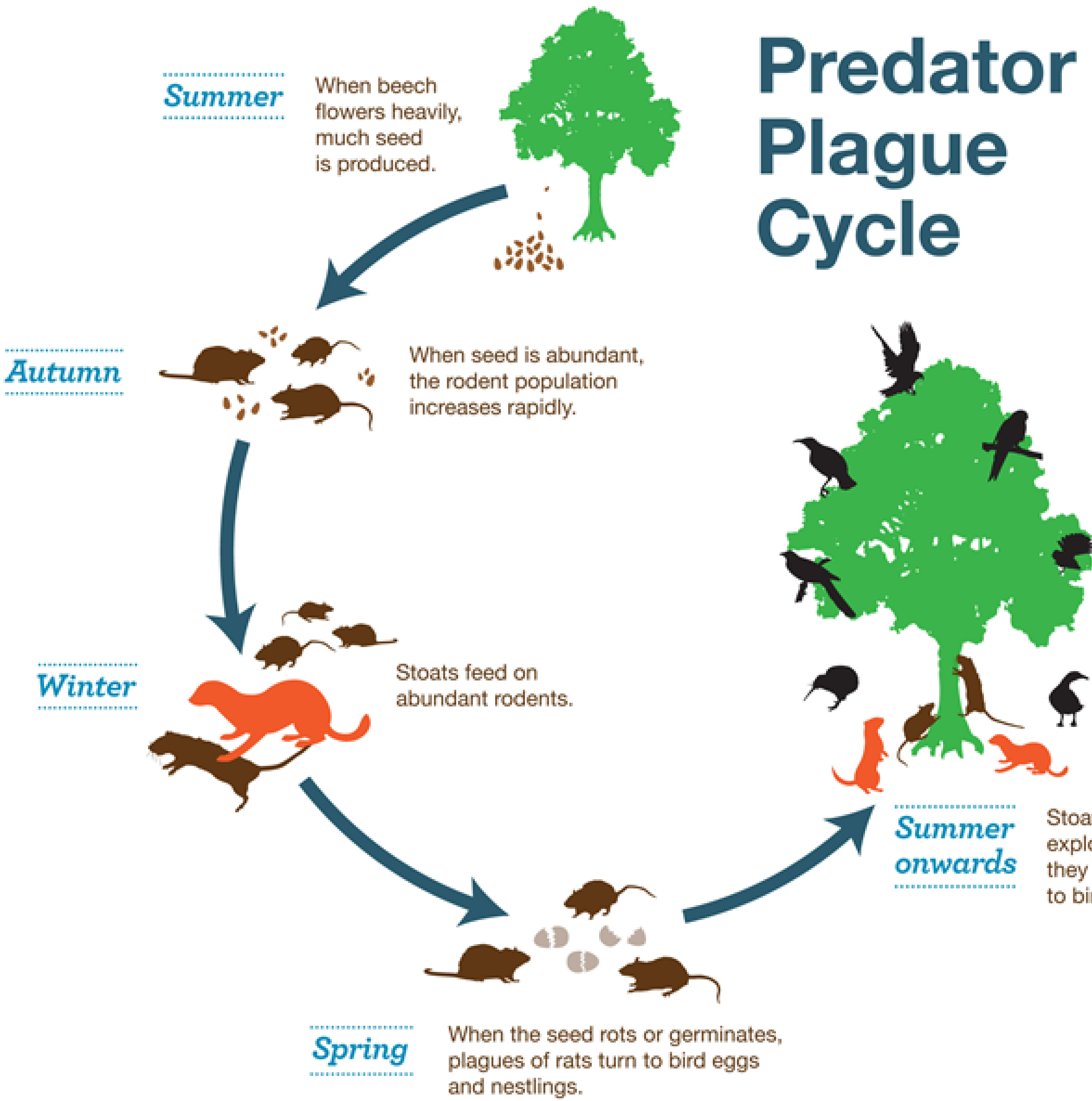

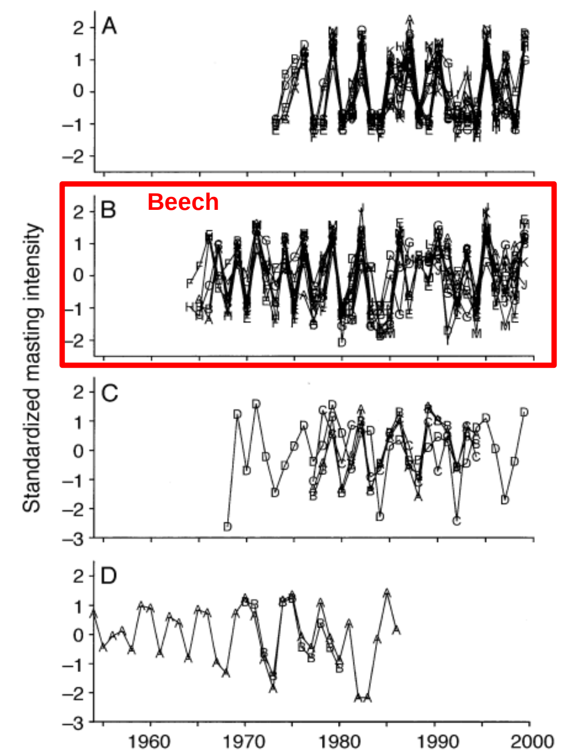

FIG. 1. Standardized time series of masting by (A) *Chionochloa* spp., (B) *Nothofagus* spp., (C) *Phormium* spp ... *Elaeocarpus dentatus*, and (D) *Dacrydium cupressinum* at var-

Schauber et al. 2002

Battle for our BIRDS
BEECH MAST 2014

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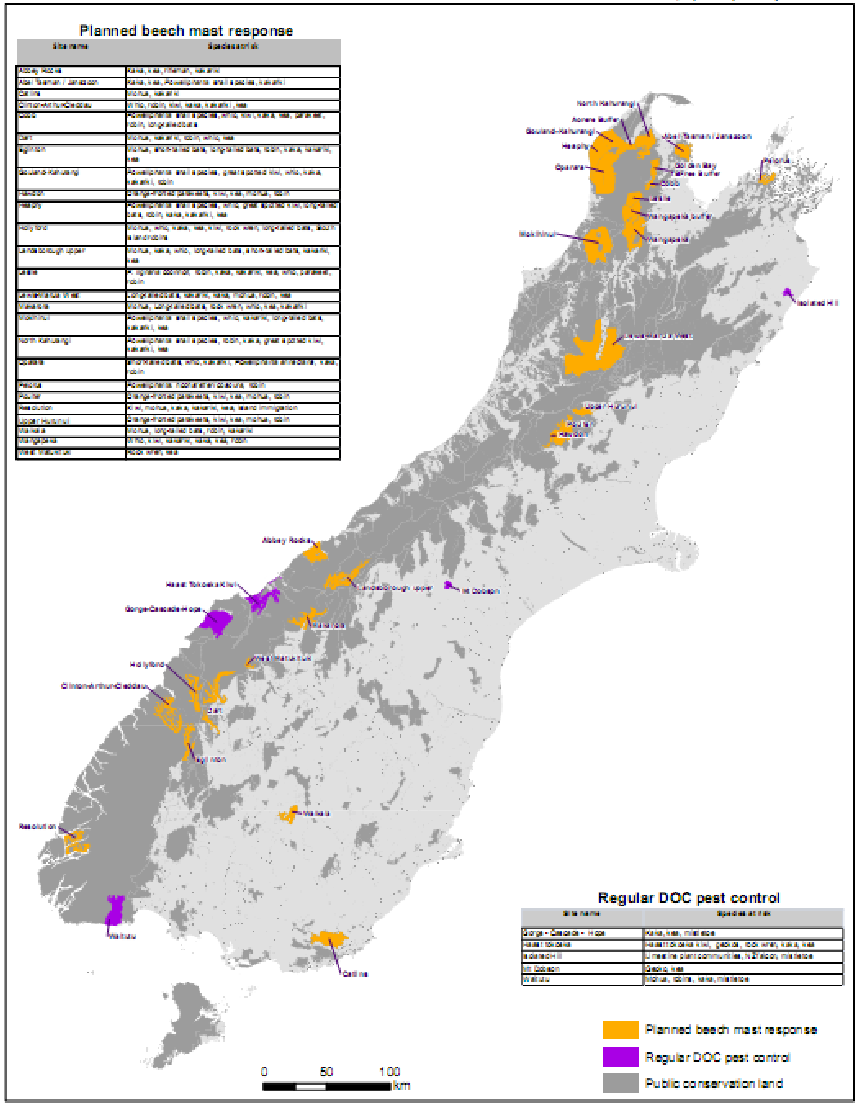
Department of Conservation
Te Papa Atawhai

"Battle for our birds" DOC pest control planed for 2014/15
South Island

Information displayed may be subject to revision



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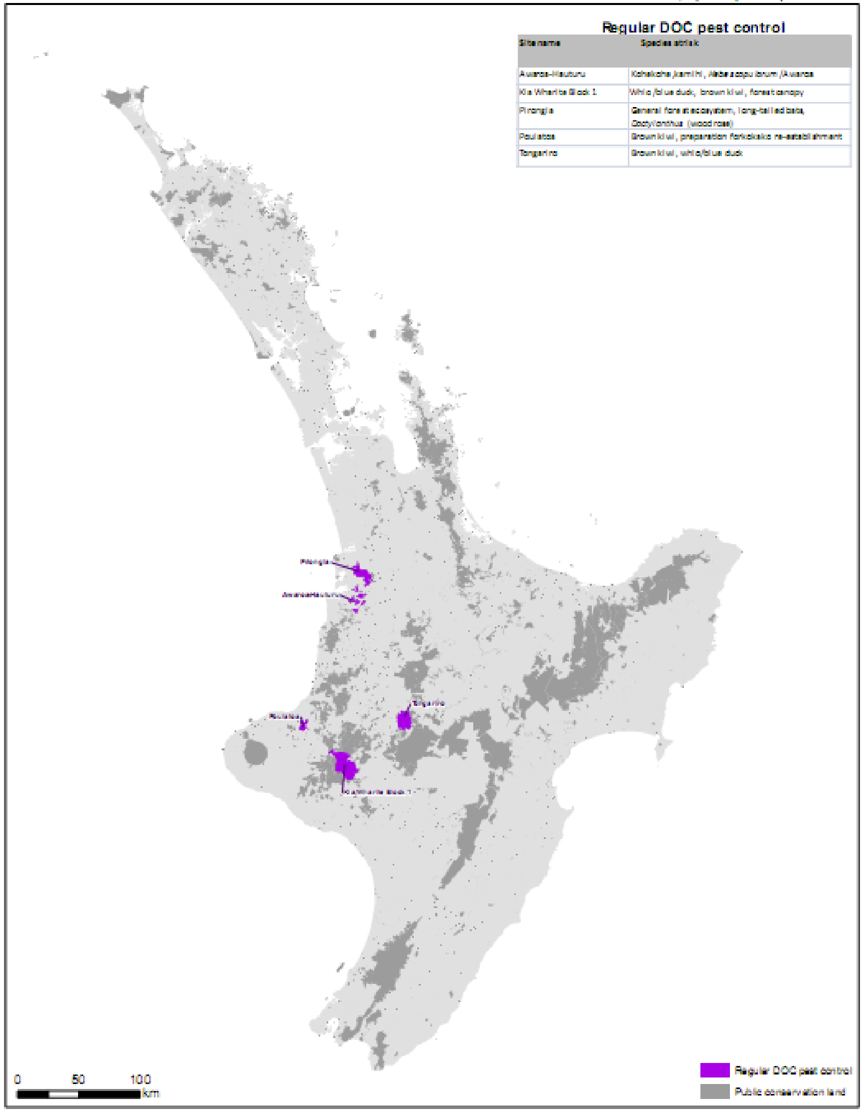


ECOLOGY LETTERS

Ecology Letters, (2012) doi: 10.1111/ele.12020

LETTER

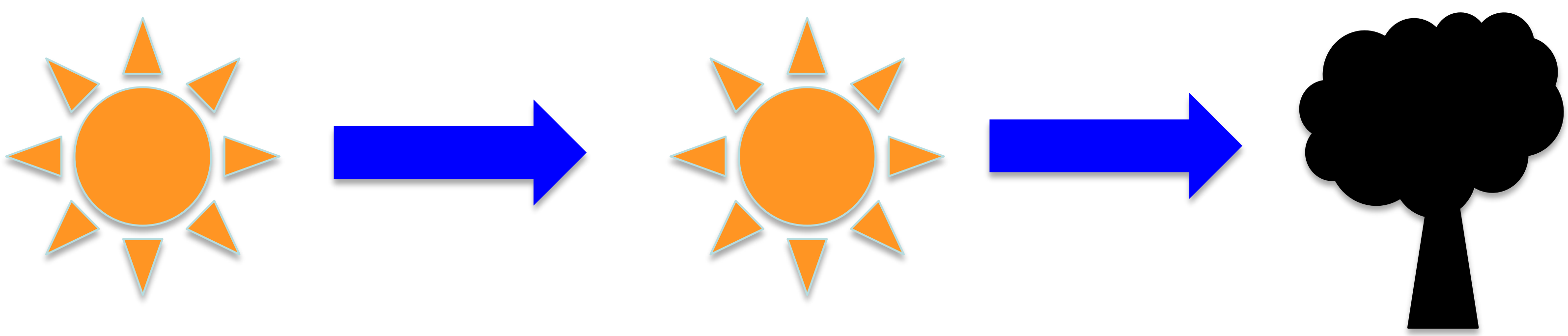
Of mast and mean: differential-temperature cue makes mast seeding insensitive to climate change

Dave Kelly,[1]* Andre Geldenhuis,[2] Alex James,[2] E. Penelope Holland,[3] Michael J. Plank,[2] Robert E. Brockie,[4] Philip E. Cowan,[3] Grant A. Harper,[5] William G. Lee,[3,8] Matt J. Maitland,[5] Alan F. Mark,[6] James A. Mills,[7] Peter R. Wilson[3] and Andrea E. Byrom[3]

The ΔT model

Difference in average summer temperature

$$\Delta T_t = T_{t-1} - T_{t-2}$$



T_{t-2}

2 years ago

T_{t-1}

Last year

Seed this year

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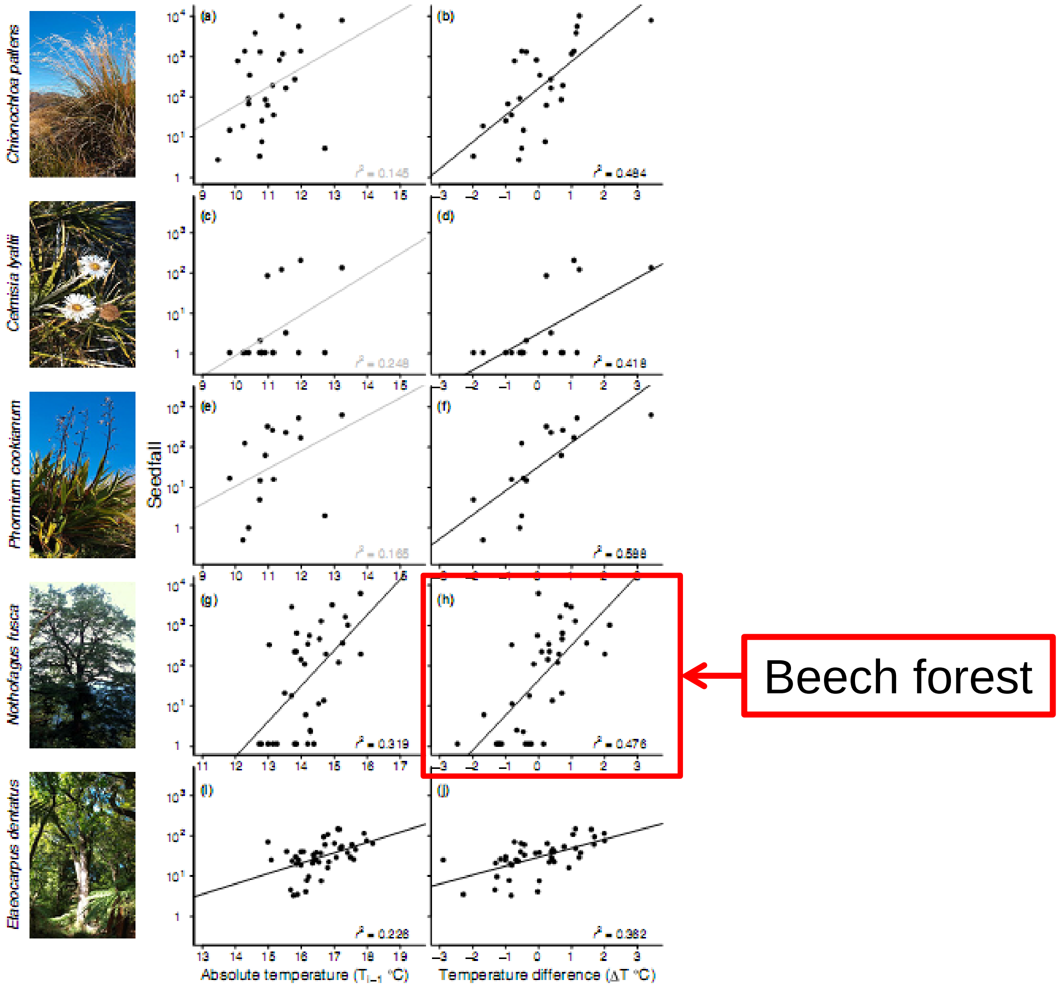
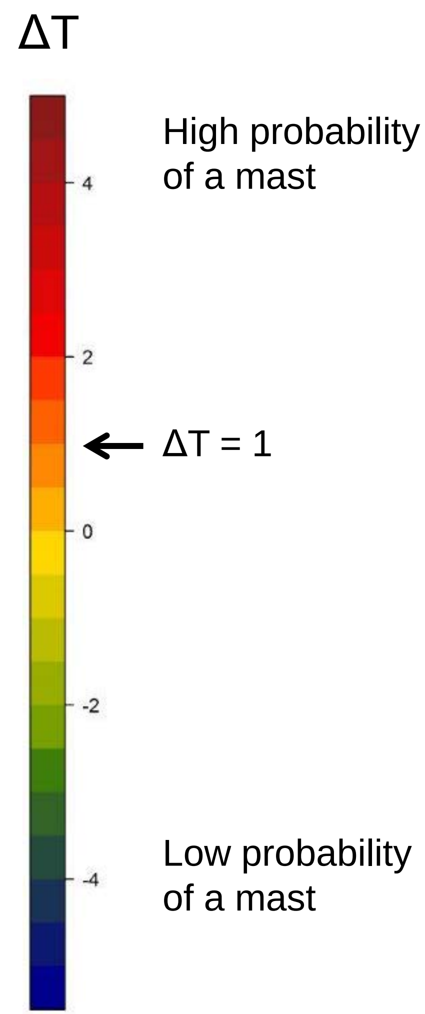
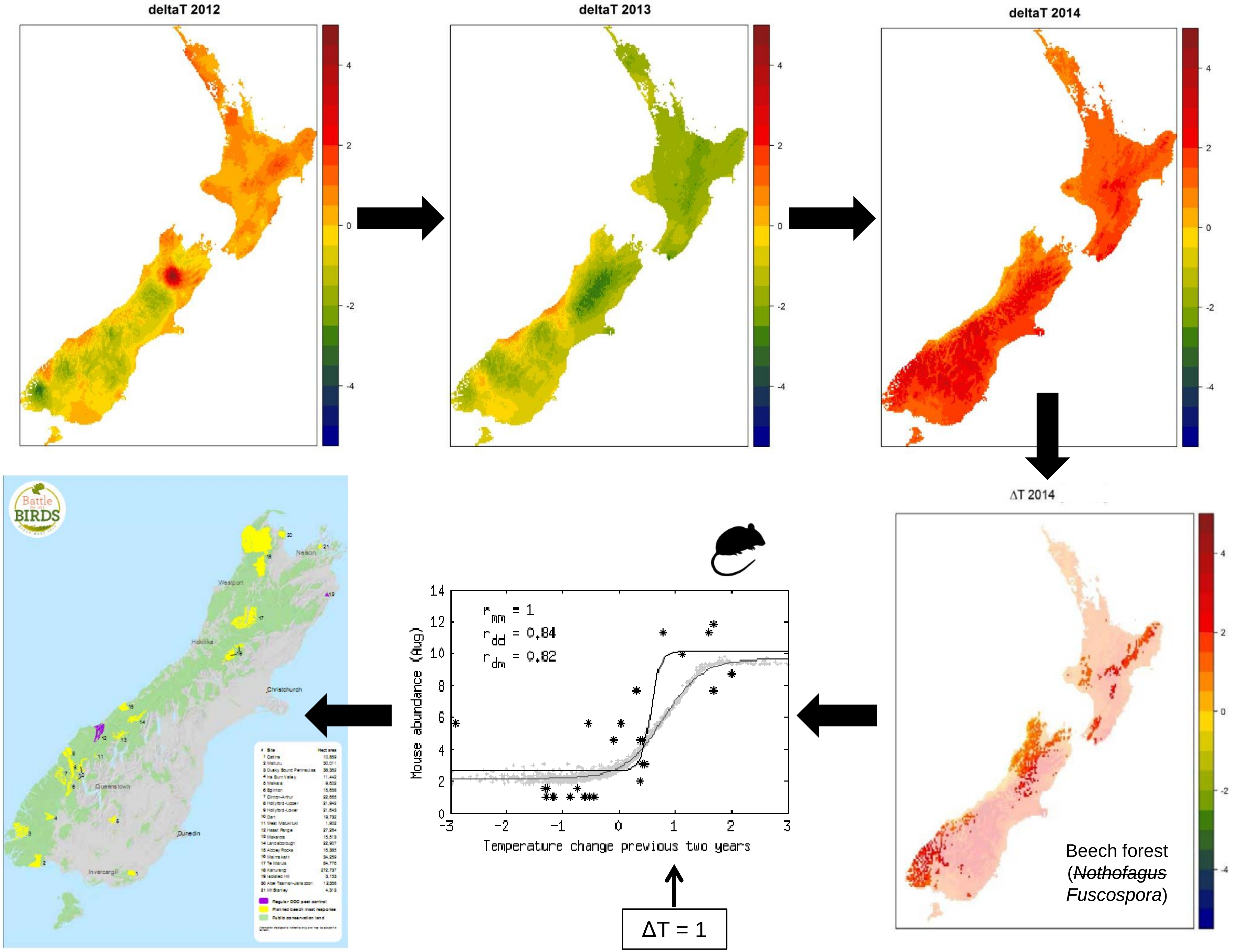


Figure 1 In five diverse plant families, seed crops were better predicted using temperature differential ΔT (summer temperature in the previous year minus summer temperature 2 years before, right column) than previous summer absolute temperature T_{i-1} (centre). The horizontal axes have different minima, but identical ranges. Light grey r^2 values and regression lines were not significant. Summer is January–March in all cases. For information on all 26 datasets see Table 2.




deltaT 2012
deltaT 2013
deltaT 2014
ΔT 2014
4
2
0
-2
-4
Battle for our BIRDS
Nelson
Westport
Hokitika
Christchurch
Queenstown
Dunedin
Invercargill
r_{mm} = 1
r_{dd} = 0.84
r_{dm} = 0.82
Mouse abundance (Aug)
Temperature change previous two years
ΔT = 1
Beech forest
(*Nothofagus Fuscospora*)

Key questions

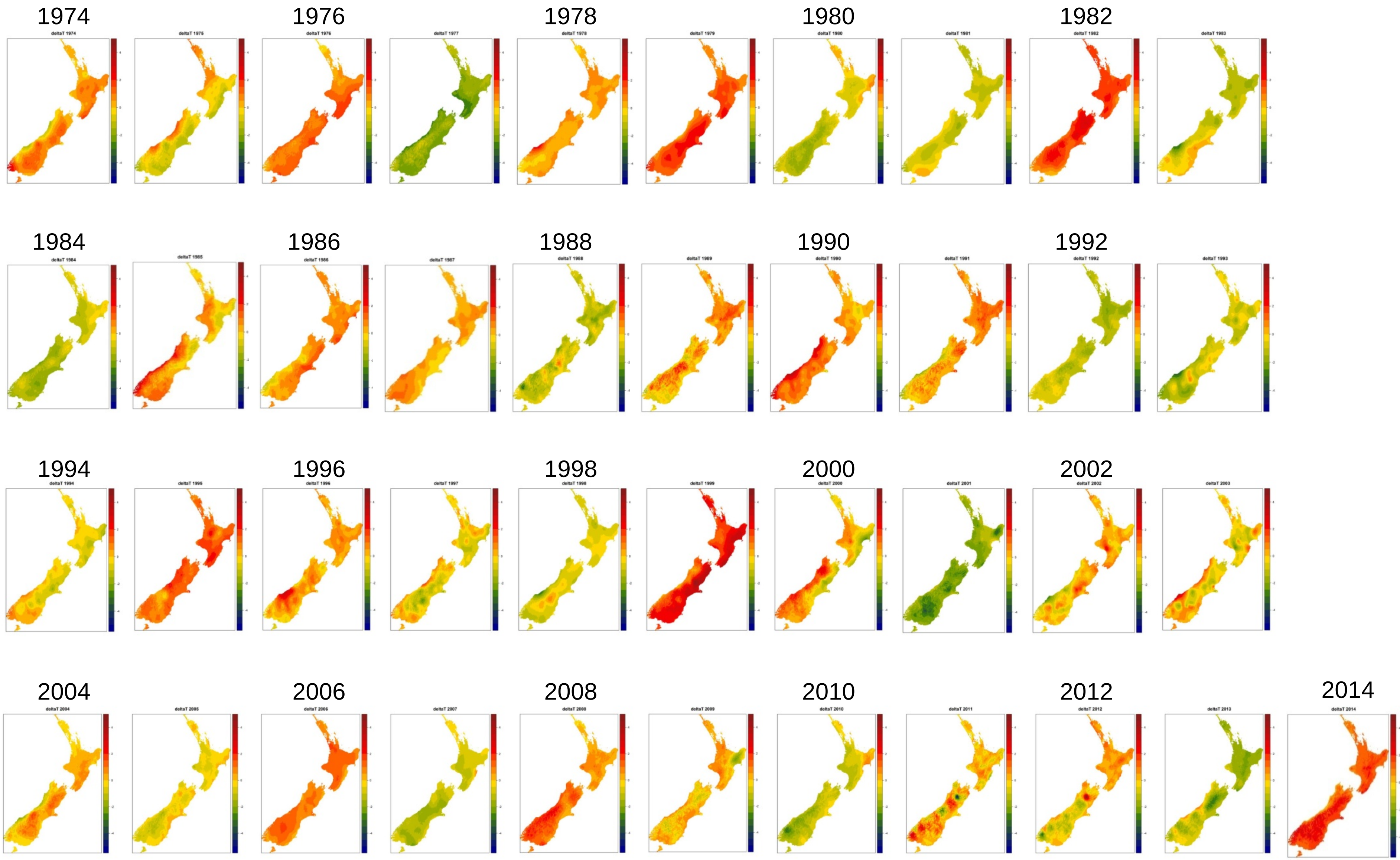
- Are some areas in New Zealand more prone to masts?
- How do mega-masts affect the cost of controlling invasive mammals?

  (‘mega-mast’: > 50% of beech forest predicted to experience a mast)
- How often have mega-masts happened in the past?
- Will the frequency of mega-masts increase in the future?

Mast-prone areas

ΔT maps for 1974-2014

(Data from A Tait, NIWA)



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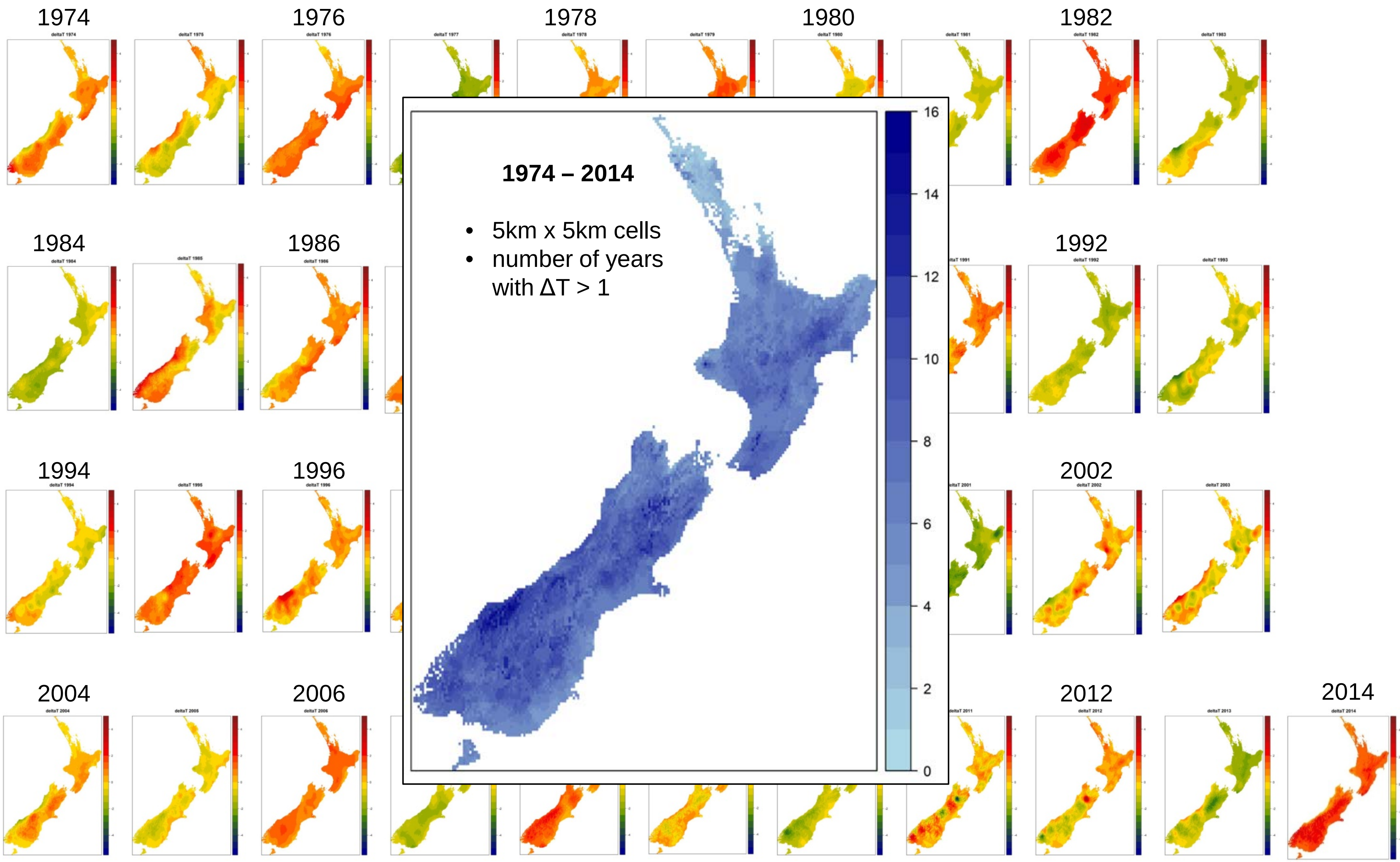


Mega-masts & the cost of pest control

Hon Dr Nick Smith

Minister of Conservation

Media Statement

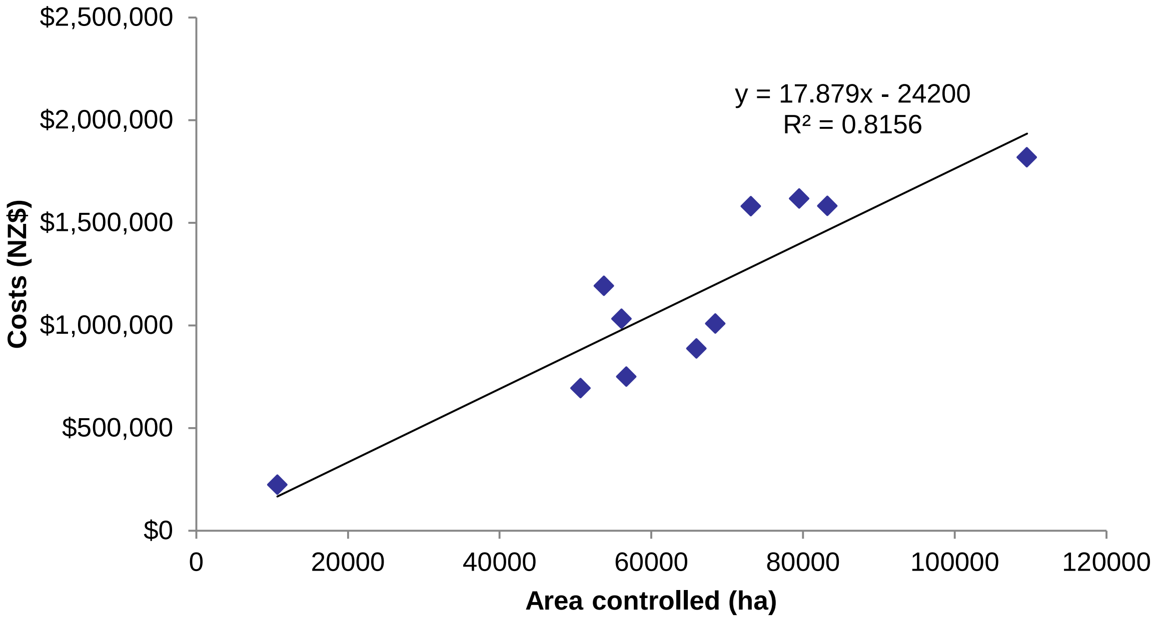
29 January 2014

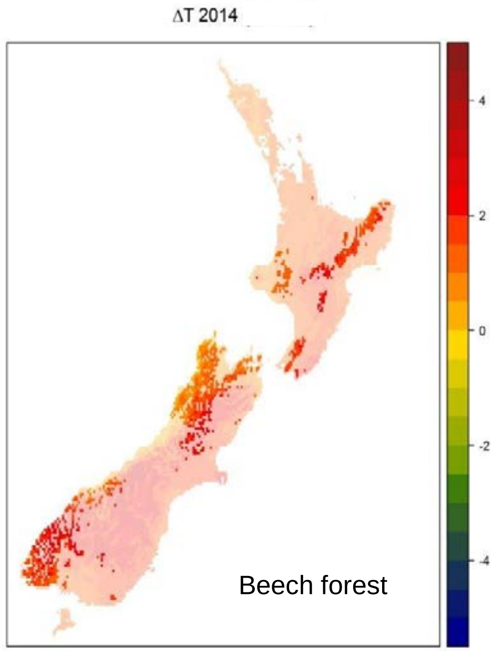
…………… This 'Battle for Our Birds' is going to cost about $21 million over the next five years, out of DOC's annual $335 million budget.

…………… It involves about 500,000 hectares of additional pest control this calendar year to respond to that beech mast. In addition to this, DOC will extend 1080 use by 50,000 hectares a year during the next five years.

Mega-masts & the cost of pest control

Expenditure on aerial 1080 control (DOC data for 2003-2014)



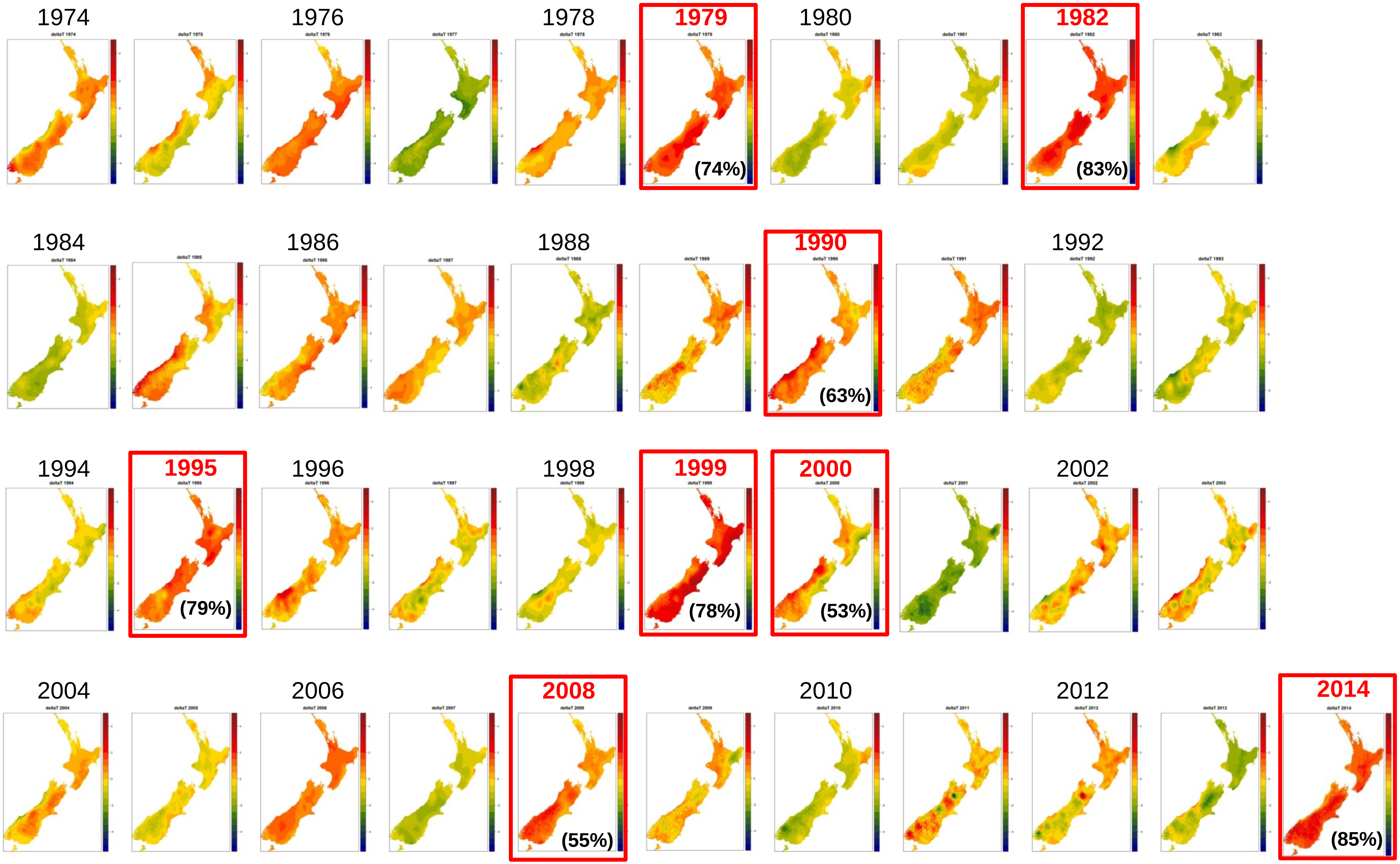


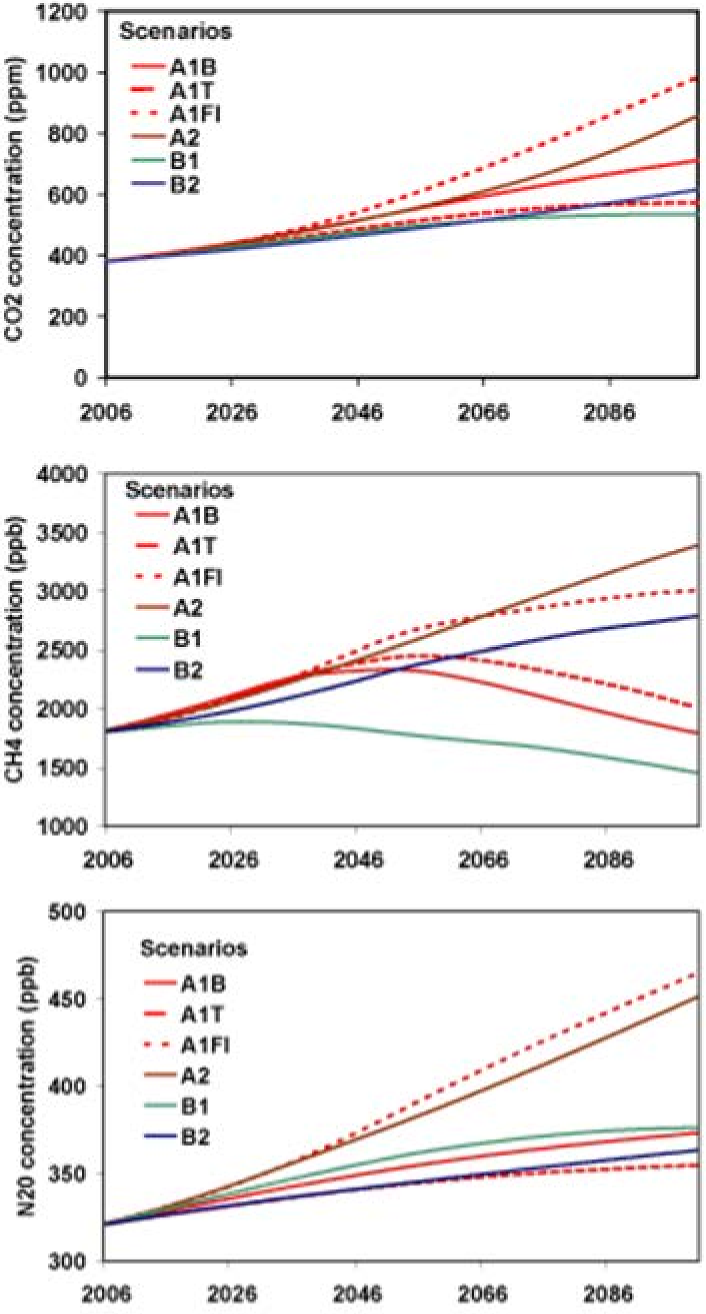
For the 2014 mega-mast:

- 85% of beech forest has ΔT > 1
- 3,632,500 ha of beech forest has high probability of a mast
- estimated cost of aerial 1080 baiting for *all* predicted beech-mast areas = $65M

Frequency of mega-masts

8 out of 41 years with ‘predicted’ beech mega-masts (>50% beech forest with ΔT>1)





Frequency of mega-masts: 2001 – 2100

ΔT projections for 3 climate-change scenarios:

- A2 = regionally oriented economic development
- A1B = intermediate case
- B1 = global environmental sustainability

Intergovernmental Panel on Climate Change's (IPCC) 2000 "Special Report on Emissions Scenarios" (SRES)

Frequency of mega-masts: 2001 – 2100

Calibration for ΔT threshold: *observed* vs. *modelled* temperatures

Observed temperatures	1974-2014	ΔT > 1	5.2 mega-masts per 25 years	←
Modelled temperatures (A2, A1B & B1, with real emission data)	1976-2000	ΔT > 1	2 mega-masts	
		ΔT > 0.75	2 mega-masts	
		ΔT > 0.5	5 mega-masts	←

Frequency of mega-masts: 2001 – 2100

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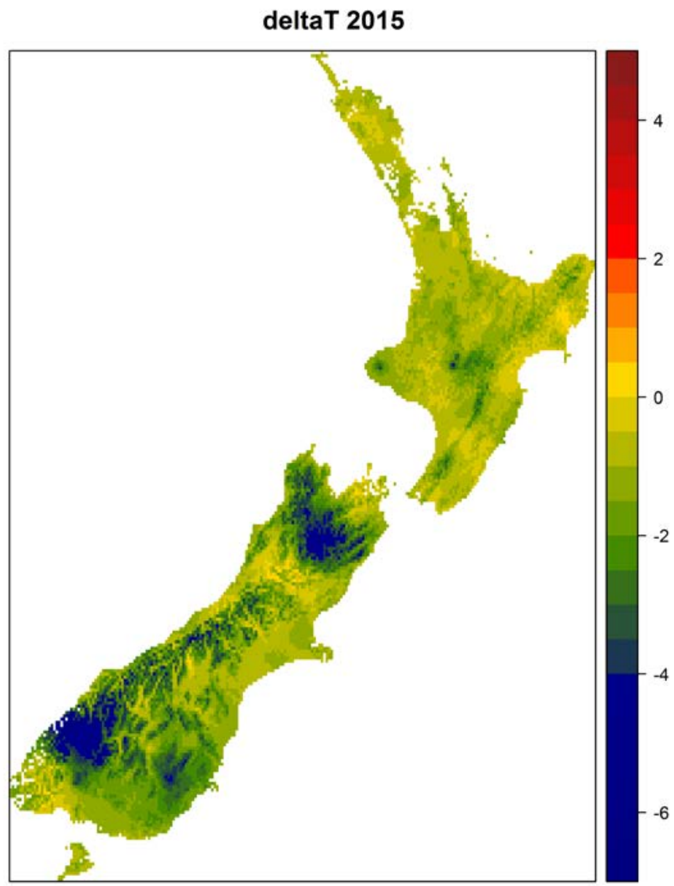
Predicted frequency of mega-masts: 2001 – 2100

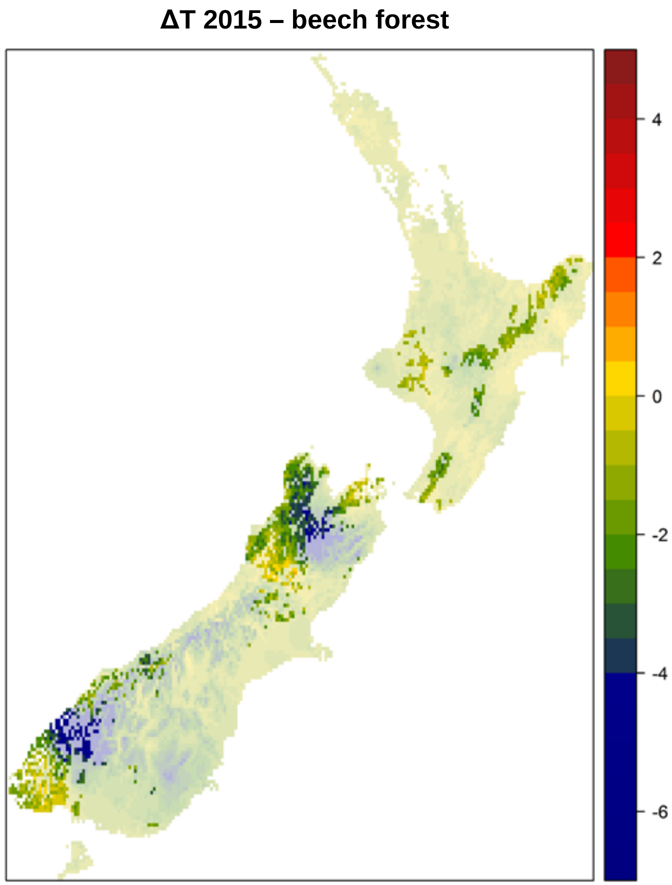
Time period	Number of mega-masts		
	A2	A1B	B1
2001 – 2025	4	5	3
2026 – 2050	6	4	4
2051 – 2075	5	9	6
2076 – 2100	8	4	5
2001 – 2100	23	22	18

Results are based on NIWA projections using the UK Hadley Center atmospheric general circulation model

Forecast for 2015

$\Delta T\ 2015 = T_{summer\ 2014} - T_{summer\ 2013}$



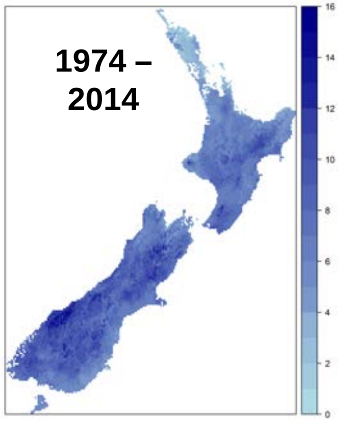


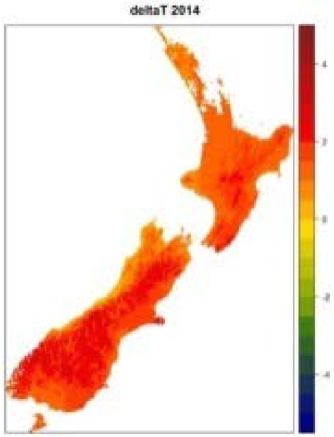
Summary

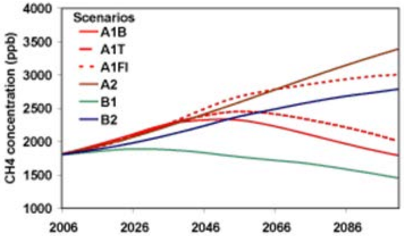
- Some areas are prone to masts

- 'Mega-masts' stretch pest-control budgets

- Climate change could
- affect the frequency of 'mega-masts'
- result in more (**A2**), or fewer (**B1**), episodic high costs of pest control







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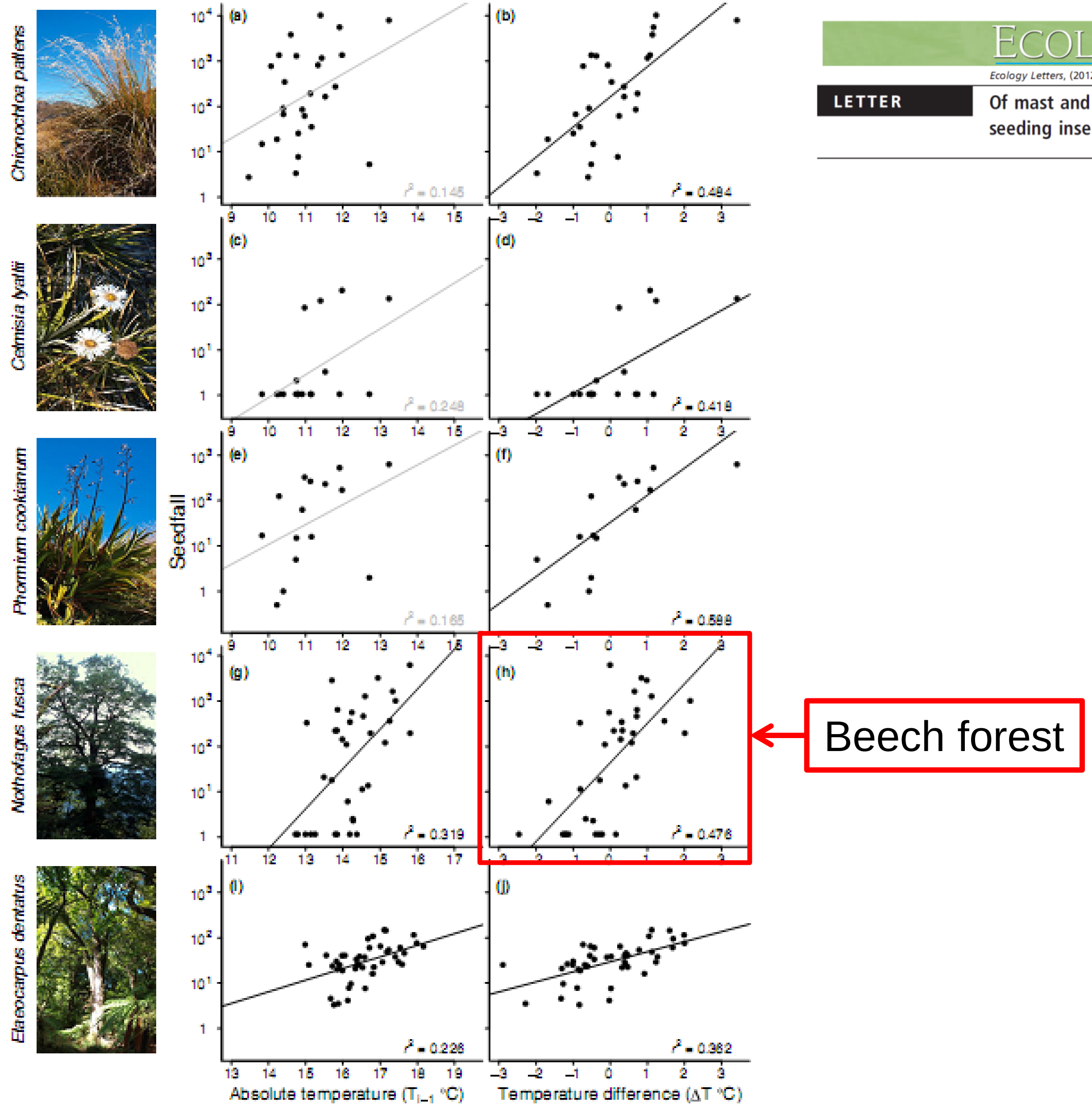

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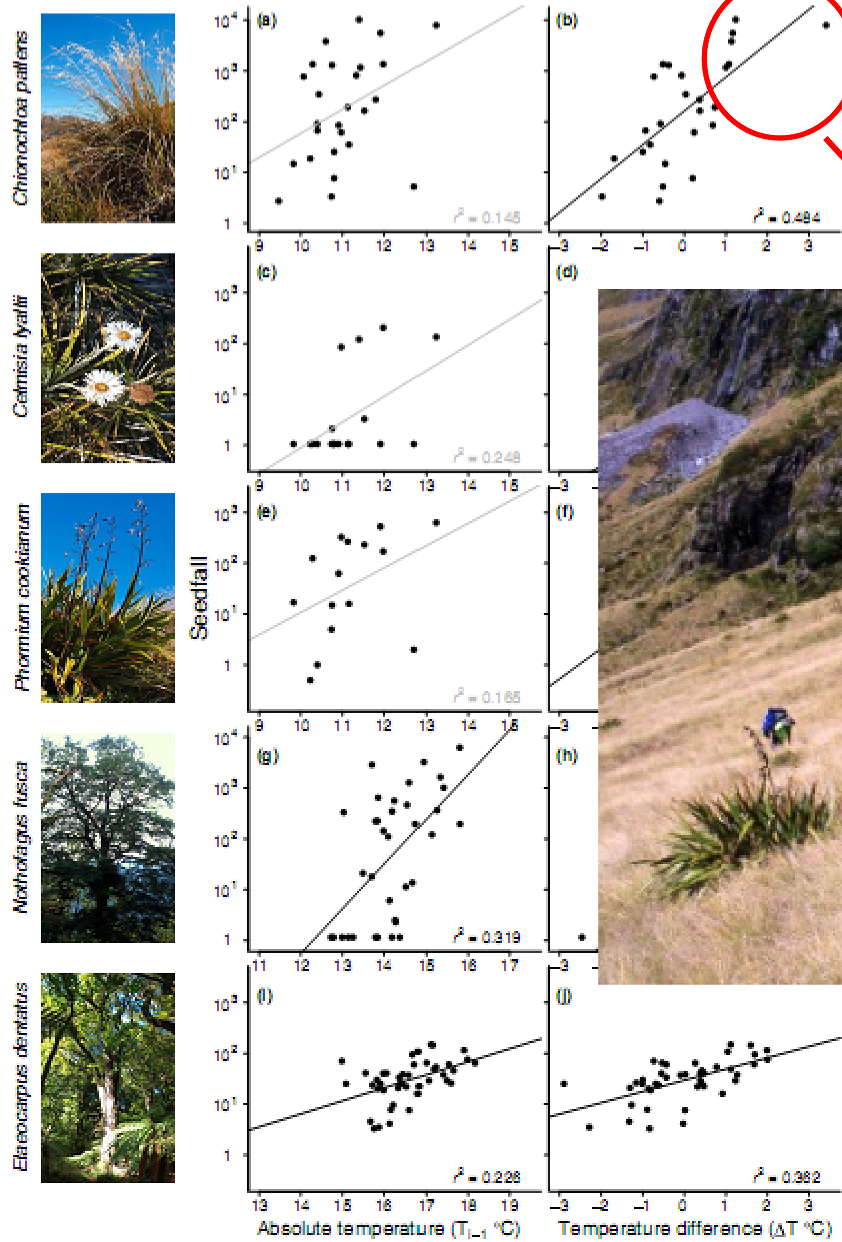

Photo: Jenny Long, DOC

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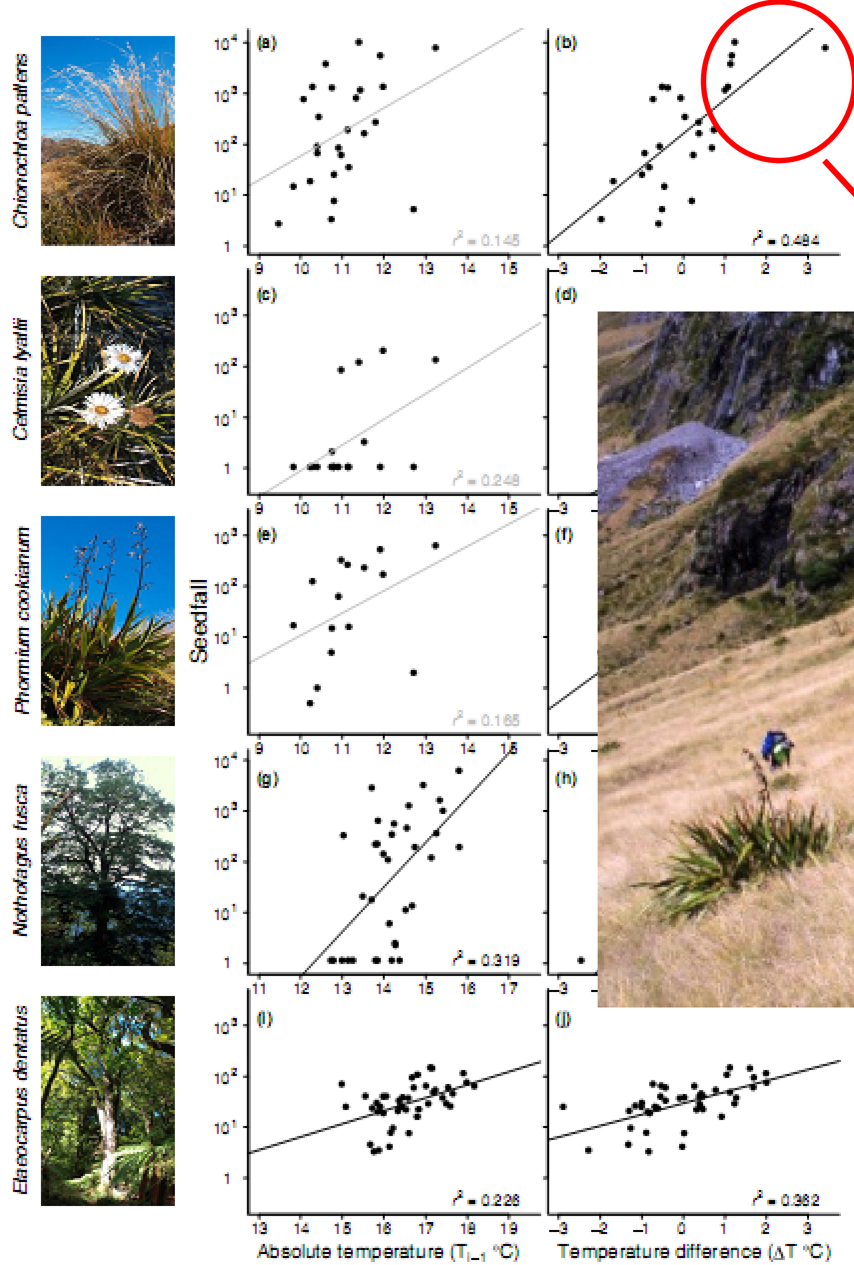

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CSIRO PUBLISHING

www.publish.csiro.au/journals/wr Wildlife Research, 2010, 37, 89–103

Primary and secondary resource pulses in an alpine ecosystem: snow tussock grass (*Chionochloa* spp.) flowering and house mouse (*Mus musculus*) populations in New Zealand

Deborah J. Wilson[A,B] *and William G. Lee*[A]