Two mega-masts in 3 years: is this the new norm?

Roger Pech, Mandy Barron, Andrea Byrom &
Jenny Christie (DOC)

LANDCARE RESEARCH
MANAAKI WHENUA

Kate Gudsell, environment reporter (kate.gudsell@radionz.co.nz):

4:35 pm on 7 May 2016

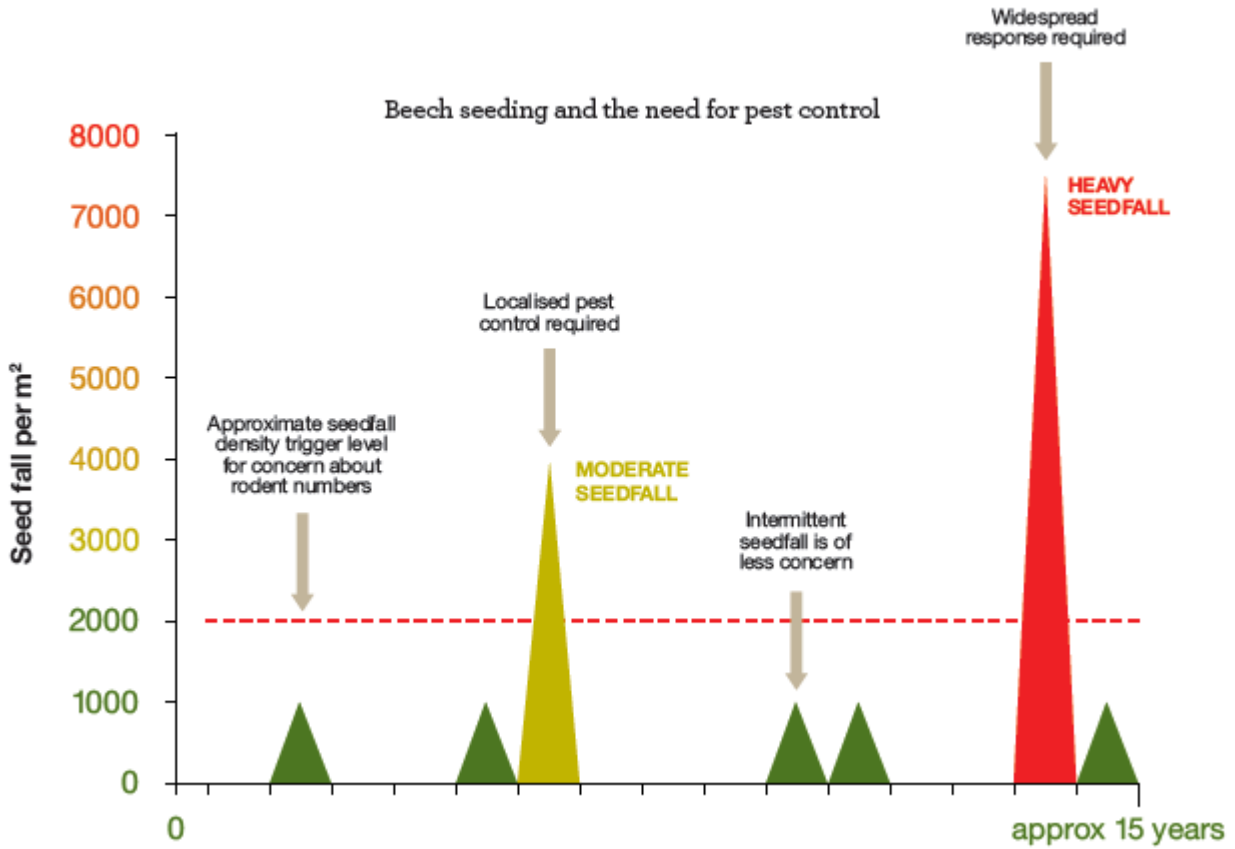
Minister announces largest ever 1080 drop

The government has today announced $20.7 million of new operating funding as part of the 2015/16 budget.

10:18 am on 8 May 2016

Conservation Minister Maggie Barry said this year's much heavier seed drop was in response to climate change.

The Department of Conservation (DOC) needs more secure long-term term funding as climate change boosts rat and stoat populations, the Green Party says. The party says climate change will increase the frequency of mast years, in which more seeds drop.



Department of Conservation
Te Papa Atawhai

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

LETTER

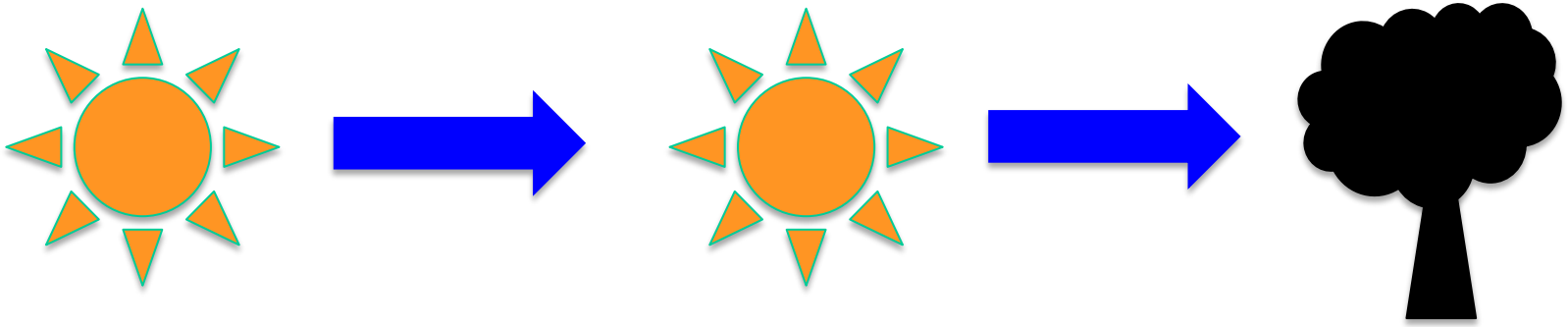
Of mast and mean: differential-temperature cue makes mast seeding insensitive to climate change

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

ECOLOGY LETTERS

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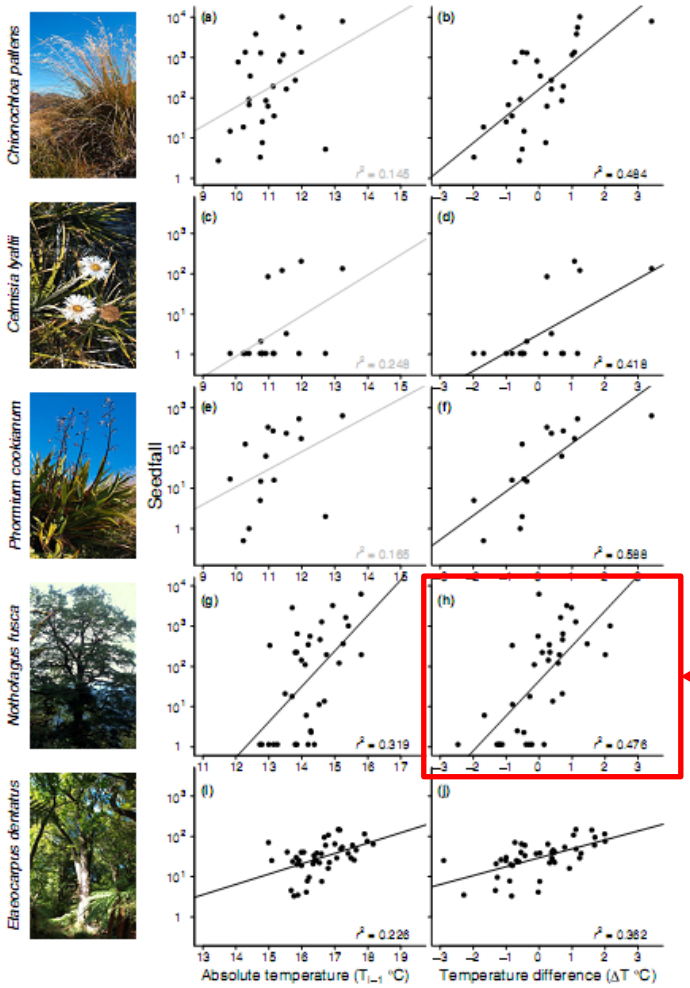
LETTER

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



Beech forest

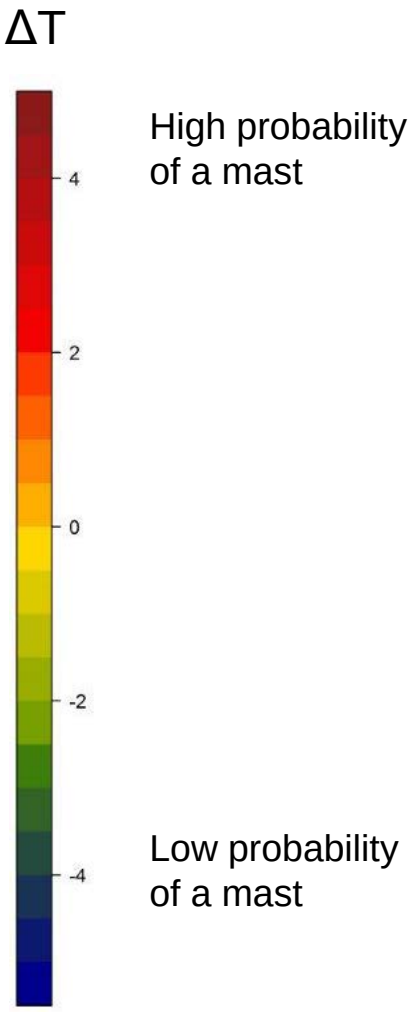


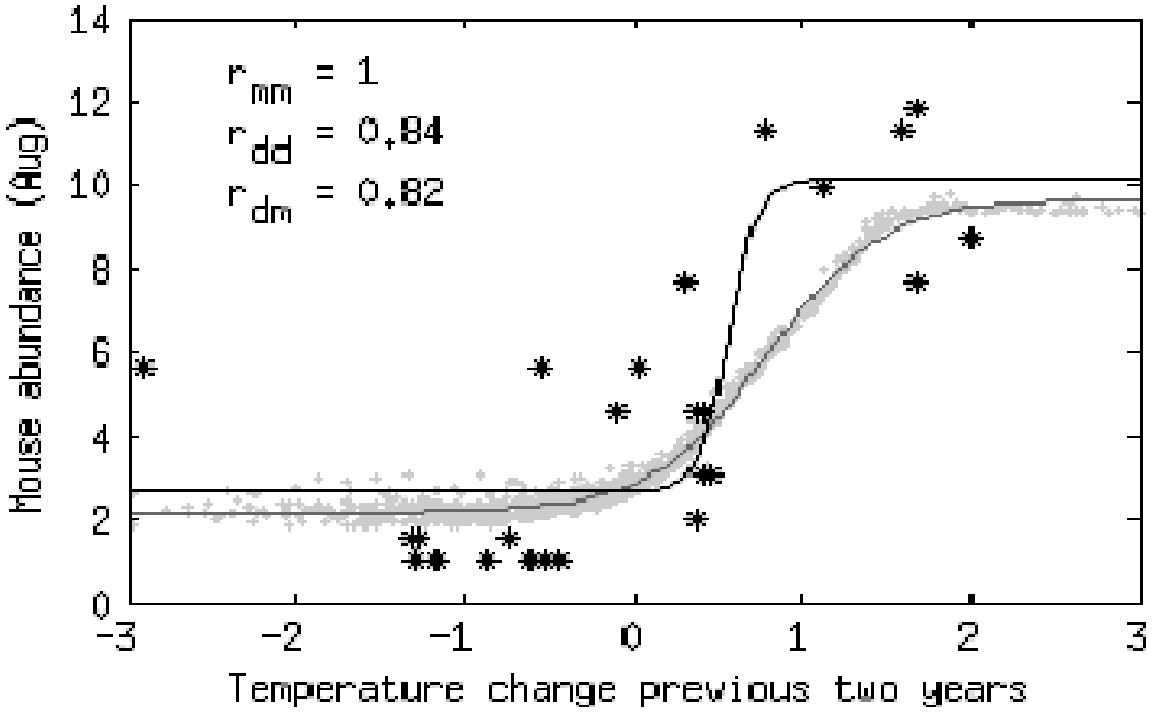
Figure 1 In five diverse plant families, seed crops were better predicted using temperature differential ΔT (summer temperature in the previous year minus summer temperature 2 years before, right column) than previous summer absolute temperature T_{t-1} (centre). The horizontal axes have different minima, 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.

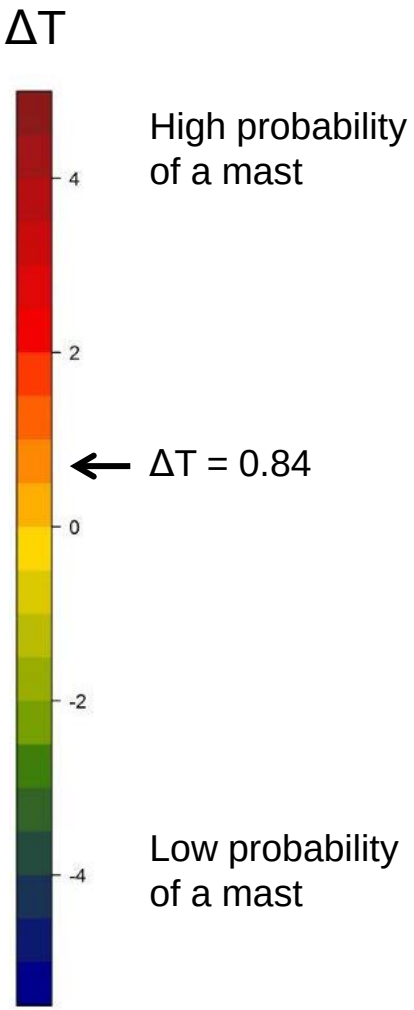
PLOS ONE | DOI:10.1371/journal.pone.0119139 March 18, 2015

RESEARCH ARTICLE

Climate-Based Models for Pulsed Resources Improve Predictability of Consumer Population Dynamics: Outbreaks of House Mice in Forest Ecosystems

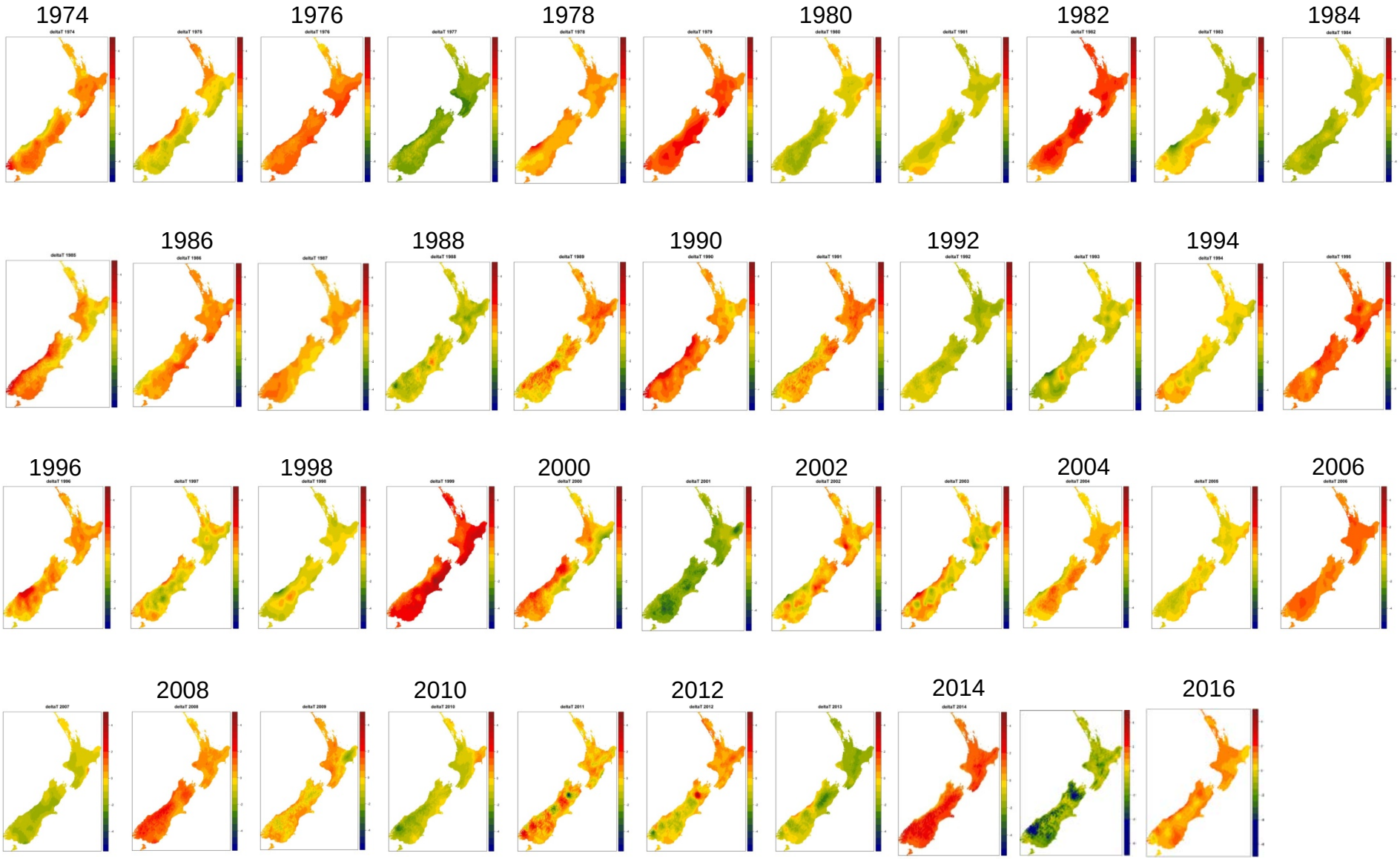
E.P. Holland, A. James, W.A. Ruscoe, R.P. Pech, A.E. Byrom



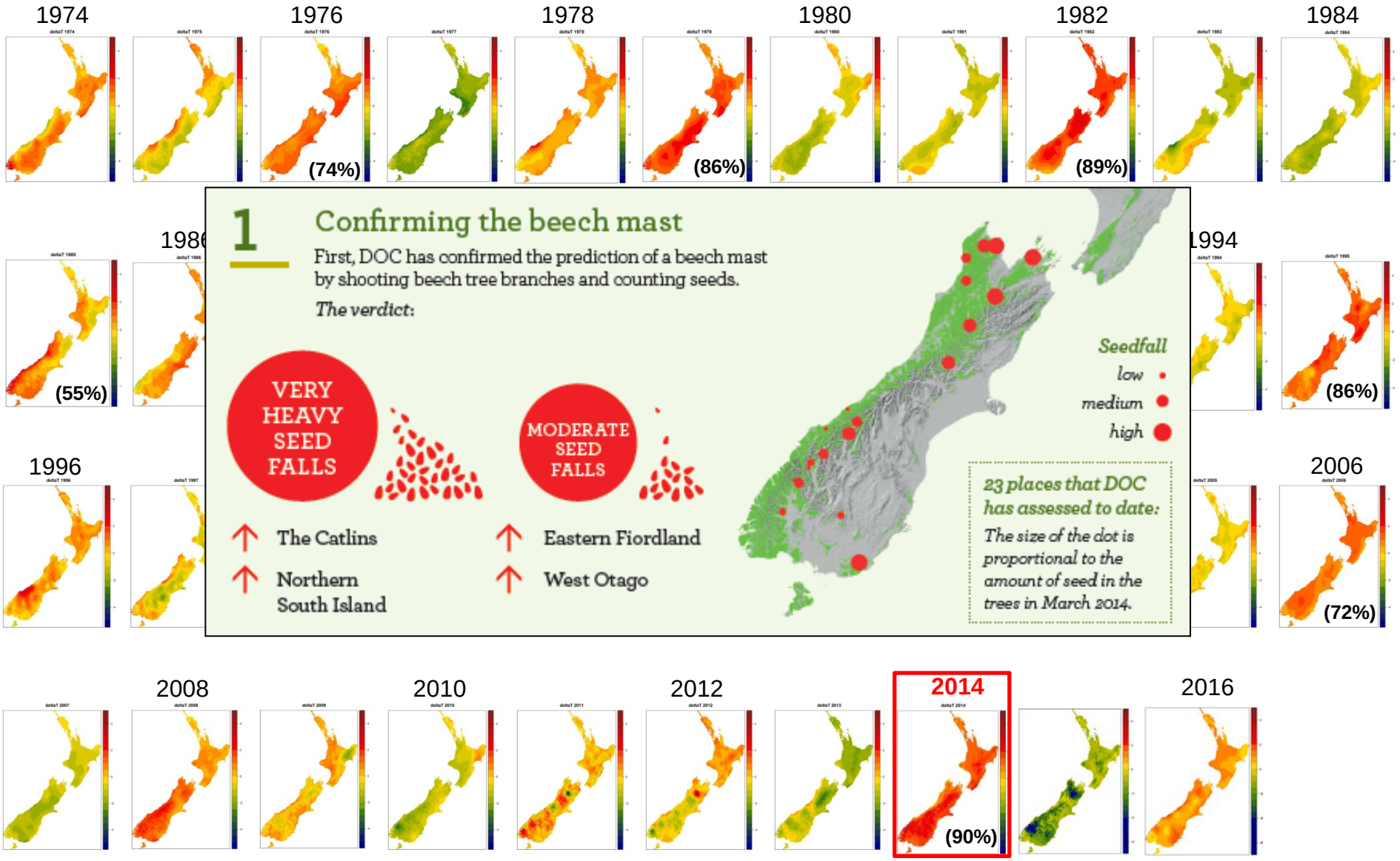


Occurrence of masts

ΔT maps for 1974-2016

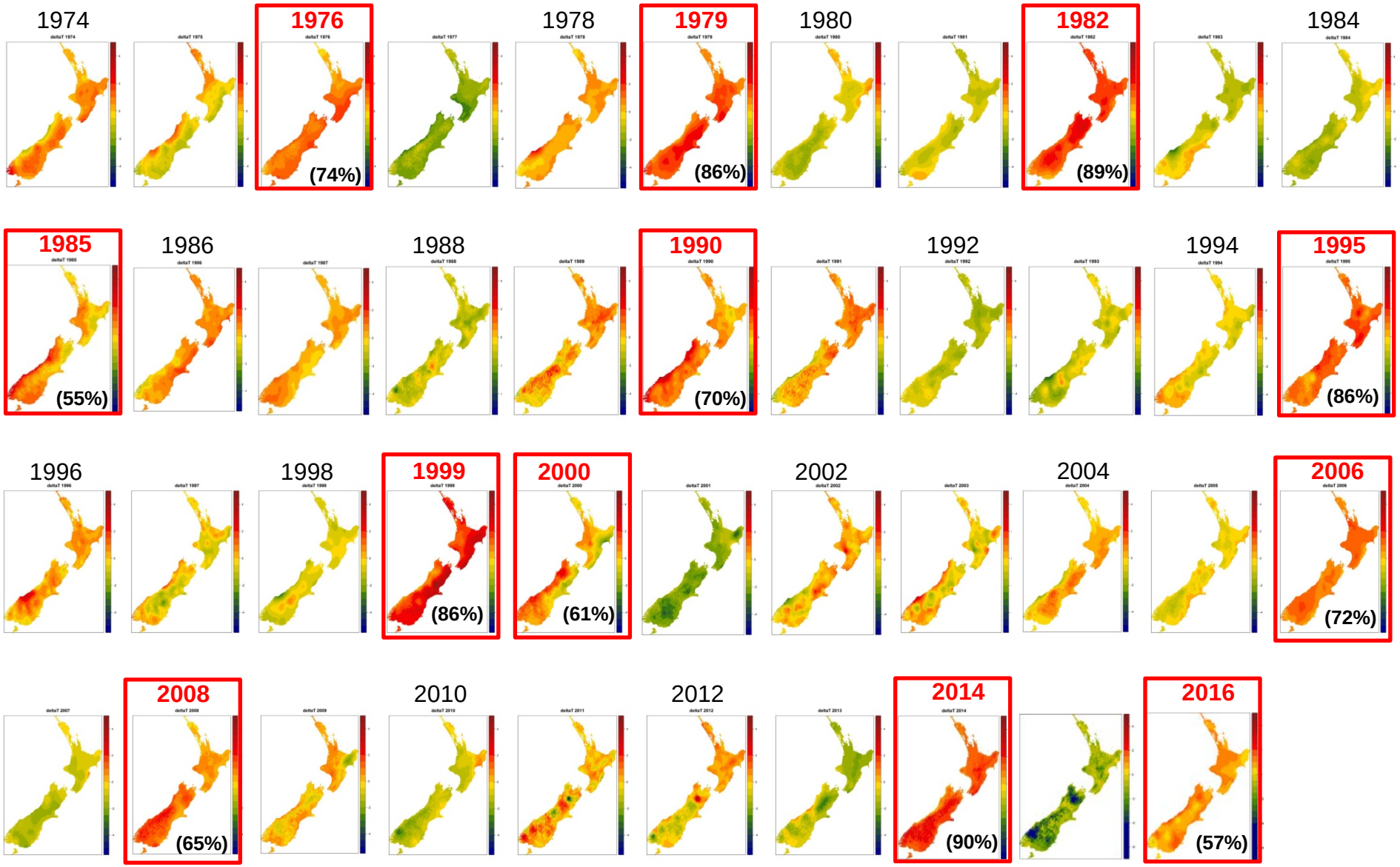


ΔT prediction: 90% of beech forest likely to mast in 2014

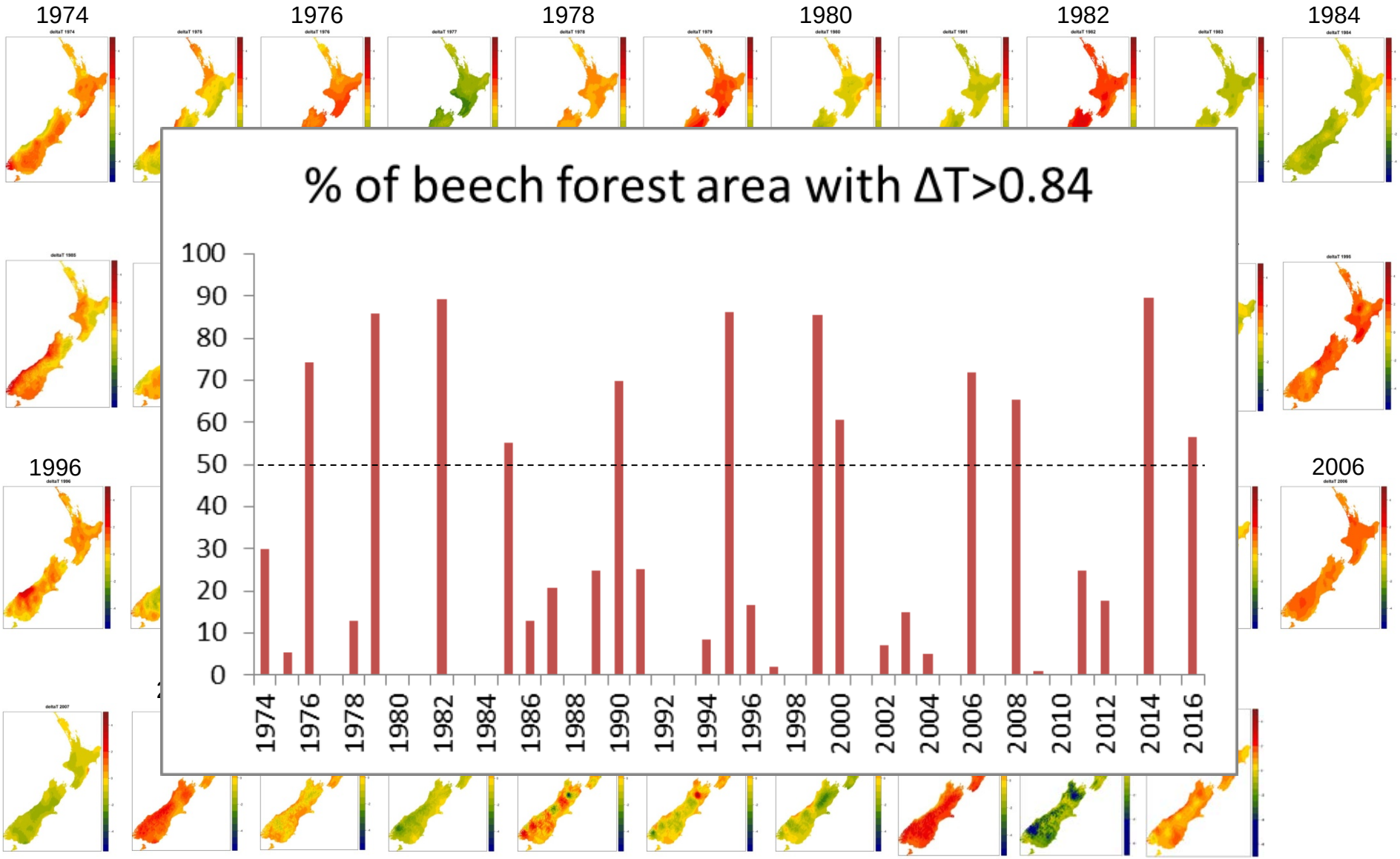


Mega-masts during 1974-2016

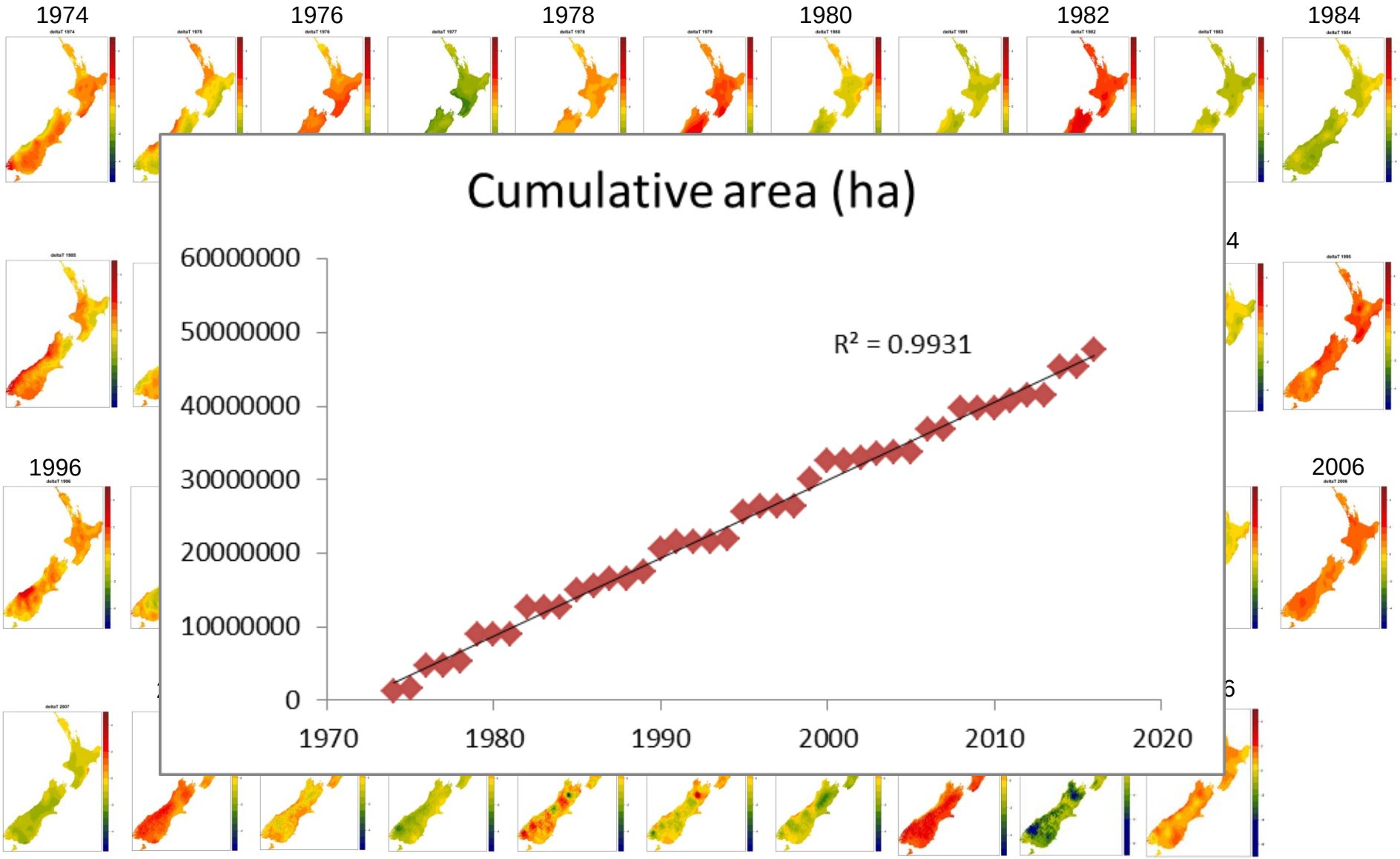
Years with 'predicted' beech mega-masts (>50% beech forest with ΔT>0.84)

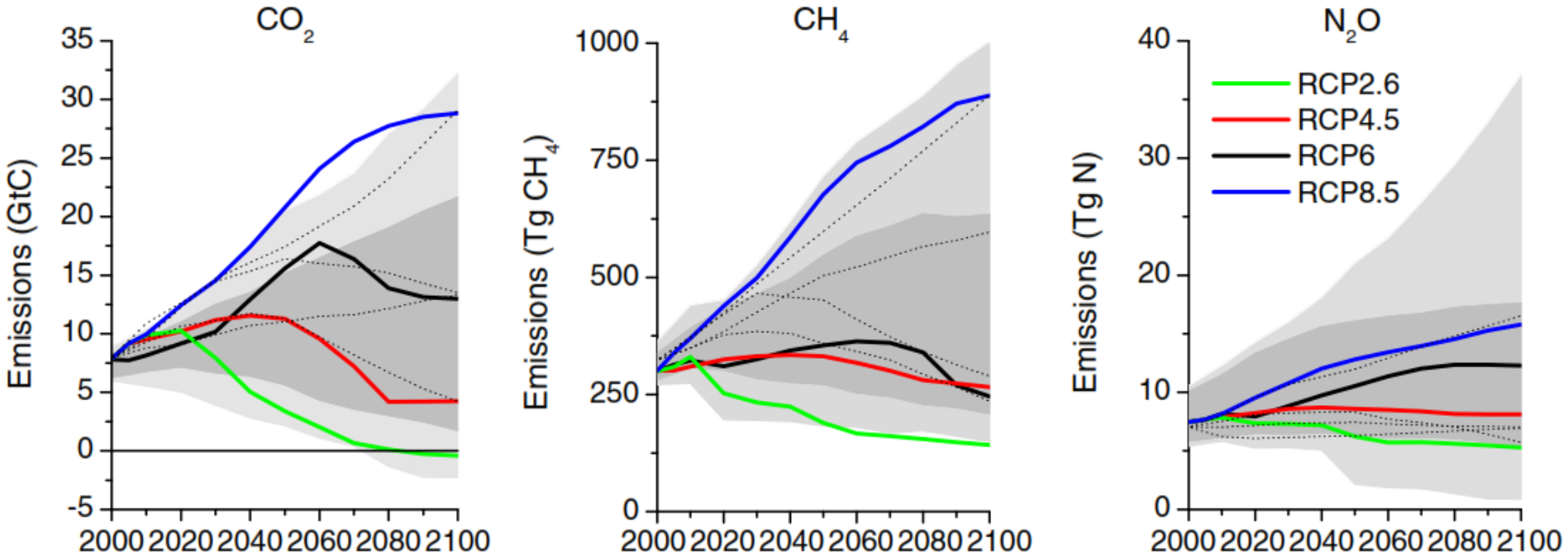


Are masts increasing?



Are masts increasing?





Van Vuuren *et al. Climate Change* (2001) 109:5–31

Global climate to 2100

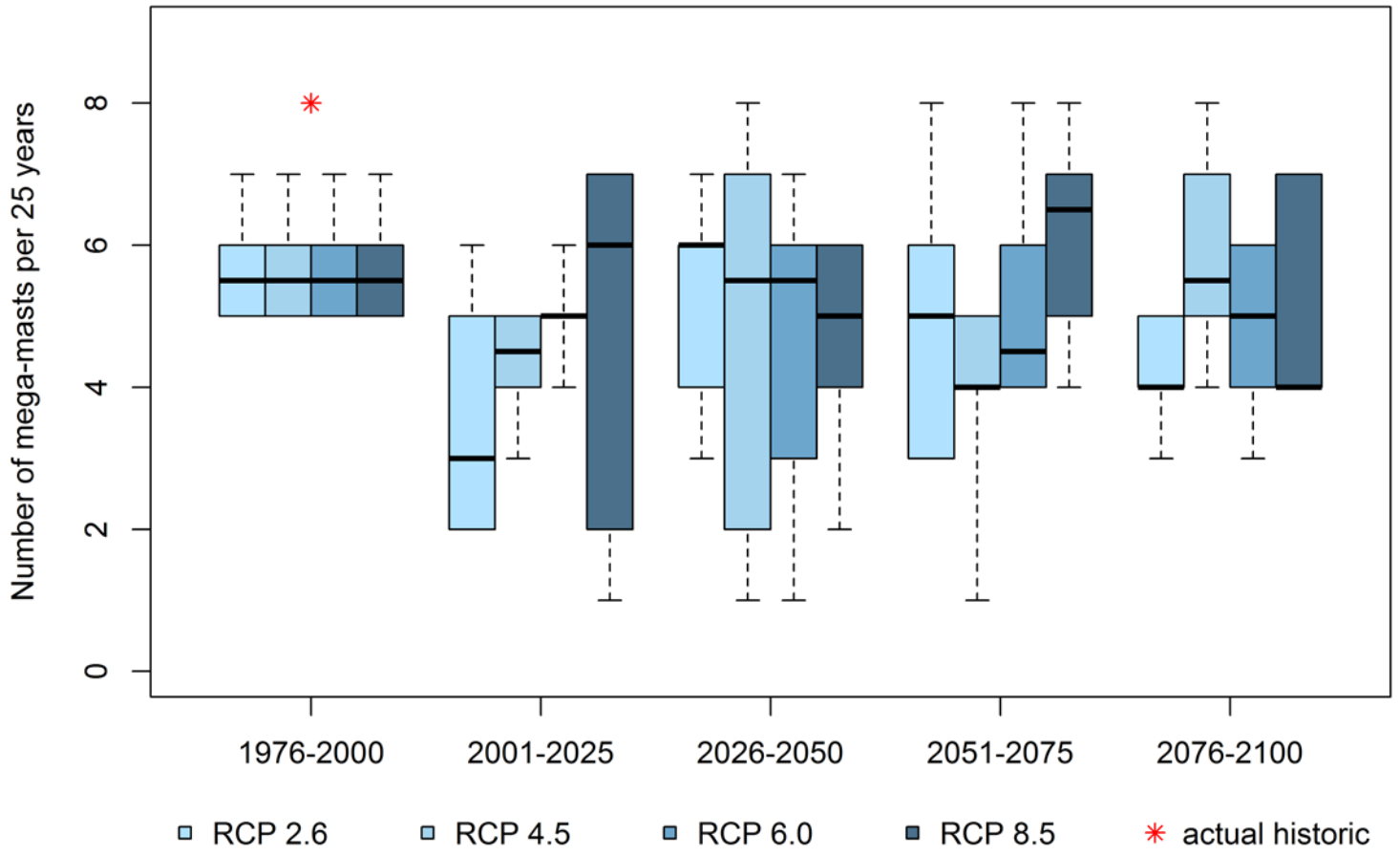
4 'Representative Concentration Pathways':

- **RCP 8.5** = very high greenhouse gas emissions
- **RCP 6** = high level stabilisation
- **RCP 4.5** = intermediate stabilisation
- **RCP 2.6** = declining greenhouse gas emissions

6 global climate models:

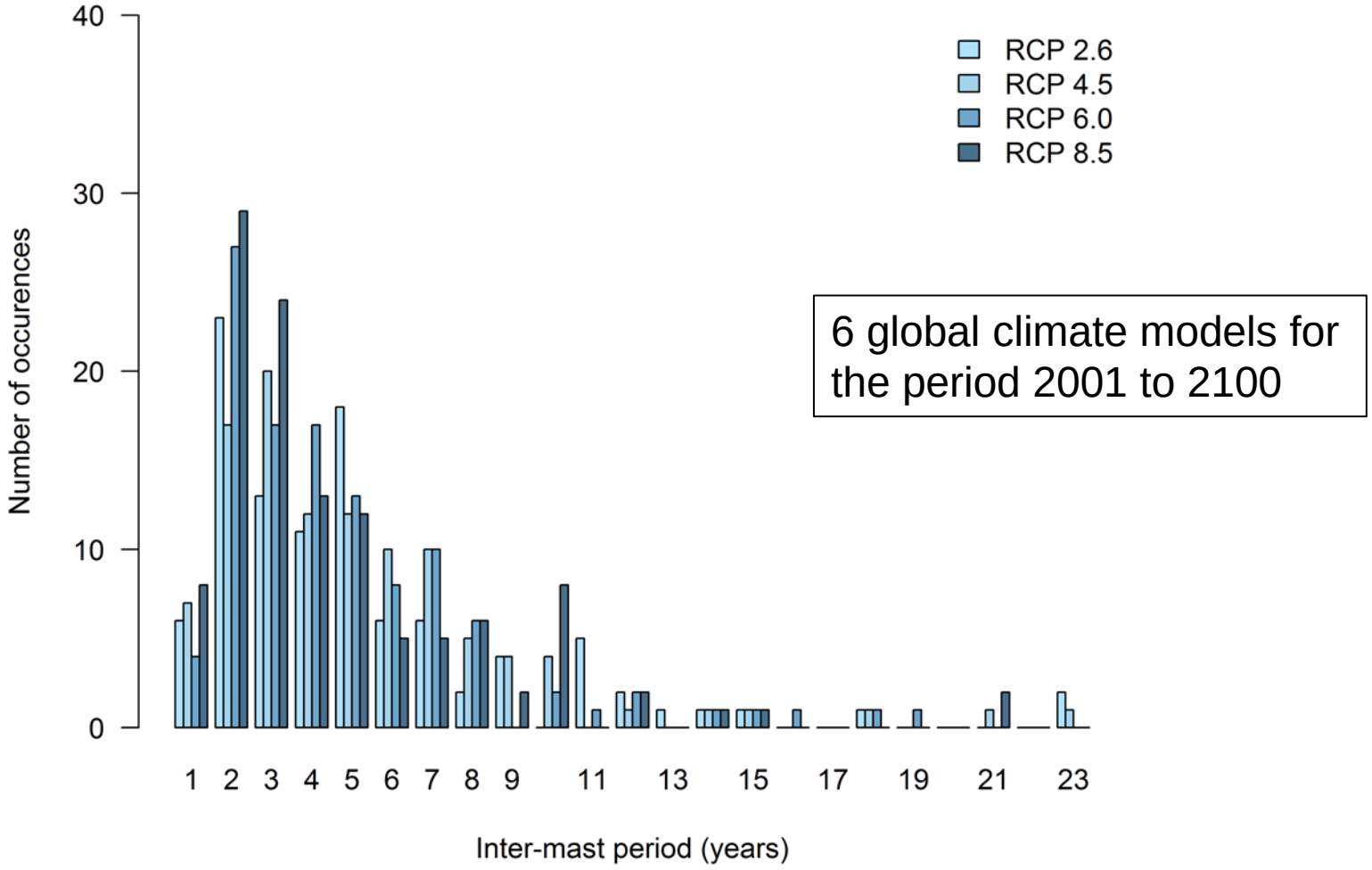
BCC-CSM1.1, CESM1-CAM5, GFDL-CM3, GISS-EL-R, HadGEM2-ES, NorESM1-M

Will climate-change affect the frequency of mega-masts?



Differences between global climate models > differences between RCPs

Will climate-change affect intervals between mega-masts?



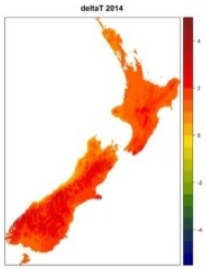
6 global climate models for the period 2001 to 2100

Summary

Management up to 2016:

- ‘Battle for our Birds’ round 1 in 2014
- ‘Battle for our Birds’ round 2 in 2016: approx. $21M for pest control
- 12 mega-masts in beech forest during the last 40 years
- Potential costs of pest control: $42M - $68M *per event*

ΔT model



Predictions to 2100:

- Mega-masts will continue to occur sporadically: return time = 1 → 20+ years
- High levels of uncertainty in climate projections

  → no clear affect of climate-change on the frequency of mega-masts
- ΔT model provides essential early warning of the likely extent of a mast

Prediction for 2017