

Climate Change

*impacts on biodiversity
and risks to ecosystems*

Graeme Newell, Matt White & Peter Griffioen

Questions

How resilient are species to a changing climate ?

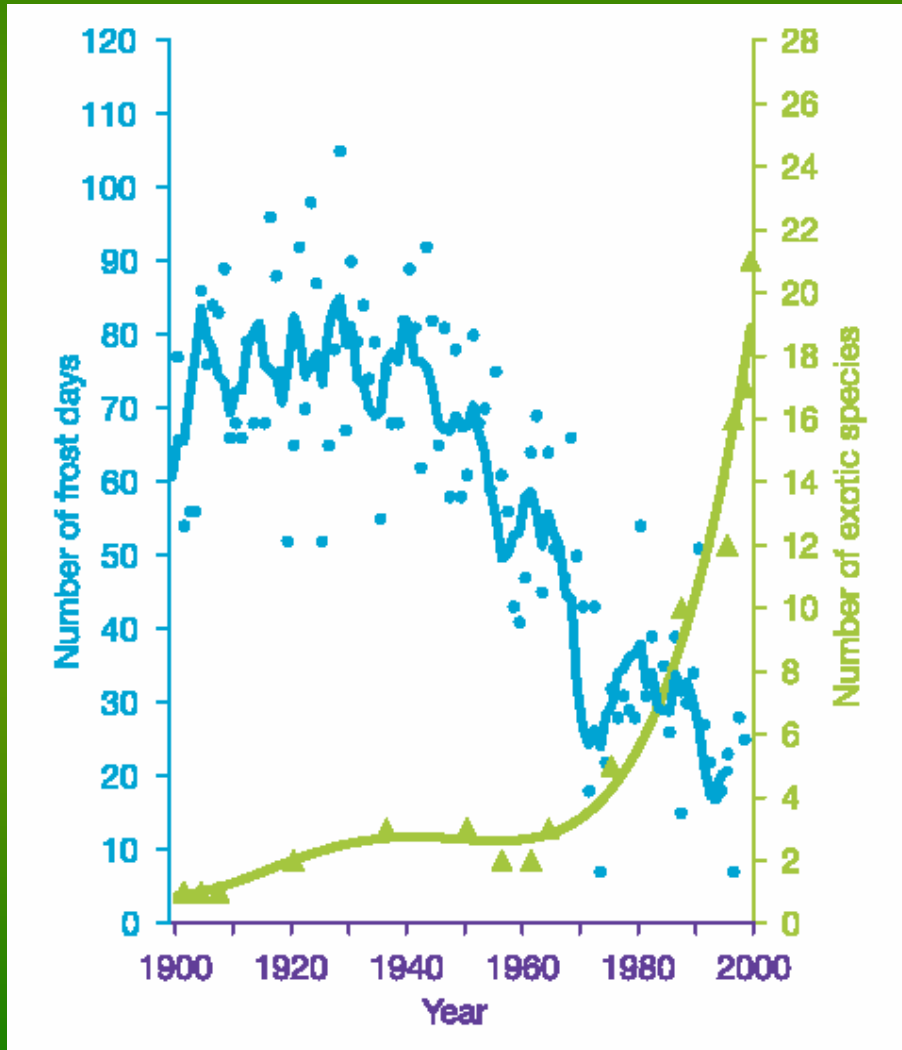
How fast will species need to adapt or move ?

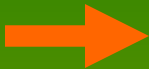
When? Over what time period ?

... effect on biodiversity ?

- Spring getting earlier
..... av. 2.3 days / decade
- Species distributions moving towards poles
..... av. 6.1 ± 2.4 km / decade
- or moving 'upwards'
..... $\sim 6 \pm 2$ m / decade

Are plant communities changing?



Indigenous deciduous  Exotic broad-leaved vegetation



... *so what ?*

flora / fauna distributions climate - driven

physiological tolerances

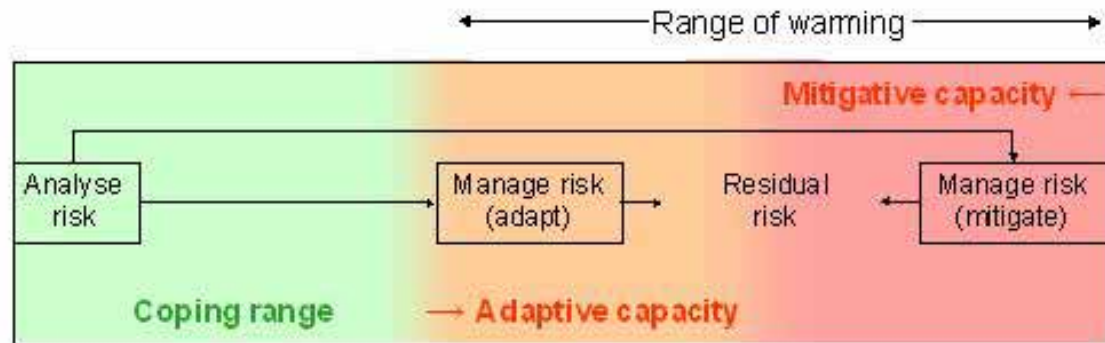
80% changes consistent with physiology

Concern ... *rate of change* is very fast

Synergism:

climate change & habitat loss / fragmentation

Managing climate risk



Highland ecosystems and isolated fragments



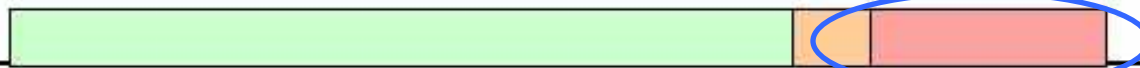
Agriculture



Healthy lowland ecosystems



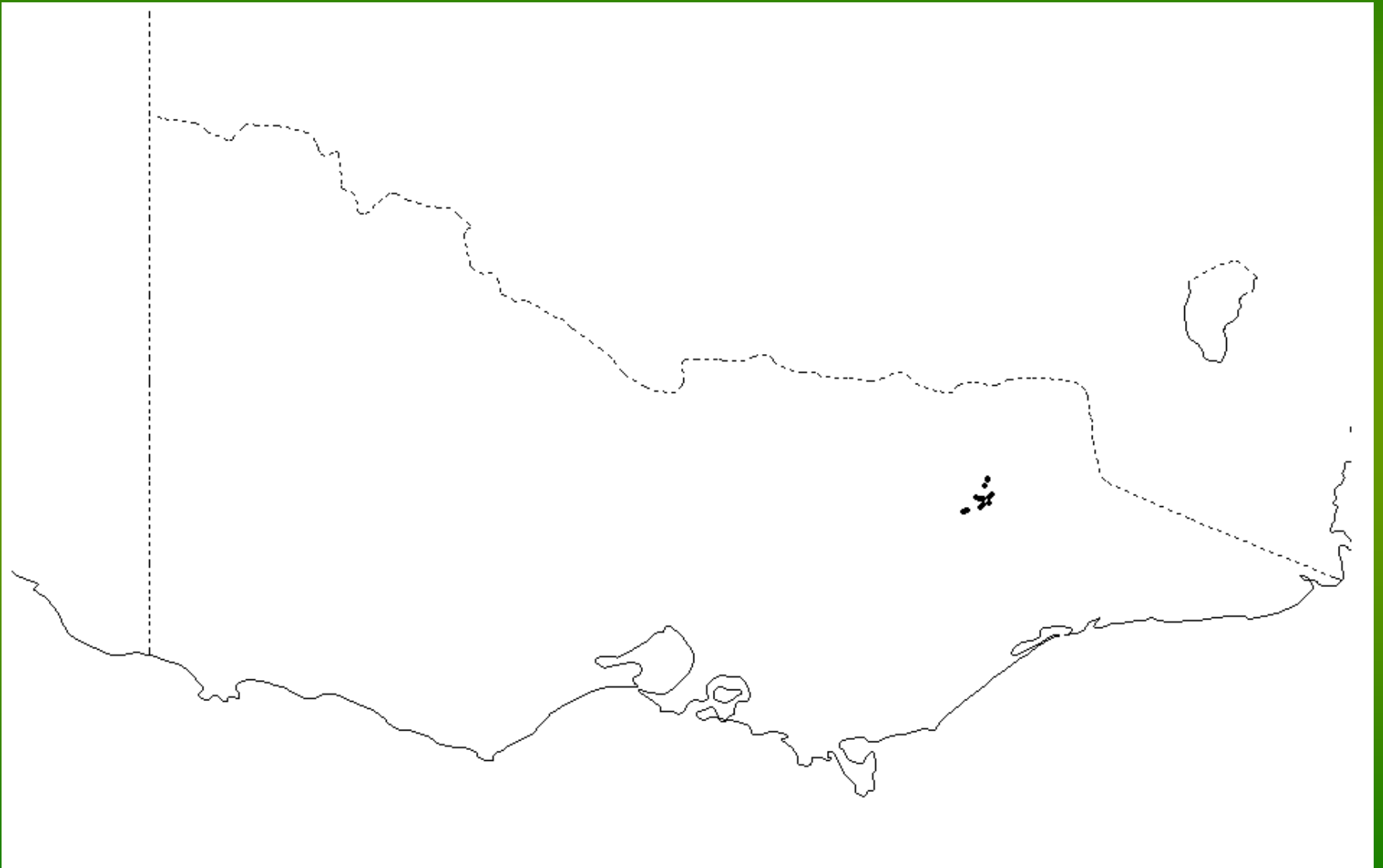
Protected Infrastructure (e.g. bridges)



Alpine Environments



Silky Snow Daisy *Celmisia sericophylla*

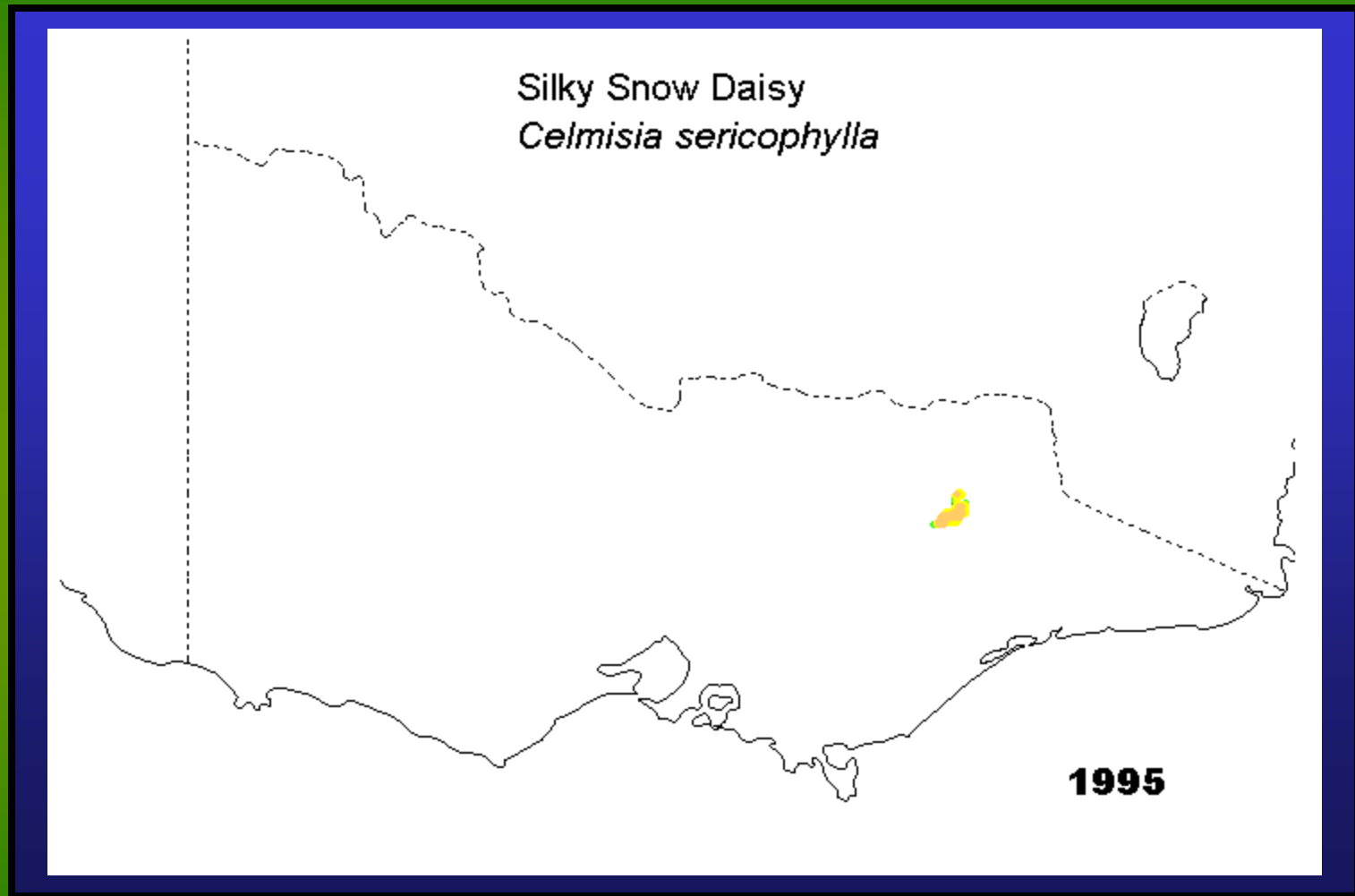


Silky Snow Daisy *Celmisia sericophylla*

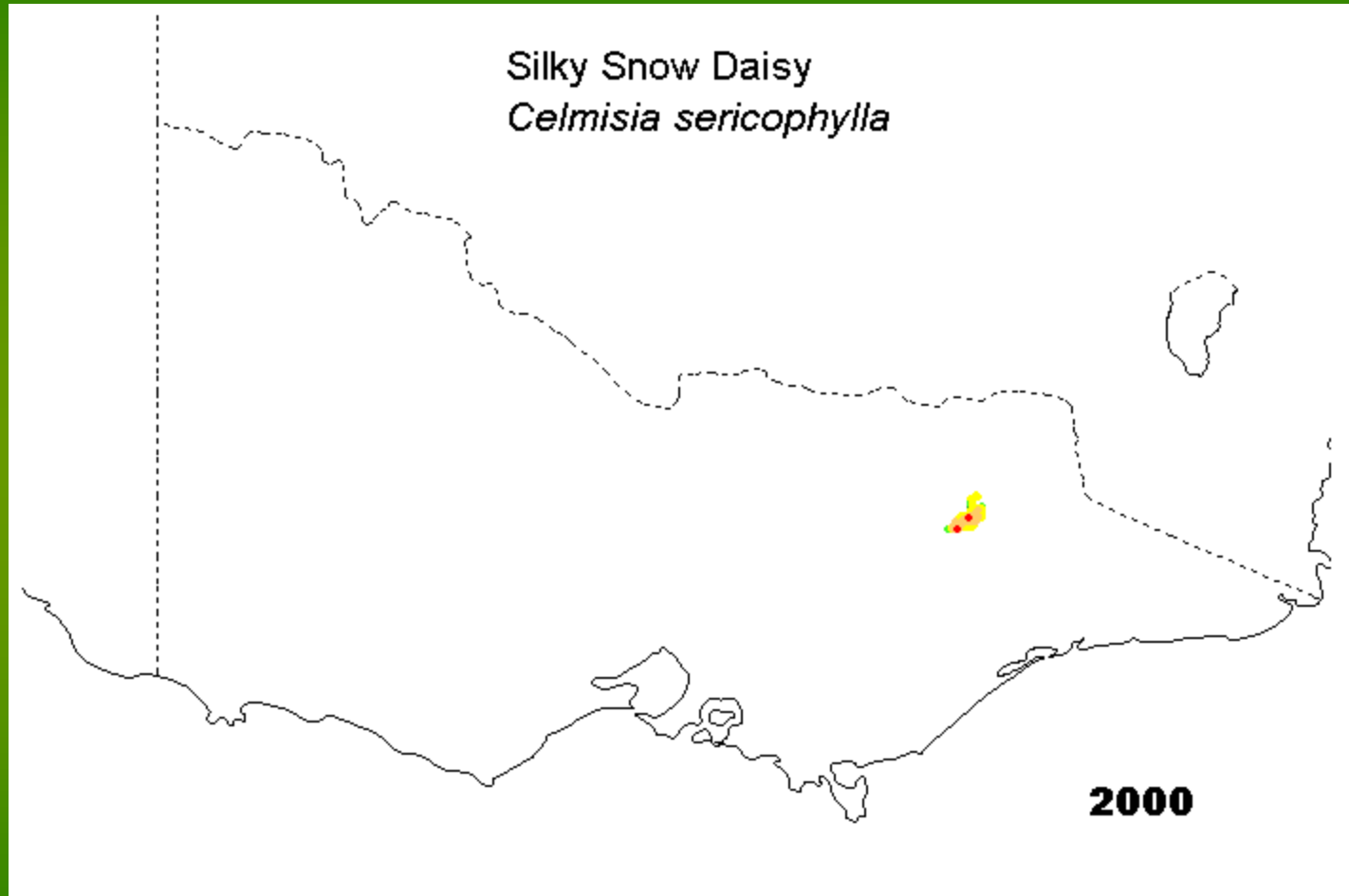




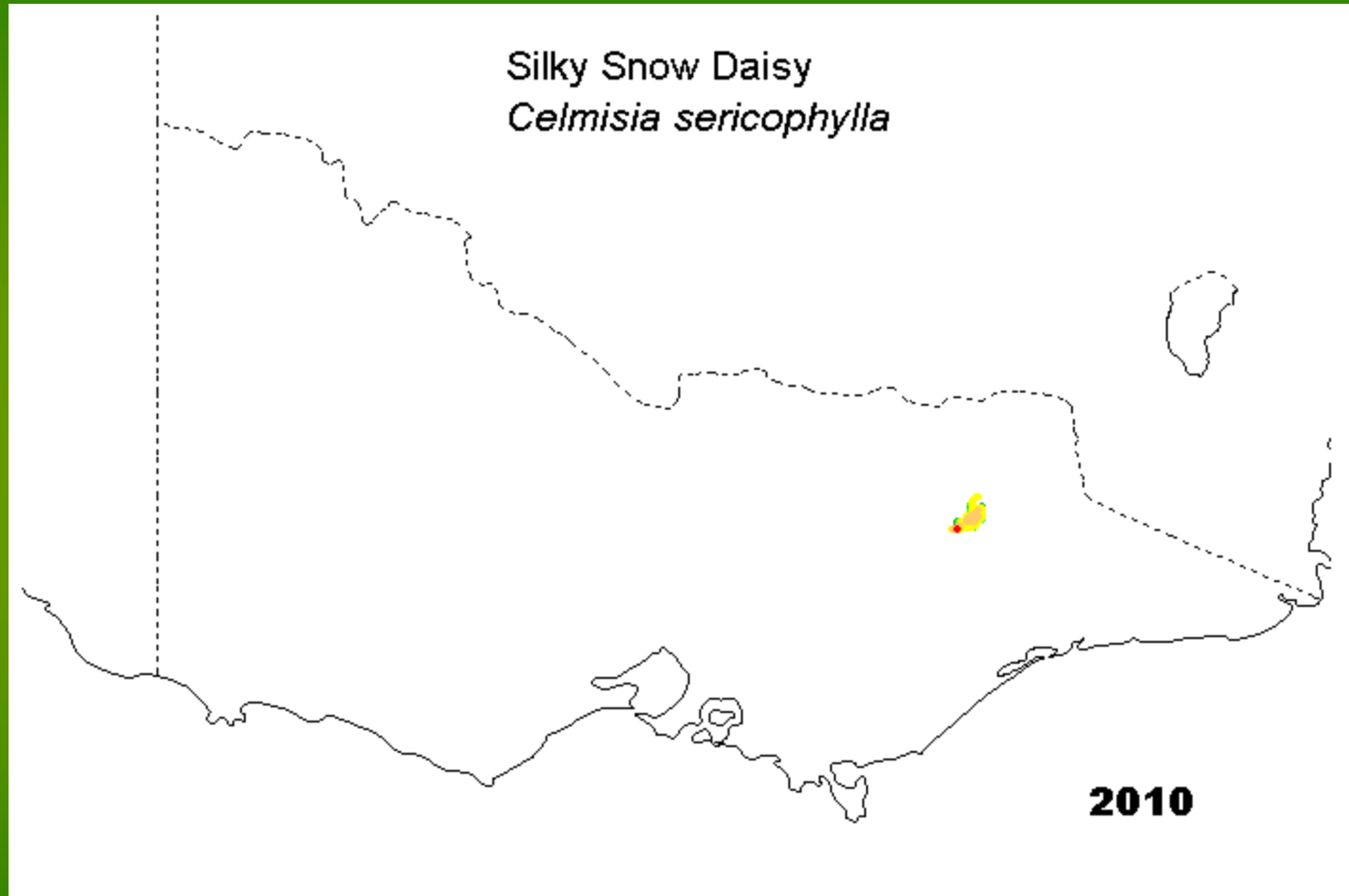
warm



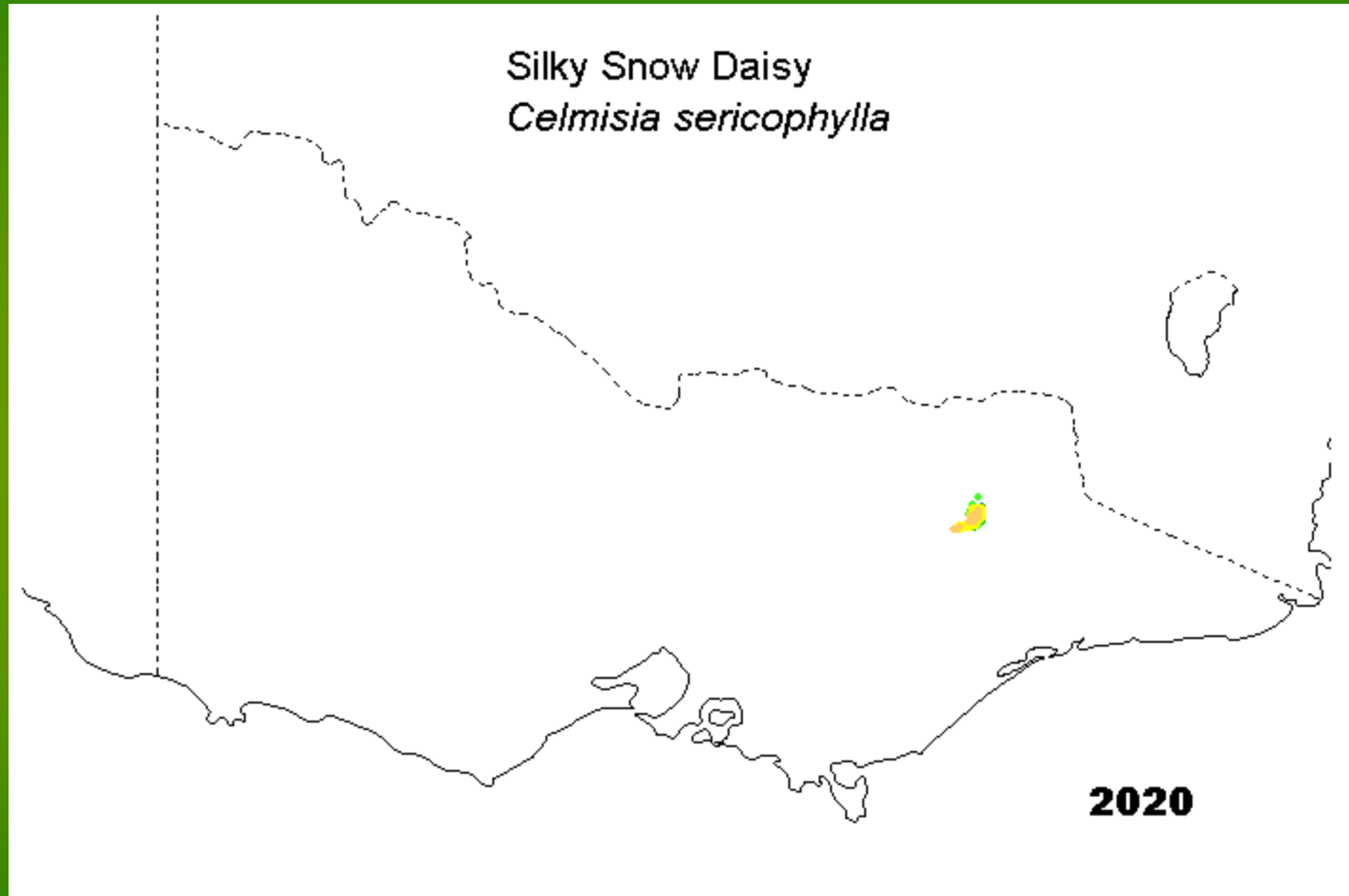
warm



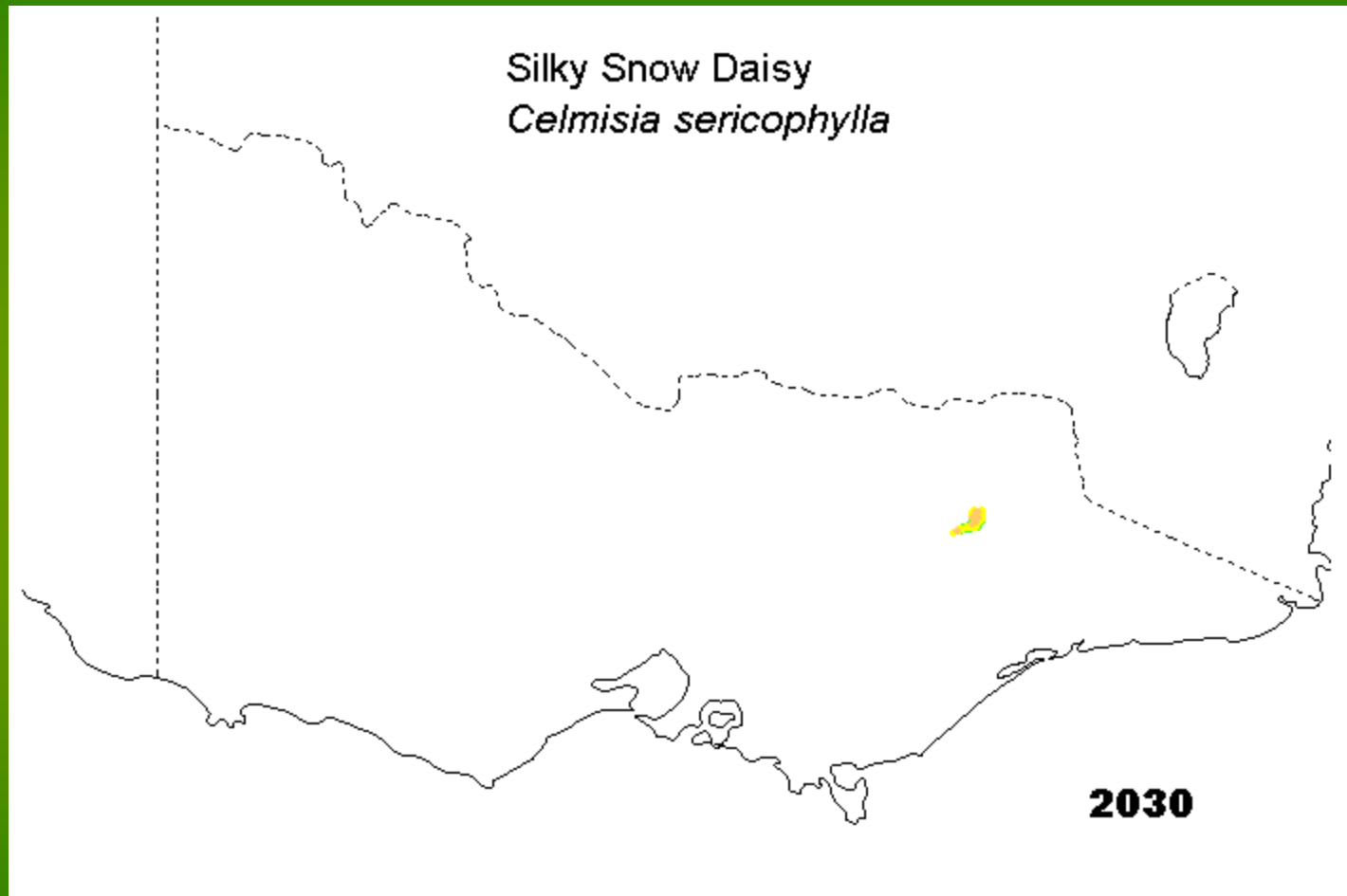
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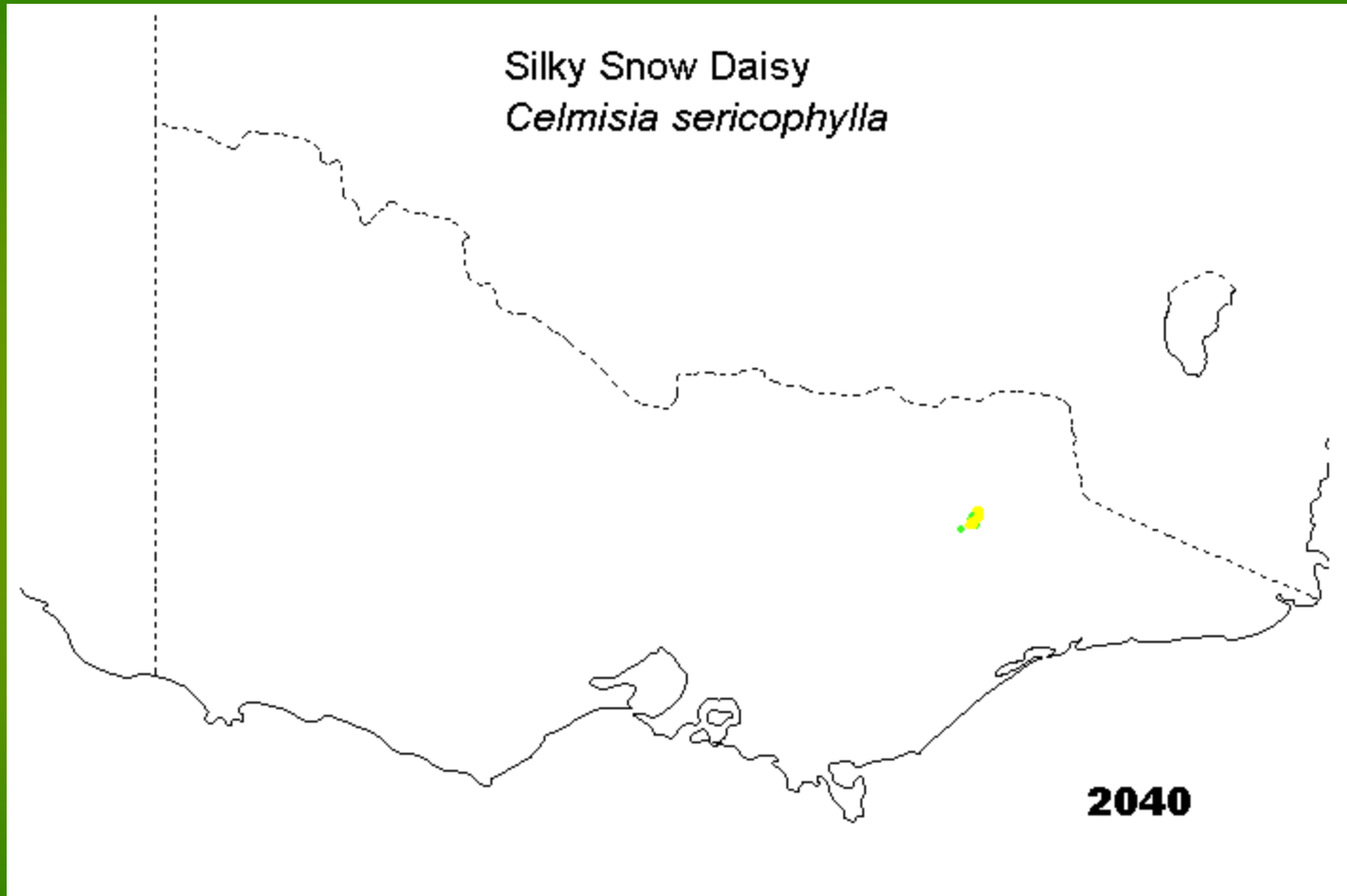
warm



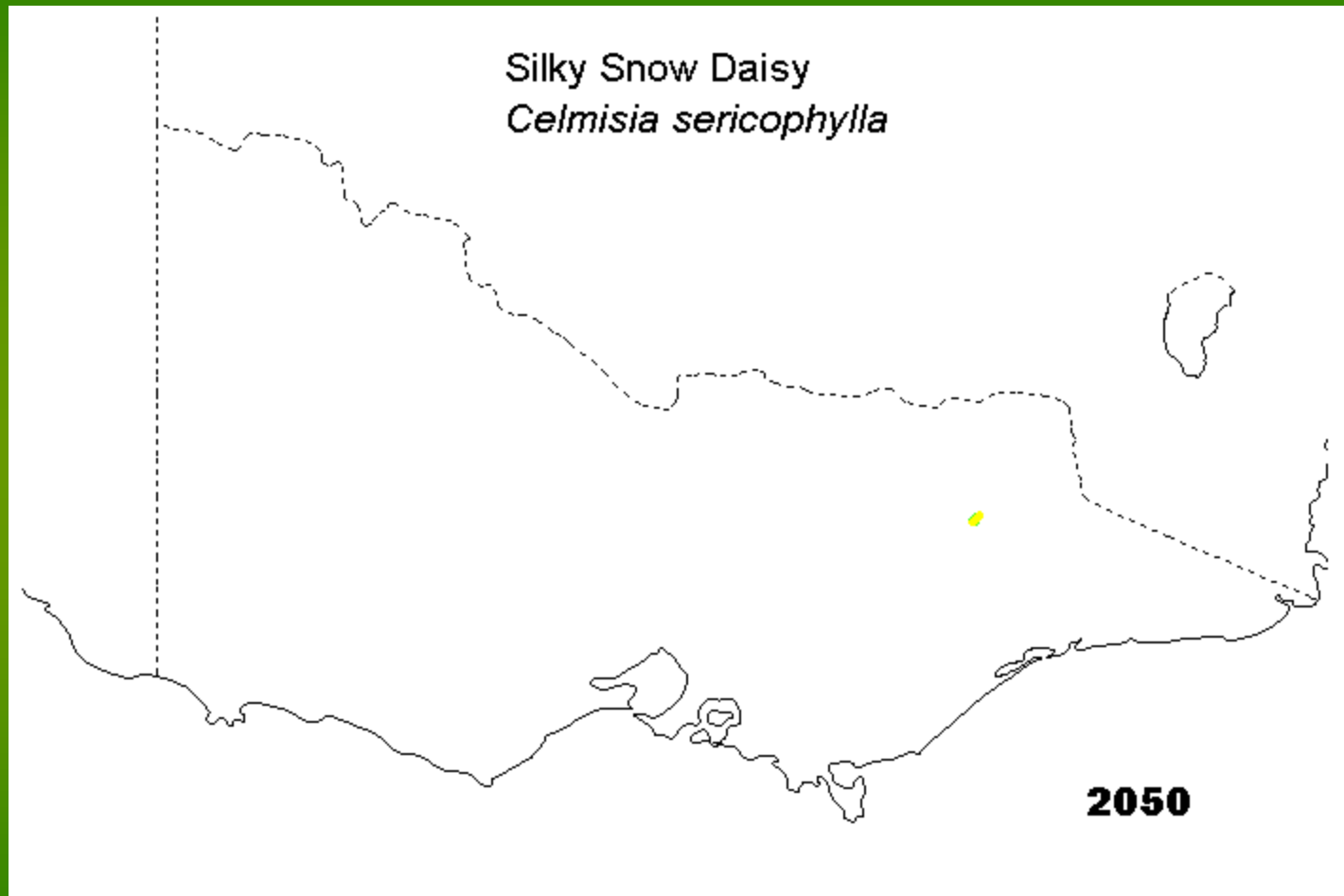
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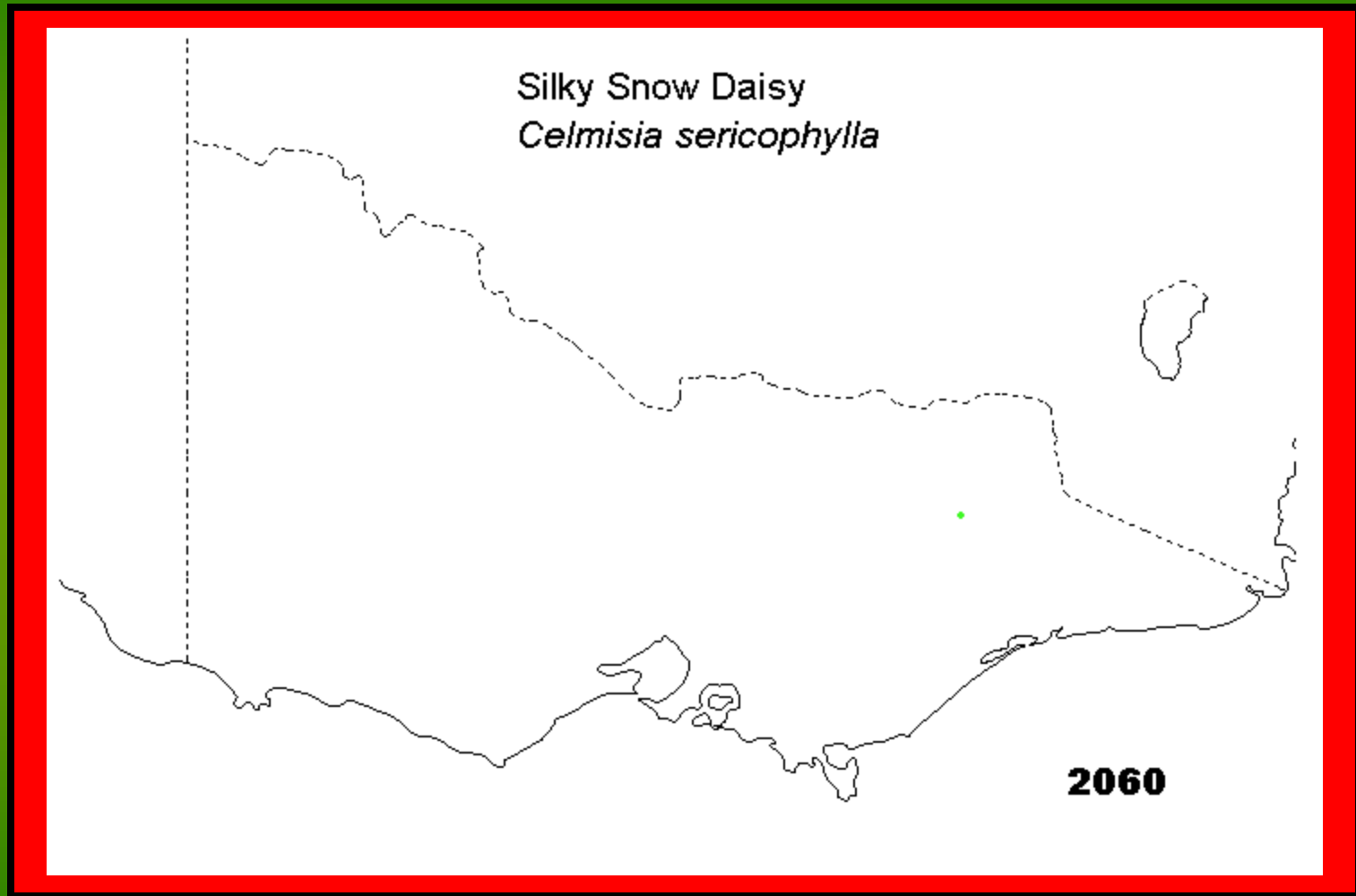
warm



warm



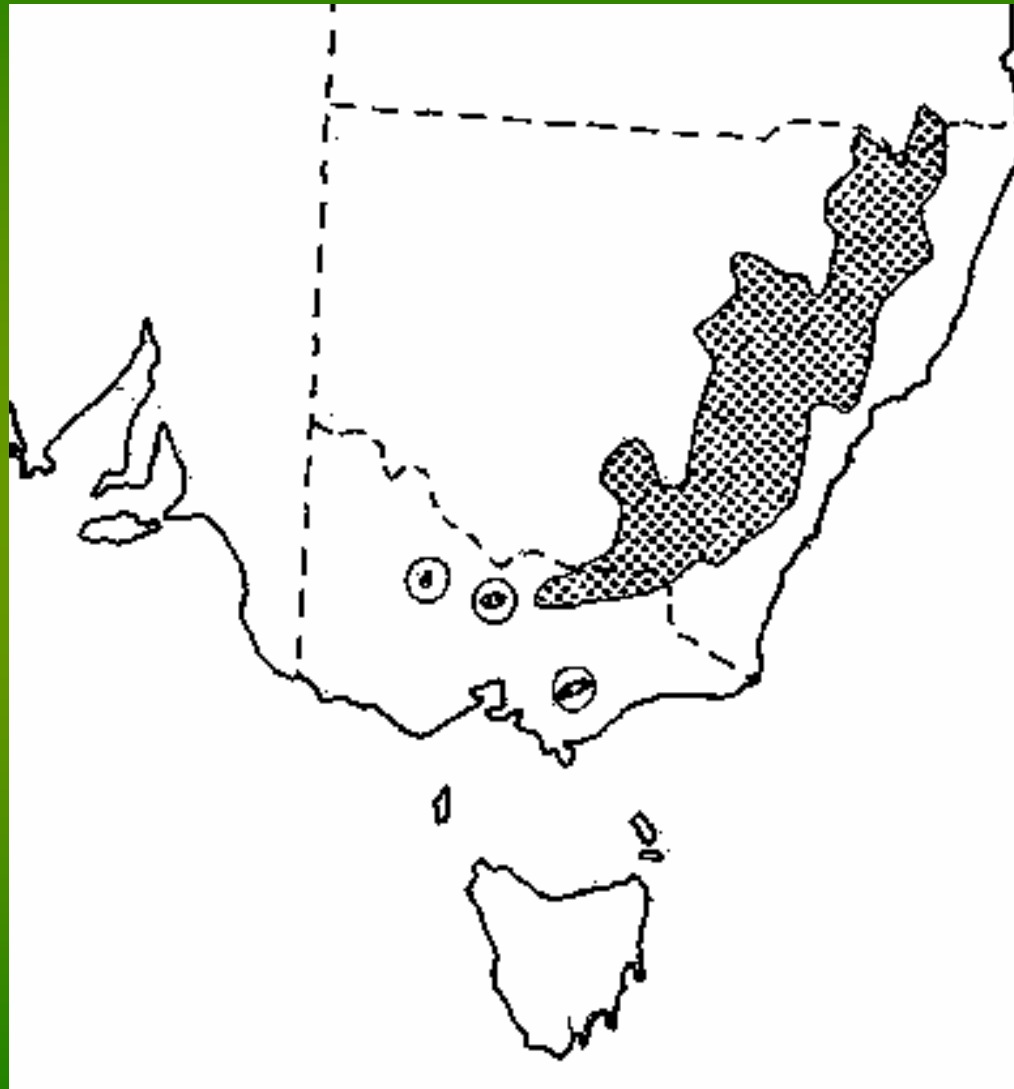
warm



Blakely's Red-gum *Eucalyptus blakelyi*



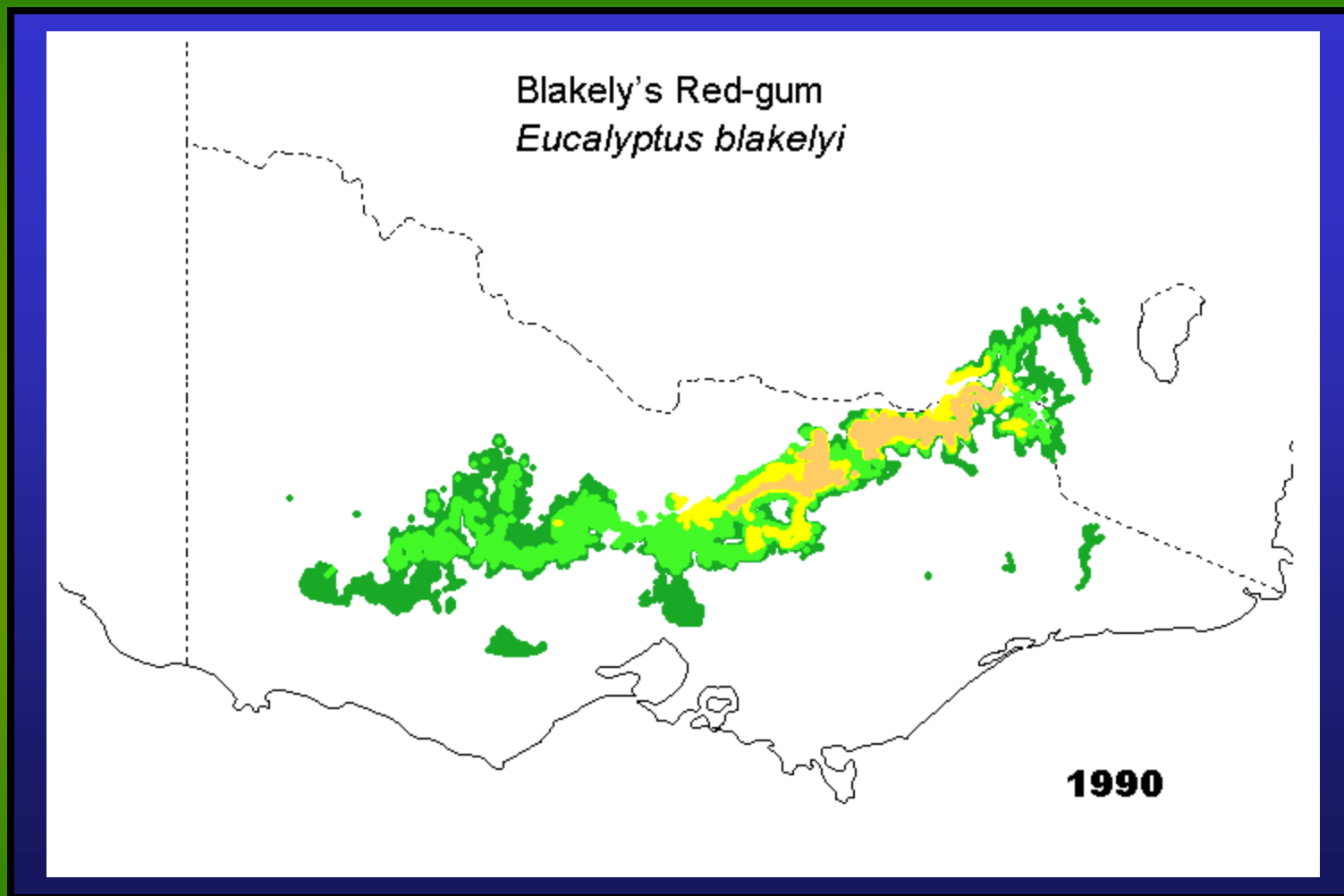
Blakely's Red-gum *Eucalyptus blakelyi*



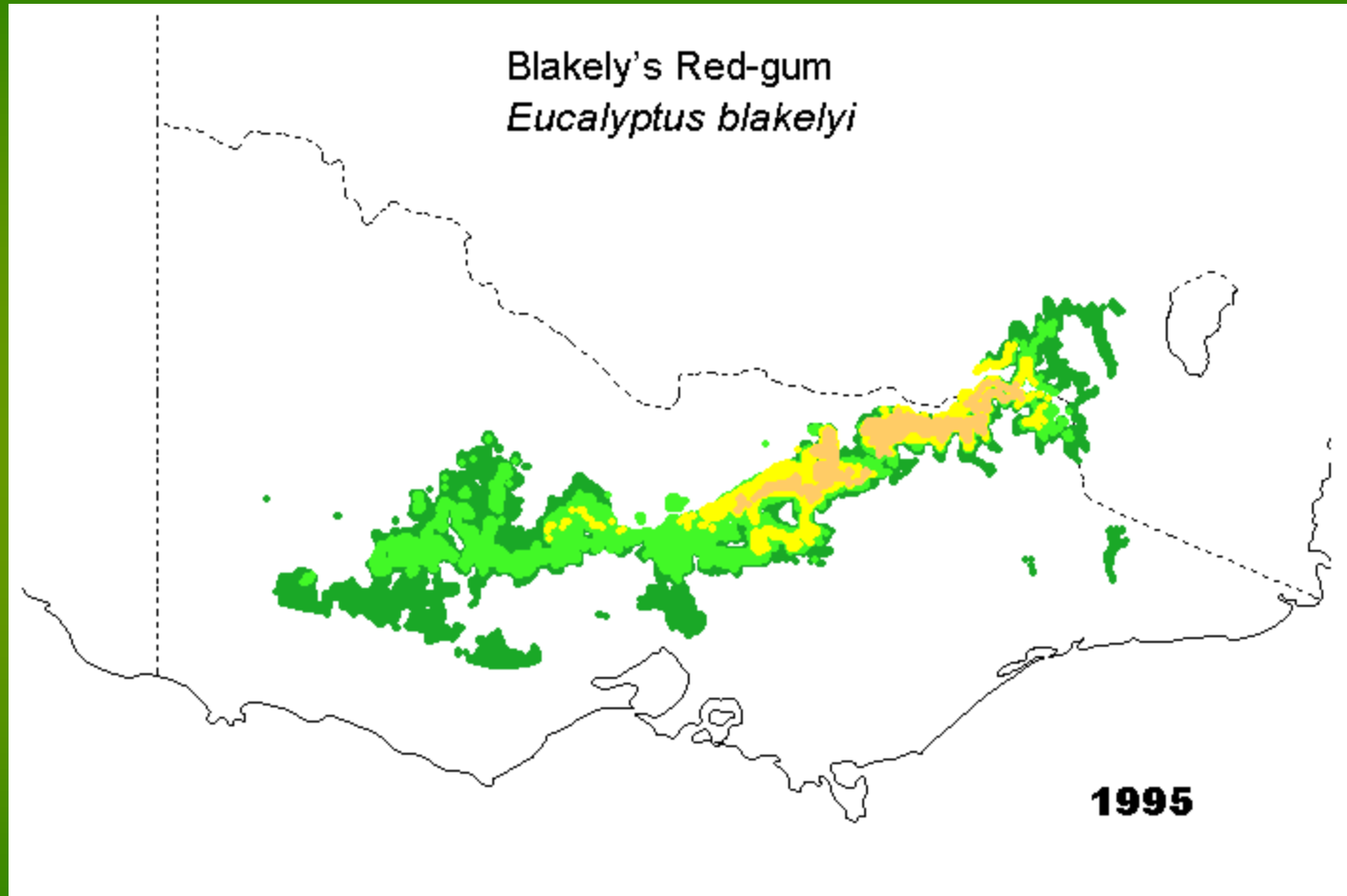
Blakely's Red-gum *Eucalyptus blakelyi*



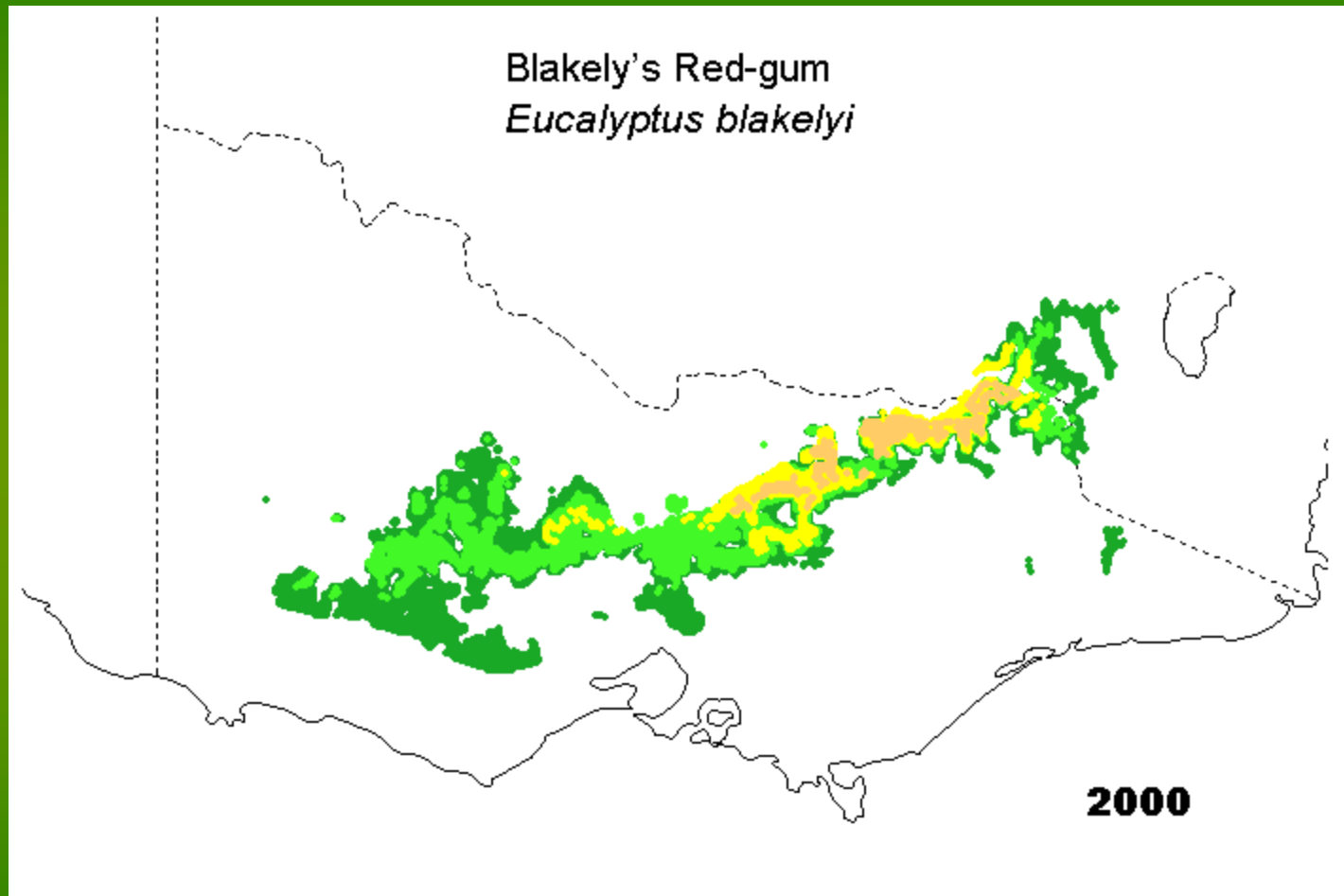
IS92d + DARLAM



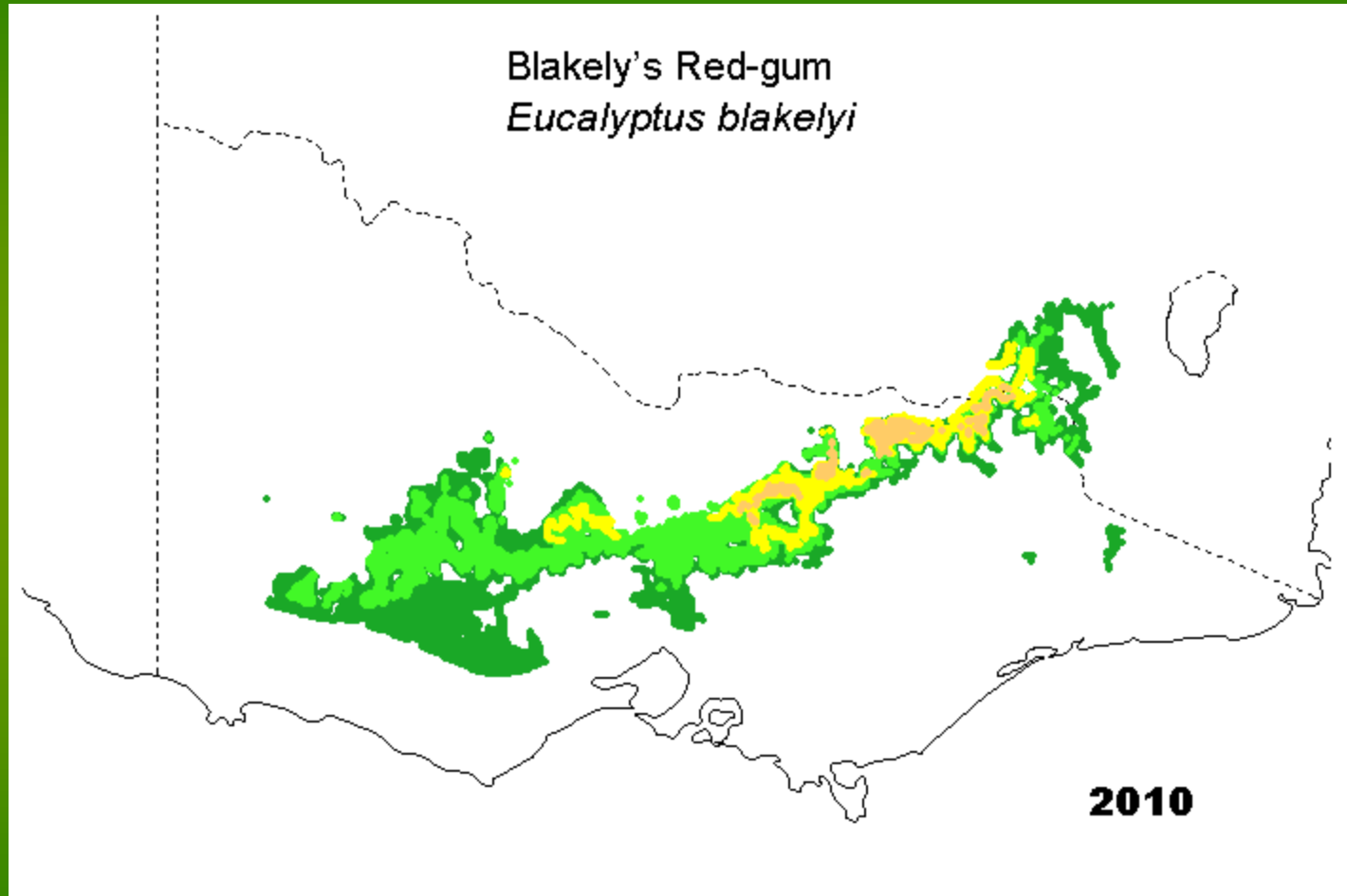
IS92d + DARLAM



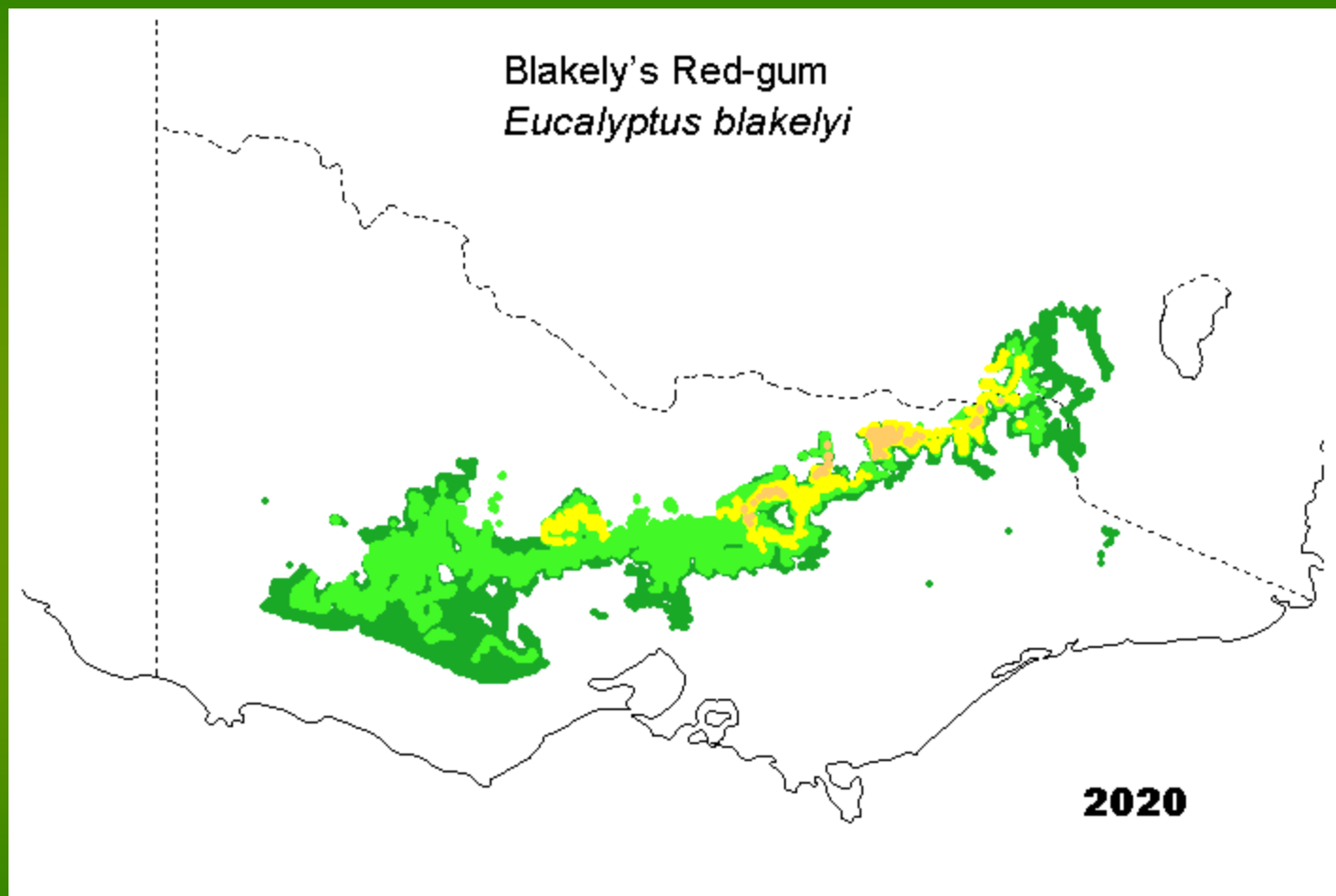
IS92d + DARLAM



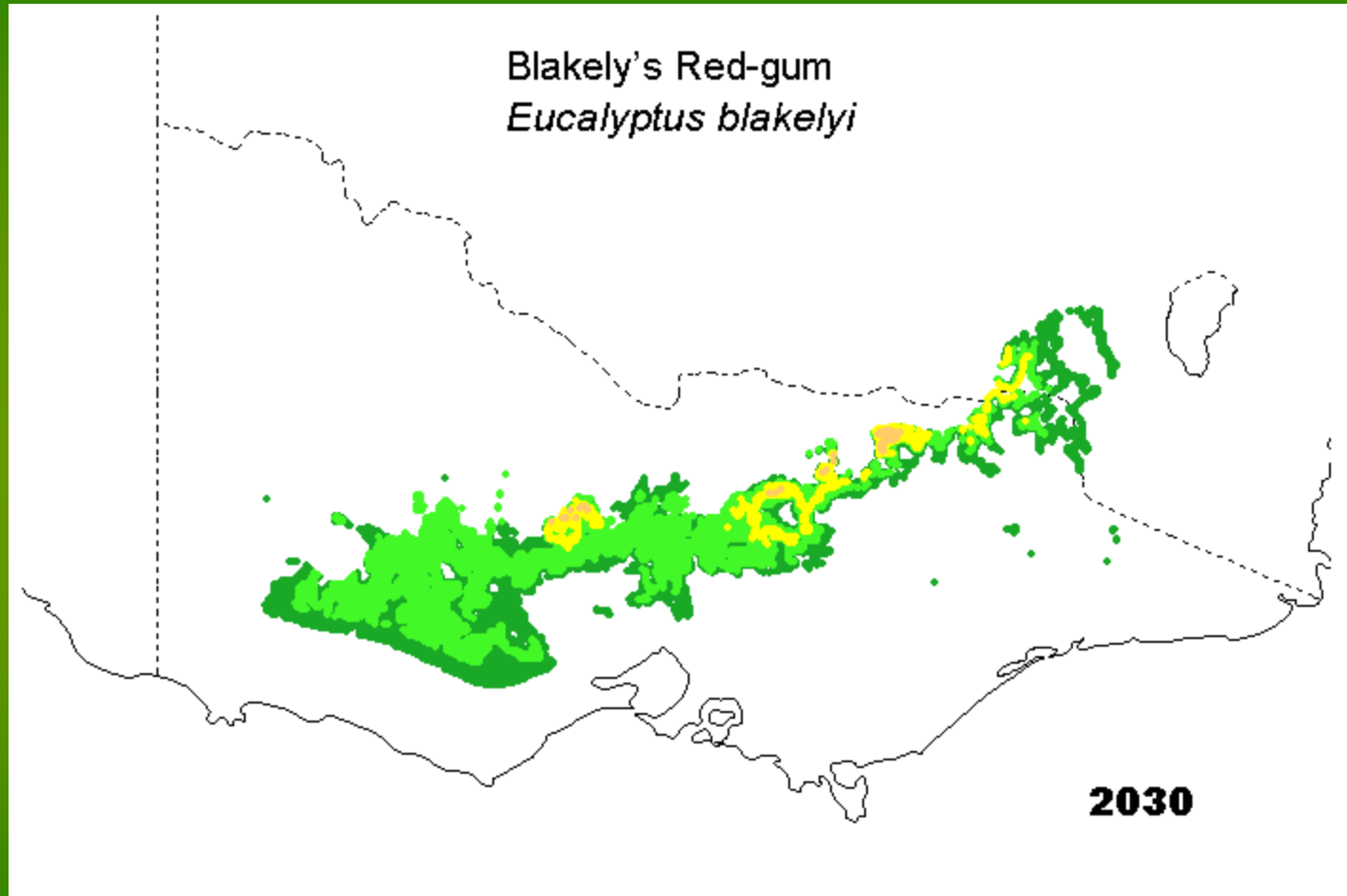
IS92d + DARLAM



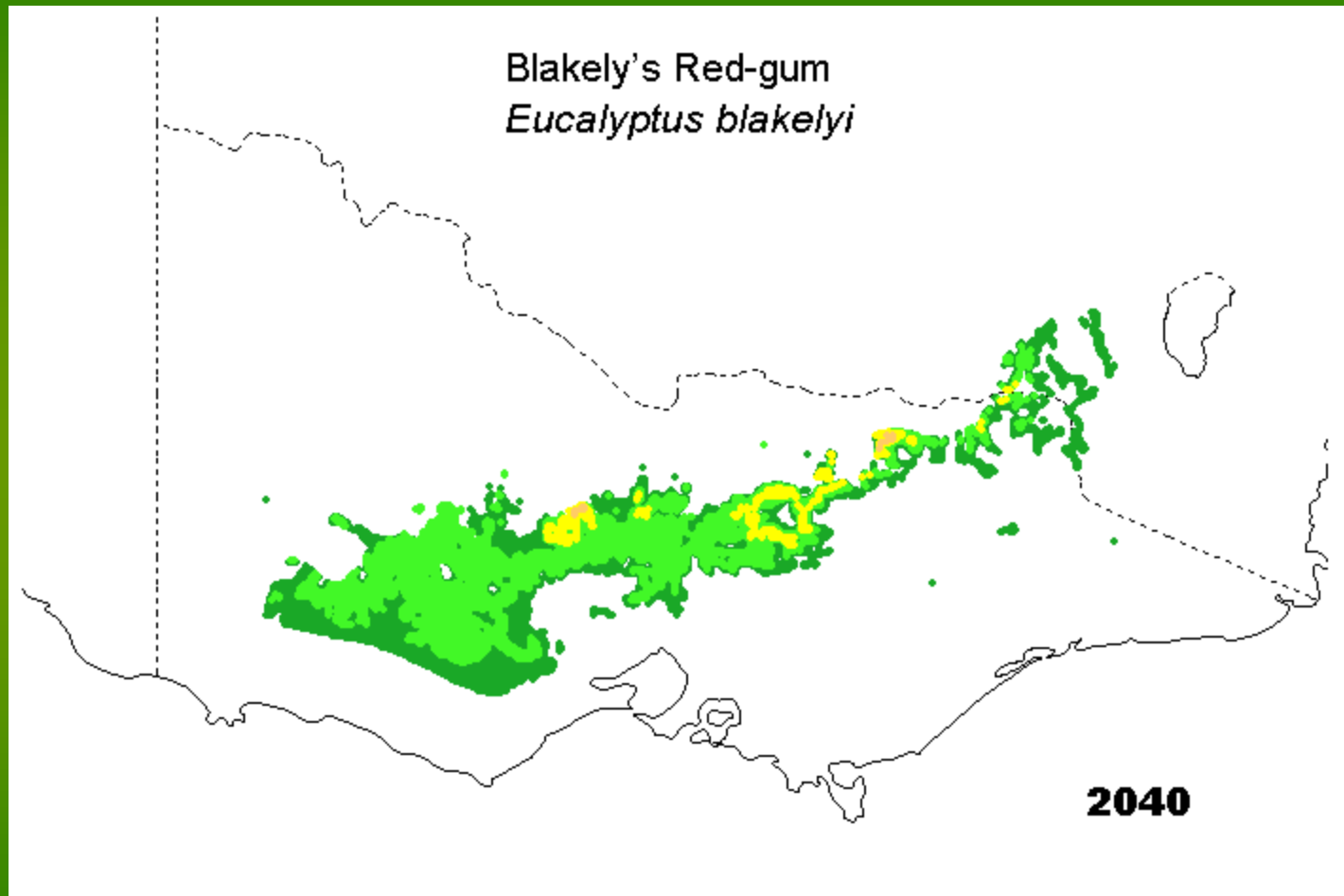
IS92d + DARLAM



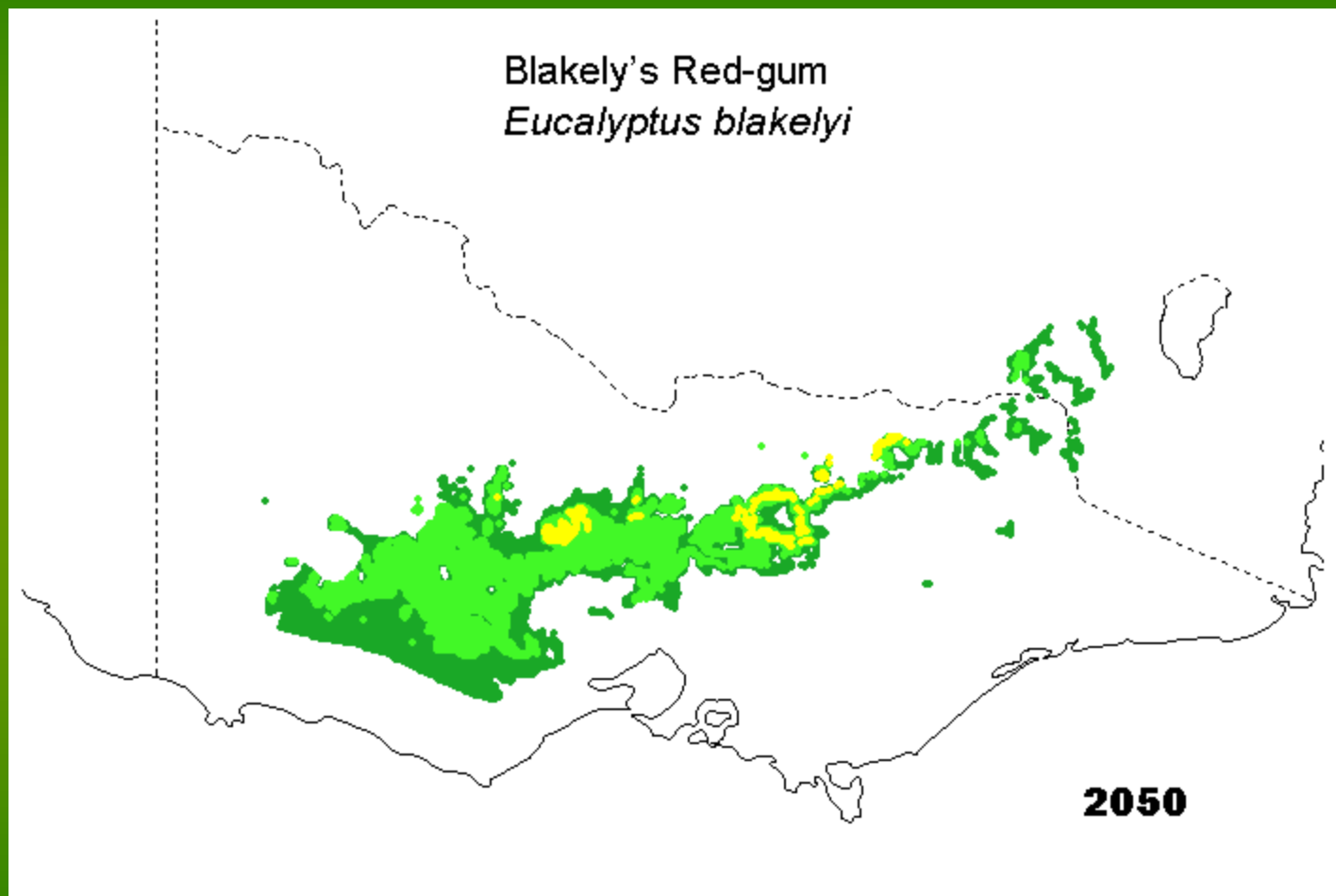
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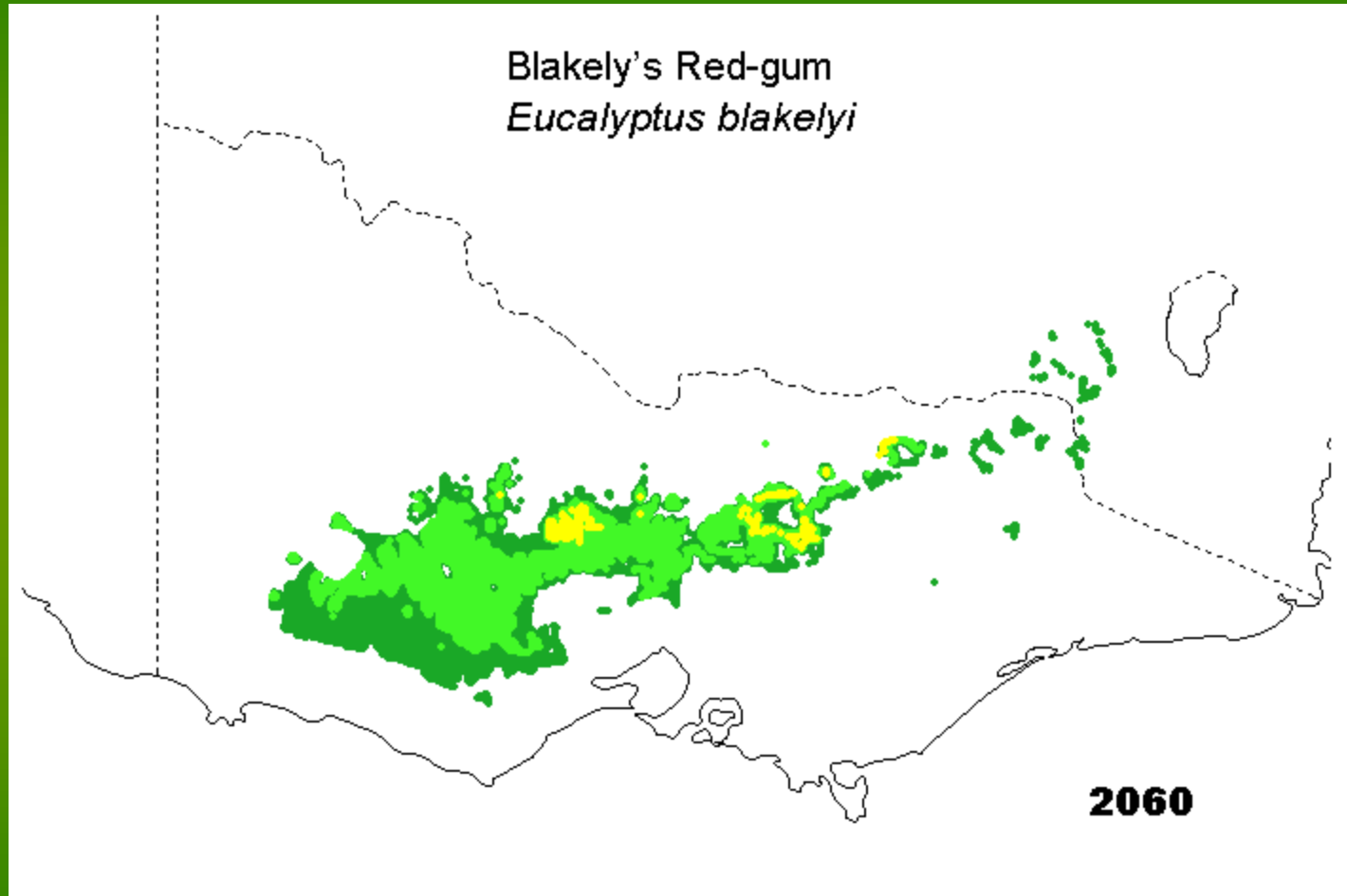
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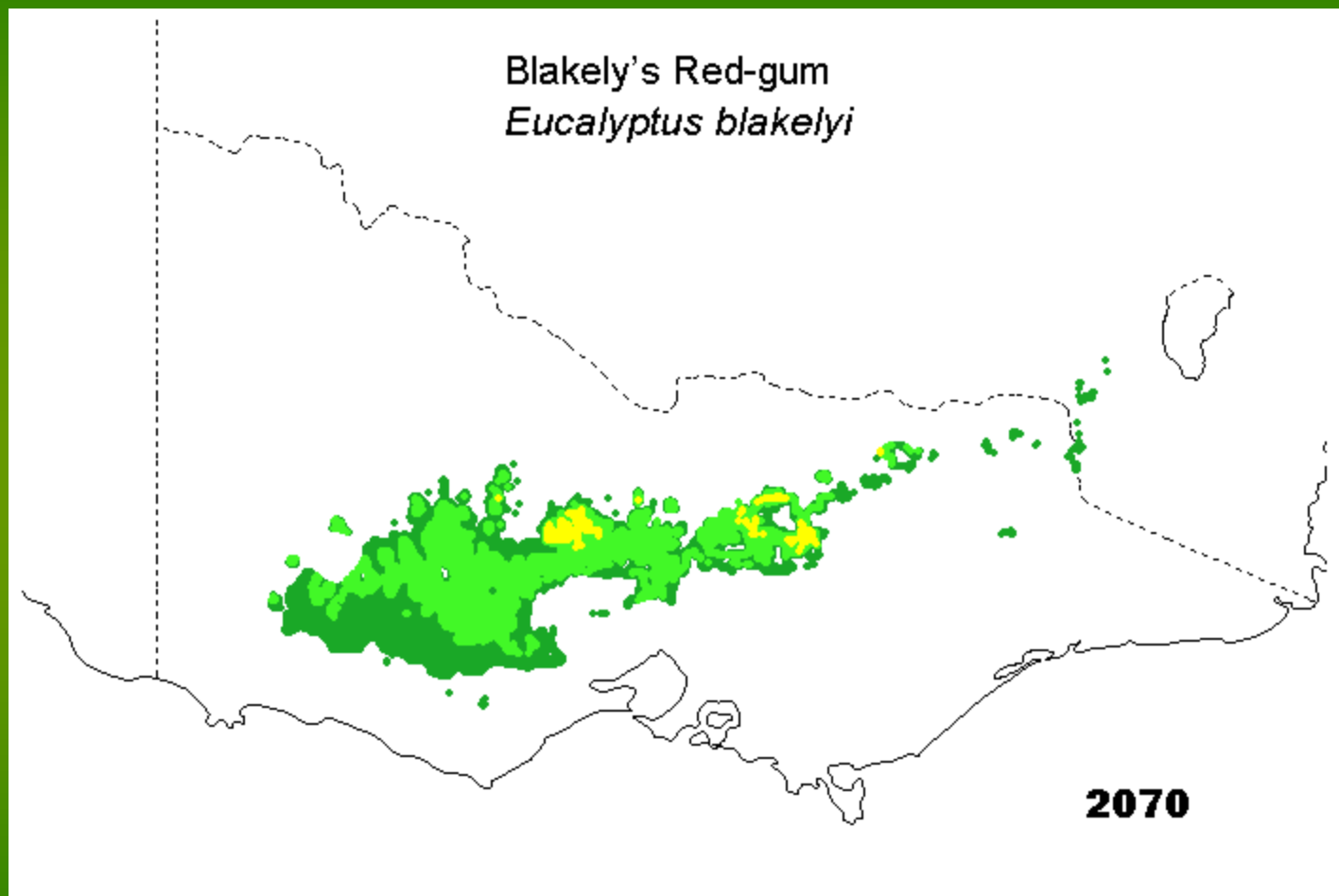
IS92d + DARLAM



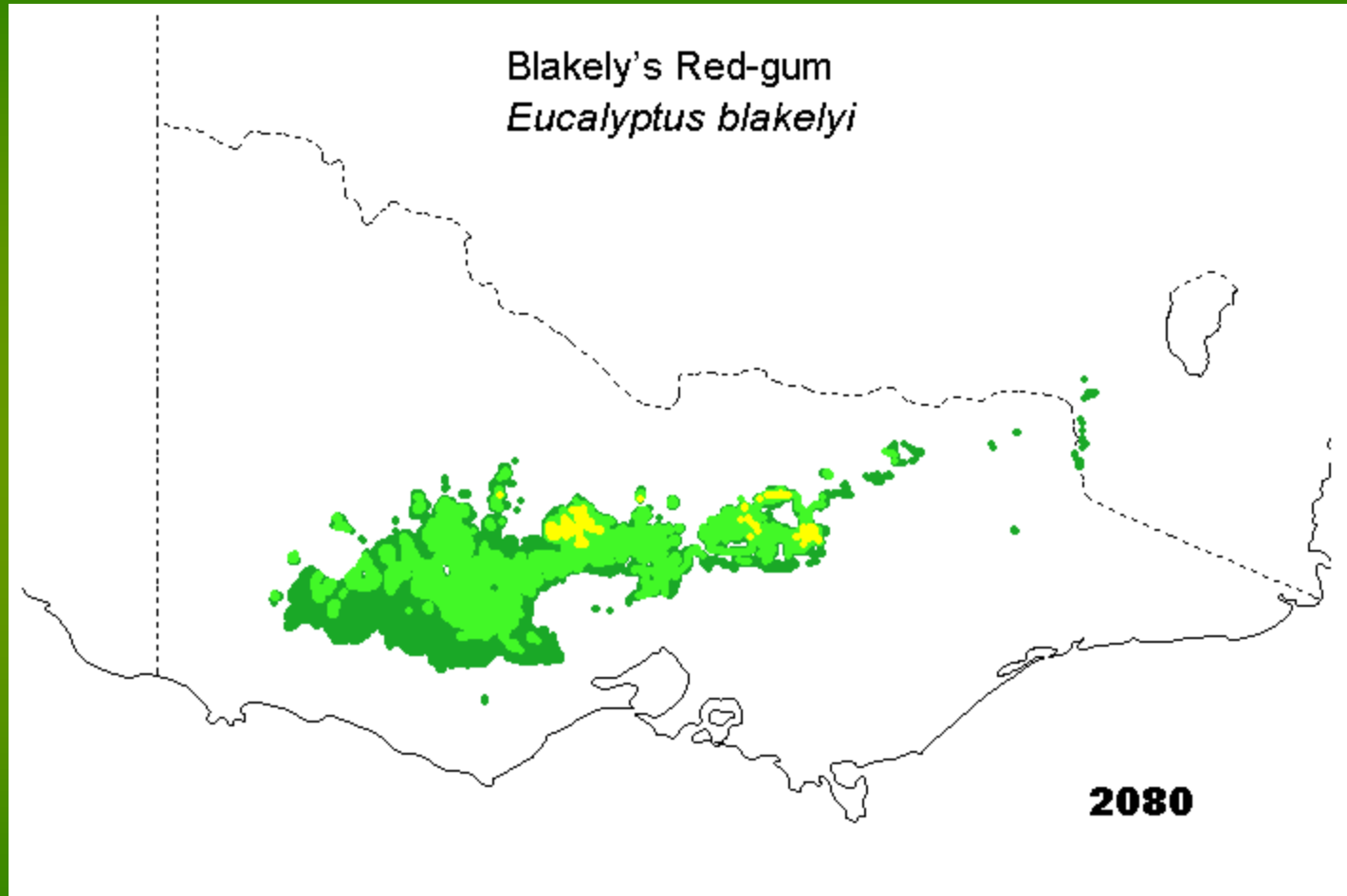
IS92d + DARLAM



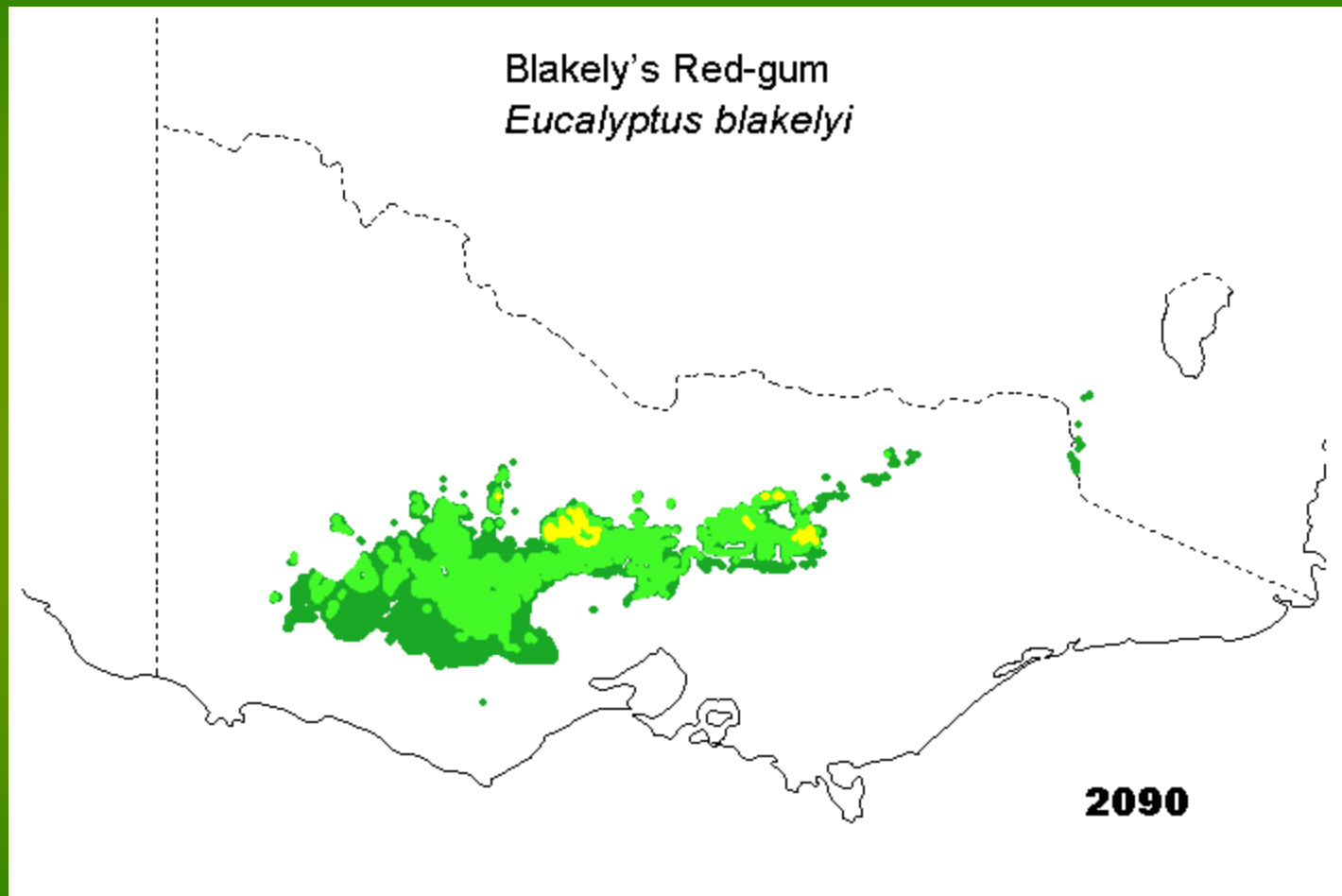
IS92d + DARLAM



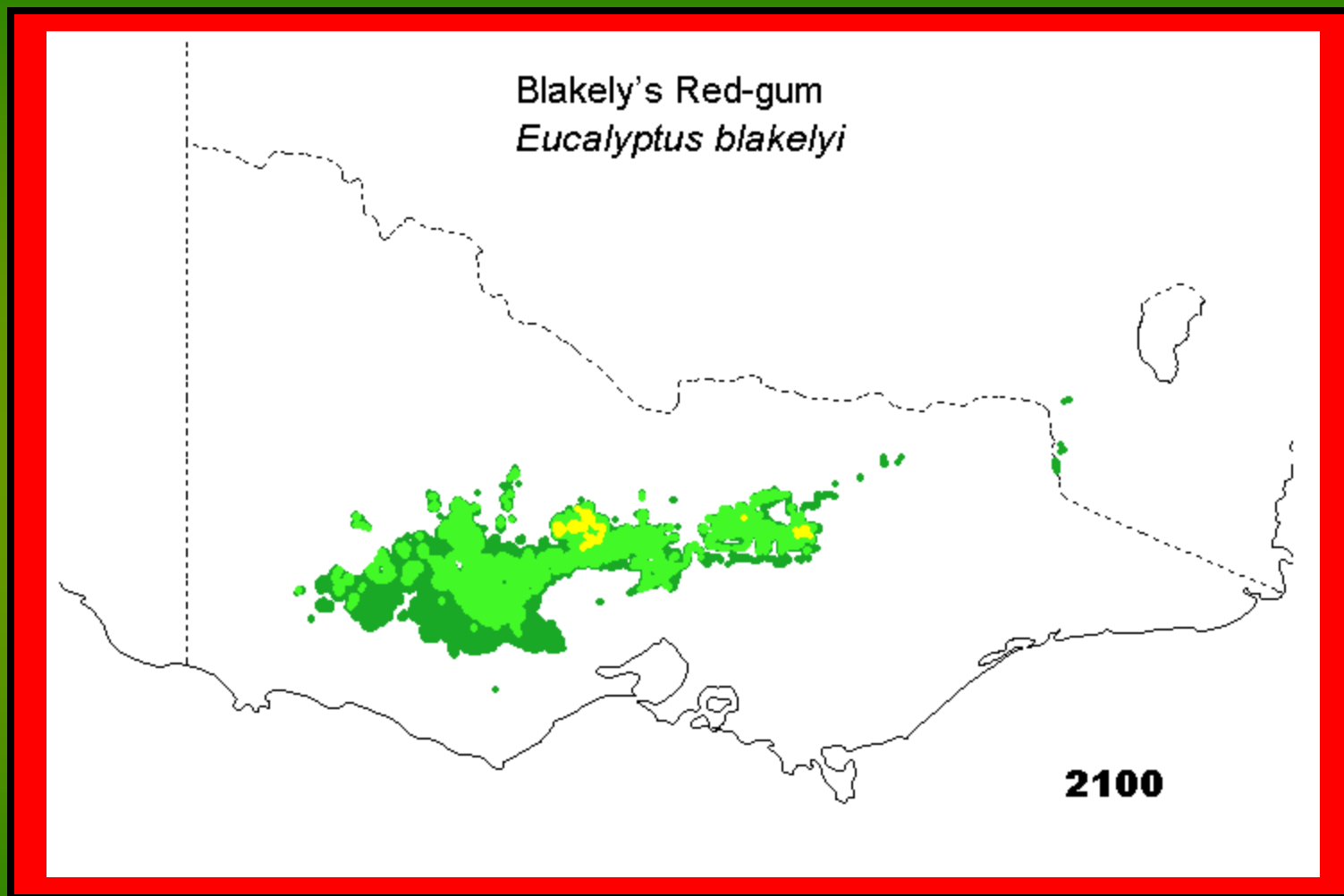
IS92d + DARLAM



IS92d + DARLAM

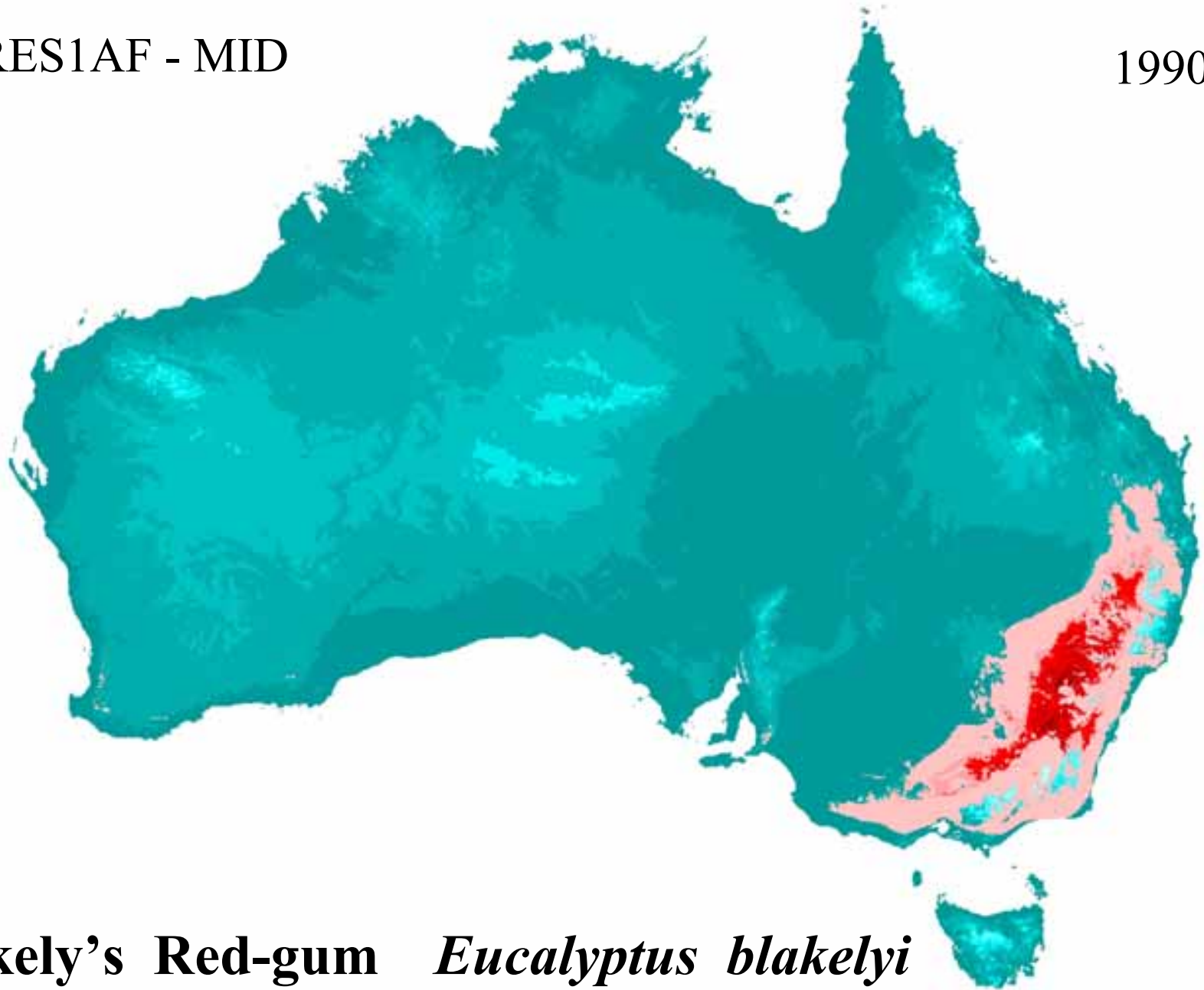


IS92d + DARLAM



SRES1AF - MID

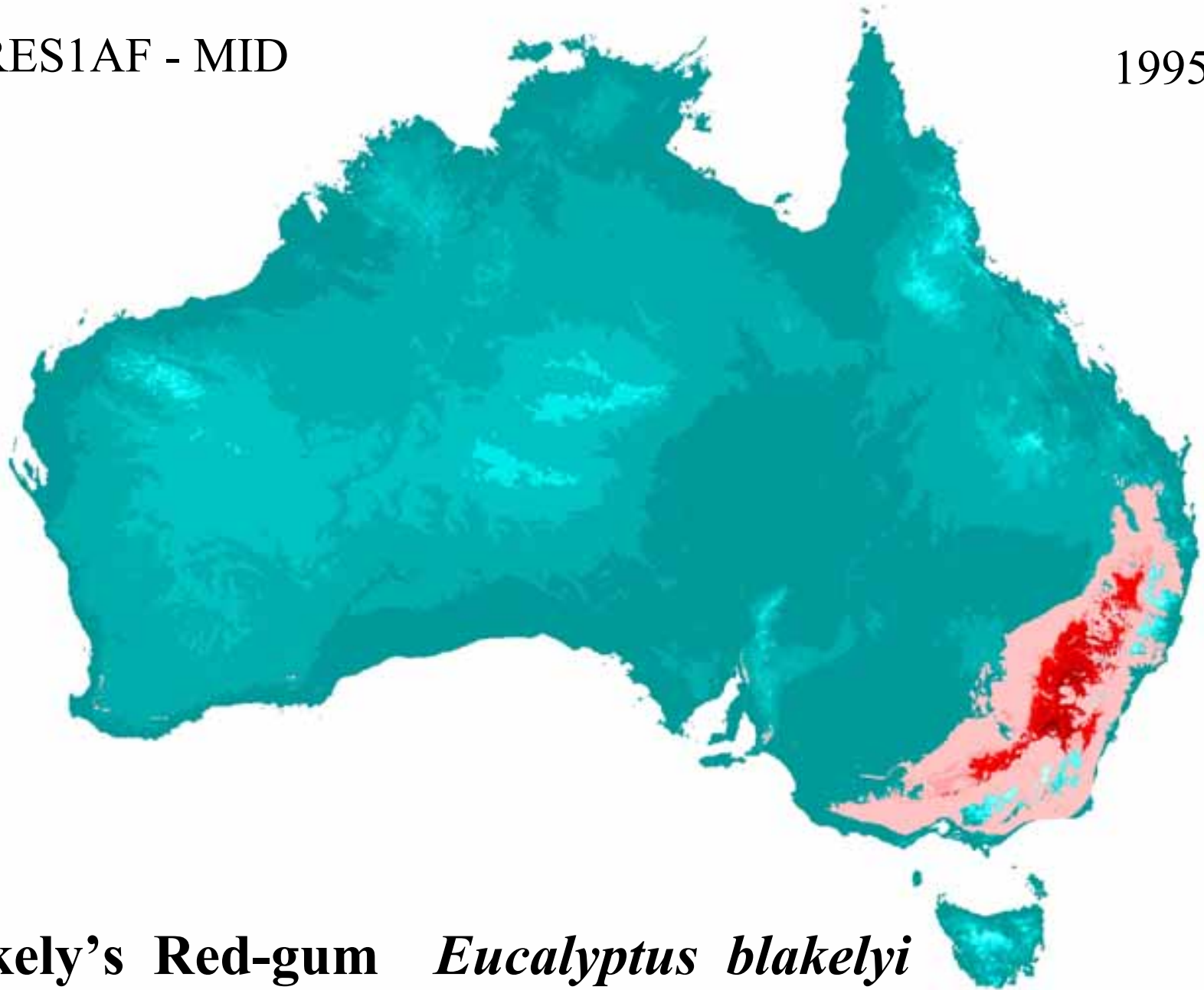
1990



Blakely's Red-gum *Eucalyptus blakelyi*

SRES1AF - MID

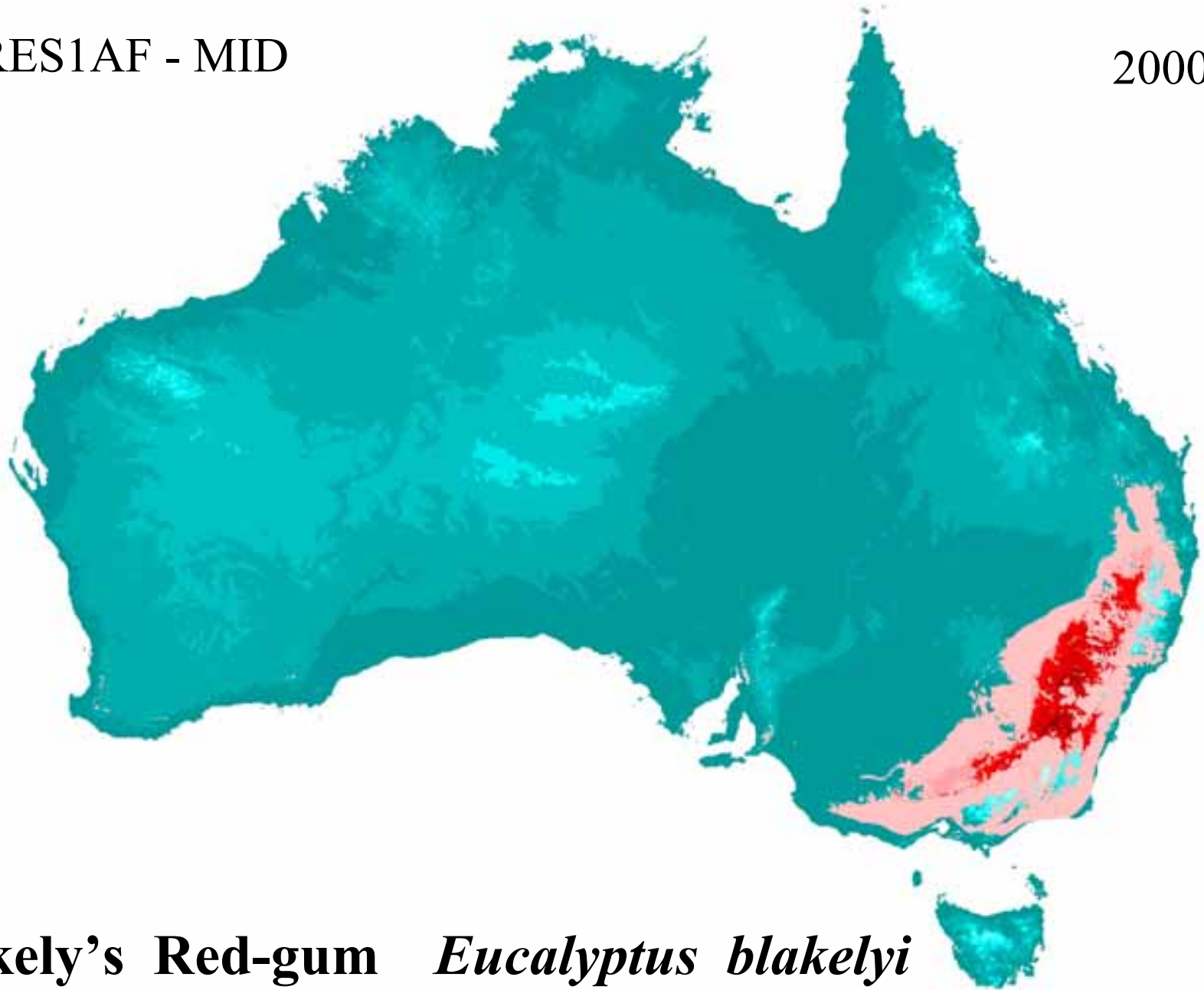
1995



Blakely's Red-gum *Eucalyptus blakelyi*

SRES1AF - MID

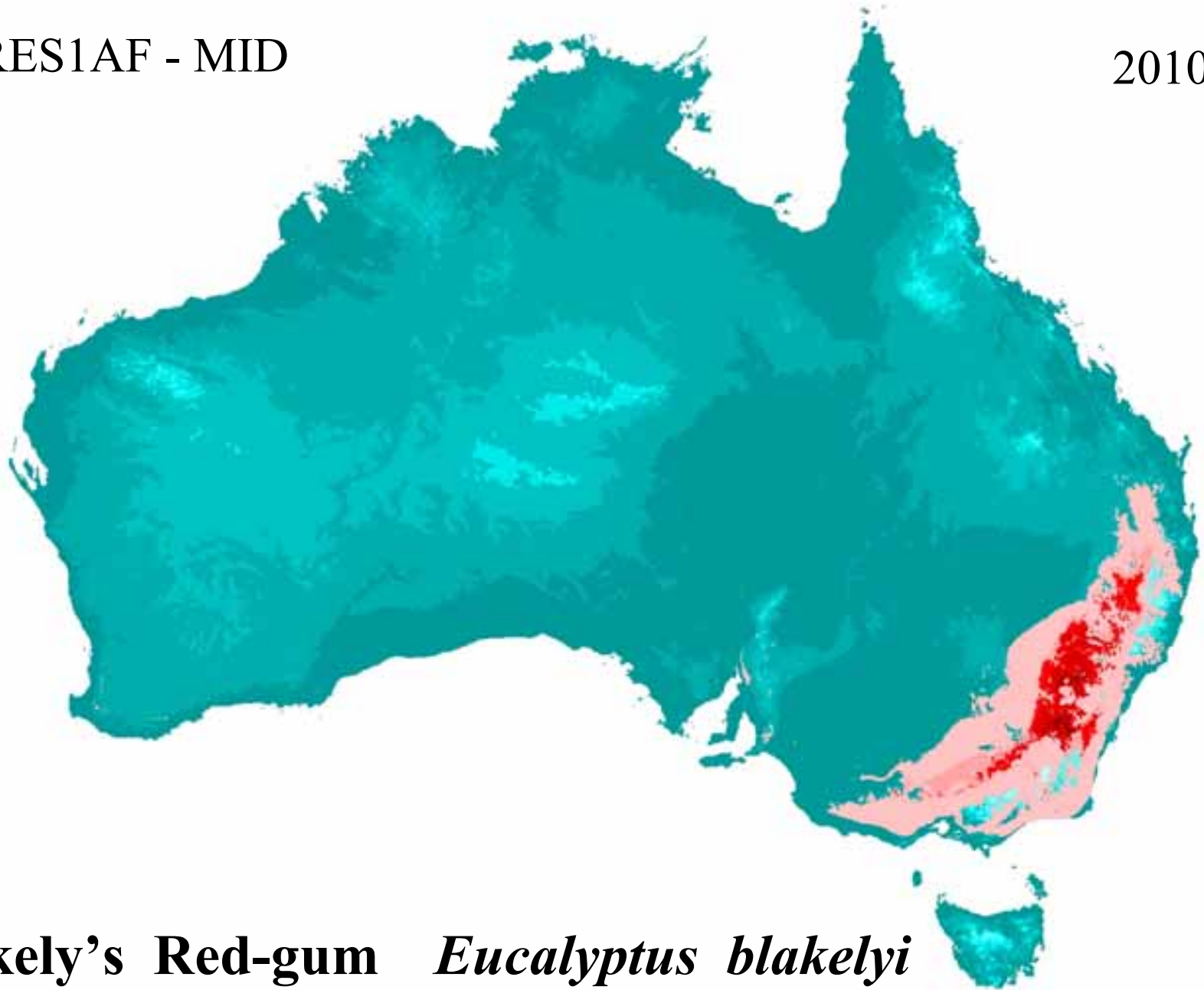
2000



Blakely's Red-gum *Eucalyptus blakelyi*

SRES1AF - MID

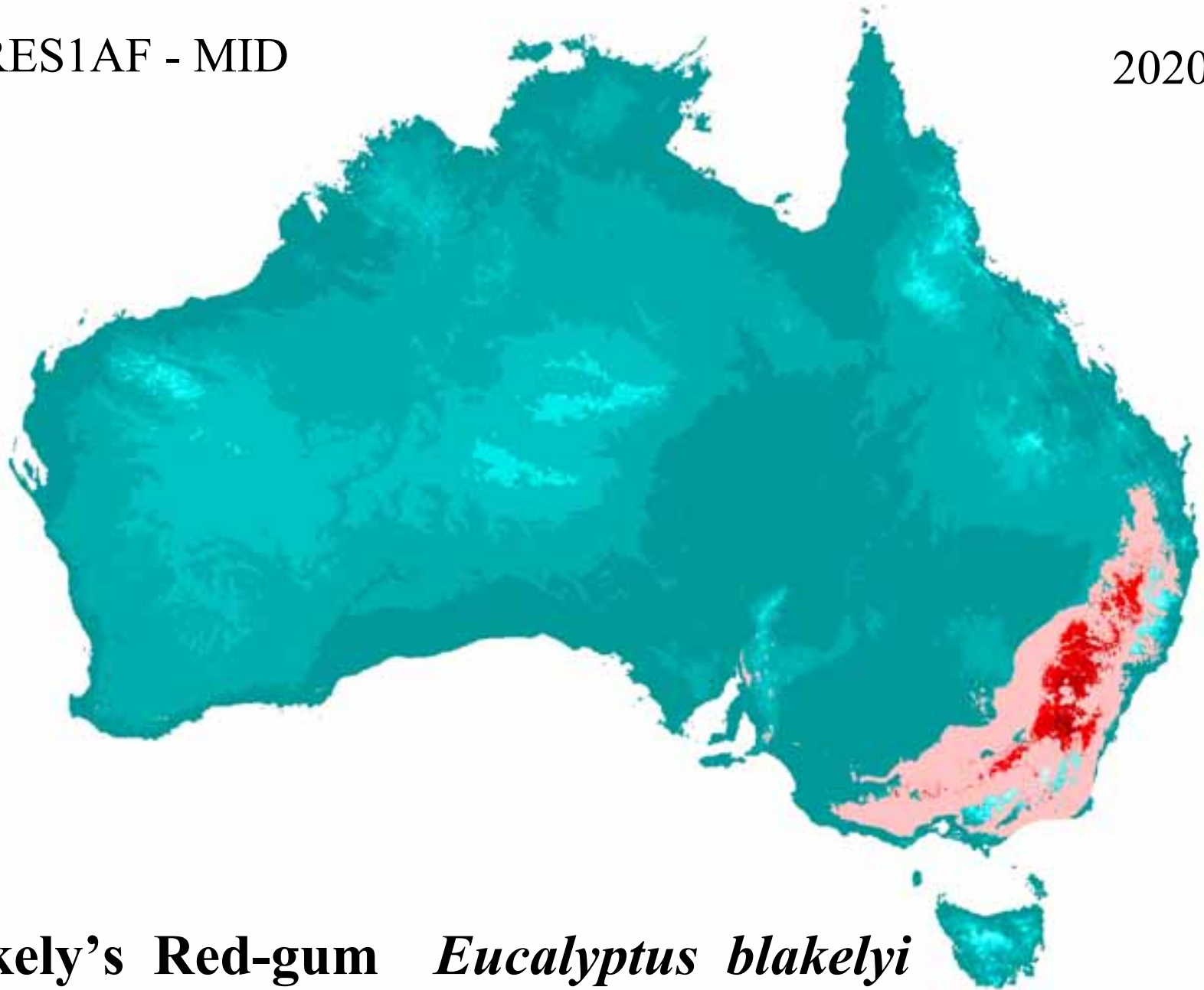
2010



Blakely's Red-gum *Eucalyptus blakelyi*

SRES1AF - MID

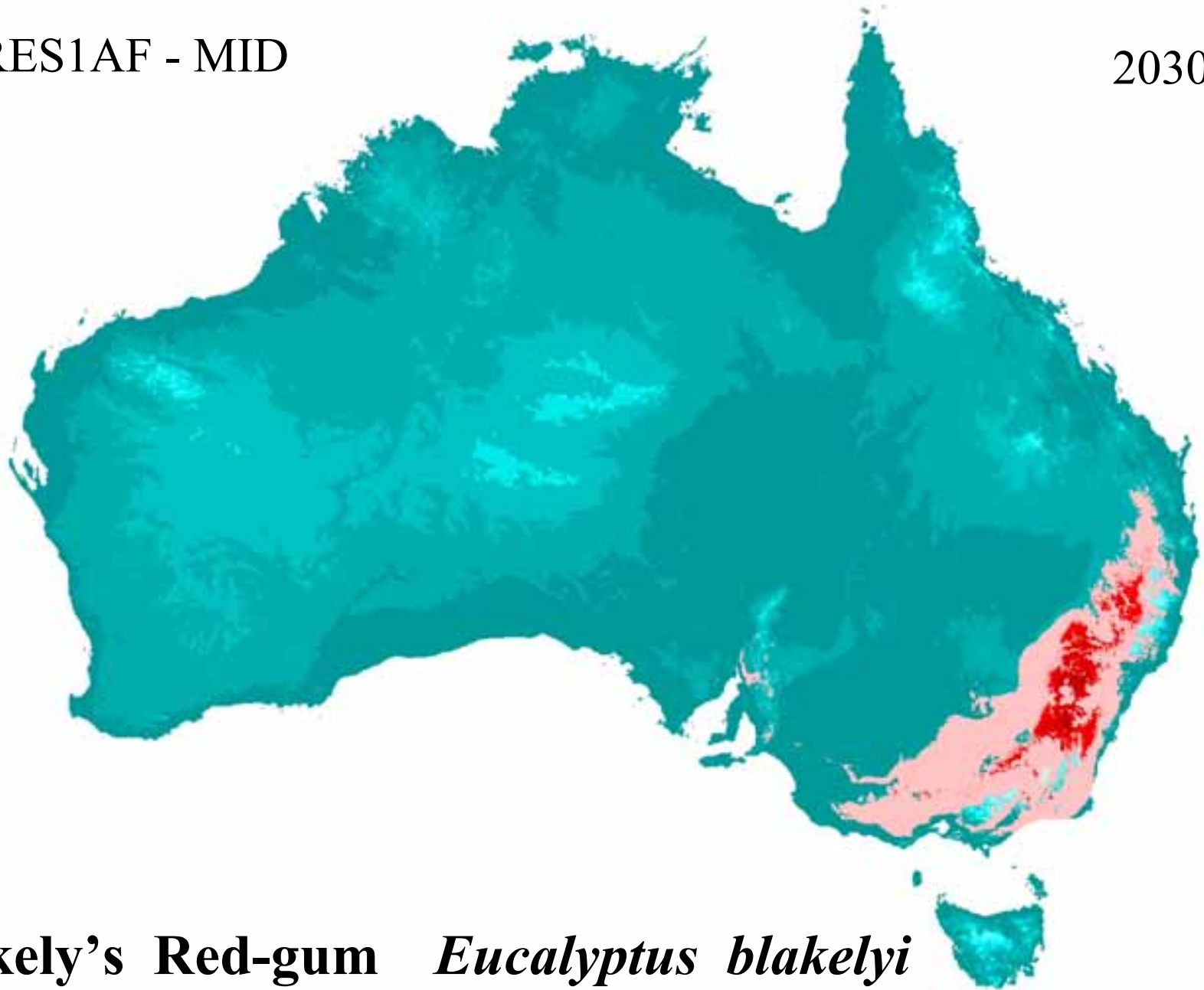
2020



Blakely's Red-gum *Eucalyptus blakelyi*

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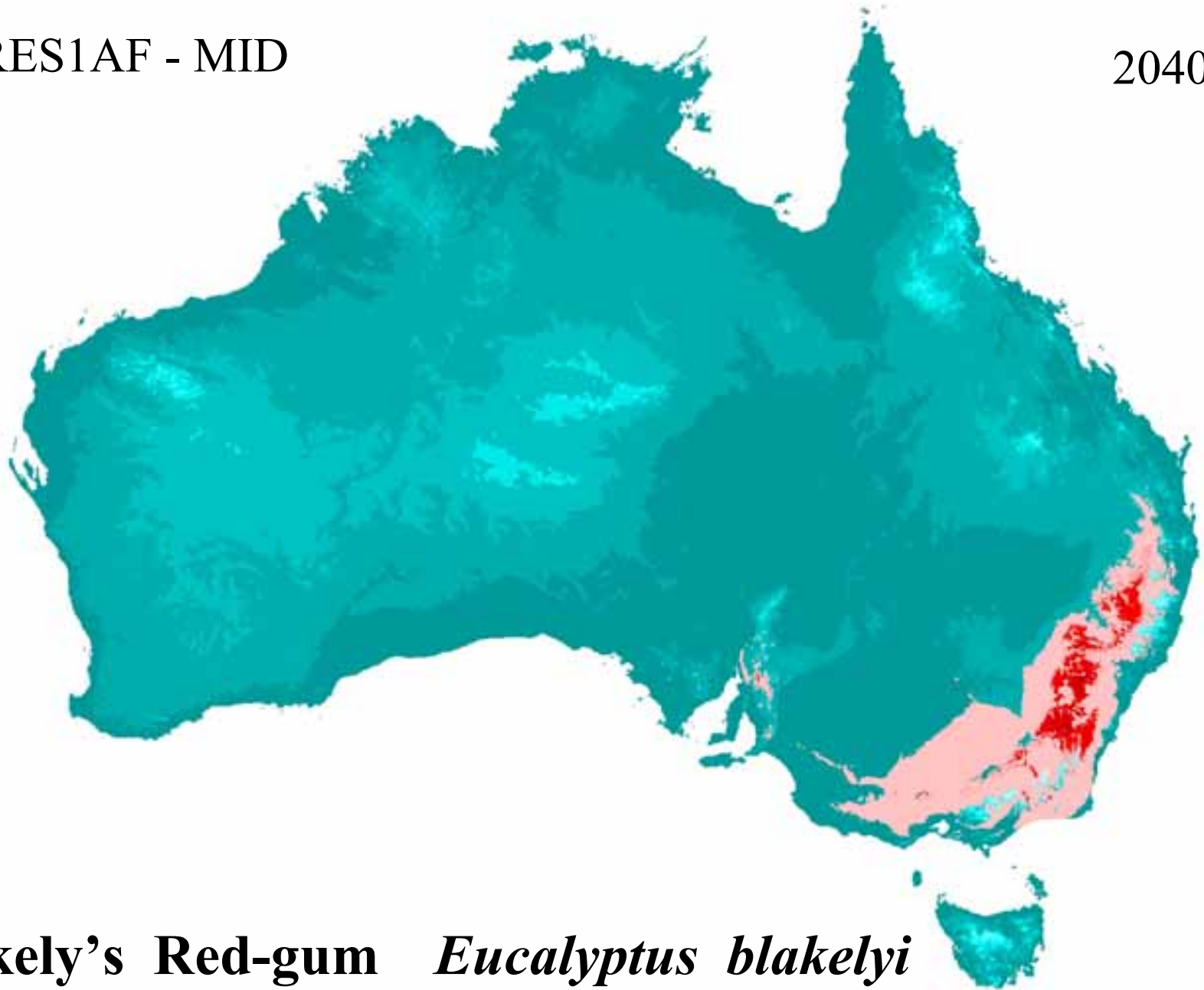
2030



Blakely's Red-gum *Eucalyptus blakelyi*

SRES1AF - MID

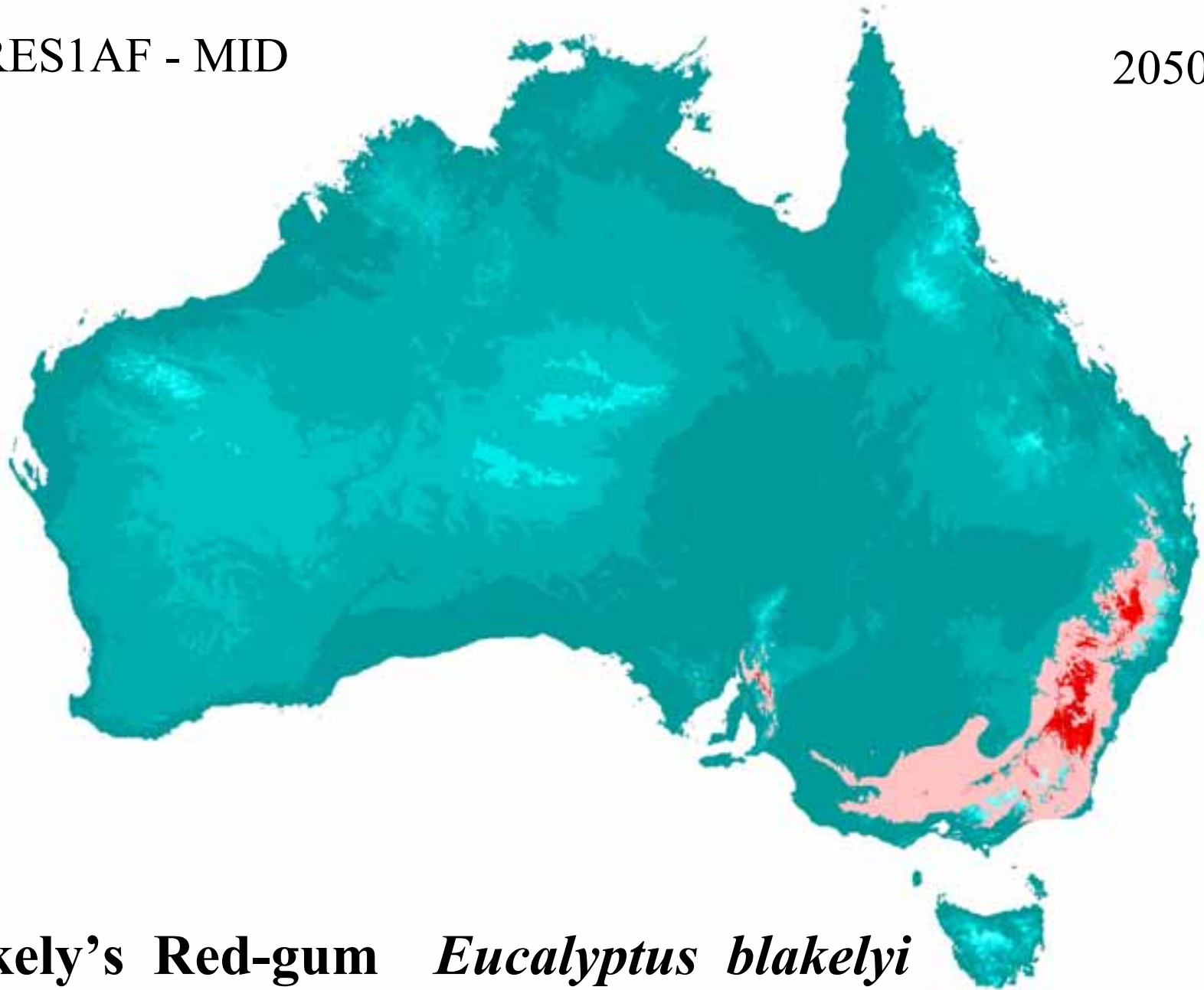
2040



Blakely's Red-gum *Eucalyptus blakelyi*

SRES1AF - MID

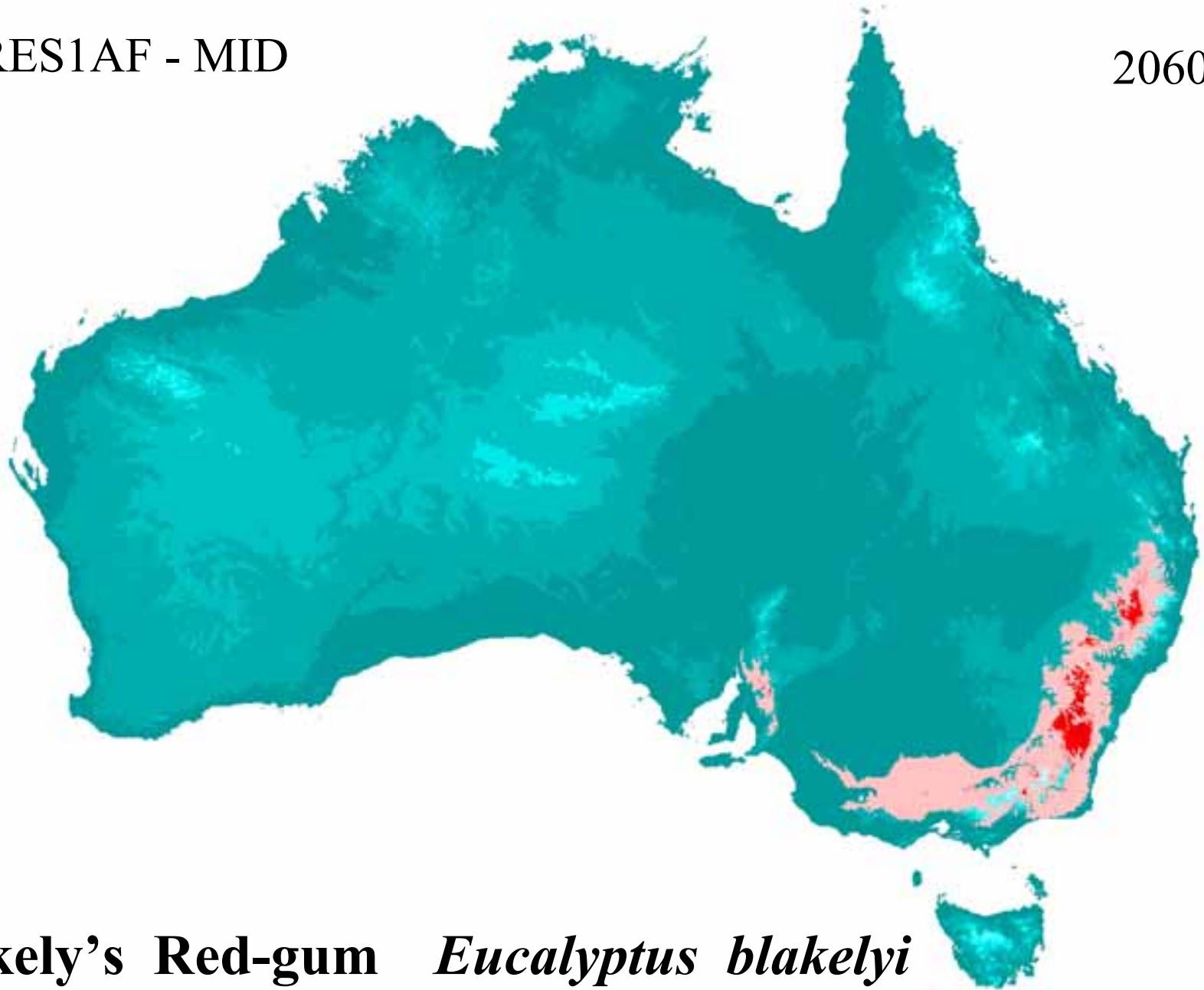
2050



Blakely's Red-gum *Eucalyptus blakelyi*

SRES1AF - MID

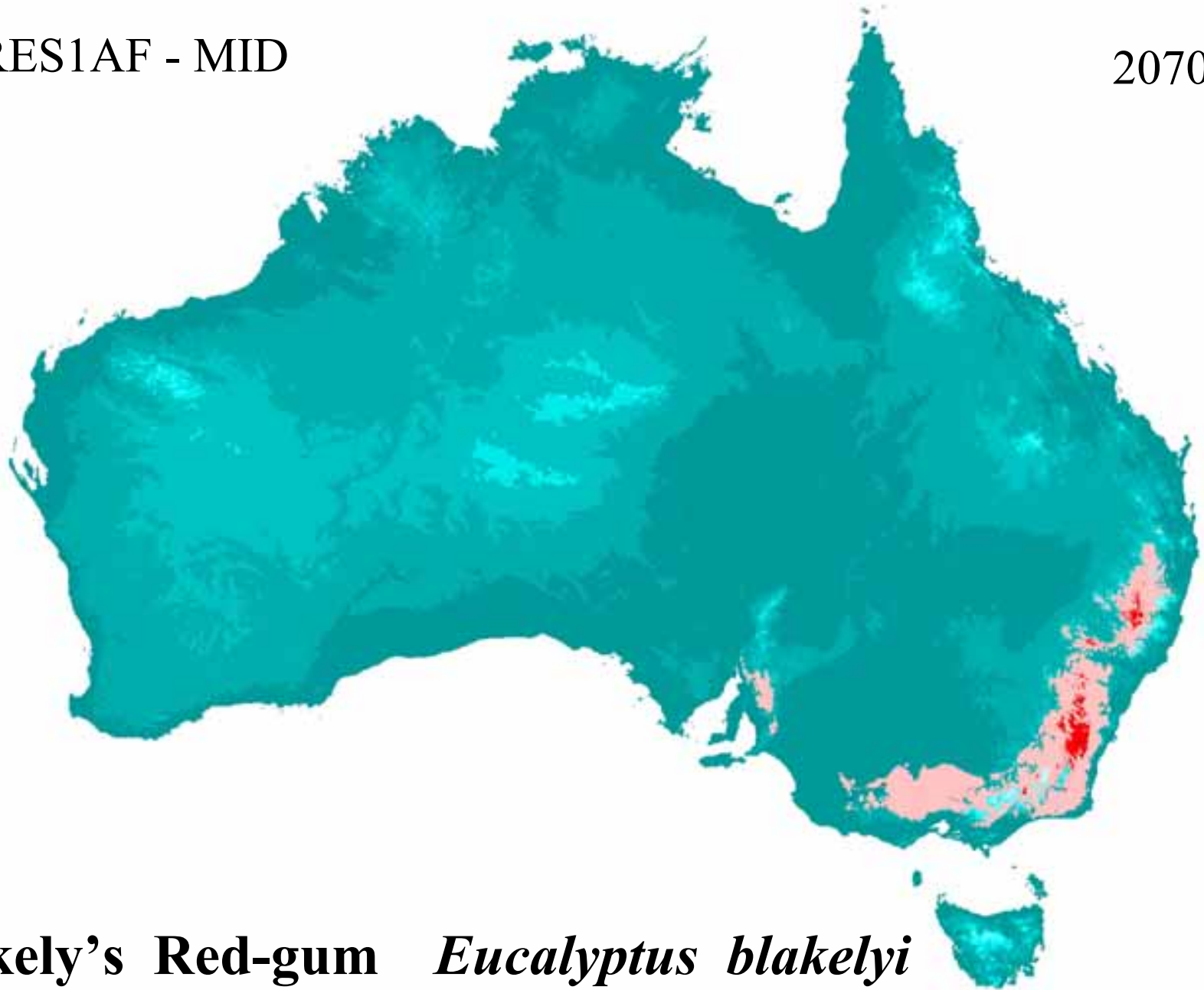
2060



Blakely's Red-gum *Eucalyptus blakelyi*

SRES1AF - MID

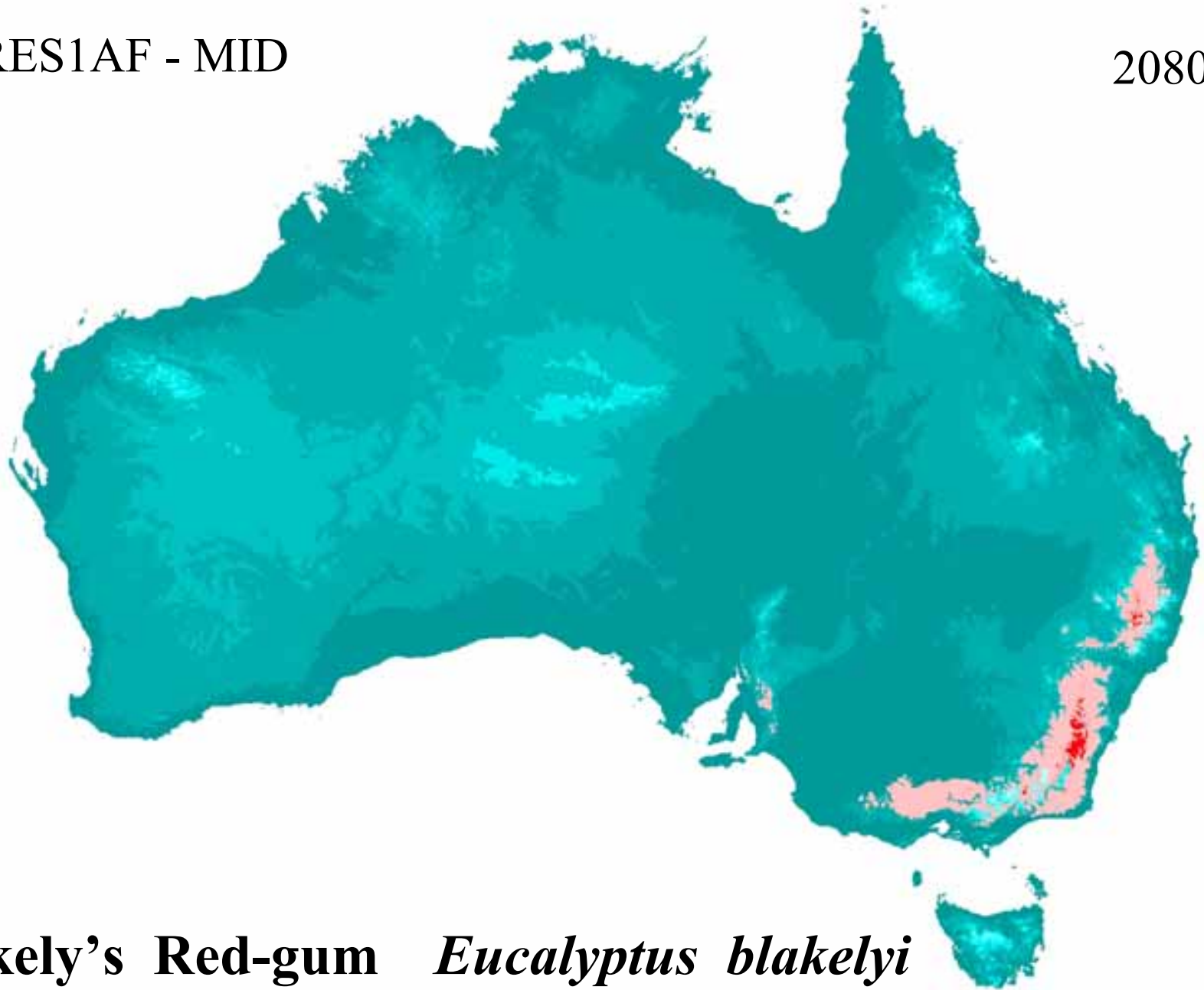
2070



Blakely's Red-gum *Eucalyptus blakelyi*

SRES1AF - MID

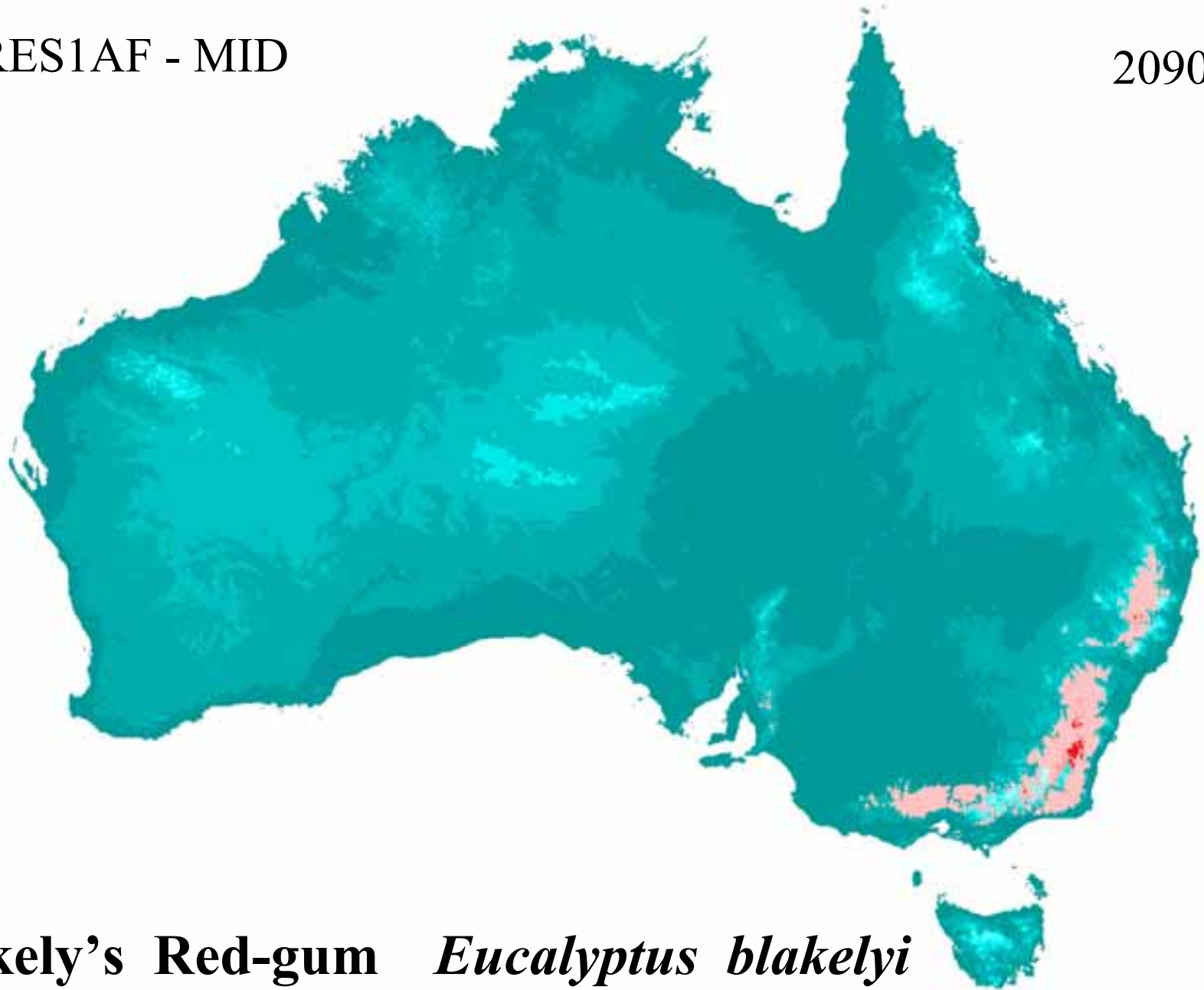
2080



Blakely's Red-gum *Eucalyptus blakelyi*

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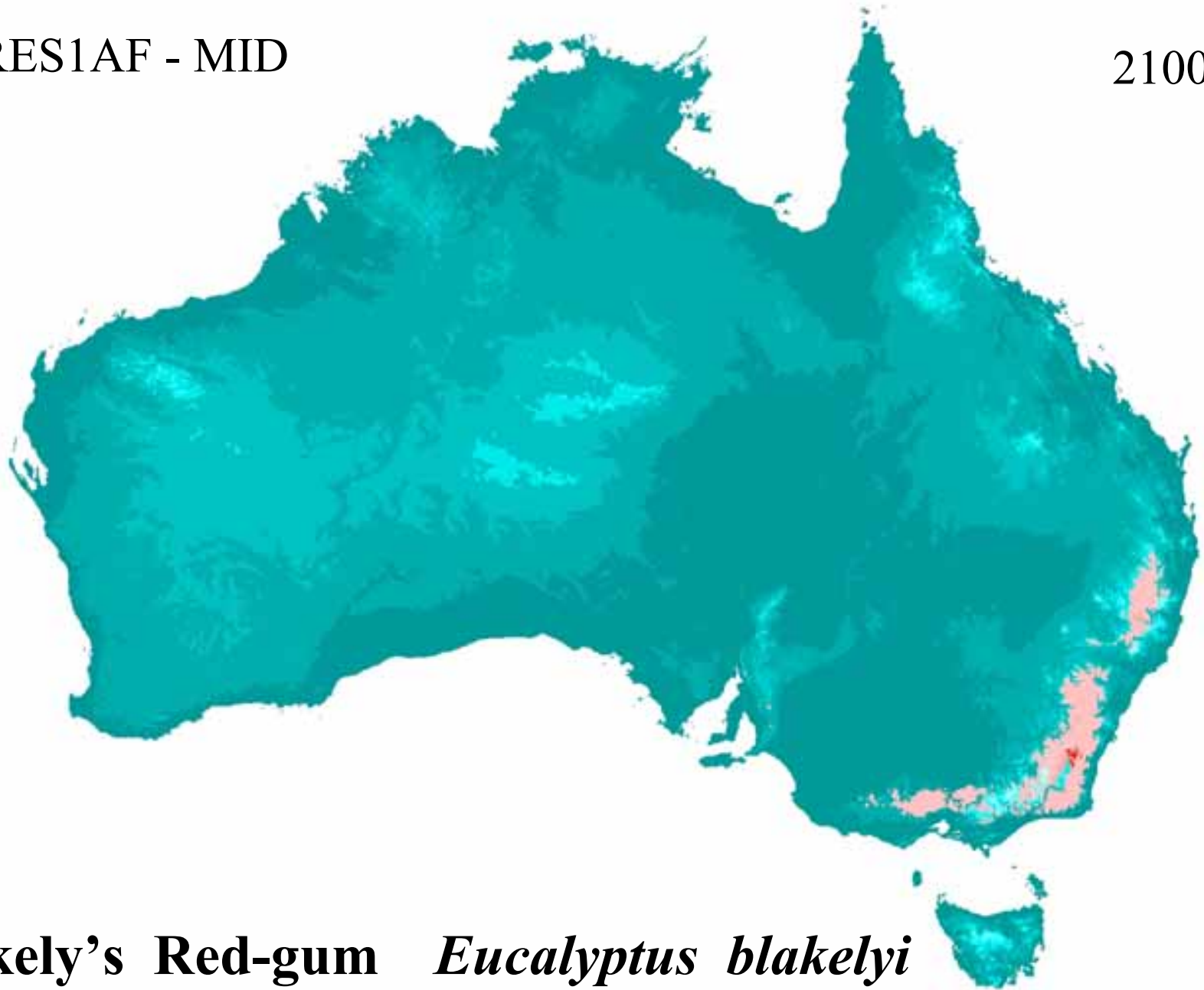
2090



Blakely's Red-gum *Eucalyptus blakelyi*

SRES1AF - MID

2100



Blakely's Red-gum *Eucalyptus blakelyi*

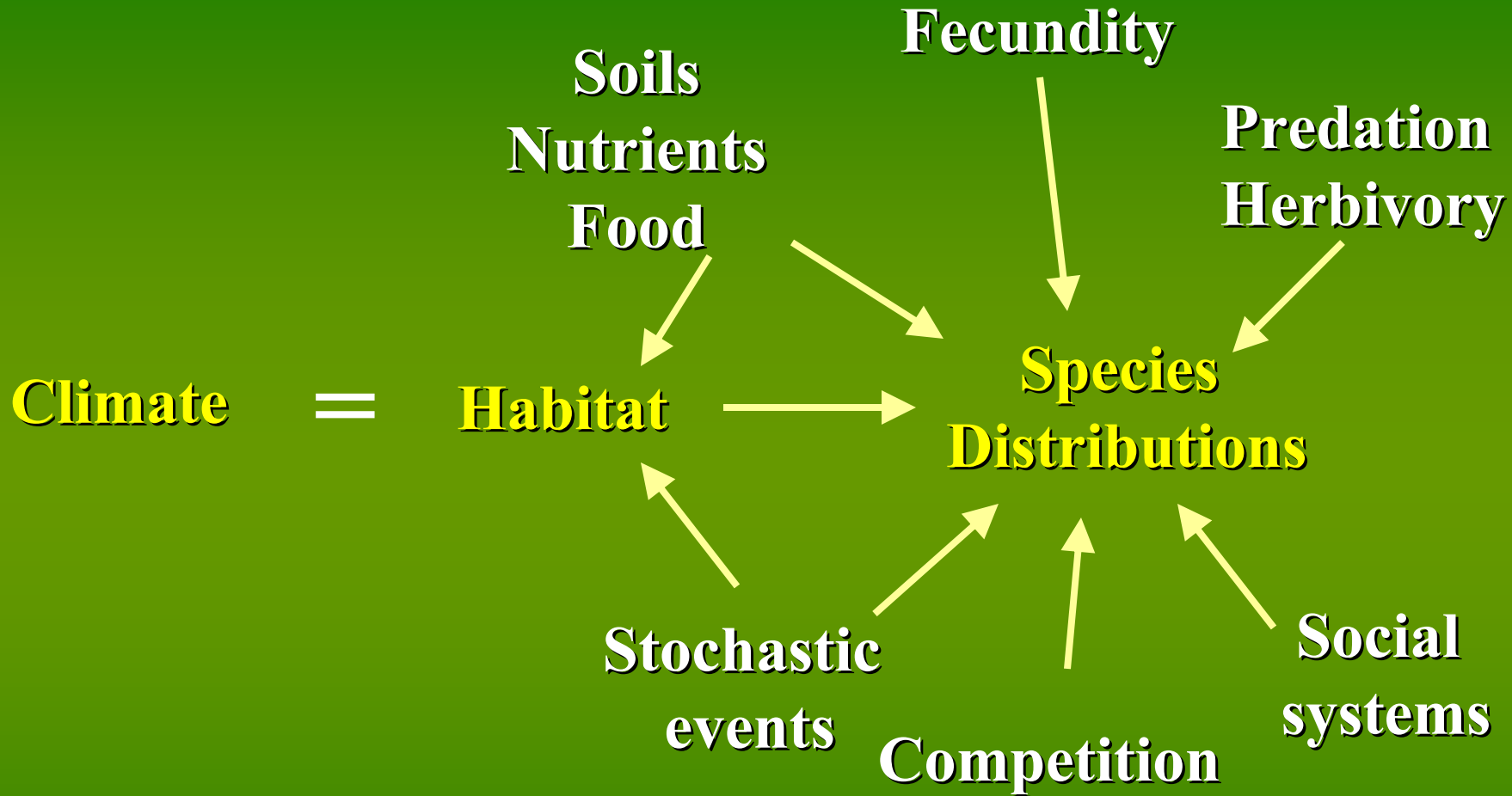
Biodiversity & Climate Change

**Climate = Species
Distributions**

Biodiversity & Climate Change

**Climate = Habitat = Species
Distributions**

Biodiversity & Climate Change



Bio-climatic models

Based on climate *only*

..... *too simplistic ??*

Need

- more complexity / ‘reality’
- other environmental factors
- multi – species
- alienated / fragmented landscapes

GDM



Fecundity

**Predation
Herbivory**

Climate

=

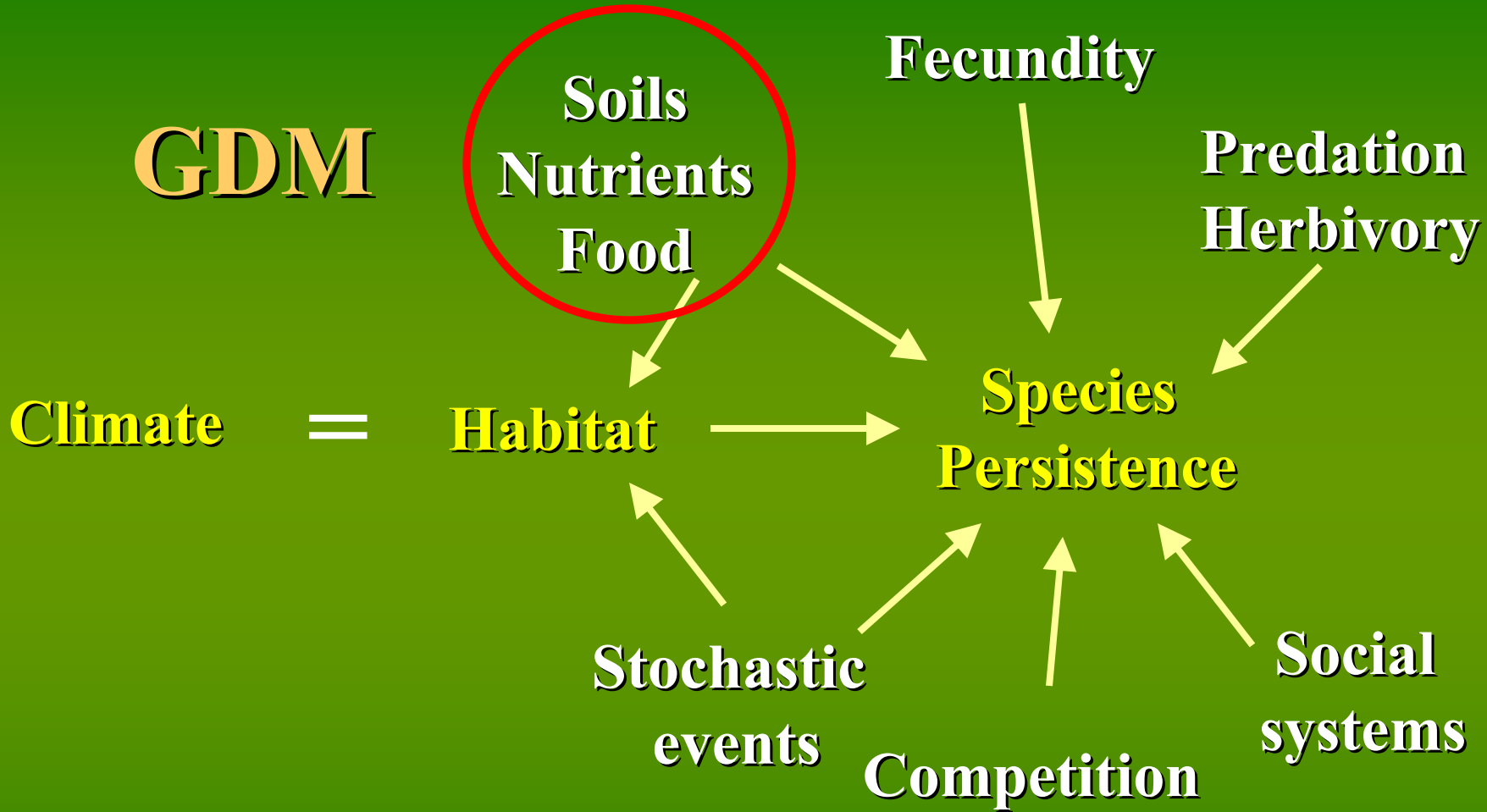
Habitat

**Species
Persistence**

**Stochastic
events**

Competition

**Social
systems**



Ecosystem Risk Project

3 *Vegetation Types* ‘Temperate Eucalypt W’lands’

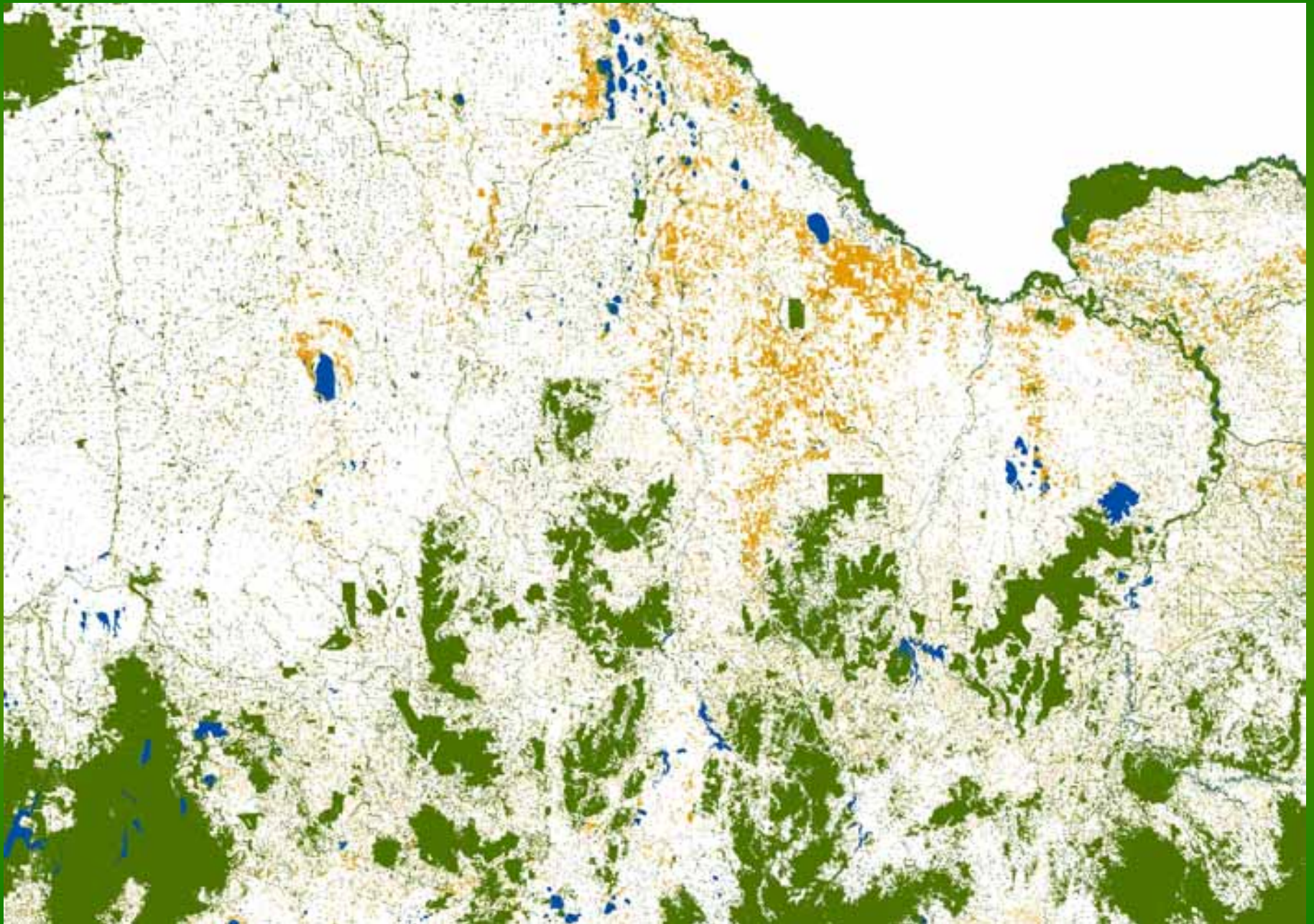
‘Mallee Woodlands’

‘Buloke / Callitris / Savannah’

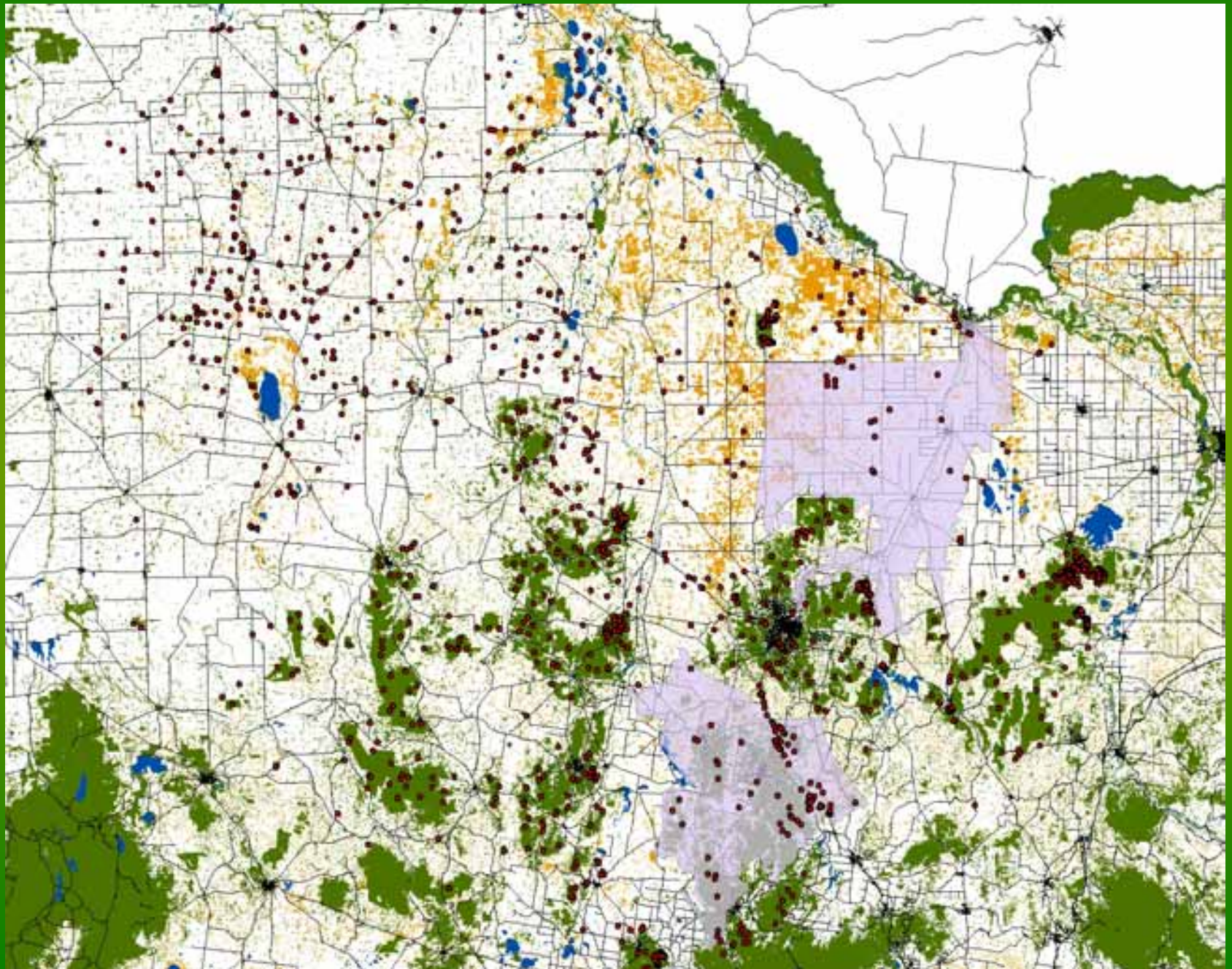
model *environmental envelope* of ‘communities’

..... not just climatic factors

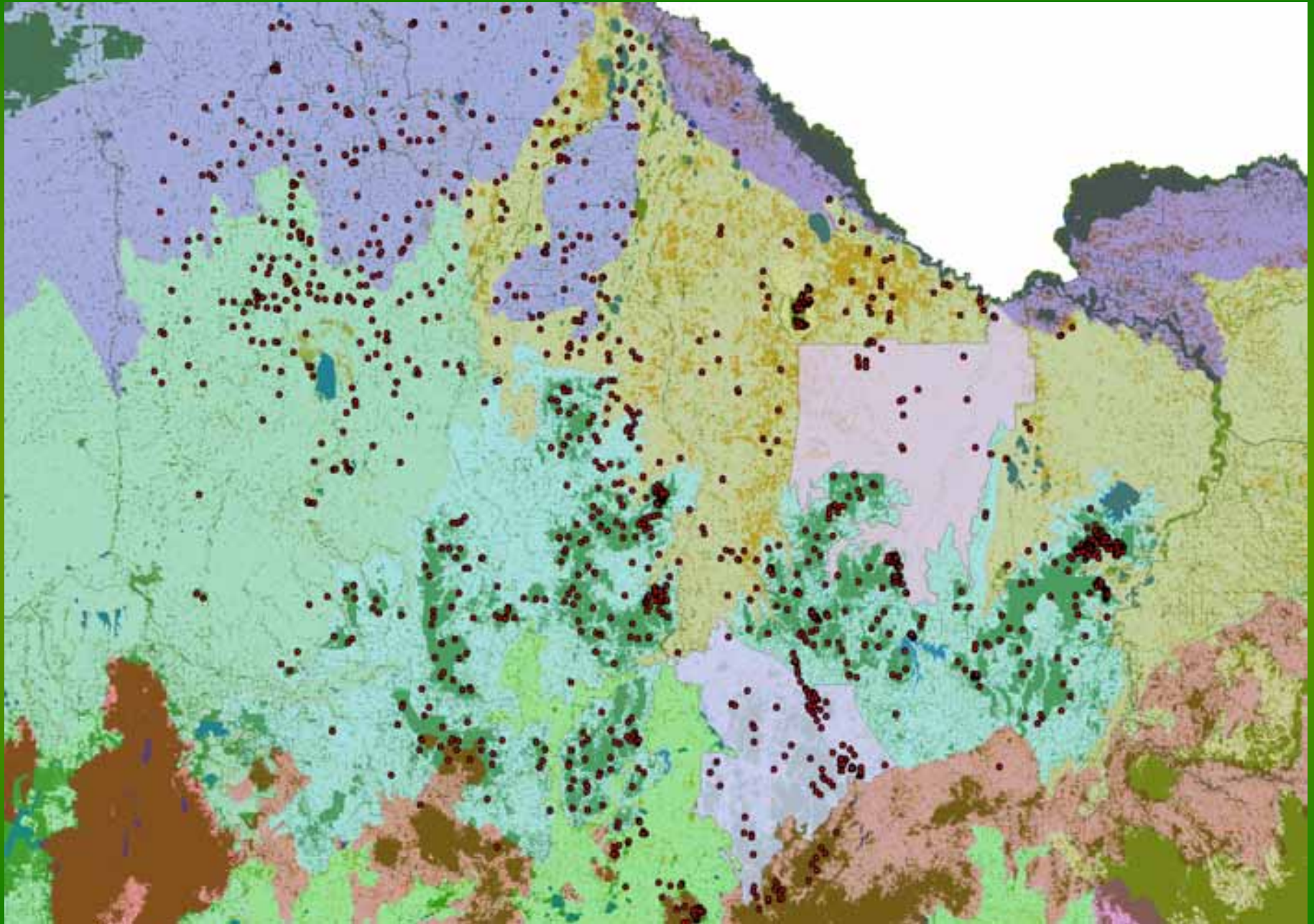
Native Vegetation



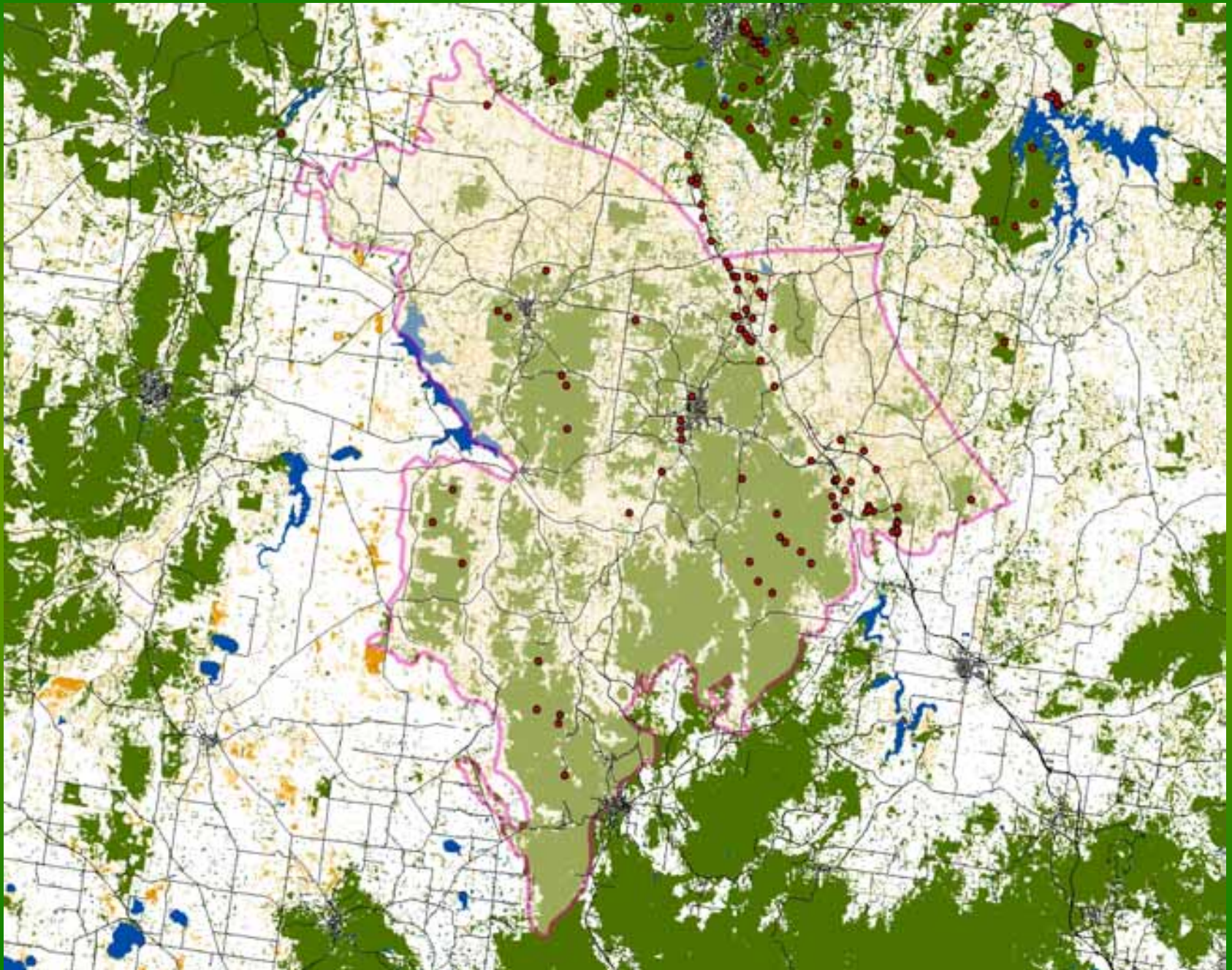
Quadrat Data - Study Zone



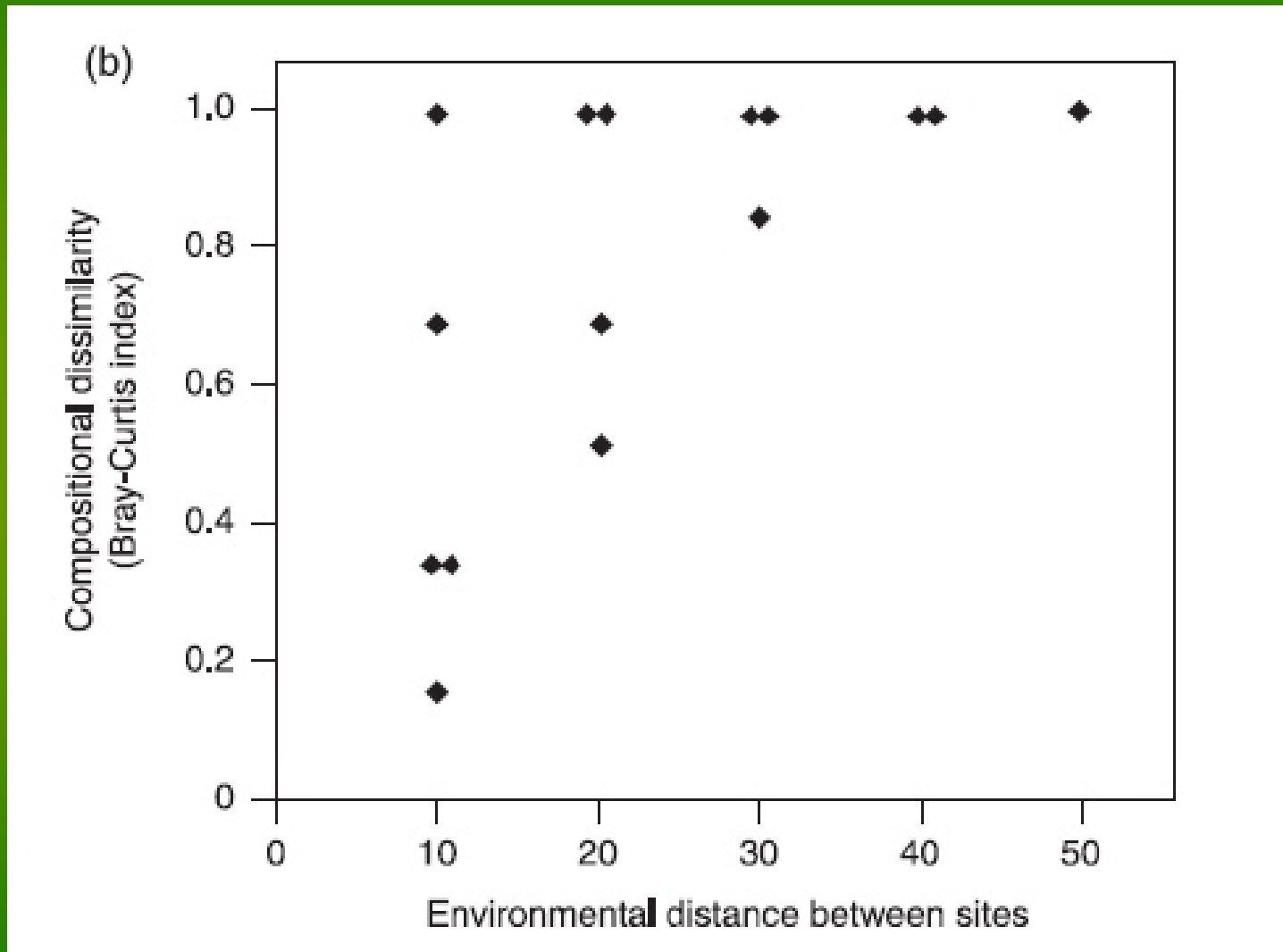
Bioregions & Quadrat Data



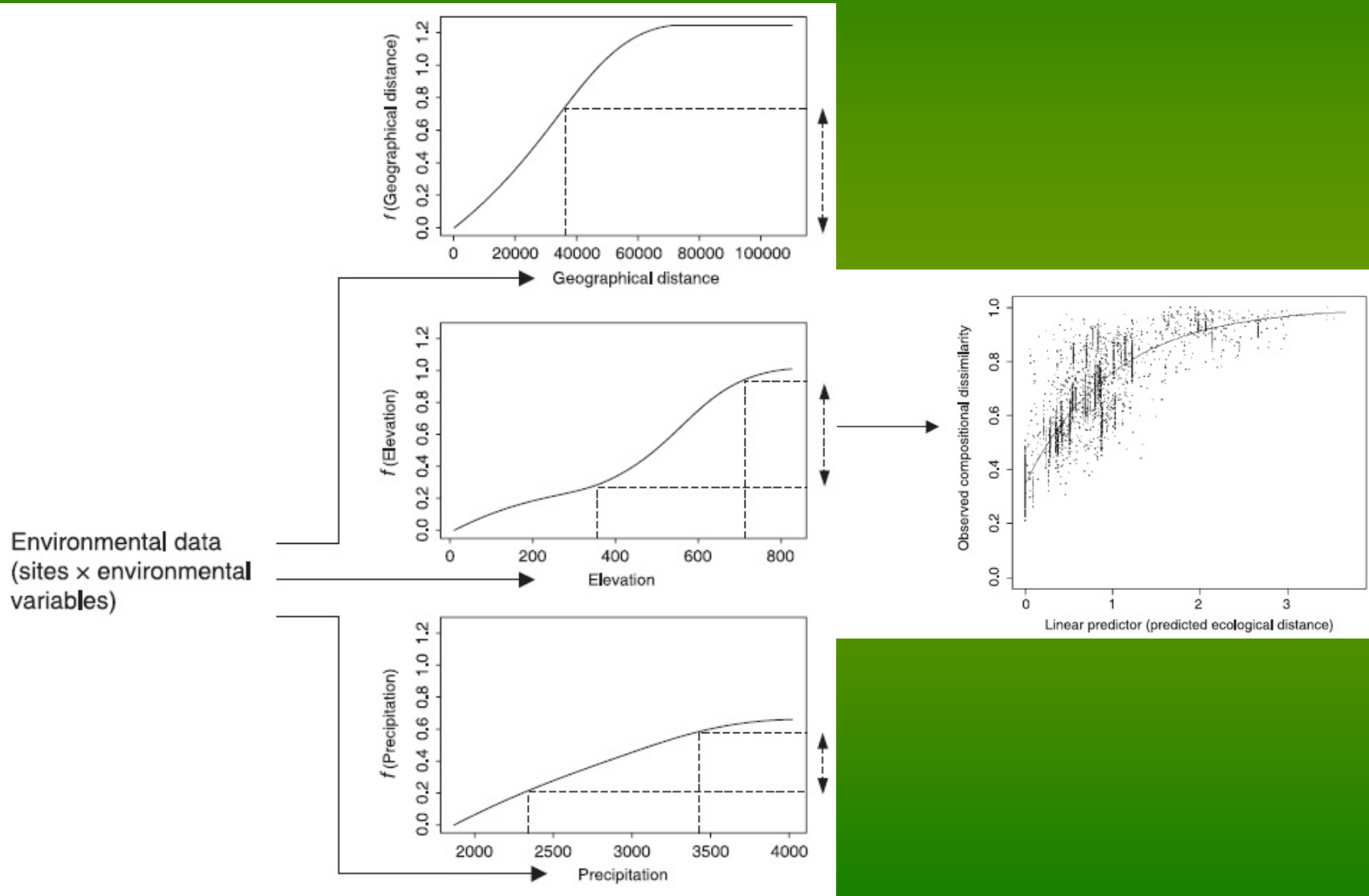
Quadrat Data - Muckleford Zone



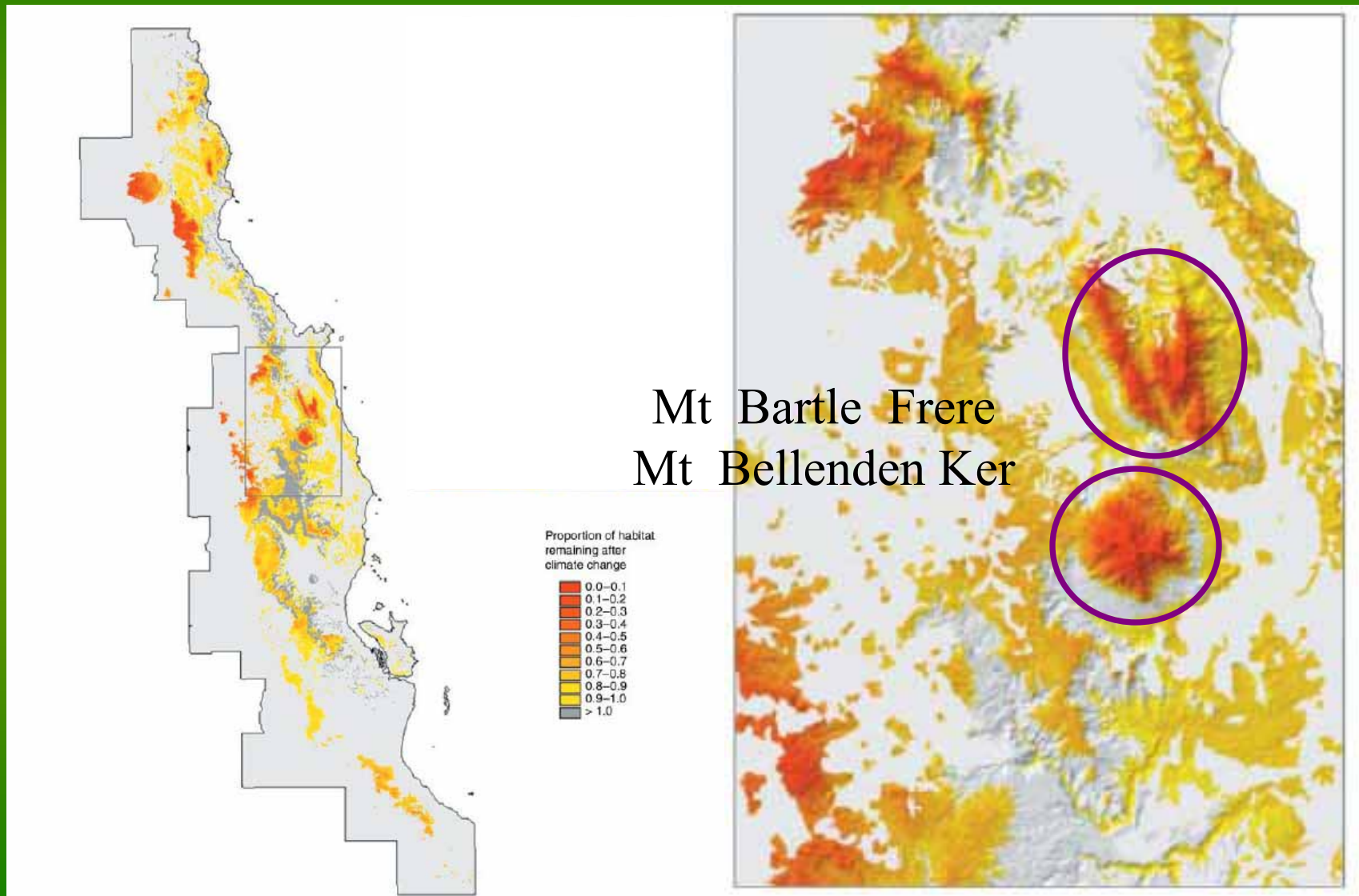
Generalised Dissimilarity Models



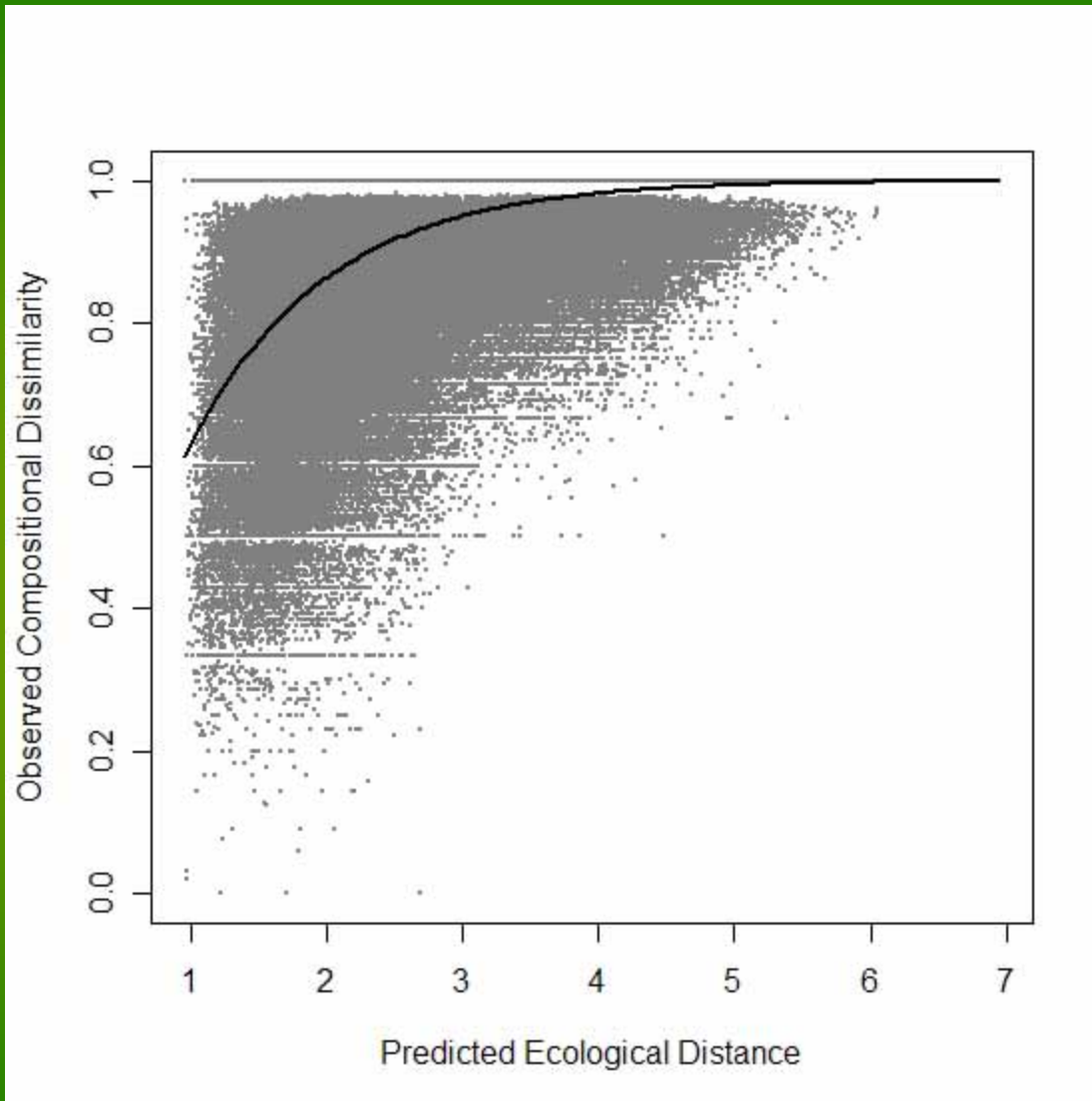
Generalised Dissimilarity Models



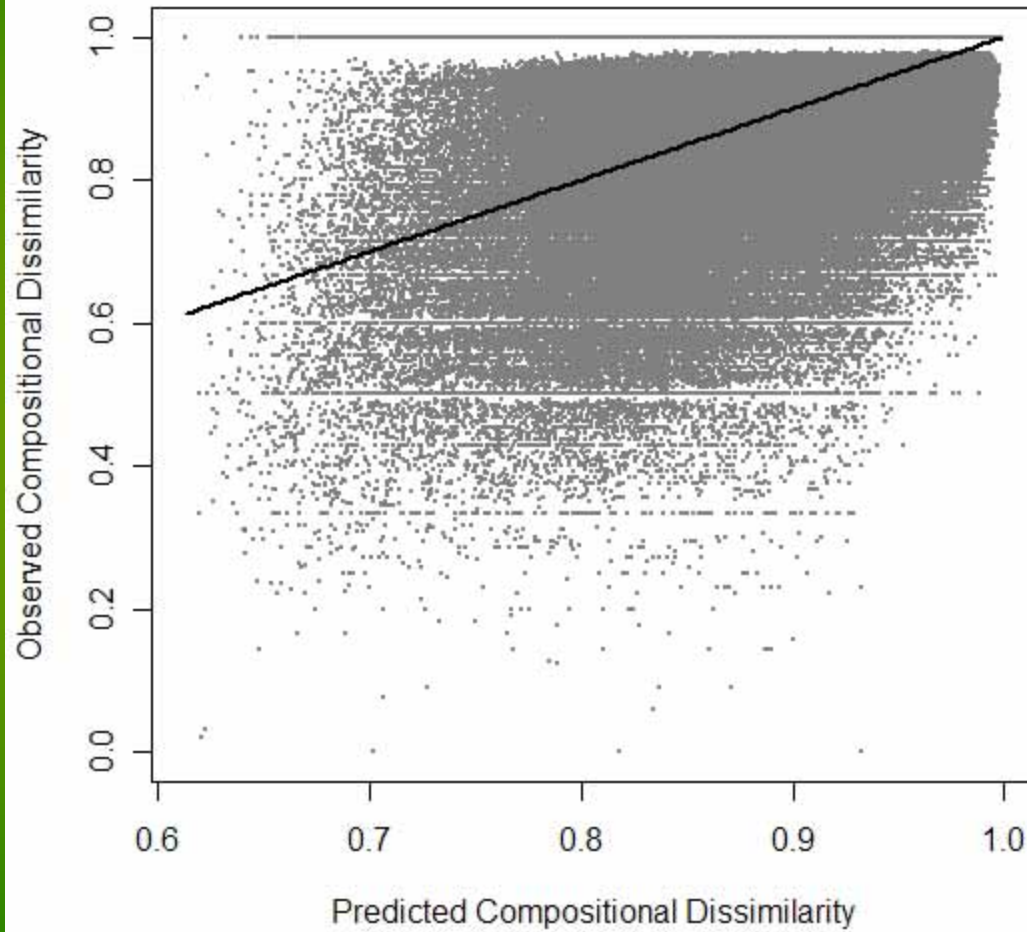
Climate Change Impacts - *Wet Tropics*



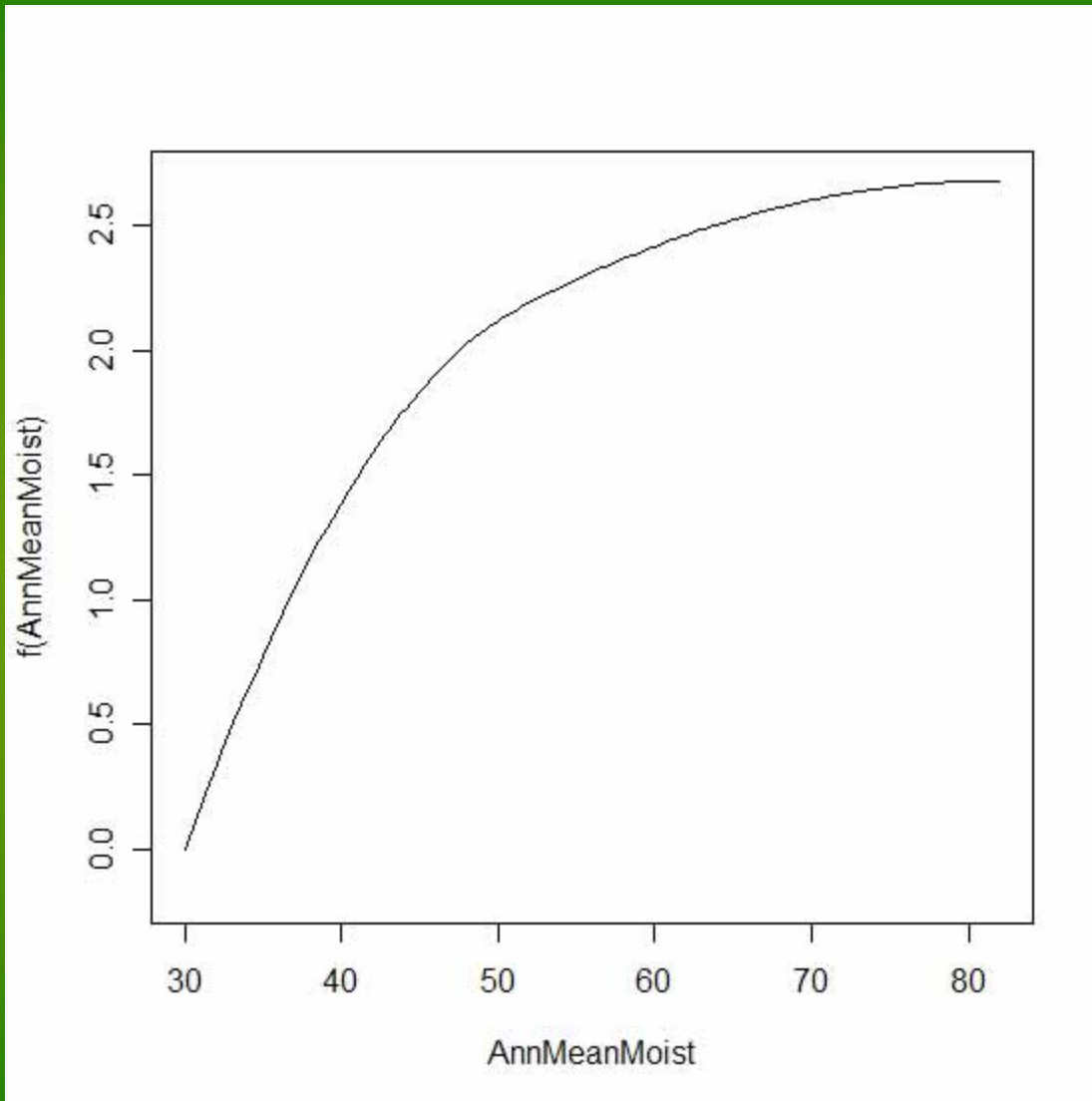
Model #5



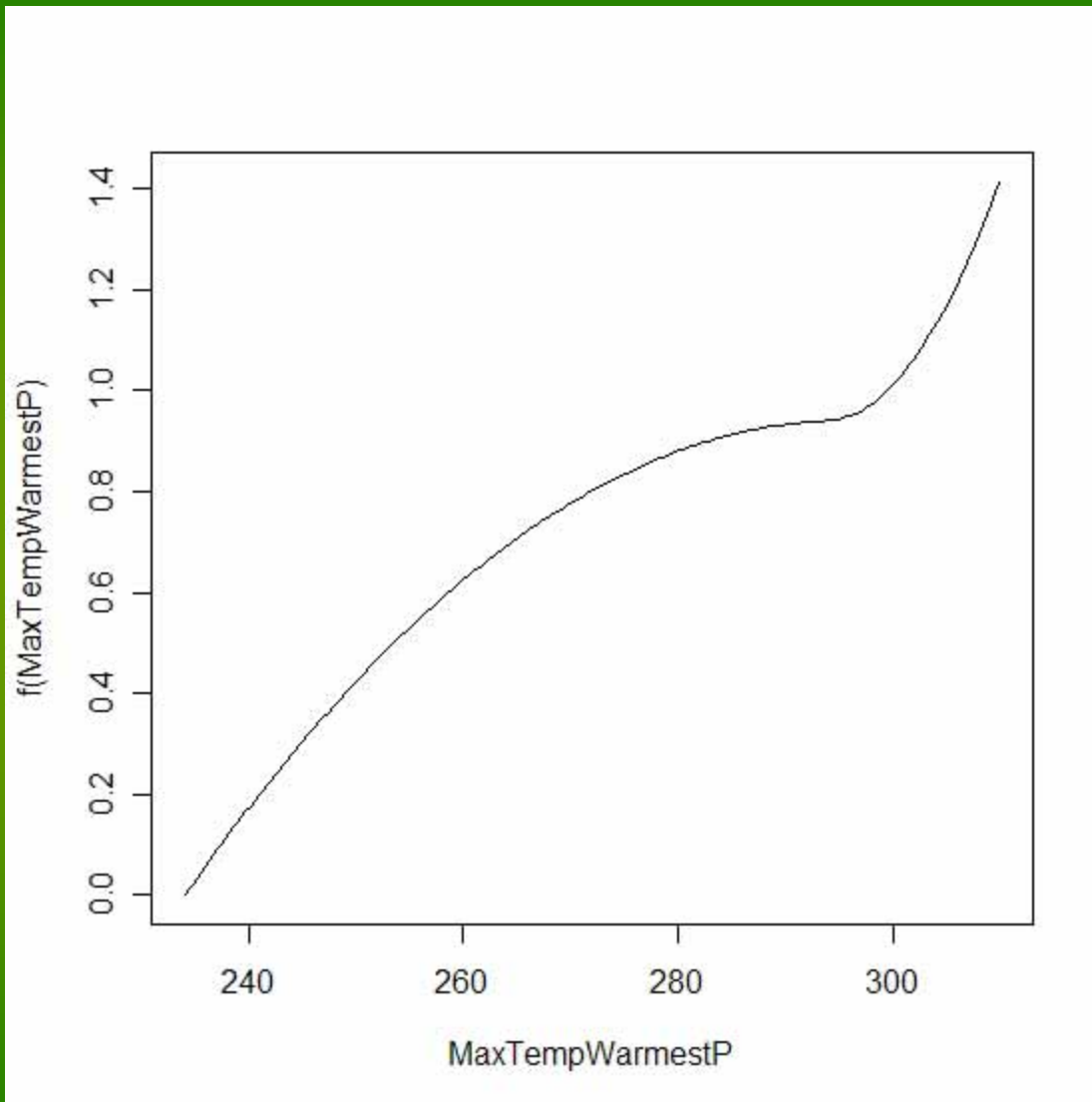
Model #5



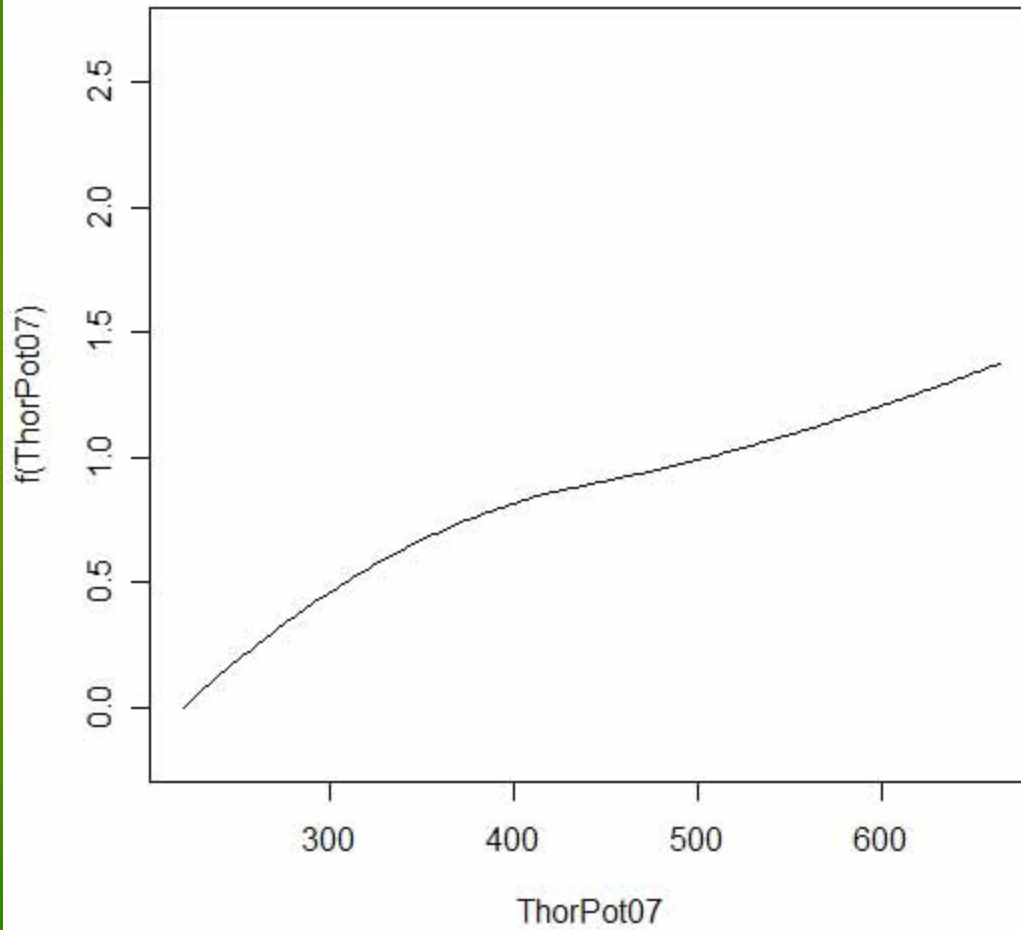
Model #5



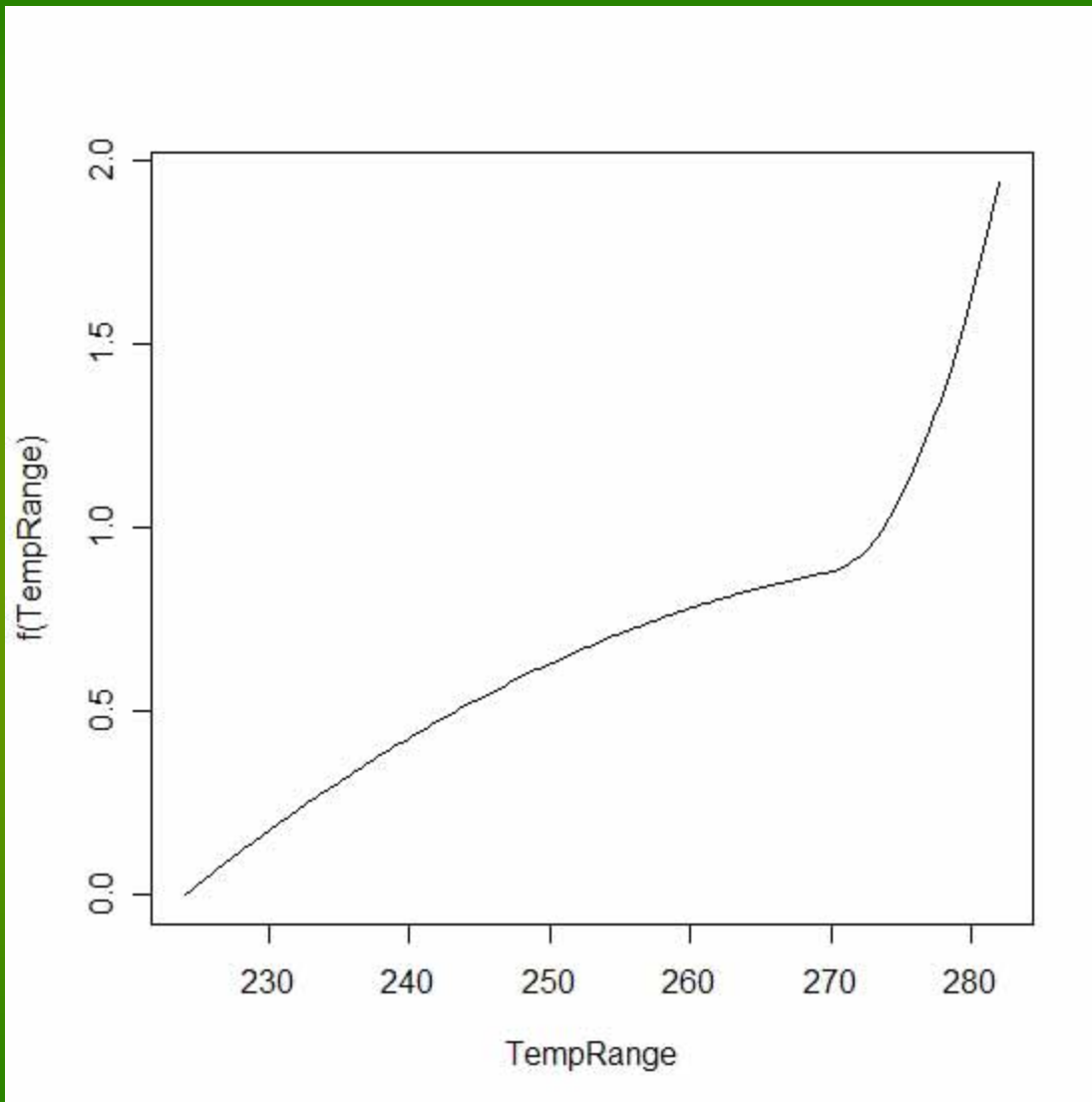
Model #5



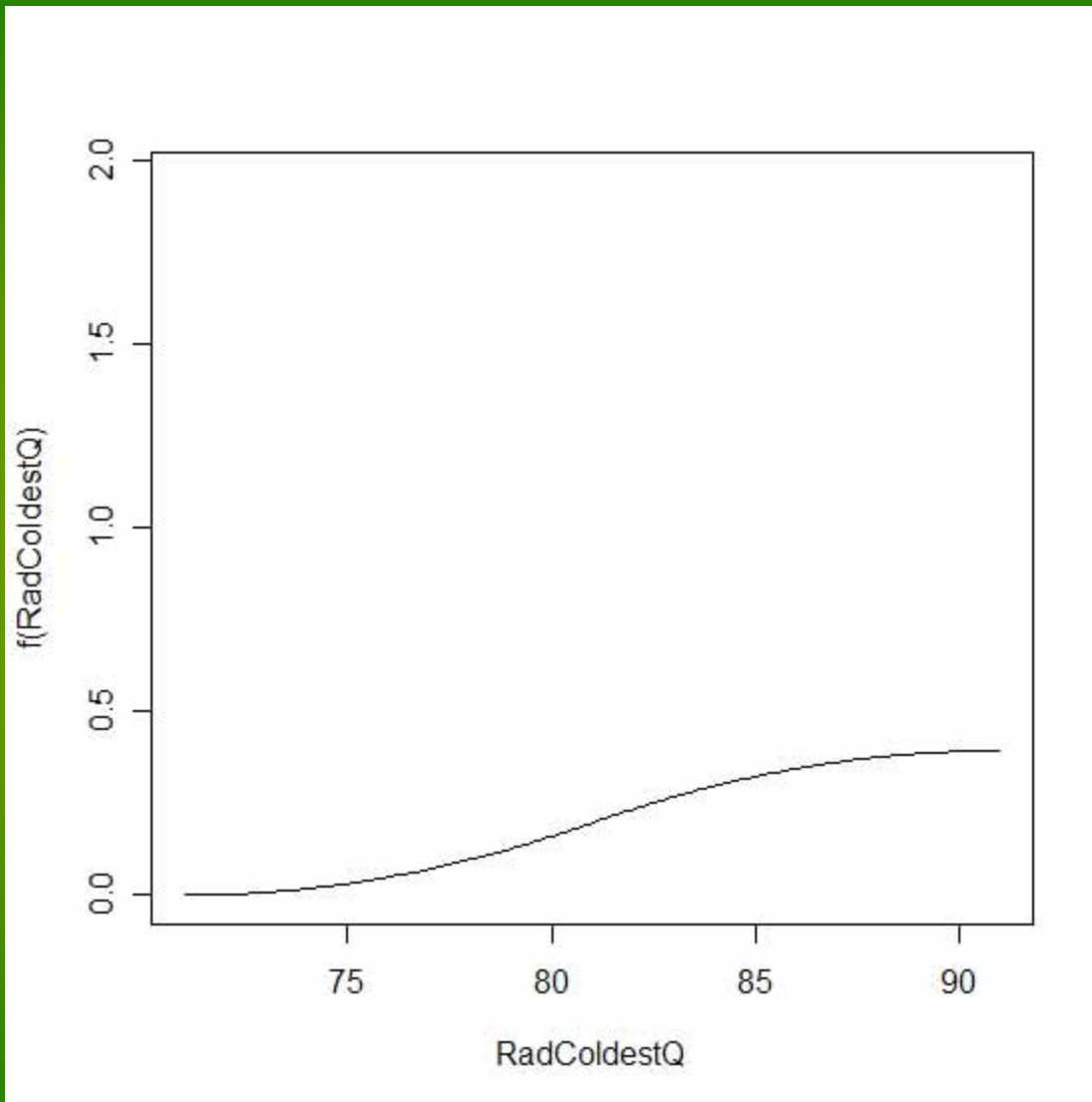
Model #5



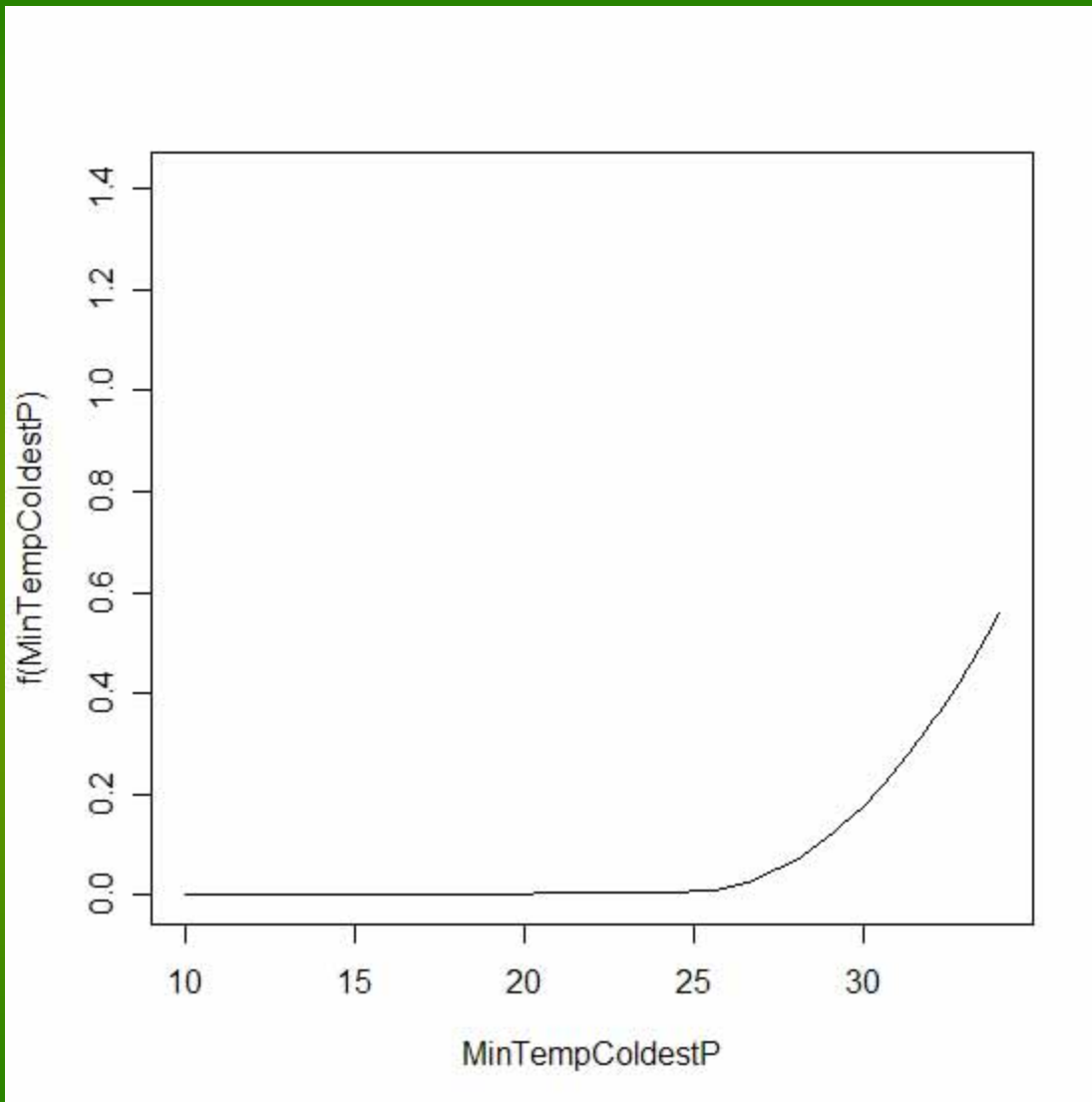
Model #5



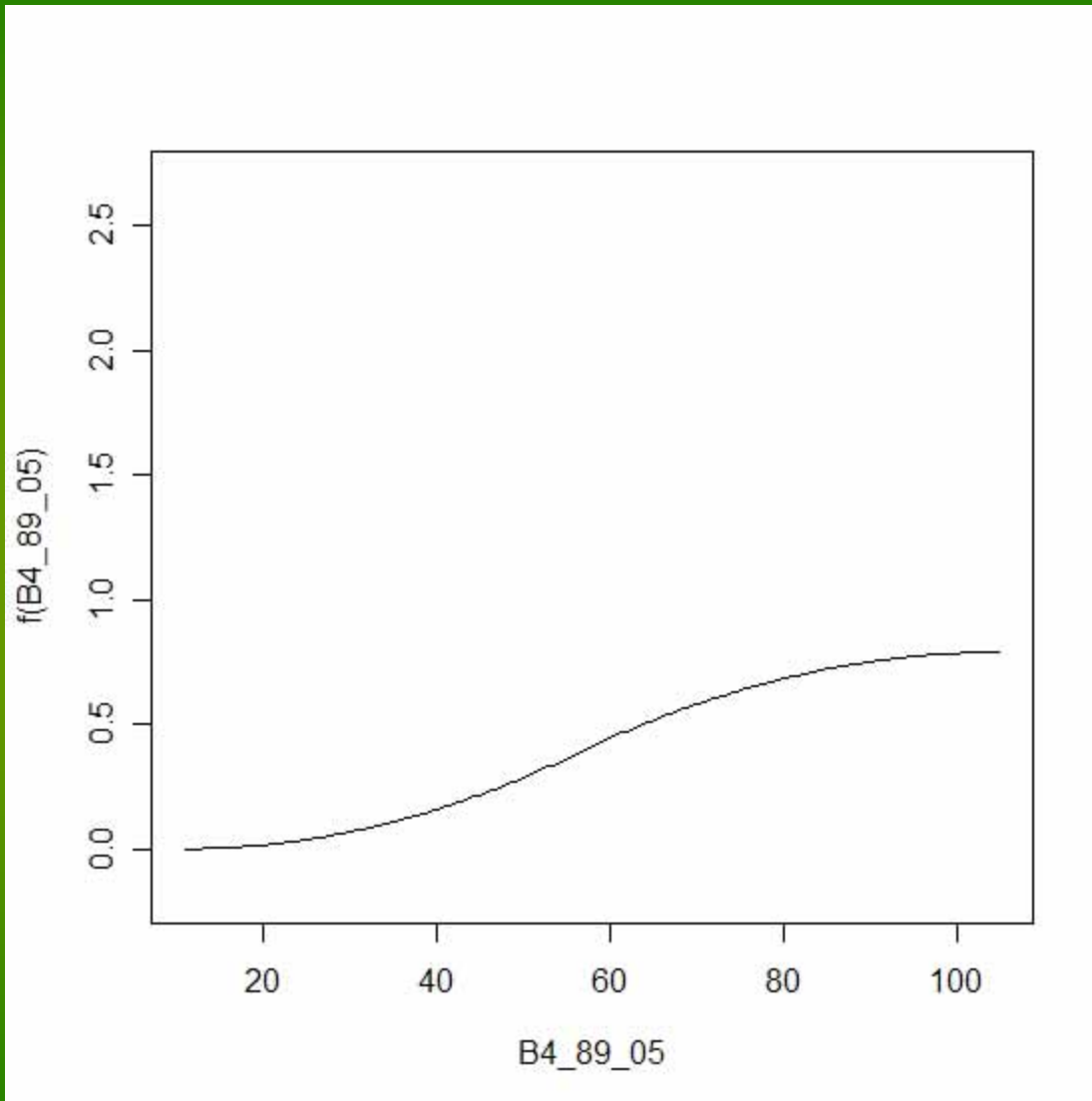
Model #5



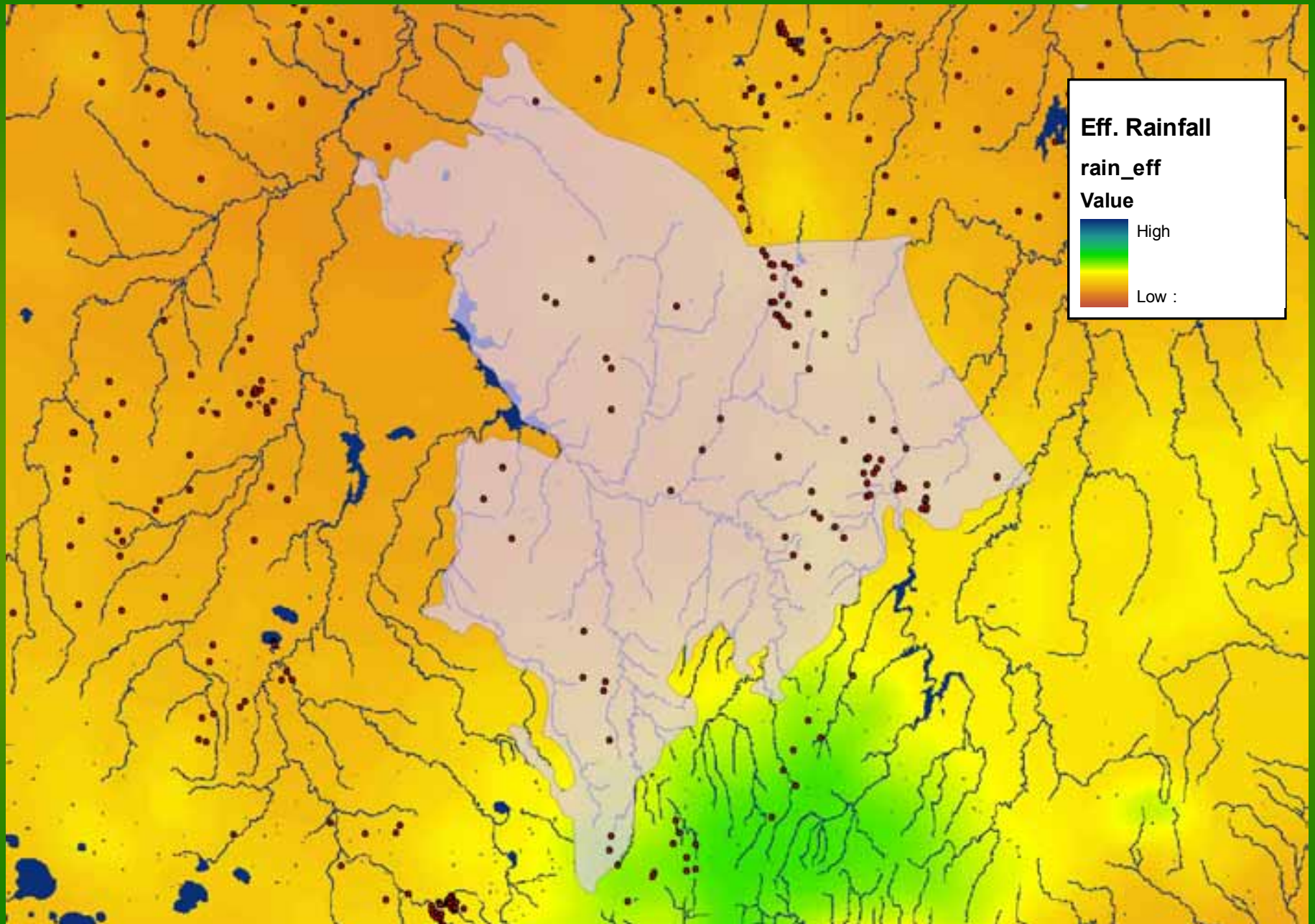
Model #5



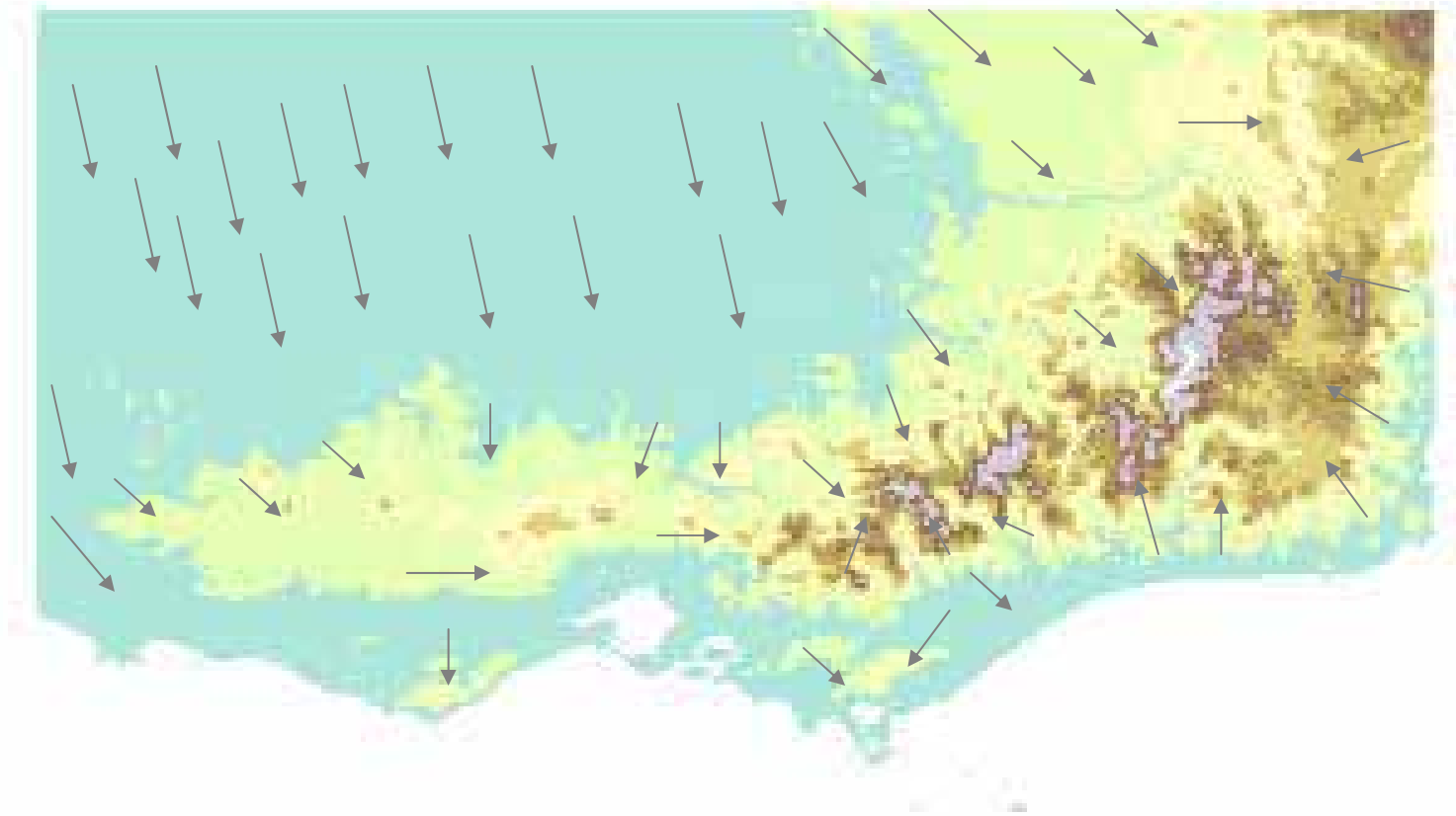
Model #5

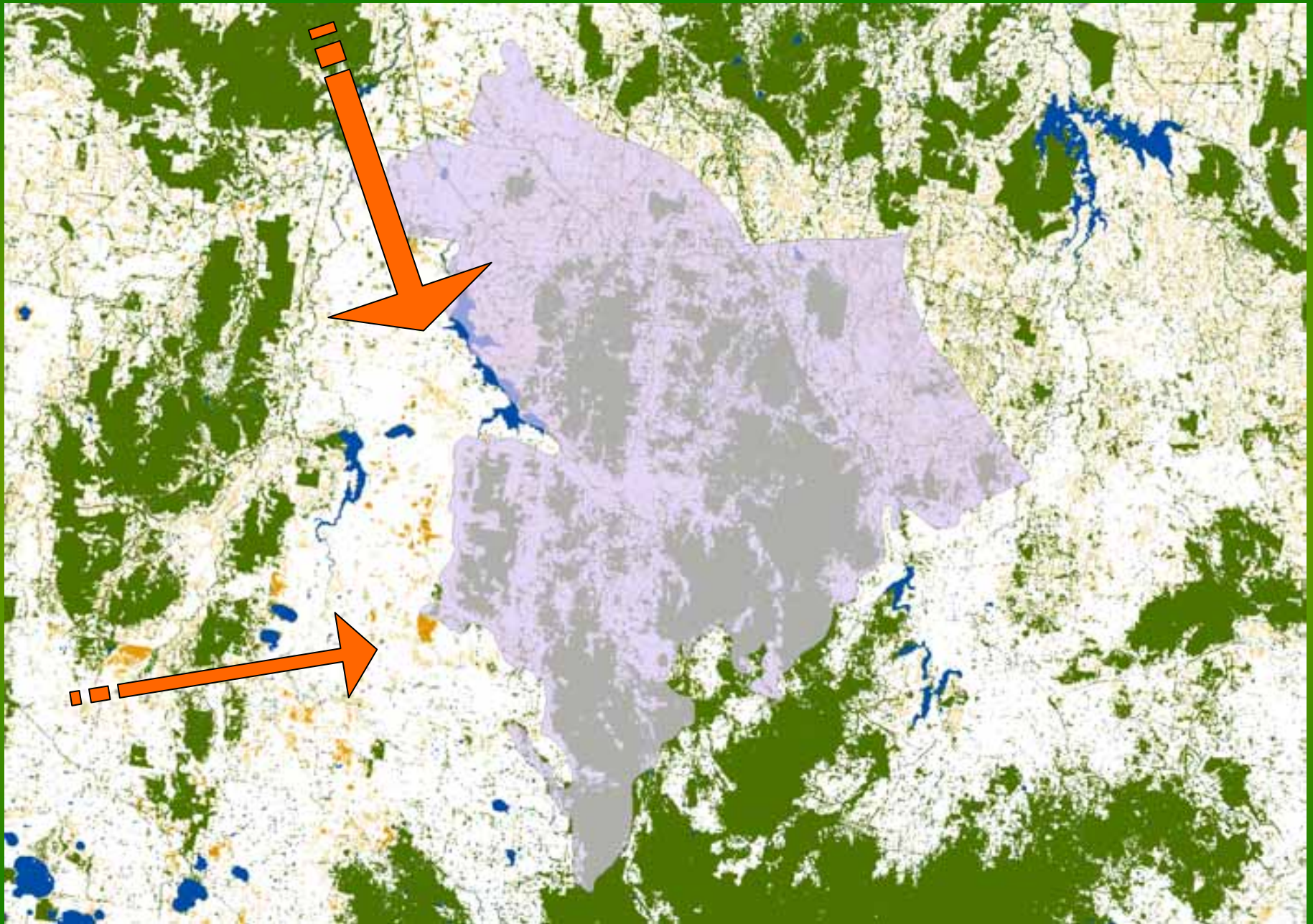




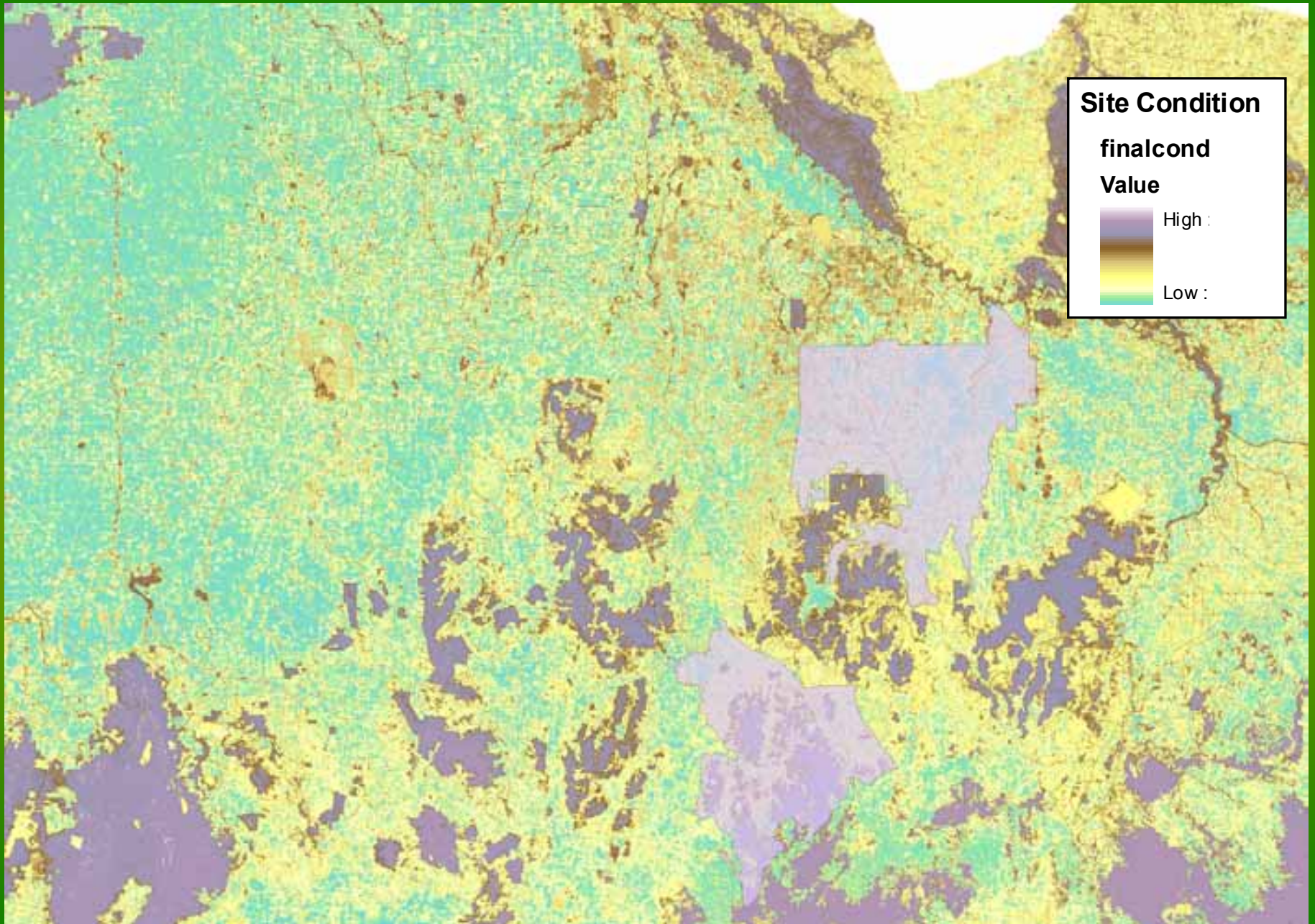


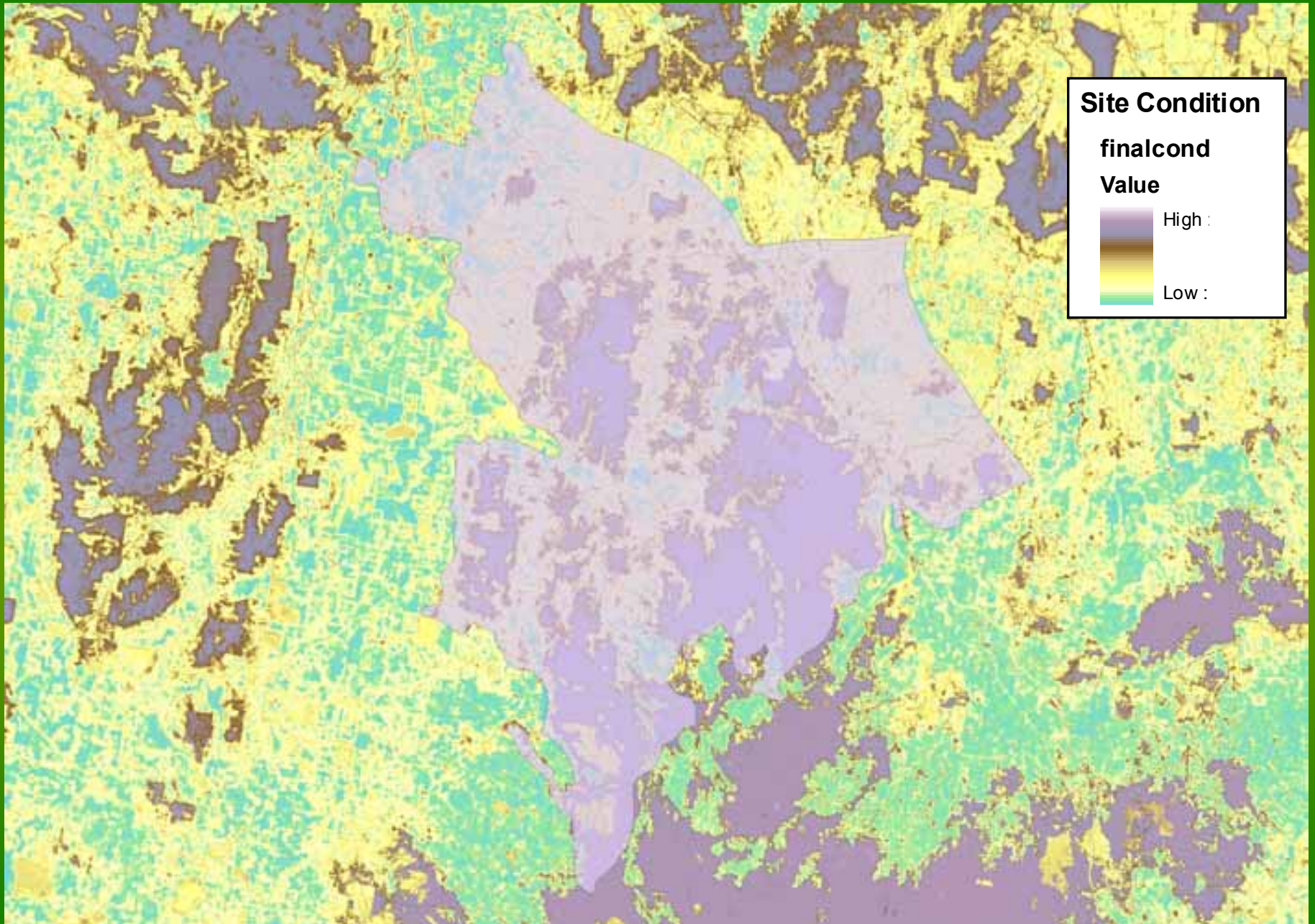
Where would 'Bioclimates' move ?

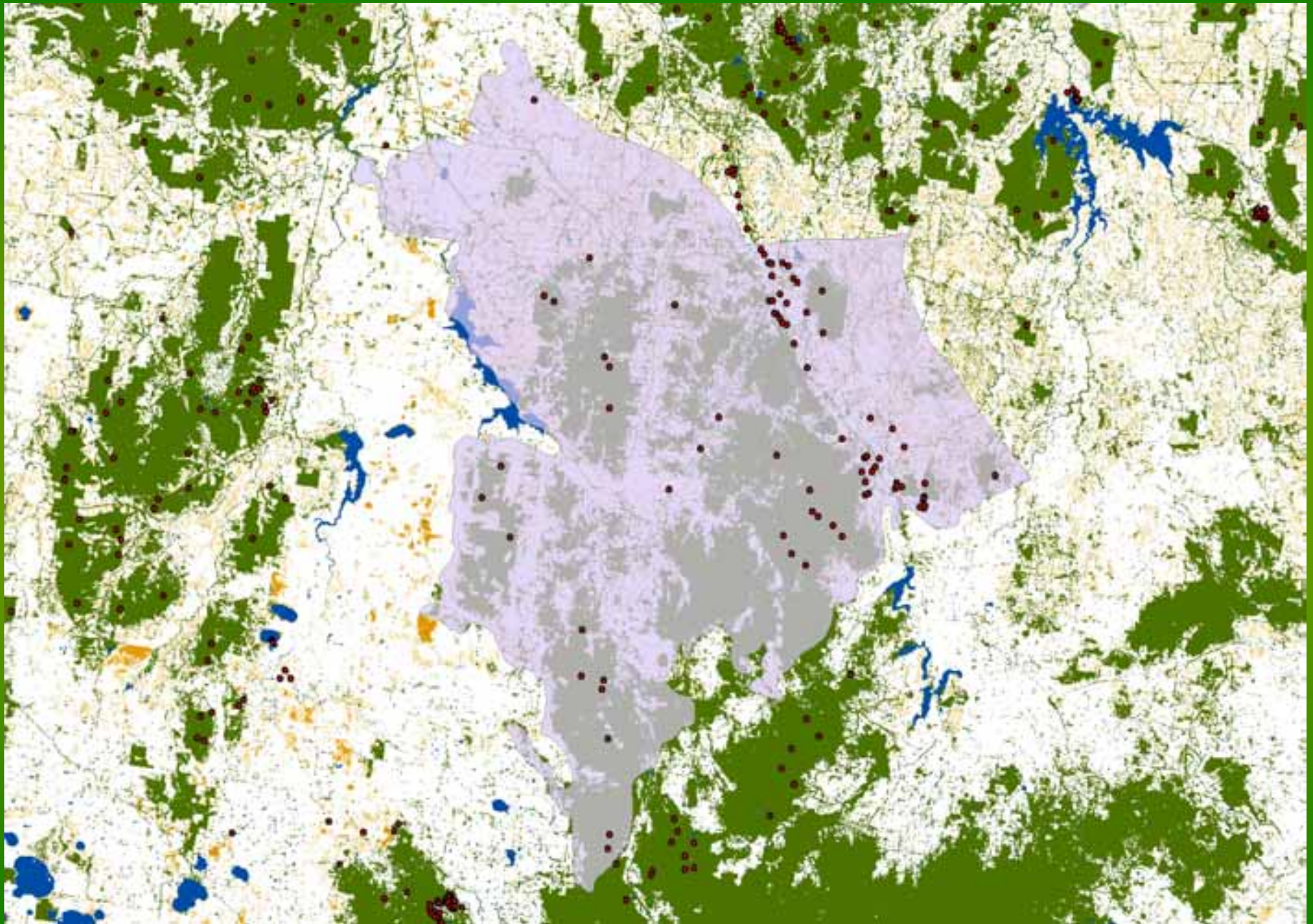




Vegetation Condition







Biodiversity & Climate Change

What can we do ??



Biodiversity & Climate Change

Threats

- *Habitat Loss*

Fragmentation, Patch Size, etc.

- *Salinity*
- *Weeds / Pathogens / Feral Predators*
- **Climate Change**

Biodiversity & Climate Change

Individual Organism

Threats

Climate Change

- *Habitat Loss*

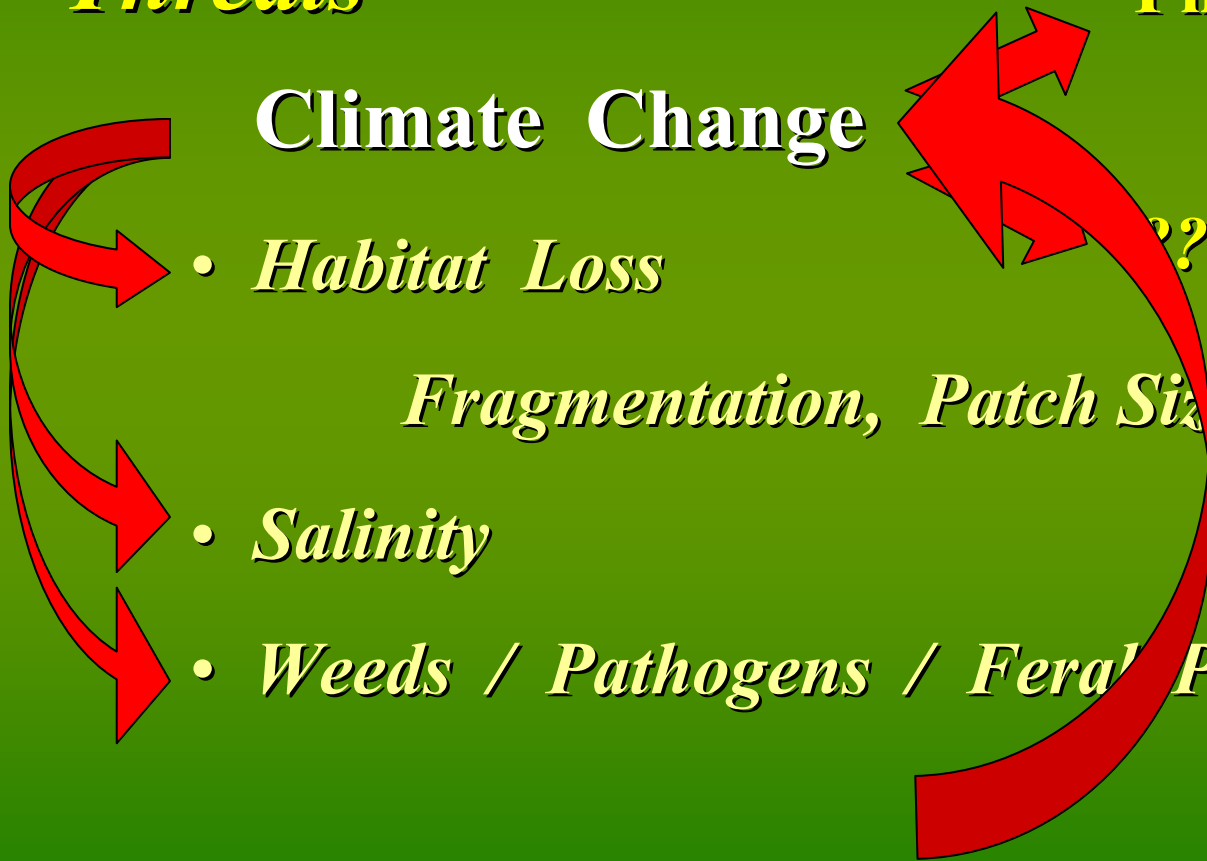
Fragmentation, Patch Size, etc.

- *Salinity*

- *Weeds / Pathogens / Feral Predators*

Physiological Stress

?????



Biodiversity & Climate Change

What can we do ??

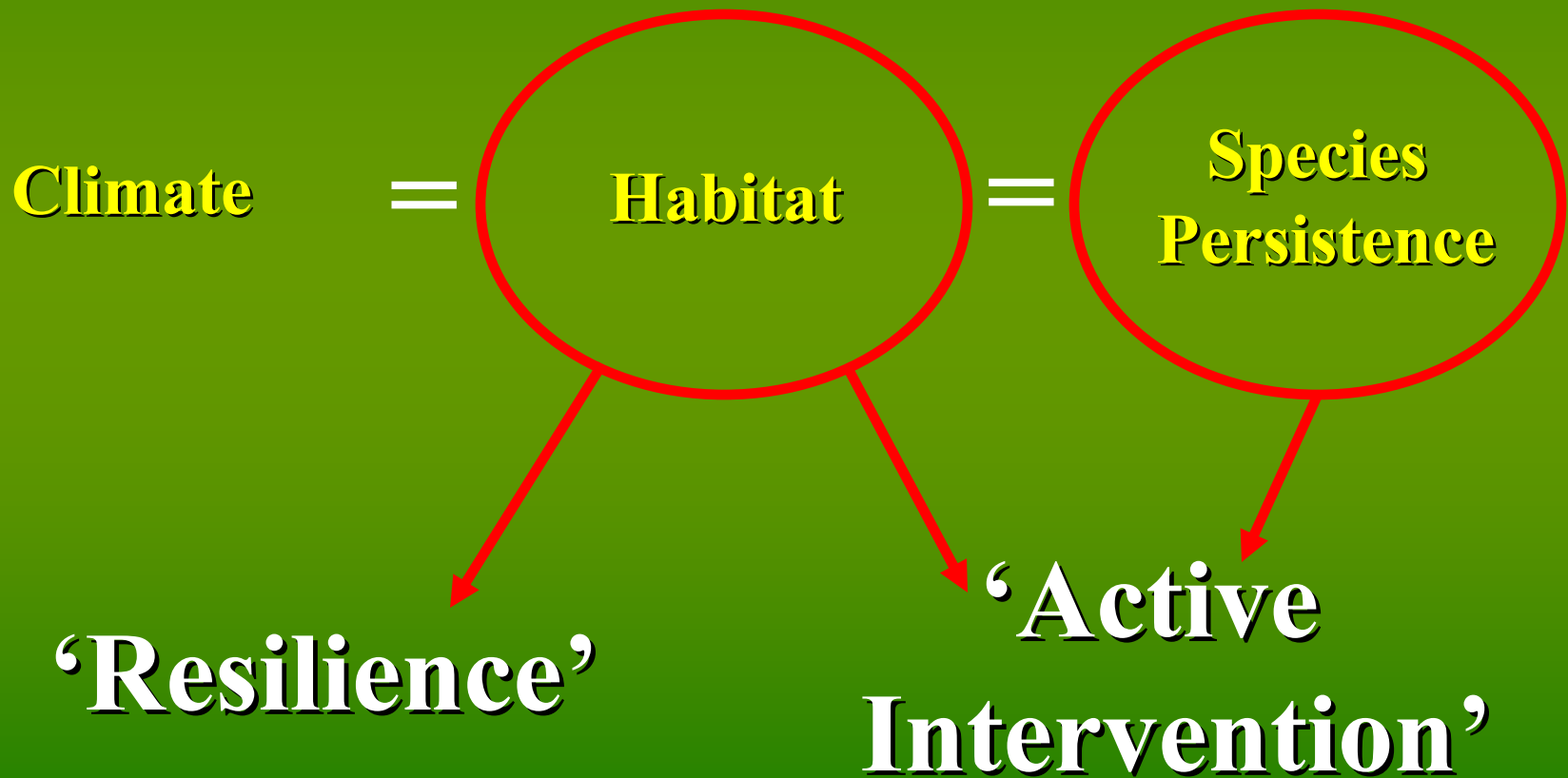
Habitat

- *Extent*
- *Type* *are vegetation communities stable ?*
- *Configuration / Context* *corridors ?*
- *Condition / Quality* *weeds ?*

Resilience

Biodiversity & Climate Change

What can we do now ??



‘Pre – 1750’ Landsat Imagery

