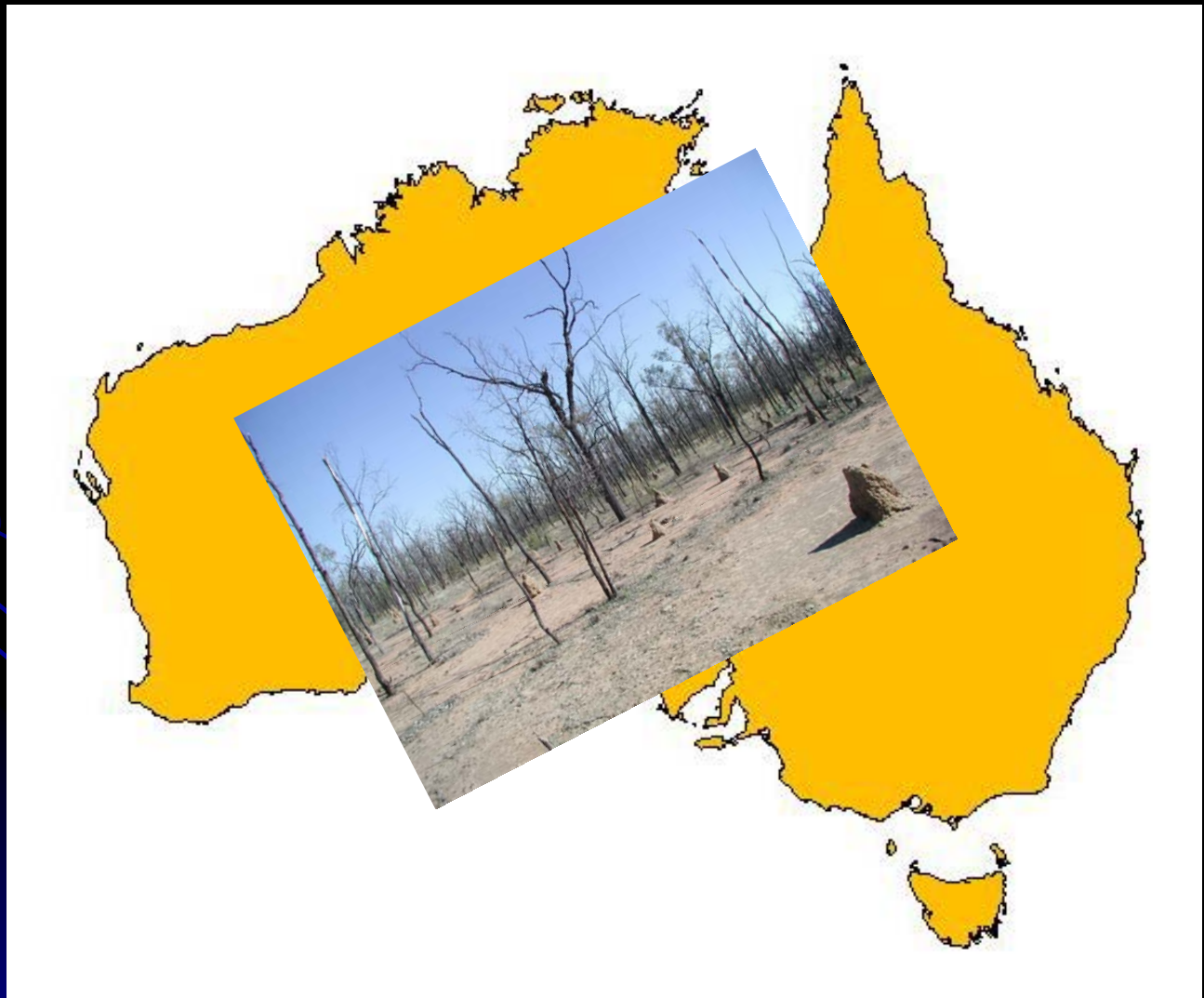
Impact of climate trends and extremes

Rod Fensham

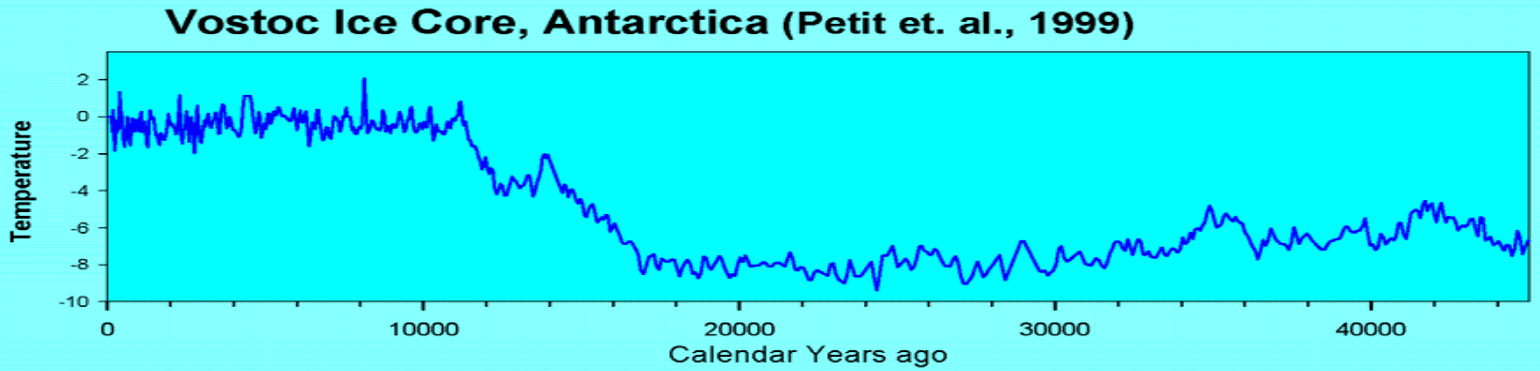


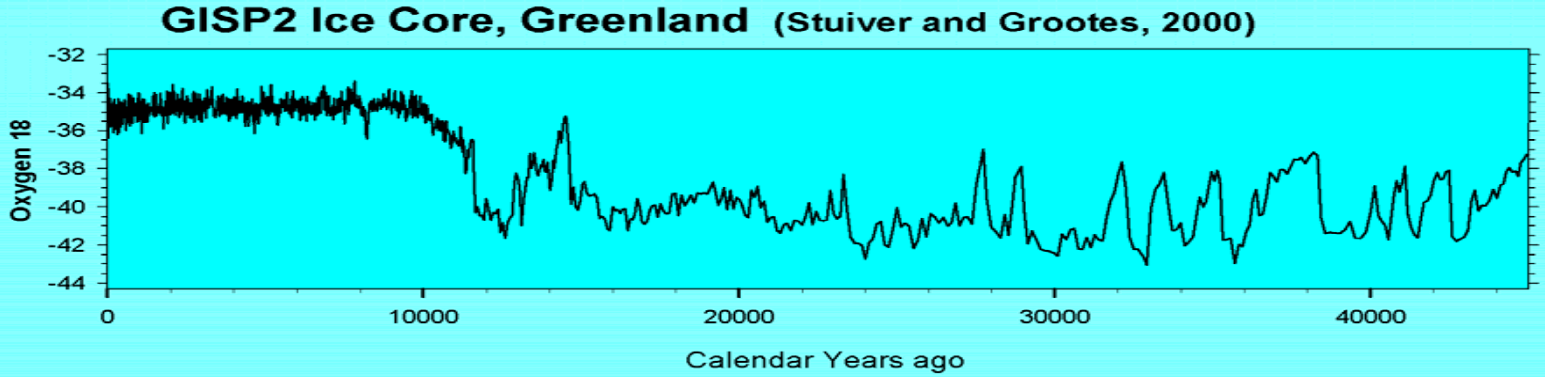
Projections

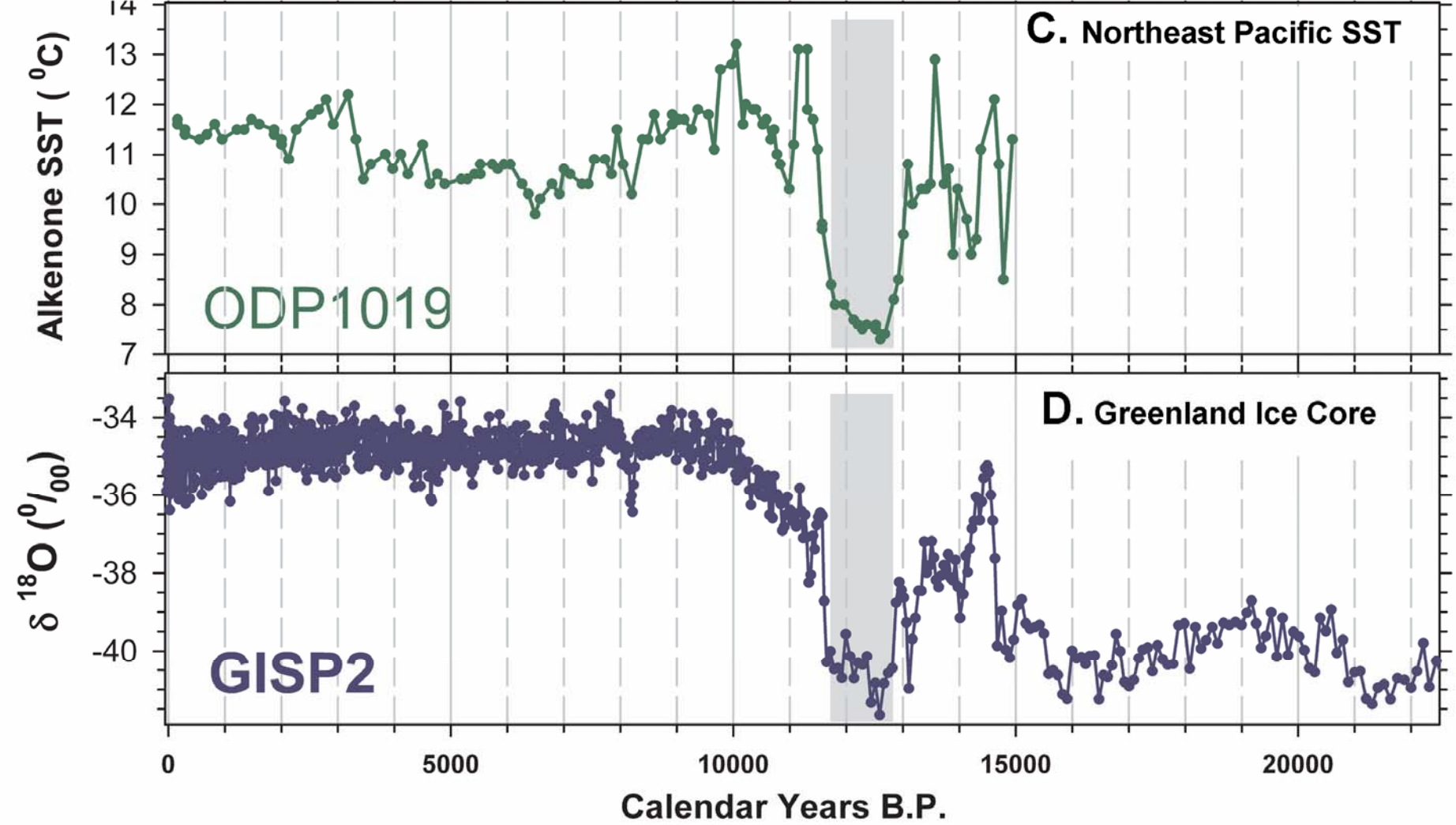
- 3-6^{0}C by 2050
- Global average water vapor and global mean precipitation will increase
- Larger year to year variations in precipitation
- Timing of precipitation may change

Precedents of climate change

- Pleistocene-Holocene interface: probably 8ºC temperature increase and a doubling of rainfall in less than 2000 years
- The ‘normal’ vicissitudes of the Australian climate







- Pleistocence-Holocene: wetter, warmer
- Post greenhouse climate: warmer, more extreme

Plants will move to suitable habitat

- Provided suitable habitat exists
- Dispersal can occur
- Exotics do not outperform them

Cold dependent species in trouble

Montane cloud forest

- Some species may already be out of range

Alpine vegetation

0.2 – 2.6^{o} C by 2050 (Hennesy *et al.* 2002)

10-90% reduction in snow cover

However, data from southern Tasmania indicates cooling trend 1989-2000

What plant species cannot disperse?

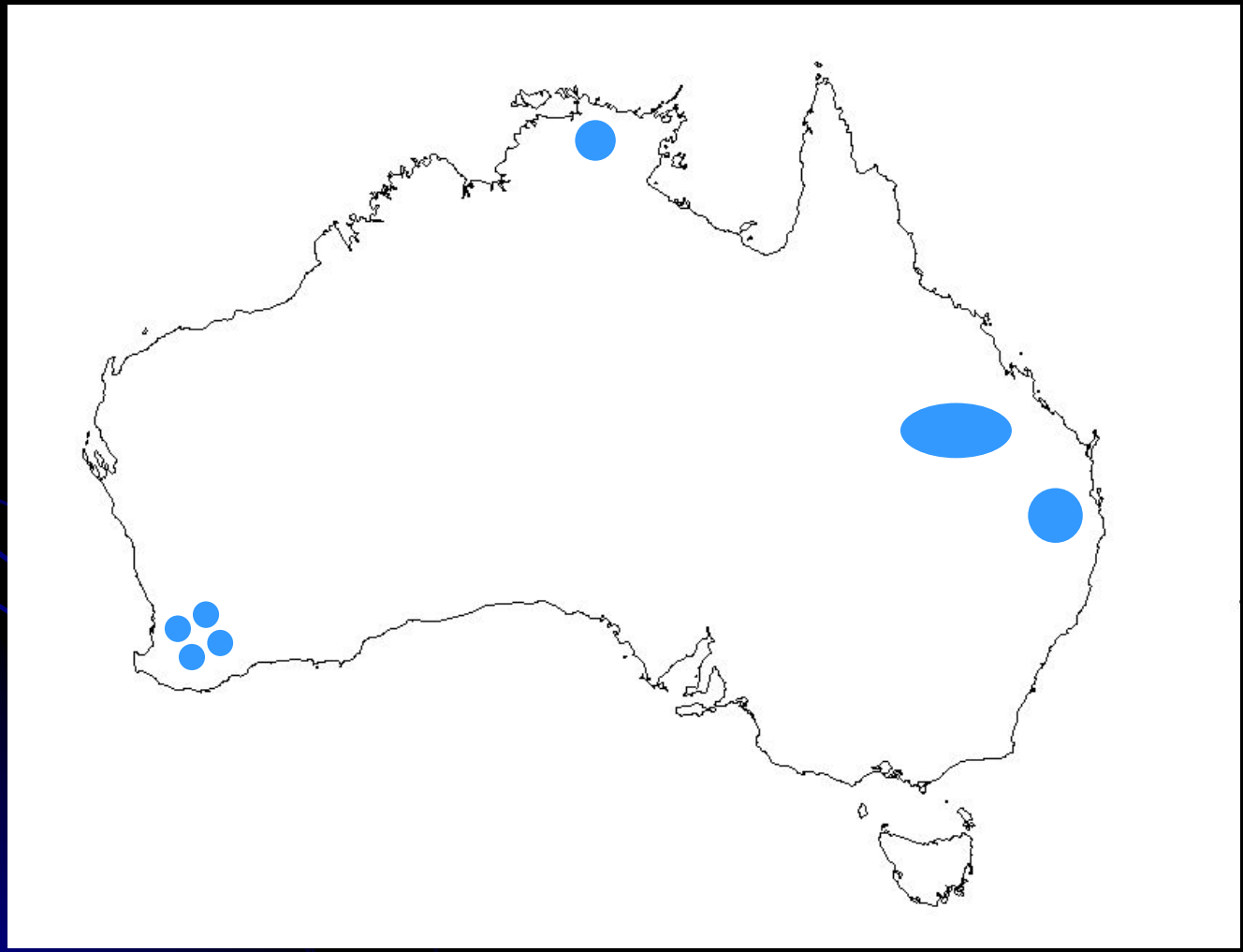
- Rainforest relatively well dispersed
- *Eucalyptus* and the sclerophyll flora less so

Temperature envelope analysis (*Eucalyptus*)

Temperature range	% of 819 spp.
1°C	25
2°C	41
3°C	53

Hughes *et al.* 1996

The local infertility and mega-species diversity conundrum



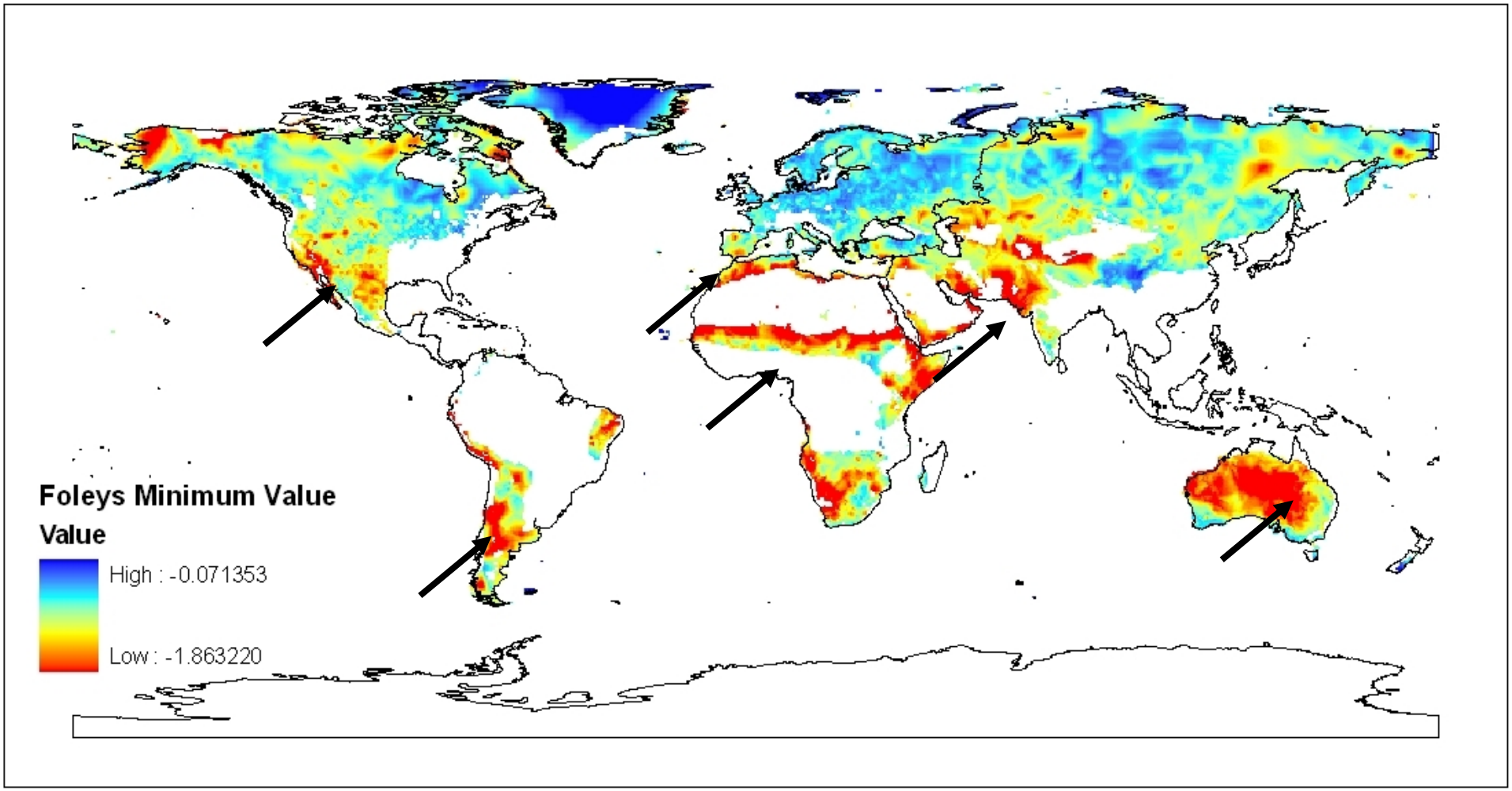
How will range changes occur

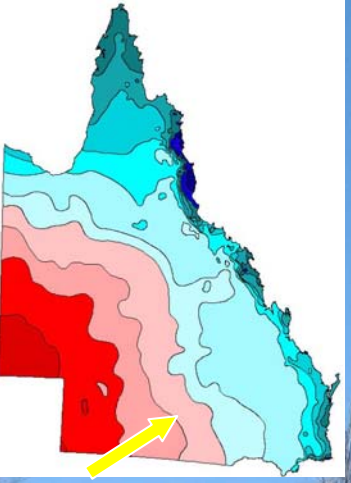
- Changes will be less evident for ephemeral species
- Perennial species populations will dwindle during extreme events, particularly drought

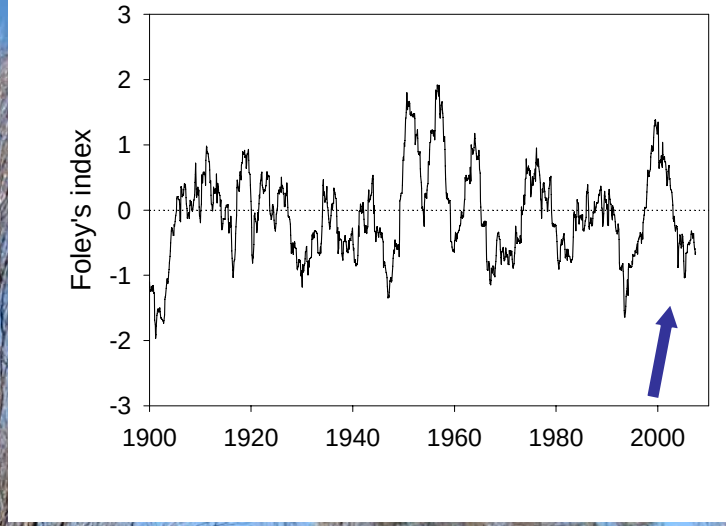
Searching for a drought index?

Mr Foley's Index
(Actual rainfall for a period – Expected rainfall for the same period)/ Expected annual rainfall

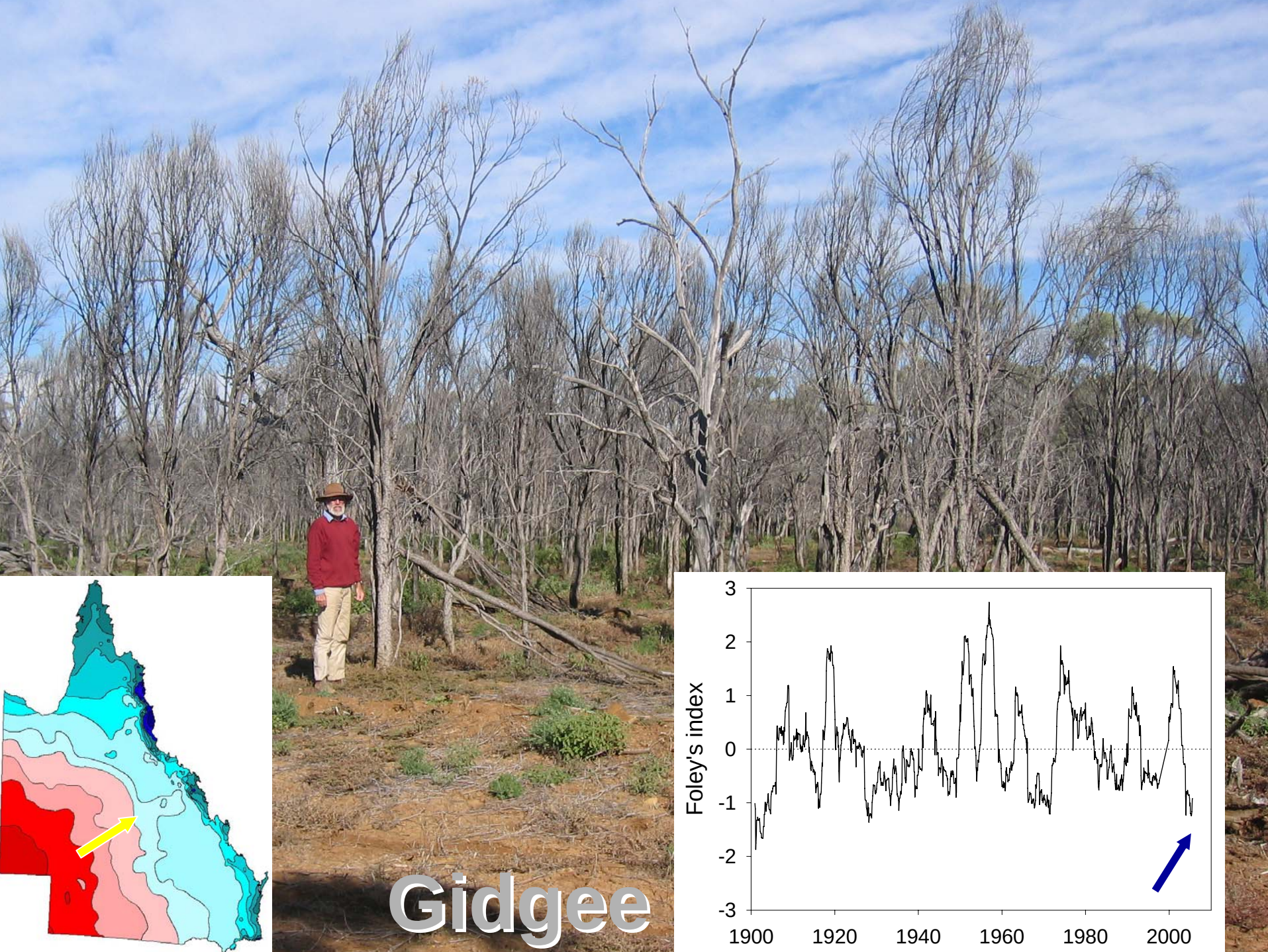
3-year Foley's Drought Index (1901-2003)
120-900 mm m.a.r. zone





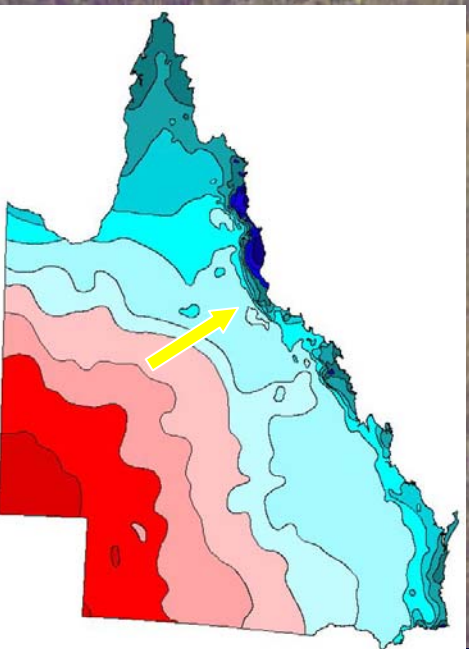


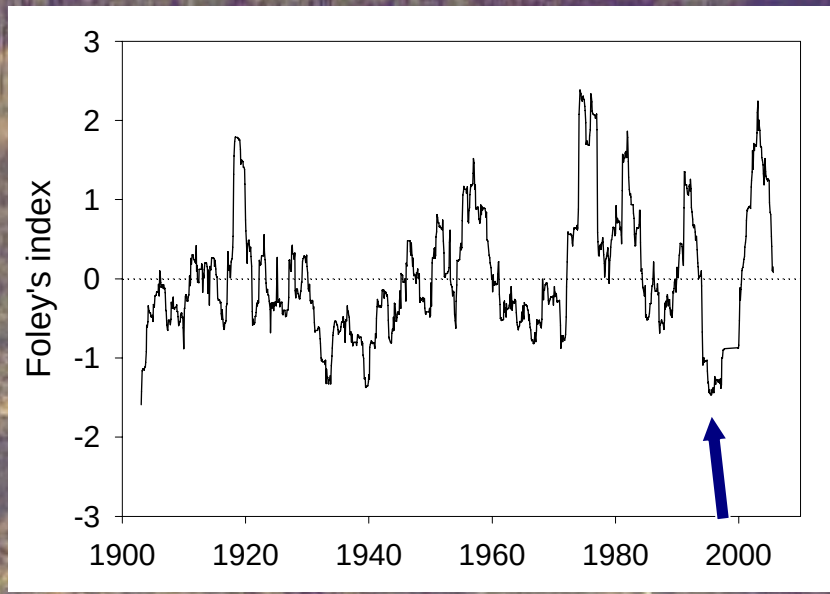
Mulga


Gidgee

Foley's index
3
2
1
0
-1
-2
-3
1900
1920
1940
1960
1980
2000

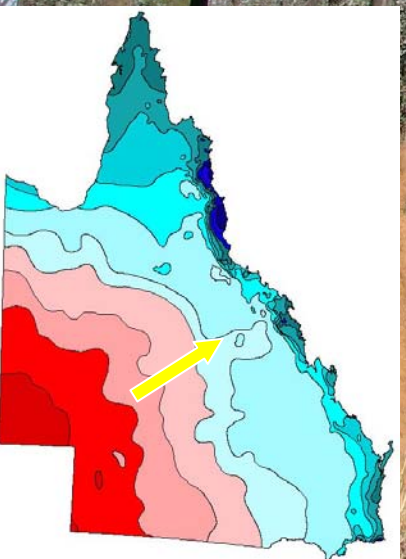
Eucalypt



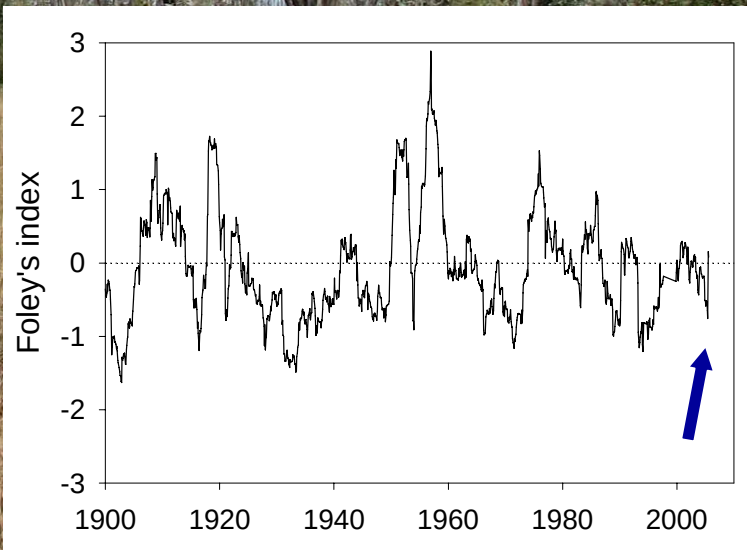


Fensham and Holman 1999

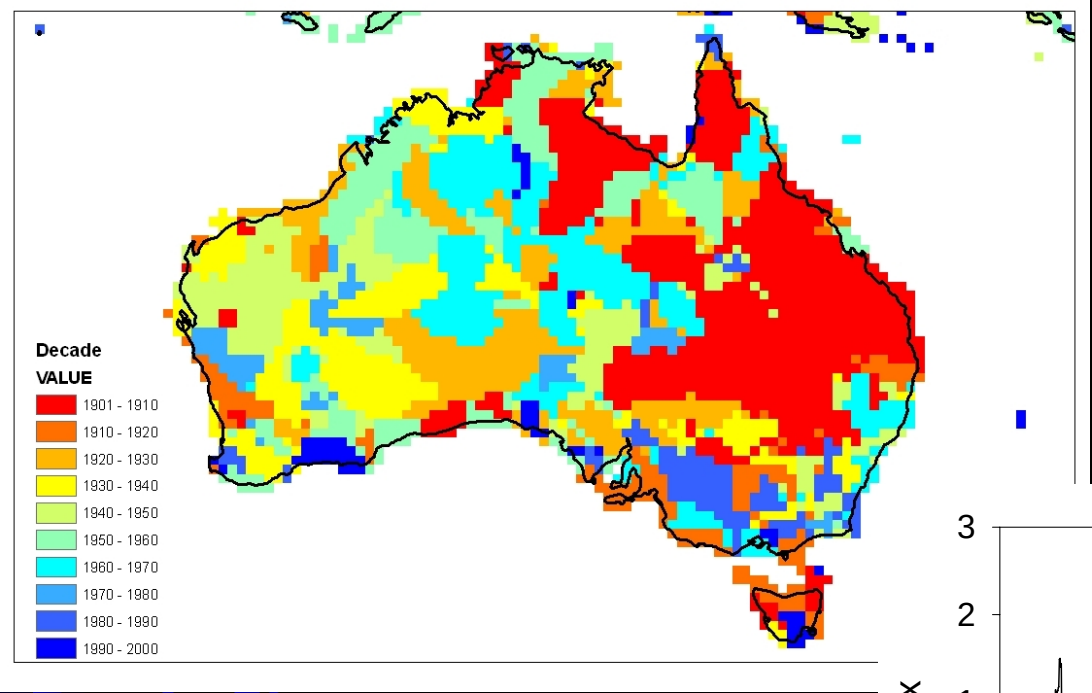
Eucalypt

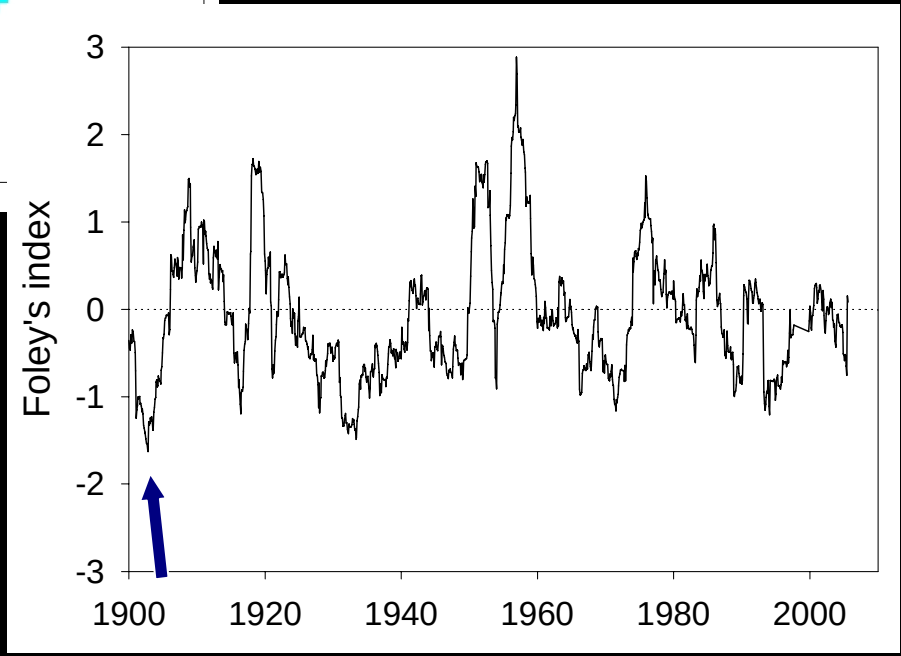


Fensham and Fairfax 2007



The Big Drought ending 1904 and the historical record

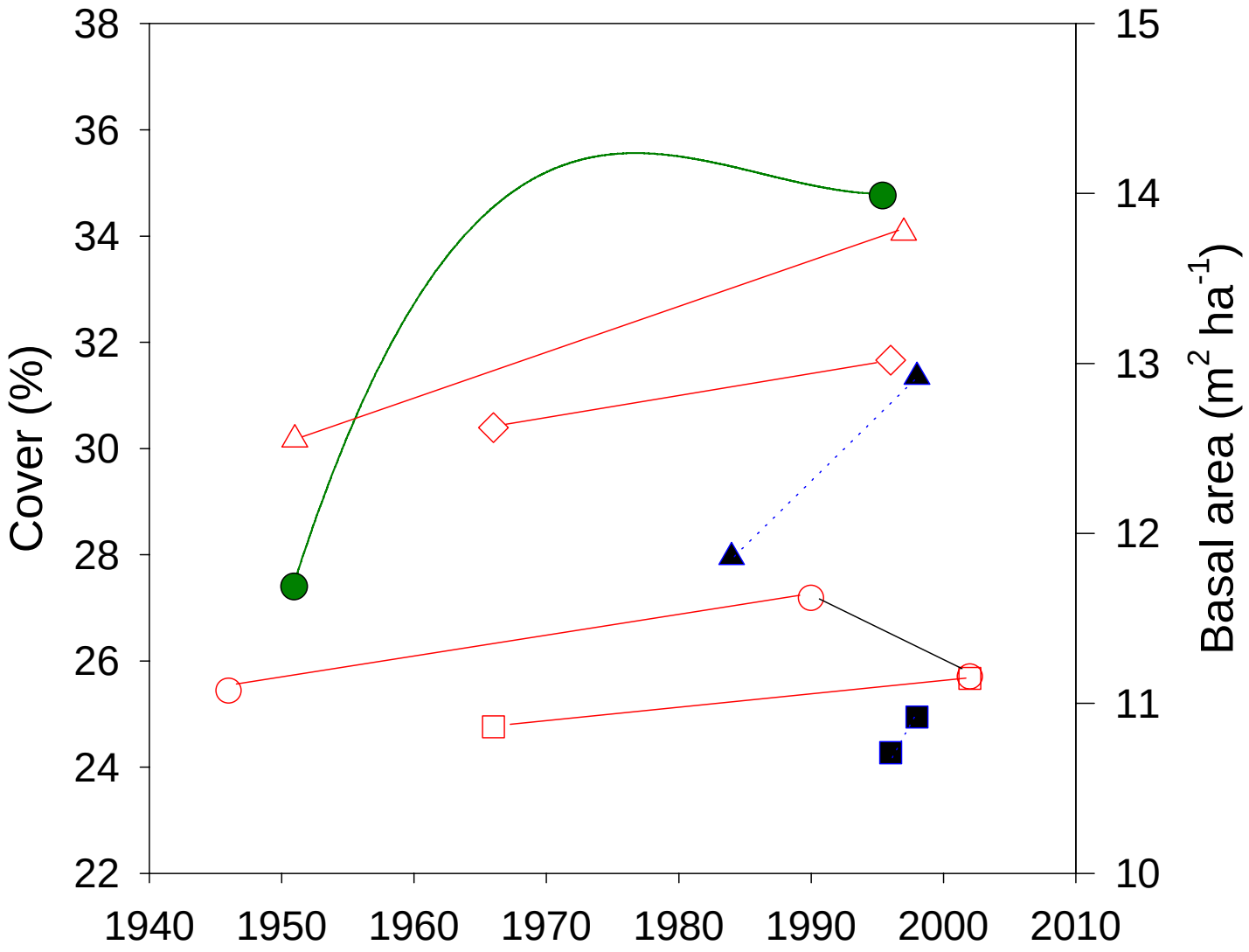




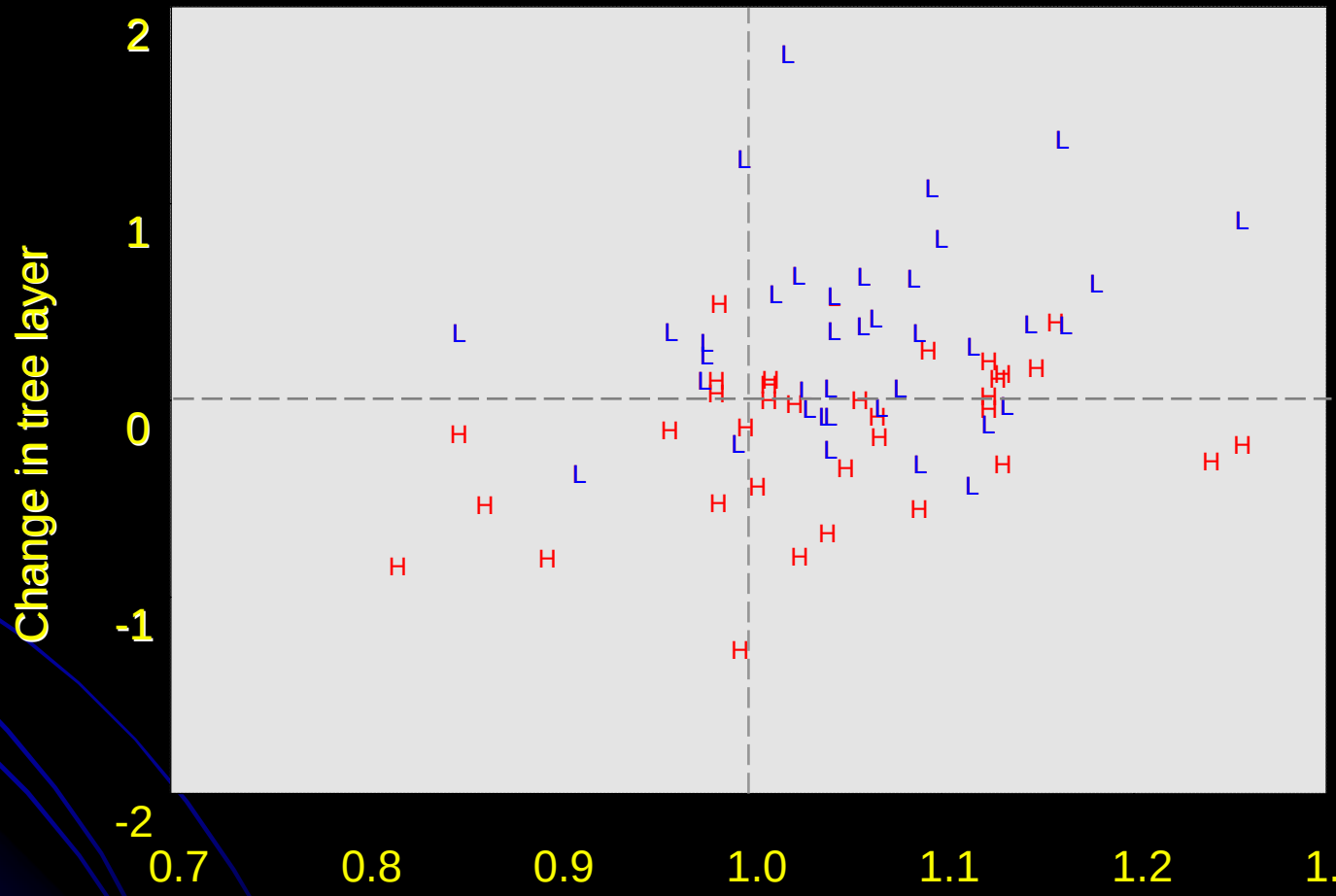
Fensham and Holman 1999

Mimi Christison and the Big Drought

"...now they confronted the record of five years of drought in the dead trees that still stood up from the silvery grass for miles and miles, black trunks grotesquely abbreviated, for winds had whipped away the branches. Mimi was appalled by the sight: "Surely those trees have not been killed by the drought?" she said, but her father did not answer. Some day when people start burning off the dry grass a bush fire will be started which will destroy these skeletons of ironbark forest, and with them the last traces of the Big Drought will disappear."

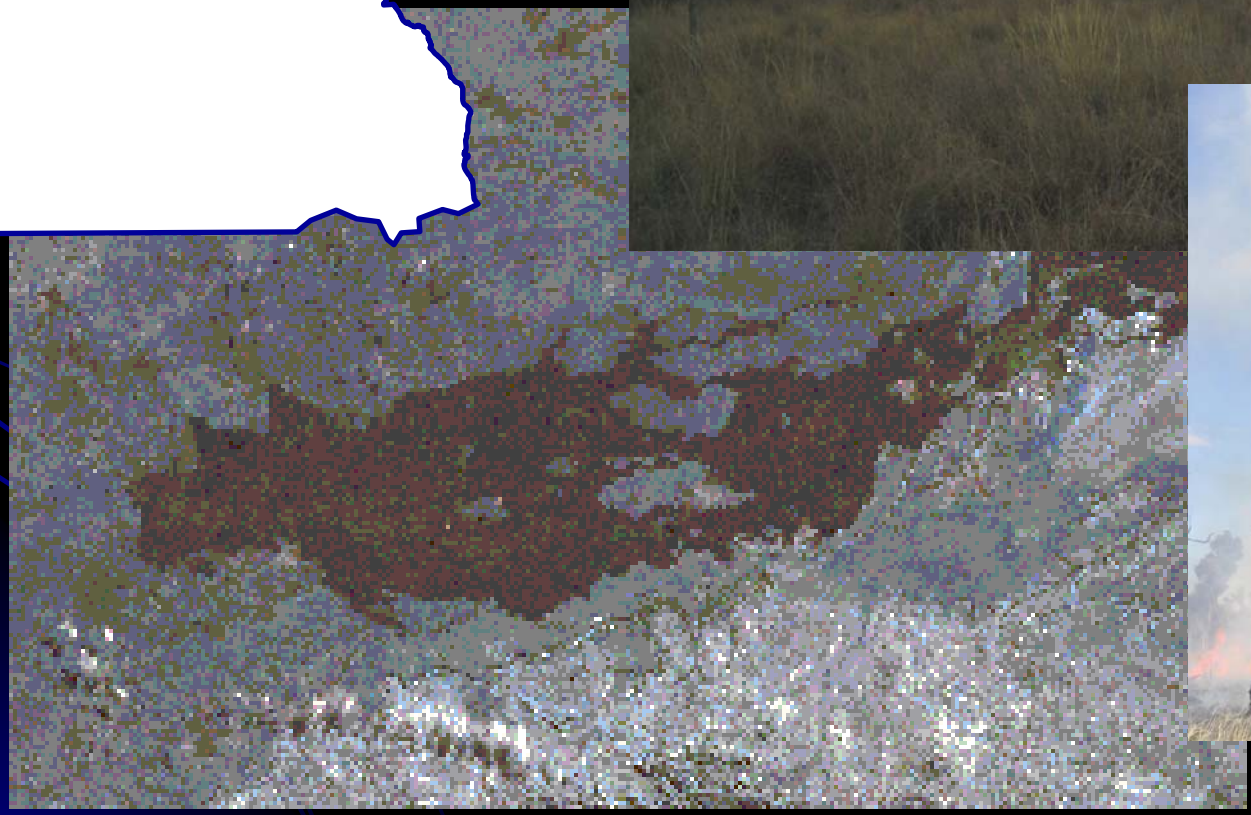

Cover (%)
38
36
34
32
30
28
26
24
22
Basal area (m2 ha-1)
15
14
13
12
11
10
1940
1950
1960
1970
1980
1990
2000
2010

Competition or density dependence landscape scale examination



Fensham *et al.* 2005

Grazing and fire



Fensham 1998; Fensham *et al.* 2003

Sensitivity of different tree species

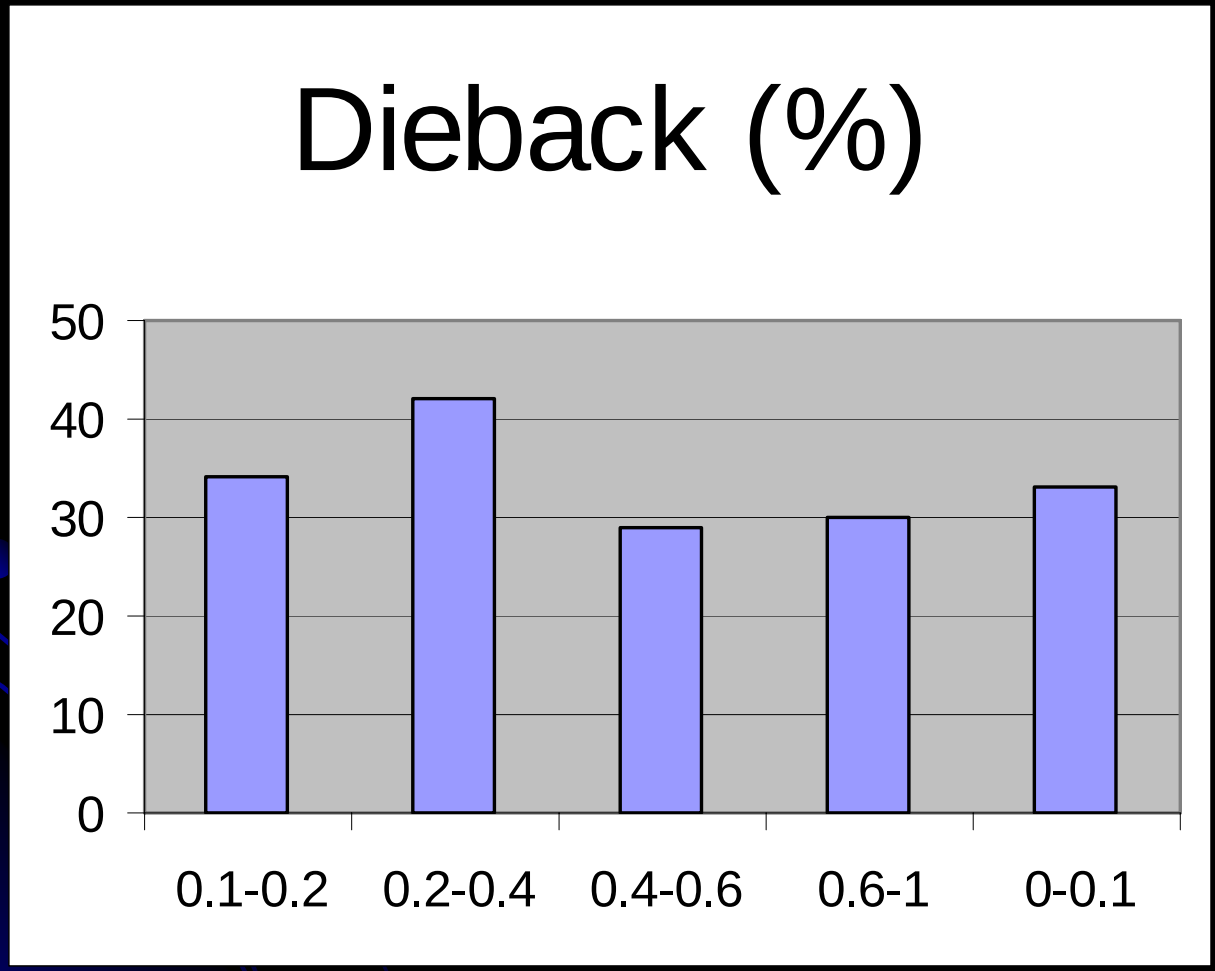
Dallachy's bloodwood

Clarkson's bloodwood

Poplar box,
Silver-leaved ironbark

Fensham and Holman 1999, Fensham and Fairfax 2007

Explaining patchiness



Fensham and Holman 1999

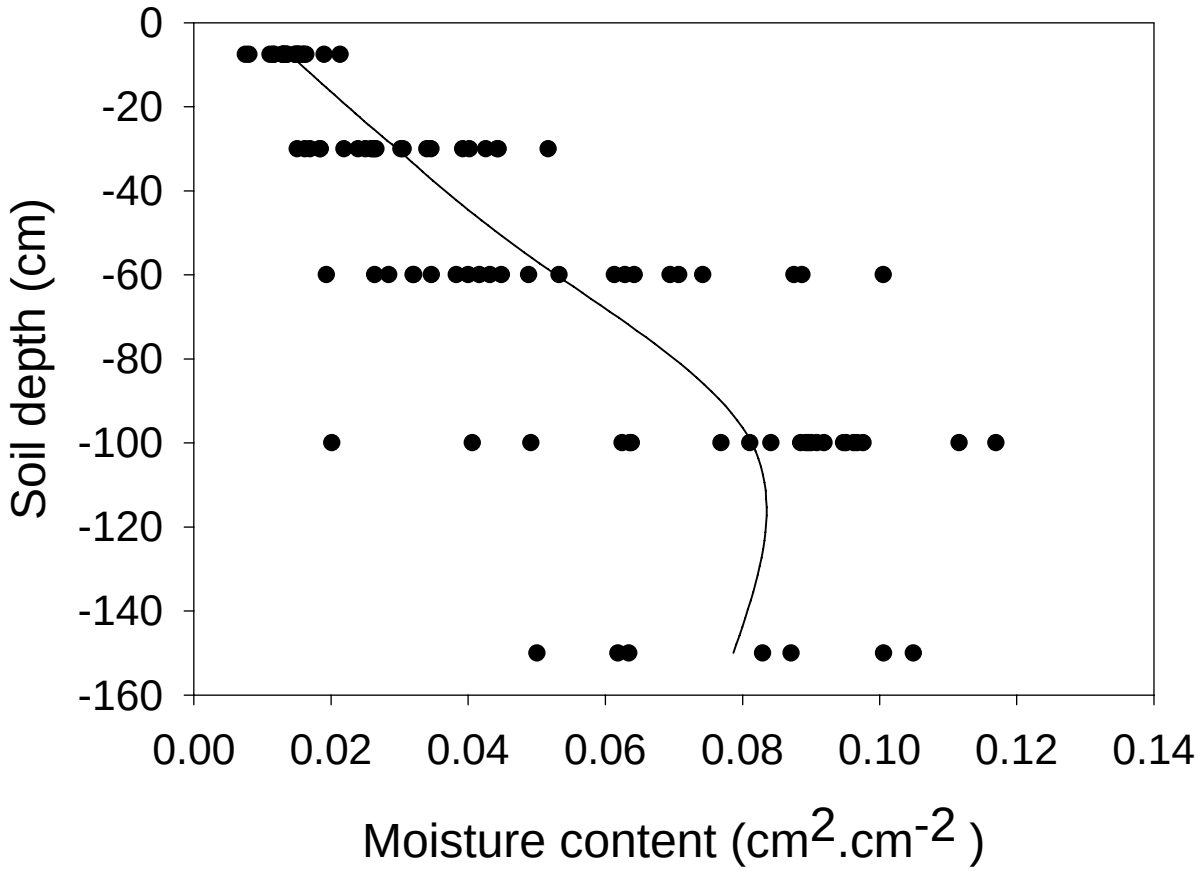
Soil differences - geology

	Average basal area death (%)
Basalt	49.8
Meta-sediments	35.8
Tertiary sandstone	30.3
Granite related rocks	21.1
Alluvium	15.2

Fensham and Holman 1999

Soil moisture availability

Soil moisture and soil depth



What is going to happen when temperature goes up?

- Urgent need to initiate studies across temperature and precipitation gradients within major biomes