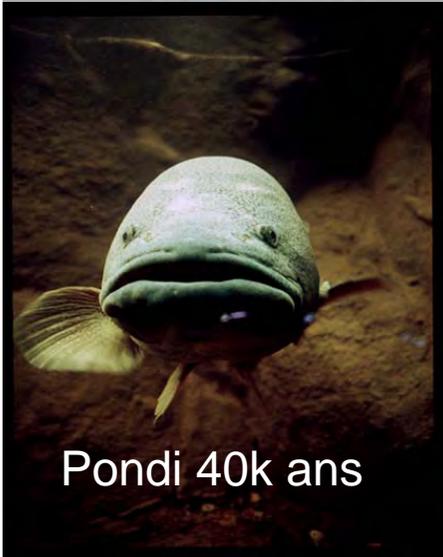




Australian Government



Pondi 40k ans



Australia's river basins – new directions for an ancient land

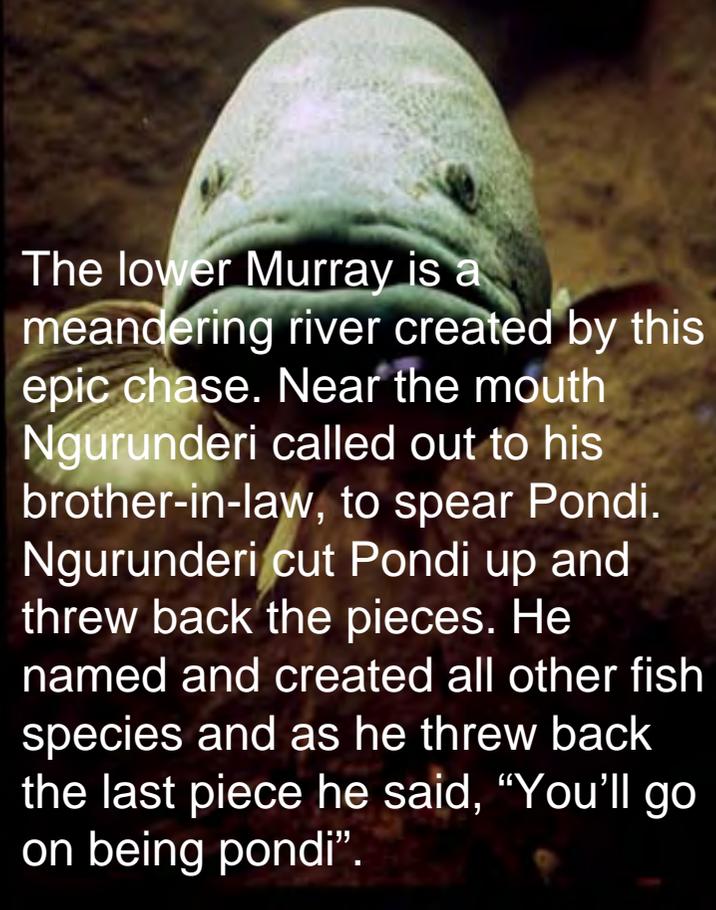
Jason Alexandra INBO 2010



A new world continent transformed –
Need new stories for an ancient land,
Creation stories or extinction stories

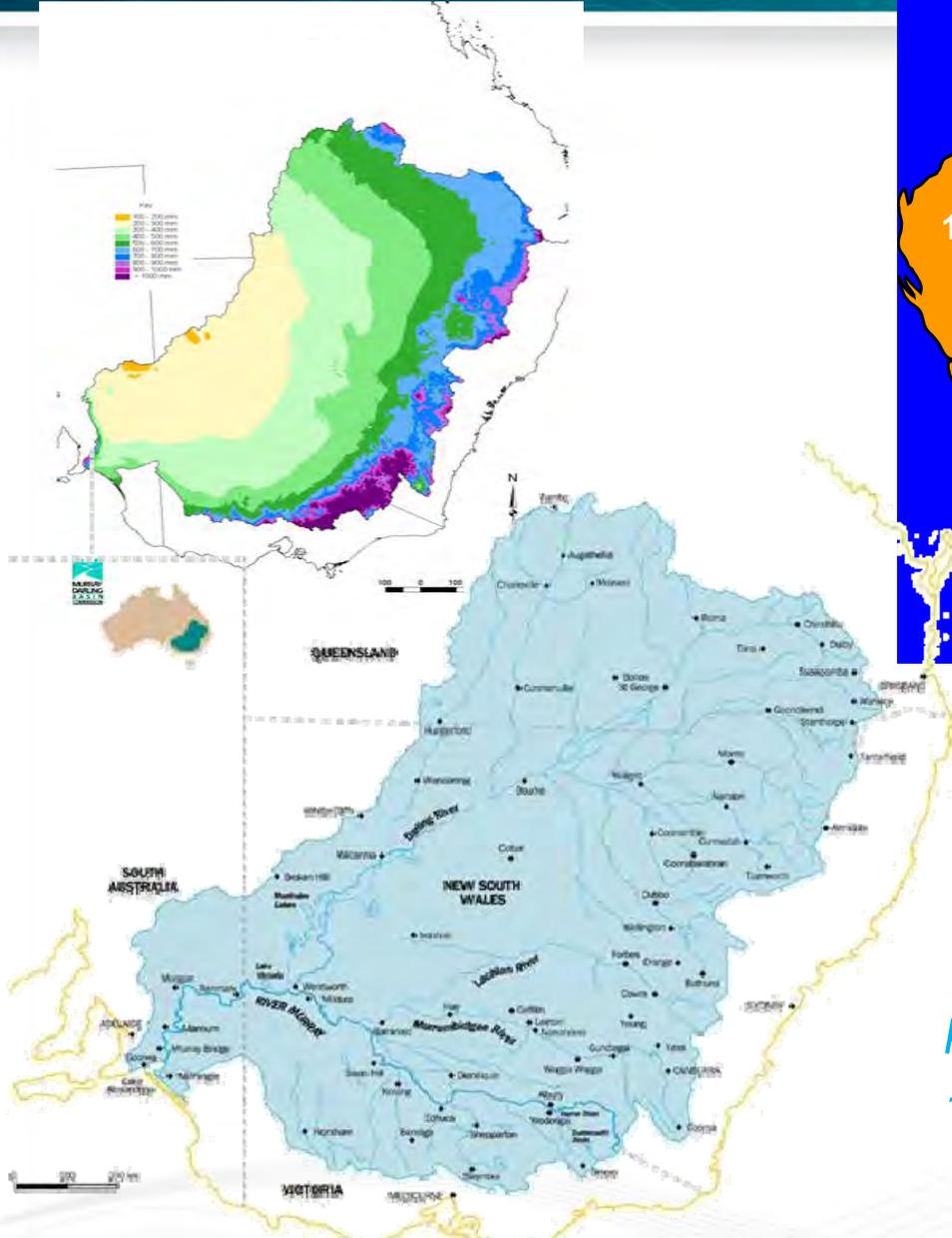


Ngarrindgeri creation story:
Ngurunderi, started to chase
Pondi near the Murray and
Darling junction. Pondi took off
to escape. He thrashed his tail
and widened the river.

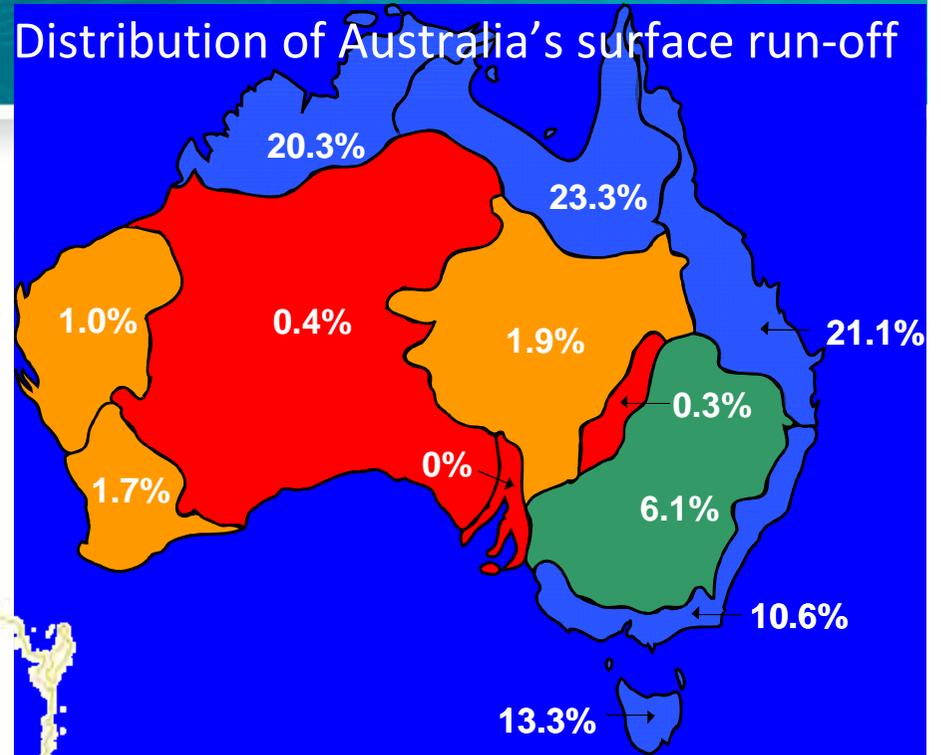


The lower Murray is a
meandering river created by this
epic chase. Near the mouth
Ngurunderi called out to his
brother-in-law, to spear Pondi.
Ngurunderi cut Pondi up and
threw back the pieces. He
named and created all other fish
species and as he threw back
the last piece he said, “You’ll go
on being pondi”.

Average Yearly Rainfall in Murray-Darling Basin



Distribution of Australia's surface run-off



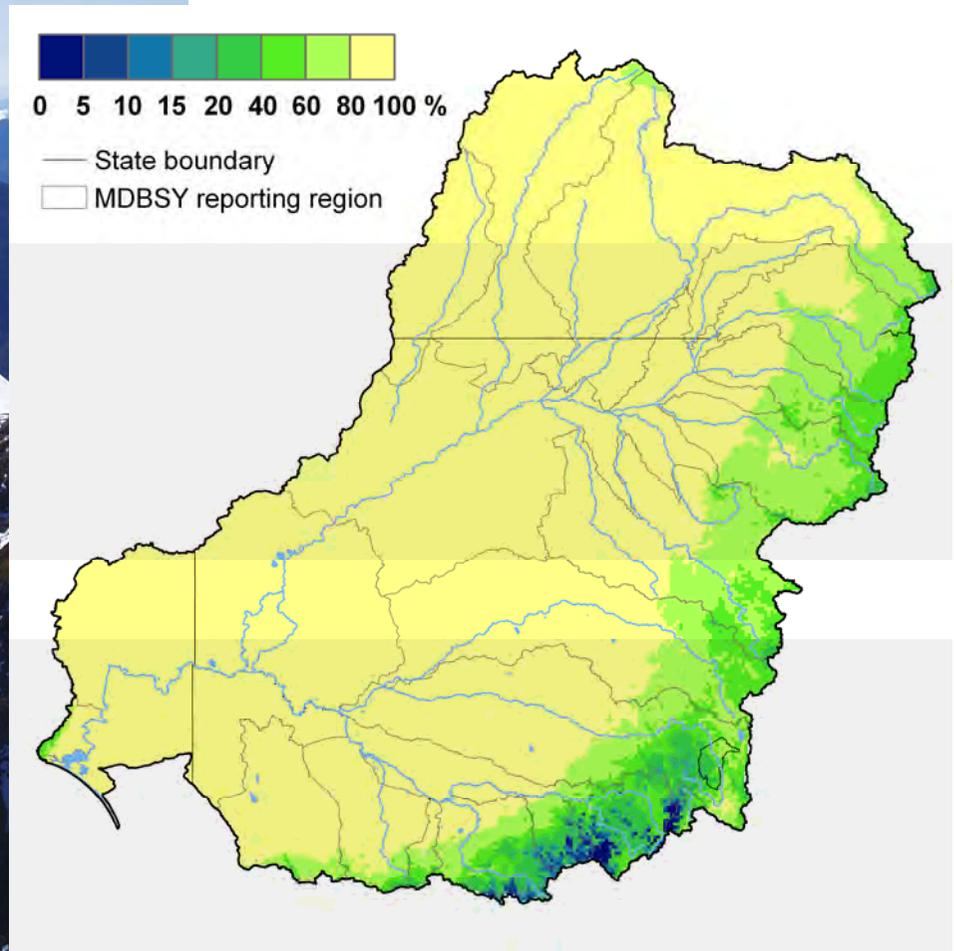
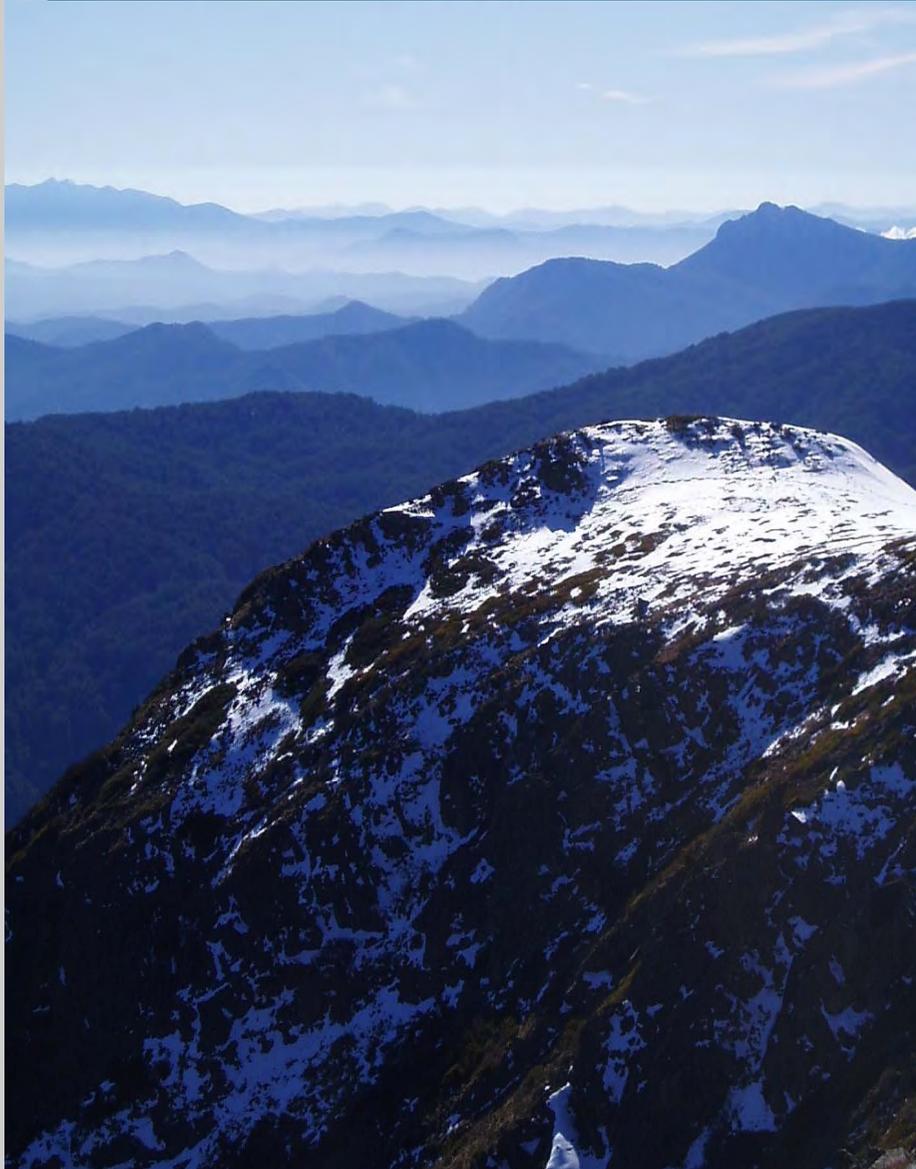
>1 million km² = 1/7th of Australia, size of France and Spain
 Covers 5 States and Territories
 >population of 2 million people
 > 40% agricultural produce



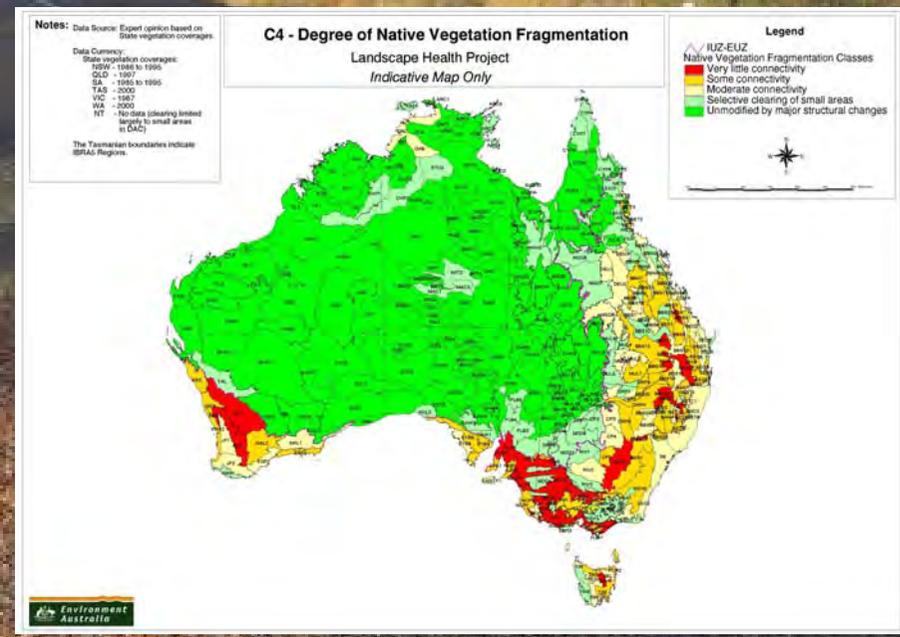
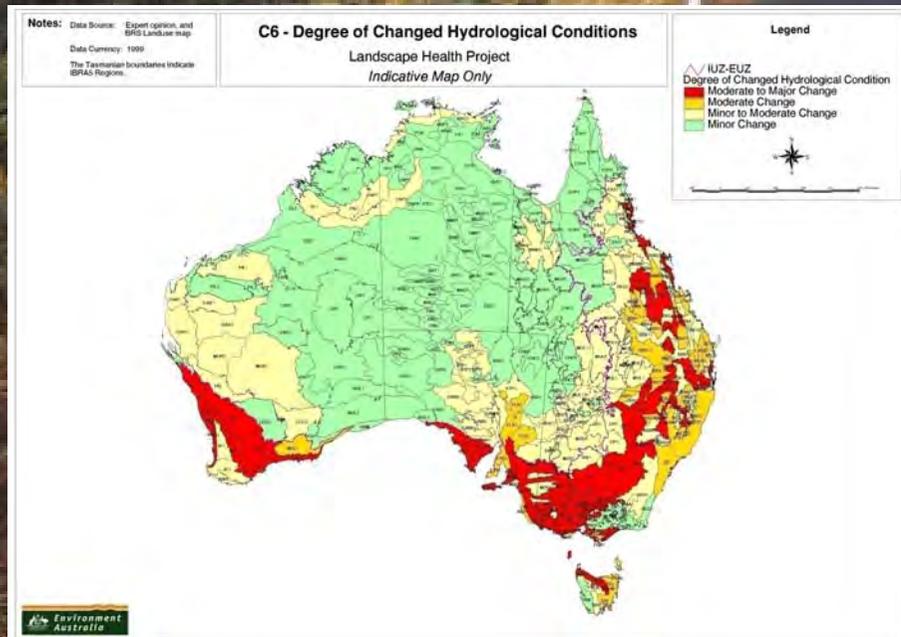
Australian Government



Most river flow comes from our alps



Australia is an ancient nutrient poor land with low population density, limited industrial development and yet we have poor water quality and ecological condition in most rivers and aquatic systems

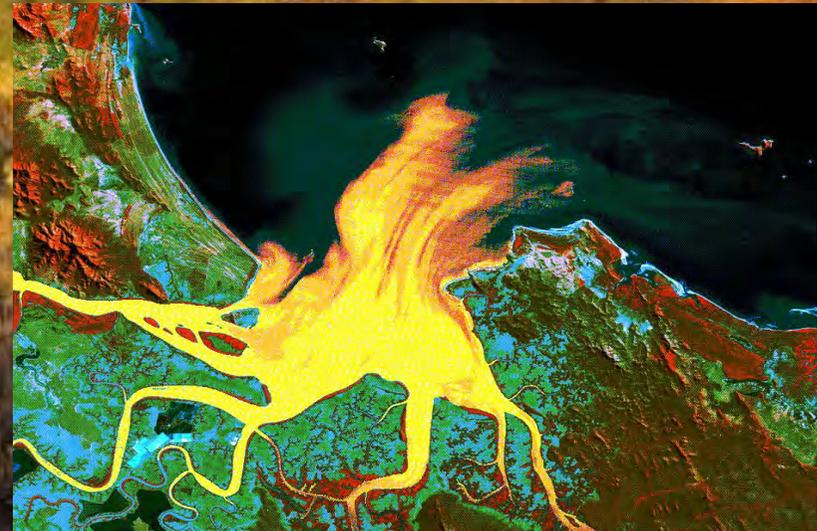
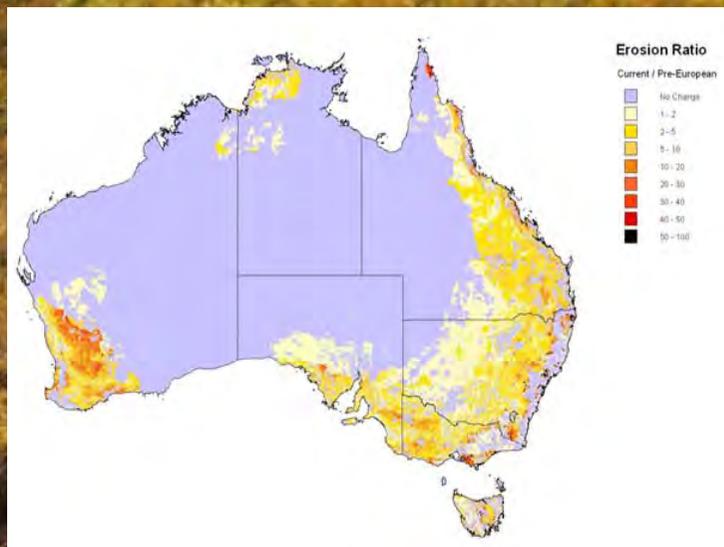




Australian ecosystems evolved to capture water and nutrients – not leak. When disturbed through clearing for agriculture they leak massively

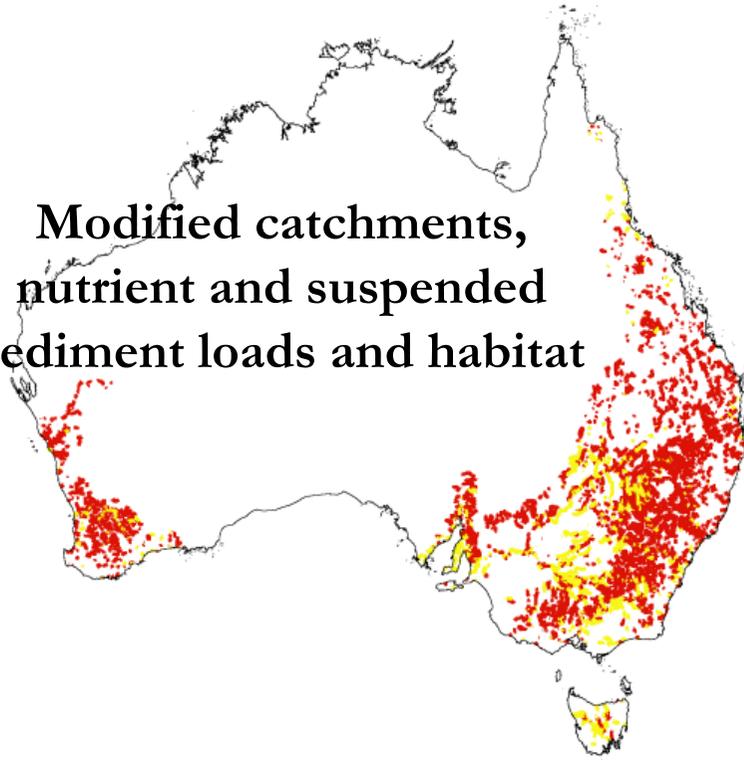
Cost and consequences of transforming an ancient continent

Most agricultural lands have erosion 5-50 times greater than pre-European settlement.

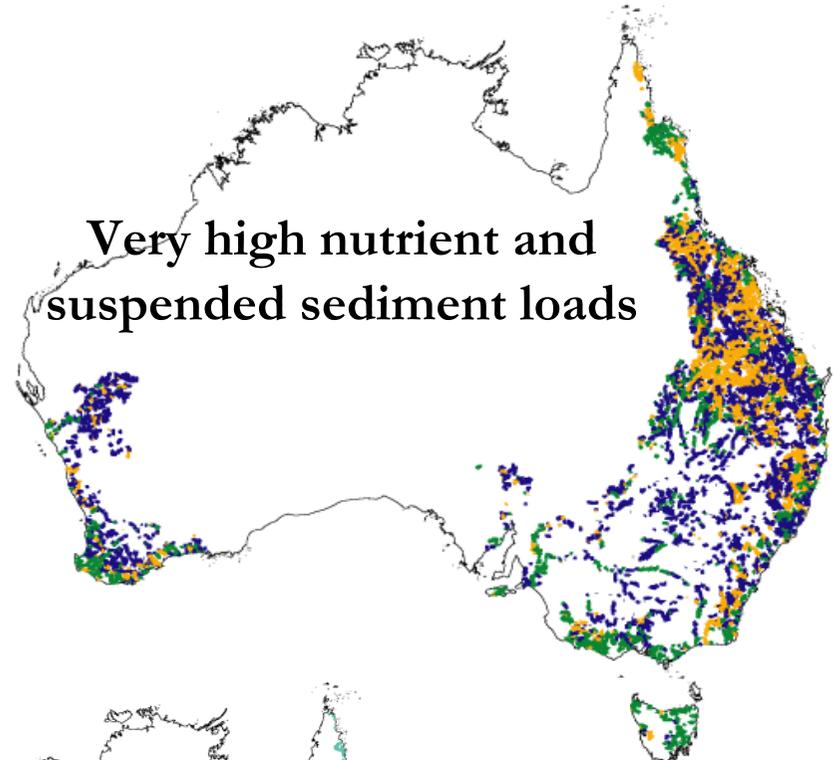


4M tonnes of sediment pa and phosphorus exports - about 13,000 tonnes pa

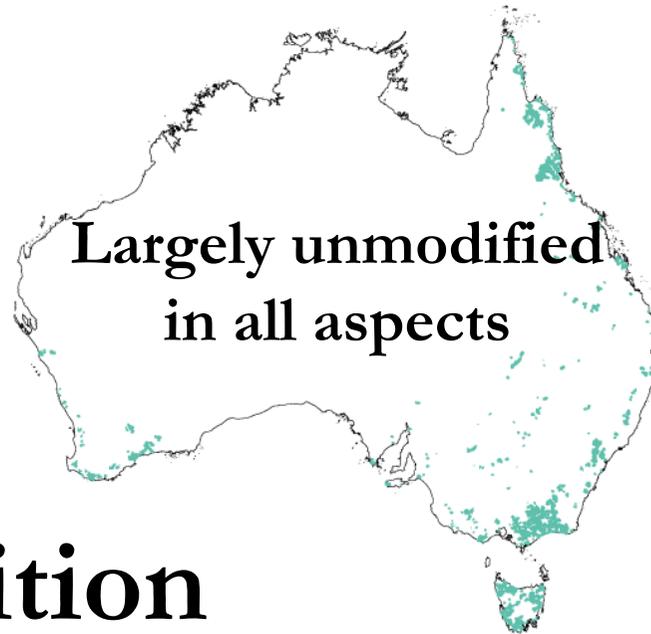
**Modified catchments,
nutrient and suspended
sediment loads and habitat**



**Very high nutrient and
suspended sediment loads**



**Largely unmodified
in all aspects**



Catchment Condition



ustralian Government



Ecological Health

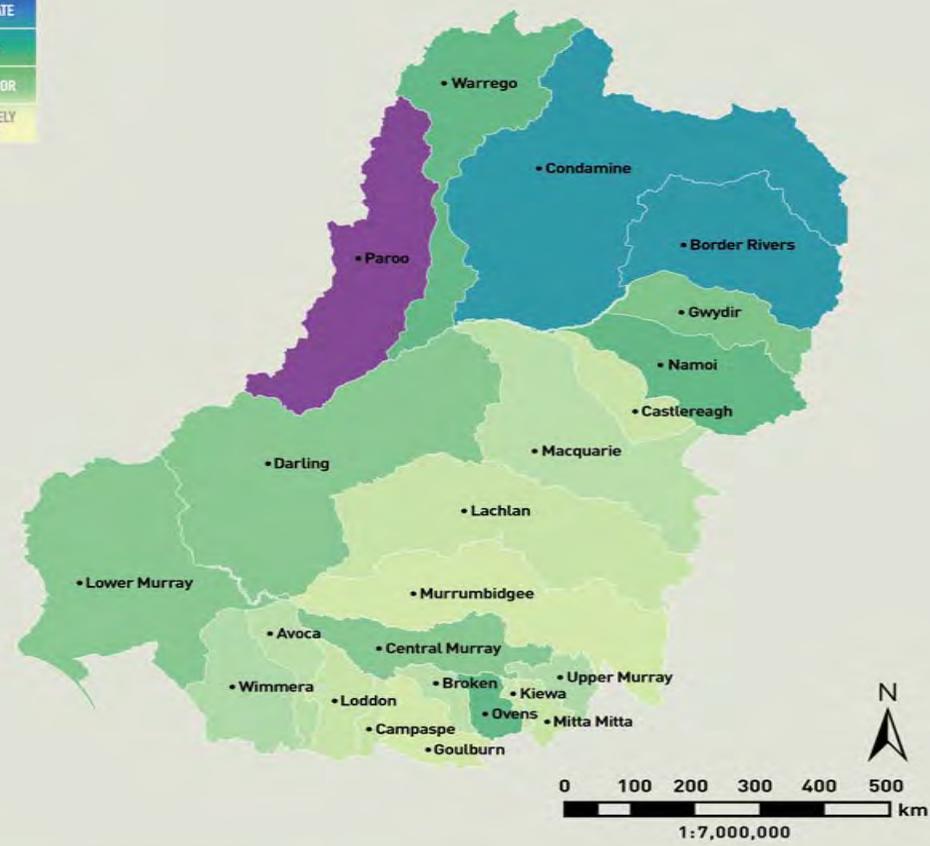
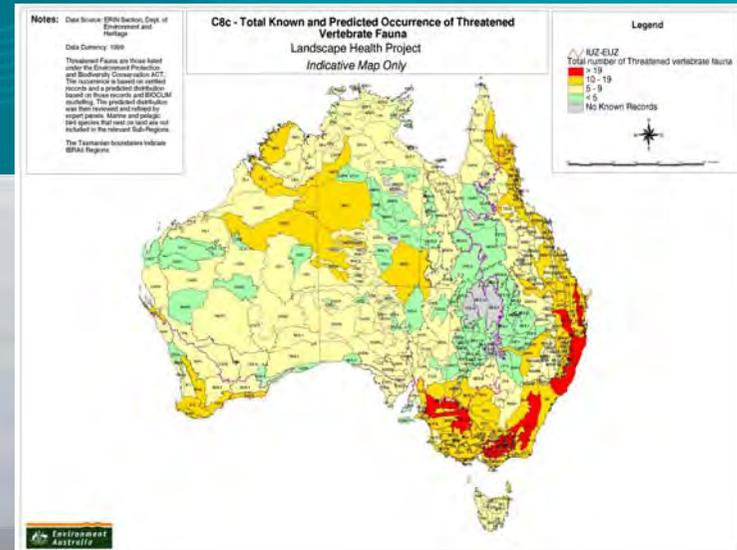


Figure 6. Ecosystem Health assessments by Valley, 2004-2007



Responsibility for 60 million years of separate evolution



Environment special



Doomed? This spiny-tailed gecko could disappear if nothing's done

Australia has the worst conservation record on earth...

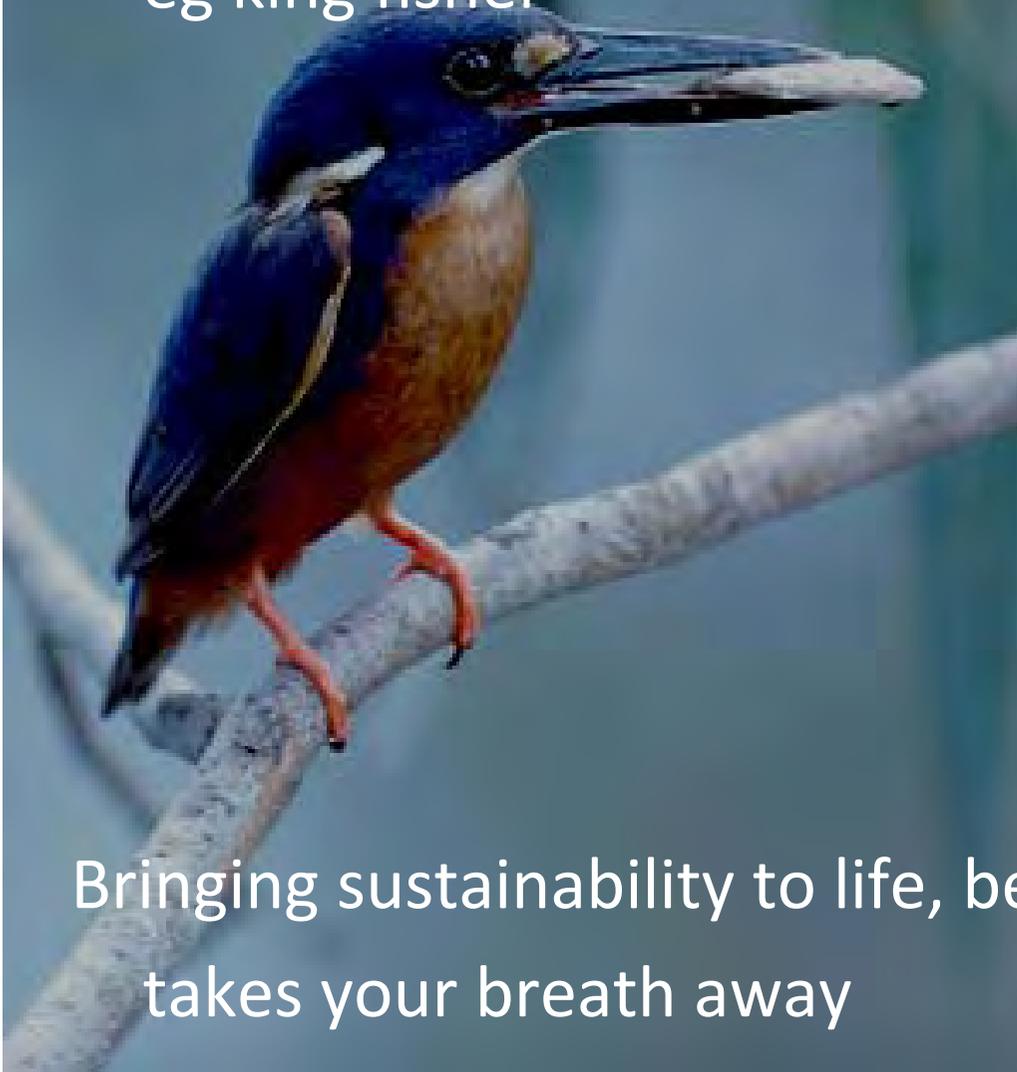
- 20 species of mammal lost in two centuries



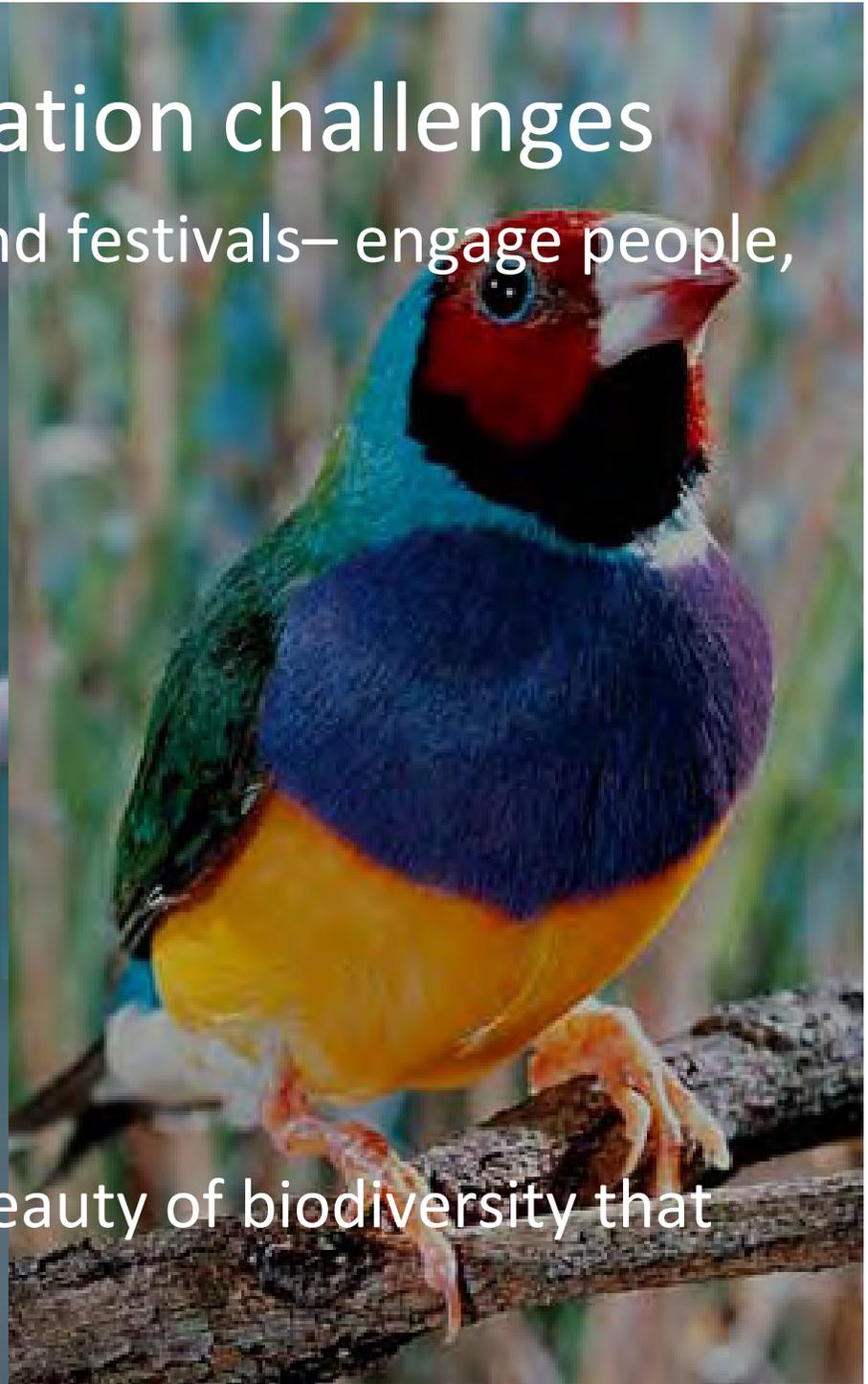
Now - creation stories or extinction stories

Biodiversity conservation challenges

Poor record but local totems and festivals– engage people,
eg king fisher



Bringing sustainability to life, beauty of biodiversity that
takes your breath away

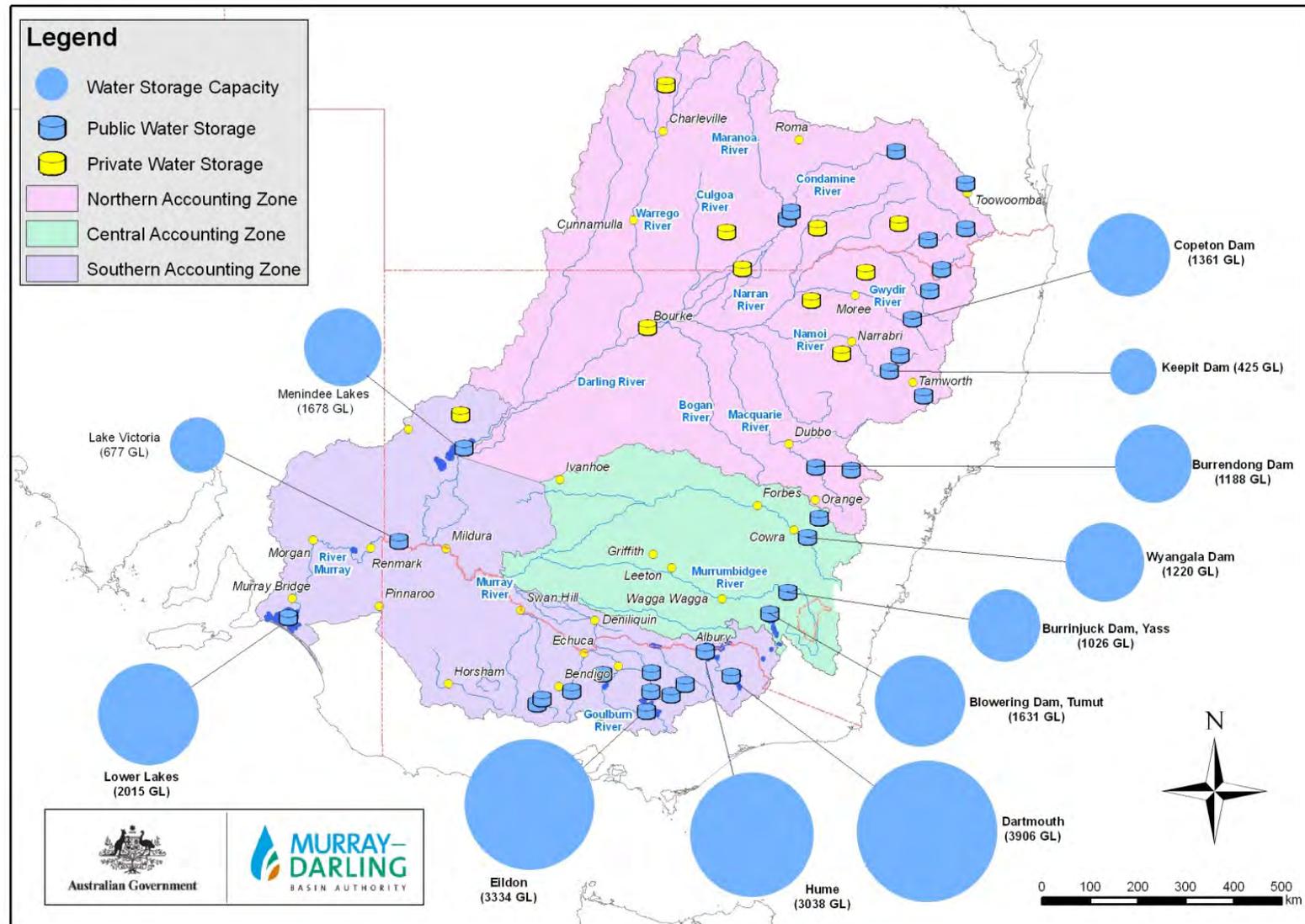


An aerial photograph of a large dam and reservoir. The dam is a long, low structure with a spillway, situated in a valley. The reservoir is a large body of water that fills the valley and extends into the distance. The surrounding landscape is a mix of green fields, forests, and mountains. The sky is clear and blue.

Large dams era 1920-1980's – nation building and response to climate variability?

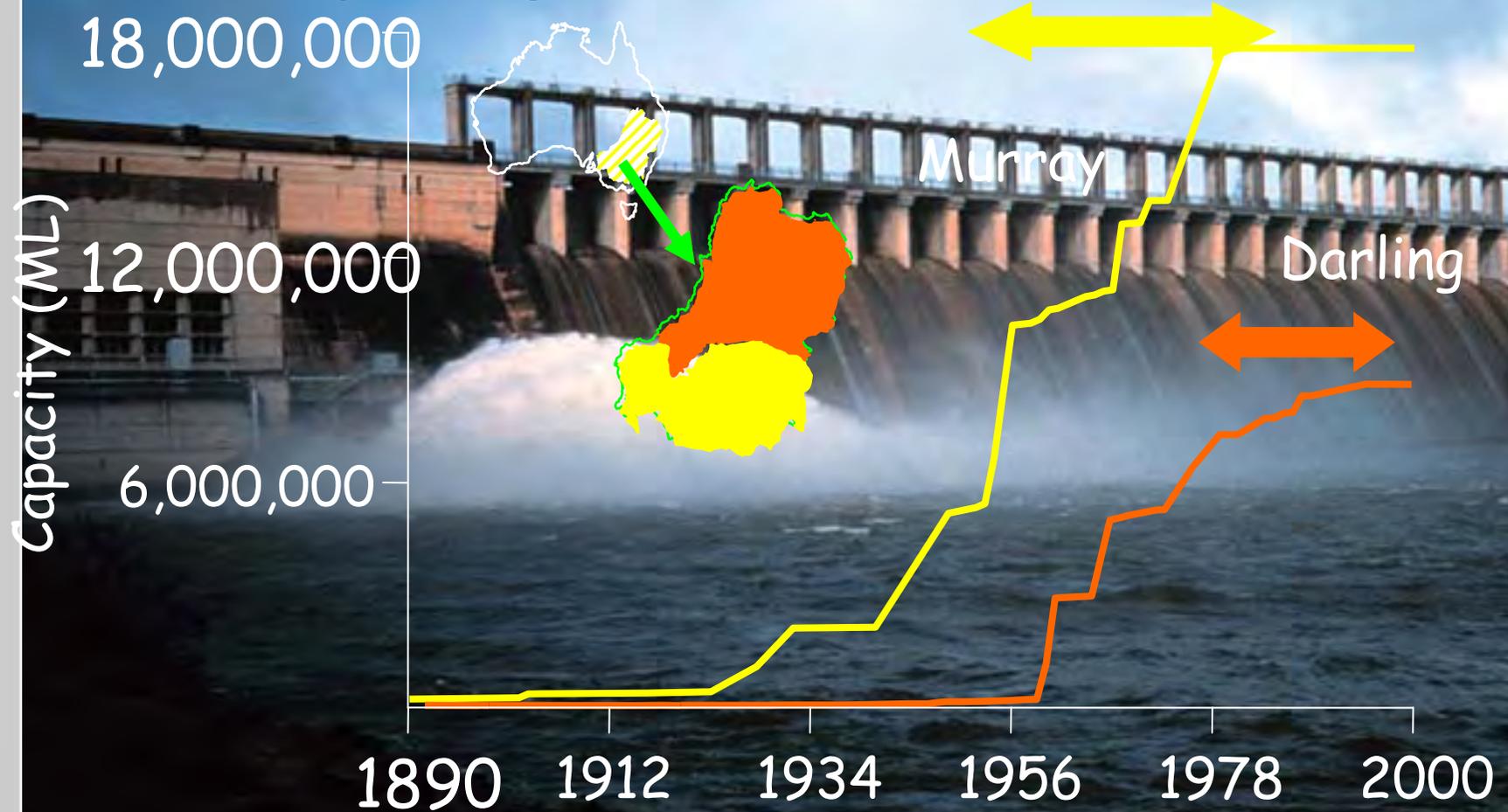
1990's new policy directions
2004 national water initiative – like WFD

Major Water Storages on almost all tributaries in the MDB



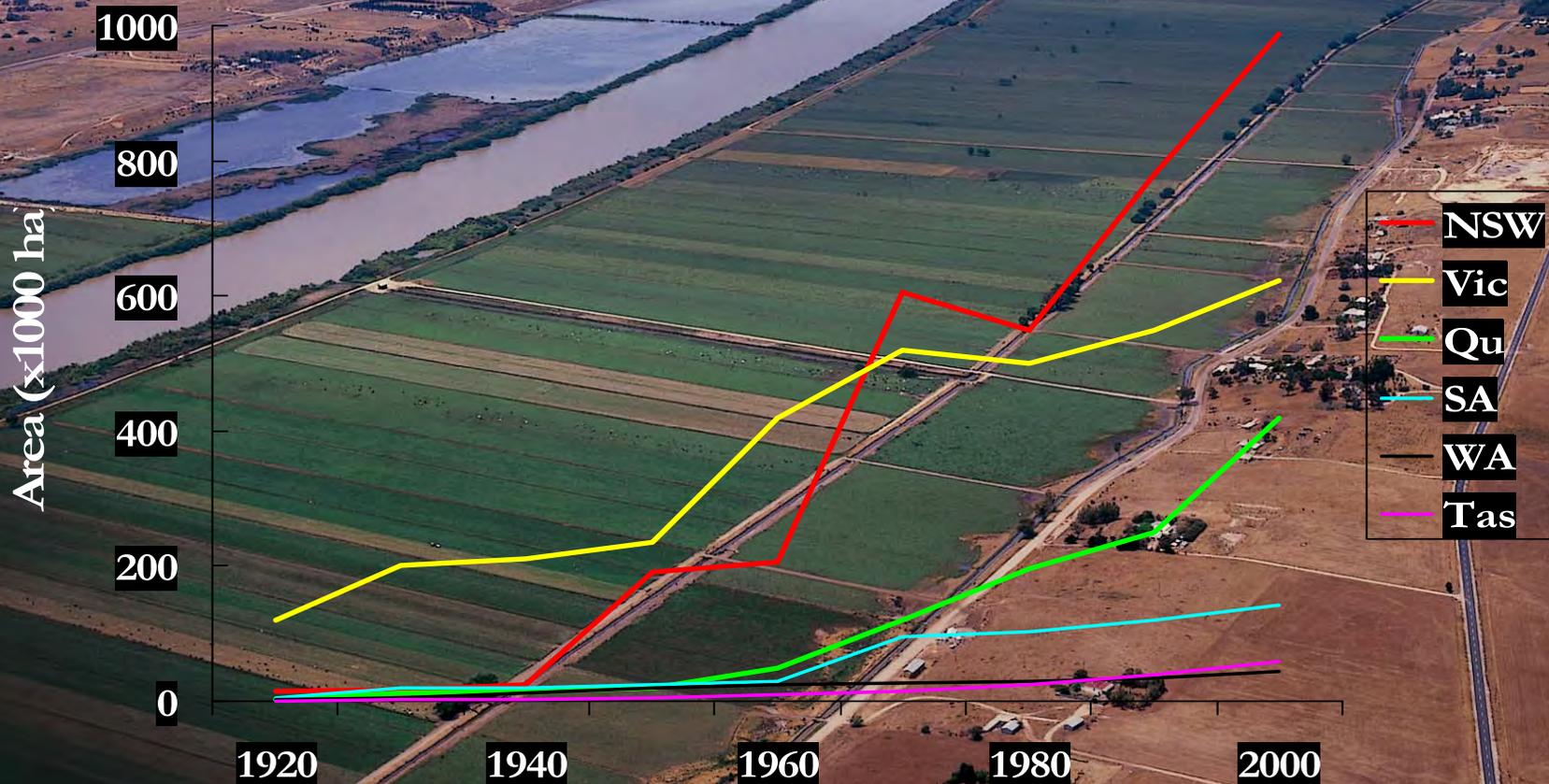
Government funded development of dams

Periods of water diversion development (Kingsford)
(note Murray average inflows approx 9,000,000 ml)



Irrigation – 70% of use - most in MDB

- Produces more than half the profit in Australian Agriculture & Horticulture, from 0.5% of land (NLWRA 2002)



The (Ramsar) wetlands – degrading

- ~28,000
- 6.3 million ha
- 98% floodplains
- ~3% protected

Narran Lakes



Gwydir wetlands



Macquarie Marshes



Lowbidgee floodplain

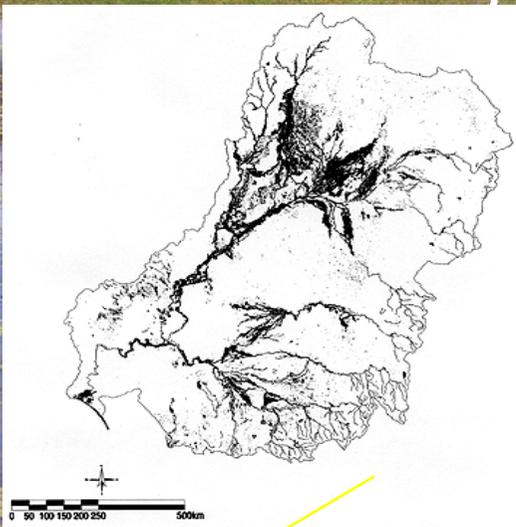


Coorong

Chowilla floodplain

Kulkyne Lakes

Barmah-Millewa Forest

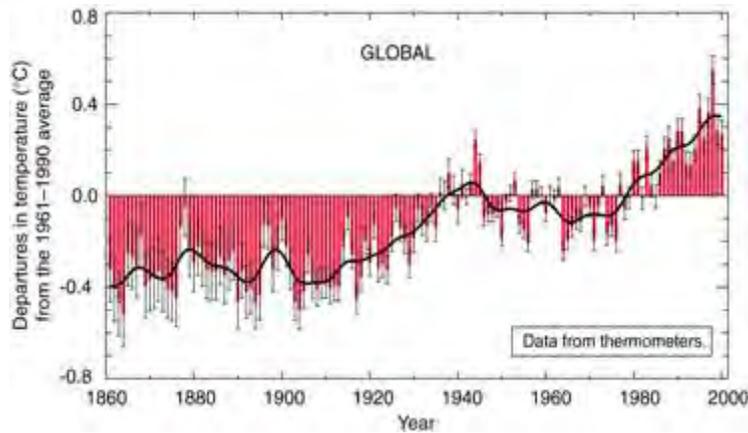


The approaching storm? climate chaos!!!

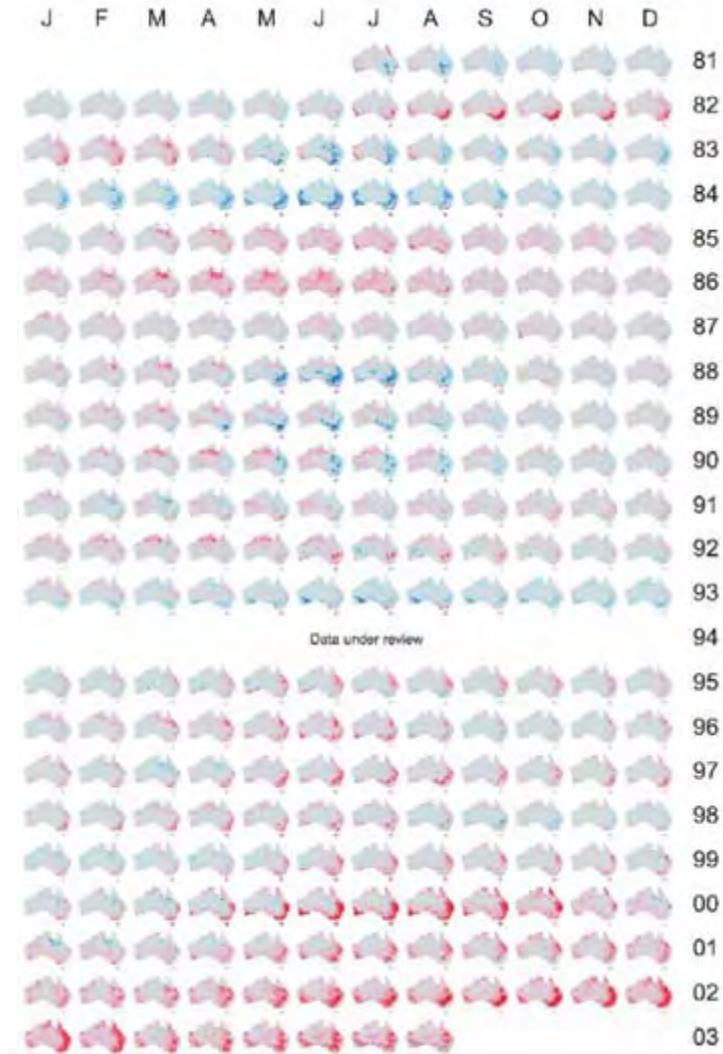


SEA Climate is hotter and drier

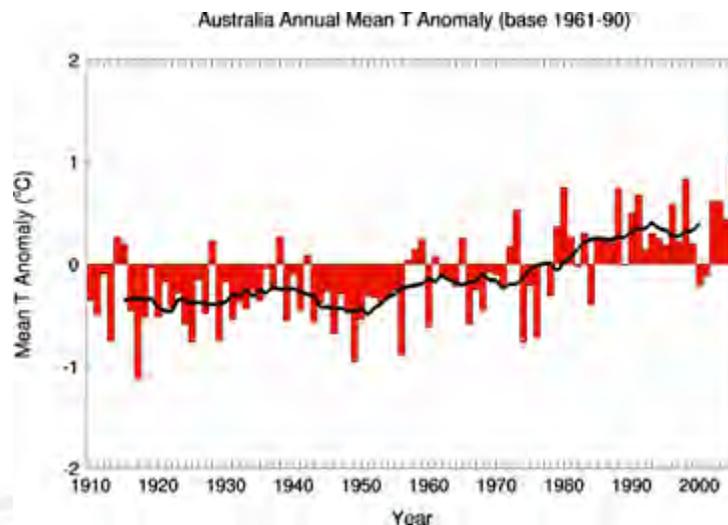
Global average temperature



Satellite estimate of soil moisture

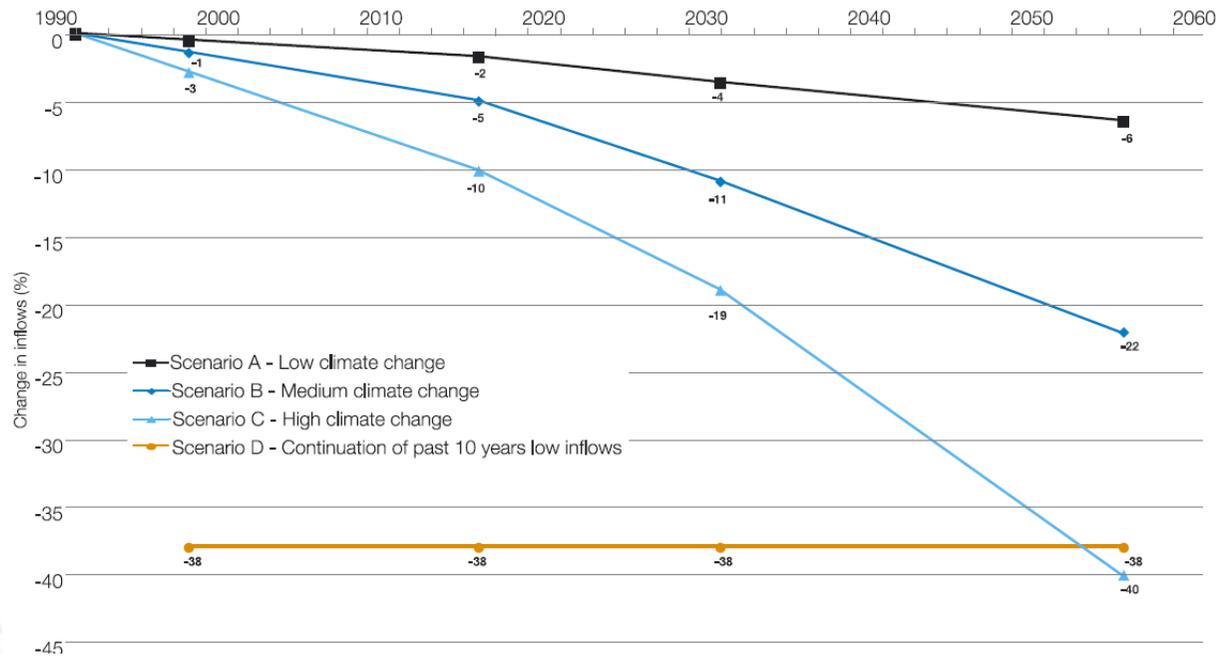
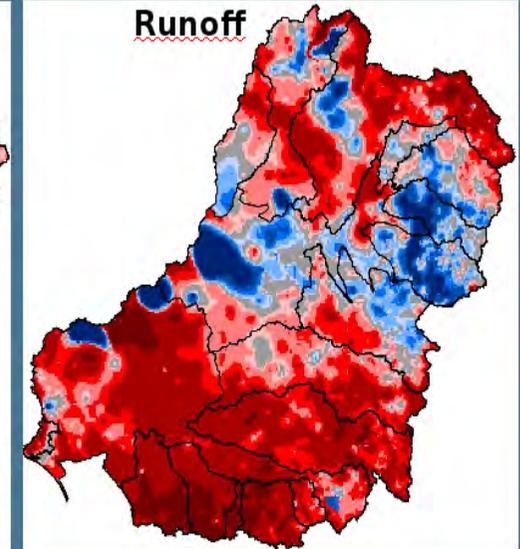
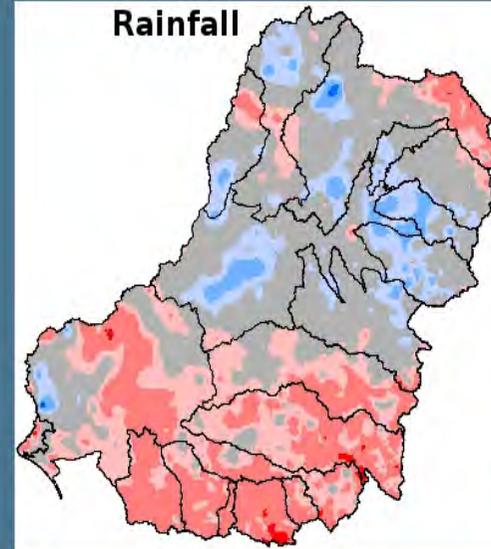
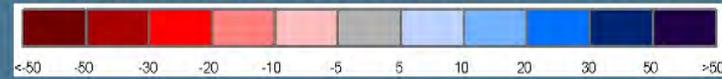


Australian average temperature



Modelled and actual decreases in runoff - flows

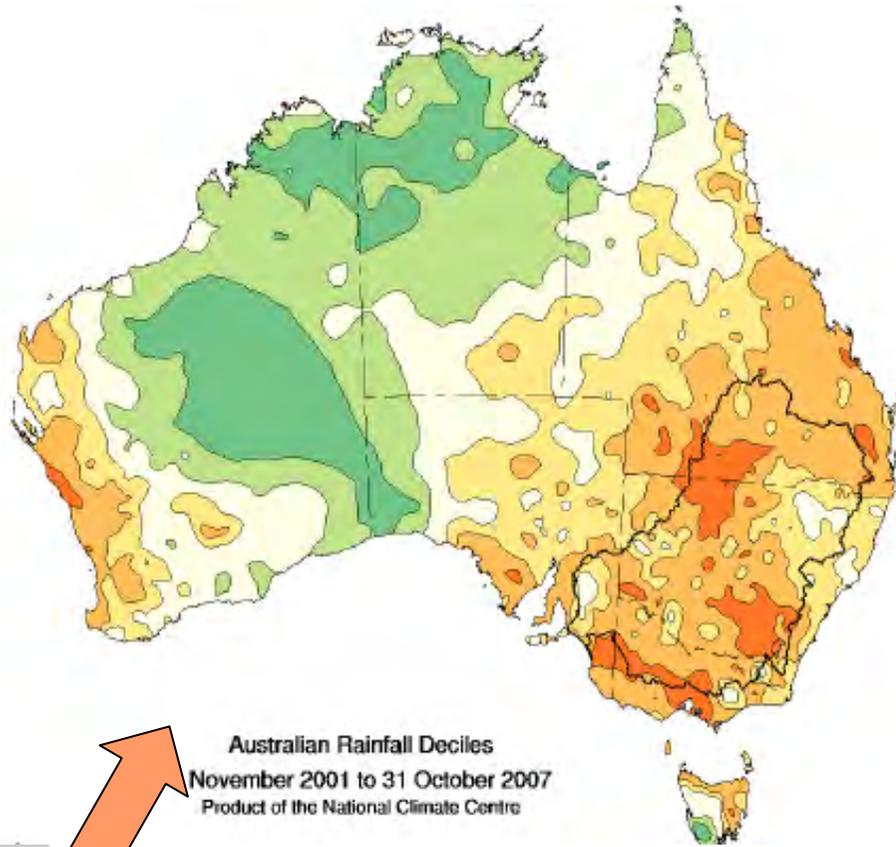
Percent difference (1997-2006 relative to 1895-2006)



Australian Government

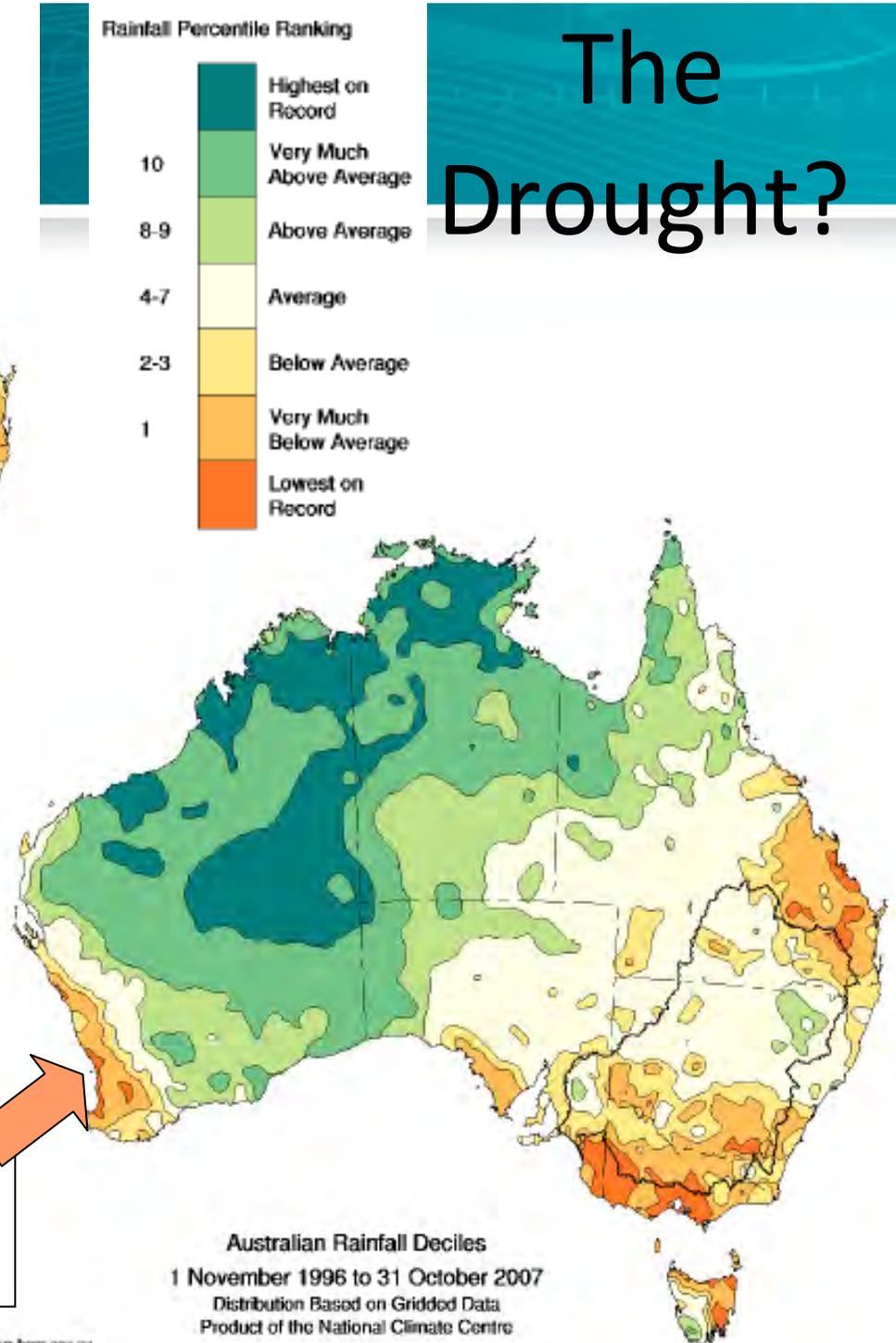


The Drought?



Australian Rainfall Deciles
November 2001 to 31 October 2007
Product of the National Climate Centre

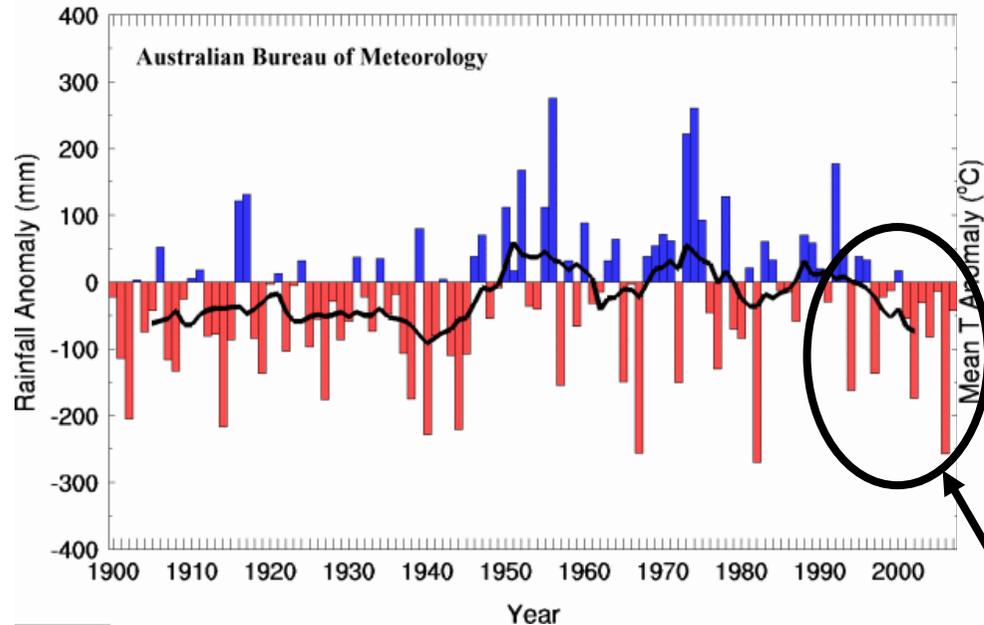
Australian rainfall deciles for the six-year period November 2001 to October 2007.



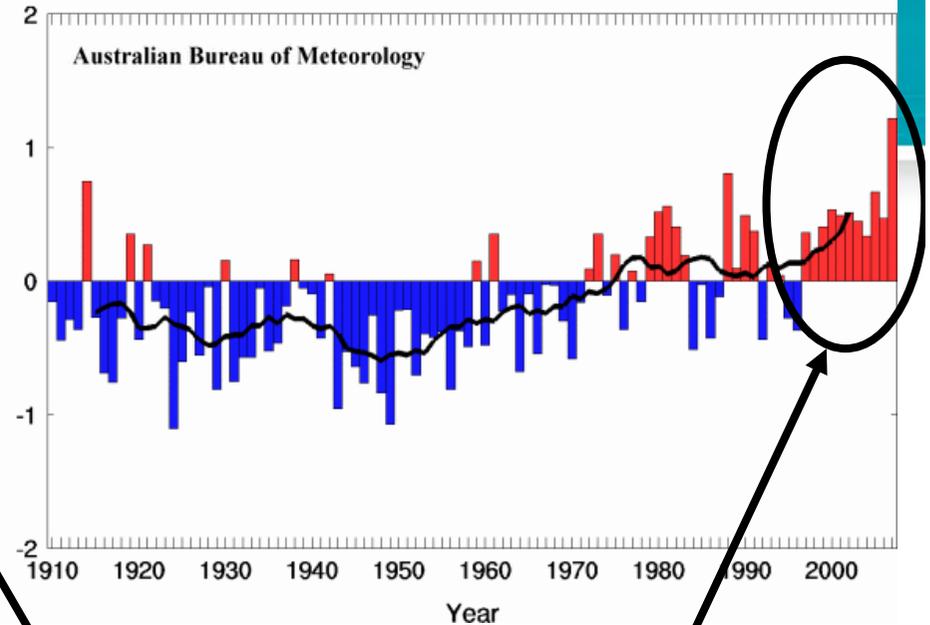
Australian Rainfall Deciles
1 November 1996 to 31 October 2007
Distribution Based on Gridded Data
Product of the National Climate Centre

Australian rainfall deciles for the 11-year period November 1996 to October 2007.

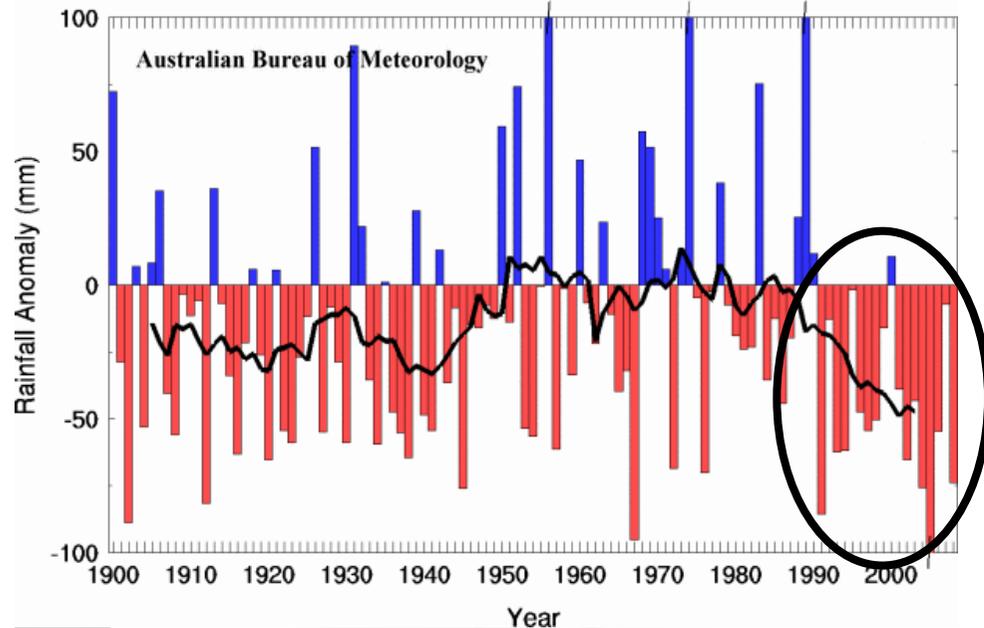
Southeastern Australia Annual Rainfall Anomaly (base 1961-90)



Southeastern Australia Annual Mean T Anomaly (base 1961-90)



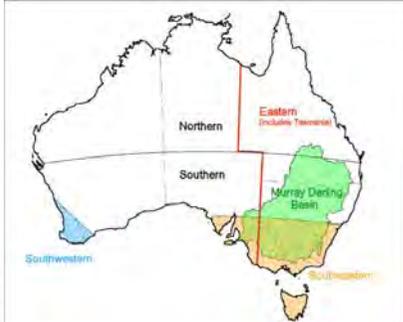
Southeastern Australia Autumn Seasonal Rainfall Anomaly (base 1961-90)



**lack of sustained
intervening wet
periods**

**combined with
record high
temperatures**

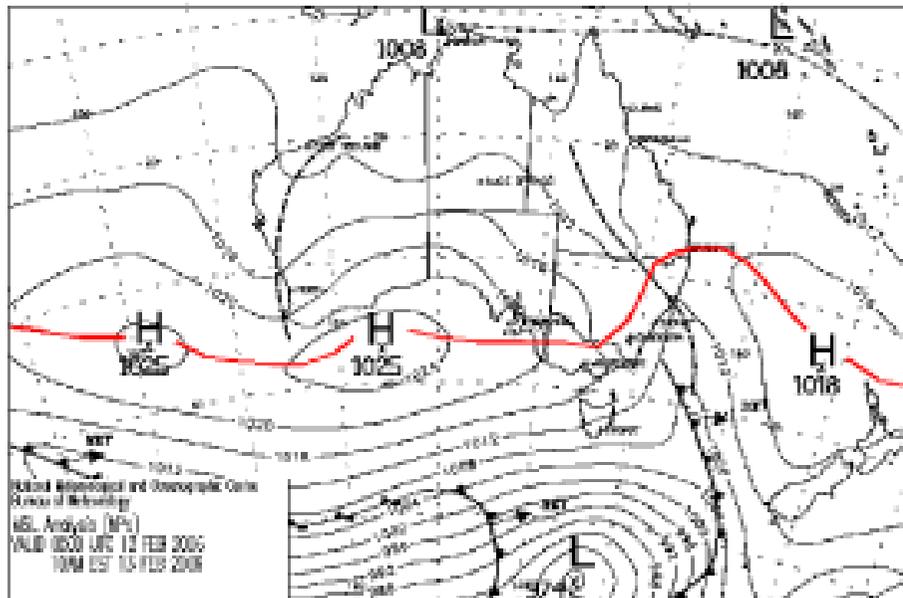
**most notably in
autumn**



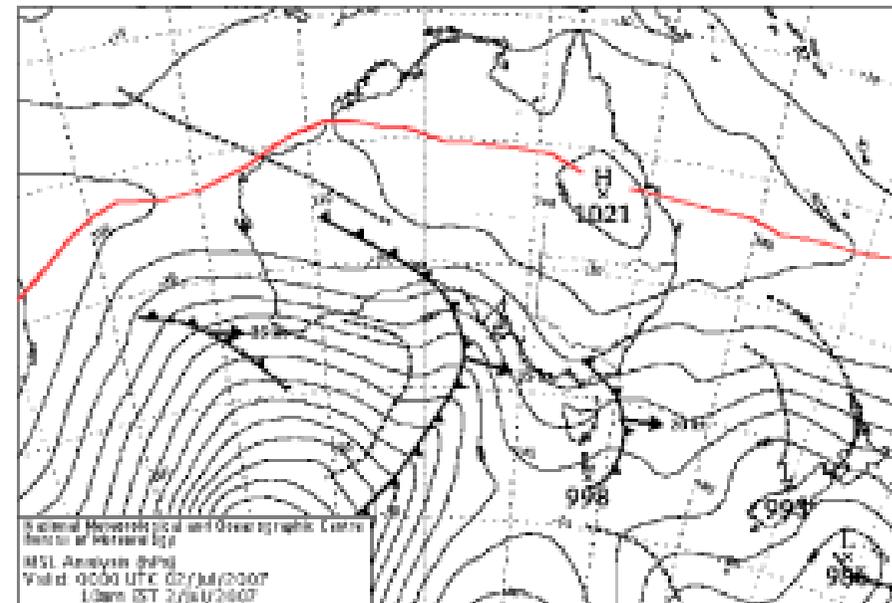
**→ a drought
without
historical
precedent in
Southeastern
Australia**

Increasing pressure in the subtropical Ridge?

Summer



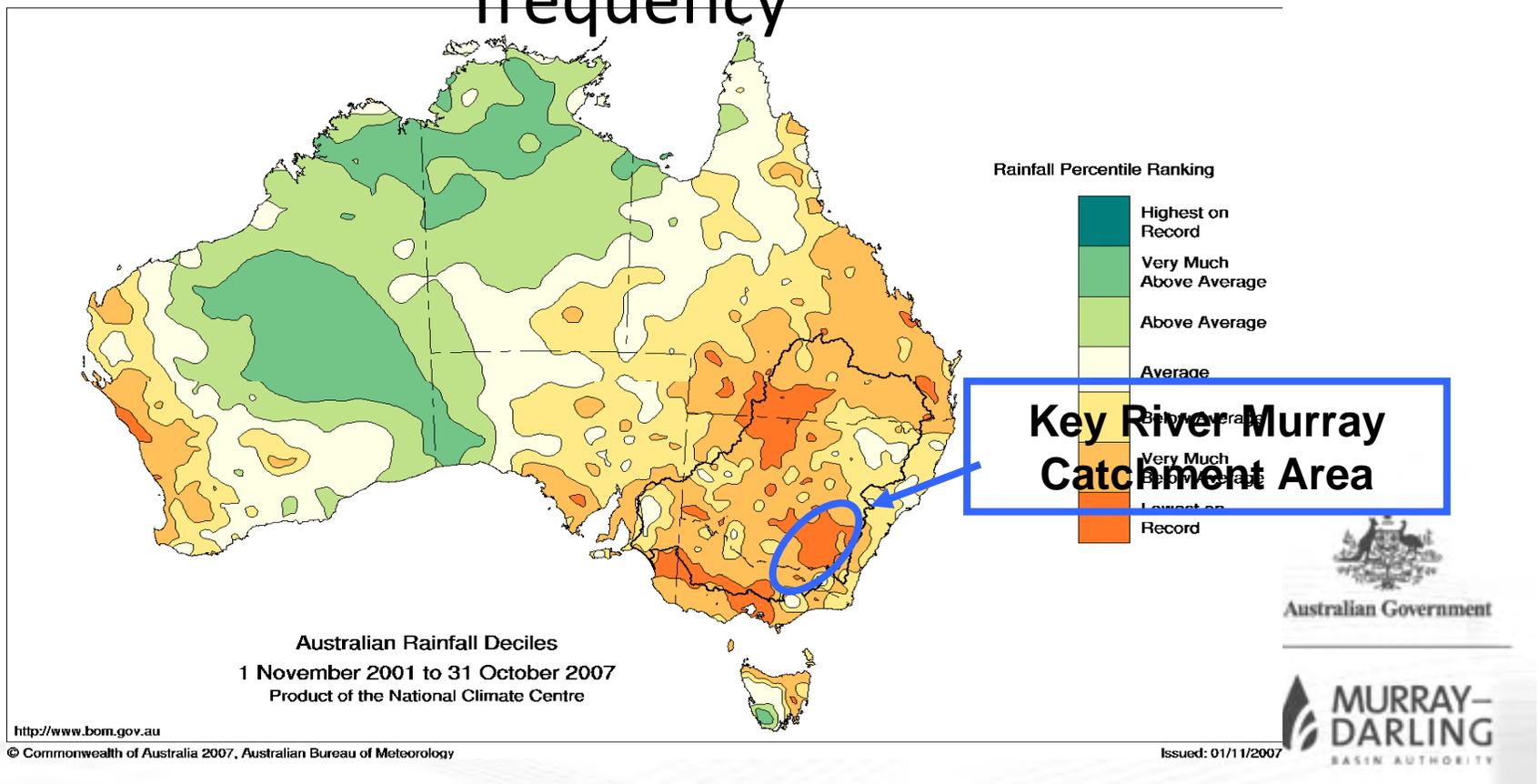
Winter

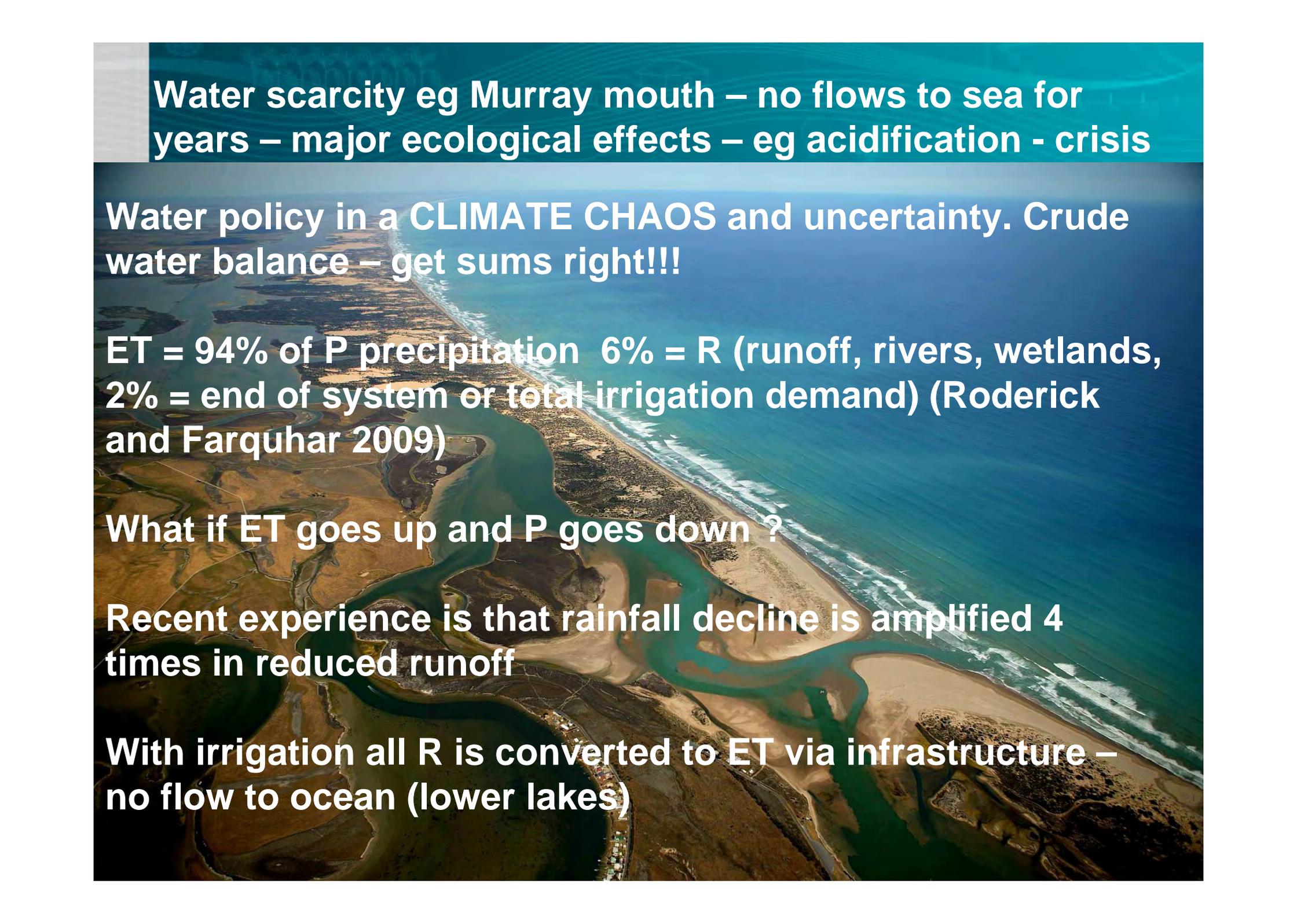


The sub-tropical ridge is shown as a red line in the above MSLP charts (13th February 2006 and 2nd July 2007).

What if this Drought is Different?

If the factors that make Australia's climate variable are vulnerable to global warming?
What now? What next? New states or frequency



An aerial photograph of a river delta system, likely the Murray-Darling Basin. The image shows a large, winding river channel that branches out into a complex network of smaller channels and wetlands. The water in the channels is a deep blue-green color, contrasting with the brownish, sandy soil of the surrounding land. In the foreground, there is a large, circular reservoir or lake. To the right, the river meets the ocean, with waves breaking on a sandy beach. The sky is a clear, light blue.

Water scarcity eg Murray mouth – no flows to sea for years – major ecological effects – eg acidification - crisis

Water policy in a CLIMATE CHAOS and uncertainty. Crude water balance – get sums right!!!

ET = 94% of P precipitation 6% = R (runoff, rivers, wetlands, 2% = end of system or total irrigation demand) (Roderick and Farquhar 2009)

What if ET goes up and P goes down ?

Recent experience is that rainfall decline is amplified 4 times in reduced runoff

With irrigation all R is converted to ET via infrastructure – no flow to ocean (lower lakes)

Water policy under uncertainty

Last decade - extremely low water availability

Impacts of the drought/climate change unprecedented

Long term reductions in rainfall and runoff likely

Intense competition for water – nature a legitimate user

Adaptation and policy innovation required

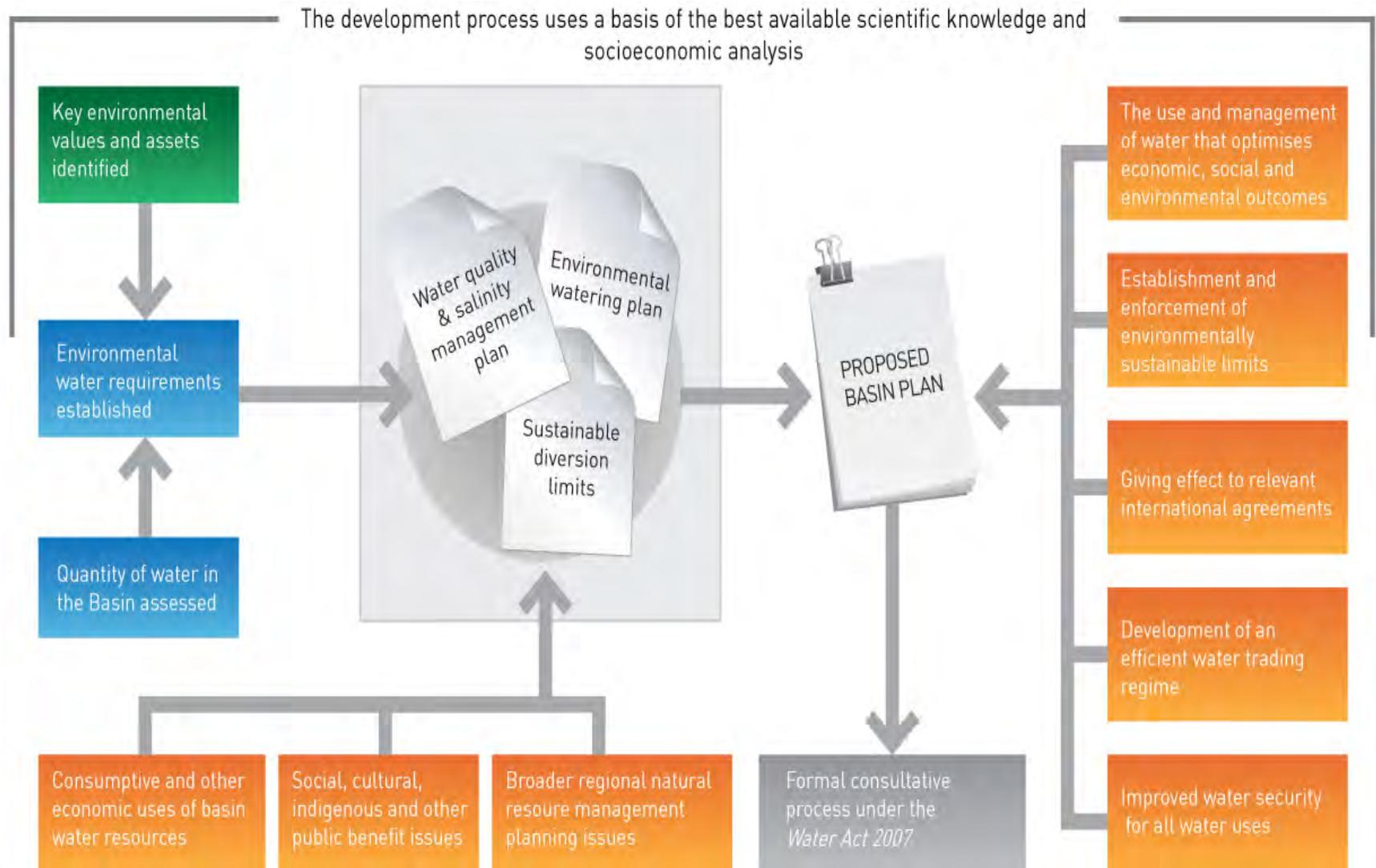
New water Act 2007 – basin plan, policies to support adjustment and adaptation

Use of best available science to plan for rebalance share of water for nature - in face of uncertainty and climate chaos, attempting to meet International treaty obligations – biodiversity, Ramsar etc

Water market reforms and increased power to central government

Key Elements of the Basin Plan

Page 8 of the Concept Statement



Conclusions 1: Water and drought

Learning to live as
Australia's

Water is a limited
resource!

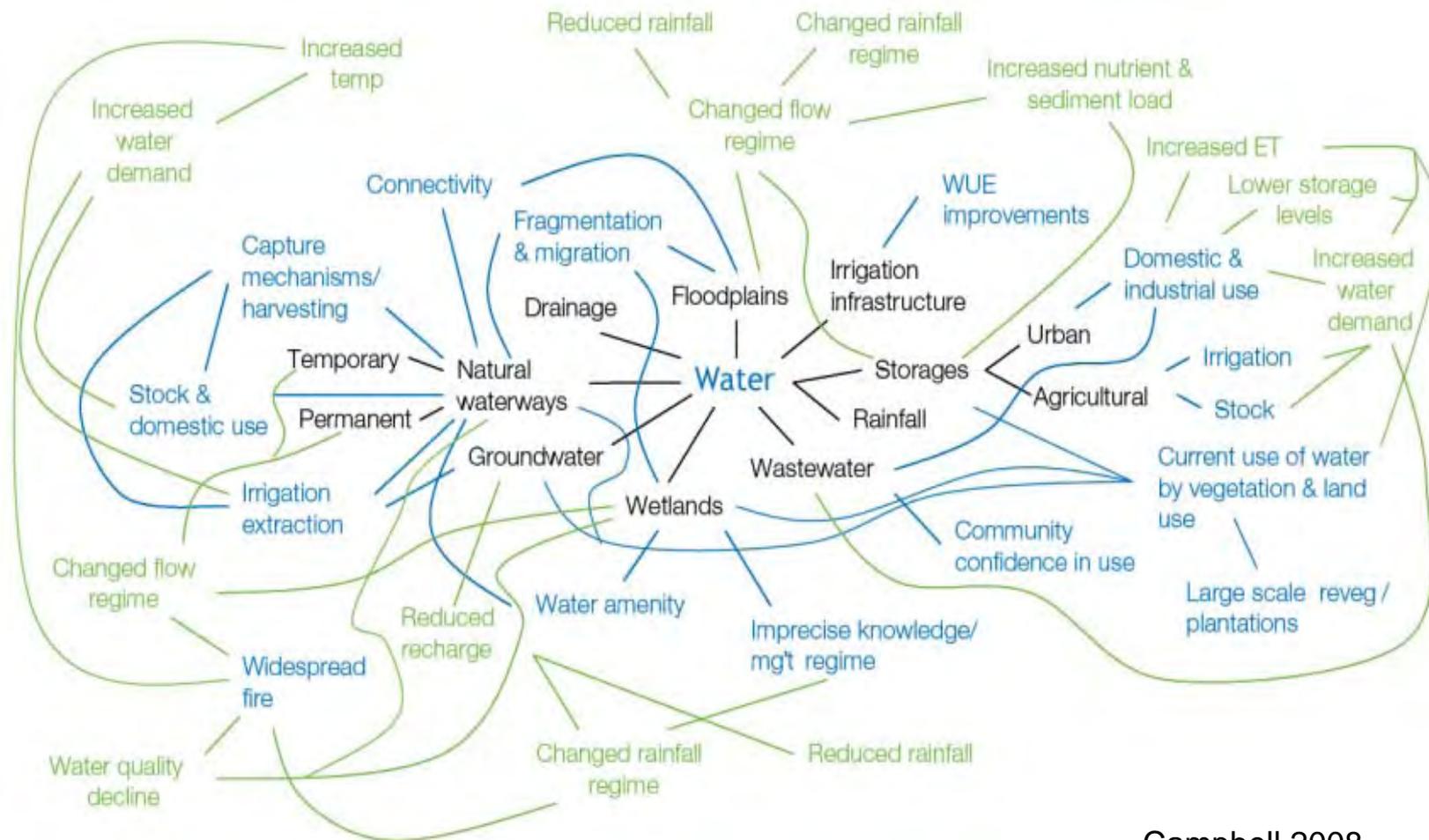
Bush burns!

Floodplains flood!

Droughts regularly
dry out the country –
70 out of 200 years



Conclusions 2: Pedagogy of complexity - Interrelated issues require multi-disciplinary, integrated and holistic approaches



Campbell 2008

Australia's river basins, landscapes and public policies will evolve in the next two hundred years in directions set by profound shifts in the underpinning cultural, institutional and economic relationships with nature, along with climate change and a reduced abundance of fossil fuels and fresh water. Hopefully the policy shifts of the first decade of the 21 century will be recognised as the end of the frontier and the beginning of the settler society in which a new dominant culture emerges based on respect and care for the nature of this ancient continent. New stories of hope, of restoration are emerging. These signs of hope inspire bolder action and bigger visions: eventually the momentum will be unstoppable.

