Climate Change in the Northern Jarrah Forest

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60 years of experience as a Forester, Environmental Scientist and Consultant in NRM

Topical

- COP 28
- Forest Management Plan
  - Minister Whitby "The science that climate change is having and will have a devastating impact on our environment is well established and cannot be ignored"
  - CPC Chairman " A fundamental aspect of the draft FMP is responding to the ongoing consequences of climate change in native forests"
  - Government decision to cease timber harvesting in native forests

My Hypotheses

- Major changes in hydrology, forest structure and ecology since 1880
- Current “drier” condition is the “norm”
- 1915-1965 “baseline” was unusually wet and caused serious environmental impacts
- The forest has shown resilience and is unlikely to collapse

Selecting a baseline

- Measures extent and direction of change
- 1915-1965 selected by Water Corporation and DBCA
- Using this period as “baseline’, since 1965
  - Rainfall has decreased about 20 percent
  - Watertables have dropped 10-15 metres
  - Streamflow has fallen by 75 percent
  - Drought deaths observed on shallow soils (2011)
  - The forest is under threat of “collapse” IPCC

Rainfall data from 1880

Perth (DoW data)

- 1880-1914 735mm
- 1915-1968 862mm
- 1969-2004 776 mm
- 1994-2019 727mm

Jarrahdale (BOM data)

- 1880-1910 1100mm
- 1911-1965 1251mm
- 1966- 2013 1054mm
- 2014-2023 1031mm

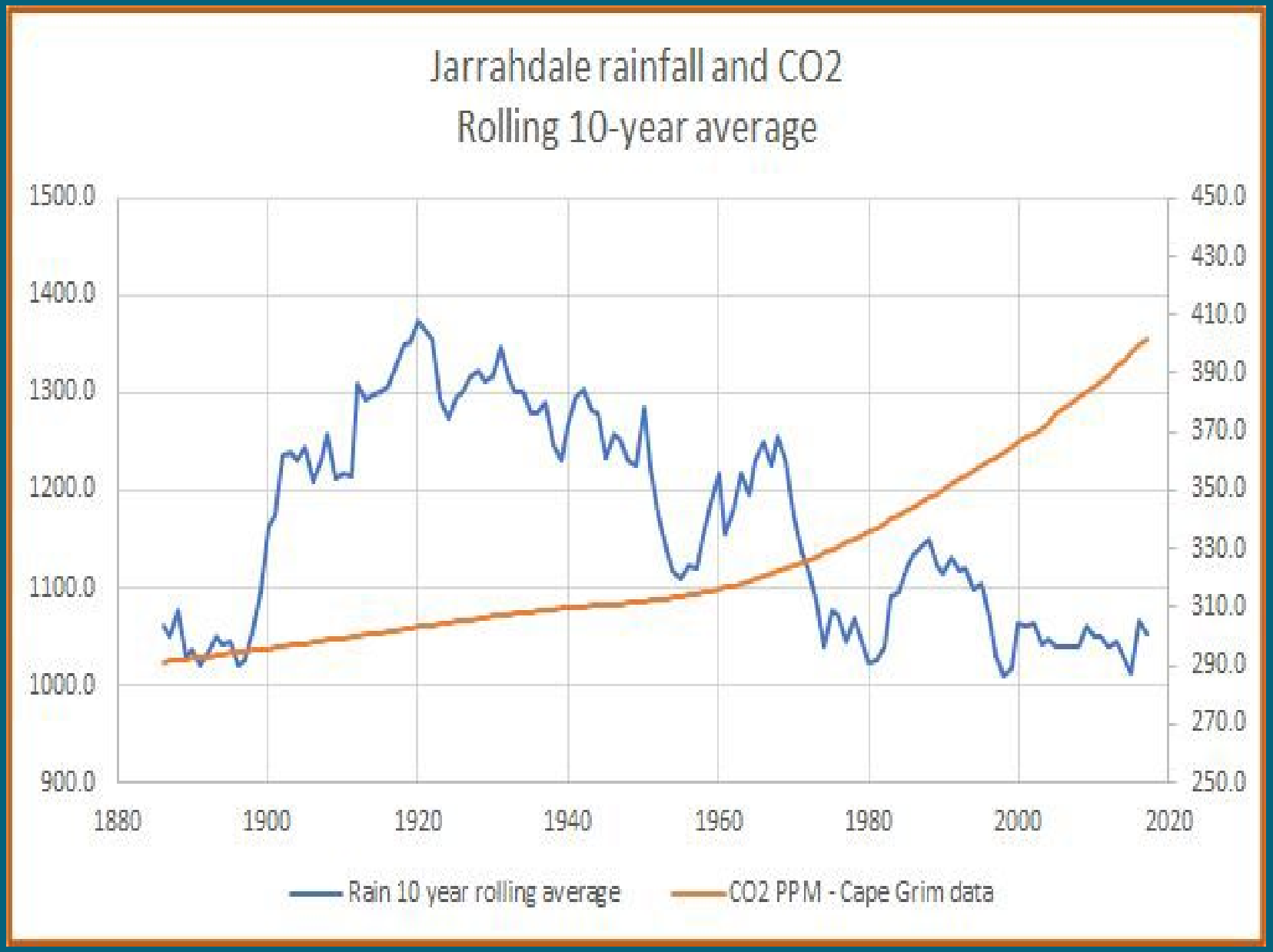
Cyclical rainfall. Corellation with rising CO_2 levels?

UWA (tree ring study)

1915-1965 wettest period since 1350 CE

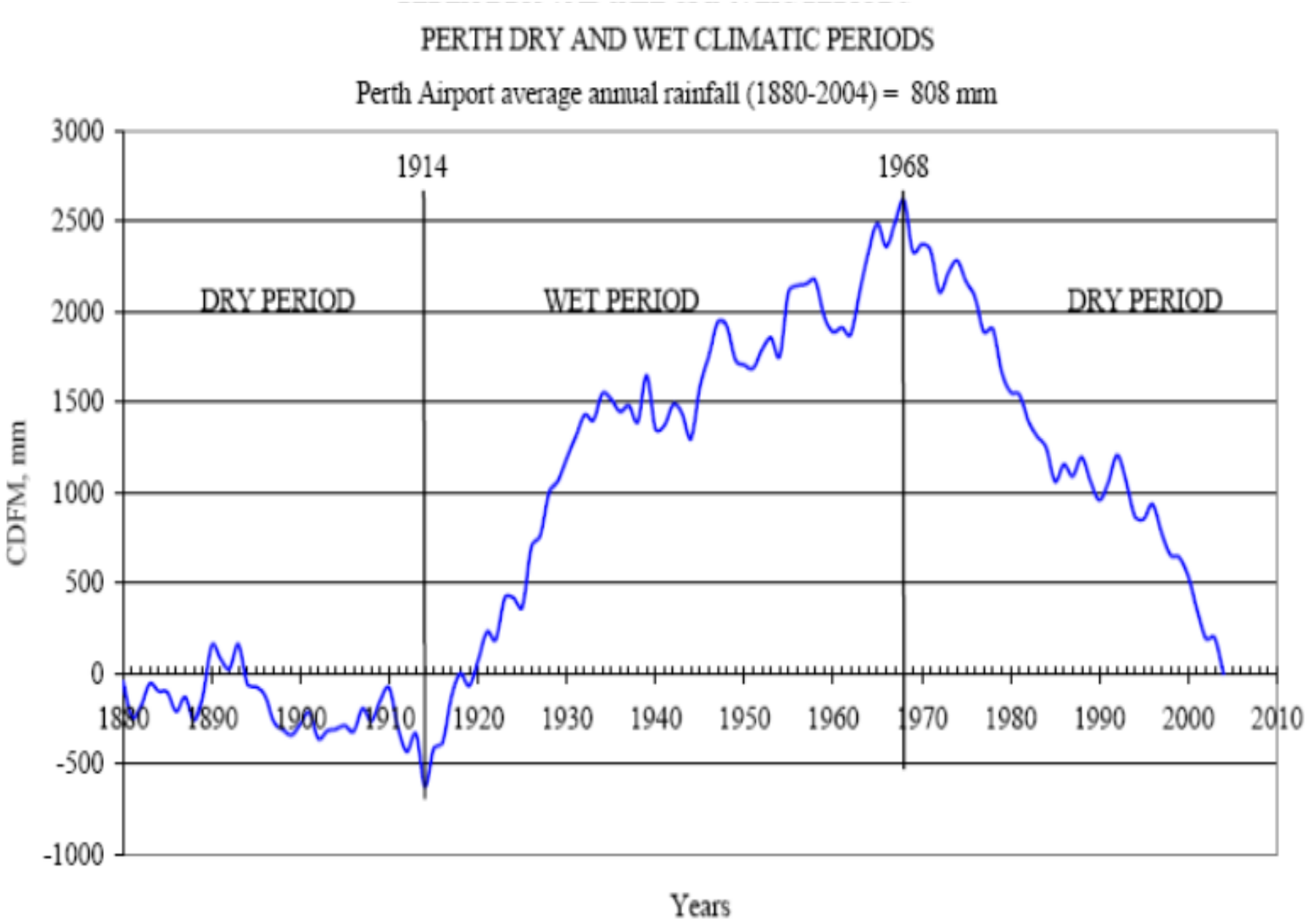
Corellations

- A corellation is not same as causation
- Positive- as A increases B also increases
- Negative- as A increases B decreases
- Looking at SW of WA from 1915-2022
  - As carbon dioxide and temperature rose
  - 1915-1965 rainfall and streamflow increased
  - 1966-2022 rainfall and streamflow decreased
  - Very unusual.

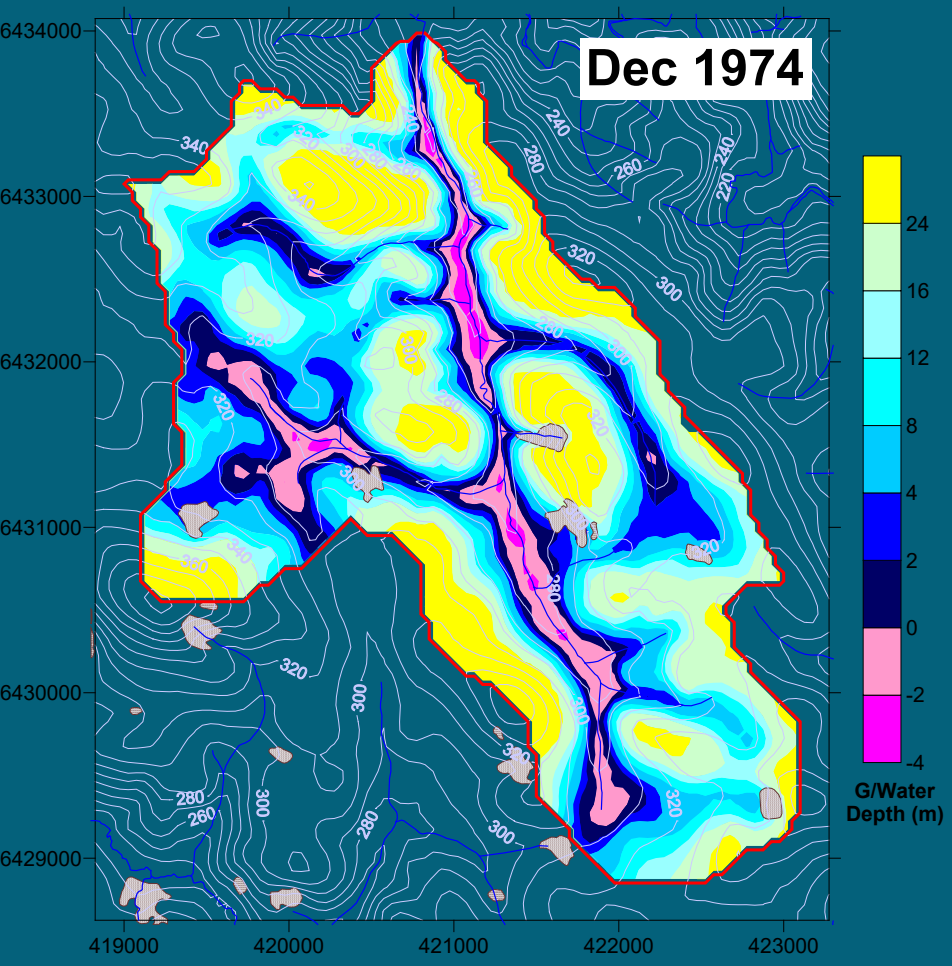

Jarrahdale rainfall and CO2
Rolling 10-year average
1500.0
1400.0
1300.0
1200.0
1100.0
1000.0
900.0
450.0
430.0
410.0
390.0
370.0
350.0
330.0
310.0
290.0
270.0
250.0
1880
1900
1920
1940
1960
1980
2000
2020
Rain 10 year rolling average
CO2 PPM - Cape Grim data

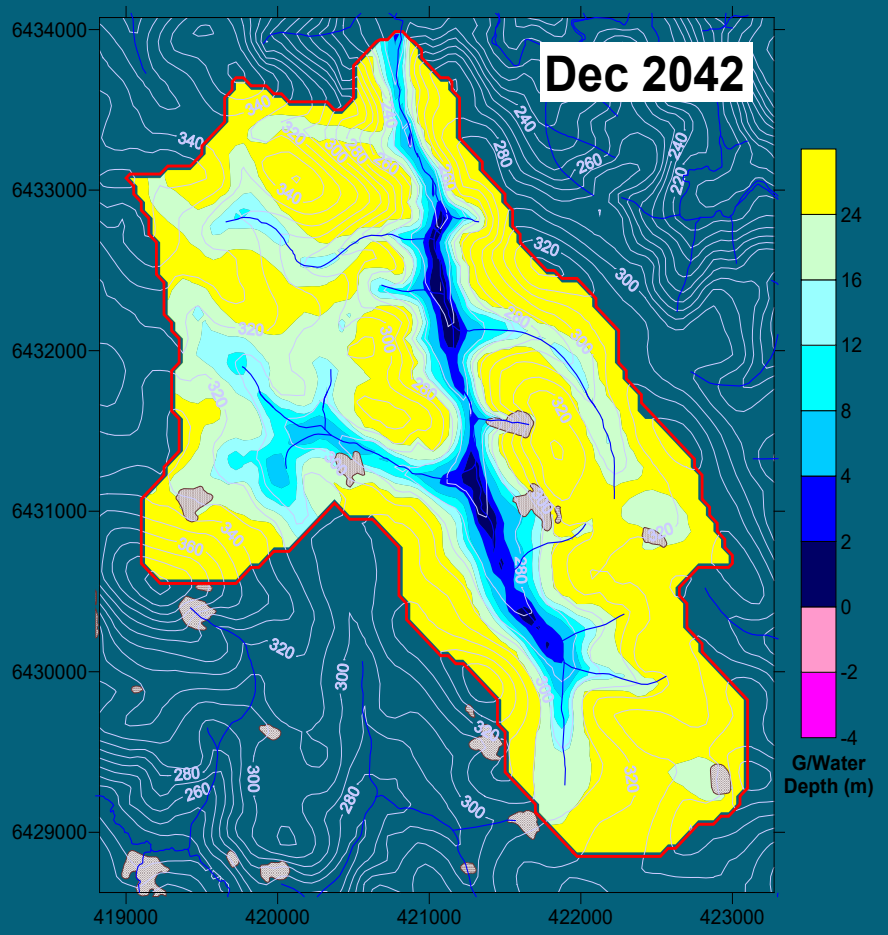
Watertable response

- Watertables rise and fall depending on rainfall
- Gnangara watertables rose 2.5 m (1914-1968) then fell 2.5 m (1968-2004) (DoW data)
- Modelling 31 mile brook show watertables well above ground level in 1970's but now many metres below (Croton)


PERTH DRY AND WET CLIMATIC PERIODS
Perth Airport average annual rainfall (1880-2004) = 808 mm
1914
1968
DRY PERIOD
WET PERIOD
DRY PERIOD
CDFM, mm
3000
2500
2000
1500
1000
500
0
-500
-1000
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Years

Simulated depth to groundwater Croton 2012





Streamflow

- Watertables influence the “wetted area”
- Streamflow increased from 1940 and peaked in 1975 (CSIRO)
- Years when streamflow was twice the mean value were- 1917, 1926, 1945, 1946, 1954, 1963 and 1964
- Since 1965 streamflow has decreased by about 75 percent
- What was streamflow in 1880’s? Similar to now?

Water storages

Mundaring Weir

- built early 1900's
- 5000 ha ringbarked to increase flow

Other dams

- Built 1940- 1994 (high rainfall years)
- Overflowed occasionally

Harvey weir 1964

- Town evacuated due to fear of weir collapse

Water quality

- Hills fire 2005 in Helena catchment

Waterlogging and Phytophthora

- High rainfall and rising watertables caused waterlogging, erosion, salinity and damage to infrastructure in wheatbelt
- Jarrah is susceptible and deaths observed, especially in “gully-heads”, higher rainfall area
- Invasion of jarrah sites by bullich and blackbutt
- First major concern after 1945/1946 winters
- Major ecological impact, by 1965 about 15 percent of high rainfall area was affected

Drought

- Has been a regular feature on shallow soils, eg 2002, 2007, 2011, 2020 and 2024(Chandler road)

- Megadroughts of more than 30 years duration have occurred in WA in the 18th and 19th century (UWA tree ring studies)

- 2011 drought effects
  - 90000 ha of worst area was surveyed and 1.5% was affected
  - Overall <5000 ha of forest affected
  - Over time 40 percent of stems died
  - Sites mainly on shallow soil near exposed rock
  - Occasional death of bullich in gully-heads

  - The 2024 drought effects near Jarrahdale not as serious as 2011

  Not a catastrophy (IPCC- Fact? Sheet)

Vegetation responses

- Change is constant (subtle to stand-replacing)
- 31 mile brook vegetation monitored (480 plots) from 1972 to present.
- Despite major changes in hydrology only slight “xeric” shift noted (around granite rocks and gully-heads)
- Jarrah leaf area can fluctuate by 20 percent annually
- The regrowth jarrah forest has shown remarkable resilience and also grows in much lower rainfall zones

* Havel site-vegetation types can show expected change

Ecological changes

- Aquatic
  - Substantial change noted 1980-2010 (Davies and Storey). Fauna with longer life cycles are most affected.
  - Is 1980 a suitable baseline? Why not 1880?
- Terrestrial
  - Minor, since a key habitat, the streamside vegetation is unaffected
  - Another key habitat, the shrub/herb/moss vegetation on and near exposed rocks are also unaffected

Ecological thinning

- Thinning is beneficial . It will raise watertables, increase streamflow , tree growth rates, ecosystem health, employment and reduce fire hazard.
- Consider scale, cost and public acceptance
- 8000 hapa for FMP = 80000ha
- This equates to about four percent of forested area in south-west
- Most of the forest will need to survive unthinned
- Cost estimate… $12-$25 million annually

Forest structure

- Major changes since 1880
  - Timber harvesting and regeneration (pre 1920)
  - Bauxite mining and rehabilitation (post 1965)
  - Disruption of indigenous burning
  - Prescribed burning (mostly since 1965)
  - Wildfire eg Hills fire 2005. Waroona fire
  - Old trees replaced by younger trees
  - Younger trees transpire 2x more
  - Half the reduction in streamflow is due to increased Et, not lower rainfall

Baselines

- If we choose the Water Corporation baseline (1915-1965) we measure major changes in hydrology and ecology, but only the “receding tide”
- If we choose a baseline 1880-1915, the major change is in the forest structure and corresponding increases in Et
- This regrowth forest has been resilient, even though it is transpiring more than older trees.

MANGLING THE DATA

- 2011- helicopter survey, Wungong, 5% scorched FB, shallow soils and bauxite rehab
- 2011 Matusick survey 90000 ha , 1.5 % affected, 1350 ha, shallow soils, 25% mortality. Most forest is OK.
- 2018- WA climate change impacts report. Murdoch senior author says 47.5% of forest affected over 300000 ha, quotes Matusick as source.
- 2020 meeting of 30 “scientists” in Canberra identifies NJF as likely to collapse (one WA author) Again quotes Matusick as source.
- Scientists report goes to IPCC and NJF listed as “threatened” in IPCC “Fact sheet”
- No-one bothers to check with locals or look in the field

Conclusions

- I think the forest has shown resilience. Most of the forest is healthy and still a functioning ecosystem “Good news” for the FMP

- Should you believe the “experts” from Murdoch University, E/States, O/seas and IPCC. Go and look for yourself.

- Science is not about consensus, it needs to look at all the data and requires robust debate. I would rather be proven wrong than ignored.

- Negative impacts of wildfire on key values
  - On water quality (2005 Hills fire)
  - On bullich wetlands (Waroona fire)
  - On rock outcrops (Mt Cook fire)