The 31 Mile Brook Catchment

Changes in hydrology, vegetation and biodiversity

1972 to 2024

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Acknowledgement

- I have collated data by many authors into one report
- Data scattered, only some published
- Probability data could be lost

- Updated some field data from 2012 to 2024
- Reviewed long-term rainfall records
- Considered adequacy of existing baselines

- Dr Havel, Mr Edmiston, Mr Barrett

- Dr Davison, Dr Silberstein, Dr Macfarlane, Dr Mattiske, Dr Dundas, Dr Johnstone, Dr Croton, Dr Davies, Dr Storey, Ms Reid, Dr Matusick, Mr Wallace.

- Forests Department, Water Corporation, Premier's WRF, Forest Products Commission and Dept Resources.

31 mile Brook

- 50 kms from Perth along Albany highway
- Feeds into Canning dam
- Nominally in “higher rainfall” belt
- Rainfall average was 1290mmpa
- 2000 hectares, last logged before 1950 (200 ha in 2010)

Hydrology

- Since 1975 streamflow has reduced by 80 percent
- Flow days reduced by 50 percent
- In 2010 (drought) streamflow was 3 percent of pre 1975
- In 10 years 1992-2011 watertable fell 6 meters
- Loss of soil water over 25 years estimated as 1100 mm
- Contribution: Rainfall 60 percent and Vegetation 40 percent
- Water use by small trees is twice that of large trees
- 1911-1974 were unusually Wet years

Forest response

From 1989 to 2007 the forest canopy cover

Fell in the drier, eastern zone but

Increased in the western zone (why?)

From 1975 to 2009, canopy cover in 31 mile brook

gradually increased by 70 percent, but

after the 2010 drought year, it fell by 27 percent

Jarrah forest canopy can adjust rapidly by shedding leaves and branchlets

Catchment water balance

- CSIRO studied the water balance from 2004 to 2010
  - Mean annual rainfall 947mm (two drought years)
  - Mean annual water use 948mm
    - Overstorey 427 mm
    - Understorey and bare ground 400mm
    - Interception 121mm
  - Soil moisture decreased by 63 mmpa
  - Watertables fell
  - Runoff 61 mmpa (6 percent of rainfall, mostly from storage)

Effects on environmental values

- The 2010 drought led to extensive crown scorch and some tree deaths, mainly on shallow soils, near exposed rock and in bauxite rehabilitated area

- About 5 percent of Wungong catchment was affected
- About 1.5 percent of the 90000 ha surveyed by Murdoch was affected
- Some trees were more than 200 years old
- Jarrah was more susceptible than marri
- 60 percent recovered from coppice and epicormic shoots

Aquatic biodiversity

- Data span 27 years from 1984 to 2010
- Changes to abundance were observed
- Species that have long life cycles are most affected
- These include species of conservation significance- stoneflies, Gondwanic dragonflies and freshwater snails.
- Breeding habitat for frogs, native fish, mussels and gilgies will be reduced

Vegetation

- Excellent baseline set up in 1972 by Dr Havel and Mr Edmiston (Forests Department)
- Again, baseline was post 70 years higher rainfall
- 500 plots each 40m x 40m in 2000 ha
- All trees measured and understorey species recorded on 16 subplots (8000 plots in total)
- Vegetation map prepared (14 units)
- 480 plots remeasured by Dr Mattiske in 2012
- A new vegetation map produced

Vegetation 2

- Comparison 1972 and 2012
- Some species that prefer moister soil were less abundant. Some tree deaths near rock surfaces.
- No major collapse of streamside vegetation
- Brief surveys in 2020 and 2024 (2019 and 2023 were dry) noted death of bullich (E megacarpa)on one site, less than one hectare (probably from prescribed fire in 2017).
- Data from 2011-2024 on another site show how bullich recovered from drought (2020) but had scorch in 2024
- Bullich trees have invaded jarrah sites.

Terrestrial biodiversity

Most terrestrial species and many birds rely on dense streamside vegetation for cover, food and to avoid predation

This vegetation is healthy

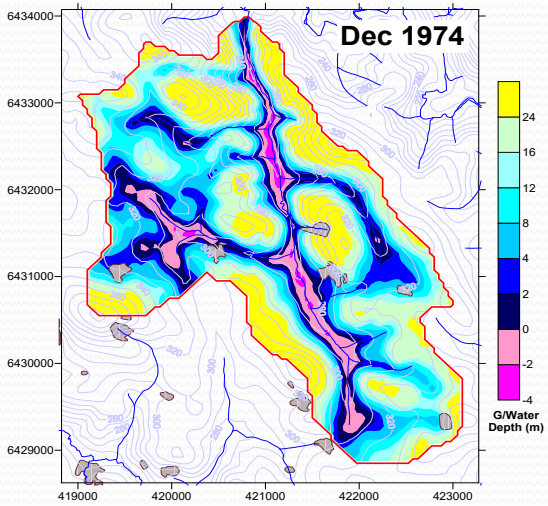
Seed-eating birds require access to water

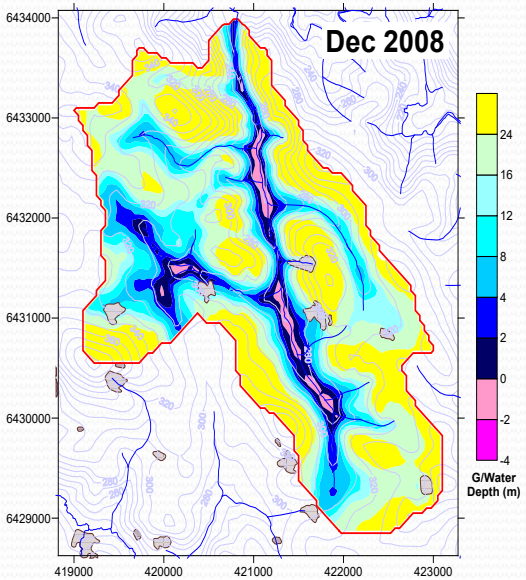
Study of quokka by Dr Dundas showed these populations were doing well

Minor impacts to date

Simulations

- Modelling used 25 years of data and produced good results(Croton 2012)
- Model used to make predictions
  - Water tables Note : gully heads
  - Stream flow and
  - Effects of thinning
    - Thinning to a basal area of 14 would
      - Improve stream flow
      - flow days
      - soil storage and
      - stabilize water tables to 2010 levels



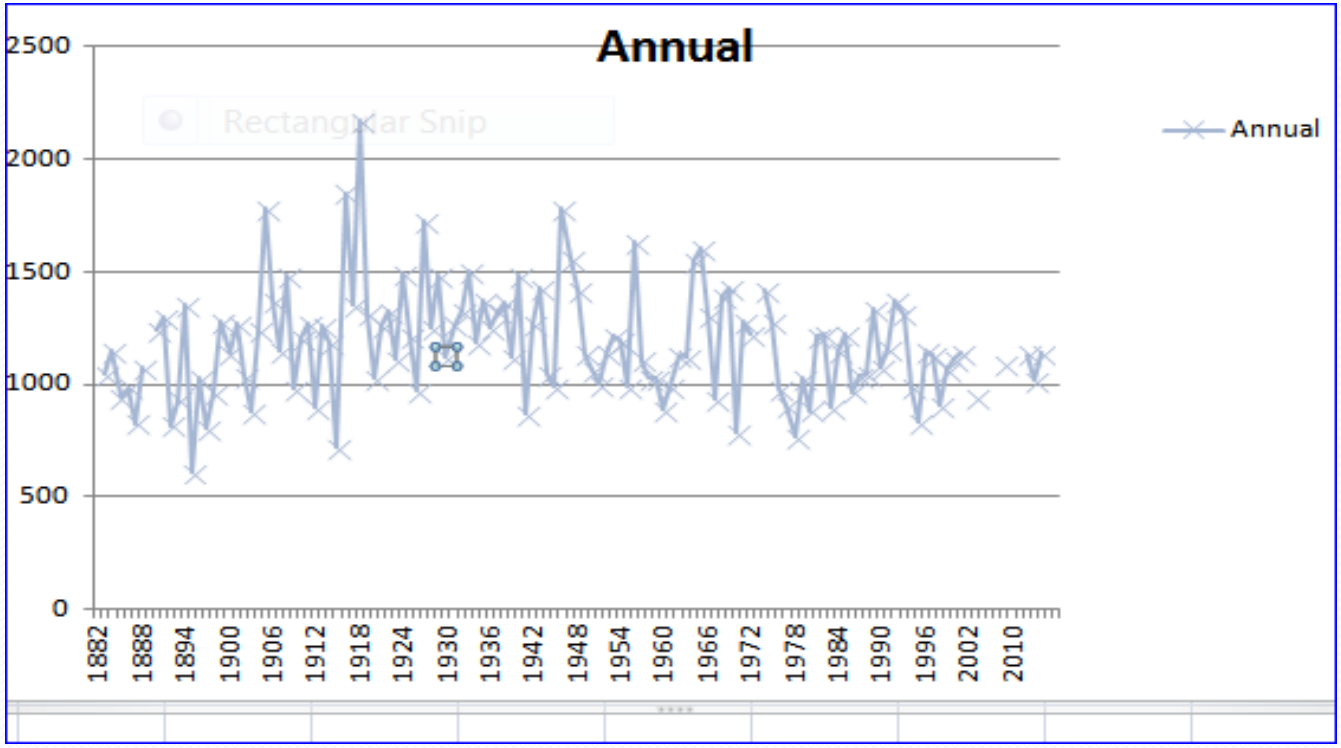


Forest studies should use long-term data

Jarrahdale rainfall 1882-2013,

mean 1177mmpa, range 607 mm 1894 to 2169 mm 1917

1882-1910 1100mm,11-75 1251mm, 75-2013 1054mm



considerations

- Very dry years 1886,1891, 1894, 1896 and 1914 cannot be explained by rising CO2 levels
- Concerns about Mundaring Weir being slow to fill
- 6/7 years above 1604mm occurred between 1911-1975
- Consecutive years > 1486mm-45 and 46, 63 and 64
- Occasional overflow Canning and Mundaring Weir
- Evacuation of Harvey due to potential collapse of weir
- Increased levels of waterlogging forests and farmland
- Increased concern about Phytophthora dieback
- Increased concerns about salinity (Collie/Hunt/Kelsall)
- Invasion of jarrah sites by bullich

Conclusions and Recommendations

- A valuable long-term study- must continue
  - Major changes in rainfall and hydrology
  - To date, only minor changes to vegetation and biodiversity
  - Ecosystem has shown resilience
  - Forest structure has changed (1860's and 1960's)
  - Mitigation by thinning is feasable
- What next??
  - Retain 31 mile brook as an untreated control catchment
  - Reopen rainfall and stream gauging
  - Remeasure water tables in autumn
  - Establish vegetation monitoring in gully-heads
  - Use appropriate baselines when making comparisons