Trish Lambert, Richard Silberstein, Craig Macfarlane, John Byrne, Chris Johnstone and Natalie Smart

http://www.ozflux.org.au/monitoringsites
South-west Western Australia has had a major climate shift since the early 1970s, with a major reduction in rainfall in the south-west since the early 1970s.
16% reduced rainfall but 55% reduced recharge

Yearly rainfall at Jarrahdale

Yearly Streamflow for Major Surface Water Sources - IWSS

Note: A year is taken as May to April

Water and carbon balances, Gingin, WA – Silberstein-Lambert, OzFlux Symposium, July 2013, Cairns
Water Issues

• Drying of forest soils & changing forest structure causing reducing stream flow into water catchment dams

• Population increase and urban expansion causing increased water demand

• Increased reliance on groundwater (5% to 75% from 1970 to 2010)

• Decline in aquifer storage at 50GL/yr ~ $1b NPV (based on sea-water desalination)

• Desalination now 25% of water supply soon to rise to 50%
The Gingin site is in the recharge area 70km north of Perth CBD
The Gingin region is subject to fire and other stresses.
Site selected with Noongar approval...
The site is chosen to understand the water use and carbon balance of the native bush, and (hopefully) contribute to sustainable management of Gnangara ecosystem and groundwater.

About 1,000km² of native woodland
Annual rainfall ~ 750mm,
Potential evaporation ~1600mm,
Actual evapotranspiration ~ 600mm
Long-term piezometer of the Dept of Water

Department of Water

Period: 36 Year
Plot Start: 00:00_01/01/1977
Interval: 1 Month
Plot End: 00:00_01/01/2013

Recharge following Wildfire, 1986

Water and carbon balances, Gingin, WA – Silberstein-Lambert, OzFlux Symposium, July 2013, Cairns
Instruments

Usual tower array plus
Digital cameras monitoring phenology
CosmOz moisture sensor
Neutron access tubes
”Nested” piezometers
Additional east & west sites
CosmOz uses cosmic rays for soil moisture
giving average moisture content to about 80cm
over a radius of about 200m
CosmOz soil moisture

6hr average soil moisture content

Soil moisture content (cm³/cm³)


-0.04 -0.02 0 0.02 0.04 0.06 0.08 0.1 0.12

NMM-12.5 Calibration

CosmOz COSMOS TDR

OzFlux-0.1m

Water and carbon balances, Gingin, WA – Silberstein-Lambert, OzFlux Symposium, July 2013, Cairns
Water fluxes at Gingin

MJ/m²/day

LE
Fa

evaporative fraction Fa/Fa ()

MJ/m²/day

Oct-11 Dec-11 Feb-12 Apr-12 Jun-12 Aug-12
Cumulative carbon flux vs cumulative evaporation

Water and carbon balances, Gingin, WA – Silberstein-Lambert, OzFlux Symposium, July 2013, Cairns
Carbon flux vs evaporation + rain + soil moisture

Water and carbon balances, Gingin, WA – Silberstein-Lambert, OzFlux Symposium, July 2013, Cairns
Down-welling short wave radiation, Air Temp, Available energy, carbon flux
Problems & Issues

- Insufficient power capabilities to run the fast instruments at the top of the tower
- Insufficient infrastructure to get that power to the fast instruments
- Irregular cleaning and calibration of instruments
- Soil moisture probes and multiplexer problem – ongoing

LESSONS

- Documentation and protocols
- Look at and process your data regularly
- Get to know people in the OzFlux network
Next steps: Putting this together with a model and finding what’s wrong

Water and carbon balances, Gingin, WA – Silberstein-Lambert, OzFlux Symposium, July 2013, Cairns

Model SLST – Tom Van Niel
Status:

• Gnangara COSMOz running since May 2011
  OzFlux station ~running since October, 2011

• What next?
  • Tie in with remote sensing, analyse flux data – gap filling!
  • Test remote sensing ET algorithms
  • Improve estimate of recharge
  • Modelling recharge, evaporation and carbon flux
  • ...
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Do come and visit
Thank you