Shallow groundwater resources and future climate change impacts: a comparison of the Ovens and Namoi catchments, Eastern Australia

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Lower Ovens River, VIC

Namoi River near Wee Waa, NSW

Content

- The water cycle
- Murray-Darling Basin context
  - Sustainable groundwater yield
  - Groundwater sustainability
- Climate change
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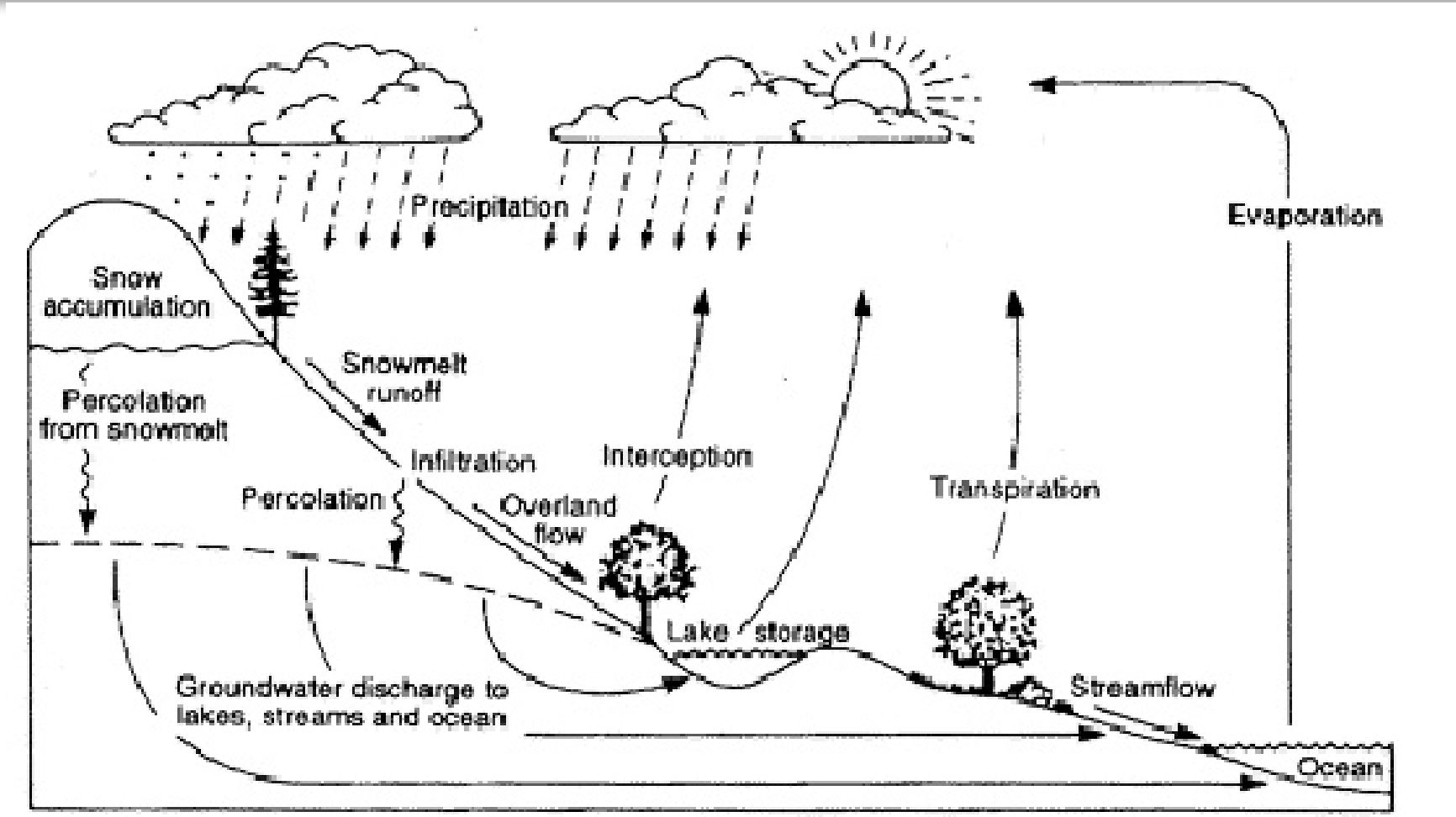
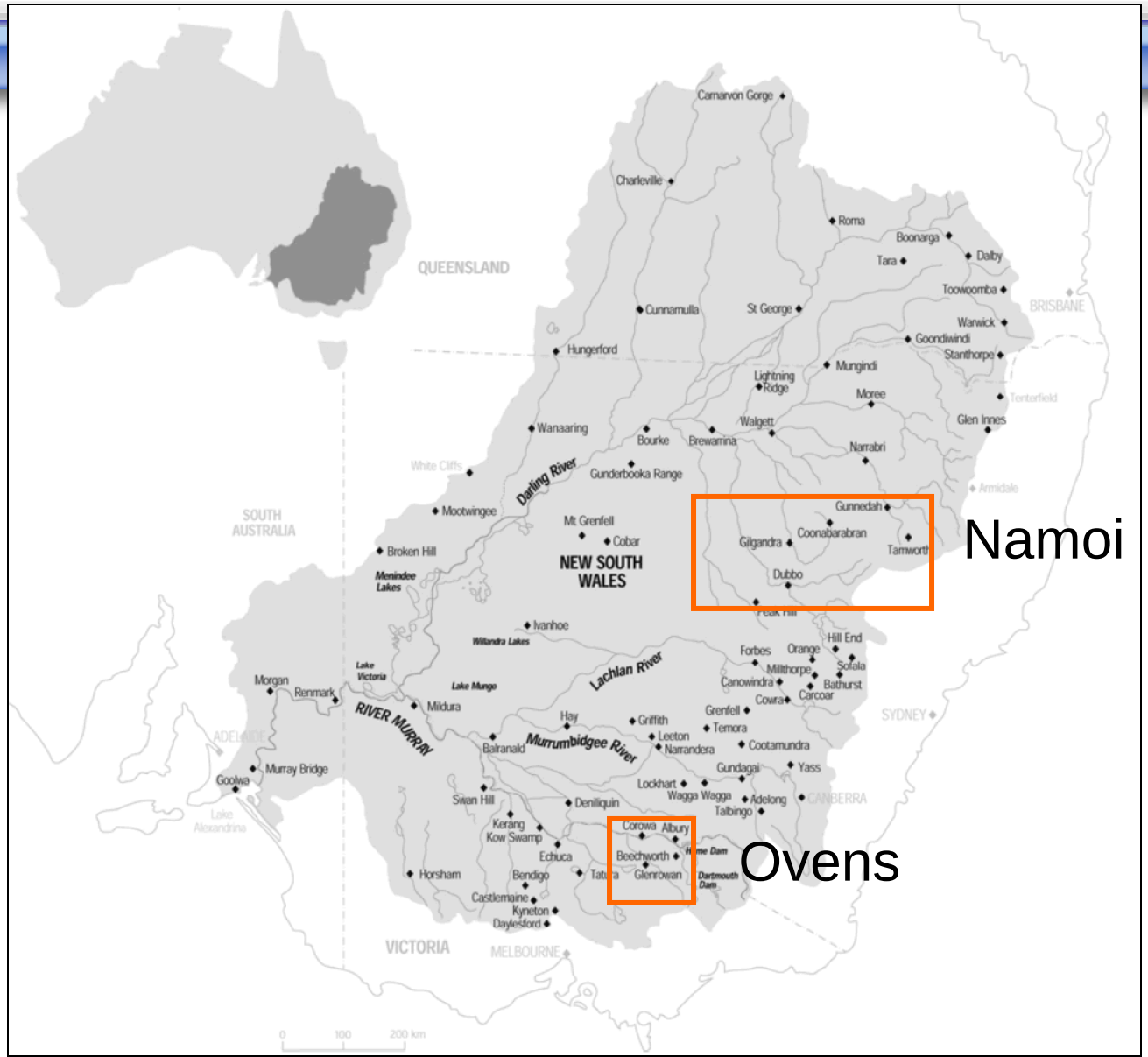
- Discussion

The hydrological cycle



Australian Government, 2008, The Hydrological Cycle Connected Water, http://www.connectedwater.gov.au/processes/hydrological.html, accessed 31/7/08

The Murray-Darling Basin (MDB)



Water resources in the MDB

- 1995 MDBC Audit found further increases in SW diversions would severely limit health, supply and reliability of supply
- A permanent ‘Cap’ on SW use at 1993/94 levels was implemented in 1997 for VIC, NSW and SA
- GW use has increased significantly
- GW provides 11% water use in MDB

Implications of groundwater use

- Increased groundwater use = adverse impacts
- Areas of over-allocation have shown declining aquifer pressure = problems for agricultural and domestic water and groundwater dependant ecosystems
- Potential to deplete streamflow (The Cap does not recognise gw-sw interaction)
- Declines in water level until equilibrium between groundwater system and pumping is found

Sustainable groundwater yield

- Sustainable yield: volume of water extraction measured over a specified timeframe that should not be exceeded to protect higher values of the aquifer (NLWRA, 2001)
- Conservation of mass principles: Inflow - Outflow = Change in storage
- Ecological requirements: Eco.Sus yield = Eco.Sus inflow - Residual outflow

Sustainable groundwater yield in the MDB

- Generally defined in MDB states by annual rainfall recharge, where sust yield < rate of recharge
- Qld, Vic and SA include throughflow and rainfall.
  - Does not include influence of climatic changes
  - Historically, the same water has often been counted twice

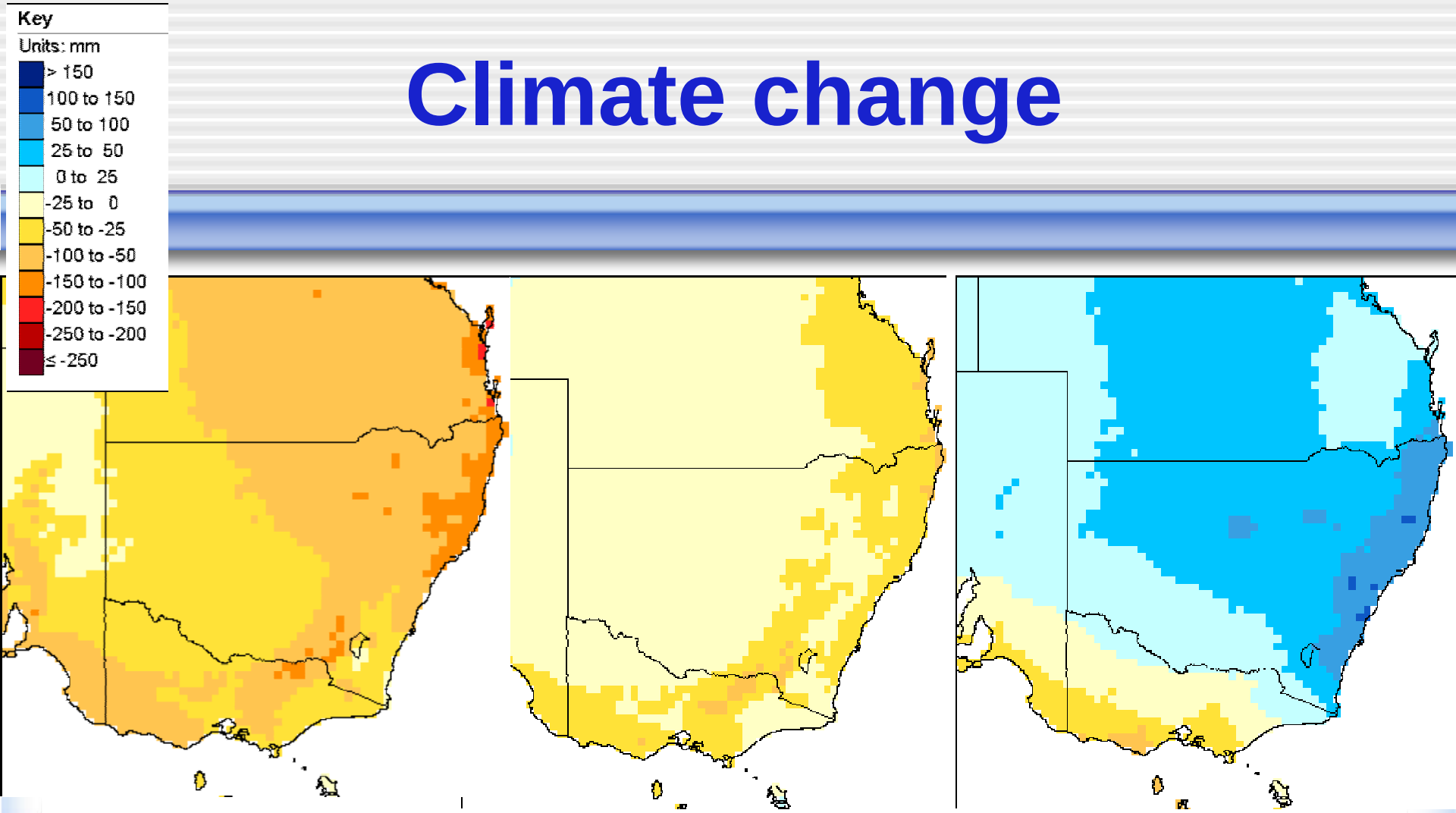
Sustainable water management

- Sustainability: can involve issues of ecology, water quality, social, economic and environmental factors, as well as 'sustainable yield'
- Qualitative and quantitative
- Future sustainability - meeting long-term objectives

Groundwater sustainability in the MDB

- Assessing sustainability is still an emerging practice
- Comparing extractions with allocated ‘sustainable yield’ is the minimum commonplace

Climate change



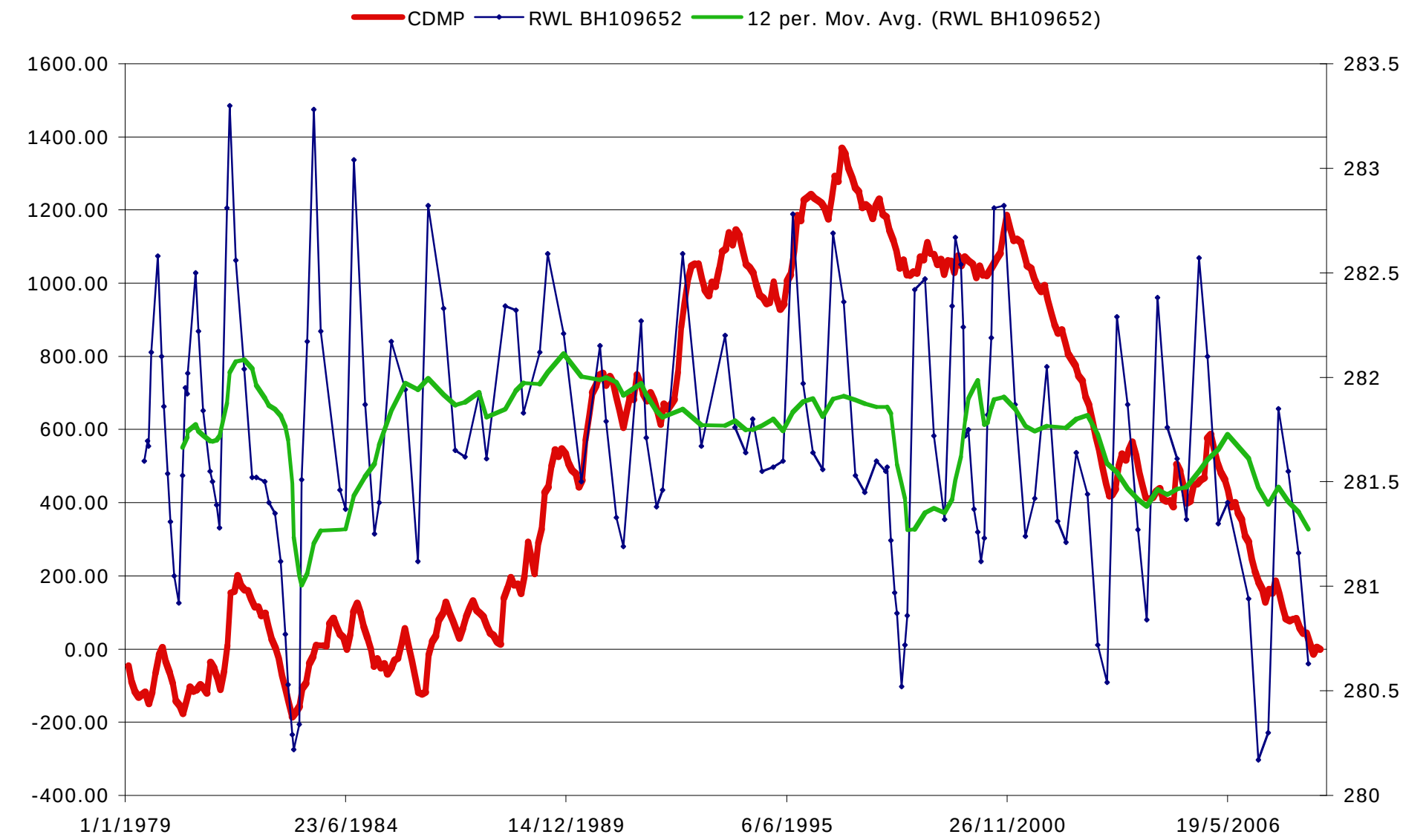
Drier Moderate Wetter

OzClim, 2008, Exploring climate change scenarios for Australia, CSIRO, http://www.csiro.au/ozclim/home.do, accessed 30/7/08

Ovens case study

- Ovens is 0.7% of the MDB
- GW largely used to supplement dry periods
  - 0.4% MDB total
  - 1.4% of water use in Ovens region
- Ovens River principle river
  - Largely unregulated with high flows close to natural magnitudes and frequency
  - Major threat to river health is extraction during low flow periods

Ovens: CDMP

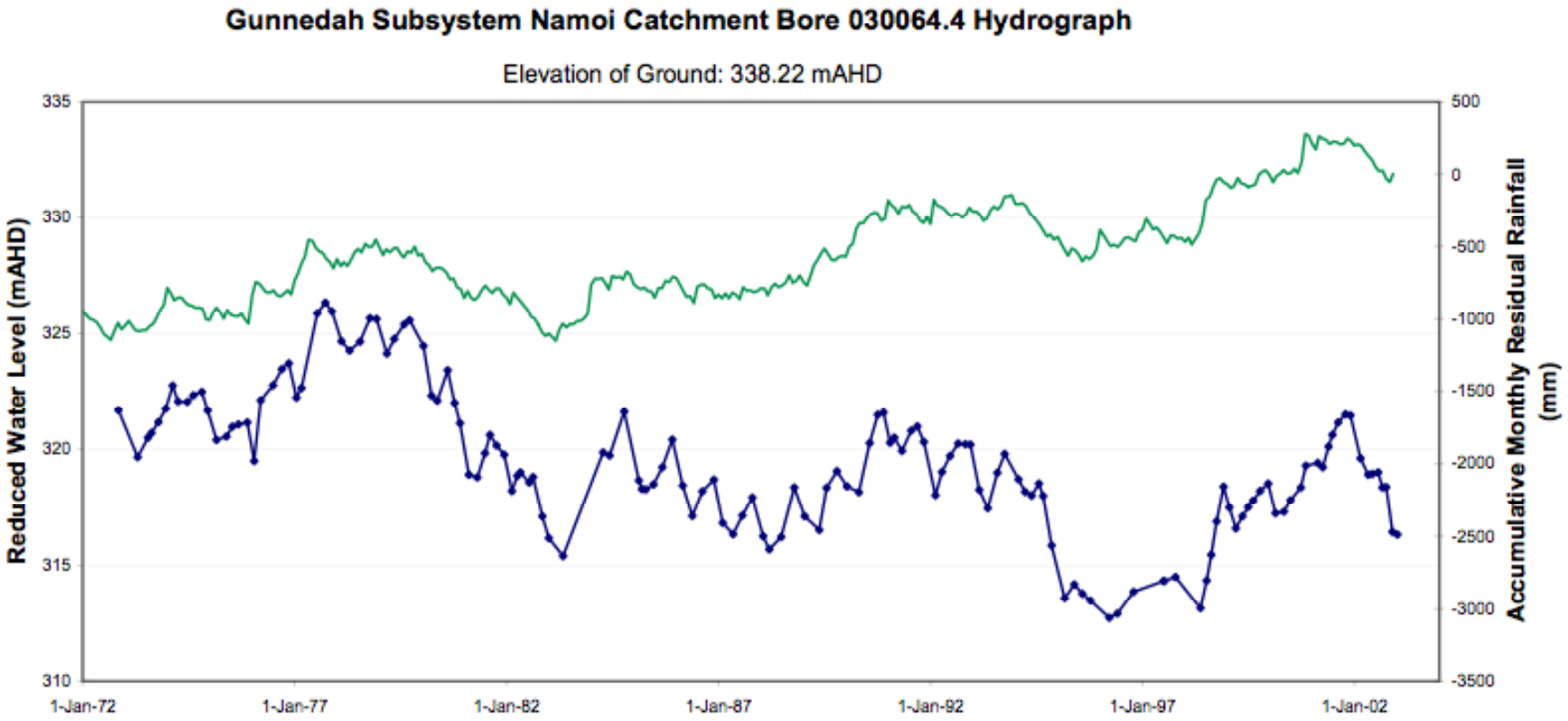

CDMP
RWL BH109652
12 per. Mov. Avg. (RWL BH109652)
1600.00
1400.00
1200.00
1000.00
800.00
600.00
400.00
200.00
0.00
-200.00
-400.00
283.5
283
282.5
282
281.5
281
280.5
280
1/1/1979
23/6/1984
14/12/1989
6/6/1995
26/11/2000
19/5/2006

Namoi case study

- Namoi is 3.8% of the MDB
- GW within Namoi is the most intensively developed in NSW
  - Highest level of GW extraction within MDB - 15.2% MDB total
- Namoi River principle river
  - Region uses 2.6% SW diverted for irrigation in MDB
  - SW around 2/3 total water use in 2000/01 and 1/3 in 2003/04

Liverpool Plains agriculture, Upper Namoi Valley, January 2010, G. Mudd

Namoi: GW and Climate



- Major source for irrigation since 1970s
- Recharge mainly from rainfall

Skelt, K., Ife, D., Woolley, D., Evans, R. & Hillier, J., 2004, Murray-Darling Basin Groundwater Status 1990-2000 Catchment Report: Namoi River, Murray-Darling Basin Commission, Canberra.

Discussion

- Climatic variability: accounting for dry and wet periods
- Climate change: using conservative estimates
- Clear evidence of shallow GW links to long-term climate trends
- Implications = vulnerable
- Monitoring - need to monitor frequently, spatial-temporal scales etc
- Long-term sustainability: clear definition of sustainable yield, one-resource management

Conclusion

- GW and SW are not isolated parts of the cycle
- GW levels are strongly influenced by climate throughout the MDB
- Reliable data must be collected
- Sustainable yields must accommodate for variable climate and climate change
- GW and SW must be managed as one resource under climatic interactions