Freshwater ecosystems and adaptation to climate change

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CSIRO

Adaptation services

- Ecosystem services that provide benefits to people in the context of climate change;

- Complements the ecosystem services framework but differs in stressing the importance of *option and insurance* values;

- Provide options for adaptation to climate change

- Our research audience: agencies involved in climate adaptation policy & implementation

Operationalising the Adaptation Services Concept

1. Characterisation of current system;
   - Dynamics under historical & current climate
   - Ecosystem attributes to be retained
2. System responses to climate change;
   - Quantify ecosystem change: river flows, builds on CSIRO Sustainable Yields Audit of water resources
3. Identification of adaptation services
   - ecological mechanisms underlying AS
4. Management of adaptation services
   - Novel forms of intervention

Murray-Darling Basin Floodplains & Rivers

- Floodplains & rivers support human well-being;
- High biodiversity, high productivity;
- Degraded by historic resource use;
- Water resources – competing demands
  - Environment v. production: environmental flows v. irrigation water
  - *The Basin Plan* & *Water Act* : water reform – redressing the balance
  - CSIRO has track record on contributing to these policy processes

Ecosystem Services from Floodplains and Rivers

Provisioning

- Irrigated agriculture – $6 bn pa
- Grazing – 53% of wetland area
- Irrigation water – 11,000 GL pa; No. 1 ES
- Domestic water – 4 GL, 3.1 mn people

Regulating

- Carbon sequestration – $0.5 bn
- Water quality – 3rd most important ES
- Erosion prevention & soil fertility – 4th most important ES
- Flood mitigation – e.g. Macquarie Marshes ca. 4,000 GL storage capacity

Cultural

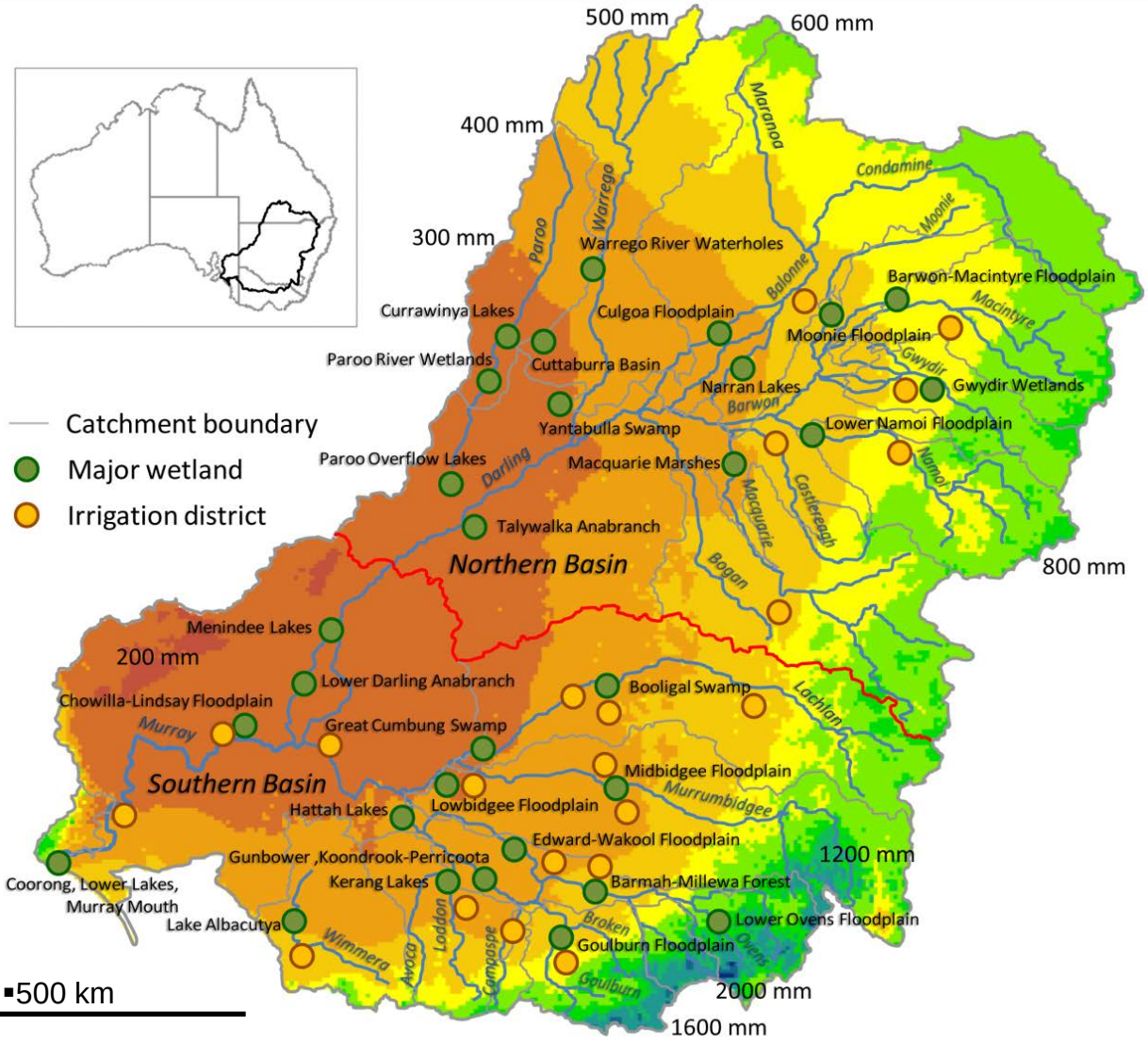
- Spiritual & sense of place – huge importance
- Recreation & tourism – $1.4 bn pa

Supporting

- Wetland habitat for biodiversity – 2nd most important ES

Murray Darling Basin: wetlands, irrigation districts & rainfall

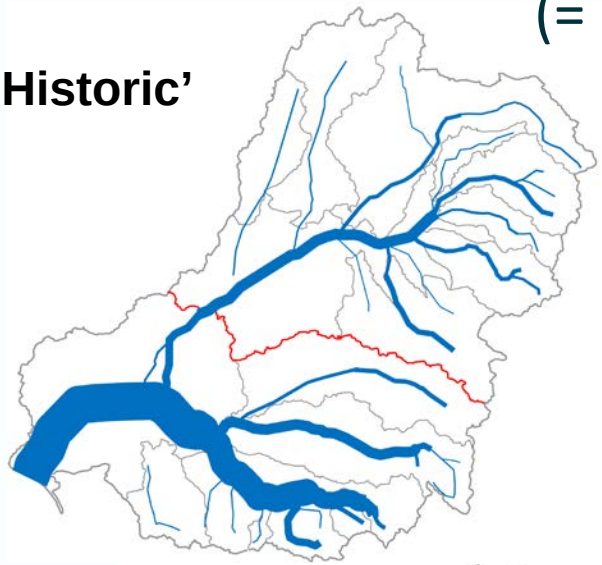
16 Ramsar wetlands (6,300 km^2); 30,000 wetlands (25,000 km$^{2)}$



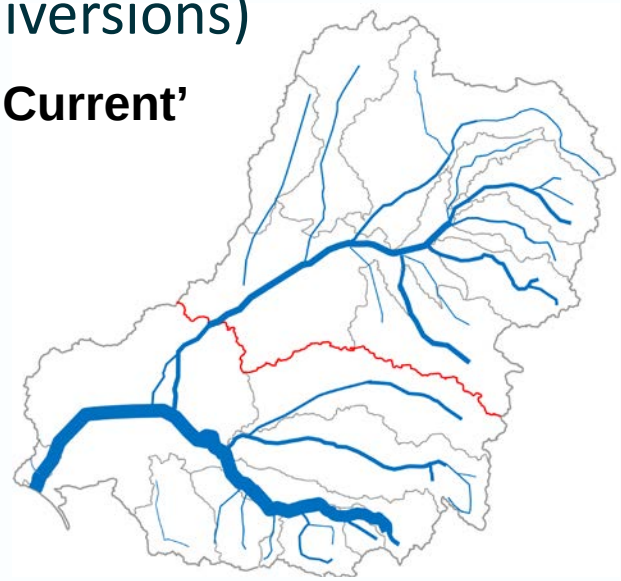
Water Available for the Environment

(= inflows – diversions)

‘Historic’

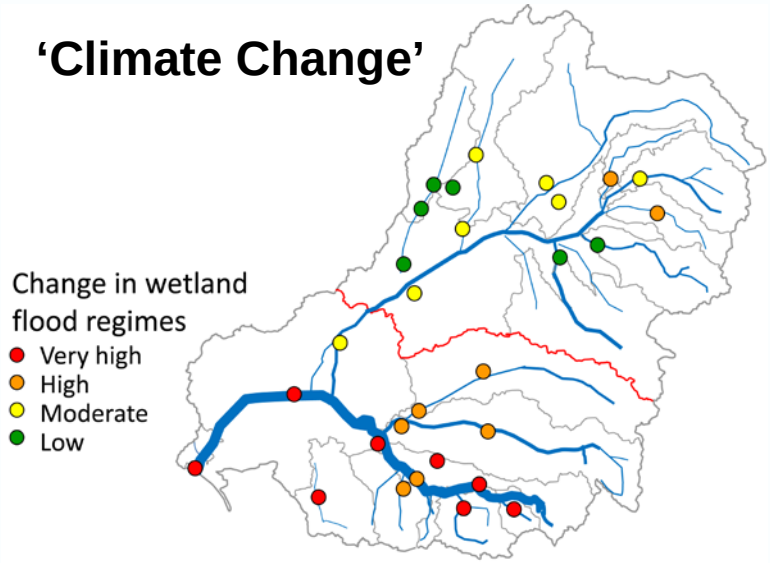


‘Current’



‘Basin Plan’

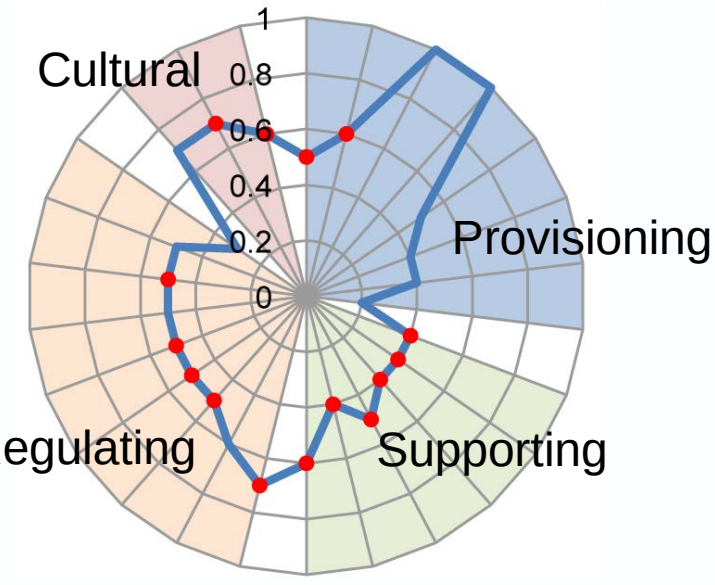
‘Climate Change’



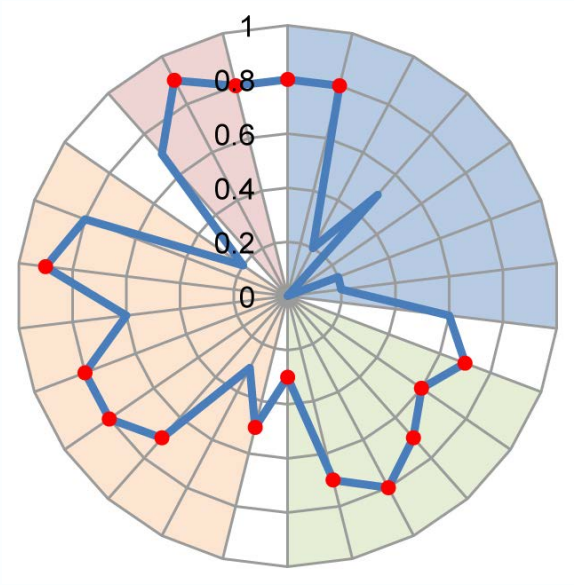
Changes in supply of adaptation services (●)

△ river flows → △ ecological response → △ ecosystem services

‘Current’



‘Climate change’



- Future climate: provisioning services *decline*; regulating, supporting & cultural services *increase*;
- Future livelihoods & well-being: based on novel profile of services