



Research to inform climate adaptation in the Murray-Darling Basin: MD-WERP

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CSIRO ENVIRONMENT
www.csiro.au



Presentation overview

- What changes have we seen to date in the Murray-Darling Basin?
- What changes are we likely to see in the future?
- What will be the impact of these changes?
- What research is being carried out in MD-WERP to help understand and mitigate these changes?

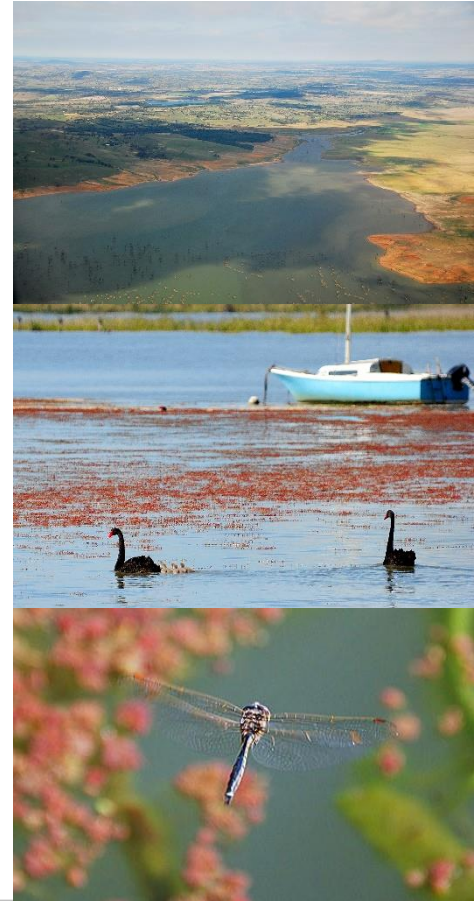
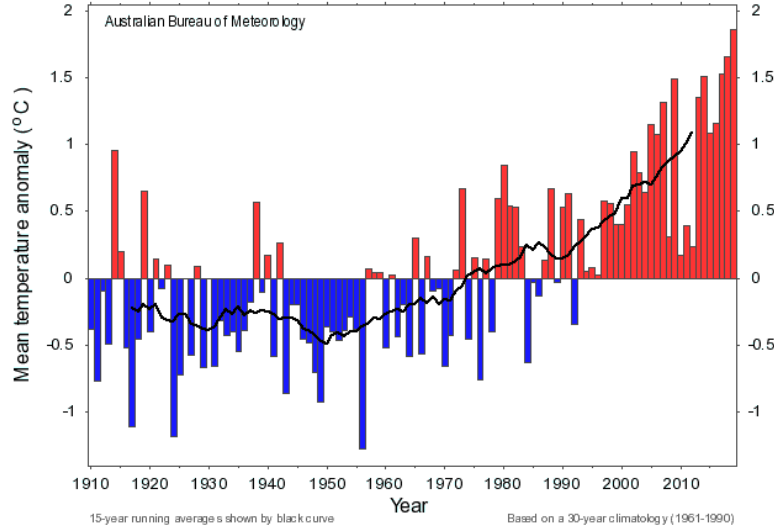


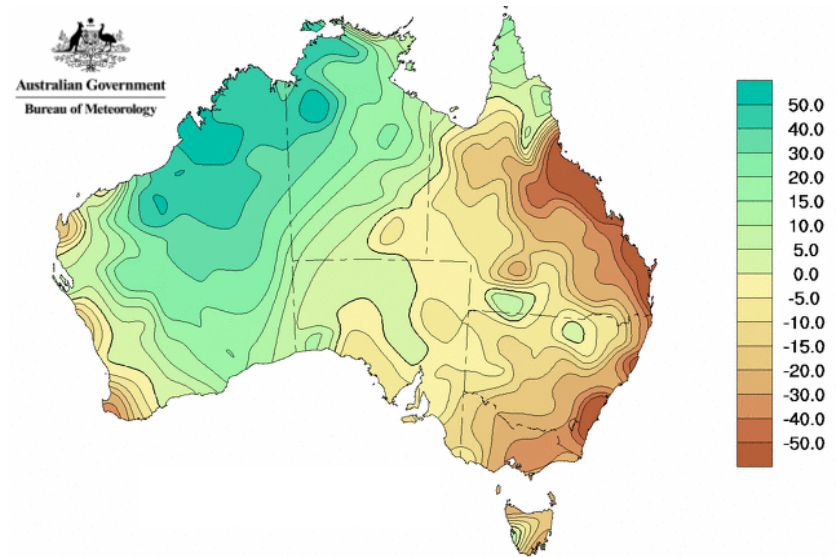
Photo credits: Tanya Doody

Observed climate change in the MDB

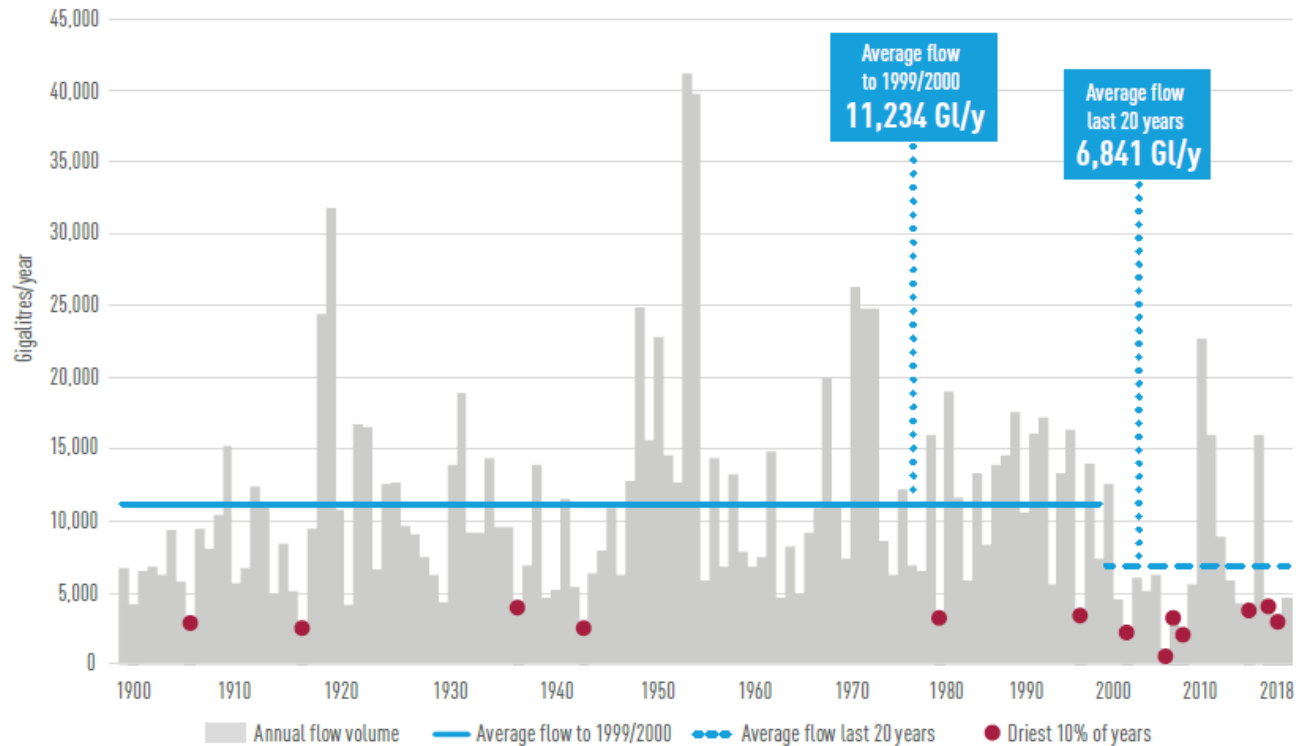
Annual mean temperature anomaly
Murray Darling Basin (1910 to 2019)



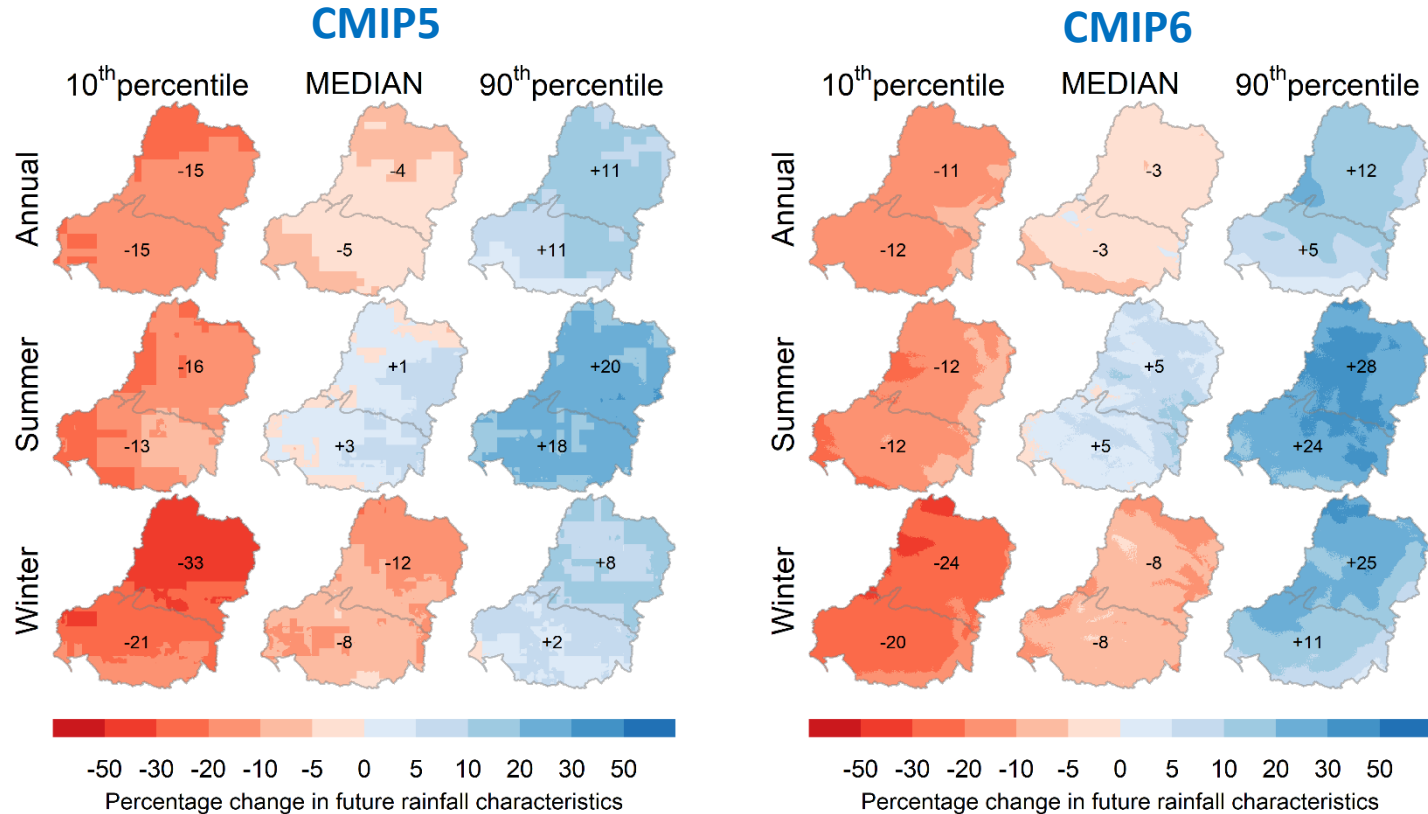
Observed trend in mean annual rainfall (1950-2020)



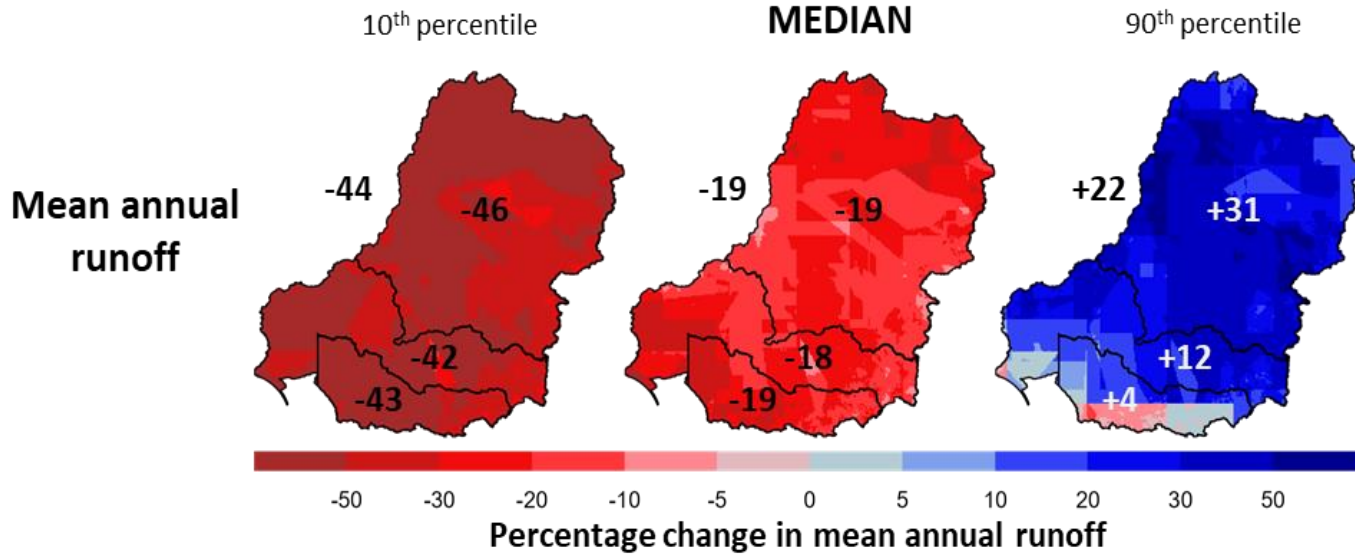
Observed impacts on MDB inflows



Projected climate change impacts on rainfall



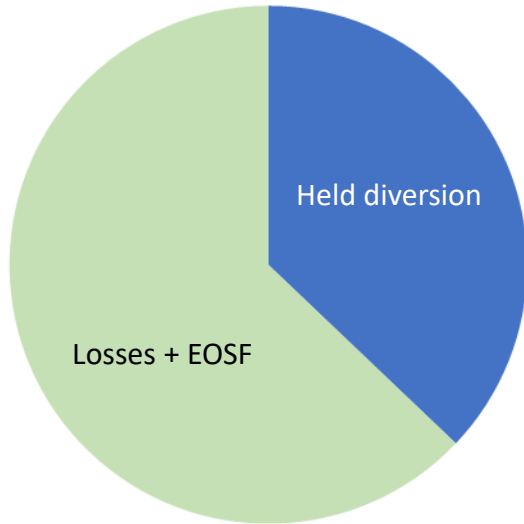
Projected climate change impacts on runoff



Water resources sharing in the MDB

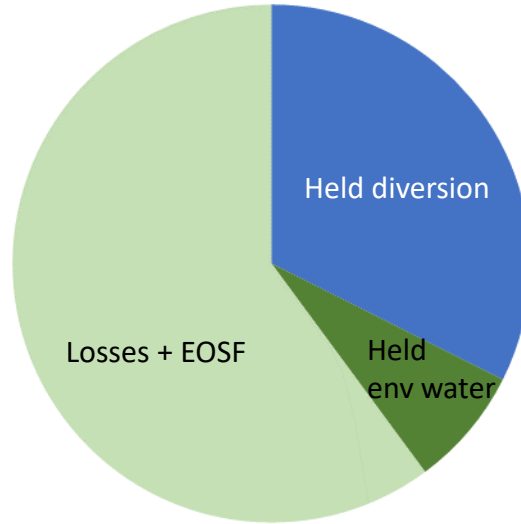
BDL

Pre-Basin Plan under
historical climate



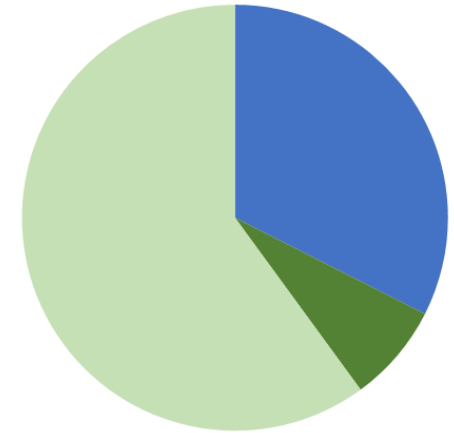
BP

Basin Plan under
historical climate



BP + CC

Basin Plan under
climate change



Climate change impact on total inflow is 18%
Climate change impact on held water is 12%

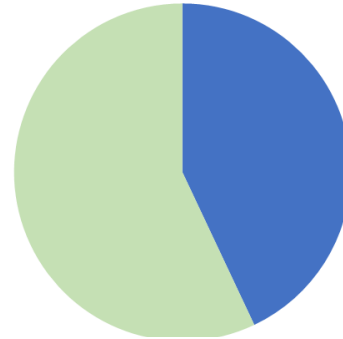
A tale of two Basins

Northern Basin

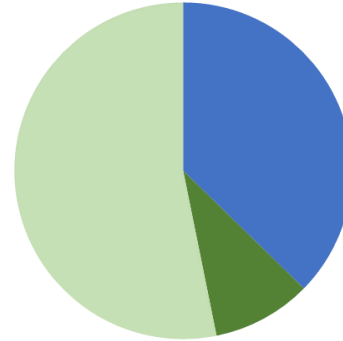


BDL

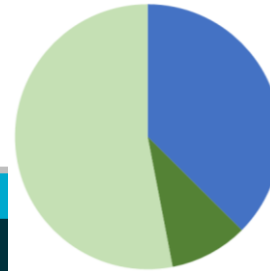
Southern Basin



BP



BP + CC

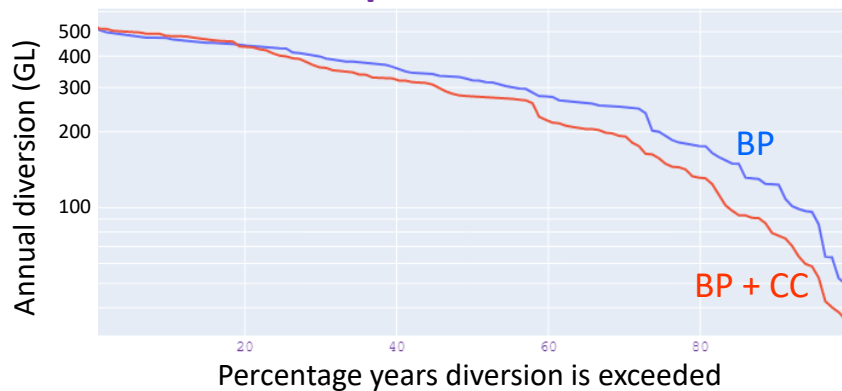


CC impact on inflow is 14%
CC impact on held water is 6%

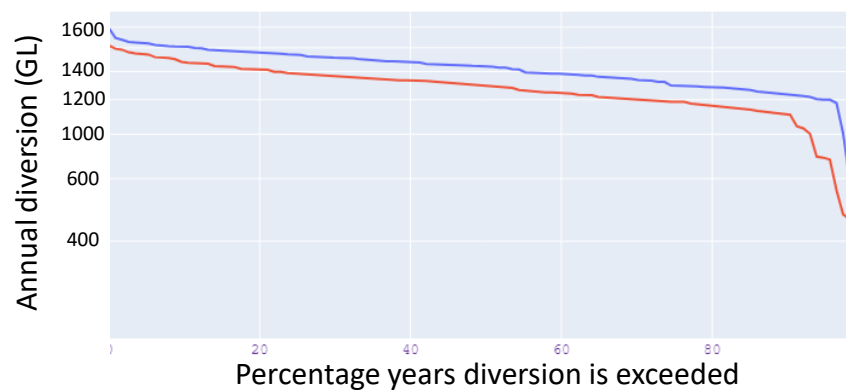
CC impact on inflow is 22%
CC impact on held water is 14%

Impacts on water availability

Macquarie Basin

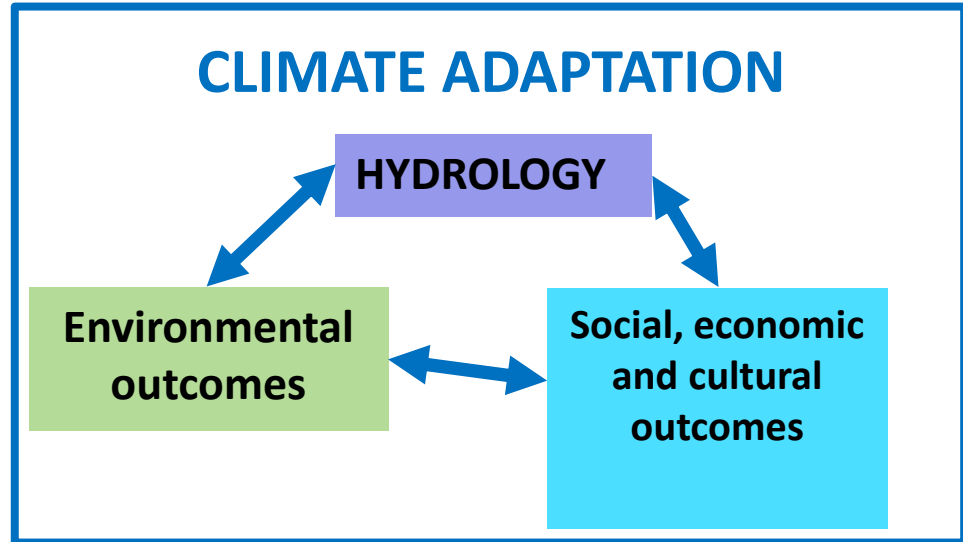


Goulburn Basin



The Murray-Darling Water and Environment Research Program

- CSIRO are responsible for two themes comprising research into Hydrology and Climate Adaptation
- An AUD\$11m, 4-year research program
- Co-funded by the Murray-Darling Basin Authority and CSIRO
- Producing research outcomes that will inform the Basin Plan review scheduled for 2026

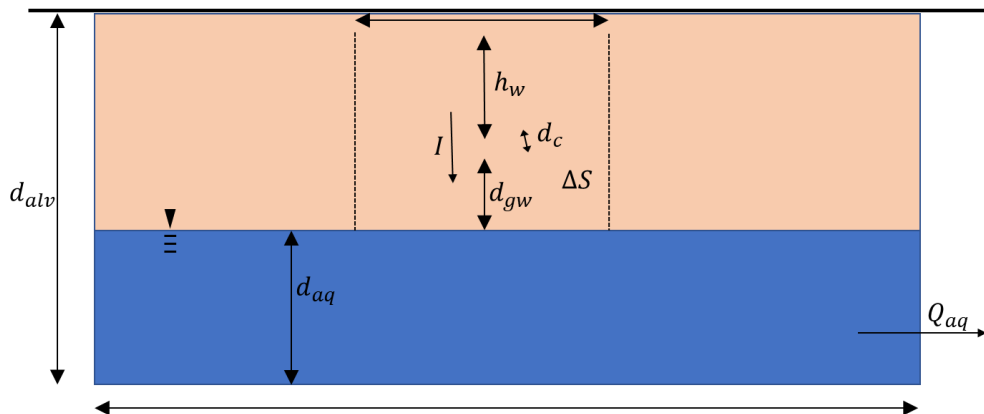




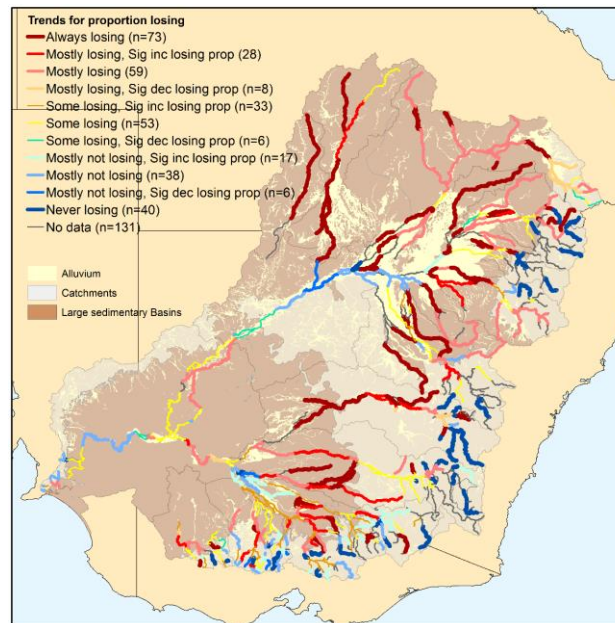
Low flow prediction

[Russell Crosbie, Jahangir Alam]

Changing nature of river and groundwater connection must be adequately modelled to meaningfully predict low flows



Enhanced parameterisation in river system model



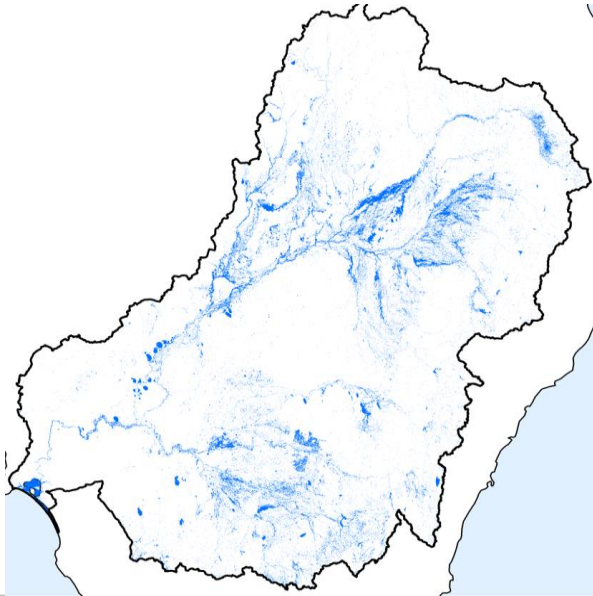
Trends in river and groundwater connection



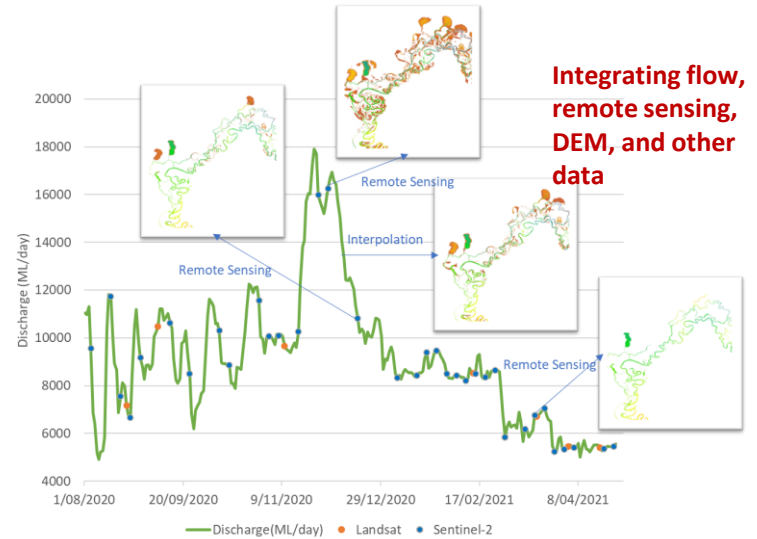
Floodplain inundation and volume

[Jin Teng, Fathata Khanam]

Characterising floodplain inundation under historical and future climates



Modelling floodplain inundation and volume dynamics



1 in 8 year flood inundation frequency

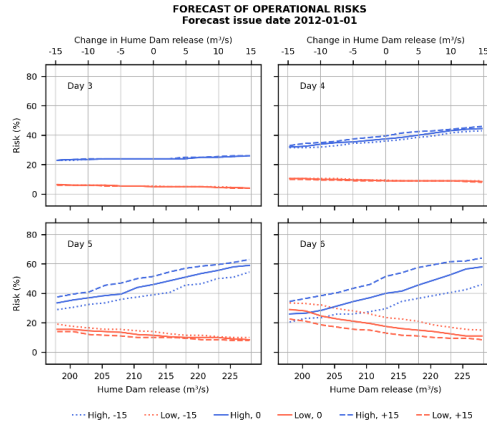
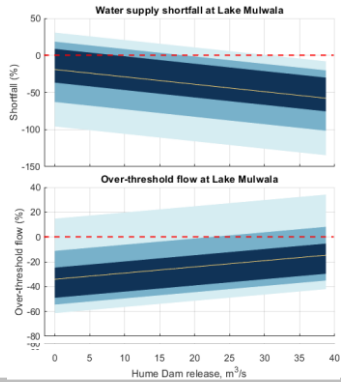
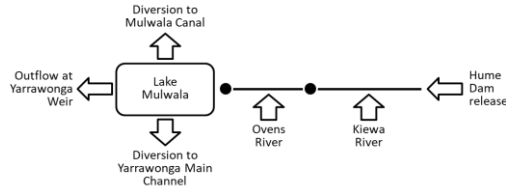


Demonstrating use of water forecasts

[David Robertson, Andrew Bishop]

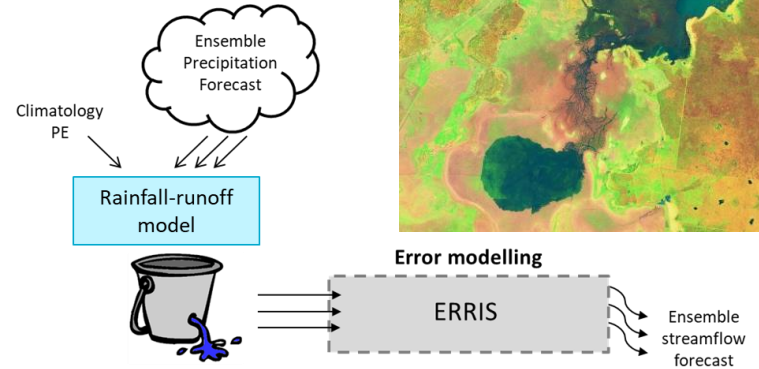
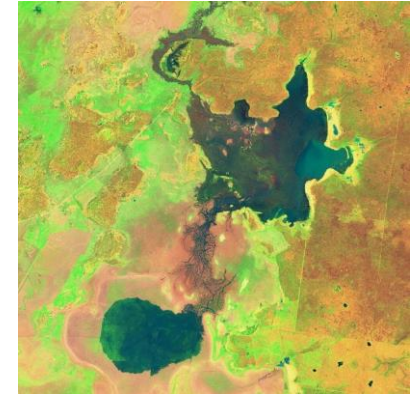
Southern Basin case study

Characterising risk of shortfall or flooding at Lake Mulwala from Hume Dam operation



Northern Basin case study

Forecasting events for Balonne River @St George to enhance e-watering at Narran Lakes

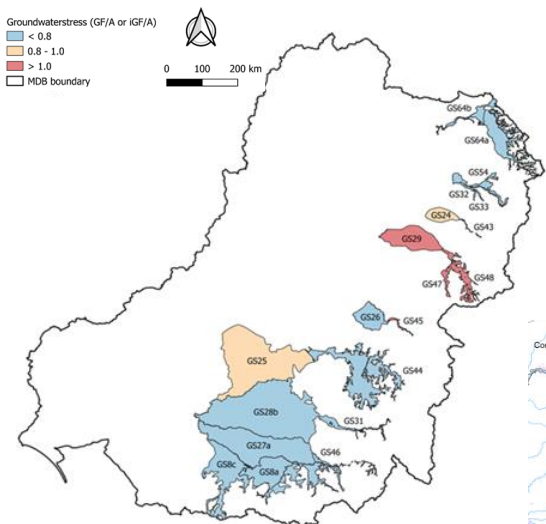




Groundwater use

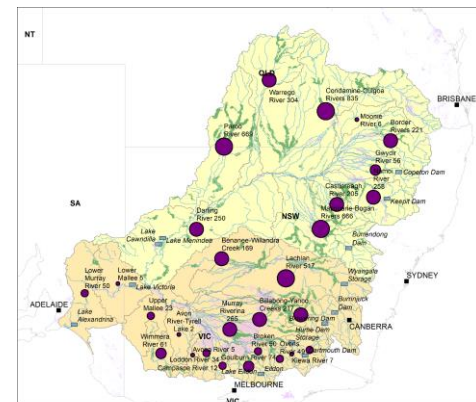
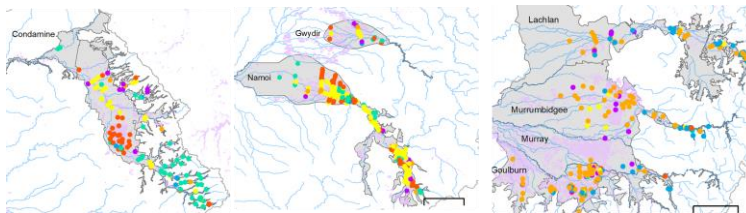
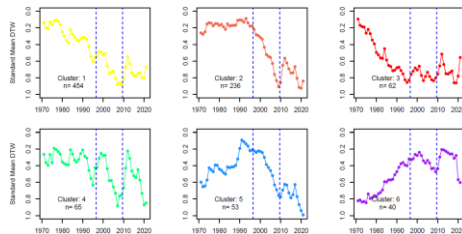
(Sreekanth Janardhanan, Ema Falez)

Groundwater trend, resilience and opportunities



Groundwater resilience, stress and sustainability

Trends in groundwater level



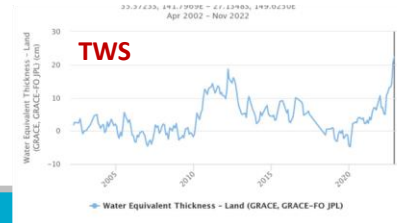
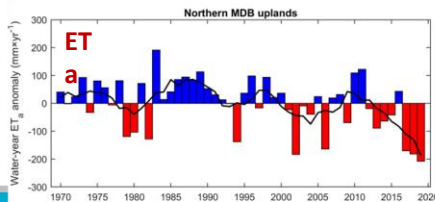
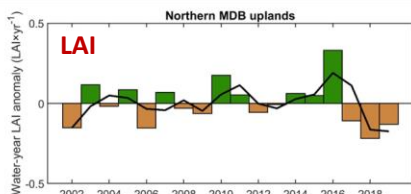
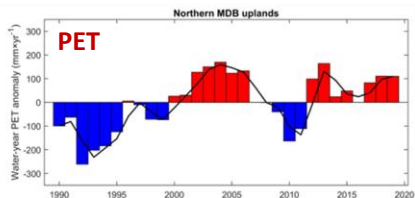
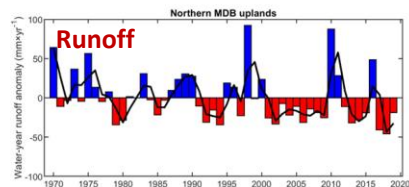
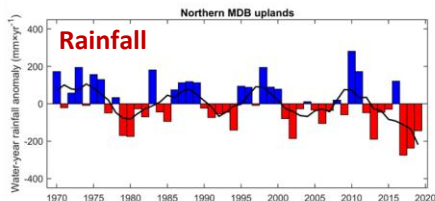
Potential for managed aquifer recharge



Northern Basin hydrology

[Jorge Peña-Arancibia]

Impact of hydrological non-stationarity and changing catchment conditions on runoff



An Australian Government Initiative
Funded through the Murray–Darling Water
and Environment Research Program

Evaluation of causes of reduced flow in the northern Murray–Darling Basin

Francis H.S. Chiew, Tony R. Weber, Santosh K. Aryal, David A. Post, Jai Vaze, Hongxing Zheng, Jorge L. Peña-Arancibia, David E. Robertson



Foundational Science

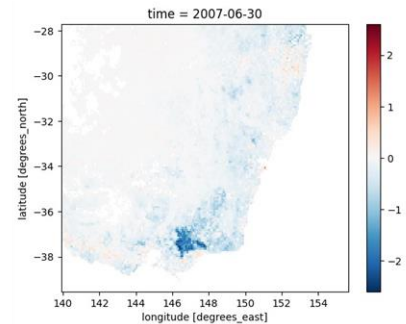
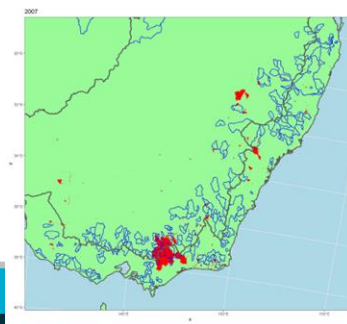
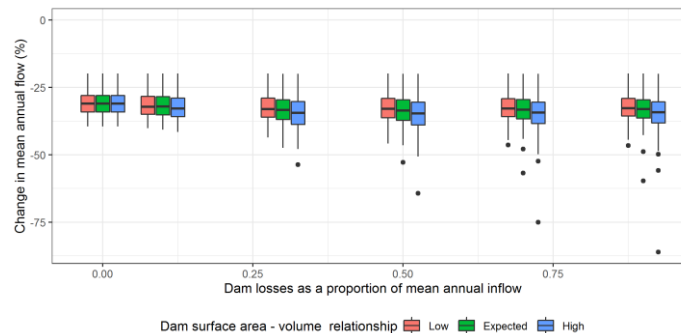
Objective: To improve understanding of the potential indirect impacts of climate change on water supply, demand and management in the Basin

2022/23 activities:

- Finalising farm dam impacts
- Understanding bushfire impacts

223/24 activities:

- Non-stationary hydrological processes
- Blackwater



Climate Adaptation Toolkit

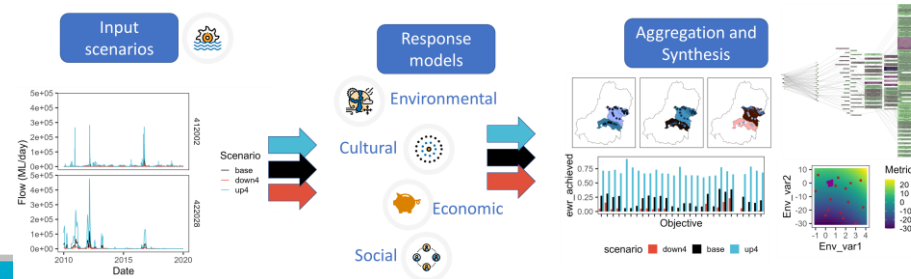
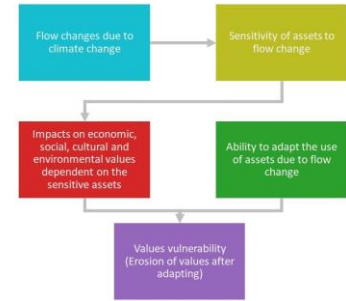
Objective: To develop (and link) tools to understand plausible future changes & the impact of adaptation strategies under a changing climate

2022/23 activities:

- Finalising Values and Vulnerability Assessment
- Toolkit development
- Scoping future modules

2023/24 activities:

- Developing new modules
- Applications for case studies



Showcasing Adaptability

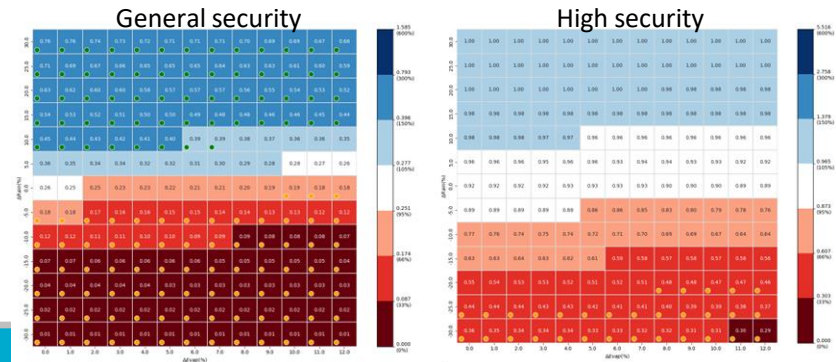
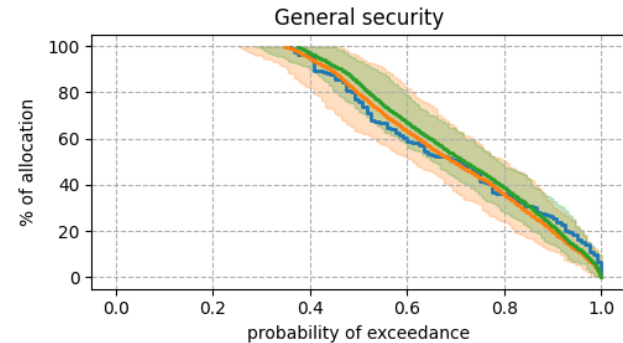
Objective: To identify options to adapt to climate change and evaluate their effectiveness in protecting Basin values

2022/23 activities:

- Hydroclimate analysis case-study
 - Macquarie river catchment
 - Climate variability
 - Climate change
- Scoping water trade case-study

2023/24 activities:

- Adaption options in Macquarie
- Water trade case-study



Synthesis and Integration

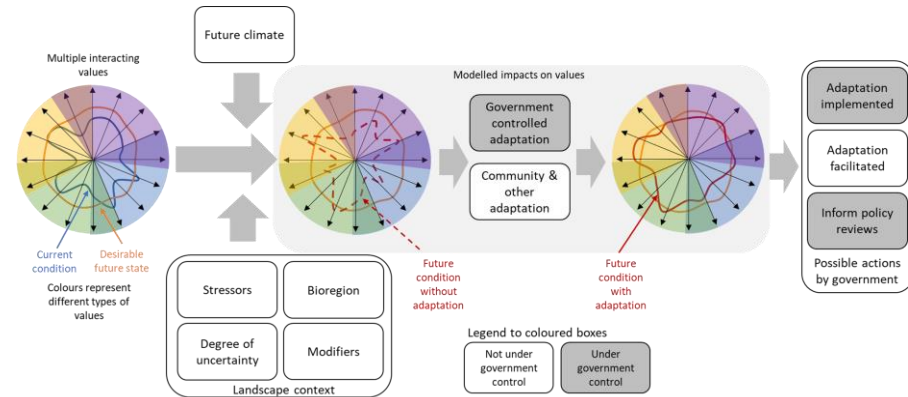
Objective: To synthesise outputs and learnings from the main research activities across the Climate Adaptation Theme and maximise relevance to policy makers and practitioners

2022/23 activities:

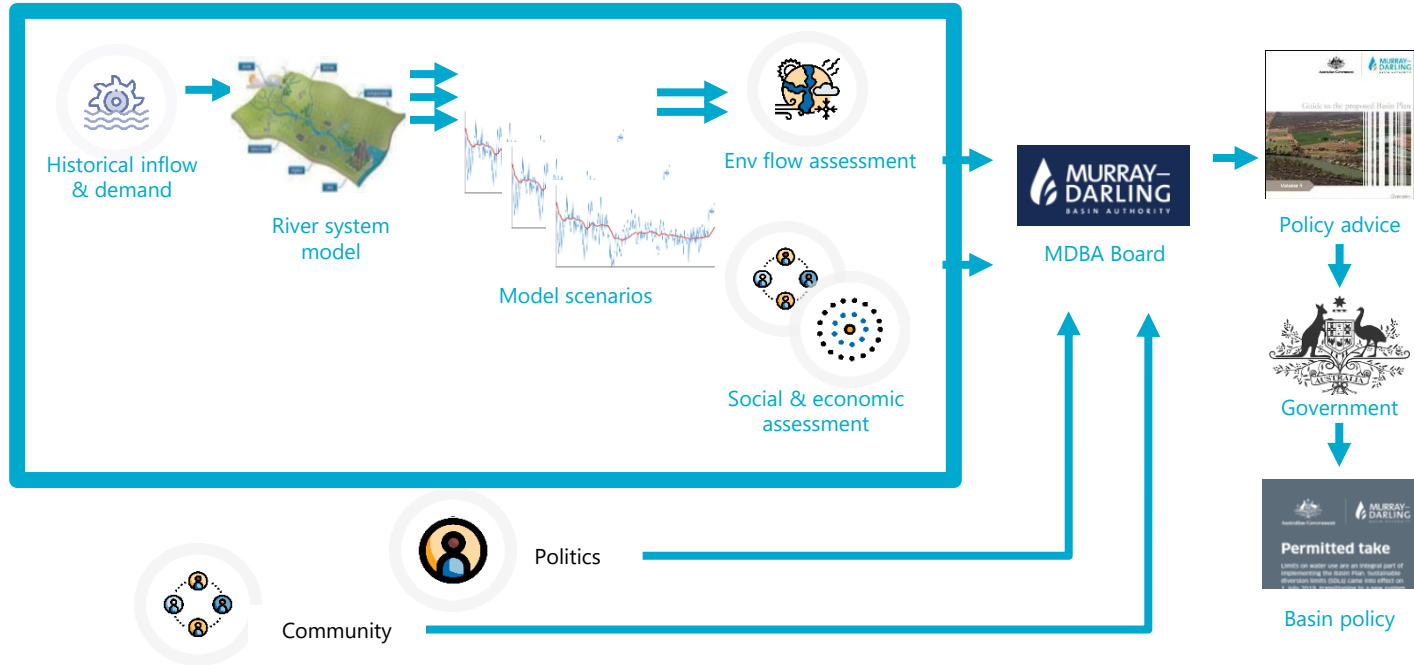
- Revising “Basin-wide monitoring management framework ”
- Planning for Traditional Owner engagement

2023/24 activities:

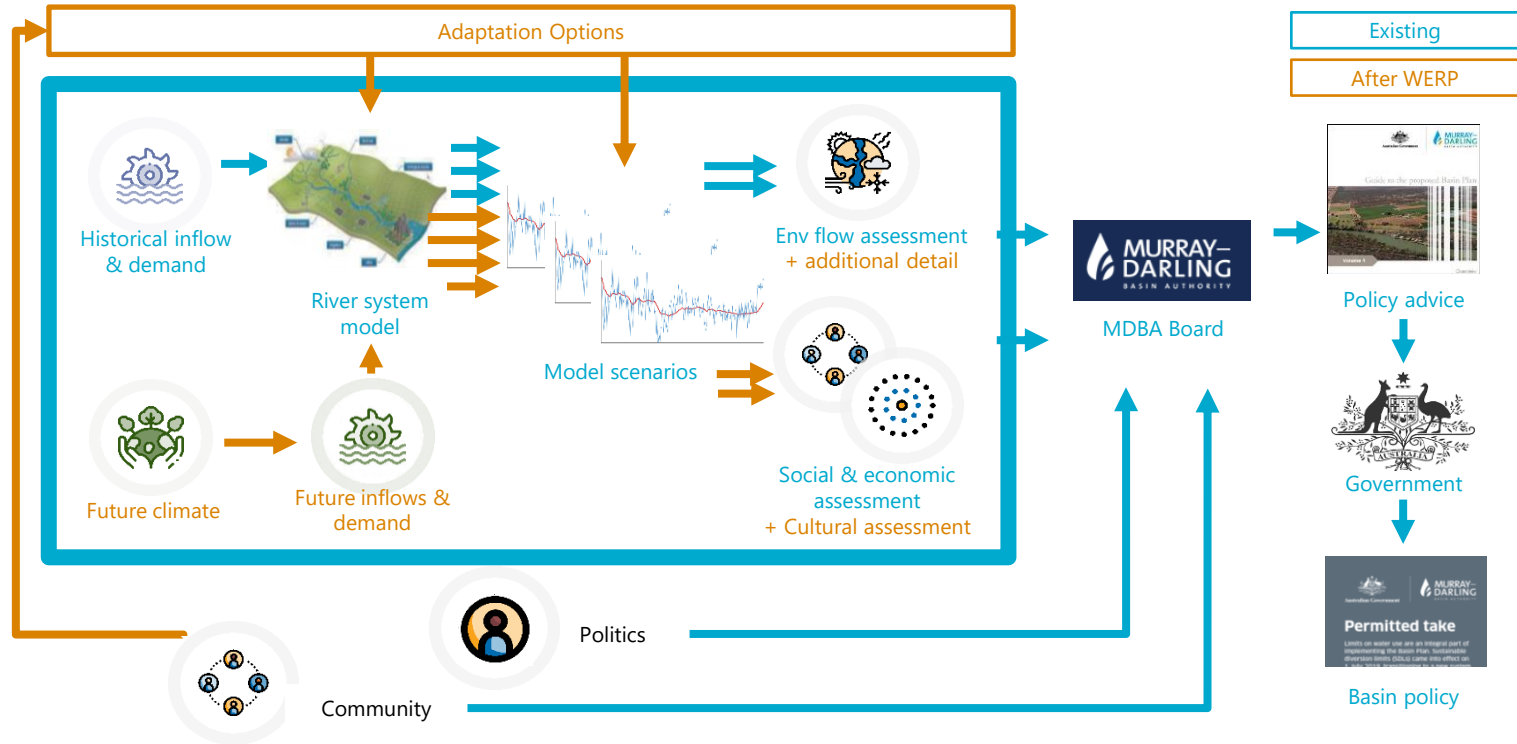
- Traditional Owner engagement



Original decision-making process



Our vision

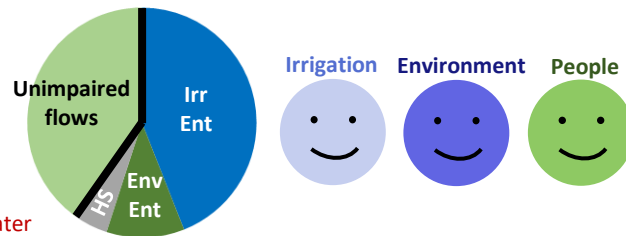


Basin Plan (Enhanced water outcome)



Enhancing water outcomes through improved knowledge, improved river operations, improved water management, improved water use efficiency, adaptation.

Basin Plan (Now)



Median climate change

– Same irr/env entitlements (some adaptation)

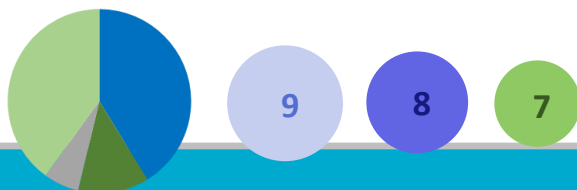


Median climate change

– Changed entitlements to get same environmental outcome



One of many example scenario/choice



We are developing knowledge, models, and tools to enable evaluation of different options and scenarios.

Questions?

<https://getinvolved.mdba.gov.au/murray-darling-water-and-environment-research-program>

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