Changes in water use of a Mountain Ash forest during and after the Millennium Drought

Clare Stephens, Larry Band, Lucy Marshall, Fiona Johnson, Belinda Medlyn, Martin de Kauwe & Anna Ukkola

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Explaining ch
after Australi

Keirnan Fowler[1], Murra
Cuan Petheram[5], Sandr
Lucy Marshall[11,12], Ann
Anna Ukkola[14], Clare St
Francis Chiew[8], Edoard
Ian Cartwright[19], and R

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Proloy Deb[a,*], Anthony S. Kiem[a], Garry Willgoose[b]

RESEARCH

DROUGHT

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Water Resources Research

the annual
ian perspective

Peel[1], and Nick J. Potter[2]

Water Resources Research

RESEARCH ARTICLE
10.1002/2017WR020683

Lags in hydrologic recovery following an extreme drought: Assessing the roles of climate and catchment characteristics

Yuting Yang[1], Tim R. McVicar[1,2], Randall J. Donohue[1,2], Yongqiang Zhang[1], Michael L. Roderick[2,3], Francis H.S. Chiew[1], Lu Zhang[1], and Junlong Zhang[1]

Key Points:
- Meteorological and hydrological aspects of the Millennium drought

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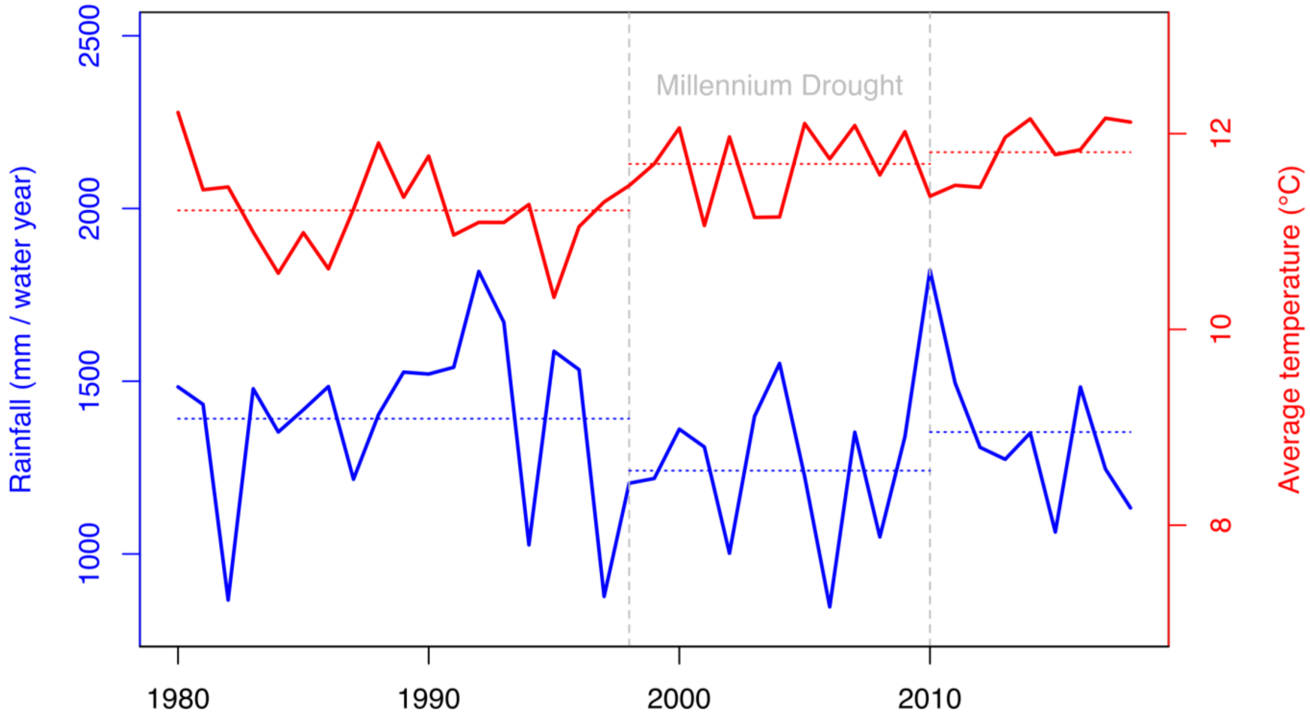
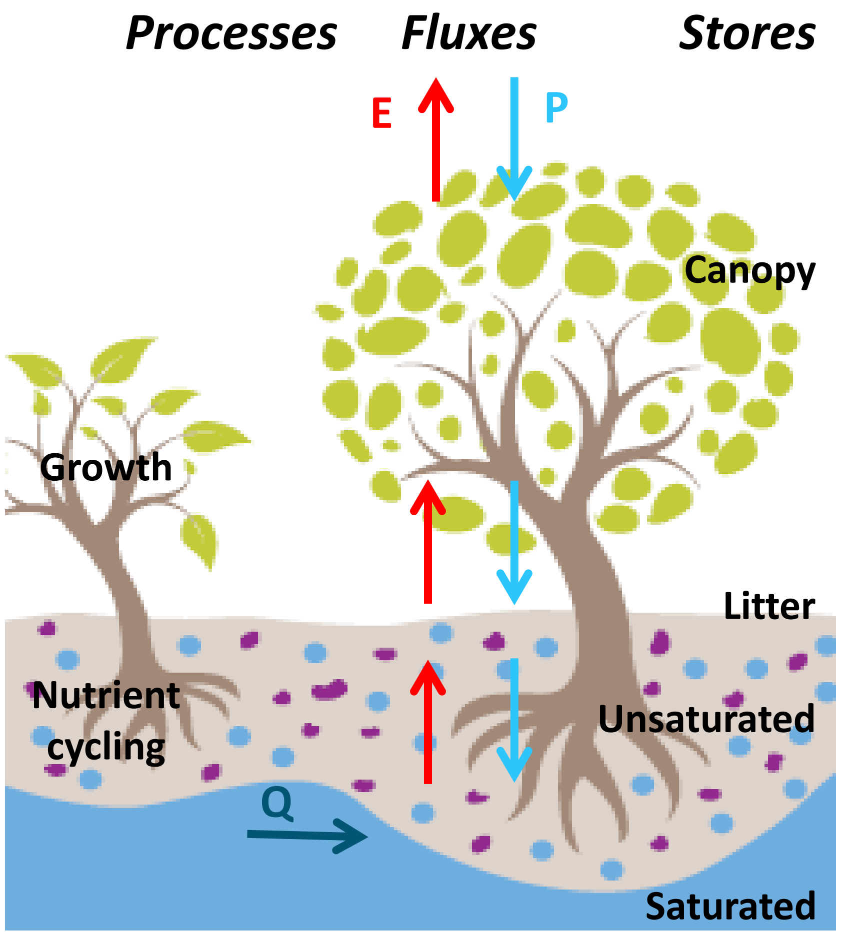
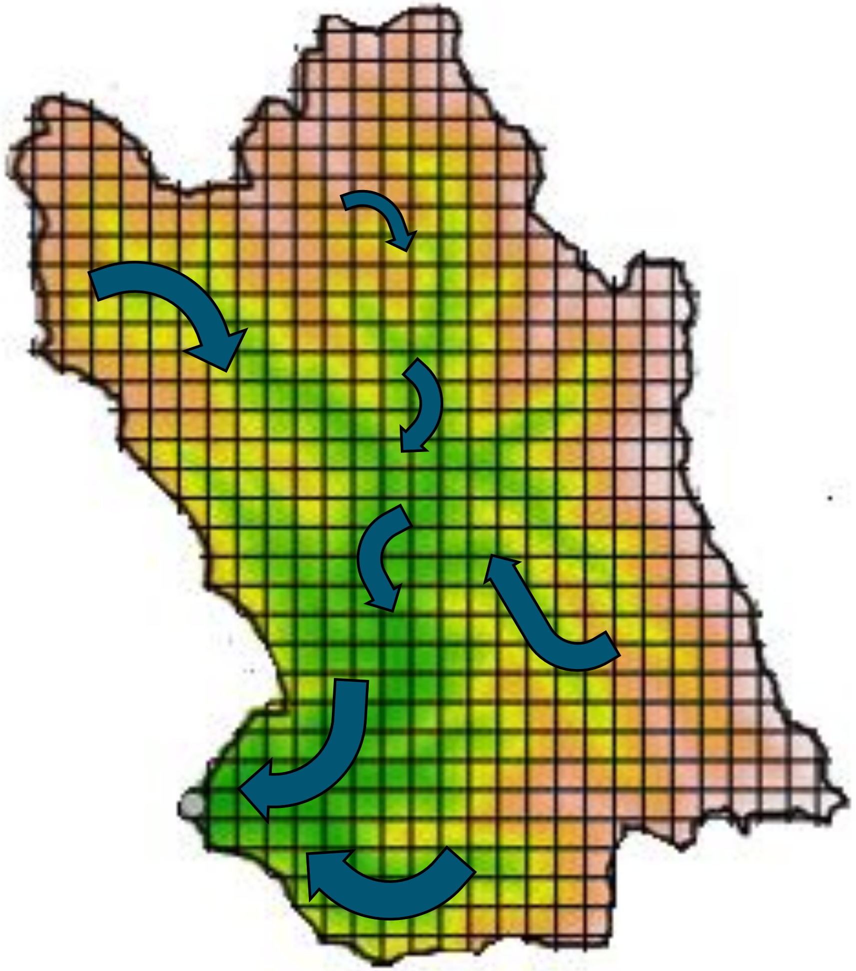
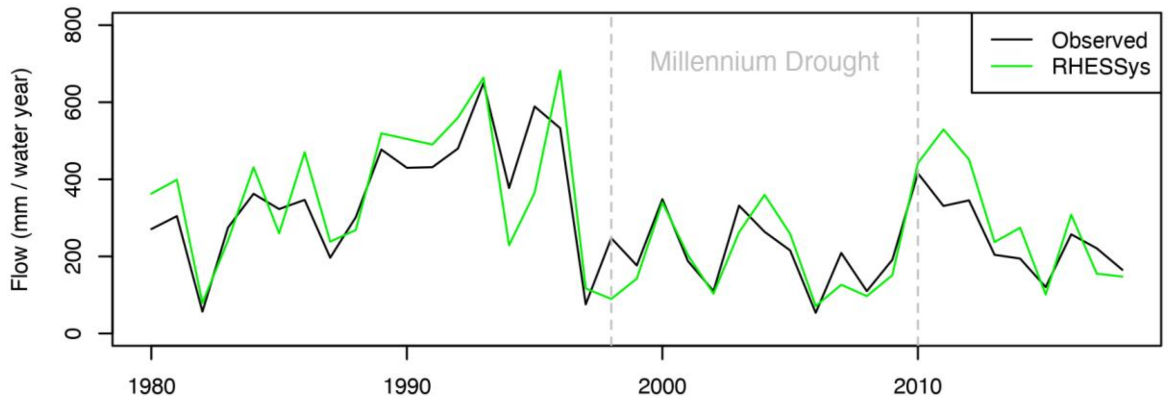


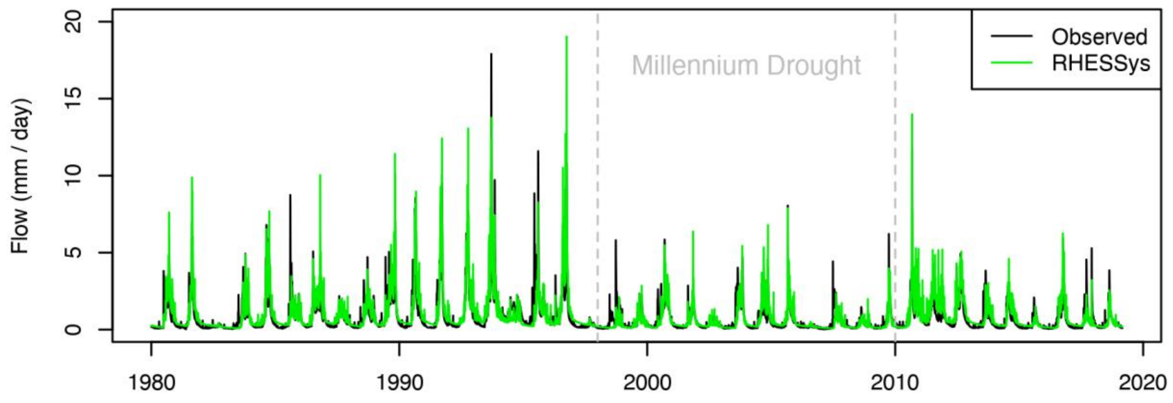
The RHESSys ecohydrologic model



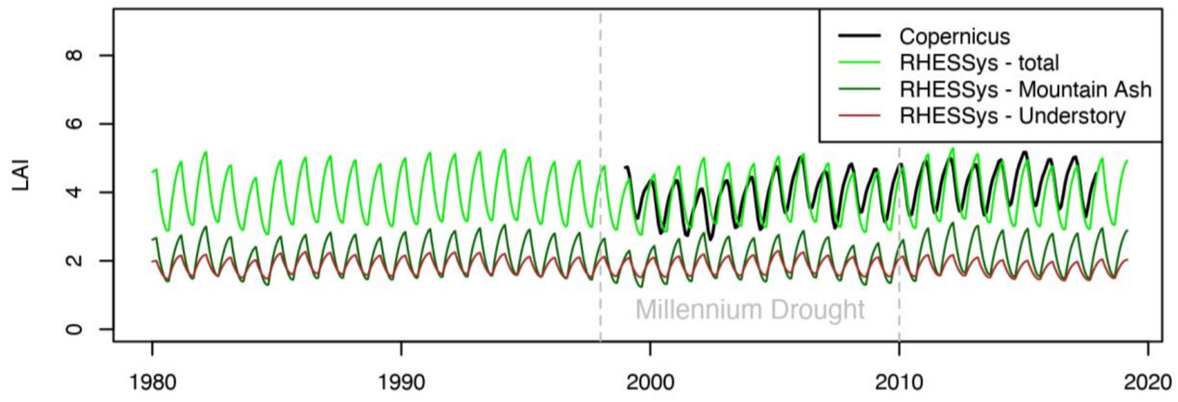


Hydrology





Vegetation



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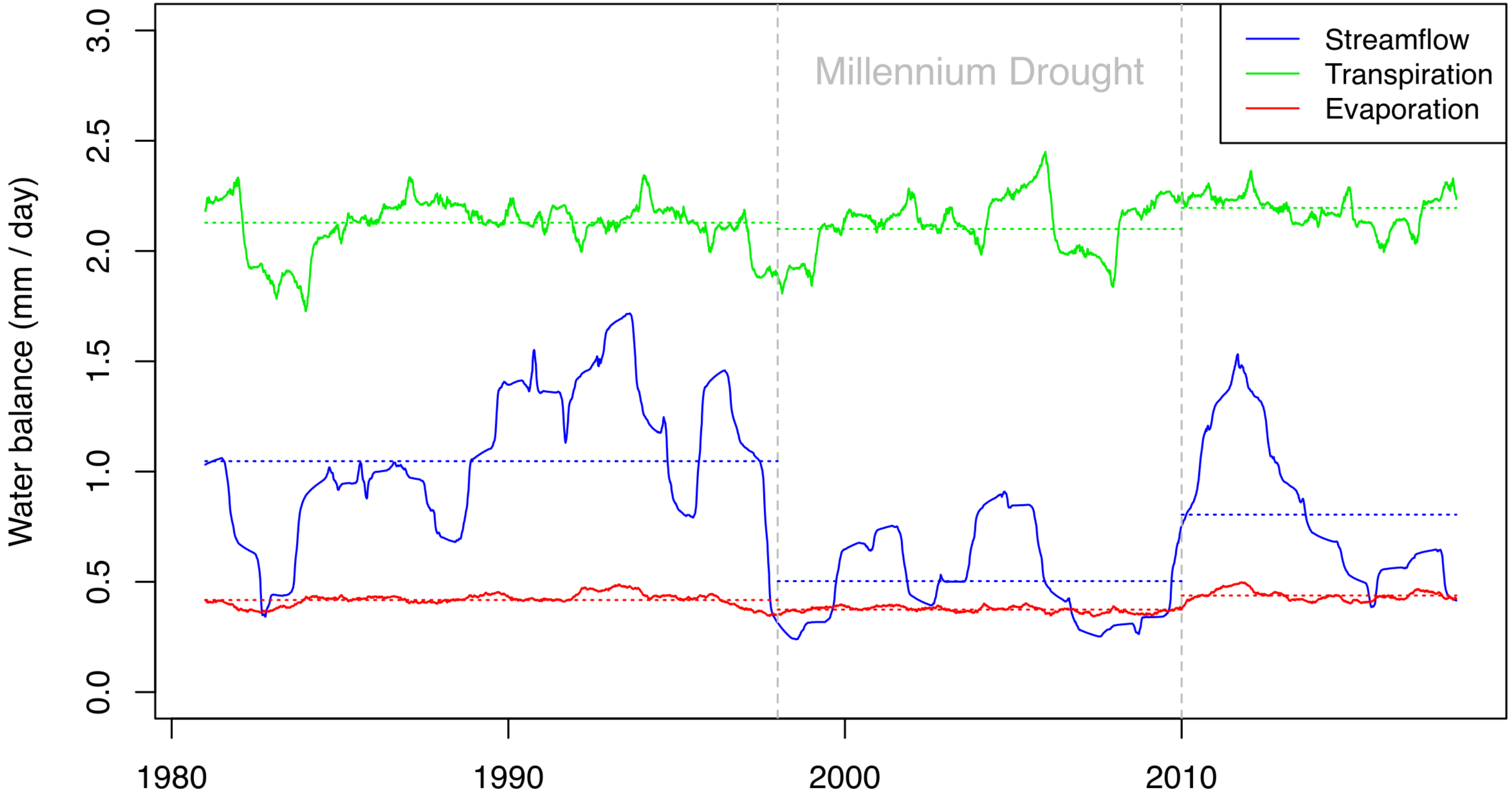

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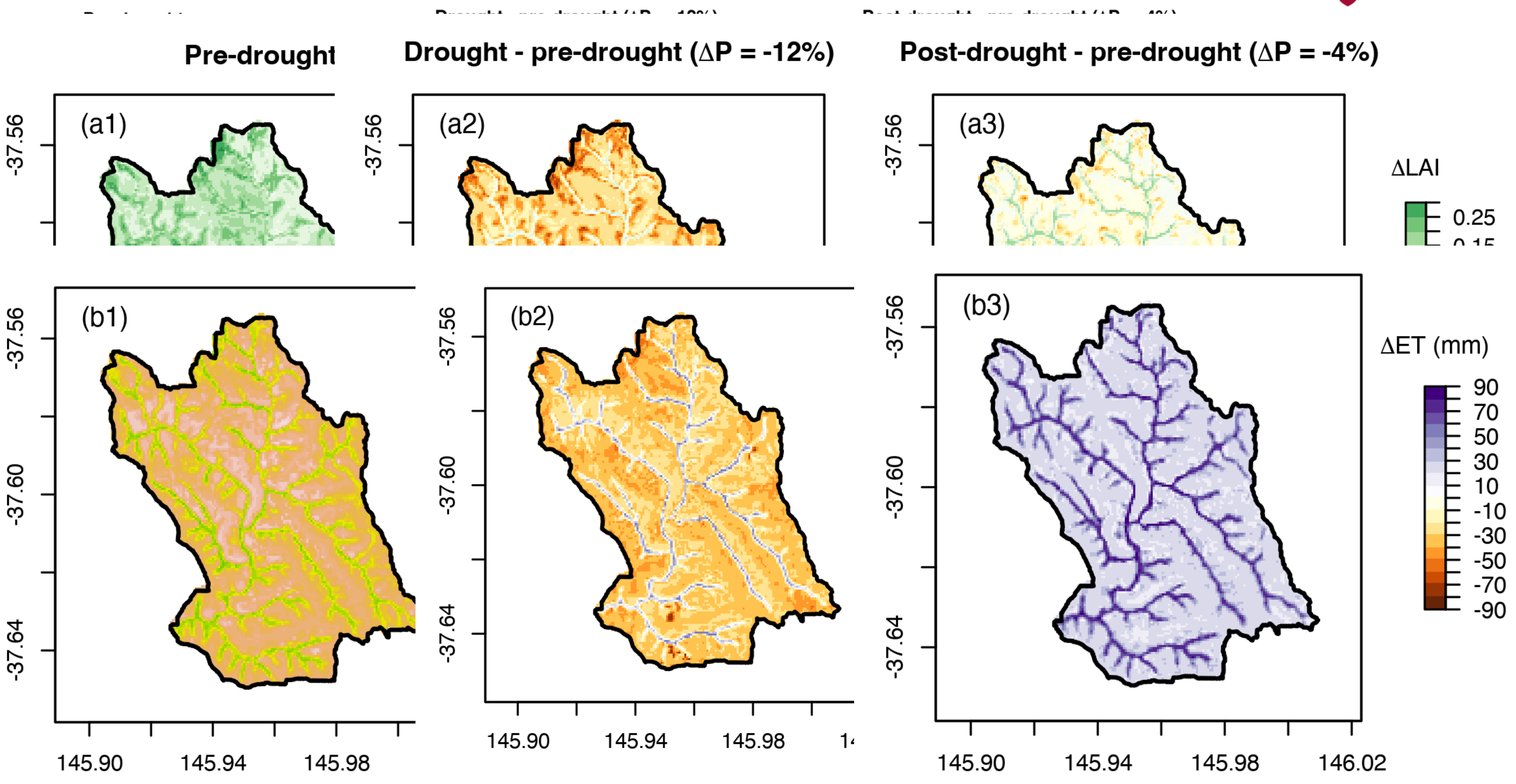
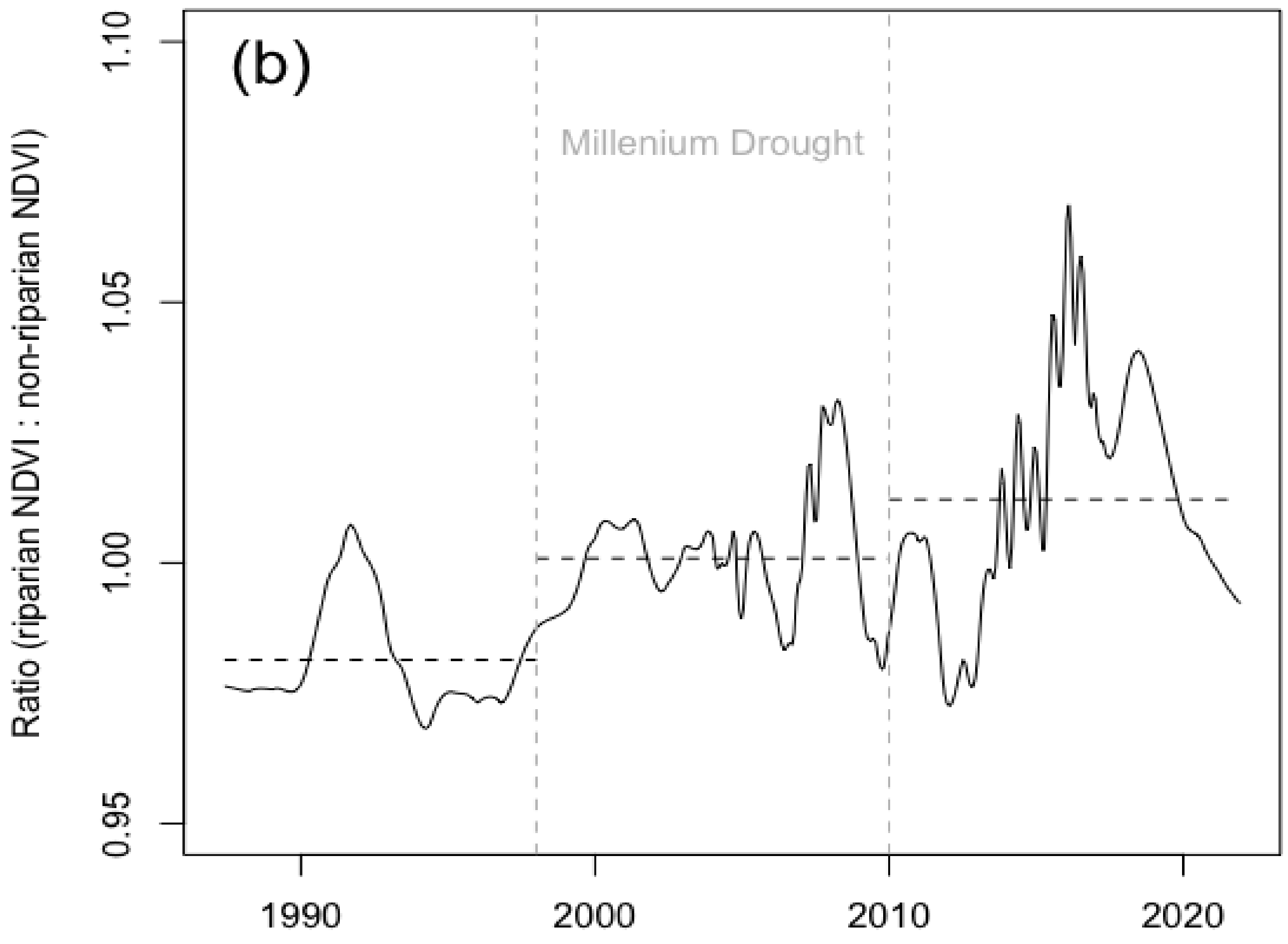
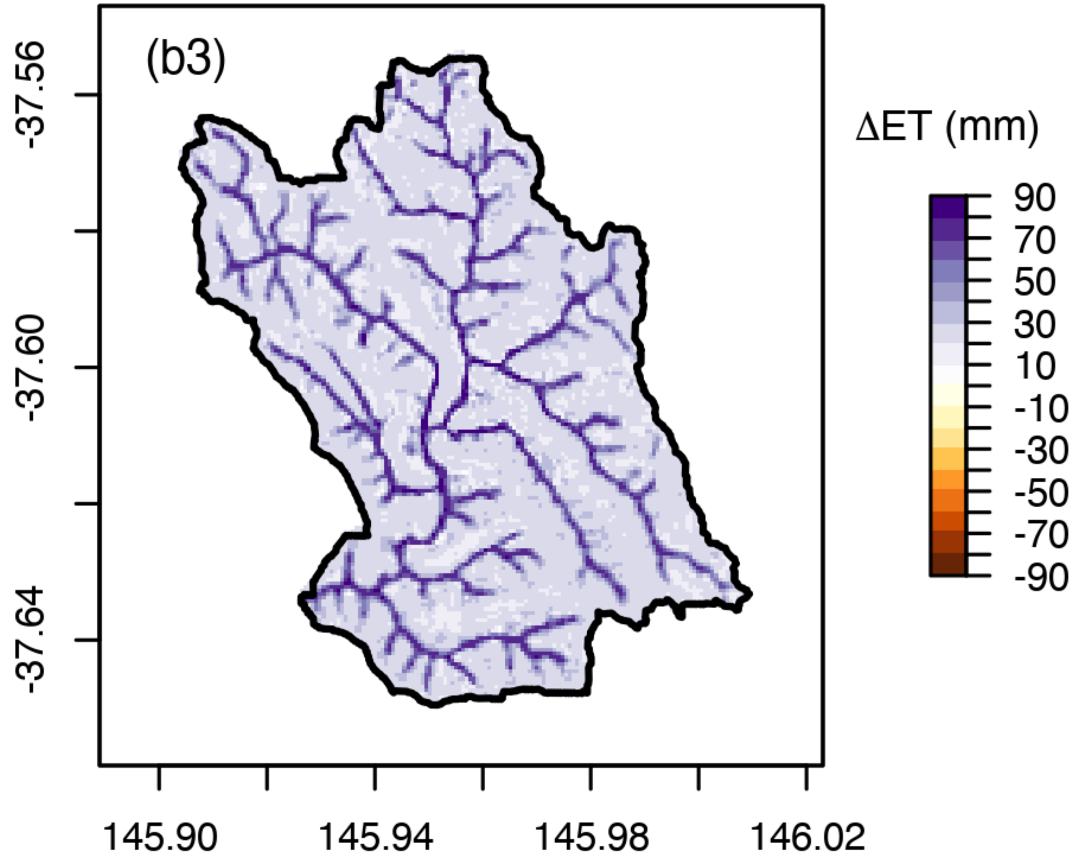



(b)
Millenium Drought
Ratio (riparian NDVI : non-riparian NDVI)
1.10
1.05
1.00
0.95
1990
2000
2010
2020

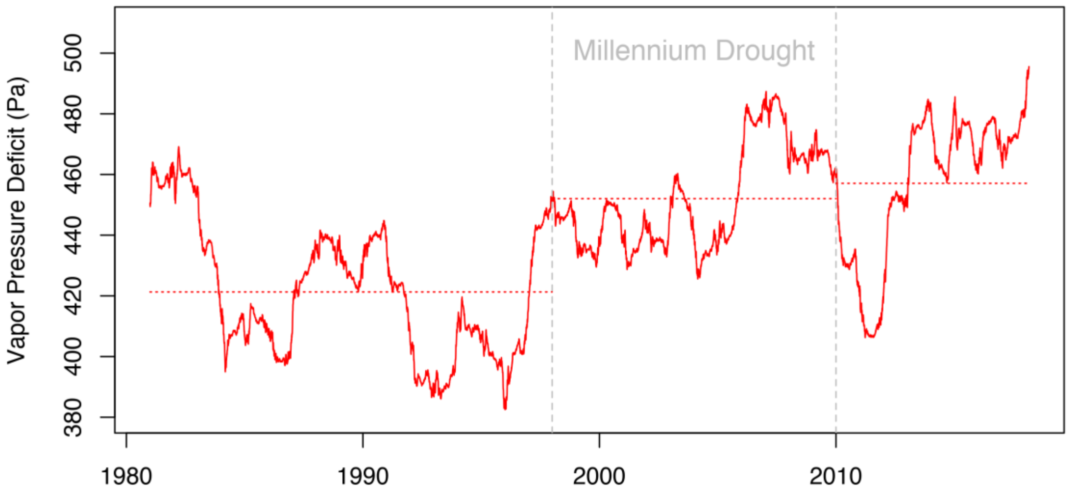
Higher evapotranspiration in the post-drought period



Higher evapotranspiration in the post-drought period

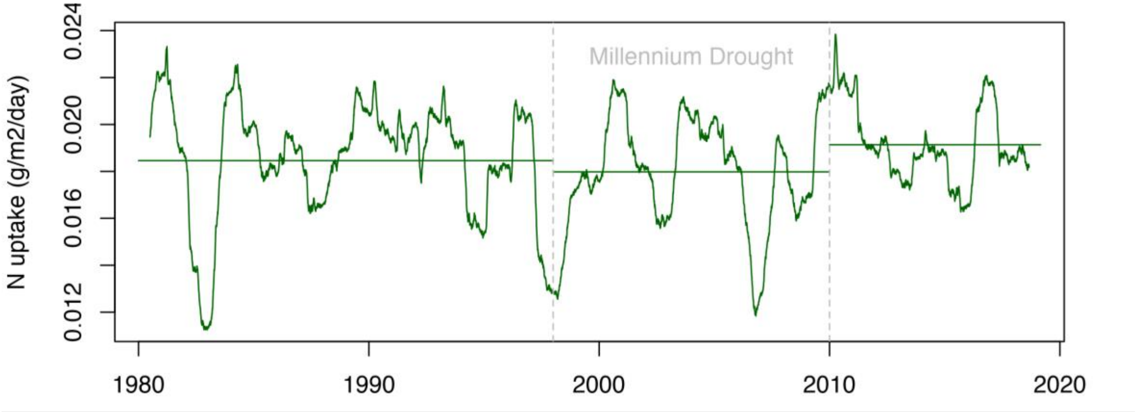
Hypothesis 1:

Altered post-drought climate (relative to pre-drought) drove higher ET at the expense of streamflow



Hypothesis 2:

Ecological effects of the drought persisted in the post-drought period, driving higher ET



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Modelling experiments

Hypothesis 1: Post-drought climate

Simulate *pre-drought – post-drought*

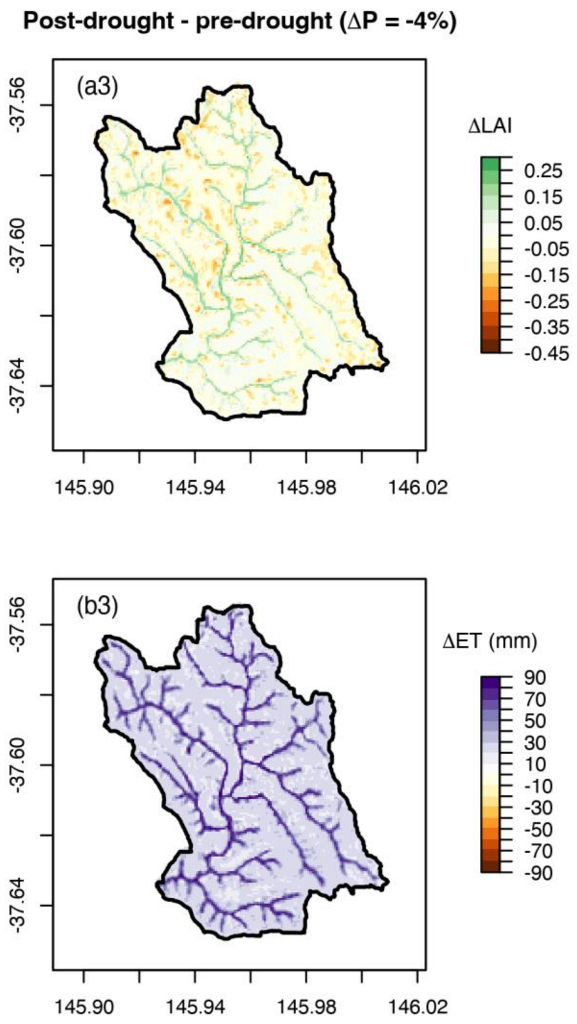
Isolates the effect of post-drought climate, no drought feedbacks

Hypothesis 2: Ecological feedbacks

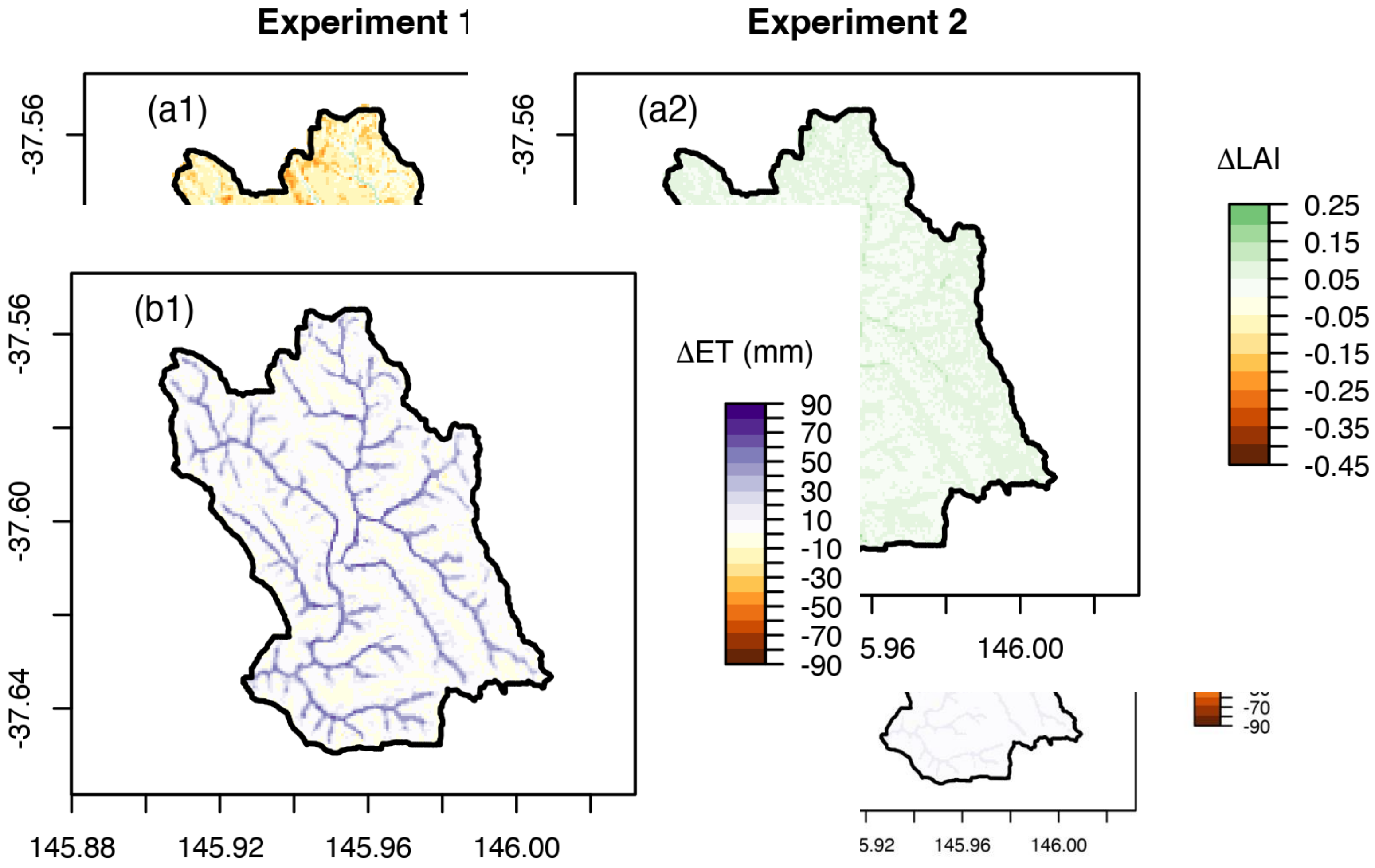
Simulate *pre-drought – drought – pre-drought*

Isolates the effects of drought feedbacks, no post-drought climate change

Original



Experiments



Summary

- **Evapotranspiration in Walshes Creek remained steady despite reduced rainfall during the drought**
- **This was partly facilitated by riparian resilience to drought (due to water and nutrient redistribution)**
- **Post-drought ET was higher than pre-drought throughout the catchment despite slightly lower rainfall**
- **Due to a combination of warmer temperatures in the post-drought period and drought-induced changes in nutrient cycling**
- **Forest hydrology is important for water supply, and these insights can aid future planning and management given long-term drying projections**

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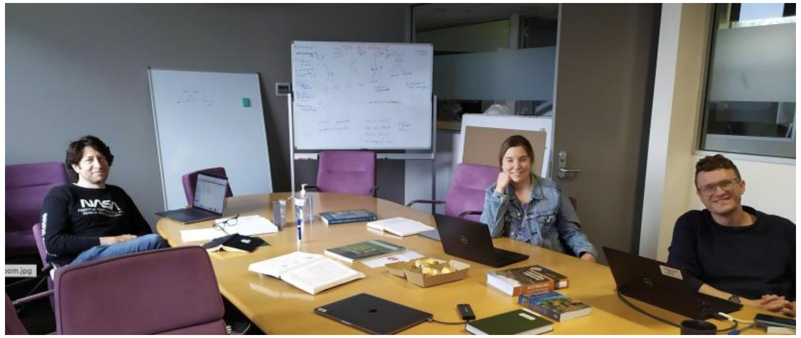
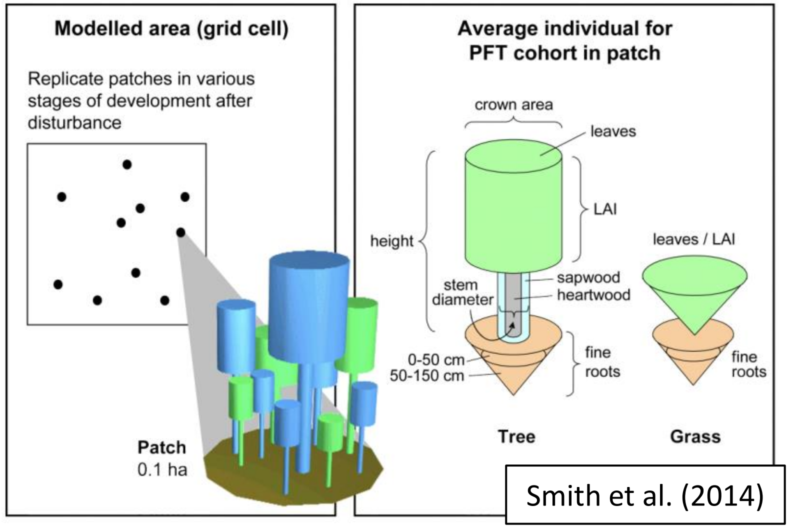
Dynamics of Australian Vegetation (DAVE)

Ongoing project to understand climate change impacts on ecosystem function





Smith et al. (2014)

Stephens, C., Band, L., Johnson, F., Marshall, L., Medlyn, B., De Kauwe, M. and Ukkola, A. (2023) Changes in blue/green water partitioning under severe drought, *Water Resources Research*

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