

From modelling to measurements: Bridging gaps in modelling with measured vegetation, evapotranspiration and soil moisture data

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Abstract: Evapotranspiration is a key component of ecohydrology and landscape water balance and is controlled by the ecophysiological dynamics of vegetation, meteorological conditions and soil moisture stores. Knowledge of interannual variability, seasonal patterns and the magnitude of evapotranspiration is essential for understanding and managing impacts such as drought and plant mortality in water limited ecosystems, such as the savanna woodlands of northern Australia. While there is data from monsoonal grazed savannas in the Northern Territory, there is limited understanding of evapotranspiration dynamics for grazed savanna woodlands of Queensland to support operational modelling, largely due to lack of data, with no other current canopy scale field measurements of water, carbon and energy fluxes in this ecosystem. To fill this gap, a new flux monitoring site has been established – the TERN Fletcherview Tropical Rangeland SuperSite.

The objective of this study is to improve evapotranspiration estimates in the grazed savanna woodlands of Queensland using direct measurements from flux towers, combined with approaches from modelling and remote sensing. Savanna ecosystems occupy approximately 40% of Queensland, 25% of Australia and 20% of the global land surface, and they contribute significantly to regional and global water and carbon budgets. We present measured datasets from the first 18 months of water and carbon flux measurements, coupled with phenology and soil moisture at this monitoring site. We use the eddy covariance method to directly measure water and carbon fluxes; a PhenoCam to measure greenness; and field measurements of pasture biomass and soil moisture. Sapflow sensors have recently been installed to partition evapotranspiration into tree and grass water use, a key uncertainty in savanna ecohydrological modelling. These datasets will improve our fundamental understanding of the links between hydrological, meteorological and ecological processes in tropical savanna woodlands that are subjected to natural climatic variability as well as grazing pressure. Given the site is a well-managed grazing operation, it will contribute important ground truthing data for parameterising, evaluating and improving satellite remote sensing products and modelling of evapotranspiration, soil moisture and vegetation dynamics using models such as GRASP and AWRA.

We also cover the challenges of collecting field data in a highly intensive monitoring site in a remote location. And the rewarding value and importance of collaborations and strong networks across multiple disciplines and organisations to make this work possible. “The whole is greater than the sum of its parts” ~ Aristotle.

Keywords: Drought, eddy covariance, savanna ecosystems, flux, water balance

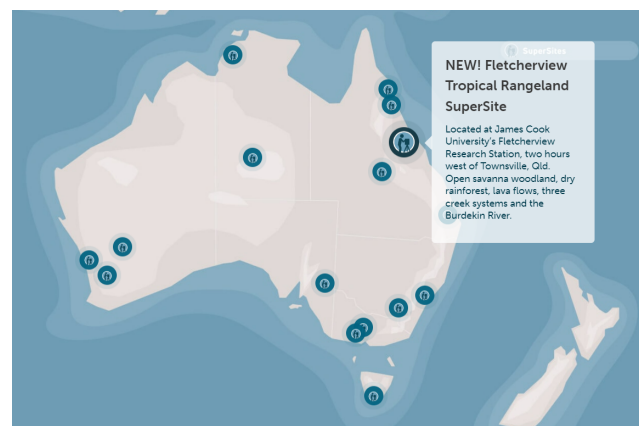


Figure 1. Fletcherview Tropical Rangeland SuperSite is one of 16 TERN supersites in Australia, an intensive ecosystem observatory set up to facilitate the environmental monitoring of vegetative and biophysical measurements in a typical and important biome (Source: <https://www.tern.org.au/tern-land-observatory/tern-ecosystem-processes/>)