Water in the Flinders-Leichhardt region

Water for a Healthy Country Flagship

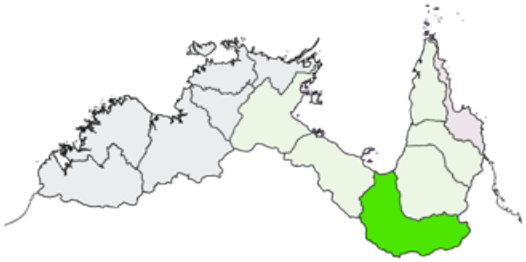
National Research FLAGSHIPS
Water for a Healthy Country

CSIRO

The CSIRO Northern Australia Sustainable Yields Project provides science to underpin the sustainable planning and management of the water resources of northen Australia

Project overview

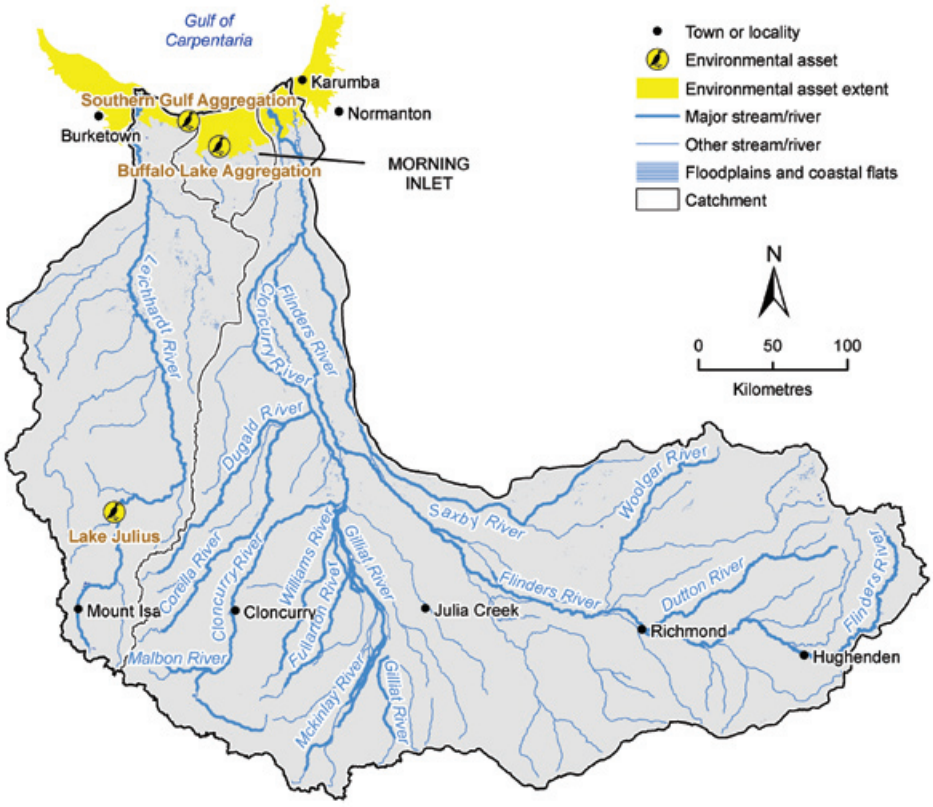
Led by CSIRO's Water for a Healthy Country Flagship, the Northern Australia Sustainable Yields Project is the nation's most comprehensive assessment of water availability in northern Australia. From Broome in Western Australia to Cairns in Queensland, this project provides critical information on current and likely future water availability for the 13 regions of northern Australia, an area renowned for its high rainfall, pristine tropical environments and relatively low level of development. This information will help governments, industry and communities consider the environmental, social and economic aspects of the sustainable use and management of the water assets of the north.



The region

The Flinders-Leichhardt region covers 145,223 km^2 and comprises the Australian Water Resources Council river basins of the Leichhardt, Morning Inlet and Flinders. The course of the Flinders River rises in the Great Dividing Range north-east of Hughenden and flows 840 km west, then north to discharge into the Gulf of Carpentaria near Karumba. At just over 1000 km, it is Australia's second longest river course outside the Murray-Darling Basin, and sixth longest overall, however, it does not flow year round.

The Leichhardt River rises in the eastern edge of the Barkly Tableland, in low-lying hills (to 300 m) that provide a low watershed between streams flowing north to the Gulf and those, such as the Georgina, that flow south to Lake Eyre. A structural basin between the higher ground to the south-west and south-east is infilled with alluvial sediments from numerous streams, dissected with entrenched riverbeds.

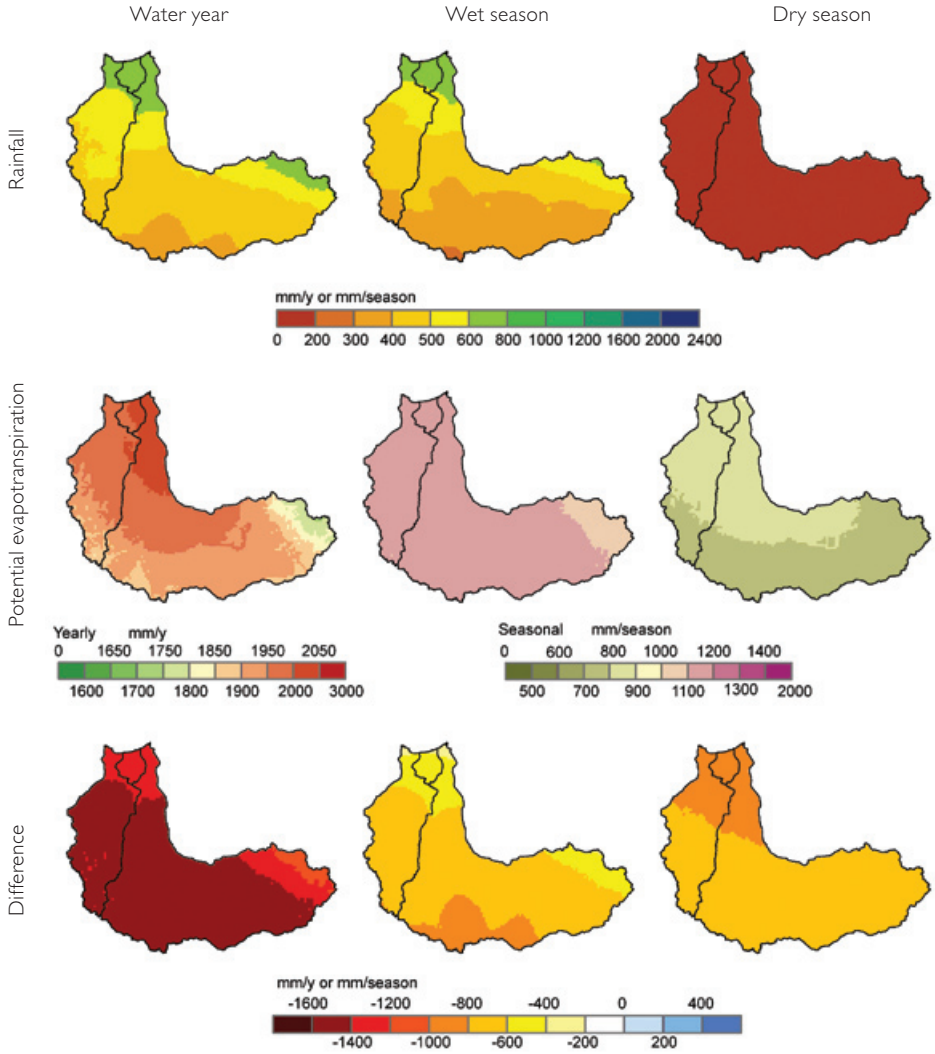


> The Flinders-Leichhardt region

These lowland plains extend far inland to the south from the Gulf, which is itself a down-warped part of the plain.

Historical and recent climate

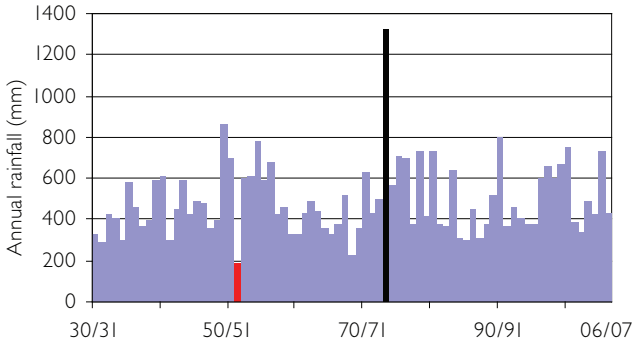
The historical (1930 to 2007) mean annual rainfall for the region is 493 mm. Mean annual potential evapotranspiration is 1326 mm. The mean annual runoff averaged over the modelled area of the Flinders-Leichhardt region is 44 mm, 9 percent of rainfall. These values are low in comparison to other regions across northern Australia. Under the historical climate the mean annual streamflow over the Flinders-Leichhardt region is estimated to be 6390 GL.



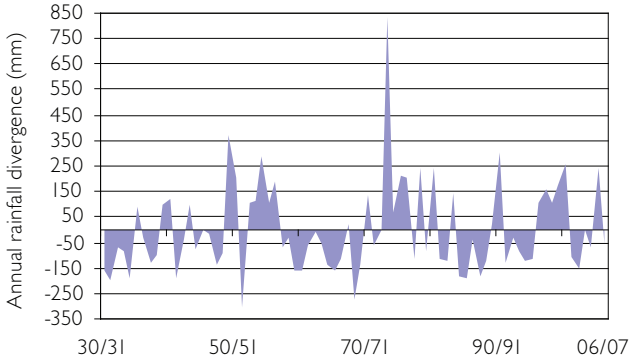
> Distribution of historical mean annual (water year), wet season and dry season rainfall and potential evapotranspiration and their difference (the annual rainfall deficit). Water year – September to August; wet season – November to April; dry season – May to October

> Historical mean annual rainfall, potential evapotranspiration and modelled runoff

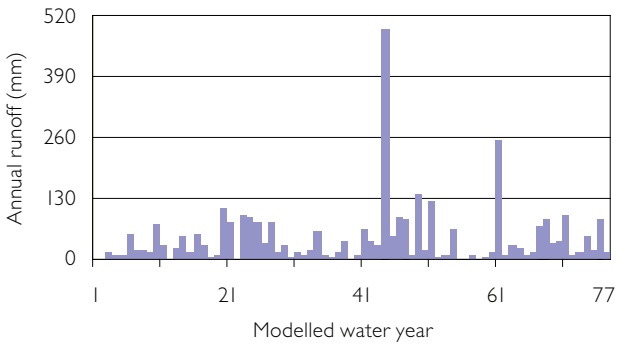
Rainfall	493 mm
Potential evapotranspiration	1326 mm
Runoff	44 mm (9 % of rainfall)



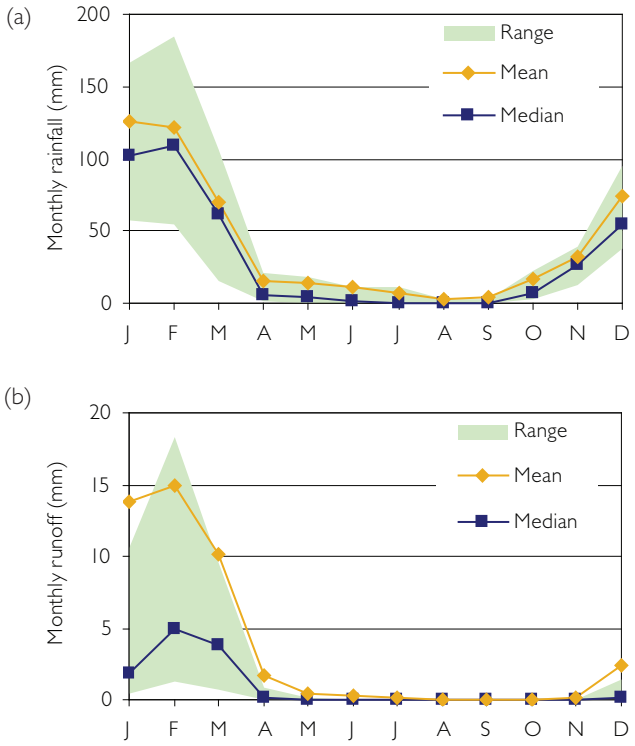
> Historical annual rainfall (1930 to 2007)



> Divergence of historical annual rainfall from the long-term mean (1930 to 2007)



> Modelled annual runoff



The Flinders-Leichhardt region has a high inter-annual variability in rainfall and hence runoff and recharge. Coefficients of variation are among the highest of the regions across northern Australia and reflect multiple years of significantly below average and above average rainfall.

There is a strong seasonality in rainfall patterns, with 89 percent of rain falling in the wet season, and a very high dry season potential evapotranspiration. The region has a relatively high rainfall intensity, and this is reflected in rapid runoff and a short lag between rainfall and runoff. Ninety-eight percent of runoff occurs between the months of December and May. There has been a slightly increasing amount and intensity of rainfall from 1930 to 2007. The Flinders and Leichhardt rivers do not flow for the entire dry season.

> Historical monthly (a) rainfall and (b) runoff (Range is the 25th to 75th percentile monthly rainfall or runoff)

Historical and current water resources

There is a strong north–south rainfall gradient, and hence also runoff, with the runoff coefficient decreasing from 25 to 3 percent of rainfall in the same direction.

Potential evapotranspiration is annually greater than rainfall, and hence the region may be considered water-limited. The region has years when it is water-limited throughout the entire year, with potential evapotranspiration exceeding rainfall even through the wet season.

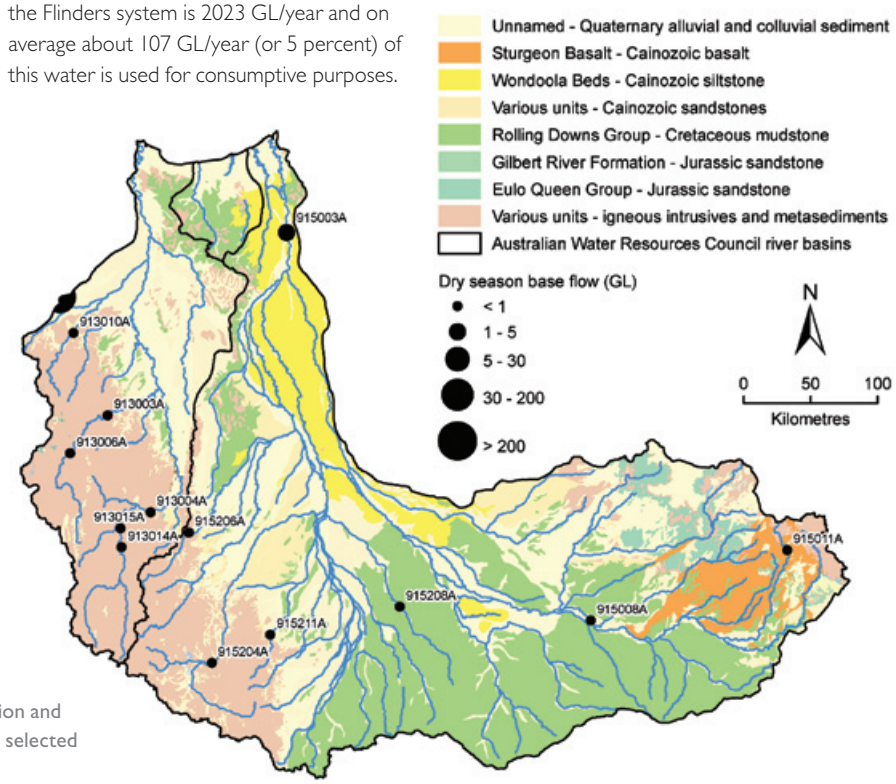
The Flinders-Leichhardt region has a recent (1996 to 2007) climate record that is statistically significantly similar to the historical (1930 to 2007) record. Modelling suggests that future (~2030) conditions will also be similar to historical conditions, and future runoff and recharge will also be similar to historical levels.

The Flinders and Leichhardt rivers are ephemeral, flowing only for a portion of the year following intensive summer storms. During the wet season, water seeps from the river into the alluvial aquifer. As the wet season comes to an end, river levels begin to drop and groundwater discharges from the aquifer back into the river. The aquifer continues to discharge to the river, keeping the river flowing until the groundwater level falls below the river bed at which point the river runs dry.

Permanent or near-permanent waterholes along most of the larger watercourses are also more likely to exist due to surface flows from the previous wet season than from groundwater.

Modelling of the river system indicates that current average surface water availability in the Flinders system is 2023 GL/year and on average about 107 GL/year (or 5 percent) of this water is used for consumptive purposes.

Current average surface water availability in the Leichhardt system is 1368 GL/year and on average about 111 GL/year (or 8 percent) of this water is used. All five major storages in the Leichhardt River system are fully utilised by the full use of existing entitlements and reserved allocations. These represent low levels of development.



> Surface geology of the Flinders-Leichhardt region and modelled historical mean dry season baseflow at selected streamflow gauging stations

What the future holds

The future (~2030) climate was modelled and the range of future climate series ranked. The 'median future climate' represents the mid-range conditions. The 'wet extreme future climate' represents the wet end of the range and the 'dry extreme future climate' represents the dry end of the range.

Modelling suggests that future (~2030) climatic conditions will be similar to historical conditions, and future runoff and recharge will also be similar to historical levels.

There are few opportunities for surface water storage and most are in the southern, drier headwater areas where potential evapotranspiration is highest within the region. Lower reaches are frequently flooded because the landscape is mostly flat.

At environmental assets, flows are highly dominated by wet season (November to April) flow, with dry season (May to October) flows only a small fraction of total annual flow. However environmental assets depend on this strong seasonality, and any significant changes in the frequency and duration of wet season high flows and dry season low flows are likely to have an environmental impact.

If entitlements are fully allocated, changes to flow are likely to disrupt flooding and dry season regimes, which could have environmental impacts.

> Hughenden district (2006). Courtesy of the Northern Territory Department of Natural Resources, Environment and The Arts

With only 29 weather stations, the region's rainfall data are sparse compared to most of Australia. The region is data-poor overall with little data on critical areas such as flood dynamics, leakage from the the Great Artesian Basin, environmental assets and dry season flows.

For further information:

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