Water in the Daly region

Water for a Healthy Country Flagship

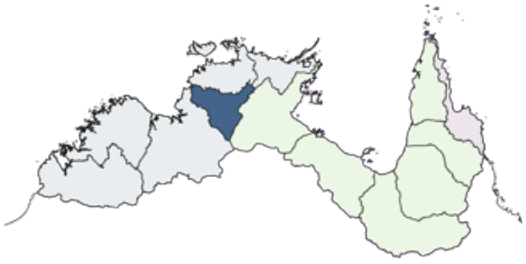
National Research FLAGSHIPS
Water for a Healthy Country

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.

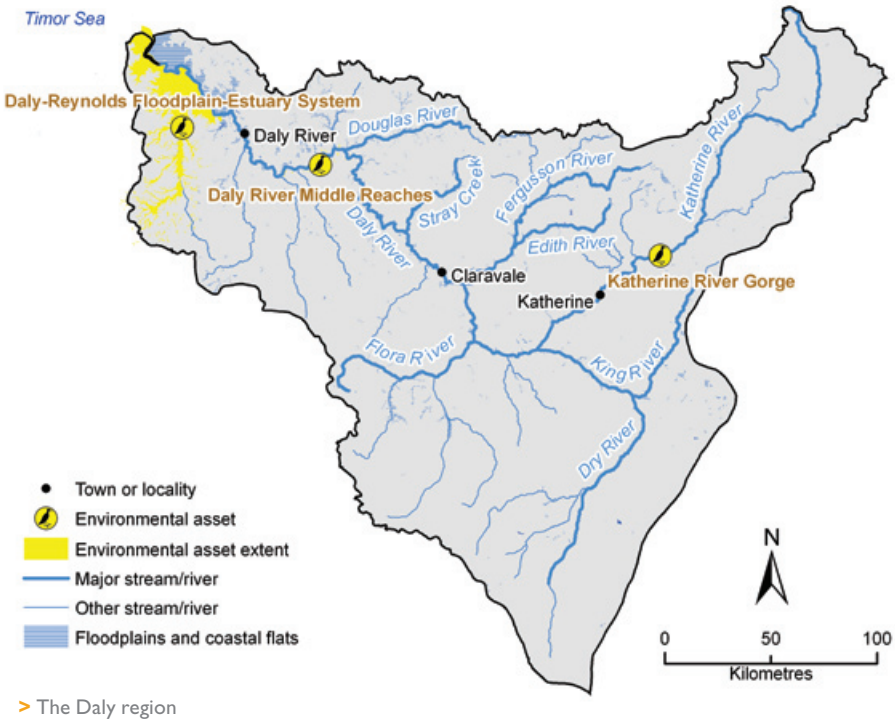


The region

The Daly region covers 54,400 km^2 to the south of Darwin. The total population of the region is less than 10,000 and the region supports extensive grazing lands together with other activities, including mining and intensive agriculture. Irrigation is locally becoming increasingly important, particularly around Katherine and at the confluence of the Douglas and Daly rivers.

The region contains a number of important rivers, including the Katherine, Flora, Edith and Douglas rivers, which have tourism and conservation value.

The main river is the Daly River, which flows 320 km from the foothills of Arnhem Land, north-west into the Timor Sea, with estuarine conditions for the last 65 km. The Daly-Reynolds Floodplain-Estuary System covers an area of 1590 km^2 and includes the entire floodplain and estuary of the Daly River. The system represents one of the largest floodplains in the Northern Territory and it contains a diverse mixture of wetland types. The river also has an important marine influence, and its discharge into the Timor Sea is the second highest of any Australian river. The Daly River system has a range of aquatic environmental assets of national significance, including the Middle Reaches and Katherine River Gorge.



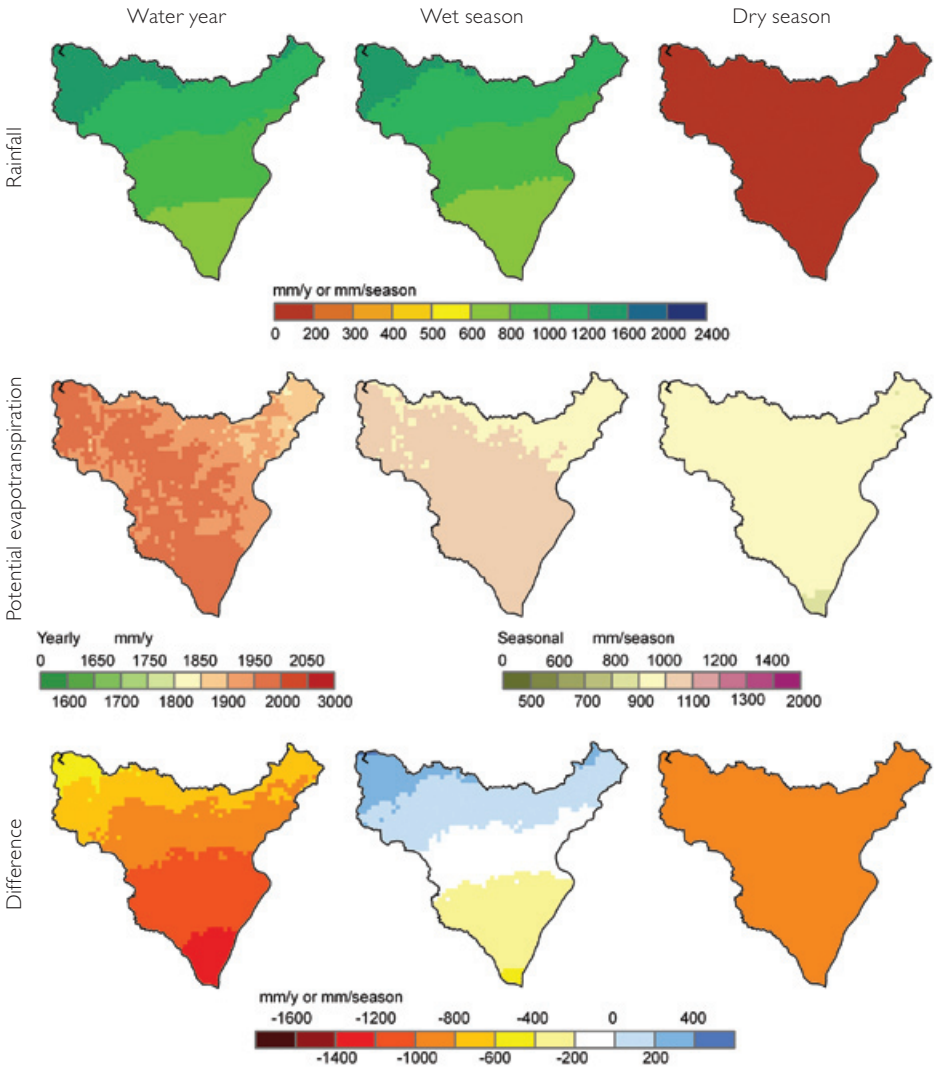
> The Daly region

The Daly River is one of the largest perennial rivers of northern Australia, with a catchment area of just over 53,000 km^2. Dry season flow is dominated by input from groundwater from two underlying limestone aquifers, the Tindall Limestone and Oolloo Dolostone, which have an intervening siltstone aquitard. In addition to these karst aquifers, there are also fractured bedrock and Cretaceous sediment aquifers that provide local sources of groundwater.

Historical and recent climate

The Daly region has a high inter-annual variability in rainfall and hence also surface water runoff and groundwater recharge.

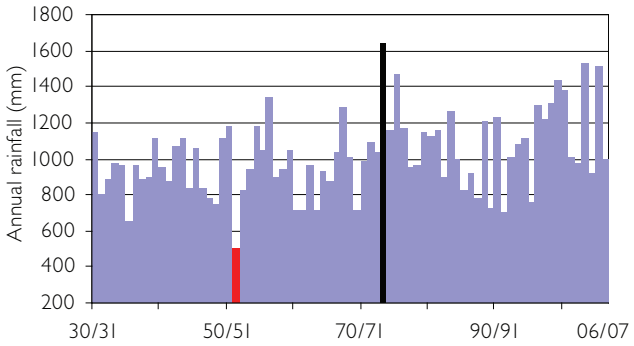
There is an extreme seasonality in rainfall patterns, with 95 percent of rain falling in the wet season, but also a very high wet season potential evapotranspiration. The region has a high rainfall intensity (mean >8 mm/rain day), and hence rapid runoff. There has been a slight increase in the amount and the intensity of rainfall over the historical (1930 to 2007) period.



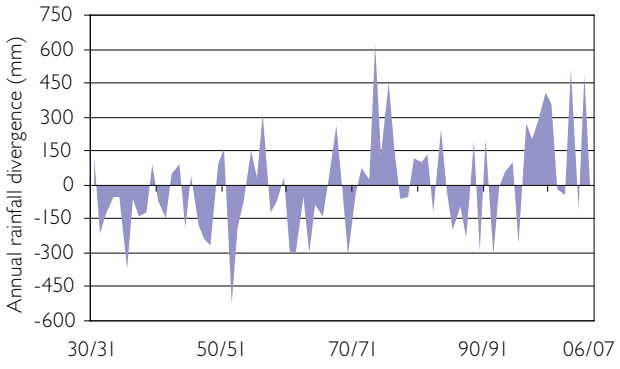
> Distribution of historical mean annual (water year), wet season and dry season rainfall and potential evapotranspiration and their difference (the annual rainfall deficit). Water year – September to August; wet season – November to April; dry season – May to October

> Historical mean annual rainfall, potential evapotranspiration and runoff

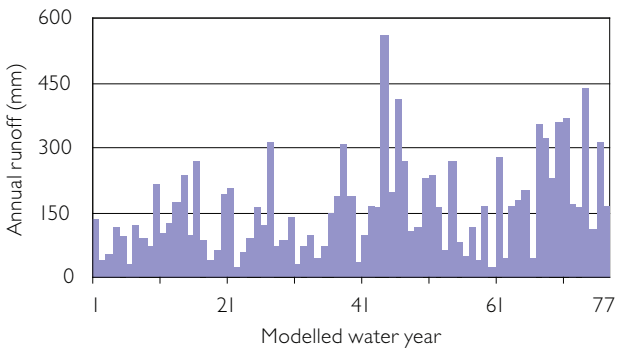
Rainfall	1019 mm
Potential evapotranspiration	1942 mm
Runoff	151 mm (15 % of rainfall)



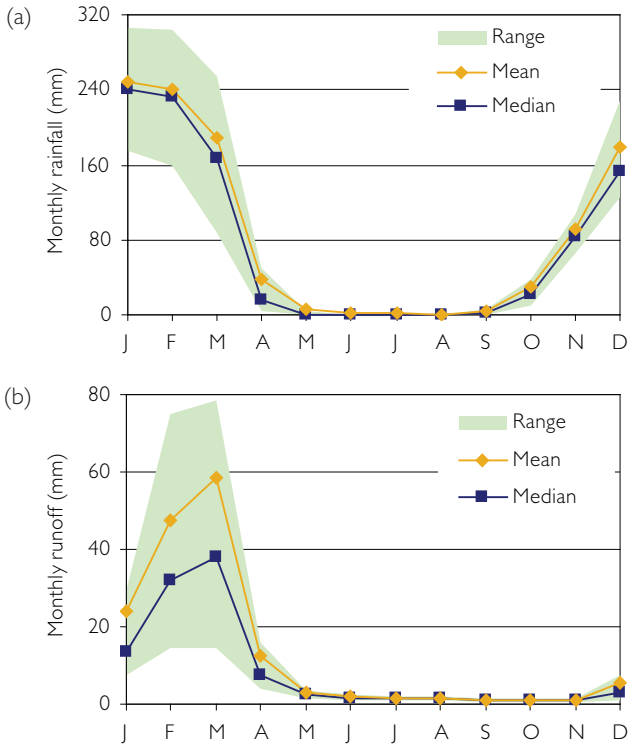
> Historical annual rainfall (1930 to 2007)



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



> Modelled annual runoff



Annually, potential evapotranspiration (1942 mm) is generally greater than rainfall (1019 mm) and thus the region is annually water-limited; in other words there is more energy available to remove water than there is water available to be removed.

The Daly region has a recent (1996 to 2007) climate record that is statistically significantly wetter than the historical (1930 to 2007) record with recent rainfall 25 percent higher and runoff 66 percent higher. Highest rainfall, however, was recorded in 1974 (1640 mm), with lowest in 1952 (498 mm).

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

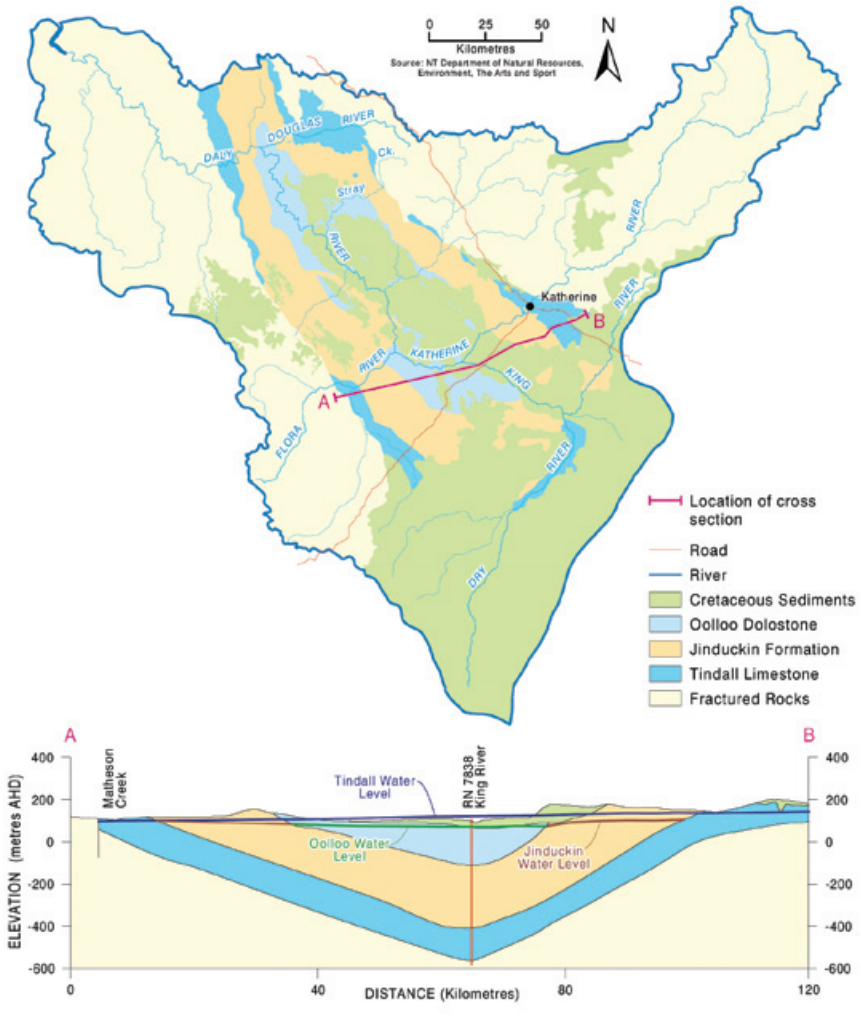
Historical and current water resources

There is a strong north–south rainfall gradient producing more runoff towards the estuary and less inland. Lower reaches are flood determined and dominated and estuaries experience significant tidal ranges. There are few opportunities for surface water storage. Mean annual runoff is 159 mm, 15 percent of rainfall. Under the historical climate the mean annual streamflow over the Daly region is estimated to be 8653 GL.

The region has a number of perennial rivers which support endemic wildlife and irrigation development, and are of high cultural and heritage value.

Groundwater is a dynamic resource, with large seasonal fluctuations in storage, and an intricate interaction with surface waters. The region is flood dependent in the wet and groundwater dependent in the dry. The main aquifers are carbonate-rich and are characterised by karstic features.

Modelled diffuse groundwater recharge has been significantly higher in the recent past than under the historical climate, particularly in the western half of the region. Despite this increase in recharge, median groundwater levels, under current development, rise by only a few metres (compared to the historical median).



> Hydrogeology of the Daly region

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.

It is likely that future (~2030) rainfall conditions will be similar to historical conditions, but lower than the recent past. Potential for evapotranspiration is likely to be higher. Future runoff and recharge are expected to be similar to historical levels, though changes in rainfall intensity may result in mean annual diffuse groundwater recharge being higher than the historical mean.

Median groundwater levels for the Tindall Limestone around Katherine are expected to be slightly lower than the historical median levels, due to an expected increase in extraction. This will also be reflected in lower groundwater discharge (a decrease of between 14 and 22 GL/year) to rivers under the future climate.

For the Oolloo Dolostone, however, median future groundwater levels are expected to be similar to historical values. Its discharge to rivers is harder to predict, ranging from a possible increase of up to 60 GL/year to a decrease of 43 GL/year.

At environmental assets, annual surface water flows are highly dominated by wet season events and dry season flows are only a small fraction of total annual flow. Dry season flows, however, are dominated by groundwater discharge, and environmental assets depend on this strong seasonality. 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. In the recent past there has been significantly more flow, with fewer low flow days and more high flow days. There are no days of zero flow under future climate at the assets investigated by this project. There are large changes to the number of days of high (flood) flow under the wet extreme and dry extreme future climate, which could have environmental impacts.

> Katherine River, NT. Courtesy of CSIRO Sustainable Ecosystems

Analysis of site-specific metrics at the Daly River Middle Reaches environmental asset showed no threat to the specified minimum environmental flow requirement for transpiration of riparian vegetation under future climate. Under the dry extreme future climate, with both current and proposed future development, there is an increase in the mean annual number of days in which flows are below the optimal threshold for nesting success for Pig-Nosed Turtles (*Carettochelys insculpta*) and for *Vallisneria nana* beds, suggesting that the survival of these species is threatened.

The region has few opportunities for increased surface water storage. Groundwater storage, through managed aquifer recharge, is problematic, as most shallow aquifers naturally fill during the wet (when there is plenty of water), with little potential for artificial recharge in the dry season, when there is no water available.

This assessment of surface and groundwater availability is based on the existing but often limited water-related data available for northern Australia.

For further information:

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