Water in the Roper 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

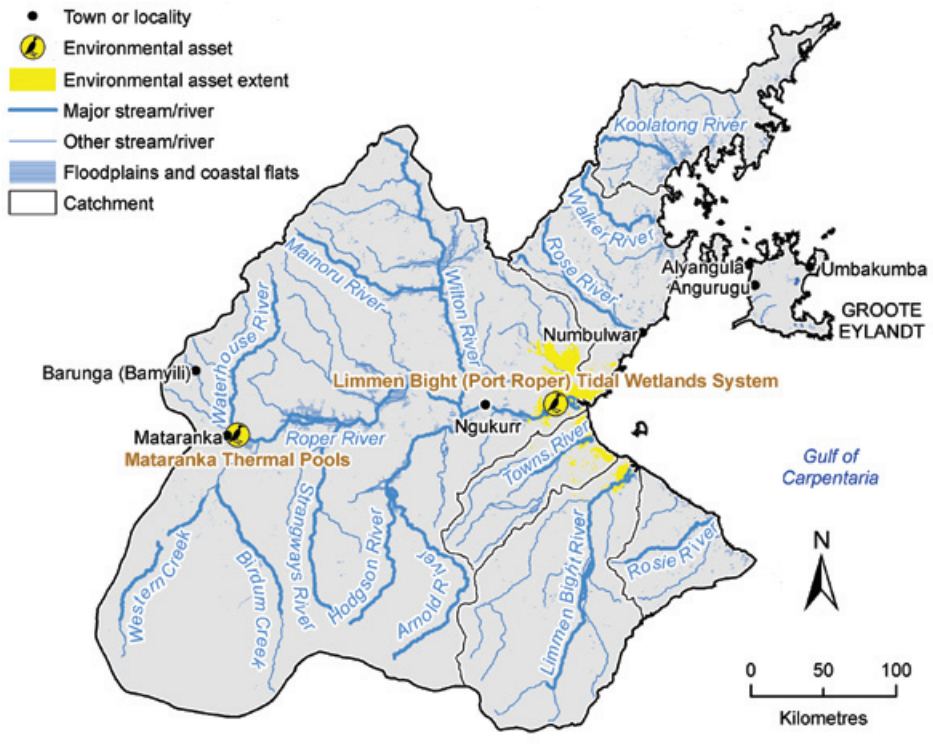
The Roper region covers 128,500 km^2 of the north-east of the Northern Territory and includes the Australian Water Resources Council river basins of Koolatong, Walker, Roper, Towns, Limmen Bight and Rosie rivers as well as Groote Eylandt. The Roper River is by far the largest of these and covers 81,000 km^2, flowing generally in an easterly direction, with the geology of the catchment influencing the direction of the drainage systems. The Arnhem Land Plateau rises to 440 m to form the northern boundary of the region; the south opens out into open plains with large braided rivers. The normal tidal limit of the Roper is 145 km from the mouth, with an extensive alluvial plain extending to form the north-western coast of the Gulf of Carpentaria.

The Limmen Bight Tidal Wetlands System is a system of tidal wetlands typical of the Gulf of Carpentaria coast. It is the second largest area of saline coastal flats in the Northern Territory and is an important coastal area for shorebirds.

There are three major aquifer types in the region: fractured rocks, karstic carbonate rocks and Cretaceous sediments. The Cretaceous rocks are the most westerly expression of the Great Artesian Basin and form the western margin of the Carpentaria Basin.

Industries in the region include grazing, mining, tourism, and recreational and commercial fishing. The fishing industry is very significant for the region, particularly for recreational barramundi and commercial prawns, the latter operating up to 60 km offshore.

Indigenous land and conservation areas combined constitute more than 50 percent of the region, specifically the north and east.

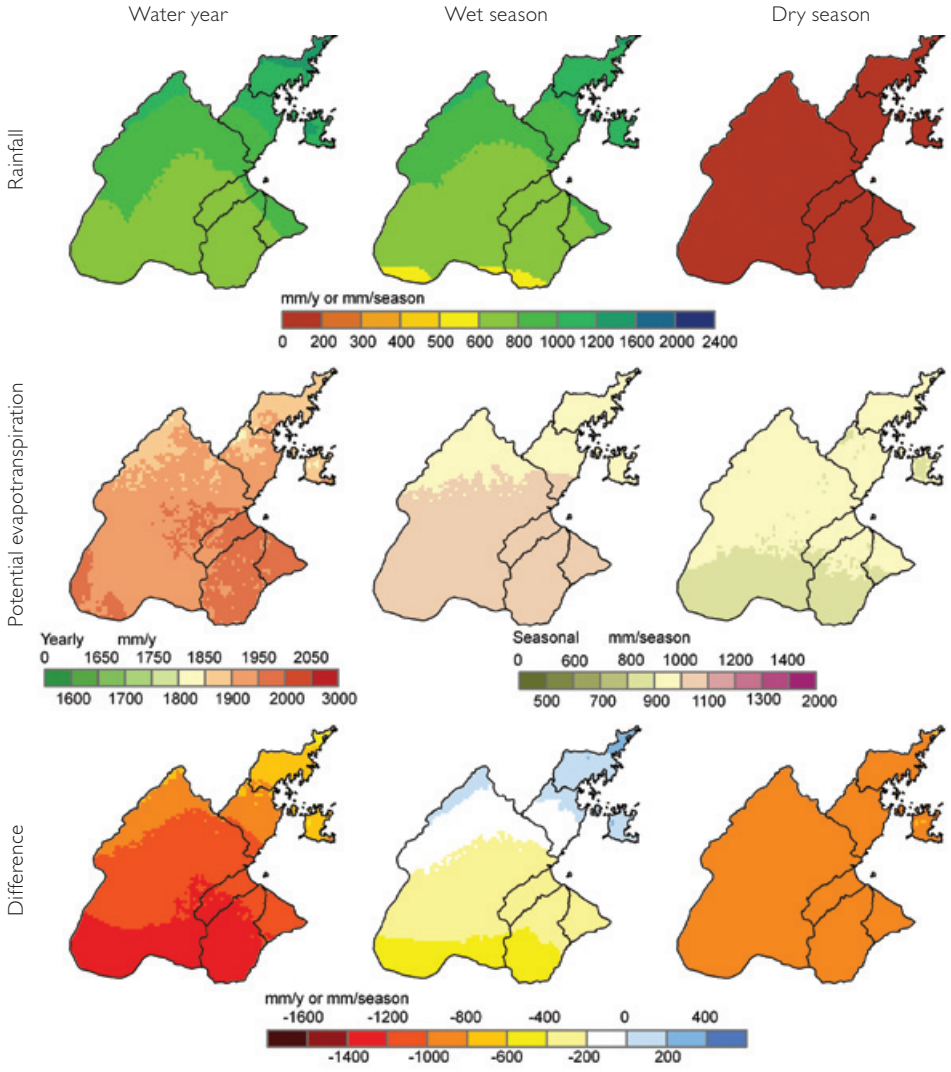


> The Roper region

Historical and recent climate

The Roper region has a high inter-annual variability of rainfall and hence also runoff and groundwater recharge, with coefficients of variation of 0.25 and 0.67 for rainfall and runoff, respectively. These values reflect multiple years of significantly below average or above average rainfall.

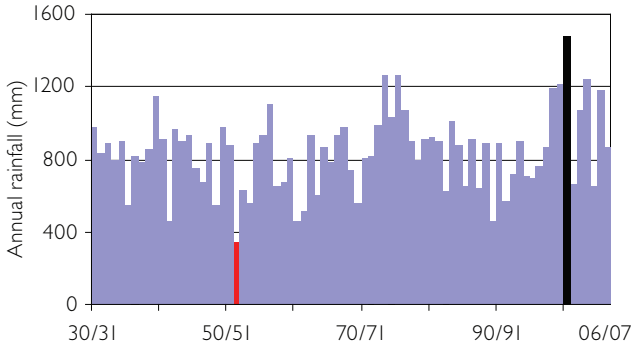
Mean annual rainfall for the region is 843 mm. Mean annual potential evapotranspiration is 1477 mm. The mean annual runoff averaged over the modelled area of the Roper region is 112 mm, 8 percent of rainfall. Under the historical climate the mean annual streamflow over the Roper region is estimated to be 14,394 GL.



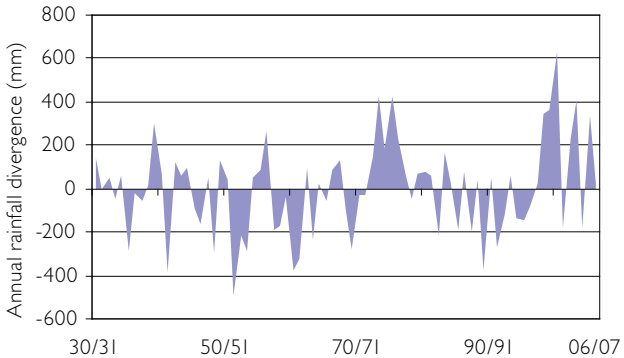
> Distribution of historical mean annual (water year), wet season and dry season rainfall and potential evapotranspiration and their difference (the annual rainfall deficit). Water year – September to August; wet season – November to April; dry season – May to October

> Historical mean annual rainfall, potential evapotranspiration and modelled unoff

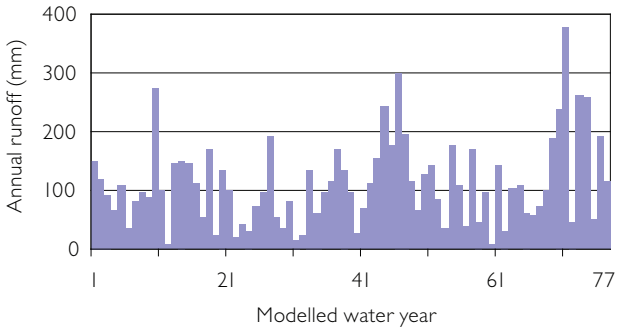
Rainfall	843 mm
Potential evapotranspiration	1477 mm
Runoff	112 mm (8 % of rainfall)



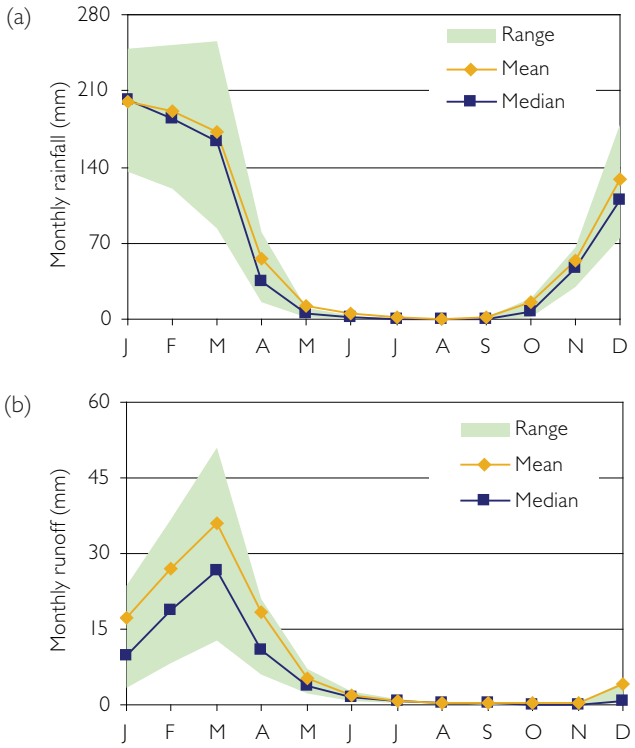
> Historical annual rainfall (1930 to 2007)



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



> Modelled annual runoff



There is a strong seasonality in rainfall patterns, with 96 percent of rain falling in the wet season. The region has a relatively high rainfall intensity and hence rapid runoff and short lag between rainfall and runoff, with a slighting increasing amount and intensity of rainfall over the historical (1930 to 2007) period. Rainfall and runoff generation both decline with distance from the coast; the rainfall gradient falls from the north coast; the runoff from the east coast.

The Roper region has a recent (1996 to 2007) climate that has been statistically significantly wetter than the historical mean by 10 to 40 percent. This resulted in a regionally averaged 54 percent increase in runoff compared to the historical mean.

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

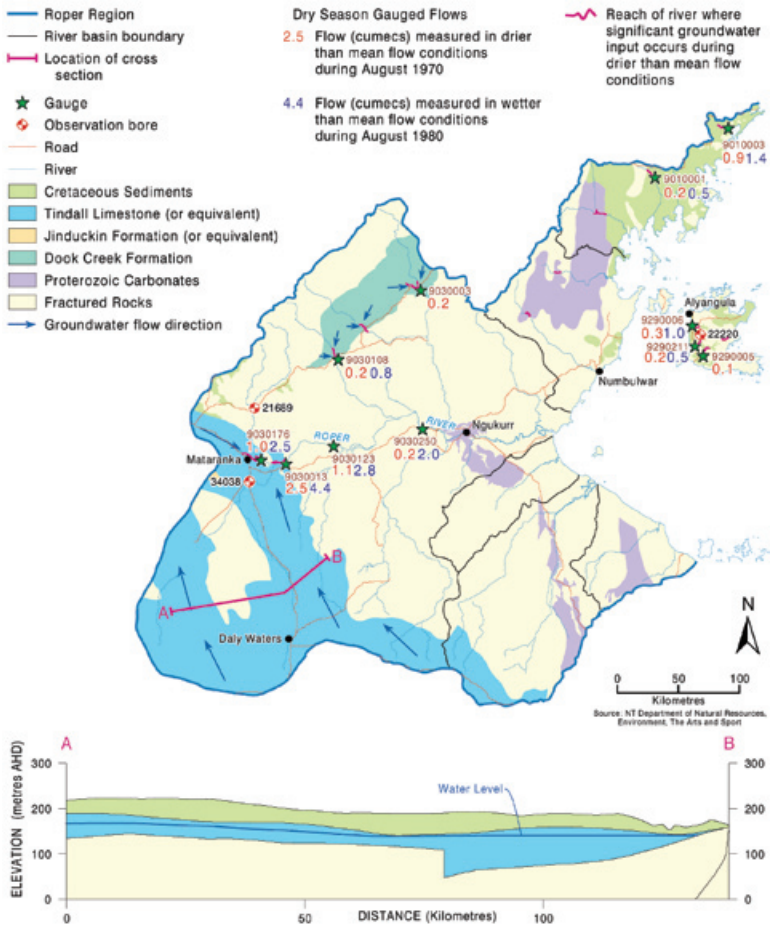
Historical and current water resources

There is a moderate north–south rainfall gradient, whilst runoff exhibits a stronger east–west gradient, varying from 20 to 4 percent of rainfall across the region, which reflects the dry inland source of the Roper River. Lower reaches, however, are characterised by floods during the wet season.

There are numerous short stretches of rivers within the region that have continuous flow through the year. Most are associated with discharge from carbonate aquifers, sourcing waters from outside the region, with a few related to coastal discharge from the Cretaceous sediments. The presence or absence of the Cretaceous sediments has a large influence on groundwater recharge rates to the important aquifers of the Tindall Limestone and Dook Creek Formation, but more work is needed to understand this influence.

These aquifers and the Cretaceous sediments are the primary source of dry season flow in the perennial rivers of the Roper region.

While groundwater use is not metered throughout the region, groundwater is sourced for both irrigation and mining development. Groundwater in the Tindall Limestone aquifer is sourced for large-scale irrigated agricultural developments in the Mataranka area, posing a significant risk to the ecology of the nearby Elsey National Park and the flow from the iconic Mataranka Hot Springs. Groundwater extracted on Groote Eylandt for the manganese mine may impact on the perennial Angurugu and Emerald rivers.



> Hydrogeology of the Roper region showing historical mean dry season flows and reaches of river that remain perennial under drier than average conditions

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, though drier than the recent past. Slightly wetter and drier conditions are expected under the wet extreme and dry extreme future climates, respectively.

Groundwater extraction in the region is low and groundwater recharge rates (especially for the northern half of the region) are high. The local carbonate aquifers are likely to be at full capacity towards the end of the wet season. Lack of data forestalls accurate determination of groundwater yields. Lack of confidence in streamflow and groundwater flow estimates in this region precludes assessment of changes to flow regimes at environmental assets.

The region has a generally sparse coverage of water resource data. There is some limited information on groundwater around Mataranka. These are only five operational gauging stations across the region.

> Minyerri Waterhole, Northern Territory. Courtesy of the Northern Territory Department of Natural Resources, Environment and The Arts

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