

Water in the Arafura region

Water for a Healthy Country Flagship

National Research
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Water for a Healthy Country



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



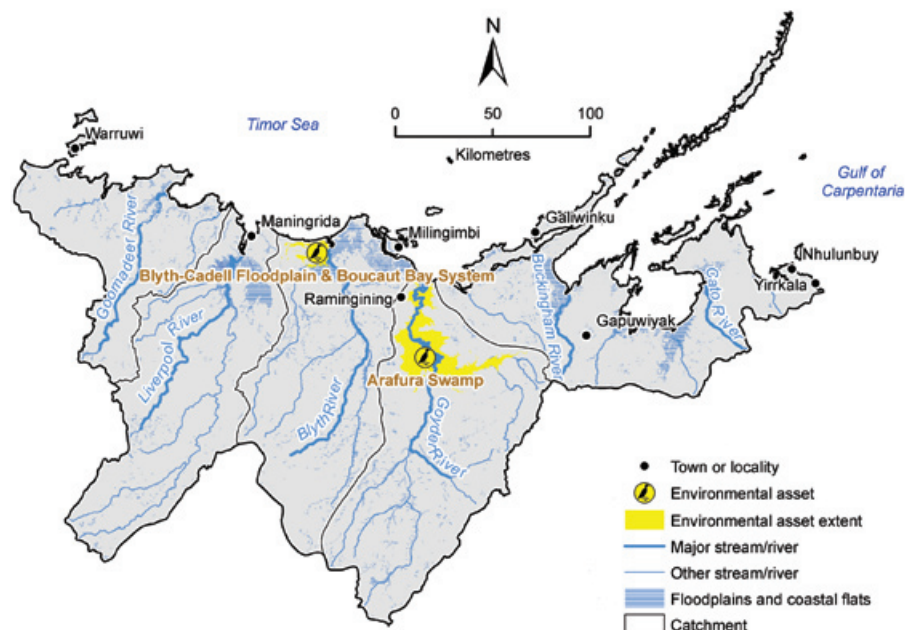
The region

The Arafura region covers 45,499 km² and comprises five Australian Water Resources Council river basins – the Goomadeer, Liverpool, Blyth, Goyder and Buckingham. The region contains major perennial rivers including the Blyth and Goyder, as well as numerous rivers and creeks draining the north of Arnhem Land, while alluvial plains cover an extensive area along the coastal northern edge of the region.

The Blyth-Cadell Floodplain and Boucaut Bay System, is a large floodplain-tidal wetland system typical of the Top End and is an important migration stop-over site for shorebirds in Arnhem Land.

This region also includes the Arafura Swamp which lies within the estuarine system of the Goyder River and is an extensive region of billabongs and river channels that provides a significant breeding area for magpie geese and crocodile species.

Groundwater in the region is found in three major aquifer types: fractured rocks, karstic carbonate rocks and Cretaceous sediments. Of these, the major karstic aquifer occurs within the Proterozoic carbonate rocks of the Dook Creek Formation. This formation



> The Arafura region

contributes very significant dry season flow to the Goyder and Blyth rivers.

The total population of the region is estimated to be less than 30,000 and the main commercial activity is mining with other activities including tourism and grazing.

The region retains a near-pristine condition, with minimal changed land use. No future water development is envisaged beyond localised stock and domestic supplies.

Historical and recent climate

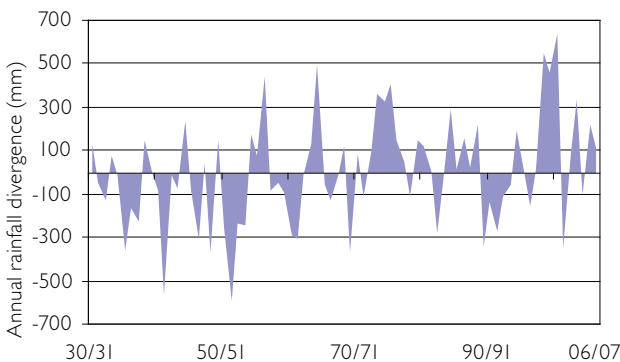
The Arafura region has a high inter-annual variability in rainfall and hence surface water runoff and groundwater recharge. Coefficients of variation are among the lowest of the regions across northern Australia and the region may experience long periods of many years that are considerably wetter or drier than others.

The mean annual rainfall for the region is 1186 mm. Mean annual potential evapotranspiration is 1898 mm. These values are amongst the highest across northern Australia.

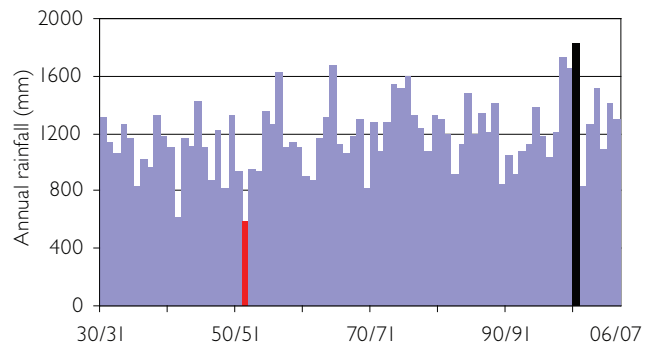
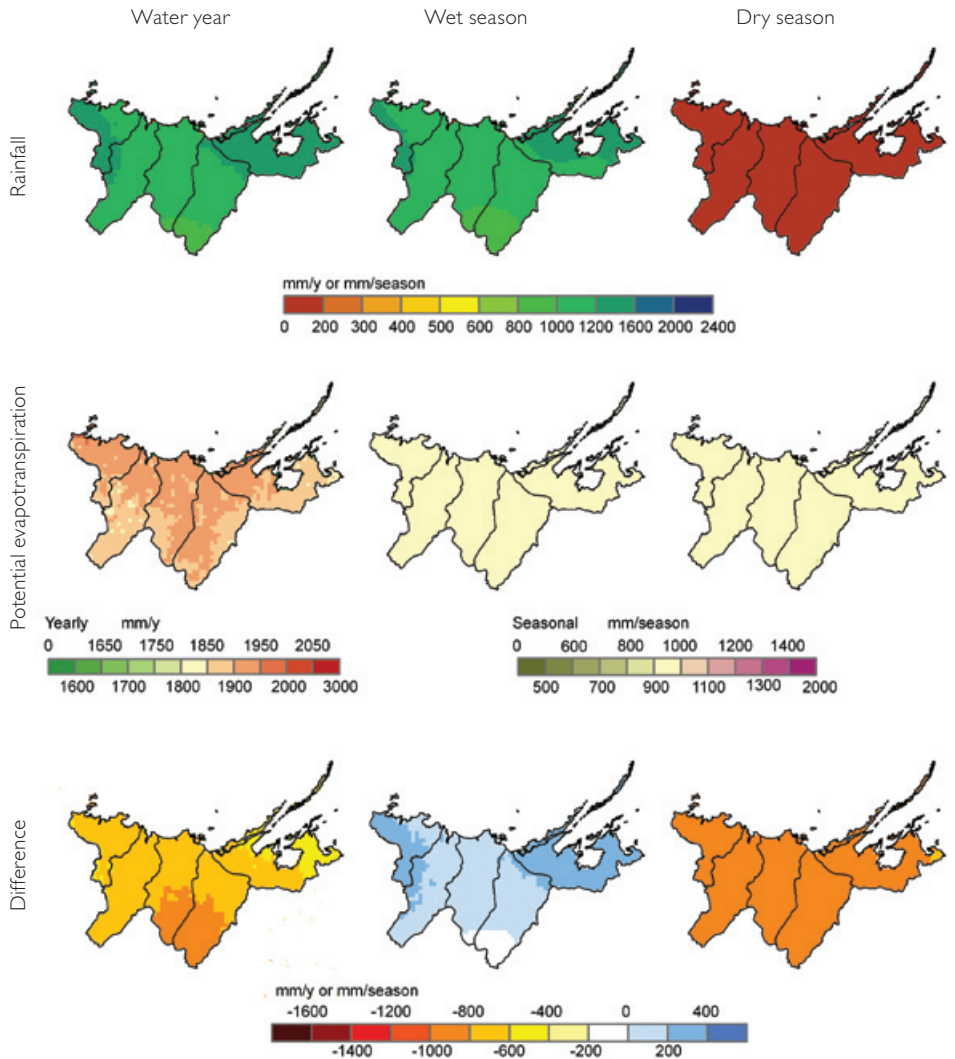
> Distribution of historical mean annual (water year), wet season and dry season rainfall and potential evapotranspiration and their difference (the annual rainfall deficit).
 Water year – September to August;
 wet season – November to April;
 dry season – May to October

> Historical mean annual rainfall, potential evapotranspiration and runoff

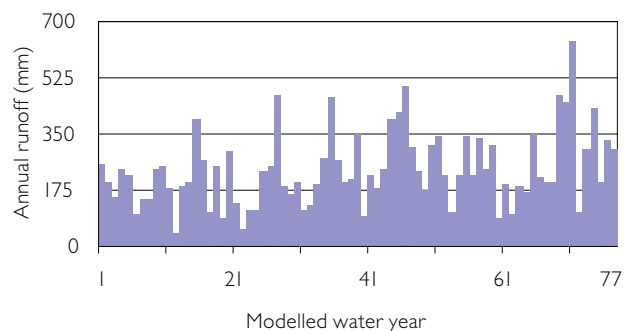
Rainfall	1186 mm
Potential evapotranspiration	1898 mm
Runoff	240 mm (20 % of rainfall)



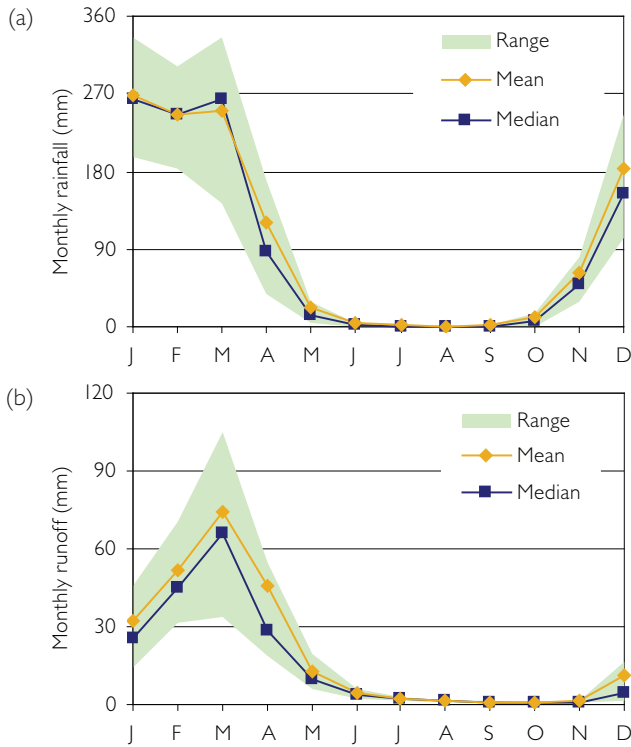
> Divergence of historical annual rainfall from the long-term mean (1930 to 2007)



> Historical annual rainfall (1930 to 2007)



> Annual runoff (modelled)



There is a very strong seasonality in rainfall patterns, with 96 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 hence rapid runoff and short lag between rainfall and runoff with a slightly increasing amount and intensity of rainfall over the historical (1930 to 2007) period.

The Arafura region has a recent (1996 to 2007) climate record that is statistically significantly wetter than the historical (1930 to 2007) record with rainfall 15 percent higher and runoff 38 percent higher. It is likely that future (~2030) conditions will be similar to historical conditions; hence, future runoff and recharge will also be similar to historical levels, and lower than the recent past.

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

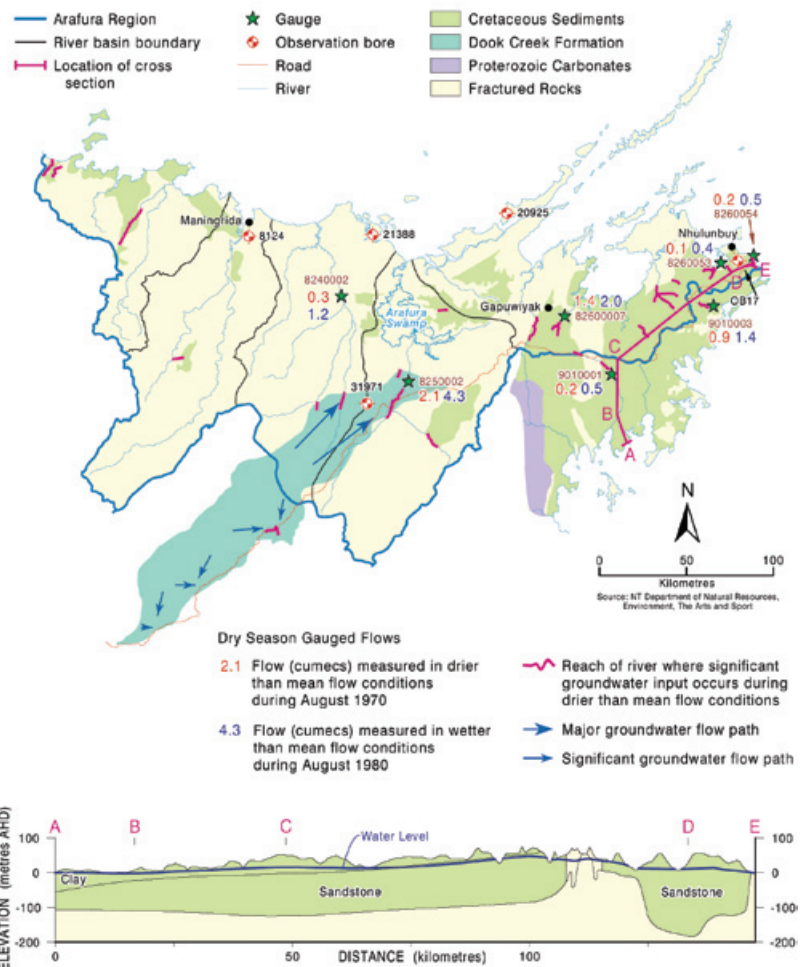
Historical and current water resources

There is a strong north–south rainfall gradient and between 12 and 38 percent of precipitation flows as runoff. The mean annual runoff averaged over the modelled area of the Arafura region is 240 mm, 20 percent of rainfall. Under the historical climate the mean annual streamflow over the Arafura region is estimated to be 10,920 GL.

Annually, potential evapotranspiration is greater than rainfall, and the region is thus water-limited – in other words there is more energy available to remove water than there is water available to be removed. The region is one of only a few, however, that is not water-limited throughout the entire year, with wet season rain exceeding potential evapotranspiration, particularly towards the coast.

There are a number of short perennial rivers in the region, mostly near the coast. These are fed during the dry season by discharge from the shallow Cretaceous sandstone aquifers and outcrops of the Dook Creek Formation, a Proterozoic karstic carbonate sequence. Groundwater extracted for the bauxite mine near Nhulunbuy may be having a significant impact on the perennial Yirrkala Creek and Latram River.

The recent past has been significantly wetter than the long-term record, with fewer low flow days and more high flow days than seen in the historical record.



> Hydrogeology of the Arafura 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.

It is likely that future (~2030) rainfall and potential evapotranspiration will be similar to historical conditions, and future runoff and recharge will also be similar to historical levels, but significantly lower than in the recent past.

None of the environmental assets in this region have any site-specific ecology related flow metrics by which to gauge the potential impacts of future climate and development. However it is likely that future (~2030) climate will be similar to historical climate conditions; therefore, future runoff and recharge will also be similar to historical levels, but lower than the recent past.

Flows are highly dominated by wet season flows with dry season flows only a small fraction of total annual flow. However, environmental assets are adapted to 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. In the recent past there has been significantly more flow, with fewer



> Top end landscape, NT. Courtesy of CSIRO Sustainable Ecosystems

low flow days and more high flow days than the historical record. Annual and seasonal flows do not change much under the median future climate; hence there is little expected change in the number of days of low and high flow. In contrast, there are large changes to the number of high flow days under the dry and wet extreme future climates which could have environmental impacts.

For further information:

Water for a Healthy Country Flagship

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