Water in the Mitchell 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

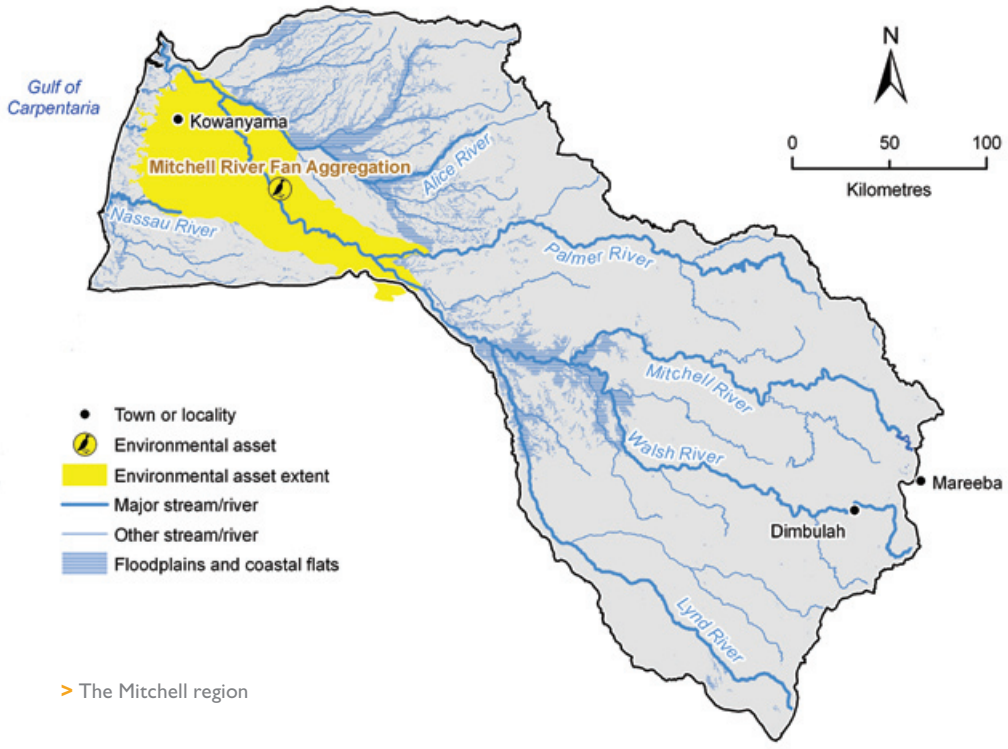
Project overview

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 Mitchell region incorporates the drainage of five major river systems: the Mitchell, Alice, Palmer, Walsh and Lynd. The catchment covers 72,229 km^2 and traverses the base of Cape York. The eastern margin, in the Atherton Tablelands along the Great Dividing Range, extends to within 30 km of the Coral Sea Coast (and 50 km from Cairns).

The rivers flow west 500 km to discharge into the Gulf of Carpentaria 30 km north-east of Kowanyama. They carve rugged gorges through the eastern sedimentary and metamorphic highlands of the Great Dividing Range, flowing west through undulating metamorphic and granitic country and onto Tertiary sediments of the western plains. There they join in the Lower Mitchell Plains, consisting of thick sequences of alluvial sands, silts and clays only a few metres above sea level.



> The Mitchell region

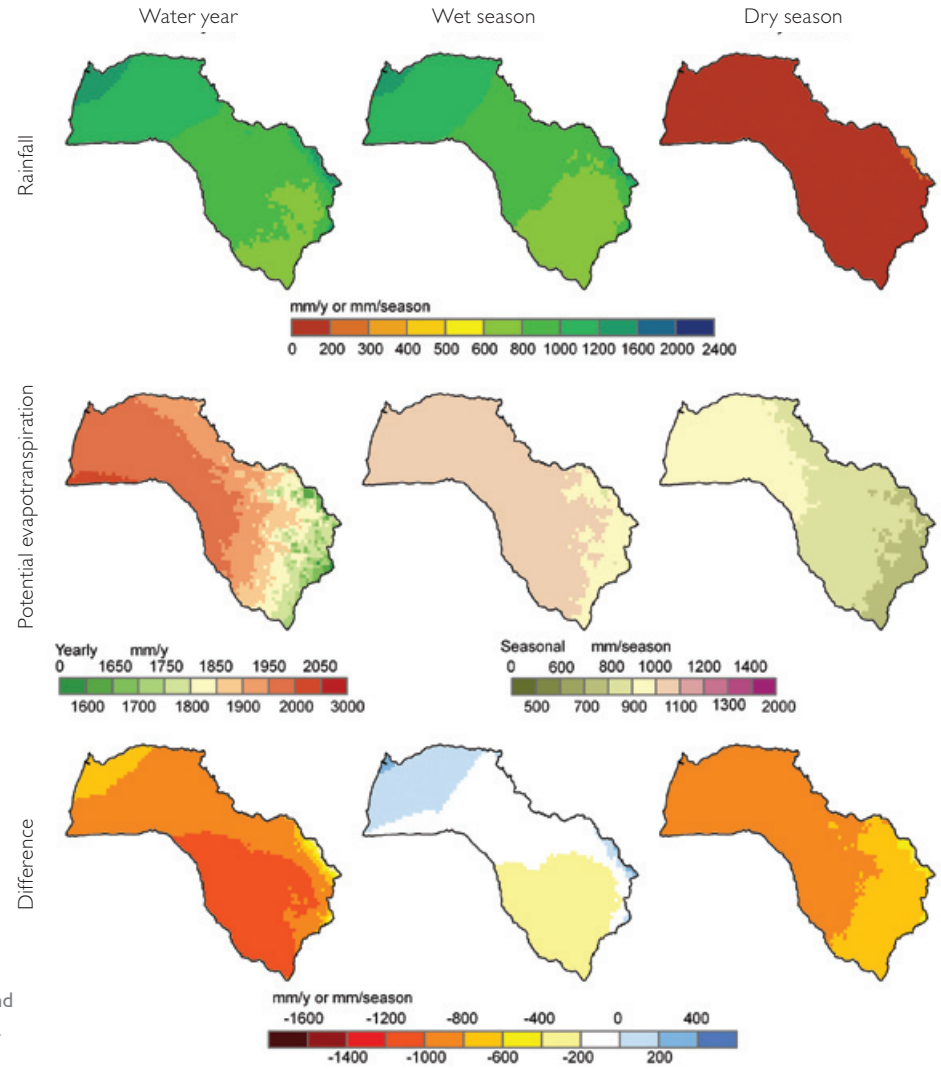
The Mitchell River Fan Aggregation is a disjunct aggregation of freshwater streams and closed depressions and is an outstanding example of a diverse and rich array of alluvial plain wetlands and deep water habitats which provide extensive areas of seasonal, semi-permanent and permanent habitat for a wide range of waterbirds. Much of the area is of high significance to the Indigenous Australians of the area, notably those associated with the Kowanyama Community.

Grazing is the main land use, but locally mining and intensive horticulture are important. Tourism and fishing are also important activities. The population is just over 5600.

Historical and recent climate

The Mitchell region has a high inter-annual variability in rainfall and hence surface water runoff and groundwater recharge. Coefficients of variation are 0.26 and 0.75, respectively. These are moderately high for the regions across northern Australia and reflect multiple years of significantly below average and above average rainfall.

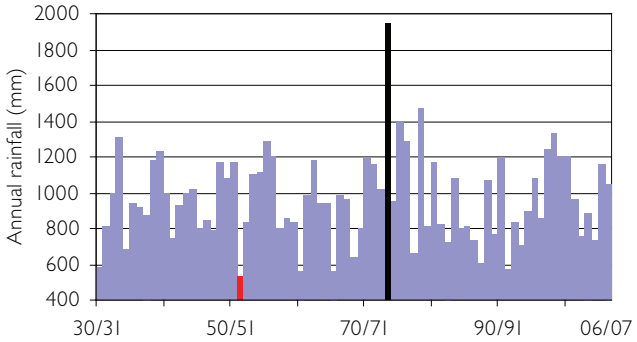
There is a strong seasonality in rainfall patterns, with 95 percent of rain falling in the wet season and a very high dry season potential evapotranspiration. The region has a relatively high rainfall intensity, and hence rapid runoff and short lag between rainfall and runoff with a slightly increasing amount and intensity of rainfall over the period from 1930 to 2007.



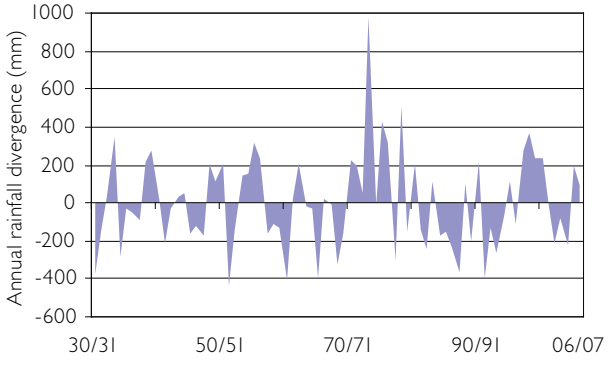
> Distribution of historical mean annual (water year), wet season and dry season rainfall and potential evapotranspiration and their difference (the annual rainfall deficit). Water year – September to August; wet season – November to April; dry season – May to October

> Historical mean annual rainfall, potential evapotranspiration and modelled runoff

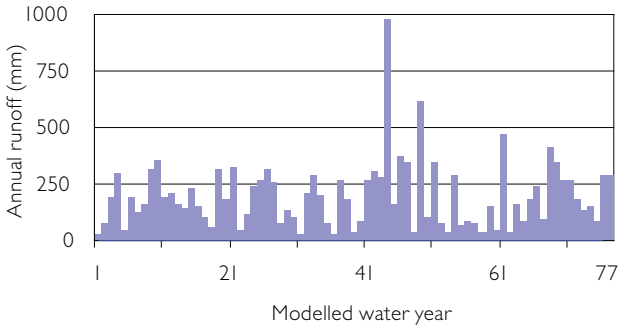
Rainfall	965 mm
Potential evapotranspiration	1905 mm
Runoff	198 mm (30 % of rainfall)



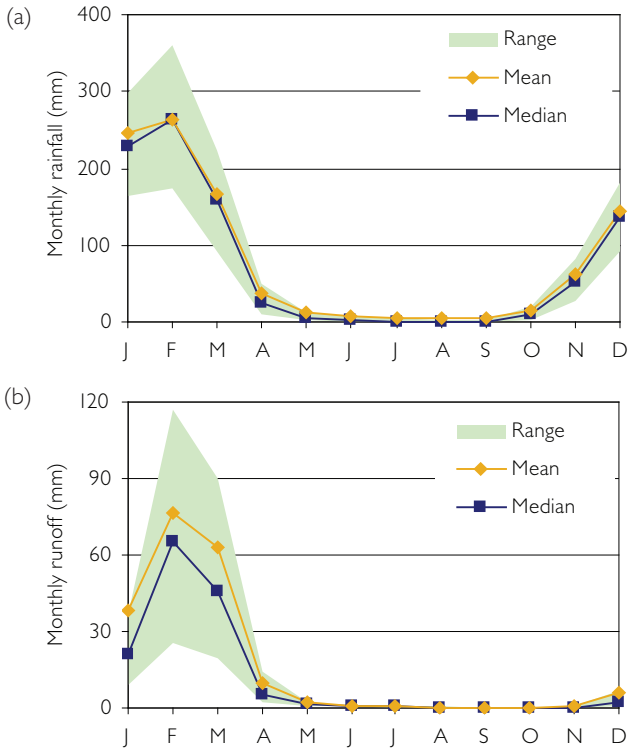
> Historical annual rainfall (1930 to 2007)



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



> Modelled annual runoff



Historical (1930 to 2007) mean annual rainfall for the region is 965 mm. Mean annual potential evapotranspiration is 1905 mm. Annually, potential evapotranspiration is generally greater than rainfall 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 Mitchell region has a recent (1996 to 2007) climate record that is statistically indistinguishable from the historical (1930 to 2007) record in the east, but slightly wetter in the west.

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

Historical and current water resources

In contrast to most rivers of northern Australia, rainfall is highest in the rivers' headwaters and this results in year-round flow, aided towards the end of the dry season by groundwater discharge from Great Artesian Basin springs. These springs provide an important source of water for both environmental and pastoral purposes.

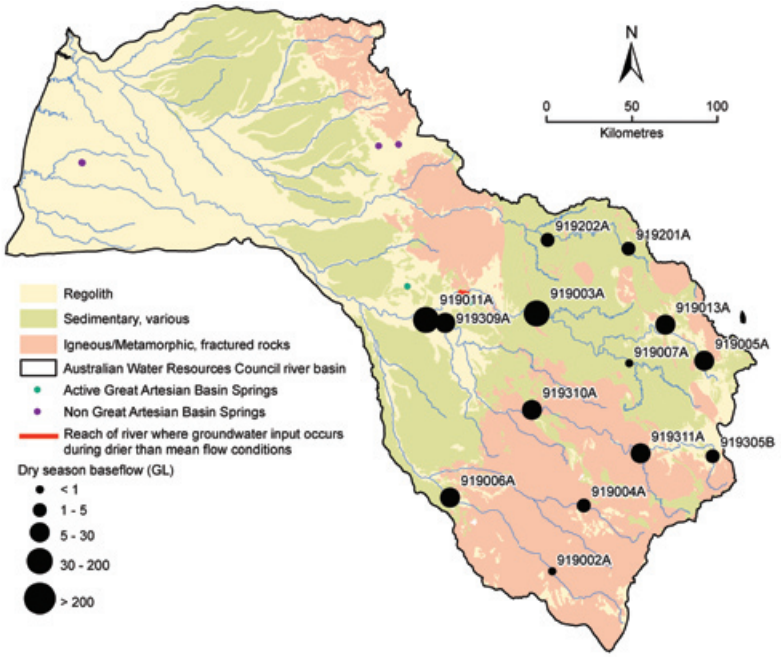
There is a strong east–west rainfall gradient and between 15 and 60 percent of rain flows as runoff. The mean annual runoff averaged over the modelled area of the Mitchell region is 198 mm, 30 percent of rainfall. Rainfall and runoff both decline with distance from the west coast but increase again across the eastern divide. Under the historical climate the mean annual streamflow over the Mitchell region is estimated to be 14,301 GL.

Lower reaches are strongly flood-influenced. Approximately half of the runoff in the Mitchell region is thought to be generated in the ungauged western half of the region. There are few opportunities for surface water storage except in the eastern, wetter headwater areas.

Current average surface water availability is 6786 GL/year and on average about 81 GL/year (or 1 percent) is used. This is a low level of development.

Aquifers within the Great Artesian Basin and deep Tertiary sediments contain the largest storages of water in the region. These aquifers are actively recharged, although much of the recharge occurs remote from the areas of utilisation. Because the Mitchell region is near the bottom end of the onshore Great Artesian Basin system there is some justification for utilising through-flow which would otherwise be lost to submarine discharge, provided seawater intrusion can be avoided and spring flows maintained.

Groundwater resources in other aquifers are limited. The shallow alluvial aquifers are characterised by variable thickness and groundwater quality and are a relatively undeveloped groundwater resource.



> Surface geology of the Mitchell region showing location of spring groups, historical mean dry season baseflow at selected streamflow gauging stations 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 the future (~2030) rainfall conditions will be similar to historical conditions; hence, future runoff and recharge are likely to be similar to historical levels. Future potential evapotranspiration is expected to be slightly (about 1 percent) higher than historical records.

Using a river systems model, under the median future climate modelling results in a 4 percent decrease in water availability and no change to diversions for all water products. The wet extreme climate results in an increase of 41 percent water availability (diversions increase by 1 percent), while the dry extreme climate results in a decrease of 25 percent (diversions decrease by 2 percent). There would be no change in high security uses from Southedge Dam under any climate scenario.

Although low or zero flow days are rare on average, under a dry extreme future climate and full allocation of existing entitlements there is potential for a large (>30 percent) increase in low and zero flow days.

> Pelican on Lake Mitchell, Queensland (November 2006). Courtesy of CSIRO Land and Water

Environmental assets are generally adapted to a strong seasonality and any significant change in the frequency and duration of wet season high flows and dry season low and zero flows is likely to have an environmental impact.

If entitlements are fully allocated, large changes under the wet and dry extreme future climate are likely to disrupt flooding and dry season regimes.

The region is generally data-poor, particularly the lower reaches, which are completely ungauged. Rainfall data across the important headwaters on the Great Dividing Range are also lacking.

For further information:

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