Water in the Fitzroy region

Water for a Healthy Country Flagship

National Research FLAGSHIPS
Water for a Healthy Country

CSIRO

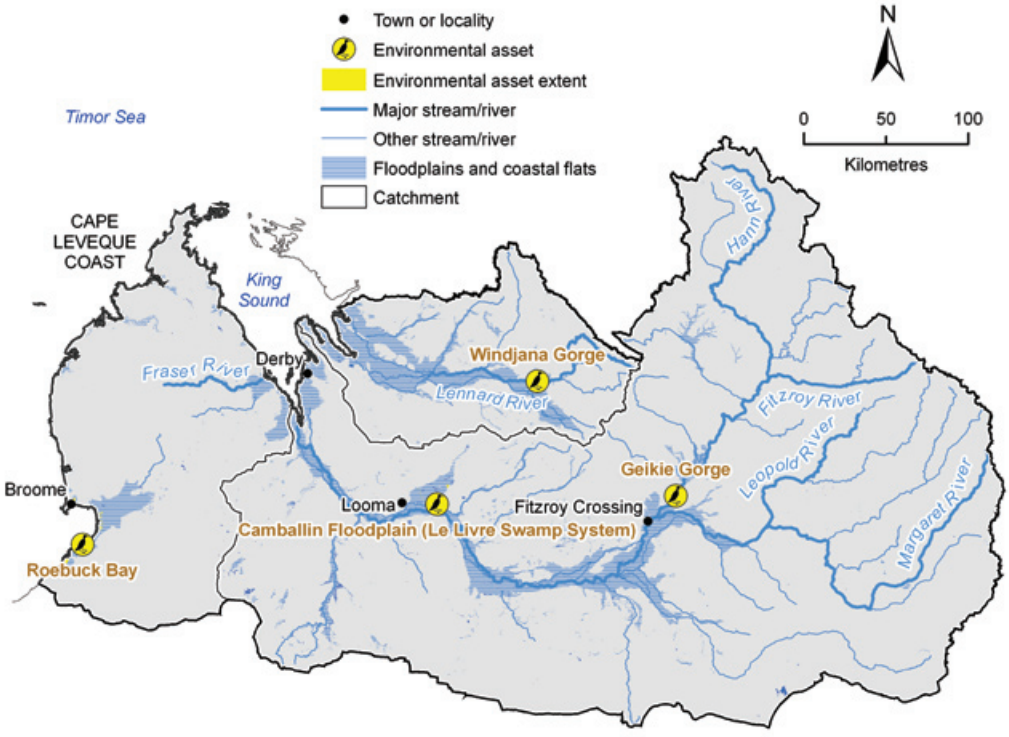
The CSIRO Northern Australia Sustainable Yields Project provides science to underpin the sustainable planning and management of the water resources of northen Australia

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 Fitzroy region comprises the Australian Water Resources Council basins of the Fitzroy River, the Lennard River and the Cape Leveque Coast. The region is bounded to the north by the King Leopold Ranges, an escarpment that separates the Fitzroy region from the Kimberley region. The Fitzroy and Lennard rivers both originate in the King Leopold Ranges and drain west into King Sound. The Fitzroy catchment covers almost 94,000 km^2; the Lennard an additional 15,000 km^2 and the Cape Leveque Coast a further 23,000 km^2. The Fitzroy is the longest river, traversing 730 km from source to coast. During the wet season (November to April), the Fitzroy can swell to extend 15 km across the floodplain, with the alluvial sediments covering over 32,000 km^2 of the catchment.

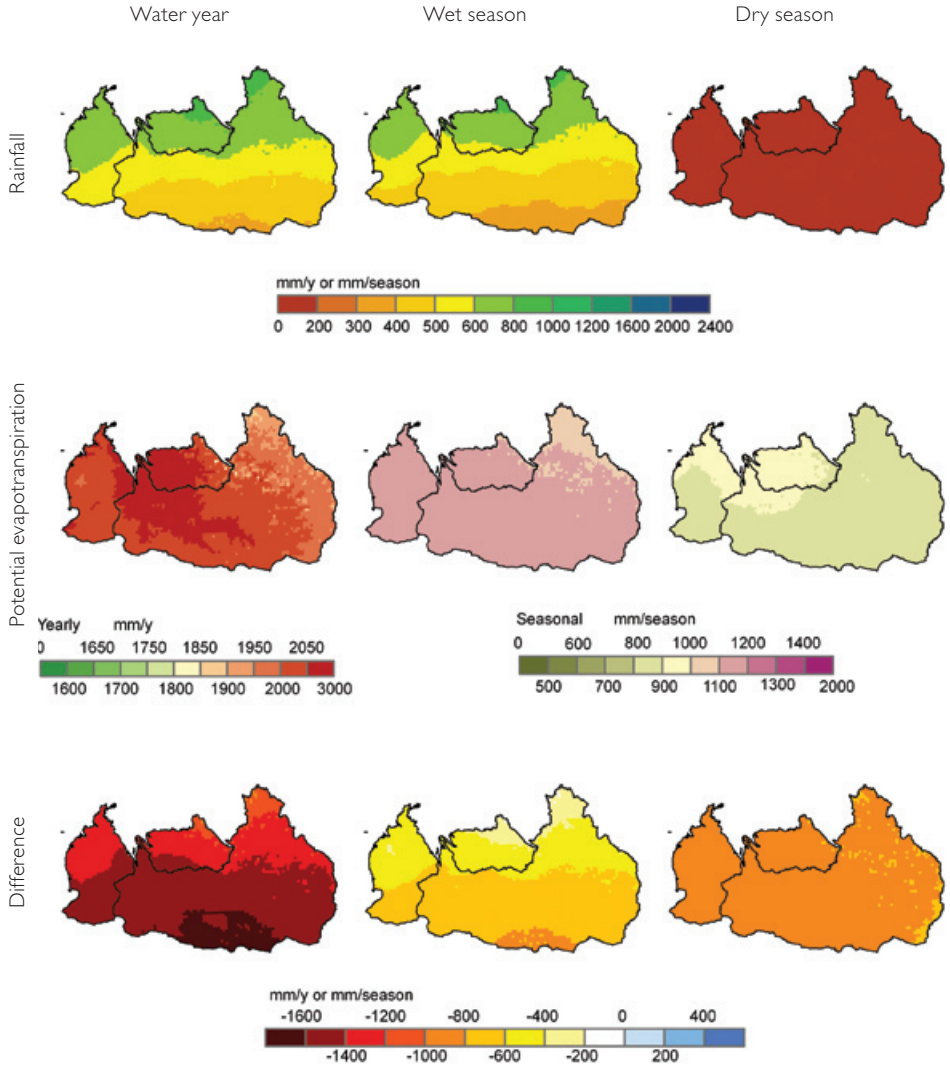


> The Fitzroy region

The region overlies late Palaeozoic to mid-Mesozoic sediments of the Canning Basin, which extends off-shore into the North-West shelf. The surface geology in the north-eastern one-third of the region is dominated by exposed igneous and metamorphic rocks of Proterozoic age, while alluvium dominates the landscape elsewhere.

Historical and recent climate

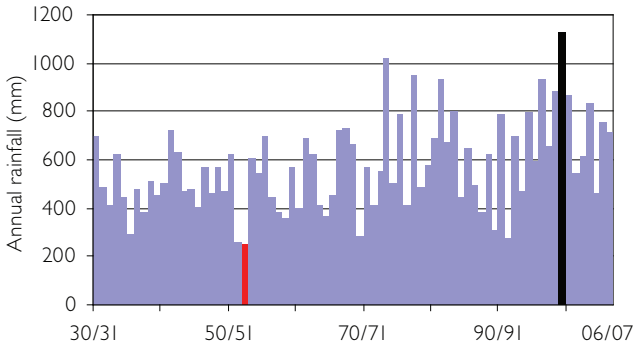
The historical (1930 to 2007) mean annual rainfall for the region is 577 mm. Mean annual potential evapotranspiration is 2023 mm. The mean annual surface water runoff averaged over the modelled area of the Fitzroy region is 76 mm, 14 percent of rainfall. These values are low in comparison to other regions across northern Australia. Under the historical climate the mean annual streamflow over the Fitzroy region is estimated to be 10,000 GL.



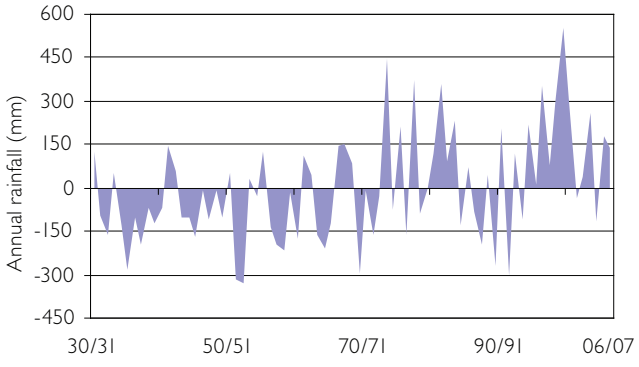
> Distribution of historical mean annual (water year), wet season and dry season rainfall and potential evapotranspiration and their difference (the annual rainfall deficit). Water year – September to August; wet season – November to April; dry season – May to October

> Historical mean annual rainfall, potential evapotranspiration and modelled runoff

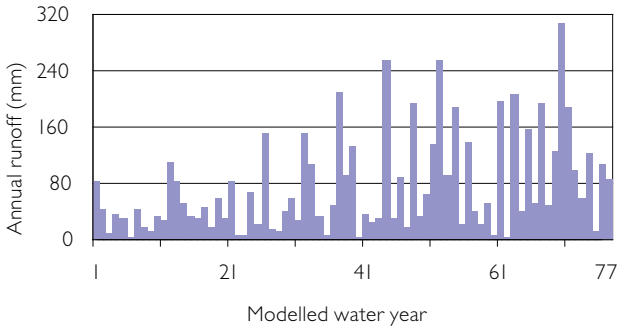
Rainfall	577 mm
Potential evapotranspiration	2023 mm
Runoff	76 mm (14 % of rainfall)



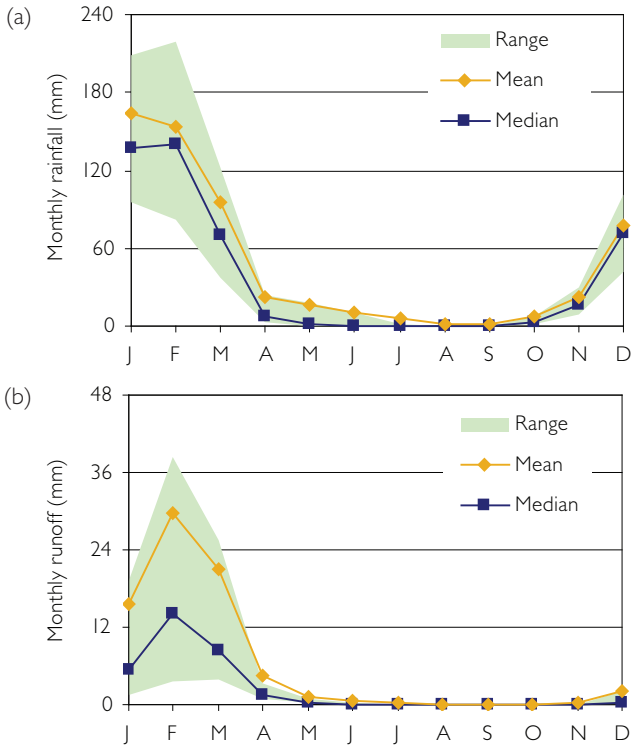
> Historical annual rainfall (1930 to 2007)



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



> Modelled annual runoff



The Fitzroy region has a high inter-annual variability in rainfall (and runoff and recharge). Relative to the rest of northern Australia, coefficients of variation are among the highest of the regions and may result in multiple consecutive years of significantly below, or above, average rainfall.

There is a strong seasonality in rainfall patterns, with 93 percent of rain falling in the wet season, and a very high dry season potential evapotranspiration. The region has relatively high rainfall intensities, and this is reflected in rapid runoff and a short lag between rainfall and runoff. Ninety-seven percent of runoff occurs between the months of December and April. There has been a slightly increasing amount and intensity of rainfall over the period from 1930 to 2007.

The recent (1996 to 2007) climate record is statistically significantly wetter than the historical (1930 to 2007) record with rainfall 31 percent higher and runoff 53 percent higher.

> 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.

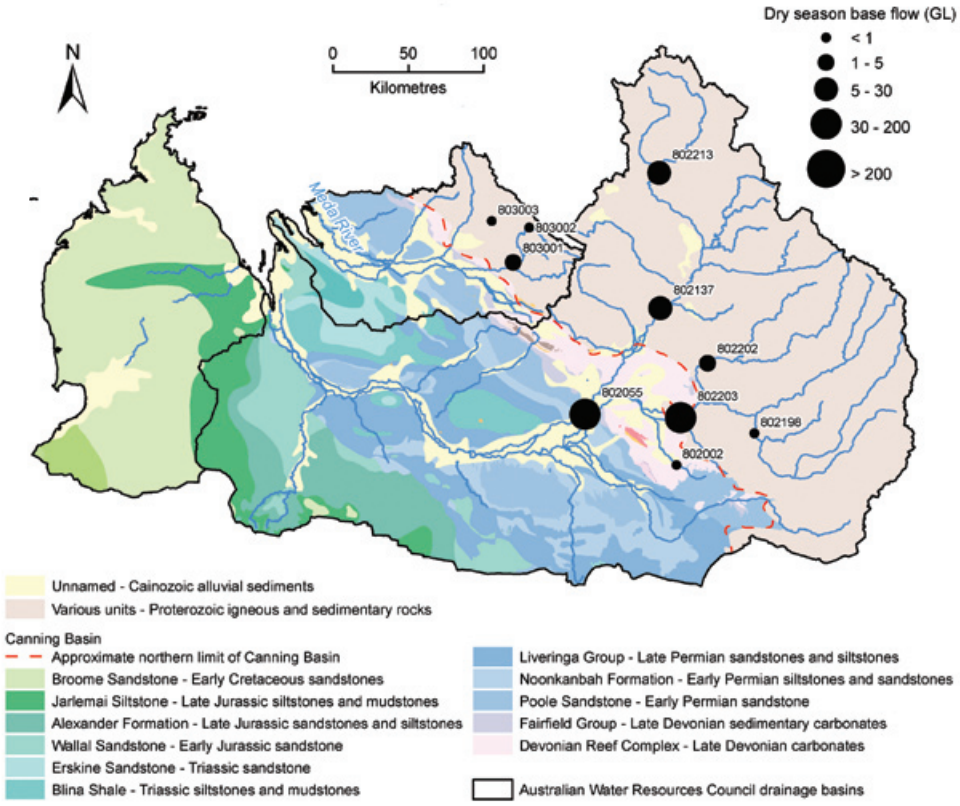
Potential evapotranspiration is annually greater than rainfall; hence the region may be considered water-limited. This is the case throughout the year, with only short periods during the wet months when rainfall exceeds potential evapotranspiration.

Deep Canning Basin aquifers contain the largest storage of groundwater, but limited data mean quantification of this resource is not possible. The shallow alluvial aquifers are characterised by variable thickness and groundwater quality and are limited as a resource by the volume of river recharge. It is a relatively undeveloped groundwater resource.

There is an intricate interaction between surface and groundwaters; river valleys are frequently flooded during the wet season and the region is groundwater-dependent in the dry. Pools are maintained into the dry season via shallow sub-surface flow, with sand bars partitioning the rivers in the region.

At environmental assets, 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.

There are few opportunities for surface water storage, except in the eastern, wetter headwater areas. Storage sites in the lower reaches are flood dominated and estuaries experience high tidal ranges.



> Surface geology of the Fitzroy 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.

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

Annual and seasonal stream flows are not expected to change much under the median future climate; hence there is little change in the flow regimes expected under flooding and near-dry conditions.

Under the wet and dry extreme future climates, however, there are large changes to flow likely to disrupt flooding and dry season regimes, respectively, and this could have environmental impacts.

Analysis of flows for the Camballin Barrage on the Fitzroy River shows that opportunities for fish passage were more frequent in the recent past and would be restricted under the dry extreme future climate.

This assessment of water resources is based on existing but limited data available for the region.

> Derby Estuary. Courtesy of CSIRO Land and Water

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