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Water in the Northern North-East Coast Drainage Division

Water for a Healthy Country Flagship

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Water for a Healthy Country

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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.

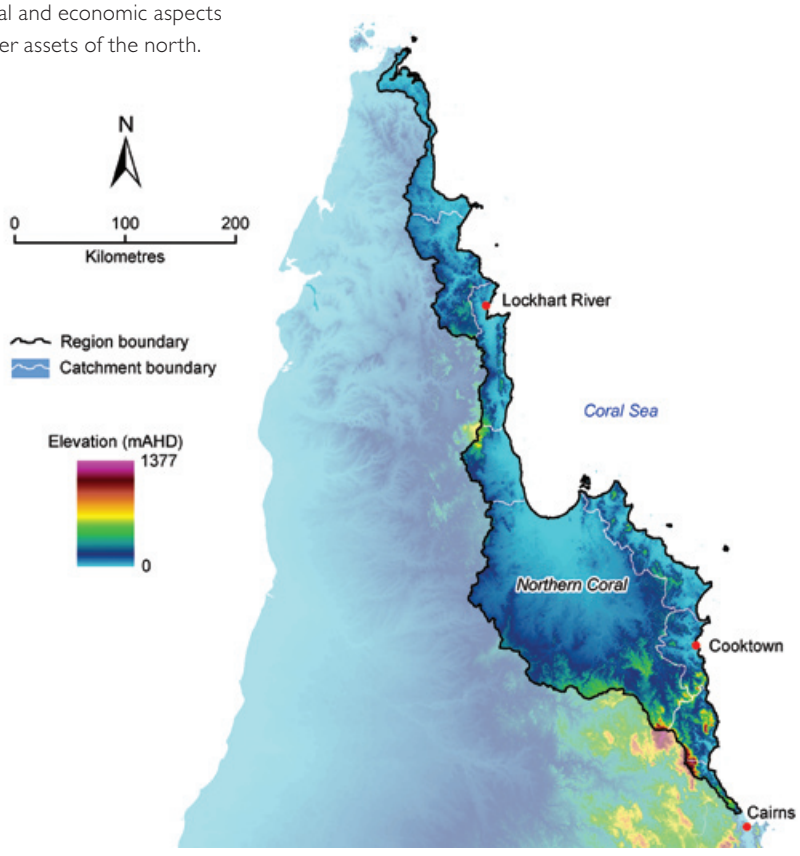
The drainage division

The Northern North-East Coast Drainage Division consists of nine river basins, the largest being Normanby at just under 25,000 km^2, and the rest around 3000 km^2. The coast rises steeply to the Great Dividing Range and the division receives substantial rainfall where air is forced to rise over the range in addition to the monsoonal and trade wind-derived rain.

The climate is tropical with high temperatures year-round and high, yet very seasonal, average rainfall.

A distinct wet season extends from November to April when rainfall averages around 137 mm/month. In the dry season (May to October) an average of only 8 mm/month is received. Ninety-two percent of annual rain falls during the wet season.

Rainfall decreases rapidly away from the east coast. Rainfall averaged over the water year (September to August) ranges from 600 mm at most inland sites, with some of the highest rainfall sites in Australia situated in the south-east corner of the area, with annual rainfall in excess of 2400 mm. Further to the south-west of the area, the climate becomes hotter and more arid and rainfall becomes less seasonal.



> The Northern North-East Coast Drainage Division

Potential evapotranspiration rates are high year-round. Annually, rainfall is usually less than potential evapotranspiration, so the area may be described as water-limited. The far south-east, however, does receive more rainfall on average during the year than can be potentially evaporated, and a small region of wet tropics occurs in this area.

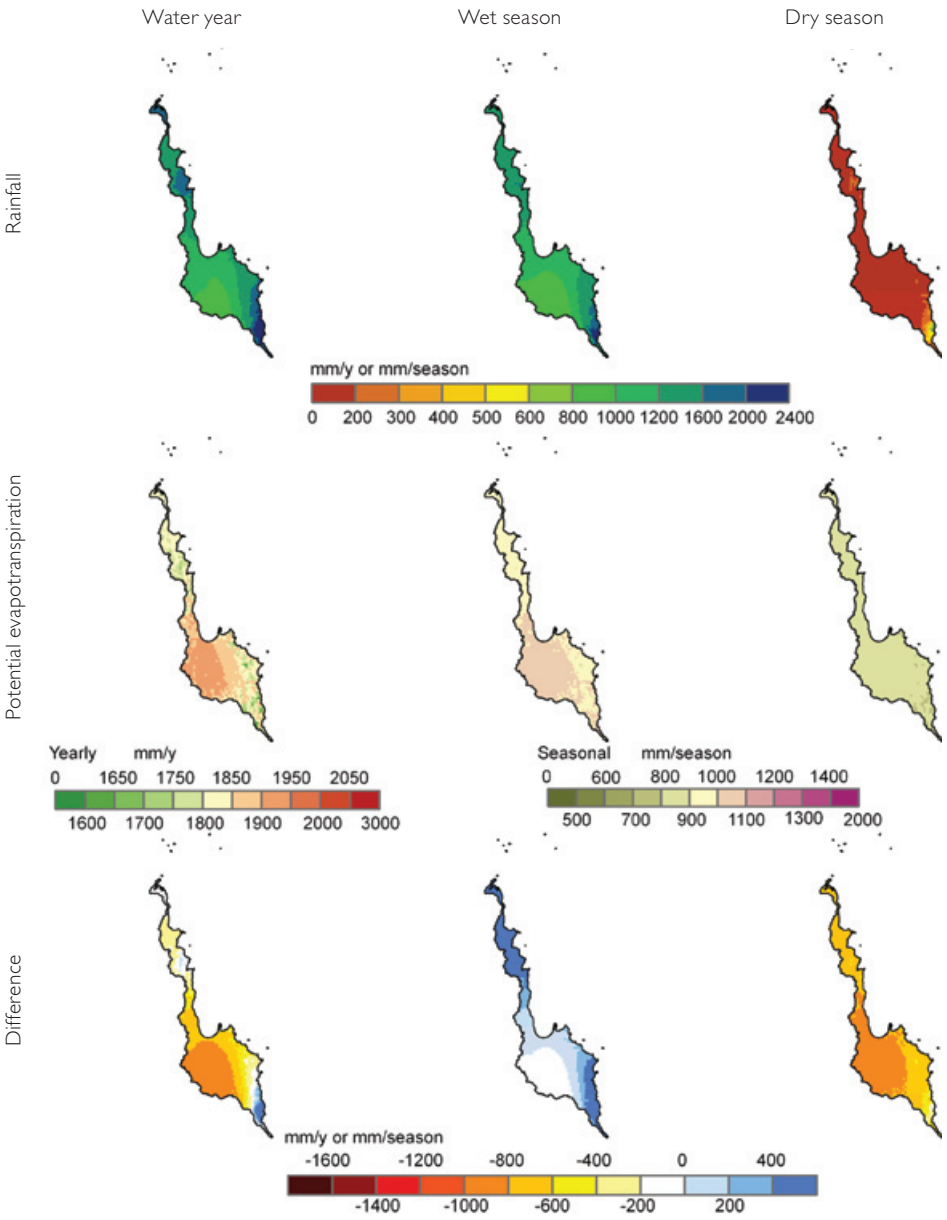
All of the division's wetlands are important for ecological reasons or because they have historical significance or high cultural value, particularly to Indigenous people, or a combination of these reasons.

Many of the larger rivers in the division area stop flowing during the dry months.

Historical and recent climate trends

For most of the area, the recent climate (1996 to 2007) has not been significantly different (statistically) to the historical climate (1930 to 2007). The wettest year was 1974, with 2143 mm. The driest year was 1961, with 769 mm. Potential transpiration was highest in 1992 and lowest in 1945.

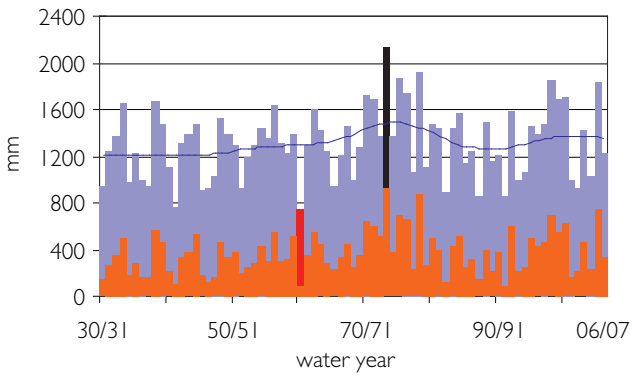
In the northern catchments, there has been a slight increase in rainfall intensity over the historical period with a slight increase both in rain days and rainfall per day.



> 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 (1930 to 2007) climate in the Northern North-East Coast Drainage Division

Mean annual rainfall	1338 mm
Mean annual potential evapotranspiration	1853 mm
Mean annual rainfall range	917 to 3640 mm
Rain falling in the wet season	92 %
Mean annual volume of rain	62,000 GL
Mean annual streamflow	17,000 GL



> Historical annual rainfall (blue) and modelled runoff (orange) averaged over the Northern North-East Coast Drainage Division. The trend line indicates longer term variability; highest and lowest rainfall years are indicated

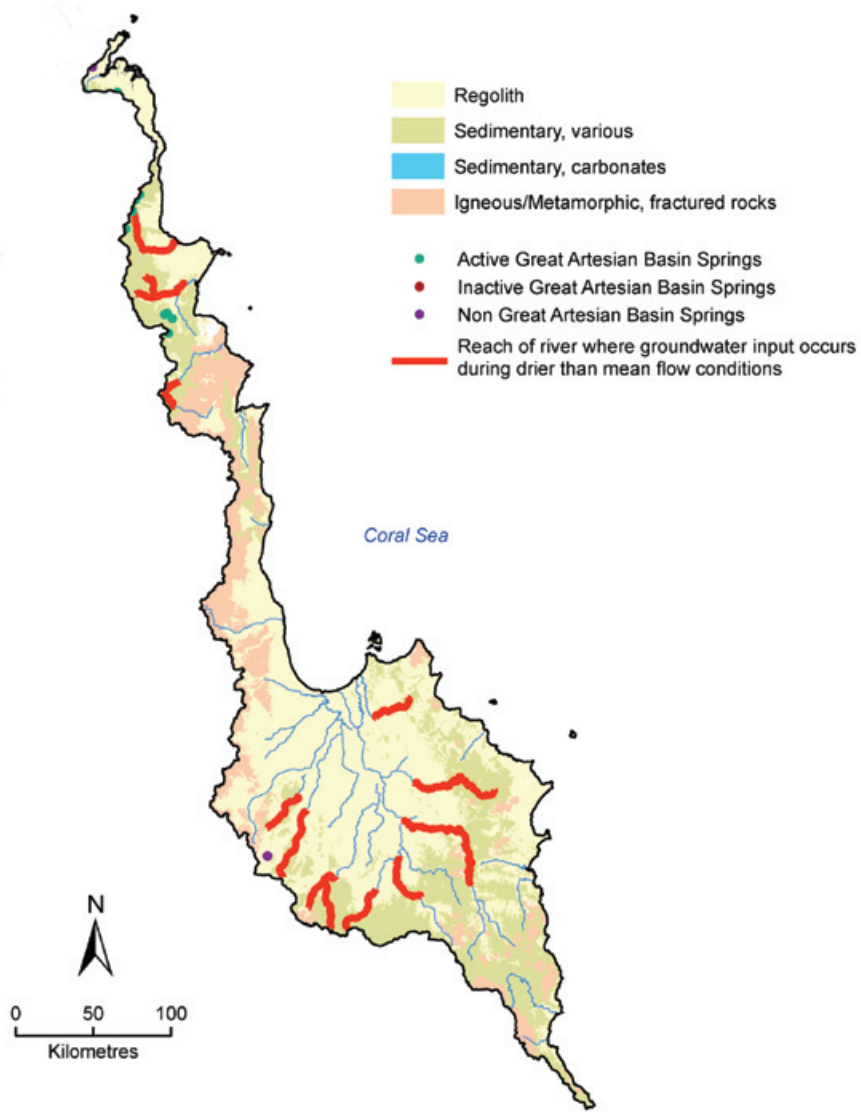
> Cloud covered Thornton Peak with sugarcane in foreground, north-east Queensland. Courtesy of CSIRO Publishing

Historical and current water resources

Most rivers in the project area do not flow during the dry months. The few that do are mostly driven by shallow groundwater systems, or discharging artesian springs. Shallow groundwater systems, however, are generally variable both in storage capacity and water quality, both spatially and temporally.

Rivers across the project area are dominated by flood conditions during the wet season and much of the area is inundated near the coast and for many kilometres inland.

Groundwater recharge is strongly seasonal and, with rapid runoff of rainfall, recharge rates are low.



> Surface geology of the Northern North-East Coast Drainage Division, showing spring groups and reaches of river that remain perennial under drier than average conditions

What the future holds

The future (~2030) climate is expected to be similar to the historical climate. Modelling gives a future range of between 9 percent lower and 13 percent higher rainfall. Potential evapotranspiration increases under all future scenarios, possibly up to 4 percent relative to the historical climate.

Extreme rainfall events are expected to increase along the northern coast, particularly in the northern Cape region.

Runoff is affected more by rainfall than by potential evapotranspiration. So, despite higher future potential evapotranspiration, future runoff is expected to be similar to historical runoff.

Uncertainty in rainfall projections makes it difficult to confidently predicta streamflow and water availability.

Recharge is expected to be similar to historical levels.

There is high relief away from the coast, so the potential for surface water storage is good, but high evaporation rates mean that storages can rarely be large enough to survive through the dry season.

The project area has six rivers that are either proposed or potential wild rivers and are to be maintained in a near-pristine state. None have quantitative river models that might be used for managing and allocating water resources.

Because groundwater recharge rates are low, there are limited groundwater storage opportunities. The greatest stores of groundwater are in the deep aquifers. There are insufficient data, however, to adequately quantify the amount stored, recharge rates and sustainable extractable yields. These storages are largely undeveloped.

The Great Artesian Basin is recharged through outcrops along the Great Dividing Range on the western margin of the area. Rejected recharge (rainfall that enters the ground but fails to recharge the aquifer) and artesian conditions result in spring discharge in the project area.

The Gilbert River Formation (and equivalents) of the Great Artesian Basin may provide opportunities for medium-scale groundwater extraction (10 to 100 gigalitres/year). There is large uncertainty, however, about the volumes of water that could be extracted.

The few perennial rivers are supplied through the dry season by discharging groundwater, mostly from Great Artesian Basin springs, particularly in the west of the project area. Rejected recharge along the Great Artesian Basin intake beds can supply streamflow throughout the year, especially in the north. Extracting groundwater in the vicinity of these springs can, therefore, have a significant impact on surface-water supplies and flow.

There is an intricate balance between surface and groundwater flows and the environmental regimes they support, resulting in a high level of endemic species across the project area.

> Future (~2030) climate compared to historical (1930 to 2007) climate

Mean annual rainfall	similar (1350 mm)
Mean annual potential evapotranspiration	slightly higher (by up to 4 %)
Rain falling in the wet season	slightly lower (91 %)
Mean annual streamflow	similar
Mean annual recharge to groundwater	similar

For further information:

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