Water in the Gulf of Carpentaria Drainage Division

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.

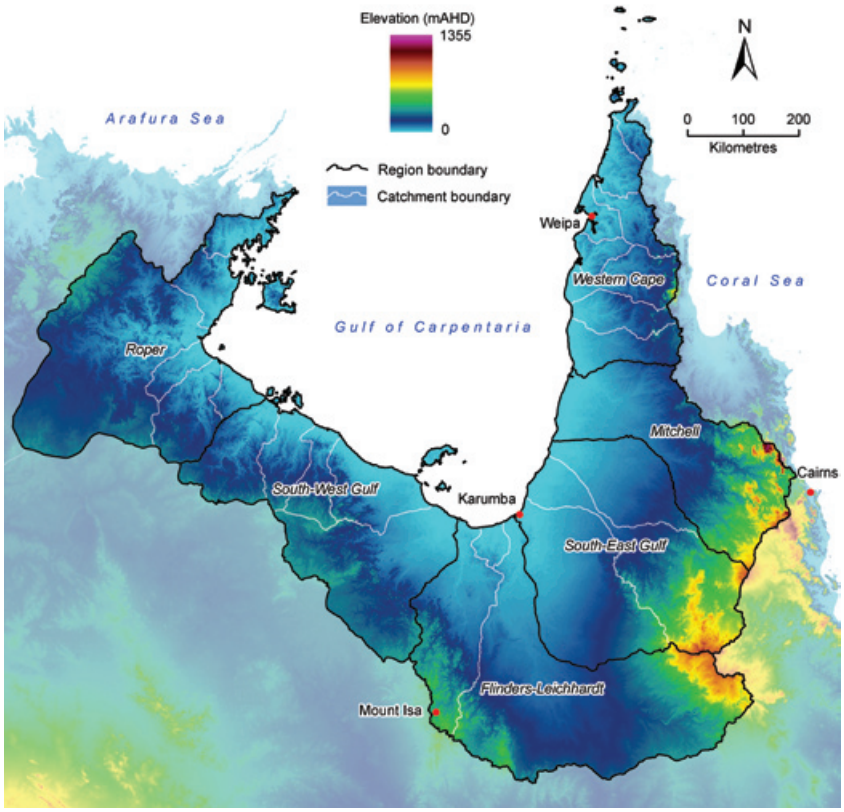
The drainage division

The Gulf of Carpentaria is the large, shallow sea enclosed on three sides by northern Australia, and bounded on the north by the Arafura Sea. Much of the region draining into the Gulf comprises floodplains and is generally flat and low-lying, resulting in significant tidal flooding during the wet season.

The climate is hot and humid with two seasons per year. The dry season runs from about April to November; the wet season from December to March. Almost all rainfall falls in two or three months of the year.

Rainfall decreases rapidly away from the northern coast. Average wet-season rainfall ranges between 300 mm in the south up to 1800 mm in the north with moderate-to-high variability year-to-year. Potential evapotranspiration rates are high year-round. Annually, rainfall is usually less than potential evapotranspiration, so the drainage division may be described as water-limited.

Gulf Country rivers, though mostly fairly short, are very large by Australian standards and carry a quarter of the continent's total yearly streamflow. Most rivers, however, flow only during the short wet season. So all perennial rivers and perennial springs are important sources of water, and most are also sacred sites.



> The Gulf of Carpentaria Drainage Division and its six regions

Grazing is the dominant land use. There are significant areas of nature conservation, Indigenous land use and forestry. Most income is generated by mining. The fishing industry is also a major employer.

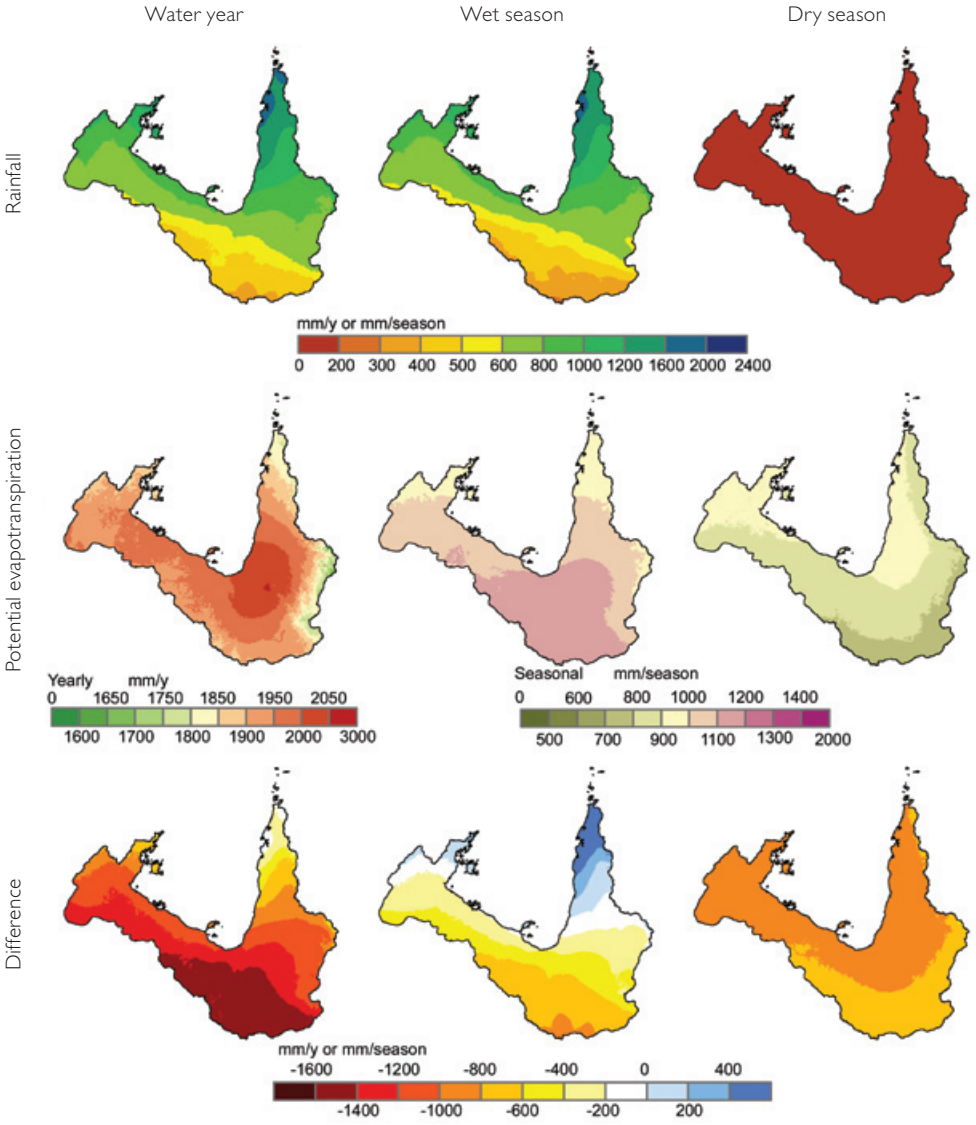
All of the drainage division's wetlands are important for ecological reasons or because they have historical significance or high cultural value, particularly to Indigenous people, or a combination of these reasons.

Historical and recent climate trends

For most of the drainage division, the recent (1996 to 2007) climate has not been significantly different to the historical climate (1930 to 2007). The far west and north, however, have been significantly wetter, and the division-average rainfall for the last 11 years has been greater than for the previous 66 years. The wettest year for the Roper and South-West Gulf regions occurred in 2001; for the Western Cape it was 1999. The south of the drainage division, however, experienced its wettest year in 1974, with the last 11 years being neither wetter nor drier than historical conditions. The driest year throughout the drainage division was 1952.

Potential evapotranspiration was highest in 1992 and lowest in 1974, though the mid-1930s were hot for the south and south-east of the drainage division.

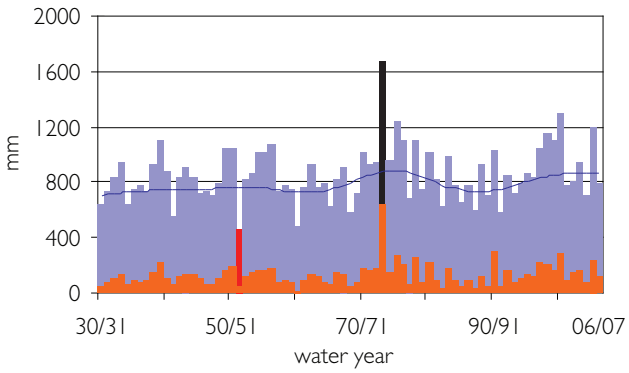
In the northern catchments, there has been a slight increase in rainfall intensity in the last 77 years, with a slight increase both in rain days and rainfall per day.



> 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 Gulf of Carpentaria Drainage Division

Mean annual rainfall	779 mm
Mean annual potential evapotranspiration	1939 mm
Mean annual rainfall range	334–1806 mm
Rain falling in the wet season	94 %
Mean annual volume of rain	510,000 GL
Mean annual streamflow	91,000 GL



> Historical annual rainfall (blue) and modelled runoff (orange) averaged over the Gulf of Carpentaria Drainage Division. The trend line indicates longer term variability; highest and lowest rainfall years are indicated

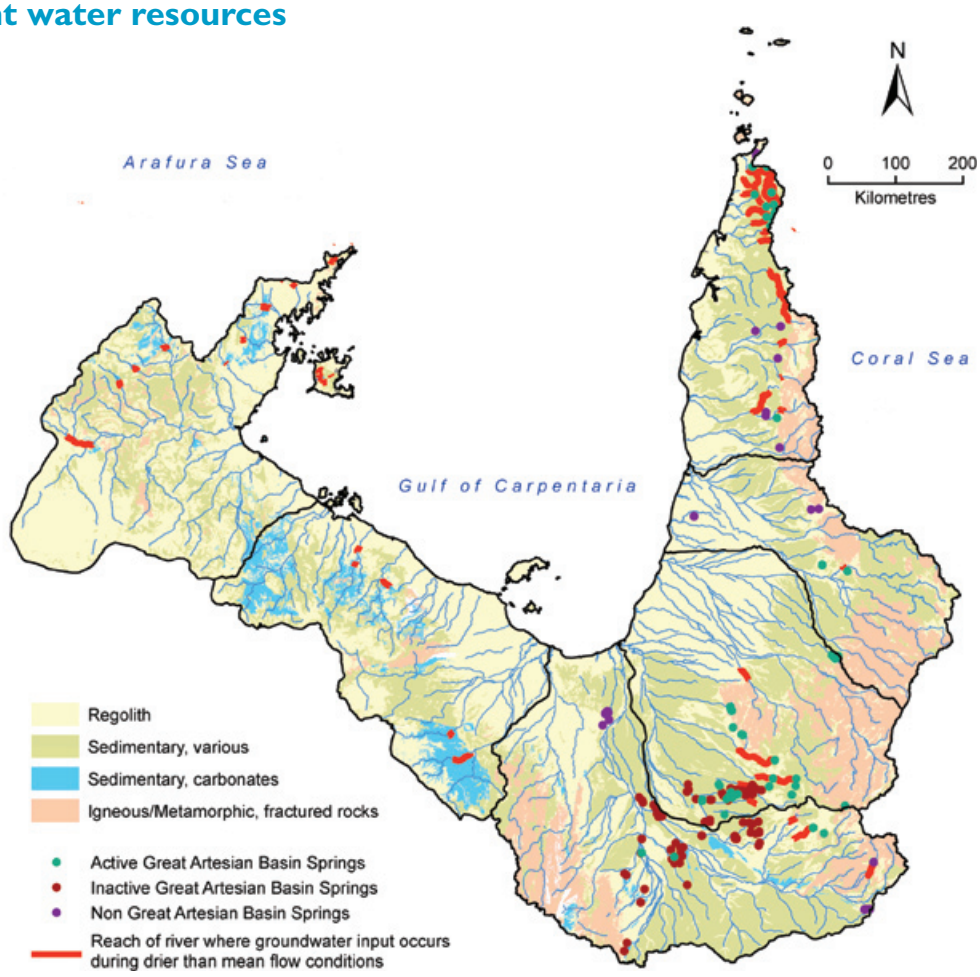
> Sun setting on cattle amongst the spinifex near Hughenden, Queensland. Courtesy of CSIRO Land and Water

Historical and current water resources

Most rivers in the drainage division 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 drainage division are dominated by flood conditions during the wet season and much of the drainage division is inundated near the coast and for many kilometres inland.

With rapid runoff of rainfall, groundwater recharge rates are low. The Great Artesian Basin is recharged through outcrops along the Great Dividing Range to the east of the drainage division. Rejected recharge (rainfall that enters the ground but fails to recharge the aquifer) and artesian conditions result in spring discharge in the drainage division. The greatest stores of groundwater are in the deep aquifers. These storages are largely undeveloped.



> Surface geology of the Gulf of Carpentaria Drainage Division showing location of 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 7 percent lower and 7 percent higher rainfall. Potential evapotranspiration increases under all future climate 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 north of the Western 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 project streamflow and water availability.

Recharge is expected to be similar to historical levels.

Because of the extremely high evaporation rates, most development will require water storages that are large enough to supply water for many years. The low gradients and generally flat landscape do not provide for good surface water storage, except in the headwater regions where rainfall is lower; so storages have to be large enough to withstand long periods of below-average rainfall.

Many rivers in the drainage division have been declared as wild rivers and are to be maintained in a near-pristine state. Others have quantitative river models used for managing and allocating water resources. Therefore, future development will occur under careful management regimes.

There are insufficient data to adequately quantify the amount of groundwater stored, recharge rates and sustainable extractable yields.

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 drainage division.

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

Mean annual rainfall	slightly drier (777 mm)
Mean annual potential evapotranspiration	slightly higher (by up to 4 %)
Rain falling in the wet season	slightly lower (93%)
Mean annual streamflow	similar
Mean annual recharge to groundwater	similar

> Minyerri waterhole, NT. Courtesy of NRETAS

For further information:

Water for a Healthy Country Flagship
Project Leader
Dr Richard Cresswell
Phone: 07 3214 2767
Email: Richard.Cresswell@csiro.au
Web: www.csiro.au/partnerships/NASY

Northern Australia Water Futures Assessment
Department of the Environment, Water, Heritage and the Arts
Phone: 02 6274 1111
Email: northern.assessment@environment.gov.au
Web: http://www.environment.gov.au/nawfa

AUGUST 2009

Printed on recycled paper

VRU 2009 • NASY_GC_Factsheet.indd

Contact Us
Phone: 1300 363 400
+61 3 9545 2176
Email: enquiries@csiro.au
Web: www.csiro.au/flagships

Australian Government
National Water Commission
Raising National Water Standards Program

CSIRO and the Flagships program

Australia is founding its future on science and innovation. Its national science agency, CSIRO is a powerhouse of ideas, technologies and skills. CSIRO initiated the National Research Flagships to address Australia's major research challenges and opportunities. They apply large scale, long term, multidisciplinary science and aim for widespread adoption of solutions.