Research Project Sheet
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CSIRO

Land and Water

Understanding the fate of nitrogen in the Lower Burdekin

A recent study of nitrogen levels in Queensland's Lower Burdekin groundwater systems has raised new questions about the fate, and likely impact, of nitrogen used in farming.

The good news is that a natural process called denitrification - where nitrate in groundwater is converted to nitrogen gas, could be helping to reduce groundwater contamination.

Iron deposits can regularly be seen in furrow irrigated sugar cane crops. Iron might be useful in helping remove nitrates from groundwater

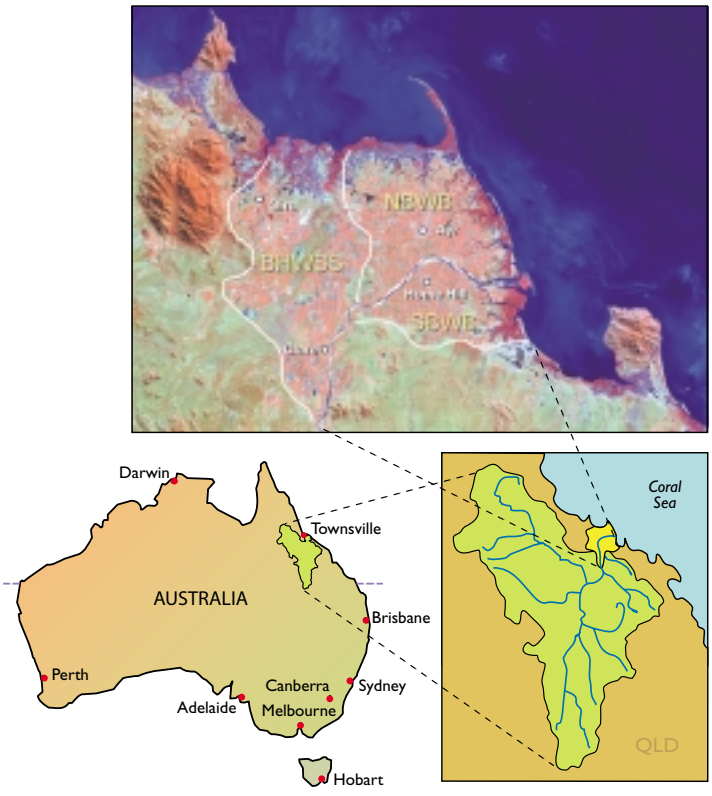
Applying nitrogen fertiliser to sugarcane

Why is nitrate a concern?

When nitrogen (or nitrate) from fertilisers enters our waterways it can trigger the growth of aquatic plants and algae, which can clog water intakes, use up dissolved oxygen, and block light to deeper waters.

Groundwater contamination by nitrates affects the health of fish and aquatic invertebrates, and can reduce animal and plant diversity.

Because excessive nitrate levels in drinking water can be harmful to infants, this is a concern for those farms and communities in the Burdekin that rely on groundwater pumped from bores.



***The Burdekin River delta** - situated approx 90 kms southeast of Townsville in north Queensland - is home to environmentally sensitive wetlands, waterways and estuaries, and is adjacent to the Great Barrier Reef Lagoon (GBRL), North Burdekin Water Board (NBWB), South Burdekin Water Board (SBWB), Burdekin/Haughton Water Supply Scheme (BHWSS)*

What is the extent of the problem?

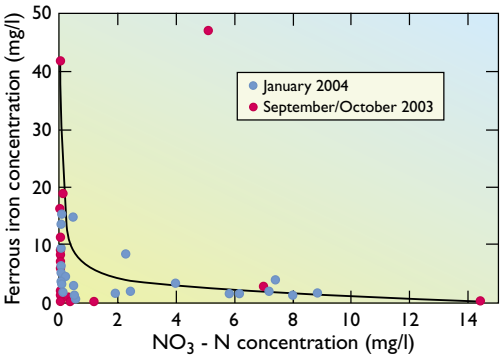
Nitrate-nitrogen levels of 5 mg L^{-1} in groundwater have been set by the Australia New Zealand Environment and Conservation Council (ANZECC) as a guideline for long term environmental sustainability. Twelve percent of the bores sampled in the Burdekin have exceeded this limit.

Are there management solutions?

CSIRO, in partnership with the CRC for Irrigation Futures and other organisations, are identifying conditions that facilitate denitrification.

Researchers have found that this process is aided by denitrifying bacteria in the presence of dissolved organic carbon, ferrous iron, or pyrite (when no oxygen is available).

Ferrous iron is of particular interest because it is naturally available in many parts of the lower Burdekin groundwater systems – a telltale sign being the 'rusty' appearance of irrigation water drawn from some bores.



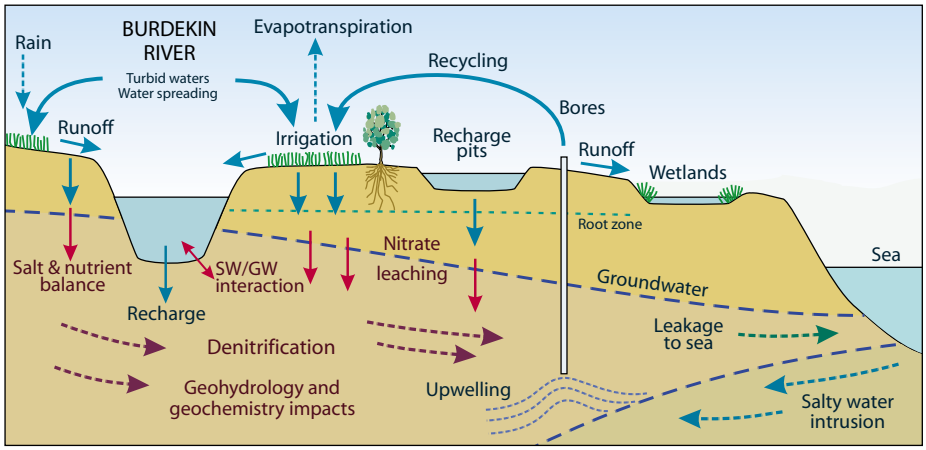
The CSIRO team sampled and analysed 57 bores in the region during September to October 2003 and in January 2004. The samples with the lowest nitrate concentration came from water that showed higher levels of ferrous iron.

Results show that conditions favourable to denitrification exist in the Lower Burdekin region, and that the shallow groundwater systems have greater potential for denitrification than deeper groundwater systems. This research suggests that nitrate levels in groundwater could be reduced before groundwater is discharged into the Great Barrier Reef Lagoon.

What are the next steps?

Denitrification and the associated loss of nitrogen from the groundwater has significant implications for coastal agriculture and its impacts on the Great Barrier Reef Lagoon.

Ongoing studies in the region will be conducted to confirm the processes involved and ascertain the quantity of nitrogen likely to be 'consumed' by denitrification.



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Cooperative Research Centre for IRRIGATION FUTURES

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