

Herbicides threaten north Queensland's coastal mangroves

The intensive agriculture of north Queensland has recently become known for its downstream environmental impacts. Now a new threat is looming. Researchers have recently discovered that a common agricultural herbicide, diuron, is correlated with the severe dieback of common grey mangroves (*Avicennia marina*), a widespread species integral to coastal ecosystems of the north.

Back in 1993, concerned Mackay fishermen contacted Sunfish Queensland (Queensland's peak recreational fishing body) about the mangrove deaths they were seeing in the region's estuaries. Initially, a major cause was thought to be pollution from a nearby sewage treatment plant. However, Noel Whitehead, a Sunfish representative and member of the Mackay Marine Advisory Committee says, 'articles on the internet about using mangroves to treat sewage in artificial wetlands made me wonder if this was the only cause.'

When, in recent years the situation worsened, Sunfish Mackay and other local conservationists – including the Bird Observers Club – contacted Dr Norm Duke, the Leader of the Marine Botany Group, Centre for Marine Studies at the University of Queensland. Dr Duke, a mangrove specialist, took a research team to Mackay in 2002 to begin investigating the unusual dieback.

After assessing the scale of the problem,



The extensive dieback of normally resilient grey mangroves in estuaries around Mackay is testament to the penetration of agricultural runoff into coastal ecosystems.

Norm Duke



Norm Duke

Dieback in grey mangroves is the most severe seen by researchers.

Dr Duke concluded 'The dieback is serious. It's the worst case I've seen in 27 years of researching mangroves.'

His research team investigated a number of possible causes including sedimentation, insect damage, disease, herbicides and excess nutrients. They set up transects and plots in the forest, surveyed the affected areas, and used aerial photography and satellite imagery to accurately map the extent of the dieback.

The researchers discovered that the sediments and core water had high levels of agricultural herbicides, especially diuron. Furthermore, levels of diuron correlated with the amount of dieback and poor health of remaining trees and seedlings. No such correlations were found with other factors.

The team then conducted greenhouse trials using high concentration levels of the chemicals, and found, of the four species

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tested, the grey mangrove was most affected by the herbicides. Of the herbicides tested – diuron, atrazine and ametryn – diuron proved the most lethal. Diuron is also toxic to seagrasses.

Commenting on the study's results, Norm Duke said 'The implications of this are enormous. This is a common chemical and if it causes this reaction to one of the hardiest types of mangrove, then what is it doing to the more sensitive seagrasses and reef systems of the Great Barrier Reef?'

More about mangroves

'Mangrove' is a term used to describe a suite of highly specialised tree and shrub species growing in intertidal estuarine and sheltered marine areas. Soils in mangrove forests are inundated twice daily by tides, and are often anoxic (lacking oxygen) and hypersaline with few nutrients.

Mangroves are adapted to harsh environmental conditions. Some species excrete the excess salt through their leaves, and most grow breathing roots above the soil surface. Mangroves often grow in parallel zones.

Mangrove forests are integral to highly biodiverse coastal and marine ecosystems. They provide

sheltered 'nursery' habitats for a range of fish and animal species which attracted to mangrove estuaries' diverse food supply and high productivity.

The grey mangrove is the most common of the 20 or so mangrove species found in the Mackay area. It is a resilient species and can withstand a range of environmental conditions. The grey mangrove, together with the red mangrove (*Rhizophora stylosa*), often occurs on the more exposed seaward side of a mangrove community. Grey mangroves also occur on landward fringes exposed to salinity stress during dry spells.



Alex Thomas/Science Image Online

Mangroves have evolved unique root systems adapted to nutrient retrieval under tidal conditions.

The research project has been controversial. Some organisations have disputed the outcome, arguing that the mangrove deaths arose from excess sedimentation after an unseasonal flood event in 1998. However, Noel Whitehead from Sunfish Queensland says, 'Mangrove deaths are observable on aerial photographs dating as far back as 1991.'



CSIRO Marine Research

A researcher collects seagrass. There are fears that offshore meadows are also being affected by agricultural herbicides.

If the mangrove deaths are from diuron – and the evidence seems to indicate this – it is unlikely to be caused by only one industry. Diuron is used in many industries and on boats as an anti-fouling agent. However, landowners in the Mackay region are noted as some of the largest users of diuron in Queensland.

Noel Whitehead says, 'Our major concern is what can we do to alleviate the problem and bring life back into the mangrove forest. We don't know all the answers and neither does anyone else. The perfect solution is to stop the chemicals from entering the streams. How do you do that in a high rainfall area? Stopping the use of these chemicals may be a solution, but what can be used in their place, and what effect would they have on the aquatic system?'

In other areas, such as the Tweed Valley, landowners such as Mr Robert Quirk, a previous Churchill scholar recognised for his work on acid sulfate soil remediation, are reducing their reliance on chemicals like diuron. Mr Quirk says, 'A water quality project conducted by the NSW sugar industry clearly showed a major decrease in the use of atrazine and diuron since two new, more environmentally-friendly chemicals – Flame (imazapic) and Balance (isoxaflotol) – came on the market.'

Many Mackay cane farmers already practice sustainable farming practices, using alternative herbicides and reducing runoff. Some local farmers use the

COMPASS (Combining Profitability And Sustainability in Sugar) workbook, which covers 10 different environmental management aspects of sugarcane growing, including nutrition and fertiliser use, drainage, riparian management, integrated pest management, soil health and conservation. However, there appears to be plenty of potential for further improvement in environmental practice and understanding.

● Heather Shearer

More information

Serious dieback of mangroves around Mackay – August 2003 Factsheet. <http://www.marine.uq.edu.au/marbot/publications/pdf/Mackay.pdf>
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Mackay region mangrove dieback http://www.library.cqu.edu.au/mackay/Mangrove_Dieback_Project.htm

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