Project 2.5

# LAND USE IMPACTS ON RIVERS

COOPERATIVE RESEARCH CENTRE FOR CATCHMENT HYDROLOGY

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CATCHMENT HYDROLOGY

## Project 2.5
## Nitrogen and Carbon Dynamics in Riparian Buffer Zones

Coastal CRC
CRC for Coastal Zone, Estuary and Waterway Management

### Project Objectives

*There is a need to minimise the movement of nitrogen from land-based activities to streams, in order to protect downstream water quality and ecosystem health. Riparian buffer zones offer the potential for reducing nitrogen delivery to streams, but their effectiveness in Australian catchments has not yet been assessed.*

*We aim to identify key factors influencing nitrogen and carbon dynamics in riparian zones and to determine the most effective riparian management options for minimising stream loadings of nitrogen.*

### Expected Outcomes

- An assessment of the potential of riparian zones to reduce sub-surface delivery of nitrogen to streams for a range of locations within a catchment
- Development of conceptual and numerical models of key processes influencing nitrogen and carbon dynamics in riparian zones
- Enhanced guidelines for nitrogen management in riparian buffer zones to help protect downstream water quality

### Target Problems

Increased stream loadings of nitrogen are now recognised as a significant impact of land use on streams and rivers, both in Australia and overseas. Nitrogen (rather than phosphorus) has been identified as the major problem nutrient in coastal systems in eastern Australia (eg Moreton Bay, Port Phillip Bay, the Great Barrier Reef lagoon). Furthermore, recent research suggests that an increased delivery of nitrogen to some Australian river systems is likely to boost algal growth, to the detriment of ecosystem health. This is particularly the case for bio-available forms of nitrogen such as ammonium and nitrate, which can constitute a significant proportion of the total nitrogen loading.

The presence of riparian zone buffers has been suggested to be the most important factor controlling the delivery of nitrate to streams. Fluxes of nitrate through the riparian zone are intrinsically linked to water movement (both over and through the soil) and are also strongly influenced by biological processes occurring in that zone. Nitrogen and organic carbon dynamics in riparian zones are closely interrelated. Nitrogen loss to the atmosphere through the process of denitrification is one of the most important and effective means by which nitrate loads can be reduced. There is presently little quantitative information available on nitrate reduction by riparian zones under Australian conditions and on the key riparian characteristics that favour denitrification.

Governments at all levels are now expending considerable resources on riparian restoration. However, the effectiveness of these investments is constrained by a lack of sound, scientifically based guidelines for reducing contaminant fluxes, particularly for nitrogen. Enhancement of present guidelines will help optimise benefits and cost-efficiencies in terms of improving stream water quality.




The Cooperative Research Centre for Catchment Hydrology is a cooperative venture formed under the Commonwealth CRC Program between:

- Brisbane City Council
- Bureau of Meteorology
- CSIRO Land and Water
- Department of Land and Water Conservation, NSW
- Department of Natural Resources, Qld
- Department of Natural Resources and Environment, Vic
- Goulburn-Murray Water
- Griffith University
- Melbourne Water
- Monash University
- Murray-Darling Basin Commission
- Southern Rural Water
- The University of Melbourne
- Wimmera Mallee Water

**Associates:**

- SA Water
- State Forests of NSW

## Research Plan

Detailed measurement of the processes of nitrogen and carbon transport and transformation will initially be investigated in intact and disturbed riparian zones in low order streams in the Brisbane River catchment. At a later stage we plan to test the methods and conceptual models developed for the Brisbane in other focus catchments, including the Fitzroy and Murrumbidgee.

The research will be undertaken through a combination of field and laboratory experimentation. We will assess the fluxes of water, nitrate and other solutes through the riparian zone at selected sites by installing a grid of piezometers from the hillslope edge, through the riparian zone to the stream. Techniques using the stable isotopes of nitrogen and carbon will be used to help determine key cycling and transport processes. We will also evaluate the denitrification potential of a range of riparian soils.

Subsequent research is planned to focus on the development of numerical models of nitrogen and carbon fluxes in riparian lands, testing them in a variety of riparian settings and linking them to other components of the CRC's Catchment Toolkit.

## Key Research Tasks - 2000-2003

- Measure fluxes of water, nitrate and organic carbon through the riparian zone at selected sites and assess the influence of riparian conditions and seasonal variations
- Determine key processes by which nitrate fluxes are reduced in riparian zones
- Develop a conceptual model of carbon and nitrogen dynamics in riparian zones in the Brisbane River catchment
- Use research findings to enhance existing guidelines for riparian zone management

## Linkages

The project is jointly supported by the CRC for Catchment Hydrology and the CRC for Coastal Zone, Estuary and Waterway Management. The project is closely linked to two other CRC for Catchment Hydrology projects:

- Project 2.1 Sediment movement and water quality in streams
- Project 2.2 Sediment and nutrient delivery from hillslopes to streams

The project is also integrated with research being undertaken for development of the South-east Queensland Regional Water Quality Management Strategy.

## End-users and Stakeholders

Stream managers and catchment management groups will be the primary users of the research outcomes.

## Staff Involved

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| ***Project Leader*** | Dr Heather Hunter (Department of Natural Resources, Qld) |
| ***Researchers*** | Professor Stuart Bunn (Griffith University)<br>Dr Christy Fellows (Griffith University)<br>Bernie Powell (Department of Natural Resources, Qld)<br>Hydrologist/modeller (to be appointed), (Department of Natural Resources, Qld) |

## Participating Organisations

Department of Natural Resources, Qld • Griffith University • CRC for Coastal Zone, Estuary and Waterway Management

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