

Sugarcane is the second largest agricultural export in Queensland and covers 400,000 ha in the Great Barrier Reef catchment. Sugarcane growing contributes 42% of the total dissolved inorganic nitrogen load and is the dominant source of pesticides delivered to the Great Barrier Reef. Several land management practices in sugarcane areas are proven to be cost-effective in improving water quality, but translating these into more substantial pollutant reductions requires scaling up and greater knowledge of the costs and co-benefits of practice adoption.

Water quality and the Great Barrier Reef

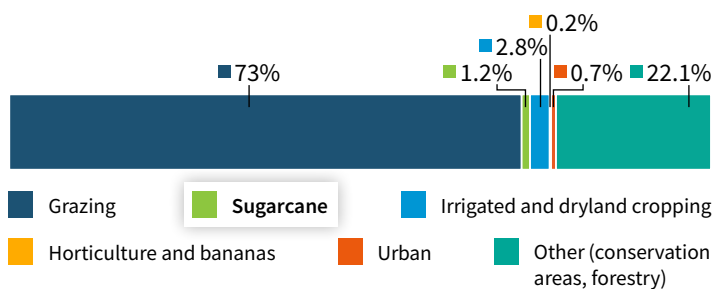
Poor water quality, which can be caused by elevated levels of fine sediments, nutrients and pesticides, has a detrimental impact on Great Barrier Reef ecosystems, particularly freshwater, estuarine, coastal and inshore marine ecosystems. These environments provide critical ecosystem services and have high tourism, aesthetic, cultural, recreational and economic values.

How do land-based activities affect water quality?

The Great Barrier Reef catchment area has been modified by changes in land use over time. These modifications affect the type and amount of materials that runoff from land and enter our waterways.

Compared to pre-development conditions, the volume of river discharge and loads of suspended sediment, dissolved and particulate nutrients (nitrogen and phosphorus), and pesticides have increased for most river basins of the Great Barrier Reef catchment. Overall, exports of anthropogenic dissolved inorganic nitrogen are twice as high as pre-development rates, mainly as a result of fertiliser applied to crops and pastures.

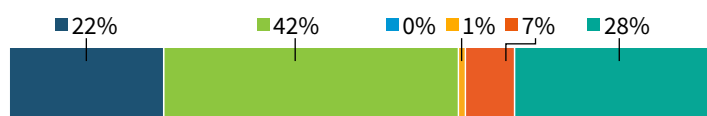
Land uses in the Great Barrier Reef catchments



How do sugarcane growing areas contribute to overall pollutant loads?

Basins dominated by sugarcane make the greatest contribution to total dissolved inorganic nitrogen exports (42% of total) through the use of nitrogen-based fertilisers. Other land uses including urban, bananas and other horticulture contribute smaller amounts but can be locally important. Sugarcane areas are the largest contributor to end-of-catchment pesticide concentrations (>97% in some regions) and are dominated by photosystem II herbicides. Sugarcane areas also contribute 10% of fine sediment and particulate nutrient exports to the Great Barrier Reef although grazing lands are the major contributor (~60%).

Dissolved inorganic nitrogen loads by land use



How are changes to land-based runoff measured?

Scientists use multiple lines of evidence to estimate changes over time



Monitoring



Modelling



Remote sensing



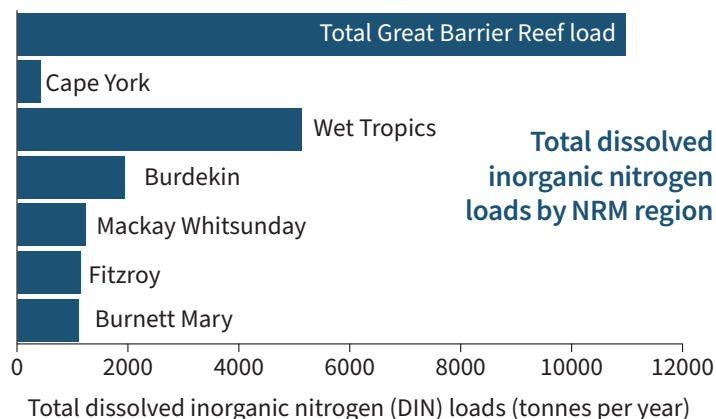
Records of fertiliser use



Isotope tracing

Which areas are the dominant sources of key pollutants associated with sugarcane?

Anthropogenic exports of dissolved inorganic nitrogen are greatest in basins dominated by sugarcane including those in the Wet Tropics, Burdekin and Mackay Whitsunday Natural Resource Management (NRM) regions.



Sites in the Mackay Whitsunday region, along with Barratta Creek in the Burdekin region, that feature intense cropping and lower river and creek flows (related to rainfall), consistently record higher concentrations of pesticides and higher ecological risk than other locations.



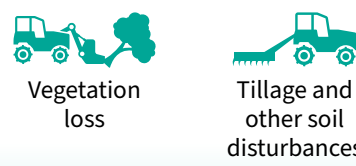
Most export occurs in the wet season, with chronic and continuously high exports of dissolved nutrients in wet tropical catchments

Drivers and transport pathways

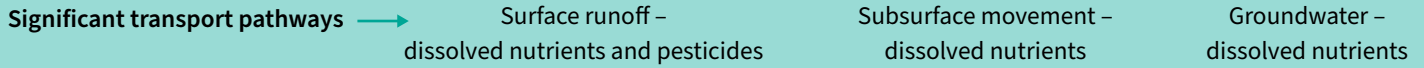
Primary drivers of anthropogenic nitrogen and phosphorus export:



Primary drivers of fine sediment and particulate nutrient export:

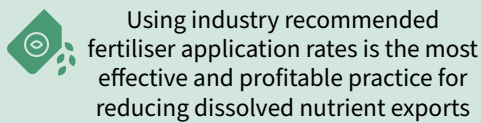


Drivers influencing pesticide export:



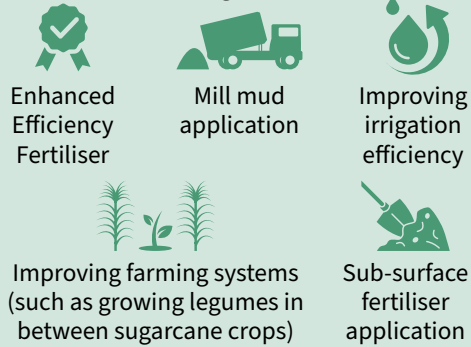
Management options

To reduce dissolved nutrient exports



Using industry recommended fertiliser application rates is the most effective and profitable practice for reducing dissolved nutrient exports

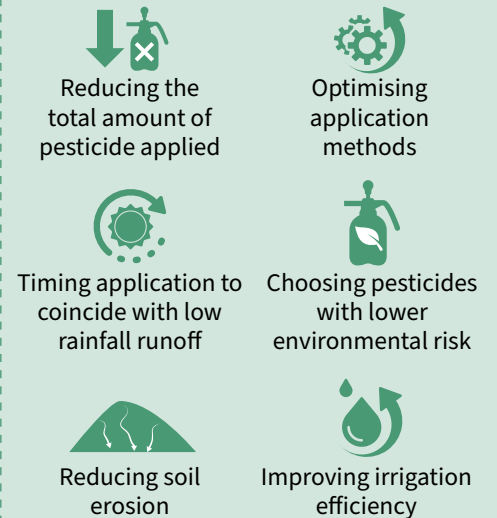
Other things to consider



To reduce sediment and particulate nutrient losses



To reduce pesticide risk



Potential ecosystem impacts

N_P Nutrients are highest in estuaries and inshore waters, and lower in midshelf and offshore waters

Pesticides are present in most monitored fresh, estuarine and marine waters of the GBR

Pesticides are harmful to aquatic species and can increase species vulnerability to other stressors, including heatwaves and reduced light

have a negative impact, particularly on inshore coral reefs

Excess nutrients can be detrimental to coral health and increase coral susceptibility to bleaching

cause phytoplankton blooms that can increase food supply for crown-of-thorns starfish larvae, possibly contributing to outbreaks

Climate change may exacerbate these effects further

Sediments can reduce water clarity and light, decrease abundance diversity, spatial extent growth and recovery rates of seagrasses and coral reefs and associated communities

The Mackay Whitsunday region and Barratta Creek in the Burdekin region, consistently record higher pesticide concentrations and risk than elsewhere

Related questions and confidence ratings



For more information on the questions addressed in the 2022 Scientific Consensus Statement, scan the QR code

