Latest Scientific Consensus Statement on land-based impacts on Great Barrier Reef water quality and ecosystem condition released

The **most comprehensive and rigorous review** about the effects of land-based activities on Great Barrier Reef water quality and ecosystem condition has been released today: the 2022 Scientific Consensus Statement.

The Statement brings together the latest scientific evidence to understand how land-based activities can influence water quality in the Great Barrier Reef, and how these influences can be managed.

Led by C_2O Consulting and funded by the Australian and Queensland governments, **the Statement involved more than 200 experts** including 78 authors and 69 reviewers from Australia and overseas. The outputs are based on **evidence from over 4,000 publications.**

Jane Waterhouse, project lead from C_2O Consulting stated that the process to develop the 2022 Scientific Consensus Statement is unparalleled for the Great Barrier Reef and has delivered high-quality outputs using transparent, robust and standardised methods.

“We adhered to internationally recognised best practices for evidence synthesis, peer review, and consensus. The methods used to develop the Statement focus on providing non-biased information that can be used by managers,” she said.

“For the first time, we assessed the confidence in the evidence. We identified that some issues have very strong foundational evidence, while others need more research. This can give policy-makers greater confidence in their approach to managing water quality issues in the Great Barrier Reef.”

Australia’s Chief Scientist Dr Cathy Foley provided oversight of the process to ensure that the approaches used were best practice, credible and robust.

“The 2022 Scientific Consensus Statement is an exemplar of the academic methods for reaching scientific consensus. The public can trust the processes used to develop the Statement, and the conclusions can be relied upon and trusted to inform decision-making.”

Experts addressed 30 priority questions examining evidence from the catchment to the reef. The questions cover values, conditions and drivers of the health of the Great Barrier Reef, sediments and particulate nutrients, dissolved nutrients, pesticides and other pollutants, as well as human dimensions of water quality improvements and emerging science. All outputs were independently peer reviewed by local, national, and international experts.

Based on the evidence, **35 scientific experts reached consensus** on eight overarching conclusions, Concluding Statements and a Summary report.

Overarching Conclusions

- Historical and continuing land management and catchment modification impair Great Barrier Reef water quality through extensive vegetation degradation, changed hydrology, increased erosion, and expansion of fertilised land uses, urban centres and coastal developments.
- Pollutant loads from the catchment area to the Great Barrier Reef have increased from pre-development loads by 1.4 to 5 times for fine sediments, and 1.5 to 3 times for dissolved inorganic nitrogen (with variations depending on basins).
- Poor water quality, particularly elevated levels of fine sediments, nutrients and pesticides, continues to have detrimental impacts on Great Barrier Reef ecosystems. The greatest impacts are on freshwater, estuarine, coastal and inshore marine ecosystems.
- Human-induced climate change is the primary threat to the Great Barrier Reef and poor water quality can exacerbate climate-related impacts. Good water quality is critical for healthy and resilient ecosystems and supports recovery from disturbances such as mass bleaching and extreme weather events. Meeting water quality improvement targets within the next ten years is imperative.
- While several land management practices and remediation actions are proven to be cost-effective in improving water quality, translating these into more substantial pollutant reductions will require significant scaling up of the adoption of these actions, prioritisation of pollutant hotspots, and greater knowledge of the costs and potential co-benefits of practice adoption.
- Greater focus on locally effective management solutions can encourage faster adoption, especially when designed and delivered using collaborative approaches involving landholders, Indigenous communities, the broader community, policy makers and scientists.
- World-leading monitoring, modelling and reporting programs underpin the Great Barrier Reef ecosystems and provide essential knowledge to inform water quality improvement strategies. These programs could be strengthened and refined by increasing their spatial and temporal coverage to capture regional and local differences, provide more balanced coverage across land uses and ecosystems, improve trend analysis and quantify uncertainties.

All outputs from the 2022 Scientific Consensus Statement are available online.

Contributors to the 2022 Scientific Consensus Statement

More than 200 experts contributed to the development of the Statement, with 78 expert authors from James Cook University, CSIRO, Australian Institute of Marine Science (AIMS), Griffith University, University of Queensland, Macquarie University, Burnett Mary Regional Group, Central Queensland University, Great Barrier Reef Foundation, Queensland Government, Alluvium Consulting, University of East Anglia, University of Guam, University of Canberra, University of South Australia and independent consultants.

James Cook University, CSIRO, AIMS and Griffith University were major contributors with multiple lead authors. These institutions provide comments below.

Five experts from AIMS contributed as authors to the Statement, including four as lead authors.

Dr Katharina Fabricius, Senior Principal Research Scientist, Lead author and co-author.

“The review shows how important good water quality is to help the Great Barrier Reef recover from climate change impacts. This is particularly important in areas close to the coast, which are more susceptible to runoff and not recovering as well as reefs further offshore. Climate change is increasing the intensity of floods and droughts, making it even more challenging to minimise the runoff of pollutants.

“Managing water quality, along with carbon emissions reductions, and research to improve the recovery and resilience of corals, will help the Great Barrier Reef survive climate change.”

Eighteen James Cook University experts contributed as authors to the Statement, including eight as lead authors.

Dr Steve Lewis, Research Scientist TropWATER, Lead author and co-author.

“It was challenging yet rewarding to synthesise decades of peer-reviewed scientific literature, paying tribute to the numerous researchers who have studied the Great Barrier Reef and documenting the history of my field.”

"The review shows a substantial rise in sediment, nutrient, and pesticide concentrations since European settlement in most river basins of the Great Barrier Reef catchment. This evidence was gained through multiple sources from monitoring data, model simulations, coral cores and sediment cores.”

“The influence varies between locations and over time, and is most pronounced in freshwater, estuarine, coastal and inshore marine environments”.

Ten Griffith University experts contributed as authors to the Statement, including three as lead authors.

Associate Professor Andrew Brooks, Lead author.

“The 2022 Scientific Consensus Statement confirms that gully and streambank erosion represent around 80% of all sediment delivered to the Great Barrier Reef.

“There is good evidence that the remediation of large alluvial gullies applying treatments typically used on major civil engineering projects, is both highly effective and highly cost-effective. Fine sediment reductions over 90% were demonstrated within one to two years of remediation.”

“The evidence for riparian management was, however, more equivocal. The review found that while there was a sound theoretical basis for the sorts of management activities currently being undertaken to reduce channel erosion through riparian management, the scientific evidence specific to the Great Barrier Reef does not yet exist to back this up.”

Professor Guillermo Diaz-Pulido, Lead Author and co-author.

“The review confirms that excess dissolved inorganic nutrients (such as nitrogen and phosphorus) affects a variety of organisms and ecosystems in the Great Barrier Reef, from phytoplankton, seagrasses, macroalgae, corals, mangroves to freshwater habitats. However, the effects are very variable and difficult to generalise, which is not surprising given the high diversity of species in the Great Barrier Reef”.

“While there are direct effects of elevated nutrients such as reduced coral calcification, negative impacts on coral reproduction, and potentially lowering thermal tolerance to bleaching, the most severe impacts of increased nutrients on corals may be indirect. For instance, elevated nutrient availability on inshore reefs is generally (but not always) positively correlated with increased fleshy macroalgal abundance. This algae can reduce coral settlement and recruitment, outcompete corals, reduce coral cover and negatively affect coral calcification”.

Six experts from CSIRO contributed as authors to the Statement including four as lead authors.

Dr Rebecca Bartley, Research Scientist, Lead author.

“We continue to work collectively with governments, landholders and communities to tackle deteriorating water quality, which remains one of the biggest threats to the Reef. Six CSIRO experts contributed to the latest consensus statement and synthesised research from a range of topics including sediment and nutrient transport and processes, catchment management and remediation options as well as intervention effectiveness.”

Dr Anthea Coggan, Senior environmental economist, Lead author.

“Most of the changes in land management for water quality improvement have been in the sugarcane and grazing industries. Often the first step to achieving a water quality benefit is improving the knowledge, aspirations, skills and attitudes of land managers towards the land management change and many programs have been very successful at this. A consistent way of measuring factors such as the extent and longevity of change will further improve our understanding of the impact on water quality outcomes into the future.”

Contacts

C_2O Consulting, Jane Waterhouse

M: 0409 053 367, j.waterhouse@c2o.net.au

James Cook University, Molly McShane

M: 0448 015 278, molly.mcshane1@jcu.edu.au

AIMS, Kate Green

M: 0419 741 724, media@aims.gov.au

CSIRO, Amy Edwards

M: 0419 228 147, amy.edwards@csiro.au or csiromedia@csiro.au

Griffith University, Carley Rosengreen

M: 0468 574 720, c.rosengreen@griffith.edu.au

Office of Australia's Chief Scientist, Biljana Wenning

M: 0499 860 603, biljana.wenning@industry.gov.au

Images

Images relevant to the 2022 Scientific Consensus Statement for media use can be found here

About the Scientific Consensus Statement

This is the fifth iteration of the Scientific Consensus Statement, with the first report developed in 2002. The Scientific Consensus Statement is used by policymakers as a key evidence-based document for making decisions about managing Great Barrier Reef water quality. The Statement does not make recommendations for policy and management.

About C_2O Consulting

C_2O Consulting coasts | climate | oceans is a partnership between Jane Waterhouse and Johanna Johnson. It translates science into practical solutions for management and conservation with projects focused on the Great Barrier Reef and the Pacific. C_2O Consulting was appointed by the Australian and Queensland governments to independently lead the delivery of the 2022 Scientific Consensus Statement.