TULLY-JOHNSTONE WATER QUALITY PROGRAM

Achievements and learnings

August 2024

Australian Government | REEF TRUST | Great Barrier Reef Foundation

Introduction

The Great Barrier Reef is globally renowned for its intrinsic beauty, immense spatial scale, outstanding biodiversity as well as its natural, social, economic, and cultural values. A healthy and resilient Great Barrier Reef is critical to protect the vast array of ecological communities and species that inhabit coastal, marine, and terrestrial ecosystems. However, the health of the Reef is at risk from a range of factors including climate change, expanding coastal development, direct human use and poor water quality from land-based runoff.

In a bid to significantly improve the health of the Great Barrier Reef, the Reef Trust Partnership (the Partnership) – a landmark collaboration between the Australian Government's Reef Trust and the Great Barrier Reef Foundation (the Foundation) – was awarded $443 Million to elevate and amplify efforts to build Reef resilience. As part of the Partnership, the Water Quality Program received $199 Million to address poor water quality from land-based runoff and respond to the priorities of the Reef 2050 Water Quality Improvement Plan (WQIP).

Image credit Cassowary Coast Reef Smart Farming, CANEGROWERS Innisfail

The information contained in this report is current as at 30 August 2024. A final verison of the report will be developed in February 2025 when the Program is complete.

Tully-Johnstone Water Quality Program

The Tully-Johnstone Water Quality Program was one of ten regional water quality programs delivered under the Partnership between 2021 and 2024. Through the adoption of improved land management practices, this $11 Million program aimed to prevent 170 tonnes of dissolved inorganic nitrogen lost from farms from entering the Reef's waters every year.

The Tully and Johnstone catchments have high rainfall and are close to the Great Barrier Reef. Intensive agriculture on the coastal plains includes over 50,000 hectares of sugarcane and 7,000 hectares of banana production.

The WQIP identified the reduction of Dissolved Inorganic Nitrogen (DIN) as priority for the region. The Tully-Johnstone Water Quality Program (the Program) was delivered by four organisations implementing four on-ground projects, with individual pollutant reduction targets where appropriate.

Projects tracked their progress to targets using the Paddock to Reef (P2R) Projector Tool which estimates water quality improvements based on a reported change in the management practices by sugacane farmers involved in the program.

Banana projects used rates as per the Department of Agriculture and Fisheries paper to calculate DIN savings based on the area of practice change.

To meet regional requirements, the Program took a holistic approach to management practices that better matched farm aspirations, and addressed Nitrogen Use Efficiency (NUE), the constraints limiting yield, and used novel technologies while remaining relevant to water quality improvement.

Growers accessed tools to aid decision-making, and extension services to improve nutrient management practices on their farms to improve soil health, productivity, profitability, and sustainability.

Cross-cutting activities included water quality communcation and monitoring technical support, innovative technology trials, and independent verification of on-ground management practices and reporting.

Over 100 sugarcane farmers and 30 banana farmers improved their nitrogen use which positively impacted over 25,000 hectares of production land. This collective effort has achieved a reduction of more than 50 tonnes of DIN while maintaining or improving productivity.
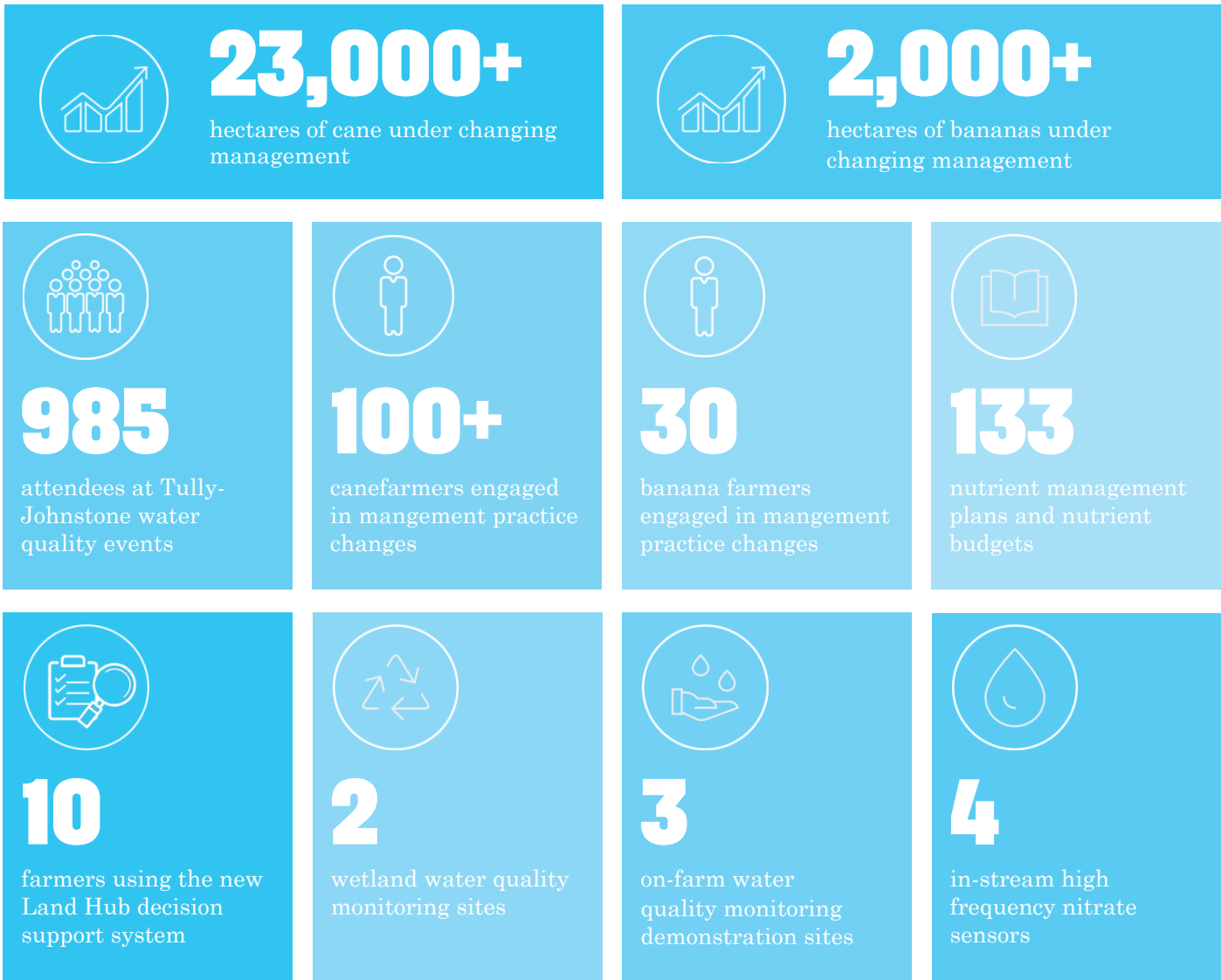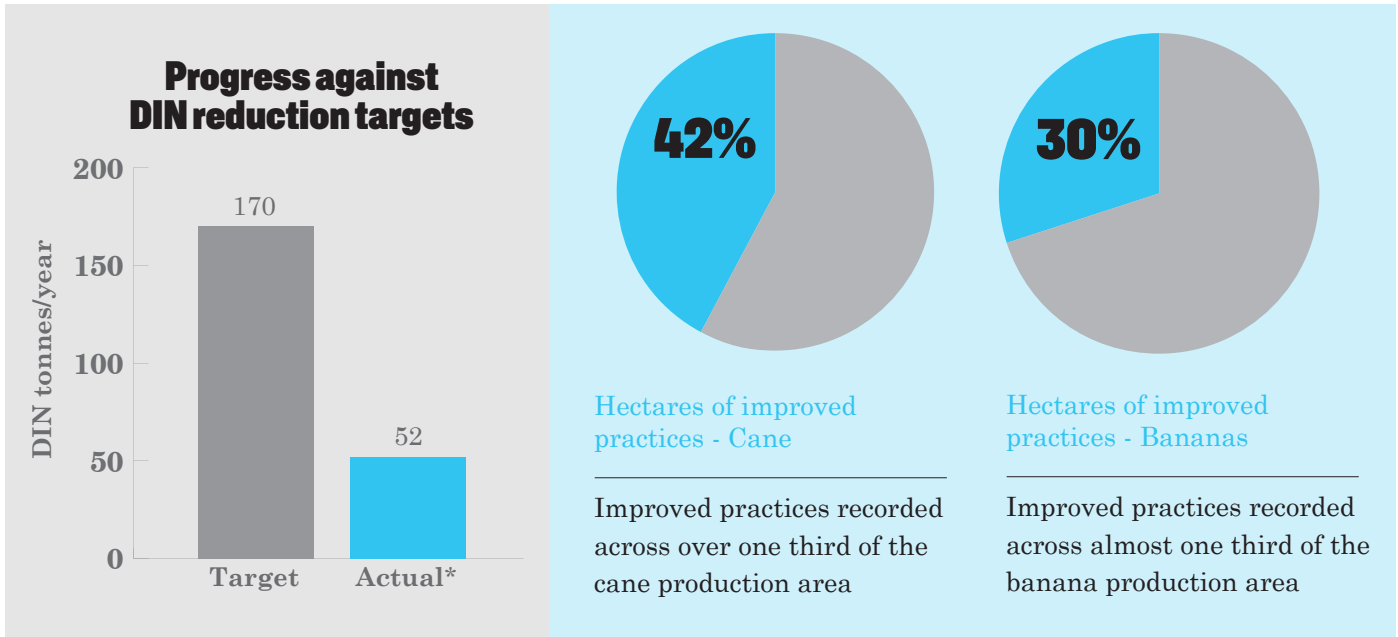
"The highlight for me was learning from other growers in the room. I learnt how to identify nutrient deficiencies I'd never seen before, but some other growers see often."

Banana farmer Kayla Zecchinati pictured with dad Michael

Achievements

23,000+
hectares of cane under changing management

2,000+
hectares of bananas under changing management

985
attendees at Tully-Johnstone water quality events

100+
canefarmers engaged in mangement practice changes

30
banana farmers engaged in mangement practice changes

133
nutrient management plans and nutrient budgets

10
farmers using the new Land Hub decision support system

2
wetland water quality monitoring sites

3
on-farm water quality monitoring demonstration sites

4
in-stream high frequency nitrate sensors

PROGRAM IMPACTS ON THE TULLY-JOHNSTONE REGION

Progress against DIN reduction targets

DIN tonnes/year

- Target: 170
- Actual*: 52

42%
Hectares of improved practices - Cane

Improved practices recorded across over one third of the cane production area

30%
Hectares of improved practices - Bananas

Improved practices recorded across almost one third of the banana production area

*It was identified early that there would be a significant short-fall in the regional-level DIN target set by the Alluvium Report due to limitations with the original investment scenario and the P2R projector tool when estimating DIN associated with precision agriculture practices and nitrogen use efficiency.

"*Using the LANDHub app, I can see on my phone which fertilisers and rates are allocated across paddocks and change the rate as I go and then set it as done when I'm finished the block.*"

Feluga canefarmer Allen O'Kane and LAND project participant has reduced DIN output on the farm

Image credit LiquaForce LandHUB

Tully-Johnstone Water Quality program

Priority catchments

Malanda ●

● Innisfail

Johnstone River

South Johnstone River

JOHNSTONE

Tully River

TULLY

● Tully

0   20   40   60   80   N
Kilometres

Program Model

Governance arrangements for the Program ensured projects delivering on the ground reported directly to the Foundation while also being supported by a regional program manager and partnership coordinator.

This model has increased transparency of outcomes and agility to manage contractual commitments while providing access to local support to manage risk, coordinate activities, identify synergies, and promote the program to the wider regional audience.

A key role of the regional program manager was to oversee the program's spatial reporting dashboard, which allowed checking for historical overlaps, vetting of farm-level projects to ensure adoption of practices not previously funded, and tracking of progress towards targets.

The program manager and partnership coordinator reported directly to a regional steering committee made up of key stakeholders including CANEGROWERS Innisfail, Terrain NRM, the Queensland Government and the Foundation.

The steering committee was supported by a Technical Advisory Group and the Water Quality Working Group, which provided technical and strategic advice across the whole of the Reef Trust Partnership Water Quality Program.

The design of the governance model recognised the importance of independent local leadership and oversight, as well as strategic and technical guidance and collaboration.
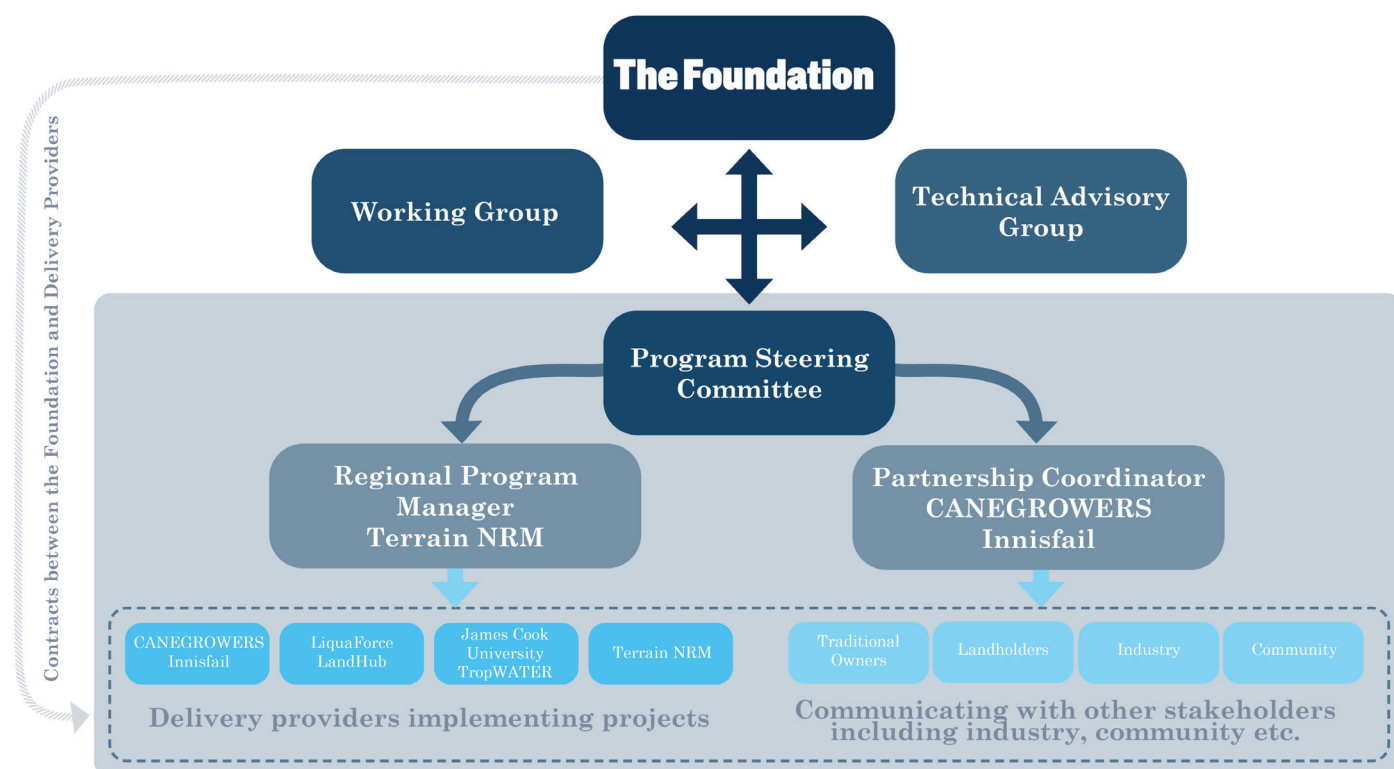

Figure 1 Reef Trust Partnership Tully-Johnstone Water Quality Program governance model

"This project is raising awareness of wetlands and their usefulness in the farming landscape. It has helped us understand how wetlands work and how we can optimise their ability to treat water."

Greg Shannon, Cane Productivity and Development Manager at Tully Sugar Limited (pictured L-R, Tully Sugar COO John Edwards, CEO Andrew Yu and Greg Shannon)

Funded Projects

Image credit: Great Barrier Reef Foundation

CASSOWARY COAST REEF SMART FARMING

CANEGROWERS Innisfail worked in partnership with CANEGROWERS Tully, Sugar Research Australia, and the Australian Banana Growers Council to improve nutrient use efficiency in the Tully and Johnstone catchments.

Over 100 sugarcane farmers managing 19,000 hectares and 30 banana farmers managing 2,000 hectares were supported to refine nutrient inputs, reduce DIN losses and fertiliser costs, and keep Reef ecosystems healthy.

Growers accessed tools to aid decision-making, extension services to improve nutrient management practices, and improved the soil health, productivity, profitability, and sustainability of their farms.

TULLY-JOHNSTONE WATER QUALITY MONITORING PROGRAM

James Cook University's (JCU) Centre for Tropical Water and Aquatic Ecosystem Research (TropWATER) and CSIRO worked with Terrain NRM to deliver a robust, multi-scale (paddock to sub-catchment) water quality monitoring system.

Three in-paddock monitoring sites and 4 in-stream monitoring sites measured rainfall, water height sensors showed how much water was running off the paddock, and high frequency nitrate sensors measured how much nitrogen was in the runoff water.

The dynamic, interactive water quality monitoring and extension approach fostered a mutual understanding between scientists, extension practitioners, land managers and farmers.

Image credit Terrain NRM

Funded Projects

WETLAND MONITORING

Terrain NRM worked with JCU TropWATER, Griffith University, and the Queensland Government's Departments of Environment and Science, and Agriculture and Fisheries to monitor one natural and one constructed wetland in Innisfail and Tully.

The Wetland Monitoring project provided important insights into how wetlands can work as a treatment option for DIN and sediment reduction in the Wet Tropics.

The monitoring data provided the scientific community with increased understanding of wetland hydrological processes, nutrient dynamics, and the role these landscape features play in improving the quality of agricultural runoff in Great Barrier Reef catchments.

Image credit Terrain NRM

Image credit LiquaForce LANDhub

LOCAL AREA NUTRIENT DATAHUB (LAND)

The LiquaForce LAND project supported ten growers to implement practice changes across 4,710 hectares of sugarcane land. The combination of agronomic and technological support provided has improved both the economic and environmental sustainability of the sugarcane farming operations involved.

The LAND Hub decision support sytem stores critical data such as crop history, land topography, electro-magnetic mapping, and soil composition to produce optimised Six Easy Steps nutrient management plans that reduce excess nutrients flowing into local waterways.

This all-in-one solution for fertiliser management has given growers the tools for confident, fast and efficient decision-making.

Image credit CANEGROWERS Innisfail

The biggest challenge to the adoption of precision agriculture was identified as poor connectivity. "Reliable access to very high-speed broadband on both of these sites has been a game changer."

Grazier and canefarmer Chris Condon is developing and trialling innovative technologies for precision agriculture across commodities through the LAND research project.

Cross-cutting activities

Water Quality Monitoring Support and Communication

This TropWATER-led project supported delivery providers with improving the design and implementation of paddock water quality monitoring as part of on-ground extension projects to ensure monitoring activities were fit for purpose.

The project also assisted deliver providers with interpreting and communicating water quality results to growers and produced key messages around common water quality questions to improve understanding and knowledge for growers and extension staff. This distinctive approach integrated scientific expertise from leading water quality researchers with strategies from science communication specialists.

Independent Verification and Engagement

This initiative focused on independently verifying the extent and quality of the on-ground projects which were being reported to ensure the accuracy of the spatial dashboard.

The process also provided the unique opportunity to hear first-hand from sugarcane growers their experiences participating in the program while facilitating communication between growers, delivery providers and funders. This included discussion on communication and engagement, effectiveness and extent of practice change and legacy outcomes relating to the program.

Innovative Technologies

AutoWeed

AutoWeed is an innovative technology, developed for herbicide application on sugarcane farms, that uses robotic spot spraying to directly target weeds rather than the current-best-practice blanket spraying method. The Partnership-funded innovation project conducted trials over 108 hectares in Reef catchments, demonstrated that AutoWeed is 96 per cent as effective as traditional methods in weed knockdown while reducing herbicide usage by an average of 44 per cent. Reade more about AutoWeed.

Precision Agriculture

Through the LiquaForce LAND research project, a Starlink Satellite Broadband network was installed on a mixed grazing and cane operation near Tully.

This has enabled effective communication within and between farms and equipment, utilise cloud-based software tools, access to accurate local real time data for planning of activities such as spraying, and the ability to adopt Precision Agriculture practices. Read more about how new technologies are being used.

Real-time data provides a timely nitrogen story

The 2023-24 wet season was affected by Tropical Cyclone (TC) Jasper with flash flooding, heavy rains and strong winds in December 2023, followed by TC Kirrily in January 2024. Despite this, in-paddock and in-stream water quality monitoring sites provided a nitrogen story of paddock scale runoff events through the collaborative JCU TropWATER, CSIRO and Terrain NRM Tully Johnstone Water Quality Monitoring project.

In-field sensors included gauges recording rainfall, water height sensors showing how much water was running off the paddock, and nitrate sensors measuring how much nitrogen was in the runoff water. Data from these sensors was available within 10 minutes of being collected and the paddock team communicated results directly with the grower.

The data showed that the reduced nitrogen application treatment did lead to lower nitrogen losses through runoff. Discussion between scientists and growers centred around how different soil types may alter these results on other farms in different areas. The farmer will continue to only apply fertiliser at planting after a legume fallow, as he understands this reduces nitrogen losses, and so far, has not affected biomass growth when compared to the standard application treatment.

Sugarcane grower Brendan Calleja surveys damage from ex Tropical Cyclone Jasper

Image credit: Cassowary Coast Reef Smart Farming, CANEGROWERS Innisfail
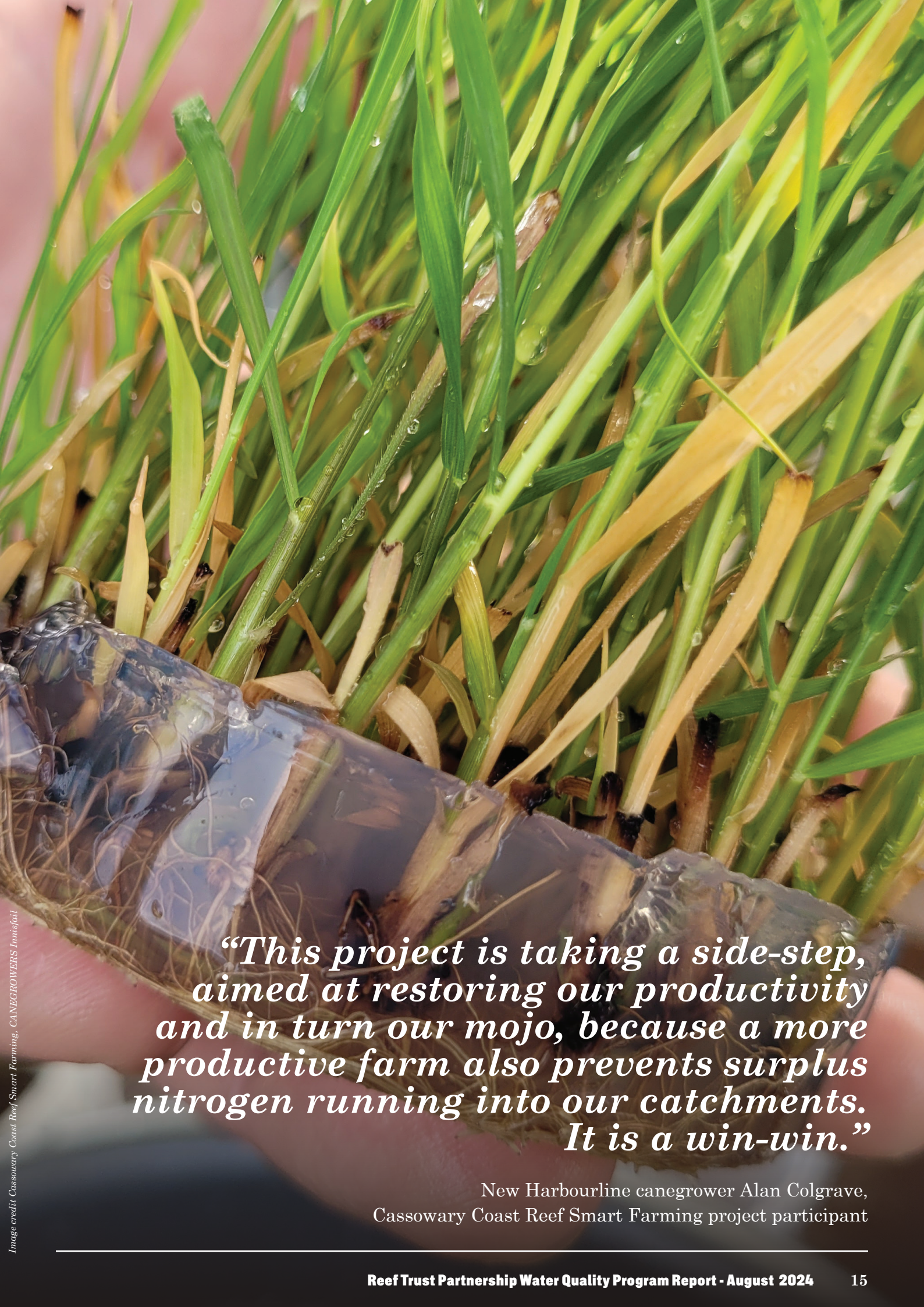
"This project is taking a side-step, aimed at restoring our productivity and in turn our mojo, because a more productive farm also prevents surplus nitrogen running into our catchments. It is a win-win."

New Harbourline canegrower Alan Colgrave, Cassowary Coast Reef Smart Farming project participant

Learnings

1. Building on the foundation of previous programs and collaboration between regional providers to leverage existing networks was critical to effective grower engagement across the Tully and Johnstone catchments.

2. Bringing together small groups of growers enabled sub catchment-specific peer-to-peer learning which benefited young growers and those new to the industry.

3. The localised water quality monitoring program delivered a substantial improvement in grower's trust in science. Real-time water quality and quantity monitoring data enabled timely discussions between scientists and farmers for the adoption of management practices that save money and reduce DIN losses.

4. Specific training for increased knowledge across the variety of fertiliser products available will support growers to evaluate their necessity in their farming system. Growers need to be empowered to effectively communicate their fertiliser preferences to resellers.

5. Wetland monitoring data showed that wetland performance can be optimised through vegetation management. Open water is required to improve flow and reduce pockets of extremely low dissolved oxygen; oxidised nitrogen can be removed without generating as much ammonia through reduced wetland vegetation.

Learnings

6. There is scope for increased support to be provided for research into nutrient management approaches and water quality monitoring in the banana industry. Limited available science hampers the ability of extension staff to provide evidence-based and clear advice to banana growers.

7. Decision support system access and the ability to store farm soil, and production data for easy long-term monitoring of performance has increased digital literacy and grower confidence in decision making.

8. Soil testing identified that the sugarcane disease Pachymetra is prevalent in the region. This soil-borne fungus, native to Australia, attacks the roots that help absorb essential nutrients. Access to disease-free high-yielding varieties is critical to nitrogen use efficiency. Three tissue culture plots were established to accelerate basin-wide adoption of newer varieties.

*Image credit Cassowary Coast Reef Smart Farming, CANEGROWERS Innisfail*

Summary

Over the 3.5 years of the Reef Trust Partnership-funded Water Quality Program, more than 100 sugarcane farmers and 30 banana farmers improved nitrogen use efficiency increasing the productivity and sustainability of over 23,000 hectares of sugarcane growing land and 2,000 hectares of bananas in the Tully-Johnstone region.

Transparency and accountably were delivered through a regionally-specific governance model. Real-time data of on-ground actions provided timely and public progress towards pollutant reduction targets. A broad range of delivery providers with established grower networks supported increased farmer engagement, and small groups shared peer-to-peer learnings from personal farming experiences.

The combination of agronomic extension support, new decision-making tools, and extension services to improve nutrient management practices on farms resulted in improved soil health, productivity, profitability, and sustainability. New data is enhancing the understanding of how wetlands work as treatment for dissolved inorganic nitrogen and sediment in the Wet Tropics. The timely communication of real-time water quality monitoring data has changed the way farmers apply fertiliser. Digital literacy has increased through the use of new data platforms for nutrient and pesticide planning and management.

The combination of all the above has contributed to the Program achieving a reduction of more than 55 tonnes of DIN per year. This has resulted in more sustainable sugar and banana industries, and better water quality in the Tully and Johnstone rivers and the Great Barrier Reef lagoon.
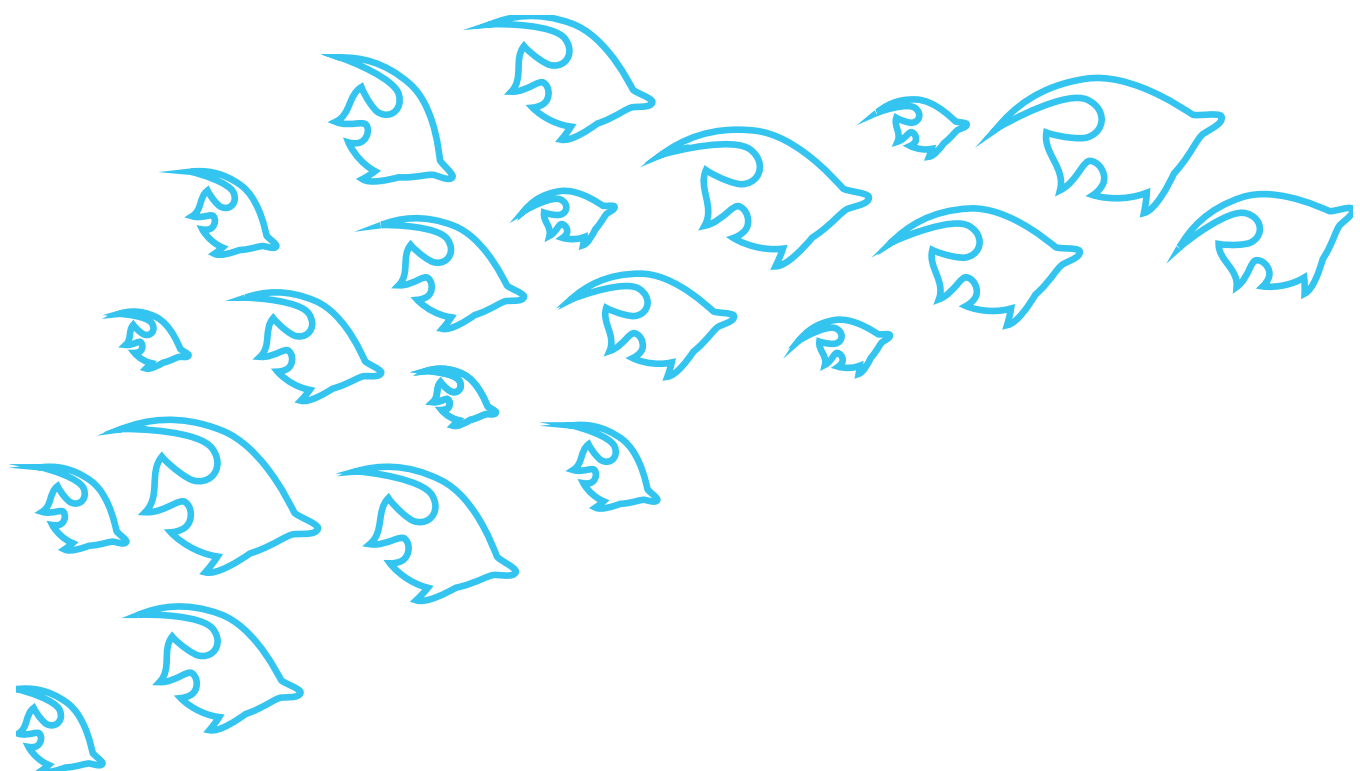
Acknowledgements

Reef Traditional Owners have been caring for land and sea Country for more than 60,000 years, using Traditional Knowledge passed down through ancestral lines for millennia. The Great Barrier Reef Foundation extends its deepest respect and recognition to all Traditional Owners of the Great Barrier Reef and its Catchments, as First Nations People holding, the hopes, dreams, traditions and cultures of the Reef.