

Appendix 2 Case Study A: Approaches to Developing and Implementing Sustainable Agriculture Best Management Practices

Introduction

Sustainable management of the primary production systems and the resultant improvement in the quality of water leaving farms is a major focus of research, development and extension activities within catchments of the Burdekin and Wet Tropics regions.

This case study describes some of the steps being taken to develop and achieve adoption of Best Management Practices in the grazing, horticulture and sugar cane industries through initiatives of Burdekin Dry Tropics NRM, industry and the NHT2 strategic reserve-funded project Reef Extension (DPI&F). It focuses on the partnership approaches that have been employed to address sustainable agriculture issues.

The case study also discusses broader issues involved in the development and adoption of Best Management Practices (BMPs) within the region where there are numerous factors and stakeholders influencing farmer decision-making and practice change.

Regional Context

Land use in catchments draining into the Great Barrier Reef lagoon is dominated by agriculture, i.e. grazing, sugarcane and tropical horticulture. While grazing occupies the greatest area, sugarcane and tropical horticulture employ intensive production systems using large quantities of chemical inputs. Irrigation is also an important management practice in many areas within these industries. Thus it is important that management practices are developed and adopted to improve the quality of water leaving sugarcane and tropical horticulture farms in Reef catchments, despite their relatively small area. Of these two production systems, sugarcane occupies the largest area (Thorburn et al. 2006).

The Reef Water Quality Protection Plan 2003 establishes a water quality policy for the Reef which has been influential in guiding the focus of agricultural extension in the Burdekin and Wet Tropics regions. One of the key catalysts for the recent industry shift toward more sustainable farming practices is the mounting evidence of catchment based impacts from an array of land uses on receiving water quality of the Great Barrier Reef, and subsequent impacts on marine ecosystem processes (Davis, 2007). Similarly, the Reef Extension Project was developed to directly address Strategy B Action 1 of the Reef Plan which states: *In collaboration with Regional NRM Bodies and peak agricultural industry bodies, develop and implement education and extension programs and undertake trialing of practices to increase the voluntary uptake by producers of sustainable agricultural practices, tailored to particular land uses, locations and pollutants.*

The Reef Plan also promotes the need for the development of best management practices and programs to encourage their adoption. Furthermore, it recommends the development of Water Quality Improvement Plans which would provide a framework to support these activities.

In the Burdekin region, sugarcane, grazing and horticulture industries are the dominant primary industries and for the Wet Tropics region, horticulture and sugarcane are dominant with relatively small grazing and dairy industries. Across the two regions, there are approximately 2100 sugarcane producers (200,000ha), 800 horticultural producers (30,000ha) and 600 graziers (14 million ha).

Working towards Sustainable Agriculture

Science Review

A significant step in the journey towards the development of BMPs for sugar cane farming was a review² to provide the Burdekin Coastal Catchments Initiative (CCI) with a rigorous and comprehensive technical basis to act as a starting point for development of locally relevant and justifiable guidelines to benefit off-site water quality.

The review, funded by NHT2, was undertaken by the Australian Centre for Tropical Freshwater Research with support from a reference group, the Water Quality Focus Group, convened by BDTNRM with members representing CANEGROWERS, Growcom, BSES Limited, CSIRO and DPI&F agencies.

The review considered the local farming practices involved in sugar cane farming:

- Fertiliser use
- Pesticide use
- Crop irrigation supply
- Green cane trash blanketing (GCTB)

The review found that there was no shortage of major knowledge gaps impeding sound management decision making by natural resource managers in the lower Burdekin. Issues requiring urgent attention included:

- The complexity of interactions between chemical usage, irrigation application and off-site environmental effects are significant, but poorly known.
- Research on groundwater hydrodynamics in the region highlighted how little is really known regarding groundwater under pressure on an array of fronts. Issues such as nitrate leaching processes from farm to whole aquifer scale are in need of significant research effort.
- Detailed information of the costs and benefits of conversion to GCTB systems is still largely absent. The uncertainties and concerns identified in grower community reviews a decade ago still exist today and little meaningful information has emerged since.
- The potential shift toward permanent beds and controlled traffic farming systems opens up an array of potential unknowns as well as opportunities from an environmental as well as productivity standpoint.
- The issues of pesticide usage patterns, off-site movement and environmental effects of pesticides requires research attention focusing on Burdekin farming systems.

² Overview of research and environmental issues relevant to development of recommended practices for sugar cane farming in the Lower Burdekin region. A. Davis, Burdekin Dry Tropics Coastal Catchment Initiative. Australian Centre for Tropical Freshwater Research, James Cook University

- Recommended practices for fallow management are largely absent. How farmers should manage their fallow crop from a productivity and environmental perspective remains uncertain (harvesting a legume crop versus plough-out etc.).

This review highlighted the need to address two key factors pivotal to sustainable agriculture:

1. the development of BMPs that industry can implement with confidence that the practices will be profitable and will deliver the desired NRM outcomes, and
2. the need to overcome the limited scientific understanding of the impacts, costs and benefits of different farm management practices.

A strength of the Water Quality Focus Group partnership involved in the review was that it enabled a broad range of perspectives on agriculture to be included which drew on the expertise of the respective organizations.

The engagement with industry in this process also revealed an asymmetry in knowledge of water quality issues that existed between industry and scientists. While water scientists and associated NRM staff were well versed in the water quality issues affecting the area – and thus the need for BMPs to address them – growers were largely isolated from this basic information, receiving the bulk of their knowledge about water quality issues through irregular, general or sensationalist stories in the media. Thus, a crucial first step in working towards BMPs was to share the scientific data that underpinned the need for such guidelines with those who would be most affected by them: cane growers.

To help address the industry's information needs, a compilation of locally relevant water quality data into an easy to understand format was done. This was then communicated to local groups of growers, with the help from industry representatives and Reef Extension staff and their pre-established networks of growers and legitimacy with them.

The growers were generally highly receptive to this information about their local area and what it implied about their impact on the environment. Extension staff also benefited from the exercise, which was an unintended outcome but important given their contact and influence over a large number of growers.

Sugar Cane BMPs for Water Quality

Following on from the science review, the Water Quality Focus Group developed a set of guidelines on recommended best management practice for sugar cane farms in the Burdekin region.

This collaborative project received financial support through a variety of agencies. The Water Quality Management Principle Framework was funded by the Australian Government and sugarcane industry through the Sugar Research and Development Corporation. The Best Management Principles for Sugarcane Growth component was supported through the BDTNRM Coastal Catchments Initiative with funding from the Australian Government (National Heritage Trust). The two separate but linked investments for this project illustrates the nature of investment that commonly occurs in sustainable agriculture, i.e. funding is sourced from a variety of investors and brought together in a coordinated project to support complementary investor objectives or outcomes.

The actual development of the BMPs was a two-way process, utilising both a 'bottom up' and 'top down' approach. In agriculture, there is considerable uncertainty about the

environmental outcome of a particular management practice. This occurs because multiple drivers (e.g. site and soil conditions at the time of the operation, weather conditions following the operation), often outside the influence of the farmer, will determine that outcome. (Thorburn et al, 2007³). Thus a bottom up approach to developing management practices to address environmental (e.g. water quality) objectives must be 'connected' to the objective through sound biophysical principles.

The bottom up approach involved using a group of diverse growers and extension staff (from BSES Ltd, DPI&F, Burdekin Bowen Floodplain Management Advisory Committee (BBIFMAC)) who developed a detailed list of recommended practices for growers during a series of workshops. It was envisaged that a largely grower-driven process would provide the best outcomes in terms of industry ownership and best practice guidelines with a basis grounded in reality.

A group of local farmers from across the Burdekin region were approached and taken through a workshop process facilitated by a number of local industry extension and natural resource management staff. The farmers were selected with the intent of representing the range of different farming systems, scale of operations and varying farm management issues apparent across the region as a whole. The underlying aim of the workshop process was to document local growers' perceptions of what constituted desirable or "best practice" farm management for their particular situations. Subsequently, the water quality management goals to which each of these practices would contribute was identified.

The top down approach involved working with CSIRO staff to develop a set of overarching principles in which to structure particular recommendations.

The result is a set of generic BMPs that aims to reflect local conditions while also avoiding a prescriptive approach that would fail to accommodate the range of farming conditions and systems in the area. This desire to avoid a prescriptive approach reflects the complexity and diversity of the farming situations in the Burdekin sugarcane industry.

The guidelines consider two main components: (1) a framework illustrating the links between specific water quality goals and on-farm management actions, and (2) a collation of detailed current management principles for sugarcane growing in the Burdekin region. Together these components provide the basis for assessing the potential water quality benefit of management practices and for developing specific on-farm management plans to improve water quality.

Importantly, the Water Quality BMPs are intended to produce water quality benefits without diminishing profitability. The main areas of farm management that the BMPs address are:

- Water management – aim to minimise water excess through controlled irrigation timing and amount of water applied, and increase in evapotranspiration through better crop growth
- Nutrient management – aim to minimise Nitrogen surplus through improved fertiliser regimes and increased Nitrogen uptake
- Herbicide management – aim to minimise herbicide losses through minimising herbicide applications and maximising efficacy of product use

³ Best management practices to improve the quality of water leaving irrigated sugarcane farms: Guidelines for the Burdekin region. P. Thorburn, A. Davis, S. Attard, R. Milla, T. Anderson & T. McShane

- Sediment management – aim to minimise Nitrogen losses through reduced cultivation and maintaining surface cover

Grazing Land BMPs

The identification and acceptance of grazing land BMPs guidelines for achieving water quality outcomes was seen as an essential first step towards minimising the impact of grazing practices on water quality. To commence that process, a review⁴ of current and proposed grazing land best management practices was undertaken by DPI&F and BDTNRM funded by NHT2. An important finding from the review was the difficulty the reviewers had in separating science from opinion. This problem was compounded by the fact that many current BMP recommendations were largely based upon anecdotal, experiential evidence. Although potentially valid, these BMPs were accordingly largely untested scientifically.

The Burdekin Dry Tropics NRM body with DPI&F is now developing guidelines⁵ for Best Management Practices (BMPs) within grazing lands of the Burdekin to reduce the load of sediments and nutrients entering waterways and reaching downstream wetlands and the Great Barrier Reef lagoon.

The guidelines are intended at this stage to be non-prescriptive; rather they will provide options and case studies to graziers on practices that can be adapted to their individual property needs. Suggested guidelines are strongly reliant on indicators to measure land condition and direct grazing management. Incentives for uptake of practices are being considered and it is thought that by undertaking these practices graziers will see a return in the long-term economic and environmental sustainability of their properties. While some BMPs presented are strongly supported by science (particularly those for upland grazing) others are based upon interpretive knowledge and grazier experience.

Some suggested practices such as wet season spelling are known to present challenges to graziers who cannot readily implement them, which illustrates that developing BMPs is a continuing process that needs to be adapted as knowledge and circumstances change.

The process of bringing stakeholders together to develop BMPs is very influential in helping broaden individual perspectives on what is sustainable agriculture and how it can be promoted. This attitudinal change among institutional personnel is an indirect but valuable outcome from programs that involve a range of stakeholders in genuinely collaborative processes.

Research into Adoption of BMPs

Building an improved understanding of factors influencing adoption of BMPs, plus an assessment of different incentive instruments was the focus of a research project⁶ commissioned by BDTNRM. This research was funded from the National Action Plan for Salinity and Water Quality and the Natural Heritage Trust.

This research involved a systematic review of existing information and literature on the socio-economic issues relating to the adoption of water quality best management practices

⁴ Coughlin, T., O'Reagan, P. and Nelson, B. (2006) A Review of Current and Proposed Grazing Land Best Management Practices for Achieving Water Quality Objectives in the Burdekin Catchment.

⁵ Coughlin, T., Nelson, B. and O'Reagan, P. (2007) Grazing Land Best Management Practices (BMPs) Draft Guidelines.

⁶ Greiner, R., Lankester, A. and Patterson, L. (2007) Incentives to enhance the adoption of 'best management practices' by land managers: Achieving water quality improvements in the Burdekin River catchment. Research Report for the Burdekin Dry Tropics NRM and the Coastal Catchment Initiative (Burdekin)

by land managers in the Burdekin region. This supported the design of an extensive landholder survey and the interpretation of the survey results. It aimed to advance the understanding of the adoption of conservation practices by establishing socio-economic profiles, perceptions, motivations, preferences and risk attitudes in relation to measures associated with water quality improvements.

This understanding served as a foundation for assessing a range of incentive instruments, including market-based instruments (MBIs), suitable for accelerating the adoption of conservation practices, which will result in an improvement in the quality of the water discharged from the Burdekin River.

The research strongly endorsed previous research which has called for an incentives 'tool-box' approach. It demonstrated that different types of incentives are important and have a role to play to support the implementation of conservation practices by supporting various stages of the adoption process and specifically targeting the various constraints that land managers face.

Different financial incentive instruments are regarded as effective in addressing various financial constraints — but also other impediments to adoption — by enabling land managers to adopt conservation practices in the presence of those constraints.

Whilst the research was undertaken by a consulting business and a university, some of the key activities, such as landholder meetings that underpinned the study, were supported through the Reef Extension project. It appears that there is more work to be done to gain stakeholder buy-in to the research findings and for the findings to be incorporated within the planning of extension programs of the region.

Water Quality Improvement Tender

Following on from the research project, BDTNRM has commenced implementation of an innovative water quality tender scheme for cane growers and graziers in the Lower Burdekin. The scheme involves BDTNRM staff who manage the tender process and DPI&F Reef Extension staff and BSES Ltd staff who provide technical advice and conduct property visits. The scheme, funded by the Department of Agriculture, Fisheries and Forestry, will provide up to \$600,000 to purchase activities by land managers to improve water quality.

There has been a very positive response from land managers to the recent call for Expressions of Interest with approximately 60 cane growers and 20 graziers seeking to participate. The next stage of the program entails property visits by technical extension officers from BSES Ltd or DPI&F to provide land managers with the information and assistance needed to develop a submission. Once submissions have been received they will be considered to compare the estimated water quality improvement against the associated cost. Submissions will be ranked and the most cost-effective ones will be selected until the available funding is allocated. Successful land managers will then enter into an agreement with the BDTNRM.

Being a new type of incentive scheme compared to the typical approaches, there is a great deal of interest in seeing how cost-effective it is in obtaining water quality improvements but also in its impact on landholder attitudes towards traditional group activities. For example, DPI&F staff queried what effect market-based instruments may have on Landcare groups, if any, which tends to encourage communities to work together, and not in competition.

Reef Extension Project

The Reef Extension Project was conceived to achieve a measurable increase in the voluntary uptake of sustainable land management and best management practices that improve the quality of water entering the Great Barrier Reef lagoon. The Department of Primary Industries and Fisheries is responsible for the project, which is a cross-regional project funded through NHT2.

This extension project comprises a small team of technical extension specialists in cane growing, horticulture and grazing that have an excellent local understanding of their respective industries, in particular farm profitability, management practices, natural resource management issues, etc. This industry expertise provides the team with strong credibility with producers, as well as making the team a valuable resource within the regions for other stakeholders in sustainable agriculture to draw on.

In working towards the project's objective, the team has delivered and been involved in an enormous range of activities and processes, such as:

- Producer demonstration trials of different management practices for bananas and sugar cane and other horticultural crops;
- Field days and producer meetings;
- Development of draft BMP guidelines for bananas, cane and grazing;
- Benchmarking of current practices; and
- Technical contributions to many other related projects of other stakeholders such as BDTNRM and BSES Ltd.

The project has been challenged by a redirection of resources due to the State's response to Cyclone Larry. This provided a major setback to the project and was beyond the influence of the project team themselves to manage. The loss of staff was damaging to the project's credibility and placed a burden on the project team members to keep the project on track.

The project also commenced without clearly defined performance indicators of adoption rates that the project was to achieve and there were insufficient funds within the project to establish baseline data across the industries.

The project has suffered from a lack of a strong and explicit image of what it does. This is partly attributable to the relatively low level of communication to stakeholders external to the region, but also due to the problems faced in the early stages of the project as described above.

One of the project's successes has occurred within the grazing industry with 'Research to Reality'. This component of the Reef Extension has supported small teams of graziers to explore and test research, technologies and concepts on-property to find practical solutions to key animal production and land management issues and has been based on having a whole of business systems approach.

The Reef Extension project has been able to leverage investment in this activity from DPI&F, BDTNRM and the CRC for Beef Genetics Technology.

Research to Reality has provided a sound foundation for achieving increased adoption rates in the grazing industry through meeting the information needs of graziers and delivering the information in accessible ways.

This component has worked intensively with a small number of land managers. The challenge now is to determine how to achieve widespread adoption in a cost-effective way.

In relation to how the project relates to other activities in the regions, the philosophy of the extension team is to maintain strong relationships in order to stay connected and to find the most appropriate role for Reef Extension. This can be anything from a leadership role to involvement to small contributor to watching from the side. Frequently, the team, due to their networks, provides an important linking role that brings relevant stakeholders together on issues of common concern.

This identification and development of linkages, and coordinating operations, between related investments in the regions is an important but often unrecognised role that Reef Extension plays. It is particularly important when addressing sustainable agriculture because it often requires integration across a number of related production and NRM issues. One small practical example of this was a fertiliser management field day for growers where the Reef Extension team coordinated the resources and involvement from the local Water Quality Improvement Plan (WQIP) initiative, R&D support and analysis from a NRW research station, and growers representing industry.

The communication and technical skills of the team are critical in being able to work smoothly between stakeholders who have different programs that impact on agriculture, particularly where production-oriented stakeholders and conservation oriented-stakeholders and scientists struggle to communicate effectively together.

Anecdotal evidence also suggests that the Reef Extension project has been instrumental in influencing stakeholder attitudes towards what constitutes sustainable agriculture. Through the extension team's activities and involvement in many other related initiatives, it is likely that there has developed a more consensual view on sustainable agriculture among stakeholders. This may be partly attributed to the ability of the extension team to provide a bridge between production and conservation perspectives and demonstrate that sustainable agriculture is about both profitability and conservation of natural resources. Having scientists, growers and extension staff working in collaboration provides a powerful mix of knowledge, e.g. industry body representatives provided a more sophisticated understanding of local farming conditions and politics, growers provided the group with a much deeper understanding of the complexity of production.

Additional benefits from the project identified by the extension team include:

- Guidance on industry R&D investment (MLA, SRDC, HAL) to be applicable to producers' needs
- Input to DPI&F policy development relating to Nutrient Management Zones
- Input to modelling activities for the Reef Water Quality Partnership and WQIPs

These additional benefits represent the inherent capacity building outcomes that can accrue from projects such as Reef Extension which are not reported or measured as part of conventional project reporting requirements.

Another message arising from the philosophy of the Reef Extension project is that regardless of what organization leads an initiative to address sustainable agriculture, e.g. DPI&F, regional NRM body, CSIRO, industry, etc. organizations need to be open to collaboration and not exclude others that have a legitimate contribution to make. In Reef Extension, a feature of their approach has been to seek opportunities for collaboration and sharing of information between industry, NRM groups and scientists.

Conclusions & Lessons

Overall, this case study of partnership approaches to sustainable agriculture and development of water quality BMPs highlights a number of lessons for sustainable agriculture:

- the development of BMPs is as much about the strengthening of relationships and capacity building outcomes as it is about the BMP guidelines;
- the need for strong relationships between stakeholders to foster the sharing of information and a convergence of perspectives;
- the need for strong and comprehensive scientific research into the environmental issue in question and the outcomes of recommended management practices to support other anecdotal and experiential evidence, and the ongoing dissemination of these findings to all stakeholders;
- presenting land managers with the scientific evidence of the impact of agricultural practices on condition of natural assets can help land managers understand the need for BMPs;
- generic BMP recommendations are difficult for growers to implement and therefore there is a strongly held view that one to one extension is needed to promote and assist the actual on-ground implementation of BMPs. This level of extension places a large burden on existing extension staff and so highlights a potential area to be addressed in future programs;
- widespread uptake of the BMPs among growers is the next challenge that the partners in science, extension, industry and NRM face. One potentially useful approach to explore involves bringing in another partner: private chemical companies and private sector advisors more generally. With pesticide residues being one of the major water issues behind the development of the BMPs, the role of these influential 'trusted intermediaries' in shaping the practices of growers needs to be harnessed.
- many of the sustainable agriculture activities have involved strong partnerships between stakeholders, but in spite of their successes, the partnerships still appear to be largely driven by individuals rather than being embedded within the culture of the organisations.