

Reef Water Quality Protection Plan: Scoping of issues associated with industry practices



Australian Government
Department of the Environment
and Water Resources



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with industry practices

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Abbreviations

AgSIP	Sustainable Agricultural State-level Investment Program
ARIES	Australian Research Institute in Education for Sustainability
BMP	Best Management Practice
CCI	Coastal Catchments Initiative
CIRM	Consortium for Integrated Resource Management
CRC	Cooperative Research Centre
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEW	Department of the Environment and Water Resources
DNR / DNRW	Queensland Department of Natural Resources, Mines and Water (Queensland)
DPI / DPIF	Department of Primary Industry and Fisheries (Queensland)
EIS	Environmental Impact Statement
EMS	Environmental Management System
EPA	Environmental Protection Agency (Queensland)
FMS	Farm Management System
FNQ	Far North Queensland
FNQ _{NRM}	Far North Queensland Natural Resource Management
GBR	Great Barrier Reef
GBRMPA	Great Barrier Reef Marine Park Authority
GCTB	Green Cane Trash Blanket
GPS	Global Positioning System
IAWM	Integrated Area Wide Management
KIG	Key Informants Group
MTSRF	Marine and Tropical Science Research Facility
NHT	Natural Heritage Trust
NAP	National Action Plan
NRM	Natural Resource Management
QMDB	Queensland Murray-Darling Basin
RAC	Reef Advisory Committees
RWUE	Rural Water Use Efficiency Initiative
SEQ _d WQP	South East Queensland Water Quality Protection
WQIP	Water Quality Improvement Plan
WUE	Water Use Efficiency
WWF / WWFA	World Wide Fund for Nature, Australia

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Executive Summary

A significant body of scientific research developed over the last two decades indicates that the Great Barrier Reef is being harmed by changes in its catchment. The Australian and Queensland Governments are taking the matter very seriously and responding with a Reef Water Quality Protection Plan. One of the major thrusts of Reef Plan is measures to improve runoff from the river catchments that drain to the Great Barrier Reef.

One of the key issues is take-up of better management practices by landholders. Grazing and agriculture are major land uses in the catchment. This project scoped issues associated with grazing and agricultural industry practice, focusing on how take-up can be accelerated. Its specific task was to:

1. identify the realities and complexities of farmers' situations and understand the barriers, triggers and support required for change, and
2. understand what approaches to education and learning are likely to be most effective to support change.

The core of the research was (i) interviews with graziers, cane growers, horticulturalists, NRM professionals and researchers, (ii) a workshop held in Townsville with representatives of all these groups, and (iii) advice from a Key Informants Group (KIG) about how the research should be approached and matters that should be considered. Our local partner in this research was the Burdekin-Dry Tropics NRM group.

Working cooperatively with producers to foster changes in land management that make financial and lifestyle sense for producers, and benefit the environment, is currently the most cost-effective approach from both government and producer perspectives. There are many practices that make sense from a business perspective and improve catchment water quality that could be adopted more widely (Box 1). The report's recommendations therefore focus on what producers need from government to make this cooperation work in practice.

Workshop participants and interviewees provided us with extensive feedback on barriers to the adoption of new practices. Major areas of difficulty include:

- ◆ costs of change,
- ◆ risks of change,
- ◆ uncertainty about what will work in practice,
- ◆ tensions between government and producer agendas, including:
 - » different levels of commitment to private and public benefits, and
 - » producers' focus often at the project level, and governments often focused on larger scale outcomes,
- ◆ weak community networks, and
- ◆ producers' capacities (e.g. the skills needed for evaluation and reporting).

Producers' needs

Support that is highly valued by farmers and graziers is:

1. Business focused.

What producers need, centrally, is to understand the significance of a practice for their business.

2. Respectful.

For very many decades, government policy and Australian culture strongly valued and supported improving, and maximizing, the productivity of agricultural and grazing land. Their productivity was seen as vital to the nation's economic wellbeing. Environmental outcomes, on the other hand, were very secondary considerations. Respectful support understands this history. It is not naive about the mistakes that have been made in the past, it takes responsibility for governments' failures, and it is aware that mistakes may be being made now.

3. Easy.

It is easy to create barriers for producers, unintentionally, by designing a procedure that producers find difficult in practice. Proposed processes need to be evaluated from producers' perspectives, when they are being designed.

Producers' preferred methods of support are:

1. Financial assistance.

Farmers and graziers look for some support when they are asked to make changes that provide a poor return on the investment of their time or make them worse off from financial or lifestyle perspectives. Diverse kinds of financial support can be helpful. These include:

- ◆ incentives for adoption,
- ◆ payments for outcomes delivered on farm, and
- ◆ underwriting risk.

2. Practical demonstrations.

Practical on farm demonstrations are a highly valued form of support. They greatly reduce the risk to farmers of adopting a new practice, because they can see:

- ◆ how a new practice has been used on farm,
- ◆ how well it has worked out financially, and
- ◆ whether there are significant differences between the demonstration site and their own property or business situation that need to be taken into account in considering its relevance to them.

3. Extension officers.

The key benefits that extension officers can offer (whether government, industry, commercial or NRM group based) are:

- ◆ direct assistance in the process of working out how a new practice can be used on a particular property;

- ◆ support that complements farmers on-farm efforts, by managing the interface with government agencies who are a source of funds and to whom producers are accountable; and
- ◆ keeping abreast of changes in practice, so that staying up to date is much less work for each individual farmer or grazier.

Recommendations

1. Funding simplification and flexibility

Develop alternative funding models that give flexibility with accountability and efficiency by decreasing the emphasis on paperwork and increasing the emphasis on conversation. This will involve less effort for the funded, and richer communication that will help funders understand better how programs are playing out on the ground. The increased difficulty of demonstrating transparency and accountability to third parties will be managed by finding ways to shift the emphasis in funding programs from inputs to outputs and outcomes.

2. Financing options review

Review financing of efforts to accelerate take-up of beneficial practices by producers by assisting producers with the risks of changing practices, the costs of using new practices, and transition costs. Identify effective, equitable options, developing innovative strategies as necessary.

3. Incentives for innovation

Catalyse faster innovation in practices by establishing a framework to make successful innovation in practices profitable for primary producers, beyond the benefit that accrues to them from using the innovation in their own businesses. In particular, consider establishing a scheme to generate some kind of income stream for innovators, for instance, a royalty over a period of ten years, paid in proportion to the practice's take-up.

4. Aligning lending practices with sustainable development

Investigate the contribution of banking and other investment institutions (especially lending decisions) to unsustainable land management, and (i) develop training materials for institutions to improve their lending practices, to better align them with sustainable development goals, and (ii) develop training materials for borrowers to help them better evaluate their risks as property purchasers.

5. Best practice sites review and online directory to BMP information

Provide an online resource for producers and those who support them that provides a directory to demonstration sites and a directory to best management practice material, that is designed so that it builds users' capacities to manage farms in ways that protect the Reef.

6. Enhancing take-up processes for practices with substantial potential

Assist farmers and graziers to think through ways to use promising practices in their particular businesses (given constraints re time, money, land, etc) by enhancing and complementing existing tools (e.g. Best Management Practice manuals) used to help producers take up new practices.

7. Sustainability for grazing properties with small carrying capacities

Identify pathways to sustainability for properties with small carrying capacities or high levels of debt relative to their carrying capacities. These properties contribute disproportionately to water pollution, because financial pressures drive graziers to overgraze.

8. Strengthen industry support networks

Develop or expand incubator functions (for new businesses), development functions (for established successful businesses), and clinic functions (for businesses experiencing difficulties), in each industry sector.

9. Develop advocates' capacities to champion practice innovations from business perspectives

Develop the capacities of professionals and non-professionals who are championing good land management practices to explain to farmers and graziers how beneficial changes in practices make sense from business and lifestyle perspectives.

10. Skills development for new extension officers

Establish a process of relatively rapid skills transfer, within extension officer networks, that substantially decreases the time that it takes for new officers to get up to speed with an industry and a region, and the time that it takes for them to build trust. This is particularly important because staff turnover in many of these positions is relatively high, because funding is insecure.

11. Developing capacities for complex problem solving

Use complex, multi-disciplinary decisions that participants are making as occasions for learning a variety of ways of solving problems and thinking innovatively in capacity building workshops. This will contribute directly to current natural resource management in each region, build networks, and develop stakeholders' capacities at the same time.

We have taken the view in this report that where there are cooperative, win-win paths to follow, which have a real prospect of achieving what is needed from a Reef perspective, then that is where efforts to catalyse change in farming and grazing practice should focus, in the first instance. This is the main thrust of this report. If, as adaptive management of the catchment-Reef ecosystem proceeds, we learn that harder choices are unavoidable, it will still have made sense to pursue these lower cost improvements to catchment management first.

1 Introduction

1.1 Why this research

A significant body of scientific research developed over the last two decades indicates that the Great Barrier Reef is being harmed by changes in its catchment, and that changes in land use and land management practices could make an important contribution to lowering the environmental stress on the Reef system.

A Panel of Scientists formed to advise the developers of Reef Plan summarised the research to 2003. Their key conclusions were:

“The Panel found that there are clear indications that major land use practices in the Reef catchment have led to accelerated erosion and greatly increased the delivery of nutrients over pre 1850 levels. The reasons for this decline are varied but relate to activities within the river catchments, such as the extensive grazing practices in the drier catchments and overgrazing in general, urban development, agricultural production, water use practices, extensive vegetation clearing and wetland drainage on coastal plains and development on acid sulphate soils.

“The Panel found that there is clear evidence of the effect of these practices on some rivers, estuaries and inshore areas. Reefs at a number of inshore locations along the coast have been disturbed and have remained in a disturbed state. These reefs exhibit characteristics consistent with altered ecological function due to enhanced nutrient availability or sedimentation. Evidence of impacts on offshore areas of the Reef is not well understood, however information from overseas shows that by the time such effects are obvious the system would be almost irreparably damaged. In light of the above factors the Panel confirmed that there is a serious risk to the long term future of at least the inshore reef area and that action is necessary to avoid such damage.”¹

The Australian and Queensland Governments are taking the matter very seriously and have developed a series of programs under the Reef Water Quality Protection Plan, released in October 2003, to address a number of these issues.² One of the major thrusts of Reef Plan is the introduction and implementation of a series of measures to improve runoff from the river catchments that drain to the Great Barrier Reef. There is concern, however, that better management practices have not been taken up by landholders as extensively as had been hoped.

Numerous reports on Reef water quality issues have been prepared and many consultation workshops have been held with various stakeholder groups. There are diverse programs by industry groups and State government agencies, and Australian government support, designed to catalyse practice changes in specific areas of the farming sector (see

Appendix 1 for more details). A Key Informants Group advising this project suggested that grounding the project in an exploration of primary producers' perspectives – looking at the range of current and possible programs to catalyse change in practices from their shoes – would add significant value to the work currently taking place.

Wide take-up of Best Management Practices³ will only occur where adopting the practice makes sense to primary producers, so their perspectives are vital in the design of programs that are intended to have ecologically significant effects. Grazing and agricultural land are diffuse sources of pollution, so wide take-up is essential if reduction in exports of sediments and nutrients from these lands is to make a significant contribution to protection of the Great Barrier Reef.

1.2 What the research is about

The task of this project, funded by the Australian Government Department of the Environment and Water Resources under the Natural Heritage Trust Fund, was to:

1. Identify the realities and complexities of farmers' situations and understand the barriers, triggers and support required for change, and
2. Understand what approaches to education and learning are likely to be most effective to support change.

The key questions we put to producers, and to agency staff and researchers who work with them, were:

1. "What aspects of existing water quality management programs do and do not make sense, from a farm business perspective?"
2. "In what ways can we make reef water quality protection make better business sense for farmers?"

Answers to these questions presented in this report are not exhaustive. We have been pragmatic: focusing on insights and comments that signal opportunities for governments to catalyse change in industry practices.

1.3 The logic behind government and producers working cooperatively

Primary production occupies a large percentage of the Reef's catchment. Catalysing sufficient change in primary production for the Reef to be managed sustainably is a major challenge. From a long term perspective, improving primary production practices is part of a management experiment exploring what level of catchment change is necessary to sustain the Reef, and how that change can be brought about.

Working cooperatively with producers has been emphasised here for a number of reasons.

Looking at primary production methods from a Reef perspective, there are uncertainties about the links between specific land management practices and outcomes in terms of a healthy environment for the GBR. Key uncertainties relate to:

- ◆ how much catchment water quality can be improved by specific changes in practice on grazing and agricultural land;
- ◆ what changes are necessary to deliver significant benefits to the Reef; and
- ◆ what the lag times between catchment management changes and Reef responses might be.

When imposing substantial costs on producers to deliver public benefit that in some cases may prove to be surprisingly small at least initially, care needs to be taken that the science is clear. There are changes in practices that benefit producers, or are cost neutral, that can be implemented first. A least cost path is both more considerate, and less expensive for all concerned.

Of course the Reef is not the only location affected by on farm practices that pollute waterways. Income on properties may be less under high erosion, other things being equal; local waterways are directly impacted; and downstream areas may be declining. More stringent approaches may be readily justified on the basis of these impacts. Where these improvements are made, the Reef may also benefit.

The approach taken here - that governments and producers should work cooperatively to reduce pollution from primary production, focusing on measures that are attractive from both public and private perspectives - can be understood as a minimum standard for land management in the Reef's catchment as a whole, while uncertainty about the benefits to the Reef of particular changes in practices remains high.

There are also financial reasons from a government perspective for emphasising a cooperative approach focused on changes in practices that benefit both producers and the Reef. These changes can be implemented without, or with a relatively modest, regulatory regime. Accountability mechanisms of some kind are essential if government funds are being provided to producers of course. Diffuse sources of pollution are expensive to regulate. Measurement of performance is much more difficult than it is with point sources. Where cooperation can deliver substantial change in practice, this makes better financial sense from a government perspective as well as from a producer perspective. It should also be noted that if a strong regulatory regime is introduced, and it is used to impose substantial costs on producers, a strong political response is likely. So from an ecosystem management perspective, the political risks of forcing unwelcome changes on producers need to be factored in when making judgments about what paths to follow.

For all these reasons, we have taken the view in this report that where there are cooperative, win-win paths to follow, which have a real

prospect of achieving what is needed from a Reef perspective, then that is where efforts to catalyse change in farming and grazing practice should focus, in the first instance. This is the main thrust of this report. If, as adaptive management of the catchment-Reef ecosystem proceeds, we learn that harder choices are unavoidable, it will still have made sense to pursue these lower cost improvements to catchment management first.

2 Methods

2.1 How the research was undertaken

The core of the research was (i) interviews with graziers, cane growers, horticulturalists, NRM professionals and researchers, (ii) a workshop held in Townsville with representatives of all these groups, and (iii) advice from a Key Informants Group (KIG) about how the research should be approached and matters that should be considered. The farmers, graziers, extension officers, managers and researchers who contributed to this research are listed in Appendix 2. Participants in the workshop were selected on the basis of advice from the KIG, government agencies, and staff of the primary producer organisations, during discussions with them in the early stages of the project. Participants were selected on the basis of the relevance of their experience to the problem of improving reef water quality.

Our local partner in this research was the Burdekin-Dry Tropics NRM group. The Burdekin region was selected because this NRM group was commencing work on reef water quality issues, because diverse primary production sectors are present in the region, and because the wet tropics areas were also accessible from its Townsville base.

Promising approaches to education and learning are fundamentally ones that are likely to have a significant positive effect on water quality outcomes on the Reef. The foundation for assessing education and learning opportunities is therefore a consideration of where the largest changes in industry practices are possible. Promising education and learning programs are then ones with the potential to make a major contribution to catalysing and supporting those changes. Our research process has therefore tracked from:

1. where are the best opportunities to improve practices, from a water quality perspective?, to
2. what kinds of support will help farmers and graziers make those shifts?, to
3. what roles should education and learning processes play in these efforts to support shifts in producers' practices?

2.2 How do we know that our findings are valid?

2.2.1 Testing the accuracy of our understanding of participants' perspectives

We tested the accuracy of our understanding of primary producers' perspectives in a number of ways.

1. During the workshop we recorded key points from the discussion on electronic whiteboards. This is a form of active listening, which provides workshop participants with direct feedback on our understanding of what they are saying that they can use to correct us. We also asked participants to advise us, in anonymous feedback forms, on whether our records of the conversation were accurate. They reported that they were accurate. On average they rated the accuracy of our whiteboard notes, of which they had photocopies, as 4.2, where 4 indicated that the notes reflected participants' views well, and 5 that they reflected participants' views very well (see Appendix 4 for more details). These whiteboard notes are the core material for the tables of workshop findings (Appendix 3) on which this report is based.
2. For a significant core of the workshop - identification of promising practices, barriers to their take-up, and opportunities for enhancing take-up - participants recorded their initial thoughts on forms provided (prior to discussing them in small groups, then in the whole group). These forms are a very direct record of their input, and have been used in compiling the tables of workshop findings (Appendix 3).
3. We also used interviews with producers, extension officers and researchers to check our understanding of specific issues, following the workshop.
4. We sought comment on a draft of this report, again in part to test the accuracy of our understanding of farmers' and graziers' perspectives.

Together these processes provide confidence that our reporting of farmers' and graziers' perspectives is relatively accurate. More can always be said to lay out any group's perspectives. What we report reflects our understanding of the dialogues in which we participated, and feedback from reviewers of a draft report on what it is most important to emphasise. Of course there is scope for many other points to be emphasised.

2.2.2 Integrating participants' contributions

We asked workshop participants to consult with some of their colleagues before they attended, so that they could contribute with a number of producers' perspectives in mind. A number of the participants did this, and provided notes on their colleagues' key concerns. In addition, many of the participants were or had been involved in industry bodies, so they spoke from relatively wide experience within their industry. We are confident that we drew on a broad base of industry experience for this project.

We weighed and synthesised participants' comments via a number of processes that tested what it is, and is not, reasonable to conclude about primary producers' situations. Key processes were as follows.

1. We sought comments from stakeholders with three kinds

of perspective on producers' situations: (i) the producers themselves, and then (ii) extension officers (and others who work with producers), and (iii) researchers. Researchers and extension officers provide perspectives on producers' situations with different kinds of distance and intimacy. The findings reported here resonated with all three groups.

2. It is commonplace to seek perspectives on primary production practices by working with producers in separate industry specific groups. That was originally proposed for this project, but we employed a different approach here: having participants from all major farm based industries in the catchment of the Great Barrier Reef in the one workshop. For a project of this kind, this approach has a number of strong advantages:
 - a. When producers are in industry groups, it is natural for them to foreground industry specific issues, notably definitions of what good practice is. Conversely, there is more sensitivity to discussing the financial aspects of their businesses, because the participants are often in direct competition with each other. By designing a cross-sectoral workshop we made it easier to explore underlying business issues. As these are commonly the critical issues influencing take-up of practices, this process served this project's needs better - our focus in this project is 'what changes in practices make good business sense?'
 - b. Cross-sectoral discussion is educative for all concerned, because it exposes participants to a wider range of perspectives and values.
 - c. In a catchment management context, it helps each industry accept responsibility for its own contributions by making it evident that problems in receiving water bodies are jointly produced.
3. We placed a workshop at the centre of the process, rather than interviews, because in a workshop the tasks of synthesising diverse insights and selecting the points to emphasise are shared with the participants. This is a much stronger process than researchers doing the integration and synthesis themselves, working from records of interviews.
4. The Key Informants Group provided a very useful 'sounding board' for the authors' readings of producers' situations throughout the project. The Key Informants Group and all workshop participants and interviewees were asked to comment on the perspectives laid out in a draft report.

3 Potential to better adapt industry practices to the needs of the Reef

3.1 Opportunities to improve outcomes for both producers and the Reef.

Producers and graziers participating in this project identified a wide range of practices that could be taken up by more producers, delivering benefits for both the Reef and the producers (Box 1).

3.2 The size of the water quality benefit that further take-up of each practice can provide is unclear.

There are many factors that make the relative importance of different practices to Reef water quality difficult to assess, and that make it difficult to assess the benefits that a given change in practice will produce. For many practices, we have a qualitative appreciation of their importance, but we have not measured their effectiveness in the field. The sharp issue here is: if we had better data, what would we do differently? Of course we can't tell in advance; on the other hand, it is clear that there are some uncertainties that are worth probing. For example, for grazing land, much of the emphasis is on ground cover on properties, and thence on pasture management regimes (Figure 6). However it may be that finer resolution processes determine much of the pollution load. One example of a process that could have a surprisingly large influence is feeding by feral pigs. In the Burdekin they frequent riparian areas. The damage to soil structure can be extensive, creating areas that erode easily under high river flows (Figure 7). Feral pigs are present in over 30% of the riparian area of the Burdekin, and are widespread in the wet tropics.⁴

There are quantitative uncertainties at every resolution. We only understand the relative contributions of different landscapes, different land uses, and different practices relatively coarsely. To manage the uncertainties proactively, an adaptive management framework is needed, incorporating a formal, scheduled review process. In our view, it is currently not reasonable to require producers to adopt costly practices, without financial support, given the high levels of uncertainty about the eventual benefits for the Reef. Changes in practice that improve farm incomes and lifestyles should be emphasised, because there are many opportunities to change practice in ways that benefit both producers and the Reef. These changes are much more cost-effective to implement, and it is possible that they will end up being sufficient from a Reef perspective.



Figure 1 New drainage line in a cane field in the wet tropics



Figure 2 Laser levelled cane field in the wet tropics prior to planting



Figure 3 Grassed inter-rows in banana plantations in the wet tropics

Box 1: Practices with potential for significant further take-up, as identified by participants in the ARIES Great Barrier Reef water quality workshop

More information:

Appendix 3 includes additional information from workshop participants and interviewees on how take-up of these practices can be accelerated.

The practices themselves are well documented in industry and government documents, many of which are available online.

Grazing

- ◆ Fencing to improve management of land
 - » fencing to land type
 - » fencing rivers
 - » for 4 way rotation
 - » off-stream watering (*Figure 5*)
- ◆ Fire management
- ◆ Removal of woody weed infestations, to be replaced with fodder (grasses) to obtain ground cover (*Figure 9*)
- ◆ Satellite based property condition monitoring
- ◆ Sell stock early in difficult circumstances (notably drought)
- ◆ Use of supplements to manage pressures of drought
- ◆ Using lighter stocking rates to get higher production
- ◆ Wet season spelling (*Figure 8*)

Cane growing

- ◆ Companion planting
- ◆ Controlled traffic: matching row space to harvesters and haul-outs
- ◆ Double disc planting
- ◆ Drainage improvements in wet tropics cane growing (*Figure 1*)
- ◆ Green cane trash blanketing
- ◆ Irrigation changes:
 - » Irrigation scheduling
 - » Soil moisture probes
 - » Tailored nutrient / irrigation systems
 - » Trickle, drip or overhead irrigation
- ◆ Laser leveling (*Figure 2*)
- ◆ Minimum tillage / reduced tillage
- ◆ Recycle pits
- ◆ Variable rate fertiliser application

Horticulture

- ◆ Directed spraying
- ◆ Good soil / plant nutrition
 - » soil testing
 - » sap / leaf testing
 - » soil moisture & nutrient monitoring
- ◆ Integrated pest management
- ◆ Minimum tillage
- ◆ Grassed inter-rows (*Figure 3*)
- ◆ Move agricultural use to its highest value, whilst minimising environmental risk
- ◆ Retire / compensate unsuitable land uses
- ◆ Rotation cropping / companion planting
- ◆ Tailored nutrient / irrigation systems
- ◆ Waste management (*Figure 4*)

3.3 Information on the extent of take-up of these practices is poor.

Most of the data on take-up of practices that is currently available are one-off surveys done to support particular management reviews. Ongoing programs measuring the take-up of practices are essential for the long term management of the Reef's catchment, because to assess the aptness of policy settings over time, we need to know the extent to which they are being actioned, as well as ecological outcomes on the Reef. If Reef outcomes (or outcomes in a given river system) are poor, we need to be able to differentiate between (i) whether the programs to accelerate uptake are working, and (ii) whether the changes in industry practice that are being championed are appropriate. It is in the interests of landholders also to know if their sub-catchment is contributing more than a reasonable proportion of the load into the system. We note that some programs of this kind are underway, notably work through the Australian Government's Coastal Catchments Initiative programme on Water Quality Improvement Plans (WQIP) including the completed Douglas Shire WQIP and the Tully WQIP in partnership with peak industry bodies and FNQNRM, and a benchmarking investment programme under the Australian Government's Marine and Tropical Science Research Facility (MTSRF). A more comprehensive and coordinated effort, however, would appear to be required.



Figure 4 Accumulating waste on a banana and cane farm in the wet tropics



Figure 5 A watering point on a grazing property

3.4 Lag times between commitment to change practice and environmental benefits for the Reef are usually long; uncertainties don't justify inaction.

From a Reef perspective, the lag times between work done to champion a change of practice and ecological improvement at the Reef are long. The phases are:

- a. The time taken between championing and a producer committing. Usually there are early adopters, then the bulk of producers adopt a new practice, and then a long tail of late adopters. It can take 5 to 10 years for the bulk of producers to commit to a new practice.
- b. The time taken between commitment and implementation. Depending on the practice, this can be relatively quick or very slow. Drainage changes in wet tropics horticulture may need to wait till the next planting, which may be 5 or more years away, for instance. Transition to off-stream watering with more intensive fencing may also take 5 or more years to implement on a grazing property.
- c. The lag time between on farm changes and changes in the pollutant load delivered to the Reef. For example, sediment



Figure 6 Excellent winter ground cover on a grazing property: good feed; fire is a risk



Figure 7 Impact of feral pigs on a riparian area in the Burdekin



Figure 8 Cattle being fattened for sale in a riparian area that has been spelled



Figure 9 A 'woody weed' on grazing land



Figure 10 Bananas recovering after cyclone damage in the wet tropics in 2006

that leaves grazing properties in the upper catchment may take years to reach the reef, perhaps waiting for a cyclonic event to transport it to inshore waters.

- d. The lag time between a reduction in sediment load from the catchment, and a return to a pre-European nutrient regime on the inner reefs. Nutrients recycle in the Reef, so the signal of increased nutrient loads may be visible for one or more decades after catchment performance has improved.

These lag times add greatly to the difficulty of managing the catchment in a way that sustains the Reef. They underline how essential it is that we act early rather than late to address the problem, notwithstanding the uncertainties about many aspects of these dynamics.⁵

3.5 Practice changes with good returns, and reasonable risks, are attractive to farmers and graziers. Government action can improve the affordability of change, and reduce risks.

Practices with a good return on investment, after subsidies and other financial support are taken into account, are very attractive for producers. For example, growers greatly appreciate Growcom's *Water for Profit* program⁶ as it provides a 4:1 or 5:1 return on investment, whilst also delivering water quality benefits. (Growcom is the horticulture industry's representative body.⁷ The program is funded by the Queensland Department of Natural Resources and Water's Rural Water Use Efficiency Initiative.⁸)

Financial viability is basic for primary producers. Key facets of this are:

- ◆ short term profitability (so it is often helpful for government to fund transition costs to new land management practices),
- ◆ long term financial sustainability (here producers and Reef interests are often aligned), and
- ◆ reasonable levels of risk (governments can reduce risks by direct funding, by underwriting, and by providing reliable, accessible information).

4 Barriers to good on-farm outcomes

Workshop participants and interviewees provided us with extensive feedback on what producers experience as barriers to the adoption of new practices. The advice they provided is summarised in the following table (Table 1).⁹

Table 1 Barriers to good on-farm outcomes as experienced by producers

Area	Barriers	Detail, examples
Business environment		
Primary production's inherent risks	<ul style="list-style-type: none"> Climate variability is a major risk factor for producers 	<ul style="list-style-type: none"> Flood, drought, fire and cyclones are obvious examples Figure 10 shows recovery from cyclone damage on a banana plantation
Markets for products	<ul style="list-style-type: none"> There is no price premium for product produced sustainably, so practices whose costs exceed their benefits make businesses less viable 	<ul style="list-style-type: none"> Market driven economy – need to educate consumers about value in buying sustainably produced goods
Financial markets	<ul style="list-style-type: none"> Lending institutions focus on profit, not environmental outcomes, when making loans 	
Inherent difficulties of changing practices		
Costs of change	<ul style="list-style-type: none"> Good practice from a water quality perspective can be an expensive additional burden on the primary producer 	<ul style="list-style-type: none"> Some capital works that are very environmentally friendly, e.g. runoff recycling pits, are poor investments financially
	<ul style="list-style-type: none"> Costs of transitioning to a new product or process may be difficult to fund 	<ul style="list-style-type: none"> Capital investment may be required, but funding this may be difficult, given the crossing of public and private interests
	<ul style="list-style-type: none"> Desirable practices may give little financial reward 	<ul style="list-style-type: none"> Income from cane is high: why change when income will come anyhow
	<ul style="list-style-type: none"> A practice may work financially, but not from a lifestyle perspective 	<ul style="list-style-type: none"> People not looking at their options financially: more about lifestyle
Risks of change	<ul style="list-style-type: none"> Practices may be risky yet provide little financial benefit 	<ul style="list-style-type: none"> Relative costs of inputs like fertiliser compared to risk of under-application
	<ul style="list-style-type: none"> Producers may not have the money to fix problems that arise as they change practices 	
	<ul style="list-style-type: none"> Any increase in risk may be unattractive for good business or lifestyle reasons 	<ul style="list-style-type: none"> Age - farmers 65 plus looking to retirement
Time required for change	<ul style="list-style-type: none"> Changing practices takes time 	

Area	Barriers	Detail, examples
Quality of information and understanding		
Uncertainty about what will work in practice	<ul style="list-style-type: none"> The suitability and financial sustainability of practices needs to be proven to the satisfaction of producers 	<ul style="list-style-type: none"> Need to see more long term successes on different soils Practices must be proven to work over a range of weather conditions, soil types, crop varieties
Poor quality advice	<ul style="list-style-type: none"> Best Management Practices are not evaluated holistically; evaluations focus on specific industries' interests 	<ul style="list-style-type: none"> <i>Hymenachne amplexicaulis</i> was promoted as a ponded pasture grass in grazing land; it is now a major weed in Queensland's wet tropics.
	<ul style="list-style-type: none"> The funding of CSIRO has been politicised, and this has done enormous damage to their standing <ul style="list-style-type: none"> they work the media to raise the profile of an issue to let funds for research this applies generally now (e.g. to university researchers also) CSIRO is seen as hopelessly politicised. Not so 20 years ago.¹ 	
	<ul style="list-style-type: none"> Agronomy and advice on the ground often comes from sales people whose interests are in tension with producers' and the Reef's 	
Poor business understanding	<ul style="list-style-type: none"> Producers may lack relevant knowledge 	<ul style="list-style-type: none"> Some growers think that they know it all - that their practice cannot improve Belief that "more is better": don't understand economics of what they do on farm Growers may not see the financial savings that are possible
Tensions between government and producer agendas		
Different interests	<ul style="list-style-type: none"> Different levels of commitment to private and public benefits 	
Focuses at different scales	<ul style="list-style-type: none"> Producers' focus is often at the project level, while governments are often focused on larger scale outcomes 	
	<ul style="list-style-type: none"> Planning is centralised, and land management decision-making is decentralised 	
	<ul style="list-style-type: none"> A tendency for communication and education to be driven by a top down agenda, rather than demonstration led 	
Poor relations between government and producers	<ul style="list-style-type: none"> Trust (distrust) is a major issue when it comes to persuading graziers (and others) to change their practices 	
	<ul style="list-style-type: none"> Fear of regulations affecting the financial viability and economics of farms 	

Area	Barriers	Detail, examples
	<ul style="list-style-type: none"> Government management is perceived as often weak by producers. 	<ul style="list-style-type: none"> Producers' comments included <ul style="list-style-type: none"> Poor framing of purpose NRMs trying to do things on the cheap NRM Boards not capable of being agents of change: they need a capacity to work 1 to 1 with producers
Flawed management arrangements	<ul style="list-style-type: none"> Funding arrangements driving environmental decline 	<ul style="list-style-type: none"> Perverse government action: subsidising graziers to keep cattle on drought stricken land: the tools / mechanisms used to respond to drought are poor
	<ul style="list-style-type: none"> No framework to enforce management change on producers with poor practice 	
	<ul style="list-style-type: none"> Funds going into the bureaucracy rather than into on ground landholder action 	
	<ul style="list-style-type: none"> Inflexibility in funding: difficult to change uses of funds when circumstances change 	
Social capital		
Stakeholders not aligned	<ul style="list-style-type: none"> Lack of coordination / integration of government / community action 	
	<ul style="list-style-type: none"> Support for landholders being seen as a handout rather than a public investment 	
Weak community networks	<ul style="list-style-type: none"> Fear of failure 	<ul style="list-style-type: none"> Threat of vilification by peers and government Fear of being a laughing stock Peer group pressure
	<ul style="list-style-type: none"> Networks amongst producers may be poor 	<ul style="list-style-type: none"> History of growers being secretive. One benefits from the next growers' disaster.
Producers' capacities	<ul style="list-style-type: none"> Producers may find change difficult, they may be set in their ways 	
	<ul style="list-style-type: none"> Producers may not have the skills needed for evaluation, reporting, etc 	
	<ul style="list-style-type: none"> Tolerance of risk: many producers have a conservative attitude to risk 	
Environmental values ²	<ul style="list-style-type: none"> For some farmers, environmental outcomes are a low priority 	

Notes:

- This shift in researchers' standing signals a major unanticipated cost of the shift to part commercial funding for research institutions.*
- These differences in environmental values might not seem like a social capital issue, but farmers seeing*

environmental outcomes as a low priority is in fact a failure of social solidarity: they are not taking into account the interests of communities downstream and of future generations appropriately, as they make their business decisions.

5 Triggering changes in practices and appealing to differing interests

When ARIES together with DEW conceived this project the intention was to report on “triggers” for change: events that lead to changes in industry practice occurring. Our implicit model was that when farmers and graziers change their practices, (i) their contexts have shifted in ways that make change attractive, and (ii) that some specific “trigger” has occurred that moves them to action.

Clearly sometimes change processes have this character. On the other hand, there are situations where adopting a new practice makes such good sense that talk of “triggers” is not illuminating. For example, cane farmers in many regions have adopted green cane trash blanketing¹⁰ rather than burning cane because it is less effort, conditions their soil better, and reduces erosion. This kind of take-up is more organic - a matter of the practice making sense, and this coming to be generally understood in the industry. Take-up accelerates as producers find that the practice works for them, and as they share their experience with other producers. (This can be a very informal process.)

Our interest in “triggers” is an interest in what, for a producer, makes the difference between deciding to adopt a new practice, and deciding not to? Many things may make the difference. These can include:

- ◆ what they learn,
- ◆ the kind of support they receive,
- ◆ peer pressure,
- ◆ their own thinking, and
- ◆ changes in circumstances (e.g. increases or decreases in farm income).

From the perspective of the Reef, the “triggers” of most interest are (i) events government and industry can initiate or influence, that (ii) influence many producers, or influence producers who are particularly significant from a water quality perspective.

We therefore suggest a different question: if we approach accelerating take-up in a given way, how large a group of producers will be influenced?

This question brings a crucial issue into focus - producers’ interests differ. Some changes in practice have wide appeal - they benefit virtually all producers. Other changes in practice appeal to smaller groups of producers because they appeal under some circumstances, but not others. Industry type, rainfall regime, and kinds of landform all influence a practice’s relevance¹¹. But apart from these there are important differences in producers’ interests that govern how wide an appeal a change in practice has.

The key factors identified by farmers and graziers - i.e. the differentiations they themselves rely on - are differentiations in:

Financial position	<ul style="list-style-type: none"> ◆ Well off ◆ OK ◆ Hard times
Financial focus	<ul style="list-style-type: none"> ◆ Short term profit ◆ Medium term profit ◆ Long term financial sustainability ◆ Viability and lifestyle (making decisions mainly on a lifestyle basis, providing viability is assured)
Willingness to change practices	<ul style="list-style-type: none"> ◆ Basically against (e.g. close to retirement and conservative re risk and debt) ◆ Prepared to change if thoroughly convinced ◆ Innovator: attracted by exploring change
Commitment to sustainable land management ¹²	<ul style="list-style-type: none"> ◆ Strong ◆ Moderate ◆ Absent

From a Reef perspective, we can advocate for change more efficiently if

- i) we champion practices with wide appeal across this range of interests, and
- ii) we explain the benefits of a change in practice in ways that people with diverse interests can appreciate.

By asking how wide an appeal across this range of interests a program has, we can:

- ◆ evolve a program's design to broaden it's appeal,
- ◆ make better judgments about which programs to invest in, and
- ◆ better appreciate the strengths and weaknesses of a particular practice innovation.

6 Producers' needs

As we emphasised in section 1 of this report, working cooperatively with producers to foster changes in land management that make financial and lifestyle sense for producers, and benefit the environment, is currently the most cost-effective approach from both government and producer perspectives. There are many practices that are mutually beneficial that could be adopted more widely (Box 1). The focus of this section is therefore on what producers need from government to make this cooperation work in practice.

6.1 Relationship qualities

There are qualities of relationship that producers value particularly - sensitivity to business needs, respect, and ease - so we have outlined them first. Any kind of support for, or cooperation with, producers will work better if governments embody them as they work with producers.

6.1.1 Business focused

Farmers' and graziers' experience is that many government professionals only understand relationships between government policy and farm business decision-making in very broad terms, to the detriment of the objectives of both. Jointly funded riparian fencing programs illustrate the need. Fencing in grazing properties can be used to manage grazing pressure to maintain pasture cover. However the environmental benefit that riparian fencing provides depends upon how the property is managed. To assess how well the property is being managed, from a water quality perspective, an agency representative needs to understand a great deal more about grazing properties than they do to assess whether fences have been erected as planned. Without good business understanding one can design programs that only deliver superficially.

Support programs that are aligned (in scope, focus, and processes) with farmers' and graziers' business interests have more influence. The less aligned they are, the harder it is for a farmer or grazier to make use of them. Programs that meet business needs provide holistic support from a business perspective: their scope is defined by business needs, not by a boundary between what has or has not a direct relevance to the Reef's needs. 'Grazing for Profit' illustrates this: its scope matches graziers' needs; it teaches sustainable land management within the context of viability and profitability. They are also designed with a sensitivity to the differences between businesses. For example, whether and how a particular change in practice should be adopted by a particular farmer or grazier depends in part on differences in soils,

slopes, property size, financial position, available time, skills, current management practice, crop history, on-farm infrastructure, and the like.

Support that is professional, from a farm business perspective, is attuned to which differences are relevant in which circumstances.

Government professionals' understanding of producers' experience and perspectives makes a large difference to their effectiveness, when they are working cooperatively with producers to foster changes in land management that make sense for both producers and the Reef.

6.1.2 Respectful

From the perspective of the Reef, cattle, cane and horticulture properties have not been managed sustainably. But this is not a special case; downstream ecosystems have declined throughout Australia, wherever catchments have been extensively developed. Moreover grazing and agricultural land management, and thence their environmental consequences, often directly express past governments' policy.

For very many decades, government policy and Australian culture strongly valued and supported improving, and maximizing, the productivity of agricultural and grazing land. Their productivity was seen as vital to the nation's economic wellbeing. Environmental outcomes, on the other hand, were very secondary considerations. Pastoral lease holders used to be required to clear their land; clearing was a condition of their leases. Many "heart break blocks" - grazing properties that are too small to support a grazing family - are small because that was the size allocated in soldier and other settlement programs. Introduction of Brahman cattle and use of supplementary feeding to reduce loss of stock in droughts was encouraged by government agencies without an appreciation that this would lead to more even, more intense grazing pressure in droughts, because these cattle survive longer in harsh conditions.

The history of government policy is usually poorly understood by government employees, so they don't appreciate their collective involvement in driving environmental decline. Many primary producers, on the other hand, have decades of experience of changing government policy. Ways in which they are unfairly blamed for environmental problems are very obvious to them.

Respectful support takes its own history into account. It is not naive about the mistakes that have been made in the past, it takes responsibility for governments' failures, and it is aware that mistakes may be being made now. Equally, it appreciates the good work that has been done to integrate environmental outcomes into grazing and farm business practice, and it appreciates the business effects of policy options and proposals - particularly since the default effect of a change in environmental policy is often to increase costs to businesses. The financial significance of policies should be clearly understood when they are being considered and implemented, so that governments act fairly and without unintended effects on businesses' viability.

6.1.3 Easy

Good support makes improving water quality outcomes easy. Government expectations of primary producers can be quite unrealistic from the producers' perspectives. Three difficulties mentioned frequently are:

- ◆ funding applications are often difficult to prepare;
- ◆ monitoring and evaluating is often difficult; and
- ◆ difficulty negotiating variations to projects, particularly when they are grant funded, when circumstances change.

Producers want 'user friendly' processes. When a process is unavoidably difficult from a producer perspective, e.g. to comply with governments' standards for accountability, producers want assistance with compliance. Help from extension officers, Landcare coordinators, and the like has been greatly appreciated.

When designing processes for working with producers, a key step is to evaluate the proposed processes from producers' perspectives. A process that seems easy to a government professional may seem difficult to a producer. It is easy to create barriers for producers unintentionally by designing a procedure that producers find difficult in practice.

6.2 Kinds of support

6.2.1 Financial assistance

Financial viability is a basic need of farming and grazing businesses. Farmers' and graziers' views are that where they are being asked to incur business or lifestyle costs to achieve public good, then a level of public support is appropriate. Return on investment is a key issue from a farm business perspective: a change in practice that pays for itself as well or better than other uses of primary producers' time and money doesn't require direct financial support. For example, green trash blanketing has been widely taken up by cane growers without incentives because it requires less effort, retains nutrients better, and reduces erosion.

Some public funding may be appropriate where:

1. primary producers are expected to manage land in ways unrelated to their core business to achieve public good objectives (e.g. keeping land out of production to achieve conservation goals);
2. changes in practices are required to achieve environmental outcomes, but the change process is quite risky from a business perspective (e.g. adoption of precision farming practices in cane to reduce erosion and nutrient loss, occurring at times when profitability is low);
3. a change sought by government provides a relatively poor return

on investment for producers, compared with other uses of the same time or money (i.e. there are significant opportunity costs; e.g. in the Burdekin, the cost of water recycling pits is a strong barrier for many cane farmers).

Diverse kinds of financial support can be helpful. These include incentives for adoption, payments for outcomes delivered on farm, and underwriting risk. Incentives have been widely used. With incentives, the community, through government, part funds changes in business practices. What levels of support are appropriate is of course debated. These need to be set taking into account (i) the extents of the public and private benefits involved, and (ii) producers' capacities to fund changes themselves.

Outcome oriented funding is illustrated by a program running on grazing land in the desert uplands. It provides a financial benefit to graziers who have retained 40% ground cover on their properties at the end of the dry season. Graziers are allowed to opt out. They are not told by agency staff how to do it; it is up to them to manage their own properties to achieve the desired outcomes. This is a flexible program from graziers perspectives, and from a public investment perspective has no implementation risk.

Underwriting has not been used to reduce producers' risks of implementing water quality changes, to our knowledge. It has the potential to be very cost-effective from a public perspective. For example, a cane farmer commented "in the last 5 years in sugar, you had to get it right, or you went broke". In these circumstances innovation is very difficult. Underwriting can transform a change in practice from too risky to very attractive. Good systems for measuring financial and operational performance are needed to implement schemes of this kind.

6.2.2 Practical demonstrations

Practical on farm demonstrations are a highly valued form of support. They greatly reduce the risk to farmers of adopting a new practice, because they can see:

- ◆ how a new practice has been used on farm,
- ◆ how well it has worked out financially, and
- ◆ whether there are significant differences between the demonstration site and their own property or business situation that need to be taken into account in considering its relevance to them.

Farmers and graziers specifically requested:

- ◆ producer demonstration sites,
- ◆ field days on graziers and farmers properties, so they can explore issues on the ground with producers,
- ◆ more "open houses", where producers can learn from what others are doing on their properties, and
- ◆ practical workshops on nutrient management for farmers.

Every other kind of evidence comes with much higher risks from farmers' and graziers' perspectives. Government advice is only trusted when the producers know that the advisers understand business issues; that is more the exception than the rule under current producer support regimes. Scientific research usually does not address all the issues that are important to producers. From a farm business perspective, research findings are often over-sold: producers want to understand what the financial, lifestyle and environmental effects of a change in practice will be in their particular circumstances.

6.2.3 Extension officers

Farmers and graziers provided a great deal of advice about how to make extension officer programs work well - all of it taken for granted that when they do work well they are very valuable. The key benefits that extension officers can offer (whether government, industry, commercial or NRM group based) are:

- ◆ direct assistance in the process of working out how a new practice can be used on a particular property;
- ◆ support that complements farmers on-farm efforts, by managing the interface with government agencies who are a source of funds, and to whom producers are accountable; and
- ◆ keeping abreast of changes in practice, so that staying up to date is much less work for each individual farmer or grazier.

The key characteristics of extension officers who are highly valued are that:

- ◆ they understand and are sympathetic to farm business perspectives, so that the advice they provide is very pertinent to the producers' own decision-making;
- ◆ they understand how to manage the government / producer interface so that the interests of both parties are met; and
- ◆ they have the time to provide producers with the support they need - in particular the time to provide one-to-one support when this is needed to work through an issue (as it may well be given the differences between properties, business situations, etc).

To make extension work well, extension officers need better job security than is usual (three year contracts are commonplace as a result of project funding). Trust is fundamental in extension work, and that takes considerable time to develop. Secure funding would be much more efficient financially, from a water quality perspective.

One to one support plays an important role in adoption of new practices. Descriptions of Best Management Practices (BMPs) commonly answer "how to" questions in detail, but describe the business logic for using (or not using) them in very general terms. Differences in soils, slopes, property size, financial position, available

time, skills, current management practice, crop history, on-farm infrastructure, and the like affect decisions about whether a new practice is appropriate, how it should be employed, and how the transition to new practice should be managed. It's often hard for farmers and graziers to find good support for thinking these issues through. For some innovations this support is unnecessary; for many it is helpful; in some situations it is essential.

6.2.4 Managing context

Like the community at large, producers look to government to manage (or, more accurately, to positively influence) the wider socio-economic and ecological environment within which production happens. Two areas that producers raised as areas of particular concern are:

1. *Better, more holistic assessment of risks when new practices are being evaluated by governments.*

There have been concerning errors in risk assessments by government departments when new practices have been evaluated, that result from not looking at how a change might affect the catchment as a whole. For example, *Hymenachne amplexicaulis* was promoted as a ponded pasture grass. It is invasive, is having a major impact in Queensland's wet tropics, and is now a declared weed. Benefits to grazing impacts were considered, but not the downstream impacts.

2. *Effective government action on 'hard problems' that are undermining collective efforts to improve environmental outcomes.*

There are major tensions between government aspirations and government action that undermine governments' standing with primary producers, who are (on the whole) outcome focused. These relate to difficult issues that undermine collective efforts to improve catchment water quality.

Three key examples from a grazing context are:

- » graziers recognise a perversity in practice in drought subsidies: effectively the current system subsidises graziers to keep cattle on drought stricken land, degrading it; (regarding this a key comment was: "I'm not rejecting support in droughts, but the tools / mechanisms used are poor.");
- » "the prices of land have been going up and up: a block can be priced in a way that makes it impossible to manage it sustainably (if the owner has borrowed most of the purchase price)"; and
- » properties which have carrying capacities that are too small are regularly sold and resold (because purchasers go broke); "why let blocks that are too small to be a living area be sold?".¹³

7 Recommendations

The recommendations which follow are focused on delivering both practical environmental outcomes and research which can point to further actions. Each has been developed working with producers contributing in this project's workshops and interviews. We are confident, on the basis of these contributions, that projects that address these recommendations will interest and engage groups of producers.

How these recommendations relate to current agency programs has not been thoroughly explored. We have had some input from agency staff, who contributed through interviews, the workshop, and as members of the Key Informants Group. Projects that address these recommendations will need to be worked up in the light of the work that the agencies are doing in these areas, and the approaches that they have experimented with.¹⁴

These recommendations are drawn from a wide range of possibilities; the range is signalled in part by key comments from the workshop sessions, included in the tables in Appendix 3 and Appendix 4.

7.1 Financing

1. Funding simplification and flexibility

Recommendation

Develop alternative funding models that give flexibility with accountability and efficiency by:

- i) decreasing the emphasis on paperwork and increasing the emphasis on conversation, as this will involve less effort for the funded, and richer communication that will help funders understand better how programs are playing out on the ground; and
- ii) managing the increased difficulty of demonstrating transparency and accountability to third parties by finding ways to shift the emphasis in funding programs from inputs to outputs and outcomes.

Background

Managing relations between funders and those funded is a critical process from all stakeholders' perspectives. For farmers and graziers, issues that are foregrounded include:

- ◆ funding for projects that deliver both environmental and

financial benefits is highly valued;

- ◆ the effort involved in applying for and reporting on projects is challenging, particularly because of the time and skills required;
- ◆ lack of flexibility to adapt projects when circumstances change causes concern (e.g. negotiating variations from grant applications can be difficult); and
- ◆ a sense of not being well heard, derived from experiences of government programs being implemented without an appreciation of how they are experienced from a farm business perspective.

For funding bodies issues raised in a Reef water quality context include:

- ◆ getting take-up of practices to a level that is sufficient to sustain the Reef within an appropriate timeframe;
- ◆ difficulty getting clarity regarding outputs and outcomes of programs (hence the increasing emphasis on monitoring and evaluation);
- ◆ uncertainty about how to use funds efficiently, working with primary producers, to achieve public goods.

Accountability and clarity are central issues here. The flow of information from projects to funders is not meeting the needs of either the funders or the fundees.

An example of the kind of funding program that might be possible is as follows. Initially, Australian and State governments could fund a suite of programs proposed by NRM bodies on the basis of projected improvements in water quality outcomes. This would create flexibility for the NRM organisations to adapt their approaches as they proceed. As programs evolve, Australian and State funding would be aligned increasingly with demonstrated success in catalysing on ground change - NRM organisations' programs would be funded primarily on the basis of cost effectiveness.¹⁵ In each funding round, some funds would be directed to unproven approaches - taking a portfolio approach to funding: the bulk of funds going to proven processes but some going to innovative, exploratory programs. A program like this depends on good measurement of take-up of practices, and on research into practices' effectiveness continuing.

2. Financing options review

Recommendation

Review financing of efforts to accelerate take-up of beneficial practices by producers by assisting producers with the risks of changing practices, the costs of using new practices, and transition costs. Identify effective, equitable options, developing innovative strategies as necessary.

Background

- ◆ There are limits to the influence of education. Where costs are high, education needs to be coupled with other influences (e.g. regulation and/or incentives) if take-up rates are to be altered significantly.
- ◆ Approaches to funding change to consider include:
 - » incentives,
 - » payments for outcomes delivered on farm,
 - » underwriting risk,
 - » funding targeted capital works,
 - » tax breaks, and
 - » refining property ratings, so that land that is not productive is rated as such.
- ◆ There is scope to accelerate take-up of some practices by innovative financial support, e.g. underwriting risks, and by new forms of outcome-based funding.

3. Incentives for innovation

Recommendation

Catalyse faster innovation in practices by establishing a framework to make successful innovation in practices profitable for primary producers, beyond the benefit that accrues to them from using the innovation in their own businesses. In particular, consider establishing a scheme to generate some kind of income stream for innovators, for instance, a royalty over a period of ten years, paid in proportion to the practice's take-up.

Background

Innovation in practices tends to be the province of individual farmers and graziers. Often research scientists get their inspiration from innovative practitioners. These innovators enjoy much more modest rewards compared to innovators in many other areas of business, because usually they don't have intellectual property rights in their innovations. If we make the rewards for innovation higher, the rate of change may increase substantially.

There may be difficulties, at least in some circumstances, in differentiating producers' responsibilities for 'an innovation', because practices evolve, so there are practice genealogies. An alternative approach that may have merit is to provide modest 'royalties' to industry bodies based on the take-up of changes in practices by their industry or their members.

Issues that will need to be considered when developing programs to address this recommendation include:

- ◆ what “newness” is and how to demonstrate it: perhaps via some kind of independent assessment, and
- ◆ how to demonstrate the environmental and financial viability of a practice.

We envisage the program providing grant funds to research partners to evaluate promising practices, to complement royalties paid to practitioner partners. Proposed innovations need to be evaluated from a whole system perspective, not simply from specific industry and water quality perspectives. An “innovation incubator” could be developed as a proactive adjunct to an innovation incentives scheme.

4. Aligning lending practices with sustainable development

Recommendation

Investigate the contribution of banking and other investment institutions (especially lending decisions) to unsustainable land management, and (i) develop training materials for institutions to improve their lending practices, to better align them with sustainable development goals, and (ii) develop training materials for borrowers to help them better evaluate their risks as property purchasers.

Background

Banks and other lending institutions are perceived by many primary producers to have interests that are opposed to good environmental outcomes for the Reef. Producers’ reading of the their situation is:

- ◆ it is in the institutions’ interests to write loans: if a borrower pays too a high a price for a property (in relation to the achievable primary production income stream), the lending institutions still have their interest paid, and they have the property as security, so can sell the property when the borrower defaults; and then
- ◆ when selling the property, it is not in the interests of the institutions to ensure new buyers purchase at a realistic price.

With the withdrawal of the banks from the bush (i.e. smaller number of branches in larger regional centres), both (i) the average banker’s knowledge of primary production has lessened, and (ii) their personal commitment to farming communities has lessened.¹⁶

This issue was raised primarily with respect to grazing properties.

One reviewer commented:

“A few years ago when I was working on rural reconstruction projects across Australia the ABA and a few banks had some very good programs on this, but I suspect that like extension officers the initiators have moved on. The banks have some good statistics on this. Remember not all bank decisions are made locally. This issue is worth following up and I think you will find that it has been

worked over many times. Like all the other issues corporate change leaves behind many soundly based initiatives that don't meet current organisational priorities for resourcing."

7.2 Practice demonstrations

5. Best practice sites review and online directory to BMP information

Recommendation

Provide an online resource for producers and those who support them (or one for each of cane growing, horticulture, and grazing) that:

1. provides a directory to demonstration sites, in a way that enables producers to explore how producers in similar circumstances have improved their practices;
2. provides a directory to best management practice material available online (and on paper, for key texts);
3. is designed in such a way as to build users' capacities to manage farms and properties with an awareness of their environmental context, and of the downstream effects of their management.¹⁷

Background

- ◆ Producers need to see more long-term successes achieved under different circumstances, e.g. on different soils, with different financial resources, so it is important to provide information about diverse demonstration sites.
- ◆ One site covering all industries is a better support for mixed businesses. However producers who identify with just one industry may not identify with a multi-industry site. Opportunities to enhance existing web sites should be considered, as well as development of new site(s).
- ◆ Accounts of practices should cover 'how to', 'why to', and provide links to background research.
- ◆ It may well be that information on good business practice (for producers) will be needed as part of the site, to make it an attractive resource for producers. The scope of the site should be defined by producers needs rather than by Reef Plan goals.

6. Enhancing take-up processes for practices with substantial potential

Recommendation

Assist farmers and graziers to think through ways to use promising practices in their particular businesses (given constraints re time, money, land, etc) by enhancing and complementing existing tools (e.g. Best Management Practice manuals) used to help producers take up new practices.

Background

Farmers, graziers, extension officers and agricultural researchers readily identify practices which both improve profitability and improve water quality outcomes (Box 1). Because they make business sense, these are the practices with the best potential for fast take-up. Accelerating their take-up is a key opportunity from a Reef perspective.

Farmers and graziers value two kinds of support highly:

1. financial support for adoption, and
2. ease of access to support at the property level (people to help farmers and graziers work out how a practice should be used on their property, and to broker access to funds (writing grant applications, etc)).

Financial support is less important with practices that make a strong contribution to profitability or have strong lifestyle benefits. For example, green trash blanketing is now widely used in cane growing because it is less effort, retains nutrients better, and reduces erosion. Farmers and graziers need to understand these benefits, of course, and generally this requires careful consideration of how the particular practice fits their property, business and lifestyle. Sometimes these matters are obvious; quite often they are not.

Descriptions of BMPs commonly answer “how to” questions in detail, but describe the business logic for using (or not using) them in very general terms. Situations where producers’ decisions about when, where and how to use a practice are not straightforward are situations where the work recommended here can add substantial value. Articulations of Best Management Practices can be improved by bringing to it a strong emphasis on how to help producers evaluate and employ best practices in their particular circumstances.

7. Sustainability for grazing properties with small carrying capacities

Recommendation

Identify pathways to sustainability for properties with small carrying capacities or high levels of debt relative to their carrying capacities.¹⁸

Background

Grazing properties are 90% of the catchment of the Burdekin, and a major land use in the catchment of the Great Barrier Reef. Grazing properties with smaller carrying capacities typically do not generate enough income to support grazing families. Larger properties carrying high levels of debt can be in the same situation. These properties contribute disproportionately to water pollution, because financial pressures drive graziers to overgraze.¹⁹

Graziers in these situations commonly need support to find ways forward; for example, support to step back and recognise their dilemma, support identifying business and financial options, and support to change.

There is debate about whether properties with small carrying capacities - “heart break blocks” - can be managed voluntarily to sustain reasonable pasture cover, and thence about what pathways are actually viable for producers and the Reef.

- ◆ Perhaps regulation of some sort is needed, triggered by poor land condition *and* absence of a viable management strategy.
- ◆ Perhaps neither education or regulation will work, because the properties aren't viable under any management. In this case exit strategies for property owners are needed. (These would need to be combined with arrangements that prevent new purchasers from reproducing the difficulty.²⁰)
- ◆ Perhaps different financial management approaches are needed, e.g. treating the loan funds used to purchase the property as an interest only loan (i.e. the interest is a long term cost of running the business).

By investigating these issues, alternative paths for graziers in this position can be mapped, which extension officers and others can use to support management change on these properties.

7.3 Extension

8. Strengthen industry support networks

Recommendation

Working with producers' organisations, investigate opportunities to expand industry support networks. In particular explore how well (i) new entrants to industries, and (ii) producers who are struggling financially, are supported. Investigate the potential of developing or expanding incubator functions (for new businesses), development functions (for established successful businesses), and clinic functions (for businesses experiencing difficulties), in each industry sector, considering the roles that producer organisations, private sector consultancies, voluntary collaborations of small groups of producers, and government can play in this process. Strengthen industries' support networks in ways identified during this research.

Background

- ◆ Producers' organisations (e.g. Growcom), private sector consultancies (e.g. Resource Consulting Services 'Grazing for Profit'), and small groups of cooperating producers all help primary producers develop their businesses in ways that improve both financial and environmental performance. Limitations of these channels are:
 - » some producers prefer to work alone, and so do not use these channels to develop their skills;
 - » the incubator and clinic functions are not well developed;
 - » costs prevent some producers from accessing private sector advice; and
 - » staff time available in producers' organisations limits producers' access to advice from them.
- ◆ Cooperative arrangements amongst small groups of producers can be very effective. Two grazing examples are:
 - » 'Grazing for Profit' includes a program in which a group of graziers function as Board Members for each other; and
 - » an Argentinian program in which graziers function as Boards for each other, and pool funds to hire consulting resources that they need as a group.
- ◆ A program could be developed to enhance the capacities of producer organisations to catalyse formation of these groups. ('Grazing for Profit' is a successful commercial model.)
- ◆ Processes for referring producers who are managing their farms unsustainably to clinics could be enhanced as part of this program.

9. Develop advocates' capacities to champion practice innovations from business perspectives

Recommendation

Develop the capacities of professionals and non-professionals who are championing good land management practices to explain to farmers and graziers how changes in practices make sense from business and lifestyle perspectives.

Background

Farmers' and graziers' primary considerations when they are making decisions about what to do on their land are financial and about lifestyle. Many professionals and non-professionals pursuing environmental outcomes do not understand how changes in practice are experienced by producers, and so don't advocate for their proposals in ways that show how a change makes sense for farmers and graziers, in the light of all their interests.

An approach to consider is:

1. developing a set of property case studies which show how to think into whether and how to implement an environmentally beneficial practice on a property;
2. drawing on the case studies and on extension officers' experience, provide materials which cover:
 - » existing resources for extension workers to use when they help farmers and graziers evaluate a practice
 - » processes to follow (questions to ask, kinds of evidence to gather, etc); the process material may well also draw on traditions re listening, negotiation, finding common ground, etc; and
3. piloting this material in professional and community development courses, evolving the design of the courses; these could be structured richly with a training / mentoring / training design, organised around participants learning *in practice* how to shift their frames of reference.

10. Skills development for new extension officers

Recommendation

Establish a process of relatively rapid skills transfer, within extension officer networks, that substantially decreases the time that it takes for new officers to get up to speed with an industry and a region, and the time that it takes for them to build trust.

Background

Farmers and graziers consistently assert that a combination of financial support and extension officers working closely with landholders is the best way to support relatively fast take-up of innovative practices. However, extension officer “churn” is a major problem. The typical pattern is:

- ◆ an extension officer is employed on a three year contract;
- ◆ they spend Year 1 learning how to do the job and gaining trust, and
- ◆ Year 2 working effectively, and
- ◆ Year 3 looking for their next contract (i.e. they don't stay the full year).

We can reduce the impact of “churn” by enhancing transfer of skills amongst extension officers, so that new officers come up to speed much more quickly.

An approach would be to Identify experienced, competent extension officers / industry support people, and pilot a process designed to support development of new officers' skills, including some mix of:

- ◆ workshop based training,
- ◆ mentoring by phone, email and website,
- ◆ part-time apprenticing (e.g. assisting an experienced professional one day per week), and
- ◆ co-learning groups involving technical experts, landholders, community, government, etc (with discussion centred on current decisions being made by one or more of the participants, in the style of adaptive management planning workshops²¹).

11. Developing capacities for complex problem solving

Recommendation

Develop the capacities of NRM professionals and other stakeholders to solve complex, multi-disciplinary problems and think innovatively.

Background

Failures in government practice have had a very negative impact on producers' willingness to follow government advice. Two kinds of problem stood out in this study:

1. Farmers and graziers have experienced significant problems with advice from government departments. For example, graziers were given *Hymenachne amplexicaulis* to plant by government agronomists. *Hymenachne* proved to be invasive and is now a major weed in the wet tropics.
2. There are various 'wicked problems' - like the recycling of "heart break blocks" (see Recommendation 7) - where persistent government inaction leads to a view that governments are not serious about solving environmental problems. Government action (notably allocation of resources) is often in tension with government policy (which is often articulated in aspirational language).

Examples of persistent contradictions and badly flawed advice are taken as evidence by producers of "a silo mentality in government, the lack of a whole of system approach, and thence a lack of credibility".

Activities of NRM professionals in the field obviously can't be expected to 'solve' these problems. However, sophisticated, skillful explanation of the difficulties governments' face and innovative development of practical options makes a great difference to the quality of relations between producers and government. NRM professionals' capacities are fundamental to this.

Learning by doing processes using actual projects as the learning medium have been used successfully in urban NRM contexts.²² We recommend them as a capacity building medium. What we envisage is that participants would workshop complex, multi-disciplinary decisions that they or their colleagues are making that are important

to at least one participant.

Facilitators would assist participants to use a variety of problem solving and innovation processes to make their decisions - selected on the basis of their relevance to the particular problem. The toolkit drawn on would include:

- ◆ Adaptive Management planning processes, in which dialogue and systems analysis play a central role, and which pay particular attention to uncertainty, surprise and resilience;
- ◆ crossing systems analysis, management system auditing, and conflict analysis to bring technical, managerial and political sensitivities into play in the one decision-making process;
- ◆ techniques for innovation and creative thinking, including lateral thinking techniques, mindmapping, brainstorming, etc;
- ◆ back of the envelope calculations, spreadsheet analyses, more formal modeling, etc to assist participants to think about the relative importance of various influences both on a geographic basis and a property basis, and about timescales, the scale of responses, what needs to be monitored to evaluate performance, and so on;
- ◆ financial analyses (e.g. cash flow modeling, and calculating returns on investment).

At the one time, workshops of this kind would build networks, be a valuable professional development experience, and contribute directly to current natural resource management in each region, because actual problems are the case studies.

Table 2: Other possible educational projects and project areas

A number of other starting points from which worthwhile education and learning projects could be developed have been identified.

Supporting networking

- In the grazing community, in particular, women have been identified as playing a strong role in networking. There is scope to explore programs geared specifically to supporting women on grazing properties, and/or to intentionally leverage their networks in education and learning projects.
- Support informal networking, e.g. neighbours helping each other and (by doing that) sharing their knowledge of practices.

Working with off-farm business partners

- Working developmentally with further off-farm stakeholders to improve take-up of practices on-farm, e.g. working with cane harvesters to facilitate take up of green trash blanketing by cane growers.
- Develop a program for technical specialists who provide producers with advice and equipment (e.g. farm equipment sales representatives) to improve their capacity to provide ecologically astute advice. Working with groups of specialists,
 - » review current skills and knowledge, and
 - » develop their capacities to advise appropriately.

Leveraging successful research and education projects

- One way in which a project can be highly successful is by inspiring others to emulate it, or to version it in ways that fit a related situation. By looking at genealogies of education and learning programs, characteristics of projects with wider influence can be identified.

These suggestions are drawn from the workshop report provided in Appendix 3.

Table 3: Possible non-educational projects and project areas

In the course of conversation in the workshop and interviews, diverse starting points for projects that would benefit the Reef, that are not primarily education and learning projects, were identified. Action in these areas is also worth considering.

Strategic questions

- investigate the potential to manage primary production in the catchment of the Great Barrier Reef in a way that sustains the Reef
 - » At present we don't know whether primary production systems, operating at their current scale, can be adapted sufficiently to protect the Reef. Many uncertainties are in play, including:
 1. rates at which changes in practices will be adopted,
 2. the environmental and financial performance of diverse practices under many scenarios,
 3. how reef ecosystems will respond to changes in catchment loads, and
 4. influences of climate change.

A combination of catchment investigations (particularly investigations of the performance of practices in actual businesses), reef investigations, and modeling could improve understanding. An Adaptive Management planning process could help set research priorities.

- Ways to test the reasonableness of current funding levels are needed. Some producers argued, for instance, that Queensland's Natural Resource Management organisations are not funded sufficiently for them to be influential agents of change. The performance of their catchments over time will be revealing, of course; however it may be that the gap between stated goals and committed funding is large enough so that success is highly unlikely. Early recognition of this may improve outcomes. Adaptive Management planning processes are one means by which this can be tested.

Target hotspots

- Develop frameworks to enforce management change on producers with poor practice who are unwilling to improve.
 - » Producers to focus on are those:
 - a. who are managing their properties substantially less well than their peers, and
 - b. who have not adopted a management approach that will improve their performance.
- Investigate ways to intervene in property markets to avoid properties (notably grazing properties) being purchased by people who will not be able to manage them in a financially (and thence ecologically) sustainable way.
- Control of feral pigs.
 - » First phase could be an assessment of their relative importance as eroders of riparian areas. In some locations their damage to streambanks is so intense that they would overwhelm other efforts to improve a farm's performance⁴.
 - » Their importance to Aboriginal communities needs to be considered before committing to a project.
 - » Control in National Parks is essential.
 - » This would need recurrent financing.
 - » Hunters with an interest in eliminating pig populations entirely are needed (agency staff?).
- Alternative models for supporting producers in times of drought are needed. From the perspective of sustaining the land, moving early to reduce pressures on a property is preferable (e.g. on grazing properties, selling stock or moving stock to adjustment earlier rather than later). Current drought subsidy arrangements encourage producers to persist as long as possible.
- Responding to the proposed "Sustainability for grazing properties with small carrying capacities", one reviewer commented: "this issue is equally applicable to other commodities / sectors (cane, horticulture, etc)".

Develop resilience

- Develop non-traditional income streams for farm businesses, e.g. farm stays, carbon sequestration, and wildlife corridors⁵.
- Develop data sets that producers need for more knowledge intensive farming, e.g. soil mapping, catchment water quality.

Align stakeholders' interests with the common good

- Research institutions (CSIRO, universities) are viewed by some as biased participants in public debate; one producer commented, "the funding of CSIRO has been politicised, and this has done enormous damage to their standing".
 - » Some participation is experienced by producers as biased by the desire of researchers to raise the profile of an issue, and raise hopes in particular lines of research. That kind of bias is also reported in the research literature⁶.
 - » There is scope to investigate biases introduced by the changed approach to funding, and to explore alterations to institutional arrangements (and notably funding methods) to improve researchers' independence.

These suggestions are drawn from the workshop report provided in Appendix 3.



Endnotes

- ¹ A summary of the research prepared by a Panel of Scientists formed to advise the developers of Reef Plan is available at <http://www.dew.gov.au/coasts/pollution/reef/science/pubs/science.pdf> (31 October 2006). The full report is available at <http://www.dew.gov.au/coasts/pollution/reef/science/pubs/full-science.pdf> (31 October 2006).
- ² The full text of Reef Plan is available at <http://www.reefplan.qld.gov.au/> (31 October 2006)
- ³ 'Best Management Practices' is the term used to describe current recommended practice for some area of activity. For example, Best Management Practices have been defined for cane growing for minimum tillage, fertiliser and chemical use, irrigation, and water quality and runoff, amongst others.
- ⁴ If feral pig populations could be kept at a far lower level, it may be that sediment loads from some areas of the Burdekin would be reduced greatly. A key question here is what is the relative contribution of sheet flow off grazing land and bank erosion in riparian areas. A property with good pasture cover but extensive feeding by pigs may still deliver a high per hectare sediment load to waterways. Managing feral pig populations in riparian areas to reduce erosion requires (i) control in National Parks as well as on grazing land, (ii) hunters with an interest in eliminating pig populations entirely (so perhaps agency staff?), and (iii) recurrent financing, not a one-off program. [We make recurrent investments in regulation as a matter of course; financially this is analogous.]
- ⁵ There are many uncertainties in the dynamics. It may be, for example, that pollutant loads need to drop below some threshold before a recovery process kicks in, in the inshore reefs.
- ⁶ <http://www.growcom.com.au/land&water/waterforprofit.html> (31 October 2006)
- ⁷ <http://www.growcom.com.au/aboutus.html> (31 October 2006)
- ⁸ <http://www.nrw.qld.gov.au/rwue/> (31 October 2006)
- ⁹ This analysis focuses on general barriers to take-up of practices that benefit reef water quality. Some barriers have high relevance to a relatively small number of producers (e.g. grazing properties that have carrying capacities that are too small to be financially viable). These are discussed where they have a particular relevance to water quality outcomes. For the general case, our assumption is that issues affecting small numbers of producers will be identified and addressed

when each specific program is being designed or actioned.

¹⁰ “GCTB (Green Cane Trash Blanketing.) Process of spreading cane leaves and tops on the ground after harvesting a cane crop green (without burning). Trash blanketing helps reduce soil erosion, retains soil moisture, minimises weed growth and improves soil structure.” (<http://www.canegrowers.com.au/information-centre/about-the-industry/glossary.aspx> (31 October 2006))

¹¹ The main differentiations amongst producers are:

<i>Industry type(s)</i>	<ul style="list-style-type: none"> • Grazing / cattle • Sugar cane • Horticulture
<i>Region / climate</i>	<ul style="list-style-type: none"> • Dry tropics • Wet tropics
<i>Landscape</i>	<ul style="list-style-type: none"> • Rangelands • Floodplain • Coast

Note that some producers are involved in multiple industries.

¹² Note that these factors are not completely independent, as dimensions in a mathematical space would be. Also, actual farmers’ and graziers’ interests shift over time, so what is sketched here is a ‘space’ in which shifts in their interests could be mapped.

¹³ These quotations are from graziers who participated in the scoping workshop. They are as recorded on the whiteboard, which means that they are not necessarily verbatim, but have been presented once for review by the workshop participants.

¹⁴ One reviewer commented: “as part of the process of turning your projects to action plans there needs to be a lot of review of what has been done in each of these project areas so that any final projects are based on the best information. This in itself could be used as an action learning process. The reason I say this is that I know that there has been a lot of good work done on some of the issues you raise but this has not been moved forward for whatever reasons at the time. Worse still many of the people who were involved in your workshops may not even be aware of the reasons why they have not been progressed or secondly were not able to make input into the decision.”

¹⁵ These judgments will evolve as knowledge of the effectiveness of different practices evolves. This funding model would make it relatively easy for NRM groups and others to adapt their effort to take on the latest research into the effects of different practices. For instance, it is possible that we will discover that in the Burdekin reducing populations of feral pigs in riparian areas has more impact on water quality outcomes than stock management, under most circumstances. This funding model would allow a quite rapid response to such a discovery.

- ¹⁶ This is as perceived by graziers, in particular.
- ¹⁷ One producer commented: “Might be a better place to spend government funds instead of reinventing the wheel for the 25th time.” Urbanwater.info is an illustration of what is possible: it is an online capacity building toolkit with an online directory at its heart.
- ¹⁸ Responding to the discussion of “Sustainability for grazing properties with small carrying capacities”, one reviewer commented: “this issue is equally applicable to other commodities / sectors (cane, horticulture, etc)”.
- ¹⁹ Note: there are also some properties where the grazing strategy is to “drive the land hard”. That is demonstrably not the best strategy financially (from a medium and long term perspective) but not everybody is convinced of that yet.
- ²⁰ The desirable outcome here is that an established primary producer purchases the property, so that the property can be managed sustainably as part of a larger business.
- ²² See <http://www.ecologyandsociety.org/vol11/iss1/art48/main.html> (31 October 2006) .
- ²² See <http://www.urbanwater.info/Organisation/9-CapacityBuilding.cfm> (31 October 2006) for example.



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Appendix 1: Key Informant Group report

Introduction

The Key Informants Group (KIG) was set up to advise on the shape of the ARIES “Reef Water Quality Protection Plan: Scoping of Issues associated with Industry Practices” project. The KIG’s brief is to advise on where the project should focus its effort, and how the scoping process should be undertaken, and to comment on draft findings and recommendations.

The project’s aim (as initially formulated) was to investigate:

1. “what will trigger and support a farmers’ change of practice towards sustainability when it comes to reef water quality?”, and
2. “how could an Education for Sustainability program influence and support change within the different farming sectors?”

This focus has evolved, and the current articulation of the project’s goal is that it will:

1. identify the realities and complexities of farmers’ situations and understand the barriers, triggers and support required for change, and
2. understand what approaches to education and learning are likely to be most effective to support change.

This shift reflects, in part, input from the Key Informants Group.

In this review, the KIG’s advice is drawn together as responses to three aspects of the project:

1. **Focus: how best to add value** - how can the project best add value to the work already being undertaken to improve the management of agricultural and grazing land in ways that benefit the Great Barrier Reef?
2. **Methodology** – how should scoping be undertaken? This advice is at two resolutions: (i) overall research design, and (ii) specific questions to explore with primary producers and relevant experts.
3. **Preliminary advice on the project’s research questions** – indications of issues relevant to the project’s final report.

Under each heading, advice received is summarised, and the way the project has been shaped in response to this advice is outlined.

Focus: how best to add value

- 1. That there is potential for considerable overlap between this project and other NREM projects being undertaken with primary producers in the catchment of the Great Barrier Reef.*

The Queensland Department of Primary Industries and Fisheries is involved in or aware of many projects (see Appendix 1). The Queensland Department of Natural Resources and Mines also runs a significant number of relevant projects.

A number of projects are being run by industry groups in the region. The Canegrowers organisation runs a program called “The Compass Self-Assessment Program” (Compass) to help growers “identify areas where they can improve the profitability and sustainability of their farming operations”.

AgForce, the umbrella organisation that represents broad-acre agriculture including the cattle industry run a series of workshops throughout the state covering a range of issues of interest to farmers.

Growcom, the umbrella organisation for the fruit and vegetable – including horticulture – industries in Queensland, supports the development of a Farmcare Code of Practice, the use of Farm Management Systems which operate through the existing third-party certified food and quality assurance systems, and run a series of workshops for farmers called “Water for Profit” as part of the Queensland Government Water Use Efficiency Initiative. They have also supported a project to survey horticulture growers’ perspectives on natural resource management issues in the Burnett catchment run by the Queensland Department of Primary Industries and Fisheries.

Comments from KIG members regarding earlier research designs included:

- ◆ “The harsh reality is that there are multiple initiatives already underway within the north that would appear to be targeting similar, if not the same, questions you have detailed”.
- ◆ “At a broader level, I am still concerned that there is already a lot underway such as:
 - » discussions between industry groups and government on management responses/programs that should be implemented in the reef plan’s “nutrient sensitive zones”
 - » the Sustainable Coastal Agricultural Systems project run by Neil Cliffe
 - » the various activities of the regional NRM groups
 - » the various projects and programs run by agricultural industry organisations
- ◆ Anything that happens through your project needs to coordinate with these and aim to add value. I appreciate that this is your intention, but it’s not always easy to do!!”

Response:

- ◆ Working out how this project can add value to the work already being done is a critical issue for the project. The KIG has provided helpful direction on how to do this (see the following section).
- 2. That grounding the project in an exploration of primary producers’ perspectives – looking at the range of current and possible programs to catalyse change in practices from their shoes – would add significant value to the work currently taking place.*

The pivotal issue here is that wide take-up of best practices will only occur where adopting

the practice makes sense to primary producers, so their perspectives are vital in the design of programs that are intended to have ecologically significant effects. The underlying issue is that grazing and agricultural land are non-point sources, so wide take-up is essential if reduction in exports of sediments and nutrients from these lands is to make a significant contribution to protection of the Great Barrier Reef.

Specific comments supporting this focus included:

- ◆ “Worthwhile ambition – to develop ‘actions on how to address issues of agricultural land use and sustainability from farmers’ perspectives’. I think refocusing the methodology and primary outputs of the project such that it aims to give policy operatives a better understanding of the education and extension policies, processes and delivery frameworks required to be amended, enhanced or initiated is achievable. Even more important is that it is from a primary producer *business* perspective.”
- ◆ “My suggestion is to approach it from their [the primary producers’] perspective and build in the science as required and identify from the [the primary producers’] answers what education is needed.”
- ◆ “I can see some value in the first stages of your project in terms of making the effort to actually sit down with agricultural industry members to talk about:
 - » their knowledge of reef issues and what needs to happen on farm,
 - » what actually is happening on farm,
 - » what the barriers to further action are, and
 - » what should be done by government to support further actions on farm”.
- ◆ “I think it would be difficult to establish triggers for actions unless you have the capacity to drill down into the behaviours and identify cost vs benefit relating to those motivators.”

Response:

We have embraced this shift. The project’s first goal is now to “identify the realities and complexities of farmers’ situations and understand the barriers, triggers and support required for change”.

The workshop’s key questions are now:

Water quality from a farm business perspective	Landholders experiences of existing water quality management programs: what does and does not make business sense?
Opportunities	Sound business cases for water quality management: how can we best make reef water quality protection make business sense for farmers (bearing in mind different market environments, financing constraints, etc)? What does or may trigger on-ground action by farmers?
Recommendations	What would the design of high take-up programs look like?

We anticipate that focusing the research on primary producers’ perspectives, and specifically on what makes business sense for them, will provide a much sharper focus to our recommendations. What does make business sense has potential for wide take-up. Showing how an approach makes business sense is a strong foundation for efforts to catalyse changes in practice, and specifically for identifying valuable education and learning approaches.

Methodology

RESEARCH DESIGN

3. *That this project should leverage existing networks and processes, rather than follow a separate track.*

- ◆ “I think its going to be quite challenging to find a few growers who are prepared to participate in the proposed workshop – mostly because of the necessary time commitment, but also because of the cynicism around reef issues and the reluctance to get involved in what are perceived as government talkfests and really just sheer busyness/other priorities.”
- ◆ The [2005] approach should be “something like ‘Identify existing industry and community networks and identify opportunities for, and preferred methods pf communication’, i.e. it should be basing the methodology on a ‘farmer’s perspective’ not on the researchers perspective.”
- ◆ “Good to hear you have a partner – that’s critical.”

Response:

- ◆ We are working through existing channels and networks to contact primary producers, extension officers, policy professionals and scientists.
- ◆ We are working with a local partner organisation - the Burdekin-Dry Tropics NRM group.
- ◆ The workshop remains a distinct event (not, for example, being replaced by a series of sessions in existing primary producer forums), so that a substantial and sustained discussion of how to catalyse further take-up of water quality protection measures can occur.
- ◆ We have added an interview strand to the project – visiting primary producers on their properties and talking through the issues with them – to enable us to explore the issues with a wider range of people than a workshop can guarantee. We have structured this with a view to:
 - » having the opportunity to explore the issues on the ground with some primary producers before the workshop,
 - » having the opportunity to test preliminary conclusions from the workshop with a few primary producers after the workshop,
 - » being able to cover all industry sectors well, even if some prove difficult to get to the workshop,
 - » meeting some farmers and graziers on their own territory as this may allow for different views to be expressed, and
 - » using these dialogues to build these primary producers’ understanding of when reducing water pollution off their properties makes business sense, and of what changes or support they need for additional best practices to be viable from a business perspective.

4. *That differentiating target groups (other than by business type) could be helpful.*

Two kinds of differentiation were recommended for consideration:

- ◆ psychographic profiles – differentiation on any of personality, values, attitudes, interests, or lifestyles (this is a marketing and advertising term); and
- ◆ pre-contemplation, contemplation, action and maintenance groups, defined here as:
 - a. “pre-contemplation – not undertaking any environmentally sustainable activities and not even thinking about them,
 - b. contemplation – those who are thinking about undertaking these sustainable activities, and
 - c. action – those who are undertaking the activities etc”;

the rationale for this differentiation is that adoption of better practices is a process, and people at different stages in such processes have different needs.

Response:

- ◆ Rather than assume the relevance of differentiations in personality, values, attitudes, interests, or lifestyles to catalysing change in primary production, we will take this on board as a question for the workshop and for our interviews with primary producers and extension officers, asking them whether differentiations of any of these kinds influence adoption of water quality management practices to any significant extent.
- ◆ The “pre-contemplation, contemplation, action and maintenance” differentiations have a role when one has little personal contact with the community one is trying to influence, e.g. when designing an advertising campaign. That could become relevant if the educational program develops an advertising component. Currently we are scoping the issues, and a differentiation based on whether primary producers are “undertaking environmentally sustainable activities” is itself not differentiated enough from a water quality perspective to be helpful during the scoping process. From a “pre-contemplation, contemplation, action and maintenance” perspective, primary producers are at different stages with different water quality management best practices.

Other advice indicates, for example, that,

- » “most growers use practices to ensure good ground cover, [and practice] careful use of fertilisers, and many are looking at ways to manage runoff and reduce the amount of sediment and water and fertilisers in surface run off (through both careful scheduling and monitoring of irrigation and fertigation [supplying dissolved fertiliser to crops through an irrigation system] and some use of sediment traps etc)”, and
- » some primary producers are already employing some good practices for commercial reasons, without appreciating that they also significantly reduce pollution exports from their properties.

5. *That our research process focus on the experience of facilitators of change in land management (extension officers, employees of primary producers’ representative bodies, etc) as much as on the landholders themselves.*

- ◆ “I get the feeling from the workshop agenda that the results will tend to focus in on the landholders and the key insights re systemic change may in reside with providers.”

Response:

- ◆ A variety of extension officers and others who work face to face with primary producers, supporting their capacity development, are members of the KIG, and are participating in the workshop. This will provide a good opportunity to explore these issues from both primary producer and extension officer perspectives.
 - ◆ Our focus on testing what makes business sense might be read as privileging landholder experience and perspectives. In a sense that's correct. The landholders have to live with the impacts of water quality protection programs, and only programs that make business sense to landholders are likely to be widely adopted. So an exploration of their experience and interests must play a central role. Creative ways forward will be sought from all quarters of course.
6. *That participants in our process will not reflect the spread of experience and perspectives amongst primary producers well, because the primary producers who participate will be those with unusually high levels of interest in these issues.*
- ◆ "Sample bias will be a major issue if the current [i.e. 2005] methodology is used, as you will attract a group of informants who may not be representative of the generally very busy primary producers who have little or no time to participate in such exercises."

Response:

- ◆ Action research projects are grounded in partnerships between researchers and those affected by the questions being researched. So the primary producers participating in this project will not be a random sample of primary producers – they are distinguished by their willingness to contribute to this enquiry. However research of this kind does not depend on random sampling for its powers of generalisation. Because the research focus, in the workshop and interviews, is "what makes business sense to farmers", it should be possible to see quite clearly whether this project is delivering widely applicable findings. Approaches to managing water quality that do make business sense to primary producers will be approaches that have potential for wide adoption.

QUESTIONS TO PUT TO PRIMARY PRODUCERS

7. *That asking primary producers questions about how their properties influence water quality, and what effects pollution from their properties has downstream, would be capacity building in its own right. However, they will need assistance from people with relevant expertise for this process to work.*

One of our early drafts of the questionnaire for primary producers to put to their colleagues was:

- ◆ Do you keep records about the quantity of water that comes on to your property?
- ◆ Have water flows altered the landscape within your sub-catchment?
- ◆ Have you carried out work on your property to reduce sediment or nutrient loads running off your property downstream
- ◆ What would be most useful to help you make such a contribution to improving Reef water quality?

A key comment on this was:

“when I thought about the processes that landholders would have to go through to answer the questions I thought this could be an innovative approach. For it to work well the people who are faced with the questions need to have access to people who could help them with some of the questions they will raise in trying to answer the q’s. This will be important when talking to regions as this in itself would be part of an action learning process and there is no doubt that after going through this they would talk to others about it.”

Response:

- ◆ This comment underlines that this kind of questioning can support people’s learning effectively. From a process perspective these questions sit much better within the workshop or our interviews with primary producers, where there are experts on hand to help. We will ask these questions in our interviews, in particular, both as a capacity building contribution and to help us gauge the level of understanding of farm / reef connections in grazing and agricultural communities.

8. That the project focus is specifically on why it is that primary producers often do not adopt good environmental management practices, even though a stewardship ethos is strong.

A specific focus suggested was to seek:

- ◆ “to understand why most farmers think it is rational to continue utilising the current [farming] system, and what policy / education and extension interventions need to be changed to address these [reasons. ...] In the late 1980s and early 1990s studies indicated that Australian producers held a strong stewardship ethos [...] however, rarely does the attitude of stewardship translate into behaviours of improving natural resource management practices on private land. [...] In terms of sustainable resource management, a positive attitude to the environment might be necessary, but it is hardly a sufficient factor to drive the adoption of environmentally-sound practices. Lawrence identified four main reasons explaining why producers professing stewardship continue to practice poor natural resource management. They consider that uptake will not occur when:
 - » there is no knowledge of the problem,
 - » the problem is contested,
 - » the problem is denied,
 - » the problem is accepted but:
 - it is rational for the farmers to continue with the present system of production
 - farmers have few ideas about how to alter current practice or move to viable alternatives
 - financial circumstances dictate ‘business as usual’
 - the nature of agriculture militates against change
 - governments are blamed for causing the problem
 - it is viewed as ‘too far gone’.”

Response:

- ◆ The project is designed to explore these issues. By asking primary producers what does and does not make business sense, we will open conversations that canvass the extent to which environmental management recommendations are contested, understood, ignored in practice, etc. The points raised here function as possibilities to be aware of as we explore primary producers' experience.
9. *That we ask participants to review current programs' strengths and weaknesses.*
- ◆ "For example should there be a session which simply asks the participants to identify strengths and weaknesses of products and services that have been thrown at them in the past. Eg.
 - » Why do people trying to "educate" primary producers fail?
 - » What are the key success factors that you have seen in successful awareness/ education/ extension projects that have lead to on-ground change?
 - » If you are a busy farmer what can training/ extension providers offer that entices you to become involved in learning processes?"
 - ◆ "Suggest asking relevant agricultural sectors if they are aware of contemporary drivers (FMS, Reef Plan etc) and if so, how did they come to know about it (existing categories) and what do they think it means for their particular sector / farming enterprise. As part of this, it would also be interesting to gauge:
 - » Differences in level of understanding from those of 5 – 10 years ago.
 - » Understanding of current industry and community based support mechanisms (Eg. BSES COMPASS Program in sugar or availability of NHT support / monies (Eg. Reef Ext initiative or incentives).
 - » Further to the above, level of subscription to said initiatives within the growing community."
 - ◆ A suggested question:
 - a. "What actions/ strategies do you consider to be responsible for the biggest changes in agricultural land management practices (some examples)
 - i) One-on-one farmer extension focussing on the whole enterprise
 - ii) Group training sessions focussing on natural resource management
 - iii) Training processes and workshops targeting whole property planning
 - iv) Demonstration of new farming systems which are more profitable
 - v) Programs/ projects that aim to improve the sustainability of the local community"

Response:

- ◆ These questions will be canvassed at length in the first workshop session, whose focus is:

"Landholders experiences of existing water quality management programs: what does and does not make business sense?"

10. That we ask participants what changes to policies, processes and delivery frameworks would support wider take-up of practices to improve the quality of water leaving properties.

- ◆ “[T]he majority of investment to date has been focussed on voluntary/self management approaches. With this in mind, one may want to make available prompts for consideration:
 - » More extension services and tailored change management programs (IAWM, Systems, FMS)
 - » Incentives / Ecosystem Service and Market Based Instruments
 - » Better reference material / information knowledge transfer.”

The alternative is regulatory intervention. e.g. Land Water Management Plans and potential legislative impost through Nutrient Management Zones (D8 Reef Plan).”

- ◆ Some suggested questions:
 - b. How important is accessing more information to you in terms of changing/improving your practice?
 - c. Is understanding the ecological/ soil/water processes by which land management practices can impact on reef process likely to lead you to make changes to your production system?
 - d. How important is it to you that new practices can be tested by running small trials of rather than having to change the whole farming systems?”

Response:

- ◆ These questions will also be canvassed at length - in the second and third workshop sessions, whose foci are:

“How can we best make reef water quality protection make business sense for farmers (bearing in mind different market environments, financing constraints, etc)? What does or may trigger on-ground action by farmers?”

and

“What would the design of high take-up programs look like?”

11. That we explore landholders’ expectations of government agencies.

- ◆ “I suspect that there will be considerable criticism of government and GBRMPA and it will be important to record what landholders think their responsibilities are.”
- ◆ “My work with landholders about property management planning over the last 12 months has indicated just how angry and suspicious they are of government – particularly since the OnePlan approach to legislation in Qld.”

We note that the Queensland Government’s perspective on OnePlan is:

“OnePlan is a state government initiative designed to make it easier for landholders to prepare property management plans. It is a new framework that provides a common approach to preparing the property plans that are already required by government. OnePlan does not introduce new requirements for landholders.”¹

Response:

- ◆ Landholders' expectations of government agencies will be canvassed throughout the workshop, as appropriate. We will focus on what does or might work, i.e. problems with existing programs or approaches will be taken as catalysts for exploring alternative approaches and program designs.

Preliminary advice on answers to the project's research questions

Some of the advice we have received is primarily of interest as input to discussions of the project's eventual findings and recommendations. These points are noted without responses here, as they need to be considered by the working group at the workshop.

ANTICIPATED FINDINGS

12. That lack of information about water quality and downstream environmental impacts is not a constraint.

- ◆ Most landholders in the GBR catchments have been given heaps of information already on reducing runoff and nutrients etc and there are strategies in the regional NRM plans. [...] I think the issues are not about technical knowledge”.

13. That there are major biophysical challenges involved in managing the catchment of the Great Barrier Reef to sustain reef ecosystems, and that these difficulties must be part of the frame of education and learning programs.

A critical issue is the difficulty of managing runoff water quality in major rainfall events. Exploration of these issues (which will often need to be via forms of action research, e.g. adaptive management) is fundamental context for education and learning programs in the catchment of the Reef.

- ◆ “My experience, 5% of major rainfall events cause about 90% of the runoff and the significance of the runoff is what risk state the land is in at the time of the event. Eg fallow, between crops, recovering from drought etc. Thus a wet/dry division probably is not as relevant. [...] I remember early work I did in the Burdekin trying to convince the Water Resources Commission that if they put the right bank channel through and irrigated the Dalrymple soils, they would get major salting and groundwater problems. They were great disbelievers although they agreed to an experimental farm. That year there were 2 cyclones through in fairly short period and the groundwater bubbled through the soils surface. This was a very unusual episodic event that really caused all the issues and I suspect [it] will be the same with runoff. One other issue that has been a concern is that landholders may opt to build retention basins on their grazing properties to minimise flows (eg Condamine valley although for irrigation). The result is greatly reduced flows and reduced sediment and nutrients to coastal waters impacting on the fishing industry. Thus it is a vexed question.”

14. That uncertainty about effectiveness is a constraint on farmers commitments.

Speaking generally, one KIG member commented:

- ◆ “certainty of actions and risk are important attributes that will influence decisions and it may be worth capturing this information”.

Uncertainties at three levels have been flagged:

1. Uncertainty about the ecological efficiency of best management practices.
 - » “The other major challenge [...] is establishing quantitative data that underpins the success of BMP in terms of improving water quality. A lot of information on BMP remains anecdotal in nature.”
2. Uncertainty about what is actually appropriate for particular farms.

- » “The detail is in the water management practices employed and these differ widely depending on the commodity and the region. For example in the wet tropics, the only irrigation is within the horticulture sector. Issues facing cane revolve around removal of water (drainage networks) to achieve an adequate freeboard under the root zone so as to not adversely affect production. [...] Not only can flow alter the landscape, but altering the landscape (laser level, drainage) can markedly alter flow (times of concentration, base flow contributions post event). A myriad of other works / practices hold sway in the quality of water leaving farms. Whilst generic BMP can apply across farming systems, the challenge [from my perspective] is documenting agreed practices that are tailored / relevant to a regional or catchment scale. A case in point is sugar. You only have to drive two hours along the eastern seaboard (Burdekin to Herbert) and two totally different sugar production systems are at play:
 - Burdekin – Furrow based irrigation, largely burnt.
 - Wet Tropics – Relies on rainfall, largely GCTB and extensive drainage networks.

Whilst both are cane production systems, water management ‘best practice’ varies greatly between the two.

This member of the KIG added, however, that a great deal of work is being done to address this presently:

“Extensive project work is currently underway in terms of documenting agreed BMP and it’s application uptake into relevant farming systems (AgSIP, Reef Extension, Industry Initiatives, WQIP’s etc).”

3. Uncertainty about the ecological effectiveness of unilaterally changing land management practices; a coordinated change is necessary to achieve acknowledged environmental goals:
 - » “Off-farm runoff is really part of the ‘tragedy of the commons issue’ where there is no gain by any one landholder reducing their export unless all do it equally.”

15. That BMPs that are not in the primary producers’ best interests, from a business perspective, are difficult to get adopted.

This point is particularly sharp when combined with the uncertainty (discussed above) about the public benefit delivered by the additional expenditure (of time and/or money) by primary producers:

- ♦ “There is a lot of anger because they are being told to do things that won’t necessarily benefit them or give a good result. [There are issues ...] about applicability to individual’s properties and what the motivation and direct benefit is for them.”

Essentially, expensive measures, undertaken unilaterally, with uncertain benefits from a community perspective, are not attractive to landholders.

POSSIBLE DIRECTIONS FOR RECOMMENDATIONS

16. That the recommendations heed primary producers' different capacities and willingnesses to change their land management practices in ways that improve water quality.

- ◆ “If you adopt a one size fits all approach, relating to the different farming varieties and the market segments within them, it may be a very big leap for someone who isn't committed to any form of sustainable practice to be influenced to undertake the environmental activities that you promote – the leap from pre-contemplation to action is often just too big and intimidating (particularly if they don't feel they are relevant to their farming sector). But if there is the capacity to move people gradually and logically (according to their opinions and behaviours) through the behaviour change paradigm then the chances of achieving the outcomes you are seeking will be greater.”

17. That we aim to add value to existing education and extension programs.

The thinking here is that there is a wide variety of extension programs and other educative processes already in place, and that it will be more efficient, from a collective perspective, if we direct these efforts better than if we simply add new educational program(s) to the mix.

- ◆ “A method of feeding the results into existing programs rather than a new environmental education program.”
- ◆ “I would probably be concerned if the project recommended an environmental education program completely independent to other initiatives underway.”
- ◆ “Would like to see governments tap into our work [as a primary producer representative body] more and support us to do more to facilitate industry progress on sediment and nutrient management through targeted programs. But our resources and funds are stretched to the absolute limit at the moment. We believe we can do so much to help government achieve its reef objectives, but to date, there has been no real progress on government acknowledging what we can do or taking action to design a targeted industry program.”

Conclusion

We have received clear advice from the KIG on two fundamental issues:

1. that there are diverse projects exploring questions in the same general area, and that this project must find ways to add value to the mix; and
2. that a sharp focus on primary producers' perspectives (as opposed to those of government, researchers and educators) is a way to add significant value; and in particular, explicating business perspectives on options for managing the quality of water leaving properties would be usefully clarifying.

Both the project's accountabilities to the Australian Government Department of the Environment and Water Resources, and the focus of the workshop and supporting research work have been changed accordingly.

Looking ahead, key issues which are looming are:

- ◆ How closely can we align 'business rationality' and 'changing land management to protect the Reef'?, and in particular, what shifts in government policy and practice could bring them into closer alignment, and what would be the place of education and learning process within that?

- ◆ How should uncertainties about the efficacy of landholders' interventions, viewed from the perspective of Reef outcomes, be addressed and honoured in government policy and practice regarding land management, and specifically in educational and learning initiatives?
- ◆ In what ways is it helpful to differentiate landholders from the perspective of catalysing change in land management (apart from by industry types)? How influential are factors such as values, property financing, depth of understanding of land / reef issues, etc, when it comes to changing property level land management practice? How similar, and how diverse, are the underlying interests of landholders in the Great Barrier Reef's catchment?

KIG Report Appendix 1

Advice regarding relevant projects from the Queensland Department of Primary Industries and Fisheries

Activity Ref	Agency Activity
Act007	Research into development of integrated pest management techniques to reduce chemical impact on the environment. CITRUS IPM CD PACKAGE AG16 building & scoping NRM ISS CRC48C Optimising Field & Farm Scale Water Use Eff Best Water Management Practices for Cotton & Grain NY03014 Dev EMS framework for Nursery Accred Schem ADVANCING ENVIR SUST IN WET & DRY TROPIC
Act020	Support for research and extension to reduce chemical use by the sugar industry.
Act030	Work with irrigated cotton and grains industries to move towards the wider adoption of riparian and wetland management practices within a BMP framework. (NAP Ag SIP Project 15).
Act032	Work in partnership with regional bodies in extension, education and monitoring programs by providing technical information to minimise off site impacts.
Act277	Sustainable grazing for a healthy Burdekin catchment
Act283	Develop and deliver with NRM bodies, customised Grazing Land Management Program in priority Reef catchments to assist in reducing sedimentation, including follow-up extension and evaluation of impacts through case studies.
Act284	Develop hardwood tree taxa suitable for production in marginal landscapes & for environmental amelioration.
Act287	Develop performance benchmarks for offsite pesticide and nutrient movement in horticultural and new cane farming systems and support the design and implementation of a monitoring framework (NAP Ag SIP Project 5)
Act300	Environmental implications and management of intensive dairy systems to develop sustainable grazing management systems. Farmlet-sustainable dairy farm systems for profit Warm season legumes for dairy production Managing riparian zones on Queensland dairy farms Better fertiliser decisions for grazed pastures RWUE Stage – Dairy Water for Profit
Act304	Evaluate grazing management strategies and systems for their impact on land condition, erosion risk and profitability; includes the ability of different strategies and systems to cater for variability in both climate and land type
Act314	Investigation into application of alternative farming methods such as minimum tillage and controlled traffic.

Project's location	Theme	BDT	FBA	BMRG	SEQ (WC)	CA	QMDB Inc.
AG 05: Benchmarking pesticides and nutrient movement in horticultural and new cane farming systems	Industry NRM support			X			
AG 15: NRM Extension in irrigation- Cotton and Grain	Industry NRM support		X			X	X
AG 16: Capacity building and scoping of NRM issues in the horticultural industry in the dry tropics	Industry NRM support			X			
AG 17: Developing an integrated small catchment approach to management of pesticides and nutrients for cane	Industry NRM support	X					
Ag 03: coordination and process support to sustainable agriculture initiatives in NAP	Coordination and process support			X			X
AG 07: Decision support to assess impact of land use change on salinity and water quality at a property or sub-catchment scale in NAP Regions	Coordination and process support	X	X	X		X	X
AG 13: Resource economic assessment of cost/ benefit involved in land use change and incentive mechanisms to support change	Coordination and process support		X				X
Ag 14: Adoption of sustainable landscape design practices on small holdings	Coordination and process support				X		
Ag 18: Engaging communities for NRM in densely populated areas	Coordination and process support				X		
AG 01: Planning and implementation support to landscape 'Best Practice' through the Integrated Area Wide Model (IAWM) across NAP Regions of QLD.	Integrated area wide management		X				
AG 08: Landscape 'Best Practice' through support to the Integrated Area Wide Model in Condamine Alliance	Integrated area wide management					X	
AG 11: Landscape 'Best Practice' through support to the Integrated Area Wide Model in Fitzroy Basin	Integrated area wide management		X				
AG 12: Landscape 'Best Practice' through support to the Integrated Area Wide Model in QMDB	Integrated area wide management						X
AG 02: Grazing lands Extension 'Best Practice' in the Burdekin Rangelands	Grazing land management	X					
Ag 04: Grazing lands 'Best Practice' in the Fitzroy Basin	Grazing land management		X				
Ag 06: Grazing lands 'Best Practice' in Queensland's Murray Darling Catchment	Grazing land management						X
Ag 10: Modelling simulation to support adoption of grazing lands management "Best Practice" in NAP grazing lands	Grazing land management		X				
Ag 09: Monitoring program across NAP grazing lands to support Regional and State target setting and impact assessment.	Grazing land management		X				



Appendix 2: Contributors to the research

Workshop participants and interviewees

** People who participated in the workshop are marked with an asterix.*

Name	Affiliation
Chris Allingham	Grazier, via Charters Towers
Tony Allingham*	Grazier, Townsville
Andrew Apap	Banana Grower, Tully
Mario Barbagallo*	Canegrower, Ayr
Mick Caplin	Manager, Land Mgt, DNRMW, Brisbane
Ian Dight*	Coastal Catchments, Burdekin Dry Tropics NRM Group
Gale Duell*	Landcare Coordinator, C/o Burdekin Dry Tropics NRM Group
Geoff Edwards	Manager, Land & Regional Planning, DNRMW, Brisbane
Kent Fowler*	Canegrower, Homehill
Leigh Gray*	GBRMPA, Townsville
Ian Haigh*	Canegrower, Brandon
Aaron Hawdon*	CSIRO Land & Water, Townsville
Marc Jackson	Banana Grower, Tully
Sally Kirkwood*	Grazier, via Charters Towers
Robert Kirkwood*	Grazier, via Charters Towers
Allyson Lankester*	Coastal Catchments, Burdekin Dry Tropics NRM Group
Richard Leck*	National Marine and Coastal Policy Officer, WWF
Paul LeFeuvre*	Horticulture, Giru
Andrea Leverington*	Reef Plan Secretariat, Premiers Department, Brisbane
Lucio Mastrippolito*	Canegrower, Macknade
Lorelle McShane*	Horticulture, Dalbeg
Noleen Meteyard*	Grazier, Giru
Margie Milgate	NR Networks Coordinator, Growcom, Brisbane
Sheriden Morris*	Research Director, CRC Reef, Townsville
Peter O'Reagain	Researcher, DPIF, Charters Towers
Denis Pozzebon*	Canegrower
Egberto Soto*	Growcom, Ayr
Jeanette Stanley	Social Scientist, DNRMW, Brisbane
Marie Vitelli*	Landcare Coordinator, C/o DPIF Charters Towers
Mark Warmington	Growcom, Tully
Adam West*	Principal Catchment Hydrologist, DPIF, Townsville
Peter Weston*	Grazier, Woodstock
Murray Whitehead*	EPA, Townsville
Tim Wrigley*	Senior Manager, Environment & NR, Canegrowers, Brisbane
Andrew Zuch	Climate Impacts and Natural Resource Systems, DNRMW, Brisbane

Members of the Key Informants Group

Name	Affiliation
Mike Bradby	Dept NRMW, Brisbane
Noel Dawson	Chair GBR RAC, Brisbane
Ian Dight	Burdekin Dry Tropics NRM, Townsville
Richard Leck	WWFA, Brisbane
Andrea Leverington	Reef Plan, Premiers Dept, Brisbane
Geoff McDonald	CSIRO Sustainable Ecosystems, Brisbane
Sheridan Morris	Research Director CIRM, Townsville
Jane Muller	NRM Program Leader, Growcom, Brisbane
Roger Shaw	Coastal CRC, Brisbane
Dan Skehan	Policy Officer, AgForce (Cattle), Brisbane
Brian Stockwell	Principal Catchment Hydrologist DPIF, Nambour
Stephen Tapsall	Australian Government Facilitator Landcare DEW, Brisbane
Di Tarte	SEQldWQP, Brisbane
Adam West	Principal Catchment Hydrologist DPIF, Oonoonba
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Members of the Steering Committee

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Jenny Tomkins	Environmental Education DEW
Karen Vohland	GBRMPA
Ros Taplin	ARIES
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Appendix 3: Workshop report

Review of existing programs

	Sugar industry infrastructure program	Burdekin rangelands group riparian fencing	Other recommended programs
	<i>Workshop participants' and interviewees' comments</i>		
Brief description of project	<ul style="list-style-type: none"> involved a large number of substantial works - 150 Environmental Impact <ul style="list-style-type: none"> Statements were required: works to improve water quality, farm drainage, tide gates, revegetation, etc 	<ul style="list-style-type: none"> Riparian fencing program on the Burdekin 	<p>Riverdale:</p> <ul style="list-style-type: none"> A project similar to the Sugar industry infrastructure program Funded major infrastructure Did not involve farm plans; much less work was done on farms <p>Rangeland to Reef initiative:</p> <ul style="list-style-type: none"> this was about working with traditional owners to put weed spraying teams on the ground <p>Ecograzing project:</p> <ul style="list-style-type: none"> DPI program promoting profitable sustainable grazing Done in the 1980s and 1990s <p>Future Profit:</p> <ul style="list-style-type: none"> DPI program promoting profitable sustainable grazing <p>Grazing for Profit:</p> <ul style="list-style-type: none"> Private sector program promoting profitable sustainable grazing <p>Dept. of State Development programs:</p> <ul style="list-style-type: none"> Some programs that have provided substantial incentives and funding for innovation <p>Water for Profit:</p> <ul style="list-style-type: none"> Growcom program; that is, an industry led program <p>Meat and Livestock's Beef Groups:</p> <ul style="list-style-type: none"> Networking between graziers Program integrating a suite of projects funded by different sources

	Sugar industry infrastructure program	Burdekin rangelands group riparian fencing	Other recommended programs
	<i>Workshop participants' and interviewees' comments</i>		
Time required for the project	<ul style="list-style-type: none"> Program took 10 years took a long time to get off the ground (EISs required, etc) 	<ul style="list-style-type: none"> The program took 5 years to complete 	Riverdale: Program took 10 years
Sources of funds	<ul style="list-style-type: none"> Infrastructure was funded on the following model: <ul style="list-style-type: none"> 1/3 Commonwealth, 1/3 State, with the remaining 1/3 shared three ways: <ul style="list-style-type: none"> 1/3 industry, 1/3 local government, 1/3 producer 	<ul style="list-style-type: none"> Government provided the fencing; graziers' provided the labour, the gates and tie wire 	Rangeland to Reef initiative: <ul style="list-style-type: none"> graziers provided accommodation, food and chemicals government provided wages Water for Profit: <ul style="list-style-type: none"> Funded by Rural Water Use Efficiency - a DNR program
Business logic			
How it provided a financial benefit			
at property level	<ul style="list-style-type: none"> drainage benefits: in wet tropics the management problem is to get water away from cane in the wet season 	<ul style="list-style-type: none"> Financial benefits accompanying environmental benefits: graziers weren't asked to keep cattle out <ul style="list-style-type: none"> both sides of the creeks were fenced; as a result, cattle weren't lost in floods graziers were allowed to use the area, but not to flog it Not having to put up flood gates was a huge advantage 	
at industry level	<ul style="list-style-type: none"> The project involved a major expansion of the area under cane. 		
Return on investment / project profitability for primary producer		<ul style="list-style-type: none"> there were demonstrated benefits for graziers that led to most graziers participating 	Water for Profit: <ul style="list-style-type: none"> For growers, a 4:1 or 5:1 return on investment
Other economic benefits		<ul style="list-style-type: none"> it provided work for out of work traditional owners 	

	Sugar industry infrastructure program	Burdekin rangelands group riparian fencing	Other recommended programs
	<i>Workshop participants' and interviewees' comments</i>		
Environmental logic			
How it provided an environmental benefit	<ul style="list-style-type: none"> supported shifts to laser leveling (which reduces runoff and soil and fertiliser loss from farmland) Environmental benefits included: <ul style="list-style-type: none"> negotiations re the siting of sediment dams reinstating wetlands The project involved a major expansion of the area under cane. From an environmental perspective that required a shift to more sustainable practices. 		Ecograzed project: <ul style="list-style-type: none"> Underpins wet spelling, etc
Magnitude / ambiguity of environmental benefits	<ul style="list-style-type: none"> Very good environmental outcomes; e.g. Lagoon Creek 	<ul style="list-style-type: none"> Good environmental outcomes 	Program in the Russell-Mulgrave: <ul style="list-style-type: none"> The suite of programs had great beneficial effects <ul style="list-style-type: none"> Recreational fishing club reopened
Enabling factors			
Contextual	<ul style="list-style-type: none"> This project was basically a trade off - funding offsetting industry restructuring; this explains the high level of funding involved. The fact this program was funded was very much a function of the politics of the situation 	<ul style="list-style-type: none"> Input of extension officers and the Landcare coordinator was critical <ul style="list-style-type: none"> help with funding applications doing inspections Womens' involvement was crucial: <ul style="list-style-type: none"> an active women's group supported the program commonly it is the women who work through the forms involved in accessing grant funds 	

	Sugar industry infrastructure program	Burdekin rangelands group riparian fencing	Other recommended programs
	<i>Workshop participants' and interviewees' comments</i>		
Contextual <i>(continued)</i>		<ul style="list-style-type: none"> - women contribute strongly to information flows - often more outwardly focused than the men - the Landcare group had 20 men on it, but an Executive of women • There was stunning leadership by individual leaders • The program depended on peer pressure for take-up • The political process was <i>key</i> to getting these funds <ul style="list-style-type: none"> - graziers need mechanisms to keep political engagement working: another argument for communication that feeds back information about successes 	
In program development & implementation	<ul style="list-style-type: none"> • started out as drainage schemes but turned into a water quality management: the growers had wanted drainage, but what they wanted was not aligned with what good science recommended (taking water quality outcomes into account, particularly); so a lot of negotiation was required 	<ul style="list-style-type: none"> • The program took 5 years to complete; there was a call for applications every year for 3 years <ul style="list-style-type: none"> - If you didn't do your year 1 work, you didn't get year 2 funding, etc - To access funds a grazier needed to attend 4 Landcare group meetings 	<p>Grazing for Profit:</p> <ul style="list-style-type: none"> • Proper change management design <ul style="list-style-type: none"> - facing financial realities - succession planning - Teaches you how to measure and forecast, and how to evaluate performance - Includes an 'Executive link' program where a grazier works with another 6 properties, and the other 6 act as a Board for each other - Strong on not flogging the land <p>Water for Profit:</p> <ul style="list-style-type: none"> • People getting together and opening up discussion channels <ul style="list-style-type: none"> - the cane industry has shed meetings, the growers tend not to, so catalysing networking is important

	Sugar industry infrastructure program	Burdekin rangelands group riparian fencing	Other recommended programs
	<i>Workshop participants' and interviewees' comments</i>		
In program development & implementation <i>(continued)</i>			<p>Program in the Russell-Mulgrave:</p> <ul style="list-style-type: none"> • Brought together a suite of projects: <ul style="list-style-type: none"> - riparian revegetation - Australian Government wetland purchasing - removal of commercial netting from a fishery
Difficulties that arose that were not resolved			
Contextual		<ul style="list-style-type: none"> • Introduction of riparian fencing, and fencing generally, has led to more equal flogging of the country <ul style="list-style-type: none"> - Riparian fencing is not good on its own: it needs to be part of a management approach • Weed problems, e.g. rubber vine which has brought pigs and has been moving out into paddocks; whole system issues here however: weeds also act as sediment traps • A feral pig program - baiting, trapping, etc - to go with the riparian area program would make sense. A context issue here is the lack of control of feral pigs in National Parks. 	<p>General:</p> <ul style="list-style-type: none"> • Introduction of Brahman cattle and urea supplementation to tropical cattle industry: before the introduction of Brahman s, cattle died in droughts; now they don't, so land is over-utilised/overgrazed • From a whole system perspective, a substantial failure was the introduction of <i>Hymenachne amplexicaulis</i> <ul style="list-style-type: none"> - graziers were given Hymenachne to plant - it is invasive and is now a declared weed <p>when it was introduced, the downstream impacts were not considered; those introducing it saw the on farm economic benefits, but not the downstream impacts</p> • Silo mentality in government: no whole of system approach, and thence a lack of credibility <ul style="list-style-type: none"> - the prices of land have been going up and up: a block can be priced in a way that makes it impossible to manage sustainably (if the owner has borrowed funds to purchase) - why let blocks that are too small to be a living area be sold? <ul style="list-style-type: none"> ▪ e.g. a block that was sold for \$2 million

	Sugar industry infrastructure program	Burdekin rangelands group riparian fencing	Other recommended programs
	<i>Workshop participants' and interviewees' comments</i>		
Contextual <i>(continued)</i>			<ul style="list-style-type: none"> ▪ the banks don't care: they get their interest paid, and when the owner goes broke they sell up the block ▪ this is: ruining a good piece of land <ul style="list-style-type: none"> • Funding models keep changing
Project level	<ul style="list-style-type: none"> • Water quality monitoring requirements made doing jobs on the ground difficult 	<ul style="list-style-type: none"> • Some graziers were not happy because they were not funded to shift watering points; only early adopters had this funded • One grazier who got year 3 funding didn't do their work for 10 years; in a similar program on the Bowen, there were cases where a property owner bought the materials, then sold their property and took the materials with them 	<p>Rangeland to Reef initiative:</p> <ul style="list-style-type: none"> • administering the project was very difficult: it required 2 or 3 dedicated staff <p>Future Profit:</p> <ul style="list-style-type: none"> • Future Profit didn't cost anything, so had trouble keeping people in the room
Program level	<ul style="list-style-type: none"> • Programs like this don't deliver the ongoing funding that's needed, however 	<ul style="list-style-type: none"> • Learning re where to place watering points is needed: the trial at Wombeyan (a DPI experimental property) is helping 	<p>Rangeland to Reef initiative:</p> <ul style="list-style-type: none"> • the funding was one-off: provide one-off funds then walk away
Influence of program			
Take-up by producers		<ul style="list-style-type: none"> • Taken up by approximately 82 properties • More graziers joined the project because there were demonstrated benefits 	<p>Ecograz project:</p> <ul style="list-style-type: none"> • Has had large take-up <p>Future Profit:</p> <ul style="list-style-type: none"> • Was not taken up heavily <p>Grazing for Profit:</p> <ul style="list-style-type: none"> • Four meetings to promote it are run each year, each attended by 100 graziers
Direct effects	<ul style="list-style-type: none"> • involved a lot of social change • many kilometres of cane infrastructure built 		<p>Riverdale:</p> <ul style="list-style-type: none"> • Funded major infrastructure

	Sugar industry infrastructure program	Burdekin rangelands group riparian fencing	Other recommended programs
	<i>Workshop participants' and interviewees' comments</i>		
Flow ons	<ul style="list-style-type: none"> This project was the catalyst for various other projects 	<ul style="list-style-type: none"> cultural shifts in industry, e.g. <ul style="list-style-type: none"> interest in riparian plants grass monitoring Led on to the Rangeland to Reef initiative which was about working with traditional owners to put weed spraying teams on the ground; this was also a follow on from the strategic weeds program 	<p>Future Profit:</p> <ul style="list-style-type: none"> led a lot of people on to the privately run "Grazing for Profit" program <p>Douglas Water Quality Project:</p> <ul style="list-style-type: none"> Burdekin Dry Tropics CCI initiative is a follow on
Scope for further work	<ul style="list-style-type: none"> A lot more of this work could be done; e.g. only 20% to 30% of the work possible in the Herbert was done - specifically there is a lot of in farm work to be done. Difficulty of getting funding for programs on this scale is high, however. 		
Overall evaluations			
	<ul style="list-style-type: none"> say 80% success 		<p>Riverdale:</p> <ul style="list-style-type: none"> View: lack of demonstrated benefits <p>Ecograz project:</p> <ul style="list-style-type: none"> Done well Really good work <p>Grazing for Profit:</p> <ul style="list-style-type: none"> The best teaching available besides degrees <p>Dept. of State Development programs:</p> <ul style="list-style-type: none"> Recommended

Notes:

- This review is primarily from primary producers' perspectives, as our focus was: what makes business sense (as well as achieving significant environmental outcomes). The workshop participants were graziers, cane growers, horticulturalists, researchers, and government agency staff (with the bulk of participants primary producers).*

Specific practices to encourage

because they work well both financially and environmentally (specifically for water quality)

Area	Specific practices	Barriers / Constraints / Context	Opportunities
<i>Workshop participants and interviewees comments</i>			
Grazing			
Managing ground cover	<p>Improving pasture coverage through:</p> <ul style="list-style-type: none"> • nutrition • herd management • land management 		
Grazing pressure			
	Using lighter stocking rates to get higher production		
	Wet season spelling		
	<p>Fencing to improve management of land</p> <ul style="list-style-type: none"> - fencing to land type - fencing rivers - for 4 way rotation <p>Fencing can enable much better management of grazing pressure on land. Needs to be used to do that - i.e. as a management tool where that is one objective - to deliver the benefits.</p>	<ul style="list-style-type: none"> • 4 way rotation suits some people, not all • For people on heart break properties (where the carrying capacity of the property is not big enough to support a farm business), even 50/50 or 1/3 / 2/3 funding is not generous enough. They need more help with fencing project costs to be able to participate. 	<ul style="list-style-type: none"> • Realistic funding support for environmentally friendly fencing, e.g. fence rivers, swamps, soft country
	Use of supplements to manage pressures of drought		
	Sell stock early in difficult circumstances (notably drought)	<ul style="list-style-type: none"> • In extreme situations - drought, flood, fire, etc - where <ul style="list-style-type: none"> - cattle prices are low - adjustment is expensive, financial pressures on businesses lead to increased pressures on land. Reducing pressures on businesses can reduce pressures on land. • Tax breaks when sell early not good 	<ul style="list-style-type: none"> • Provide better tax breaks • On ground help and financial support to relieve the land in times of drought, flood, fire, etc <ul style="list-style-type: none"> - destocking to sell or adjustment - but sometimes the price of cattle is too low at these times or the price of adjustment too high
Fire management	Fire management		

Area	Specific practices	Barriers / Constraints / Context	Opportunities
	<i>Workshop participants and interviewees comments</i>		
Woody weeds	Removal of woody weed infestations, to be replaced with fodder (grasses) to obtain ground cover		<ul style="list-style-type: none"> • Slight relaxation of tree clearing legislation to allow easier removal of some of these weed infestations (not for mass clearing - for the opportunity to remove these woody weeds without the fear of the massive fines associated with this legislation) • Perhaps making it easier to obtain permits without all the associated paperwork just to open a few hundred acres
Assessment	Rapid appraisal systems		
	Remote metering		
Non-grazing land uses	Landholders manage their properties for carbon sequestration, in particular managing fire and weeds.	<ul style="list-style-type: none"> • Land Act needs to recognise the legitimacy of this in leaseholds. • Opportunities will be much larger when generalised carbon trading schemes available. 	<ul style="list-style-type: none"> • In the Northern Territory there are areas where (e.g.) Mitsubishi is paying graziers to manage land for carbon sequestration. These areas achieve carbon sequestration outcomes more cost-effectively than devices fitted on power stations.
			<ul style="list-style-type: none"> • Desert Uplands has a program to pay graziers to supply land corridors for wild life <ul style="list-style-type: none"> - you bid for the subsidy and get paid on the areas set aside as a corridor
Cane	<ul style="list-style-type: none"> • Overview of current best practices 		
Improving irrigation	<ul style="list-style-type: none"> • Irrigation scheduling 	<ul style="list-style-type: none"> • People have bought potentiometers, but need a simpler tool for irrigating. • Fertiliser is a lowish cost input, so savings are not a strong driver from a business perspective • Work is involved in initially calibrating equipment (and regular checking of calibration) 	

Area	Specific practices	Barriers / Constraints / Context	Opportunities
<i>Workshop participants and interviewees comments</i>			
	<ul style="list-style-type: none"> Tailored nutrient / irrigation systems 		
	<ul style="list-style-type: none"> Soil moisture probes 		
	<ul style="list-style-type: none"> Trickle or drip irrigation overhead 		
Managing runoff	<ul style="list-style-type: none"> Laser leveling 		
	<ul style="list-style-type: none"> Recycle pits (in the Burdekin delta) 	<ul style="list-style-type: none"> Farming areas too small and wrong drainage to justify expense 	<ul style="list-style-type: none"> Funding for joint farms; how do you allocate water in pit?
	<ul style="list-style-type: none"> Drainage improvements in wet tropics cane growing 		
Reducing erosion	<ul style="list-style-type: none"> Green cane trash blankets 	<ul style="list-style-type: none"> If neighbours don't adopt the practice (and thence still burn the cane fields) there is a risk of the trash blanket catching burning 	<ul style="list-style-type: none"> Not widely adopted
	<ul style="list-style-type: none"> Minimum tillage / reduced tillage <ul style="list-style-type: none"> pre-formed beds 		<ul style="list-style-type: none"> Has been adopted reasonably well Have seen successful demonstrations
	<ul style="list-style-type: none"> Green cane trash blanketing 	<ul style="list-style-type: none"> Mindset that it cannot be done Harvesters complain and charge too much to cut cane green Some irrigation management issues 	<ul style="list-style-type: none"> Needs support from harvesting sector
Precision agriculture		<ul style="list-style-type: none"> Costs of setup 	
Planting	<ul style="list-style-type: none"> Double disc planting double disc open planting 		<p>So far taken up by:</p> <ul style="list-style-type: none"> 50% of Burdekin 80% of BRA. <p>Scope to expand land area in which used.</p>
Harvesting	<p>Controlled traffic</p> <ul style="list-style-type: none"> matching row space to harvesters and haul-outs: controlled traffic where crop row spacing matches wheel track width 	<ul style="list-style-type: none"> Cost is a difficulty of the change over People are looking for a productivity improvement when they need to look at profitability 	<ul style="list-style-type: none"> Seeing more success stories Incentive funding Needs support from harvesting sector

Area	Specific practices	Barriers / Constraints / Context	Opportunities
<i>Workshop participants and interviewees comments</i>			
Reducing fertiliser use			
Variable rate fertiliser application	<ul style="list-style-type: none"> Fertiliser is not needed at a constant rate. Can use less (environmental and modest financial benefits) and produce higher sugar cane (substantial financial benefit) by applying just what the plants need. GPS is also being used to track harvesters: block recording Using NIR technology to report back to growers re whether there is too much or too little nutrient in their cane 	<ul style="list-style-type: none"> Can be very expensive . . . need satellite imagery and expensive equipment Having teething problems in the Herbert, re getting the tractor in the right spot: GPS signal issues The size of the business opportunity that this presents is not known - because it is new technology. Only 2/3 of the district has had its soils mapped. NB that there can be very fine resolution variation in soils . . . it is cutting edge work. Workers fearing that the GPS technology is being used to keep an eye on them 	<ul style="list-style-type: none"> A district approach is much cheaper: can get satellite imagery at 60c per Ha In the Herbert they are levying growers and CSR
Companion planting	<ul style="list-style-type: none"> Legume fallow crops: planting legumes (between, in?) cane rows in fallow periods: <ul style="list-style-type: none"> nitrogen fixation a supplementary income for growers 	<ul style="list-style-type: none"> The legumes need to be watered Planting soybeans in cane fields may bring in white fly, which can in turn impact neighbouring horticulturalists, increasing their chemical costs, etc 	
Fallow practice	<ul style="list-style-type: none"> Fallow practice 		
Genetically modified cane varieties	<ul style="list-style-type: none"> Using genetically modified cane varieties; huge business and environmental benefit <ul style="list-style-type: none"> less cultivation less chemical usage less nutrient application 		
Comments on current programs	<ul style="list-style-type: none"> Sugar Yield Decline Joint Venture outcomes <ul style="list-style-type: none"> sustainable farming economic results Key parts of the model: <ul style="list-style-type: none"> controlled traffic break crops (soybean and peanut) minimum tillage trash blanket (green cane harvesting) 	<ul style="list-style-type: none"> Cost Risks <ul style="list-style-type: none"> Lack of confidence <ul style="list-style-type: none"> current dollar returns too high to justify focus in these savings fear of unknown 	<ul style="list-style-type: none"> Examples of success Expert guidance <ul style="list-style-type: none"> extension officers Hold hand for a while Recognise and support leaders

Area	Specific practices	Barriers / Constraints / Context	Opportunities
<i>Workshop participants and interviewees comments</i>			
Horticulture			
Improving irrigation	<ul style="list-style-type: none"> Tailored nutrient / irrigation systems 		
Managing runoff	<ul style="list-style-type: none"> Minimum tillage 		
Reducing erosion	<ul style="list-style-type: none"> Companion planting 		
Reducing fertiliser use	<ul style="list-style-type: none"> Rotation cropping / companion planting 		
	<ul style="list-style-type: none"> Good soil / plant nutrition <ul style="list-style-type: none"> soil testing sap / leaf testing soil moisture & nutrient monitoring 		
Reducing pesticide use	<ul style="list-style-type: none"> Directed spraying 		
	<ul style="list-style-type: none"> Integrated pest management 		
Waste management	<ul style="list-style-type: none"> Waste management 		
Changing land use	<ul style="list-style-type: none"> Retire / compensate unsuitable land uses Move agricultural use to its highest value, whilst minimising environmental risk 		

Barriers to good on farm outcomes, from financial and environmental (specifically water quality) perspectives

These are barriers that stand out from farmers and graziers perspectives

AT FARM LEVEL

Area	General	Grazing	Cane	Horticulture	Program design implications
	<i>Workshop participants and interviewees comments</i>				
Interests and values				Some farmers not caring much about environmental outcomes: giving them a low priority	
Risks	<p>Risks</p> <ul style="list-style-type: none"> climatic extremes <ul style="list-style-type: none"> flood fire drought Conservative attitude to risk Trust (distrust) is a major issue when it comes to persuading graziers (and others) to change their practices Need to see more long term successes on different soils 				<ul style="list-style-type: none"> Prove the sustainability of practices Field tours in growers and graziers own areas, as well as outside the area

Area	General	Grazing	Cane	Horticulture	Program design implications
<i>Workshop participants and interviewees comments</i>					
	<ul style="list-style-type: none"> Financial constraints re ability to fix problems that they might find changing practices 				
	<ul style="list-style-type: none"> Fear of regulations affecting the financial viability and economics of farms 				
Minimising financial risk		<ul style="list-style-type: none"> Selection of breeds to manage pressures of drought <ul style="list-style-type: none"> Usual practice tends to <i>increase</i> pressures on land 			
				<ul style="list-style-type: none"> Some capital works that are very environmentally friendly, e.g. recycling pits, are not so beneficial financially 	<ul style="list-style-type: none"> Encourage and subsidise appropriate capital works
Market pressures	Bank managers only finance activities that show an immediate profit, and they don't care about the environment				
	No price premium for product produced sustainably				

Area	General	Grazing	Cane	Horticulture	Program design implications
	<i>Workshop participants and interviewees comments</i>				
Benefit / cost	<ul style="list-style-type: none"> Cost of change 			<ul style="list-style-type: none"> Substantial equipment: <ul style="list-style-type: none"> capital investment required, but may have no money high maintenance costs (too many moving parts) electronics break down, and delays re getting them repaired 	<ul style="list-style-type: none"> Financial support for capital purchases Or underwrite risks of hiring equipment (cover the loss in case of failure)
	<ul style="list-style-type: none"> Don't believe there is an issue or advantage in changing 		<ul style="list-style-type: none"> Income from cane is high: why change when income will come anyhow 	<ul style="list-style-type: none"> Relative costs of inputs like fertiliser compared to risk of under-application 	
	<ul style="list-style-type: none"> People not looking at their options financially: more about lifestyle 				
	<ul style="list-style-type: none"> Age - farmers 65 plus looking to retirement 				
Business understanding	<ul style="list-style-type: none"> Lack of knowledge 				
	<ul style="list-style-type: none"> Agronomy and advice on the ground comes primarily from sales people whose interests are conflicting 				
			<ul style="list-style-type: none"> Growers thinking that they know it all - cannot improve 		
			<ul style="list-style-type: none"> Belief that "more is better": don't understand economics of what they do on farm 		

Area	General	Grazing	Cane	Horticulture	Program design implications
<i>Workshop participants and interviewees comments</i>					
Time required for change	<ul style="list-style-type: none"> Changing practices takes time 		<ul style="list-style-type: none"> Growers not seeing the \$ savings that are possible 		
Cultural difficulties	<ul style="list-style-type: none"> Lifestyle change - locked in old ways Simplicity - mountains of recording etc too much 				<ul style="list-style-type: none"> Provide personnel to take samples
Community	<ul style="list-style-type: none"> Threat of vilification by peers and government Fear of failure: being a laughing stock 			<ul style="list-style-type: none"> Peer group pressure 	<ul style="list-style-type: none"> Use linked monitoring and evaluation to demonstrate success
				<ul style="list-style-type: none"> Inadequate networking 	
				<ul style="list-style-type: none"> History of growers being secretive. One benefits from the next growers' disaster. <ul style="list-style-type: none"> But water quality information is not business competition threatening In the Burdekin, for horticulturalists, there is no support system for disseminating information. 	

AT GOVERNMENT LEVEL

Area	Barriers / Constraints	Program design implications
	<i>Workshop participants and interviewees comments</i>	
Management arrangements	Tension between government driven big picture approach vs. producer led projects	
	Centralised planning with decentralised land management decision-making	
	Lack of coordination / integration of government / community action	
	Poor framing of purpose	<ul style="list-style-type: none"> • Provide confidence that government understands balance between sustainability and economics of farm enterprises
	No framework to enforce management change on producers with poor practice	
	<p>New NRMs trying to do things on the cheap</p> <ul style="list-style-type: none"> • Active graziers (etc) don't have time to be Chairpersons, so these roles are going to retired graziers or others (e.g. well liked ex-government people) • Not the right people to have in these roles, <i>for the purpose</i> 	<ul style="list-style-type: none"> • Support active farmers & graziers sufficiently so that they have time to do this work <ul style="list-style-type: none"> – so that they can pay someone to run their property
	NRM Boards <i>not</i> capable of being agents of change	<ul style="list-style-type: none"> • Go back to 1 to 1 extension officers or use private providers
Information quality	<ul style="list-style-type: none"> • Information not relevant, too technical, too vague, needing to be provided in too short a time frame 	
	<ul style="list-style-type: none"> • BMPS not being evaluated holistically (i.e. evaluations focused on specific interests) 	
	<ul style="list-style-type: none"> • The funding of CSIRO has been politicised, and this has done enormous damage to their standing <ul style="list-style-type: none"> – they work the media to raise the profile of an issue to get funds for research – this applies generally now (e.g. to university researchers also) • CSIRO seen as hopelessly politicised. Not so 20 years ago. 	<ul style="list-style-type: none"> • Decouple the need for employment from research and extension roles
Communication	<ul style="list-style-type: none"> • Top down driven communications and education, rather than demonstration led 	
	<ul style="list-style-type: none"> • Media loves beat ups 	<ul style="list-style-type: none"> • Maintaining the profile of work done
	<ul style="list-style-type: none"> • Support for landholders being seen as a handout 	<ul style="list-style-type: none"> • Shift perception from support as a handout to a public investment

Area	Barriers / Constraints	Program design implications
<i>Workshop participants and interviewees comments</i>		
Financial management		
Uses of funds	<ul style="list-style-type: none"> • History of (government) spending on changes that haven't delivered <ul style="list-style-type: none"> - n.b. that from a primary producers' perspective one must look after the <i>short</i> term 	
	<ul style="list-style-type: none"> • Funds going into the bureaucracy rather than into on ground landholder action 	<ul style="list-style-type: none"> • Devolved grant programs generally seen by the community as most effective for on ground works <ul style="list-style-type: none"> - e.g. a program in far north Queensland providing \$5K / property for purchase of farm equipment - foci for program can be identified locally, but they're usually done at a regional level, a level above the NRM groups
Funding arrangements driving environmental decline	<ul style="list-style-type: none"> • Perverse government action: subsidising graziers to keep cattle on drought stricken land <ul style="list-style-type: none"> - Not rejecting support in droughts, but the tools / mechanisms used are poor - There is a mixture of public & private benefit involved in managing the impacts of drought: people get too cute: supporting the landholder <i>does</i> give a public benefit 	<ul style="list-style-type: none"> • Quantify the economic rationale for mechanisms, and redesign based on what works for both graziers and catchment condition: shift subsidies so better financial <i>and</i> environmental sustainability
	<ul style="list-style-type: none"> • There are parcels of land, including sections of grazing properties, that are rated as grazing land, but which will not in fact support grazing. Sometimes the percentage of a property that is not actually suitable for grazing can be quite high, so rating these areas as "grazing land" applies inequitable financial pressure to properties. 	<ul style="list-style-type: none"> • Adjusting land rating by local government (and any others) so that only land actually suitable for grazing is rated as such
Grant funding	<ul style="list-style-type: none"> • Inequity of grants <ul style="list-style-type: none"> - one person takes up a practice independently, another gets a grant to change 	
	<ul style="list-style-type: none"> • Lack of ability to change approach: funding applications not easy to change 	

General forms of support that are highly valued by graziers and farmers

Area	Opportunities	Barriers / Constraints / Context
	<i>Workshop participants and interviewees comments</i>	
Business oriented support		
	<ul style="list-style-type: none"> • Supporting the change process: not a one-size-fits approach. Focus on supporting change as such. Change in a business is not generic. <ul style="list-style-type: none"> - need holistic support from a business perspective - provide different kinds of support people as needed; could be help with accounting systems, with irrigation, etc; need someone who can put you in touch with an accountant, etc <p>The professionalness of this service from a farm business perspective is missing.</p>	
		<ul style="list-style-type: none"> • Threshold effects in capital investment for profitability <ul style="list-style-type: none"> - Have to invest enough to get a return on investment
		<ul style="list-style-type: none"> • Succession planning <ul style="list-style-type: none"> - farmers and graziers homes are their businesses: a very different situation from most business people
	<ul style="list-style-type: none"> • Mapping desired projects at farm level to possible funding sources 	
Support systems		
	<ul style="list-style-type: none"> • Coordination of support systems 	
	<ul style="list-style-type: none"> • Dedicated professional support 	
	<ul style="list-style-type: none"> • Characteristics of good support: <ul style="list-style-type: none"> - innovative approaches - capacity improvement - suitable time frames - producers' own outcomes 	
	<ul style="list-style-type: none"> • All programs need supportive resources, i.e. extension staff, facilitators, etc <ul style="list-style-type: none"> - Longer term funding / contracts; keep good people where they are most useful 	

Area	Opportunities	Barriers / Constraints / Context
<i>Workshop participants and interviewees comments</i>		
Extension officers		
	<ul style="list-style-type: none"> • Need extension officers who fit in and stay. 	
	<ul style="list-style-type: none"> • Industry Development Officer 	
	<ul style="list-style-type: none"> • Providing job security and appropriate resourcing for Landcare and extension officers (trust takes time to build, and these professionals often have poor job security) <ul style="list-style-type: none"> - preferably provide long contracts for these people - extension officers are supposed to be managed by NRM groups: give them permanency for a group's life - arrangements where offers of new contracts must be made 6 (or 12) months prior to current contract ending could help considerably 	<ul style="list-style-type: none"> • With extension and Landcare officers, specifically, a major issue is their short term contracts. Relationships of trust take time to build. <ul style="list-style-type: none"> - Typically these professionals have 3 year contracts: 1 year to learn the job, 1 year to do it, 1 year to look for their next job.
	<ul style="list-style-type: none"> • Projects must be grass roots supported but need extension staff coordinators to do the paperwork and ensure it is done as expected and write the reports at the end of the project • Extension officers: <ul style="list-style-type: none"> - Staff must be long term and obtain trust before they are effective - Direct support for extension officers to assist graziers to learn new ideas 	<ul style="list-style-type: none"> • Need support to have a go at a grass roots level <ul style="list-style-type: none"> - need hand holding with grant applications, etc - a mountain of paperwork is needed to get approval for environmentally beneficial work have project ideas at grass roots level, but need help to make them real in / through government processes
	<ul style="list-style-type: none"> • Develop local industry officers to help disseminate information regarding best practices 	
Support local leaders		
	<ul style="list-style-type: none"> • What to do if the 3 year contracts for EOs regime stays in place? Perhaps: invest more in local landholders, rather than Extension officers, because <i>they</i> stay. <ul style="list-style-type: none"> - Look at the Landcare groups that have done well <i>without</i> coordinators 	
	<ul style="list-style-type: none"> • Recognising and supporting leaders <ul style="list-style-type: none"> - using increasing levels of technology, e.g. the Internet - providing on farm support so that they can leave their properties <ul style="list-style-type: none"> ▪ n.b.. a support person needs an induction period ▪ very hard to find a person a landholder feels they can trust to leave with their land 	<ul style="list-style-type: none"> • But community based NRM has a history of breaking people. • Relatedly: tall poppy syndrome: people can be waiting for 'champions' to be making mistakes

Area	Opportunities	Barriers / Constraints / Context
<i>Workshop participants and interviewees comments</i>		
	<ul style="list-style-type: none"> - good administrative support - good technical support • Use men / women on the ground to advise on what works in that (any given) area <ul style="list-style-type: none"> - beware of creating envy - recognise that “good information” is only good if it applies to you 	
Financial support		
Financial incentives	<ul style="list-style-type: none"> • Provide more financial incentives for change: resources and funding 	
	<ul style="list-style-type: none"> • Seed / incentive funding 	
	<ul style="list-style-type: none"> • Incentives / funding 	<ul style="list-style-type: none"> • Funds / dollars (lack of / access to) <ul style="list-style-type: none"> - available to support change
	<ul style="list-style-type: none"> • More supportive government incentive framework for BMPs (many innovative) 	
	<ul style="list-style-type: none"> • Financial incentives to change . . . and equipment for improved monitoring and application . . . for a limited time (?) 	
	<ul style="list-style-type: none"> • Target those who want to change - to set example 	
	<ul style="list-style-type: none"> • Use technology for improvements: <ul style="list-style-type: none"> - pay for or subsidise use of available technology, software, etc 	
	<ul style="list-style-type: none"> • Financial incentives to participate 	
	<ul style="list-style-type: none"> • Financial incentives to act to improve (sugar Water Use Efficiency Program is a good example) 	
	<ul style="list-style-type: none"> • Funds for technology to make it work - hardware and software 	
Rewarding outcomes	<ul style="list-style-type: none"> • Provide some financial benefit for Retaining 40% of biomass / grass cover at the end of the dry season <ul style="list-style-type: none"> - allow people to opt out - not telling people how to achieve it - payments made only if people deliver the outcomes • A program in the desert uplands is already doing this • But there are risks of fire: with a fire you lose it • Graziers worried that this might change from a voluntary standard to a mandatory one 	

Area	Opportunities	Barriers / Constraints / Context
<i>Workshop participants and interviewees comments</i>		
Underwriting risk	<ul style="list-style-type: none"> • Underwrite trials: sharing the risk <ul style="list-style-type: none"> - good measurement systems are needed: ways of measuring success and using it to support decision support systems <ul style="list-style-type: none"> ▪ provide technical support with the analysis ▪ provide really easy to use software ▪ n.b. DNR are progressing satellite mapping of properties <p>For example: In the last 5 years in sugar, you had to get it right, or you went broke.</p>	
Project cost sharing	<ul style="list-style-type: none"> • When proposing 50/50 or 1/3 / 2/3 funding arrangements, its essential to check whether this will actually enable projects to get up • Change government department attitude that no benefit should accrue to the grazier from the project. (Win/win solutions must prevail.) 	
	<ul style="list-style-type: none"> • No requirement for grazier to cover costs for environmental outcomes - the costs of the work is often enough or too much to bear. That is: programs in which the whole of the grazier's contribution is in kind. 	
Sustained funding	<ul style="list-style-type: none"> • Long term programs 	
Funding applications	<ul style="list-style-type: none"> • Kit form applications to obtain permits 	
Communication / education		
	<ul style="list-style-type: none"> • Communication re what funds are available <ul style="list-style-type: none"> - e.g. for National Water Fund, \$50K - \$100K available per property owner 	
	<ul style="list-style-type: none"> • Speaking to multiple values <ul style="list-style-type: none"> - lifestyle - product (quality) - environment 	People who don't see a reason to change, e.g. they're farming or grazing (in the way they do it) for the lifestyle (rather than, say, for profitability)
	<ul style="list-style-type: none"> • Schools like 'Grazing for profit' to teach people the tools to look at their businesses from both financial and environmental perspectives 	
Reporting and evaluation		
	<ul style="list-style-type: none"> • Linked monitoring and evaluation 	
	<ul style="list-style-type: none"> • User friendly recording system 	

Area	Opportunities	Barriers / Constraints / Context
<i>Workshop participants and interviewees comments</i>		
Practical demonstrations		
	<ul style="list-style-type: none"> • Producer demonstration sites 	
	<ul style="list-style-type: none"> • More “open houses”: where graziers can learn from what others are doing on their properties 	
	<ul style="list-style-type: none"> • Field days on graziers and farmers properties, so they can explore issues on the ground with property owners 	
	<ul style="list-style-type: none"> • Attend practical workshop on nutrient management (for growers) to lay out program and issues 	
	<ul style="list-style-type: none"> • Communication of practical projects to assist, by practical people who can get the confidence of growers 	
Community development		
	<ul style="list-style-type: none"> • Use Landcare groups 	
	<ul style="list-style-type: none"> • More grower groups 	
	<ul style="list-style-type: none"> • <i>Some</i> formal structure through which landholders can work together <ul style="list-style-type: none"> - for highly technical skills graziers and farmers don't go to community NRM groups, but do go there for communication - perhaps focus on equipping specialist sector groups with more environmental skills, rather than provide them through other groups 	
	<ul style="list-style-type: none"> • Sharing jobs across two properties (graziers working with each other), so that people, graziers, can learn from each other <ul style="list-style-type: none"> - e.g. young grazier learning from experienced grazier 	
Researching practices		
	<ul style="list-style-type: none"> • The best innovations in agriculture come from innovative farmers (not the show ponies). The best practices need to be: <ul style="list-style-type: none"> - identified in the field - measured to prove efficiency - supported with scientific information - supported with outcomes based funding 	

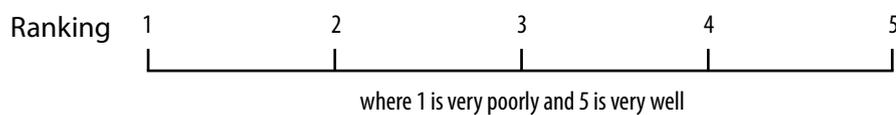
Area	Opportunities	Barriers / Constraints / Context
<i>Workshop participants and interviewees comments</i>		
	<ul style="list-style-type: none"> • Implementations of innovative BMPs that are monitored and evaluated for both productivity and water quality benefits 	
	<ul style="list-style-type: none"> • More hard facts and figures 	
	<ul style="list-style-type: none"> • Research: trials showing that a new practice is sustainable and achieves a better environmental outcome • Communication to relay what research has actually proven is helpful • Support individuals who are actually experimenting with a new system 	
	<ul style="list-style-type: none"> • Provide tools for property managers: refocus research to provide needed base information <ul style="list-style-type: none"> - soil mapping - water quality testing - its not sexy research so its not done by discovery scientists • Need information at appropriate scale / resolution, with demonstrated accuracy derived from ground truthing • KISS!: research products are often too complex 	<ul style="list-style-type: none"> • Property mapping, e.g. soil mapping, is very coarse in various rangelands
	<ul style="list-style-type: none"> • How to get an holistic approach? More research is needed into why growers adopt some practices and not others <ul style="list-style-type: none"> - Griffith University & CRC researching this - Desert Uplands research also - Practitioners providing answers re adoption - Comes down to economic support in every area: money, money, money - Demonstrations 	



Appendix 4: Participants' feedback on the workshop

We asked workshop participants to provide anonymous feedback on the workshop process at three points in the process: (i) at the end of the first session where objectives had been explained; (ii) at the end of the first day; and (iii) at the end of the workshop. The details of their responses are provided in the table below.

The scale used with each question was:



We invited participants to add comments to their ratings to explain them or elaborate on them. For the second question reported here - Have we canvassed all the issues related to existing programs to encourage producers to adopt better land management practices? - participants comments were as follows:

- ◆ No, but it would be almost impossible to achieve the above in the timeframe.
Further funding programs:
 - » Great Barrier Reef coastal wetlands programs
 - » Private philanthropy
- ◆ No. There is an enormous scope of governmental, industry and community initiatives underway. I am aware of 11 current programs dealing with BMP, improved practice / benchmarking and barriers to adoption within the FNQ region alone. This does not take into account historical initiatives that are now complete. Bear in mind we have had over a decade of dedicated investment in this arena.
- ◆ A lot of focus on incentives programs - we have not discussed many education programs for landholders to improve their practices without available funding. It is important to work out where grower funded type projects work and why as there will not always be incentives available.
- ◆ It would need extra time to discuss them.
- ◆ We attending are the converted. We will always have problems converting everyone.
- ◆ A lot of issues have been covered, but there is more, lots more. More time would be advantageous. Bringing together all research projects and findings into a central data base may help with adoption of better land management practices. Might be a better place to spend government funds instead of reinventing the wheel for the 25th time. Some projects need longer time frame to run, i.e. weed control, feral animal control. National Parks should be managed for weed and feral animals. Government needs to obey their own land management rules.
- ◆ There have been a few examples given, but I think the issues encountered are common to all successful programs:

- » active participation from individuals and government;
- » whole system approach integrated across geographic and political boundaries;
and
- » carrot versus stick approaches.
- ◆ Did not have much discussion on the Burdekin cane growing area.
- ◆ The successful programs were all strongly supported by excellent facilitators and support. There was a lot of help.
- ◆ Most projects discussed were from grazing Landcare issues. Not many agriculture projects were put forward.
- ◆ No.

	Day 1				Day 2		
	Have the objectives of the workshop been made clear to you?	Have we canvassed all the issues related to existing programs to encourage producers to adopt better land management practices?	Are you happy with the running of the workshop? (At the end of the first day.)	Are the workshop outcomes listed on the photocopies a true reflection of the views of the participants?	Do you feel the recommendations adequately reflect the views of participants?	Do you feel that the workshop was well organised and that you had a good opportunity to express your views?	
Participants' individual ratings	3	3.5	4	4	4	4	
	4	3	4	5	4	5	
	5	3	4	5	5	4.5	
	4	3	4	4	4	5	
	4	3	5	4	3	4	
	3.5	3	4	4	4	2	
	2	2.5	4	4.5	4	4	
	3	4	4	4	5	4	
	3	4	3	4	3	4	
	4	5	4	3	4	5	
	4	5	4	4	3	4	
	1	4	4	3.5	3.5	4.5	
	5	2	3	5	4	4	
	4	2	5	5	4.5	4	
	4	3	5	4	4	5	
			2.5	4	4.5	5	
		3.5					
		3					
		4					
Frequency: the number of participants who answered	15	15	20	17	17	16	
Mode: the most commonly selected answer	4	3	4	4	4	4	
Median: the answer in the middle of the group	4	3	4	4	4	4	
Mean: the average answer	3.6	3.3	3.9	4.2	4.0	4.3	



Appendix 5: Education and learning projects to carry forward the recommendations

This appendix comprises the main recommendations from section 7 as education and learning projects. The projects outlined here are all intended as action research projects: projects where the process of changing practices is itself the vehicle for researching what is and is not possible, and what works best.

For each project, the process that we envisage is:

1. identifying key stakeholders;
2. collaboratively developing a detailed project design;
3. designing the projects to build ongoing collaboration amongst stakeholders and researchers into the research process: the intent is that the stakeholders be co-researchers, and that each project be designed as an action learning experience for all stakeholders;
4. leveraging further input re current and past agency programs, as experienced from all sides, should be a key part of this process, so that designs are worked up that carry agency learning forward;
5. collaboratively managing the project, evolving it as needed; and
6. sharing what is learnt from each project through networks of stakeholders, so that project genealogies can evolve (via imitation, versioning, adaptation, and so on); this should include some formal documentation of learning, but the emphasis should be on telling stories and passing on techniques face to face.

The background to each of these projects is provided in section 7 of the main report, above.

Financing

1. FUNDING SIMPLIFICATION AND FLEXIBILITY

Project

Develop alternative funding models that give flexibility with accountability and efficiency in ways that are substantially better than current practice.

Methods

An approach is to:

- a. decrease the emphasis on paperwork and increase the emphasis on conversation, as this will involve less effort for the funded, and richer communication that will help funders understand better how programs are playing out on the ground, and
- b. manage the increased difficulty of demonstrating transparency and accountability to third parties by finding ways to shift the emphasis in funding programs from inputs to outputs and outcomes.

To explore this approach:

1. Work with key stakeholders - funding bodies and those funded - to develop ways to shift funding commitments further towards outputs and outcomes, rather than inputs.
The research would track whether output oriented funding models effectively catalysed take-up of key practices, and whether they provided transparency and simplicity that benefited all stakeholders.
2. Concurrently, stakeholders would experiment with different kinds of accountability process, e.g. bimonthly conversations between regional program managers and State and/or Australian Government agencies they are accountable to, with more detailed follow up on an exceptions basis (either on the spot or with an audit visit).
Working with each of Commonwealth, State, regional and local partners, the research would explore the benefits and costs from each stakeholders' perspective, considering time required, risks, accuracy and clarity, and flexibility. The researchers would facilitate the evolution of the model to address weaknesses encountered by each stakeholder, as the research proceeds.

Outputs

- ◆ A funding model that provides better flexibility, a stronger focus on outcomes, and appropriate accountability.

Outcomes

- ◆ More efficient pursuit of good water quality outcomes for the Reef.

2. FINANCING OPTIONS REVIEW

Project

Review financing of efforts to accelerate take-up of beneficial practices by producers, considering the equity and effectiveness of alternative approaches to risks of changing practices, the costs of using new practices, and transition costs. Identify effective, equitable options, developing innovative strategies as necessary.

Methods

1. Working with representatives of government and industry, analyse the approaches currently taken to financial risks and costs, both explicit and de facto.
 - » Consider what is equitable, having regard to practice in other industries.
2. Review alternative approaches to funding change, including uses of:
 - » incentives,
 - » payments for outcomes delivered on farm,
 - » underwriting risk,
 - » funding targeted capital works,
 - » tax breaks, and
 - » refining property ratings, so that land that is not productive is rated as such.

Financial innovations could make a significant contribution to accelerating take-up of practices.

Outputs

- ◆ Recommended funding models, which include financial innovations designed to accelerate take-up of better practices.

Outcomes

- ◆ Faster take-up of beneficial practices.

3. INCENTIVES FOR INNOVATION

Project

Catalyse faster innovation in practices by establishing a framework to make successful innovation in practices profitable for primary producers, beyond the benefit that accrues to them from using the innovation in their own businesses.

Methods

Working with industry bodies and government, establish a scheme to generate some kind of income stream for innovators.

- ◆ For instance, a royalty over a period of ten years, paid in proportion to the practice's take-up.
- ◆ Issues to address in the design include:
 - ◆ what “newness” is and how to demonstrate it: perhaps via some kind of independent assessment
 - ◆ how to demonstrate the environmental and financial viability of a practice
 - ◆ royalties go to the practitioner partners, but one could provide grant funds to research partners to evaluate promising practices (payable to universities / research institutions)
 - ◆ the importance of evaluating innovations from a whole system perspective, not simply from specific industry and water quality perspectives
 - ◆ a program of this kind could be shaped so it is more proactive than this - evolving a kind of “innovation incubator”.

Outputs

- ◆ Establish a program to proactively recognise and reward innovation in cane, horticulture and grazing in the catchment of the GBR, for innovations that have strong water quality and strong financial benefits.

Outcomes

- ◆ Accelerated change in practices to improve reef water quality outcomes.

4. ALIGNING LENDING PRACTICES WITH SUSTAINABLE DEVELOPMENT

Project

Investigating the contribution of banking and other investment institutions (especially lending decisions) to unsustainable land management, and developing training materials for institutions to improve their lending practices, to better align them with sustainable

development goals, and training materials for borrowers to help them better evaluate their risks as property purchasers.

Methods

1. Research relevant case law as background.
2. Work with the lending institutions to evaluate a set of cases of successful and failed loans.
 - » Institutional partners are essential.
 - » Begin with the files, and then explore the experience of landholders who have gotten into difficulty.
3. Explore the cases asking:
 - » how has lending practice failed?,
 - » how could lending procedures be strengthened?, i.e. what education do lenders need to reduce risks of funding financially and environmentally unsustainable property purchases?
4. Develop training materials based on findings.

Outputs

- ◆ Training materials for managers of lending institutions. These would be developed so that they could be included by the institutions in their training materials for staff in the region.
- ◆ Initial training by institutions for staff influencing these lending decisions in the region.
- ◆ Training materials for purchasers (perhaps provided online).

Outcomes

- ◆ Less grazing and agricultural businesses being established that are not financially (and thence ecologically) viable.

Practice demonstrations

5. BEST PRACTICE SITES REVIEW AND ONLINE DIRECTORY TO BMP INFORMATION

Project

Provide an online resource for producers and those who support them (or one for each of cane growing, horticulture, and grazing) that:

- ◆ provides a directory to demonstration sites, in a way that enables producers to explore how producers in similar circumstances have improved their practices;
- ◆ provides a directory to best management practice material available online (and on paper, for key texts);
- ◆ is designed in such a way as to build users' capacities to manage farms and properties with an awareness of their environmental context, and of the downstream effects of their management.

Methods

1. Working with producers' representatives and other stakeholders develop a design for the website.
2. Compile a database of demonstration properties, cataloguing them in a way that assists producers to compare demonstration sites with their own circumstances. Make the database available online.
3. Compile an online directory of Best Management Practice information.
4. Shape the database and directory, and contextual information (e.g. on catchment management and reef ecology) in such a way that by using the site the awareness, understanding and skills of users are enhanced.

Outputs

- ◆ An online resource (or resources) for producers that builds their awareness and understanding of environmental issues as it directs them to quality information about demonstration sites and best management practices.

Outcomes

- ◆ Better use of existing information, so more effective use of taxpayers funds spent on developing BMPs.
- ◆ Enhancing the capacities of producers to manage their properties in ways that respect their environmental contexts.

6. ENHANCING TAKE-UP PROCESSES FOR PRACTICES WITH SUBSTANTIAL POTENTIAL

Project

Accelerate take-up of promising practices by assisting farmers and graziers to think through ways to use these practices in their particular businesses (given constraints re time, money, land, etc).

Methods

Working with farmers, graziers, extension officers and agricultural science researchers:

1. Identify a workable number of practices to champion. The participants workshop provided a number of recommendations (Box 1).
2. Draw out how these practices make business and/or lifestyle sense, and how their business and lifestyle logic has underpinned take-up to date.
3. Enhance and complement existing tools (e.g. Best Management Practice (BMP) manuals) used to help producers take-up new practices by documenting how to help producers decide:
 - » whether a new practice is appropriate,
 - » how it should be employed, and
 - » how the transition to new practice should be managed.
4. Pilot the use of these tools in specific locations, working with NRM professionals and other partners.

Outputs

- ◆ Tools for NRM professionals to use to help primary producers evaluating and implementing practices in business specific ways.
- ◆ Training for NRM professionals.
- ◆ Work with primary producers to support take-up of key practices.

Outcomes

- ◆ Accelerated take-up of financially attractive practices that deliver strong water quality benefits.

7. SUSTAINABILITY FOR GRAZING PROPERTIES WITH SMALL CARRYING CAPACITIES*Project*

Identify pathways to sustainability for properties with small carrying capacities or high levels of debt relative to their carrying capacities.

Methods

1. Work closely with a number of these graziers and local NRM practitioners to explore graziers' options.
 - » Work with a set of cases cover the breadth of situations people may find themselves in.
2. The research focus will be pathway oriented:
 - » helping graziers work out ways to get from their current situation to better ones (financially and environmentally), and specifically
 - » to support shifting away from a 'boom and bust' model of grazing property management.

Outputs

- ◆ Guidance materials for use by extension officers (and others) with graziers to identify their alternative paths forward.
- ◆ Self-help tools for graziers to undertake this evaluation.
- ◆ Recommendations regarding the relative importance of innovative business models, regulation, and exit strategies for addressing these high risk properties.

Outcomes

- ◆ Improvements in the performance of this relatively high risk sector of the catchment.

Extension**8. STRENGTHEN INDUSTRY SUPPORT NETWORKS***Project*

Strengthen industries' capacities to support themselves.

Methods

1. Working with producers' organisations, investigate opportunities to expand support networks in ways that will improve the sustainability of properties and farms. In particular explore how well (i) new entrants to industries, and (ii) producers who are struggling financially, are supported.
2. Investigate the potential of developing or expanding incubator functions (for new businesses), development functions (for established successful businesses), and clinic functions (for businesses experiencing difficulties), in each industry sector, considering the roles that producer organisations, private sector consultancies, voluntary collaborations of small groups of producers, and government can play in this process.
3. Strengthen industries' support networks in ways identified during this research.

Background

- ◆ Producers' organisations (e.g. Growcom), private sector consultancies (e.g. Resource Consulting Services 'Grazing for Profit'), and small groups of cooperating producers all help primary producers develop their businesses in ways that improve both financial and environmental performance. Limitations of these channels are:
 - » some producers prefer to work alone, and so do not use these channels to develop their skills;
 - » the incubator and clinic functions are not well developed;
 - » costs prevent some producers from accessing private sector advice; and
 - » staff time available in producers' organisations limits producers' access to advice from them.

- ◆ Cooperative arrangements amongst small groups of producers can be very effective. Two grazing examples are:
 - » 'Grazing for Profit' includes a program in which a group of graziers function as Board Members for each other; and
 - » there is an Argentinian program in which graziers function as Boards for each other, and pool funds to hire consulting resources that they need as a group.

A program could be developed to enhance the capacities of producer organisations to catalyse formation of these groups. ('Grazing for Profit' is a successful commercial model.)

- ◆ Processes for referring producers who are managing their farms unsustainably to clinics could be enhanced as part of this program.

Outputs

- ◆ Ways for producers to access better support, either from producer organisations, or from consultancies, or by cooperation with peers - particularly for new businesses and businesses in difficulty.
- ◆ Means by which producers who are putting their land under unusually high pressure can be helped to change their business models.

Outcomes

- ◆ Stronger industry networks and organisations.
- ◆ Industries better placed to take responsibility for their own sustainability.

9. DEVELOP ADVOCATES' CAPACITIES TO CHAMPION PRACTICE INNOVATIONS FROM BUSINESS PERSPECTIVES

Project

Develop the capacities of professionals and non-professionals who are championing good land management practices to explain to farmers and graziers how changes in practices make sense from business and lifestyle perspectives.

Methods

1. Develop a set of property case studies which show how to think into whether and how to implement an environmentally beneficial practice on a property.
2. Drawing on the case studies and on extension officers' experience provide materials which cover:
 - » existing resources for extension workers to use when they help farmers and graziers evaluate a practice
 - » processes to follow (questions to ask, kinds of evidence to gather, etc); the process material may well also draw on traditions re listening, negotiation, finding common ground, etc.
3. Pilot this material in professional and community development courses, evolving the design of the courses.
 - » These could be structured richly with a training / mentoring / training design, organised around participants learning in practice how to shift their frames of reference.

Outputs

- ◆ Training program for NRM professionals on 'Understanding farm business perspectives on environmental management'.
- ◆ Website with a directory to online resources, and the training materials developed in this project. The website could incorporate short vide

Outcomes

- ◆ Substantial improvement in the communication between NRM professionals and primary producers about changes in practices that improve water quality outcomes.
- ◆ Better communication will in turn support faster, higher quality take-up of better practices.

10. SKILLS DEVELOPMENT FOR NEW EXTENSION OFFICERS

Project

Establish a process of relatively rapid skills transfer, within extension officer networks, that substantially decreases the time that it takes for new officers to get up to speed with an industry and a region, and the time that it takes for them to build trust.

Methods

1. Identify experienced, competent extension officers / industry support people.
2. Pilot a process designed to support skills development, including some mix of:
 - » workshop based training,
 - » mentoring by phone, email and website,
 - » part-time apprenticeship (e.g. assisting an experienced professional one day per week), and
 - » co-learning groups involving technical experts, landholders, community, government, etc (with discussion centred on current decisions being made by one or more of the participants, in the style of adaptive management planning workshops).

Outputs

1. A training model and related materials for use by organisations in the catchment of the GBR that provide extension services (including NRM groups, industry groups, government departments).
2. Development of the capacities of extension officers who participate in the pilot.
3. The pilot program can itself be carried forward and expanded, becoming a long term program in the catchment.

Outcomes

1. Substantially higher quality support for farmers and graziers.
2. Better networks between individuals and organisations who assist farmers and graziers to adopt better water quality protection practices.

11. DEVELOPING CAPACITIES FOR COMPLEX PROBLEM SOLVING

Project

Use complex, multi-disciplinary decisions that NRM professionals and other stakeholders are making as occasions for learning a variety of ways of solving problems and thinking innovatively in capacity building workshops.

Methods

Working with NRM professionals, pilot and develop professional development processes for NRM professionals, and other interested stakeholders, that develop their skills in complex problem solving.

Participants would workshop decisions that they or their colleagues are making. Any decision that is complex, multi-disciplinary, and important to at least one participant could be a candidate.

Educational facilitators would assist participants to use a variety of problem solving and innovation processes to make their decisions - selected on the basis of their relevance to the particular problem. The toolkit drawn on would include:

- ◆ Adaptive Management planning processes, in which dialogue and systems analysis play a central role, and which pay particular attention to uncertainty, surprise and resilience;

- ◆ crossing systems analysis, management system auditing, and conflict analysis to bring technical, managerial and political sensitivities into play in the one decision-making process;
- ◆ techniques for innovation and creative thinking, including lateral thinking techniques, mindmapping, brainstorming, etc;
- ◆ back of the envelope calculations, spreadsheet analyses, more formal modeling, etc to assist participants to think into the relative importance of various influences both on a geographic basis and a property basis, and into timescales, the scale of responses, what needs to be monitored to evaluate performance, and so on;
- ◆ financial analyses (e.g. cash flow modeling, and calculating returns on investment).

Other stakeholders and experts would be welcome to attend for the duration of discussions of particular problems of interest to them.

These processes would contribute directly to current natural resource management in each region, build networks, and be a valuable professional development experience at the same time.

Recommendation

Develop the capacities of NRM professionals and other stakeholders to solve complex, multi-disciplinary problems and think innovatively.

Background

Failures in government practice have had a very negative impact on producers' willingness to follow government advice. Two kinds of problem stood out in this study:

1. Farmers and graziers have experienced significant problems with advice from government departments. For example, graziers were given *Hymenachne amplexicaulis* to plant by government agronomists. *Hymenachne* proved to be invasive and is now a major weed in the wet tropics.
2. There are various 'wicked problems' - like the recycling of "heart break blocks" (see Recommendation 7) - where persistent government inaction leads to a view that governments are not serious about solving environmental problems. Government action (notably allocation of resources) is often in tension with government policy (which is often articulated in aspirational language).

Examples of persistent contradictions and badly flawed advice are taken as evidence of "a silo mentality in government, the lack of a whole of system approach, and thence a lack of credibility".

Activities of NRM professionals in the field obviously can't be expected to 'solve' these problems. However, sophisticated, skillful explanation of the difficulties governments' face and innovative development of practical options makes a great difference to the quality of relations between producers and government. NRM professionals' capacities are fundamental to this.

Learning by doing processes using actual projects as the learning medium have been used successfully in urban NRM contexts. We recommend them as a capacity building medium. What we envisage is that participants would workshop complex, multi-disciplinary decisions that they or their colleagues are making that are important to at least one participant.

Facilitators would assist participants to use a variety of problem solving and innovation

processes to make their decisions - selected on the basis of their relevance to the particular problem. The toolkit drawn on would include:

- ◆ Adaptive Management planning processes, in which dialogue and systems analysis play a central role, and which pay particular attention to uncertainty, surprise and resilience;
- ◆ crossing systems analysis, management system auditing, and conflict analysis to bring technical, managerial and political sensitivities into play in the one decision-making process;
- ◆ techniques for innovation and creative thinking, including lateral thinking techniques, mindmapping, brainstorming, etc;
- ◆ back of the envelope calculations, spreadsheet analyses, more formal modeling, etc to assist participants to think about the relative importance of various influences both on a geographic basis and a property basis, and about timescales, the scale of responses, what needs to be monitored to evaluate performance, and so on;
- ◆ financial analyses (e.g. cash flow modeling, and calculating returns on investment).

At the one time, workshops of this kind would build networks, be a valuable professional development experience, and contribute directly to current natural resource management in each region, because actual problems are the case studies.

Outputs

- ◆ Advanced training for participating NRM professionals and others, that also contributes directly to work on current NRM problems and builds networks.

Outcomes

- ◆ Improvements in the quality of NRM advice and decision-making in the catchment of the GBR

ARIES is the Australian Research Institute in Education for Sustainability based at Macquarie University, Sydney. ARIES is primarily funded by the Australian Government Department of the Environment and Water Resources.

Its core business is to undertake research that informs policy and practice in Education for Sustainability across a range of sectors including: business and industry, school education, community education, and further and higher education.

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