Understanding adoption and economic implications of grazing management practice change in the Cape York Catchment.

A review and insight into achieving sediment reductions through changing management practices.

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1 Introduction

The decline in the health of the Great Barrier Reef has resulted in the development of the 2050 long term sustainable target of a 20% reduction in sediments (Queensland Department of the Premier and Cabinet 2013). Grazing is listed as the prime determinant of changes in water quality regarding sediment, with beef production accounting for the largest single industry by land use, covering 90 per cent of the relevant land area (Karfs *et al.* 2009). The agricultural sector is a contributor to the declining water quality. However, the size and economic importance of the industry means it may be costly to reduce impacts.

The Cape York region has a mix of extensive grazing systems integrated with horticulture. There are approximately 84,828 head of cattle over at total of 47 businesses of which majority are family owned. Extensive grazing industry is an important industry which contributes a gross value of $14.39 million to the local economy (ABS May 2015). In 2015, Grazing Industry Roundtables held in Cape York examined the level of landholder willingness to adopt changed practices that benefit the Reef. These practices included: improving herd management, improving management of off-stream and dam watering points, improving pastures, reducing pest and weed pressure, improving road and firebreak maintenance, marketing opportunities, reducing late season wildfire, and spelling gully prone areas.

To achieve increased adoption of improved management practices requires understanding the private and public trade-offs to justify public spending. Targeting of resources more efficiently and effectively has been a key policy recommendation in reviews of natural resource management programmes (Rolfe *et al.* 2007; Pannell 2009). Key considerations include understanding the public and private costs and benefits to evaluate which policy mechanism is most effective in achieving environmental outcomes (Pannell 2009). Pannell *et al.* (2006) developed a framework for investing in natural resource management (NRM) projects where the trade-offs between public and private benefits and costs identify which policy mechanism is likely to be the most effective, however this is difficult to apply in a large complex savannah grazing system.

This report seeks to highlight the economic implications of different management approaches and propose recommendations regarding future program design. It initially provides a background of the grazing industry, followed by a review of current NRM policy mechanisms, three case study approaches and finally recommendations are given.

2 Background

In 2002, regional natural resource bodies were required to develop a ‘strategy and investment plan’ to improve management of natural resources. This involved identifying assets; ranking and prioritising assets after accounting for risk; establishing and prioritising goals, objectives and targets for realistic achievement through the investment planning process; and consulting the public (Farrelly and Conacher 2007).

These tasks are complex and require expertise in gathering and using science and information, local and practical knowledge, and an understanding of public values. This range of skills and knowledge are reported to be lacking in regional natural resource bodies (Seymour et al. 2008), but are critically needed for prioritisation decisions. The spatial and temporal impact of a decision can vary

dramatically from an individual field to a whole region and from a year to a whole century, based on the complexity and geography of the natural resource management (NRM) issue.

Changing land use management practices may be very costly for landholders, thus there is a need to explore how water quality improvement targets can be achieved, the level of potential improvements, and the cost involved (Bouman et al., 1998; Michaud et al., 2007; Cools et al., 2011).

Water Quality Improvement Plans aim to provide direction and allocation of future resources to achieve water quality outcomes. In the past, NRM investment programs have experienced deficiencies in delivering targeted investments efficiently and were lacking the ability to demonstrate measured outcomes (Pannell 2009b). Criticisms of past policies and programs have resulted in changes to natural resource management in Australia and increased pressure to demonstrate outcomes which are based on biophysical and economic information. Pannell (2009) noted that environmental problems are often technically complex and uncertain. Robust decisions about natural resource management need to be based on knowledge about the degree of threat or damage to environmental assets at risk, and the extent to which this threat or damage can be reduced by particular changes in management. In many cases, generic knowledge is not sufficient, hence, local specific knowledge is required (Pannell 2009a).

3 Cape York Grazing Industry

In 2015, the Cape York NRM group ran several Grazing Industry Roundtables to examine the level of landholder willingness to adopt changed practices that benefit the Reef. An analysis of the results indicated that the improved management practices that are expected to have both a productivity improvement for landholders and water quality benefits are the most favoured by la`ndholders (ranked highest). Table 1 shows the practices that were discussed and the proportions of landholders who are or would like to adopt the practice on their property.

Table 1: Grazing improved management practices for Cape York and landholder willingness to adopt

Rank	Improved Practice	Proportion of landholders who want to adopt this practice on their property
1	Improving herd management	87.5%
2	Improving water points	87.5%
3	Improving pastures	62.5%
4	Reducing pest and weed pressure	75%
5	Improving road and firebreak maintenance	75%
6	Marketing opportunities	62.5%
7	Reducing late season wildfires	62.5%
8	Spelling gully prone areas	62.5%

Importantly, the activities that are perceived as primarily water quality focussed such as spelling gully prone areas (gully management) are still of interest to be undertaken by more than 60% of graziers. Further economic analysis that shows the productivity benefits of improved fire and gully management could see even higher proportions of graziers interested in these activities in the future.

Discussion at the Grazing Industry Roundtables also focused on the landholder's willingness to contribute financially to these improved management practices. The discussion indicated that while all grazing landholders were willing to undertake improved management practices, the private financial costs of adopting are a limiting factor for many landholders.

50% of land managers said they would provide 50% of the total cost, however 12.5% of landholders said they were unable to provide any financial contribution. The large scale of properties and the very remote nature of Cape York means that many graziers are unable to afford the infrastructure costs of improving management practices. However, with financial assistance of 75% to cover the upfront private costs of infrastructure, more than 85% of landholders would adopt improved practices in the next 2 to 5 years.

All graziers were willing to develop a property management plan to support implementation and 37.5% have either already done so, or are in the process of completing one.

All graziers were interested in receiving practical on-ground training with half being very interested. A mix of instruments for training should be considered.

Graziers across Cape York predominately operate enterprises that either finish bullocks, or breed and sell store cattle. Store cattle are usually sold at either the Mareeba Sale yards or freighted to Charters Towers for those businesses who own finishing properties located outside of the Cape York region.

Although the level of debt across the northern beef industry increased by 17.2% during 2009-2011, the level of debt in Cape York remained stable. In Cape York In 2011, only 10% of total debt resides with borrowers who are considered non-viable, while 57% of total debt lies with borrowers who are considered viable under most or all circumstances (Rural Debt Survey 2011).

The eastern young cattle index has risen dramatically during 2014 and 2015 with producers receiving significantly higher prices across the board (Figure 1). The increase in prices is largely due to the declining cattle numbers across Queensland resulting from increased turn-off of both breeding stock and finished stock as drought conditions have worsened. Cash flow often proves difficult in grazing businesses and the high prices present an opportunity for producers to have a complete muster and remove stock that do not fit in the usual enterprise categories and manage stocking rates more closely heading into the El Nino.

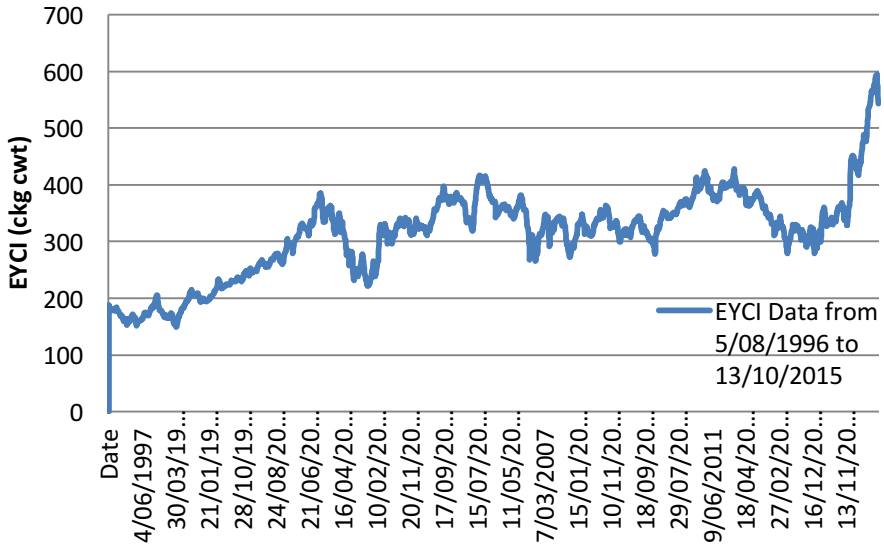

Figure 1: Eastern Young Cattle Index – 1996 to 2015.

Currently, more than 80 per cent of Queensland is drought declared under state government processes. The high probability of the current El Niño event further developing and the threat of another dry summer for some regions poses a risk of current drought conditions becoming more protracted. Based on previous years when the SOI has been in a 'Consistently Negative' phase at the end of August, the probability of rainfall being above median for the next three-month period (September to November) is less than 40 per cent for most of Queensland and less than 10% for the Cape York region (Figure 2). This risk should be factored into decision making and allocation of resources across the Cape York NRM region, as this will further limit the ability of landholders to improve management practices.

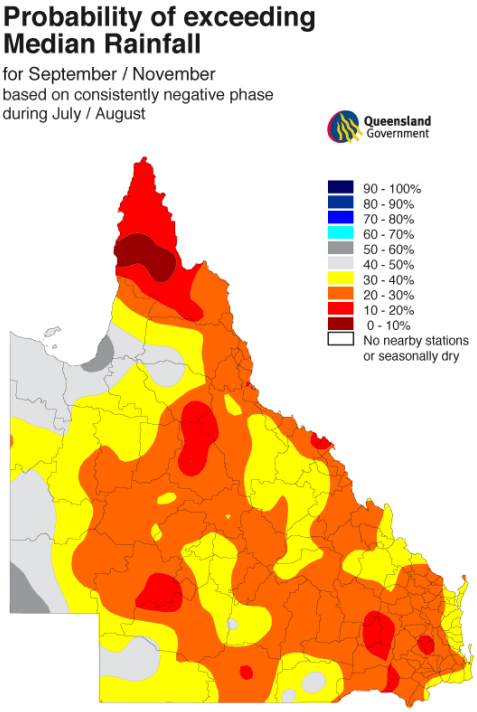

Figure 2: Probability of exceeding median rainfall.

4 Current Mechanisms

As an extension of *Reef Plan* and in line with the national priority areas of Caring for Our Country, 'Reef Rescue' was formed. Reef Rescue has the objective "to improve the water quality of the Great Barrier Reef lagoon by increasing the adoption of land management practices that reduce run-off of nutrients, pesticides and sediments from agricultural land" (Queensland Department of the Premier and Cabinet 2009).

Over $2 billion has been allocated to fund this objective (Queensland Department of the Premier and Cabinet 2009), through the following five main components:

- Water Quality Improvement Grants ($146 million over five years)
- Reef Partnerships ($12 million over five years)
- Land and Sea Country Indigenous Partnerships ($10 million over five years)
- Reef Water Quality Research and Development ($10 million over five years)
- Water Quality Monitoring and Reporting, including publication of an annual Great Barrier Reef Water Quality Report Card ($22 million over five years).

Recently re-named as *Reef Programme*, the Water Quality Grants and Reef Partnerships components have been continued as a key mechanism for funding on-ground practice change. The program has been structured as an incentives package with a matching financial contribution required from the receiving landholder. These payments for infrastructure were designed to assist and encourage land management changes across the whole property.

4.1 Private costs, benefits and adoption

Depending on the complexity of the NRM issue, an astute policy response will include a suite of policy responses, where many instruments can complement each other. This approach is more likely to achieve outcomes and provide more flexibility in responding to changed conditions. Some instruments are likely to function more efficiently when used in conjunction with other instruments. However, in practice, the selection of mechanisms is often not selected through a rigorous process, so the policy response tends to rely on a small number of policy mechanisms. This highlights the importance of understanding the public and private benefits when selecting an appropriate suite of mechanisms (Pannell 2009).

Key considerations include understanding the full range of public and private costs and benefits to evaluate which policy mechanism will be most effective at achieving environmental outcomes (Pannell 2009). Similarly, information regarding the importance of the environmental asset to the community, the project risks, current level of adoption of new practices, time lags and private costs are all required to fully understand how to prioritise investments and the subsequent policy recommendations.

'Public net benefits' are defined as benefits minus costs accruing to society in addition to benefits accruing to the person whose land management is to be altered. 'Private net benefits' are defined as the benefits minus the costs accruing to the private land manager as a result of the proposed changes in land management excluding transaction costs that are a part of the policy intervention (Pannell 2009b). Landholders will adopt land management practices with positive private net benefits, provided that they are able to learn about those practices. Positive incentives refer to land use change being encouraged through the use of regulation or financial instruments. Negative incentives are regulatory or financial incentives that are used to force change.

Pannell (2009b) articulates the following rules for selecting policy mechanisms (refer to Figure 3):

1. Do not use positive incentives for land-use change unless the net benefits of change are positive.

2. Do not use positive incentives if landholders would adopt the land-use changes without those incentives.

3. Do not use positive incentives if private net costs outweigh public net benefits.

4. If private net benefits outweigh public net costs, the land-use changes should be accepted if they occur, implying no government action. Alternatively, if it is not known whether private net benefits are sufficient to outweigh public net costs, a relatively flexible negative incentive instrument may be used to communicate the public net costs to landholders (e.g. pollution tax) leaving the decision to landholders. Inflexible negative incentives, such as regulations, should not be used.

5. If public net costs outweigh private net benefits from a set of land-use changes, use negative incentives to discourage uptake of these land-use changes.

6. If public net benefits and private net benefits from a set of land-use change are both negative and landholders accurately perceive this, then no action is required. Adverse practices are unlikely to be adopted. If there is concern that landholders have misperceptions about relevant land uses, adoption of environmentally adverse practices could be discouraged by extension, or more strongly by negative incentives.

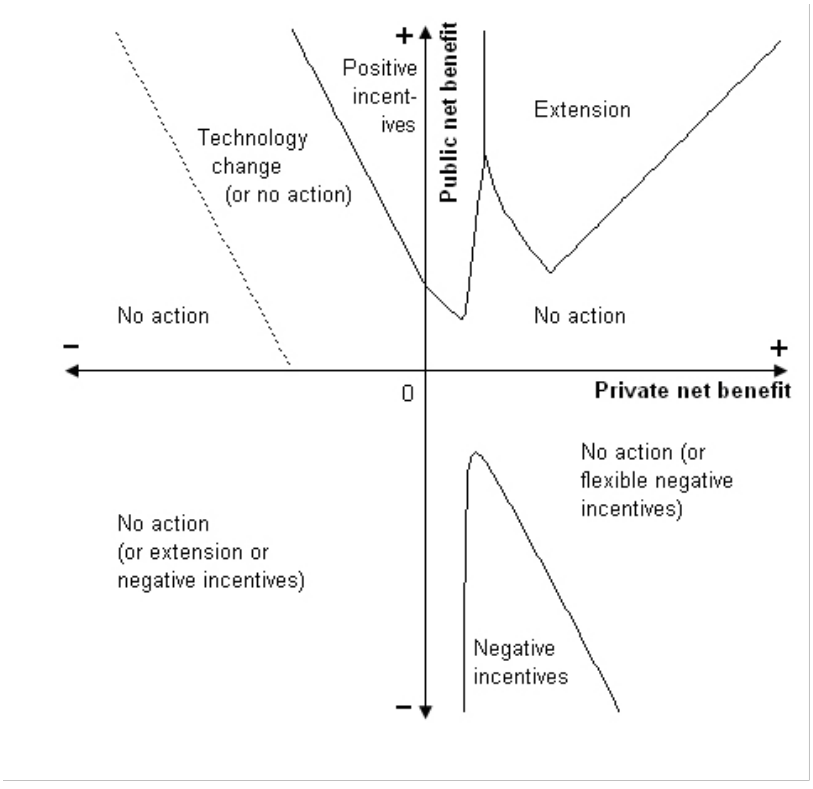

Figure 3: Selecting policy mechanisms based on public and private trade-offs.

It is clear from the adoption literature that the approach required to achieve water quality improvements, via adoption of specific management practices, should be a diverse suite of instruments to accommodate the heterogeneity of attitudes, circumstances and conditions faced by graziers. The management practices promoted through the instruments must take the goals of

landholders into account, including a financial advantage over their existing management practices and have the ability to be trialled by graziers. In addition, conservation programs need to take advantage of farmers' stewardship ethic for maximum effectiveness and efficiency, and minimize the risk of crowding out intrinsic motivation and altruistic behaviours of the landholders (Greiner & Gregg 2011).

Key limitations of the framework are underlying assumptions that the public and private trade-offs are understood by policy makers and by landholders, and that the public and private benefits and costs are homogenous across different enterprises, locations and management practices. In addition, the framework does not account for the time required to shift to a new overall environmental position. It does, however, integrate the private and public costs and benefits, and the most appropriate policy mechanisms. The increasing pressure for improved health of the GBR, and imperatives to meet targets and efficiently use resources, means that policymakers need to evaluate the net public and private benefits of reducing sediment emissions, and the policy mechanisms to achieve this. Improved understanding of the net private benefits of changed management practices is an essential step in the process.

Landholders face substantial uncertainty about markets, climates and the benefits of changing management practices, and are likely to consider these in any assessment of the private net benefits associated with practice changes. Of particular interest to landholders are the private benefits from changing management practices, taking into account expected variations in future rainfall patterns. A simple hypothesis is that managers who are more optimistic regarding future patterns of climate are more likely to adopt particular management practices, while those more pessimistic about future patterns of climate may be reluctant to change. The current El Niño weather pattern is likely to place a significant hurdle for adoption of improved management practices during the coming 1-2 years.

Star et al. (2015) highlight the difficulty in applying such NRM frameworks when there is uncertainty and dynamic variation in the private benefits of changing landholder management practices. It also provides insights into why offering a bundle of practices and mechanisms is required to increase adoption when there is considerable uncertainty and variability in private benefits and costs, and, therefore, allow further flexibility and ability to make dynamic changes (see Figure 4).

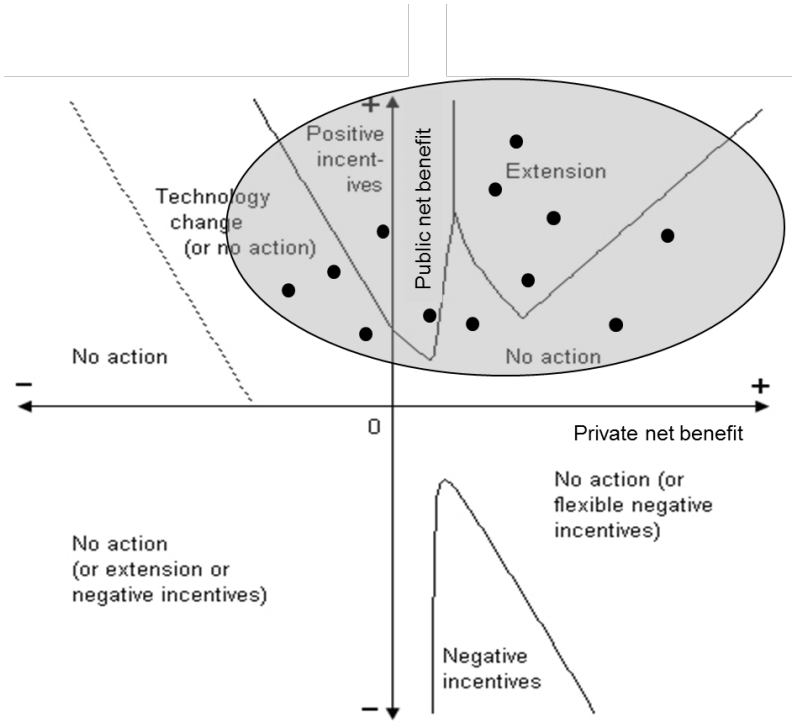

Figure 4: Selecting policy mechanisms based on public and private trade-offs when there is uncertainty and dynamic variation in the private benefits of changing landholder management practices.

Star et al. (2015) conclude that to encourage landholder adoption of improved management practices, rainfall and climate variation requires a mix of mechanisms. This results in a suite of mechanisms being used at one time to compliment the suite of practices that are required to be adopted.

5 Case Studies

5.1 Fairlight Station- Sheree and Craig Callagan

Sheree and Craig run a breed and finish operation at Fairlight Station north of Laura. It has been three years since they made the decision to make changes to their business including property planning and infrastructure, herd management and enterprise changes. They acknowledge it is a long way to go however they have started to make large scale changes to manage their business sustainably in the future. Their short term goals as owners of the enterprise is to improve grazing land management, riparian management and herd management to ensure a profitable and sustainable grazing operation.

Figure 5: Images of Fairlight Station.

The first step has been to fence 25km of the Kennedy River and to provide four new dams as off stream watering points for cattle. The Callaghan's will then create two paddocks which will each be managed to improve joining times and breeder management. It will also allow cattle to utilise the whole area of the paddock and not just the distance surrounding the watering point. Increasing the ground cover present on the river bank and within paddocks will slow the rate of sediment run off. It is assumed that these changes to their property will improve the quality of the water entering the Great Barrier Reef.

As a result of these improvements, there are three main advantages to the Callaghan's enterprise:

1. Increased calving rates of 20% through their ability to match breeder condition with pasture growth during drier periods leading up to the calving season.
2. Improved weaning rates by 25% through increasing their ability to control stocking rates and segregate different classes of females in order to manage them post-calving.
3. Improved access to markets.

The benefits from the improvements can be seen through the increase of their gross margin per adult equivalent ($GM/AE). Before the fence and dams are erected the GM of the area of change is $46.18/AE. After taking into consideration the increases in calving and weaning rates resulting from the new infrastructure, the area's GM increases to $81.89/AE.

The capital costs Sheree and Craig will incur in order to fence approximately 25km of the Kennedy River as well as erect four new dams are outlined below:

Dozers:	*Budgeted Cost*
• Dams & Clearing – D7G with driver - $135 x 30 days	$40,500
• Dams & Clearing – 824C with driver - $140 x 15 days	$21,000
• Fuel for Dozers and Compressor Pose Hole Driver & Bobcat	$25,000
Construction/Labour of Fence line:	
• 2 workers @ $200/day @ 28 days	$11,200
• 2 contractor workers @ 240/day @ 28 days	$13,400
• Fencing Materials – Approximately 25km x $2,000/km	$50,000

Therefore total budgeted capital costs of implementing the changes will be $161,100.

To assess the economic viability for Sheree and Craig to undertake the fencing, an investment analysis was undertaken. It generates a net present value (NPV) which provides an indication of whether the marginal benefit is sufficient to cover the initial capital costs, taking into account that the benefits in today's dollar terms are larger than at the end of the 20 year period. The discount rate used was 7% and the analysis was completed over 5, 10 and 20 year periods. If the NPV returns a positive result the investment is estimated to be economically viable. Sensitivity testing to account for price variance was completed.

This provides an indication of how the return on investment will vary if the benefits received from the changes are more or less than those assumed above. The results are outlined in Table 2 below.

Table 2: NPV analysis of the investment on Fairlight Station.

	NPV		
Length of Time (years)	**GM increase of 20% ($98.27/AE)**	**Current GM ($81.89/AE)**	**GM decrease of 20% ($65.51/AE)**
20	$5,008,096	$4,146,738	$3,285,380
10	$3,052,294	$2,518,593	$1,984,892
5	$1,719,189	$1,407,627	$1,096,065

Through completing the investment analysis of the changes Sheree and Craig have conducted on Fairlight Station, it can be seen that fencing off the river banks and building four new dams is a beneficial investment to their cattle enterprise. The benefits of improved calving and weaning rates increases the gross margin of the area by $35.71/AE, and the NPV analysis completed indicates that the investment will return a positive value and pay for itself within the first five years after implementation. Even if the GM of the margin is less than $81.89/AE the investment is still viable.

It must be noted that a comprehensive risk analysis has not been completed and any grazier seeking to implement this management practice should seek individual economic advice.

These results show that the improvements to the property will work towards fulfilling Sheree and Craig's goals in running a profitable and sustainable grazing enterprise.

5.2 Koolburra Station- The Ryans

Evan, Paul and Scott run a breed and finish operation at Koolburra Station near Laura in Cape York. Koolburra has a pasture area of 125,000 hectares and runs approximately 6,500 AEs. The family operation has been growing with the acquisition of surrounding properties with the increase in scale the Ryans plan to achieve further economies of scale and larger environmental outcomes.

Evan, Paul and Scott have identified several paddocks which would benefit from extra watering points allowing more consistent utilisation of pasture. They have also decided to fence the Kennedy and St George rivers on Koolburra to restrict livestock and control their access to rivers and banks. This will improve their livestock management and overgrazing of river banks will be eliminated. They are hopeful this will reduce the amount of sediment draining into the rivers as a result of the more natural percentage of ground cover present.

Figure 6: Images from Koolburra Station

Koolburra has infestations of Sicklepod around most water and lick points which have the potential to spread into local water courses. Areas of black soil on the property have significant infestations of rubber vine and grader grass which has depleted the number of natural grasses in the area. The proposed fencing of riparian areas will limit the transfer of weed infestations.

As a result of these improvements to the property, the Koolburra enterprise will receive a number of benefits:

1. An increase of 10% in the number of adult equivalents held on the property. This is due to increased utilisation of the pasture within the paddocks from the extra watering points installed.
2. An improved weaning percentage rate of 5% resulting from increased herd management.

The GM for Koolburra was calculated to be $134.72/AE before the improvements were made. With the benefits of an increased herd size and weaning rate taken into account in the calculations, the gross margin of the area increased to $144.59/AE.

Capital costs incurred in order to implement the changes to the property were budgeted at $130,555. A break-down of these costs and the activities they are attributed to is provided in table 3 below.

Table 3: The budgeted costs involved in fencing the river banks and constructing extra watering points on Koolburra Station.

Budgeted Item	Budgeted Cost
Star Pickets - 3180 pickets - approx. 26.5km	$12,879.00
Barb wire – 66 rolls	$5,098.50
Plain wire – 4 rolls	$344.00
Gates with accessories	$1,010.40
Steel post appox. 100 – 100 x 100mm steel - $40.00 each	$4,000.00
Concreate Premix - $8.00 per bag - 3 bags per post	$31,800.00
Administration - $55.00 per hour – 30 hours	$1,650.00
Solar Bore Pump Complete	$8,045.45
Floating Solar Bore Pump Complete	$6,909.09
50mm Poly Pipe - $1.50 per metre	$3,750.00
Koolburra staff labour - $35/hour	$7,840.00
Grader - $145/hour – 2 hours	$3,770.00
Koolburra C6 Dozer - $175/hour inc. driver & fuel – Track clearing – 215 hours	$37,625.00
Bobcat for post hole boring - $85/hour - approx. 33 hours	$2,833.50
Transport of Dozer to project – 4 hours - $150/hour	$600.00
Total Cost (GST excl)	**$130,555.00**

To assess the economic viability for the Ryans to undertake the fencing, an investment analysis was undertaken. It generates a net present value (NPV) which provides an indication of whether the marginal benefit is sufficient to cover the initial capital costs, taking into account that the benefits in today's dollar terms are larger than at the end of the 20 year period. The discount rate used was 7% and the analysis was completed over 5, 10 and 20 year periods. If the NPV returns a positive result the investment is estimated to be economically viable. Sensitivity testing to account for price variance was completed.

This provides an indication of how the return on investment will vary if the benefits received from the changes are more or less than those assumed above. The results are outlined in Table 4 below

Table 4: NPV analysis of investment on Koolburra Station.

	NPV		
Length of Time (years)	**GM increase of 20% ($173.51/AE)**	**Current GM ($144.59/AE)**	**GM decrease of 20% ($115.67/AE)**
20	$1,880,259	$1,544,768	$1,209,276
10	$1,123,894	$916,023	$708,151
5	$605,317	$483,967	$362,616

Through completing an economic analysis of the changes Evan, Paul and Scott have conducted on Koolburra Station, it can be seen that fencing off the river banks and constructing extra watering points throughout the property, is a beneficial investment. Over a 5 year period the investment is estimated to yield a NPV of $483,967. The benefits of improved weaning and stocking rate increases the gross margin of the area by almost $10/AE, and the NPV analysis completed indicates that the investment is profitable and will return a positive value.

It must be noted that a comprehensive risk analysis has not been completed and any grazier seeking to implement this management practice should seek individual economic advice.

These results demonstrate that improvements to grazing land management at such a large scale improve the economic outcomes for the Ryans.

5.3 Kings Plains Station- South Endeavour Trust and Tim Hughes

Tim Hughes in conjunction with Southern Endeavour Trust run a breeding operation at Kings Plains. The property is approximately 68,000ha of which 52% is used for grazing, and carries 2200 head of cattle. Their goals for the grazing enterprise are focused on conservation and increased biodiversity with improving quality of the water just one of their conservation goals.

Figure 7: Images from Kings Plains Station.

The property owners plan to significantly reduce sediment run off to the Normanby River and Great Barrier Reef and protect wetlands present on the property. This will be achieved by fencing off Mt Emily Lagoon on the Top Plains of the property and reducing the amount of cattle they stock around the wetlands. This area currently receives a high amount of damage from both feral pigs and cattle. These animals disturb the lagoon and diminish vegetative cover thus diminishing the ecological function of the wetland. Figure 8 below shows a conceptual model of the expected improvements to the wetlands from the fencing Tim is erecting. Photographs of the damage caused to the area by feral pigs as well as cattle are shown in Figure 9.

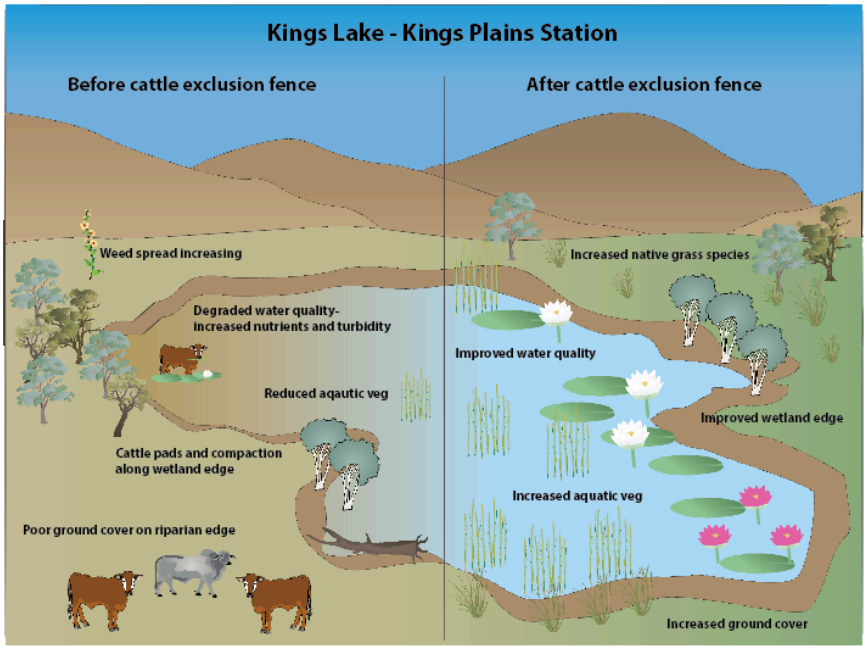

Figure 8: A conceptual model of the expected improvements to Mt Emily Lagoon from the exclusion fence.

Figure 9: Mt Emily Lagoon on Kings Plain Station just after the wet season (top) and early in the dry season with feral animal damage (bottom).

In order to achieve an increase in quality of the grasslands surrounding the wetlands and the actual wetland, a 3.5km pig proof fence will be built around Mt Emily Lagoon which will encompass approximately 30 hectares of land and provide protection from animal damage (see Figure 10).

Figure 10: The proposed area around Mt Emily Lagoon to be fenced (approximately 30ha*).*

Monitoring and comparisons between the pasture within the exclusion zone and that outside will be conducted.

The initial capital costs in constructing the 3.5km pig proof fence are:

- Fencing Materials at $5,000/km $17,500
- Fencing Labour at $3,000/km $10,500

Therefore total budgeted cost to pig proof fence the area surrounding the Mt Emily Lagoon will be $28,020.

The opportunity cost of the land around the lagoon which previously held more cattle on it, was calculated using the property GM of $144.59/AE. It was assumed that 50% of the area fenced off around the lagoon would be suitable and dry enough to graze cattle on for six months of the year. The revenue foregone by destocking 15ha of the wetlands was calculated to be approximately $361.48/year assuming a stocking rate of 3ha/AE.

The changes made on Kings Plains incur capital costs of approximately $28,000 and decrease the revenue earnt by the enterprise. Therefore there are no tangible economic benefits to the Hughes that can be accounted for in an economic sense. Although there are limited private benefits for restoring wetlands there are public benefits. Previous work from Windle and Rolfe (2005) has estimated the benefit per percent improvement to be $3.39 over 20 years. Completing a benefit transfer an improvement of 50% is assumed in this case, resulting in a wetland health benefit of $120 per person over 20 years. This provides only an insight for wetland restoration benefits and a further study would be required to validate such values.

6 Recommendation for program design to increase adoption and reduce pollutant run-off

Although Fairlight and Koolburra resulted in positive NPVs there is significant risk and initial capital cost required highlighting the importance of a cost sharing agreement. The variance that exists amongst landholders for the private and public benefits across the NRM framework in such a geographically diverse area such as Cape York highlights the importance of using a suite of policy mechanisms in program design, including extension, incentives and innovative approaches.

6.1 Extension

Numerous evaluation studies conducted recently in the grain, grazing and sugarcane sectors confirm the importance of extension support in conjunction with planning and financial incentives in achieving complex NRM outcomes. Extension in this context implies professional capacity building which employs the range of extension models (Figure 10), depending on the situation and need. These extension models have varying requirements for resourcing and also great variation in their effectiveness, particularly for complex issues. The extension models towards the left of Figure 10 are suited to more easily adopted practices or simple issues. More complicated changes to management practices, or those practices with track records of low adoption generally require more emphasis on the extension models toward the right side of Figure 10.

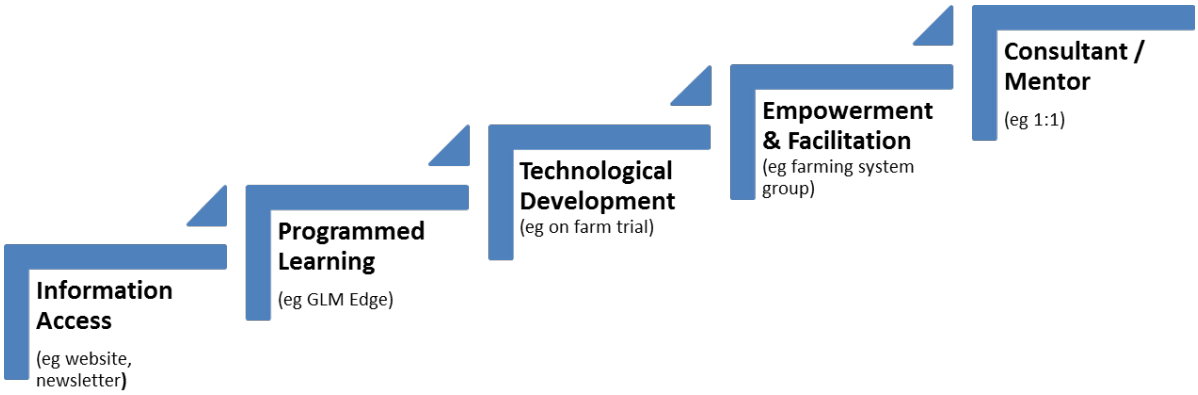

Figure 10: Extension models employed in capacity building extension (Adapted from Coutts and Roberts, 2003).

Due to the expansive nature and remoteness of Cape York, it is likely to be very difficult to provide a similar level of extension services to landholders in this region. In other Queensland catchments, the extension provision has occurred primarily through industry BMP programs, which currently do not exist in Cape York. Therefore, Cape York requires a unique and specifically designed program which considers the diverse characteristics of the region and the isolation of landholders. It is essential to design a program which integrates the range of extension models, particularly when linked with incentive programs, so that landholder access to programmed learning and consultants can be increased. Maintaining investment and collaboration with industry programs should be a priority for Reef Plan investments generally. In addition to integrating the extension models and providing a critical extension mass, these programs provide a planning and justification step with landholders that provides increased certainty for investors.

6.2 Incentives

In an industry such as grazing where there are very marginal returns (on average between 2-5%) the ability for landholders to adopt management practices in a shorter time frame or at all is significantly hindered by irregular and uncertain cash flows. The ability to offer extension and an incentive scaled based on the public benefit it critical to long term adoption and change. The uncertainty and risk around implementing changes can be appeased with offering incentives as a component of an overall program design. Critical elements that need to be thought through and considered include:

- Perverse outcomes where only private benefits are achieved and progress to adoption of other management practices is not supported.

- Similarly, where the incentives do not support the overall progression of the business towards a more sustainable management approach.
- Be too prescriptive that they do not support innovative or trialled approaches that are yet to be proven. Often landholders have an in-depth understand of their property and approaches to management of streams or gullies that may not be noted in the literature however are a sound and practical approach must not be “crowded out” by only funding specific interventions.
- Focused on achieving outcomes and not only inputs.
- On-going monitoring of the infrastructure and how the outcomes are being achieved.

6.3 Innovative approaches

There are a number of technologies and that have the opportunity to provide innovative approaches to how pollutant reductions are achieved in the grazing industry. One of these technologies that is increasingly important for quantifying change is the use of satellite imagery to estimate cover. To ensure that cover is maintained could be a reverse tender mechanism whereby landholders are paid for increasing cover to a point and then paid to maintain it. This would allow graziers to implement innovative management techniques and develop specific management approaches to ensure that the cover targets are achieved, and to help manage their cash flow.

There are a number of considerations that would be required:

- Offering a reverse auction would require firstly running stakeholder engagement and support as this is a very new mechanism for landholders to engage with in a natural resource management context.
- Landholders would then have to bid on what they would be willing to accept for a particular level of cover in a particular location.
- Additionally would be required as a condition for landholders to be eligible and this potentially would be for 10% increments in cover, or to maintain cover within a range i.e between 50-70% cover throughout the year.
- It would then also involved updates of how the landholders were tracking with the satellite imagery to make a decision about adapting their management to suit the information. This allows for asymmetric information (i.e. the inability to understand where in the context the manager is operating) to be addressed a key issue in natural resource management.
- Landholders must establish a site and provide monitoring with GPS coordinates attached before any payment is processed allowing for validation and monitoring of outcomes.
- Allowances for fire management in a five year cycle must also be considered.
- Extension will still be required to support the capacity building of landholders to implement the required management changes.

7 Conclusions

The complexity of the Cape York grazing operations highlights the need to offer a suite of mechanisms in an overarching program. To support the adoption of a range of management practices that improve natural resource management outcomes further biophysical and process understanding is required in the region. This report contributes to understanding the complexity of trade-offs for environmental outcomes and provides insights into plausible program design.

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