

Questionnaire Design, Sampling Strategy and Preliminary Findings: The Burdekin region

Marina Farr, Lynne Eagle, Rachel Hay and Meryl Churchill



(C) Lynne Eagle

Questionnaire Design, Sampling Strategy and Preliminary Findings

The Burdekin region

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ACRONYMS

APEN	Australasia-Pacific Extension Network
B	Behaviour
BB	Behavioural Belief
BBIFMAC	Burdekin Bowen Integrated Floodplain Management Advisory Committee
BI	Behavioural Intentions
BIRRR	The Better Internet for Rural, Regional and Remote Australia
BPS	Burdekin Productivity Services
CB	Control Belief
CEO	Chief Executive Officer
CHRRUP	Central Highlands Regional Resources Use Planning Cooperative Limited
CRM	Customer Relationship Management
CSIRO	The Commonwealth Scientific and Industrial Research Organisation
DAFF	Department of Agriculture and Fisheries
DEHP	Department of Environment and Heritage Protection
DERM	Department of Natural Resources and Mines
DoEE	Department of the Environment and Energy
DPI	Department of Primary Industries
DSITI	Department of Science, Information Technology and Innovation
EU	European Union
GBR	Great Barrier Reef
GBRMPA	Great Barrier Reef Marine Park Authority
GLM	Grazing Land Management
GPS	Global positioning system
JCU	James Cook University
MLA	Meat & Livestock Australia
MP	Member of Parliament
MSA	Meat Standards Australia
NB	Normative Belief
NESP	National Environmental Science Programme
NRM	Natural Resource Management
NQ	North Queensland
NQDT	NQ Dry Tropics
QLD	Queensland
QOL	Quality of life
RCS	Resource Consulting Services
RPL	Recognition of prior learning
SDB	Social desirability bias
SEM	Structural equation model
SNA	Social Network Analysis
SRA	Sugar Research Australia
SRI	Sugar Research Institute
ToPB	Theory of Planned Behaviour
UNESCO	The United Nations Educational, Scientific and Cultural Organization
WQ	Water quality

Abbreviations

ac	Acre
approx.	approximately
ha	hectare
km	kilometre
M	million
ML	megalitre
mm	millimetre

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EXECUTIVE SUMMARY

This report focuses firstly on the survey instrument development and the sampling design for this project. It then provides a preliminary analysis of the initial data collected from land managers in the Burdekin region, mainly in the form of descriptive statistics. It also provides provisional recommendations for key stakeholders regarding possible actions that should be considered in future interactions with land managers.

Two questionnaires were developed – one for cane growers and one for graziers. When developing questionnaires, we sought to keep questions similar in each questionnaire wherever possible, to enable comparisons between both groups (e.g. socio-demographics, attitudes and motivations) and between the case study areas (e.g. cane growers in Wet Tropics and cane growers in Burdekin). As such, two questionnaires have been developed with identical questions on the first three pages. The remaining questions were similar but relevant to particular behaviours for the grazing and sugar cane industries. The final versions of the questionnaire are included as Appendices 4 and 5.

The sample population in the preliminary analysis was obtained from a membership database of cane and cattle producers supplied by NQ Dry Tropics. Each respondent was allocated a unique identifier which enable the researchers to de-identify the data. This identifier will also allow the researchers to track changes in future responses across the three years and to analyse those changes.

The preliminary analysis captures only people in the Burdekin region who were already engaged in programs including those that related to water quality improvement as well as other programs in the Burdekin region.

Insights from the preliminary analysis of data collected in round one show that the respondents:

- Have a mature profile - the median age of cane growers and graziers is 52 years which is significantly greater than the median age of the Australian population (37 years).
- Own or own & manage (80% of cane growers and 84% of graziers) their property.
- Have lengthy land management experience - (average of 18.9 years for graziers and 20.9 years for cane growers), often following earlier generations on properties: maintaining traditions and heritage is important (over 50% of respondents indicated this to be of the highest importance).
- Do not make decisions in isolation – family / extended family are commonly involved.
- Are positive about overall quality of life (>90%).
- Have no significant plans to change future practices (>90%).
- Do not believe their farming practice adversely impacts water quality in local streams, rivers, and waterways (61% of cane growers and 30% of graziers).
- Do not believe that the cane/grazing industry plays a significant role in the declining health of the Great Barrier Reef (GBR) (66% of cane growers and 39% of graziers).

- Tend to shift the blame related to water quality and the health of the Great Barrier Reef to other industries, organisations and individuals.

The findings indicate that there is a need to 'sell the science' to gain acceptance of the cause-effect relationship between farming practice and water quality.

There is potential to extend the key role of extension officers in potentially influencing increased uptake of best management practices. The main ways in which they can be supported in their interactions with land managers include:

- Supporting innovators ('positive deviants').
- Ensuring that land managers see their expertise is valued and their voices are heard.
- Facilitating sharing of ideas and practices.
- Building on the role of farmers whose views are respected as potential information gatekeepers / disseminators / role models.
- Ensuring that all persuasive communications are integrated in terms of key messages.
- Developing strategies for minimising the impact of competing and conflicting messages.
- Incorporating social media strategies as part of an integrated communication strategy that centres on the information channels and platforms used and preferred by land managers.
- Incorporate long-term relationship management strategies based on customer relationship management and business to business marketing concepts.
- Utilise Social Network Analysis to identify:

(a) key information gatekeepers / opinion leaders who may help or hinder information dissemination and innovation uptake, and

(b) where individual extension officers may fit into various networks.

- Consider the use of farmer typologies in developing resources to aid extension officers in their interactions with land managers.

Note: The survey was delivered in both the Dry Tropics and the Wet Tropics region of Queensland, therefore, the survey development and sampling strategy (Section 2) and recommendations (Section 4) of this report include common content with Section 2 and 4 of the *Interim report - Questionnaire Design, Sampling Strategy and Preliminary Findings (The Wet Tropics)* (Farr et al., 2017b).

1.0 INTRODUCTION

This report is associated with NESP Tropical Water Quality Hub Project 2.1.3 Harnessing the science of social marketing and behaviour change for improved water quality in the GBR: an action research project. It focuses firstly on the survey development for the project and the associated sampling strategy (Section 2). It then provides a preliminary overview of the initial data collected from land managers in the Burdekin region, mainly in the form of descriptive statistics (Section 3). Section 4 presents the provisional recommendations and conclusion. The appendices provide supporting materials (e.g. letter of support; copies of questionnaires). A more sophisticated data analysis will be undertaken and reported on separately in the next reporting period.

2.0 SURVEY DEVELOPMENT AND SAMPLING STRATEGY

2.1 Questionnaire development

Two questionnaires were developed – one for cane growers and one for graziers, using information gathered from an initial literature review related to the science of social marketing (see Eagle et al., 2016 for more details) and from literature surrounding agriculturally relevant behaviours that impact water quality (see Churchill et al., 2017). Key determinants of pro-environmental behaviour in the agricultural sector (see Farr et al., 2017a) were also used to guide the development of the questionnaires. When developing the questionnaire, all variables that were found to be significant in Theory of Planned Behaviour (ToPB) studies within the agricultural context were considered. Impact assessment and consultations with stakeholders and end-users were used to develop preliminary questions for the survey. The aim was to create the survey questions in such a way that the responses could be used to create variables for Structural equation modelling (SEM) or other similar analytical techniques.

The first drafts of the questionnaires were distributed to team members for comments and suggestions. All other drafts of the questionnaire were distributed to key partners and stakeholders in the Department of the Environment and Energy (DoEE), Department of Environment and Heritage Protection (DEHP), Department of Science, Information Technology and Innovation (DSITI), NQ Dry Tropics, Terrain NRM and Great Barrier Reef Marine Park Authority (GBRMPA) for feedback and discussion. After each round of consultation, comments, suggestions and insights were incorporated into the draft to ensure that key partners and stakeholders were satisfied with the questions. The final draft was used to conduct a pre-test/pilot survey in October 2016. The pre-test/pilot provided us with an opportunity to determine, more precisely, which questions did and did not ‘work’. The feedback from the pre-test was incorporated into the final questionnaire (see Appendices 4 and 5).

Which behaviours should be changed?

In behavioural studies such as this, survey development involves a number of steps. First, we needed to decide which behaviours should be changed to improve environmental quality. The literature review on agriculturally relevant behaviours that impact water quality in cane growing and grazing in the Wet Tropics and Burdekin regions identified various behaviours related to water quality (WQ) improvement (e.g. paddock spelling, stocking rates, fertiliser application) (see Churchill et al., 2017 for more details). As such, we started with long lists of behaviours (for example: 17 questions from the cane industry including questions about green cane trash blankets, traffic management, row spacing, fallow management and in-crop tillage etc.) hoping that we could simply rank/prioritise each of the behaviours. However, the literature review (Churchill et al., 2017; Farr et al., 2017a) highlighted the existence of complex interdependence between the behaviours, implying that there was a need to look at some key behaviours/practices. For instance, which behaviours are relatively more important to water quality improvement and which are important interactively. Key partners and stakeholders from the DoEE, DEHP, DSITI, NQ Dry Tropics, Terrain NRM and GBRMPA were consulted to refine the ‘behaviour’ questions. Consultation ensured confidence that data collected could be quantified and analysed using appropriate econometric techniques, and that it was meaningful

to the stakeholders. Six behaviours/practices were identified – three of which were associated with cane growers and three associated with grazing activities.

Three final 'behaviours' in consideration for cane growers were:

- What irrigation scheduling tools do you use?
- How do you calculate fertiliser application rates?
- How do you handle run-off from rainfall or irrigation?

Three final 'behaviours' in consideration for graziers were:

- Did you spell paddocks during the most recent wet season?
- In the previous 12 months, have you adjusted stock numbers to paddock conditions?
- How do you manage stock around waterways?

Which factors determine relevant behaviour?

The next step was to decide which factors would determine relevant behaviour. Using insights from the literature review with respect to the ToPB (see Farr et al., 2017a) we created questions that would allow us to construct variables often used in ToPB studies and to identify statistically significant determinants of all specific behaviours in consideration (e.g. attitudes, beliefs, social norms etc. toward a specific behaviour). The modified Theory of Planned Behaviour provided the conceptual base for key questions in the cane grower and grazier surveys. A brief explanation of core sections of both questionnaires is provided below.

When developing the questionnaires, we sought to keep the questions similar (to enable comparisons) between cane growers and graziers (e.g. socio-demographics, satisfaction with overall quality of life, attitudes and motivations, etc.) and between the case study areas (e.g. cane growers in the Wet Tropics and cane growers in the Burdekin areas). As such, two questionnaires were developed with identical questions on the first three pages. The rest of the questions were similar but relevant to particular behaviours for grazing and sugar cane industries. Specific sections of the land manager questions included:

- Socio-demographic background of participants (e.g. age, gender, cultural heritage, income, etc.)
- Background information of farm characteristics (farm ownership, number of years owned/managed the property, land-use etc.)
- Main goals, motivators and priorities associated with farming (e.g. how health, family tradition, spending time with family and friends, financial situation, local community and environment are important when making decisions about what to do on a farm)
- Satisfaction with overall quality of life and the reason for that satisfaction
- Attitudes towards grants, financial assistance, workshops and training designed to encourage adoption of practices and how useful they are to achieve personal goals
- Current 'practices' (self-reported behaviours)¹, with specific focus on:

¹ There are some arguments on how to measure behaviours. Most studies in environmental psychology use self-reported measures of behaviour and consider them as appropriate indicators of actual behaviours (Fuj et al., 1985). Other researchers found low correlation between actual and self-reported behaviour (Corral-Verdugo, 1997). Behavioural decision-making models

- Irrigation, run-off from rainfall and irrigation, and calculation of fertiliser application rates for cane farmers;
- Managing stock around waterways, wet-season paddock spelling, and adjusting stock numbers to pasture conditions for graziers
- Attitudes toward each practice/behaviour under consideration because in order to find a highly significant correlation between attitude and behaviour, attitude needs to be measured towards that particular behaviour (Ajzen & Fishbein, 1980)
- Plans to participate in a specific behaviour (e.g. calculating fertiliser application) next year, which will enable us to measure the expression of land managers behavioural intentions (Flick, 2013)
- The reasons and motivations for involvement in current practice/behaviour, and whose advice is most important when making the decision to participate in current practice/behaviour
- Non-motivational factors such as lack of funds and financial assistance, lack of skills and environmental factors (e.g. drought) which will allow us to measure if a participant has actual control to perform specific behaviour (Flick, 2013)
- Perceptions of the contribution to water quality in local streams, rivers, and waterways compared to other concerns
- Optional specific questions about net income earned from the property

Most of the questions about motivations and general attitudes have been assessed on a 7-point Likert scale (=1 if extremely unimportant (irrelevant); =4 if neutral; =7 if extremely important (essential)). Attitudes, norms and beliefs towards a specific behaviour have been assessed on a 7-point Likert scale (=1 if strongly disagree; =4 if neutral; =7 if strongly agree). Satisfaction with overall quality of life was measured on scale from 0 (very unsatisfied) to 100 (very satisfied) (see Appendix 4 and 5, which contain copies of cane growers and graziers questionnaires respectively).

Figure 1 demonstrates how the questions are mapped to the ToPB.

usually rely on self-reported behavioural data, thus they may be vulnerable to self-presentational biases (Gaes, Kalle, & Tedeschi, 1978).

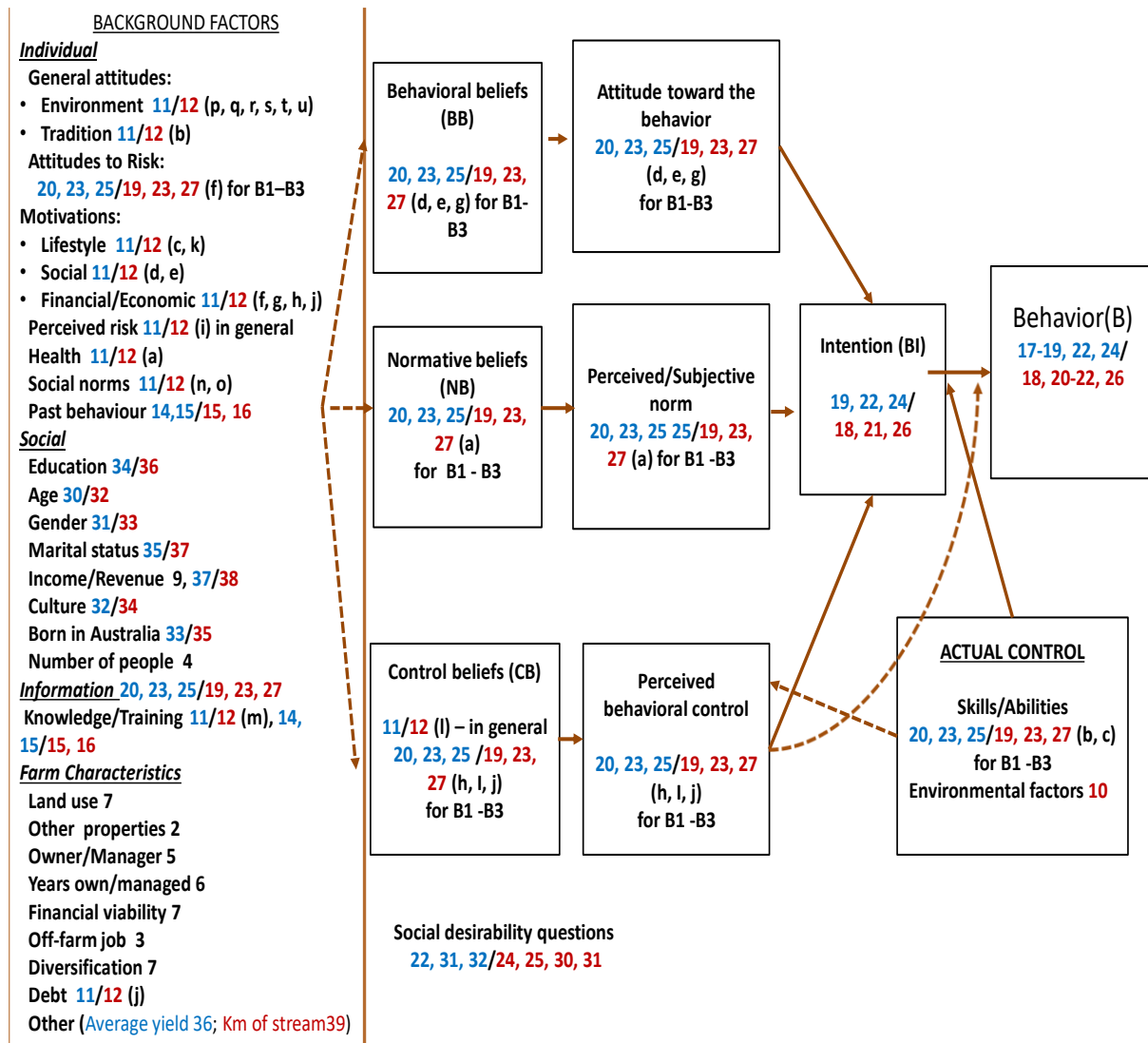


Figure 1: Mapping the questionnaire to the Theory of Planned Behaviour

Note: Black colour corresponds to questions used in both questionnaires; Red – only in graziers survey; Blue – only in cane growers survey. Letter next to the question number corresponds to a particular part of the question.

Behavioural beliefs (BB); Normative beliefs (NB); Control beliefs (CB); Behaviour intention (BI); Behaviour (B)

This study is longitudinal (White & Arzi, 2005) where survey questions were designed to collect data over three years (2016 – 2018). We will be asking the same land managers to complete the survey for two more years (i.e. three consecutive years in total). The survey was administered either as a telephone interview or as a self-administrated online survey during October/November 2016 and January 2017 and took up to forty-five minutes to complete. Telephone interviews are ‘a social activity where an interviewer asks each question and records all responses’ (Leggett et al., 2003, p. 562), thus responses are subject to social desirability bias (SDB) (Fisher, 1993). It has been empirically proved that participants can distort their responses trying to make it more socially desirable/acceptable or that they might try to give answers that an interviewer wants to hear (Atkin & Chaffee, 1972; Babbie, 1998; Leggett et al., 2003). Those distortions arise from what psychologists define ‘cognitive dissonance’ – when a participant feels ‘some emotional discomfort’ (Loomis, 2014, p. 38) while revealing his/her actual answer (e.g. opinion, value, attitudes etc.). SDB ‘has been shown to

influence individuals to over-report (under-report) desirable (undesirable) traits and behaviors across a wide range of contexts' (Dalton & Ortegren, 2011, p. 75) including drug and alcohol use (Groves, 1989), level of cheating (Bernardi & Adamaitis, 2006), and self-reported ethical behaviour (Randall & Fernandes, 1991). Presence of the SDB can moderate, diminish or contaminate the true relationships between the dependent variable (e.g. behaviour) and the independent variables (e.g. social and personal norms, attitudes towards environment etc.) (Fernandes & Randall, 1992).

One of the approaches to minimise social desirability bias and cognitive dissonance is to ask participants what they think others do instead of what they do. Participants are more likely to provide responses that are more realistic and as such eliminate social desirability bias (Lusk & Norwood, 2009; Norwood & Lusk, 2011). Anonymity is another way of trying to reduce socially desirable responses. Assuring respondents that their names will not be placed on the questionnaire and that their names will never be associated with the research findings are commonly used by researchers but cannot completely eliminate social desirability response bias (Randall & Fernandes, 1991).

Trying to minimise social desirability bias, land managers have been informed that:

- all participants are anonymous to the project researchers
- only NQ Dry Tropics staff are involved in the database management (but they do not have access to un-aggregated data)
- each land manager has been allocated a unique identifier so that he/she could not be identified
- all contact details were strictly confined to the NQ Dry Tropics offices, and
- participation is voluntary

In addition, two most sensitive questions (shown below in Table 1) in both the cane grower and grazier questionnaire were included to enable the researchers to test if the SDB is present. Following Welters and Muysken (2008) we tested the data for the SDB and found it present for those particular questions. As such, the responses for self-reported desirable (undesirable) behaviour might also be over reported (underreported) and the SDB can potentially moderate the effect of independent variables (e.g. norms, attitudes) on the dependent variable (e.g. behaviour). Thus, our findings should be interpreted with an appropriate level of caution.

Table 1: Survey question to test social desirability bias**Social desirability question included in cane grower questionnaire**

Roughly how much nitrogen fertiliser per hectare (acre) do you think most other cane growers in your region (not you personally) apply to their crops each year? (*Please circle if measurement is in hectares or acres*)

KG of nitrogen per hectare (acre) per year _____ (plant cane) _____ (ratoon cane)

OR bags of fertiliser per hectare (acre) per year _____ (plant cane). Name of fertiliser? _____

_____ (ratoon cane). Name of fertiliser? _____

Social desirability question included in grazier questionnaire

At the moment, what stocking rate do you think that most other graziers in your area (not you personally) are running at/ stocked at?

_____ cattle (head/Adult Equivalent) per _____ hectares OR

_____ cattle (head/Adult Equivalent) per _____ acres

2.2 Sampling design

2.2.1 Study area

Two catchments were chosen as the case study areas:

- The Burdekin region because of its recognition as the “catchment hot spot” nitrogen, sediment and pesticide run-off (Lankester et al., 2009); and
- The Wet Tropics region, which is recognised as having high or very high nitrogen run-off

Table 2 gives a breakdown of the relative risk of degraded water to the Great Barrier Reef from the Northern Regions.

Table 2: Relative risk of degraded water quality to the Great Barrier Reef

Region	Overall relative risk	Priority pollutants for management		
		Nitrogen	Pesticides	Sediment
Cape York	LOW			
Wet Tropics	Very High	Very High	High	
Burdekin	High	Very High	Very High	Very High
Mackay	Moderate	High	Very High	
Whitsunday				
Fitzroy	High		High	Very High
Burnet Mary	Uncertain			High

Source: Brodie *et al.*, 2013 Scientific Consensus Statement, Chapter: 3

'Sugarcane production has been the predominant agricultural industry for coastal Queensland since the middle of the 19th century' and over 85% of cane production in Queensland (QLD) occurs in the Burdekin, Mackay-Whitsunday, and Wet Tropics regions (Smith et al., 2014, p. 1). The Burdekin region produces both cattle and sugarcane, whereas the Wet Tropics mainly produces sugar cane. While grazing covers around 96% of the regions inland area, sugar cane is often located near the coastal areas and is grown with substantial use of nitrogen fertiliser (Thorburn et al., 2013). Run-off from grazing activities in the catchments adjacent to the GBR are mainly blamed for pollutants (e.g. sediments and nutrients loads) running to the GBR lagoon (Brodie & Mitchell, 2005; Haynes et al., 2007). Nitrogen losses from sugar cane activities can be discharged through 'deep drainage below the root zone, or as surface run-off' (van Grieken et al., 2012, p. 2). Surface run-off has little opportunity to be filtered through streams implying that pollutants flow quickly to the GBR lagoon.

Poor land management practices often result in land degradation and, consequently, have a negative impact on in-stream and/or downstream quality of water. Brodie et al. (2003) note that 70% of the sediment loads to the coastal areas are coming from relatively small areas of the GBR catchment which are close to the coast (e.g. the Wet Tropics, Mackay-Whitsunday catchments, and sub-catchments of the Burdekin).

The Burdekin region

The Burdekin region is the second largest catchment in Queensland, which covers approx. 134 000 km² (NQ Dry Tropics, 2016). The region is extremely bio-diverse and includes semi-arid drylands, mountainous tropical rainforests, wetlands and wooded grasslands, coastal plains, ocean and islands. The population of the region is about 240 000 people, which includes major urban centres such as Townsville, Ayr, Bowen and Charters Towers (NQ Dry Tropics, 2016). The Burdekin River and the Fitzroy River are the two largest dry catchment rivers entering the GBR lagoon. The annual average rainfall in the region is 727mm (Furnas, 2003) but the rainfall, and thus run-off, has significant variability in time and space (Petheram et al., 2008; Rustomji et al., 2009). Rainfall near the coast is much higher (e.g. 2000mm) than in the western areas of the region (e.g. 600mm). There is a clear distinction between wet and dry seasons. However, long periods of below average rainfall can be interrupted with little warning by tropical depressions, which could bring rainfall up to 1000mm just in a few weeks' time (Bartley et al., 2014a).

Agriculture can be attributed to approximately 82% of land use in the Burdekin catchment and it is the main employer for the region (NQ Dry Tropics, 2016). Grazing activities in the region have been dominant for more than 100 years (Bartley et al., 2014b) and they are often taking place on native pastures inside open woodlands. It was estimated in 2009 that 827 land managers were grazing in the Burdekin region (The State of QLD, 2011). Grazing properties are usually large (e.g. 30 000 hectares and run between 3300 and 3600 head of cattle) (Beare et al., 2003), they often have low input management focusing on beef production for domestic and international markets (Rolfe & Gregg, 2015). Land condition in the region is susceptible to decline 'during drought periods, particularly when high stocking rates and grazing pressures are maintained' (Rolfe & Gregg, 2015, p.183). Overgrazing (particularly in dry seasons),

extensive clearing of vegetation, water use practices and wetlands drainage have been specifically related to decline in water quality (Greiner, Lankester, & Patterson, 2007).

In 2009, around 657 land managers were growing sugarcane in the Burdekin region, which accounted for 2% of farming activities in the region (NQ Dry Tropics, 2016). Sugarcane properties are much smaller than grazing properties, on average about 120 hectares (Beare et al., 2003). Sugarcane activities are predominantly occurring in the lower flood plains where crops are intensively cultivated (Davis, 2006; Bartley et al., 2014a). Sugarcane in the Burdekin region is growing under full irrigation with the highest average yield in Australia (approx. 123 tonne per hectare) and with the highest average water use for irrigation in Queensland (between 8 to 15 ML per hectare) (Qureshi, Wegener, Bristow, Mallawaarachchi, & Charlesworth, 2001; Davis, 2006). The dry tropical climate and low rainfall result in 'naturally low organic matter compared to the soils of most other cane growing regions across Australia' (Davis, 2006, p. 3).

Kroon et al. (2012) argue that the Burdekin catchment area is a major contributor of anthropogenic-derived fine sediment to the GBR. It was estimated that sediment loads from this region in total are approx. 4.7 million tonnes per annum with 4.1 million tonnes related to human activities² while thirty percent of sediment loads to the GBR mainly result from extensive grazing (The State of Queensland (DEHP), 2011, 2012). Agricultural use of fertiliser is the main source of nitrogen and phosphorus run-off and the dissolved nitrogen loads in the Burdekin catchment are estimated as being 5 700 tonnes per annum with 3 500 tonnes related to either human activities or loss of fertiliser from sugarcane areas (The State of Queensland (DEHP), 2011, 2012). Overall quality of water in the region is in moderate condition (Australian and Queensland governments, 2016).

2.2.2 Sampling

'A fundamental goal of survey-based research is to be able to generalise' research findings 'on the basis of the people that completed the survey' (Greiner & Miller, 2008, p. 27). Our survey was aiming to collect data from both cane growers and graziers in the Burdekin region.

As was mentioned earlier, this study is longitudinal (White & Arzi, 2005) and the survey questions were designed to collect data from land managers over three years in a row (2016 – 2018). One of the major disadvantages of longitudinal data surveys is a steady decline in the response rate (Cheshire et al., 2011). Longitudinal surveys are more burdensome for the participants than any other surveys. They are also more problematic in terms of initial recruitment of participants as well as difficulties with retaining them over time (Singer & Ye, 2013). Thus, the researchers were aiming to survey as many cane growers and graziers in the study area as were willing to participate. To assist in retaining respondents an incentive was

² Human activities can include urban development, infrastructure and industry development, mining, agriculture, pastoralist and forestry (The State of Queensland (DEHP), 2012)

offered. Incentive offering is one tool that has been applied in many research areas to reduce the nonresponse component. In longitudinal studies, incentives have mainly been used as part of a motivational package for recruiting and retaining survey participants (Singer & Ye, 2013). Incentives have been found to:

- increase the response rates in all survey methods (e.g. Web, panel, cross-sectional) (Singer & Ye, 2013)
- increase the response rate when the size of the incentive increases but no evidence of how big an incentive should be (Goldenberg, McGrath, & Tan, 2009; Singer & Ye, 2013)
- increase the completion rate of web-based surveys (Göritz, 2006; 2010)
- have little or no effect on quality of responses (Singer & Kulka, 2002), sample composition (Cantor, O'Hare, & O'Connor, 2008) and response distribution (Singer & Ye, 2013)

Furthermore, monetary incentives (e.g. cash) do not produce differential measurement error in face-to-face or mail surveys (Ryu, Couper, & Marans, 2006).

'It seems clear that the use of respondent incentives is an important element of the strategy to minimize attrition for many longitudinal surveys . . . but we have limited knowledge of what the optimum strategies are for any given design and whether or how incentive strategies translate into improvements in the accuracy of estimation over the longer term' (Laurie & Lynn, 2009, p.230).

Consequently, trying to minimise non-response bias³ the survey was kept as short as possible and an additional incentive for potential participants was provided – the study offered an opportunity to enter the draw to win a drone or a travel voucher valued at \$1500.

NQ Dry Tropics was contracted to help with data collection activities in the Burdekin. Each respondent has been allocated with a unique identifying number, which will allow the research team to track changes in responses across the three-year period, while also enabling analysis of those changes. Having a unique identifier allows NQ Dry Tropics to protect the confidentiality of the participants. A detailed record of people who refused to be involved was kept during each round of data collection to ensure that they would not be contacted again.

Survey of graziers and cane growers (Burdekin region)

NQ Dry Tropics accessed and compiled a list from various internal databases to identify landholders who were already engaged in programs including those that related to water quality improvement as well as other programs in the Burdekin region. All graziers and cane growers in the study area who were registered to a NQ Dry Tropics database were given an equal opportunity to participate in the survey. The membership database consisted of land managers who have participated at least in one workshop, training session or water quality

³ Non-response bias is the bias that results when participants differ in important ways from non-participants (e.g. land managers who are willing to do something for water quality improvement and those who care about water quality are more likely to complete the survey than those who do not care. Consequently, participants will differ in meaningful way from non-participants resulting in non-response bias).

program. In total 795 land managers were invited to participate in the survey (408 graziers and 387 cane growers). On the 27th October 2016, the first email with attached copy of the survey, letter of support and project information sheet was sent to 341 graziers and 350 cane growers in the Burdekin region (copies of the initial email, letter of support and project information sheet are provided in Appendix 1, 2 and 3). A reminder email was sent one week later. The email stated that the land managers could participate in a telephone interview or they could complete the survey online. Those land managers who did not have an email address were invited to participate by mail. An information sheet, letter of support and copy of the survey were sent by post on 14 November 2016. In total, NQ Dry Tropics mailed 104 surveys (37 of those were cane growers and 67 were graziers). Of the 408 graziers' contacted, 27 had an invalid email address, an invalid phone number, no longer lived at the address or had passed away which reduced our available contacts to 381. Five people said that they were very busy and suggested calling them in January or February in 2017 and 5 graziers did not want to participate at all.

Of the 387 cane growers' contacted, 41 had invalid email address, an invalid phone number, no longer lived at the address, had passed away or quit farming which reduced our available contacts to 346. Nine cane growers said that they are very busy now and suggested calling them in January or February next year and 23 did not want to participate at all (this may be due to the extended harvest season and limited time and fatigue).

The survey was administrated according to strict ethical guidelines concerning:

(a) **Anonymity and confidentiality** – while the interviewers knew the name and contact details of the participants while completing the interviews, all participants were anonymous to the JCU researchers. NQ Dry Tropics were involved in the data management process (e.g. working with contacting details of the land managers), where the land managers were allocated a unique identifier so that they could not be identified. In addition, all contact details stayed strictly within the confines of the NQ Dry Tropics offices.

(b) **Voluntary participation** – land managers were sent an email containing a copy of the survey. A letter of support from NQ Dry Tropics was also provided to land managers. This letter offered the participant instructions about voluntary participation. In addition, participants were asked at the beginning of the both the telephone survey and the online survey if they agreed to participate. The participants were also told they could stop at any time. As such, they had a choice to participate or to reject participation.

(c) **No physical or psychological harm** – the interviewers were alerted to certain words, themes or ideas that may trigger a negative reaction in the respondents. The interviewers were requested to remain neutral and passive in their interview technique.

(d) **Privacy** – land managers were given an option to complete the survey online or to be interviewed by JCU research staff member.

(e) **Informed consent** – an information sheet was attached to the email and the participant was required to verbally agree that they understood the research before agreeing to start or for the online survey, to tick a box with the text 'by clicking next you agree to participate in the survey'.

Land managers received a copy of the survey, a fact sheet and the introduction letter one week prior to participating in the survey. The letter explained the research and allowed an opportunity for the participants to be familiar with purpose of the research. The copy of the survey allowed each participant to be aware of the questions that were to be asked. Receiving the survey information prior to the study, the land managers were given time to think about the responses before they completed the survey online or by telephone interview.

2.2.3 Pre-test of the survey

A pre-test survey is often used to a sample a small group of participants with similar characteristics as the population in the larger survey (Denzin, 1970). On 18th October 2016 pre-test surveys, were activated using the Qualtrics survey software. A link was available for a number of graziers and cane growers in the Burdekin and Wet Tropics regions to determine if the structure of the survey was easy to follow, if the questions were easy to understand, and if the wording was appropriate and clear. The responses were analysed to refine the questions contained in the survey.

3.0 DATA

3.1 Data collection

During the period from February to September 2016, the research team worked with key people from Department of Agriculture and Fisheries (DAF), DSITI, DEHP, Terrain NRM, NQ Dry Tropics, and DPI to determine the best way in which to collect data and to develop and finalise the surveys. The working group discussed what to include in the questionnaires, specifically paying attention to questions that were already asked in other surveys, which behaviours should be analysed and appropriate ways to ask the questions. After each round of consultation, the suggestions and recommendations made by key stakeholders and end-users were incorporated into the surveys. Many of the survey questions that captured information about land management practices were refined to suit the working group.

The consultation aimed to combine information being collected from many interested stakeholders into one survey (specifically, surveys that were conducted annually) to limit the amount of time land managers were surveyed. While we aimed to combine the data collection with other researchers and organisations, we were unable to due to a number of factors including a delayed harvest season, conflicting collection times between key groups that were related to specific times in the production cycle and delays related to survey design.

Working closely with stakeholders and end-users enabled the research team to develop a much more comprehensive and useful questionnaire, which will generate reliable and valuable information for project stakeholders, researchers, government agencies, and for land managers. Our aim was to develop a high quality survey that will enable us to apply more sophisticated quantitative approaches to produce high quality outcomes. Furthermore, this comprehensive survey can be used as a standard tool across the Burdekin region for future monitoring and evaluation.

In October 2016, James Cook University recruited casual research staff to conduct telephone interviews. NQ Dry Tropics provided selection criteria unique to cattle and cane landholder and land management issues to ensure candidates were suitable to complete the interviews. The JCU research team with involvement of NQ Dry Tropics staff provided a two-hour training session on how to best engage with landholders in the region and to conduct the survey. All interviews were conducted from within the NQ Dry Tropics office at 12 Wills Street, Townsville QLD 4810 with assistance, supervision and administration support from NQ Dry Tropics personnel and the JCU research team. Telephone interviews started in early November 2016. The telephone interviews took place between 12pm and 2pm (sometimes 3 pm depending on the land managers' time preferences) and from 6.30pm to 8.30pm to catch the land managers at home in the evenings. To address confidentiality issues, NQ Dry Tropics e-mailed/mailed the survey, cover letter and information sheet about the survey to the land managers advising them that the interviewer would contact them. A reminder was sent a week later (see Appendix 1). The reminder informed the land manager that they would receive a phone call and it also gave the land managers the option to complete the survey online (both initial email/mail and

the reminder provided the survey link so participants had a choice being interviewed or to complete the survey themselves).

3.2 Preliminary results

This section of the report provides a summary of characteristics of the respondents and insights from the preliminary analysis of initial data collected in round one (as at 10 January 2017). This analysis captures people who were already engaged in water quality programs in the Burdekin region as well as other programs in the Burdekin region.

The initial analysis is limited by a failure in the skip logic used in the online survey where a positive response for Question 5 and Question 19 skipped the respondent past the following four questions before continuing the survey. Once identified, the skip logic was corrected and the remaining surveys were recorded without error. As such, the number (N) of respondents reported in the preliminary analysis will vary.

One hundred and thirty-four land managers (80 graziers and 54 cane growers) attempted to either complete the survey online or through a telephone interview as at 10 January 2017. Of those who attempted to complete the survey, only 65% of graziers and 70% of cane growers completed 100% of the survey, as such only those who completed more than 9% of the survey were included in the analysis.

Respondents were asked to provide socio-demographic information about their age, education, marital status, cultural heritage and other information. The respondents were also asked questions about their main property and about other properties that they might manage and/or own.

3.2.1 Background information

Making decisions relating to land-management and farming on the main property

We asked the land managers about making decisions relating to land-management and farming on their main property. Nearly 41% of cane growers and 66% of graziers said that they share their decisions while 39% of cane growers and 14% of graziers said that they make decisions entirely on their own. Another 20% said that the majority of the decision-making is theirs (see Table 3).

Table 3: Respondent's decisions making parties

		Percent of respondents (%)	
		Cane growers (N=49)	Graziers (N=71)
Making decisions about land-management & farming on main property	Joint/Shared decision	40.82%	66.20%
	Entirely my decision (i.e. individual)	38.78%	14.08%
	Majority of decision is mine	20.41%	19.72%

If joint/shared decision, who is involved

Of those who are sharing decisions, 22% of cane growers consult only with their brothers, 22% make decisions with their children and another 22% consult with their parents. Nearly one third of graziers prefer to share the decision solely with their spouses, while 25% consult with both their spouse and their children (see Table 4). It is noted in the preliminary data that there was no option to select sister. This was an oversight from the testing phase. For future surveys this has been changed to brother or sister.

Table 4: Who is involved in join/shared decision on main property

	Percent of respondents (%)	
	Cane growers (N=18)	Graziers (N=47)
Brother	22.22%	2.13%
Children	22.22%	2.13%
Parents	22.22%	4.26%
Spouse	11.11%	31.91%
Spouse/Children	5.56%	25.53%
Spouse/Parents		10.64%
Brother/Other	5.56%	
Management team	5.56%	
Spouse/Children/In-laws	5.56%	4.26%
Parents/Brother		2.13%
Spouse/Parents/Children		2.13%
Spouse/In-laws		2.13%
Spouse/Children/Employees/Consultants		2.13%
Spouse, Land owner		2.13%
Spouse/Parents/NPRSR Department/Forestry Department/Government red tape		2.13%
Townsville City Council		2.13%
Other (not specified)		4.26%

Other properties

Over 40% of cane growers and 39% of graziers indicated that they own, manage, and lease other properties (Table 5).

Table 5: Proportion of land managers who owns or manage other properties

	<i>Percent of respondents (%)</i>	
	<i>Cane growers (N=47)</i>	<i>Graziers (N=71)</i>
No	55.32%	60.56%
Yes	44.68%	39.44%

Other properties' location and land use

The majority of cane growers (>90%), who selected that they own, manage, and/or lease other properties, use their land for growing sugarcane and nearly 45% of those properties are located in Home Hill (Table 6).

Table 6: Other property location and land use (Cane growers)

<i>Location</i>	<i>Land use</i>	<i>Cane growers</i>	
		<i>Number of properties</i>	<i>Percent of properties</i>
Home Hill	Sugarcane	22	44.90%
Ayr	Sugarcane	7	14.29%
Claire	Sugarcane	6	12.24%
Giru	Sugarcane	3	6.12%
Osman	Sugarcane	1	2.04%
Mackay	Sugarcane	1	2.04%
Winton	Grazing	1	2.04%
St Lawrence	Grazing	2	4.08%
Clermont	Grain	1	2.04%
Other*	Sugarcane	5	10.20%
Total		49	100%

Note: * Category 'Other' includes Mackay, Millaroo, and Herbert

Similarly, the majority of graziers (88%), who stated that they own, manage, and/or lease other properties, use their land for grazing activities. Nineteen percent of those properties are located in Clermont, 14% in Charters Towers, nearly 9% located in Ayr and the rest are located in Bowen, Alpha, Collinsville, Glenden, Giru, Barcaldine, Belyando, Coppabella, Greenvale, Moranbah, Mt Coolon, Winton, Baralaba, Julia Creek, Mackay, Moura, Sapphire, and Bakers Creek (Table 7).

Table 7: Other property location and land use (Graziers)

<i>Location</i>	<i>Land use</i>	<i>Graziers</i>	
		<i>Number of properties</i>	<i>Percent of properties</i>
Clermont	Grazing	11	19.30%
Charters Towers	Grazing	8	14.04%
Alpha	Grazing	3	5.26%
Bowen	Grazing	3	5.26%
Collinsville	Grazing	3	5.26%
Glenden	Grazing	2	3.51%
Ayr	Grazing	5	8.77%
	Sugarcane	1	1.75%
Giru	Grazing	3	5.26%
	Sugarcane/Grazing	1	1.75%
	Mango/Grazing	1	1.75%
Claire	Sugarcane	2	3.51%
Other*	Grazing	12	21.05%
	Sugarcane	2	3.51%
Total		57	100%

Note: Category 'Other' includes Barcaldine, Belyando, Coppabella, Greenvale, Moranbah, Mt Coolon, Winton, Baralaba, Julia Creek, Mackay, Moura, Sapphire, and Bakers Creek.

Off-farm 'job'

The majority of respondents (77% of cane growers and 77% of graziers) and their spouses (60% and 76% respectively) are not working off-farm (Table 8). However, when working off farm, graziers spouses (19%) are working for more than 20 hours per week away from the property, while cane growers' spouses also work off farm, 20% indicated that they are working for less than 20 hours per week off-farm.

Table 8: Respondent and his/her spouse off-farm work employment

	<i>Percent of respondents (%)</i>	
	<i>Cane growers (N=45)</i>	<i>Graziers (N=71)</i>
No – do not work off-farm	77.78%	77.46%
Yes, less than 20 hours per week off-farm	4.44%	8.45%
Yes, more than 20 hours per week off-farm	17.78%	14.08%
	<i>Spouse (cane grower) (N=45)</i>	
	<i>Spouse (grazier) (N=71)</i>	
No – do not work off farm	60.0%	76.06%
Yes, less than 20 hours per week off-farm	20.0%	4.23%
Yes, more than 20 hours per week off-farm	20.0%	19.72%

Number of people living on the main farm/property

The respondents were asked how many people live on their main farm/property. The distribution of the number of people that live on the main farm is shown in Table 9. Twenty percent of cane growers indicated that four people live at their property and 21% of graziers said that only two people live on the farm. Just over 4% of cane growers and 8% of graziers said that there was no-one living on the property, which may relate to other properties that are leased or owned. We caution re the small numbers involved in this analysis.

Table 9: The distribution of number of people live in the main farm/property

<i>Number of people</i>	<i>Percent of respondents (%)</i>	
	<i>Cane growers (N=45)</i>	<i>Graziers (N=71)</i>
0	4.44%	8.45%
1	6.67%	2.82%
2	15.56%	21.13%
3	11.11%	14.08%
4	20.00%	8.45%
5	17.78%	14.08%
6	6.67%	8.45%
7	8.89%	4.23%
8		8.45%
9		2.82%

10	1.41%
12	2.82%
13	4.44%
16	1.41%
17	1.41%
2 families	2.22%
6 families	2.22%

Main property characteristics and land uses

The respondents were asked questions about the main property that they manage and/or own. The majority of cane growers (80%) and graziers (84%) either own or own and manage their properties (Table 10). The small proportion of respondents (15% of growers and 14% of graziers) only manage their properties while 4% of growers and 1% of graziers are leasing their land. (Note: some of the data for cane growers is missing due to the skip logic error).

Table 10: Proportion of land managers who owns, manage, lease or both their main property

	<i>Percent of respondents (%)</i>	
	<i>Cane growers (N=45)</i>	<i>Graziers (N=71)</i>
Own	80.00%	53.52%
Manage	15.56%	14.08%
Lease	4.44%	1.41%
Own/Manage		21.13%
Own/Lease		2.82%
Own/Share		1.41%
Own/Manage/Lease		1.41%
Own/Manage/Share		2.82%
Manage/Lease		1.41%

Number of years owned/managed the main property

Sixty-one percent of cane growers and 65% of graziers said that they have owned and/or managed their main property for a period of 5 to 25 years (see Table 11). Respondents have considerable land management experience (average of 20.9 years for cane growers and 18.9 years for graziers).

Table 11: Number of years land manager owns/managed his/her main property

Years	Percent of respondents (%)	
	Cane growers (N=44)	Graziers (N=70)
>5	4.55%	13.05%
5-10	9.09%	14.50%
10-15	22.72%	21.75%
15-20	9.09%	17.40%
20-25	20.46%	11.60%
25-30	9.09%	2.90%
30-35	11.37%	2.90%
35-40	2.27%	2.90%
40-45	6.82%	4.35%
45-50	-	-
50-55	2.27%	2.90%
<55	2.27%	5.80%

Main land use on the main property

We asked the respondents about land-use on their main property (see Table 12). Eighty-five percent of cane growers and 96 percent of graziers said that sugarcane and grazing activities are the main land-uses on their main property.

Table 12: Main land-use on main property

Land-use	Percent of respondents (%)	
	Cane growers (N=44)	Graziers (N=64)
Sugarcane	85.0%	3.57%
Grazing/ Beef cattle/Production/Breeding	5.0%	96.42%
Grain	5.0%	

Land-uses that is most important to the financial viability of the main property and importance of enjoyment

Just over 69% of graziers said that grazing activities are the most important use of land to the financial viability of their property and 69% of graziers also said that they are enjoying grazing. Both graziers and cane growers indicated that they are breeding and selling cattle (11% and 2% respectively) but it was, unsurprisingly, more important for graziers (18%) than for cane growers (2%). To be expected, cane growing was not financially important or enjoyable for graziers at all. Likewise, grazing for cane growers in our sample was not important land-use either financially or for enjoyment. By contrast, 72% of cane growers indicated that growing cane was the most important land-use to the financial viability of the farm and just over half (55%) said they enjoy it most. Cane growers indicated that there were other land uses that they enjoy such as planting other crops such as beans and rice (Table 13).

Table 13: Land-uses which are most important to the financial viability and enjoyment on main property

Activities	Percent of respondents (%)			
	<u>Financial importance</u>		<u>Enjoyment importance</u>	
	Cane growers (N=44)	Graziers (N=66)	Cane growers (N=44)	Graziers (N=66)
Sugarcane	72.73%	1.52%	54.54%	1.52%
Sugar cane & off-farm			4.55%	
Grazing	2.27%	69.70%	2.27%	69.71%
Breeding, growing & selling cattle	2.27%	10.62%	2.27%	18.20%
Grazing & Mangoes		1.52%		
Grazing, Hay, Silage		1.52%		1.52%
Grazing & off-farm work		3.04%		
Aquaculture & Grazing	2.27%			
On Farm	9.09%	4.56%	9.09%	4.55%
Off-farm work	6.82%	6.06%	6.82%	1.52%
On farm/Off-farm			2.27%	
Bean crops			6.82%	
Grain	2.27%		2.27%	
Rice			2.27%	
Other, see comments below	2.27%*		2.27%**	1.52%***
N/A			2.27%	1.52%
None/Don't enjoy any		1.52%	2.27%	

*include 'my health'

**include 'on farm uses' and 'making the farm more environmentally friendly'

***include land care, maintaining weeds and erosion control, and land management

Sixty-one percent of cane growers and 55% of graziers said that this year's revenue is better than previous years (Table 14).

Table 14: Average revenue from the last year

		<i>Percent of respondents (%)</i>	
		<i>Cane growers (N=44)</i>	<i>Graziers (N=66)</i>
This year's revenue	Is better than previous years	61.36%	54.55%
	Is about the same as previous years	27.27%	36.36%
	Is worse than previous years	11.36%	9.09%

3.2.2 Personal goals and aspirations

Land managers were asked about two personal goals and aspirations for their farm/property that are most important when they aim to achieve something on their farm. Just over 23% of cane growers said that an increase in productivity was the main goal for their property; sustainability (19%), financial security (12%) and soil improvement (12%) were also among their main goals. Nearly twenty one percent of graziers said that sustainability was the main goal for their farm and 13% stated that their main goal is profitability. Improving ground cover/pasture (10%), and financial security (8%) were also amongst their main goals. The most important second goals for cane growers were sustainability (18%), profitability (13%) and lifestyle and self-satisfaction (10%). For graziers sustainability (19%) and passing on healthy property to future generation (12%) were amongst the most important second goals indicated by graziers (Table 15).

Table 15: Personal goals to achieve on farm/property

	Percent of respondents (%)			
	Personal goal 1		Personal goal 2	
	Cane growers (N=43)	Graziers (N=62)	Cane growers (N=38)	Graziers (N=58)
Productivity	23.26%	4.84%	7.89%	6.90%
Sustainability	18.62%	20.96%	18.42%	18.97%
Profitability	9.30%	12.90%	13.16%	8.62%
Financial security	11.63%	8.07%	7.89%	5.17%
Pass on a healthy property to future generation	4.65%	6.45%	7.89%	12.07%
To improve soil health	11.63%	3.23%	2.63%	
Improved groundcover/pastures		9.67%	2.63%	8.62%
Maximize development/ Sustainability		1.61%	2.63%	6.90%
Better property management		4.84%	2.63%	3.45%
Viability	4.65%	4.84%		
Happiness/Enjoyment	2.33%	3.23%		
Lifestyle/Satisfaction			10.53%	3.45%
Improving farm/property			7.89%	5.17%
Improving overall herd fertility		3.23%		1.72%
Debt reduction		4.84%		3.45%
Drought sustainable		1.61%		3.45%
Improve carrying capacity		1.61%		3.45%
Good sustainable crop	9.31%			
Efficiency			5.27%	
Low costs			5.27%	
Other, see below	4.65%*	8.06%**	5.27%***	8.62%****
	100%	100%	100%	100%

*Category 'Other' (Goal 1 – Cane growers) include 'build tractor transporters that suit our 1.524m rows', 'keep farming the property'

** Category 'Other' (Goal 1 – Graziers) include 'educating children', 'improve genetics', 'improvement', 'just getting to the next year. Sane. Between drought and politics lucky to be still alive'

***Category 'Other' (Goal 2 – Cane growers) include 'safety' and 'the best use of water'

****Category 'Other' (Goal 2 – Graziers) include 'better infrastructure', 'bulldozing all the trees and planting buffer grass', 'cattle prices & rain are good', 'climate insulation', 'improving weight for age through bull selection and pasture improvement'

3.2.3 Importance of different factors when making decisions about what to do on the farm / property

Land managers were asked to indicate how important a range of different factors were when making decisions about what to do on the farm / property (using a seven – point Likert scale from extremely unimportant through to extremely important).

For cane growers, being able to make their own decisions about farm/property and leaving the land/farm in better condition than it was when they first started managing it were the two most important factors (Table 16). Decisions about minimising sediment run-off and/or nutrient losses were also sighted as important decisions on the farm. Economic factors such as maximising farm profits (income minus costs) (72%), keeping a stable (steady) cash-flow (67%) and minimising risk (67%) were also extremely important to cane growers.

Interestingly, nearly 19% of cane growers indicated that having efforts recognised by the wider community is extremely unimportant or unimportant to them while 30% were neutral about wider community recognition, more than half thought it was important to essential. Having enough time to pursue hobbies was also not that important for growers. Helping to safeguard local waterways was more important for decision-making about what to do on the farm/property than helping to safeguard the Great Barrier Reef.

Table 16: Importance of various factors when making decisions on farm/property – Cane growers (N=43)

	Percent of cane growers (%)							
	Extremely unimportant (irrelevant)	2	3	Neutral	5	6	Extremely important (essential)	I do not know
Physical & mental health of family	2.3	2.3	2.3	4.7	4.7	23.3	58.1	2.3
Family traditions and heritage	9.3	4.7		23.3	11.6	23.3	25.6	2.3
Spending face-to-face time with family & friends	2.3	4.7		14.0	4.7	34.9	37.2	2.3
Keeping in contact with family & friends in other ways		9.3	2.3	18.6	9.3	34.9	25.6	
Good relations with other farmers/graziers	2.3	2.3	4.7	16.3	18.6	27.9	27.9	
Keeping farm costs low	2.3			2.3	7.0	20.9	67.4	
Keeping a stable cash-flow		4.7	2.3	2.3	7.0	16.3	67.4	
Maximising farm profits		2.3	2.3	4.7	2.3	16.3	72.1	
Minimising risk		2.3		2.3	7.0	25.6	62.8	
Servicing debt	2.3	2.3		4.7	11.6	20.9	58.1	
Having time to pursue hobbies	2.3	4.7	2.3	16.3	27.9	18.6	27.9	
Being able to make your own decisions	2.3	2.3		2.3		20.9	72.1	
Learning about & testing new ways of doing things		2.3		2.3	16.3	34.9	44.2	
Sharing new ideas with others	2.3		2.3	23.3	7.0	32.6	32.6	
Efforts recognised by the wider community	9.3	9.3	4.7	30.2	11.6	16.3	18.6	
Leaving the land/farm in better condition		2.3			2.3	27.9	67.4	
Maintaining/improving water supplies & storages			2.3	2.3	11.6	16.3	65.1	2.3
Minimising sediment run-off and/or nutrient losses	2.3	2.3			9.3	18.6	67.4	
Helping to safeguard native plants & animals		2.3	4.7	9.3	11.6	25.6	44.2	2.3
Helping to safeguard local waterways		2.3		2.3	9.3	27.9	58.1	
Helping to safeguard the GBR		2.3	2.3		9.3	25.6	55.8	4.7

For graziers, being able to make their own decisions about farm/property, physical and mental health of family, and leaving the land/farm in better condition than it was when they first started managing it were the three most important factors (Table 17). Decisions about minimising sediment run-off and/or nutrient losses were also sighted as important decisions on the farm. Economic factors such as maximising farm profits (income minus costs) (59%), keeping a stable (steady) cash-flow (50%) and minimising risk (58%) were also extremely important for graziers.

Interestingly, nearly 31% of graziers indicated that having efforts recognised by the wider community is extremely unimportant or unimportant to them while 35% were neutral about wider community recognition. Having enough time to pursue hobbies was also not that important for graziers. Helping to safeguard local waterways was more important for decision-making about what to do on the farm/property than helping to safeguard the Great Barrier Reef.

Table 17: Importance of various factors when making decisions on farm/property – Graziers (N=62)

	Percent of graziers (%)							
	Extremely unimportant (irrelevant)	2	3	Neutral	5	6	Extremely important (essential)	I do not know
Physical & mental health of family	1.6			1.6	6.5	22.6	67.7	
Family traditions and heritage	6.5	6.5	3.2	32.3	21.0	11.3	19.4	
Spending face-to-face time with family & friends		1.6	3.2	1.6	24.2	30.6	38.7	
Keeping in contact with family & friends in other ways	1.6	3.2	3.2	8.1	24.2	27.4	32.3	
Good relations with other farmers/graziers			1.6	4.8	32.3	43.5	17.7	
Keeping farm costs low			1.6	8.1	25.8	25.8	38.7	
Keeping a stable cash-flow	1.6			6.5	11.3	30.6	50.0	
Maximising farm profits	1.6		1.6	1.6	14.5	21.0	59.7	
Minimising risk				8.1	9.7	24.2	58.1	
Servicing debt	4.8		1.6	8.1	11.3	22.6	51.6	
Having time to pursue hobbies	14.5	9.7	4.8	17.7	21.0	24.2	8.1	
Being able to make your own decisions	1.6			1.6	6.5	29.0	61.3	
Learning about & testing new ways of doing things	1.6	3.2		4.8	16.1	38.7	35.5	
Sharing new ideas with others	1.6	1.6	1.6	19.4	25.8	30.6	19.4	
Efforts recognised by the wider community	19.4	11.3	3.2	35.5	12.9	11.3	4.8	1.6
Leaving the land/farm in better condition			1.6		3.2	21.0	74.2	
Maintaining/improving water supplies & storages				1.6	6.5	24.2	67.7	
Minimising sediment run-off and/or nutrient losses	1.6			3.2	8.1	30.6	56.5	
Helping to safeguard native plants & animals	6.5		1.6	6.5	19.4	33.9	32.3	
Helping to safeguard local waterways	1.6	1.6	1.6	3.2	22.6	29.0	40.3	
Helping to safeguard the GBR	8.1	3.2		9.7	17.7	29.0	30.6	1.6

3.2.4 Life satisfaction

Land managers were asked to respond on a 100 point scale (0=very unsatisfied; 100=very satisfied) about their quality of life (QOL) to better understand factors that might influence decision making (Table 18). More than 62% of cane growers and graziers were very satisfied and more than 22% were satisfied with their overall quality of life. Just over 3% were neutral and over 7% unsatisfied or very unsatisfied with their QOL. The mean satisfaction with the QOL was estimated as being 77.4 for cane growers and 76.8 for graziers indicating that the majority of land managers are satisfied or more than satisfied with their overall quality of life.

Table 18: Overall satisfaction with quality of life

Life satisfaction score	Percent of respondents (%)	
	Cane growers (N=42)	Graziers (N=62)
0 (Very unsatisfied)	2.38%	
19		1.61%
25 (Unsatisfied)		1.61%
30		1.61%
40	4.76%	
45		1.61%
50 (Neutral)	4.76%	3.23%
57		1.61%
59		1.61%
60	7.14%	6.45%
61		1.61%
63		1.61%
65		1.61%
70	11.90%	6.45%
71	4.76%	
72		1.61%
74	2.38%	
75 (Satisfied)	2.38%	3.23%
79	2.38%	
80	4.76%	9.68%
81		4.84%
82		4.84%
83		1.61%
85	7.14%	6.45%
86	2.38%	3.23%
87	2.38%	1.61%
88	2.38%	3.23%
90	16.67%	11.29%
91	2.38%	3.23%
92	2.38%	3.23%
95	9.52%	8.06%
100 (Very satisfied)	7.14%	3.23%
	100.00%	100.00%

The main reasons for both growers and graziers for feeling very satisfied were about self-satisfaction, achievement, enjoyment and working with family. The respondents indicated that they have a good balance of work and lifestyle, financial security, profitability, control over life, good health and good family. Some of the supporting statements are in Table 19 below.

Table 19: Comments from land managers - Positive responses about quality of life

<i>'Good balance of work and lifestyle'</i>
<i>'Farming is a great lifestyle and provides flexibility, work when it has to be done'</i>
<i>'We're doing well, profitable'</i>
<i>'Because I'm doing what I want and making money. Kids at exciting time their life'</i>
<i>'Self-satisfaction and achievement'</i>
<i>'Because I enjoy seeing the crops grow and I enjoy the challenges of being with nature'</i>
<i>'Good family, great community, good job, nice landscape and culture'</i>
<i>'Get to relax and chill out with family. Have beers with mates on weekends. Good workforce, get along, put in the effort'</i>
<i>'Great family and friends, financially comfortable, great cattle station'</i>
<i>'We are providing food for the world, we enjoy what we do and we get to work with our children'</i>
<i>'Good health, good family, doing what I love'</i>
<i>'I believe our family has a good work/life balance. We live and breathe our cattle and our horses, therefore what we do for a living, also constitutes our leisure time. While we spend 95% of our time working on the property, we also make time to involve ourselves in the local community'</i>
<i>'We have a happy and healthy family and our land is improving'</i>

Even though those cane growers and graziers who were very satisfied with their overall quality of life, some pointed out that there were difficulties being a land manager (Table 20).

Table 20: Comments from land managers about difficulties being a land manager

<i>'Uncertainty about succession processes, and the role we are playing compared to the role we want to play'</i>
<i>'Room to improve with time management and expectations of ourselves'</i>
<i>'Not everything is perfect leaves room for improvement'</i>
<i>'Could be a little less stress'</i>
<i>'Finances could be less stressful'</i>
<i>'Not enough time - work too many hours'</i>

Only 7% of cane growers and 6% of graziers were dissatisfied with their overall quality of life. The main reasons for dissatisfaction were strict government legislations, lack of recognition of improvement, personal circumstances and health issues.

3.2.5 Grants, funding, workshops and training programs

Grants and financial assistance

Land managers were asked to tell us about the grants and financial assistance that they applied for to do things on their property. Fifty percent of cane growers and 44% of graziers applied for at least one grant or financial assistance (Table 21).

Table 21: The proportion of respondents that applied for grants and/or financial assistance to do things on property

	Percent of respondents (%)	
	Cane growers (N=40)	Graziers (N=61)
No	47.5%	52.46%
No, I did not apply for any	2.5%	3.28%
Yes	50.0%	37.7%
Yes, I applied for 3 or less		4.92%
Yes, I applied for more than 3		1.64%

Note: Due to the 'skip logic' error, the 'No' response for graziers includes people who may have applied for less than 3 grants

Land managers were asked to identify the grants and financial assistance programs that they have applied for in the past 5 years. They were also asked to select on a seven point scale (1= complete waste of time to 7=completely useful) the usefulness of the grant (see Table 22). There were 44 applications in total. Some respondents applied for 2 or 3 grants/financial assistance programs. The majority of grant and funding applications were successful (>93%). Reef Rescue was the most popular grant (84.1%) and it was the most useful for the applicants (M=6.76), followed by the drought funding, which was also very useful (M=6.50). While Canegrowers BPS water improvement and the Reef Trust Tender were less applied for, the mean shows that both programs were still useful to the land managers.

Table 22: Grants and financial assistance programs that cane growers applied for in the last 5 years and their usefulness for land management (Total number of applications = 44)

Grant/Financial assistance program	Cane growers	
	Percent of applications (%)	Usefulness score Mean
Reef Rescue	84.1%	6.76
Drought	4.5%	6.50
Canegrowers BPS Water improvement	2.3%	5.00
Reef Trust Tender	9.1%	4.50

Note: Usefulness of grants and financial assistance programs was measured using a seven – point Likert scale from 1 = 'complete waste of time' through to 7 = extremely useful

The most important things mentioned by cane growers that they hoped to achieve with Reef Rescue program included implements or tools that they were able to purchase and elements of practice change (see Table 23).

Table 23: Comments from cane growers about what they hoped to achieve with funding/grants from the Reef Rescue Program

<i>Implement/Tool</i>	<i>Practice Change</i>
• Shielded sprayer • GPS • Put in trickle irrigation • Compost turner	• Irrigation water run-off control • Provide farmer with a link to take up a farming practice by providing funding to bridge the gap re allowing a farmer to not be financially inhibited to make the decision to change practice. Normally farmer wouldn't be able to • Demonstrable sustainability • Precision nutrient application • Sustainability • Reduce residual chemical use • Making work economical • Stopped a lot of sediment run-off. Bought a leg implanter. Put in cover crops and used bevel rake with GPS to control fertiliser instead of putting it straight on top of the land. Prevents run-off • Quality of water run-off to decrease it to nearly nothing

The main sources of information about the grants were NQ Dry Tropics, BSES/Canegrowers, and extension officers. When applying for grants and funding, water quality improvement, decrease in use of nitrogen, sustainability, profitability, decrease in costs and erosion control were most important things that cane growers were hoping to achieve (Table 24).

Table 24: The main sources of information about the grants and financial assistance programs (Cane growers)

<i>Information source</i>	<i>Source percentage (%)</i>
NQ Dry Tropics	23.41%
BSES/Canegrowers	14.90%
Extension officer	12.77%
Media	8.51%
BPS meetings/newsletter	6.39%
Lobby organisation	6.38%
My need to know - I sought the opportunities	4.26%
Organisation	4.26%
Common knowledge	4.26%
Dale Larsen MP for the Burdekin	2.13%
Other*	12.77%

*Category 'Other' includes Dale Larsen MP for Burdekin; Ergon; Word of mouth

Grants and financial assistance programs that graziers applied for in the last 5 years are listed in Table 25. There were 55 applications in total. Some respondents applied for 2 or 3 grants/financial assistance programs. The majority of grant and funding applications were successful (>93%). Drought grants and financial assistance programs were the most popular (20% of applications) and extremely useful for the applicants (mean usefulness is 7).

Table 25: Grants and financial assistance programs that graziers applied for in the last 5 years and their usefulness for land management (Total number of applications = 55)

<i>Grant/Financial assistance program</i>	<i>Graziers</i>	
	<i>Percent of applications (%)</i>	<i>Usefulness score Mean</i>
Drought	20.0%	7.00
Water	18.2%	7.00
Reef Rescue	9.1%	7.00
NQ Dry Tropics Water Quality Improvement Grant	3.6%	7.00
Water Quality Improvement Grant	1.8%	7.00
Weed control	1.8%	7.00
Solar rebate	1.8%	7.00
Holistic Management A Class Trial	1.8%	7.00
Fencing	7.3%	6.73
NQ Dry Tropics Erosion Control	5.5%	6.29
Burdekin Grazing Sub-program	1.8%	6.00
Reduced electricity	1.8%	3.00
Other*	10.9%	7.00
Not specified	14.5%	-

*Category 'Other' grants includes Desert uplands landscape linkages; Nature refuge assist grants; Nuffield bursary Nuffield Scholarship; On-Ground Biodiversity Project

Note: Usefulness of grants and financial assistance programs was measured using a seven – point Likert scale from 'complete waste of time' =1 through to extremely useful =7

The most important things mentioned by graziers that they hoped to achieve with Drought grants and financial assistance programs were related to practice change (Table 26).

Table 26: Comments from graziers about what they hoped to achieve with funding/grants from the Drought grant and financial assistance program

<i>Implement/Tool</i>	<i>Practice Change</i>
None	• Utilise water • Distribute water more effectively so cattle wouldn't over-graze, less reliance on natural waters, make more off stream man made water supplies • Sustainability • Help with transport cost

The main sources of information about the grants were extension officers, NQ Dry Tropics, emails, Google and media (Table 27). When applying for grants and funding, water quality and soil health improvement, decrease in farm run-off, sustainability, spreading stocking pressure over the property for better grazing and erosion control were most important things that land managers were hoping to achieve.

Table 27: The main sources of information about the grants and financial assistance programs (Graziers)

<i>Information source</i>	<i>Source percentage (%)</i>
Extension officer	26.79%
NQ Dry Tropics	23.21%
Email	14.29%
Google	10.71%
Media	5.37%
DAFF	3.57%
Family/Neighbour	3.58%
Other*	8.95%
Not specified	3.57%

*Category 'Other' includes Agforce; DPI drought info; Government announcements; Invited to apply; Standard financing arrangement

Workshops and training programs

Land managers were asked about participation in workshops, training programs and extension activities in the last 5 years. Nearly 59% of cane growers and 48% of graziers stated that they had participated in workshops, training programs and extension activities (Table 28).

Table 28: The proportion of respondents that participated in workshops, training programs or field days

	<i>Percent of respondents (%)</i>	
	<i>Cane growers (N=41)</i>	<i>Graziers (N=58)</i>
No, I have not participated in any	41.46%	51.72%
Yes	58.54%	48.28%

Land managers growers were also asked to identify the workshops, training programs or other support activities such as field days and on-farm demonstrations that they have participated over the past 5 years. They were also asked to select on a seven-point scale (1= complete waste of time to 7= completely useful) the usefulness of the workshop, training program or field day.

There were 59 participations of cane growers in total (Table 29). Some growers participated in 2 or 3 workshops and/or training programs. Six Easy Steps and Smartcane BMP were the most popular workshops/programs and both programs were useful to the land managers (the mean usefulness score for those programs were 4.45 for Smartcane BMP and 5 for 6 Easy Steps). The most useful workshops and training programs indicated by growers were Project Catalyst, Reef run-off workshops and Soil biology & health.

Table 29: Workshops and training programs that cane growers participated in the last 5 years and their usefulness for land management (Total number of participation is 59)

<i>Workshops and training programs</i>	<i>Percent of participation (%)</i>	<i>Usefulness score Mean</i>
Project Catalyst	5.1%	7.00
Reef run-off workshops	5.1%	7.00
Soil biology & health	3.4%	7.00
Herbicide application	1.7%	7.00
Reef Rescue Nitrogen Trial	1.7%	7.00
Water Quality Grant	1.7%	7.00
Reef Trust Tender	3.4%	6.00
AICD	1.7%	6.00
Ergon efficiency	1.7%	6.00
Kym Kruse/RegenAg	1.7%	6.00
SPAA	1.7%	6.00
Water use management	6.8%	5.75
Cane productivity	3.4%	5.50
Shed meetings BPS	6.8%	5.50
On farm demos bus tours	5.1%	5.33
6 Easy Steps	22.0%	5.00
Chemcert	3.4%	5.00
Soil test program	1.7%	5.00
Smartcane BMP	18.6%	4.45
Farm Management	1.7%	4.00
Reef sediment control	1.7%	4.00

Note: Usefulness of grants and financial assistance programs was measured using a seven – point Likert scale from 'complete waste of time '=1 through to extremely useful =7

The most important things mentioned by cane growers that they hoped to achieve with 6 Easy Steps were:

- Correct nutrient application rates
- Keep up with modern trends
- Get new information
- Knowledge to improve practice

The main sources of information about these workshops and training programs were extension officers (29%), friends/peers (16%), and NQ Dry Tropics (12%) (Table 30). When making decision to participate in workshops and training programs increasing knowledge, learning about new techniques and best land management practices, improving soil and land management, and decreasing nitrogen rates were most important things that cane growers were hoping to achieve.

Table 30: The main sources of information about the workshops/training programs (Cane growers)

<i>Information source</i>	<i>Source percentage (%)</i>
Extension officer	29.41%
Friend/Peers	15.69%
NQ Dry Tropics	11.76%
Email	7.84%
BSES	7.84%
Canegrowers	7.84%
My own initiative	5.88%
Advertised	5.88%
Grant process	3.92%
Pharmacist	1.96%
Neighbour	1.96%

Workshops and training programs that graziers participated in the last 5 years are listed in Table 31. There were 59 participations in total. Some graziers participated in 2 or 3 workshops and/or training programs. Holistic Management (14%) and BMP (10%) were the most popular programs and graziers find them to be useful (the mean usefulness for those programs was 5.6 for Holistic Management and 4.8 for BMP). The most useful workshops and training programs indicated by graziers were Biosecurity, Rural mental health, Breed plan, Cost efficiency and returns of production feeding, and Beef up forums.

Table 31: Workshops and training programs that graziers participated in the last 5 years and their usefulness for land management (Total number of participation is 59)

<i>Workshops and training programs</i>	<i>Percent of applications (%)</i>	<i>Usefulness score Mean</i>
Biosecurity	5.10%	7.00
Rural mental health	1.72%	7.00
Beef up forums	1.72%	7.00
Breed plan	1.72%	7.00
Cost efficiency and returns of production feeding	1.72%	7.00
Soil Management	5.17%	6.67
Stock handling	5.17%	6.67
Grader	6.90%	6.25
RCS	6.90%	6.25
Mapping	6.90%	6.25
Holistic Management	13.79%	5.63
GLM	3.45%	5.50
Women in grazing	3.45%	5.50
Weed Management	6.90%	5.00
Wild Dog Trapping	3.50%	5.00
National Biological Farmers Conference	1.72%	5.00
BMP	10.34%	4.83
Peter Andrews	5.17%	4.67
MLA Advocacy workshop	1.72%	4.00
Succession workshop	1.72%	4.00
Not specified	5.15%	7.00

Note: Usefulness of grants and financial assistance programs was measured using a seven – point Likert scale from 'complete waste of time' through to extremely useful

The most important things mentioned by graziers that they hoped to achieve with Holistic Management were:

- Land management
- Drought resilience, less input costs, work with nature
- Find fresh ideas
- To learn about holistic management

The main sources of information about these workshops and training programs were emails (30.5%), NQ Dry Tropics (18.6%), and friends (10.2%) (Table 32). When making decision to participate in workshops and training programs increasing knowledge, improving cattle management, understanding a farm business, and learning about new techniques were most important things that graziers were hoping to achieve.

Table 32: The main sources of information about the workshops/training programs (Graziers)

<i>Information source</i>	<i>Source percentage (%)</i>
Email (RCS, Three rivers etc.)	30.49%
NQ Dry Tropics	18.64%
Friend	10.17%
Extension officer	8.47%
CHRRUP	8.47%
Personally holds them	5.08%
Agforce	3.39%
Media	3.38%
Cotton Growers Australia	1.69%
DPI	1.69%
MLA	1.69%
YouTube/Facebook	1.69%
Not specified	5.08%

3.2.6 The most useful workshops or training programs and reasons they were useful

Cane growers were asked what was the most useful of these workshops or training programs and why. The growers' comments are shown in Table 33.

Table 33: Cane growers' comments about the most useful workshops and training programs

<i>Workshops/Training programs</i>	<i>Comments</i>
6 Easy Steps	- Fertilizer rate change - Because it gave you an idea of how much fertiliser you should be putting on - Gives confidence on fertiliser application - Although i did not agree with the 6ix Easy Steps recommendations when i first saw them, i am starting to see that they are close to the mark with application rates - Teaches about soil structure, helps to understand soil tests - Most useful - Control run-off and fertilizer usage
6 Easy Steps/Catalyst/BMP	All equally useful
6 Easy Steps/AICD/Canegrower BMP	All as each has a relevance to its own topic
BMP	- Required for accreditation - Industry standards
Smart cane BMP/Project catalyst	All are useful. I see what my farming methods are against standard practice'
BPS meetings	Because its day to day information
David and Geoff's presentations	Because they explain how soils actually function Note: David and Geoff are external presenters for soil health workshops
Irrigation workshop	To help with irrigation schedule
Water efficiency	Relating water to growth
Water tests	Help show nutrients in water
Nitrogen Trial	Because it showed that the crop isn't compromised when the Six Easy Steps are applied
Spraying	No comments
Reef run-off	No comments
Shed meetings	No comments

Graziers were asked what was the most useful of these workshops or training programs and why. The graziers' positive comments are shown in Table 34.

Table 34: Graziers' comments about the most useful workshops and training programs

<i>Workshops/Training programs</i>	<i>Comments</i>
Holistic Management	• It was very comprehensive and allowed us to determine some goals for our business and personal lives • Got me thinking about land management differently
Holistic Management /Neil McDonald stock handling, training & working dogs	• Both equally essential to anyone who has anything to do with cattle
Holistic Management/ RCS Kit day Strathalbyn/Stock handling course	• They were all useful in different ways
Hosted Holistic Management Day/GLM/Grazing for profit	• They all have been useful in different ways
Grazing for profit	• Most information able to be implemented, very practical
Resilience in Grazing	• We went onto do the trial project and it has changed the future of our
Erosion	• Learnt the most
Pill injection of weeds	• Shows scientists are trying to help control weeds
Gape Brown great info	• Watches on you tube reg. Peter Andrews info - good on soil/erosion
Farm Biosecurity Workshop/ Grazing BMP/ Google Mapping	• I found all of these workshops very useful as they were all very important to our business. Hard to pick a most useful one as they each had a use within our business
Rural mental health	• Eight years running with over 200 participants, shows results
Biosecurity and WHS/Decision making in difficult times/ Cost efficiency and returns of production feeding	• All were useful for different purposes
Breed plan/ BJD and new biosecurity act	• The fact that they're online and you can listen to the post-recording. If she's busy (e.g. with kids) then she can play it later - flexibility. Don't have to leave house, waste time driving
RCS grazing for profit	No comments
Peter Andrews land and water management	No comments
Women in grazing	No comments
Wild Dog Trapping	No comments
Any run by NQ Dry Tropics	No comments

The graziers' suggestions and criticism were:

- BMP – 'Needs restructuring'
- 6 Easy Steps – 'Not really useful. We were already doing the stuff from 6 Easy Steps before they taught us'

3.2.7 What could be done to make grants, training programs, workshops and/or extension activities work better for cane growers and graziers to help them meet their personal goals

Cane growers were asked 'what could be done to make grants, training programs, workshops and/or extension activities work better for cane growers to help them meet their personal goals'?

Growers' positive and negative comments are shown in Table 35 below.

Table 35: Cane growers' positive and negative comments about making grants, training programs, workshops and/or extension activities better to help them meet their personal goals

Positive comments

'All good'

'Happy with them now'

Negative comments

'People (e.g. government) who come to your farm and tell you what to do need to look at it from a farm view (e.g. advising to apply 3 chemicals - that makes no sense - time consuming). They go overboard with things and you lose connection with them because you can see they don't understand how much work that would involve. They're offering another option but it's not necessarily better than what you're already doing - reinventing the wheel. They don't consider the financial viability for the farmer. Theory doesn't translate in the paddock. The training often involves 4 steps, rather than 2 so it's not anything new and it's all extra unnecessary stuff that someone has put a new spin on'

'Don't just throw info at us - say WHY it's good and important. Someone else has decided it's good for us, but it's not enough. We need more. The credibility of the program is stifled by this'

'Less red tape to apply'

'Grant money being wasted on irrelevant unnecessary things. Funding must be more specific to the issues'

Some other growers' comments and suggestions are shown in Table 36.

Table 36: Cane growers' other comments and suggestions

<i>'Assistance from agronomist'</i>
<i>'GPS for us older people, using technology for better practices. Smaller farms this won't be useful but for us, larger farm, it's important'</i>
<i>'Less paperwork'</i>
<i>'Probably make grants easier the apply for'</i>
<i>'More time to do them, improved cost benefits'</i>
<i>'Farmers need to know it's available'</i>
<i>'Particular website on all grants available'</i>
<i>'Need to know about their existence, relevant people to know about programs, ability to look up'</i>
<i>'I live in CQ - he lives on the cattle farm, not the cane - Cane is managed by somebody else. Stuff on GPS on tractors, plant equipment to manage run-off and maximise absorption, special fertiliser box to incorporate fertiliser into stool. Helps farmers to adopt new techniques from older generations. Farmers need to know it's available'</i>
<i>'The grants to be more than 50%'</i>
<i>'To be more beneficial'</i>
<i>'Practical people on ground advice and smaller grower meetings in your own area which totally relates to your soil type and practice'</i>
<i>'They need to bring back/look at more bringing GPS systems into smaller farms who don't have them'</i>
<i>'GPS on tractors, plant equipment to manage run-off and maximise absorption, special fertiliser box to incorporate fertiliser into stool. Helps farmers to adopt new techniques from older generations'</i>
<i>'Grants are the biggest thing - you can get a machine that you couldn't normally afford. Equipment is expensive, so grants make it easier. Plus helps with sediment run-off'</i>
<i>'Grants should only be able to be accessed through grower committees'</i>
<i>'Make sure grants are going to innovative projects not to catch up lazy farmers'</i>
<i>'The grants to pay for stool splitter was practical. To enhance farmer cooperation, you need to think of things they want. The land owner needs to be convinced. Levelling of blocks so irrigation can flow slowly but organised through the drills - this was cut out but should have stayed. Farmers have trouble with cash flow. Need real results'</i>
<i>'On farm training, increased funding, better feedback, realistic targets, open discussions and farmer input'</i>
<i>'Better advertising, informed decisions to know what to attend'</i>
<i>'Go back to the way the first Reef Rescue no more tenders'</i>
<i>'Programs suitable for area'</i>
<i>'Recycle them, rather than focusing on nitrogen run-off. No reason to give money for people for reducing nitrogen run-off - no point. Rate controllers, tail off for drains, etc. would be better'</i>
<i>'They need to look outside the box (blue sky innovations - not mainstream projects). Need to focus on less mainstream funding - focus on more out there stuff that could become mainstream if given the chance'</i>
<i>'Put on a meal, get more people in'</i>
<i>'Don't know. Time frame to get approved, dealing with wet seasons'</i>
<i>'Do not have them during the season as it is very hard to attend'</i>
<i>'Helping growers'</i>

We also ask graziers ‘what could be done to make grants, training programs, workshops and/or extension activities work better for cane growers to help them meet their personal goals’?

Graziers’ positive and negative comments are below (Table 37).

Table 37: Graziers’ positive and negative comments about making grants, training programs, workshops and/or extension activities better to help them meet their personal goals

Positive comments:

‘I think alright now’

‘Happy with the experts’ opinions’

‘Not a lot, we access any that we want to at the time. There is plenty of information available and assistance from department people’

‘Very happy with the Burdekin Dry Tropics system’

‘We know grants are available and have used them in the past and have been very satisfied with both getting the grant and the results (e.g. gully erosion, whoa boys on property roads and fenced off a main creek)’

Negative comments:

Abolished - Government got too much say to control. Get a grant and have to report back and the government agenda not necessarily helpful’

‘Please consider the intelligence of the participants and do not dumb down content - it is insulting’

‘Speak to us and advertise more’

‘Extreme constraints by poor legislation impact on results - allow common sense to assist with implementation’

‘Don’t agree with grants and subsidies, Government leave me alone, don’t tell me how to do things’

‘Goes through a huge process of applying for grants but it sometimes doesn’t go anywhere. Need to have a high chance of receiving funding when applying. Need to have more clear rules and regulations to know if it is worth the time to achieve the result. Need to be more grants put into things that will make a difference (e.g. pests and rubber vine)’

Some other graziers' comments and suggestions are shown in Table 38.

Table 38: Graziers' other comments and suggestions

<i>'Less red tape, more practicality, higher percentage of government contributed funds, better allowance for owner contributed hours, programs that deliver real outcomes - need to actually genuinely target things and then assess verifiable benefit to the ecology of the streams. If the person did it, they should get more money. Genuinely improve ecology of river'</i>
<i>'Make the paperwork more user friendly. Give more funding to be distributed by organisations such as CHRRUP as we, as graziers, don't have the time to spend searching for funding opportunities. Our business runs on a skeleton staff as prolonged droughts and low prices for our stock for decades, have forced us to take on more workload which was once shared with employees. There is too much legislation and red tape involved in employing people in today's society, so we choose to not employ. Hence, our enterprise has become more efficient, but our time to "manage" our business gets less and less. If we can be notified of possible grant opportunities by organisations such as CHRRUP or NQ Dry Tropics, it would certainly be a help'</i>
<i>'Ensure that the funding is shared evenly. However, if there is funding available and there is no other interest, ensure that those who are willing to put the effort into doing projects can do so, even if they have already received previous funding'</i>
<i>'For the grants to be made available to me'</i>
<i>'Transparent application process'</i>
<i>'Know they are available, not too difficult or time consuming to apply for'</i>
<i>'Make funding recipients more accountable so that funding is available for more genuine people'</i>
<i>'Make grants etc. easier to find. Let the training provider know & advertise the availability of funding for their course. As most people have to travel long distances, travel & accommodation assistance is necessary'</i>
<i>'Grants are getting harder to get, not easier. Last grant was unachievable for us. We had to use less fertiliser but I wasn't going to do it. Our property is on marginal soils and if we did that, nothing would grow on it'</i>
<i>'Extension help available and advertised locally in newspaper, in terms of letting you know what's available, advice and helping with applications'</i>
<i>'Needs to be holistic approach - not going to achieve in current form - needs check up on funding us'</i>
<i>'Current extension staff at DAFF Charters Towers and NQ Dry Tropics notify landholders when above are available. I have a quite good network so am kept'</i>
<i>'Have extension officers visiting farms'</i>
<i>'Grants for weeds should target all weeds, not just a select few'</i>
<i>'More about our problems weeds etc. - and our type of soil - NOT about how things are done in the coastal region'</i>
<i>'Greater ownership over the method used to improve the land'</i>
<i>'More assistance with spreading water and fencing land. He had help through NQDT and it was extremely helpful'</i>
<i>'More on-property programmes would be better. Visits to the property to assess the grants also help us display our good management'</i>
<i>'Hands on seeing what can be done information on how to do things to take home and apply to your farm'</i>
<i>'More tailored info for local land types'</i>
<i>'Tailored to suit individual properties'</i>

'Quality trainers/facilitators. Many lack essential skills'

'Advertising more'

'Hearing of more of them'

'More of them'

'Childcare available during the programs/workshops or run them on weekends'

'Make more workshops free of charge and close to us. One day workshops are much easier to get to than a two day workshop'

'More of a variety of dates training is run'

'Online education - time restraints'

'Online training, remote access, integrate RPL for academic courses'

'Streamed through internet - e.g. if there's someone in Townsville, she can't go'

'Pandering to lowest common denominator. Leave the lower end, focus middle upper skilled farmers'

'Subsidise them more, especially for multiple attendees, assistance with travel/accommodation'

'We find with my spouses off farm employment it is not always convenient to leave the property, we just go if we can'

3.2.8 Extension support or training that cane growers and graziers would like to have in the future to help them make farm improvements

We ask cane growers ‘what extension support or training would cane growers like in the future to help you make farm improvements’?

Growers’ positive and negative comments are shown below (Table 39).

Table 39: Cane growers’ comments about extension support and training

Positive Comments

Happy with what’s out there’

‘No training needed for him’

‘What they’re doing is fine - 6 Easy Steps and BPS is irrelevant but if you want to keep doing it, no changes needed. BMP should be more relevant for farmers in the Burdekin’

‘None in particular’

Negative comments

‘Understanding of water management from the government - we don’t have enough understanding of government policies and where they’re taking us. We get paid but we don’t get asked. Some people need to be told but if you don’t ask, you won’t learn anything’

Cane growers’ other comments and suggestions are shown in Table 40.

Table 40: Cane growers other comments and suggestions about extension support and training

‘Bag of cash! Stopping water run-off/flow off country e.g. contour banks. That’s the main thing’

‘More scrutiny on how grant money is being used and further checking that the equipment hasn’t been sold months after the grant’

‘More grants’

‘All the help we can get’

‘Irrigation’

‘Irrigation, electricity, more efficient way of pumping’

‘Automate irrigation’

‘Water quality testing’

‘More effective water monitoring with an officer or officers taking samples and processing the information’

‘Continue supplying farmers with innovations’

‘Innovative ideas’

‘Better communication re improved practices - automation, new age thinking, drones, new technology. Need more info so farmers will consider this as an option’

‘More information on properties of the cane we grow. All in place too’

‘Stuff on GPS on tractors, plant equipment to manage run-off and maximise absorption, special fertiliser box to incorporate fertiliser into stool. Helps farmers to adopt new techniques from older generations. Farmers need to know it’s available’

'Aquaculture, undertaking land management for drought preparation/hardiness, mentoring for pasture management and herd management'
'Bookwork and paperwork courses'
'Cane variety management'
'Pharmacist program'
'Free agronomy services'

We ask graziers 'what extension support or training would graziers like in the future to help you make farm improvements'?

Graziers' positive and negative comments are shown in Table 41.

Table 41: Graziers' positive and negative comments about extension support and training

Positive comments

'Nothing at this time'
'There is good information available from MLA, AgForce, and other organisations. We have plenty to go on at the moment'

Negative comments

'We don't need training - we need to train the ecologists, the training needs to be reversed. Land owners and managers should be teaching ecologists what works. Two way flow of info'

Graziers' other comments and suggestions are below (Table 42).

Table 42: Graziers' other comments about extension support and training

'On farm support'
'Practical people on ground advice and smaller grower meetings in your own area which relates to your soil type and practice'
'Shed meetings (Sugar SRI comes along with field technology and lectures, practice advice, examples). Grants for recycling pits'
'One on one, no groups'
'In the business side of things - type of record keeping that's available - there's no real record keeping system for sugar itself that's easy to use. This is the biggest problem because older farmers don't want to use a computer. ALSO infrastructure needs to be put in help with the transition'
'Nutrient management'
'More about chemicals. It's a dangerous area and a small course or label doesn't help much. A booklet would be better. Explain in layman's terms what can be mixed together, what can't be etc.'
'Saves an extra man's wage by using chemicals - cuts the workload in half'
'More text based messages - to read at leisure'
'About \$4M'
'Money for improving water infrastructure (i.e. drilling for water/solar bores/dams) - more watering points in each paddock to disperse cattle more evenly and prevent overgrazing near watering points'

'Needs resources to implement the information rather than more training'
'I am interested in the veterinary and disease side of cattle production, water run-off workshops and soils and grasses workshops are all useful'
'Something on how marketing is changing and how to market their own farm. Bullocks vs. backgrounding? MSA vs. growth promote?'
'More support in the battle against woody weed infestation'
'Tax relief for programs that you do that actually make a difference'
'The grants we have utilised in the past have given us a huge helping hand in improving our land which in return helps better our management. Grants are very important to us'
'Fencing equipment. Tank & paddock monitoring. Water infrastructure. Training & travel. Farm record systems & software: cattle numbers, grazing plans, LPA requirements'
'Need decent & affordable access to INTERNET!!'
'Support after program - support for application - means tested'
'Support for investigating other ways for achieving the same outcome'
'More one on one support'
'Creating better networks for information from trusted experts'
'More constructive field days'
'Fenceless fencing - saves time and energy'
'Innovative shade, feed and water solutions to aid rotational grazing'
'I don't need to go to a field day or training when I can just ring the person who will have the knowledge of what I'm chasing'
'Not so much for me, but training for children as they are young adults, things like low stress stock handling etc.'
'We have done training in the past and enjoyed it and learned from it. At the moment would prefer son and wife to go to training when their outside work permits'
'We are fighting a noxious weed problem to which other properties up stream are doing nothing'
'If there are multiple watering points, one point can be shut down to allow for grass regeneration while another point is opened up at different periods during the year'
'Computer program for accounting (Payroll and leave loading)'
'Land management - erosion control'
'Mapping'
'Grazing for profit workshop'
'Holistic management; better understanding of entire eco system'
'How to repair land to bring back into production'
'Mentor in financial management and strategic thinking for grazing business'
'Erosion control'
'More on holistic management'
'Weed eradication, water management storage and irrigation'
'Contour bank construction'
'Pest removal- non-native weeds, vines, trees, etc.'
'Reducing run-off'
'How to improve soil health and techniques to improve fodder production'
'Soil health in depth'
'Research on improving pasture on low productive soil'
'Any area in understanding soils'
'Work around soil and soil carbon, regenerative/sustainable land management, valuating beef'
'Sustainable agriculture'
'Vegetation management - Australian species'

'Improved pasture training to help choose correct grasses to plant for production & resilience'

'Maybe just business management'

'Training on mapping and grading roads'

'Forage budgeting, pasture quality and assessment techniques, digital mapping skills'

'Training is difficult to access in their area, government incentives would help, flexible modes of training for specific issues in the area would help (e.g. online pest and weed control training)'

3.2.9 Specific questions – Cane growers

This initial analysis is based on a very small sample (N=38) and there is incomplete data in relation to specific issues (for example due to issues with skip logic in the survey software, cane growers did not answer every question). Therefore, the number of participants reported may vary.

Irrigation practices

Cane growers were asked if they were involved in any irrigation practices, how much irrigated water they use per hectare (acre) for their crops each year (see Table 43), how much irrigation water runs off their blocks (Table 44) and which irrigation scheduling tools they are using (Table 45).

The majority of respondents (92%) said that they are using irrigation practices. More than 65% of cane growers said that they use between 5ML and 15ML of irrigated water per hectare per annum, nearly 14% of respondents use 15-20ML, 7% up to 5ML and the rest of cane growers are using 25ML and more (Table 43).

Table 43: The amount of irrigated water that cane grower uses per hectare (N=29)

<i>ML per Ha</i>	<i>Percent of respondents (%)</i>
0-5ML	6.90%
5-10ML	20.69%
10-15ML	44.83%
15-20ML	13.80%
20-25ML	-
25-30ML	3.45%
30-35ML	-
35-40ML	3.45%
40-45ML	3.45%
>45ML	3.45%

The majority of cane growers (91%) estimated their run-off from irrigation as being between zero and 25% of all irrigated water used on the block (Table 44).

Table 44: The amount of irrigated water that cane grower uses per hectare (N=29)

<i>Percent of water</i>	<i>Percent of respondents (%)</i>
0 - 25%	91.43%
25 - 50%	8.57%

Fifty-seven percent of cane growers are using multiple irrigation scheduling tools. Nearly 30% of respondents are not using any irrigation scheduling tools instead they are using their own experience and knowledge, gut feeling and moisture levels, shovel, expert eye, and years of observation. Fifteen percent of respondents use a single irrigation scheduling tool (mini pans) (see Table 45). Ninety-four percent of participants were planning to use the same irrigation scheduling tools next year.

Table 45: Irrigation scheduling tools used by cane growers (N=35)

<i>Irrigation scheduling tools</i>	<i>Percent of respondents (%)</i>	<i>ABCD framework</i>
Mini pans*	14.71%	C
Soil moisture probes such as tensiometers & capacitance probes/Calculation of daily crop water use, using crop factors, class A pan, or crop model (e. g. WaterSense)**	11.76%	B
Mini pans/Soil moisture probes such as tensiometers & capacitance probes	8.82%	C
Calculation of daily crop water use, using crop factors, class A pan, or crop model (e. g. WaterSense)/Mini pans	8.82%	B
Soil moisture probes such as tensiometers & capacitance probes***	8.82%	D-C
Soil moisture probes such as tensiometers & capacitance probes/Trickle irrigation	2.94%	B-A
Mini pans/Soil moisture probes such as tensiometers & capacitance probes/Calculation of daily crop water use, using crop factors, class A pan, or crop model (e. g. WaterSense)/Trickle systems/Experience/Envirofans	2.94%	B-A
Calculation of daily crop water use, using crop factors, class A pan, or crop model (e. g. WaterSense)	2.94%	B
Calculation of daily crop water use, using crop factors, class A pan, or crop model (e. g. WaterSense)/Mini pans/Soil moisture probes such as tensiometers & capacitance probe	2.94%	B
Mini pans/Soil moisture probes such as tensiometers & capacitance probes/G dots	2.94%	B
Mini pans/Soil moisture probes such as tensiometers & capacitance probes/Irrweb	2.94%	C-B
None	8.82%	D
Other****	20.59%	D

*also mentioned G dots, 'my own experience', knowledge, rule of thumb, recycle pits

** also mentioned 'visually' and plant growth rate

*** also mentioned 'my knowledge' and 'work it out myself'

**** category 'Other' includes 'amount of supply restraint', 'Gut feeling and look at moisture levels', leaf stress, 'run all pumps and cover as much ground as possible and repeat', 'my own practical experience', 'shovel and expert eye', and 'years of observation'

Cane growers were asked how much they agree or disagree with statements related to their current tools for scheduling irrigation (a seven-point Likert scale from strongly disagree through to strongly agree was used to assess each statement) (Table 46).

Due to an error in the survey software responses to this question are low (N=6). Of those that were able to respond, sixty-six percent of cane growers indicated that their current system for scheduling irrigation is the best way to maintain good cash-flow and the best way to reduce business risk. Sixty seven percent of participants agreed that their current system is the best

way to meet their own personal goals and it is the most effective way of controlling nutrient loss from their property. Thirty-three percent believe they were not forced to use irrigation scheduling tools and 16% felt they were somehow forced (Table 46).

Table 46: Attitudes and motivations associated with scheduling irrigation (N=6 due to skip logic error)

	Percent of cane growers (%)							
	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree	Do not know/ Not sure
The farmers I respect most do this				16.7	16.7	50.0		16.7
Most farmers in this region would not have the technical knowledge	16.7	16.7	16.7	16.7		16.7		16.7
Most farmers in this region would not be able to afford to do this	16.7	16.7	16.7				16.7	33.3
I only do it because I am forced to	33.3			33.3	16.7			16.7
The people/organisations whose advice I follow most think I should do this		16.7		16.7	16.7	33.3		16.7
The best way to meet my own personal goals				16.7	16.7	33.3	16.7	16.7
The best way to maintain good cash-flow				16.7		50.0	16.7	16.7
The best way to reduce business risk				16.7		50.0	16.7	16.7
The least time-consuming (or labour intensive)		16.7		33.3		16.7	16.7	16.7
The most effective way of controlling nutrient loss from my property				16.7	16.7	16.7	33.3	16.7

Cane growers were asked to select whose advice they follow most when scheduling irrigation (Table 47). Due to an error in the survey software the number of responses is low (N=6). Of those that were able to respond, family who are also cane farmers, other cane farmers, private agronomist, researchers and industry extension advisors were highly ranked of whose advice cane growers follow most.

Table 47: Rank of importance of whose advice cane growers follow most when scheduling irrigation (N=6 due to skip logic error)

	Very impor tant	Rank of importance of whose advice cane growers follow most when scheduling irrigation												Very unimp ortant
		1	2	3	4	5	6	7	8	9	10	11	12	
Family who are also cane farmers	1					1								
Other cane farmers	1	1				1								
Cane growers (the organisation)										1				
Regional cane association (e.g. from Kalamia, Invicta, Inkerman, Tully Sugar)										1				
People from NQ Dry Tropics/Terrain				1		1								
Private Agronomists	1		1			1								
Landcare						1								
Researchers	1			1		1								
Industry extension advisors (SRA [BSES], Production Boards, Productivity Services group)			2			1								
Other extension officers. From where?				1										
People from government departments. Which departments?						1								
Other. Who?														

Note: no comments for 'Which departments?' and 'Other extension officers. From where?'

Calculating fertiliser application rates

Cane growers were asked how they calculate fertiliser application rates, they were allowed to give more than one answer. Nearly 45% of the participants said that they are using multiple ways to calculate application rates. Eighteen percent indicated that they tailor their fertiliser rates to different parts of the property, 16% use their advisors and 10% of respondents use soil test (Table 48).

Table 48: Different ways to calculate fertiliser application rates (N=38)

	<i>Percent of respondents (%)</i>	<i>ABCD framework</i>
I tailor my fertiliser rates to different parts of the property	18.42%	B
My advisor does this for me*	15.79%	B
Soil tests/types**	10.52%	B
My advisor does this for me/I tailor my fertiliser rates to different parts of the property	7.89%	B
I use industry standard rates for district yield potential, & use that amount on all parts of my farm/I tailor my fertiliser rates to different parts of the property	7.89%	C-B
I estimate amounts from my farm yield and use that amount on all parts of my farm	7.89%	C
I use industry standard rates for district yield potential, & use that amount on all parts of my farm/My advisor does this for me/I tailor my fertiliser rates to different parts of the property	5.26%	B
I use industry standard rates for district yield potential, & use that amount on all parts of my farm/I use more fertiliser on high-performing (high yielding) blocks/I tailor my fertiliser rates to different parts of the property	2.63%	B
My advisor does this for me/I use more fertiliser on under-performing (low yield) blocks than on other blocks/I tailor my fertiliser rates to different parts of the property	2.63%	B
6 Easy Steps	2.63%	B
I estimate amounts from my farm yield & use that amount on all parts of my farm/I use more fertiliser on under-performing (low yield) blocks than on other blocks/I tailor my fertiliser rates to different parts of the property	2.63%	B
I use more fertiliser on high-performing (high yielding) blocks	2.63%	B
I use more fertiliser on under-performing (low yield) blocks than on other blocks/I tailor my fertiliser rates to different parts of the property	2.63%	B
I use industry standard rates for district yield potential, & use that amount on all parts of my farm	2.63%	C
I use industry standard rates for district yield potential, & use that amount on all parts of my farm/I use more fertiliser on high performing (high yielding) blocks	2.63%	C
Other***	5.26%	D

*also mentioned 6 Easy Steps

**also mentioned advice, agronomist, recommended by 6 easy steps via consultancy

***same amount on everything

Cane growers were asked how much they agree or disagree with statements related to their current system for calculating fertiliser application rates (a seven-point Likert scale from strongly disagree through to strongly agree was used to assess each statement) (Table 49).

Eighty-four percent of respondents indicated that their current system for calculating fertiliser rates is the best way to meet their own personal goals and it is the most effective way of controlling nutrient loss from their property (86%). Ninety-two percent of participants agreed that it is the best ways to maintain good cash flow. Nearly 53% believe they were not forced to calculate fertiliser application rates and 10% felt they were somehow forced. Only one person made a comment on who/what forcing people to calculate the application rate and indicated that it was Government.

Table 49: Attitudes and motivations associated with calculating fertiliser rates (N=38)

	Percent of cane growers (%)								
	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree	Do not know/Not sure	
The farmers I respect most do this	7.9	7.9	5.3	13.2	5.3	31.6	23.7	5.3	
Most farmers in this region would not have the technical knowledge	18.4	23.7	5.3	10.5	15.8	18.4	2.6	5.3	
Most farmers in this region would not be able to afford to do this	15.8	23.7		23.7	15.8	10.5	2.6	7.9	
I only do it because I am forced to	21.1	28.9	2.6	28.9	5.3	2.6	2.6	7.9	
The people/organisations whose advice I follow most think I should do this	10.5	2.6	2.6	15.8	13.2	34.2	15.8	5.3	
The best way to meet my own personal goals		2.6		13.2	18.4	28.9	36.8		
The best way to maintain good cash-flow			2.6	2.6	15.8	47.4	28.9	2.6	
The best way to reduce business risk			2.6	15.8	15.8	34.2	28.9	2.6	
The least time-consuming (or labour intensive)	5.3	23.7	5.3	21.1	7.9	21.1	15.8		
The most effective way of controlling nutrient loss from my property				10.5	10.5	44.7	31.6	2.6	

Cane growers were asked to tell us whose advice they follow most when calculating fertiliser application rates (Table 50). Of those that were able to respond, private agronomist and extension advisors were highly ranked of whose advice cane growers follow most.

Table 50: Rank of importance of whose advice cane growers follow most when calculating fertiliser application rate (N=38)

	Rank of importance of whose advice cane growers follow most when calculating fertiliser application rate												
	Very important												Very unimportant
	1	2	3	4	5	6	7	8	9	10	11	12	13
Family who are also cane farmers	2	4	1	4	3		1				2		
Other cane farmers		1	5	1	3	3				1			
Cane growers (the organisation)			1		2	1	3	1	2	1			
Regional cane association (e.g. from Kalamia, Invicta, Inkerman, Tully Sugar)		1			1	2	1	2	3	1	1		
People from NQ Dry Tropics/ Terrain	1	1	2	3			3	2	1				
Private Agronomists	1 7	5	4	3									
Landcare			1	1	1			1	2	3		1	
Researchers	4	1	3	2	1	4		1					
Industry extension advisors (SRA [BSES], Production Boards, Productivity Services group)	8	9	2	1		1			1				
Other extension officers. From where?**	2	1	1	1		2				1			
People from government departments. Which departments?			1			1	1			1	2*	2	
Other. Who?***	4	2		1				2	1		1		

* DERM; DEHP

**Extension officers from SRA and pharmacist

*** Soil tests, elders, Geoff Bassett (my biological consultant), LANDMARK, 6 Easy Steps, trial results, Evan Shannon; 'buy the fertiliser from', and 'lots of people make up own mind' were mentioned by respondents

Note: no other comments for 'Which departments?'

Handling run-off practices

Similar to irrigation and fertiliser rate application, nearly half of the cane grower participants (47%) are using multiple ways to handle run-off. Nearly half (47.4%) had both recycle pits and adequate pumping capacity to recycle the water, 24% of participants have only recycle pits, 7.94% indicated that they do not capture run-off. Nearly every respondent was planning to use their current approaches next year (Table 51).

Table 51: Practices for handling run-off from rainfall and irrigation (N=38)

	<i>Percent of respondents (%)</i>	<i>ABCD framework</i>
I have recycle pits and have adequate pumping capacity to recycle the water*	47.37%	B
I have recycle pits**	23.68%	C
I capture what i can but whole farm is not able to recycle	2.63%	C
All water from irrigation stays on farm	2.63%	C
Paddocks are laser levelled so there is min run-off	2.63%	C
I have recycle pits/Alluvial Soils	2.63%	D-C
I do not capture run-off	7.89%	D
Other***	10.53%	D

*Participants also mentioned practices such as 'end banks to stop paddock run-off but want to install more recycle pits', 'recycle other farmers irrigation run off as well', 'shape of drill furrow, makes it easier, less water and power'; 'excess capacity - water is 100% used and then re-used'; 'keep grassy headland', 'up to 100mm of rain'.

**Participants also mentioned practices such as 'contour banks and beds', 'natural lagoons enhanced replenishment activities to remove barriers within lagoon systems naturally within the property', 'run day and night without sleep'

***Category 'Other' includes practices such as 'grassed headlands', 'end banks', 'good ground cover', 'alluvial soil'

Cane growers were asked how much they agree or disagree with statements related to their current system for handling run-off (a seven – point Likert scale from strongly disagree through to strongly agree was used to assess each statement) (Table 52).

Table 52: Attitudes and motivations associated with handling run-off from rainfall and irrigation (N=38)

	Percent of cane growers (%)							
	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree	Do not know/ Not sure
The farmers I respect most do this	5.3	10.5	5.3	15.8	10.5	26.3	21.1	5.3
Most farmers in this region would not have the technical knowledge	18.4	34.2	10.5	18.4	2.6	10.5	2.6	2.6
Most farmers in this region would not be able to afford to do this	13.2	13.2	13.2	15.8	13.2	15.8	10.5	5.3
I only do it because I am forced to	23.7	39.5	2.6	18.4		5.3	2.6	7.9
The people/organisations whose advice I follow most think I should do this	5.3	10.5	7.9	18.4	10.5	26.3	18.4	2.6
The best way to meet my own personal goals	2.6		2.6	10.5	5.3	26.3	50.0	2.6
The best way to maintain good cash-flow		2.6	5.3	7.9	5.3	39.5	36.8	2.6
The best way to reduce business risk		2.6	5.3	15.8	2.6	39.5	28.9	5.3
The least time-consuming (or labour intensive)	2.6	15.8	5.3	13.2	13.2	26.3	21.1	2.6
The most effective way of controlling nutrient loss from my property			2.6		10.5	39.5	44.7	2.6

Nearly 95% of cane growers indicated that their current practices for handling run-off is the most effective way of controlling nutrient loss from the property and 82% said that it is best way to meet their own personal goals as well as the best way to maintain good cash flow. Forty percent of cane growers believed that most farmers in the Burdekin region have enough technical knowledge to deal with run-off from rainfall and irrigation and nearly 66% indicated that they were not forced to do it. Cane growers were asked to tell us whose advice they follow most when it comes to handling run-off from rainfall and irrigation (Table 53). Private agronomist and extension advisors were highly ranked for whose advice cane growers follow most.

Table 53: Rank of importance of whose advice cane growers follow most when handling run-off (N= 35)

	Rank of importance of whose advice cane growers follow most when handling run-off												
	Very important												Very unimportant
	1	2	3	4	5	6	7	8	9	10	11	12	13
Family who are also cane farmers	3	1		2	3		2				1		
Other cane farmers	2	2	3	1		3	1	1		2			
Cane growers (the organisation)	1		1	2	3	2			2		1		
Regional cane association (e.g. from Kalamia, Invicta, Inkerman, Tully Sugar)			1	1	1	3	2	2					
People from NQ Dry Tropics/ Terrain	3	4	2	3	2		2	1					
Private Agronomists	10	6	1	1		1	1		1	1			
Landcare			2		1	2		3	2			1	
Researchers	4		2	2	2			2	3				
Industry extension advisors (SRA [BSES], Production Boards, Productivity Services group)	5	7	3			1	1						
Other extension officers. From where?*	1	1	5	1						1	2		
People from government departments. Which departments?		1		1						3	2	2	
Other. Who?*	7	2		1			1	1		1	1		

*Pharmacist, Catalyst Program, PSG, any

**Bismac, myself, my needs to meet BMP and sustainability, my own knowledge, Reef Rescue, You were the innovator, others come to you, BBIFMAC - very helpful, practical advice rather than scientific

3.2.10 Specific questions – Grazier

This initial analysis is based on a small sample (N=54) and there is incomplete data in relation to specific issues (graziers did not answer every question). Therefore, the number of participants reported may vary.

Graziers were asked if their property is located in a declared drought area and for how many years they have been in drought. Eighty percent of respondents were in a declared drought area. Of those 28% were in drought for 4 years, 36% for three years and 18% were in drought for two years.

Pasture spelling practices – Spelling paddocks during the most recent wet season

Seventy two percent of graziers said that they have spelled paddocks during the most recent wet season while just over 6% have not spelled their paddocks. Of those who did spell paddocks, 38% spelled about one quarter of their paddocks while 21% spelled all of their

paddocks. Nearly 16% spelled half of their paddocks and 13% spelled three quarters of their paddocks. Around 13% spelled less than one quarter of their paddocks (Table 54). Sixty-four percent of graziers spelled their paddocks for 3 months or more, 27% for 2 months, and 10% for 1 month. Ninety-two percent of those who did spell paddocks were planning to do it again next year.

Table 54: The proportion of paddock spelled and for how long were the paddocks spelled (N=39)

<i>The proportion of paddock spelled</i>	<i>Percent of respondents (%)</i>
About $\frac{1}{4}$	38.46%
2 months	17.95%
3 months or more	20.51%
About $\frac{1}{2}$	15.38%
3 months or more	15.38%
About $\frac{3}{4}$	12.82%
1 month	2.56%
2 months	2.56%
3 months or more	7.69%
All	20.51%
1 month	5.13%
2 months	5.13%
3 months or more	10.26%
Less than $\frac{1}{4}$	12.82%
1 month	2.56%
3 months or more	10.26%
Total	100.0%

Graziers were asked how many years they have practiced spelling paddocks during the wet season. Nearly one third of respondents said that they have spelled paddocks for up to 5 years while another one third said that were spelling from 10 years to 15 years. Just over 13% of graziers are spelling their paddocks for less than a year (Table 55).

Table 55: Number of years of spelling paddock during the wet season (N=38)

<i>Number of years</i>	<i>Percent of graziers (%)</i>
Less than 1 year	13.16%
1-5 years	28.95%
5-10 years	7.89%
10-15 years	28.95%
15-20 years	10.53%
20-25 years	5.26%
>25 years	5.26%

Graziers were also asked how much they agree or disagree with statements related to their current practice for spelling or not spelling paddocks during the wet season (a seven – point Likert scale from strongly disagree through to strongly agree was used to assess each statement) (Table 56).

Seventy - eight percent of participants chose agree/strongly agree that their current practices for spelling paddocks during the wet season is the best way to meet their own personal goals. Fifty-nine percent said that it was the best way to reduce business risk as well as the best way to maintain good cash-flow. Sixty-one percent of graziers chose strongly agree or agree that spelling is the most effective way of controlling erosion on their property. More than one third (35%) disagreed or strongly disagreed that most graziers in the Burdekin region would not be able to afford to spell paddocks, indicating that most graziers would be able to afford to do the practice. Over 39% thought that the practice was time consuming and labour intensive. Sixty-five percent of graziers believe that they are not forced to spell paddocks while 5.6% feel they are at some level.

Table 56: Attitudes and motivations associated with spelling paddocks (or not spelling paddocks) during the wet season (N=54)

	Percent of graziers (%)							
	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree	Do not know/Not sure
The graziers I respect most do this	3.7	3.7	7.4	22.2	9.3	25.9	20.4	7.4
Most graziers in this region would not have the technical knowledge	11.1	16.7	7.4	27.8	13.0	13.0	3.7	7.4
Most graziers in this region would not be able to afford to do this	13.0	22.2	3.7	13.0	18.5	7.4	9.3	13.0
I only use this system because I am forced to	44.4	16.7	3.7	14.8	1.9	3.7		14.8
The people/organisations whose advice I follow most think I should do this	5.6	5.6	1.9	18.5	3.7	29.6	18.5	16.7
The best way to meet my own personal goals	1.9	3.7	1.9		7.4	46.3	31.5	7.4
The best way to maintain good cash-flow		7.4	1.9	13.0	13.0	37.0	22.2	5.6
The best way to reduce business risk		3.7		14.8	16.7	31.5	27.8	5.6
The least time-consuming (or labour intensive)	5.6	16.7	16.7	9.3	11.1	27.8	9.3	3.7
The most effective way of controlling erosion on my property		7.4	1.9	11.1	11.1	27.8	33.3	7.4

Graziers were asked to rank by importance whose advice they follow most when it comes to spelling paddocks during the wet seasons (Table 57). Family who are also graziers, other graziers, people from NQ Dry Tropics and respondents themselves were highly ranked of whose advice graziers follow most.

Table 57: Rank of importance of whose advice graziers follow most when making decision about spelling paddocks (N=51)

	Very important		Rank of importance of whose advice graziers follow most when making decisions about spelling paddocks										Very unimportant	
	1	2	3	4	5	6	7	8	9	10	11	12	13	
Family who are also graziers	20	1				1								
Other graziers	10	9	5	2	2									
Non-farming family/friends	1			1				1						
Agforce	2			2					1					
QLD Farmers Federation one	1			1						1				
Meat & Livestock Australia	2	1	2	1			1							
Private Agronomists	1	1		1	1						1			
Extension officers. From where?*	3	3	4	3	1									
People from NQ Dry Tropics/ Terrain	7	6	3	3										
Landcare	1	3	1	3										
Researchers	1	1	6	2	1	1								
People from government departments. Which departments?	1	2*	1	1								1		
Other. Who?***	13	4	3	1	1								1	

*DAFF & DPI. All other responses for "Which departments?" were "blank"

**CSIRO, DAFF, Northern gulf resource group, Department of Natural Resources, NQDT

*** Myself; My own experience; Manager of the property; Grazing BMPs; Education programmes/Courses; Other graziers who are pro-active in Holistic Management or regenerative grazing or otherwise environmentally aware, other successful graziers; People who are achieving what we want; Private consultant; RCS/RCS Yeppoon; Reading trial results; Townsville City Council.

Graziers who feel that they are forced to spell paddocks during the wet season were asked who or what is forcing them, the following items were mentioned (Table 58).

Table 58: Graziers' comments about who is forcing them to spell paddocks

'Pasture health'

'Better land health'

'I do it all year every year'

'Ground cover for erosion control'

'Dry conditions'

'The weather & management decisions - I want to marry up my breeding program with spelling'

Adjusting stock numbers to paddock conditions practices (other than wet-season spelling)

The majority of graziers (96.3%) adjusted stock numbers to paddock conditions and nearly 91% indicated that they have an end-of-season target for pasture condition. Of those who have an end-of-season target, 75.5% were aiming to leave between one third and one half of the feed that was grown that season (Table 59) and 94% of participants were planning to do it again next year.

Table 59: Amount of feed participants aimed to leave in the paddock at the end of the season and how often they achieved this (N=49)

	<i>Percent of respondents (%)</i>
Between 1/2 and 3/4 of the feed that was grown that season	16.33%
Between 5 and 7 years in 10	6.12%
Less than 3 in 10 years	8.16%
More than 7 years in 10	2.04%
Between 1/3 and 1/2 of the feed that was grown that season	75.51%
Between 3 and 5 years in 10	14.29%
Between 5 and 7 years in 10	26.53%
Less than 3 in 10 years	6.12%
More than 7 years in 10	28.57%
Less than 1/3rd of the feed that was grown that season	6.12%
Less than 3 in 10 years	2.04%
More than 7 years in 10	4.08%
More than 3/4 of the feed that was grown that season	2.04%
More than 7 years in 10	2.04%
Total	100.0%

Graziers were asked for how many years they have been practicing stock adjustment to pasture conditions. The majority of respondents (77%) said that they have been doing it for 10 years or longer (Table 60).

Table 60: Number of years of adjusting stock numbers to paddock conditions (N=48)

<i>Number of years</i>	<i>Percent of graziers (%)</i>
1-5 years	10.42%
5-10 years	12.50%
10-15 years	29.17%
15-20 years	16.67%
20-25 years	16.67%
>25 years	14.58%

Graziers were also asked if they would consider using forage budgets to determine stock numbers. More than 70% of respondents said that they would consider using forage budgets to determine stock numbers.

Graziers were then asked how much they agreed or disagreed with statements related to their current system for adjusting stock (or not adjusting stock) to pasture conditions. A seven-point Likert scale from strongly disagree through to strongly agree was used to assess each statement (Table 61).

Fifty-five percent of graziers chose agree or strongly agree that current practices for adjusting stock to pasture conditions are the best way to meet their own personal goals. Forty-eight percent said that it was the best way to reduce business risk; 50% indicated that current stock adjustment practices are the best way to maintain good cash flow. Fifty-nine percent of graziers chose strongly agree or agree that stock adjustment is the most effective way of controlling erosion on their property. More than one third (35%) disagreed or strongly disagreed that most graziers in the Burdekin region would not be able to afford to adjust stock to pasture conditions, indicating that most graziers would be able to afford to do the practice. Fifty-five percent of graziers believe that they are not forced to adjust stock to pasture conditions.

Table 61: Attitudes and motivations associated with adjusting stock (or not) to pasture conditions (N=54)

	Percent of graziers (%)							
	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree	Do not know/ Not sure
The graziers I respect most do this	1.9	7.4	3.7	29.6	11.1	20.4	14.8	11.1
Most graziers in this region would not have the technical knowledge	9.3	22.2	1.9	31.5	3.7	11.1	7.4	13.0
Most graziers in this region would not be able to afford to do this	13.0	22.2	1.9	27.8	7.4	9.3	5.6	13.0
I only use this system because I am forced to	25.9	29.6	3.7	18.5				22.2
The people/ organisations whose advice I follow most think I should do this	5.6	5.6		22.2	5.6	22.2	18.5	20.4
The best way to meet my own personal goals		3.7		20.4	16.7	25.9	29.6	3.7
The best way to maintain good cash-flow		3.7	1.9	27.8	9.3	24.1	25.9	7.4
The best way to reduce business risk		3.7	1.9	25.9	13.0	24.1	24.1	7.4
The least time-consuming (or labour intensive)	5.6	13.0	9.3	24.1	11.1	20.4	13.0	3.7
The most effective way of controlling erosion on my property	1.9	3.7	3.7	18.5	7.4	22.2	37.0	5.6

Graziers who said that they are somehow forced to adjust stock to pasture conditions mentioned who or what is forcing them (see Table 62).

Table 62: Graziers' comments about who/what is forcing them to adjust stock

'Drought is a key influence'

'For our cows to calve each year they need to have a rising plan of nutrition through pregnancy and lactation. We achieve this through wet and dry lick supplement depending on animal age. These are only effective if you have a reasonable body of roughage to offset the supplement program'

'Keep pasture in good condition and keep cattle performing'

'Sustainability, pasture health'

'Management plan - I made the plan and I need to stick with it...and environment'

Graziers were asked to rank by importance whose advice they follow most when it comes to adjusting stock numbers to pasture conditions (Table 63). Family who are also graziers, other graziers, people from NQ Dry Tropics and respondents themselves were highly ranked of whose advice graziers follow most.

Table 63: Rank of importance of whose advice graziers follow most when deciding how to adjust stock (or not) to pasture condition (N= 52)

	Rank of importance of whose advice graziers follow most when deciding how to adjust stock												
	Very important												Very unimportant
	1	2	3	4	5	6	7	8	9	10	11	12	13
Family who are also graziers	20	1	2	1									
Other graziers	9	8	5	3	1								
Non-farming family/friends		1	1								1		
Agforce			1						1				
QLD Farmers Federation one			1							1			
Meat & Livestock Australia	1	1	2	2		1							
Private Agronomists	1		2					1					
Extension officers. From where?*	2	2	4	2									
People from NQ Dry Tropics/Terrain	7	3	4	3									
Landcare		3	2	2									
Researchers	2	3	3	1			1						
People from government departments. Which departments?	2 [#]	3 ^{##}	2										1
Other. Who?***	15	2	5									1	

*CSIRO, DAFF, Department of Natural Resources

**Education and experience, myself, RCS, Through application I have proven it to work, Townsville City Council, DAFF, Grazing best practices/Holistic etc., Consultant, Myself - acquired knowledge from resources, webinars, Others who are achieving and making progress

DAFF; Future beef DPI

##DAFF; DAFF through trials based on property; DPI

Stock management around waterways practices

All graziers in the sample have waterways on their property. When asked about preventing cattle from accessing the waterways, 31% said that they prevented their cattle from entering some waterways at all times and 24% said they only prevent access in the wet (Table 64).

Only 3.7% of respondents said that they prevent cattle from accessing all waterways at all times, while eighteen percent of respondents do not prevent access. Sixteen percent said they do something different for example 'have bore and trough set up to encourage cattle away from creek' and 'controlling riparian vegetation as needed to maintain ground cover and stop erosion' (Table 64). Ninety-four percent of graziers were planning to use their current system to manage stock around the waterways next year.

Table 64: Stock management around waterways practices (N=54)

	<i>Percent of respondents (%)</i>
I do not prevent cattle from accessing waterways	18.52%
I prevent cattle from accessing all waterways at all times	3.70%
I prevent cattle from accessing all waterways during the wet season	5.56%
I prevent cattle from accessing some waterways at all times	31.48%
I prevent cattle from accessing some waterways during the wet season	24.07%
Other. Please tell us what you do	16.67%

Graziers were asked about how many years they have used their current practice for managing stock around waterways. More than one third of respondents (40.4%) said that they have been doing it for 5 and up to 15 years (Table 65) and another 44% have been doing it for 15 years and over.

Table 65: Number of years of managing stock around waterways (N=52)

<i>Number of years</i>	<i>Percent of graziers (%)</i>
1-5 years	15.38%
5-10 years	21.15%
10-15 years	19.23%
15-20 years	17.31%
20-25 years	13.46%
>25 years	13.46%

Next graziers were asked how much they agreed or disagreed with statements related to their current system for managing stock around waterways (a seven - point Likert scale from strongly disagree through to strongly agree was used to assess each statement) (see Table 66).

Seventy-eight percent of graziers believed that current practices are the best way to meet their personal goals and 72% believed it is the best way to reduce business risk. Nearly 61% of participants chose agree or strongly agree that current practices for managing stock around waterways are the most effective way of controlling erosion on their property. More than a half (52%) chose disagree or strongly disagree to the statement that most graziers in the Burdekin region would not be able to afford to manage stock around waterways; 65% of graziers believed that no one forcing them to do this while 9% feel they are forced to manage stock around waterways at some level.

Table 66: Attitudes and motivations associated with managing stock around waterways (N=54)

	Percent of graziers (%)							
	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree	Do not know/ Not sure
The graziers I respect most do this	1.9	1.9	3.7	18.5	11.1	29.6	27.8	5.6
Most graziers in this region would not have the technical knowledge	5.6	18.5	1.9	33.3	7.4	18.5	3.7	11.1
Most graziers in this region would not be able to afford to do this	14.8	37.0	1.9	16.7	9.3	7.4	1.9	11.1
I only use this system because I am forced to*	38.9	25.9	3.7	5.6	3.7	1.9	3.7	16.7
The people/ organisations whose advice I follow most think I should do this	5.6	5.6	1.9	16.7	5.6	29.6	22.2	13.0
The best way to meet my own personal goals		1.9		3.7	13.0	25.9	51.9	3.7
The best way to maintain good cash-flow		1.9	1.9	13.0	16.7	29.6	35.2	1.9
The best way to reduce business risk		1.9	1.9	7.4	14.8	33.3	38.9	1.9
The least time-consuming (or labour intensive)	3.7	5.6	18.5	20.4	13.0	20.4	16.7	1.9
The most effective way of controlling erosion on my property		3.7	1.9	11.1	18.5	18.5	42.6	3.7

*No comments for 'who is forcing you'

Graziers were asked to rank by importance whose advice they follow most when it comes to manage stock around waterways (Table 67). Family who are also graziers, other graziers, people from NQ Dry Tropics and respondents own experience were highly ranked of whose advice graziers follow most.

Table 67: Rank of importance of whose advice graziers follow most when deciding how to manage stock around waterways (N= 49)

	Rank of importance of whose advice graziers follow most when deciding how to manage stock around waterways														
	Very important												Very unimportant		
	1	2	3	4	5	6	7	8	9	10	1	1	1	2	3
Family who are also graziers	18	2	1	1											
Other graziers	8	8	4	3	1										
Non-farming family/friends		1	1									1			
Agforce			1				1								
QLD Farmers Federation one			1					1							
Meat & Livestock Australia	1	1	2	1					1						
Private Agronomists	1		1				1			1					
Extension officers. From where?*	2	2	3	3		1									
People from NQ Dry Tropics/Terrain	8	6	6	1	1										
Landcare	2	3	3	2	1										
Researchers	3	3	4	1		1									
People from government departments. Which departments?	1**	1**	2										1		
Other. Who?***	15	2	4	1											1

*CSIRO, DAFF, Department of Natural Resources

**DAFF

*** Experience; Townsville City Council; DAFF; Grazing best practices/Holistic etc.; Consultant; Myself/Ourselves; People who are achieving similar goals; RCS

3.2.11 Other innovative practices to reduce nitrogen and/or run-off

Land managers were asked if they use any other innovative practices to reduce nitrogen and/or run-off. Sixty-eight percent of graziers and 58% of cane growers indicated that they do use other innovative practices. Some of other innovative practices mentioned by cane growers and graziers are listed in Table 68 below.

Table 68: Practices listed by the respondents as innovative

Cane growers	Graziers
<i>'Designing an automated system for flood irrigation'</i>	<i>'Restricting cattle access, riparian fencing, Peter Andrews techniques'</i>
<i>'We add soluble humates and soil microbes as the fertilizer is placed in the ground'</i>	<i>'Some key line ripping levels'</i>
<i>'Integrated system where the land and water resources come before financial wealth, put fertiliser at top of hill so doesn't run off. Uses 'humate' carbon to help slower release fertiliser'</i>	<i>'Placement of supplementation; bale grazing, high stock density'</i>
<i>'Trash incorporator - he wasn't sure of name. Destroy hill, cultivate fertiliser into it, rebuild hill with topsoil. Target at roots. No fertiliser in atmosphere - otherwise evaporation and waste money'</i>	<i>'Biological carpeting'</i>
<i>'Slow release fertilizers'</i>	<i>'Peter Andrews - Natural sequence farming'</i>
<i>'Water sampling/testing, soil testing, government data for bore regiments'</i>	<i>'Diverting a road to assist in stopping erosion and graveling and installing sill drains'</i>
<i>'Green cane harvesting, covered crops, beans, spoon drains, minimum tillage'</i>	<i>'Contours in cultivation paddocks, small contours on access tracks around the property, try to maintain high grass cover at all times but this is subject to seasonal conditions'</i>
<i>'GPS rate control and placement'</i>	
<i>'Overhead irrigation, variable rate control'</i>	
<i>'Stool splitting, minimum stillage'</i>	
<i>'Put fertiliser at top of hill so doesn't run off. Uses 'humate' carbon to help slower release fertiliser'</i>	

3.2.12 Land managers' perceptions of top causes and pressures on water quality

Land managers were asked about their perceptions of sediment/nutrient loss from their property and what they think about water quality in local streams, rivers and waterways (Table 69).

Sixty one percent of cane growers and 30% of graziers said that they are somewhat agree, agree or strongly agree that sediment/nutrient losses from their properties are having no impact on water quality in local streams, rivers and waterways, indicating that they do not believe that

the losses from their properties are impacting water quality locally. By contrast 25% of cane growers and 55% of graziers somewhat to strongly disagree with the statement indicating that compare to cane growers, greater proportion of graziers are inclined to believe that their activities are somehow negatively impacting the water quality of local streams, rivers and waterways. Twenty four percent of respondents remain neutral (Table 69).

Table 69: Land managers' perceptions of water quality in local streams, rivers, and waterways

<i>Sediment/Nutrient loss has no impact on WQ locally</i>	<i>Percent of respondents (%)</i>	
	<i>Cane growers (N=36)</i>	<i>Graziers (N=53)</i>
Strongly agree	16.67%	11.32%
Agree	19.44%	13.21%
Somewhat agree	25.00%	5.66%
Neutral	11.11%	13.21%
Somewhat disagree	8.33%	15.09%
Disagree	5.56%	24.53%
Strongly disagree	11.11%	15.09%
Do not know/Not sure	2.78%	1.89%

When land managers were asked about the top causes of poor water quality in their local streams, rivers and waterways (Table 70), 11% of cane growers cited there was no issue with water quality. For growers that thought there was poor water quality they cited the causes as run-off from farms and bush areas (11%); excessive chemical usage (8%); nutrient and sediment run-off (8%); poor farming practices and other farmers (8%) as the top causes. They also mentioned coral bleaching, water deoxygenation, water turbidity, and poor government policies (e.g. water pricing systems in the Burdekin irrigation area) as other causes of poor water quality. Graziers cited that poor water quality was caused by poor grazing practices and cattle country (15.4%); drought, dry weather and lack of rain (13.5%); and poor weed control management (9.6%) as the main causes of poor water quality locally. Run-off from urban & commercial areas; run-off from farms and bush areas; poor farming practices; nutrient and sediment run-off; and unsealed Council roads were mention by graziers as the main causes (see Table 70).

Table 70: Land managers' perceptions of the top causes of poor water quality locally

<i>The top causes of poor water quality in local streams, rivers, and waterways</i>	Percent of respondents (%)			
	Top cause 1		Top cause 2	
	<i>Cane growers (N=36)</i>	<i>Graziers (N=52)</i>	<i>Cane growers (N=12)</i>	<i>Graziers (N=36)</i>
Run-off from farms/bush	11.11%	1.92%		
Excessive chemical usage	8.33%	1.92%	25.00%	5.56%
Poor grazing practices/Cattle	5.56%	15.38%		11.12%
Poor farming practices/Other farmers	8.33%	1.92%	16.67%	11.11%
Drought/Dry weather/Lack of rain	2.78%	13.46%		11.11%
Sediment/Nutrient run-off	8.33%	5.77%	8.33%	
Excess fertiliser run-off	8.33%			
Poor weed control/Weed infestation	5.56%	9.62%	8.33%	5.56%
Erosion/Soil erosion/Gully erosion		7.69%		11.11%
Floods/Rain events/Cyclones	5.56%	1.92%	8.33%	11.12%
Poor ground cover management	2.78%	5.77%		11.11%
Mining		3.85%	8.33%	2.78%
Dirty water from river/No clean streams			8.33%	2.78%
Deoxygenation	2.78%			
Bleaching	2.78%			
Poor government policies	2.78%			
Turbidity	2.78%			
Pollution		5.77%		
Low flows		3.85%		
Unsealed Council road		1.92%		
Run-off from urban & commercial areas			8.33%	
Poor cane farming practice				2.78%
Other	5.56%*	11.54%*	8.33%**	13.89%**
No issue with poor water quality	11.11%	7.69%		
No idea/Unknown	5.56%			
	100%	100%	100%	100%

*including 'leaves', 'pigs', 'rotting vegetation', 'salt intrusion', 'salts in water', 'sodic soil', 'suspended clay', 'too much remnant vegetation'

**Including 'rotting vegetation', 'black water events', 'poor landscape management', 'fast moving water', 'rubbish from recreational campers up stream', 'the abolition of the Two Chain Law in the 1960s/70s. Chain is 22 yards. Protection of the banks of creeks, was abolished'

The second top causes of poor water quality were identified by the majority of cane growers as excessive chemical usage (25%); and poor farming practices and other farmers (17%). Graziers said that the second top cause of poor water quality were poor grazing practices and poor cattle country (11%); poor farming practices and other farmers (11%); soil and gully erosion (11%), extreme weather events such as cyclones and floods (11%); and poor ground cover management (11%) (see Table 70).

Table 70 shows that 11% of cane growers and 7.7% of graziers believe that there is no issue with water quality in their area. The respondents' comments (Table 71) highlight that this could be because they are at the head of the river system or that the water quality has improved over time.

Table 71: Cane growers and graziers' comments about water quality

'Good quality water in my area, dirt in system after rain'
'I don't think there is as poor quality in our creek systems that is lead to believe. I have lived here for 48 years and have seen a lot of changes in the Barratta creek from 20 years ago when you had a dead system that you could not fish out of too now where it is vibrant and fish stocks are good and clean'
'We are at the head of the river system - our springs etc. are of the highest water quality when they leave our property. There is no chemical run-off from our land as we don't spray our forage crops'

The data in Table 70 indicates that there may be a tendency of blame shifting related to water quality. Six percent of cane grower responses indicate that overgrazing or cattle country generally, and run-off from grazing are the main reasons for poor water quality in local streams, rivers, and waterways. While 3% of grazier responses blame the cane industry and poor cane farming practices for water quality in waterways.

Land managers were asked about their perceptions of the cane growing/grazing industry and its role in the declining health of the GBR (Table 72). Sixty-six percent of cane growers do not believe that the cane industry plays a significant role in the declining health of the GBR. Graziers' perceptions of the role that their industry plays in the declining health of the reef is divided nearly equally – 37% think that grazing plays at least some role in declining health of the GBR while 39% think that it is not true or only partly true, while the remaining grazier respondents remain neutral.

Table 72: Land managers' perceptions of cane growing/grazing industry and its role in the declining health of the GBR

<i>Cane/Grazing industry plays almost no role in the declining health of the GBR</i>	<i>Percent of respondents (%)</i>	
	<i>Cane growers (N=36)</i>	<i>Graziers (N=53)</i>
Strongly agree	19.44%	13.21%
Agree	19.44%	13.21%
Somewhat agree	27.78%	13.21%
Neutral	16.67%	20.75%
Somewhat disagree	8.33%	15.09%
Disagree	2.78%	11.32%
Strongly disagree	2.78%	11.32%
Do not know/Not sure	2.78%	1.89%

Participants were also asked what they consider the top two pressures to be on the health of the Great Barrier Reef (Table 73). The top pressures cited by cane growers are climate change and global warming (21.6%); nutrient and sediment run-off (13.5%); urban run-off (5.4%); extreme weather events (e.g. cyclones, an increase in sea temperature) (5.4%); tourism industry (5.4%); and shipping accidents, anchor damage and oil spills (5.4%). They also cited mining, natural growth and decline, fishing, and natural changes/cycles.

Graziers mainly blamed run-off from urban areas and coastal development (26%), climate change and global warming (19.7%) for the declining health of the GBR (Table 73). Like cane growers, graziers also mentioned shipping accidents, anchor damage, oil spills, but then added tourism, the crown of thorns starfish, extreme weather events, excessive chemical usage, coastal horticulture, existing traditional land use practices, pigs in the rainforest, and siltation.

The second top pressure on the health of the Great Barrier Reef identified by cane growers included global warming and climate change (25%); chemical run-off from urban development, cities and towns being close to the reef (18%); extreme weather events (11%); and politicians, Government, or negative media coverage (8.3%). The second top pressure identified by graziers included sediment and nutrient run-off (18.8%); run-off from urban areas and coastal development (12.5%); extreme weather events (10.4%) and global warming and climate change (10.4%). Graziers also cited tourism, overfishing, ports, shipping accidents, and Government parties and their opinion towards rural industry. Five percent of cane growers and 5% of graziers believe that there is no issue with the health of the GBR.

There is also a tendency of blame shifting related to the health of the reef. Just over 15% of cane growers believe that cattle farmers and graziers' land, use of hormones on cattle production, and overgrazing causing sediment run-off are the top pressures on the health of

the GBR. Two percent of graziers blame cane growers and farmers near the coast for declining health of the reef.

Table 73: Land managers' perceptions of top two pressures on the health of the GBR

<i>The top pressures on the health of the GBR</i>	<i>Percent of respondents (%)</i>			
	<i>Top pressure 1</i>		<i>Top pressure 2</i>	
	<i>Cane growers (N=37)</i>	<i>Graziers (N=56)</i>	<i>Cane growers (N=28)</i>	<i>Graziers (N=48)</i>
Climate change/Global warming	21.63%	19.70%	24.99%	10.41%
Urban run-off	5.41%	26.32%	17.85%	12.49%
Sediment/Nutrient run-off	13.52%	7.21%	3.57%	18.75%
Extreme weather events (e.g. cyclones)	5.40%	3.60%	10.71%	10.42%
Excessive chemical usage	2.70%	5.40%	7.14%	
Environmental changes/Natural changes/Cycle	1.80%	7.14%	2.08%	4.17%
Poor grazing practices/Cattle	5.41%	1.80%	7.14%	
Government/Bureaucrats/Negative media	1.80%	3.57%	8.33%	
Mining	2.70%	1.80%	3.57%	8.33%
Crown of thorns	5.40%	1.80%	3.57%	4.17%
Tourism	5.41%	3.60%		4.17%
Overfishing	2.70%			2.08%
Seasonal variability	5.41%	1.80%	3.57%	2.08%
Shipping/Anchor damage/Oil spill	5.41%	1.80%		2.08%
Ports			3.57%	
Urban run-off/Grazing	2.70%			
Poor cane growing practices				2.08%
Other	5.41%*	7.20%*	3.57%**	2.08%**
It's healthy/Natural growing & decline	5.40%	5.41%		
Which one do we believe		5.40%		
No idea/No opinion/Not sure	5.41%	3.60%		6.25%
	100%	100%	100%	100%

*Coastal horticulture, existing traditional land use practices, lack of knowledge, pigs in the rainforest, siltation, United Nations & green groups

**Stream run off, unclean water

3.2.13 Perceptions of land conditions and water quality

Graziers were asked about their perceptions of the condition of grazing land on their property (see Table 74). The majority of graziers in the sample are taking measures to reduce soil loss from their properties and to improve land conditions (>90%). Nearly 80% of graziers believe that soil losses from their property have an impact on pasture and grazing land condition while 11% thinks that it is not true or only partly true (Table 74).

Table 74: Graziers' perceptions of land conditions (N=53)

<i>Cane/Grazing industry plays almost no role in the declining health of the GBR</i>	<i>Percent of respondents (%)</i>	
	<i>I am taking measures to reduce soil loss & improve land conditions</i>	<i>Soil loss from my property negatively impacts my pasture production & grazing land condition</i>
Strongly agree	49.06%	41.51%
Agree	41.51%	26.42%
Somewhat agree	3.77%	11.32%
Neutral	3.77%	7.55%
Somewhat disagree		1.89%
Disagree		5.66%
Strongly disagree		3.77%
Do not know/Not sure	1.89%	1.89%
	100%	100%

3.2.14 Demographic background

As expected the sample was dominated by males. One hundred percent of cane growers identified as male. Sixty-two percent of graziers identified as male and 37% identified as female. The majority of respondents were born in Australia. Sixty-three percent of cane growers and 92% of graziers were non-Indigenous Australian while 24% of cane growers had Italian cultural heritage. The remaining 13% were of other cultural heritage including Spanish, Canadian or Irish. The majority of respondents were either married or in de facto relationships (>94%) (see Table 75).

Table 75: Demographic characteristics of cane growers/graziers

	<i>Percentage of respondents (%)</i>	
	<i>Cane growers (N=38)</i>	<i>Graziers (N=53)</i>
Gender	Male	100%
	Female	62.26%
Born in Australia	Yes	37.74%
	No	94.34%
Cultural Heritage	Australian (non-indigenous)	5.66%
	Italian	92.45%
	Other (e.g. Spanish, Canadian, Irish)	23.68%
	Other (not specified)	13.16%
Marital status	Married or De-factor	1.89%
	Divorced	94.34%
	Single	2.63%
		3.77%
		1.89%

More than 63% of cane growers and 54% of graziers who answered the survey were aged between 45 and 64 years of age. There was 16% and 9% aged 65+ of cane growers and graziers respectively. Five percent of graziers were under 30 (Table 76). Medium age of cane growers and graziers was 52 years which is significantly greater than the median age of the Australian population (37 years).

Table 76: Age of respondent

<i>Age group</i>	<i>Percent of respondents (%)</i>	
	<i>Cane growers (N=38)</i>	<i>Graziers (N=53)</i>
20-24 years		1.89%
25-29 years		3.77%
30-34 years	5.26%	11.32%
35-39 years	7.89%	7.55%
40-44 years	7.89%	11.32%
45-49 years	13.16%	13.21%
50-54 years	18.42%	11.32%
55-59 years	18.42%	16.98%
60-64 years	13.16%	13.21%
65-69 years	7.89%	7.55%
70-74 years	2.63%	1.89%
75-79 years	2.63%	
80-84 years	2.63%	
Total	100.0%	100.0%

Twenty-one percent of cane growers and nearly 36% of graziers answered that they have completed a university degree. Thirty-four percent of cane growers and 21% of graziers completed to year 10. The other respondents either completed to year 12, achieved a trade or apprenticeship or went to agricultural college. Five percent chose other, which included a diploma in animal husbandry and year 8 or 9 in high school (Table 77).

Table 77: Highest level of education completed by respondent

<i>Education</i>	<i>Percent of respondents (%)</i>	
	<i>Cane growers (N=38)</i>	<i>Graziers (N=53)</i>
High school (year 10)	34.21%	20.75%
High school (year 12)	10.53%	7.55%
Trade / apprenticeship	13.16%	13.21%
Agricultural college	13.16%	9.43%
TAFE	2.63%	7.55%
University	21.05%	35.85%
Other	5.26%*	5.66%**

*category 'Other' include grade 8 and Diploma animal husbandry

**include grade 8 and 9, certificate IV

3.2.15 Additional property characteristics

Cane yield per hectare (per acre) achieved on the main property

Cane growers were asked to average out over good and bad years their cane yield per hectare (per acre) that they achieved on their property (Table 78). The majority of cane growers (78%) said that on average they achieved cane yield between 100 tonnes per ha (40.5 tonnes per ac) and 160 tonnes per ha (72.8 tonnes per ac).

Table 78: Average cane yield per hectare (per acre) (N=37)

<i>Tonnes per Ha/Ac</i>	<i>Percent of cane growers</i>
0-20 tonnes per ha (0-8.1 tonnes per ac)	2.70%
40-60 tonnes per ha (16.2-24.3 tonnes per ac)	2.70%
60-80 tonnes per ha (24.3-32.4 tonnes per ac)	5.41%
80-100 tonnes per ha (32.4-40.5 tonnes per ac)	8.11%
100-120 tonnes per ha (40.5- 48.6 tonnes per ac)	21.62%
120-140 tonnes per ha (48.6-56.6 tonnes per ac)	43.24%
140-160 tonnes per ha (56.6-64.7 tonnes per ac)	13.51%
160-180 tonnes per ha (64.7-72.8 tonnes per ac)	2.70%

Streams and river-frontage on the main property

Graziers were asked if they had streams and river-frontage on their properties and how much vegetation, other than grass, those streams and river-frontages have (Table 79). Nearly half of respondents (46%) have 10 to 50 km of streams/river-frontages on their main property. Twenty-two percent have more than 50 km and 2% have none. Of those who have streams/rivers frontage, nearly 23% of graziers said that they have 10 to 20 km of shrubs and trees, other 19% have 5 to 10 kilometres and 20-50 kilometres of vegetation other than grass. Just over 6% said that they have more than 100 kilometres of shrubs and trees while 4% have none.

Table 79: Number of kilometres (km) of streams/river-frontage and vegetation other than grass that are on the main property (N=50)

<i>Number of km</i>	<i>Percent of graziers (%)</i>	
	<i>Streams/River Frontage</i>	<i>Vegetation other than grass</i>
None	2.0%	4.17%
Less than 5 kms	12.0%	14.58%
5-10 kms	16.0%	18.75%
10-20 kms	22.0%	22.92%
20-50kms	24.0%	18.75%
50-100 kms	16.0%	12.50%
More than 100 kms	6.0%	6.25%
Do not know	2.0%	2.08%

4.0 RECOMMENDATIONS AND CONCLUSION

Note: The recommendations have already been provided in draft form to the CEO of NQ Dry Tropics for comment. Further discussions will be needed to decide on how best to implement the recommended strategies. This preliminary analysis of the first round of data within the NQ Dry Tropics area revealed no 'unexpected findings' that run contrary to previous studies as outlined in our 2016 literature review (Eagle, Hay, & Farr, 2016) and we have therefore cross referenced to specific sections of that report if additional information is required, adding in additional references where relevant. The responses from both cane growers and graziers indicate that there is a reluctance to accept that their actions impact negatively on the water quality of the Great Barrier Reef. Survey results show that cane growers were reluctant to accept that nutrient loss from their property also has an impact on water quality in local streams, rivers and waterways. Graziers, however, were more critical about their activities and role that sediment plays in reducing water quality. Both groups, for each sector, have a tendency to shift blame to the other sector, and to see issues of water quality as due to residential or industrial activity as well as due to weather patterns and climate change.

Drawing on the climate change adaptation literature, there is growing recognition of the need to reconsider the strategies for encouraging wider uptake of BMP and recognition of a need for more than incremental (small to moderate) changes to existing practice and a refocusing on more significant changes to practices (Dowd et al., 2014). We note that similar challenges exist in other parts of the world such as the EU (McGonigle et al., 2012). The recommendations that follow outline strategies that can be used to fine-tune existing landholder interactions.

Land Manager Profiles - Key Factors

- 21% of cane growers and 36% of graziers have completed a university degree while 34% of cane growers and 21% of graziers completed year 10 high school
- The majority of respondents are either married or in de-factor relationships
- 24% of cane growers have Italian cultural heritage
- 80% of cane growers own their properties and 84% of graziers selected that they own or own & manage the property
- 69% of graziers say that grazing activities are the most important use of land to the financial viability of their property and they are enjoying grazing
- 72% of cane growers indicate that growing sugarcane is the most important use of land to the financial viability of their farm and 52% were enjoying cane growing

Mature profile – older than overall population

More than 63% of cane growers and 54% of graziers who answered the survey were aged between 45 and 64 years of age. The median age of cane growers and graziers is 52 years which is significantly greater than the median age of the Australian population (37 years) (Australian Bureau of Statistics, 2016).

Lengthy land management experience

The majority of cane growers (80%) and graziers (84%) either own or own and manage their properties. Respondents have considerable land management experience (average of 18.9 years for graziers and 20.9 years for cane growers), often following earlier generations onto

properties: *maintaining traditions and heritage* are important (over 50% of cane growers and graziers indicated this to be of the highest importance).

Decisions are not made in isolation – influence of family / extended family

Forty one percent of cane growers and 66% of graziers share their decisions with family or extended family. Graziers consult solely with spouses (32%) or with both their spouse and their children (25%), while cane growers prefer to share the decision with their brothers (22%), parents (22%) and children (22%).

Positive about overall quality of life

Approximately 62% of cane growers and 67% of graziers were either very satisfied or satisfied with their overall quality of life. The majority of both growers and graziers (over 90%) had no significant plans to change future practices.

Blame shifting

Sixty one percent of cane growers and 30% of graziers do not believe their farming practice adversely impacts water quality in local streams, rivers, and waterways. Sixty-six percent of cane growers and 39% of graziers do not believe that cane/grazing industry plays a significant role in the declining health of the GBR. Six percent of cane growers believe that overgrazing, cattle country, and run-off from grazing are the main reasons for poor water quality in local streams, rivers, and waterways while 3% of graziers blame the cane industry and poor cane farming practices for water quality in waterways. Similarly, just over 15% of cane growers believe that producing cattle, use of hormones in cattle production, and overgrazing causing sediment run-off are the top pressures on the health of the GBR. Two percent of graziers blame cane growers and farmers near the coast for declining health of the reef.

Selling the Science

As 61% of cane growers do not accept that their farming practices negatively impact water quality, there is a clear need to engage them in discussions on this issue and to 'prove' cause and effect in ways that will lead to engagement. This will require liaison with environmental science specialists to help 'sell the science' AND to offer practical and affordable behavioural practice advice, both in face-to-face and via meetings and workshops.

Extension Officers

Note: On the basis of discussions with stakeholders re the material below, the research team was asked to submit a paper for the 2017 International Conference of the Australasia-Pacific Extension Network (APEN) conference. This paper has been accepted and discussion will take place at the conference regarding appropriate strategies and tactics. A more extensive set of recommendations in the form of a full academic paper for submission to an appropriate journal will then be developed. The key role of extension officers in interactions with Australian and managers has been recognised (see, for example, Ampt, Cross, Ross, & Howie, 2015; Vanclay, 2004). The challenge now is to support officers at a regional level in their interactions, particularly in difficult relationships with land managers who hold entrenched views regarding the best practice for managing their own land, which also may be more difficult when there is a considerable difference between the land manager and extension officer ages. Land managers believe their expertise and opinions are not valued and their 'farmer voices' are not being heard, leading to scepticism regarding the need to change practice. Practice change

requires building a level of trust that is needed for positive long-term relationships (see Eagle et al., 2016 Section 1.3).

We note that the role of agricultural extension officers has altered over time, often as the result of major policy and funding changes and note that there are calls for major professional development strategies to help these key individuals facilitate innovation and significant practice change (Ampt, Cross, Ross, & Howie, 2015), with possible implications for on-going professional training. We now outline possible ways in which their role can be supported and strengthened. Recommendations for an increased focus on the role of extension officers are not new, and are consistent across countries, including Australia (see, for example, Di Bella, O'Brien, Nash, & Wegscheidl, 2015; Hunt, Birch, Vanclay, & Coutts, 2014; Wegscheidl, Trendell, & Coutts, 2015), The USA (Warner, 2014; Warner, Stubbs, Murphrey, & Huynh, 2016) and Greece (Koutsouris, 2014). An American approach is noteworthy because of the recommendations that extension officers be given professional development training in social marketing techniques, particularly in the use of message framing and message tailoring techniques. The outcomes of this strategy are claimed to increase positive behaviour change but also the job satisfaction of extension officers together with their confidence in their ability to continue to influence behaviour change (Warner, 2014; Warner, Stubbs, Murphrey, & Huynh, 2016). It is noted that communications training improves active engagement particularly where there is added complexity caused by controversial topics such as the impact of climate change (Diehl et al., 2015).

Support for Innovators / Positive Deviants

Support for those land managers who have changed practice but who are seen by their peers as 'going against the norm' (described in the literature as 'positive deviants' (Pant & Hambly Odame, 2009) needs to be considered given the strength of comments from both cane growers and graziers. Survey comments indicate that "*farmers I respect*" (i.e. strong social norms as part of farmer identity) is a stronger influence than wider community factors, and that sharing new ideas is important (see the discussion of diffusion of innovation in Section 2.1 of Eagle et al., 2016, particularly the issues of compatibility, trialability and observability). 'Positive deviants' experiencing success are meeting their personal goals and expected outcomes of a particular practice. Meeting personal goals and expected outcomes are beliefs that are highlighted as important in the survey responses. Perceived control was also highlighted as important. Therefore, efforts to promote best management practice clearly and convincingly should demonstrate the ecological benefits, such as improving environment and enhancing land managers ability to participate in ecological conservation activities to meet the perceived control behaviour. This suggests opportunities for extension officers to facilitate group 'social learning' with land managers, to share ideas and to learn from and support each other (Hermans, Klerkx, & Roep, 2015) as part of strategies for '*persuasion by discussion*' (Scott, 2012, p. 64) and collective action (Blackstock, Ingram, Burton, Brown, & Slee, 2010).

Integrated marketing communication

There are a range of competing and conflicting messages received by land managers, including largely negative media coverage of issues relating to the health of the Great Barrier Reef, and messages from mills and farm supply merchants. We note that information overload appears to be an irritating factor for some land managers and recommend that a system be set up to monitor information from all sources and to combat messages that run counter to the desired core messages re BMP. There is a need for consistent messages to be sent,

irrespective of the source with key informants being involved in message design and delivery where possible. Ideally this would be as part of an integrated communications strategy (Dahl, Eagle, & Low, 2015), using a combination of both traditional and digital media (Batra & Keller, 2016; Keller, 2016) that encompasses federal, state and local-originated material and encompasses all forms of communication, whether print, electronic or face-to-face advice as part of this integration. We note, however, that there is widespread distrust of government-originated information, therefore the source of information must be considered, along with the readability issues identified in our earlier report (Hay & Eagle, 2016) and also the communication channels preferred by land managers.

Proactive plans should be developed for combating or at least minimising the effects of competing and conflicting messages including negative media coverage (see Eagle et al., 2016, Section 2.7). We have reviewed media coverage of the Great Barrier Reef during 2016 (excluding tourism-related coverage). The findings are summarised in Table 80 and indicate that the media presents a sensationalised and, at times, hostile perspective on reef-related issues.

Table 80: Great Barrier Reef 2016 Media coverage examples

Category	Example
Climate change / Global Warming / Ocean Acidification (23 articles)	Ritter, D. (2016). Great Barrier Reef: why are government and business perpetuating the big lie? <i>The Guardian</i> , November 1.
Coral bleaching (42 articles)	Brissenden, M. (2016). Two-thirds of the northern Great Barrier Reef wiped out. <i>ABC Radio</i> , 29 November.
Reef is Dead / Dying (21 articles)	Marshall, P. & Smith, A. (2016). Outside magazine Great Barrier Reef wiped out. ing the big lie <i>The Australian</i> , 4 November.
“Peter Ridd controversy” (10 articles)	Micheal, P. (2016). Great Barrier Reef threat overstated, says Queensland professor. <i>Courier Mail</i> , May 19.
UNESCO potential ‘at risk’ listing (16 articles)	Day, J., Grech, A. & Brodie, J. (2016). Great Barrier Reef needs far more help than Australia claims in its latest report to UNESCO. <i>The Conversation</i> , 6 December.
Water quality improvement (4 articles)	Smail, S. (2016). Great Barrier Reef water quality improved by wetlands restoration, scientist says. <i>ABC News</i> , 14 June.
Funding increase calls (17 articles)	Michael, P., Viellaris, R. (2016). Great Barrier Reef Marine Park authority ‘starved of funds’. <i>Courier Mail</i> , 7 November.
Cane monitoring compliance measures (4 articles)	Anon. (2016). Queensland to enforce Great Barrier Reef protection methods with cane farmers. <i>Envirotech-online.com</i> , April 1.
Farmer protests at negative portrayal (4 articles)	McKillop, C. (2016). Great Barrier Reef debate leaves farmers frustrated over their negative portrayal on water quality improvements. <i>ABC Rural</i> , 29 June.
Government actions re reducing run-off (5 articles)	Gregory, K. (2016). Great Barrier Reef: Qld Government’s cattle station purchase ‘makes agriculture sector scapegoat’. <i>ABC News</i> , 23 June
Reef Report Card (5 articles)	Smail, S. (2016). Barrier Reef Reef: Report card reveals pollution levels too high. <i>ABC News</i> , 20 October.
Plastic bags (14 articles)	Aust Assoc Press (2016). Qld government seeks plastic bag ban reactions. November 25.
Coal mines (22 articles)	Knaus, C. (2016). Minister defends coal industry after call to ban new mines to save reef. <i>The Guardian</i> , 25 November.
Shipping	Whigham, N. (2016). Research shows the devastation of a potential coal spill on Great Barrier Reef. <i>News.com</i> , May 17.

Social media strategies

There are some who propose the “cyber extension” model, where the bulk of communications are electronic. This is a concept that has evolved from developing countries (Burman et al., 2013) but we recommend that this be viewed with some caution and that digital media communication be considered as part of a wider integrated communication strategy rather than replacing existing strategies. A strategy for the inclusion of strategic uses of social media may have several benefits. It may help to reach individuals who are hard to reach via conventional media (Quinton, 2013) or who resist face to face contact. It can be a low cost and fast way of distributing information (White, Meyers, Doerfert, & Irlbeck, 2014). However, we note that while there are claims that people ‘are swarming to social media’ (Heller Baird & Parasnis, 2011, p. 31), internet use varies widely, including across the agricultural sector, with both insufficient / inadequate Internet connections and information overload being significant barriers (Jespersen et al., 2014).

There is a need to separate email (the most commonly used digital medium) from other electronic platforms AND to ensure that the platforms used are those that land managers can access and prefer to use, for example smart phone technology, tablets and laptops (Hay & Pearce, 2014, p. 322). In a recent study, land managers surveyed about the technology they use, identified that 87% were using smart/mobile phones, 86% were using laptops, 72% were using a tablet and another 72% were using a home PC (Hay, 2017). While having access to technology does allow communication with land managers via social media, we must keep in mind that 20% of the population of developing countries have literacy problems and a further 20% have limited literacy (see Hay & Eagle, 2016, p. 2). Therefore, we must ensure that the platform used is appropriate and that the content is written at a level suitable to the audience. In addition, not all land managers have access to social communication platforms. Seventy three percent of respondents to a Regional Access Survey stated that they did not have reliable mobile coverage, 74% of mobile broadband users had download speeds of less than 5Mbps and that they had limited data (88% stated that current data did not meet their needs) (BIRRR Regional Internet Access Survey, 2016). Those connected to the Sky Muster nbn™ in some cases are experiencing even less connectivity (BIRRR Skymuster Survey Results, 2017). Overall message fatigue needs to be recognised as an additional barrier as it leads to both message avoidance and resistance irrespective of the media channel used (So, Kim, & Cohen, 2016). Where social media strategies are included, communication will be interactive, with participants generating content and no one individual or organisation being able to control the exchange of information (Dijkmans, Kerkhof, & Beukeboom, 2015). Further, organisations such as NRMs need to resource social media activity due to its proactive direct relationship between participants rather than the passive nature of one-way information distribution via more traditional media channels (Aula, 2010).

An additional factor to consider is the use of visual imagery. While visual imagery may at first gain attention and interest, it can also help those who struggle to understand the text-based information or other concepts (Dowse, 2004). It can also make specific elements of the communication stand out (Altinay, 2015). Where the topic has a high involvement for the farmer, the image becomes a central route to persuasion and may influence decisions. Likewise when there is low involvement with the topic, imagery allows for low or non-conscious information processing, which may change an attitude toward the message or a non-conscious belief, leading to behavioural and/or attitude change (Petty & Cacioppo, 1984). Therefore it is important that visual imagery is relevant and reflects the topic being presented. In addition,

local imagery is more effective when gaining acceptance or when there is a need for local action. Further investigation of current imagery will be completed in the upcoming NESP Project 3.1.3.

Customer relationship management plans

The application of Customer Relationship Management (CRM) principles in agriculture is relatively new but it is acknowledged that “a farmer’s commitment to their advisor will remain strong if they have frequent meaningful interaction over a long period of time, high perceptions of equity and value, trust and confidence” (Kuehne, Nettle, & Llellyn, 2015, p. 1). Therefore, CRM may be of use, in conjunction with the use of social network analysis, typologies and other strategies outlined in this document. Additionally, the principles of business-to-business marketing may be useful in recognizing long decision-making cycles, complex decision making units and the importance of reference groups (Brennan, Canning, & McDowell, 2014)

Social network analysis

Given the evidence that decisions are generally not made by one single individual and that the views of ‘farmers I respect’ are important, we believe that there is value in considering the use of Social Network Analysis (SNA). A set of techniques used to analyse the social and informational contacts between individuals with graphical representation (‘sociograms’) that use dots or circles to represent individuals and lines to represent connections between them (Dempwolf & Lyles, 2012), as the following example of the connections between a group of 24 individuals illustrates.

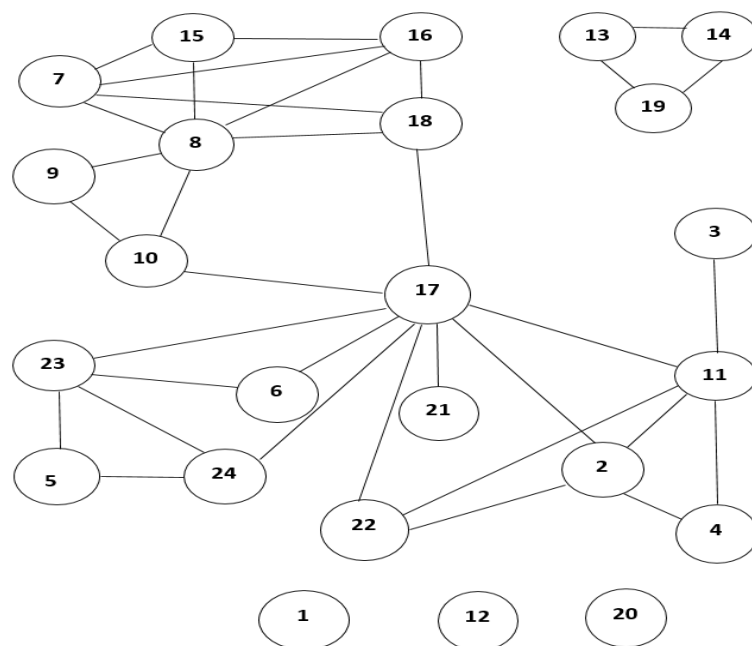


Figure 2: Social network Analysis Example: ‘Sociogram’ of 24 people (Scott, 2012, p. 29 reproduced from Moreno, 1934, p. 145)

The sociogram in Figure 2 shows that there are three individuals who are not connected to any others (individuals 1, 12 and 20), three that are connected only to two other people (individuals 13, 14 and 19), while all other individuals are connected to a wider group. Within this ‘connected’ group, individual 17 is an example of someone with multiple connections and who

should be examined to determine their actual or potential role as an information gatekeepers or opinion leaders and also what role they may play in decision making among those other individuals with whom they are connected. These people may be valuable in helping to 'sell the science', particularly through information sharing and facilitating actual demonstrations of practice change.

The value of SNA in the agri-environment context will lie in analysing the flow of information and discussions, and in particular in identifying the extent of influence of key information gatekeepers and opinion leaders who may have either power or influence over the adoption of innovations. It overcomes the limitations of analysis based only on geographic proximity by analysing social relationships that may be based on kinship or other factors. Advanced analysis can identify the strength of ties or connections between individuals (Prell, Hubacek, & Reed, 2009), as the impact of these two types of ties are different as shown in Table 81 below, with both positive and negative implications.

Table 81: Network concepts relevant for natural resource management (adapted from Prell, Hubacek, & Reed, 2009, p. 505) + indicates positive effect, - indicates negative effect

<i>Network concept</i>	<i>Effect on resource management</i>
Strong ties	
+	Good for communicating about and working with complex information
+	Hold and maintain trust between actors
+	Actors more likely to influence one another's thoughts, views, and behaviours
+	Encourage creation and maintenance of norms of trust and reciprocity
-	Encourage the likelihood that actors sharing strong tie hold redundant information
-	Actors less likely to be exposed to new ideas and thus may be less innovative
-	Can constrain actors
Weak ties	
+	Tend to bridge across diverse actors and groups
+	Connect otherwise disconnected segments of the network together
+	Good for communicating about and working with simple tasks
+	New information tends to flow through these ties
-	Not ideal for complex tasks=information
-	Actors sharing weak ties are less likely to trust one another
-	Can break more easily

It may therefore be useful to attempt to map out social networks for land managers where there is the potential for identifiable individuals to play a key role, positive or negative, in information dissemination. It may also be useful for extension officers to map networks for the land managers with whom they interact and to also consider their own roles within these networks.

The ability of an individual (also called 'actors' in recent academic literature) or an organization to disseminate or manipulate knowledge depends on how many other individuals look to them as a credible source of information and knowledge (Muñoz-Erickson & Cutts, 2016).

Early adopters have larger numbers of social contacts and influence the rate of adoption because of their role in those networks (Dowd et al., 2014). However ideas will only be taken up if there is a favourable attitude towards them, which occurs when "others who he or she have cause to trust are considering it or have already adopted it" (Scott, 2012, p. 69). Thus these key people may act as a significant barrier to uptake of innovations (see the discussion of diffusion of innovation in Section 2.1 of the literature review).

It is related to other concepts such as social capital (see Eagle et al., 2016, Section 4.1.3) and to the concepts of networks or communities of practice which evolved from the education sector. Communities of practice are defined as "groups of people who share a common pursuit, activity or concern. Members do not necessarily work together, but form a common identity and understanding through their common interests and interactions" (Oreszczyn, Lane, & Carr, 2010, p. 405). These authors suggest that networks of practice have weaker ties between members and may be linked by shared practice.

Typologies

The diversity of farmers and farming practice is acknowledged, but it is useful to consider the role of typologies in developing resources to aid extension officers in their interactions with land managers through the identification of the range decision-making drivers and the types of land managers who are motivated by similar drivers (Graymore, Schwarz, & Brownell, 2015). Shrapnel and Davie (2001) used semi structure interviews to discover the dominant personality styles of cattle and crop producers in Queensland. Five dominant personality styles emerged which may be used to direct learning (Table 82).

For example the "vigilant personality" values autonomy, therefore may prefer a one on one approach to information gathering. Whereas the "solitary personality" feels comfortable alone, and prefers not to deal with people at all, therefore may suit an online learning environment or learning from trade magazines or television. The "serious personality" is not outgoing and does not like to be told things and would value information sharing in educated groups, and by contrast, the "sensitive personality" is cautious when in groups, and is stressed by unfamiliar surrounds, therefore would learn better in small groups of familiar people for example extension staff (Shrapnel & Davie, 2001). Recognising cattle producers as having unique personality traits is a large step towards shared understanding.

Table 82: Characteristics of the dominant personality Styles (reproduced from Shrapnel and Davie, 2001)

Personality Style				
<i>Vigilant</i>	<i>Conscientious</i>	<i>Solitary</i>	<i>Serious</i>	<i>Sensitive</i>
Autonomy	Hard Work	Solitude	Cogitates	Needs Familiarity
Caution	Does the right thing	Stoicism	Keeps a straight face	Circumspect
Perceptiveness	Order and detail	Sexual composure	Dislikes pretensions	Likes a structured role
Self defence	Prudence	Sangfroid	Predictable	Reserved
Fidelity	Perseverance	Grounded	Accountable	Very private
Alertness to criticism	Perfectionist Accumulator	Independence	Contrite Insightful	Concerned about other regards

A summary of our key recommendations are given below:

- There is a need to 'sell the science' to gain acceptance of the cause-effect relationship between farming practice and water quality. NRM groups should work with environmental science specialists to change views on the impact of farming practice on water quality.
- There is a potential to extend the key role of extension officers in potentially influencing increased uptake of BMP practices. There is a need to recognise the key role of extension officers and determine what professional development support might be beneficial in continuing to build trust and engagement with land managers.
- It is crucial to support innovation by celebrating success and sharing ideas. Land managers should see their expertise is valued and their voices heard.
- Facilitating sharing of ideas and practices.
- Building on the role of farms whose views are respected as information gatekeepers / disseminators / role models.
- A need to ensure all communication, by whatever means, sends consistent messages irrespective of source, and channelling communication through trusted sources. Developing strategies for minimising the impact of competing and conflicting messages.
- Ensuring that all persuasive communications are integrated in terms of key messages.
- Monitor media coverage and respond to inaccurate messages and develop proactive media relationships.
- Incorporating social media strategies as part of an integrated communication strategy that centres on the information channels and platforms used and preferred by land managers. Review communication strategies, adding social media where appropriate, recognising that this is likely to be most popular with younger land managers. Need to recognise the overall diversity of information sources and preferences.
- Incorporate long-term relationship management strategies based on customer relationship management and business to business marketing concepts.

- Utilise Social Network Analysis to identify:
 - key information gatekeepers / opinion leaders who may help or hinder information dissemination and innovation uptake, and recognise social relationships based on cultural / kinship factors.
 - where individual extension officers may fit into various networks
- Recognise land manager diversity but use typology principles to develop material and communication approaches to support extension officers in their interactions with specific subsets of land managers.

The analysis of data presented in this report is primarily descriptive. The results of full structural equation based analysis will be provided in the next reporting period, with findings linked back to the literature and the implications for future water quality improvement practices will be discussed.

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APPENDIX 1: LETTER EMAILED TO PARTICIPANTS IN THE BURDEKIN REGION

Subject: Have your say in JCU research - chance to win a drone

To:

Dear Sir/Madam,

NQ Dry Tropics and a team from James Cook University are working together to evaluate the training programmes, extension activities and grants/tenders that the government uses when trying to support land managers to control erosion and reduce nitrogen use. I'd like to invite you to have your say on the design of future programmes. In particular, we want to know what's important to you when you make land management decisions. This information will be used to improve future programmes, making them more relevant to you and your needs.

The survey will be conducted in 2016 and then repeated in 2017 and 2018. The survey will collect data from cane farmers in the Burdekin and the Wet Tropics. You can complete the survey online at the following link:

[NESP Water Quality Cane Growers Survey](#)

Please find a factsheet enclosed, which provides some more information about our study. We have also included a copy of the questionnaire, so you can see the questions that the team will be asking.

I would like to personally assure you that the information that is collected will be kept strictly confidential and anonymous. Your information will be combined with others in reports and papers to give general information, such as, "one-quarter of graziers thought that activity X was not useful". Your name will never be linked to any of that information nor will you be identifiable from your answers. Furthermore, the data will only be accessible to the research team.

What next?

One of our team members will contact you by telephone within the next week to see if you are willing to help with the survey. If you are agreeable, we will arrange a time to interview you over the telephone.

Or

You can complete the survey online at the following link:

NESP Water Quality Cane Growers Survey

How much time is involved?

Saying 'yes' would involve you spending up to forty-five minutes (total) in the first year, either with a person on the phone or completing the survey online. We will contact you again in 2017 and 2018 with a much shorter survey. Participation is entirely voluntary and you can stop taking part in the study at any time without explanation. However, we would be very grateful for your input and the opportunity to learn from your experiences.

We know that your time is valuable. In recognition of this, everyone who participates in the survey will go into a draw for a major prize.

If you have any questions about the survey, please contact Carlie Rocco at NQ Dry Tropics on 07 4722 5771 or via email at carlie.rocco@nqdrytropics.com.au or Lynne Eagle at JCU on 07 4781 5717 or via email at lynne.eagle@jcu.edu.au.

Kindest regards,

Scott Crawford

Chief Executive Officer, NQ Dry Tropics

Second letter emailed to land managers in the Burdekin region

Reminder: Have your say in JCU research - chance to win a drone

Hi there!

Last week you received a letter/email from NQ Dry Tropics asking you to assist by completing a survey about what training programmes, extension activities and grants or tenders you have been involved in to control sediment run-off. We also want hear about what you are doing if you are not involved in any programmes, activities or tenders.

We would love it if you could tell us your opinion about what works/ doesn't work for you by completing the survey online at the following link:

Grazier Survey Link: [NESP Water Quality Grazier Survey](#)

One of our researchers will follow up with a phone call next week to see if we can help you to complete the survey. There is also more information attached to this email.

Finally, by completing the survey you will be included in the prize draw for a drone or cash or travel vouchers valued at \$1500.

Thank you for telling us your story!

James Cook University/NQ Dry Tropics

APPENDIX 2: INFORMATION SHEET FOR THE BURDEKIN REGION



Project 2.1.3 Harnessing the science of social marketing and behaviour change for improved water quality in the GBR: an action research project

What is the problem?

To improve the quality of water entering the Great Barrier Reef, land managers need to adopt best practice. The programmes that have been available in the past targeted land managers who were already using best management practice. Some programmes assumed that land managers are driven by profit, but we know this is not the case. We need programmes that understand land managers that will work with them to support positive change.

How will research address the problem?

We would like to know "what works, for whom, in what circumstances and for how long". So this project will (a) look at previous research on marketing and engagement strategies that inspire practice change; (b) talk to local cane farmers and graziers about what works for them, and (c) work with government and other delivery agents to implement changes so future programmes can be improved and better tailored land managers' needs.

What will the research involve?

We are collecting data from cane farmers and graziers in the Burdekin Dry Tropics and Wet Tropics, regardless of whether they have chosen to engage with best management practice programmes in the past.



Photo: NQ Dry Tropics

Burdekin cane farmer

We'll be asking:

- What motivates you, your goals and your aspirations;
- Your opinion of various government best management practice programmes; and
- What activities are undertaken on the property that relate to the use of nutrients and control of sediment.

How will the research be used?

The information collected will be kept strictly confidential and anonymous. We will use the data to assess the extent that on-farm activities are impacted when land managers are engaged in best management practice programmes. We'll also examine how goals and aspirations differ between different groups and land managers, which will help government and other organisations to optimise strategies and programmes in the future. By repeating the survey in 2017 and 2018, we can accurately assess how attitudes and practices are changing over time, and whether changes to engagement strategies are working to achieve better results for graziers and cane farmers. *Please help us now so we can help you in the future.*

Further information

Professor Lynne Eagle – JCU
T: 07 4781 5717
E: lynne.Eagle@jcu.edu.au

Dr Marina Farr – JCU
T: 07 4781 5014
E: marina.farr@jcu.edu.au

Rachel Hay – JCU
T: 07 4781 3131
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Carlie Rocco – NQ-Dry Tropics
T: 07 4722 5771
E: carlie.rocco@nqdrytropics.com.au



This project is supported through funding from the Australian Government's National Environmental Science Programme

APPENDIX 3: LETTER OF SUPPORT BURDEKIN REGION

20 October 2016



Dear Sir/Madam

NQ Dry Tropics and a team from James Cook University are working together to evaluate the training programmes, extension activities and grants/tenders that the government uses when trying to support land managers to control erosion and reduce nitrogen use. I'd like to invite you to have your say on the design of future programmes. In particular, we want to know what's important to you when you make land management decisions. This information will be used to improve future programmes, making them more relevant to you and your needs.

The survey will be conducted in 2016 and then repeated in 2017 and 2018. The survey will collect data from cane farmers and graziers in the Burdekin and the Wet Tropics.

Please find a factsheet enclosed, which provides some more information about our study. We have also included a copy of the questionnaire, so you can see the questions that the team will be asking.

I would like to personally assure you that the information that is collected will be kept strictly confidential and anonymous. Your information will be combined with others in reports and papers to give general information, such as, *"one-quarter of graziers thought that activity X was not useful"*. ***Your name will never be linked to any of that information nor will you be identifiable from your answers. Furthermore, the data will only be accessible to the research team.***

What next?

One of our team members will contact you by telephone within the next week to see if you are willing to help with the survey. If you are agreeable, we will arrange a time to interview you over the telephone.

Or

You can complete the survey online at the following links

Sugar Cane Land Manager Survey Link: [NESP Water Quality Cane Growers Survey](#)

Grazier Survey Link: [NESP Water Quality Grazier Survey](#)

How much time is involved?

Saying 'yes' would involve you spending up to forty-five minutes (total) in the first year, either with a person on the phone or completing the survey online. We will contact you again in 2017 and 2018 with a much shorter survey. Participation is entirely voluntary and you can stop taking part in the study at any time without explanation. However, we would be very grateful for your input and the opportunity to learn from your experiences.

We know that your time is valuable. In recognition of this, everyone who participates in the survey will go into a draw for a major prize.

If you have any questions about the survey, please contact Carlie Rocco at NQ Dry Tropics on 07 4722 5771 or via email at carlie.rocco@nqdrytropics.com.au or Lynne Eagle at JCU on 07 4781 5717 or via email at lynne.eagle@jcu.edu.au.

Kindest regards,

A handwritten signature in black ink, appearing to be 'SCC', with a long horizontal line extending to the right.

Scott Crawford
Chief Executive Officer
NQ Dry Tropics

APPENDIX 4: CANE GROWER SURVEY

Cane Grower survey

First, some background information about you and your property – Cane growers

1. Who makes decisions relating to land-management and farming on your property, or if you own more than one, your main property?

☐ Entirely my decision (i.e. individual) ☐ Majority of decision is mine ☐ Joint/Shared decision

If joint/shared decision, could you please tell us who is involved? (Please tick)

☐ Spouse ☐ Parents ☐ Children ☐ Brother ☐ In-laws ☐ Other (please specify) _____

2. Do you own or manage other properties? (Please tick) ☐ Yes ☐ No

If yes, please tell us where they are, and what the land is (mostly) used for

Location (e.g. nearest town)	Approximate area		Main land-use (e.g. cane, grazing, sugar, horticulture)	
	Ha	Ac	Ha	Ac

3. Do you (or your spouse, if relevant) have an off-farm 'job'? (Please tick)

You	Your spouse
☐ No	☐ No
☐ Yes, I work less than 20 hours per week off-farm	☐ Yes, she/he works less than 20 hours per week off-farm
☐ Yes, I work more than 20 hours per week off-farm	☐ Yes, she/he works more than 20 hours per week off-farm

4. How many people live on your main farm/property? _____

5. Do you manage or own/lease/share main farm/property or both? (Please tick)

☐ Manage only ☐ Own/lease/share only ☐ Manage/own/lease/share

If own/leased/shared, approximately what percent of the property is

owned _____%, leased _____% or shared _____%

6. How many years have you owned/managed your main property? _____

7. Please provide us with some background information about land-use on your main property

Land use (e.g. grazing, sugar, bananas, rice)	Approximate area used for this (e.g. 10ha for sugar)	
	Ha	Ac

Which of those land-uses is most important to the financial viability of your property? (if off-farm income is most important, please write 'off farm') _____

Which of those land-uses do you ENJOY doing the most (again, if off-farm activities are the most enjoyable, write 'off farm') _____

8. Are there any other properties on which you would like to comment? _____

9. On average, is the revenue from the last year better, worse or the same as previous years? (Please tick)

☐ This year's revenue is better than previous years ☐ This year's revenue is worse than previous years
☐ This year's revenue is about the same as previous years

Cane Grower survey

Background on what 'drives' you and about your overall sense of well-being

10. Please think about your own personal goals and aspirations for your farm/property. What are the two most important things you hope to achieve (your goals) for your farm / property?

1) _____ (2) _____

11. How important are each of the following to you, when making decisions about what to do on your farm / property

									Do not know
	Extremely unimportant (irrelevant)			Neutral	Extremely important (essential)				
Maintaining physical and mental health of family	☐	☐	☐	☐	☐	☐	☐	☐	
Maintaining family traditions and heritage	☐	☐	☐	☐	☐	☐	☐	☐	
Spending face-to-face time with family and friends	☐	☐	☐	☐	☐	☐	☐	☐	
Keeping in contact with family and friends in other ways (e.g. via phone, through social media)	☐	☐	☐	☐	☐	☐	☐	☐	
Maintaining good relations with other farmers/graziers in the local area	☐	☐	☐	☐	☐	☐	☐	☐	
Keeping farm costs low	☐	☐	☐	☐	☐	☐	☐	☐	
Keeping a stable (steady) cash-flow	☐	☐	☐	☐	☐	☐	☐	☐	
Maximising farm profits (income minus costs)	☐	☐	☐	☐	☐	☐	☐	☐	
Minimising risk (of very high costs or very low income)	☐	☐	☐	☐	☐	☐	☐	☐	
Servicing debt	☐	☐	☐	☐	☐	☐	☐	☐	
Having time to pursue hobbies	☐	☐	☐	☐	☐	☐	☐	☐	
Being able to make your own decisions about your farm/property	☐	☐	☐	☐	☐	☐	☐	☐	
Learning about and testing new ways of doing things on your farm/property	☐	☐	☐	☐	☐	☐	☐	☐	
Sharing new ideas with others	☐	☐	☐	☐	☐	☐	☐	☐	
Having efforts recognised by the wider community	☐	☐	☐	☐	☐	☐	☐	☐	
Leaving the land/farm in better condition than it was when you first started managing it	☐	☐	☐	☐	☐	☐	☐	☐	
Maintaining/improving water supplies and storages	☐	☐	☐	☐	☐	☐	☐	☐	
Minimising sediment run-off and/or nutrient losses	☐	☐	☐	☐	☐	☐	☐	☐	
Helping to safeguard native plants and animals	☐	☐	☐	☐	☐	☐	☐	☐	
Helping to safeguard local waterways	☐	☐	☐	☐	☐	☐	☐	☐	
Helping to safeguard the Great Barrier Reef	☐	☐	☐	☐	☐	☐	☐	☐	

12. Please think about your own life and personal circumstances (yes, this is a 'big' question ☺). How satisfied are you with your quality of life as a whole? (Please circle a number)



0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
 Very unsatisfied Unsatisfied Neutral Satisfied Very satisfied

13. Why do you feel this way?

Cane Grower survey

Attitudes towards programs that are designed to help you manage your land

14. **GRANTS & FINANCIAL ASSISTANCE.** There are many different ways/places you can apply for grants and /or financial assistance to do things on your property (e.g. Reef Rescue, Reef Program, Reef Trust, Drought assistance (cheap electricity)). Please tell us about the grants you have applied for by answering the following questions (if you have applied for more than 3, just tell us about the most recent applications).

Please tick if you have applied for more than 3 grants in the last 5 years ☐ yes

Name of grant/financial assistance program that you applied for...	Year you applied	How did you find out about it? (e.g. friend, google, extension officer)	Was your application successful? (tick if yes)	What was the most important thing you hoped to achieve with this grant?	How useful was the grant in helping you achieve that aim?
					 Complete waste of time Neutral Extremely useful
			☐		☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
			☐		☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
			☐		☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

15. **WORKSHOPS, TRAINING PROGRAMS (including on-line and face-to face) or other support and activities (such as field-days, and on-farm demonstrations).** Please tell us about various workshops/training programs or other support and activities you have participated in (or led) which have been focused on land-management issues over the last 5 years (6 Easy Steps, Smart Cane BMP or other such as produce boards e.g. Herbert Cane Productivity Services / Burdekin Productivity Services). If more than 5, just tell us about the most recent ones.

Please tick if you have participated in more than 5 during the last 5 years ☐ yes

Name of workshop/training program /activity	Year	How did you find out about it? (e.g. friend, google, extension officer)	What was the most important thing you hoped to achieve by doing this?	How useful was the training in helping you achieve that aim?
				 Complete waste of time Neutral Extremely useful
				☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
				☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
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				☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
				☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Which of these workshops or training programs was the most useful and why?

16. What could be done to make grants, training programs, workshops and/or extension activities work better for you (i.e. to help you meet your own personal goals)

What extension support or training would you like in the future to help you make farm improvements?

Cane Grower survey

Irrigation Practices – Cane growers**SKIP QUESTION IF NO IRRIGATED CROPS**

17. Roughly, how much irrigated water do you use per hectare (acre) for your crops (e.g. ML per acre) each year?

_____ ML per hectare per year _____ ML per acre per year

18. How much irrigation water do you estimate runs off the block? (Please tick) **SKIP QUESTION IF NO**

IRRIGATED CROPS

- ☐ 0-25% ☐ 50-75%
☐ 25-50% ☐ 75-100%

19. What irrigation scheduling tools do you use? (Please tick all that apply)

- ☐ None ☐ Mini pans
☐ Soil moisture probes such as tensiometers and capacitance probes ☐ Calculation of daily crop water use, using crop factors, class A pan, or crop model (e. g. WaterSense).

How long have you used those tools to schedule irrigation? _____ years

Do you plan to do this next year? (Please tick) ☐ Yes ☐ No

If you plan to do something different, what is it? _____

20. Think about your current tools for scheduling irrigation and tell us how much you agree or disagree with each of the statements. **SKIP IF NO IRRIGATED CROPS**

	 Strongly disagree			Neutral			 Strongly agree	Do not know/ Not sure
The farmers I respect most do this	☐	☐	☐	☐	☐	☐	☐	☐
Most farmers in this region would not have the technical knowledge to do this	☐	☐	☐	☐	☐	☐	☐	☐
Most farmers in this region would not be able to afford to use this system for scheduling irrigation	☐	☐	☐	☐	☐	☐	☐	☐
Compared to other ways of scheduling irrigation, this is:								
The best way to meet my own personal goals (question 10)	☐	☐	☐	☐	☐	☐	☐	☐
The best way to maintain good cash-flow	☐	☐	☐	☐	☐	☐	☐	☐
The best way to reduce business risk	☐	☐	☐	☐	☐	☐	☐	☐
The least time-consuming (or labour intensive)	☐	☐	☐	☐	☐	☐	☐	☐
The most effective way of controlling nutrient loss from my property	☐	☐	☐	☐	☐	☐	☐	☐
I only do this because I am forced to	☐	☐	☐	☐	☐	☐	☐	☐
Who/what is forcing you? _____	☐	☐	☐	☐	☐	☐	☐	☐

Cane Grower survey

The people/organisations whose advice I follow most think I should do this ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Please tell us whose advice you follow most when scheduling irrigation (please rank by importance)

- | | |
|--|---|
| ☐ Family who are also cane farmers | ☐ Landcare |
| ☐ Other cane farmers | ☐ Researchers |
| ☐ Cane growers (the organisation) | ☐ Industry extension advisors (e.g. from |
| ☐ Regional cane association (e.g. from Kalamia, Invicta, Inkerman, Tully Sugar) | SRA [BSES], Production Boards, Productivity Services group) |
| ☐ People from NQ Dry Tropics/TERRAIN | ☐ Other extension officers. From where? _____ |
| ☐ Private Agronomists | ☐ People from government departments. Which departments? _____ |
| ☐ Other. Who? _____ | |

Calculating Fertiliser Application Rates – Cane growers

21. Roughly how much nitrogen fertiliser did you apply per hectare (acre) on your crops last year? (Please circle if measurement is in hectares or acres)

KG of nitrogen per hectare (acre) per year _____ (plant cane) _____ (ratoon cane)
 OR bags of fertiliser per hectare (acre) per year _____ (plant cane). Name of fertiliser? _____
 _____ (ratoon cane). Name of fertiliser? _____

22. How do you calculate fertiliser application rates? (Please tick all that apply)

- | | |
|--|--|
| ☐ I use industry standard rates for district yield potential, and use that amount on all parts of my farm | ☐ I use more fertiliser on high – performing (high yielding) blocks |
| ☐ I estimate amounts from my farm yield and use that amount on all parts of my farm | ☐ My advisor does this for me |
| ☐ I use more fertiliser on under-performing (low yield) blocks than on other blocks | ☐ I tailor my fertiliser rates to different parts of the property |
| | ☐ Other. Please tell us what you do _____ |

How long have you used this system to calculate fertiliser application rates?

☐ I have always done this

If you have not always done this, please tell us for how many years you have used this system _____ (years)

Do you plan to do this next year? (Please tick) ☐ Yes ☐ No

If you plan to do something different, what is it?

Cane Grower survey

23. Think about your current system for calculating fertiliser rates and tell us how much you agree or disagree with each of the statements.

	 Strongly disagree		Neutral	 Strongly agree	Do not know/ Not sure
The farmers I respect most do this	☐	☐	☐	☐	☐
Most farmers in this region would not have the technical knowledge to calculate fertiliser rates in this way	☐	☐	☐	☐	☐
Most farmers in this region would not be able to afford use this system for calculating fertiliser rates	☐	☐	☐	☐	☐
Compared to other ways of calculating fertiliser rates, this is					
The best way to meet my own personal goals (question 10)	☐	☐	☐	☐	☐
The best way to maintain good cash-flow	☐	☐	☐	☐	☐
The best way to reduce business risk	☐	☐	☐	☐	☐
The least time-consuming (or labour intensive)	☐	☐	☐	☐	☐
The most effective way of controlling nutrient loss from my property	☐	☐	☐	☐	☐
I only do this because I am forced to Who/what is forcing you? _____	☐	☐	☐	☐	☐
The people/organisations whose advice I follow most think I should do this	☐	☐	☐	☐	☐

Please tell us whose advice you follow most when it comes to calculating fertiliser application rates
(please rank by importance)

- | | |
|--|---|
| ☐ Family who are also cane farmers | ☐ Landcare |
| ☐ Other cane farmers | ☐ Researchers |
| ☐ Cane growers (the organisation) | ☐ Industry extension advisors (e.g. from SRA [BSES], Production Boards, Productivity Services group) |
| ☐ Regional cane association (e.g. from Kalamia, Invicta, Inkerman, Tully Sugar) | ☐ Other extension officers. From where? _____ |
| ☐ People from NQ Dry Tropics/TERRAIN | ☐ People from government departments. Which departments? _____ |
| ☐ Private Agronomists | |
| ☐ Other. Who? _____ | |

Cane Grower survey

Practices for handling run-off – Cane growers

24. How do you handle run-off from rainfall or irrigation? (Please tick all that apply)

- ☐ I have recycle pits
 ☐ I do not capture run-off
☐ I have recycle pits and have adequate pumping capacity to recycle the water
 ☐ Other. Please tell us what you do _____

How long have you used this system to handle run-off? _____ years

Do you plan to do this next year? (Please tick) ☐ Yes ☐ NoIf you plan to do something different, what is it?
_____25. Think about your current system for handling run-off (from rainfall and irrigation) and tell us how much you agree or disagree with each of the statements.

	 Strongly disagree  Neutral  Strongly agree Do not know/ Not sure						
The farmers I respect most do this	☐	☐	☐	☐	☐	☐	☐
Most farmers in this region would not have the technical knowledge to do this	☐	☐	☐	☐	☐	☐	☐
Most farmers in this region would not be able to afford to use this system for handling runoff	☐	☐	☐	☐	☐	☐	☐
Compared to other ways of handling run-off, this system is:							
The best way to meet my own personal goals (question 10)	☐	☐	☐	☐	☐	☐	☐
The best way to maintain good cash-flow	☐	☐	☐	☐	☐	☐	☐
The best way to reduce business risk	☐	☐	☐	☐	☐	☐	☐
The least time-consuming (or labour intensive)	☐	☐	☐	☐	☐	☐	☐
The most effective way of controlling nutrient loss from my property	☐	☐	☐	☐	☐	☐	☐
I only do this because I am forced to Who/what is forcing you? _____	☐	☐	☐	☐	☐	☐	☐
The people/organisations whose advice I follow most think I should do this	☐	☐	☐	☐	☐	☐	☐

Please tell us whose advice you follow most when it comes to handling run-off (from rainfall and irrigation) (please rank by importance)

- ☐ Family who are also cane farmers
 ☐ Landcare
☐ Other cane farmers
 ☐ Researchers
☐ Cane growers (the organisation)
 ☐ Industry extension advisors (e.g. from SRA [BSES], Production Boards, Productivity Services group)
☐ Regional cane association (e.g. from Kalamia, Invicta, Inkerman, Tully Sugar)
 ☐ Other extension officers. From where? _____
☐ People from NQ Dry Tropics/TERRAIN
 ☐ People from government departments. Which departments? _____
☐ Private Agronomists
☐ Other. Who? _____

Cane Grower survey

26. Do you use any other innovative practices to reduce nitrogen and/or runoff? (Please tick)

☐ Yes ☐ No

If so, which practices _____?

27. Please indicate if you agree or disagree with each statement below

	Strongly disagree	Neutral	Strongly agree	Do not know/ Not sure
Nutrient loss from my property has no impact on water quality in local streams, rivers & waterways	☐	☐	☐	☐
What are the top causes of poor water quality in your local streams, rivers & waterways?	1) _____ (2) _____			
Cane-growing plays almost no role in the declining health of the Great Barrier Reef	☐	☐	☐	☐
What are the top two pressures on the health of the Great Barrier Reef?	1) _____ (2) _____			

28. Roughly how many ML per hectare (acre) of water do you think most other cane growers in your region (not you personally) apply to their crops each year? **SKIP QUESTION IF NO IRRIGATED CROPS IN YOUR AREA**

_____ ML per hectare per year _____ ML per acre per year

29. Roughly how much nitrogen fertiliser per hectare (acre) do you think most other cane growers in your region (not you personally) apply to their crops each year? (Please circle if measurement is in hectares or acres)

KG of nitrogen per hectare (acre) per year _____ (plant cane) _____ (ratoon cane)

OR bags of fertiliser per hectare (acre) per year _____ (plant cane). Name of fertiliser? _____
 _____ (ratoon cane). Name of fertiliser? _____

More background information about you – Cane growers

30. What is your age group?

- ☐ 15 – 19 years ☐ 35 – 39 years ☐ 55 – 59 years ☐ 75 – 79 years
☐ 20 – 24 years ☐ 40 – 44 years ☐ 60 – 64 years ☐ 80 – 84 years
☐ 25 – 29 years ☐ 45 – 49 years ☐ 65 – 69 years ☐ 85 years and older
☐ 30 – 34 years ☐ 50 – 54 years ☐ 70 – 74 years

31. What is your gender? (Please tick) ☐ Male ☐ Female

32. What is your cultural heritage? (Please tick)

- ☐ Australian (Non-Indigenous) ☐ Aboriginal and/or Torres Strait Islander
☐ Italian ☐ Greek ☐ English ☐ Indian ☐ Other (Please specify) _____

33. Were you born in Australia? (Please tick) ☐ Yes ☐ No

34. What formal education do you have? (Please tick)

- ☐ High school (year 10) ☐ Trade / apprenticeship ☐ TAFE ☐ University
☐ High school (year 12) ☐ Agricultural college ☐ Other (please specify) _____

35. What is your marital status? (Please tick)

- ☐ Single ☐ Married or De-facto relationship ☐ Divorced ☐ Widowed

Cane Grower survey

OPTIONAL QUESTIONS – Cane growers

We know many businesses do not like providing this type of information, so will understand if you choose not to answer the following questionsIf you do, please rest assured the information WILL be kept confidential, and it will really help us understand your situation better.

36. Averaged out over good and bad years, roughly what cane yield per hectare (per acre) do you achieve on your property?

- | | | |
|--|--|---|
| ☐ 0-20 ton/ha (0-8.1 ton/ac) | ☐ 20-40 ton/ha (8.1-16.2 ton/ac) | ☐ 40-60 ton/ha (16.2-24.3 ton/ac) |
| ☐ 60-80 ton/ha (24.3-32.4 ton/ac) | ☐ 80-100 ton/ha (32.4-40.5 ton/ac) | ☐ 100-120 ton/ha (40.5-48.6ton/ac) |
| ☐ 120-140 ton/ha (48.6-56.6 ton/ac) | ☐ 140-160 ton/ha (56.6-64.7 ton/ac) | ☐ 160-180 ton/ha (64.7-72.8 ton/ac) |
| ☐ 180-200 ton/ha (72.8-80.9 ton/ac) | ☐ 200-220 ton/ha (80.9-89 ton/ac) | ☐ More than 220 ton/ha (more than 89 ton/ac) |

37. Roughly, what was the NET income earned from this property last year (after all costs and taxes were taken out)? _____

Is this before or after you have paid yourself (and other family members who help on the property) wages/salary?

- ☐ Before paying myself and family ☐ After paying myself and family

Thank you for your help!

APPENDIX 5: GRAZIER SURVEY

Grazier Survey

First, some background information about you and your property - Graziers

1. Who makes decisions relating to land-management and farming on your property, or if you own more than one, your main property?

☐ Entirely my decision (i.e. individual) ☐ Majority of decision is mine ☐ Joint/Shared decision
 If joint/shared decision, could you please tell us who is involved? (Please tick)
☐ Spouse ☐ Parents ☐ Children ☐ Brother ☐ In-laws ☐ Other (please specify) _____

2. Do you own or manage other properties? (Please tick) ☐ Yes ☐ No

If yes, please tell us where they are, and what the land is (mostly) used for

Location (e.g. nearest town)	Approximate area		Main land-use (e.g. cane, grazing, sugar, horticulture)	
	Ha	Ac	Ha	Ac

3. Do you (or your spouse, if relevant) have an off-farm 'job'? (Please tick)

You	Your spouse
☐ No	☐ No
☐ Yes, I work less than 20 hours per week off-farm	☐ Yes, she/he works less than 20 hours per week off-farm
☐ Yes, I work more than 20 hours per week off-farm	☐ Yes, she/he works more than 20 hours per week off-farm

4. How many people live on your main farm/property? _____

5. Do you manage or own/lease/share the main farm/property or both? (Please tick)

☐ Manage only ☐ Own/lease/share only ☐ Manage/own/lease/share

If own/leased/shared, approximately what percent of the property is

owned _____%, leased _____% or shared _____%

6. How many years have you owned/managed your main property? _____

7. Please provide us with some background information about land-use on your main property

Land use (e.g. grazing, sugar, bananas, rice)	Approximate area used for this (e.g. 10ha for sugar)	
	Ha	Ac

Which of those land-uses is most important to the financial viability of your property? (if off-farm income is most important, please write 'off farm') _____

Which of those land-uses do you ENJOY doing the most (again, if off-farm activities are the most enjoyable, write 'off farm') _____

8. Are there any other properties on which you would like to comment? _____

9. On average is the revenue from the last year better, worse or the same as previous years? (Please tick)

☐ This year's revenue is better than previous years ☐ This year's revenue is worse than previous years
☐ This year's revenue is about the same as previous years

10. Are you in declared drought area? ☐ No ☐ Yes.

If so, for how many years have you been in drought? _____

Grazier Survey

Background on what 'drives' you and about how satisfied you are with your life overall

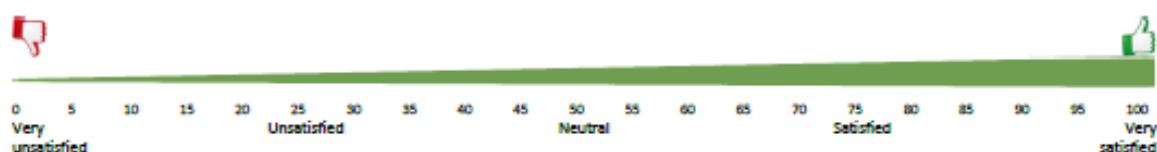
11. Please think about your own personal goals and aspirations for your farm/property. What are the two most important things you hope to achieve (your goals) for your farm / property?

1) _____ (2) _____

12. How important are each of the following to you, when making decisions about what to do on your farm / property

	 Extremely unimportant (irrelevant)			Neutral			 Extremely important (essential)			Do not know
Maintaining physical and mental health of family	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Maintaining family traditions and heritage	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Spending face-to-face time with family and friends	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Keeping in contact with family and friends in other ways (e.g. via phone, through social media)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Maintaining good relations with other farmers/graziers in the local area	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Keeping farm costs low	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Keeping a stable (steady) cash-flow	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Maximising farm profits (income minus costs)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Minimising the risk of very high costs or very low income	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Servicing debt	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Having time to pursue hobbies	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Being able to make your own decisions about your farm/property	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Learning about and testing new ways of doing things on your farm/property	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Sharing new ideas with others	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Having efforts recognised by the wider community	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Leaving the land/farm in better condition than it was when you first started managing it	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Maintaining/improving water supplies and storages	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Minimising sediment run-off and/or nutrient losses	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Helping to safeguard native plants and animals	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Helping to safeguard local waterways	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Helping to safeguard the Great Barrier Reef	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

13. Please think about your own life and personal circumstances (yes, this is a 'big' question ☺). How satisfied are you with your quality of life as a whole? (Please circle a number)



14. Why do you feel this way?

Grazier Survey

Attitudes towards programs that are designed to help you manage your land

15. **GRANTS & FINANCIAL ASSISTANCE.** There are many different ways/places you can apply for grants and / or financial assistance to do things on your property. Please tell us about the grants you have applied for by answering the following questions (if you have applied for more than 3, just tell us about the most recent applications).

Please tick if you have applied for more than 3 grants in the last 5 years ☐ yes

Name of grant/financial assistance program that you applied for...	Year you applied	How did you find out about it? (e.g. friend, google, extension officer)	Was your application successful? (tick if yes)	What was <u>the</u> most important thing you hoped to achieve with this grant?	How useful was the grant in helping you achieve that aim?
			☐		Complete waste of time Neutral Extremely useful
			☐		☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
			☐		☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
			☐		☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

16. **WORKSHOPS, TRAINING PROGRAMS (including on-line and face-to face) or other support and activities (such as field-days, and on-farm demonstrations).** Please tell us about various workshops/training programs or other support and activities you have participated in (or led) which have been focused on land-management issues over the last 5 years. If more than 5, just tell us about the most recent ones.

Please tick if you have participated in more than 5 during the last 5 years ☐ yes

Name of workshop/training program /activity	Year	How did you find out about it? (e.g. friend, google, extension officer)	What was <u>the</u> most important thing you hoped to achieve by doing this?	How useful was the training in helping you achieve that aim?
				Complete waste of time Neutral Extremely useful
				☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
				☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
				☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
				☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Which of these workshops or training programs was the most useful and why?				

17. What could be done to make grants, training programs, workshops and/or extension activities work better for you (i.e. to help you meet your own personal goals)

What extension support or training would you like in the future to help you make farm improvements?

Grazier Survey

Pasture spelling practices – Graziers

18. Did you spell paddocks during the most recent wet season? (Please tick) ☐ Yes ☐ No

How long have you done this (or not)? _____ years

If you did spell paddocks during the most recent wet, please tell us (roughly) the proportion of paddocks that were spelled

☐ All ☐ About ¾ ☐ About ½ ☐ About ¼ ☐ Less than ¼

Roughly how long were the paddocks spelled?

☐ 3 months ☐ 2 months ☐ 1 month ☐ A few weeks ☐ A week or less

Do you plan to do this again next year? (Please tick) ☐ Yes ☐ No

If you plan to do something different, what is it? _____

19. Think about your current practice for spelling paddocks (or not) during the wet season and tell us how much you agree or disagree with each of the statements.

	 Strongly disagree		Neutral		 Strongly agree	Do not know/ Not sure
The graziers I respect most do this	☐	☐	☐	☐	☐	☐
Most graziers in this region would not have the technical knowledge to do this	☐	☐	☐	☐	☐	☐
Most graziers in this region would not be able to afford to do this	☐	☐	☐	☐	☐	☐
This system for spelling paddocks (or not) during the wet season is:						
The best way to meet my own personal goals (question 11)	☐	☐	☐	☐	☐	☐
The best way to maintain good cash-flow	☐	☐	☐	☐	☐	☐
The best way to reduce business risk	☐	☐	☐	☐	☐	☐
The least time-consuming (or labour intensive)	☐	☐	☐	☐	☐	☐
The most effective way of controlling erosion on my property	☐	☐	☐	☐	☐	☐
I only use this system for spelling paddocks during the wet season because I am forced to.	☐	☐	☐	☐	☐	☐
Who/what is forcing you? _____						
The people/organisations whose advice I follow most think I should do this	☐	☐	☐	☐	☐	☐

Please tell us whose advice you follow most when making decision about spelling paddocks (or not) during the wet season (please rank by importance)

- | | |
|---|--|
| ☐ Family who are also graziers | ☐ Private Agronomists |
| ☐ Other graziers | ☐ Extension officers. From where? _____ |
| ☐ Non-farming family/friends | ☐ People from NQ Dry Tropics/TERRAIN |
| ☐ Agforce | ☐ Landcare |
| ☐ QLD Farmers Federation one? | ☐ Researchers |
| ☐ Meat & Livestock Australia | ☐ People from government departments. |
| ☐ Other. Who? _____ | Which departments? _____ |

Grazier Survey

Adjusting stock numbers to paddock conditions practices (other than wet-season spelling)

20. In the previous 12 months, have you adjusted stock numbers to paddock conditions? ☐ Yes ☐ No

21. Do you have an end-of-season target for pasture condition? (Please tick) ☐ Yes ☐ No

If yes, how much feed do you aim to leave in the paddock at the end of the season?

- ☐ Less than 1/3rd of the feed that was grown that season ☐ Between 1/3 and 1/2 of the feed that was grown that season
- ☐ Between 1/2 and 3/4 of the feed that was grown that season ☐ More than 3/4 of the feed that was grown that season

Roughly how often do you achieve this?

- ☐ Less than 3 in 10 years ☐ Between 3 and 5 years in 10
- ☐ Between 5 and 7 years in 10 ☐ More than 7 years in 10

How long have you been doing this? _____ years

Do you plan to do this next year? (Please tick) ☐ Yes ☐ No

If you plan to do something different, what is it? _____

22. If not already doing so, would you consider using forage budgets to determine stock numbers? (Please tick) ☐ Yes ☐ No

23. Think about your current system for adjusting stock (or not) to pasture condition and tell us how much you agree or disagree with each of the statements.

	 Strongly disagree		Neutral	 Strongly agree	Do not know/ Not sure
The graziers I respect most do this	☐	☐	☐	☐	☐
Most graziers in this region would not have the technical knowledge to do this	☐	☐	☐	☐	☐
Most graziers in this region would not be able to afford to do this	☐	☐	☐	☐	☐
This method of adjusting stocking rates (or not) to pasture condition is					
The best way to meet my own personal goals (question 11)	☐	☐	☐	☐	☐
The best way to maintain good cash-flow	☐	☐	☐	☐	☐
The best way to reduce business risk	☐	☐	☐	☐	☐
The least time-consuming (or labour intensive)	☐	☐	☐	☐	☐
The most effective way of controlling erosion on my property	☐	☐	☐	☐	☐
I only do this because I am forced to. Who/what is forcing you? _____	☐	☐	☐	☐	☐
The people/organisations whose advice I follow most think I should do this	☐	☐	☐	☐	☐

Please tell us whose advice you follow most when deciding how to adjust stock (or not) to pasture condition (please rank by importance)

- | | |
|---|---|
| ☐ Family who are also graziers | ☐ Private Agronomists |
| ☐ Other graziers | ☐ Extension officers. From where? _____ |
| ☐ Non-farming family/friends | ☐ People from NQ Dry Tropics/TERRAIN |
| ☐ Agforce | ☐ Landcare |
| ☐ QLD Farmers Federation one? | ☐ Researchers |
| ☐ Meat & Livestock Australia | ☐ People from government departments. Which departments? _____ |
| ☐ Other. Who? _____ | |

Grazier Survey

24. What do you regard as a 'sustainable' stocking rate for properties in your area? (A sustainable stocking rate is the number of cattle per area that can be run averaged out over good and bad years)

_____ cattle (head/Adult Equivalent) per _____ hectares OR

_____ cattle (head/Adult Equivalent) per _____ acres

25. At the moment, what stocking rate do you think that most other graziers in your area (not you personally) are running at/ stocked at?

_____ cattle (head/Adult Equivalent) per _____ hectares OR

_____ cattle (head/Adult Equivalent) per _____ acres

Stock management around waterways practices – Graziers **SKIP IF NO WATERWAYS ON PROPERTY**

26. How do you manage stock around waterways? (please tick one) **SKIP IF NO WATERWAYS ON PROPERTY**

- | | |
|--|---|
| ☐ I prevent cattle from accessing all waterways at all times | ☐ I prevent cattle from accessing some waterways at all times |
| ☐ I prevent cattle from accessing all waterways during the wet season | ☐ I prevent cattle from accessing some waterways during the wet season |
| ☐ I do not prevent cattle from accessing waterways | ☐ Other. Please tell us what you do _____ |

How long have you used this system to manage stock around waterways? _____ years

Do you plan to do this again next year? (Please tick) ☐ Yes ☐ No

If you plan to do something different, what is it? _____

27. Now think about your current system for managing stock around waterways and tell us how much you agree or disagree with each of the statements. **SKIP IF NO WATERWAYS ON PROPERTY**

	 Strongly disagree  Neutral  Strongly agree							Do not know/ Not sure
The graziers I respect most think I should do this	☐	☐	☐	☐	☐	☐	☐	☐
Most graziers in this region would not have the technical knowledge to do this	☐	☐	☐	☐	☐	☐	☐	☐
Most graziers in this region would not be able to afford to do this	☐	☐	☐	☐	☐	☐	☐	☐
This system for managing stock around waterways is:								
The best way to meet my own personal goals (question 11)	☐	☐	☐	☐	☐	☐	☐	☐
The best way to maintain good cash-flow	☐	☐	☐	☐	☐	☐	☐	☐
The best way to reduce business risk	☐	☐	☐	☐	☐	☐	☐	☐
The least time-consuming (or labour intensive)	☐	☐	☐	☐	☐	☐	☐	☐
The most effective way of controlling erosion on my property	☐	☐	☐	☐	☐	☐	☐	☐
I only use this system to manage stock around waterways because I am forced to	☐	☐	☐	☐	☐	☐	☐	☐
Who/what is forcing you? _____								

Grazier Survey

The people/organisations whose advice I follow most think I should do this ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Please tell us whose advice you follow most when deciding how to manage stock around waterways (please rank by importance)

- | | |
|---|--|
| ☐ Family who are also graziers | ☐ Private Agronomists |
| ☐ Other graziers | ☐ Extension officers. From where? _____ |
| ☐ Non-farming family/friends | ☐ People from NQ Dry Tropics/TERRAIN |
| ☐ Agforce | ☐ Landcare |
| ☐ QLD Farmers Federation one? | ☐ Researchers |
| ☐ Meat & Livestock Australia | ☐ People from government departments. |
| ☐ Other. Who? _____ | Which departments? _____ |

28. Do you use any other innovative practices to reduce runoff and/or prevent gully erosion? (Please tick)

☐ Yes ☐ No

If so, which practices _____?

29. Please indicate if you agree or disagree with each statement below

	Strongly disagree		Neutral		Strongly agree	Do not know/ Not sure
Soil loss from my property negatively impacts my pasture production and grazing land condition	☐	☐	☐	☐	☐	☐
I am taking measures to reduce soil loss from my property and improve land conditions	☐	☐	☐	☐	☐	☐
Sediment loss from my property has no impact on water quality in local streams, rivers & waterways	☐	☐	☐	☐	☐	☐
What are the top causes of poor water quality in your local streams, rivers, & waterways?						
1) _____ (2) _____						
The grazing industry plays almost no role in the declining health of the Great Barrier Reef	☐	☐	☐	☐	☐	☐
What are the top two pressures on the health of the Great Barrier Reef?						
1) _____ (2) _____						

30. What is the 'sustainable' stocking rate for your property? (A sustainable stocking rate is the number of cattle per area that can be run averaged out over good and bad years)

_____ cattle (head/Adult Equivalent) per _____ hectares OR

_____ cattle (head/Adult Equivalent) per _____ acres

31. What is the current stocking rate of your property?

_____ cattle (head/Adult Equivalent) per _____ hectares OR

_____ cattle (head/Adult Equivalent) per _____ acres

Grazier Survey

More background information about you - Graziers

32. What is your age group?

- | | | | |
|--|--|--|---|
| ☐ 15 – 19 years | ☐ 35 – 39 years | ☐ 55 – 59 years | ☐ 75 – 79 years |
| ☐ 20 – 24 years | ☐ 40 – 44 years | ☐ 60 – 64 years | ☐ 80 – 84 years |
| ☐ 25 – 29 years | ☐ 45 – 49 years | ☐ 65 – 69 years | ☐ 85 years and older |
| ☐ 30 – 34 years | ☐ 50 – 54 years | ☐ 70 – 74 years | |

33. What is your gender? (Please tick) ☐ Male ☐ Female

34. What is your cultural heritage? (Please tick)

- ☐ Australian (Non-Indigenous) ☐ Aboriginal and/or Torres Strait Islander
☐ Italian ☐ Greek ☐ English ☐ Indian ☐ Other (Please specify) _____

35. Were you born in Australia? (Please tick) ☐ Yes ☐ No

36. What formal education do you have? (Please tick)

- ☐ High school (year 10) ☐ Trade / apprenticeship ☐ TAFE ☐ University
☐ High school (year 12) ☐ Agricultural college ☐ Other (please specify) _____

37. What is your marital status? (Please tick)

- ☐ Single ☐ Married or De-facto relationship ☐ Divorced ☐ Widowed

OPTIONAL QUESTIONS – Graziers

We know many businesses do not like providing this type of information, so will understand if you choose not to answer the following questions but if you do, please rest assured the information WILL be kept confidential, and it will really help us understand your situation better.

38. Roughly, what was the NET income earned from this property last year (after all costs and taxes were taken out)? _____

Is this before or after you have paid yourself (and other family members who help on the property) wages/salary? ☐ Before paying myself and family ☐ After paying myself and family

39. Roughly, how many kilometres of stream/river-frontage are on your property?

- | | | | |
|-----------------------------------|--|--|--------------------------------------|
| ☐ None | ☐ Less than 5 kms | ☐ 5-10 kms | ☐ 10-20 kms |
| ☐ 20-50kms | ☐ 50-100 kms | ☐ More than 100 kms | ☐ Do not know |

If you do have streams/ivers on your property (even if only during the wet), how many stream/river frontage have vegetation other than grass (e.g. shrubs, trees?)

- | | | | |
|-----------------------------------|--|--|--------------------------------------|
| ☐ None | ☐ Less than 5 kms | ☐ 5-10 kms | ☐ 10-20 kms |
| ☐ 20-50kms | ☐ 50-100 kms | ☐ More than 100 kms | ☐ Do not know |

Thank you for your help!



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