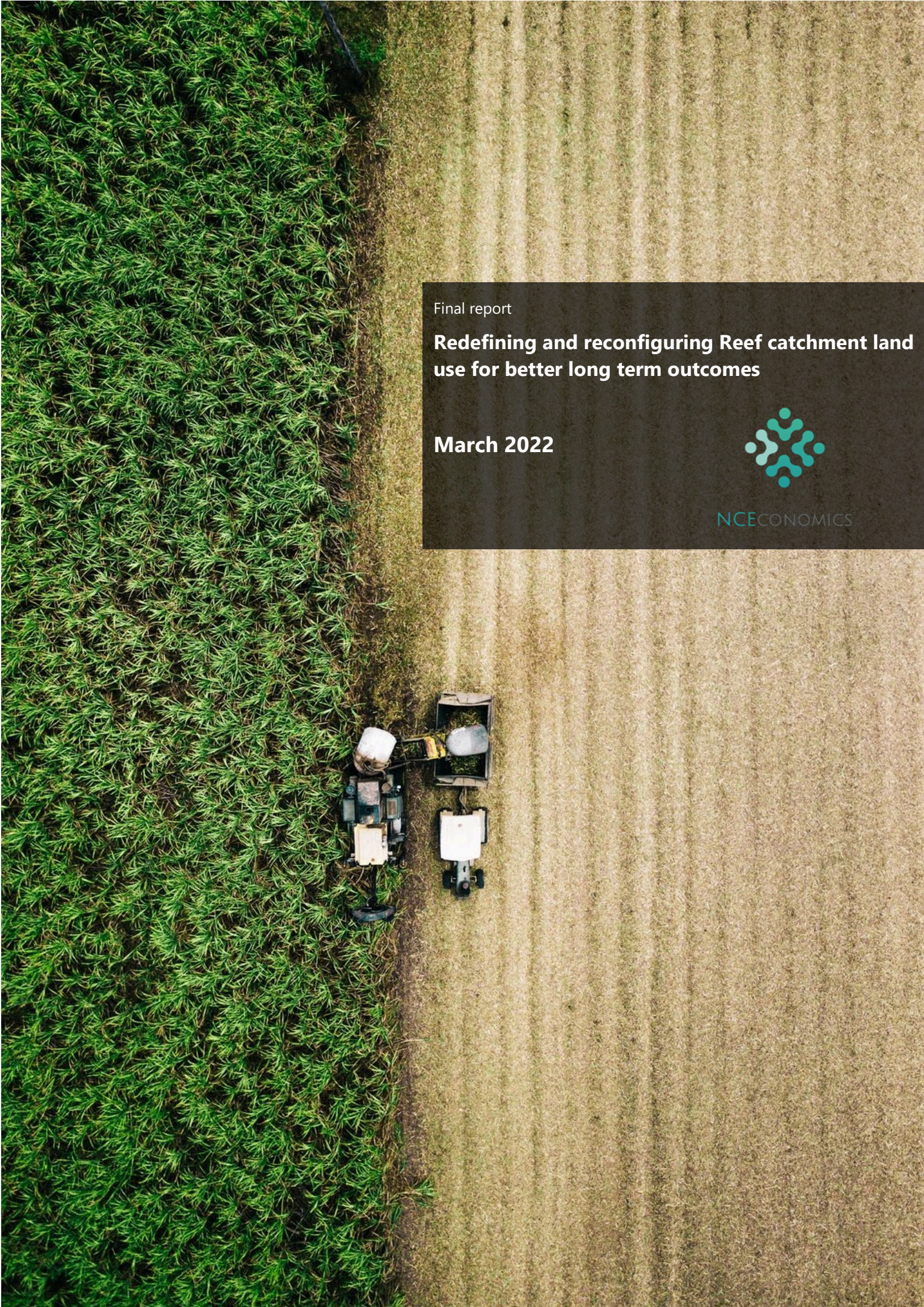

Final report

Redefining and reconfiguring Reef catchment land use for better long term outcomes

March 2022

NCECONOMICS

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EXECUTIVE SUMMARY

20 second soundbite

Addressing diffuse runoff from sugarcane farms to the Great Barrier Reef (GBR) is complex, costly, and faces multiple economic, social, market and institutional impediments. A full arsenal of policy and programme tools is required that addresses the diversity of drivers and impediments to meaningful change.

This research assesses multiple economic and social farm and farmer characteristics, industry trends, impediments to change and land use transition, and policy options to facilitate change. It analyses the potential use of a revolving fund (a voluntary market approach) that could simultaneously address the need to permanently reduce diffuse loads, improve industry commercial performance, and facilitate land use transition and enhance succession opportunities across the cane production areas of the GBR. This would not be a replacement to existing approaches. Rather it is a complementary approach that overcomes impediments that the existing suite of policies cannot overcome.

Background

In the past five years, there has been significant research effort undertaken to support the management of the catchments surrounding the Great Barrier Reef (GBR, or the Reef). From this research, it is known that the Reef is under threat from a range of pressures including the combined impact of run-off associated with past and ongoing catchment and coastal development activities, extreme weather events and climate change impacts such as recent extensive coral bleaching events. The focus of the research undertaken for this project was the impact that cane farming has on water quality, with nutrients from farm fertilizers, particularly nitrogen, entering the Reef in runoff through flood plumes during major flood events.

There are many drivers of farmer behaviour that affect water quality. Anecdotally, it is known that (generally):

- Smaller landholders are less profitable.
- Smaller and low (or no) profit landholders are less likely to invest in new initiatives and government programs.
- Smaller and unprofitable landholders find it hard to exit the cane industry (for a variety of reasons including their farms have limited appeal to investors seeking a commercial rate of return).
- Larger landholders are generally more profitable.
- Larger and more profitable landholders are more likely to invest in new initiatives and government programs.

Approach

The project drew together information about financial performance of sugarcane farms across the catchments adjacent to the GBR and sought to document the relationships between various farm and farmer characteristics (e.g. farm profitability and farmer age), where they may be relevant to land use transitions (i.e., to buy or sell land). These relationships were then used to identify potential policy mechanisms for facilitating land use transitions, and to model the likely impacts of land use transitions on a range of different indicators (e.g. water quality, profitability).

This was done using a range of analytical techniques (i.e. economic, social, spatial, biophysical) organised into distinct phases. Figure ES1 presents an outline of the seven phases of the project including their respective objectives.

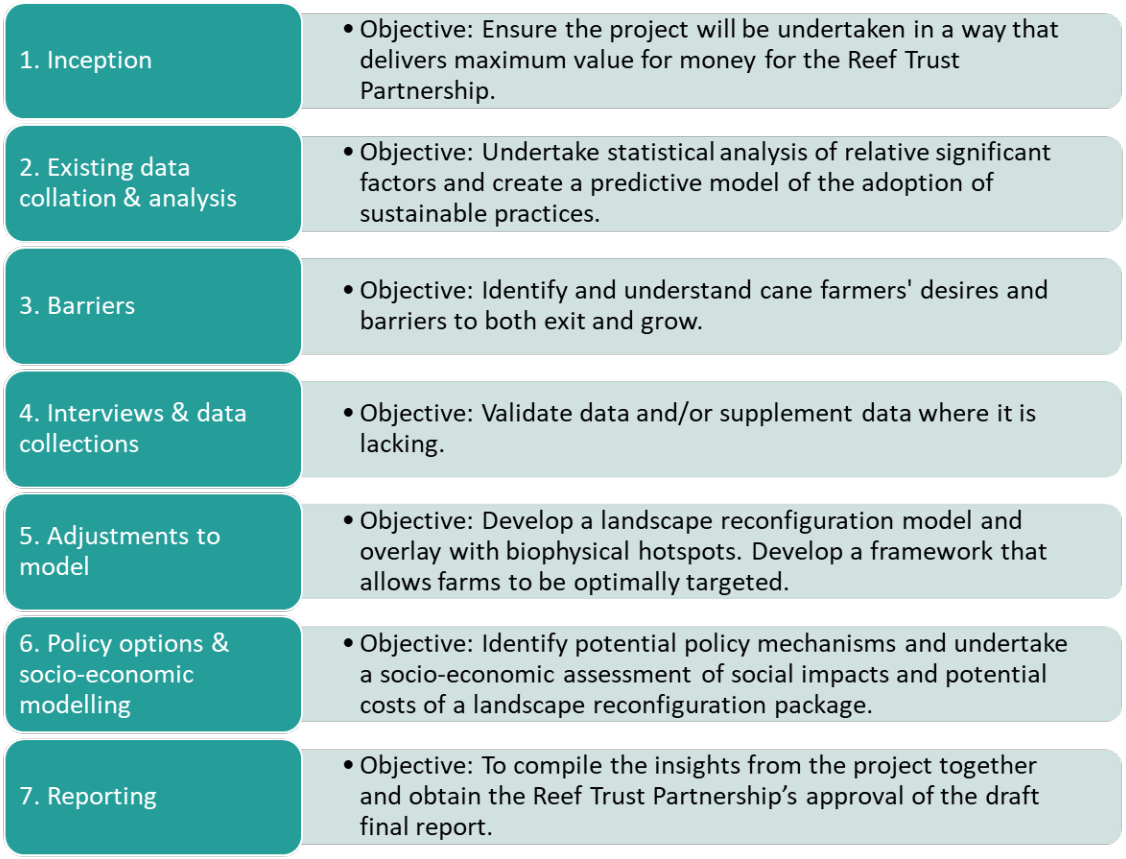

Figure ES1. Project phases

Key findings

Farmer and farm characteristics

Initially, it was identified that there were potentially many factors that could influence land use transition potential. These included:

- Farm and farmer characteristics such as size, financial performance, and farmer age.
- Attitudes and behaviours.
- Prior investment in management practice.
- Pollutant loads and targets.

Based on both a literature review and interviews with subject matter experts, factors that have the greatest influence on landholder decision-making were identified. For example, these included factors such as landholder values, financial capacity, and life stage. This understanding was used to develop a typology of landholders with five sub-groups:

1. Traditionalist.
2. Experimenter/Diversifier.
3. Enterprise Farmer.
4. Conservationist.
5. Lifestyle/Hobby Farmer.

Influences on land use transitions

Very little previous research has explored the drivers and barriers to land use transitions specifically. Through semi-structured interviews with the industry, a survey of farmers, and desktop research it was shown that the factors outlined above can be drivers and barriers to land use transitions, and therefore present a number of ways to target any policies towards farms and farmers where they are likely to have the greatest impact.

The consultation indicated that factors likely to have the greatest influence were:

- Smartcane BMP accreditation.
- Lack of financial capacity.
- Reliance on off-farm income.
- Attitude towards taking risks.
- Life-stage (i.e. whether nearing or post retirement).
- Succession planning.
- Identity as a cane farmer.

It is key to note that data exists on the majority of these factors and therefore it is very feasible to leverage them to assist with targeted discussion on reconfiguration matters.

Policy options

A range of policy options to assist with the amalgamation and reconfiguration of sugarcane farms were considered. These included:

- Suasive mechanisms such as information and extension.
- Compulsory acquisition to acquire properties for subsequent amalgamation.
- Revolving funds as a (market) mechanism for voluntary purchases and subsequent amalgamation.
- Tradable development rights.
- Planning scheme amendments to underpin reconfiguration.
- Stamp duty and other state levy exemptions to reduce costs of reconfiguration activities.
- Landcare tax deductions to reduce costs of reconfiguration activities.
- Covenants to areas converted to conservation purposes.

These options were compared to policy attributes that were preferred by survey respondents and packaged in order to define a comprehensive set of policies which are likely to result in cost-effective water quality improvements.

Revolving fund case study: The Burdekin

A modelling exercise was undertaken to determine the likely costs and benefits of a policy package that included a revolving fund and amendments to local government planning schemes to allow for subdivision of farm properties.[1] The model focussed on the Burdekin region, building on modelling from earlier project phases. It used a nominal $30 million initial investment to purchase, amalgamate, reconfigure, and sell farms (see Figure ES2).

[1] The subdivision allows retiring farmers to sell on their productive land while remaining in their home and local community.

It was assumed that reconfiguration would take farms from D class practice to C class practice[2], as well as upgrading irrigation infrastructure (including shortening the furrow lengths), and reserving 5% of the productive area for conservation purposes. The target amalgamated farm size was 200 hectares, considerably above the profitability threshold for the Burdekin. To do this, the model drew from a range of publicly available data sources.

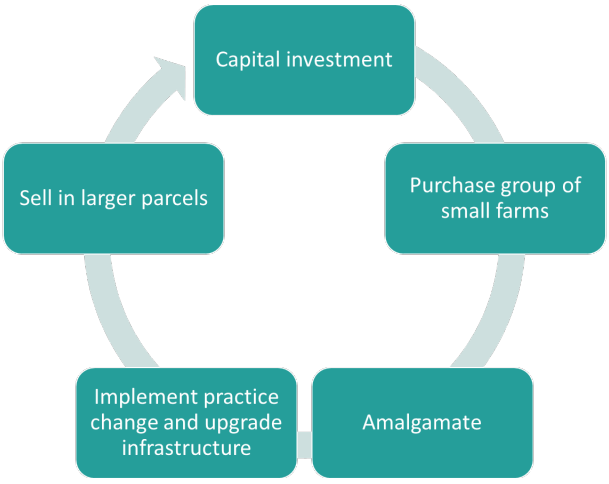

Figure ES2. Revolving fund model structure

Table ES1 presents the key outcomes for this revolving fund case study, including an 80% confidence interval derived from 50,000 Monte Carlo simulations.[3] The $30 million investment in the Burdekin region is estimated to result in the abatement of around 37 tonnes of annual dissolve inorganic nitrogen (DIN) loads over 11 'revolutions' of the fund, along with a range of other benefits that accrue to a number of different stakeholders.

An alternative scenario was tested that did not include allowance for changes to the planning scheme. This scenario resulted in far lower load reductions (18t versus 37t) as well as performing relatively poorly across the entire range of other outcome variables.

Table ES1. Key outcomes from case study fund implementation

Key outcomes	Estimate	Range (80% C.I.)
Initial investment ($)	$30,000,000	n/a
Time to exhaustion (no. of revs)	11	10 - 12
Remaining capital ($)	$780,000	$730,000 - $840,000
Number of farms amalgamated (no.)	191	178 - 205
Area of cane land converted (ha)	7,130	6,430 - 7,870
Water quality impacts (kg annual DIN abated)	37,100	32,100 - 42,400
Cost-effectiveness ($/kg annual DIN abated)*	$790	$690 - $910
Economies of scale ($million/year)	$23.8	$21.7 - $25.7
Practice change impact on profitability ($million/year)	$0.2	$0.2 - $2.0
Total change in annual returns ($million/year)	$24.0	$22.5 - $27.0
Area left to conservation (ha)	375	284 - 458
Ecosystem service value ($million/year)	$1.4	$0.9 - $1.9

Source: NCEconomics estimates
*Note that the cost-effectiveness reported is from the perspective of the Fund only and therefore does not include the costs or benefits that accrue to landholders (e.g. profitability improvements, ongoing maintenance costs, etc.).

[2] Under the Smartcane BMP program.

[3] Monte Carlo simulations are a statistical technique used to model the probability of different outcomes in a process that cannot easily be predicted due to the variability in multiple input variables used in the analysis. It is a technique used to understand the impact of risk and uncertainty in prediction and forecasting models.

Recommendations

There are a number of key conclusions and recommendations that follow from the analysis outlined in this report. They are as follows:

- **Farmers are supportive of policies that make it easier to amalgamate or reconfigure existing land holdings to enhance profitability and achieve broader sustainability goals.** The survey responses indicated that policies that consider amalgamation are likely to be supported by farmers.
- **A suite of policies is needed to address different farmer demographics, risk attitudes, and desires.** For example, farmers in Northern cane growing regions had lower support for amalgamation policies than those in Southern regions. As a result, different policies may be required to best target both groups. As Smartcane accreditation, off-farm income, lifestyle motivations, and life stage had the greatest influence on policy preferences, they should be some of the top considerations when designing the suite of policies. Furthermore, those farmers who already had high stewardship values were the only group that tended to be less supportive of packaging a number of policies together. Therefore, the packaged approach could be designed to suit a wide range of farmers.
- **A policy mechanism should be developed that aims to achieve amalgamation of small, unprofitable sugar cane farms.** Implementation of policy mechanisms that results in amalgamation of small farms is likely to have positive impacts on farm profitability, mill viability, and water quality outcomes in a cost-effective way.
- **A revolving fund may be a suitable model to use for the amalgamation of sugar cane farms.** The case study shows that this is a way to cost-effectively reduce DIN loads to the Reef, particularly when combined with compatible policy mechanisms (e.g. changes to planning schemes so that farmers can sell their farms and retain their homes).
- **Local governments should reconsider their planning schemes to allow for farmers wishes to sell their farm while remaining in their home.** The revolving fund case study demonstrated a considerable improvement in water quality outcomes and cost-effectiveness when the sale of farms was made easier by allowing for subdivision in the planning scheme. This allows retiring farmers to stay in their community after selling their farm and does not result in the eventual landholder having to purchase land with a house that has little value to them.
- **Positive outcomes beyond water quality improvements should be considered in policy development.** The analysis demonstrates the likely positive impacts of a revolving fund on profitability, mill viability, social outcomes, and ecosystem services. This indicates that it is possible for policies to provide a 'win-win' scenario where all parties can benefit.
- **Available information on farm and farmer characteristics (e.g. farm size and demographics) can and should be used to effectively target policy mechanisms towards farms where it will have the greatest success.** The analysis demonstrates the utility of leveraging this data to achieve cost-effective load reductions as well as positive economic and social impacts.

There are also a number of limitations that relate to the analysis which are worth noting. These can be found in Section 5 of the report.

CONTENTS

1 PROJECT OBJECTIVE AND SCOPE

1.1 Background

In the past five years, there has been significant research effort undertaken to support the management of the catchments surrounding the Great Barrier Reef (GBR, or the Reef). Some of the higher profile publications during this time included:

- 2016 Reef Costings Study, Great Barrier Reef Water Science Taskforce
- Reef 2050 Plan – Investment Framework (2016), Australian and Queensland governments
- Report Card 2016, Australian and Queensland governments
- 2017 Scientific Consensus Statement, Queensland government
- Basin Specific Water Quality Targets (2017), Centre for Tropical Water and Aquatic Ecosystem Research and James Cook University
- Reef 2050 Water Quality Improvement Plan 2017-2022 (2018), Australian and Queensland governments

From the above research, we know that the Reef is under threat from a range of pressures including the combined impact of land run-off associated with past and on-going catchment and coastal development activities, extreme weather events and climate change impacts such as the recent extensive coral bleaching events.

The 2017 Scientific Consensus Statement, which investigated water quality issues, made the following recommendations (amongst others) that underpin the motivation for our project:

- Develop strategies to manage impacts of future land use changes (coastal development and land retirement).
- Urgently implement more targeted and substantial effort to improve GBR water quality.
- Prioritise agricultural sources of pollutants while at the same time assessing other potentially important pollutant sources such as urban, industrial and port areas.
- Improve the management of wetlands, rivers and floodplains and their connectivity to the GBR.

The focus of this research was the impact that cane farming has on water quality, with nutrients from farm fertilizers, particularly nitrogen, entering the Reef in runoff through flood plumes during major flood events.

There are many drivers of farmer behaviour that affect water quality. Anecdotally, it is known that (generally):

- Smaller landholders are less profitable.
- Smaller and low (or no) profit landholders are less likely to invest in new initiatives and government programs.
- Smaller and unprofitable landholders find it hard to exit the cane industry (for a variety of reasons including their farms have limited appeal to investors seeking a commercial rate of return).
- Larger landholders are generally more profitable.
- Larger and more profitable landholders are more likely to invest in new initiatives and government programs.

The project drew together information about financial performance of sugarcane farms across the catchments adjacent to the GBR and sought to document the relationship between profitability, sustainability and farm size.

From there, the project developed an understanding of landholders needs in the context of redefining and reconfiguring land use within the Reef catchments for better long-term outcomes. This understanding was then used to develop a number of policy recommendations for the future management of water quality issues related to the sugarcane industry.

1.2 Project objective

This project aimed to develop a comprehensive understanding of the socio-economic benefits and costs of a broad scale, targeted land reconfiguration (consolidation and retirement) process that simultaneously improves outcomes for the GBR, improves economic viability of agriculture through enhanced scale and efficiency, and improves social resilience for communities. It also assessed how any reconfiguration process could work in conjunction with other GBR initiatives and other emerging environmental and product markets to 'crowd in' co-investment from a broader suite of sources.

Key questions that were addressed include:

1. What are the key drivers of commercial viability of cane farms, and is there a strong correlation between farm scale and viability? What might the scale thresholds be?
2. What are the economic and financial impediments (cashflow and availability of financial capital) to deliver permanent improvements in practice?
3. What are the social and cultural impediments to a permanent improvement in practice?
4. Given 1 to 3, is there a typology of properties that allows for the identification of properties where reconfiguration and partial retirement from production may be the best long-term solution?
5. What is the scale of identified properties in terms of area potentially available for reconfiguration, and what are the costs and benefits of reconfiguration?
6. What are the key elements required to design a mechanism (innovative funding approach) to underpin the reconfiguration?
7. Given the broader suite of ecosystem services and other benefits (including commercial) derived from reconfiguration and partial retirement of land to conservation purposes, what are the opportunities for 'crowding in' co-investment? Does this enable recycling of financial capital contributions?

The project has supported the development of a comprehensive understanding of how, using financial levers in conjunction with market-like mechanisms, the partial / complete exit of selected landholders and reconfiguring of the landscape into more viable and better managed farms can be targeted and facilitated to deliver voluntary land retirement outcomes along riparian corridors to achieve environmental objectives.

In effect, this project identified a way forward to reconfiguring the landscape in cane production areas to deliver more sustainable and commercially viable outcomes for the community.

1.3 Scope and boundaries

There are a number of parameters that established the scope and boundaries for the research:

- **Target industry.** The project focused on sugarcane farmers in the production zone across the GBR catchments. Both small-scale and large-scale farms were included within the scope of the analysis. The scope also included analysis of aggregate impacts on production and foregone profit (if any).
- **Geographic focus.** The study areas were those parts of the GBR catchments with sugarcane farming, but a case study was also used to consider the feasibility in the Burdekin in more detail.
- **Target pollutants.** Given the focus on cane producing areas, the focus was on reducing dissolved inorganic nitrogen (DIN) and total phosphorous (TP) loads attributable to either improvements in practice or to change in land use to conservation purposes, including wetlands).
- **Other ecosystem services.** Potential land reconfigurations (e.g. rehabilitated riparian zones of wetlands) that generated ecosystem services beyond direct load reductions (e.g. carbon sequestration or habitat values) were identified, and to a degree valued, to identify and scope the potential for co-investment and the 'stacking' of ecosystems services for multiple environmental markets such as carbon markets or the Land Restoration Fund.
- **Policy intervention scope.** While the focus of the project was on interventions to facilitate reconfiguration of the landscape, the research conducted within the context of the broader scope of interventions available could be either alternative or complementary approaches. Therefore, regulatory, policy and market-like approaches were within scope including those being considered (but not adopted) in the GBR (e.g. nutrient trading from diffuse sources). There are a number of different interventions that could be used to address diffuse loads entering the GBR. Only a fraction of options have been adopted to date, and the majority of options adopted rely on voluntary participation in incentive programs that exhibit potentially high levels of dis-adoption risk once contract obligations cease. This research identified and analysed reconfiguration options that are more akin to a step-wise change in practice and land use and are therefore complementary to other research and intervention options.
- **Primary vs. secondary sources of information.** A mixed research approach was adopted with information and data drawn from existing sources as well as generated within this project through consultation activities (semi-structured interviews) and the survey.
- **Links to other initiatives and research.** This project drew on, and built on, information and data from a number of GBRF and other research projects including previous modelling of the efficacy of pollution mitigation such as Alluvium (2019) Efficient investment pathways for pollution reduction to the Great Barrier Reef), or the Reef 2050 Water Quality Improvement Plan 2017-2022 to inform sub-regional targeting. This project built on the previous significant body of work, while informing the targeting of future research and investment implementation.
- **Research into 'no regrets' pilot**. The research identified opportunities to broaden the scope of interventions available to underpin practice change and landscape reconfiguration. This is likely to open up opportunities for a subsequent 'no regrets' pilot of any viable option(s) identified within later tranches of GBRF investments, or complementary programs.
- **Time period for analysis.** The project will be delivered over a 19-month period (01/07/20 to 15/02/22).

2 PROJECT METHODOLOGY

This section outlines the project methodology, including an overview of the methodological framework, staged approach, tasks and inputs.

2.1 Implementation approach

The project has been undertaken drawing on a combination of desktop research using both primary and secondary research techniques, supported by targeted consultation with landholders and other key stakeholders.

A range of analytical approaches have been used throughout the project. These include:

- **Economic analysis.** This included economic analysis to estimate relationships between key parameters and their relative importance in predicting farm financial performance. It involved the development of a predictive model of potential target areas for structural adjustment. It also involved socio-economic analysis of the impacts of structural adjustment (both costs and benefits). The statistical and economic modelling underpinning this project required the use of a wide range of input variables and assumptions. Therefore, sensitivity analysis has been undertaken to present results as a probabilistic range, and to assist in understanding the inputs and assumptions that impact on the results the most. This sensitivity analysis informs targeting of any future analysis (i.e. addressing the most important factors that influence the success of programs) as well as informing any implementation (e.g. designing any pilot program to test assumptions as well as deliver on-ground change).
- **Social analysis.** This was undertaken to provide an understanding of the drivers of landholder behaviour in relation to continuing to farm or to leave the industry, and the non-financial impediments / barriers to change.
- **Spatial analysis and water quality modelling.** This identified the intersection between biophysical hotspots and where targeted structural adjustment could potentially yield greatest improvements in water quality.
- **Stakeholder consultation.** This supported the economic analysis by facilitating the collection of primary data on landholder attitudes. The focus was on understanding barriers to and drivers of retirement from the industry. This was undertaken through both semi-structured interviews, and through a survey of landholders.
- **Documentation and research finding socialisation.** End-user documents and other supporting materials have been developed to socialise the research findings to key stakeholder groups as well as to form key deliverables from this contract.

The project has been delivered over six phases, as follows:

1. Project inception.
2. Collating and analysing farm-level data.
3. Identifying landholder barriers and desires to exit or grow.
4. Landholder interviews, stakeholder consultation, and data collection.
5. Refining the predictive model.
6. Identifying policy options and modelling socio-economic impacts.
7. Reporting.

The focus of this current report is to synthesise and consolidate all previous reports.

Through this structured approach to the analysis and consultation, a robust and realistic picture of the prospects for a structural adjustment approach to deliver major landscape reconfiguration has been established, and the critical pathway to implementation developed. Ultimately, this research will inform future investment by GBRF and other parties including private sector investors, with a view to enabling the longer-term recycling of capital investments to improve water quality. This reduces the long-term reliance on public funding of pollution load reduction.

2.2 Approach

The project was undertaken in seven main phases. These are outlined in Figure 1, with further detail regarding specific phases provided below.

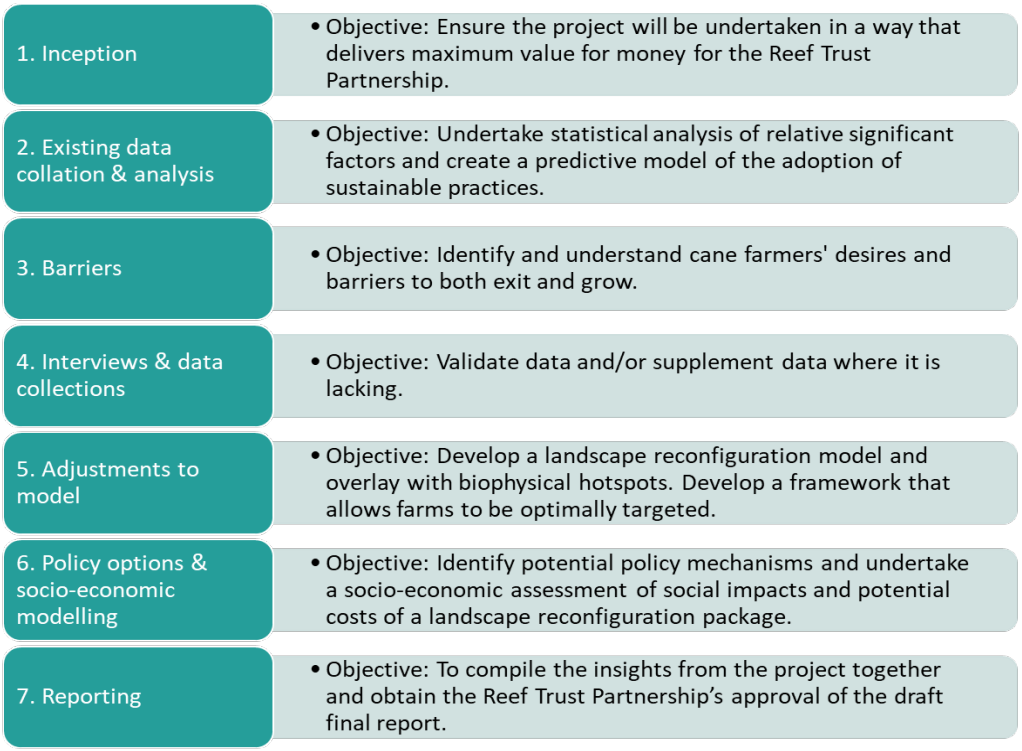

Figure 1. Overview of approach

Phase 1: Inception

The core tasks undertaken in Phase 1 included:

- Project inception meeting.
- Developing an engagement plan.
- Preparing a Project Management Plan (inc. QA, M&E, and Stakeholder engagement plan).

Phase 2: Existing data collation and analysis

The objective of Phase 2 was to undertake statistical analysis of the relative significance of factors that influenced the adoption of sustainable practices on cane farms (e.g. farm size, financial performance, adoption of government incentive programs, demographics, level of indebtedness). The core tasks undertaken in Phase 2 included:

- Collating farm characteristic data (e.g. size, land use, catchment). Overlay characteristic data with sub-catchments and end of catchment water targets (e.g. DIN, TP and TSS).
- Collating farm financial, demographic data, and practices (e.g. small area demographics and farm financial from ABARES).

- Statistical analysis of data from above tasks to identify trends, relationships and relative importance of factors.
- Overlaying analysis with sub-catchment maps and sub-regional end of catchment targets.
- Developing a simplified predictive framework and scenario model. Run model to identify potential hot-spot focal areas for structural adjustment.
- Creating a predictive model of the adoption of sustainable practices on cane farms from with relevant legislation and guidelines.
- Preparing the Phase 2 report.

Phase 3: Barriers to exit or grow

The utility of a landholder typology is fundamentally determined by the evidence available to support the typology. A staged approach was adopted to identify existing evidence and develop, test and refine the typology. The core tasks undertaken in Phase 3 included:

- Reviewing literature.
- Developing a typology of social, economic and other factors that influence cane farmers' desires to exit or grow.
- Testing the typology through a series of semi-structured interviews with content experts.
- Refining the typology.

Phase 4: Interviews and data collection

During Phase 4 industry groups and individual landholders were consulted to validate the data and / or to supplement data where it was lacking in depth and extent. This consultation was supported by an engagement plan. The core tasks that were initially planned for Phase 4 included:

- Developing an engagement plan.
- Conducting a series of semi-structured interviews with industry representatives.
- Developing a grower survey (the Future of Farming survey) based on semi-structured interviews and findings from Phase 2 and 3.
- Launching and administering the survey on-line.
- Collating and analysing survey responses.
- Preparing the Phase 4 report.

It should be noted that, as outlined in the 'Additional data collection' section below, the initial survey response rate was insufficient to extract meaningful insights from the survey. This was addressed by collecting additional responses.

Phase 5: Adjustment of model

Drawing on findings from Phases 2-4, the model was designed to identify areas where a transfer of ownership may be more likely and result in positive water quality outcomes. These areas were intersected with biophysical hotspots (i.e. areas where land use change will result in improvements on water quality). The core tasks undertaken in Phase 5 included:

- Developing a more detailed model, drawing on the previous phases. The model was used to predict the areas where farmers are most likely to be receptive to incentives to exit the industry.
- Establishing scenarios to estimate the locations where a transfer of ownership could be more appropriate, based on regional characteristics.

- Determining the likely costs and benefits of these scenarios to provide an indication of cost-effectiveness.
- Comparing scenarios with different management actions (i.e. practice change versus conservation).
- Benchmarking against available data (e.g. water quality targets, other estimates of cost-effectiveness).

Phase 6: Policy options and socio-economic modelling

Phase 6 involved further modelling to better understand the impacts of farm amalgamation and explore the potential policy mechanisms available to accelerate the process of landscape reconfiguration. The core tasks undertaken in Phase 6 included:

- Modelling profitability impacts of a range of amalgamation scenarios.
- Determining farm size thresholds at which the profitability increase is likely to offset the costs of practice change.
- Comparing available policy mechanisms.
- Undertaking a case study on implementing a 'revolving fund' in the Burdekin region, including an assessment of costs, water quality outcomes, compatible policy mechanisms, and other socio-economic impacts (i.e. profitability, employment, mill viability).
- Identifying areas where policy mechanisms of this kind could be targeted based on spatial data on demographics and farm size.

Additional data collection

The Future of Farming survey administered as part of Phase 4 did not draw a high response rate and as a result additional effort was required to increase the response rate. While it was initially distributed via industry newsletters and local newspapers, additional participants were recruited with the assistance of a market research company (https://qandapanel.com.au/) from 3rd December to the 16th December 2021. A $100 voucher was offered as incentive for participation.

Survey respondents were asked to complete an anonymous 33 question survey designed to assess landholder characteristics (such as their age, attitudes and values), farm characteristics (such as size and ownership), their land use transition plans over the next five years as well as their views towards policy, financing and funding mechanisms for land management practices.

In total, 102 people participated the survey (n = 45 via industry newsletters/newspapers and n = 57 via the recruitment panel). After data screening, 28 respondents were excluded from the main analysis because they indicated that they were not cane farmers (i.e., neither owned, managed nor leased a cane farm). While not cane farmers, most of those excluded respondents (n = 20) did indicate that they were members of the broader agricultural industry. They were invited to respond to questions targeting their attitudes towards different policy and funding mechanism attributes.

A total of 74 cane farmers responses were retained for the main analysis, with ages ranging from 35 to 93 years and the average age of 64 years. There was a wide representation across the Reef regions, with most respondents from the Wet Tropics region (43%), and the least number of survey respondents from the Burnett Mary region (8%). The distribution of respondents is generally representative of the broader cane farming industry, where there are more cane farmers located in the North compared to the Southern Reef regions.

A detailed analysis of the survey responses is provided in Appendix E, while key insights from the survey are provided throughout the body of this report where relevant.

3 KEY FINDINGS

There are a range of key findings that came out of the work undertaken for each of the project phases. These are summarised in this chapter with a particular focus on those aspects which are likely to influence future policy design.

3.1 Farmer typologies and demographics

Typologies

Identifying the social factors of landholders or farming enterprises that are more/less receptive to different types of land use transitions was a key component of the project. Factors that influenced typology were:

- Financial capacity
- Income source
- Management goals
- Values (profit, conservation and lifestyle)
- Property succession plans
- Life stage
- Support for innovation
- Risk perceptions
- Trust
- Social Identity
- Social networks

An extensive literature search and content expert interviews provided a typology of five cane farmer groups or 'sub-groups' (see Table 3 in Appendix B for detailed discussion of group characteristics):

1. **Traditionalists** - high 'production-ist' value, lower levels of innovation. Tended to have low levels of financial capacity, smaller farms, highly motivated to keep the farm in the family. Tend not to be involved in agri-environmental schemes. Low trust in government programs.
2. **Experimenters/Diversifiers** - mixed crops, high risk threshold, high trust in government programs.
3. **Enterprise Farmers** - high financial capacity, no off-farm income, large farms, strong profit/expansion values, high risk threshold.
4. **Conservationists** - high environmental values, small farms, no off-farm income, high engagement in agri-environmental programs.
5. **Lifestyle/Hobby Farmers** - high incidence of off-farm income but low financial capacity, strong lifestyle values, low risk threshold.

Understanding the key drivers and barriers for different types of transitions (i.e., exiting, growing, or retiring part of the land) was another key focus; however, very little research had been conducted previously focussing on these drivers and barriers to land use transitions. Drivers and barriers were found to be closely linked to the behaviours and social factors that characterise farmers and their attitude towards land use transitions.

These attitudes varied significantly between farmer typologies. One farmer from the Future of Farming survey stated "our family is dedicated to reducing runoff from our farms. We've handed over some land to become wetlands, working with Landcare and Greening Australia, and we planted a lot of trees near the wetlands." Another argued "we're making absolutely no impact on the Reef". This demonstrates the extreme contrast in farmer attitudes.

Understanding this is important for ensuring effective policy design. For example, policy mechanisms that focus on conservation type farmers will not necessarily appeal to the enterprise farmer, but policy mechanisms which focus solely on profit may exclude lifestyle and conservationist farmers. Therefore, a key finding was that no single policy approach will fulfill the necessary demands of all cane farmers.

Consequently, there is a requirement for a suite of policy options that can address multiple farming demographics, risk attitudes and desires.

Demographics

Targeting specific demographics that are more likely to sell properties (e.g. older farmers looking to exit the industry) was also validated as a viable approach. From the Future of Farming survey data analysed, older cane farmers (those post the retirement age of 65) answered more frequently that they are planning to change farm ownership in the next five years.[4] One added that "current GBR policy is making farming uninviting for the next generation".

Figure 2 presents the distribution of sugarcane farmer ages for each region, showing some regions have greater proportions of older farmers, with many beyond the traditional retirement age. This indicates that many of these farmers may be receptive to leaving the industry, providing the opportunity for a new operator to implement new management and actions and improve farm viability.

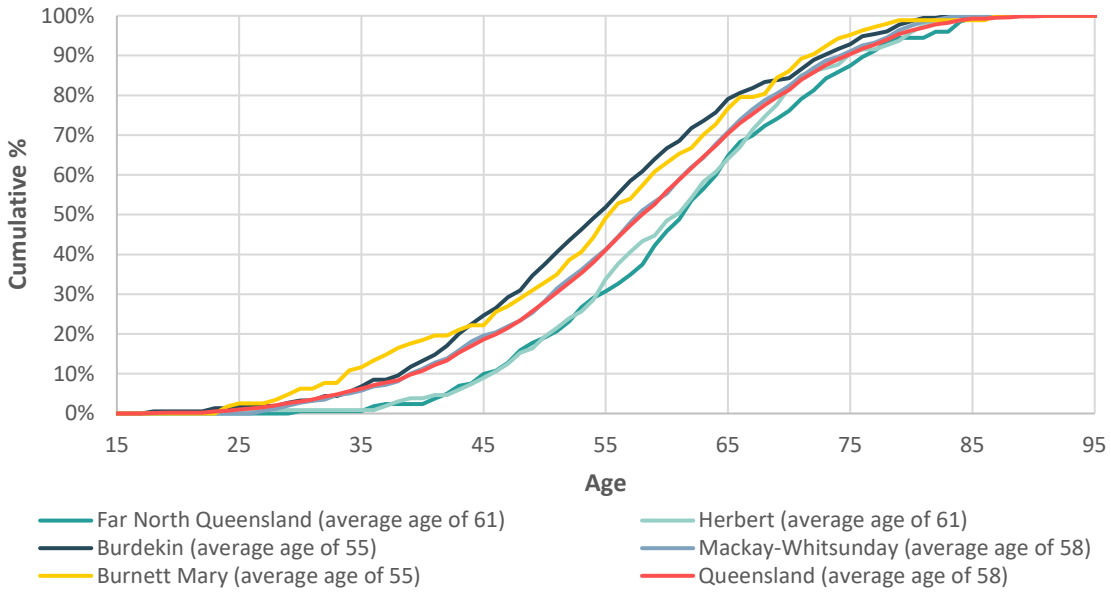

Figure 2. Farmer age distribution by growing region
Source: ABS (2020)

The analysis of farmer age was also analysed at a more granular spatial level (e.g. the SA2 level). It shows that in the Northern regions, the highest concentrations of retiring age farmers live in the Ingham region, Johnstone, and Daintree SA2 areas, while in the Southern regions high numbers of retiring age farmers live in the Burrum-Fraser, Pioneer Valley, and Proserpine SA2 areas (ABS, 2020). See Appendix D for further discussion around the location of retiring age farmers.

Another key factor to consider when trying to encourage change of ownership of land is succession planning. For some farmers, this is a key factor, with one stating in the Future of Farming survey that "there should be some credit given to generational farming, and the value of stewardship of the land. I'm a fourth-generation farmer, and we've been successful both financially and through sustainability of the soil." This was also reflected in the survey responses about succession planning, where 54% of participants indicated that they did have a succession plan, with 80% of those planning to pass on the farm (as opposed to selling it). The general consensus of the semi-structured interviews was that there

[4] The mean age of survey participants was 64 years old, not dissimilar from the ABS data.

is a lack of succession planning; however, the presence of some corporate style large family farms was also noted.

Other key social and demographic indicators that influence land use transitions included:

- Attitude towards taking risks – Those more willing to take risks on new technologies or markets were more likely to be considering a change of ownership in the near future.
- Identity as a cane farmer – Those who identified strongly with being a cane farmer were less likely to be planning a change of ownership; however, were more likely to be planning to intensify or diversify their business.
- Existing relationships – The importance of existing relationships when purchasing farms from older growers was mentioned by one interviewee. Conversely, another interviewee mentioned reluctance of farmers to sell or lease to their direct neighbours.

3.2 Market and enterprise characteristics

In addition to the farmers themselves, it was also considered important to study the characteristics of their farming businesses.

Farm finances

Analysis of farm financial performances shows that farm profitability generally increases with farm size. Smaller farms tend to have high amounts of off-farm income and higher equity ratios, while a high proportion (85%) of farms with less than 50 ha under production were operating with negative business profits. This was also reflected in a recurring theme of the semi-structured interviews where it was thought that many older farmers have off-farm income which can 'mask' the actual financial performance on-farm, meaning that they are able to stay on their farms for longer. Many interviewees, while acknowledging the need for improved environmental outcomes, emphasized the need for practice change to be economically viable. Furthermore, most interviewees agreed that larger farms generally had better management practices, with one interviewee suggesting that government could play a role by purchasing farms and leasing back to good farmers in larger parcels who would be required to buy the land over a period of time. This relationship between farm size and management practice has also been studied in the literature, with some authors finding that farm size is likely to be an indicator of adoption (see Van Grieken et al., 2019; Van Grieken et al., 2014; Van Grieken et al., 2012; and Smith et al., 2014 in limited cases). It should be noted however, that others find the relationship to be inconclusive (e.g. Rolfe & Harvey, 2017; Knowler & Bradshaw, 2007).

It was also mentioned that while monitoring water quality outcomes can be difficult and expensive, amalgamation would also make monitoring at the individual farm level cheaper and easier.

In agreement with the above insights, from the Future of Farming survey, 40% of participants agreed that *"My existing levels of farm debt make it more difficult to invest in new initiatives that would improve the long-term performance of my farm, including diversifying into new cashflow generating opportunities",* and 34% of participants agreed that *"My farm relies heavily on off-farm income to get through commodity price downturns and climate cycles"*.

Table 1 presents average farm financial performances by farm size based on ABARES data, while Table 2 presents average financial performance by growing region.

Table 1. Average farm financial performance, Australian sugar cane growing farms, by farm size, 2013-14 (inflation adjusted)

Farm size	Farm cash income	Percentage of farms with negative cash income	Farm business profit	Percentage of farms with negative business profit	Total off-farm income	Sugar cane operating margin (before finance costs)	Equity ratio*
< 50 hectares	$16,400	44%	-$61,300	85%	$50,300	$10/ha	91%
50-125 hectares	$80,000	12%	-$15,300	46%	$37,900	$550/ha	95%
125-250 hectares	$128,900	17%	-$14,900	60%	$19,800	$620/ha	87%
>250 hectares	$423,000	11%	$165,600	45%	$37,400	$900/ha	73%

*Equity ratio defined as total owned business capital less debt as a percentage of total owned business capital.

Source: ABARES (2015)

Table 2. Average farm financial performance by growing region, 2013-14 (inflation adjusted)

Growing region	Area planted to sugar cane	Yield	Proportion of total farm area irrigated	Farm cash income	Farm business profit	Sugar cane operating margin (before finance costs)	Equity ratio*
Far North Queensland	123 ha	94 t/ha	12%	$132,500	$21,800	$750/ha	83%
Herbert	118 ha	76 t/ha	2%	$106,700	$2,600	$640/ha	89%
Burdekin	157 ha	102 t/ha	98%	$114,300	-$22,000	$790/ha	80%
Mackay	128 ha	73 t/ha	84%	$90,400	-$14,300	$780/ha	78%
Bundaberg	108 ha	73 t/ha	96%	$103,600	-$26,100	$260/ha	93%

*Equity ratio defined as total owned business capital less debt as a percentage of total owned business capital.

Source: ABARES (2015)

While the Future of Farming survey did not corroborate the influence of farm size on land use transitions, it did show the influence of financial capacity. Those farmers with limited financial capacity were more likely to be planning a change of ownership in the near future.[5]

Therefore, understanding the relationship between farm size and profitability may still be useful for identifying farms which are unprofitable, are less likely to be able to invest in practice change, and are more likely to sell. The Farm Economic Analysis Tool (FEAT) (Queensland Government DAF, 2020) was used to estimate profitability for different farm sizes and across each production region. The values presented in Table 3 reflect the financial performance for an average farm operating by region for a given farm size. Red text indicates that the farm is operating at a loss whereas black text indicates that

[5] Farmers who agreed with the statement *"My existing levels of farm debt make it more difficult to invest in new initiatives that would improve the long-term performance of my farm, including diversifying into new cashflow generating opportunities."* were considered to have limited financial capacity.

the farm is operating at a profit. For most regions, farms needed to be above 100 hectares to achieve positive profits.

Table 3. Estimated profitability of sugarcane farms by farm size and growing region ($/ha)

Farm size	Far North Qld	Herbert	Burdekin	Mackay-Whitsunday	Burnett Mary
50 hectares	-$1,245	-$1,194	-$1,809	-$1,349	-$930
75 hectares	-$614	-$520	-$773	-$670	-$457
100 hectares	-$226	-$104	$123	-$251	-$166
150 hectares	$227	$380	$678	$237	$173
200 hectares	$483	$654	$1,137	$513	$365
500 hectares	$1,004	$1,212	$2,095	$1,075	$756
1,000 hectares	$1,198	$1,420	$2,461	$1,284	$902
Farm size profitability threshold (ha)	**125**	**111**	**96**	**126**	**124**

Source: Based on DAF (2020)

Market for sugar

While the profitability estimates above are based on current prices, the sugar price is not expected to improve significantly in the near future. Figure 5 shows the projected world indicator sugar price according to the World Bank Commodities Outlook (World Bank, 2021) along with the historical price. This shows the low likelihood of a comeback in sugar prices to pre-2012 levels.

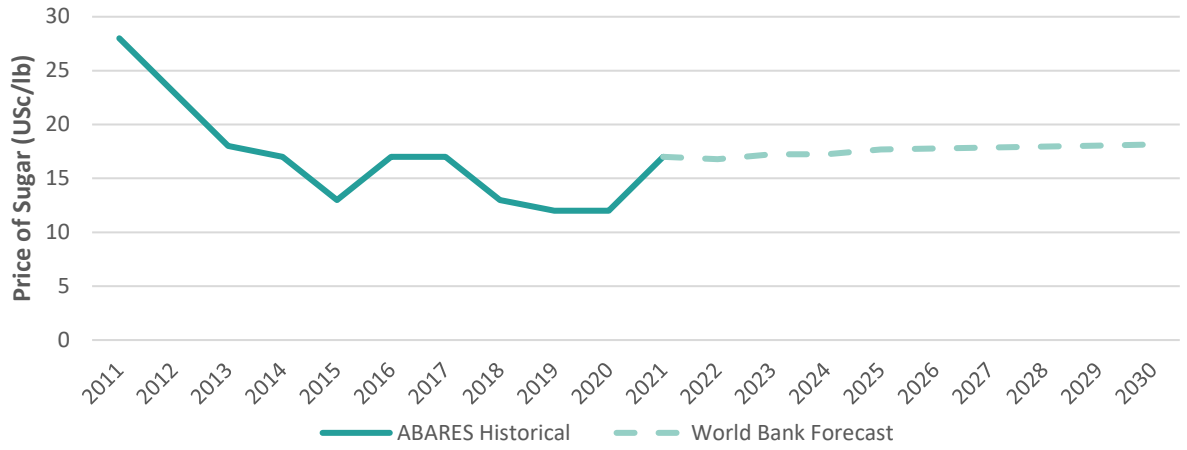

Figure 3. Historical and forecast price of sugar

Source: ABARES (2021), World Bank (2021)

The risk of dis-adoption of practices was also raised as a key threat to the achievement of water quality improvements. One interviewee observed that, when cane prices are strong or when there is government support, there adoption rates are usually higher. However, when prices drop or funding ceases to provide the incentive, dis-adoption can occur which undermines long-term improvements.

Furthermore, increasing input costs (e.g. energy, water, etc.) put a squeeze on farmers' margins, limiting their capacity to invest in improving practice, take risks, expansion through the purchase of neighbouring properties, or even diversifying into green markets (e.g. leave productive areas to conservation to receive credits).

Other farm level drivers

Other farm characteristics that were shown to have an influence on land use transitions in the near term were Smartcane BMP accreditation and reliance on off-farm income. As there is data available on both of these factors they may serve as useful tools to target any policies for facilitating land use transitions.

3.3 Policy solutions

The policy problem and current policy environment

Before considering policy options the policy problem must be well understood. In the absence of any policy, water quality impacts from farming are likely to remain (or worsen) as there is no incentive to improve. As no single entity owns a property right over the Reef (i.e. it is a common resource), and the farmers do not directly experience the full cost of the pollution (i.e. it is an externality), there is no incentive for farmers to reduce their water quality impacts (i.e. a market failure is occurring). Policies that reduce the net benefit of pollution to the farmer may result in improved water quality outcomes. One way to achieve this would be to amalgamate and reconfigure farms such that they are operated more efficiently, lowering the relative cost of pollution reduction (as a proportion of profits), and improving profitability more generally due to economies of scale. This represents a win-win outcome where more efficient farmers have better practices that deliver greater profits and lower pollution.

The current policy environment can be prohibitive of the amalgamation and sale of sugarcane farms. Barriers exist in the form of high transaction costs, planning scheme limitations, and lack of investment capital. Many existing policies lack flexibility and do not reflect farmers' individual circumstances. One survey participant suggested that *"government policies should be taking into account the experience of farming"*, while another also argued that *"it shouldn't be one size fits all"*, noting the differences between wet northern areas and drier southern areas as an example. The limitation of planning schemes in particular was highlighted during interviews as they may limit options for those who wish to stay in their family home when they retire, as well as selling on their farm.

Policy options

A selection of policy instruments was investigated that could be used to implement the amalgamation of land into larger, more sustainable and more commercially viable enterprises. There is a spectrum of policy/program mechanisms, as no single policy will suit the purposes and requirements of the varying typologies of farmers. These policies are not necessarily mutually exclusive and could be sequenced and packaged to achieve more effective and efficient outcomes. One farmer in the Future of Farming survey highlighted that "*farmers are flexible, adaptable and willing*". Policy instruments identified include:

- Suasive mechanisms such as information and extension.
- Compulsory acquisition could be used to acquire properties for subsequent amalgamation.
- Revolving funds as a market mechanism for voluntary purchases and subsequent amalgamation.
- Tradable development rights.
- Planning scheme amendments to underpin reconfiguration.
- Stamp duty and other state levy exemptions to reduce costs of reconfiguration activities.
- Landcare tax deductions to reduce costs of reconfiguration activities.
- Covenants to areas converted to conservation purposes.

See Appendix D for more detailed descriptions of policy options.

The Future of Farming survey asked participants about their preferences over various policy attributes and the response show a few key interactions. Overall, there was very strong agreement (4 out of 5 cane farmers surveyed) that policy and funding mechanisms should:

- Have a focus on voluntary participation as opposed to involuntary.
- Be flexible to reflect local circumstances rather than GBR-wide scale.
- Have a focus on incentives over regulations.

- Should make it easier to amalgamate or reconfigure existing landholdings to enhance farm profitability and achieve broader sustainability goals.
- Make it easier to 'package' policies and funding together to ensure they meet my circumstances.

Responses were more evenly split (approximately 50/50) in terms whether mechanisms should:

- Focus on agricultural inputs (e.g. fertiliser application rates) as opposed to agricultural outputs (e.g. nitrogen runoff).
- Focus on temporary measures as opposed to permanent measures.
- Consider succession plans.

Table 4 presents a matrix of suitability for different policy options based on policy characteristics and participant preferences from the survey. The colour coding represents the strength of response of a given attribute to respondents (i.e. green=important, red=not important), while the ticks represent how well a given policy aligns with each attribute (i.e. cross=not aligned, one tick=somewhat aligned, two ticks=well aligned). It shows that no single policy is well aligned with all attributes. Those that align well with amalgamation-based policies are compulsory acquisition, revolving funds, and planning scheme amendments; however, compulsory acquisition is not aligned with the other policy attributes that farmers tended to favour.

Table 4. Policy suitability matrix

	Policy attributes*						
Policy options	**Voluntary**	**Flexible/Local**	**Ag Inputs**	**Incentives**	**Temporary**	**Succession**	**Amalgamation**
Suasive mechanisms (information and extension)	✓✓	✓✓	✓	✓	✓	✓	✓
Compulsory acquisition	×	×	n/a	×	×	×	✓✓
Revolving fund for land purchases	✓✓	✓✓	n/a	✓✓	×	✓	✓✓
Tradable development rights	✓✓	✓✓	n/a	✓✓	×	✓	✓
Planning scheme amendments to allow amalgamation	✓✓	✓✓	✓	✓	×	✓	✓✓
Stamp duty exemptions	✓✓	n/a	n/a	✓	×	✓	✓
Landcare tax deductions	✓✓	×	✓✓	✓	✓	×	×
Covenants to areas converted to conservation purposes.	✓	×	✓	×	×	×	×
Comprehensive policy package *(revolving fund, planning scheme amendments)*	✓✓	✓✓	✓	✓✓	×	✓✓	✓✓

*Note that policy package preferences was asked in the survey but was not included in this matrix seeks to reflect analysis of individual policy options.

Revolving funds and planning scheme amendments are not mutually exclusive and are both well aligned with the attributes that were most favoured by survey respondents (flexible/local and

voluntary). When combined they are also aligned with input focused policies and are compatible with succession planning. This is represented by the comprehensive policy package. If desired, this package could be further augmented using suasive mechanisms, stamp duty exemptions, and covenants for conservation areas, as a high proportion of farmers (78%) indicated that they thought it should be easier to package policies and funding together.

The strongest indicator for support for these policy attributes was Smartcane accreditation. Those who said they were Smartcane accredited tended to be more supportive of all of the policy attributes above. Other key indicators of support for policy attributes were:

- Farmers with reliance on off-farm income – more supportive for input-based, incentive-based, and temporary policies.
- Post-retirement age farmers – more supportive for policies which consider succession planning.
- Lifestyle motivated farmers – more supportive of voluntary, input-based, temporary policies.
- Stewardship motivated farmers – less supportive for voluntary, flexible/local, and packaged policies.

3.4 Moving forward revolving fund as part of policy prescription

Based on the findings above, revolving funds, complemented by other policies, were analysed more closely.

Revolving funds in detail

Taken as an example for policy prescription, a revolving fund would have significant potential as a market-based mechanism. This is where:

1. Properties are purchased from voluntary sellers.
2. These properties are amalgamated with other properties to achieve better economies of scale and reconfigured to reduce loads entering waterways (e.g. shortening furrow lengths to reduce runoff into drainage system and reduce energy and water consumption and/or rehabilitate part of the amalgamated enterprise to provide enhanced ecosystem services.). This could be underpinned by registering a conservation covenant on the land.
3. Amalgamated (and larger) properties are then sold back onto the agricultural land market as ongoing and more efficient enterprises that generate lower loads.

Unlike the current dominant approach for incentives (grants) where funds, once expended, are not available for future investment, financial capital invested in properties under a revolving fund mechanism is partially/fully recovered from proceeds of the land sale when amalgamated properties are sold. Hence the financial capital is 'revolved'. Several revolving funds are currently in operation across Australia, primarily focused on terrestrial biodiversity projection on private land. Revolving funds potentially have a number of advantages over other incentive mechanisms, including:

- Unlike grants, financial investments can be 'revolved', potentially achieving greater environmental outcomes in the long-term.
- Reconfigured properties generally result in a low level of dis-adoption as there is a significant investment required to dis-adopt (as opposed to many practice changes that are easily reversed).
- Reconfigured properties may attract a market price premium when sold (e.g. due to higher profitability).
- Aggregated and revolved properties can enhance regional economic resilience as they are more profitable.
- Revolving funds can work well with other mechanisms (e.g. conservation covenants) (Binney and Whiteoak, 2010; Hardy et al., 2018).

However, it should be noted that a higher initial investment is required than for most incentive mechanisms and the transactions are more complex.

Case study

A model of a revolving fund was developed for the Burdekin region, building on modelling from earlier project phases. It used a nominal $30 million initial investment to purchase, amalgamate, reconfigure, and sell farms (see Figure 4).

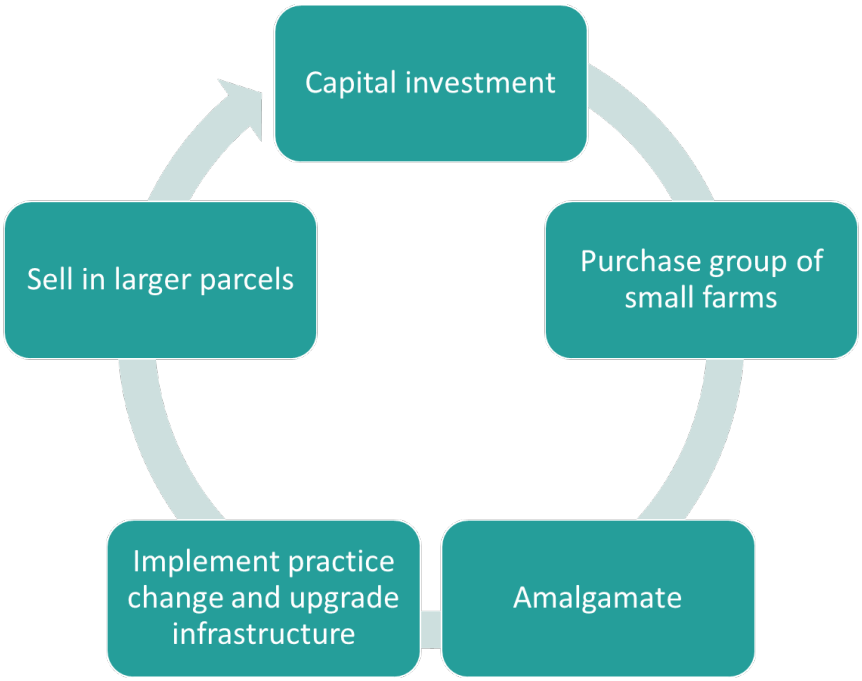

Figure 4. Revolving fund model structure

This model is a little different to a traditional revolving fund in that is seeks to *amalgamate* purchased farms. Another approach would be to purchase farms that are operating at low management practice classes, reconfigure them, and then resell them. While it is possible this approach could be effective in achieving water quality improvements and could result in lower search costs for finding contiguous sellers, the lack of amalgamation means that there are unlikely to be additional profitability improvements or social benefits. The lack of profitability improvement may also mean that the eventual owners have lower capacity to maintain the higher management practice levels in the long-term, resulting in dis-adoption.

It was also combined with two other policies: amending the planning scheme to allow subdivision, and stamp duty waivers. It was assumed that reconfiguration would take farms from D class practice to C class practice, as well as upgrading irrigation infrastructure (including shortening the furrow lengths), and 5% of the productive area would be left for conservation. The target amalgamated farm size was 200 hectares, considerably above the profitability threshold for the Burdekin. To do this, the model drew from a range of data sources, as described in Table 5.

Table 5. Revolving fund input data

Data	Description
Farm level data	The model requires farm level data on farm size and valuation. These were taken from the Land valuations spatial dataset published by the Department of Resources, which provides land valuation for individual land parcels (Queensland Government, 2021a). Additionally, the buildings spatial dataset also provided information on whether a property included a house and/or shed (Queensland Government, 2021b).

Data	Description
Reconfiguration data	Data on the costs and water quality impacts of reconfiguration was required. To model the problem from the perspective of the Fund, the costs had to be limited to the subset of costs which would actually be incurred by the Fund administrator and not to other parties (e.g. landholders). This information was taken from Alluvium (2019).
Ecosystem service values	Benefit transfer values from NCEconomics (2018) were used to determine the likely magnitude of ecosystem service values resulting from the reconfiguration. The ecosystem services associated with the purchased land can include services like carbon sequestration, or habitat provision (among others), and are assumed to be delivered through the creation of conservation areas.
Purchase and sale requirements	A number of different data sources were used to model farm sale transactions. Standard stamp duty rates for Queensland (Queensland Government, 2021c) were used along with an assumption of a 2% real estate commission. The valuation data mentioned above was used for individual farms in the purchase, and were also used to estimate the value when sold by the Fund. Sales involving residential buildings included a value for potential rental income in the sale price, based on a search of Realestate.com for rentals in the region. Additionally, an assumed water requirement of 10ML/ha and allocation price of $427/ML was used to include the value of water allocations in the purchase and sale prices.
Fund characteristics	A number of Fund characteristics had to be selected for the modelling exercise in order to illustrate the likely impacts of the Fund. These included the initial Fund investment, a reserve requirement (10%), and an operating cost (1% of Fund value per revolution).

Box 1 outlines an example amalgamation to provide clarity around the flow of funding as it was modelled.

Box 1. Example revolving fund amalgamation

Focussing on an individual amalgamation may provide clarity on the fund operation. Take a group of 4 small co-located farms which have approximately 50 hectares of productive land each. These farms perform poorly from both a profitability (i.e. average annual profitability of negative $1,800/ha) and a management practice perspective (i.e. D class practice). Their owners, like many sugarcane farmers in the Burdekin, are looking to pass on or sell their farm in order to retire; however, they would like to stay in the community and ideally the family home.

The Fund purchases these farms from the willing sellers who, after planning scheme amendments, are able to sell the productive area of their farm separately to their house. This costs the fund $1.72 million (approx. $8,600/ha, based on the Queensland Government's land valuation dataset and assuming stamp duty is waived under a complementary policy). The Fund then determines a contiguous area across the combined properties to transition to conservation use, spending $73,000 to transition an area of 10 hectares (5% of the combined area of 200ha at a cost of approx. $7,300/ha). For the remaining productive land, the Fund implements upgrades to bring the farm from D class management practice to C class management practice, costing $88,000 (remaining 190ha at a cost of approx. $460/ha), as well as upgrading the irrigation infrastructure from C class to B class for $147,000 (190ha at a cost of approx. $780/ha).

Once upgrades are complete, the Fund seeks to sell on the combined properties as a single farm. Assuming there is a willing buyer, the Fund sells the farm for $1.39million (approx. $7,300/ha based on the Queensland Government's land valuation dataset, excluding the area for conversation). The Fund also pays a real estate commission of 2% on the sale (approx. $28,000).

Additionally, there are costs involved in operating the Fund which are dependent on the Fund size. These are assumed to be in the order of 1% of the total Fund value per revolution (e.g. if the Fund value is $30 million it will cost approximately $300,000 to operate it for a single revolution). This works out at approximately $130 per hectare of land purchased, which for the above transaction comes to $26,000.

As a result, the net cost of the above transaction can be calculated as follows:

$$\begin{aligned} &Net\ cost\ of\ transaction \\ &\quad = Sale\ value\ of\ productive\ land - Real\ estate\ commission - Operating\ cost \\ &\qquad\qquad - Reconfiguration\ costs - Purchase\ cost \\ &\quad = \$1{,}390{,}000 - \$28{,}000 - \$26{,}000 - (\$147{,}000 + \$88{,}000 + \$73{,}000) - \$1{,}720{,}000 \\ &\quad = \$692{,}000 \end{aligned}$$

For this $692,000 in net costs, a load reduction of a little over 1,000kg of DIN has been achieved (430kg from practice change improvements, 500kg from irrigation upgrades, and 80kg from transitioning area to conservation). In addition potential annual profitability improvements of around $569,000 (from -$1,800/ha to $1,100/ha due to economies of scale could be achieved (after accounting for the small reduction in productive area), and the original owners were able to remain in their family home. Furthermore, the areas transitioned to conservation are likely to provide other ecosystem service values (e.g. carbon abatement) in addition to the water quality improvements. These could be in the order of $36,000.

Table 6 presents the key outcomes for this revolving fund case study, including an 80% confidence interval (CI) derived from 50,000 Monte Carlo simulations.[6] The $30 million investment in the Burdekin region is estimated to result in the abatement of around 37 tonnes of annual DIN loads over 11 'revolutions' of the fund. Additional benefits include improvement in farm profitability, maintaining the long-term commercial viability of local mills, social benefits for older growers looking to retire, and ecosystem services provided by newly established wetlands or riparian vegetation on converted properties (see Appendix D for detailed discussion).

It should be noted that these results represent a best-case scenario. They are based on implementing a suite of complementary policies (i.e. planning scheme changes and stamp duty waivers), and do not explicitly include the potential search costs involved in finding suitable farms for purchase. In order for amalgamation to be possible, the Fund would need to find a number of small farms that are co-located, being operated with poor management practice levels, and with owners who are willing to sell. Potential avenues for targeting farms to reduce search costs and maximise efficiency are discussed further down.

An alternative scenario was tested that does not include allowance for changes to the planning scheme. This scenario resulted in far lower load reductions (18t versus 37t) as well as performing relatively poorly across the entire range of other outcome variables.

Table 6. Key outcomes from Fund implementation

Key outcomes	Estimate	Range (80% C.I.)
Initial investment ($)	$30,000,000	n/a
Time to exhaustion (no. of revolutions)	11	10 - 12
Remaining capital ($)	$780,000	$730,000 - $840,000
Number of farms amalgamated (no.)	191	178 - 205
Area of cane land converted (ha)	7,130	6,430 - 7,870
Water quality impacts (kg annual DIN abated)	37,100	32,100 - 42,400
Cost-effectiveness ($/kg annual DIN abated)*	$790	$690 - $910
Economies of scale ($million/year)	$23.8	$21.7 - $25.7
Practice change impact on profitability ($million/year)	$0.2	$0.2 - $2.0
Total change in annual returns ($million/year)	$24.0	$22.5 - $27.0
Area left to conservation (ha)	375	284 - 458
Ecosystem service value ($million/year)	$1.4	$0.9 - $1.9

Source: NCEconomics estimates
*Note that the cost-effectiveness reported is from the perspective of the Fund only and therefore does not include the costs or benefits that accrue to landholders (e.g. profitability improvements, ongoing maintenance costs, etc.).

Analysis of varying revolving fund sizes determined how impacts on the two primary outcomes (load reductions and profitability improvements) would change with the initial investment amount. Figure 5 presents the results of this analysis, showing load reduction and profitability impact by Fund size. Note that the largest Fund size is $74 million; this is the point at which the Fund is able to purchase all of the farms below the profitability threshold within the region of interest.

[6] Monte Carlo simulations are a statistical technique used to model the probability of different outcomes in a process that cannot easily be predicted due to the variability in multiple input variables used in the analysis. It is a technique used to understand the impact of risk and uncertainty in prediction and forecasting models.

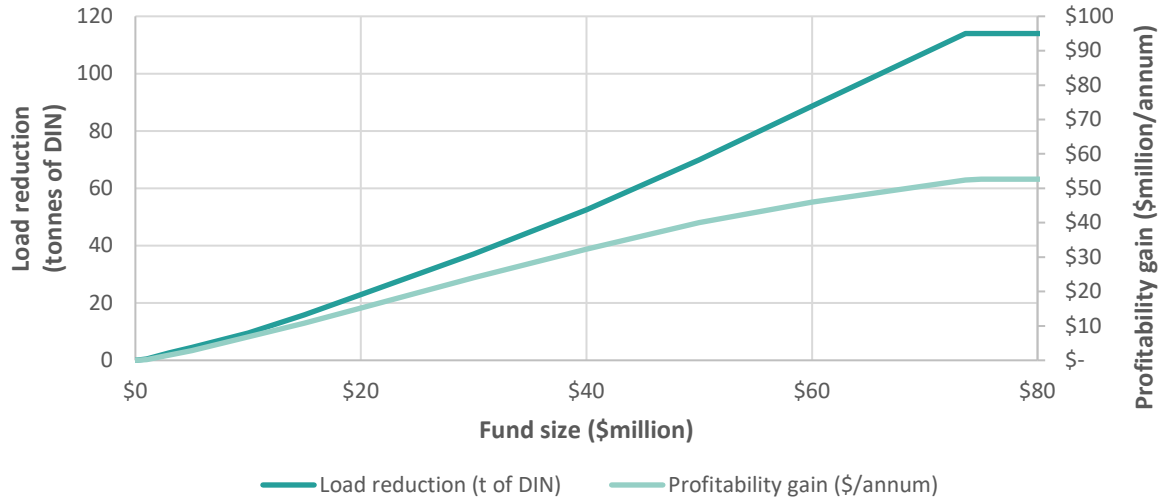

Figure 5. Impact of increasing Fund size

Source: NCEconomics estimates

Targeting

As mentioned above, there will likely be search costs involved in locating farms which are suitable for amalgamation. Appendix D provides a more in-depth discussion of targeting; however, the two key avenues to achieve this utilising available data are:

- Spatial data on farm size – Publicly available spatial data on land parcels intersected with sugarcane land use data can show areas where there are high concentrations of small sugarcane farms. By targeting these areas the Fund may improve its chances of acquiring co-located small farms.
- Farmer age – Census data on farmer age can show areas (at an SA2 level) with high concentrations of farmers nearing or past retiring age. By targeting these areas the Fund may improve its chances finding farmers who are willing to sell.

While small farms are more likely to be operating at poorer management practice levels, this won't be the case for all of them. This represents a gap in the available data for targeting, where additional information on the management practice levels of individual farms could further reduce search costs for the Fund. However, it should also be noted that Alluvium (2019) indicates that a high proportion (57%) of the sugarcane production area in the Burdekin is operating at D class management practice levels. Considering this proportion, and the greater likelihood that small farms are operating at D class management practice, it may not be difficult to locate suitable farms just by using data on farm size.

Figure 6 and Figure 7 present examples of the farm size data and farmer age data for Northern Queensland, respectively.

Ultimately, targeting based on available data will establish insight on smaller regions where the intervention will likely make the greatest impact. However, given the fact it is an approach that operates in a voluntary land market, expressions of interest should be used as a means to elicit participation. A multiple-round expressions of interest approach would enable elicitation of bids from adjacent properties, where success is based on packages of complementary proposals. This approach has been used previously for establishing biodiversity corridors across multiple parcels of private land.

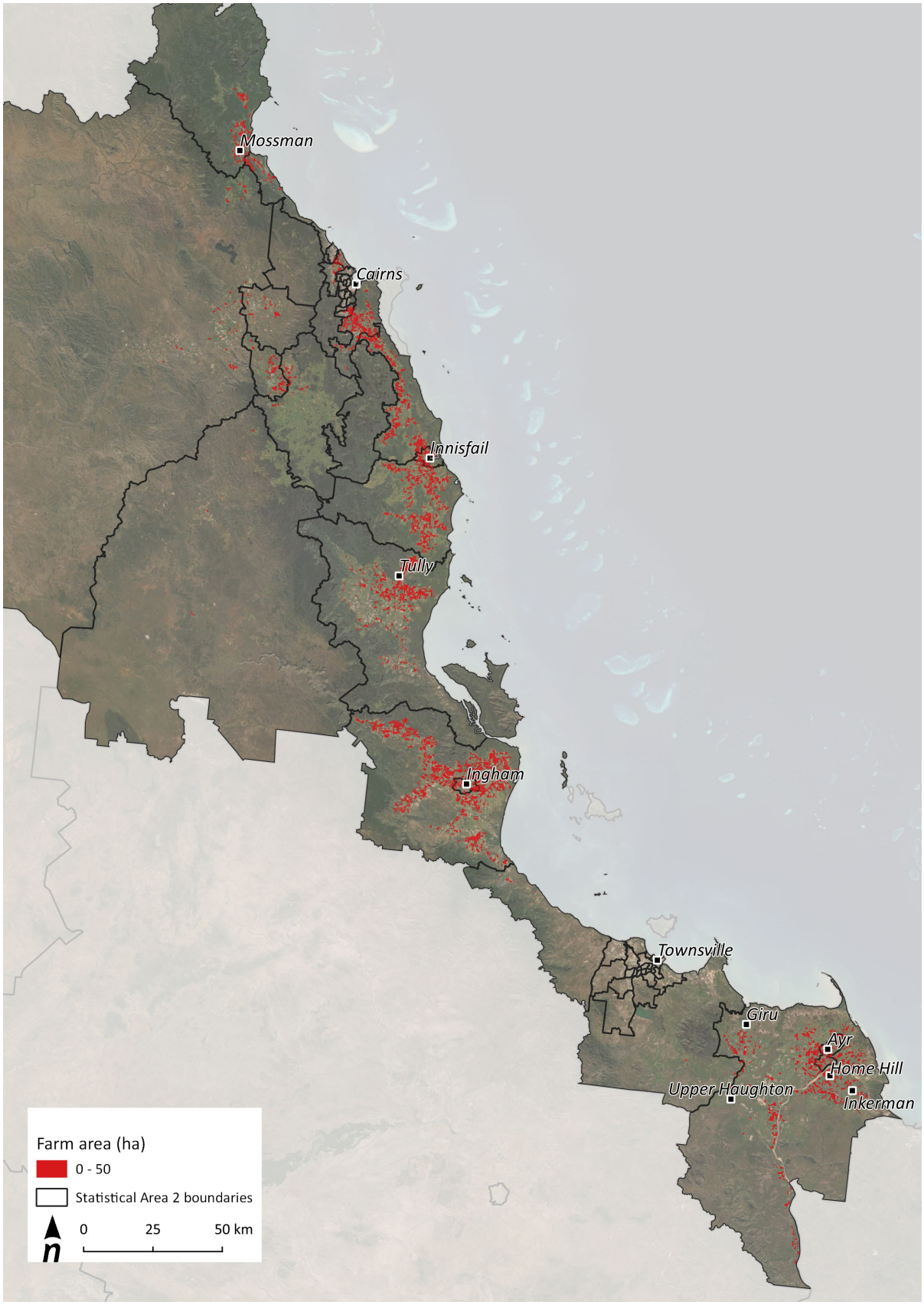

Figure 6. Location of sugarcane farms below 50 hectares in Northern Qld

Source: Queensland Government (2020a, 2020b)

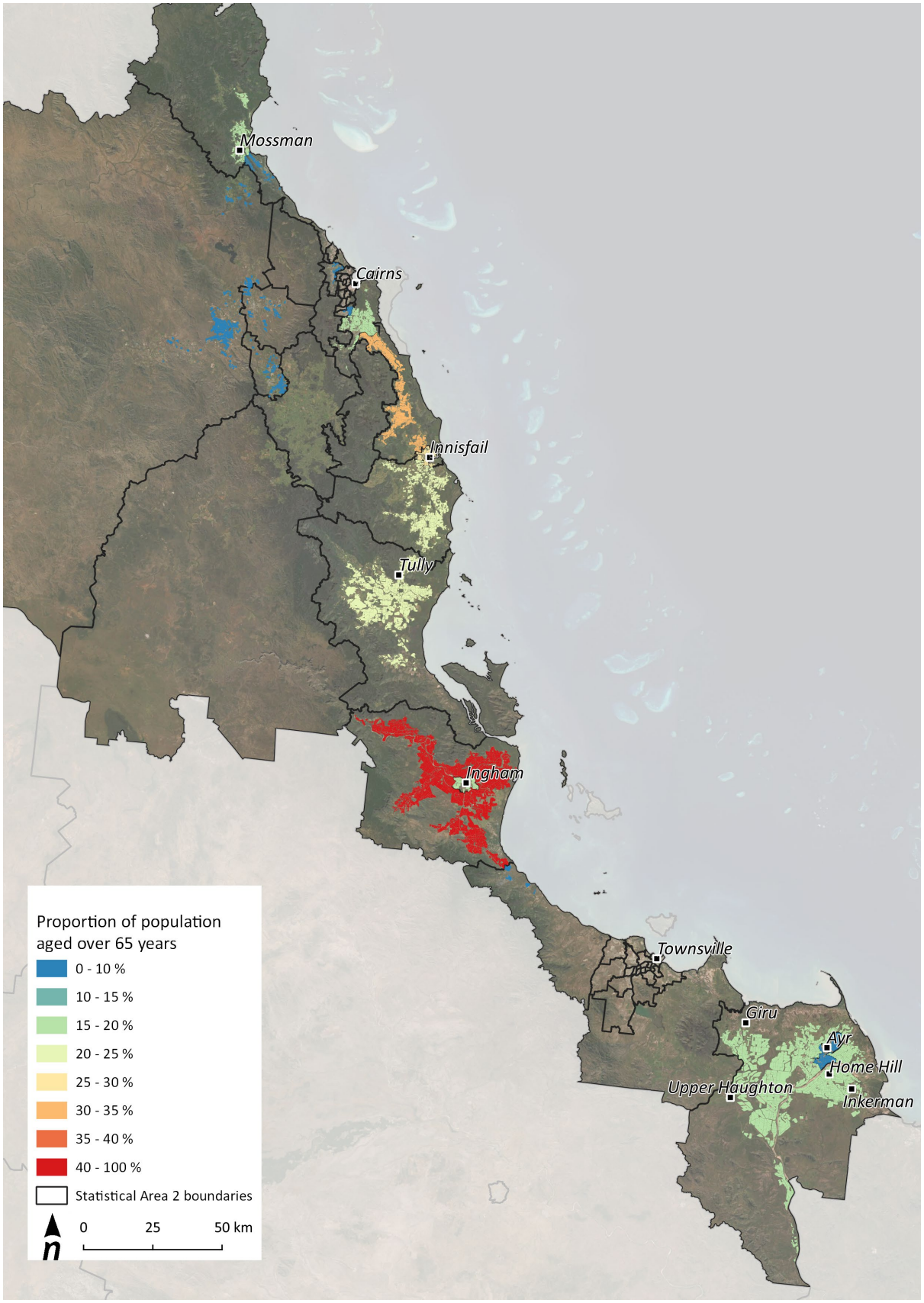

Figure 7. Concentrations of sugarcane farmers past retiring age in Northern regions

Source: ABS (2020)

4 KEY RECOMMENDATIONS

There are a number of key conclusions and recommendations that follow from the analysis outlined in this report. They are as follows:

- **Farmers are supportive of policies that make it easier to amalgamate or reconfigure existing land holdings to enhance profitability and achieve broader sustainability goals.** The survey responses indicated that policies that consider amalgamation are likely to be supported by farmers.
- **A suite of policies is needed to address different farmer demographics, risk attitudes, and desires.** For example, farmers in Northern regions had lower support for amalgamation policies than those in Southern regions. As a result, different policies may be required in order to best target both groups. As Smartcane accreditation, off-farm income, lifestyle motivations, and life stage had the greatest influence on policy preferences, they should be some of the top considerations when designing the suite of policies. Furthermore, those farmers who already had high stewardship values were the only group that tended to be less supportive of packaging a number of policies together. Therefore, the packaged approach could be designed to suit a wide range of farmers.
- **A policy mechanism should be developed that aims to achieve amalgamation of small, unprofitable sugar cane farms.** Implementation of policy mechanisms that result in amalgamation of small farms is likely to have positive impacts on farm profitability, mill viability, and water quality outcomes in a cost-effective way.
- **A revolving fund may be a suitable model to use for the amalgamation of sugar cane farms.** The case study shows that this is a way to cost-effectively reduce DIN loads to the Reef, particularly when combined with compatible policy mechanisms (e.g. changes to planning schemes so that farmers can sell their farms and retain their homes).
- **Local governments should reconsider their planning schemes in order to allow for farmers wishes to sell their farm while remaining in their home.** The revolving fund case study demonstrated a considerable improvement in water quality outcomes and cost-effectiveness when the sale of farms was made easier by allowing for subdivision in the planning scheme. This allows retiring farmers to stay in their community after selling their farm and does not result in the eventual landholder having to purchase land with a house that has little value to them.
- **Positive outcomes beyond water quality improvements should be considered in policy development.** The analysis demonstrated the likely positive impacts of a revolving fund on profitability, mill viability, social outcomes, and ecosystem services. This indicates that it is possible for policies to provide a 'win-win' scenario where all parties can benefit.
- **Available information on farm and farmer characteristics (e.g. farm size and demographics) can and should be used to effectively target policy mechanisms towards farms where it will have the greatest success.** The analysis demonstrates the utility of leveraging this data to achieve cost-effective load reductions as well as positive economic and social impacts.

5 LIMITATIONS

When considering the case study results and the above recommendations, there are a number of limitations that should also be taken into account. These are:

- **Demand for farms.** The analysis assumes that demand for larger properties exists. This may, to some extent, depend on the amalgamated farm sizes; however, buying a large number of properties within a given area may help the Fund to be flexible with the amalgamated farm sizes and therefore to tailor them to market demand.
- **Proximity of small properties.** Small properties may not all be located next to other small properties. There is an implicit assumption in the model that there are sufficient groupings of small properties for amalgamation for any revolution of the Fund. This assumption is likely to be more realistic for larger Fund sizes, where a greater number of properties can be purchased in a given revolution, therefore increasing the likelihood that some of them are next to each other. Regardless of Fund size, there may be some additional search costs involved in finding co-located small farms.
- **Availability of farms operating at low management practice standards.** While small farms may be more likely to be operated at low management practice standards, this does not mean it is the case for all small farms. There may be some small farms which are already being operated at very high management practice standards. This means the pool of suitable farms is likely less than the full list of small farms that were inputted into the model; however, the constraining factor for the total number of farms amalgamated in the case study scenario was the Fund value and not the availability of small farms. This means that even if the pool is reduced there are likely many suitable farms available, although locating them may be more difficult without data on management practice classes of individual farms.
- **Willingness to sell.** While the research in this report and elsewhere provides avenues through which farms with a greater willingness to sell can be targeted, the decision comes down to individual landholders. Despite issues with profitability, desires to retire or exit, and enabling changes to planning scheme, some growers may still not want to sell (e.g. lifestyle/hobby farmers). This may be particularly the case if the Fund is seen as government intervention as opposed to another, independent, third party. This could exacerbate the search costs involved in finding co-located farms for amalgamation.
- **Farm property data.** While the properties in the farm valuation dataset are aggregated from a number of smaller lots, it is still possible that some of these properties are already being operated in combination with others. The implication of this is that the model may overestimate the number of small farms that are potential candidates for amalgamation. Additional data from councils on rates notices may help to reduce this issue for future modelling exercises.
- **Fund influence on property market.** Leading on from the previous point, knowledge of revolving Fund as a player in the market may have an influence on prices, particularly where the Fund is known to have 'deep pockets'. This may reduce the effectiveness of the Fund due to higher prices.
- **The average farm.** It should be noted that much of the analysis is based on 'the average farm'. This is often necessary to model these types of problems; however, there is considerable variability in the way farms are operated and any decisions to sell or exit the industry come down to the individual landholders.
- **Time required for amalgamation.** The modelling results were deliberately framed in terms of the number of revolutions required as there is significant uncertainty around the length of time required for a single revolution[7]. The case study scenario presented in this study involved 11

[7] Because of the time spent to identify, approach sellers, and finalise transactions.

revolutions and if, for example, 3 to 5 years was required for each revolution, the Fund would need a potential lifespan of 33 to 55 years to complete the revolutions required to achieve the results. This may have an impact on the amount of load reductions that the Fund could contribute towards meeting the 2050 targets; however, the load reductions are likely to be front-loaded due to the Fund being able to purchase a greater number of farms in earlier revolutions, when the Fund balance is greatest.

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APPENDIX A: PHASE 2 REPORT

APPENDIX B: PHASE 3 REPORT

APPENDIX C: PHASE 4 AND 5 REPORT

APPENDIX D: PHASE 6 REPORT

APPENDIX E: FUTURE OF FARMING SURVEY ANALYSIS

FUTURE OF FARMING SURVEY ANALYSIS

1 WHAT WAS THE SURVEY?

The survey targeted cane farmers located in Reef catchments. The survey was open from April to December 2021. It was distributed via industry newsletters and local newspapers. It was initially distributed via industry newsletters and local newspapers. Additional participants were recruited with the assistance of a market research company (https://qandapanel.com.au/) from 3rd December to the 16th December 2021. A $100 voucher was offered as incentive for participation.

Survey respondents were asked to complete an anonymous 33 question survey designed to assess landholder characteristics (such as their age, attitudes, and values), farm characteristics (such as size and ownership), their land use transition plans over the next five years as well as their views towards policy, financing and funding mechanisms for land management practices.

2 WHO RESPONDED TO THE SURVEY?

In total, 102 people participated the survey (n = 45 via industry newsletters/newspapers and n = 57 via the recruitment panel). After data screening, 28 respondents were excluded from the main analysis because they indicated that they were not cane farmers (i.e., neither owned, managed nor leased a cane farm). While not cane farmers, most of those excluded respondents (n = 20) did indicate that they were members of the broader agricultural industry. They were invited to respond to questions targeting their attitudes towards different policy and funding mechanism attributes. Their responses have been summarised in a later section.

A total of 74 cane farmers responses were retained for the main analysis, with ages ranging from 35 to 93 years and the average age of 64 years. There was a wide representation across the Reef regions, with most respondents from the Wet Tropics region (43%), and the least number of survey respondents from the Burnett Mary region (8%). The response rate for each region is presented in Figure 1. The distribution of respondents is generally representative of the broader cane farming industry, whereby there are more cane farmers located in the North compared to the Southern Reef regions.

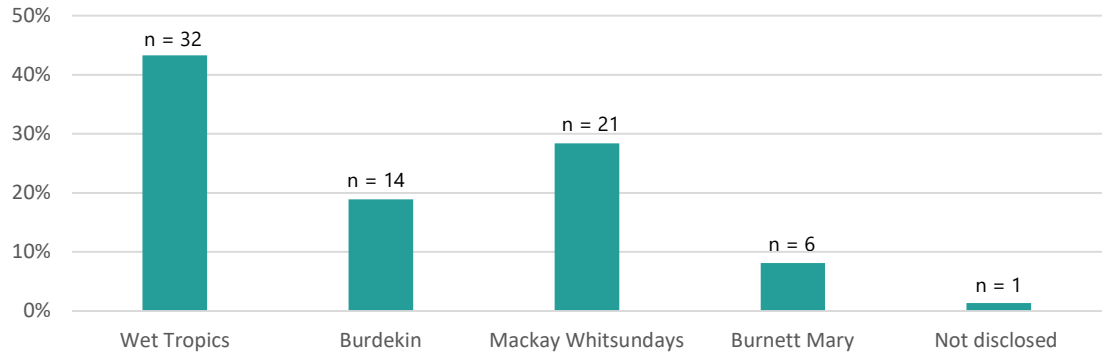
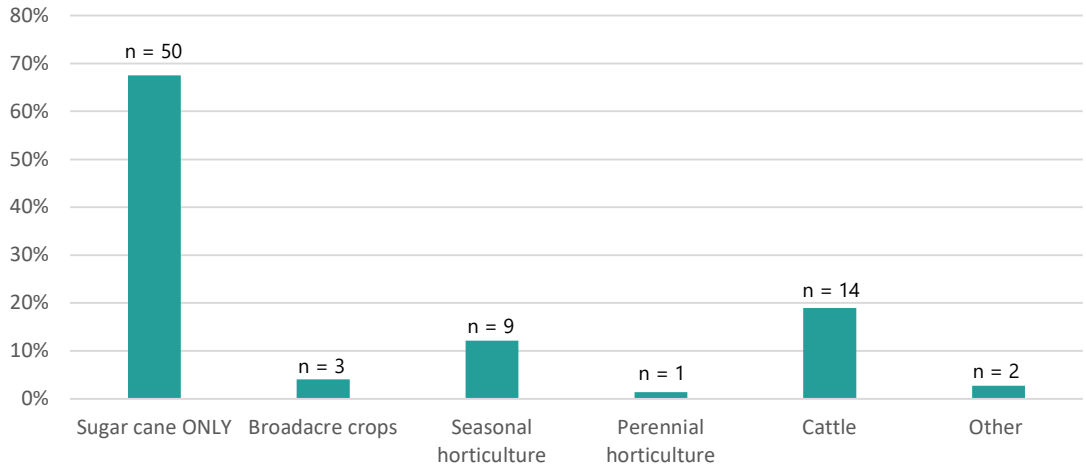


Figure 1. Distribution of survey respondents across Reef regions (n = 74)

The large majority, (n = 66, 90%) indicated that they owned their farm (noting that 10 of those respondents additionally managed or leased other cane farms). The remaining respondents (n = 8, 10%) either managed or leased a cane farm. Only a very small proportion of respondents (n = 5, less than 7%) indicated that the held more than one farm, with the majority of those indicated that the

farms are run as a combined enterprise. Total farm/s size ranged from 10 to 6,000 hectares, with a median size of 170 hectares.

A moderate proportion (n = 24, 32%) indicated that they farmed other products, in addition to cane. The products farmed are presented in Figure 2.



*Other crops included rice and "cover crops"

Figure 2. Distribution of survey respondents across farm types (n = 74, note: respondents could select more than one response).

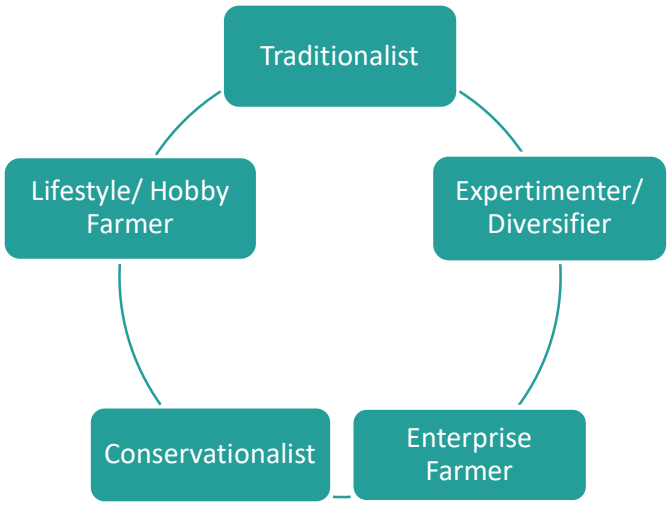
A large proportion of the cane farmers indicated that their farm borders or contains a waterway (n = 62, representing 87% of respondents), with the majority of those cane farmers (n = 55, or 90%) indicating that they have a deliberately managed riparian buffer between the production zones and the waterway.

A small majority of respondents indicated that they were currently Smartcane BMP accredited (n = 46, 65%). Of those not Smartcane BMP accredited (n = 25, 35%), again a small majority (n = 15, 60%) indicated that they were likely to get achieve Smartcane BMP accreditation in the future.

They survey generated 74 responses that could be considered as part of the analysis. The average age of respondent was 64 years. There was a wide representation of cane farmers from across the Reef catchments, with most farmers growing only sugarcane crops. Around 1 in 10 also farmed other products such as horticulture. Nearly all farms contained a waterway and the large majority of these are already protected by a riparian buffer. Just over half of the respondents were Smartcane Accredited.

3 WHAT "TYPE" OF FARMERS WERE THEY?

In Phase 3 of the project, a typology of the social, economic and cultural factors that influence cane farmers' land use transitions was developed. These typologies group together similar types of landholders based on factors, sometimes referred to as the human dimensions, demonstrated to influence decision-making processes and behaviour. The typology identified six farmers typologies: traditionalists, lifestyle or hobby farmer, experimenters/diversifiers, conservationist, enterprise farmers.



It is important to note that each group defined in the typology is based on a generalization of the factors that are *most likely* to be present within that group. Furthermore, the groups should not be considered to be mutually exclusive. That is, it is highly likely that there are overlaps between some groups. For example, some cane farmers with off-farm income (more commonly associated with the lifestyle group) have high conservation values (more commonly associated with the conservationist group), and some profit driven cane farmers (more commonly associated with the enterprise group) are highly innovative (more commonly associated with the experimenter/diversifier group). Therefore, it is not possible to neatly classify and divide all cane farmers into one typology over another. Rather the typology is useful for purposes of understanding on-farm practice changes and land use decisions by understanding and exploring the factors that underpin and explain the typology. Those factors that have been demonstrated to have the greatest utility for understanding land use transitions include:

1) Financial capacity
2) Income source
3) Values (profit, conservation and lifestyle)
4) Property succession plans
5) Life stage
6) Support for innovation/Risk perceptions
7) Social Identity
8) Trust
9) Social Networks

Therefore, a key aim of the survey was to describe the prevalence of each of the identified factors[1] among the participating cane farmers and to explore each factors relationship to both land use transitions as well as support for different policy mechanism attributes.

Table 1 provides a summary of the descriptive statistics. Each of the factors assessed in the survey are listed along a brief description as well as the actual question used to measure each of the factors. Unless otherwise stated all respondents were asked to indicate the extent to which they agreed or disagreed with each factor statement on a seven-point Likert Scale whereby 1 = Strongly agree and 7 = Strongly disagree. To assess the frequency or proportion of responses survey respondents were grouped into those that agreed and those that did not agree (which included neutral or "Don't know" responses) with the statements.

[1] Two of the factors identified in the Phase 3 Report (trust and social networks) were not included in the survey. These factors, while likely important, were not included as they are generally considered more difficult to measure using a survey instrument as well as a desire to limit survey length. More detail on each of the factors can be found in the Stage 3 Report.

Table 1. Summary descriptive statistics for typology factors (N = 74)

Factor	Question	n	Mean (SD)	Frequency
Financial capacity	*"My existing levels of farm debt make it more difficult…"*	65	4.25 (2.14)	40% agree 60% did not agree
Income source	*"My farm relies heavily on off-farm income…"*	71	4.47 (2.09)	34% agree 67% did not agree
Risk Perceptions	*"I like taking risks on new technologies…"*	71	2.86 (1.23)	70% agree 30% did not agree
Life-stage (age)	*"What is your year of birth?"*	68	64.19 (13.00)	53% pre-retirement 47% post-retirement
Succession plan	*"Do you have a succession plan…"*	71	n/a	54% yes 46% no or unsure
Social identify	*"Being a cane farmer is an important part…"*	71	2.31 (1.39)	85% agree 15% did not agree
Values				
Economic	*"…is primarily financially motivated."*	71	2.78 (1.38)	73% agree 17% did not agree
Lifestyle	*"…primarily motivated by opportunities to benefit from the farming lifestyle."*	67	3.21 (1.56)	67% agree 32% did not agree
Stewardship	*"…primarily motivated by a desire to be a land steward."*	68	2.46 (1.45)	80% agree 20% did not agree

3.1 Financial Capacity

Financial capacity can play a significant part in production and land use decisions. For example, a lack of available capital and/or high levels of debt have been identified as a significant barrier to the adoption of sustainable practices among cane farmers. Respondents were asked to indicate whether *"My existing levels of farm debt make it more difficult to invest in new initiatives that would improve the long-term performance of my farm, including diversifying into new cashflow generating opportunities."* Responses were relatively evenly split, with a slightly smaller proportion (40%) agreeing with the statement.

3.2 Income source

Having off-farm income as the primary income source can also influence on-farm decision-making, such that farmers that are more reliant on off-farm income are thought to be less likely to participate in agri-environmental schemes. For the analysis, respondents were asked to indicate the extent to

which they agreed with the statement *"My farm relies heavily on off-farm income to get through commodity price downturns and climate cycles."* Survey responses indicated that approximately 1 in 3 of the cane farmers are reliant on off-farm income.

Additionally, there is thought to be a strong tie between having off-farm income and lifestyle motivations, and this was demonstrated in our sample whereby there was a significant positive correlation such that respondents that indicated that were reliant on off farm income where more likely to having strong lifestyle values in relation to cane farming ($r = .32$, $p = .008$).

Additionally, as would be expected, having an off-farm income was related to age, whereby pre-retirement age survey respondents were more likely to be reliant on off-farm income ($M = 3.94$, whereby 75% agreed with the statement) compared to post-retirement age survey respondents ($M = 4.97$, or 25% agreed).

3.3 Risk Perceptions/Support for Innovation

Risk perceptions were identified as a key factor whereby past research has indicated that landholders that perceived significant risks are less willing to try new technologies and are also less likely to participate in agri-environmental schemes. Therefore, survey respondents were asked to indicate their agreement with the *statement "I like taking risks on new technologies and market opportunities."*, with most survey respondents agreeing with the statement (70%).

3.4 Life-stage

It was identified that life-stage, specifically in relation to retirement, can have a significant effect on landholder land use decisions. The respondents were asked to provide their year of birth and were grouped into pre- and post- retirement ages for the analysis. Interestingly, the retirement age of 65 years strongly aligned to the mean age of the survey respondents at 64 years of age, so that sample was reasonably evenly split between those pre-retirement (53%) versus those post-retirement age (47%). As mentioned above, life-stage was linked to having off-farm income. Life-stage was not linked to having a succession plan. Survey respondents' that were pre-retirement age were no more likely to have a succession plan compared to those post-retirement age. This is shown in Table 2.

Table 2. Life stage and succession planning

		Succession Plan				
		Yes – passing on	**Yes – selling**	**No**	**Unsure**	**Total**
Pre-retirement	Count	13	5	13	4	35
	% within row	37 %	14 %	37 %	11 %	100 %
Post-retirement	Count	17	3	10	2	32
	% within row	53 %	9 %	31 %	6 %	100 %
Total	Count	30	8	23	6	67
	% within row	44 %	11 %	34 %	8 %	100 %

3.5 Succession Plan

Having a succession plan was identified as a key factor, with past research suggesting that many farmers wish to pass the farm onto their children, and this plan can exceed rational economic land use decision-making. Respondents were asked whether they had a succession plan (i.e., a plan to pass the farm onto the next generation, or a plan to change ownership). Rather than respond on a scale, survey respondents were able to answer "Yes – passing on the farm", "Yes – selling the farm", "No" or

"Unsure". The responses were equally split, with 54% indicating that they have a succession plan. Only a small proportion of those had plans to sell the farm – representing only 8 respondents (or 10% of the total sample).

3.6 Social identity

Social identity refers to membership of a group where belonging is emotionally significant. The more a person identifies with a social group, the more they will abide by the rules and behaviours demonstrated by this group (called a social norm). There is strong evidence, from both the agricultural landholder literature as well as the broader behaviour change and pro-environmental literature, to demonstrate that people's decisions and behaviours are strongly influenced by the rules and behaviours (i.e. the social norms) of the groups they identify with. Accordingly, respondents were asked whether *"Being a cane farmer is an important part of my identity"*, with a large majority (85%) agreeing with the statement. Having a strong cane farming identify was positively related to lifestyle values ($r = .36$, $p = .003$) and stewardship values ($r = .24$, $p = .046$), such that respondents that strongly identify as a cane farmer were also more likely to value lifestyle and stewardship values highly. Identity was not related to economic driven values.

3.7 Values

Research on agricultural landholder values highlight three core values that have been consistently demonstrated to influence landholder decisions. These are economic, lifestyle and conservation values. Landholders that hold 'conservation' or 'lifestyle' values are more likely to adopt conservation practices, whereas landholders with strong financial and economic drivers are unlikely to adopt conservation practices unless there are clear financial incentives. Three questions were indicated to assess different values among the responding cane farmers: *"My on-farm decision-making is primarily financially motivated."; "My on-farm decision-making is primarily motivated by opportunities to benefit from the farming lifestyle."*; and, *"My on-farm decision-making is primarily motivated by a desire to be a land steward."*

Generally, all three values were held highly by most of the respondents. Stewardship values were held most highly by the respondents with 80% agreeing with the statement, compared to 73% of respondents who agreed with financial values and 67% who agreed that the value the farming lifestyle.

Lifestyle and financial values were positively related, whereby respondents who highly value the cane farming lifestyle tend to also highly value economic values ($r = .49$, $p < .001$). This was not the case for respondents that highly valued stewardship. Stewardship values were independent to both lifestyle and financial values.

There was a relatively even distribution of respondents in terms of financial capacity, income source, risk perceptions, life stage and succession planning. The sample was less evenly split in terms of social identity and values, whereby close to 4 out of every 5 respondents indicated that they highly identified as a 'cane farmer' and/or held strong economic, lifestyle and/or stewardship values. Respondents who highly valued the lifestyle of cane farming tended to also have high economic values. Highly valuing the lifestyle of cane farming was also related to having off-farm income, such that respondents that were reliant on off farm income were more likely to have strong lifestyle values and were also more likely to be pre-retirement age.

4 HOW LIKELY ARE FARMERS TO TRANSITION THEIR LAND IN THE NEXT 5 YEARS?

The survey respondents were asked several questions about how likely they were to undertake a number of different land use transitions within the next 5 years, including changing ownership, expanding, intensifying or diversifying their farming business, or creating a riparian buffer. The results are summarized in Table 3. Except where stated, respondents were asked to rate their likelihood on a 7-point Likert Scale from 1 = Very likely to 7 = Very unlikely. Respondents were grouped into those that indicated the land use transition was likely and those that did not (including neutral or "Don't know" responses).

Table 3. Likelihood of undertaking different land use transitions within the next 5 years

Land Use Transition	Question	n	Mean (SD)	Frequency
Change of ownership*	*"Does that plan involve a transition of ownership …"*	45	n/a	29% yes 71% no
Expand	*"….expand your farming business…"*	69	4.73 (2.21)	32% likely 68% not likely
Intensify	*"…intensify your farming business…"*	70	4.56 (2.19)	33% likely 66% not likely
Diversify	*"…diversify my farming operation to take advantage of environmental markets…"*	65	3.89 (1.92)	37% likely 63% not likely
Riparian Buffer	*"…add a riparian buffer…"*	17	4.35 (2.42)	41% likely 59% not likely

**Responses to this question were limited to those cane growers that indicated that they currently held a succession plan.*

Across the entire sample, a large majority all the cane farmers surveyed (86%, n = 64) indicated that they were likely to undertake *at least* one of the listed land use transitions over the next 5 years, i.e., either a change of ownership and/or expanding, diversifying or intensifying their farming business. Respondents that indicated that they are likely to expand their farming business were also more likely to indicate that they are likely to intensify their business, r = .55, $p < .001$. However, there was no relationship between plans to either expand or intensify their farm with plans to diversifying their farming business to take advantage environmental markets, indicating that these are separate cohorts of farmers. Similarly, there was no relationship between plans for land use transitions (i.e., expand, intensify or diversify) with change of ownership. That is, respondents that indicated that they were planning (or not planning) change ownership in the next five years were not more (or less) likely to have indicated plans to expand, diversify or intensify their farming operations.

Most respondents indicated that they already had a riparian buffer for their waterway (90%). For the small number of cane farmers that had a waterway but had not yet established a riparian buffer (n = 6), only two cane farmers indicated that they were willing to establish one within the next five years.

Due to the small number of respondents that fall within this category it was not considered in the following section exploring factors that influence land use transitions.

A large majority all the cane farmers surveyed (excluding only 10 cane farmers) indicated that they were likely to undertake at least one of the listed land use transitions over the next 5 years. While the most frequently mentioned land use transition was to add a riparian buffer, this was relevant to only a small proportion of cane farmers as most had already established a riparian zone. The next most common land use transition was diversifying the farm to take advantage of environmental markets representing nearly 2 out of 5 survey respondents. Around 1 in 3 cane farmers indicated that had plans to either expand and/or intensify their farming operations.

5 WHAT INFLUENCES FARMERS LIKELIHOOD TO "TRANSITION" THEIR LAND?

To understand factors that influence the likelihood of different land use transitions, a series of contingency tables were created to compare the proportions of cane farmers that fell into each grouped category. The summary table below (Table 4) describes the overall pattern of results[2] with the following sections describing the results in more detail.

Table 4. Summary of influences on land use transitions in the next five years

	Change ownership	Expand	Intensify	Diversify
Region	Limited difference	Limited difference	Limited difference	Limited difference
Farm size	Limited difference	Limited difference	Limited difference	Limited difference
Smartcane Accredited	More likely	Limited difference	More likely	More likely
Limited financial capacity	More likely	Limited difference	More likely	Limited difference
Off-farm income source	More likely	Less likely	Limited difference	More likely
High risk comfort	More likely	Limited difference	More likely	More likely
Post-retirement age	More likely	Limited difference	Less likely	Less likely
Succession plan	More likely	Limited difference	Limited difference	Limited difference
Strong identity	Less likely	Limited difference	More likely	More likely

[2] Due to the small sample size, statistical tests for differences between the groups were not conducted. Caution should be taken in interpreting the results as differences described by may not be 'true effects' and could be due to sampling error/random variation. To determine if differences are meaningful a larger sample would need to be collected to ensure that any planned statistical analyses met minimum criteria for statistical power. For more information read: https://psycnet.apa.org/record/2010-15425-006

	Change ownership	Expand	Intensify	Diversify
Values				
High economic	Limited difference	Less likely	Limited difference	Less likely
High lifestyle	Limited difference	Less likely	More likely	Limited difference
High stewardship	Limited difference	Limited difference	Limited difference	More likely

5.1 Region

There was no evidence that region was related to any likely land use transitions.

5.2 Farm Size

There was no evidence that farm size was related to any likely land use transitions.

5.3 Smartcane Accreditation

Future likelihood of land use transitions did vary depending on whether the cane farmers indicated that they were Smartcane Accredited, whereby cane farmers are accredited more frequently indicated that they had plans to:

- change ownership (37% compared to 13% of non-accredited cane farmers)
- intensify their farming operation (39% compared to 24% of non-accredited cane farmers)
- diversify their farming operation (41% compared to 28% of non-accredited cane farmers)

There was little difference with regard to plans to expand their farming operations.

The relevant response summaries are presented in Table 5 to Table 7.

Table 5. Smartcane accreditation and plans to change ownership

Smartcane Accreditation		Change Ownership: Likely	Change Ownership: Unlikely	Total
Yes	Count	11	19	30
	% within row	37 %	63 %	100 %
No	Count	2	13	15
	% within row	13 %	87 %	100 %
Total	Count	13	32	45
	% within row	29 %	71 %	100 %

Table 6. Smartcane accreditation and plans to intensify

Smartcane Accreditation		Intensify Farming		
		Likely	Unlikely	Total
Yes	Count	18	28	46
	% within row	39 %	61 %	100 %
No	Count	6	19	25
	% within row	24 %	76 %	100 %
Total	Count	24	47	71
	% within row	34 %	66 %	100 %

Table 7. Smartcane accreditation and plans to diversify

Smartcane Accreditation		Diversify Farming		
		Likely	Unlikely	Total
Yes	Count	19	27	46
	% within row	41 %	59 %	100 %
No	Count	7	18	25
	% within row	28 %	72 %	100 %
Total	Count	26	45	71
	% within row	37 %	64 %	100 %

5.4 Financial Capacity

Financial capacity was linked to change of ownership plans, such that those cane farmers that agreed with the statement *"my levels of farm debt make it more difficult to invest in new initiatives"* were more likely to indicate that they had a plan to change ownership in the next 5 years (44% compared to 17%). The relevant response summaries are presented in Table 8 and Table 9.

Table 8. Debt perception and plans to change ownership

Debt perception		Change Ownership		
		Likely	Unlikely	Total
Agree	Count	8	10	18
	% within row	44 %	56 %	100 %
Did not agree	Count	4	20	24
	% within row	17 %	83 %	100 %
Total	Count	12	30	42
	% within row	29 %	71 %	100 %

There was no identified relationship between debt perception and plans to expand or diversify. However, those that reported that their level of debt was making it difficult to invest in new initiatives

were also more likely to indicate that are planning to intensify their farming operations (42% compared to 25%).

Table 9. Debt perception and plans to intensify

		Intensify Farming		
Debt perception		**Likely**	**Unlikely**	**Total**
Agree	Count	11	15	26
	% within row	42 %	58 %	100 %
Did not agree	Count	10	29	39
	% within row	26 %	74 %	100 %
Total	Count	21	44	65
	% within row	32 %	68 %	100 %

5.5 Income source

Having a strong reliance on off-farm income was related to all transitions considered by the survey. Cane farmers that indicated that they rely on off-farm income were twice more likely to indicate they had plans to change ownership in the next five years (44% compared to 21% of cane farmers that don't rely on off-farm income). The relevant response summaries are presented in Table 10 to Table 12.

Table 10. Off-farm income and plans to change ownership

		Change Ownership		
Off-farm Income		**Likely**	**Unlikely**	**Total**
Agree	Count	7	9	16
	% within row	44 %	56 %	100 %
Did not agree	Count	6	23	29
	% within row	21 %	79 %	100 %
Total	Count	13	32	45
	% within row	29 %	71 %	100 %

While having an off-farm income meant that those cane farmers were *less* likely to expand their farm (24% compared to 37% of farmers that do not rely on off-farm income), they are more likely to be planning to diversify their farming to take advantage of environmental markets their farm (52% compared to 28%). There was no noticeable difference between the two groups in terms of plans to intensify their farming.

Table 11. Off-farm income and plans to expand

Off-farm Income		Expand Farming		
		Likely	Unlikely	Total
Agree	Count	6	19	25
	% within row	24 %	76 %	100 %
Did not agree	Count	17	29	46
	% within row	37 %	63 %	100 %
Total	Count	23	48	71
	% within row	32 %	68 %	100 %

Table 12. Off-farm income and plans to diversify

Off-farm Income		Diversify Farming		
		Likely	Unlikely	Total
Agree	Count	13	12	25
	% within row	52 %	48 %	100 %
Did not agree	Count	13	33	46
	% within row	28 %	72 %	100 %
Total	Count	26	45	71
	% within row	37 %	63 %	100 %

5.6 Risk Perceptions

Cane farmers likelihood of land use transitions also varied depending on how comfortable they were with taking risks. Cane farmers that indicated that they are likely to take risks on new technologies and market opportunities were more likely to indicate that:

- They have plans to change ownership in the next 5 years (36% compared to 8% for cane farmers that are not comfortable with risk)
- They planning to intensify their farming (40% compared to 19% for cane farmers that are not comfortable with risk)
- They willing to diversify their farming (40% compared to 29% for cane farmers that are not comfortable with risk)

There was little difference between the two groups in terms of plans to expand the farm.

The relevant response summaries are presented in Table 13 to Table 15.

Table 13. Risk attitudes and plans to change ownership

		Change Ownership		
Risks		**Likely**	**Unlikely**	**Total**
Agreed	Count	12	21	33
	% within row	36 %	64 %	100 %
Did not agree	Count	1	11	12
	% within row	8 %	92 %	100 %
Total	Count	13	32	45
	% within row	29 %	71 %	100 %

Table 14. Risk attitudes and plans to intensify

		Intensify Farming		
Risks		**Likely**	**Unlikely**	**Total**
Agreed	Count	20	30	50
	% within row	40 %	60 %	100 %
Did not agree	Count	4	17	21
	% within row	19 %	81 %	100 %
Total	Count	24	47	71
	% within row	34 %	66 %	100 %

Table 15. Risk attitudes and plans to diversify

		Diversify farming		
Risks		**Likely**	**Unlikely**	**Total**
Agreed	Count	20	30	50
	% within row	40 %	60 %	100 %
Did not agree	Count	6	15	21
	% within row	29 %	71 %	100 %
Total	Count	26	45	71
	% within row	37%	63 %	100 %

5.7 Life-stage

There is evidence to suggest that the stage of life for the cane farmer, retirement age specifically, may also influence land use transitions. Older cane farmers (those post the retirement age of 65) answered more frequently that they are planning to change ownership of farm in the next five years. While there was little difference between the two ages groups in term of plans to expand the farm, there was a noticeable difference with regard to plans to either intensify or diversify the farm. Pre-retirement cane farmers indicated that there were more likely to want to intensify their farming operations (46%

compared to 25% for post-retirement cane farmers) and indicated that there were more likely to want to diversify their farming operations (43% compared 31%). The relevant response summaries are presented in Table 16 to Table 18.

Table 16. Life-stage and plans to change ownership

		Change Ownership		
Age		**Likely**	**Unlikely**	**Total**
Pre-retirement age	Count	5	18	23
	% within row	22 %	78 %	100 %
Post-retirement age	Count	8	13	21
	% within row	38 %	62 %	100 %
Total	Count	13	31	44
	% within row	30 %	70 %	100 %

Table 17. Life stage and plans to intensify

		Intensify Farming		
Age		**Likely**	**Unlikely**	**Total**
Pre-retirement age	Count	16	19	35
	% within row	46 %	54 %	100 %
Post-retirement age	Count	8	24	32
	% within row	25 %	75 %	100 %
Total	Count	24	43	67
	% within row	36 %	64 %	100 %

Table 18. Life stage and plans to diversify

		Diversify Farming		
Age		**Likely**	**Unlikely**	**Total**
Pre-retirement age	Count	15	20	35
	% within row	43 %	57 %	100 %
Post-retirement age	Count	10	22	32
	% within row	31 %	69 %	100 %
Total	Count	25	42	67
	% within row	37 %	63 %	100 %

5.8 Succession Plan

Unsurprisingly, the survey responses suggest that having a succession plan in place is related to plans to change ownership, such that cane farmers that have a succession plan in place were more likely to indicate that they have plans to change ownership in the next 5 years (32% compared to 14% for cane

farmers that do not have a success plan). Plans to expand, intensify or diversify the farming operations did not vary largely from having a succession plan in place. The relevant response is presented in Table 19.

Table 19. Succession planning and plans to change ownership

		Change Ownership		
Succession Plan		**Likely**	**Unlikely**	**Total**
Yes	Count	12	26	38
	% within row	32 %	68 %	100 %
No	Count	1	6	7
	% within row	14 %	86 %	100 %
Total	Count	13	32	45
	% within row	29 %	71 %	100 %

5.9 Identity

Cane farmers land use transitions plans also varied depending on whether they agreed that being a cane farmer was important to their identify or not, whereby survey respondents that indicated that being a cane farmer was important to their sense of identify less frequently responded that they had plans to change ownership within the next five years (26% compared to 43% that responded that being a cane farmer is not important).

There were no noticeable differences between the two groups in terms of plans to expand the farm, however, plans to intensify or diversify the farm did vary. For those cane farmers for whom the cane farmer identify was important, are also more likely to indicate that they plan to intensify their farm (37% compared to 18% of respondents for whom the cane farmer identity was not important) and to diversify the farm (38% compared to 27% of respondents for whom the cane farmer identity was not important). The relevant response summaries are presented in Table 20 to Table 22.

Table 20. Farmer identity and plans to change ownership

		Change Ownership		
Identity		**Likely**	**Unlikely**	**Total**
Important	Count	10	28	38
	% within row	26 %	74 %	100 %
Not important	Count	3	4	7
	% within row	43 %	57 %	100 %
Total	Count	13	32	45
	% within row	29 %	71 %	100 %

Table 21. Farmer identity and plans to intensify

Identity		Intensify Farming		
		Likely	Unlikely	Total
Important	Count	22	38	60
	% within row	37 %	63 %	100 %
Not important	Count	2	9	11
	% within row	18 %	82 %	100 %
Total	Count	24	47	71
	% within row	34 %	66 %	100 %

Table 22. Farmer identity and plans to diversify

Identity		Diversify Farming		
		Likely	Unlikely	Total
Important	Count	23	37	60
	% within row	38 %	62 %	100 %
Not important	Count	3	8	11
	% within row	27 %	73 %	100 %
Total	Count	26	45	71
	% within row	37 %	63 %	100 %

5.10 Values – Economic

While valuing profit or financial gains did not seem to influence cane farmers plans to change ownership of the farm or plans to intensify their farming operations, it did seem to influence their plans to expand or diversify farms but in an unpredicted way. Cane farmers that indicated that they were not primarily financially motivated were more likely to indicate that they were planning to expand their farming operation (47% compared to 27% of cane farmers that were primarily financially motivated) and were more willing to diversify their farms (47% compared to 33% of cane farmers that were primarily financially motivated). The relevant response summaries are presented in Table 23 and Table 24.

Table 23. Financial motivation and plans to expand

Financial Motivation		Expand Farming		
		Likely	Unlikely	Total
Agree	Count	14	38	52
	% within row	27 %	73 %	100 %
Did not agree	Count	9	10	19
	% within row	47 %	53 %	100 %
Total	Count	23	48	71
	% within row	32 %	68 %	100 %

Table 24. Financial motivation and plans to diversify

Financial Motivation		Diversify Farming: Likely	Diversify Farming: Unlikely	Total
Agree	Count	17	35	52
	% within row	33 %	67 %	100 %
Did not agree	Count	9	10	19
	% within row	47 %	52 %	100 %
Total	Count	26	45	71
	% within row	37 %	63 %	100 %

5.11 Values – Lifestyle

Plans to change ownership and/or diversify the farm did not differ greatly between those cane farmers that agreed that they were primarily motivated by opportunities to benefit from the farming lifestyle compared to those that were not. However, plans to expand and/or intensify *did* vary depending on lifestyle values, whereby cane farmers that value the lifestyle were less likely to nominate that they are planning to expand the farm (29% compared to 45% of canefarmers that do not primarily value the cane farming lifestyle) but were more likely to indicate that they had plans to intensify their farming (40% compared to 23% of canefarmers that do not primarily value the cane farming lifestyle). The relevant response summaries are presented in Table 25 and

Table 26.

Table 25. Lifestyle motivation and plans to expand

Lifestyle Motivation		Expand Farming: Likely	Expand Farming: Unlikely	Total
Agree	Count	13	32	45
	% within row	29 %	71 %	100 %
Did not agree	Count	10	12	22
	% within row	45 %	55 %	100 %
Total	Count	23	44	67
	% within row	34 %	66 %	100 %

Table 26. Lifestyle motivation and plans to intensify

Lifestyle Motivation		Intensify Farming: Likely	Intensify Farming: Unlikely	Total
Agree	Count	18	27	45
	% within row	40 %	60 %	100 %
Did not agree	Count	5	17	22
	% within row	23 %	77 %	100 %
Total	Count	23	44	67
	% within row	34 %	66 %	100 %

5.12 Values – Stewardship

Highly valuing being a land steward did not seem to influence land use transitions for the cane farmers surveyed except for plans to diversify the farm in response to environmental markets, such that if the respondents highly valued being a land steward they more frequently indicated (42%) that they were likely to diversify their farm compared to those that did not highly value stewardship. The relevant response summary is presented in Table 27.

Table 27. Stewardship motivation and plans to diversify

Stewardship Motivation		Diversify: Likely	Diversify: Unlikely	Total
Agree	Count	18	25	43
	% within row	42 %	58 %	100 %
Did not agree	Count	8	17	25
	% within row	32 %	68 %	100 %
Total	Count	26	42	68
	% within row	38 %	62 %	100 %

There were a number of factors that influenced the cane farmers plans to change ownership over the next five years. Cane farmers that are Smartcane BMP Accredited, have off-farm income and/or are

post-retirement age all more frequently nominated that they had plans to change ownership over the next five years.

Comparatively, very few factors influenced the cane farmers surveyed with regard to plans to expand the farm. The most notable factor was income source, whereby cane farmers that are reliant on off-farm income less frequently nominated that they had plans to expand the farm. Contrary to what might be expected, cane farmers with that held strong economic values were less likely to indicate that that had plans to expand the farm.

With regard to plans to intensify their farming operations, the cane farmers surveyed that indicated they were Smartcane Accredited, pre-retirement age, with a strong cane farming identity and/or strongly lifestyle values all more frequently indicated that they had plans to intensify their cane farming operations. Interestingly, those cane farmers that indicated limited financial capacity also indicated that that had plans to intensify their farming operations.

Lastly, with regards to plans to diversify the farm, cane farmers with strong stewardship values were more likely to have also responded that they had plans to diversify the farm in response to environmental markets. However, farmers with strong economic values were less likely to indicate that they had plans to diversify. Instead, farmers with Smartcane Accreditation, off-farm income and were pre-retirement age are all more likely to be interested in diversification.

Across all the factors considered, Smartcane Accreditation, income source, life stage and social identity seemed to have the most impact on land use transitions. Likelihood of future land use transitions did not seem vary dependent on farm size nor Region.

6 WHAT PREFERENCES DO CANE FARMERS HAVE FOR DIFFERENT POLICY MECHANISM CHARACTERISTICS?

The cane farmers surveyed were asked a number of questions in relation to their preferences for different policy and funding mechanism attributes, including voluntary participation, reflecting local circumstances, the use of incentives and/or temporary measures. A summary of the responses has been provided in the below table. Respondents were asked to rate their support for preferences on a 7-point Likert Scale from 1 = Strongly agree to 7 = Strongly disagree. To explore the frequency or proportion of responses respondents were additionally grouped into those that agreed and those that did not agree (including neutral or "Don't know" responses).

Overall, there was very strong agreement (4 out of 5 cane farmers surveyed) that policy and funding mechanisms should:

- Have a focus on voluntary participation as opposed to involuntary
- Be flexible to reflect local circumstances rather than GBR-wide scale
- Have a focus on incentives over regulations
- Should make it easier to amalgamate or reconfigure existing landholdings to enhance farm profitability and achieve broader sustainability goals
- Make it easier to 'package' policies and funding together to ensure they meet my circumstances

Responses were more evenly split (approximately 50/50) in terms whether mechanisms should:

- Focus on agricultural inputs (e.g. fertiliser application rates) as opposed to agricultural outputs (e.g. nitrogen runoff).
- Focus on temporary measures as opposed to permanent measures.
- Consider succession plans

As might be expected there was a positive correlation in terms of support for many of the policy and funding mechanism attributes. Cane farmers that indicated strong support for local policies, also tended to strongly support voluntary mechanisms ($r = .50$, $p < .001$), incentives over regulation ($r = .25$, $p = .042$), temporary mechanisms ($r = .29$, $p = .022$) and policy "packages" ($r = .26$, $p = .04$). Cane farmers that strongly support policy mechanisms that make it easier to amalgamate or reconfigure land also tended to strongly support mechanisms that make it easier to "package" policies ($r = .55$, $p < .001$).

Additionally, 20 survey respondents from the wider agricultural community (for example, graziers or agricultural extension officers) that opened the survey were asked to complete the survey questions related to their preferences towards different policy and funding mechanisms. Their responses have been added to Table 28.

There were some noticeable differences between the two cohorts in terms of support for different policy and funding mechanism attributes. While approximately 80-85% of the cane farmers surveyed agreed that mechanisms should focus on voluntary participation (as opposed to involuntary participation) and incentives (as opposed to regulations), only 60-65% of other survey respondents agreed. Support for the need to focus on agricultural inputs was noticeably lower in the other cohort (35%) compared to cane farmers whose responses were more evenly split. The only other large difference was with regard to the need for mechanisms to consider succession plans. While only 42% of cane farmers agreed that policies and funding mechanisms that don't consider succession reduce their uptake of new initiatives, 70% of the additional respondents agreed with this statement.

Otherwise, like canefarmers, the additional respondents strongly agreed that mechanisms need to be flexible to reflect local circumstances, should make it easier to amalgamate or reconfigure existing landholdings and should make it easy to 'package' policies and funding together.

Table 28. Preferences for policy and funding mechanism attributes

Policy attributes	Question	Cane farmers			Other respondents		
		n	Mean (SD)	Frequency	n	Mean (SD)	Frequency
Voluntary	*"…should focus on voluntary participation as opposed to involuntary (or forced) participation."*	69	1.91 (1.13)	85% agree 15 % did not agree	20	2.87 (2.42)	65% agree 35 % did not agree
Local	*"…needs to be flexible to reflect local circumstances rather than the GBR-wide scale."*	69	1.69 (1.15)	87% agree 12% did not agree	20	1.87 (1.36)	90% agree 10% did not agree
Agricultural Inputs	*"…should focus on agricultural inputs (e.g. fertiliser application rates) as opposed to agricultural outputs (e.g. nitrogen runoff)."*	69	3.54 (1.85)	52% agree 48% did not agree	20	4.00 (2.00)	30% agree 70% did not agree
Incentives	*"…should rely on incentives (carrots) as opposed to stringent regulations (sticks)."*	69	2.29 (1.74)	84% agree 15% did not agree	20	2.43 (2.14)	60% agree 40% did not agree
Temporary Measures	*"…should focus on temporary measures as opposed to permanent measures."*	69	3.48 (1.78)	48% agree 52% did not agree	20	4.53 (2.13)	35% agree 65% did not agree
Succession	*"…mechanisms that don't consider succession reduce my uptake of new initiatives."*	69	3.43 (1.57)	42% agree 58% did not agree	20	2.47 (1.06)	70% agree 30% did not agree
Amalgamation	*"Land use planning, policies and funding mechanisms should make it easier to amalgamate or reconfigure existing landholdings to enhance farm profitability and achieve broader sustainability goals."*	68	2.27 (1.26)	84% agree 16% did not agree	20	1.67 (0.72)	80% agree 20% did not agree
Packages	*"It should be easier to 'package' policies and funding together to ensure they meet my circumstances (e.g. a package including BMP, a farm improvement loan, and financial incentives to reduce nitrogen runoff)."*	68	2.44 (1.34)	78% agree 12% did not agree	20	1.80 (0.77)	75% agree 25% did not agree

7 WHAT INFLUENCES PREFERENCES FOR ATTRIBUTES OF POLICY AND FUNDING MECHANISMS?

With regard to what influences preferences for different attributes of policy and funding mechanisms, a series of contingency tables were created to compare the proportions of cane farmers that fell into each category. The summary table below (Table 29) describes the overall pattern of results for cane farmers[3].

[3] Due to the small sample size, statistical tests for differences between the groups were not conducted. Caution should be taken in interpreting the results as differences described by may not be 'true effects' and could be due to sampling error/random variation. To determine if differences are meaningful a larger sample would need to be collected to ensure that any planned statistical analyses met minimum criteria for statistical power. For more information read: https://psycnet.apa.org/record/2010-15425-006

Table 29. Summary of influences on support for policy and funding mechanism attributes

	Voluntary	Flexible/Local	Ag Inputs	Incentives	Temporary	Succession	Amalgamation	Packages
North Queensland	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Less supportive	Limited difference
Farm size	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference
Smartcane Accredited	More supportive	More supportive	More supportive	More supportive	Less supportive	More supportive	More supportive	More supportive
Limited financial capacity	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference
Off-farm income source	Limited difference	Limited difference	More supportive	More supportive	More supportive	Limited difference	Limited difference	Limited difference
High risk comfort	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference
Post-retirement age	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	More supportive	Limited difference	Limited difference
Succession plan	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference
Strong identity	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference
Values								
High economic	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Less supportive	Limited difference
High lifestyle	More supportive	Limited difference	More supportive	Limited difference	More supportive	Limited difference	Limited difference	Limited difference
High stewardship	Less supportive	Less supportive	Limited difference	Limited difference	Limited difference	Limited difference	Limited difference	Less supportive

7.1 Region

Depending on the region the cane farmer came from influenced their responses in terms of support for one of the policy and funding mechanism attributes. Specifically, policies and funding mechanisms that make it easier to amalgamate or reconfigure existing landholdings to enhance farm profitability and achieve broader sustainability goals were less supported by cane farmers from North Queensland (77%) compared to cane farmers from Central and Southern Queensland (96%; It should be noted however that across both groups support was generally high). The relevant response summary is presented in Table 30.

Table 30. Region and support for amalgamation-based policy

		Amalgamation		
Region		**Supportive**	**Not Supportive**	**Total**
North Queensland	Count	34	10	44
	% within row	77 %	23 %	100 %
Central/Southern Queensland	Count	23	1	37
	% within row	96 %	4 %	100 %
Total	Count	57	11	68
	% within row	84 %	16 %	100 %

7.2 Farm Size

There was no evidence to suggest that farm size was related to support for different policy and funding mechanism attributes.

7.3 Smartcane Accreditation

Among all the farmer characteristics considered, whether the cane farmer was Smartcane Accredited or not influenced support for different policy and funding mechanism attributes the most.

Cane farmers that indicated that they are Smartcane accredited, also tended to be more supportive of policy and funding mechanisms that:

- Focus on voluntary participation as opposed to involuntary (or forced) participation (95% compared to 50% of cane farmers that are not accredited).
- Are flexible to reflect local circumstances rather than the GBR-wide scale (95% compared to 50% of cane farmers that are not accredited).
- Focus on agricultural inputs (e.g. fertiliser application rates) as opposed to agricultural outputs (e.g. nitrogen runoff; (63% compared to 40% of cane farmers that are not accredited).
- Rely on incentives (carrots) as opposed to stringent regulations (sticks; 95% compared to 50% of cane farmers that are not accredited).
- Make it easier to amalgamate or reconfigure existing landholdings to enhance farm profitability and achieve broader sustainability goals (89% compared to 56% of cane farmers that are not accredited).
- Make it easier to 'package' policies and funding together to ensure they meet my circumstances (e.g. a package including BMP, a farm improvement loan, and financial incentives to reduce nitrogen runoff; (84% compared to 44% of cane farmers that are not accredited).

The only mechanisms for which accredited farmers were less supportive when compared to non-accredited farmers was in regard to support for temporary measures as opposed to permanent measures (47% compared to 60% of cane farmers that are not accredited) and in relation to agreeing that mechanisms that don't consider succession reduce uptake of new initiatives (38% compared to 50% of cane farmers that are not accredited). The relevant response summaries are presented in Table 31 to Table 38.

Table 31. Smartcane accreditation and support for voluntary-based policy

Smartcane Accreditation		Voluntary	Involuntary	Total
Yes	Count	18	1	19
	% within row	95 %	5 %	100 %
No	Count	5	5	10
	% within row	50 %	50 %	100 %
Total	Count	23	6	29
	% within row	79 %	21 %	100 %

Table 32. Smartcane accreditation and support for locally targeted policy

Smartcane Accreditation		Local	GBR Wide	Total
Yes	Count	18	1	19
	% within row	95 %	5 %	100 %
No	Count	5	5	10
	% within row	50 %	50 %	100 %
Total	Count	23	6	29
	% within row	79 %	21 %	100 %

Table 33. Smartcane accreditation and support for input-based policy

Smartcane Accreditation		Agricultural Inputs	Agricultural Outputs	Total
Yes	Count	12	7	19
	% within row	63 %	37 %	100 %
No	Count	4	6	10
	% within row	40 %	60 %	100 %
Total	Count	16	13	29
	% within row	55 %	45 %	100 %

Table 34. Smartcane accreditation and support for incentive-based policy

Smartcane Accreditation		Incentives	Regulations	Total
Yes	Count	18	1	19
	% within row	95 %	5 %	100 %
No	Count	5	5	10
	% within row	50 %	50 %	100 %
Total	Count	23	6	29
	% within row	79%	21 %	100 %

Table 35. Smartcane accreditation and support for policy with a temporary focus

Smartcane Accreditation		Temporary	Permanent	Total
Yes	Count	9	10	19
	% within row	47 %	52 %	100 %
No	Count	6	4	10
	% within row	60 %	40 %	100 %
Total	Count	15	14	29
	% within row	52 %	48 %	100 %

Table 36. Smartcane accreditation and support for policy that considers succession planning

		Succession Plans		
Smartcane Accreditation		Supportive	Not Supportive	Total
Yes	Count	17	28	45
	% within row	38 %	62%	100 %
No	Count	12	12	24
	% within row	50 %	50 %	100 %
Total	Count	29	40	69
	% within row	42 %	57 %	100 %

Table 37. Smartcane accreditation and support for amalgamation-based policy

Smartcane Accreditation		Amalgamation		
		Supportive	Not Supportive	Total
Yes	Count	17	2	19
	% within row	89 %	11 %	100 %
No	Count	5	4	9
	% within row	56 %	44 %	100 %
Total	Count	22	6	28
	% within row	79 %	21 %	100 %

Table 38. Smartcane accreditation and support for packaging of policies

Smartcane Accreditation		Policy Packages		
		Supportive	Not Supportive	Total
Yes	Count	16	3	19
	% within row	84 %	16 %	100 %
No	Count	4	5	9
	% within row	44 %	56 %	100 %
Total	Count	20	8	28
	% within row	71 %	29 %	100 %

7.4 Financial Capacity

There was no evidence to suggest that financial capacity, specifically the extent to which debt hinders cane farmers' willingness to try new initiatives, was related to support for different policy and funding mechanism attributes.

7.5 Off-farm income

Across all the cane farmer characteristics considered, income source seemed to have the greatest influence on support for different policy and funding mechanism attributes. While it made no difference in terms of support for voluntary or localised mechanisms, cane farmers that were reliant on off-farm income tended to be more supportive of policy and funding that:

- Focus on agricultural inputs as opposed to agricultural outputs; 71% compared to just 42% of cane farmers that are not reliant on off-farm income)
- Rely on incentives (carrots) as opposed to stringent regulations (sticks; 96% compared to 78% of cane farmers that are not reliant on off-farm income)
- Focus on temporary measures as opposed to permanent measures (63% compared to 40% of cane farmers that are not reliant on off-farm income)

The relevant response summaries are presented in Table 39 to Table 41.

Table 39. Off-farm income and support for input-based policy

Off-farm Income		Agricultural Inputs	Agricultural Outputs	Total
Agree	Count	17	7	24
	% within row	71 %	29 %	100 %
Did not agree	Count	19	26	45
	% within row	42 %	58 %	100 %
Total	Count	36	33	69
	% within row	52 %	48 %	100 %

Table 40. Off-farm income and support for incentive-based policy

Off-farm Income		Incentives	Regulation	Total
Agree	Count	23	1	24
	% within row	96 %	4 %	100 %
Did not agree	Count	35	10	45
	% within row	78 %	22 %	100 %
Total	Count	58	11	69
	% within row	84 %	16 %	100 %

Table 41. Off-farm income and support for policy with a temporary focus

		Temporary		
Off-farm Income		Supportive	Not Supportive	Total
Agree	Count	15	9	24
	% within row	63 %	37 %	100 %
Did not agree	Count	18	27	45
	% within row	40 %	60 %	100 %
Total	Count	33	36	69
	% within row	48 %	52 %	100 %

7.6 Risk perceptions

There was no evidence to suggest that perceived risk perceptions, that is the extent to which cane farmers indicated that they like taking risks on new technologies and market opportunities, were related to support for different policy and funding mechanism attributes.

7.7 Life-stage

As might be expected, whether the cane farmer was pre and post retirement age, only influenced one of the listed policy and funding mechanism attributes; namely policies and funding mechanisms that don't consider succession to reduce my uptake of new initiatives. Cane farmers that are post-

retirement age were less likely to indicate support for mechanism that don't consider their succession plans (34% compared to 52% of cane-farmers post retirement age). The relevant response summary is presented in Table 42.

Table 42. Life-stage and support for policy that considers succession planning

		Succession Plan		
Age		**Supportive**	**Not Supportive**	**Total**
Pre-retirement age	Count	17	16	33
	% within row	52 %	48 %	100 %
Post-retirement age	Count	11	21	32
	% within row	34 %	66 %	100 %
Total	Count	28	37	65
	% within row	43 %	57 %	100 %

7.8 Succession Plan

There was no evidence to suggest that having a succession plan in place was related to support for different policy and funding mechanism attributes.

7.9 Identity

There was no evidence to suggest that identifying as a 'cane farmer' was related to support for different policy and funding mechanism attributes.

7.10 Values – financial

Holding financial values was related to only one policy and funding attribute, namely support for funding mechanisms that make it easier to amalgamate or reconfigure existing landholdings to enhance farm profitability and achieve broader sustainability goals. Interestingly, this was not in the direction that might be predicted, whereby cane farmers that indicated that they were primarily motivated by finances were less supportive (78%) of policies that support amalgamations compared to cane farmers that were not primarily motived by finances (100%). It should be noted that across both groups however, support for this type of policy is high. The relevant response summary is presented in Table 43.

Table 43. Financial motivation and support for amalgamation-based policy

		Amalgamation		
Financial Motivation		**Supportive**	**Not Supportive**	**Total**
Agree	Count	39	11	50
	% within row	78 %	22 %	100 %
Did not agree	Count	18	0	18
	% within row	100 %	0 %	100 %
Total	Count	57	11	68
	% within row	83 %	16 %	100 %

7.11 Values – lifestyle

Those cane farmers that indicated that they were primarily motivated by the farming lifestyle tended to be more supportive of policy and funding mechanism that:

- Focus on voluntary participation as opposed to involuntary (or forced) participation (93% compared to 71% of cane farmers that are not primarily motivated by the farming lifestyle). Noting that support across both groups was high)
- Focus on agricultural inputs as opposed to agricultural outputs (61% compared to 42% of cane farmers that are not primarily motivated by the farming lifestyle).
- Focus on temporary measures as opposed to permanent measures (57% compared to 38% of cane farmers that are not primarily motivated by the farming lifestyle).

The relevant response summaries are presented in Table 44 to

Table 46.

Table 44. Lifestyle motivation and support for voluntary-based policy

Lifestyle Motivation		Voluntary	Involuntary	Total
Agree	Count	41	3	44
	% within row	93 %	7 %	100 %
Did not agree	Count	15	6	21
	% within row	71 %	29 %	100 %
Total	Count	56	9	65
	% within row	86 %	14 %	100 %

Table 45. Lifestyle motivation and support for input-based policy

Lifestyle Motivation		Agricultural Inputs	Agricultural Outputs	Total
Agree	Count	27	17	44
	% within row	61%	39 %	100 %
Did not agree	Count	9	12	21
	% within row	42%	57 %	100 %
Total	Count	36	29	65
	% within row	55 %	45 %	100 %

Table 46. Lifestyle motivation and support for policy with a temporary focus

Lifestyle Motivation		Temporary	Permanent	Total
Agree	Count	25	19	44
	% within row	57 %	43 %	100 %
Did not agree	Count	8	13	21
	% within row	38 %	62 %	100 %
Total	Count	33	32	65
	% within row	51 %	49 %	100 %

7.12 Values – Stewardship

Support for many of the policy and funding mechanism attributes did vary depending on whether the cane farmers surveyed agreed that they were primarily motived by being a land steward, whereby they tended to be less supportive in terms of policy and funding that:

- Focus on voluntary participation as opposed to involuntary (or forced) participation (82% compared to 100% of cane farmers that don't primarily value stewardship). Noting that support across both groups was high.
- Are flexible to reflect local circumstances rather than the GBR-wide scale (83% compared to 100% of cane farmers that don't primarily value stewardship). Noting that support across both groups was high.
- Are easier to 'package' together to ensure they meet my circumstances (e.g. a package including BMP, a farm improvement loan, and financial incentives to reduce nitrogen runoff; 76% compared to 90% of cane farmers that don't primarily value stewardship).

The relevant response summaries are presented in Table 47 to Table 49.

Table 47. Stewardship motivation and support for voluntary-based policy

Stewardship motivation		Voluntary	Involuntary	Total
Agree	Count	45	10	55
	% within row	82 %	18 %	100 %
Did not agree	Count	11	0	11
	% within row	100 %	0 %	100 %

Stewardship motivation		Voluntary	Involuntary	Total
Total	Count	56	10	66
	% within row	85 %	15 %	100 %

Table 48. Stewardship motivation and support for locally targeted policy

Stewardship Motivation		Local	GBR Wide	Total
Agree	Count	46	9	55
	% within row	84 %	16 %	100 %
Did not agree	Count	11	0	11
	% within row	100 %	0 %	100 %
Total	Count	57	9	66
	% within row	86 %	14 %	100 %

Table 49. Stewardship motivation and support for packaging of policies

		Policy Packages		
Stewardship Motivation		Supportive	Not Supportive	Total
Agree	Count	42	13	55
	% within row	76 %	24 %	100 %
Did not agree	Count	9	1	10
	% within row	90 %	10 %	100 %
Total	Count	51	14	65
	% within row	78 %	22 %	100 %

Compared to land use transitions, there was a less variation between cane farmer characteristics with regard to their support for different funding mechanisms. The notable exception was Smartcane Accreditation, whereby cane farmers that indicated that they are Smartcane accredited, also tended to be more supportive of policy and funding mechanisms that focus on voluntary participation, are flexible to reflect local circumstances, focus on agricultural inputs, rely on incentives, make it easier to amalgamate or reconfigure existing landholdings and make it easier to 'package' policies and funding together to ensure they meet my circumstances. It is worth noting however, that support for those attributes tended to high among all cane farmers surveyed.

The location of the farm had some influence on support (for example, cane farmers from North Queensland were less supportive of mechanisms that enable amalgamation) as did income source (for example, cane farmers reliant on off farm income are more supportive of incentives as opposed to stringent regulations) and some values (for example, cane farmers who agreed that they were primarily motived by being a land steward tended to be less supportive in terms of policy and funding that focus on voluntary participation).

There were a number of characteristics that had no influence on support for different attributes, including farm size, financial capacity, risk perceptions, succession plans and identity. As might be expected, being retirement age only influenced support for whether policy and funding considered succession.

8 DO PLANNED FUTURE LAND USE TRANSITIONS VARY DEPENDING ON SUPPORT FOR DIFFERENT POLICY MECHANISMS?

Overall, there was very little difference between the groups in terms of those cane farmers that had indicated that they planned to undertake a land use transition in the next five years and their preferences for different policy mechanisms. There were exceptions, however.

Those cane farmers that indicated that they were planning to change ownership of the farm within the next five years were much more likely to indicate that policies and funding mechanisms that don't consider succession reduce their uptake of new initiatives (62% compared to 43% of cane farmers that do not have plans to change ownership). They were also more supportive of policies that enable them to "package" policies and funding (92% compared to 69% of cane farmers that do not have plans to change ownership). Support for packages was also higher among farmers that are considering diversifying their farming operations in response to environmental markets (92% compared to 67% of cane farmers that do not have plans to diversify their farms).

The relevant response summaries are presented in Table 50 to Table 52.

Table 50. Succession planning and plans to change ownership

		Succession Plans		
Change Ownership		**Supportive**	**Not Supportive**	**Total**
Likely	Count	8	5	13
	% within row	62 %	38 %	100 %
Unlikely	Count	13	17	30
	% within row	43 %	57 %	100 %
Total	Count	21	22	43
	% within row	49 %	51 %	100 %

Table 51. Policy packaging and plans to change ownership

		Policy Packages		
Change Ownership		**Supportive**	**Not Supportive**	**Total**
Likely	Count	12	1	13

Change Ownership		Policy Packages		Total
		Supportive	Not Supportive	
Unlikely	% within row	92 %	8 %	100 %
	Count	20	9	29
	% within row	69 %	31 %	100 %
Total	Count	32	10	42
	% within row	76 %	24 %	100 %

Table 52. Policy packaging and plans to diversify

Diversify Farming		Policy Packages		Total
		Supportive	Supportive	
Likely	Count	23	2	25
	% within row	92 %	8 %	100 %
Unlikely	Count	30	13	43
	% within row	67 %	30 %	100 %
Total	Count	53	15	68
	% within row	78 %	22 %	100 %

There was little evidence to suggest that support for different policy and funding mechanism attributes was related to future land use transitions. The only exceptions were that cane farmers that indicated that they were planning to change ownership of the farm within the next five years were much more likely to indicate that policies and funding mechanisms that don't consider succession would likely reduce their uptake of new initiatives. Cane farmers that were looking to change ownership were also more supportive of policies that enable them to "package" policies and funding. Support for packages was also higher among farmers that are considering diversifying their farming operations, although support was generally high among all cane farmers surveyed.

9 WHAT OTHER RELATED ISSUES ARE IMPORTANT TO FARMERS?

The survey also provided an opportunity for participants to enter open-ended responses about any other issues or comments they had that might be relevant. Of the 102 participants, 61 responded, of whom 54 participants were farmers while the remaining 7 were non-farmers. Responses were categorized into four themes for analysis. Responses have also been divided between farmers and non-farmers and are presented in Figure 3.

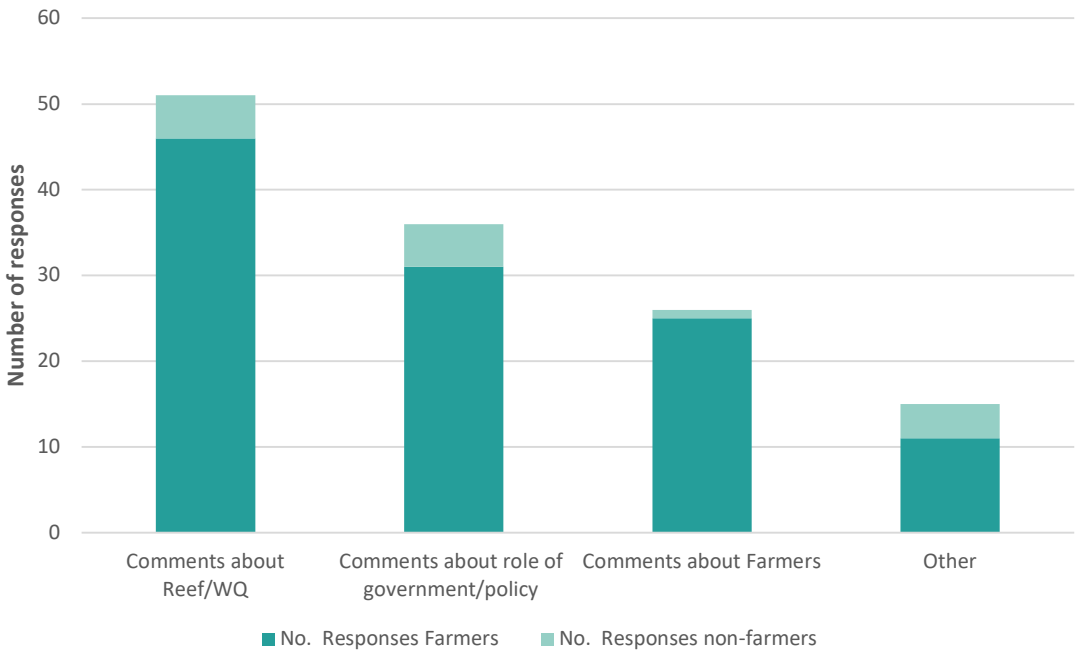


Figure 3. Open ended response themes

Note: Some responses are included in multiple categories.

Looking at these broad themes, as well as 51 comments about the reef and water quality, there were 36 respondents who made comments about the role of government/policy. Specifically, a number of these comments highlighted that government decision-makers lack knowledge of what is happening in the field and that the environment is highly political. Other policy comments were in relation to preferences towards different mechanisms. Some comments were broader in nature, simply indicating that farmers need more support, while other comments indicated a preference for particular mechanism attributes. For example, more voluntary measures (more "carrot" less "stick") or noting that the current regulations/BMP programs were too hard to follow. There were also 26 respondents in total who made statements surrounding their own farming. Many of these comments were regarding a desire for more recognition of farmers that are doing a good job, as well as comments focused on the next generation of farmers. These more detailed response themes are presented in Figure 4.

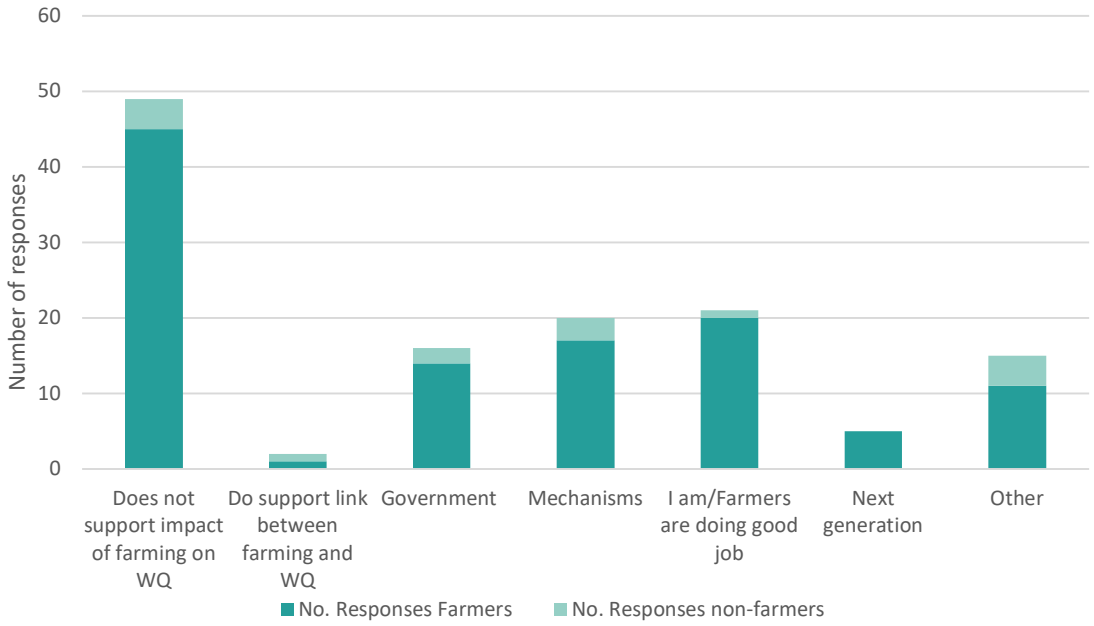


Figure 4. Open ended response sub-themes

Note: Some responses are included in multiple categories.

When considering the sub-themes, a significant number of respondents (49 in total) stated that they did not believe that their farming was having impacts on the water quality of the Great Barrier Reef (or that the scientific link between farming and the reef was not strong enough). Many farmers (21) believed that they and other farmers were doing the best they could, while 20 had comments regarding current policy mechanisms (i.e. too many regulations, "more carrot and less stick" and not enough support). Overall, considering the small number of non-farmer responders (7), attitudes between the two groups were largely consistent.