



Marine and Tropical Sciences Research Facility

# Profiles of rural landholders in relation to Natural Resource Management in the Wet Tropics region of North Queensland



Nick Emtage and John Herbohn



Australian Government  
Department of the Environment,  
Water, Heritage and the Arts



THE UNIVERSITY  
OF QUEENSLAND  
AUSTRALIA





# **Profiles of rural landholders in relation to Natural Resource Management in the Wet Tropics region of North Queensland**

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## Acronyms Used In This Report

<b>ANOVA</b>	.....	Analysis of Variance (between groups)
<b>BRS</b>	.....	Bureau of Rural Sciences
<b>BSES</b>	.....	Bureau of Sugar Experiment Stations
<b>DNRW</b>	.....	Queensland Department of Natural Resources and Water
<b>DPIF</b>	.....	Queensland Department of Primary Industries and Fisheries
<b>EPA</b>	.....	Queensland Environmental Protection Agency
<b>KMO</b>	.....	Kaiser-Meyer-Olkin Measure of Sampling Adequacy Test
<b>NRM</b>	.....	Natural Resource Management

## Introduction

This report presents analyses of responses to the mail-based survey of rural landholders' NRM attitudes, values and practices in the Wet Tropics NRM region undertaken by staff from The University of Queensland between December 2007 and January 2008<sup>1</sup> (Figure 1). This report describes the first stages in the development of a typology of rural landholders in relation to their management of natural resources in the Wet Tropics region. The first half of the report describes the results of principal component (factor) analyses of responses to the questionnaire. The second part of the report presents a series of analyses of the differences between groups of landholders. The groups were defined according to the stated main purpose(s) for owning a rural property, their main land use(s), and groups of landholders classified according to their scale of agricultural operations.

Principal components (factor) analysis can be a useful technique to aid interpretation of responses to attitude surveys and reduce the number of variables used in analyses. Principal components analyses are used to help identify patterns in response to questions in surveys. Surveys of peoples' attitudes commonly use questions about a range of issues on a chosen topic to try and gain better understanding of the dimensions of the topic, for example 'importance of various NRM problems on property'. In the survey of rural landholders undertaken for this project, participants were asked to indicate how important they considered sixteen separate items for the topic 'importance of NRM issues on property'. When asking people to provide their response to a substantial number of issues within one topic, it is common that people respond in a similar manner (e.g. high importance, low importance, agree, disagree) to groups of items. Where there is high correlation in the responses to items in a topic it is then possible to define and test whether to compute a representative score (scale) to represent a respondent's views using highly correlated items. This information provides insight into the underlying structure of communities' opinions about the subject being investigated. Constructing and calculating a scale to represent the dimensions or group of issues to which landholders respond in a similar way also reduces the number of variables used in subsequent analyses where patterns in the differences of opinion about issues with the community can be investigated.

Previous applications of factor analysis to some of the above topics in Australia include studies of vegetation management attitudes and values reported by Emtage (1995), Specht and Emtage (1998), Emtage *et al.* (2001), Herbohn *et al.* (2005) and Jennings and van Putten (2006). Factor analysis has been applied to measures of landholders' management goals and objectives by Gasson (1973), Kerridge (1978), Cary and Holmes (1982), all reviewed by Frost (2000). Maybery *et al.* (2005) and Greiner *et al.* (2007) have also used factor analysis to assess landholders' motivations for property management, with Greiner *et al.* (2007) also examining landholders' perception of impediments to the adoption of 'best management practices' (BMPs) and perception of the effectiveness of various incentives to adopt BMPs.

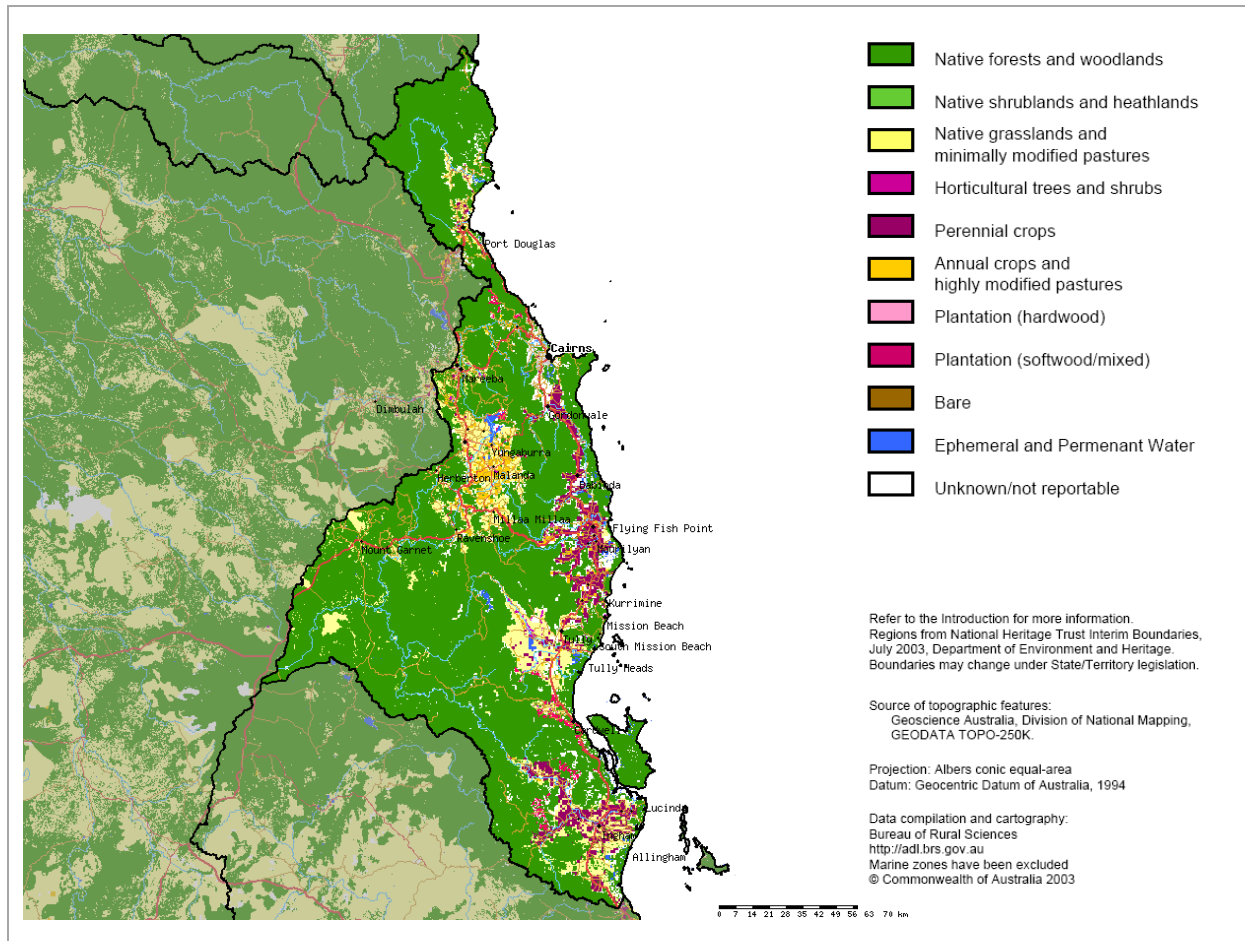
### **Development of a typology of rural landholders in relation to NRM**

The value of a typology can be determined by assessing two separate questions (Hair *et al.* 2006). The first question is: *does the typology have practical utility?* In the case of this project the question could be expressed as: *can the information in the typology be used to*

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<sup>1</sup> This report builds on earlier reports about the survey which provided descriptions of the responses (Emtage and Reghenzani 2008) and a second report which provided information about the background to the survey, the sampling frame used and the analysis and reporting that have been applied to the survey responses (Emtage in prep.).

*improve the design and delivery of NRM policies and programs in the region?* For this to occur, the profiles need to provide insight into landholders' property management motivations, activities, capacity to undertake currently recommended management practices and communication behaviour.



**Figure 1:** The Wet Tropics Natural Resource Management Region (Source: Bureau of Rural Sciences, 2008).

The second principle for assessing a typology is: *are the identified characteristics and differences between the groups those that would be expected given the results of previous research into the topic of interest?* The characteristics which have been identified as differentiating between the types of landholders described in earlier studies provide a guide for assessing the consistency of the results of the current analyses with previous research. In reviewing previous studies, Emtage *et al.* (2006: 89) concluded that there are a number of consistencies between the types of landholders that are described, arguing that:

‘...there are several socio-economic factors that have been consistently reported to differentiate between the landholder types in these studies. These factors include the economic characteristics of the landholding, such as size and productivity and the degree of dependence of the landholder on the property for income; social characteristics, such as the history of family ownership of a landholding and the family size, structure and time in life-cycle; and personal characteristics, such as the level of formal education. Landholders’ attitudes to land management issues, such as the legitimate role of governments and the

relative importance of biodiversity conservation, are also similar between the similar landholder types described by different authors.'

A variety of approaches have been used to develop typologies of Australian farmers and landholders in relation to enterprise development and NRM which have varying strengths and weaknesses (see Emtage *et al.* 2006 for a review of these studies). The intention in the present project is to compare the outcomes of a range of techniques to classify landholders.

When defining a landholder typology, a critical step is to decide on which criteria to use as a basis to classify the respondents into a series of groups as this will determine structure and character of the groups formed (Hair *et al.* 2006, Emtage *et al.* 2007). The criteria used to define the groups for which profiles are developed can be based on physical characteristics (such as the size, location or land uses on the landholding), can be based on psychographic characteristics (for example attitudes and values), or on a combination of these (Emtage *et al.* 2006, 2007). Once the criteria have been determined and a set of groups has been defined, the next stage is to make an assessment of the typology based on the principles outlined above. Because of the dominant influence of the criteria used to define groups in a typology, it is prudent to have a strong conceptual basis for choosing the criteria to apply (Hair *et al.* 2006). It is also advisable to compare group membership using a range of classifying criteria to assess the stability of the characteristics of the groups formed to help identify 'natural' clusters of landholders' with similar attitudes, values, circumstances and behaviour.

One method of exploring the diversity of rural landholders is to classify them according to the stated main purpose(s) for owning a rural property or property size (e.g. agricultural production, hobby farm, conservation, residential, etc.) (Byron *et al.* 2006a; b). Comparison of the differences in the characteristics of people with grazing and cropping operations and assessment of within industry variation represents a useful starting point for the development of a landholder typology using multiple criteria. Furthermore, these analyses can generate information useful for the assisting NRM policy and program design in their own right. Understanding differences in the motivations, capacity, goals and behaviour between those involved in agriculture and those who are not, the differences between those involved in cropping and those involved in grazing and the differences between landholders with varied scales of operation can help to better target development programs designed to assist these types of people.

Following the analyses, the observed differences between groups used in for this report will be compared to the differences to assess the consistency of the results with previous studies.

### **Overview of this report**

The first section of this report describes the application of factor analysis to responses to a number of topics in the landholders' survey. Four series of landholder profiles are defined, then described and compared. The first two sets of profiles are based on groups of landholders classified according to the landholders' reported primary reason for property ownership and the dominant land use(s) of the property. The third and fourth profiles concentrate on an exploring the variation within the cropping and grazing industries, classifying participants in these industries into a series of groups according to their scale of operation (i.e. the area of land they have available for cropping and grazing activities respectively).

## **Methodology applied in undertaking the analyses**

The analyses undertaken in the first steps were reported in the first (interim) report from the survey (Emtage and Reghenzani 2008) (i.e. the description of responses to the various topics in the survey). This report describes the results of the factors analyses of variables collected using Likert scales and a series of one-way ANOVA and Chi-square analyses of differences between groups of landholders.

When including psychographic variables in a multivariate analysis, a typical first step involves the application of principal component (factor) analyses to assess the underlying structure of responses to the survey and reduce the data for following analyses. This study is one of the first attempts to apply factor analysis to a quantitative data set representing rural landholders' perceptions of:

- On-property NRM management issues;
- Regional development issues;
- Vegetation management issues;
- Use of information sources; and
- The trustworthiness of institutions.

All analyses were undertaken using the SPSS (vers. 14) software program.

### ***Methods used to apply principal component (factor) analyses***

Factor (principal component) analyses were applied to the data set topics to examine the underlying structure of responses and reduce the number of variables used in the analysis of differences between respondents (Hair *et al.* 2006). The data analysed using factor analyses are the topics that were measured using Likert scales in the questionnaire. These topics include the respondents:

- Perception of the importance of various NRM issues on their property;
- Perception of the importance of various rural development issues in the region;
- Perception of the importance of various potential property management goals;
- Intentions in regard to various possible future strategic management intentions;
- Perception of management goals and values in relation to native vegetation;
- Perception of the usefulness of various potential sources of information for assisting land management decisions; and
- Perception of trustworthiness of various institutions;

A series of steps were followed for the analysis of responses to each topic. The first stage was to examine whether there was sufficient overall correlation between items within each topic for factor analysis using the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) test and the Bartlett test of Sphericity. The second stage was to apply the factor (principal component) analysis with varimax rotation, examining the communalities of each item and the factor loadings to assess whether each item is sufficiently accounted for by a factor solution. Where items did not show sufficient loadings on any factor (i.e. greater than 0.50) and had low communality scores (less than 0.50) they were removed from subsequent factor analyses on that topic.

At the next step in the analyses, factors were extracted with Eigenvalues greater than 1. The total level of variance accounted for by these factors were next assessed to see if they accounted for more than sixty percent of the variance, a level that is generally thought to be adequate for social science applications (Hair *et al.* 2006: 120). Where the factors accounted for less than sixty percent of the variance, the factor analysis was run again to extract a greater number of factors until greater than sixty percent of the variance was accounted for. The rotated factor solution was examined to determine whether the items with high loadings on a factor (greater than 0.50) had a common conceptual basis. Where a common conceptual basis could be determined a name was given to the factor to reflect the concept - based primarily on the items with the highest loadings on the factor. Next, Cronbachs reliability (alpha) tests were undertaken to assess whether reliable scales could be computed from the items i.e. scales that adequately account for the variation of the items it includes. Where sufficient reliability was found (alpha > 0.60), scales including items with high loadings on a particular factor were computed and used in subsequent analyses. Respondents were assigned scores for scales calculated as the average score of the high loading items. Scores for items that had negative loadings on a factor were reversed prior to calculating the averages.

### **Testing for differences between groups of respondents**

Three sets of criteria were used to classify respondents into a series of different groups. The first two relate to the land use practices on the landholding. The first criteria was the 'primary purpose of land ownership' data, in which landholders chose whether they were in one of the following categories: 'agriculture', 'conservation', 'hobby/lifestyle farm', 'residential' and 'other'.

The second set of criteria applied (termed 'land use types') in which those respondents involved in agricultural enterprises (sixty percent of the sample) were classified into three basic groups (i.e. cropping, grazing, and grazing and cropping). The sub-sets of landholders who reported their primary land use as 'conservation' and 'hobby farm' were combined with the 'other' group from the 'primary purpose' classification to create a single group ('other'). The fifth group in the land use classification is the 'residential only' group.

The third set of criteria used to classify landholders concentrated on agricultural operators. Those respondents involved in either cropping or grazing activities were grouped into a series of size classes according to the land area used for this activity.

Assessment of differences in the values, attitudes, resources and practices of landholders in the groups identified using the above sets of criteria included the use of ANOVA for testing differences between classes of landholders in continuous variables and chi-square (Pearsons' statistic and linear association tests) to assess differences. For the ANOVA tests, assessment of significant homogeneity of variance was assessed. For variables where there was no significant homogeneity of variance between the groups tested, the Bonferroni post-hoc test for significant differences between individual classes was used. Where homogeneity of variance was significant, the Tahmane test was applied.

Caution is urged in the interpretation of the results of the chi-square tests which involved assessment of differences between the landholder classes defined according to the scale of operations in the grazing and cropping industries and variables with more than three categories due to the relatively low number of respondents in these detailed tests.

## Data reduction and examination of underlying structures in responses

### *Respondents' perceptions of the importance of NRM issues on their own landholding*

The data set showed high scores for correlation between items ( $KMO > 0.70$ ) and was considered appropriate for principal component analysis (Table 1).

Following the initial analyses the items 'water erosion' and 'impacts from neighbours' were removed from analysis due to low communality scores and low factor loadings. The total variance explained in the final three factor solution was 63.6%. The items with high loadings on the first factor were all conceptually related to 'soil health' issues (Table 2). Items with high loadings on the second factor were all related to general natural 'environmental health' including vegetation, native fauna and water health. Items with high loadings on the third factor are all related to 'pests and weeds'.

Testing of the reliability of potential scales based on items with high loadings on the three identified factors all showed moderate to high levels of reliability (Table 2). As such, scales were constructed for each of these sets of items for use in subsequent analyses.

**Table 1:** Tests of sampling adequacy for items in the topic 'respondents' perceptions of NRM issues on their landholding'.

<b>KMO and Bartlett's Test</b>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.887
Bartlett's Test of Sphericity	Approx. Chi-Square	1489.42
	df	120
	Sig.	0.000

**Table 2:** Rotated component matrix for items in the topic 'respondents' perceptions of NRM issues on their landholding\*.

Item	Soil health	Environmental health	Pests and weeds
Soil health	<b>0.79</b>	0.24	0.24
Soil pH	<b>0.77</b>	0.18	0.27
Nutrient deficiency	<b>0.76</b>	0.13	0.31
Soil compaction	<b>0.74</b>	0.08	0.35
Nutrient toxicity	<b>0.73</b>	0.20	0.12
Acid sulphate soils	<b>0.70</b>	0.38	0.00
Water logging	<b>0.61</b>	0.09	0.45
Wind erosion	<b>0.54</b>	0.33	0.05
Reduced native vegetation	0.12	<b>0.87</b>	0.15
Reduced health of native vegetation	0.15	<b>0.84</b>	0.21
Decline native animals	0.15	<b>0.76</b>	0.28
Health of waterways	0.31	<b>0.60</b>	0.06
Water availability	0.45	<b>0.57</b>	-0.06
Native pests	0.17	0.06	<b>0.84</b>
Introduced pests	0.20	0.21	<b>0.80</b>
Weeds	0.30	0.23	<b>0.56</b>
Cronbach's Alpha	0.90	0.84	0.73
Scale mean score <sup>a</sup>	1.34	1.24	2.58
Standard deviation	0.876	0.898	1.240
N	186	258	273

\* Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization  
Rotation converged in six iterations.

<sup>a</sup> Scale ranged from 1 = *not important* to 5 = *very important*.

### **Respondents' perceptions of issues relating to rural development in the region**

Analysis of the sampling adequacy of the items in the data set for this topic showed high scores for correlation between items and was considered appropriate for principal component analysis (Table 3).

Survey participants were asked to rate the importance of a variety of NRM and non-NRM issues affecting their local region. Following the initial analyses, items removed included 'climatic variation', 'impacts of urban expansion', 'lack of soil health' and 'lack of extension services for agriculture' due to a combination of low communality scores and low loadings on identified factors. The final analysis adopted for later use was a three factor solution (Eigenvalues all > 1) (Table 4). Scales to represent factors related to issues concerning the 'viability of agriculture', 'lack of services' and lack of environmental health' were tested and found to be reliable (Table 4).

**Table 3:** Tests of sampling adequacy for items in the topic 'respondents' perceptions of rural development issues in their region'.

<b>KMO and Bartlett's Test</b>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.907
Bartlett's Test of Sphericity	Approx. Chi-Square	1996.176
	df	171
	Sig.	0.000

**Table 4:** Rotated component matrix for items in the topic 'respondents' perceptions of rural development issues in their region'\*

<b>Regional development issue</b>	<b>Viability of agriculture</b>	<b>Decline in services, employment and housing</b>	<b>Lack of environmental health</b>
Poor prices for agriculture products	<b>0.90</b>	0.04	0.09
Profitability of farming	<b>0.89</b>	0.02	0.07
Cost of agriculture inputs	<b>0.83</b>	0.25	0.00
Lack of young people in farming	<b>0.82</b>	0.10	0.21
Lack of skilled labour	<b>0.75</b>	0.27	0.22
Excessive government regulation	<b>0.60</b>	0.44	-0.04
High land prices	<b>0.59</b>	0.30	0.17
Pest control	<b>0.56</b>	0.42	0.14
Decline in community	<b>0.56</b>	0.31	0.19
Lack of community services	0.14	<b>0.67</b>	0.15
Lack of affordable housing	0.24	<b>0.67</b>	0.21
Lack of employment	0.25	<b>0.65</b>	0.03
Lack of services	0.19	<b>0.60</b>	0.34
Lack of public transport	-0.03	<b>0.53</b>	0.47
Lack of native vegetation	0.13	0.10	<b>0.83</b>
Patchiness of native vegetation	0.09	0.28	<b>0.79</b>
Reduced water quality	0.22	0.14	<b>0.72</b>
Cronbach's Alpha	0.91	0.72	0.79
Scale mean score <sup>a</sup>	3.39	2.42	1.62
Standard deviation	1.319	1.203	1.141
N	245	253	<b>257</b>

\* Rotation converged in five iterations. These factors accounted for 60.5% of total variance of these items in the data set (KMO = 0.90; Bartlett's test significance = 0.000).

<sup>a</sup> Scale ranged from 1 = *not important* to 5 = *very important*.

### **Respondents' perceptions of the importance of various property management goals**

Analysis of the sampling adequacy of the items in the data set for this topic showed high scores for correlation between items and was considered appropriate for principal component analysis (Table 5).

Identification of factors with Eigenvalues greater than one resulted in three factors or components being identified. These factors accounted for 60.1% of variance. No items were dropped from the topic for the analyses as all items had sufficiently high factor loadings on at least one factor and minimal cross-loading across factors (Table 6). The items with high loadings on the first factor were conceptually related to the idea of 'building a business'; items with high loadings on the second factor were related to the idea of 'improving the natural and social environment'; and items with high loading on the third topic were related to the concept of keeping the property in the family. Testing of the reliability of potential scales computed from items which shared high loadings on the three factors revealed high scores of reliability for the first two potential scales, and a lower but still acceptable reliability score for the third factor (Table 6).

**Table 5:** Tests of sampling adequacy for items in the topic 'respondents' perceptions of the importance of various property management goals'.

<b>KMO and Bartlett's Test</b>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.904
Bartlett's Test of Sphericity	Approx. Chi-Square	2806.044
	df	153
	Sig.	0.000

**Table 6:** Rotated component matrix for items in the topic 'respondents' perceptions of the importance of various property management goals\*.

Item	Build business	Improve the environment	Keep in family
Build a viable business	<b>0.92</b>	0.06	0.08
Increase property production	<b>0.88</b>	0.15	0.05
Provide most of house income	<b>0.88</b>	0.07	0.06
Build sound long term invest	<b>0.75</b>	0.18	0.22
Build asset to fund retirement	<b>0.67</b>	0.13	0.13
Freedom to work for myself	<b>0.62</b>	0.32	0.29
Provide habitat	-0.16	<b>0.72</b>	-0.01
Improve property NRM	0.22	<b>0.71</b>	-0.18
Improve environemtnal health of region	0.30	<b>0.69</b>	0.07
Live in attractive environment	-0.06	<b>0.68</b>	0.33
Conserve and improve water	0.19	<b>0.66</b>	0.23
Improve soil health	0.51	<b>0.66</b>	0.07
Live in a close community	0.38	<b>0.56</b>	0.27
Be able to work outside	0.45	<b>0.50</b>	0.24
Provide opportunity to be innovative	0.42	<b>0.50</b>	0.28
Maintain family tradition	0.44	0.07	<b>0.70</b>
Pass property to family	0.24	0.02	<b>0.66</b>
Maintain lifestyle	-0.13	0.38	<b>0.57</b>
Cronbach's Alpha	0.91	0.87	0.64
Scale mean score <sup>a</sup>	3.54	3.80	3.52
Standard deviation	1.525	1.066	1.230
N	302	304	310

\* Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in five iterations. These factors accounted for 60.1% of variance. (KMO = 0.904; Bartlett's test significance = 0.000).

<sup>a</sup> Scale ranged from 1 = not important to 5 = very important.

### **Respondents' future management intentions**

Analysis of the sampling adequacy of the items in the data set for this topic showed high scores for correlation between items and was considered appropriate for principal component analysis (Table 7).

Following the initial analysis, the items 'I will continue to live on and farm a rural property in the Wet Tropics region', 'set part of the property aside (e.g. covenant)' and 'I will live off-farm but continue to work the property' were removed from the analysis due to low communality levels and poor loading scores. Total variance explained by final factor analysis producing four components with Eigenvalues greater than one was 70.7%. Items with high loadings on the first factor are related to the concept of 'expanding business' (Table 8). Items with high loadings on the second factor are related to the concept of 'selling the property'. Items with high loadings on the third factor relate to 'leasing the property', while items with high loadings on the fourth factor relate to reducing or 'scaling back' property management activities. Assessment of the reliability of scales constructed based on the results of the factor analysis revealed high scores of reliability for two scales, acceptable reliability for one scale, and an unacceptable score (Alpha < 0.60) for the fourth scale (Table 8). Scales were computed using item scores for items with high loadings on the first three factors for use in subsequent analyses.

**Table 7:** Tests of sampling adequacy for items in the topic 'respondents' future management intentions'.

<b>KMO and Bartlett's Test</b>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.663
Bartlett's Test of Sphericity	Approx. Chi-Square	675.7897
	df	45
	Sig.	0.000

**Table 8:** Rotated component matrix for items in the topic ‘respondents’ perceptions of the importance of various property management goals\*.

Item	Expand business	Sell property	Lease property	Scale-back
Intensify current enterprises	<b>0.86</b>	-0.18	0.02	-0.04
Diversify enterprises	<b>0.81</b>	-0.07	0.24	-0.05
Expand by purchasing or leasing more land	<b>0.75</b>	-0.11	-0.15	0.02
The property will be sold	-0.23	<b>0.82</b>	0.07	0.23
Property will be passed on to family	0.25	<b>-0.78</b>	-0.07	0.20
Part of the property will be sold	0.10	<b>0.61</b>	0.05	0.50
All of the property will be leased out	0.03	0.13	<b>0.88</b>	0.03
Part of the property will be leased out	0.04	0.01	<b>0.86</b>	0.17
I will live on excised house block but will no longer farm the property	-0.06	-0.14	0.20	<b>0.80</b>
Scale back operations	-0.03	0.25	0.01	<b>0.73</b>
Cronbach's Alpha	0.77	0.68	0.75	0.51
Scale mean score <sup>a</sup>	-0.64	-0.53	-1.44	-0.87
Standard deviation	1.134	1.119	0.864	1.073
N	290	297	297	288

\* Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in five iterations. Total variance explained 70.7%. KMO = 0.663; Bartlett's test significance = 0.000.

<sup>a</sup> Scale ranged from -2 = *very unlikely* to 2 = *very likely*.

## **Respondents' perceptions of issues relating to management of native vegetation**

Analysis of the sampling adequacy of the items in the data set for this topic showed high scores for correlation between items and was considered appropriate for principal component analysis (Table 9).

Initial analyses examined the number and structure of factors extracted on the basis they had Eigenvalues greater than 1 and four factors met this criterium. The statement, 'I have a personal interest in forests' was dropped from analysis after examination of the communalities for the results which showed a low (<0.50) result indicating a low degree of influence of this variable on the factor analysis (Hair *et al.* 2006). The total variance accounted for by the four-factor solution at 58.2% was slightly lower than the suggested cut off for acceptable solutions by Hair *et al.* (2006) which is sixty percent.

Several variations of the analysis were attempted identifying sets of three, four and five factors. Each of the resulting sets of factors included factors that were primarily related to statements concerning a desire to clear remnant vegetation areas and a separate factor relating to statements that timber harvesting are possible and sustainable on the respondents' own land. Other common factors related to management difficulties, with the three factor solution containing all such variables and the four factor solution splitting these into difficulties with resources and difficulties in accessing information. The fifth factor in the five factor solution included the statements that native forest improved the look and decreased the value of a landholding. The level of variance accounted for by the three-factor solution was fifty percent while the five factor solution accounted for 64% of the variance. Given the higher and more acceptable level of variance accounted for by the five factor solution as well as the recommendation that a higher number of factors were desirable when a heterogeneous sub-samples or respondents are anticipated (Hair *et al.* 2006: 121), the five factor solution was selected to reduce the data for use in later analyses (Table 10).

Items with high loadings on the first factor relate to the idea that native vegetation is not wanted on landholdings (Table 10). Items with high loadings on the second factor included those relating to management difficulties. Items with high loadings on the third factor related to 'management information, items with high loadings on the fourth factor related to 'timber harvesting', and items with high loadings on the fifth relate to the 'aesthetics and value' of native vegetation on the landholding.

Testing the reliability of the scales that would be constructed from the analyses revealed that four of the proposed scales (i.e. all other than 'management information') meet the Cronbach Alpha test of reliability cut-off score for acceptability for exploratory projects of 0.60 using standardized items (Hair *et al.* 2006) (Table 10).

**Table 9:** Tests of sampling adequacy for items in the topic 'respondents' perceptions of vegetation management issues on their landholding'.

<b>KMO and Bartlett's Test</b>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.735
Bartlett's Test of Sphericity	Approx. Chi-Square	778
	df	105
	Sig.	0.000

**Table 10:** Rotated component matrix for items in the topic ‘respondents’ perceptions of vegetation management issues on their landholding’\*.

Item	Prefer to clear	Management difficulties	Management information	Timber harvesting	Aesthetics and value
Public forest areas provide enough habitat for native animals	<b>0.80</b>	0.04	-0.01	0.12	0.09
Native forest areas harbour more animals that badly affect my farming enterprises than good ones	<b>0.75</b>	-0.03	-0.14	0.11	0.11
It is better to clear forest regrowth where possible so the government does not prevent use of that land for agriculture in future	<b>0.68</b>	0.10	0.05	0.11	0.36
I would like to clear forest to expand areas available for other enterprises	<b>0.60</b>	0.23	0.07	0.19	0.42
Lack of finances greatly limits my ability to properly manage my forest areas	0.13	<b>0.79</b>	-0.22	0.02	-0.16
I do not have the necessary equipment to manage my forest areas effectively	-0.10	<b>0.72</b>	-0.29	0.11	0.09
Government regulations often prevent necessary management activities	0.15	<b>0.61</b>	0.29	0.14	0.49
I have access to sufficient labour to properly manage my forest areas	-0.24	<b>-0.54</b>	0.36	0.28	0.21
I can easily access information and advice on how to manage forests	-0.07	-0.09	<b>0.74</b>	-0.05	-0.14
I do not have the knowledge and experience to manage my forest areas well	0.11	0.13	<b>-0.73</b>	0.07	-0.05
I can protect my native forest areas from fire and pest risks	0.12	-0.18	<b>0.61</b>	0.15	-0.08
Harvesting timber or other forest products from my native forest areas could be profitable in the long term	0.19	0.13	0.04	<b>0.86</b>	0.04
My forest areas are suitable for timber production	0.16	-0.05	-0.03	<b>0.85</b>	-0.02
Native forest areas improve the look of my property	-0.28	0.16	0.04	0.14	<b>-0.72</b>
Having native forest decreases the value of my property	0.26	0.02	-0.26	0.11	<b>0.71</b>
Cronbach's Alpha	0.78	0.65	0.54	0.74	0.57
Scale mean score <sup>a</sup>	-0.37	0.45	0.27	-0.15	-0.98
Standard deviation	1.021	0.746	0.747	1.050	0.914
N	209	204	212	210	214

\* Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in seven iterations. Five-factor solution accounted for 64% of the variance. KMO = 0.735; Bartlett's test significance = 0.000.

<sup>a</sup> Scale ranged from -2 = *strongly disagree* to 2 = *strongly agree*.

**Respondents' perceptions of the usefulness of various information sources to inform property management**

Analysis of the sampling adequacy of the items in the data set for this topic showed high scores for correlation between items and was considered appropriate for principal component analysis (Table 11).

Following the initial factor analysis the item 'local government' were removed from the analysis due to low communality levels and lack of significant factor loading scores. The subsequent factor analysis identified four factors with Eigenvalues greater than one, accounting for 62% of total variance (Table 12). The items with high loadings on the first factor related to information about enterprises, the items for the second item related to information from finance specialists and family members, items with high loadings on the third factor related to groups concerned with environmental management, and items with high loadings on the fourth factor was related to the mass media and other written sources.

Testing the reliability of the scales that would be constructed from the analyses revealed that four of the proposed scales had high scores of reliability for use as scales (Table 12). The item 'government agents' had moderate loading scores on the scales 'Finance and family' and 'Environmental groups' and not used in assessing either of these scales for reliability. Scales to represent these factors were subsequently constructed for use in subsequent analyses.

**Table 11:** Tests of sampling adequacy for items in the topic 'respondents' perceptions of the usefulness of various information sources to assist with management of their landholding'.

<b>KMO and Bartlett's Test</b>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.917
Bartlett's Test of Sphericity	Approx. Chi-Square	2787.728
	df	210
	Sig.	0.000

**Table 12:** Rotated component matrix for items in the topic ‘respondents’ perceptions of vegetation management issues on their landholding’\*.

Item	Enterprise information	Finance and family	Environmental groups	Media sources
Agribusiness agents	<b>0.75</b>	0.13	0.10	0.17
Industry associations	<b>0.69</b>	0.45	0.23	-0.07
Private consultants	<b>0.68</b>	-0.02	0.13	0.17
Best practice groups	<b>0.68</b>	0.33	0.41	-0.02
Industry groups	<b>0.66</b>	0.37	0.32	0.02
Wholesalers	<b>0.61</b>	0.27	0.06	0.28
Market trends	<b>0.57</b>	0.38	-0.05	0.38
Training	<b>0.54</b>	0.29	0.46	0.11
Accountant	0.34	<b>0.75</b>	0.05	0.04
Family	0.07	<b>0.68</b>	0.15	0.16
Other farmers	0.19	<b>0.65</b>	0.18	0.30
Banks	0.36	<b>0.62</b>	0.16	0.08
Field days	0.24	<b>0.58</b>	0.25	0.44
Environmental groups	0.07	0.08	<b>0.84</b>	0.13
Landcare	0.21	0.15	<b>0.75</b>	0.23
NRM groups	0.46	0.20	<b>0.67</b>	0.08
Mass media	0.21	-0.08	0.05	<b>0.77</b>
Books	-0.06	0.32	0.30	<b>0.64</b>
Internet	0.12	0.19	0.12	<b>0.64</b>
Brochures	0.18	0.46	0.15	<b>0.61</b>
Government agents	0.22	0.45	0.46	0.27
Cronbach's Alpha	0.89	0.81	0.79	0.71
Scale mean score <sup>a</sup>	2.00	2.95	2.11	2.89
Standard deviation	1.414	1.367	1.495	1.250
N	285	296	303	297

\* Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in seven iterations. Four factors accounted for 62% of total variance. KMO = 0.917; Bartlett's test significance = 0.000.

<sup>a</sup> Scale ranged from 1 = *not important* to 5 = *very important*.

### **Respondents' trust in institutions**

Analysis of the sampling adequacy of the items in the data set for this topic showed high scores for correlation between items and was considered appropriate for principal component analysis (Table 13).

Factor analysis of the items included in the topic 'trust in institutions' revealed five factors with Eigenvalues greater than one which explained 72.8% of the total variance of the items (Table 14). Items with high loadings on the first factor relate to institutions involved in improving the productivity or profitability of agricultural enterprises. Items with high loadings on the second factor included local, state and federal governments in general. Items with high loadings on the third factor relate to State Government agencies. Items with high loadings on the fourth factor relate to respondents neighbours, and items with high loadings on the fifth factor relate to groups concerned with environmental management.

Testing of the reliability of scales based on items with high loadings on each of the five identified factors revealed that scales for each of the five factors would be reliable (Table 14).

**Table 13:** Tests of sampling adequacy for items in the topic 'respondents' trust in institutions involved in NRM in the [Wet Tropics] region'.

<b>KMO and Bartlett's Test</b>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.676
Bartlett's Test of Sphericity	Approx. Chi-Square	873.36
	df	91
	Sig.	0.000

**Table 14:** Rotated component matrix for items in the topic ‘respondents’ trust in institutions involved in NRM in the [Wet Tropics] region’\*.

Item	Productivity groups	Government general	State Government	Neighbours	Environment Groups
Productivity board	<b>0.89</b>	0.08	0.02	-0.03	0.00
BSES	<b>0.87</b>	0.04	0.05	0.02	0.06
Industry groups	<b>0.78</b>	0.18	0.04	0.12	0.00
Terrain <sup>a</sup>	<b>0.62</b>	0.01	0.39	0.14	0.11
State government officers	0.13	<b>0.85</b>	0.23	0.04	0.04
Local Government Agencies	0.00	<b>0.83</b>	0.06	0.12	-0.01
Federal Government	0.13	<b>0.77</b>	0.19	0.09	0.04
DNRW	0.14	0.12	<b>0.89</b>	-0.02	0.00
EPA	0.01	0.22	<b>0.79</b>	0.07	0.06
DPIF	0.21	0.40	<b>0.51</b>	0.06	0.18
Neighbours	-0.04	0.06	0.10	<b>0.91</b>	0.08
Other landholders	0.22	0.18	-0.03	<b>0.86</b>	0.01
Environment groups	-0.15	0.15	0.38	-0.02	<b>0.88</b>
Landcare groups	0.22	0.00	-0.05	0.06	<b>0.74</b>
Cronbach's Alpha	0.83	0.77	0.76	0.75	0.72
Scale mean score <sup>b</sup>	1.74	1.57	1.69	2.30	1.83
Standard deviation	0.804	0.511	0.576	0.592	0.639
N	158	272	242	287	283

\* Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in six iterations. These factors explained 72.8% of the total variance of the items. KMO = 0.676; Bartlett's test significance = 0.000).

<sup>a</sup> Terrain Pty Ltd is the regional NRM Board for the Wet Tropics NRM region of Queensland.

<sup>b</sup> Scale ranged from 1 = low trust to 3 = high trust.

### **Respondents' perceptions of sustainability issues**

Analysis of the sampling adequacy of the items in the data set for this topic showed high scores for correlation between items and was considered appropriate for principal component analysis (Table 15).

Initial analyses revealed that four components had Eigenvalues of greater than 1; however, they explained only fifty percent of the total variance. The five factor solution accounted for 61% of the total variance. The item 'current activities carried out on my land will not compromise the use of the property by future generations' had no factor loading scores higher than 0.50, with moderate ratings on several factors (Table 16). Items with high loadings on the first factor related to attachment to the property. Items with high loadings on the second factor related to care about NRM issues. Items with high loadings on the third factor related to the cost of NRM. Items with high loadings related to respondents' concern for their impacts on neighbours, while items with high loadings on the fifth factor relate to the concern of neighbours for their impacts on others.

Testing of the reliability of scales constructed to represent the five factors revealed that none would be reliable and therefore no scales were constructed for this topic for use in subsequent analyses (Table 16).

**Table 15:** Tests of sampling adequacy for items in the topic 'respondents' perceptions of sustainability issues on their landholding'.

<b>KMO and Bartlett's Test</b>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.696
Bartlett's Test of Sphericity	Approx. Chi-Square	425.939
	df	66
	Sig.	0.000

**Table 16:** Rotated component matrix for items in the topic ‘respondents’ perceptions of sustainability issues on their landholding’\*.

Item	Attached to property	Care for NRM	Costs of NRM	Concern for neighbours	Concern of neighbours
I would not be able to enjoy a good quality of life if I did not live on a rural property	<b>0.78</b>	-0.03	0.07	-0.08	0.02
I am very attached to my property	<b>0.71</b>	0.09	0.12	0.23	0.09
Overall, I think my property is well suited to achieving the goals I have for my property or business	<b>0.50</b>	0.46	0.03	0.08	0.07
Reduced production in the short-term can be justified where there are long-term benefits to natural resources	0.04	<b>0.76</b>	-0.18	0.14	0.17
Natural resources on my property are less degraded than many others in the local area	0.05	<b>0.73</b>	0.37	-0.09	-0.09
Increasing regulations leave less time to manage other aspects of my property/business	0.08	-0.08	<b>0.80</b>	-0.06	0.15
Landholders should receive incentives for providing environmental services (e.g. clean air and water) that benefit the wider community	0.11	0.17	<b>0.66</b>	0.30	0.01
What I do on my property can have an important impact on other landholders in this region	0.09	-0.06	0.21	<b>0.75</b>	0.00
It is important to consider how actions undertaken on my property may impact on my neighbours’ properties	0.04	0.18	-0.09	<b>0.72</b>	0.30
Most of my neighbours would consider how actions undertaken on their property may impact on my property	-0.01	0.05	-0.06	0.22	<b>0.82</b>
Most landholders in my local area are prepared to undertake practices that benefit the environment but may not have a direct benefit to them	0.14	0.03	0.34	-0.03	<b>0.74</b>
Current activities carried out on our property will not compromise the use of the property by future generations	0.36	0.34	-0.01	0.33	-0.19
Cronbach's Alpha	0.47	0.30	0.43	0.42	0.52

\* Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in seven iterations. The five-factor solution accounted for 61% of the total variance. KMO = 0.696; Bartlett’s test significance = 0.000). Scale ranged from -2 = *strongly disagree* to 2 = *strongly agree*.

## Socio-economic and attitudinal profiles of rural landholders by scale of operation

Following the use of factor analyses to understand the underlying structures of responses to questions in regards to attitudes to various issues and reduce the data for later analyses, a series of tests were used to examine the differences between landholders. The first and second series of tests examined the character and differences between landholders with differing primary reasons for owning their property and different enterprise types. The third series of tests examined differences among landholders with cropping and grazing enterprises of differing size operations. A summary of the results of these tests are presented in the following sections with detailed tables presenting the results in Appendix 1 where indicated. The results of these tests should be read in conjunction with the report presenting the descriptive statistics of the survey responses (Emtage and Reghenzani 2008).

### *Differences between landholders with varying reasons for owning their land*

#### *Characteristics of landholdings by land use types*

Property sizes were found to differ significantly between land use types as expected (Table 17). Landholders with properties whose primary use is for residential purposes had the smallest sized holdings on average at 6.7 ha, with grazing properties the largest at an average size of 3,300 ha. The median values of property areas for properties with agricultural enterprises are substantially lower than the mean values indicating that the data is highly positively skewed by a small number of very large properties.

As expected, the number of hours worked on the property per week varies greatly between landholders with and without commercial agriculture operations (Table 18). This is partly related to the larger size properties of the agriculture landholdings (Pearsons correlation significance = 0.048), and is also related to the fact that landholders with agricultural enterprises derive a substantial proportion of their income from the property enterprises (Table 19, Pearsons correlation significance < 0.000). Those landholders with cropping enterprises derive a slightly greater proportion of their income from their property than those with grazing enterprises, though the difference is not significant at the 95% confidence level (Tables 20 to 22). Properties with agricultural enterprises also have more people living on them and support a greater number of people than residential and 'lifestyle' properties (Table 23).

**Table 17:** Total area of farm by land use type<sup>a</sup>.

Land use types	N	Mean (ha)	Median
Residential only	48	6.7	3.4
Grazing	54	3,324.4	116.6
Cropping	97	166.6	100.5
Grazing and cropping	26	1,022.1	226.5
Other*	82	33.0	12.1
<b>All categories</b>	<b>307</b>	<b>733.8</b>	

<sup>a</sup> One-way ANOVA (F = 3.1; sig. = 0.016). Residential < cropping and 'other' (Tahmane test = 0.000). 'Other' < Cropping (Tahmane test = 0.001).

\* Includes primary purpose categories 'hobby/lifestyle farm', 'conservation' and others.

**Table 18:** Average hours worked on property per week (hours)<sup>a</sup>.

Primary purpose of landownership	N	Mean (hours)
Agriculture	178	45.8
Conservation	19	18.9
Hobby/lifestyle farm	34	17.8
Residential	37	11.5
Other	4	6.5
All categories	272	35.2

<sup>a</sup> One-way ANOVA (F = 32.5; sig. < 0.000): Agriculture > other categories (Tahmane test < 0.010).

**Table 19:** Proportion of total income from farm by primary purpose of landownership<sup>a</sup>.

Primary purpose of landownership	N	Mean (%)
Agriculture	134	53.7
Conservation	19	10.8
Hobby/lifestyle farm	35	4.6
Residential	41	1.4
Other	8	12.0
All categories	237	32.5

<sup>a</sup> One-way ANOVA (F = 42.8; sig. < 0.000): Agriculture < all categories (Tahmane test < 0.030).

**Table 20:** Proportion of total income from farm<sup>a</sup>.

Land use recorded	N	Mean (%)
Residential only	40	0.5
Grazing	40	46.3
Cropping	71	55.8
Grazing and cropping	20	58.1
Other	64	8.6
All categories	235	32.1

<sup>a</sup> One-way ANOVA (F = 41.6; sig. < 0.000): Residential < all categories (Tahmane test < 0.010); Other < 'grazing', 'cropping' and 'grazing and cropping' (Tahmane test < 0.000).

**Table 21:** Whether landholders receive income from off-farm by primary purpose of landownership<sup>a</sup>.

Primary purpose of landownership	If have receive income from off-farm		Total
	No	Yes	
Agriculture	28.6%	71.4%	100.0%
Conservation	9.1%	90.9%	100.0%
Hobby/lifestyle farm	7.9%	92.1%	100.0%
Residential	8.9%	91.1%	100.0%
Other	12.5%	87.5%	100.0%
All categories	21.0%	79.0%	100.0%

<sup>a</sup> Pearsons Chi-square statistic 16.4; d.f. = 4; p = 0.003.

**Table 22:** Whether landholders receive income from off-farm by land use types<sup>a</sup>.

Land use type	If have receive income from off-farm		Total
	No	Yes	
Agriculture	9.1%	90.9%	100.0%
Conservation	33.3%	66.7%	100.0%
Hobby/lifestyle farm	21.3%	78.7%	100.0%
Residential	40.0%	60.0%	100.0%
Other	10.8%	89.2%	100.0%
All categories	20.8%	79.2%	100.0%

<sup>a</sup> Pearsons Chi-square statistic 19.2; d.f. = 4; p = 0.001.

**Table 23:** Number of people living on and supported by the property by primary purpose of property ownership<sup>a</sup>.

Primary purpose of landownership	Number of people living on the property	Number of people supported by the property
Agriculture	3.7	3.8
Conservation	2.2	1.0
Hobby/lifestyle farm	2.3	0.5
Residential	2.1	0.4
Other	0.9	1.6
All categories	3.1	2.6

<sup>a</sup> Details of statistical tests are provided in Appendix 1.

Significant differences were found in the proportion of male and female respondents with properties of various primary purposes. A higher proportion of female respondents reported owning residential and hobby/lifestyle properties compared to agriculture or ‘conservation’ properties (Table 24). Those females that did operate agricultural enterprises were more likely to be involved in grazing rather than cropping enterprises (Table 25).

**Table 24:** Gender of landholders by primary purpose of property ownership<sup>a</sup>.

Primary purpose of land ownership	Gender		Total
	Female	Male	
Agriculture	18.2%	81.8%	100.0%
Conservation	14.3%	85.7%	100.0%
Hobby/lifestyle farm	39.5%	60.5%	100.0%
Residential	41.3%	58.7%	100.0%
Other	25.0%	75.0%	100.0%
All categories	24.7%	75.3%	100.0%

<sup>a</sup> Pearsons Chi-square statistic 17.2; d.f. = 4; p = 0.002.

**Table 25:** Gender of landholders by land use type<sup>a</sup>.

Land use type	Gender		Total
	Female	Male	
Agriculture	42.2%	57.8%	100.0%
Conservation	30.4%	69.6%	100.0%
Hobby/lifestyle farm	13.6%	86.4%	100.0%
Residential	11.1%	88.9%	100.0%
Other	27.8%	72.2%	100.0%
All categories	24.7%	75.3%	100.0%

<sup>a</sup> Pearsons Chi-square statistic 17.2; d.f. = 4; p = 0.002.

Tests revealed that landholders with agricultural enterprises have lived in their local district, on rural properties and on their current property for approximately twice as long as landholders with properties whose primary purpose is for lifestyle, residential or other reasons (Table 26). This finding confirms previous research that has reported that ownership of 'lifestyle' rural properties have significantly higher turnover rates than larger agricultural properties (see Meadows and Emtage In prep. for a review of this research). The implication of this finding for NRM is that landholders with smaller properties frequently have less experience with and knowledge about how to effectively manage their properties. Furthermore, efforts to engage these types of landholders need to be on-going to attract the attention of new property owners.

**Table 26:** Mean time lived in local district and on current property (years) by primary purpose of landownership<sup>a</sup>.

Primary purpose of landownership	Time lived in local district	Time lived on rural properties	Time lived on current property
Agriculture	40.8	37.2	29.5
Conservation	18.1	19.0	13.0
Hobby/lifestyle farm	24.1	22.6	14.0
Residential	18.7	17.5	11.8
Other	21.4	16.8	3.4
All categories	32.7	30.2	22.7

<sup>a</sup> Details of statistical tests provided in Appendix 1.

Significant differences were identified in the proportion of landholders with varying primary purposes for landownership and varying enterprise types who have prepared or are preparing property or business plans and are using a farm or environmental management system (Tables 27 to 30). More than half the landholders with agricultural enterprises reported either having a property plan or being in the process of preparing one, contrasting with less than ten percent of those with hobby/lifestyle properties. Those involved in cropping enterprises have a higher rate of use of property plans and environmental management systems compared to those with grazing enterprises. If the respondents with grazing follow through with the development of their plans the proportions of graziers and croppers with plans will be approximately equal.

**Table 27:** Preparation of property management plans by primary purpose of land ownership<sup>a</sup>.

Primary purpose of landownership	'Have you prepared a written property plan or business plan?'			Total
	No	In progress	Yes	
Agriculture	49.7%	13.1%	37.2%	100.0%
Conservation	68.2%	9.1%	22.7%	100.0%
Hobby/lifestyle farm	92.5%	2.5%	5.0%	100.0%
Residential	87.5%	4.2%	8.3%	100.0%
Other	100.0%			100.0%
All categories	64.1%	9.6%	26.2%	100.0%

<sup>a</sup> Pearsons Chi-square statistic 46.6; d.f. = 8; p < 0.000.

**Table 28:** Preparation of property management plans by land use types<sup>a</sup>.

Land use types	'Have you prepared a written property plan or business plan?'			Total
	No	In progress	Yes	
Residential only	89.4%	4.3%	6.4%	100.0%
Grazing	51.9%	16.7%	31.5%	100.0%
Cropping	49.5%	10.8%	39.8%	100.0%
Grazing and cropping	55.6%	14.8%	29.6%	100.0%
Other*	81.8%	5.2%	13.0%	100.0%
All categories	65.1%	9.7%	25.2%	100.0%

<sup>a</sup> Pearsons Chi-square statistic 39.5; d.f. = 8; p < 0.000.

\* The 'other category includes landholdings whose primary purpose was conservation, hobby farms and various other uses not related to agricultural production.

**Table 29:** Whether landholders use a recognised environmental management system by primary purpose of landownership<sup>a</sup>.

Primary purpose of landownership	'Do you use a recognised farm or environmental management system?'		Total
	No	Yes	
Agriculture	81.8%	18.2%	100.0%
Conservation	81.8%	18.2%	100.0%
Hobby/lifestyle farm	93.0%	7.0%	100.0%
Residential	96.0%	4.0%	100.0%
Other	100.0%		100.0%
All categories	86.1%	13.9%	100.0%

<sup>a</sup> Pearsons Chi-square statistic 10.3; d.f. = 4; p < 0.035.

**Table 30:** Whether landholders use a recognised environmental management system by land use types<sup>a</sup>.

Land use types	'Do you use a recognised farm or environmental management system?'		Total
	No	Yes	
Residential only	95.9%	4.1%	100.0%
Grazing	90.9%	9.1%	100.0%
Cropping	76.6%	23.4%	100.0%
Grazing and cropping	85.2%	14.8%	100.0%
Other	90.1%	9.9%	100.0%
All categories	86.6%	13.4%	100.0%

<sup>a</sup> Pearsons Chi-square statistic 13.6; d.f. = 4; p < 0.009.

Testing revealed that the proportion of landholders who have attended short courses related to property management with varying primary reasons for property ownership and land use types have similar patterns to those who have prepared management plans and use environmental management systems (Tables 31 and 32). Just over half of those with larger properties with agricultural enterprises have attended a short course, contrasting with the very low proportion of people with hobby/lifestyle properties who have attended courses. There are also large differences between land use types in the proportions of landholders who have attended short courses with more than sixty percent of those with cropping having undertaken courses compared to less than thirty percent of those with grazing enterprises.

**Table 31:** Whether landholders have attended a short course related to property management by primary purpose of landownership<sup>a</sup>.

Primary purpose of landownership	'Have you attended a short course related to property management?'		Total
	No	Yes	
Agriculture	48.1%	51.9%	100.0%
Conservation	81.8%	18.2%	100.0%
Hobby/lifestyle farm	97.5%	2.5%	100.0%
Residential	91.7%	8.3%	100.0%
Other	100.0%		100.0%
All categories	65.4%	34.6%	100.0%

<sup>a</sup> Pearsons Chi-square statistic 64.0; d.f. = 4; p < 0.000.

**Table 32:** Whether landholders have attended a short course related to property management by land use types<sup>a</sup>.

Land use type	'Have you attended a short course related to property management?'		Total
	No	Yes	
Residential only	91.5%	8.5%	100.0%
Grazing	71.4%	28.6%	100.0%
Cropping	39.6%	60.4%	100.0%
Grazing and cropping	33.3%	66.7%	100.0%
Other	89.3%	10.7%	100.0%
All categories	65.9%	34.1%	100.0%

<sup>a</sup> Pearsons Chi-square statistic 73.6; d.f. = 4; p < 0.000.

Levels of formal education varied significantly between landholders with different primary purposes for their landownership and land uses. In general landholders with agricultural enterprises (including hobby farms) had higher proportions of people with primary education and lower proportions with postgraduate degrees compared to those with 'conservation' and 'other' landholdings (Table 33). Those involved in grazing enterprises only tended to have higher levels of formal education than those involved in cropping activities (Table 34).

**Table 33:** Formal education levels by primary reason for landownership<sup>a</sup>.

Primary purpose of landownership	Education level					Total
	Primary	High – Yr 10	High – Yr 12	Diploma or degree	Postgraduate degree	
Agriculture	13.3%	34.4%	22.8%	24.4%	5.0%	100.0%
Conservation		9.5%	23.8%	38.1%	28.6%	100.0%
Hobby/lifestyle farm	14.0%	23.3%	25.6%	30.2%	7.0%	100.0%
Residential	6.3%	29.2%	10.4%	41.7%	12.5%	100.0%
Other		25.0%	25.0%	25.0%	25.0%	100.0%
All categories	11.0%	30.0%	21.3%	29.0%	8.7%	100.0%

<sup>a</sup> Pearsons Chi-square statistic 34.0; d.f. = 16; p < 0.005.

**Table 34:** Formal education levels by land use types<sup>a</sup>.

Land use types	Education level					Total
	Primary	High – Yr 10	High – Yr 12	Diploma or degree	Postgraduate degree	
Residential only	6.4%	29.8%	10.6%	40.4%	12.8%	100.0%
Grazing	9.3%	31.5%	18.5%	38.9%	1.9%	100.0%
Cropping	14.6%	33.7%	25.8%	18.0%	7.9%	100.0%
Grazing and cropping	15.4%	42.3%	23.1%	19.2%		100.0%
Other	8.9%	21.5%	22.8%	31.6%	15.2%	100.0%
All categories	10.8%	30.2%	21.0%	29.2%	8.8%	100.0%

<sup>a</sup> Pearsons Chi-square statistic 28.8; d.f. = 16; p < 0.025.

Involvement in government NRM programs varied between landholdings with various land use types from less than ten percent of landholders with non-agricultural landholdings compared to greater than twenty percent of landholdings with agricultural activities (Table 35).

**Table 35:** Whether landholders were involved in government NRM programs in the last five years by land use type<sup>a</sup>.

Land use type	'Were you involved in government NRM programs in the last five years?'		Total
	No	Yes	
Residential only	95.7%	4.3%	100.0%
Grazing	78.6%	21.4%	100.0%
Cropping	75.8%	24.2%	100.0%
Grazing and cropping	56.5%	43.5%	100.0%
Other	91.0%	9.0%	100.0%
All categories	82.0%	18.0%	100.0%

<sup>a</sup> Pearsons Chi-square statistic 23.3; d.f. = 4; p < 0.000.

As expected there were significant differences in the proportion of landholders reporting making a profit from on-property activities between landholders with agricultural enterprises and those without (Table 36). There were also differences between agricultural operations of differing types, with cropping enterprises more likely to be profitable relative to grazing enterprises (Table 37).

**Table 36:** Whether a profit was made by primary purpose of landownership<sup>a</sup>.

Primary purpose of landownership	If a profit was made the previous year		Total
	No	Yes	
Agriculture	42.6%	57.4%	100.0%
Conservation	85.7%	14.3%	100.0%
Hobby/lifestyle farm	95.0%	5.0%	100.0%
Residential	93.5%	6.5%	100.0%
Other	85.7%	14.3%	100.0%
All categories	61.6%	38.4%	100.0%

<sup>a</sup> Pearsons Chi-square statistic 73.4; d.f. = 4; p < 0.000.

**Table 37:** Whether a profit was made in 2006/2007 by land use type<sup>a</sup>.

Land use type	If a profit was made 2006/2007		Total
	No	Yes	
Residential only	93.3%	6.7%	100.0%
Grazing	57.9%	42.1%	100.0%
Cropping	35.2%	64.8%	100.0%
Grazing and cropping	40.0%	60.0%	100.0%
Other	89.2%	10.8%	100.0%
All categories	62.7%	37.3%	100.0%

<sup>a</sup> Pearsons Chi-square statistic 74.8; d.f. = 4; p < 0.000.

### **Attitudes and values towards management by primary purpose of owning land and land use types**

Assessment of the ratings of importance given to various scales for the importance of on-property NRM issues revealed that landholders with agricultural enterprises rated the importance of ‘soil health’ and ‘pests and weeds’ issues significantly higher than landholders on residential properties (Table 38).

**Table 38:** Ratings of the importance of property NRM issues scales by primary reason for landownership<sup>a</sup>.

<b>Primary purpose of landownership</b>	<b>Soil health</b>	<b>Pests and weeds</b>
Agriculture	1.5	2.8
Conservation	1.3	2.2
Hobby/lifestyle farm	1.0	2.2
Residential	0.8	1.8
Other	1.4	2.9
All categories	1.3	2.6

<sup>a</sup> Scores ranged from 0 = *Not Applicable* to 5 = *Very Important*. See Appendix 1 for details of the statistical tests.

Assessment of the ratings of importance given to various scales for the importance of rural development issues revealed that landholders with agricultural enterprises rated the importance of the ‘viability of agriculture’ and ‘lack of employment and services’ issues significantly higher than landholders on residential properties (Table 39).

**Table 39:** Ratings of the importance of rural development issues in the local region scale scores by primary purpose of landownership<sup>a</sup>.

<b>Primary purpose of landownership</b>	<b>Viability of agriculture</b>	<b>Lack of employment and services</b>
Agriculture	4.1	2.4
Conservation	2.0	2.1
Hobby/lifestyle farm	3.0	1.9
Residential	1.9	1.6
Other	1.8	1.6
All categories	3.5	2.2

<sup>a</sup> Scores ranged from 0 = *Not Applicable* to 5 = *Very Important*. See Appendix 1 for details of the statistical tests.

Assessment of the ratings of importance given to various scales for the priority of on-property management goals revealed that landholders with agricultural enterprises rated the importance of 'build business' higher than other categories of landholders, 'improve environment' issues higher than residential landholders, and 'keep in family' issues significantly higher than landholders on 'other' properties (Table 40).

**Table 40:** Ratings of the importance of scales relating to priority of property management by primary purpose of landownership<sup>a</sup>.

Primary purpose of landownership	Build business	Improve the environment	Keep in family
Agriculture	4.3	4.0	3.7
Conservation	2.4	4.0	3.0
Hobby/lifestyle farm	2.6	3.8	3.4
Residential	1.8	3.4	3.3
Other	2.4	2.2	2.4
All categories	3.5	3.8	3.5

<sup>a</sup> Scores ranged from 0 = *Not Applicable* to 5 = *Very Important*. See Appendix 1 for details of the statistical tests.

Assessment of the ratings of importance given to various scales for intentions for future management revealed that landholders with agricultural enterprises rated the importance of 'expanding business' significantly higher than landholders on residential and conservation properties, while 'hobby farm' landholders also rated this scale higher than those on residential properties (Table 41).

**Table 41:** Ratings of the importance of the scale 'expand business' by primary purpose of landownership<sup>a</sup>.

Primary purpose of landownership	N	Mean*
Agriculture	181	-0.31
Conservation	20	-1.27
Hobby/lifestyle farm	39	-0.83
Residential	42	-1.52
Other	6	-1.22
All categories	288	-0.64

\* Scores ranged from -2 = *Strongly Disagree* to 2 = *Strongly Agree*.

<sup>a</sup> One-way ANOVA (F = 14.6; Sig. < 0.000); Conservation, residential < Agriculture (Bonferroni test < 0.002); Residential < hobby farm (Bonferroni test = 0.032).

Assessment of the ratings of importance given to various scales for the importance of vegetation management issues revealed that landholders with agricultural enterprises rated the importance of 'prefer to clear' significantly higher than landholders on all other types of properties, and those on hobby farms rated this issue higher than those on 'conservation' properties (Table 42). Landholders on 'agriculture' properties also rated the scale 'timber harvesting suitable' higher than 'residential' landholders. Post hoc tests for significant differences between the categories were inconclusive for the scales 'management difficulties' and 'vegetation decreases aesthetics and value'.

**Table 42:** Ratings of the importance for various scales relating to issues for management of vegetation by primary purpose of landownership<sup>a</sup>.

Primary purpose of landownership	Prefer to clear forest	Management difficulties	Timber harvesting suitable	Vegetation decreases aesthetics and value
Agriculture	0.07	0.58	0.08	-0.79
Conservation	-1.31	0.15	-0.05	-1.32
Hobby/lifestyle farm	-0.52	0.49	-0.47	-1.17
Residential	-1.04	0.23	-0.54	-1.24
Other	0.00	0.00	-0.20	-0.30
All categories	-0.37	0.45	-0.14	-0.97

<sup>a</sup> Scores ranged from -2 = *Strongly Disagree* to 2 = *Strongly Agree*. See Appendix 1 for details of the statistical tests.

Chi-square analyses revealed differences between landholders with varied primary purposes for land ownership and land use types (Tables 43 and 44). The highest level of activity in terms of the maintenance of walking tracks and encouraging the regrowth of vegetation was by 'conservation' landholders, with the lowest levels of activities in these activities by the 'other' and 'agricultural' landholders. There were several differences between 'croppers' and 'graziers', with those involved in grazing more likely to have thinned regrowth vegetation, established improved pasture and fenced remnant areas (Table 44).

**Table 43:** Proportion of respondents who have undertaken various vegetation management activities by primary purpose of landownership.

Primary purpose of landownership	Vegetation management activity	
	Maintained walking track	Encouraged regrowth of native vegetation
Agriculture (%)	17.8	52.7
Conservation (%)	47.6	95.5
Hobby/lifestyle farm (%)	14.8	57.1
Residential (%)	39.5	67.3
Other (%)	25.0	37.5
All classes	24.9	58.3
Pearson Chi-Square value	14.5	18.0
df	4	4
Sig. (2-sided)	0.006	0.001

**Table 44:** Proportion of respondents who have undertaken various vegetation management activities by land use type.

Land use types	Vegetation management activity				
	Maintained walking track	Encouraged regrowth of native vegetation	Thinned regrowth of native vegetation	Established improved pasture in forest areas	Established fencing around remnant vegetation areas
Residential only (%)	37.8	66.7	18.8	10.6	12.5
Grazing (%)	20.6	48.2	30.4	25.0	26.8
Cropping (%)	15.2	51.6	5.5	7.9	4.4
Grazing and cropping (%)	11.1	51.9	32.0	33.3	26.9
Other (%)	32.8	70.0	20.3	17.1	27.6
All classes	25.5	58.2	18.4	16.3	17.8
Pearson Chi-Square value	9.6	10.4	18.7	14.7	21.6
df	4	4	4	4	4
Asymp. Sig. (2-sided)	0.047	0.034	0.001	0.005	0.000

Assessment of the ratings of usefulness given to various scales for information sources for property management decisions revealed that landholders with agricultural enterprises rated the usefulness of 'enterprise development' and 'finance and family' higher than all categories except 'other'. Agriculture landholders also rated the usefulness of 'environmental groups' higher than 'residential' landholders and 'media sources' significantly more useful than landholders on residential and 'other' properties (Table 45). In addition, 'hobby/lifestyle' landholders rated 'finance and family' information sources more useful than did 'residential' landholders, and they rated 'media sources' as more useful than 'other' landholders.

**Table 45:** Ratings of the importance of various scales related to information source usefulness by primary purpose of landownership\*.

Primary purpose of landownership	Enterprise development	Financial advice and family	Environment groups	Media sources
Agriculture	2.7	3.5	2.4	3.1
Conservation	1.2	1.8	2.4	2.6
Hobby/lifestyle farm	1.1	2.8	1.7	3.0
Residential	0.6	1.7	1.4	2.4
Other	1.7	2.2	1.1	1.6
All categories	2.0	2.9	2.1	2.9

\* Scores ranged from 0 = *Not Applicable* to 5 = *Very Useful*. See Appendix 1 for details of the statistical tests.

Assessment of the ratings of trust given to various scales for the importance of on-property NRM issues revealed that landholders with agricultural enterprises rated 'productivity groups' as more trustworthy than other landholder categories, and 'hobby/lifestyle landholders' rated environmental groups as more trustworthy than 'other' and 'agriculture landholders (Table 46).

**Table 46:** Ratings of the importance of scales related to trust in institutions by primary purpose for property ownership\*.

Primary purpose for landownership	Productivity groups	Environment groups
Agriculture	2.0	1.7
Conservation	1.1	2.0
Hobby/lifestyle farm	1.1	2.1
Residential	1.0	1.9
Other	1.6	1.3
All categories	1.7	1.8

\* Scores ranged from 0 = *Not Applicable*, 1 = *Low level of trust* to 3 = *High level of trust*. See Appendix 1 for details of the statistical tests

## Comparison of cropping operators by size classes

Examination of the differences in socioeconomic characteristics between landholders and their holdings in the various 'cropping area size classes' revealed that landholders on larger sized holdings are more dependent on their property for income, employ more people on their property and work longer hours on their property than those on smaller size classes (Table 47).

**Table 47:** Income and working effort characteristics differentiating cropping size classes.

Cropping size class	Average per week (hrs) <sup>a</sup>	FTEs employed on-farm in past year <sup>b</sup>	Proportion of total income from farm <sup>c</sup>
Less than 20 ha	33.3	1.8	35.5
20 – 49 ha	32.8	1.4	46.1
50 – 99 ha	39.8	1.2	60.3
100 – 199 ha	61.3	2.0	67.9
200 – 499 ha	56.0	2.0	69.0
More than 500 ha	58.7	15.6	86.7
All classes	46.2	2.7	58.6

<sup>a</sup> ANOVA F value = 7.49;  $p < 0.000$ : Less than 20 ha and 20-49 ha  $<$  100-199 ha and 200-499 ha (Bonferroni test  $<$  0.034); 100-199 ha  $<$  50-99 ha (Bonferroni test = 0.003).

<sup>b</sup> ANOVA F value = 6.88;  $p < 0.000$ : Post hoc tests not significant.

<sup>c</sup> ANOVA F value = 2.71;  $p = 0.027$ : Post hoc tests not significant.

There is evidence of variation in the reported level of formal education although the results need to be interpreted with caution as a high number of cells used in the analysis have a lower than desired expected frequency count (Table 48). The patterns of difference are complex, with a general trend of increasing proportion of respondents with 'primary', falling levels of 'Year 10' and increasing levels of 'diploma or degree' education as the size classes increase in size.

**Table 48:** Level of formal education by cropping size classes.

Cropping size class	Education level					Total
	Primary	High yr 10	High Yr 12	Diploma or degree	Post graduate degree	
Less than 20 ha	13.3%	53.3%	26.7%	6.7%		100.0%
20 – 49 ha		64.3%	28.6%	7.1%		100.0%
50 – 99 ha	20.0%	33.3%	26.7%	10.0%	10.0%	100.0%
100 – 199 ha	12.5%	29.2%	20.8%	33.3%	4.2%	100.0%
200 – 499 ha	28.6%	21.4%	21.4%	28.6%		100.0%
More than 500 ha	33.3%		16.7%	50.0%		100.0%
All classes	16.5%	35.9%	24.3%	19.4%	3.9%	100.0%

As would be expected, more people live on and are supported by landholdings with larger sized cropping operations (Table 49). In addition, there is a tendency for landholders on larger holdings to have been resident on rural properties and on their current property for significantly longer than those in smaller size classes.

**Table 49:** Time in district, on property, and number of people living on and supported by property by cropping size classes.

Cropping size class	Time lived on rural properties (years) <sup>a</sup>	Time lived on current property (years) <sup>b</sup>	Number of people who live on property <sup>c</sup>	Number of people supported by property <sup>d</sup>
Less than 20 ha	35.3	24.4	4.0	3.9
20 – 49 ha	26.5	22.7	3.7	2.6
50 – 99 ha	43.9	35.6	3.0	2.7
100 – 199 ha	47.7	43.8	4.7	4.2
200 – 499 ha	45.6	35.0	4.6	4.3
More than 500 ha	43.3	29.5	8.3	17.4
All classes	41.2	33.5	4.2	4.4

<sup>a</sup> ANOVA F value = 2.65, p = 0.027: 20 – 4 ha < 100 – 199ha (Bonferroni test = 0.025).

<sup>b</sup> ANOVA F value = 3.52, p = 0.006: Less than 20 ha, 20 – 49ha < 100 – 199 ha (Bonferroni test < 0.031).

<sup>c</sup> ANOVA F value = 3.43, p = 0.007: Post hoc tests not significant.

<sup>d</sup> ANOVA F value = 7.54, p < 0.000: 100 – 199 ha > 20 – 49 ha and 50 – 99 ha (Bonferroni test < 0.047).

There were significant differences in the proportion of landholders who had undertaken a short course on land management, ranging from less than forty percent of those on properties in the class '20-49 ha' to approximately eighty percent in the class '100-199 ha' (Table 50). Participation in government NRM programs ranged from less than twenty percent of landholders in the 'less than 20 ha' and '50-99 ha' size classes to eighty percent of those in the 'more than 500 ha' class. The pattern of landholders reporting a profit from on-property activities in 2006/2007 in the various cropping size classes reporting a profit is more complex, with eighty percent of those landholders in the '20-49 ha' class reporting a profit compared to just 33% of landholders in the 'more than 500 ha' class. The other size classes had varying proportions reporting a profit ranging from 50-75% of landholders. While the tests for differences in the proportion of the various cropping size classes indicated significant differences between the classes in this aspect, these results need to be interpreted with caution due to the low number of responses used for this calculation (93% of cells had less than five expected observations) (Table 51).

**Table 50:** Proportion of landholders who have participated in various activities and profitability by cropping size classes.

Activity	Less than 20 ha	20-49 ha	50-99 ha	100-199 ha	200-499 ha	More than 500 ha
Attended a short course <sup>a</sup>	50.0	37.5	58.6	79.2	66.7	100.0
If participated in government NRM program in last five years <sup>b</sup>	14.3	26.7	17.9	41.7	40.0	80.0
If profit made 2006/2007 <sup>c</sup>	46.7	81.3	70.0	75.0	50.0	33.3

<sup>a</sup> Pearsons chi-square = 12.59, d.f. = 5, p = 0.028: 2 cells (16.7%) have expected count less than five.

<sup>b</sup> Pearsons chi-square = 11.74, d.f. = 5, p = 0.039: 5 cells (41.7%) have expected count less than five.

<sup>c</sup> Pearsons chi-square = 9.61, d.f. = 5, p = 0.087: 2 cells (16.7%) have expected count less than five.

**Table 51:** Profit level by cropping size classes<sup>a</sup>.

Cropping land size classes	Profit level								Total
	0 - 10,000	10,001 - 20,000	20,001 - 30,000	30,001 - 40,000	40,001 - 50,000	50,001 - 60,000	60,001 - 100,000	> 100,000	
Less than 20 ha	12.5%		12.5%	25.0%	25.0%	12.5%	12.5%		100.0%
20 – 49 ha	43.8%	12.5%	37.5%	6.3%					100.0%
50 – 99 ha	24.0%	36.0%	24.0%		8.0%	4.0%	4.0%		100.0%
100 – 199 ha	5.6%	11.1%	38.9%	16.7%	11.1%	11.1%		5.6%	100.0%
200 – 499 ha	20.0%	20.0%	10.0%		30.0%			20.0%	100.0%
More than 500 ha			50.0%	50.0%					100.0%
All classes	21.5%	19.0%	27.8%	8.9%	11.4%	5.1%	2.5%	3.8%	100.0%

<sup>a</sup> Pearsons chi-square = 51.35, d.f. = 35, p = 0.037: 45 cells (93.8%) have expected count less than five.

Profitability reported by respondents varied between respondents and size classes according to the crop types grown with only forty percent of 'tropical fruit' growers reporting a profit in 2006/2007 compared to one hundred percent of pawpaw growers (Table 52). Again, the number of respondents included in the analysis is small relative to the number of cells in Table 52 (including many size class – crop type combinations for which there is no data) so the data should be interpreted with caution. The data for sugar cane growers have the greatest number of data points and could be considered the most reliable.

**Table 52:** Proportion of respondents reporting profit in 2006/2007 by crop type and cropping size classes.

Crop type	Cropping land size classes							All classes average proportion
	N (all classes)	Less than 20 ha	20-49 ha	50-99 ha	100-199 ha	200-499 ha	More than 500 ha	
Sugar cane (%)	82	50	79	73	81	60	50	72
Bananas (%)	5	100	0	0	100	0	0	80
Pawpaw (%)	3	100	100	0	0	0	0	100
Tropical fruits (%)	5	0	0	0	100	0	100	40
Grasses (%)	6	100	100	0	50	100	100	83
Other (%)	19	20	0	0	83	100	0	47

Approximately thirty percent of all respondents with cropping enterprises reported having grazing land on their property. The proportion of respondents reporting grazing land varied from sixty percent to less than fifteen of respondents in the various size classes. The higher proportions of respondents with grazing land and beef cattle occurred in the upper two and the lowest class, with the lowest proportions (i.e. greatest specialisation in cropping activities) in the size classes between 20 ha and 200 ha (Table 53). A similar pattern is evident in the proportion of respondents who reported having native vegetation on their property. Overall only ten percent of respondents with cropping enterprises reported thinning vegetation,

ranging from a high of 36% of respondents in the ‘less than 20 ha’ class to no reported thinning by those in the ‘100-199 ha’ and ‘more than 500 ha’ classes (Table 53).

**Table 53:** Beef and vegetation management characteristics by cropping size classes.

Cropping size class	Have grazing land (%) <sup>a</sup>	Have beef cattle (%) <sup>b</sup>	Have native vegetation (%) <sup>c</sup>	Thinned regrowth of native vegetation (%) <sup>d</sup>
Less than 20 ha	57.1	50.0	64.3	35.7
20 – 49 ha	21.4	18.8	35.7	13.3
50 – 99 ha	13.0	7.1	25.0	6.9
100 – 199 ha	16.0	19.0	40.7	-
200 – 499 ha	42.9	37.5	50.0	13.3
More than 500 ha	57.1	66.7	85.7	-
All classes	28.9	25.7	44.0	10.6

<sup>a</sup> Pearsons chi-square = 14.71, d.f. = 5, p = 0.012: 5 cells (41.7%) have expected count less than five.

<sup>b</sup> Pearsons chi-square = 13.68, d.f. = 5, p = 0.018: 6 cells (50.0%) have expected count less than five.

<sup>c</sup> Pearsons chi-square = 16.69, d.f. = 5, p = 0.005: 5 cells (41.7%) have expected count less than five.

<sup>d</sup> Pearsons chi-square = 11.51, d.f. = 5, p = 0.042: 2 cells (16.7%) have expected count less than five.

**Note:** The proportion of people reporting having beef cattle is greater than the proportion who reported having grazing land for the size classes ‘100-199 ha’ and ‘more than 500 ha’ because of missing values in the variable ‘if have grazing land’.

While no significant differences were identified in the time and money spent on weed management activities between cropping size classes, those landowners in the ‘more than 500 ha’ class spent significantly more money on pest management than respondents in the other classes (Table 54).

**Table 54:** Money spent on pest control by cropping size classes (\$AU/year).

Cropping size class	Money spent on pest control <sup>a</sup>
Less than 20 ha	1733.3
20 – 49 ha	440.0
50 – 99 ha	1062.5
100 – 199 ha	2031.7
200 – 499 ha	1612.5
More than 500 ha	6750.0
All classes	1907.0

<sup>a</sup> ANOVA F value = 7.89, p < 0.000: More than 500 ha > all others (Bonferroni test <0.002).

Few differences were identified between cropping size classes in terms of their scores for scales relating to the topics 'NRM issues on property', 'regional development issues in the region', 'goals for property management', 'property management intentions', 'trust in institutions' and 'usefulness of information sources'. The differences that were identified are presented in Table 55. The average scores for the scale 'viability of agriculture' were positively correlated (i.e. increased in size) with increasing size classes, as were scores for the management intention scale 'expand business'. The scores for the property management goal scales 'build business' and 'keep in family' were highest for the class '200-499 ha'.

**Table 55:** Ratings of importance for various scales relating to regional development issues, management goals and intentions by cropping size classes.

Cropping size class	Regional development issue – viability of agriculture <sup>a</sup>	Goal scale – build business <sup>b</sup>	Goal scale – keep in family <sup>c</sup>	Intention scale – expand business <sup>d</sup>
Less than 20 ha	3.8	3.9	3.5	-0.5
20 – 49 ha	4.1	4.2	3.5	-0.4
50 – 99 ha	4.3	4.6	3.9	-0.7
100 – 199 ha	4.4	4.6	3.8	-0.5
200 – 499 ha	4.4	4.9	4.5	0.2
More than 500 ha	4.5	4.1	3.2	0.4
All classes	4.3	4.5	3.8	-0.4

<sup>a</sup> ANOVA Linear term = 6.23, p = 0.014: Post hoc tests not significant.

<sup>b</sup> ANOVA F value = 3.76, p = 0.004: Post hoc tests not significant.

<sup>c</sup> ANOVA F value = 2.67, p = 0.026: 20 – 49 ha < 200 – 499 ha (Tahmane = 0.035).

<sup>d</sup> ANOVA Linear term = 6.31, p = 0.022: Post hoc tests not significant.

### **Variations in the adoption of recommended cropping practices by cropping size classes**

Testing for differences in the proportion of respondents who had adopted various recommended cropping practices revealed some differences in the adoption of soil testing, the use of lime and gypsum and the use of legumes and retention of stubble (Table 56, Figures 2 and 3).

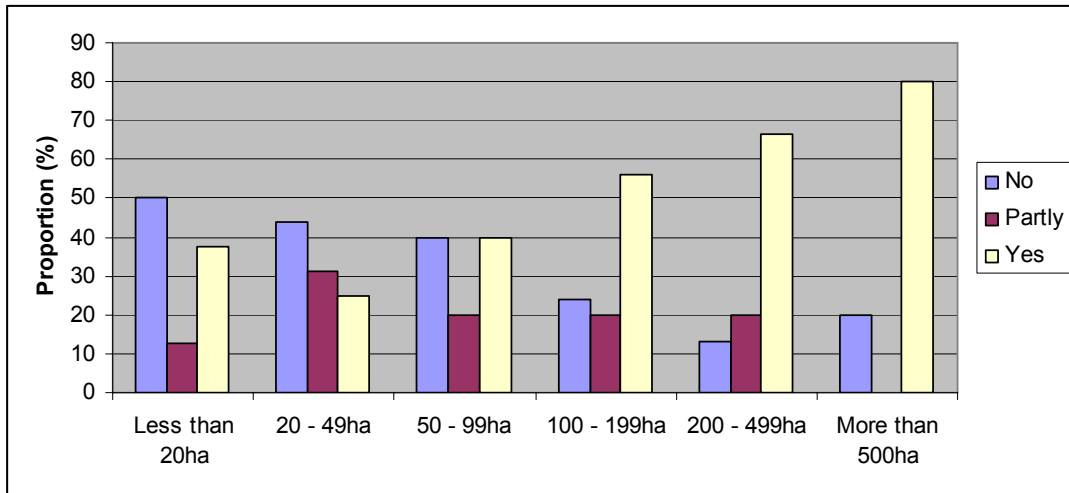
**Table 56:** Whether various practices have been partly or wholly adopted by cropping size classes.

<b>Cropping practice</b>	<b>Less than 20 ha</b>	<b>20-49 ha</b>	<b>50-99 ha</b>	<b>100-199 ha</b>	<b>200-499 ha</b>	<b>More than 500 ha</b>
Soil testing <sup>a</sup>	66.6	93.8	88.0	100.0	100.0	80.0
Legume used <sup>b</sup>	50.0	56.3	60.0	76.0	86.7	80.0
Retain stubble <sup>c</sup>	50.0	86.7	91.7	95.7	92.9	100.0

<sup>a</sup> Pearsons chi-square = 23.13, d.f. = 10, p = 0.010: 11 cells (61.1%) have expected count less than five.

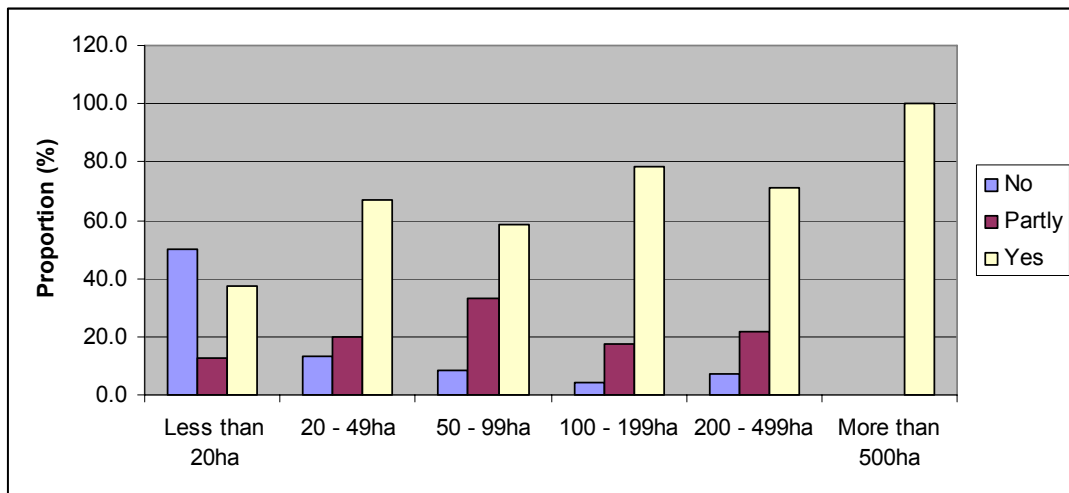
<sup>b</sup> Linear association = 8.03, d.f. = 1, p = 0.005: 9 cells (50.0%) have expected count less than five.

<sup>c</sup> Pearsons chi-square = 17.77, d.f. = 10, p = 0.059: 12 cells (66.7%) have expected count less than five.



**Figure 2:** Proportion of landholders who use legumes by cropping size classes.

In general, adoption rates for these practices are lowest by the smallest size class and increase with increases in the size classes, although the peak rate of adoption for soil testing is in the 100-199 ha and 200-499 ha classes, and use of legumes is highest in the 200-499 ha class.



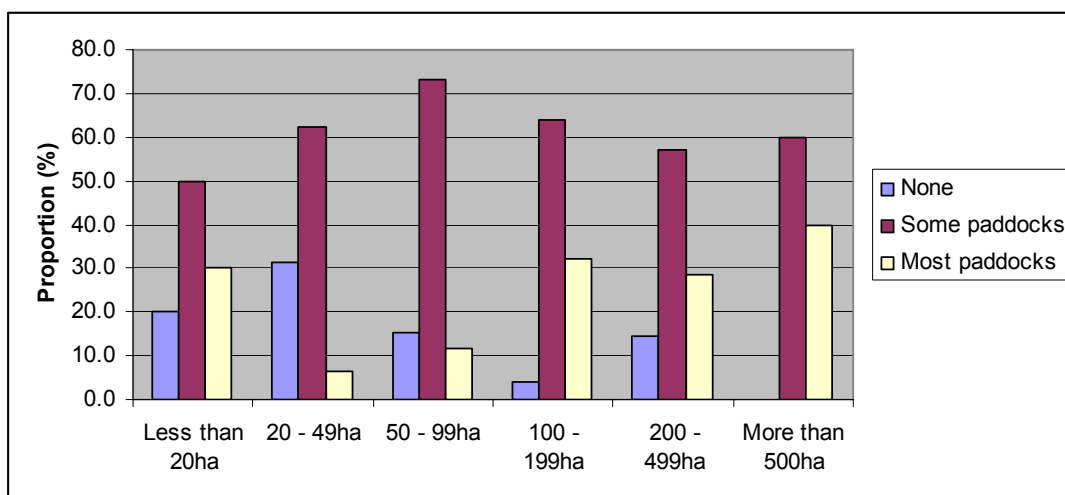
**Figure 3:** Proportion of landholders who retain stubble by cropping size classes.

Approximately 85% of respondents across all size classes with cropping enterprises reported using lime and/or gypsum in 2006 and over the past five years, with significant variation between the various size classes (Tables 57 and 58, Figures 4 and 5). Highest rates of adoption identified were in the larger size classes with the lowest rate in the '20-49 ha' class.

**Table 57:** Whether landholders applied lime and/or gypsum by crop size classes<sup>a</sup>.

Cropping land size classes	Applied lime and/or gypsum in 2006			Total
	None	Some paddocks	Most paddocks	
Less than 20 ha	20.0%	50.0%	30.0%	100.0%
20 – 49 ha	31.3%	62.5%	6.3%	100.0%
50 – 99 ha	15.4%	73.1%	11.5%	100.0%
100 – 199 ha	4.0%	64.0%	32.0%	100.0%
200 – 499 ha	14.3%	57.1%	28.6%	100.0%
More than 500 ha		60.0%	40.0%	100.0%
All classes	14.6%	63.5%	21.9%	100.0%

<sup>a</sup> Linear association = 4.47, d.f. = 1, p = 0.035: 11 cells (61.1%) have expected count less than five.

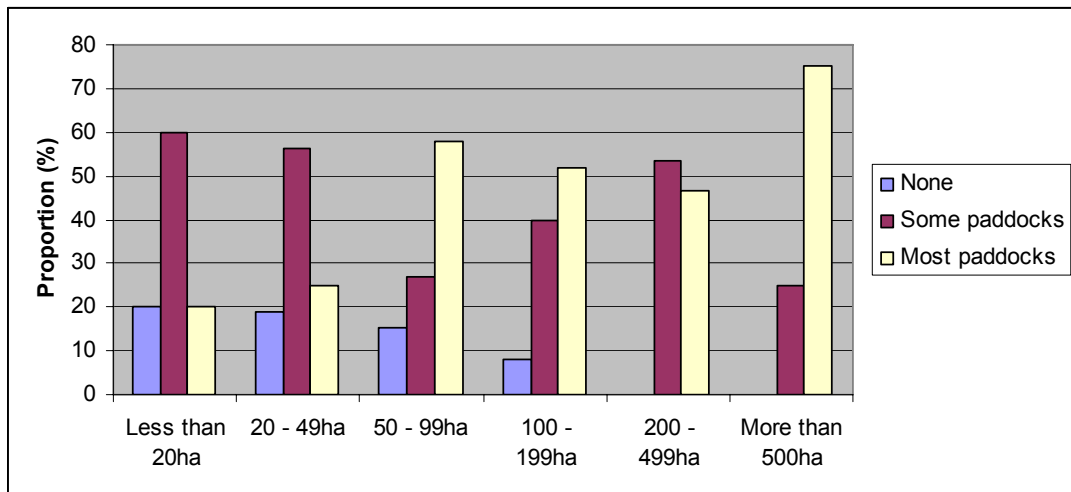


**Figure 4:** Proportion of landholders who applied lime and/or gypsum in 2006 by cropping size classes.

**Table 58:** Whether landholders applied lime and/or gypsum in the previous five years by cropping size classes<sup>a</sup>.

Cropping land size classes	Applied lime and/or gypsum over previous five years			Total
	None	Some paddocks	Most paddocks	
Less than 20 ha	20.0%	60.0%	20.0%	100.0%
20 – 49 ha	18.8%	56.3%	25.0%	100.0%
50 – 99 ha	15.4%	26.9%	57.7%	100.0%
100 – 199 ha	8.0%	40.0%	52.0%	100.0%
200 – 499 ha		53.3%	46.7%	100.0%
More than 500 ha		25.0%	75.0%	100.0%
All classes	11.5%	42.7%	45.8%	100.0%

<sup>a</sup> Chi square Linear association = 6.51, d.f. = 1, p = 0.011: 10 cells (55.6%) have expected count less than five.



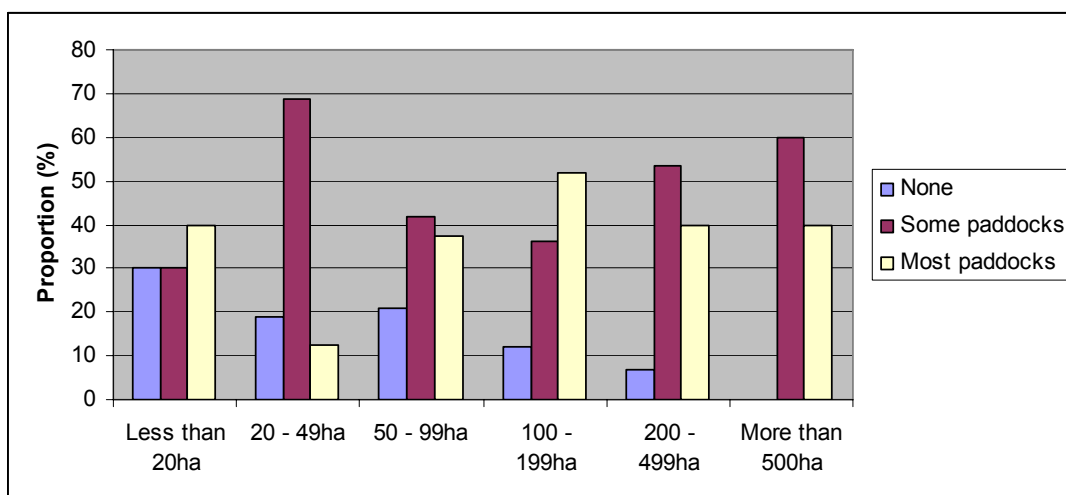
**Figure 5:** Proportion of landholders who applied lime and/or gypsum in the last five years by cropping size classes.

While testing for difference in the rate of adoption of earthworks to control soil movement by various cropping size classes were not significant at the 95% confidence level ( $p = 0.059$ ), there is some evidence of greater adoption of this practice with increasing scale of operations as seventy percent of those in the smallest class had used this practice compared with one hundred percent of those in the largest size class (Table 59, Figure 6).

**Table 59:** Proportion of respondents who have used earthworks for soil conservation and water management by cropping size classes<sup>a</sup>.

Cropping land size classes	None	Some paddocks	Most paddocks	Total
Less than 20 ha (%)	30.0	30.0	40.0	100
20 – 49 ha (%)	18.8	68.8	12.5	100
50 – 99 ha (%)	20.8	41.7	37.5	100
100 – 199 ha (%)	12.0	36.0	52.0	100
200 – 499 ha (%)	6.7	53.3	40.0	100
More than 500 ha (%)	0.0	60.0	40.0	100
All classes (%)	15.8	46.3	37.9	100

<sup>a</sup> Chi square Linear association = 3.57, d.f. = 1,  $p = 0.059$ : 10 cells (55.6%) have expected count less than five.



**Figure 6:** Proportion of landholders who have used earthworks to control soil movement by cropping size classes.

The use of an irrigation schedule and soil moisture monitoring to determine the timing and/or volume of water varies between cropping size classes, although caution is needed in interpretation of the results due to the low number of responses relative to the number of cells in the analyses (79.2% of cells have an expected count of less than five) (Tables 60 and 61). The proportion of respondents using these practices increases in general with the increasing size of the classes. The exceptions to this trend include a relatively high proportion of use of these practices by landholders in the smallest size class (less than 20 ha), and low adoption of these practices by respondents in the 200-499 ha size class.

**Table 60:** Whether landholders use an irrigation schedule to determine the timing / volume of water by cropping size classes<sup>a</sup>.

Cropping land size classes	Used an irrigation schedule to determine the timing/volume of water				Total
	None	Some paddocks	Most paddocks	All paddocks	
Less than 20 ha	66.7%	11.1%	22.2%		100.0%
20 – 49 ha	90.0%	10.0%			100.0%
50 – 99 ha	100.0%				100.0%
100 – 199 ha	66.7%	16.7%		16.7%	100.0%
200 – 499 ha	90.9%	9.1%			100.0%
More than 500 ha	25.0%		50.0%	25.0%	100.0%
All classes	79.3%	8.6%	6.9%	5.2%	100.0%

<sup>a</sup> Pearsons chi-square = 30.48, d.f. = 15, p = 0.010: 15 cells (79.2%) have expected count less than five.

**Table 61:** Whether landholders monitor soil moisture to schedule irrigation by cropping size classes<sup>a</sup>.

Cropping land size classes	Monitor soil moisture to schedule irrigation				Total
	None	Some paddocks	Most paddocks	All paddocks	
Less than 20 ha	77.8%	11.1%	11.1%		100.0%
20 – 49 ha	100.0%				100.0%
50 – 99 ha	84.6%		7.7%	7.7%	100.0%
100 – 199 ha	75.0%			25.0%	100.0%
200 – 499 ha	100.0%				100.0%
More than 500 ha	25.0%	25.0%	25.0%	25.0%	100.0%
All classes	83.1%	3.4%	5.1%	8.5%	100.0%

<sup>a</sup> Pearsons chi-square = 24.45, d.f. = 15, p = 0.058: 15 cells (79.2%) have expected count less than five.

## Comparison of grazing operations by size classes

Differences were identified between grazing size classes in terms of the level of dependence on the property for income and enterprise profitability (Table 62). The proportion of respondents with off-farm income ranged from 95% of those in the '20-49 ha' class to 45% of those in the '100-199 ha' size class. The proportion of respondents reporting their enterprises were profitable in 2006/2007 increased with increasing area of the classes, the exception being the relatively low proportion of those making a profit in the 'more than 500 ha' class.

The proportion of respondents who have participated in short courses was lowest in the smallest area class and highest in the largest area class with the middle classes ranging between 30-45% (Table 62). Participation in government NRM programs was more varied across classes, ranging from fifty percent of those in the largest area class to six percent in the 20-49 ha' class.

**Table 62:** Proportion of landholders who have participated in various activities and profitability by grazing size classes.

Activity	Less than 20 ha	20-49 ha	50-99 ha	100-199 ha	200-499 ha	More than 500 ha
If have off-farm income <sup>a</sup>	83.0	94.7	75.0	44.4	55.6	62.5
If participated in a short course <sup>b</sup>	18.8	31.6	40.0	38.9	44.4	66.7
If participated in government NRM program in last five years <sup>c</sup>	15.2	5.6	25.0	17.6	25.0	50.0
If profit made 2006/2007 <sup>d</sup>	8.7	31.6	47.6	55.6	100.0	37.5

<sup>a</sup> Pearsons chi-square = 16.69, d.f. = 5, p = 0.005: 4 cells (33%) have expected count less than five.

<sup>b</sup> Linear association = 9.37, d.f. = 1, p = 0.002: 2 cells (16.7%) have expected count less than five.

<sup>c</sup> Linear association = 8.28, d.f. = 5, p = 0.040: 5 cells (41.7%) have expected count less than five.

<sup>d</sup> Pearsons chi-square = 35.77, d.f. = 5, p < 0.000: 2 cells (16.7%) have expected count less than five.

The amount of money spent on pest control was found to differ between the various grazing size classes, though post-hoc tests for differences between individual classes were inconclusive (Table 63). The average hours per week spent working on the property, number of full-time employees (FTEs) and proportion of income derived from the property are all positively related to increasing grazing area size classes up to the 200- 499 ha class.

**Table 63:** Spending on pest control, income and work effort characteristics differentiating grazing size classes.

Grazing size class	Money spent on pest control <sup>a</sup>	Average per week (hrs) <sup>b</sup>	FTEs employed on-farm in past year <sup>c</sup>	Proportion of total income from farm <sup>d</sup>
Less than 20 ha	708.03	23.4	0.9	10.7
20 – 49 ha	2,577.27	31.3	1.1	35.6
50 – 99 ha	5,017.19	45.9	2.0	43.1
100 – 199 ha	7,762.50	50.6	2.1	56.1
200 – 499 ha	10,038.33	62.8	2.6	86.5
More than 500 ha	6,400.00	61.6	12.4	61.0
All classes	3,960.83	38.7	2.3	32.5

<sup>a</sup> ANOVA F value = 2.43, p = 0.043: Post hoc tests not significant.

<sup>b</sup> ANOVA F value = 10.53, p < 0.000: 50-99 ha, 100-199 ha, 200-499 ha, More than 500 ha > Less than 20 ha; 200-499 ha, More than 500 ha > 20-49 ha.

<sup>c</sup> ANOVA F value = 5.08, p < 0.000: 200-499 ha > Less than 20 ha.

<sup>d</sup> ANOVA F value = 9.60, p < 0.000: 50-99 ha, 200-499 ha > Less than 20 ha (Tahmane test < 0.014); 200-499 ha > 20-49 ha (Tahmane = 0.011); 200-499 ha > 50-99 ha (Tahmane = 0.017).

There were significant differences in the time that people have lived in their local district and on their current property between landholders in the various grazing area classes. Landholders in the smallest class ('less than 20 ha') had lived in their district and property less time than landholders in the '50-99 ha' class (Table 64). On average properties in the grazing area size class '50-99 ha' support more people than properties in the smallest size class.

**Table 64:** Time lived in local district and on current property and number of people living on and supported by property grazing size classes.

Grazing size class	Time lived in local district (yrs) <sup>a</sup>	Time lived on current property (yrs) <sup>b</sup>	Number of people that live on property <sup>c</sup>	Number of people supported by property <sup>d</sup>
Less than 20 ha	22.3	14.0	2.6	1.1
20 – 49 ha	31.0	20.5	2.1	1.5
50 – 99 ha	41.9	34.2	3.5	3.3
100 – 199 ha	32.7	22.7	4.0	4.8
200 – 499 ha	37.0	24.8	5.2	4.4
More than 500 ha	36.8	27.5	5.6	12.6
All classes	30.4	21.3	3.3	3.1

<sup>a</sup> ANOVA F value = 2.76, p = 0.022: 50-99ha > Less than 20 ha (Bonferroni test = 0.016).

<sup>b</sup> ANOVA F value = 3.84, p = 0.003: 50-99ha > Less than 20 ha (Bonferroni test = 0.001).

<sup>c</sup> ANOVA F value = 2.69, p = 0.025: Post hoc tests not significant.

<sup>d</sup> ANOVA F value = 7.54, p < 0.000: 50-99ha > Less than 20 ha (Tamhane test = 0.033).

### ***Differences in property management goals, intentions and vegetation management attitudes by grazing area size classes***

Landholders in various grazing area size classes varied in the importance they attach to rural development issues in their region and their goals for property management. In general, those in the smallest size class were less concerned about factors affecting the 'viability of agriculture' than those in the mid-range size classes (Table 65). Landholders with properties in the smallest size class were less likely to be aiming to 'build their business' or 'expand their business' than landholders with properties in the other size classes (Table 65).

**Table 65:** Ratings of importance for various scales relating to regional development issues, management goals and intentions by grazing size classes.

<b>Grazing size class</b>	<b>Regional development issue – viability of agriculture<sup>a</sup></b>	<b>Goal scale - build business<sup>b</sup></b>	<b>Intention scale – expand business<sup>c</sup></b>	<b>Intention scale – scale back<sup>d</sup></b>
Less than 20 ha	2.9	3.9	-0.8	-1.0
20 – 49 ha	3.9	4.2	-0.6	-0.5
50 – 99 ha	4.2	4.6	-0.3	-0.4
100 – 199 ha	4.2	4.6	-0.3	-1.1
200 – 499 ha	4.1	4.9	-0.3	-1.4
More than 500 ha	3.6	4.1	0.5	-1.3
All classes	3.6	4.5	-0.5	-0.9

<sup>a</sup> ANOVA F value = 8.11,  $p < 0.000$ : 20-49 ha, 50-99 ha, 100-199 ha, 200-499 ha > Less than 20 ha (Tahmane test < 0.014).

<sup>b</sup> ANOVA F value = 9.82,  $p < 0.000$ : 20-49 ha, 50-99 ha, 100-199 ha, 200-499 ha > Less than 20 ha (Tahmane test < 0.007).

<sup>c</sup> ANOVA F value = 2.47,  $p = 0.037$ : More than 500 ha > Less than 20 ha (Bonferroni = 0.035).

<sup>d</sup> ANOVA Linear term = 2.40,  $p = 0.041$ : Post hoc tests not significant.

Landholders in the '50-99 ha' grazing area size class with properties which have native vegetation areas varied in terms of their attitudes to vegetation management issues relative to those in the smallest size class (Table 66). Those in the '50-99 ha' class were more concerned about the issues caused by 'management difficulties' and are more likely to prefer to clear their forest areas than those in the smallest area size class.

**Table 66:** Perception of vegetation management issues by grazing size classes.

Grazing size class	Vegetation scale – prefer to clear forest <sup>a</sup>	Vegetation scale – management difficulties <sup>b</sup>
Less than 20 ha	-0.5	0.4
20 – 49 ha	-0.5	0.7
50 – 99 ha	0.4	1.1
100 – 199 ha	-0.1	0.6
200 – 499 ha	0.4	0.3
More than 500 ha	0.1	0.3
All classes	-0.2	0.5

<sup>a</sup> ANOVA F value = 2.84, p = 0.021: 50 – 99 ha > Less than 20 ha (Bonferroni test = 0.045).

<sup>b</sup> ANOVA F value = 2.48, p = 0.039: 50 – 99 ha > Less than 20 ha (Bonferroni test = 0.029).

<sup>c</sup> ANOVA F value = 2.90, p = 0.018: Post hoc tests not significant.

There were differences in the perceived usefulness of various information sources for aiding management decisions between landholders with properties in the various size area classes (Table 67, Figure 7). Those in the smallest size class gave lower ratings of ‘usefulness’ for ‘enterprise information’ and lower ratings for the scale ‘finance and family’ relative to those in some of the larger size classes. Those landholders in the ‘more than 500 ha’ class gave higher ratings of importance for the scale ‘media sources’ relative to those in the 50-99 ha class.

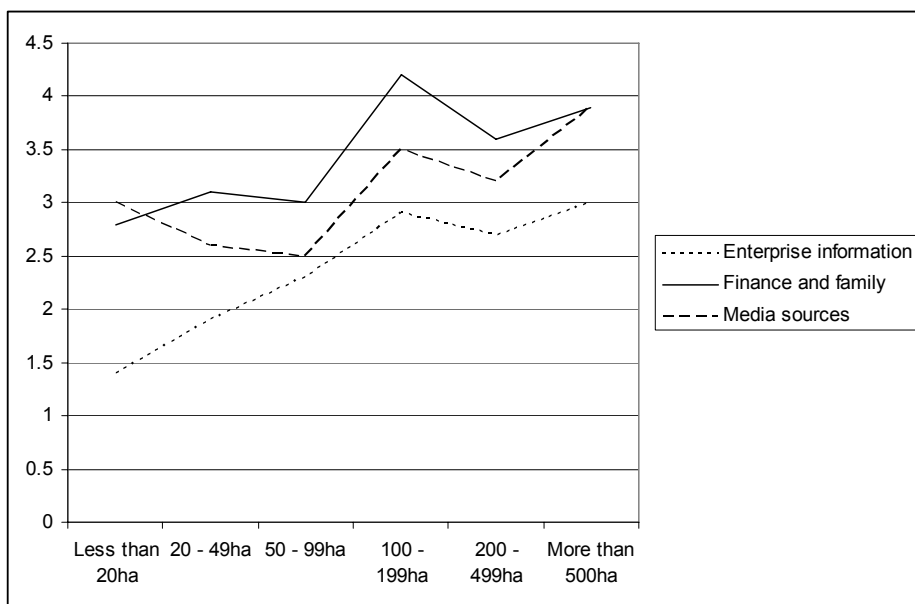
**Table 67:** Usefulness of information sources by grazing size classes.

Grazing size class	Information scale – enterprise information <sup>a</sup>	Information scale – finance and family <sup>b</sup>	Information scale – media sources <sup>c</sup>
Less than 20 ha	1.4	2.8	3.0
20 – 49 ha	1.9	3.1	2.6
50 – 99 ha	2.3	3.0	2.5
100 – 199 ha	2.9	4.2	3.5
200 – 499 ha	2.7	3.6	3.2
More than 500 ha	3.0	3.9	3.9
All classes	2.1	3.2	3.0

<sup>a</sup> ANOVA F value = 4.86, p < 0.000: More than 500 ha, 100-199 ha > Less than 20 ha (Bonferroni < 0.024).

<sup>b</sup> ANOVA F value = 4.89, p < 0.000: 100-199 ha > Less than 20 ha (Bonferroni < 0.000), 100-199 ha > 50-99 ha (Bonferroni < 0.031).

<sup>c</sup> ANOVA F value = 3.19, p = 0.010: More than 500 ha > 50-99 ha (Bonferroni = 0.041).



**Figure 7:** Mean rating of usefulness for various information sources by grazing area size classes.

***Differences in property planning and the adoption of currently recommended management activities between those in the various grazing area size classes***

The proportion of landholders who have prepared property plans varies between grazing area size classes, with the lowest rates of preparation in the smallest size class (Table 68).

**Table 68:** Whether landholders have developed a property management plan by grazing area classes<sup>a</sup>.

Grazing area classes	Have you prepared a written property plan or a business plan			Total
	No	In progress	Yes	
Less than 20 ha	87.0%	6.5%	6.5%	100.0%
20 – 49 ha	68.4%	5.3%	26.3%	100.0%
50 – 99 ha	45.0%	20.0%	35.0%	100.0%
100 – 199 ha	55.6%	16.7%	27.8%	100.0%
200 – 499 ha	55.6%	11.1%	33.3%	100.0%
More than 500 ha	44.4%	22.2%	33.3%	100.0%
All classes	66.9%	11.6%	21.5%	100.0%

<sup>a</sup> Pearsons chi-square = 17.79, d.f. = 10, p = 0.059: 10 cells (55.6%) have expected count less than five.

The use of improved pasture varies significantly between landholders in various grazing area size classes. The highest rates of adoption by landholders are in the '100-199 ha' and 200-499 ha' classes, with the lowest rate of adoption in the smallest size class (Table 69).

**Table 69:** Whether landholders used improved pasture by grazing size classes<sup>a</sup>.

Grazing area classes	If landholders used improved pasture			Total
	No	Partly	Yes	
Less than 20 ha	50.0%	11.1%	38.9%	100.0%
20 – 49 ha	12.5%	43.8%	43.8%	100.0%
50 – 99 ha	5.3%	26.3%	68.4%	100.0%
100 – 199 ha	5.6%		94.4%	100.0%
200 – 499 ha	11.1%		88.9%	100.0%
More than 500 ha	12.5%	25.0%	62.5%	100.0%
All classes	22.6%	17.0%	60.4%	100.0%

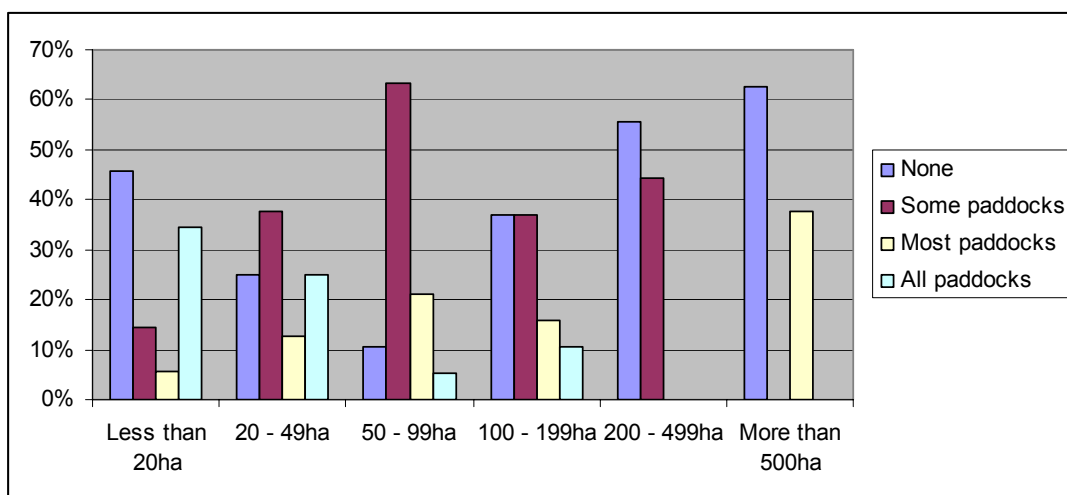
<sup>a</sup> Pearsons chi-square = 40.09, d.f. = 10, p < 0.000: 11 cells (61.1%) have expected count less than five.

The use of fencing to control stock access to waterways varies between landholdings in the various grazing area size classes (Table 70, Figure 8). The highest rates of adoption of this practice are by landholders in the '20-49 ha' and '50-99 ha' classes, with the lowest rates occurring in the two largest and smallest size class.

**Table 70:** Use of fencing along waterways to control stock access by grazing area size classes<sup>a</sup>.

Grazing area classes	Fenced waterways to control stock access				Total
	None	Some paddocks	Most paddocks	All paddocks	
Less than 20 ha	45.7%	14.3%	5.7%	34.3%	100.0%
20 – 49 ha	25.0%	37.5%	12.5%	25.0%	100.0%
50 – 99 ha	10.5%	63.2%	21.1%	5.3%	100.0%
100 – 199 ha	36.8%	36.8%	15.8%	10.5%	100.0%
200 – 499 ha	55.6%	44.4%			100.0%
More than 500 ha	62.5%		37.5%		100.0%
All classes	36.8%	32.1%	13.2%	17.9%	100.0%

<sup>a</sup> Pearsons chi-square = 37.92, d.f. = 15, p = 0.001: 15 cells (62.5%) have expected count less than five.



**Figure 8:** Fencing of waterways to control stock by grazing area size classes.

Use of controlled grazing to maintain surface cover varies between landholdings in the various grazing area size classes, with the lowest use in the 'less than 20 ha' class and highest use in the '20-49 ha' class (Table 71).

**Table 71:** Whether landholders used controlled grazing by grazing size classes<sup>a</sup>.

Grazing area classes	If landholders used controlled grazing (e.g. rotational, management of pasture residuals, etc.) to maintain surface cover in stocked paddocks				Total
	None	Some paddocks	Most paddocks	All paddocks	
Less than 20 ha	33.3%	16.7%	16.7%	33.3%	100.0%
20 – 49 ha	6.3%	12.5%	12.5%	68.8%	100.0%
50 – 99 ha	15.0%		25.0%	60.0%	100.0%
100 – 199 ha	10.5%	5.3%	15.8%	68.4%	100.0%
200 – 499 ha	11.1%	11.1%	22.2%	55.6%	100.0%
More than 500 ha	12.5%	50.0%		37.5%	100.0%
All classes	18.5%	13.0%	16.7%	51.9%	100.0%

<sup>a</sup> Pearsons chi-square = 26.49, d.f. = 15, p = 0.033: 18 cells (75.0%) have expected count less than five.

The use of soil testing to determine fertiliser requirements varies between landholdings in the various grazing area size classes, with the lowest rate of adoption again in the smallest size class, and the highest rate in the '100-199 ha' class (who also have the highest rate of adoption of improved pastures) (Table 72).

**Table 72:** Whether landholders used soil tests to determine fertiliser requirements by grazing size classes<sup>a</sup>.

Grazing area classes	If landholders used soil testing to determine fertiliser requirements				Total
	None	Some paddocks	Most paddocks	All paddocks	
Less than 20 ha	65.7%	22.9%		11.4%	100.0%
20 – 49 ha	37.5%	18.8%	18.8%	25.0%	100.0%
50 – 99 ha	31.6%	21.1%	15.8%	31.6%	100.0%
100 – 199 ha	10.5%	26.3%	21.1%	42.1%	100.0%
200 – 499 ha	33.3%	22.2%	33.3%	11.1%	100.0%
More than 500 ha	28.6%	28.6%	28.6%	14.3%	100.0%
All classes	40.0%	22.9%	14.3%	22.9%	100.0%

<sup>a</sup> Pearsons chi-square = 26.61, d.f. = 15, p = 0.032: 17 cells (70.8%) have expected count less than five.

The use of fire as a management practice varies between landholdings in the various grazing area size classes. Highest rates of use of this practice are in the larger property size classes which may be related partly to the location of these properties in the drier, western parts of the region (Table 73).

**Table 73:** Whether landholders use fire as a management practice by grazing size classes<sup>a</sup>.

Grazing area classes	If landholders use fire as a management practice				Total
	None	Some paddocks	Most paddocks	All paddocks	
Less than 20 ha	77.1%	20.0%		2.9%	100.0%
20 – 49 ha	75.0%	12.5%		12.5%	100.0%
50 – 99 ha	85.0%			15.0%	100.0%
100 – 199 ha	57.9%	21.1%	15.8%	5.3%	100.0%
200 – 499 ha	33.3%	55.6%		11.1%	100.0%
More than 500 ha	25.0%	25.0%	50.0%		100.0%
All classes	67.3%	18.7%	6.5%	7.5%	100.0%

<sup>a</sup> Pearsons chi-square = 51.11, d.f. = 15, p < 0.000: 17 cells (70.8%) have expected count less than five.

### **Summary of differences in attitudes, values and behaviour of landholders with different reasons for property management and property sizes**

A comparison of the characteristics and attitudes of landholders with different reasons for property management, land use types and various scales of operation of agriculture revealed a variety of differences between them. The main differences in socioeconomic characteristics, attitudes to management issues and adoption of recommended practices were identified between those with smallest property sizes and those with medium to large properties. The clearest differences were between landholders whose primary reason for property ownership is for residential or 'hobby farm' purposes and those with agricultural enterprises on their land. Some of these variations in socioeconomic characteristics were expected, including the increasing reliance on the property enterprise for income, and longer hours worked on-property by those with agricultural enterprises and those with larger property areas. The longer time of residence in the local district and on the current property of those on larger properties associated with commercial agriculture enterprises was also expected given the practice of inter-generational transfer of properties and findings of previous research on similar topics reviewed for this project<sup>2</sup>.

Differences in attitudes to NRM issues, the use of information, trust of institutions and property management goals and intentions were identified between landholders who have varying purposes for property ownership and between landholders with different scales of operation. Landholders who are involved in commercial agriculture, most of whom are on larger properties, are more concerned than other landholder groups about soil health and pests and weed management issues on their own properties. Compared to all or some of the other types of landholders, these 'agricultural' landholders are also:

- More concerned about the viability of agricultural enterprises and the lack of employment and services in the region;
- More likely to be considering expanding their business and keeping the landholding in the family;
- Found all types of sources of information to be more useful; and
- Are more trusting in institutions linked to 'enterprises' (including, for example, agribusiness agents and industry associations).

There is evidence of similar differences in attitudes to those described above (between agriculture and non-agriculture landholders) between those with small holdings (i.e. less than 20 ha) and those with larger holdings within the grazing and cropping industries.

There is some evidence that those involved in cropping enterprises have greater involvement than those specialising in grazing enterprises in attending short courses on property management and applying at least some elements of environmental management systems on their property. Apart from lower involvement of those in the smallest (i.e. less than 20 ha) size class compared to the larger size classes, there is little difference in these activities between the size classes within the grazing industry, while participation in these activities increases with growing area of land used for cropping industries. Within the cropping industry there is a general pattern of increasing levels of adoption for a number of recommended practices as the area of cropping activities increases. Variations in the adoption of recommended practices by landholders in the grazing industry are more complex. The lowest rates of adoption of these practices within the grazing industry are, as for cropping industries,

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<sup>2</sup> For reviews of these studies see Cary *et al.* 2001, 2002; Stanley *et al.* 2005; Emtage *et al.* 2001, 2006; and Meadows and Emtage In prep.

also in smallest size properties, but the highest rates of adoption are concentrated in the size classes between 20 and 200 ha range.

## **Comparison of findings with previous research**

Previous applications of factor analysis to some of the above topics in Australia include studies of vegetation management attitudes and values reported by Emtage (1995), Specht and Emtage (1998), Emtage *et al.* (2001), Herbohn *et al.* (2005) and Jennings and van Putten (2006). Factor analysis has been applied to measures of landholders' management goals and objectives by Gasson (1973), Kerridge (1978), Cary and Holmes (1982) Frost (2000), Maybery *et al.* (2005). More recently Greiner *et al.* (2007) used factor analysis to assess landholders' motivations for property management, perception of impediments to the adoption of 'best management practices' (BMPs) and perception of the effectiveness of various incentives to adopt BMPs. Curtis *et al.* (2001) have also examined the values that landholders ascribed to the riverfront areas of their property in the Goulburn Broken Catchment.

Frost (2000: 513) summarised the value orientations described by Gasson, which included:

- “(i) **Instrumental values** (where farming is viewed as a means to obtaining income and security): making maximum income, making a satisfactory income, ensuring future income, expanding the business.
- (ii) **Expressive values** (farming is seen as a means of self-expression or personal fulfilment): feeling pride of ownership, gaining self-respect for doing a worthwhile job, meeting a challenge, achieving an objective.
- (iii) **Intrinsic values** (farming is valued as an activity in its own right): enjoyment of work tasks, preference for a healthy farming life, purposeful activity – value in hard work, independence, freedom from supervision.
- (iv) **Social values** (farming for the sake of interpersonal relationships in work): gaining recognition and prestige, belonging to the farming community, continuing the family tradition.”

The three factors identified in the principal component analysis of respondents' priorities for land management (land management goals) are similar to those identified by Curtis *et al.* (2001), Maybery *et al.* (2005) and Greiner *et al.* (2007) in their separate studies of farmer motivations for land management and the values they attach to their property. These factors were labeled as 'economic', 'conservation' and 'lifestyle' by Maybery *et al.* (2005) and 'economic', 'environmental' and 'social' by Curtis *et al.* (2001). There appears to be some consistency between the classification of values presented by Gasson (1973) and Frost (2000), those developed by Curtis *et al.* (2001), Maybery *et al.* (2005) and Greiner *et al.* (2007), and the factors identified in the present study. The first factor identified in this topic for this study ('build business') is consistent with the 'instrumental values' described by Gasson (1973); the second factor ('improve environment') includes items that are part of the 'expressive' and 'intrinsic' values as defined by Gasson (1973); and the third factor ('keep in family') is consistent with the 'social values' described by Gasson (1973). It is difficult to compare the results of the factor analyses undertaken for this project on topics other than landholders' management goals as there are no similar studies available in the literature.

### **Comparison with previous landholder NRM surveys**

The conclusion from the presented analyses is that the main differences between the groups assessed are attributable to differences between the landholders with the smallest properties and those with medium to large properties. A similar pattern of differences was found by Byron *et al.* (2006a) in their assessment of the variations in attitudes and practices between farmers and non-farmers in the Burnett-Mary region. For example, Byron and others also reported that farmers used all information sources (apart from friends and relatives) more often than non-farmers, had higher adoption of all currently recommended practices (except tree and shrub establishment and the fencing of vegetation areas to exclude stock), higher involvement in short courses and so on.

One difference between groups in the present study that was not predicted by previous research is the high priority given to the property management goal '[to] improve the environment' by agricultural landholders. Previous studies have reported that small-scale landholders with hobby farms or residential landholdings are more inclined to be interested in managing their landholding for 'environmental' objectives or benefits (Emtage *et al.* 2001; Emtage *et al.* 2006). In the current study, the 'agricultural' landholders had the equal highest average rating of importance (together with 'conservation' landholders) for the scale '[to] improve the environment' in the topic 'priorities for property management'. This scale included nine items including the item '[to] provide habitat for native animals'. Closer examination of response variations to items within the scale reveal that landholders who reported 'conservation' as their primary purpose for property ownership rated the items 'the provision of habitat for native animals' and '[to] improve the environmental health of the region' significantly higher as a management goal than other landholders. This had no significant difference in the priority rating attached to these goals between other groups of landholders used for analyses reported in this paper.

Byron *et al.* 2006 reported that landholders who are farmers were not as concerned about issues of loss of vegetation cover and declining vegetation health as were non-farmers. Analysis of the current survey revealed that those involved with agricultural activities were more likely to agree with statements that they would prefer to clear areas of vegetation than other landholders. This finding supports the conclusions by a number of previous studies that rural landholders involved in agriculture display a high stewardship ethic, although they have some concerns in regard to vegetation management (Stanley *et al.* 2005; Byron *et al.* 2006a).

### **Landholders' understanding of environmental issues and trust in government agencies**

Previous studies have identified a high degree of cynicism regarding government involvement in NRM, due partly to the governments' failure to acknowledge and value landholders' land management experience (Stanley *et al.* 2005). The result is that landholders' appear to lack trust and confidence in government appraisals of the causes and extent of 'environmental problems'. These issues were raised by respondents on a number of occasions in discussions with the community about the topics included in the survey.

Responses to the landholder survey in the Wet Tropics confirm that landholders do not perceive environmental degradation to be an important issue on their properties or in their district (Emtage and Reghenzani 2008). The most important on-property NRM issue was seen to be weeds, which scored an average of three out of five (with a score of one relating to 'not important' ranging to a score of five for 'very important'). None of the other on-property NRM issues were rated by landholders at more than 2.5 out of five on average. The lack of importance ascribed to NRM issues relative to other issues in the region by landholders is further illustrated by the fact that of the five items relating to NRM issues included in the topic

'issues affecting the region', all except 'control of weeds and pests' (which was rated as the fifth most important on average) were the lowest rated of all the issues included.

The finding that many landholders in the Wet Tropics region do not perceive the health of the natural environment to be under threat (Emtage and Reghenzani 2008) is an attitude that is common to other parts of rural Queensland. As described by Stanley *et al.* (2005: 28), "The work undertaken by Greiner *et al.* (2003), Lockie and Rockloff (2004), Byron *et al.* (2004) and Byron *et al.* (2006) in natural resource management regions in Queensland demonstrate that '... there is still much work to be done to convince land managers of the importance and value of changing management practices'." They further argue that while a positive attitude to environmental management is important, landholders will only act if they believe something is an important issue.

### **Comparison to previous profiling studies**

Emtage *et al.* 2006 reported that common differences between landholder types in previous studies include:

- Economic characteristics of the landholding, such as size and productivity and the degree of dependence of the landholder on the property for income;
- Social characteristics, such as the history of family ownership of a landholding and the family size, structure and time in life-cycle;
- Personal characteristics, such as the level of formal education; and
- Attitudes to land management issues, such as the legitimate role of governments and the relative importance of biodiversity conservation.

Given that the classifying criteria applied to determine group membership for the current paper was directly related to the scale of operation of the landholding, it is to be expected that the groups assessed would differ in terms of the economic characteristics listed above such as their reliance on the property for income. There were differences between the groups in terms of the length of time that groups members had lived in their present district, on a rural property and on their current property, with those on larger properties having lived in their local district, on rural properties and on their current property for longer time periods than those on smaller properties. The nature of these differences are expected in that they are consistent with previous research, as are the findings from the current research that those on smaller properties not involved in agricultural production have higher levels of formal education than those on larger, agriculturally orientated properties. Differences in property management goals and intentions were identified between groups used in the present analysis. These differences are expected in that those with larger properties orientated toward agricultural production could be expected to be more interested in expanding their operations relative to residential landholders.

Overall the differences between the groups assessed in the current study are similar to many of the aspects of difference between landholder types identified in previous research on similar topics. As such, the profiles of the groups presented in this report display characteristics of 'predictive validity' (i.e. compatibility with the findings of previous research) that is one way of determining the 'value' or 'worth' of a typology (Hair *et al.* 2006). The other aspect of whether a typology is of value relates to its practical utility (Hair *et al.* 2006). The question raised in regards to this aspect at the beginning of the report was 'do the series of profiles improve our capacity to design and deliver effective NRM policies and programs?' The answer to this question is that the analyses undertaken for this report appear to improve our understanding of some of the key differences in the values, attitudes, behaviour and capacities of landholders who are and are not involved in agriculture, as well as differences between various scales of agricultural operators. The greatest differences between the

groups appraised for this report appear to lie between those with properties of less than 20 ha in area and those with larger sized properties. While the differences between the groups are similar to those found in previous research, the overall character of the various groups does not appear to closely match the landholder types described by Emtage *et al.* (2006).

Thus while the present report offers insight into the patterns of variation between landholders, further analyses are needed to explore and interpret the data. In the next series of analyses, various alternative approaches to defining, assessing and describing landholder groups will be explored. The analyses will attempt to use multiple criteria to define and describe landholder groups to develop a typology. These analyses will be guided by the patterns of landholder types identified by Emtage *et al.* (2006); livelihood theories (Ellis 2000); the theory of planned behaviour (Ajzen 1991) and the use of theories developed for social marketing (Kolter and Zaltman 1971; Kolter and Lee 2002).

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## Appendix 1

**Table A1:** Average hours worked on-property per week (hours).

Primary purpose of land ownership	N	Mean (hours)
Residential only	36	11.3
Grazing	49	47.3
Cropping	92	43.9
Grazing and cropping	27	49.7
Other*	62	19.3
<b>Total</b>	<b>266</b>	<b>35.0</b>

\* Includes primary purpose categories 'hobby/lifestyle farms', 'conservation' and others.

One-way ANOVA (F = 30.0, sig. < 0.000)

*Residential* < all categories except 'other' (Tahmane test <0.000)

*Other* < all categories except residential (Tahmane test <0.000)

**Table A2:** Time lived on rural properties (years).

Primary purpose of land ownership	N	Mean (years)
Agriculture	179	37.2
Conservation	22	19.0
Hobby/lifestyle farm	41	22.6
Residential	48	17.5
Other	6	16.8
<b>Total</b>	<b>296</b>	<b>30.2</b>

One-way ANOVA (F = 14.9, sig. < 0.010)

*Agriculture* > all categories except 'other' (Tamhane test <0.004)

**Table A3:** Time lived on rural properties (years).

Land use recorded	N	Mean (years)
Residential only	47	17.2
Grazing	54	31.6
Cropping	89	39.4
Grazing and cropping	26	45.2
Other	75	20.3
<b>Total</b>	<b>291</b>	<b>30.0</b>

One-way ANOVA (F = 19.8, sig. < 0.000)

*Residential* < all categories except 'other' (Tahmane test < 0.020)

*Other* < all categories except residential (Tahmane test < 0.014)

*Grazing and cropping* > all categories except cropping (Tahmane test < 0.022)

**Table A4:** Time lived in local district (years).

Primary purpose of land ownership	N	Mean (years)
Agriculture	176	40.8
Conservation	22	18.1
Hobby/lifestyle farm	41	24.1
Residential	47	18.7
Other	7	21.4
<b>Total</b>	<b>293</b>	<b>32.7</b>

One-way ANOVA (F = 17.3, sig. < 0.000)

*Agriculture* > all categories except 'other' (Bonferroni test < 0.000)

**Table A5:** Time lived in local district (years).

Land use recorded	N	Mean (years)
Residential only	46	18.5
Grazing	52	32.7
Cropping	89	44.2
Grazing and cropping	26	45.3
Other	75	22.4
<b>Total</b>	<b>288</b>	<b>32.4</b>

One-way ANOVA (F = 20.0, sig. < 0.000)

*Residential* < all categories except 'other' (Tahmane test < 0.012)

*Cropping* > all categories except 'grazing and cropping' (Tahmane < 0.037)

*Grazing and cropping* > residential and 'other' (Tahmane < 0.000)

**Table A6:** Time lived on current property (years).

Primary purpose of land ownership	N	Mean (years)
Agriculture	176	29.5
Conservation	21	13.0
Hobby/lifestyle farm	42	14.0
Residential	48	11.8
Other	5	3.4
<b>Total</b>	<b>292</b>	<b>22.7</b>

One-way ANOVA (F = 17.0, sig. < 0.000)

*Agriculture* > all other categories (Tamhane test < 0.000)

**Table A7:** Time lived on current property (years).

Land use recorded	N	Mean (years)
Residential only	47	12.0
Grazing	53	23.4
Cropping	88	31.4
Grazing and cropping	26	34.3
Other	73	12.7
<b>Total</b>	<b>287</b>	<b>22.3</b>

One-way ANOVA (F = 19.7, sig. < 0.000)

*Residential* < all categories except 'other' (Tahmane test < 0.007)

*Grazing, cropping and grazing and cropping* > *residential and other* (Tahmane test < 0.009)

**Table A8:** Number of people who reside on the property.

Primary purpose of land ownership	N	Mean (people)
Agriculture	177	3.7
Conservation	22	2.2
Hobby/lifestyle farm	42	2.3
Residential	46	2.1
Other	7	0.9
<b>Total</b>	<b>294</b>	<b>3.1</b>

One-way ANOVA (F = 6.7, sig. < 0.000)

*Agriculture* > all other categories (Tamhane test < 0.040)

**Table A9:** Number of people who reside on the property.

Land use recorded	N	Mean (people)
Residential only	46	2.1
Grazing	53	3.2
Cropping	90	3.6
Grazing and cropping	26	5.1
Other	74	2.2
<b>Total</b>	<b>289</b>	<b>3.1</b>

One-way ANOVA (F = 8.3, sig. < 0.000)

*Residential* < *Cropping and Grazing and cropping* (Tamhane test < 0.044)

*Cropping* > *Residential only and Other* (Tahmane test < 0.002)

**Table A10:** Number of people supported by the property.

Primary purpose of land ownership	N	Mean (people)
Agriculture	171	3.8
Conservation	21	1.0
Hobby/lifestyle farm	40	0.5
Residential	44	0.4
Other	8	1.6
<b>Total</b>	<b>284</b>	<b>2.6</b>

One-way ANOVA (F = 8.7, sig. < 0.000)  
 Agriculture > all categories except 'other' (Tamhane test <0.000)

**Table A11:** Number of people supported by the property.

Land use recorded	N	Mean (people)
Residential only	44	0.4
Grazing	52	2.8
Cropping	83	3.3
Grazing and cropping	27	7.8
Other	73	0.8
<b>Total</b>	<b>279</b>	<b>2.5</b>

One-way ANOVA (F = 16.1, sig. < 0.000)  
 Residential < all categories except Other (Tamhane test <0.042)  
 Other < Grazing and Cropping (Tamhane test < 0.000)

**Table A12:** Property NRM issues scale – soil health.

Primary purpose of land ownership	N	Mean*
Agriculture	125	1.5
Conservation	13	1.3
Hobby/lifestyle farm	21	1.0
Residential	22	0.8
Other	5	1.4
<b>Total</b>	<b>186</b>	<b>1.3</b>

\* Scores ranged from 0 = Not Applicable to 5 = Very Important.  
 One-way ANOVA (F = 4.0, sig. < 0.010)  
 Agriculture > Residential (Bonferroni test <0.004)

**Table A13:** Property scale – pests and weeds.

Primary purpose of land ownership	N	Mean*
Agriculture	175	2.8
Conservation	16	2.2
Hobby/lifestyle farm	32	2.2
Residential	41	1.8
Other	6	2.9
<b>Total</b>	<b>270</b>	<b>2.6</b>

\* Scores ranged from 0 = *Not Applicable* to 5 = *Very Important*.

One-way ANOVA (F = 7.2, sig. < 0.000)

*Agriculture* > *Residential* (Bonferroni test <0.000)

**Table A14:** Regional development issue scale – ‘viability of agriculture’ by primary purpose for land ownership.

Primary purpose of land ownership	N	Mean*
Agriculture	175	2.8
Conservation	16	2.2
Hobby/lifestyle farm	32	2.2
Residential	41	1.8
Other	6	2.9
<b>Total</b>	<b>270</b>	<b>2.6</b>

\* Scores ranged from 0 = *Not Applicable* to 5 = *Very Important*.

One-way ANOVA (F = 52.6, sig. < 0.000)

*Agriculture* > *Residential* (Bonferroni test <0.000)

**Table A15:** Regional development issue scale – ‘lack of employment and services’ by primary purpose of land ownership.

Primary purpose of land ownership	N	Mean*
Agriculture	153	2.4
Conservation	19	2.1
Hobby/lifestyle farm	27	1.9
Residential	34	1.6
Other	6	1.6
<b>Total</b>	<b>239</b>	<b>2.2</b>

\* Scores ranged from 0 = *Not Applicable* to 5 = *Very Important*.

One-way ANOVA (F = 4.5, sig. = 0.002)

*Agriculture* > *Residential* (Tamhane test = 0.048)

**Table A16:** Property management goal scale – ‘to build business’ by primary purpose of land ownership.

Primary purpose of land ownership	N	Mean*
Agriculture	183	4.3
Conservation	22	2.4
Hobby/lifestyle farm	40	2.6
Residential	48	1.8
Other	7	2.4
<b>Total</b>	<b>300</b>	<b>3.5</b>

\* Scores ranged from 0 = *Not Applicable* to 5 = *Very Important*..  
 One-way ANOVA (F = 67.3, sig. < 0.000)  
*Agriculture* > all categories except *Other* (Tamhane test = 0.000)

**Table A17:** Property management goal scale – ‘to improve the environment’ by primary purpose of land ownership.

Primary purpose of land ownership	N	Mean*
Agriculture	183	4.0
Conservation	22	4.0
Hobby/lifestyle farm	40	3.8
Residential	49	3.4
Other	8	2.2
<b>Total</b>	<b>302</b>	<b>3.8</b>

\* Scores ranged from 0 = *Not Applicable* to 5 = *Very Important*..  
 One-way ANOVA (F = 8.3, sig. < 0.000)  
*Agriculture* > *Residential* (Tamhane test = 0.089)

**Table A18:** Property management goal scale – ‘keep in the family’ by primary purpose of land ownership.

Primary purpose of land ownership	N	Mean*
Agriculture	185	3.7
Conservation	22	3.0
Hobby/lifestyle farm	43	3.4
Residential	48	3.3
Other	8	2.4
<b>Total</b>	<b>306</b>	<b>3.5</b>

\* Scores ranged from 0 = *Not Applicable* to 5 = *Very Important*..  
 One-way ANOVA (F = 4.0, sig. = 0.003)  
*Agriculture* > *Other* (Bonferroni test = 0.037)

**Table A19:** Vegetation management issue scale – ‘prefer to clear forest’ by primary purpose of land ownership.

Primary purpose of land ownership	N	Mean*
Agriculture	111	0.07
Conservation	22	-1.31
Hobby/lifestyle farm	32	-0.52
Residential	37	-1.04
Other	5	0.00
<b>Total</b>	<b>207</b>	<b>-0.37</b>

\* Scores ranged from -2 = *Strongly Disagree* to 2 = *Strongly Agree*.

One-way ANOVA (F = 19.2, sig. < 0.000)

*Agriculture* > all categories except *Other* (Bonferroni test < 0.010)

*Hobby/lifestyle farm* > *Conservation* (Bonferroni test = 0.014)

**Table A20:** Vegetation management issue scale – ‘management difficulties’ by primary purpose of land ownership.

Primary purpose of land ownership	N	Mean*
Agriculture	111	0.58
Conservation	20	0.15
Hobby/lifestyle farm	31	0.49
Residential	36	0.23
Other	5	0.00
<b>Total</b>	<b>203</b>	<b>0.45</b>

\* Scores ranged from -2 = *Strongly Disagree* to 2 = *Strongly Agree*.

One-way ANOVA (F = 3.1, sig. = 0.017)

Post hoc tests not significant.

**Table A21:** Vegetation management issue scale – timber harvesting suitable.

Primary purpose of land ownership	N	Mean*
Agriculture	111	0.08
Conservation	22	-0.05
Hobby/lifestyle farm	33	-0.47
Residential	38	-0.54
Other	5	-0.20
<b>Total</b>	<b>209</b>	<b>-0.14</b>

\* Scores ranged from -2 = *Strongly Disagree* to 2 = *Strongly Agree*.

One-way ANOVA (F = 3.6, sig. = 0.007)

*Agriculture* > *Residential* (Bonferroni test = 0.015)

**Table A22:** Vegetation management issue scale – aesthetics and value.

Primary purpose of land ownership	N	Mean*
Agriculture	115	-0.79
Conservation	22	-1.32
Hobby/lifestyle farm	32	-1.17
Residential	39	-1.24
Other	5	-0.30
<b>Total</b>	<b>213</b>	<b>-0.97</b>

\* Scores ranged from -2 = *Strongly Disagree* to 2 = *Strongly Agree*.

One-way ANOVA (F = 4.1, sig. = 0.003)

Post hoc tests not significant.

**Table A23:** Information scale – enterprise information.

Primary purpose of land ownership	N	Mean*
Agriculture	168	2.7
Conservation	20	1.2
Hobby/lifestyle farm	40	1.1
Residential	48	0.6
Other	6	1.7
<b>Total</b>	<b>282</b>	<b>2.0</b>

\* Scores ranged from 0 = *Not Applicable* to 5 = *Very Useful*.

One-way ANOVA (F = 49.3, sig. < 0.000)

*Agriculture* > all categories except *Other* (Bonferroni test < 0.000)

**Table A24:** Information scale – finance and family.

Primary purpose of land ownership	N	Mean*
Agriculture	178	3.5
Conservation	20	1.8
Hobby/lifestyle farm	40	2.8
Residential	48	1.7
Other	8	2.2
<b>Total</b>	<b>294</b>	<b>2.9</b>

\* Scores ranged from 0 = *Not Applicable* to 5 = *Very Useful*.

One-way ANOVA (F = 31.0, sig. < 0.000)

*Agriculture* > all categories except *Other* (Bonferroni test < 0.030);

*Hobby/lifestyle farm* > *Residential* (Bonferroni test = 0.002)

**Table A25:** Information scale – environment groups.

Primary purpose of land ownership	N	Mean*
Agriculture	181	2.4
Conservation	22	2.4
Hobby/lifestyle farm	42	1.7
Residential	48	1.4
Other	8	1.1
<b>Total</b>	<b>301</b>	<b>2.1</b>

\* Scores ranged from 0 = *Not Applicable* to 5 = *Very Useful*.

One-way ANOVA (F = 6.2, sig. < 0.000)

*Agriculture* > *Residential* (Bonferroni test = 0.001)

**Table A26:** Information scale – media sources.

Primary purpose of land ownership	N	Mean*
Agriculture	179	3.1
Conservation	22	2.6
Hobby/lifestyle farm	41	3.0
Residential	46	2.4
Other	7	1.6
<b>Total</b>	<b>295</b>	<b>2.9</b>

\* Scores ranged from 0 = *Not Applicable* to 5 = *Very Useful*.

One-way ANOVA (F = 5.4, sig. < 0.000)

*Agriculture* > *Residential* and other categories (Bonferroni test < 0.015)

*Other* < *Hobby/lifestyle farm* (Bonferroni test = 0.032)

**Table A27:** Trust scale – productivity groups.

Primary purpose of land ownership	N	Mean*
Agriculture	115	2.0
Conservation	8	1.1
Hobby/lifestyle farm	11	1.1
Residential	20	1.0
Other	4	1.6
<b>Total</b>	<b>158</b>	<b>1.7</b>

\* Scores ranged from 0 = *Not Applicable* to 3 = *High Trust*.

One-way ANOVA (F = 12.0, sig. < 0.000)

*Agriculture* > all categories except *Other* (Bonferroni test < 0.015)

**Table A28:** Trust scale – environment groups.

Primary purpose of land ownership	N	Mean*
Agriculture	173	1.7
Conservation	21	2.0
Hobby/lifestyle farm	40	2.1
Residential	39	1.9
Other	6	1.3
<b>Total</b>	<b>279</b>	<b>1.8</b>

\* Scores ranged from 0 = *Not Applicable* to 3 = *High Trust*.

One-way ANOVA (F = 4.9, sig. = 0.001)

*Hobby/lifestyle farm* > *Agriculture* (Bonferroni test = 0.004)

*Hobby/lifestyle farm* > *Other* (Bonferroni test = 0.037)

## Further Information

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