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Overview of Farm Mapping Software in Australia

By Bernard Fitzpatrick and Tim Neale

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Foreword

The Rural Industries Research and Development Corporation's National Rural Issues portfolio invests in research and development into cross cutting issues affecting rural and regional Australia. This includes mechanisms for enhancing sustainability. New information software can reduce complexity and enable presentation of the many layers of natural resource and production information to land managers in ways that can lead to improvements in efficiency and better use of resources.

All primary producers use some form of map in the management of their properties. The most common is the mental map which provides an association of property features both natural and human modified. The mental map can be developed further by the drawings of the relative location of property infrastructure and other actual or perceived attributes associated with the management of the property. Scaled printed maps are the next development of a farm map. The more complex the maps, the more tools that are required to develop the maps; the more skills required to use those tools; and the more time is required to be allocated to the mapping.

Complexity is added when the mapping advances to the computer. There is then the need to learn to use the computer, the software, and the technical aspects of mapping that were not previously required. In addition, there is a need to know how to manage the computer, the property information, and data that is stored on the computer. The choices are many and varied.

This report provides a comparative overview of software mapping packages for use by primary producers. It examines the range of software products available to assist landholders and natural resource managers map and manage the land and processes they are responsible for. It suggests a decision matrix for primary producers to assess their needs, and the ability of mapping packages to meet their needs and expectations.

This report, an addition to RIRDC's diverse range of over 1800 research publications, forms part of our Environment and Farm Management R&D program.

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- downloads at www.rirdc.gov.au/fullreports/index.html
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Peter O'Brien

Managing Director

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Graham Bell of AgForward (Qld) provided his preliminary software survey and report, which the team gratefully acknowledges. Independent review and editing was carried out by Dr. Jeff Tullberg of the University of Queensland. We would also like to thank RIRDC Program Manager George Wilson for his initiation of the concept, guidance and support throughout the project.

Abbreviations

GIS	Geographical Information Systems
GPS	Global Positioning System
IT	Information Technology
NRM	Natural Resource Management
PMAV	Property Map of Assessable Vegetation
QA	Quality Assurance
EMS	Environmental Management Systems
FMS	Farm Management Systems

Principle project researchers

Bernard Fitzpatrick



Bernard is a geographer with interests in regional geography, natural resource management, and agriculture. Since 1980, he has been involved with mapping and spatial information technologies having worked in the areas of traditional cartography, geographic information systems and remote sensing. Since 1987, Bernard has been involved with the applications of spatial technologies, primarily remote sensing to the natural resources and primary production sectors, and has undertaken projects in the tropical and sub-tropical regions of Australia, Indonesia, and Papua New Guinea.

Bernard worked in the Public Sector both in Queensland and the Northern Territory before joining the Private Sector in 1993. He formed Spatial 3i Pty Ltd in January 2004. He has worked in a number of roles including: technical, research and development, training, and both project and business management.

Tim Neale



Tim is an applied scientist with skills in agronomy, farm planning, mapping, remote sensing, and GIS. Tim spent 7 years in the QDPI before becoming a consultant, researching and adopting sustainable farming systems on the Darling Downs of Queensland. In 2002 Tim started his business CTF Solutions which has now utilised over 750,000Ha of high resolution satellite imagery across Australia. CTF Solutions has conducted many agricultural research and adoption projects across Australia, and services 150 farmer clients. He has also been involved in international projects in Sudan, Africa.

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Executive Summary

What is the report about?

This report provides a comparative overview of software mapping packages for use by primary producers. It examines the range of software products available to assist landholders and natural resource managers. It suggests a decision matrix for primary producers to assess their needs, and the ability of mapping packages to meet their needs and expectations.

Who is the report targeted at?

This report is targeted at primary producers who are choosing farm mapping software.

Background

Australian primary producers are increasingly using computer software packages to support on-farm enterprise management. The primary focus is financial management, plus some use in farm mapping, product management, and in recording and reporting for both government and industry initiated quality assurance schemes. Lack of comparative information about the capabilities and suitability of the various packages, particularly farm mapping software, is slowing adoption rates by farm businesses.

Aims/objectives

The objectives of this project were:

- To provide a comparative overview of software mapping packages available for use by primary producers.
- To enable primary producers to indicate what functions they saw as useful in computer mapping software packages.
- To provide a decision matrix for primary producers to assess their needs, and the ability of mapping packages to meet their needs and expectations.

Methods

An Australia-wide survey of farm mapping requirements was conducted with primary producers and non-producers who are associated with primary industry. Survey forms were distributed electronically, with some interviews conducted to further canvas views related to survey responses. The survey enabled primary producers and consultants /advisers to indicate useful functions in computer mapping software packages.

A framework was developed and used to assess the ability of software mapping packages to meet primary producer needs and expectations, and observations.

The results of the survey and the comparative overview of the selected software mapping packages were used to develop a decision matrix, which provides a formalised process for primary producers to follow when assessing their farm mapping software needs.

Results and key findings

Two thirds of the primary producers contributing to this survey do not currently use farm mapping software. More than 80% said they would like to in the future.

The surveys found that farmers desire fundamental production, financial and mapping functions, but were uncertain about the relevance of natural resource management and environmental factors.

The vast majority (85%) of producers surveyed were 'owner operators' who are unlikely to be getting 'in-house' IT support available to large agricultural companies. This suggests that there is an

opportunity to help owner operators in making better decisions in choosing and using farm mapping software to ensure greater success with its use. The decision matrix was designed to give some of this help by providing a process to follow when choosing farm mapping software.

The project team identified 48 available farm mapping software packages. Twelve were selected and reviewed with a sample of mapping data from a North Queensland property.

Most mapping programs designed specifically for farmer use were in a similar price range of \$500 to \$1500, which can be considered affordable.

The following summary comments about the 12 software packages tested are subjective and are based on a short review of each software program. Further work with the particular software, or advice from the software company, may overcome some of the issues listed here.

iFarm is a farm mapping and management package based on GIS and has linkages to cashbook, record keeping and stock movement recording. It is a very comprehensive, simple farm mapping product, and is able to handle different map datum's and projections easily.

Phoenix Mapping is a farm mapping and management package based on GIS and has linkages to cashbook, record keeping, weather, and stock movement recording. The program slowed when the large test point dataset was introduced. Start up tutorial was helpful. When a layer is not active, it becomes transparent, which is a smart function.

Farmworks offer a wide range of software levels, and is primarily designed for precision agriculture and farm finance monitoring. It is not really designed as a 'farm mapping' product in terms of this projects' brief.

GTA 100-400 was developed by AGCO using expertise from Farmworks, so comments relating to Farmworks relate directly to GTA 100-400.

SGIS (GTA500) has also been developed by AGCO and is based on GIS, primarily aimed at precision agriculture applications. Unfortunately licensing issues prevented the project team from evaluating the software.

Mapper by Back Paddock software is a paddock recording, mapping and planning software and is designed mainly for farmers but also has advisor modules. It has great mapping capabilities and is relatively easy to use. It has a navigation pane which enables the user to see where they are in relation to other data when they are zoomed into the map. The demonstration program crashed many times while it was being tested.

GP Mapper by PAM is one of the oldest and most widely used Australian mapping software programs on the market. Because of its maturity it has a wide range of functions, especially in relation to the range of data that can be imported. The team was impressed with on-the-fly projection. The map however was slow to refresh and had difficulty in handling larger datasets. Some functionality was not operating in the demonstration version and couldn't be reviewed.

Farmkeeper is a relatively new product, based on GIS and has linkages to paddock recording for intensive and extensive livestock operations, with crop recording being developed. This program is not fully mature as a fully integrated program. A good function is the auto-save every 15 minutes.

Geopdf is a free, low level data display product based on the widely used Acrobat pdf format. It is a great program to get maps sent to clients in a format that is widely accepted, but has limited functionality at present.

ArcGIS is one of the world's more widely used GIS programs. Its range of functionality is enormous, but the trade off is that it is very complex to use. Most medium level software will accept Shapefiles (a format outputted by ArcGIS) which has almost become an industry standard.

Mapinfo is also a widely used GIS program for advanced users. It has a difficult user interface. Its functionality is also large, but not suited for most primary producers.

Manifold is an advanced GIS system like ArcGIS and MapInfo which is also more suited to seasoned GIS users and so will generally not be suited to the skills levels of most primary producers. Manifold has good functionality and is much cheaper than other advanced GIS systems.

Recommendations

If a better understanding of primary producer farm mapping software requirements and adoption rates and issues on an industry by industry basis is required, a more comprehensive study is required with the resources, financial and time, to obtain larger more representative sample sizes across primary production industry groups for both primary producers and non-producers. Any such study should consider the seasonal influences on primary producer time availability to complete such a survey.

There have been and are a number of funding programmes implemented around Australia which have assisted or are assisting primary producers to purchase farm mapping software. There is a need to determine how effective these programmes have been; which primary producers have used or are actually using the software; what are/have they used the software for; why they have not or have ceased to use the software; document where and why there have been true adoption or lack of adoption of the use of the farm mapping software.

1. Introduction

At March 1999, 49% of Australian farms owned or used a computer, a 27% increase from March 1998 (ABS, 2000). By June 2005, 56% of Australian farms used a computer (ABS, 2006). In the period 2004 to 2005, the Australian Bureau of Statistics found that 44% of farmers they surveyed used their computers to manage their finances, and 31% of respondents used computers for farm recording (ABS, 2006). The increasing use of computers by primary producers for mapping over recent years has been assisted by the development of computer software to support on-farm mapping and management. Availability, capability and complexity, and price of software with mapping components suitable for primary producers are quite diverse.

At the same time, there has been increasing regulatory requirements for farm mapping, recording and reporting, from government and industry initiated QA (quality assurance) schemes. Government reporting requirements and the need for property maps of a 'professional' level (implied by recent legislation), has probably increased the demand for software for farm mapping.

Computerisation of farm equipment, increasing availability of different digital datasets, the development and integration of farm operation recording, and the need for financial (tax) recording have increased the complexity of decision making for primary producers. Producers are confused about the criteria they need to consider to make decisions about farm mapping software in the context of their current and future farm management.

Earlier versions of farm mapping software were not designed or equipped to handle current datasets and requirements. Work by Bell (2006) in his project evaluating farm mapping software found *"not one software package suitable for all producers' property planning in Queensland requirements"*. His report went on to say that *"The real problem today isn't to identify the 'best' farm mapping program, but to find the best fit between new users' needs and linking with currently available resources,"*

The term farm mapping software is not well defined, and in general use has included many and varied software programs. Software for 'mapping' can be categorised by their capabilities as follows:

- Data display and querying software is used to display, in a map form, data captured by equipment such as grain yield monitors or GPS systems. Examples include be JD Office, AgLeader SMS, and Garmin's mapsource.
- Data viewing software is a group of software that allows multiple spatial layers to be displayed and or turned on or off to create a user map, but not specific to primary producer applications. These are often developed by large software companies to allow untrained users to view spatial data in its most basic form. Examples include ESRI's ArcExplorer® and GeoPdf by TerraGo® technologies.
- CAD (Computer Aided Design) software is used for design and production of drawings associated with drafting and engineering applications. An example would be AutoCAD™.
- GIS (Geographic Information Systems) is a group of mapping and associated database capable software used in the collection, storage, retrieval, analysis and presentation of spatial data. Examples include ESRI's ArcGIS® or MapInfo®.
- Web Mapping Systems (WMS) and Internet Mapping Systems (IMS) are recently evolving technologies that provide the capacity to map or present maps over the internet. This has been driven primarily by the demand for software to enable viewing of large image datasets and spatial databases over the internet, with additional mapping functionality built on top. An example would be Image Webserver® by Earth Resource Mapping, MapTools® by GeoGenx®, and Google Eartgh™.

Farm mapping software as defined for this study is software that allows for collecting, storing, integration, analysing, and presenting spatial information specifically developed for primary producer use.

Farm mapping software can help to record, map, measure, and manage many aspects of primary production enterprises. It can assist by:

- displaying recent aerial photographs or satellite images which can be used to:
 - identify and map natural resources boundaries or management units boundaries such as soil and vegetation;
 - identify and map the location of natural features such as drainage and ridges;
 - identify and map the location of property infrastructure and assets.
- calculating lengths and areas of fences and paddocks;
- mapping the location of scheduled day to day farm management tasks;
- location recording of farm operations (such as stock movements, treatments);
- providing a tool for planning new developments;
- identifying and location recording of hazards as part of Occupational Health and Safety (OH&S) requirements for staff and contactors;
- recording and reporting location aspects of vegetation/ecology/corridor management;
- recording and tracing location based information for EMS and food safety reporting requirements;
- recording location aspects of water licensing and management;
- providing location based information for gross margin analysis; and
- recording location and extent of pesticide application.

This study is believed to be the first of its kind in Australia to survey perceived and actual issues related to farm mapping software by primary producers. The objective is to provide a decision matrix to help primary producers assess their needs and expectations of farm mapping and record keeping software, and assess the capacity of currently available software in these terms. This report includes a comparative overview of a selection of 12 commonly used farm mapping software packages, the results of an Australia-wide primary producer/consultant survey, and the decision matrix developed to help primary producers decide their current and future needs.

This information should benefit primary producers' triple bottom line (environmental, social and economic), as well as Government and auditing bodies trying to ensure that their requirements can be achieved and reported with ease, and with less assistance. The survey's findings should provide guidance to software providers on producers' current and future needs and the software requirements to meet these needs.

This study found that over recent years, the functionality of commonly available farm mapping software on the Australian market had improved to a state where most provided good mapping functionality. This being the case, primary producers should be looking beyond mapping functionality to factors such as software support; computer system and data management; and farm recording, analysis and reporting capabilities.

2. Objectives

The objectives of this project were:

- To provide a comparative overview of software mapping packages available for use by primary producers.
- To enable primary producers to indicate what functions they saw as useful in computer mapping software packages.
- To provide a decision matrix for primary producers to assess their needs, and the ability of mapping packages to meet their needs and expectations.

3. Methodology

This project was undertaken during April to June 2007 with initial aspects commencing in March. Collating and finalising analysis of data and information was undertaken in July, followed by report writing. The project included the following tasks:

3.1 Defining farm mapping software

Software that allows for collecting, storing, integration, analysing, and presenting spatial information specifically developed for primary producer use.

It was important to work with a definition as there are a large number of programs and digital tools (e.g. GPS, digital navigation mechanisms) and recording devices (e.g. yield monitors, and variable rate technology mechanisms) that may collect and/or display spatial information, but do not necessarily allow integration and analysis of the spatial information. In addition, there are a number of high-end software products (e.g. ArcGIS®, MapInfo®, AutoCAD™) that are not specifically designed for primary production, but may be used for this purpose. This definition generally excluded a wide range of GIS software, and also the low cost/free software supplied with GPS products.

3.2 Promoting the project

In an effort to attract survey participants and promote the project, a flier (Appendix A) was produced and circulated via email to a wide audience, including some media agencies. Opportunities were taken to promote the project where possible using, for instance, the Longreach ABC Rural Report. It is estimated that thousands of primary producers were exposed to the project.

3.3 Conducting primary producer and non-producer surveys

The team constructed a primary producer survey (Appendix B) and a non-producer survey (Appendix C), which was distributed electronically, or personally, with farmer groups and individuals; and professionals, government, and software developers.

Both surveys were divided into two sections. The first obtained general information on the person completing the survey to allow grouping of responses into industry, enterprise type, and location. The second section of the survey presented the respondents with a list of possible functions of farm mapping software. In the case of the primary producer, they were asked to indicate what functions they saw as useful in computer mapping software packages. For the non-producer, the same list of possible functions was presented, and respondents asked if they believed the function should be included in farm mapping software, and which of the functions they had seen used by primary producers.

3.4 Categories of software

The researchers divided the functions into what they considered conceptually different groups of functions. This was done to distinguish between pure mapping functions and those more related to farm recording and management. The list of functions was grouped as follows:

1. **Mapping:** functions that were strictly related to mapping or cartographic functions;
2. **Finances:** related to deriving or entering financial information in a spatial context;
3. **Natural Resource Management:** related to management of natural resources (water, soil);
4. **Environment:** recording spatial aspects related to environmental factors (water quality, vegetation management, riparian management);
5. **Production:** recording, deriving and integration of production related information (inputs and outputs of agricultural production);
6. **Compliance:** recording and reporting for both government compliance and product quality assurance (QA);
7. **Social:** provision of output to assist or direct contractors/workers, including O H & S; and,
8. **Other:** request any other functions they considered should be included in farm mapping software.

3.5 Field interviews with industry groups and individuals

Whilst the surveys were being distributed to thousands of primary producers across Australia, project members met with industry representatives, software companies and primary producer groups to conduct interviews. They visited Western/Southern/Central Queensland, New South Wales, Victoria, South Australia and Western Australia. These interviews followed the format of the non-producer survey, and further canvassed views on survey questions, primarily with respect to software manuals and support, and factors limiting the adoption of farm mapping software. In addition, their views were sought with respect to emerging mapping technologies such as web mapping systems.

3.6 Evaluation of software

A broadly representative group of software products were selected for evaluation against functions indicated by primary producer and non-producer surveys, and by technical requirements. Selection was based on the project's definition of farm mapping software and an understanding of the software packages in more common use in Australia. Most of these products were already being used by Australian landholders, and varied in the extent to which they met the project's software definition.

The evaluation undertaken in this study is not a comprehensive evaluation of all possible software that could be used for, or is available for, farm mapping in Australia. Other software packages are being used and a wide variety of software packages from all parts of the world can be purchased on-line. During the course of the project, the team also became aware of software that had been specifically developed and used (but not commercialised) by local Landcare groups and primary producers.

For software evaluation, the project used data from a North Queensland farm for which a good set of spatial data, including both raster and vector datasets, was available. The same datasets were used for the evaluation of each software package.

3.7 Collation, processing, analysis and interpretation

Surveys were returned in hard copy and respondents views entered into separate spreadsheets for primary producers and non-producers. This quantitative data was analysed using statistical and pivot table routines to generate relevant reports.

Comments from both primary producers and non-producers were recorded from survey forms, via email, during telephone conversations and interviews. These comments provided valuable information, and were sorted into subject groups or themes to identify related issues, ideas and opinions. This approach provided further understanding of the issues in relation to software adoption and use by primary producers, and was valuable in the development of the decision matrix for the assessment of software needs.

4. Results

4.1 Surveys

4.1.1 Results of the primary producer survey

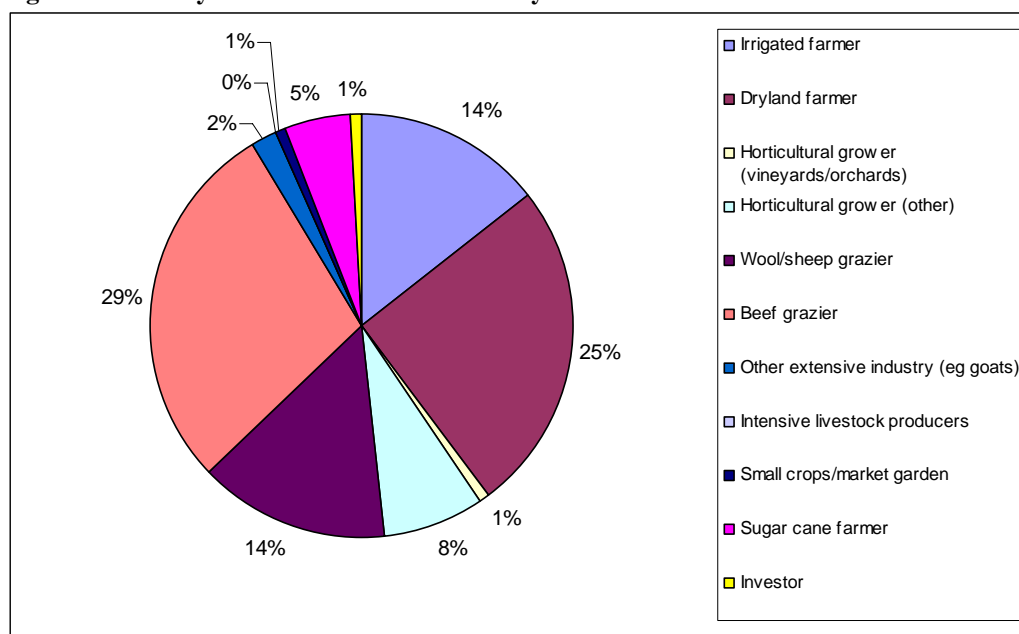
4.1.1.1 Respondent profile

Sixty-five primary producers undertook the Farm mapping survey, from 14 farmer groups across Australia. Many individuals also made a contribution from direct correspondence. The survey questions can be found in Appendix B. Key figures and tables are included in this Results section of this report. Figures and tables in Appendix D contain more detailed information.

The survey was distributed to thousands of primary producers from all states and territories, and all major industries. Exposure to the project was significant due to the support of the wide array of farmer groups, consultants and extension agencies. However, there were only a small number of responses. It is believed that the short duration of the study and the different seasonal activities of various primary producers across Australia influenced the number of responses. For example, the timing of the survey coincided with the southern Australian crop planting season which at the time was buoyed by recent rains, and the end of the early dry season muster and cattle activities in northern Australia.

The survey was primarily completed by irrigated and dryland farmers, and extensive sheep and beef graziers. Sugar cane and horticultural growers were represented also but in lower numbers. Figure 1 shows the distribution of industries represented in the survey results.

Figure 1: Primary Producer - Industries surveyed



The majority (86%) of the farmers interviewed were from owner occupied farming businesses, with the rest being either corporate or share farmers (Figure 2). More than half of the survey respondents owned more than one property in the same district and three-quarters are managing multiple properties, which may increase the need for better property planning (Figure 3). The geographical spread of survey respondents was primarily from Queensland, followed by NSW (Figure 4). Some surveys arrived too late for analysis. It is believed that the geographical spread of respondents was influenced by the timing of the survey in relation to primary production activities in various parts of Australia.

Of the survey respondents, 67% do not use farm mapping software at present (Figure 5), of which 81% would consider using farm mapping software in the future (Figure 6). This was surprising, as it was expected that producers who already used mapping software would form the greatest proportion

of respondents. This presents a good opportunity to feed the results of this project back to the community to assist them in their decision process when considering purchasing a farm mapping software program.

Figure 2: Primary Producer - Property ownership

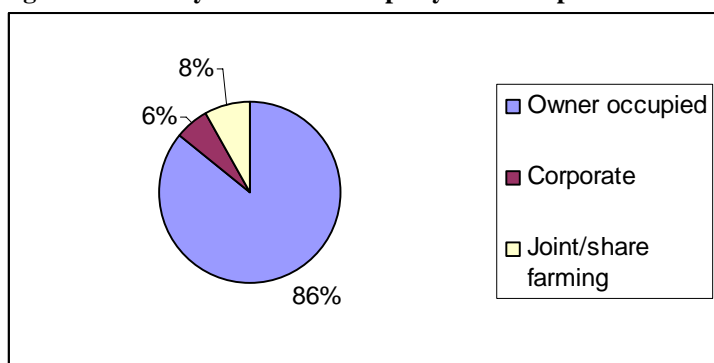


Figure 3: Primary Producer - Number of properties owned and location

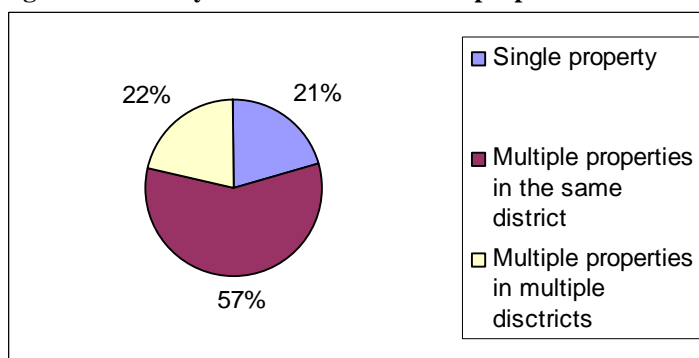


Figure 4: Primary Producer – States surveyed

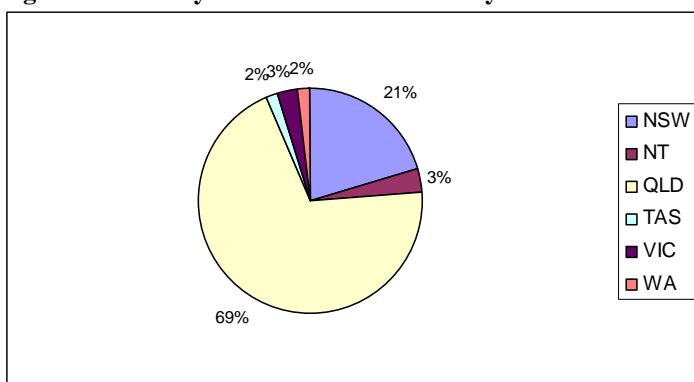


Figure 5: Primary Producer - Farm mapping software use

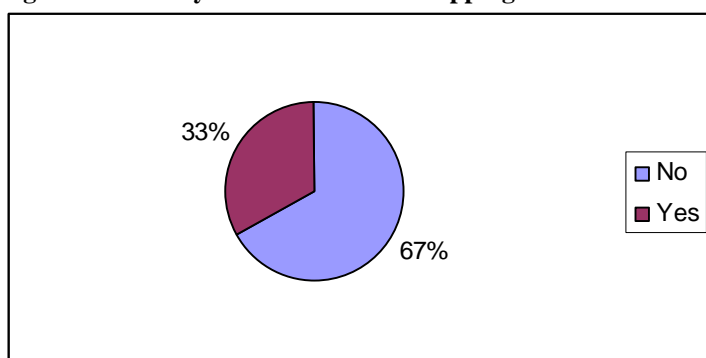
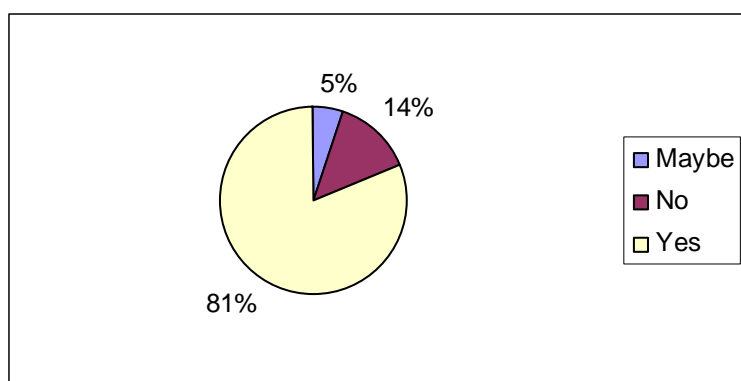


Figure 6: Primary Producer - Producers not using farm mapping software who would consider using it in the future



4.1.1.2 Preference for software

Software currently used by respondents who were already using farm mapping software is represented in Table 1. PAM/Fairport Mapper was the most widely used, and accounted for nearly one-third of respondents using mapping software packages. It is interesting to note that some of the software listed by primary producers is no longer available, and this has been the case for a few years. Also interesting was the fact that some non-producer groups and individuals were not aware that their software packages were no longer available.

Table 1: Software brands used by the 29 respondents who are using farm mapping software

Software	Number Used
AgData	1
AGIS	1
ArcGIS	1
Dlog	1
EC 38	1
Endeavour	1
PAM / Fairport GP Mapper	10
Farmap	1
Farmkeeper	1
Farmworks	1
Instant Survey	1
John Deere	1
Manifold	1
Mapsource	1
Oziexplorer	1
Pin Point	2
SMS Basic	1
Trimble	1
Viewpoint	1

4.1.1.3 Ease of use

70% of survey respondents who currently use farm mapping software said that their current software was “somewhat easy” to use. Ten percent found it “difficult” to use, whilst 15% were “not sure”, and the remaining 5% found their current software “very easy” to use. One of the most common themes from primary producers surveyed was that software had to be easy to use, and most of the software in use fits this criterion in the opinion of those using it.

More than half (53%) of survey respondents said that their current software “does most things I want”; with 26% saying that it “does all I want”. In summary, it appears that farm mapping software currently in use does most, if not all, the things producers want to do at the present time.

When asked if producers would like a consultant to do the farm mapping on their behalf, only 13% said yes. It appears that people prefer to complete the mapping themselves in their farm office, but 80% answered yes to work jointly on their farm mapping with a consultant. This may indicate the increasing complexity of farm mapping and recording, with producers still wanting to have control over data and the convenience of having all the information and software available on their office computers.

4.1.1.4 Primary producer's opinions on mapping software requirements

The second component of the survey was presented as a list of possible mapping related functions within seven categories: Mapping, Finances, Natural Resource Management, Environment, Production, Compliance, and Social (see Appendix B). Producers were asked to indicate from the list of possible mapping related functions which they believed should be included in farm mapping software packages. The results are presented and collated according to the seven categories.

The majority of primary producers believe that most of the suggested functions within the mapping category should be included in farm mapping software (Appendix D Figure 1). However, a few functions did not have as strong agreement as others. Over 25% of primary producers surveyed were not sure of the need for the “ability to import data from other agencies” (Question M6). While most agency data is available in formats that can be loaded or imported into the majority of available mapping programs, it is interesting to note that primary producers are uncertain of the need or usefulness of agency data (comments made in producer interview). There was suggestion that agency data was not detailed enough to be useful for on-farm management; however, this was influenced by land use especially in the higher production regions.

Question M7 asked whether producers saw a need to produce a map with directions to their property. Approximately one-fifth of respondents questioned this requirement, and interview comments suggested that most people visiting a property would be aware of its location, or be aware of the nature of settlement in rural areas and able to follow directions.

More than 30% of producers were unsure about the idea of local users assisting each other with software (Question M11), but less than 10% were negative. Interviews suggested that while this local assistance may occur, producers tended to be independent and other personal factors would come into consideration.

Financial information was seen as important in farm mapping software (Appendix D Figure 2). The context of the questions was the ability to relate farm mapping with farm financials in a spatial context – not necessarily in relation to paddock recording or book-keeping. Most producers also favoured the integration of mapping, financials, and paddock recording (Question F2). Many producers input the same data into many different programs, (e.g. agronomy software for the agronomist, financial software for the accountant and farm record keeping software for food safety compliance, in addition to mapping software. Although not specifically tested in this project, it is obviously important to minimise primary producers data entry tasks by integrating recording, reporting and mapping.

Natural Resource Management (NRM) questions were primarily related to the ability to import the wide range of data available from state government agencies such as catchment, Landcare and regional NRM bodies. Nearly 50% of producers do not believe, or are unsure of, the importance of information from government or catchment groups (N1, Appendix D Figure 2). This study can only surmise the reasons for this response, but it should be a concern for government agencies and regional NRM bodies in their efforts to raise awareness and improve on-ground NRM outcomes.

Primary producer comment suggests that they often found information from agencies was at an inappropriate scale (resolution) for property management and they were concerned about the nature and application of land use data. The project team's experience, however indicates that property managers are not aware of (or regard as too difficult to obtain) a number of potentially valuable

datasets held in public organisations. Some of these datasets, for example the Queensland Environment Protection Agency's Regional Ecosystems (RE) data map (Nelder et al, 2005) are more easily accessible, and several of the mapping software packages evaluated had built in automatic colouring of the RE data to ensure correct identification of vegetation communities. This is a clear sign that companies are attempting to meet the growing requirement to integrate compliance information and reporting, rather than focusing only with production. Another example of this requirement is the whole farm plan, farm map and record keeping system needed to become a certified organic producer. (McCoy and Parlevliet, 2000).

Environmental questions were included in the survey to highlight the increasing environmental compliance pressure placed on agricultural industries. Again, it appears that many farmers were unsure of the need for these functions. More than 60% of respondents questioned the requirement for functions concerned with proximity to other properties and towns in relation to odour/noise/etc (Function E7). This outcome might have been different with a greater number of respondents from intensive and horticultural industries, rather than from grain farming and extensive grazing.

Not surprisingly, most production orientated requirements were seen as important in a farm mapping program (Appendix D Figure 3). Functions P7 to P11 had a higher number of respondents that were unsure about the requirements for those criteria. These questions related to Precision Ag technologies (in the early stage of adoption), and also NLIS which is only relevant to grazing industries. Obviously these questions were industry specific which reinforces comments about sector specific requirements that are irrelevant to other primary production sectors.

Respondents showed less certainty about the need for compliance and social capability in farm mapping software (Questions C1-C4, Appendix D Figure 4), an outcome similar to that for NRM and Environmental functions. Mapping software can provide automated, spatial record keeping on farms to ensure easier and more comprehensive environmental and food safety compliance. It appears that many farmers have acknowledged the pressures of these legislative requirements, but all don't see mapping assisting them in demonstrating conformity. Product or market driven QA systems are still developing, and the importance of functionality to integrate with schemes such the NLIS (see function P9 in Appendix D Figure 3) is recognised by 60% of respondents. Functions C3 and C4 related to water licensing/planning, which will not be a requirement for many industries; hence they received a mixed, low response overall.

With regard to social functions, it is interesting to note that the percentage responses for maps for contractors/employees – (S1 - Appendix D Figure 4) and maps for the directions to the property (M7 - Appendix D Figure 1) are very similar. Of the respondents, 70% believe it would be valuable to producing a map identifying locations, but only a little over half see the need for mapping for health and safety requirements.

4.1.2 Results of the non-producer survey

The non-producer survey (Appendix C) was divided into the same two sections as the primary producer survey: responder demographic information and consideration of farm mapping software function. The survey was distributed widely across all Australian states and territories. Exposure to the project was significant due to the support of the wide array of farmer groups, consultants and extension agencies. Even so, only 33 respondents took part in this survey, 19 of whom took part in face-to-face interviews. The respondents included researchers; public, private, and non-government organization advisors; lobbyists, and three farm software companies with associations to various primary producer industries across Australia (Table 2, and Figure 7). One respondent who was associated with two distinct primary producer sector groups answered the survey for each group which then provided 34 responses to the questionnaire.

It was interesting to note that none of the three participating software companies identified all primary production groups as users of their software. In discussions they indicated that while it would be nice,

it was commercially and logistically unrealistic to attempt to make one software package that would suit all primary producers. Some software companies, for example Fairport Technologies, have produced specific software for different industries, for example grape growing/wine production.

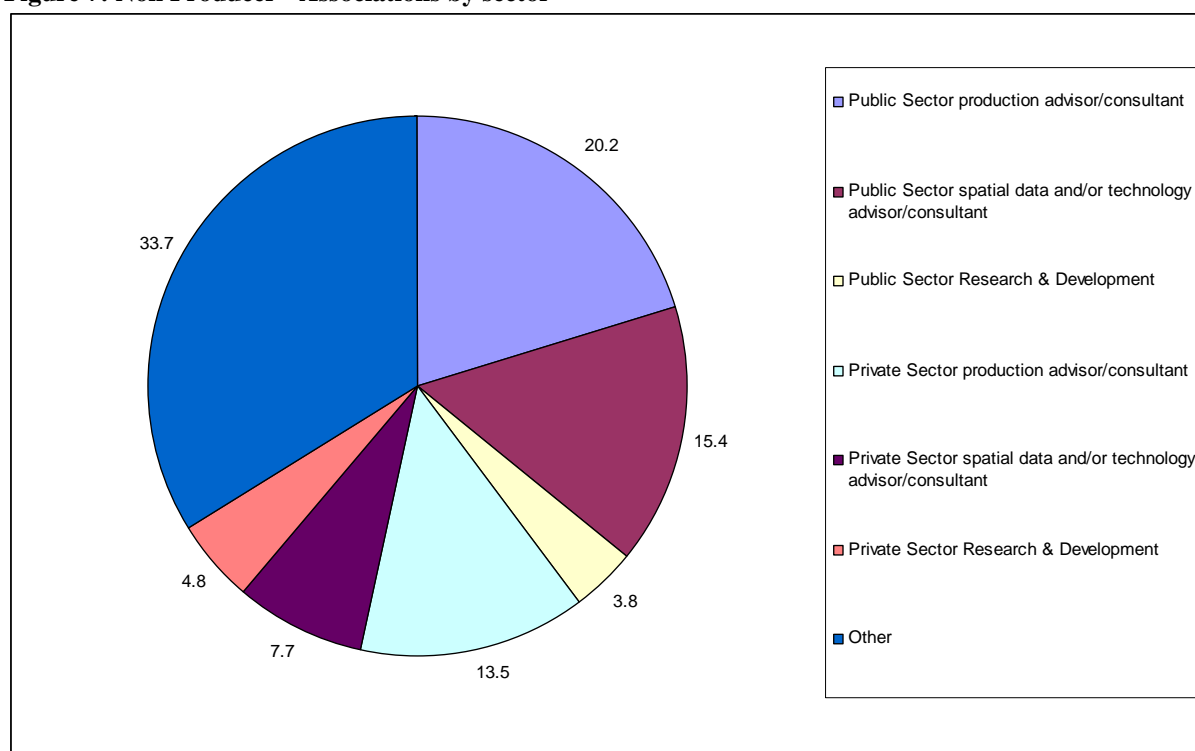
Of those who responded, 65% had associations with dryland farmers, 56% with beef graziers, and smaller numbers with irrigation farmers or wool/sheep graziers. Because a respondent can have an association with more than one primary producer group, the percentages do not total to 100% (Figure 8).

Table 2: Non-Producer -Respondents associated by sector, and mapping software use

	Number of Respondents	Does not use mapping software	Do use mapping software
Public Sector production advisor/consultant (includes land management)	7	2	5
Public Sector spatial data and/or technology advisor/consultant	3		3
Public Sector Research & Development	2	1	1
Private Sector production advisor/consultant (includes land management)	6	1	5
Private Sector spatial data and/or technology advisor/consultant	3		3
Private Sector Research & Development	3	1	2
Other	10	1	9*

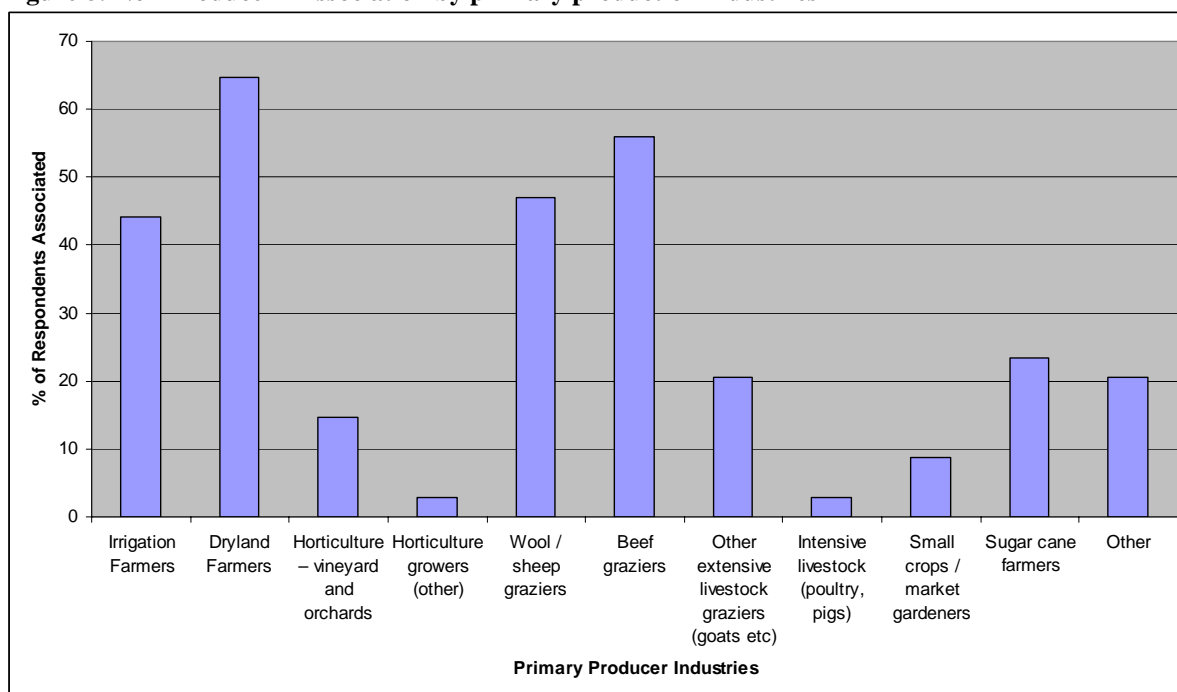
Note: * includes three software companies.

Figure 7: Non Producer - Associations by sector



Note: All values shown are percentages.

Figure 8: Non Producer - Association by primary production industries



Note: Other primary producer industry groups included turf farms, dairy, and mixed farms.

Of the respondents, 32 of the 33 (94%) were associated with individual property owners, and 79% were associated with either producer groups or corporate or company owned properties (Figure 9). 18% were associated with others groups. Of the respondents, 56% were associated with single property owners, producer groups, and corporate or company owned properties (Figure 10). Client property sizes that the non-producer respondents were associated with ranged from intensive horticultural production systems on one hectare, through to extensive pastoral properties cover thousands of square kilometres.

Figure 9: Non Producer: - Associations by primary production enterprise

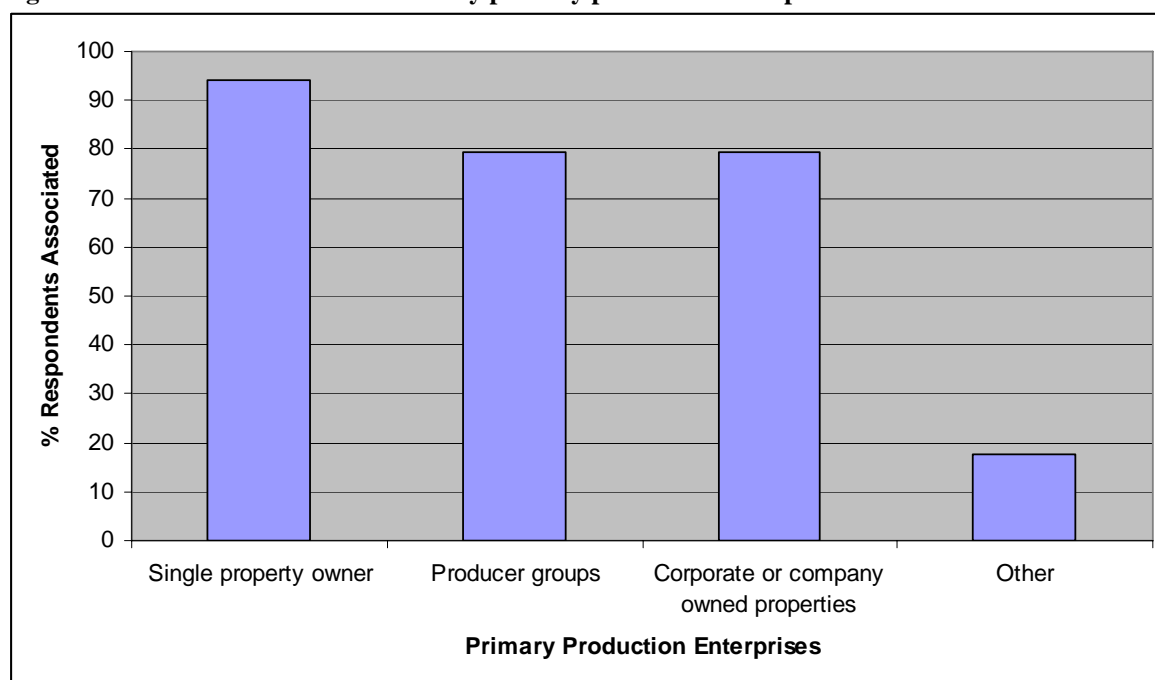
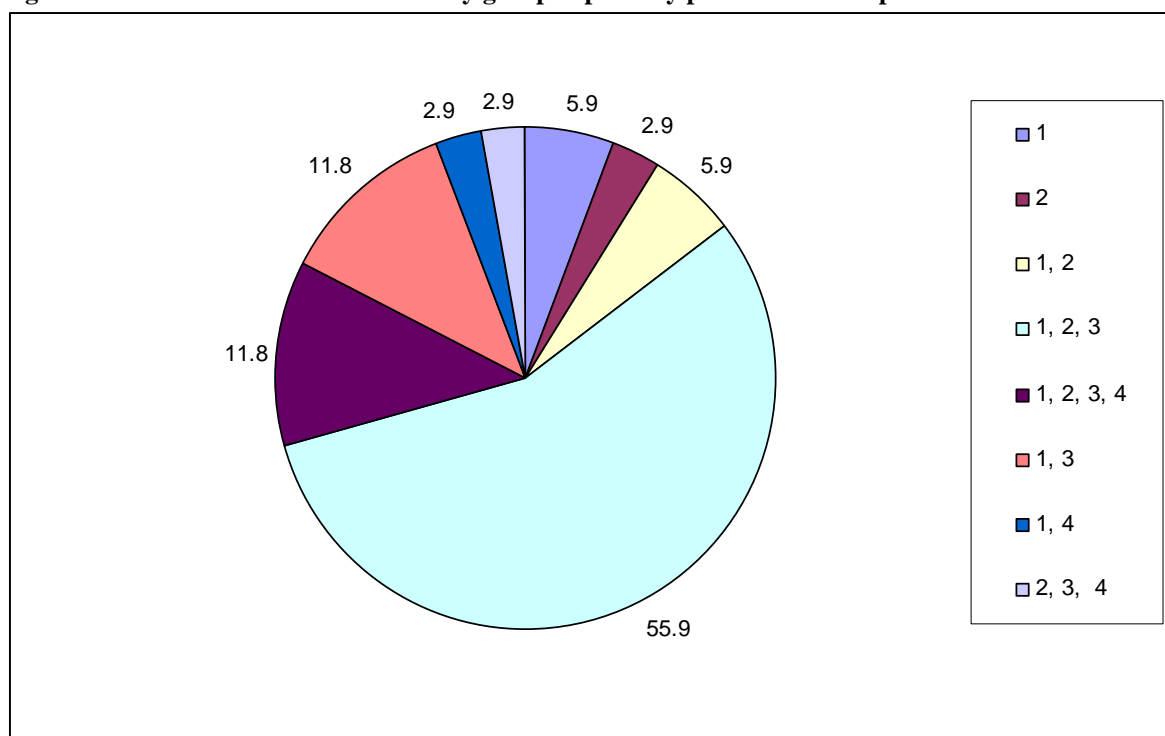


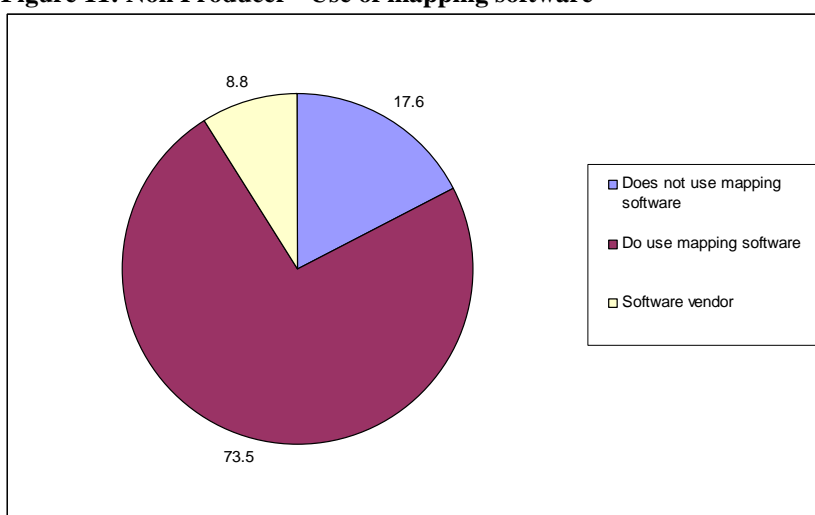
Figure 10: Non Producer - Association by grouped primary production enterprise



Note: All values shown on the pie chart are %. Legend values – 1 = Single property owner; 2 = Producer groups; 3 = Corporate or company owned properties; and, 4 = Other.

Not all who responded used mapping or GIS software themselves. Figure 11 shows 73.5% used software and 17.6% did not.

Figure 11: Non Producer - Use of mapping software

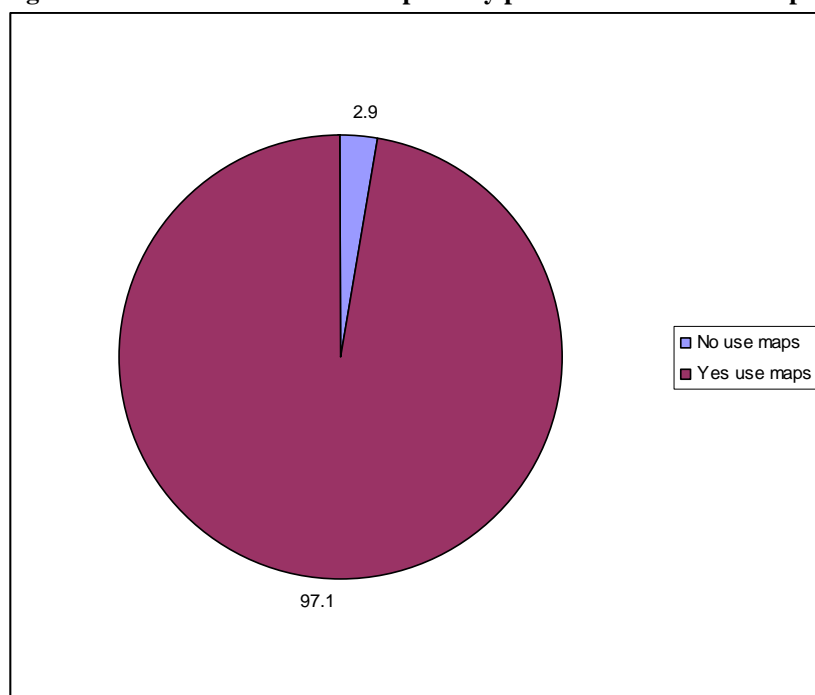


Note: All values shown are percentages.

Only one out of 33 respondents said that farmers should not use maps (see Figure 12). That person was working in the grazing industry and believed that the property owners would know their place fairly well, and their “mental map” would be good enough. One respondent, who believed primary producers should use maps, qualified the response by saying; “Farmers’ business is spatial and they use maps whether in their head or some other medium.” Others qualified their response, saying that

the map could be fairly basic, and that property size and use would determine the need for anything more than the basic mud-map. Many added that a map helps visualise a property and assist in planning and management.

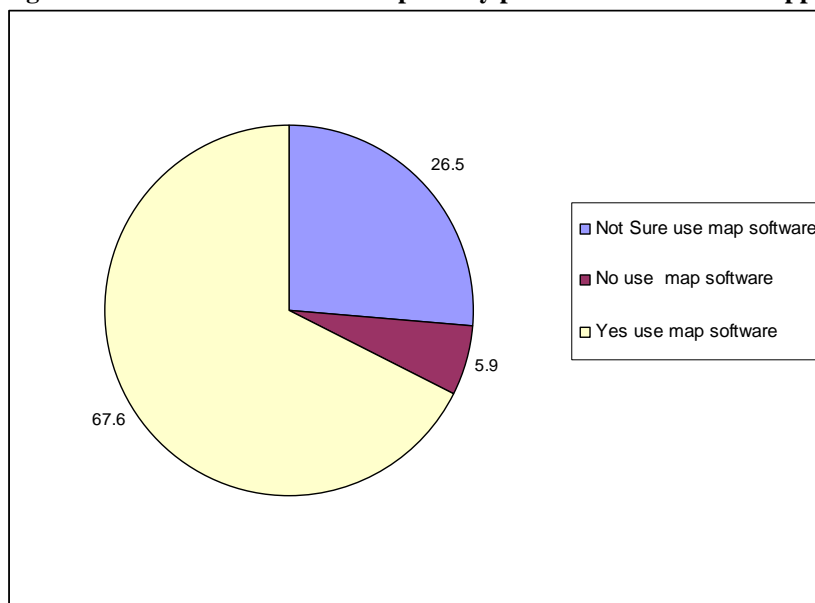
Figure 12: Non Producer – Should primary producers should use maps



Note: All values shown are percentages.

Respondents were asked if primary producers should be use mapping software (Figure 13). Of 34 respondents 10 were not sure; 2 said no; and, 22 said yes. All were asked to qualify their answer, and many saw mapping software as a good means for recording keeping, allowing primary producers to make changes as they wished. One suggested that it could be used to keep data ownership with the primary producer, allowing him to engage different consultants using the same data and build farm datasets. In cropping, it was suggested that farm mapping software provided good record keeping for monitoring costs and production, but it should also cater for developments such as auto-steer and variable rate application technologies.

Figure 13: Non Producer - Should primary producers should use mapping software



Note: All values shown are percentages.

Respondents were asked their ranking of different the map software uses: Infrastructure; Finances; Natural Resource Management; Environment; Crop or Herd Management; Compliance; Occupational Health and Safety; and Other. (See Appendix D Figure 5 and Appendix D Table 1) Other uses provided by respondents included: in paddock variability, land types, location to markets, and property planning. Some respondents did not rank individual uses from 1 to 8, or gave a number of uses the same rank. Since a respondent had associations with a number of primary producer groups, respondents were counted as a sample per primary producer group. As such, there were 104 samples from 34 respondents.

Forty-three percent of respondents believed infrastructure location to be the most important mapping function, followed by natural resource management (NRM) 34% with another 31% of respondents ranking NRM the second most important function. Crop or herd management was ranked as second (28% of responses).

Finances, Environment and Compliance were ranked third by 30% 28% and 24% respectively. Compliance also was ranked fourth by 25% of responses. Occupational Health and Safety was ranked seventh.

4.1.2.1 Non-producers opinions on software mapping requirements and comparison to producer responses.

Software functions were again divided into the same application categories used in the producer survey, i.e. mapping, finances, natural resource management, environment, production, compliance, and social and other factors.

There is a conceptual difference between purely mapping functions, and those related to farm operation recording and reporting which might also be linked to mapping. It was noted that this difference was recognised by four non-producer respondents. All respondents recognised that mapping could often provide a useful basis for data input, extraction, and reporting.

Appendix D Table 2 provides a summary of the responses by non-producers to the mapping software functionality questions. The same information has also been presented as a series of bar graphs. Differences between producer and non-producer responses could help identify issues related to low adoption, by clarifying what is important to the user, rather than the perceptions of those providing

advice. These differences can also highlight important gaps in the understanding or appreciation of technical issues.

The responses to the surveys demonstrate general agreement between primary producer and non-producer responses with respect to the Mapping category (Appendix D Figure 1 and Appendix D Figure 6). However, there was a difference of opinion with respect to the production of maps showing directions to the property (M7). This use of the mapping software was seen as useful by 70% of primary producers, but only 30% of non-producer. This suggests a lack of understanding by the non-producers of the importance held by producers for such a function.

If we compare the response of both groups to M6 (Import data from other agencies - vegetation, property boundaries, soil maps, urban areas, etc): nearly 70% of primary producers believed it useful, and only 5% disagreed, and 30% said maybe. The non-producers are more definite, with nearly 85% believing it useful. During the interviews, some non-producers suggested the level of detail in existing government agency datasets was not appropriate for property management, and therefore of little benefit to primary producers.

It is interesting to note the non-producer responses with regard to observing primary producers use of the listed functions. While the non-producers considered most of the functions listed useful, it is only in the mapping category (Appendix D Figure 1 and Appendix D Figure 6) and some production functions (Appendix D Figure 3 and Appendix D Figure 8) that they observed greatest use of functions by primary producers. The primary producer responses generally suggested that more than 60% would use most functions, but 67% of primary producers currently did not use farm mapping software. Anecdotal evidence from comments suggests that primary producer's intention to use most functions is not always carried out in practice. A number of non-producers commented that in some regions primary producers had received financial assistance through various groups to purchase mapping software, but the primary producers had failed to actually use the mapping software. There were also comments suggesting that while the intention to use software was genuine, a number of factors prevented the primary producer from doing it.

There appears to be a difference between primary producers and non-producers about the usefulness of the financial, natural resource management, and environment (Appendix D Figure 2 and Appendix D Figure 7). Responses by both groups to F1 and F2 functions were similar but over 10% more primary producers valued entering information only once. There were big differences between both groups in respect to N1 and N2, with 20% to 30% less primary producers indicating that these were useful functions. This might reflect primary producers' attitude towards, or understanding level of catchment based as opposed to property based issues, and their inter-relationship. The differences between both groups in respect to Environment functions (E1, E2, E3, and E4) only varying by about 10% for useful functions.

Responses to production functions (Appendix D Figure 3 and Appendix D Figure 8) between both groups were within 5% of each other, except for functions related to cropping (Questions P6, P7, and P8) where the primary producers recorded lower usefulness percentages than the non-producer group. This is likely to be related to the representation of the industry sectors (crop and grazing) of respondents.

There was general agreement between the groups in respect to Compliance and Social categories (Appendix D Figure 4 and Appendix D Figure 9) except for C3 (Record water use against Water Licence). Over 40% of primary producers indicated that this was useful while only 30% of non-producers did. While 30% of primary producers indicated that this function was not useful, only about 5% of non-producers indicated that the function was not useful. The difference between respondents indicating 'maybe' was large with about 26% of primary producers indicating 'maybe' and over 50% of non-producers indicating the same. This is probably related to the demographics of the respondents.

Except for the differences between responses by both groups indicated above, the majority of functions listed were considered to be useful by both groups. The strength of support by either groups for a particular function; however, did vary. Due to the small sample size of both the primary producer and non-producer groups, these finding should only be considered as indicators.

4.1.3 Issues identified from surveys

The following provides an interpretation of the comments provided by primary producers and non-producers during the study. All original comments were grouped in themes which were related to the issues of using farm mapping software by primary producers.

It is worth noting a comment provided by a Queensland primary producer who has been using satellite imagery and farm mapping/GIS software for over twelve years. During that time, he has had to:

1. assess and purchase “farm mapping software” at least twice;
2. contend with both advances in computer hardware, and changes in computer operating systems;
3. consider ill-defined software upgrades and resulting differences in data formats and lack of backward compatibility of supplied data;
4. translate previously created digital map data from one software program to another; and,
5. cope with limited software support, and non user-friendly manuals.

“For what it is worth I don't think there will be a significant number of people who will consult or use any guide to the software. And the guide will date very fast as software and operating systems change. ... My instinct is that the purchase will be much more influenced by:

- *the need to own a system, and many will just get once-off mapping done for PMAVs etc*
- *software cost*
- *software and setup support including image preparation*
- *the network that is pushing or making software available*
- *friends who have similar software*

A synthesis of issues related to farm mapping software is provided in Table 3. Included in the table are pertinent comments made in italics.

Table 3: Identified issues related to farm mapping software**Software functions and user applications**

ISSUE	BRIEF DESCRIPTION
<i>Software aspects</i>	Application issues related to the software.
Information and data capture	The processes and technical aspects of how data and information are captured or imported into the software. <ul style="list-style-type: none"> • <i>Infrastructure – once they have it, things fall into place for them.</i> • <i>Recording day to day activities.</i>
Information and data integration	The ability of the software to allow different data and information types to be integrated.
Information and data analysis	The ability of the software to be able to analyse the data and information. <ul style="list-style-type: none"> • <i>Monitoring change (usually weeds and ground cover/plant growth)</i> • <i>Require minimum capability in map algebra.</i>
Information reporting	The ability of the software to generate reports presented as maps, tables or text. <ul style="list-style-type: none"> • <i>Visual representation is important to landholder.</i> • <i>Helps visualise what is going on around the farm.</i>
<i>User aspects</i>	Application issues related to the user.
Interpretation	The user's ability to interpret the information provided by the software as output on screen or as printed versions. <ul style="list-style-type: none"> • <i>Allows them to organise thinking in relation to management of their property.</i>
Farm decision making	The user's make decisions using the information provided by the software as output on screen or as printed versions. <ul style="list-style-type: none"> • <i>Good tool for understanding their farm, planning where they want to go and how.</i> • <i>Starts farm planning process and creates a management picture for farm.</i> • <i>They are an essential component for family farms setting up a succession plan.</i> • <i>I do not think it (computer mapping) is essential component of farm management if paper maps are available. Good land management existed long before computers.</i>

Software use

ISSUE	BRIEF DESCRIPTION
Ease of use	Issues related to the ease of use of the software. <ul style="list-style-type: none"> • <i>Difficult to choose which software.</i>
User manual	Issues related to the user manual (i.e. printed or digital versions)
Training	Issues related to training in the use of the software. <ul style="list-style-type: none"> • <i>Different ways of learning for different people.</i> • <i>Having any mapping software is of questionable value if the user isn't trained in data management.</i> • <i>Most primary producers are more kinaesthetic learners.</i>
Support	Issues related to how support is provided. <ul style="list-style-type: none"> • <i>I think they should be using mapping software if they have support available and are comfortable with computers.</i>
Capacity and computer literacy of user	Issues related to the user's ability to use computers. <ul style="list-style-type: none"> • <i>Depends on computer literacy, landholders should be encouraged to be more computer literate. Most landholders prefer to work with hardcopy maps and overlays.</i> • <i>Not without assistance as they need training.</i> • <i>Depends greatly on the capacity of the enterprise including financial and people skills.</i> • <i>What is stopping use of computer mapping? Understanding of computers is major obstacle, and data management.</i> • <i>Groups get together to learn from each other.</i>
System requirements	Issues related to the computer configuration to operate the software

Software additional issues

ISSUE	BRIEF DESCRIPTION
Open standards	Issues related to the formats used by the software in relation to transferring data and information from one software program to another.
Interoperability	Issues related to directly using the software with other software and hardware (e.g. GPS).
Software updates/upgrades	Issues related to how often and how software updates/upgrades are produced and

Software functions and user applications

	delivered/provided to the user.
Longevity	Issues related to how long will the software be on the market.
Future technologies	Issues related to technology development and how these will impact on farm mapping.

Data issues

ISSUE	BRIEF DESCRIPTION
Data formats	Issues related to data formats (e.g. map datums and map projections) and structures.
Metadata	Issues related to keeping information about the data (e.g. how a dataset was captured or generated).
Information resolution	Issues related to the information content of the data in relation to the detailed required for on-farm applications. <ul style="list-style-type: none"> <i>The resolution of Government data is not good enough.</i> <i>The data needs to show the variability on the farm.</i> <i>Important to see distribution of resources (soil, vegetation) as this enables more effective planning, monitoring & record keeping.</i>
Data availability	Issues related to what data is available and how to access it, including data licensing. <ul style="list-style-type: none"> <i>General impression is people do not know what is available or Departments do not make it available.</i>

Business considerations

ISSUE	BRIEF DESCRIPTION
Cost of implementing a system	Issues related to how much it costs to implement a system, such as: hardware, software, data access, training, and support <ul style="list-style-type: none"> <i>Simple and cheap.</i> <i>The costs associated with establishing a good digital GIS system for someone not familiar with cartography, data formats, coordinate systems, etc. are quite high in time and dollars.</i> <i>Cost is stopping use of computer mapping.</i> <i>Cost is the largest constraint.</i> <i>If they are already profitable why use it?</i> <i>Maps and computer mapping are important for succession planning and for sale of property as it provides a record of what is on the place and how it is performing.</i>
Time requirements	Issues related to time required to learn the software, enter data and information, and maintain and update the data and information. <ul style="list-style-type: none"> <i>Farming is changing too quick – cannot keep up.</i> <i>How long does it take to input data and use the software?</i> <i>Management of time – valuable and limited.</i> <i>It should be part of their day, but they don't have the time, they need motivation especially with finances.</i> <i>There are probably a lot who would like to, but do not have the time to.</i>
Computer system management	Issues related to managing the computer hardware, operating system, and application software.
Consultants	Issues related to when and/or if a consultant should be engaged. <ul style="list-style-type: none"> <i>Most farmers can read maps, but may need some expert advice to determine what is causing the affects being seen.</i> <i>Consultants should do the complicated work.</i> <i>Most farmers use their GIS software a handful of times a year. Farmers should use data processing companies much like they would use an agronomist.</i> <i>Most however see the benefit, buy the program and then rarely use it (around 60 businesses that I know of). The bulk of mapping products we supply are in a hardcopy format.</i>

4.2 Evaluation of farm mapping software

The second primary component of the project was evaluating a selection of available farm mapping software programs against a common dataset and set criteria.

The project team had a clear definition of ‘farm mapping software’, but some generic GIS/mapping programs were also evaluated at the request of RIRDC. The project identified 48 different software programs (see Appendix E) that could potentially be used for farm mapping. Of those 12 were selected for evaluation, sourced primarily from Australia and the USA. Priority was given to Australian products, and only Microsoft Windows® based software was assessed.

4.2.1 Software tested

The 12 proprietary software evaluated as part of the project included:

- ArcGIS version 9.2
- Back paddock software
- Farmkeeper
- Farmworks
- Geopdf
- GTA 100-400
- iFarm
- Manifold
- MapInfo
- PAM QA+ with farmstar
- Phoenix Farms mapping
- SGIS (GTA 500)

4.2.2 Datasets tested

Evaluations were carried out using a generic dataset obtained from the project team archive, including the following real datasets:

- ArcView shapefile polygons in both Cartesian coordinate systems (i.e. Universal Transverse Mercator, UTM) and geographic coordinate systems. This was to test the software's ability to handle different datum's and projections. Polygon data was used to test if the software could identify attributes and colour accordingly.
- ArcView shapefile of line data. The aim was to test if the software could handle all types of Shapefiles.
- ArcView shapefile of high intensity point data collected from a GPS system. This data was used to test the ability to import large datasets, and also to evaluate attribute handling and colouring
- High resolution (1m pixel) satellite imagery in both GeoTiff and ECW formats. These common formats were selected to test the ability of the software to accept geo-referenced imagery. High resolution imagery was selected to test how each software program handles larger file sizes, as this is of particular concern with some software programs
- Queensland Regional Ecosystem (RE) data. This data was selected to test the ability of the software to import these files with the correct colouring as required by the Queensland Vegetation Management Act, as well as the ability to accept data from a government department. Several Australian software companies have recently included this capacity to allow primary producers in Queensland to create maps for vegetation compliance.

4.2.3 Assessment criteria

Each software program was evaluated using the following criteria determined by the project team as the basis for the detailed results (presented in section 4.2.4).

- **Software category.** This was the team's subjective view of the level believed to be targeted by the software (low, medium or high). *Medium* level represents functionality aimed at the 'average' primary producer. *Low* level software provides very basic use/ with few functions/ requiring little or no skills, while *high* level software provides a wide range of functions/ including mapping and analysis tools which require advanced mapping and/or GIS skills and is likely to be beyond the skills of most primary producers.
- **What company/engine was the software based on?** It appears that most companies designing farm mapping software base the program on existing GIS/mapping engines. The most popular engines include ESRI and Tatuk GIS.
- **Ease of use** is another subjective view of the software. The project teams experience with a wide range of remote sensing and GIS software provided a basis for categorising software as very easy, easy, moderate, difficult and very difficult. If the team could not identify how to complete an action in a relatively short amount of time, then the software was considered difficult to use. The team understands that this aspect varies greatly between users, but we are of the opinion that if a function is not obvious to experts, then producers will struggle. One of the most common responses from farmers is that the software has to be easy to use.
- **Import Shapefiles.** Much of the data coming from government departments is in ESRI shapefile format, so the objective here was to test the ease of loading ESRI shape files. All programs, except Geopdf (which is a viewer program) could read point, line and polygon ESRI Shapefiles.
- **Calculate areas/distances** capability was checked because primary producers need to be able to do this quickly and easily to get information like paddock size and find lengths of fencing, piping etc. All programs were able to do this with varying ease.
- **Handle MGA projections.** This section of the test was to determine the software's ability to work in Map Grid Australia (MGA) projections. This is the Australian standard for mapping, so is important in that context. It was pleasing to note that all Australian software can handle this. Some software even has the ability to re-project geographic data (Lats/Longs) before it is used in the program.
- **Attribute handling and colouring.** GIS files have attributes, or a database associated with them. Data with attributes was imported to check how the software responded, and if these details were identified and viewable. Testing was also done to determine if the software can colour differentially on these attributes. Several of the programs can automatically colour Regional Ecosystems data from the Queensland government, and some could colour attributes more than one colour at a time.
- **Imports GeoTiff and ECW.** This was used to test the ability of the software to handle common imagery file formats. Almost all of the software reviewed was able to import geo-referenced images, and locate them in the correct position. This is a major advance from the earlier versions of mapping software programs.
- **Shapefiles in correct location.** An ESRI shapefile, with known coordinates, was loaded into each software program and the Easting's and Northing's read off the map. All reviewed software correctly read the coordinates.

- **Image geo-referencing.** In many cases, primary producers will have access to aerial photographs of their property. This software functionality allows the user to geo-reference the photograph to 'real-world' coordinates so that other data layers can be overlaid. The simplest image registration of all of the software reviewed used two points, with the most advanced using an infinite number of points and achieving rectification rather than just registering. Obviously the greater number of well distributed points that are used, generally the better the geo-referencing will be. Industry experience suggests that a minimum of five well distributed points across the image are needed for accuracy due to the nature of aerial photography.
- **Speed of updating background with image loaded.** In the past, many of the software programs tested by the project team had particular problems with display updating when large datasets, such as imagery, are loaded. It was gratifying to see that the majority of software is able to update the background data quickly.
- **Links to GPS systems.** Many programs are spatially referenced providing an opportunity to communicate directly with a GPS system. Most of the software evaluated were able to connect to a GPS, and some were able to provide a 'moving map' where data can be streamed real-time into the software as the user moves around the farm.
- **Generate new data and export data.** This functionality allows the user to create paddocks, fences, and infrastructure features. This is an important function that mapping software should be able to do. Many of the software programs were also able export these newly created features as shapefiles or text files, enabling farmers to provide data to other agencies. Some software was only able to export the map as a picture or graphics.
- **Labelling capability.** Labels are used to display information about the attributes of drawing objects. An example might be the lot numbers of the property as registered by government departments. All software was able to label at least single attributes, with others being able to label two attributes. Label conflict was a problem with some software, where overlapping labels could not be discerned.
- **Editing function.** This section of the software is the ability to modify existing features (such as paddocks, fences). All software could edit to some degree, with some more advanced functions (such as x/y shift) being available in some.
- **Map production.** Paper based maps are often a requirement for regulation or general farm management. Whilst most software could do this, the team was particularly interested in those programs that could produce maps with a north arrow, coordinate grid, scale bars, legends and titles. This varied considerably between programs, and several could benefit from this enhancement.
- **Cost.** The project team recognised early that many of these products are 'packaged' items. Therefore, based on the team's experience it was decided just to categorise the cost of the mapping software into <\$1000, \$1000-\$2000, and >\$2000. It appears that most farm mapping software is retailing for less than \$1000, which makes it affordable for most producers.

4.2.4 Results of software tested

Table 4: Detailed summary of the software programs reviewed

Software / Criteria	iFarm by E-Agribusiness	Phonex mapping by AgData Australia	Farmworks by Farmworks
Software website	www.eagri.com.au	www.agdata.com.au	www.farmworks.com.au
Category	Medium level	Medium level	Medium to High level
Based on	ESRI products	Tatuk GIS	Proprietary (in-house)
Description	Farm mapping and management package	Mapping and recording software for farmers and graziers	Detailed and complex precision farming software with good functionality
Ease of use	very easy	easy	difficult
Imports shapefiles	yes	yes, can even colour up RE data in correct colours as a separate feature	yes
Calculates areas/distances	yes	yes, very easy	yes but areas difficult
Handles MGA Projections	yes - even projects into MGA for geographic data	yes. Will not reproject geographic data automatically, and does not display at correct location when brought into an MGA map	no - American and WGS only but handles UTM
Attribute handling/viewing	yes - attribute headings appear in label area	yes. Shows fields	displayed but difficult to manipulate
Attribute colouring	appears only one colour possible. Difficult to see otherwise	yes. Colours Qld RE maps automatically (correct colouring for veg mgt).	not evident on shapefiles, but should be possible
Imports GeoTiff	yes	yes	no
Imports ECW	yes	yes	no
Shapefiles in correct location?	yes	yes	yes
Image referencing	brings in referenced images	brings in referenced images in a range of formats including *.img	possible though 'Calibrate' software but runs out of memory when trialled
Speed of updating with image background	instantaneous	very quick	
Linkage to GPS	not sure	yes.	yes with add-on programs
Generate new data	yes - creates shapefiles	yes, creates points, lines or polygons.	yes.
Labelling capability	yes, multiple fields	yes. Can label 2 fields of the one feature	yes
Export data	not evident - all in shapefile format anyhow	yes, will export shapefiles. Possibly some problems with this as only 2 files appeared (should have been 4-7 files for a shapefile).	yes. Can export shapefiles, but shapefile doesn't have spatial reference
Editing function	yes	yes. Can even crop a layer as well as change the points.	yes but difficult. Not sure if it saves changes
Map production	Yes. Has north arrow, title, but no scale bar	not possible in demo, but scale bar, north arrow and coordinates are on the map. Can save the map as an image but not in evaluation copy.	yes. Has scale bar, legend and north arrow

Software / Criteria	iFarm by E-Agribusiness	Phonex mapping by AgData Australia	Farmworks by Farmworks
Additional Functions	linkages to cashbook, record keeping, stock movements etc	Linkages to cashbooks, cropping, livestock and weather modules as well as function for off-site data storage.	top end precision agriculture software
Cost category <\$1K, \$1K-\$2K, >\$2K	\$1000-\$2000 when combined with other modules. Cropping module is free at time of evaluation	<\$1000 for mapping part	<\$1000 for base package

Software / Criteria	SGIS (GTA500) by AGCO	Mapper by Back Paddock Software	PAM QA+ with Farmstar
Software website	www.agcocorp.com	www.backpaddock.com.au	www.fairport.com.au
Category	Medium to High Level	Medium level	Medium level
Based on	unknown	Appears to be Tatuk GIS	unknown
Description	Detailed precision farming and paddock recording software	Paddock recording, mapping and planning software mainly for farmers	mapping and paddock recording software for farmers, graziers and horticulturalists
Ease of use		easy to moderate	easy to moderate
Imports shapefiles		yes	yes
Calculates areas/distances		yes, but not in demo	yes
Handles MGA Projections		yes. Will not reproject geographic data automatically, and does not display at correct location when brought into an MGA map	yes, grid can be either MGA or LL. Handles data with different datums and projections - possibly on-the-fly reprojection capabilities
Attribute handling/viewing		yes. Shows fields very well	not apparent.
Attribute colouring		yes	only one colour possible. Appears to be able to import Qld Veg Mgt files, so may be able to attribute colour there.
Imports GeoTiff		yes	was not able to import. Says it can import tif, bmp, jpg and ecw
Imports ECW		yes	yes
Shapefiles in correct location?		yes	yes
Image referencing		not required, but has referencing software included	Brings in referenced ecw files, but also possible in software
Speed of updating with image background		very quick. Sometimes will slow down when zooming	moderately slow. Sometimes took a while to load map after zooming
Linkage to GPS		yes, apparently even has moving map	yes can import garmin and magellan files
Generate new data		yes, points, lines and polygons in shapefile format. Can import csv file format.	yes, creates points, lines and polygons. Has no undo function during editing.
Labelling capability		yes, but only one field	yes, but some problems with overlapping labels. Labels are separate to polygon.
Export data		yes, both in vector and picture. Can export into mapinfo and shapefile	yes. Shapefile, autocad, and bitmap format
Editing function		yes, shapefile format. Can do a range of cutting/merging, and	yes, can edit layers

Software / Criteria	SGIS (GTA500) by AGCO	Mapper by Back Paddock Software	PAM QA+ with Farmstar
		even x,y shifts on data.	
Map production		assumed - could not print a map in demo version, however had scale bar and legend available in the software.	yes. Good functionality here with automatic scale bar adjustments when map re-sized. Labelling of shapefiles has problems
Additional Functions		packaged with planning and recording software for farm management. Has programs for farm advisors and managers	linkages to farm record keeping for grazing, cropping and horticultural enterprises. Farmstar program imports yield monitor and other spatial data, and does VRT
Cost category <\$1K, \$1K-\$2K, >\$2K		<\$1000 per year	

Software / Criteria	Farm Keeper	Geopdf	ArcGIS 9.x
Software website	www.farmkeeper.com.au	www.terragotech.com	www.esri.com
Category	Medium level	Low level	advanced
Based on	Tatuk GIS	Acrobat reader	ESRI
Description	GIS mapping and paddock recording for intensive and extensive livestock. Crop production recording to be developed	Add on software for adobe acrobat to display maps derived by Map2pdf add-on from ArcGIS	High-end international GIS software.
Ease of use	easy to moderate	easy	very difficult
Imports shapefiles	yes.	no	yes
Calculates areas/distances	yes, automatically and manually	yes	yes
Handles MGA Projections	yes. Will not reproject geographic data automatically, and does not display at correct location when brought into an MGA map	yes, data is presented that map was exported into	yes, huge range of datums and projections worldwide
Attribute handling/viewing	not apparent, only in labelling area	no	yes
Attribute colouring	yes, and Qld RE data which can be correctly coloured automatically	no, colours are set in ArcView before export	yes
Imports GeoTiff	yes	no	yes
Imports ECW	yes	no	yes
Shapefiles in correct location?	yes	yes, exported maps are correct	yes
Image referencing	Brings in georeferenced images, but also possible in software	no	yes. Advanced level
Speed of updating with image background	very quick with .ecw, but slower with geotiff and when more data is loaded	quick	Quick when pyramids are built.
Linkage to GPS	yes	yes, in the future	yes, with free add ons
Generate new data	yes, creates paddocks, etc	yes, in the future	yes
Labelling capability	yes, appears to only label one field at a time	whatever labels were used when exported can be turned on and off	yes. Advanced level

Software / Criteria	Farm Keeper	Geopdf	ArcGIS 9.x
Export data	yes, into shapefile format	no, not at the moment. Plans are to be able to draw on pdf file and then export those as esri shapefiles	yes, range of vector and picture/pdf formats
Editing function	yes, can edit shapefiles and paddocks, etc	no, not at the moment.	yes. Advanced level
Map production	yes, appears to be good map production. Cannot print on trial version, but shows map layout. Includes north arrow, scale, legend and other information	this is the map product	yes. Advanced level
Additional Functions	linkages to farm record keeping mainly for grazing at present. Does feed budgeting	none	Wide range of geoprocessing, 3D, spatial analysis and other mapping functions.
Cost category <\$1K, \$1K-\$2K, >\$2K	<\$1000	free to users/clients. ESRI add-on is approx \$1200	>\$2,000. <\$1000 for farmers thorough Landcare/catchment mgt

Software / Criteria	MapInfo 8.5	Manifold 7.x
Software website	www.mapinfo.com	www.manifold.net
Category	advanced	advanced
Based on	MapInfo	Manifold System
Description	High-end international GIS software.	High-end international GIS software.
Ease of use	very difficult and clumsy interface for infrequent user .	very difficult
Imports shapefiles	yes, but not obvious	yes
Calculates areas/distances	yes, but not obvious	yes
Handles MGA Projections	yes, huge range of datums and projections worldwide	yes, huge range of datums and projections worldwide
Attribute handling/viewing	yes	yes
Attribute colouring	yes, but need to know how.	yes, but need to know how.
Imports GeoTiff	yes, with coordinates	yes
Imports ECW	yes, but must register	yes
Shapefiles in correct location?	yes, if know the map datum and projection when importing or loading files	yes, imports files straight with projection information.
Image referencing	ECW not referenced, GeoTIFF yes	automatic on import
Speed of updating with image background	very fast	once in and loaded into MAP quick.
Linkage to GPS	yes, with free (Blue Marbel) add ons	yes
Generate new data	yes	yes
Labelling capability	yes, Advanced level	yes, Advanced level
Export data	yes, range of vector formats. Images no, have to do via "Save As" or print options to graphics formats. Not obvious.	yes, limited number of formats depending which licence level purchased
Editing function	yes advanced options	yes advanced and not so easy
Map production	yes, advanced level	yes, but not as good as other software
Additional Functions	Has a number of advanced capabilities for advanced users.	Has a number of functions that require add-ons in other software packages.
Cost category <\$1K, \$1K-\$2K, >\$2K	>\$2000	<\$1000

4.2.5 Summary of software tested

WARNING: Some of the comments are subjective, and are based on a relatively short review of each software program. Further work with the particular software, or advice from the software company, may overcome some of the issues listed here, and there has been no attempt to remediate the issues encountered.

iFarm is a farm mapping and management package based on GIS and has linkages to cashbook, record keeping and stock movement recording. It is a functional, simple farm mapping product, and is able to handle different datum's and projections easily.

Phoenix Mapping is a farm mapping and management package based on GIS and has linkages to cashbook, record keeping, weather, and stock movement recording. When a layer is not active, it becomes transparent, which is a smart function. It comes with a helpful start-up tutorial, but the program slowed when the large point dataset was introduced.

Farmworks offer a wide range of software levels, but it has been designed largely for precision agriculture and farm finance monitoring, rather than as a 'farm mapping' product in terms of the project brief.

SGIS (GTA500) is GIS-based and also designed primarily for precision agriculture applications by AGCO. Unfortunately licensing issues prevented the project team from evaluating this software. GTA100-400 is based on Farmworks software, so the comments above relate to this program also.

Mapper by Back Paddock software is a paddock recording, mapping and planning software designed mainly for farmers. It has great mapping capabilities and is relatively easy to use. It has a navigation pane which enables the user to see where they are in relation to other data when they are zoomed into the map.

GP Mapper by PAM is one of the oldest and most widely used Australian mapping software programs on the market. Because of its maturity it has a wide range of functions, especially in relation to the range of data that can be imported. The team was impressed with on-the-fly projection, but the map was slow to refresh and had difficulty in handling larger datasets. Some functionality was not operating in the demonstration version.

Farmkeeper is a relatively new GIS-based program with linkages to paddock recording for intensive and extensive livestock operations. A crop recording is being developed, but this is still not a mature and fully integrated product. A good function is the auto-save every 15 minutes.

Geopdf is low level data display product based on the widely used Acrobat pdf format. It provides a valuable capacity for e-mail transmission of maps in a format that is widely accepted, but has limited functionality at present.

ArcGIS is one of the world's more widely used GIS programs. Being difficult to use, it is likely not to be suitable for most primary producers, unless they are able to get good support for the software's use. Its range of functionality is enormous. Most medium level software will accept ESRI Shapefiles.

Mapinfo is also a widely used GIS program for advanced users, with a large range of functionality. As with ArcGIS it is unlikely to be suitable for many primary producers because of its difficult user interface.

Manifold is an advanced GIS system, and as with ArcGIS and MapInfo is more suited to GIS users with advanced skills or the time to devote to learn it. As such, it is likely to be less suited to primary producers. It has good functionality and is much cheaper than other advanced GIS systems.

5. A decision matrix for assessing farm mapping software requirements

Taking into consideration the survey responses, comments provided during the project, the software review, and prior knowledge of mapping and computer systems, a decision matrix which will allow primary producers to assess their farm mapping software needs is presented in Table 5.

From the survey responses there is an obvious view held that farm mapping software is useful. There is no argument that valuable information and increased knowledge of farm resources and improved management can be gained by using mapping software. The increased number of farms using computers over recent years also suggests that the capacity of farmers in computer use will be increasing over the coming years. At the same time, there is no doubt that there will be further development and refinement of computer mapping software, training and support mechanisms that will only increase the usability of farm mapping software. This will no doubt be paralleled by increasing use of GIS software and spatial technologies within the agricultural consulting and advisory community, which will also strengthen computer capacity within rural communities and so the primary production sectors.

Even with this apparent positive outlook towards an increased computer capacity within the primary production sectors, there are other factors as identified through this study that will influence the decision to purchase and use farm mapping software. The most obvious factors are the allocation of financial and time resources. Given the positive assessment of the functionality of most current commonly available farm mapping software on the Australian market in relation to the mapping component of these systems, the emphasis on assessing farm mapping software for primary producers should be directed towards software support; computer system and data management; and, farm recording, data analysis, and reporting capabilities that can assist with property management.

The decision matrix for assessment presented here will provide the primary producer with a formalised process to assess farm mapping software needs. Farm operation recording is not addressed directly, but attention is drawn to it where necessary. Due to the diversity of primary production sectors and influences and development of programmes such as EMS and industry Best Practice, aspects of farm operation recording are likely to become more complex as industry specific aspects become more integrated with farm mapping. The decision matrix assumes that there has already been a decision made that farm mapping software is going to be considered.

The process is to work through the questions in Table 5, answering them and making notes as they are answered. Where there are identified questions to ask the software vendor or others, highlight them by placing an asterisk next to the question in the Yes column. Table 6, which lists desirable capabilities of farm mapping software, is also reviewed as part of the assessment process.

Table 5 Farm mapping software decision matrix: suggested considerations in assessing farm mapping software

Step 1	Define what is the intended use/application of the mapping software.	Yes	No	Notes
	Consider what it is that the farm mapping software is to be used for.			
	Is it a one-off map with no thought of producing any further maps? <i>If yes, it may be better to consider obtaining a printed map and use clear overlays on which to draw the required information, or find a consulting group that can create a map for you.</i>			
	Is it a one-off map, but there is consideration to use it as an opportunity to gain a better understanding of farm mapping software?			
	Or have you already have made up your mind and you want to implement the use of farm mapping in your enterprise?			
	Do you want to look at farm operation recording at the same time?			
	Do you already have farm operation records within a software package?			
	If yes, is there an existing mapping module from the same software company that will automatically integrate with your existing records? <i>If no, you'll need to ask the farm mapping software supplier how you would link the existing data with the mapping software.</i>			
	<i>Members of primary production sectors are likely to already be using farm mapping software and/or farm operation recording software. It would be worthwhile looking at industry sector newsletters and other literature, and doing a web-search of relevant industry both in Australia and overseas to see what others within your industry are doing and using. What information are they recording? How are they using the information? What software are they using?</i> <i>Compile a list of what you think is relevant to you. Also, make a list of the software names you come across.</i>			
	<i>Now that you have a little more information on the topic of farm mapping, compile your own list of what you think you want to record, and what aspects of your soils, vegetation, and stock or crops, and land and business practices you would like to understand better.</i>			
	<i>Note down what it is you want to do with the farm mapping software.</i>			
	<i>You've now defined what you want your farm mapping software for, and what you want to do with it. You now have the information you need to look at the available software and ask the right questions of the salesperson.</i>			

Step 2	Can the software undertake the desirable farm mapping tasks?	Yes	No	Notes
	<i>Review Table 6 and determine if it lists all the functions you are interested in as well as those outlined here. If not, add the additional functions to the list that you require. Once you have compiled your list (Table 6 with your additions), work through the list with each of the software you are considering to determine which software can do the things you require.</i>			
	<i>If possible, have a chat with others who may be using farm mapping software or know something about them.</i> <i>Ask them why they purchased their software?</i> <i>What do they like or dislike about their software?</i> <i>Does it do everything they want it to do?</i> <i>What other things would they want to do now that they know more about computer mapping?</i> <i>Knowing what they now know, would they buy the same software or purchase another one?</i>			
	<i>After you have spoken to a few people, review your description of what you want your farm software to do. Add anything else to the list in Table 6, and contact with the farm mapping software companies or visit their website to find out what they say about their software.</i> <i>See if they say their software does everything you want to do.</i> <i>Can their software do everything on your list of desirable mapping tasks?</i>			
	<i>A number of the software companies provide downloadable evaluation licences of their software so that you can have a go at using one, or you can contact them to send you an evaluation copy.</i> <i>It is worthwhile getting one evaluation licence to start with and loading it on your computer.</i> <i>This experience will provide you with further insight about what is involved with using mapping software.</i> <i>Does the User manual help you? Look for a Tutorial guide or "How to get started" guide and have another go.</i>			

Step 3	Determine the software company's methods of training in the software's use; the type of support that is provided; and the type and style of the user manual. Consider if you believe that the approach is suited to your needs	Yes	No	Notes
	<i>On your first attempt at using farm mapping software you identified what assistance, support or training you'll probably need to use the software. What does the software company offer in this area?</i> <i>Are there other organisations that could assist you? There are likely to be a number of government and/or industry opportunities around that might assist you.</i>			
	<i>You need to factor this aspect into your cost and time budget for getting up and using the software.</i>			

Step 4	Determine the recommended minimum computer configuration that is required to operate the software.	Yes	No	Notes
	<i>Have a look at the information you have on the various software programs and find out what each of the software you are considering require in computing power. If not obvious, look for something that says Minimum system requirements. It could be in small print.</i> <i>You should see something along the lines of:</i> <i>Operating System: Windows XP Home</i> <i>Processor: Pentium D 3 Ghz</i> <i>RAM: 512Mb</i>			
	<i>If you already have a computer check to see if this matches your computer. If it doesn't you may need to get advice to determine if your computer is better or worse than the minimum requirement.</i>			
	<i>You may have to upgrade your computer, or you'll now know what to ask your computer supplier to give you a quote for.</i>			

Step 5	If you are using peripheral devices such as GPS, can the software link directly, or is the data easily imported into the farm mapping software?	Yes	No	Notes
	<i>If you use a GPS, or have other equipment you want your mapping software to link up to, find out which mapping software can handle this.</i>			
	<i>Does it link by direct cable or will you need to download your data onto a memory stick and transfer it to your computer running the farm mapping?</i>			
	<i>Do you need a paddock/mobile mapping solution? Several companies offer additional software for palm pilots or similar devices.</i>			

Step 6	Determine the software upgrade frequency and cost of upgrade, or maintenance cost if available. Determine what the cost of upgrading the software if it is not maintained at the current version.	Yes	No	Notes
	<i>New versions of software are released every so often and each company has a different way of distributing and charging for the new versions. There are quite a few models that can be used, so ask the software company.</i>			
	<p><i>Some common upgrade models are as follows:</i></p> <ul style="list-style-type: none"> <i>You are able to download via the internet minor or progressive upgrades of the same version and load them onto your computer. But new version may be different.</i> <i>Sometimes you have to purchase the upgrade at either a reduced price if you already have a version, or full price.</i> <i>Enter into a maintenance agreement that has an annual subscription and you receive all upgrades while your agreement is current.</i> 			

Step 7	Determine if there is suitable data (imagery and/or map) over the property for the desired application and find out the cost of the data.	Yes	No	Notes
	<i>You need data to be able to use mapping software. This data can come from a number of sources. If you are lucky enough to be in a region with good digital data then it may be just a matter of locating a supplier and purchasing the data over your property. There are now a lot of free or very cheap datasets available. Make sure that it has enough detail so that it will be useful for your property. You may need to enter a lot of data for your own property which typically takes some time initially.</i>			
	<i>An image (aerial photograph, satellite image) provides a good base to start with, especially if there is only digital map data with poor details over your property.</i>			
	<i>You'll have to factor in the cost of data for use in the software. Since properties intending to use farm mapping software vary in size from viticulture measured in areas of hectares, to extensive pastoral properties described in square kilometres.</i>			

Step 8	Determine if and how farm mapping software fits into the farm business enterprise. How will computer system management be addressed? Estimate the overall cost in financial and time resources to purchase and implement the system.	Yes	No	Notes
	<i>By now you should have a pretty good idea about farm mapping software; what is involved; and, the time and dollars you will need to allocate.</i>			

Step 9	Determine if consultants would be more appropriate to engage to undertake particular aspects of the proposed system.	Yes	No	Notes
	<i>Can any of the aspects be undertaken for you by paying someone to do them for you?</i>			
	<i>In many cases it is worthwhile considering this as a viable option for aspects of the implementation and on-going use. One model some people have used is to have a consultant do all this for them and supply the required digital maps on a data viewer that you, the primary producer can use quite easily.</i>			
	<i>There a number of business models for implementing farm mapping into the farm enterprise, and they are evolving. They can include Natural Resource Management Groups, government agencies, and private advisory services.</i>			

Step 10	Determine the benefits gained against the initial and on-going costs of investing in farm mapping software.	Yes	No	Notes
	<i>Do you still want to implement a computer based farm mapping system on your property?</i>			
	<i>Are you going to purchase your own mapping system, or have someone else provide the service to you?</i>			
	<i>If you are purchasing the software (and hardware, and data, and training), then you'll need to have another serious go at looking at each of the software's capabilities, and which one best suits you're requirements including training (getting up and going) and support.</i> <i>You'll know what you want now, and have the right questions to ask.</i>			
	<i>It is likely that not one available system will be able to do all you think you want to do.</i>			

From the study's evaluation of farm mapping software undertaken, most farm mapping software assigned a 'medium level' category can undertake all the basic mapping functions required for farm mapping. While there are differences in the way they achieve the tasks, it is not so much the software, but the documentation and support mechanisms, and the financial and time resources that the individual is prepared to invest in the implementation and use of the software that will determine which is best suited to the individual.

Table 6 provides a list of desirable capabilities a farm mapping software should be able to do. In some cases the software may not be able to import or load a specific data format listed in Table 6. It is important to find out from the software salesperson that there is a way to load the data into the software. For example, a certain software program may not be able to import one format of digital line data; however, it can import another format. This indicates that the data can be loaded into the mapping software, but it will have to be either supplied in that required data format, or will need someone to reformat the supplied data into the required format.

Complete Table 6 by adding additional functions you have identified as desirable for your purposes as outlined in Step 2, Table 5, then under each software program you are considering, tick functions that each software has.

Table 6: Farm mapping decision matrix: desirable capabilities of farm mapping software programs.

SOFTWARE FUNCTIONS	Software 1	Software 2	Software 3	Software 4
INFORMATION AND DATA CAPTURE				
Display an aerial photograph or satellite image on base map				
Imports images – GeoTiff format				
Automatically recognises image registration from GeoTIFF file				
Imports images – ECW format				
Automatically recognises image registration from ECW format file				
Import vectors (digital line maps)				
Imports vectors - ArcView shape files				
ArcView shape file map projection information is recognised				
Imports vector - MapInfo files				
MapInfo file map projection information is recognised				
Import data other data files				
Draw areas (e.g. paddock boundaries, soil boundaries)				
Draw lines (e.g. fences, pipelines)				
Draw point for property features (e.g bores, pumps, buildings)				
Edit area, line and point data				
Edit attributes associated with area, line and point data				
Handles GDA94 map datum				
Handles MGA map projections				
Enter data for production, mapping and financial				
Locate and record natural resource (eg salt patches, erosion, flooding, etc)				
Record sampling information such as water quality samples				
Record inputs (fertiliser, chemical, etc)				
Record outputs (yield, stock numbers, quality, etc)				
Record field/paddock records/shed/operations				
Import crop yield data from a range of yield monitors				
Attribute handling/viewing (allows user to select and see information about areas, lines and points)				
Attribute colouring (allows user to select and change colouring of areas, lines and points)				
Able to add text annotation				
INFORMATION AND DATA INTEGRATION				

SOFTWARE FUNCTIONS	Software 1	Software 2	Software 3	Software 4
INFORMATION AND DATA CAPTURE				
Turn layers of information on and off				
Overlay different data layers (eg paddock boundaries over aerial photos)				
Determine proximity to other properties / towns (e.g. odour, noise, etc)				
Integrate with national programs such as NLIS (National livestock identification scheme)				
INFORMATION AND DATA ANALYSIS				
Detect changes overtime in fields/paddocks				
Make measurements (e.g. length of fence or area of paddock)				
Calculate costs per field/paddock				
Map changes in vegetation cover over time				
Track pesticide group usage over time & area				
Calculate stocking rates				
Analyse crop yield or crop image data				
Compare between different data layers (eg stocking rate and weight gains per paddock; crop yield and crop imagery)				
INFORMATION AND DATA REPORTING				
Print a paper map				
Produce a report on crop/stock performance over time				
Output information to variable rate applicator				
Output map for compliance issues e.g. Vegetation, pest management, environmental compliance				
Map for Environmental Management Systems (EMS) or Farm Managements System (FMS)				
Map for land and water management plans or water licence requirements				
Map for contractors/employees showing where work is to be done				
SUPPORT				
Are there other local users or training advisors who could assist with using the software				
Have printed user manuals				
OPEN STANDARDS				
Export ma data to Arc Shape and/or MapInfo				
INTEROPERABILITY				
Link or download data from a GPS				

6. Discussion and implications

Results of the survey undertaken as part of this study, suggest that although nearly 60% of primary producers use computers, only one third of survey respondents currently use farm mapping software, but that 80% of those not currently using mapping software would consider it in the future. The information contained in this report should make it easier for all primary producers to select and use farm mapping software. This will benefit primary producers' triple bottom line (environmental, social and economic), as well as provide Government and auditing bodies with better reports. The decision matrix presented for selecting mapping software provides a process by which farm management mapping requirements can be achieved and reported with ease, and with less assistance.

The survey's findings should provide guidance to software providers on primary producers' current and future needs and the software requirements to meet these needs.

Anecdotal evidence obtained from the non-producer survey also revealed that some primary producers purchased mapping software (assisted through funding from various sources) with the intention of using it, but failed to actually use the software. This indicates that it would be informative to know more about the adoption rate for using farm mapping software where purchases have been assisted through funding.

6.1 Conventional maps

All primary producers use some form of map in the management of their property. The most common is likely to be the mental map where they have a good understanding of the location of the properties various paddocks, infrastructure (e.g. fences, bores, pumps, and tracks), and over the top of this is other local knowledge (e.g. soil types, vegetation, paddock response to different seasons or irrigation regimes) they have gained from their years on their property. The mental map provides an association of property features based on a known relationship to each other usually in the context of the location of the "homestead".

The mental map can be developed further by the drawing of a simple graphical ("mud") map which shows the relative location of property infrastructure and other actual or perceived attributes associated with the management of the property. This graphical map may not be drawn to actual scale, but has all the relevant property attributes in positions relative to each other.

A properly scaled printed map is the next development of a farm map, where all property attributes are graphically represented at true scale and related in true geographic position. A variation of this map form includes the use of an image (aerial photograph or satellite image) as a backdrop which provides "context" both for visualisation and for identification and drawing of property attributes. However, when an image is used which has not been geographically corrected, while it is consistent in relation to the image; true location, direction and areas may be distorted.

Clear plastic overlays can be used in conjunction with a scaled map to develop farm map layers of property attributes/features. In so doing, the complexity of the farm map has increased from a "mental" location map, to a multi-attributed layer map. The skills and technical knowledge required to develop and use the map information at each level increases. The more complex the mapping, the more tools that are required to develop the maps; the more skills required to use those tools; and the more time is required to be allocated to the mapping.

6.2 Computer Mapping

Complexity is again added when the mapping advances to the computers. There is then the need to learn to use the computer, the software, and the technical aspects of mapping that were not previously required. In addition, there is a need to know how to manage the computer, the property information, and data that is stored on the computer. The time requirements have also increased.

The use of Geographic Information Systems (GIS) introduces more complexities. If designed correctly, GIS can provide a useful tool for recording, analysing, modelling, and scenario planning. Again the complexity has increased since in addition to mapping software concepts, there is now a database concept that must be gained.

In addition to mapping, new data sources such as Global Positioning Systems (GPS); handheld measuring instruments; ground based and airborne sensors/scanners are also becoming more available. Farm equipment is now providing information on application rates, yield monitoring, etc, which can be integrated with map data/information.

6.3 Software use

Use is very dependent on the user, and the level of computer literacy impacts on the adoption of farm mapping software. The term “ease of use” is related to the individual using the software. Everyone has different ways of learning and understanding, so what one person might find easy, another will find difficult. Most software has adopted a Windows display and option selections, so issues with the software interface are becoming less important than previously. The training and support (including software user manuals) that is associated with the software is extremely important. Many comments suggested that the adoption and use of farm mapping software was very much dependent on the individual’s ability to adapt to technology, ease of use of the software manual, and local support. It was likely that producers might not be able to get to training; that some software training approaches would not be suited; and the cost and time to attend training may be deterrents. It was suggested that when users are not comfortable with their initial attempts with the software, they were likely to discontinue or try other farm mapping software. Other comments suggested that while a male partner might be interested in the mapping aspects, in practice the actual operation of the software would fall on the female partner in the family farming enterprise.

Software user manuals and the shift from printed manuals to digital and/or on-line versions was seen as a draw-back to using the software, based on the idea that most primary producers would find printed manuals more useful.

While not strictly software use, the configuration of the computer hardware required by the software was an important consideration. Older computers and operating systems may not be suitable for more recently developed software. A new computer might be required where the operating system, processing speed, hard drive storage space, and/or memory (RAM) of the existing computer is not adequate to run the software.

6.4 Software additional issues

Additional issues raised in the interviews fell into two distinct areas. The first was related to the integration of the software with other systems, known as interoperability. Examples of this are connection with a GPS, or variable rate technologies, where open standards are important to allow data to move easily between different systems. The ability to provide data easily to outsiders and visa versa is an important issue.

Issues related to software updates/upgrades can also become important. There are a number of models used by software companies, and most incur additional cost above the initial cost of the software. A maintenance scheme is where the user pays an annual fee to receive updates as they become available. Some are shipped by CDs and others as downloads from the company’s website. The second is very cost effective for the software company, but not all rural Australia has suitable internet bandwidth for

this. As software becomes outdated, users will have difficulties with data formats and ability to provide and receive datasets to or from other parties.

Another issue is the longevity of software. What is more important from a primary producer's perspective is that the data and information from one mapping software program can be easily transferred to another so that the user can maintain their data and information.

There was a general view that internet bandwidth was still a big issues in rural Australia, especially when considering the size of some data that may need to be moved around. This is also a limitation on internet mapping services which are a possibility for primary producers, although the view that producers prefer "full control" of their mapping and data on their own computer was expressed several times. However, there were examples provided that some primary producers, particularly in the pastoral sector were using Google Earth TM as their basic property mapping tool.

6.5 Data issues

Data formats are becoming less of an issue as data import and export routines are increasingly capable of handling the more common data formats. Most (but not all) software evaluated for this study could handle coordinate aspects of datasets specific to Australia.

Metadata is information about the data. It includes information such as: the data name; the data format; coordinate information of the dataset; source of data; and, how the data was collected or generated. Metadata is an important aspect of digital map data and Australian guidelines have been developed (ANZLIC, 2001) to assist users with implementing metadata within their organisations. However, if the mapping software does not have some form of metadata built in, the ANZLIC guidelines can be confusing for the average person. The best form of keeping metadata for the primary producer is to keep documentation (digital or hardcopy) covering: the name of each data files (including the computer sub-directory in which it is stored); date it was created or sourced; where and how it was created or sourced; data format information, and a general note that makes sense of what it can be used for.

Information resolution or content is important when considering what data is required for the property application. Many current regional datasets lack the detail required for property mapping and management. In many situations, aerial photography or satellite imagery will be required to establish the base layers for property mapping. Because different aerial photography and satellite imagery display different detail, the primary producer must be aware of the detail level required and make decisions on their needs. Assistance with this information can usually be obtained from various farm consultants or data vendors. Data availability is related to information resolution. Digital map data is often available free from Federal and State governments, but this data may not be appropriate for any given application. Determining what is available and obtaining the data can be a challenge.

Data management is a very important issue that primary producers must take into consideration when using mapping software. Keeping metadata is one aspect of data management, but another more important aspect is that of data backup. To ensure that their considerable investment in time and financial resources is not lost, the primary producer should regularly make back-ups of their computer data.

Besides backing up farm data, most producers struggle with simple data storage. The experience of the project team suggests that a massive amount of data is lost with computer upgrades, by not knowing where it is stored. The outdated of software has also led to considerable problems, where new software will not easily read data stored in old software formats.

Licensing of corporate and government owned data is becoming increasingly important, and producers will need to agree to these conditions when purchasing data.

A good reference with respect to data management is the Natural Resources Information Management Toolkit (<http://www.nlwra.gov.au/toolkit>) a joint initiative of the National Land & Water Resources Audit and ANZLIC – The Spatial Information Council. While not designed for primary producers, this toolkit provides valuable background information for those primary producers who wish to improve their understanding of mapping or spatial information.

6.6 Business considerations

The implementation of farm mapping software is a business decision involving considerations of time and financial resources, including the direct costs involved. Implementation of farm mapping software may include:

- purchase of a new computer or upgrade of an existing system;
- cost of the farm mapping software;
- purchase of data; and
- purchase of training and/or support services.

The other major consideration is the time that must be allocated initially to learn the software, set up the property database, load or generate property map layers, and enter current farm records. The ongoing time requirement for maintenance, entry of new data, and generation of reports is also important.

Computer system management is another aspect that is easily overlooked when embarking on computer use. Users need at least some basic knowledge of the management of the computer, and especially the data. Simple tasks like regular data backup are often overlooked.

Farm mapping is a time consuming technical task, and the knowledge and skills level required increases with the complexity of the application. Growers need to think carefully about whether to attempt it all themselves, or contract appropriate skilled persons or consultants as required for particular aspects. Bramley (2004) made the sensible observation that: “...*the majority of farmers have better things to do than spend hours at the PC struggling with the vagaries of GIS, whether these are other farm tasks, playing with the kids or watching the footy.*”

These aspects are all things that the primary producer should consider when purchasing and implementing a farm mapping software system.

Delaney and Baker (2006) documented their observations of farm mapping software use by primary producers in the King Island EMS Pilot Project:

“Although the majority of participants were keen to use the computer-based mapping software their ability to utilise the software has been impeded for a number of reasons.

- (1) Not everyone had the basic computer skills to get optimum use from the program.*
- (2) Many participants’ computers were relatively old or poorly maintained (e.g. compromised by viruses etc) and as a consequence did not allow the efficient operation of the mapping software.*
- (3) There is only one part-time computer technician/information technology person working on the Island and this person is often unavailable. As a consequence some participants have had to wait several months to have computer hardware/software problems resolved.*
- (4) Although some older participants could readily see the potential benefits of the farm mapping software, they lacked the confidence to use it effectively.”*

7. Recommendations

If a better understanding of primary producer farm mapping software requirements and adoption rates and issues on an industry by industry basis is required, it is recommended to undertake a more comprehensive study with the resources (financial and time) to obtain larger more representative sample sizes across primary production industry groups for both primary producers and non-producers. Any such study should consider the seasonal influences on primary producer time availability to complete such a survey.

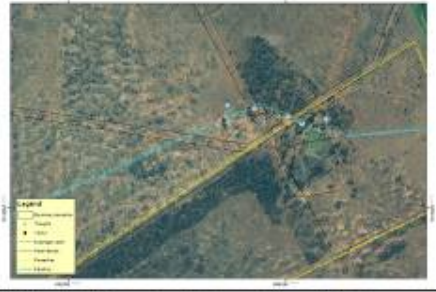
There have been and are a number of funding programmes implemented around Australia which have assisted or are assisting primary producers to purchase farm mapping software. There is a need to determine how effective these programmes have been; which primary producers have used or are actually using the software; what are/have they used the software for; why they have not or have ceased to use the software; document where and why there have been true adoption or lack of adoption of the use of the farm mapping software.

In relation to the final report, we recommend that:

1. The decision matrix and software evaluation be reformatted and published for wide distribution to Australian primary producers, CMA's and producer groups to assist with the selection of farm mapping software.
2. Results of the primary producer survey be made available to survey respondents and software companies free of charge.

Appendix A: Project promotional flier

Farm Mapping Software in Australia



Digital aerial photography and high resolution satellite imagery are combined with property information within farm mapping software to produce property maps.

An increasing number of primary producers are considering using farm mapping software to assist in property planning and management. This has resulted from:

- Increasing government requirements for property mapping;
- Advances in farm equipment, and crop and herd recording utilising GPS and map information; and
- Increasing availability of map related data and information such as satellite imagery and government digital map data.

Primary producers are finding themselves asking:

Do I need a farm mapping package?

What do I need my farm mapping software to do?

How do I decide which farm mapping package is best for me?



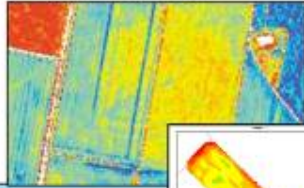
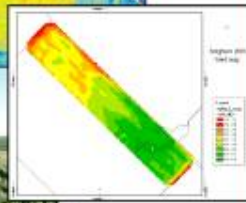
With considerable support from the **Rural Industries Research and Development Corporation (RIRDC)** (www.rirdc.gov.au), **CTF Solutions** and **Spatial 3i** are jointly undertaking a project that will address questions primary producers may have when considering farm mapping software.

Face-to-face and telephone interviews will be used to identify farm mapping software needs in a wide range of industries including grains, cotton, horticulture, intensive and extensive livestock, and sugar. This information, along with technical information on available datasets and data formats, will be assessed against a number of commercially available mapping software packages.

The end result will be an easy-to-use approach to assist primary producers in making their decision on the most suited mapping software for them.

The project report will be a publicly available and will outline assessment methods that will allow primary producers to:

- assess their farm mapping software needs; and
- assess farm mapping packages against their needs.


Field variability maps produced from digital satellite imagery and yield monitoring data are combined with other information in farm mapping software to support primary producer decision making.

If you would like further information on this project, or would like to participate in the primary producer survey, please contact:


Blue Perkowicz of CTF Solutions:
 Telephone: (07) 4662 3913
 Email: blue@ctfsolutions.com.au

or

Bernard Fitzpatrick of Spatial 3i:
 Telephone (07) 3314 6660
 Mobile: 0404 040 660
 Email: bernard@spatial3i.com



CTF SOLUTIONS is the only agricultural consultancy group **SPECIALISING IN CONTROLLED TRAFFIC FARMING** adoption across Australia. We have over 120 years combined experience in the adoption of sustainable farming systems, and have helped hundreds of Australian farmers start the journey of CTF. www.ctfsolutions.com.au



Spatial 3i is a consulting company specialising in spatial information integration and interpretation, image processing and image analysis to assist clients to make more informed decisions through the appropriate use of spatial information and technologies. www.spatial3i.com

Appendix B: Primary producer survey

Farm Mapping Software in Australia - Primary Producer Survey

Primary producers are being introduced to a growing number of computer software that can display and manipulate map information. But how does someone determine their mapping needs and which software package is suitable for their needs?

CTF Solutions Pty Ltd (www.ctfsolutions.com.au) and Spatial 3i Pty Ltd (www.spatial3i.com) are undertaking a project that will survey primary producer's mapping requirements. A straight forward approach will be developed that will allow a primary producer's identified on-farm mapping needs to be compared with various mapping software the primary producer is considering for use.

As a primary producer, your views are important to us. We would appreciate if you could fill in the following survey in relation to you.

Thank you for taking your time to complete this survey.

Kind regards,

Farm Mapping Software Team

CTF Solutions and Spatial 3i

This project is being supported through funding from the Rural Industries Research and Development Corporation (RIRDC) (www.rirdc.gov.au).

PLEASE RETURN BY 22 JUNE 2007

Personal Profile (please tick ✓)

Name (optional)	
Address (Optional)	
Email (Optional)	
Please send me results of study	Yes No
I am an	Irrigated farmer Dryland farmer Horticulture grower (vineyard and orchards) Horticulture grower (other) Wool / sheep grazier Beef grazier Other extensive grazier (goats, etc) Intensive livestock producer (poultry, pigs) Small crops / market gardener Sugar cane farmer Other (please provide)
My operation is	Single property Multiple properties in same district Multiple properties in multiple districts
My operation is	Owner occupied Corporate Joint-share farming

Approx area (Hectares)	
Farmer group or nearest town	
State (please circle)	ACT / NSW / Qld / Vic / Tas / NT / SA / WA.
I currently use mapping software?	Yes No
Name of mapping software used?	
Do you find your current mapping software easy to use?	Very easy Somewhat easy Not sure Difficult Very difficult
Does your current mapping software do all you want?	Does all I want and more Does all I want Not sure Does most things I want Does very few things I want
What is missing from your farm mapping software?	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
While I currently do not use mapping software I would consider using it for my operation.	Yes No
I would prefer a consultant to undertake my mapping needs rather than do them myself.	Yes No

I would like a computer mapping program to be able to do:
(Please tick ✓ Yes, No, Maybe, N/A)

MAPPING		Yes	No	Maybe	N/A
M1	Display an aerial photograph or satellite image on base map				
M2	Draw lines (such as fences, pipelines, soil types, and field boundaries)				
M3	Draw locations of property features (such as bores, pumps, buildings, soil sample points)				
M4	Make measurements (such as length of fence or area of paddock)				
M5	Link or download data from a GPS				
M6	Import data from other agencies (vegetation, property boundaries, soil maps, urban areas, etc)				
M7	Produce a map showing directions to the property				
M8	Print a paper map				
M9	Have easy to use Software manuals				
M10	Have a good support mechanism				
M11	Other local users to assist each other with using the software				
M12	Detect changes overtime in fields/paddocks				
M13	Turn layers of information on and off				
M14	Overlay different data layers (eg paddock boundaries over aerial photos)				
M15	Property planning (planning changes to the farm)				
FINANCES		Yes	No	Maybe	N/A
F1	Calculate costs per field/paddock				
F2	Enter data for production, mapping and financial ONLY ONCE				
NATURAL RESOURCE MANAGEMENT		Yes	No	Maybe	N/A
N1	Show catchment information from government departments or catchment groups (eg location of rivers, soils, monitoring sites, etc)				
N2	Locate and record natural resource monitoring (eg salt patches, erosion, flooding, etc)				
ENVIRONMENT		Yes	No	Maybe	N/A
E1	Record sampling information such as water quality samples				
E2	Map changes in vegetation cover over time				
E3	Track pesticide group usage over time & area				
E4	Determine proximity to other properties / towns (e.g. odour, noise, etc)				

PRODUCTION		Yes	No	Maybe	N/A
P1	Calculate stocking rates				
P2	Record inputs (fertiliser, chemical, etc)				
P3	Record outputs (yield, stock numbers, quality, etc)				
P5	Record field/paddock records/shed/operations				
P6	Produce a report on crop/stock performance over time				
P7	Output information to variable rate applicator				
P8	Import crop yield data from a range of yield monitors				
P9	Analyse crop yield or crop image data				
P10	Integrate with national programs such as NLIS (National livestock identification scheme) or "Pastures from Space"				
P11	Compare between different data layers (eg stocking rate and weight gains per paddock; crop yield and crop imagery)				
COMPLIANCE		Yes	No	Maybe	N/A
C1	Output map for compliance issues e.g. Vegetation, pest management, environmental compliance				
C2	Map for Environmental Management Systems (EMS) or Farm Managements System (FMS)				
C3	Record water use against Water Licence				
C4	Map for land and water management plans or water licence requirements				
SOCIAL		Yes	No	Maybe	N/A
S1	Map for contractors/employees showing where work is to be done				
S2	Other workplace health and safety requirements				
OTHER (please list anything else you feel you would require in a farm mapping system)					
O1					
O2					
O3					
O4					

Post back to: PO Box 1088, Dalby QLD 4405, Fax back to: (07) 4669 8537,

Or email response to: blue@cfjsolutions.com.au

PLEASE RETURN BY 22 JUNE 2007

Appendix C: Non-Producer Survey

All answers provided to the following questions remain Commercial in Confidence between yourself, CTF Solutions and Spatial 3i. Comments may be summarized within the RIRDC Report but will not be attributed to any individual without their written approval.

PERSON/s:

ORGANISATION/s:

Address	
Email	
Please send me results of study	Yes / No

Demographics

1. Which one of the following best describes your association with primary producers <i>(choose only one)</i>
<input type="checkbox"/> Public Sector production advisor/consultant (includes land management & production) <input type="checkbox"/> Public Sector spatial data and/or technology advisor/consultant <input type="checkbox"/> Public Sector Research & Development <input type="checkbox"/> Private Sector production advisor/consultant (includes land management & production) <input type="checkbox"/> Private Sector spatial data and/or technology advisor/consultant <input type="checkbox"/> Private Sector Research & Development <input type="checkbox"/> Other <i>(please provide)</i>
2. What primary production groups do you have greatest association with? <i>(choose more than one)</i>
<input type="checkbox"/> Irrigation farmers <input type="checkbox"/> Dryland farmers <input type="checkbox"/> Horticulture growers (vineyard and orchards) <input type="checkbox"/> Horticulture growers (other) <input type="checkbox"/> Wool / sheep graziers <input type="checkbox"/> Beef graziers <input type="checkbox"/> Other extensive graziers (goats, etc) <input type="checkbox"/> Intensive livestock producers (poultry, pigs) <input type="checkbox"/> Small crops / market gardeners <input type="checkbox"/> Sugar cane farmers <input type="checkbox"/> Other <i>(please provide)</i>
3. What types of groups do you have dealings with?
<input type="checkbox"/> Single property owner <input type="checkbox"/> Producer groups <input type="checkbox"/> Corporate or company owned properties <input type="checkbox"/> Other <i>(Please provide)</i>
4. What is the range of the size of the properties you have dealings with?
5. What geographical region are the primary producers you usually have dealings with?

All answers provided to the following questions remain Commercial in Confidence between yourself, CTF Solutions and Spatial 3i. Comments may be summarized within the RIRDC Report but will not be attributed to any individual without their written approval.

6. Do you currently use mapping or GIS software?
Yes / No
7. What mapping or GIS software do you use?

Farm Mapping

1. From your experience do you believe that primary producers should be using maps?
Yes / No
<i>Please provide some background to your response:</i>
2. Rank the importance (from 1 most to 8 least) of the following map uses.
<input type="checkbox"/> Infrastructure (e.g. fences, bores, yards, sheds, tracks) <input type="checkbox"/> Finances (e.g. costs related to fertilizer application, drenching) <input type="checkbox"/> Natural Resource Management (e.g. location of native vegetation, drainage) <input type="checkbox"/> Environment (e.g. herbicide and pesticide use) <input type="checkbox"/> Crop or herd management <input type="checkbox"/> Compliance (e.g. Government, or Product Compliance/Quality Assurance) <input type="checkbox"/> Occupational Health and Safety (e.g. location of hazards, maps for employees or contractors) <input type="checkbox"/> Other (Please specify)
3. From your experience do you believe that primary producers should be using mapping software?
Yes / No
<i>Please provide some background to your response:</i>

All answers provided to the following questions remain Commercial in Confidence between yourself, CTF Solutions and Spatial 3i. Comments may be summarized within the RIRDC Report but will not be attributed to any individual without their written approval.

What capabilities should be in farm mapping software, and what have you seen primary producers using?

		farm mapping software should			I have observed farmer using (place tick)
MAPPING		Yes	No	Maybe	
M1	Display an aerial photograph or satellite image on base map				
M2	Draw lines (such as fences, pipelines, soil types, and field boundaries)				
M3	Draw locations of property features (such as bores, pumps, buildings, soil sample points)				
M4	Make measurements (such as length of fence or area of paddock)				
M5	Link or download data from a GPS				
M6	Import data from other agencies (vegetation, property boundaries, soil maps, urban areas, etc)				
M7	Produce a map showing directions to the property				
M8	Print a paper map				
M9	Have easy to use Software manuals				
M10	Have a good support mechanism				
M11	Other local users to assist each other with using the software				
M12	Detect changes overtime in fields/paddocks				
M13	Turn layers of information on and off				
M14	Overlay different data layers (eg paddock boundaries over aerial photos)				
M15	Property planning (planning changes to the farm)				
FINANCES		Yes	No	Maybe	Farmers use
F1	Calculate costs per field/paddock				
F2	Enter data for production, mapping and financial ONLY ONCE				
NATURAL RESOURCE MANAGEMENT		Yes	No	Maybe	Farmers use
N1	Show catchment information from government departments or catchment groups (eg location of rivers, soils, monitoring sites, etc)				
N2	Locate and record natural resource monitoring (eg salt patches, erosion, flooding, etc)				
ENVIRONMENT		Yes	No	Maybe	Farmers use
E1	Record sampling information such as water quality samples				
E2	Map changes in vegetation cover over time				

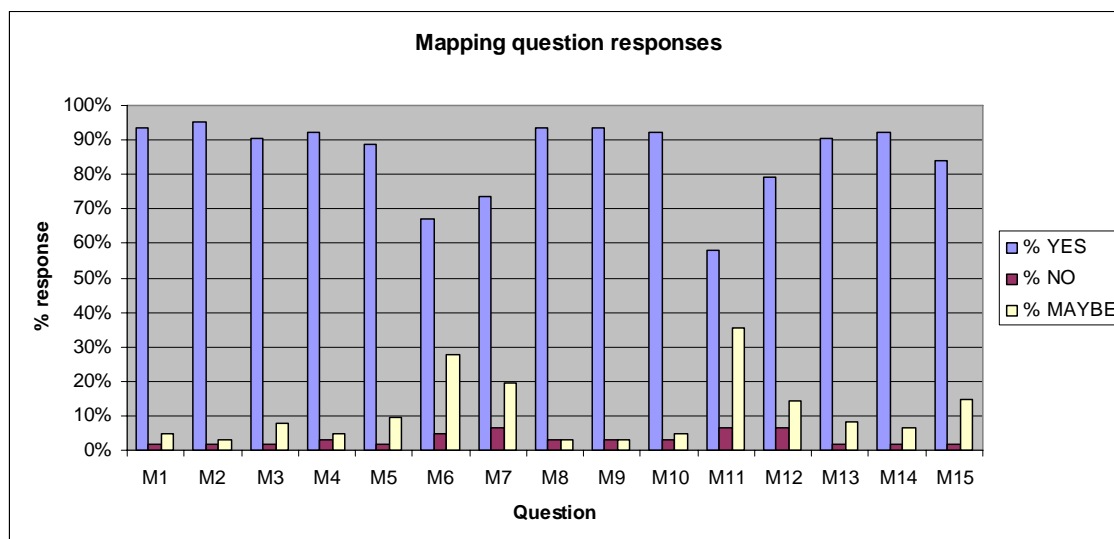
All answers provided to the following questions remain Commercial in Confidence between yourself, CTF Solutions and Spatial 3i. Comments may be summarized within the RIRDC Report but will not be attributed to any individual without their written approval.

E3	Track pesticide group usage over time & area				
E4	Determine proximity to other properties / towns (odour, noise, etc)				
PRODUCTION		Yes	No	Maybe	Farmers use
P1	Calculate stocking rates				
P2	Record inputs (fertiliser, chemical, etc)				
P3	Record outputs (yield, stock numbers, quality, etc)				
P4	Record field/paddock records/shed/operations				
P5	Produce a report on crop/stock performance over time				
P6	Output information to variable rate applicator				
P7	Import crop yield data from a range of yield monitors				
P8	Analyse crop yield or crop image data				
P9	Integrate with national programs such as NLIS (National livestock identification scheme) or "Pastures from Space"				
P10	Compare between different data layers (eg stocking rate and weight gains per paddock; crop yield and crop imagery)				
COMPLIANCE		Yes	No	Maybe	Farmers use
C1	Output map for compliance issues e.g. Vegetation, pest management, environmental compliance				
C2	Map for Environmental Management Systems (EMS) or Farm Managements System (FMS)				
C3	Record water use against Water Licence				
C4	Map for land and water management plans or water licence requirements				
SOCIAL		Yes	No	Maybe	Farmers use
S1	Map for contractors/employees showing where work is to be done				
S2	Other workplace health and safety requirements				
OTHER (please list anything else you feel you would require in a farm mapping system)		Yes	No	Maybe	Farmers use
O1					
O2					
O3					

Appendix D: Detailed Survey Results.

To appropriately use the graphs and tables presented in Appendix D, the Questionnaires presented in Appendices B and C should be referred to.

Appendix D Figure 1: Primary Producer –Software functions - Mapping category.

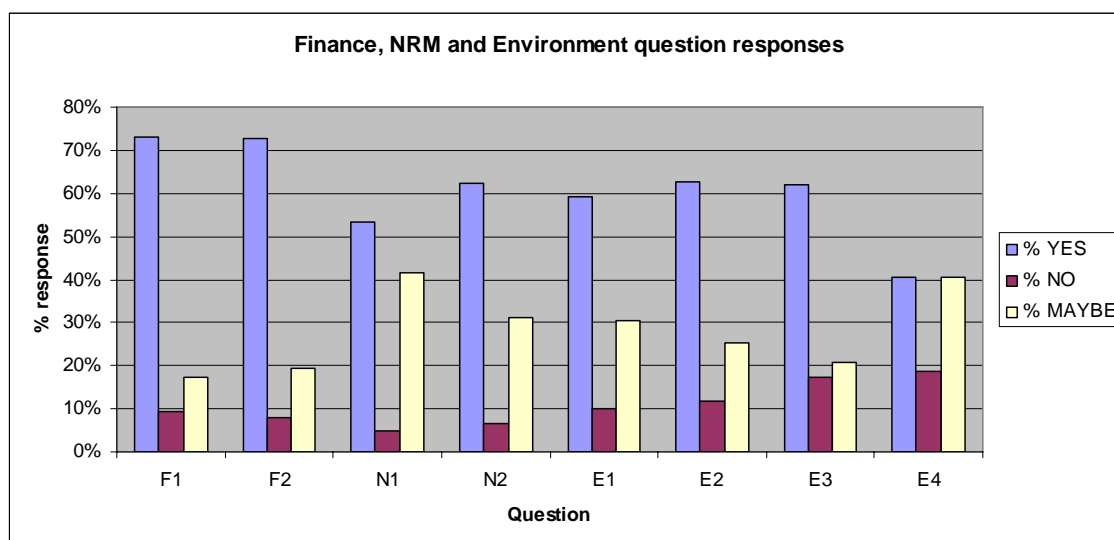


QUESTIONS

M1 – Display and aerial photo or image on a map
M2 – Draw lines
M3 – Draw locations of property features
M4 – Make measurements
M5 – Link or download data from a GPS
M6 – Import data from other agencies
M7 – Produce a map showing directions to the property
M8 – Print a paper map

M9 – Have easy to use software manuals
M10 – Have a good support mechanism
M11 – Other local users to assist with software
M12 – Detect changes over time in paddocks
M13 – Turn layers on and off
M14 – Overlay different data layers
M15 – Property planning

Appendix D Figure 2: Primary Producer –Software functions – Finance, NRM, and Environment categories.



QUESTIONS

F1 – Calculate costs/paddock

F2 – Enter data for production, mapping and finance only once

N1 – Show catchment information

N2 – Locate and record natural resource monitoring

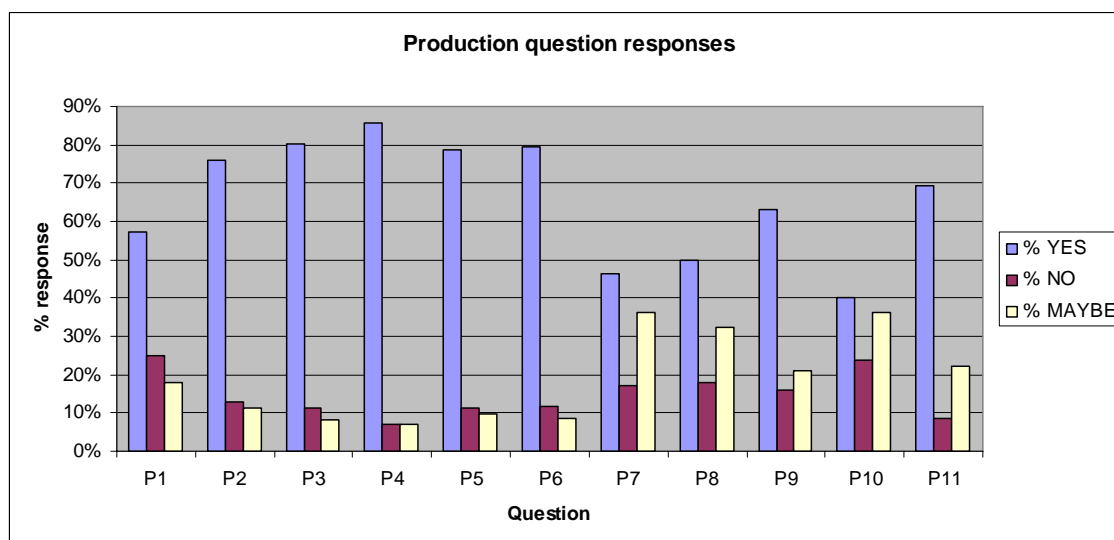
E1 – Record sampling such as water quality

E2 – Map changes in vegetation over time

E3 – Track pesticide use over time

E4 – Determine proximity to other properties/towns

Appendix D Figure 3: Primary producer – Software functions –Production category.



QUESTIONS

P1 – Calculate stocking rates

P2 – Record inputs

P3 – Record outputs

P5 – Record operations

P6 – Produce a report

P7 – Output information to a vari-rate applicator

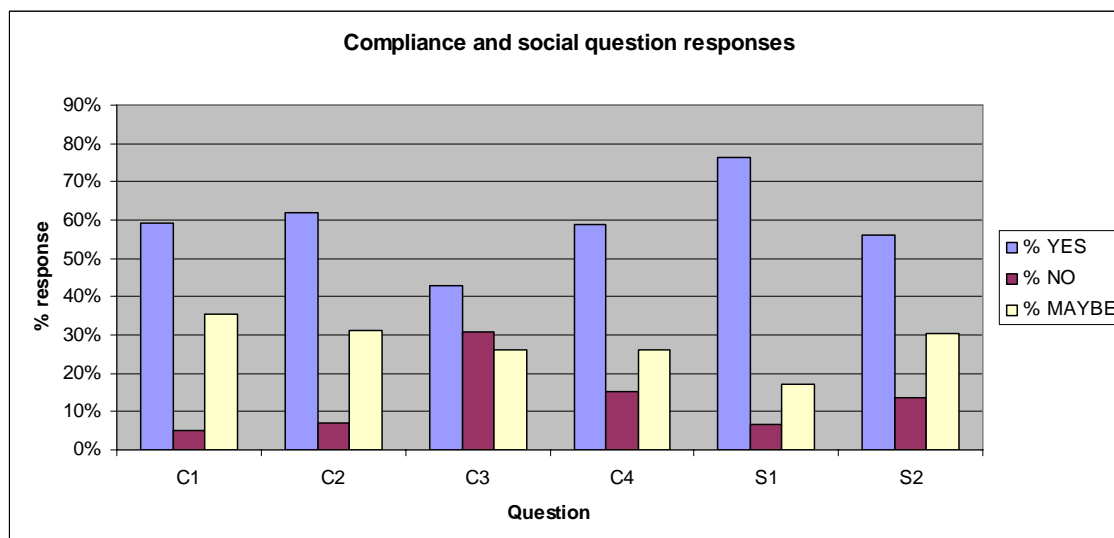
P8 – Input data from yield monitors

P9 – Analyse crop yield data or crop image data

P10 – Integrate with NLIS

P11 – Compare between data layers (eg crop yield and imagery)

Appendix D Figure 4: Primary Producer – Software functions –Compliance and Social categories.



Note: Some respondents did not rank individual uses from 1 to 8, or gave a number of uses the same rank. Since a respondent had associations with a number of primary producer groups, respondents were counted as a sample per primary producer group. As such, there were 104 samples from 34 respondents.

QUESTIONS

C1 – output a map for compliance issues

C2 – map for EMS or FMS

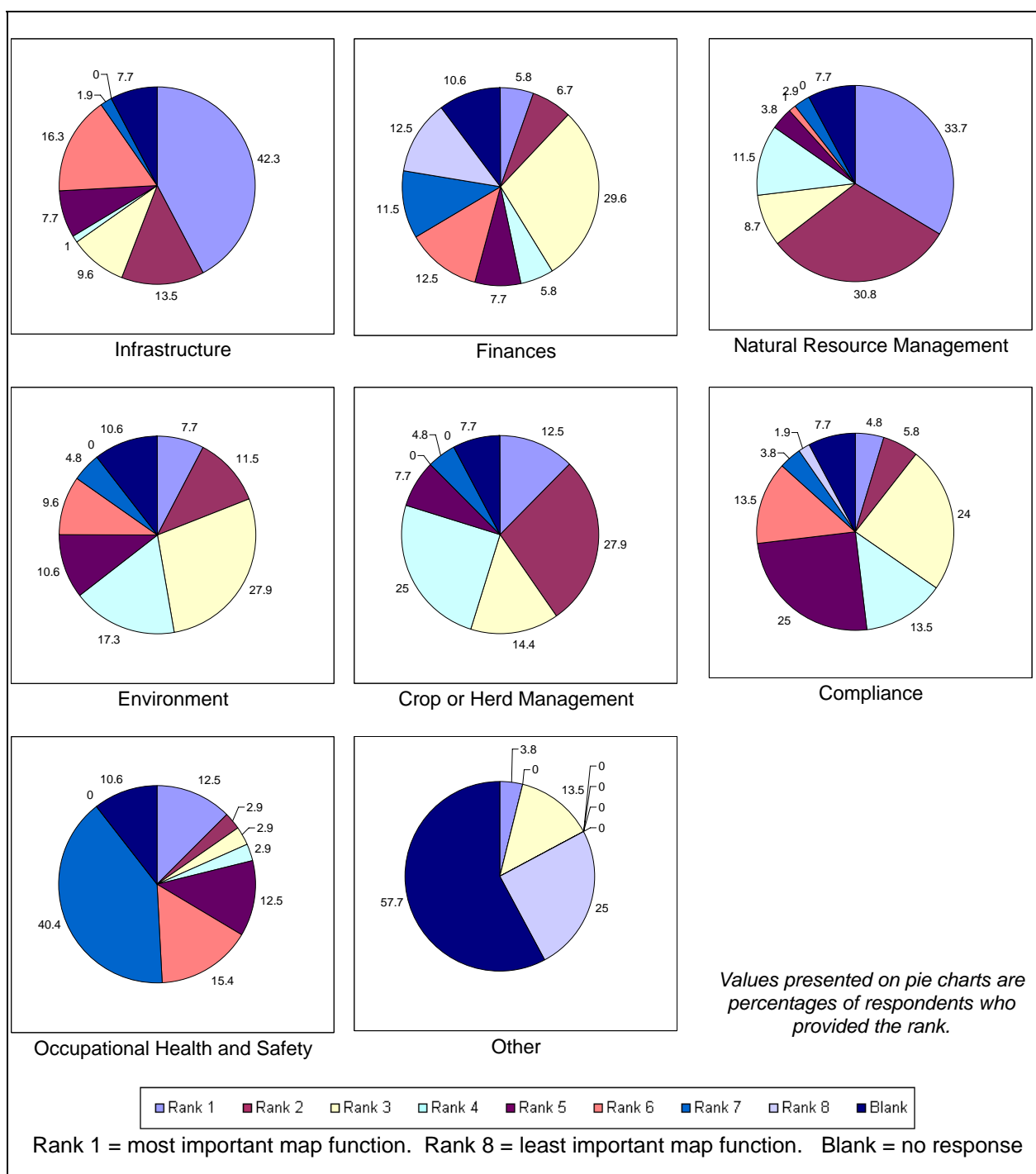
C3 – Record water use against licence

C4 – Maps for land and water management plans

S1 – Map for contractors/employees

S2 – Other OH&S requirements

Appendix D Figure 5 Non Producer - Rank of importance of map software use.



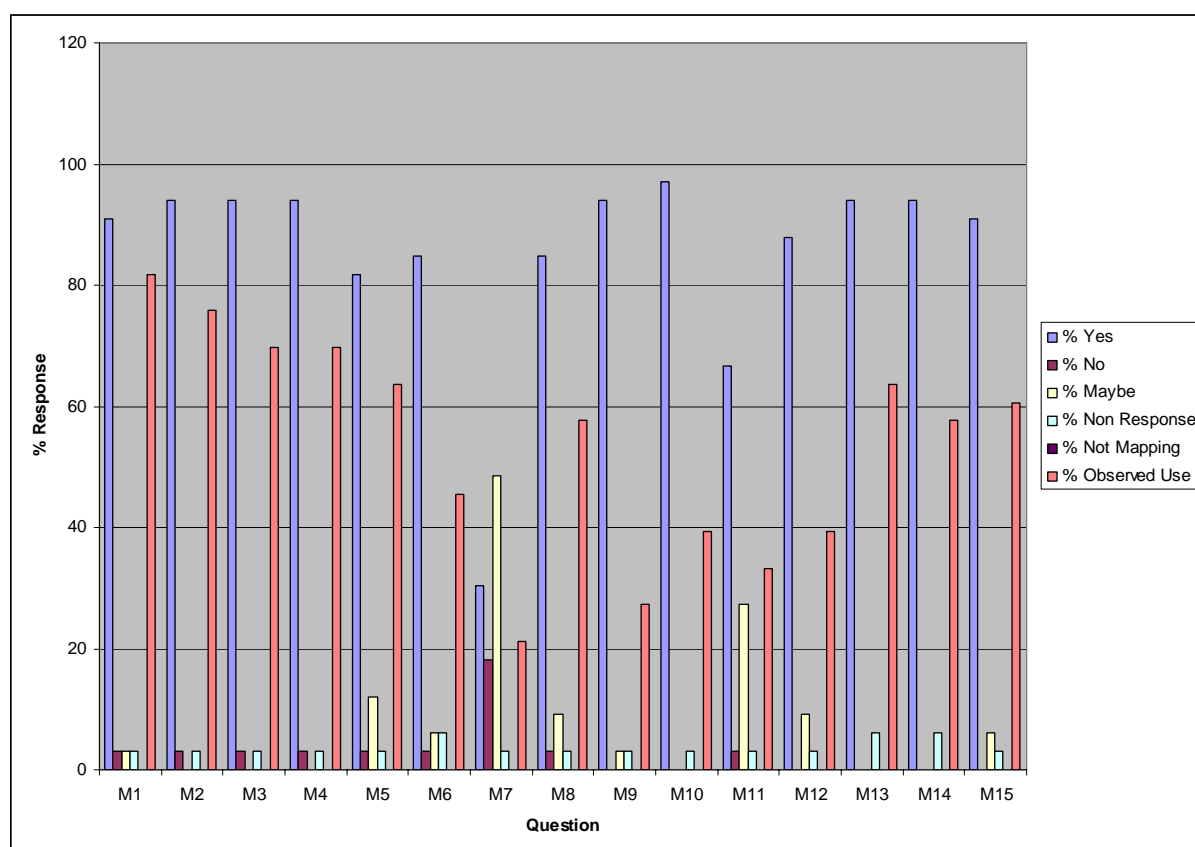
Appendix D Table 1 Non Producer - Rank of importance of map software use.

Primary Production Enterprises	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	Rank 8	Blank	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	Rank 8	Blank	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	Rank 8	Blank	
	INFRASTRUCTURE									FINANCES									NATURAL RESOURCE MANAGEMENT									
Irrigations Farmers	6	1	1	-	2	3	1	-	1	2	-	5	-	1	2	2	1	2	4	6	2	2	-	-	-	-	1	
Dryland farmers	10	3	1	1	2	4	-	-	1	2	1	5	1	2	3	3	3	2	6	8	4	1	1	1	-	-	1	
Horticulture (vineyards, orchards)	3	-	1	-	-	-	-	-	1	-	1	1	-	-	1	-	1	1	1	1	-	2	-	-	-	-	1	
Horticulture (Other)	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-		
Wool/sheep graziers	6	4	1	-	1	2	1	-	1	-	1	5	1	1	2	2	3	1	6	4	1	2	1	-	1	-	1	
Beef graziers	9	3	2	-	1	3	-	-	1	1	1	4	2	1	2	3	3	2	7	8	-	1	1	-	1	-	1	
Other extensive graziers	2	2	-	-	1	1	-	-	1	-	-	1	-	1	1	1	2	1	5	-	-	-	-	-	1	-	1	
Intensive livestock producers	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-		
Small crops / Market gardeners	2	-	-	-	-	-	-	-	1	-	-	1	-	-	1	-	-	1	1	-	-	1	-	-	-	1		
Sugar Cane farmers	2	-	3	-	1	2	-	-	-	1	2	3	1	1	-	-	-	-	1	3	2	2	-	-	-	-		
Other	2	1	1	-	-	2	-	-	1	-	1	1	1	1	1	1	-	1	2	2	-	1	1	-	-	1		
TOTALS	44	14	10	1	8	17	2	0	8	6	7	28	6	8	13	12	13	11	35	32	9	12	4	1	3	0	8	
	ENVIRONMENT									CROP AND/OR HERD MANAGEMENT									COMPLIANCE									
Irrigations Farmers	1	2	1	5	2	2	-	-	2	1	5	2	4	-	-	2	-	1	1	-	3	1	4	4	-	1	1	
Dryland farmers	1	1	7	5	3	3	-	-	2	2	6	3	7	2	-	1	-	1	-	2	4	4	5	3	2	1	1	
Horticulture (vineyards, orchards)	-	1	2	-	1	-	-	-	1	1	2	-	1	-	-	-	-	1	-	-	1	-	3	-	-	-	1	
Horticulture (Other)	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-		
Wool/sheep graziers	1	2	7	1	1	1	2	-	1	4	3	3	4	1	-	-	-	1	1	1	4	2	4	2	1	-	1	
Beef graziers	1	1	5	4	1	3	2	-	2	2	4	4	6	2	-	-	-	1	1	1	5	4	6	1	-	-	1	
Other extensive graziers	1	1	2	1	-	-	1	-	1	-	2	3	1	-	-	-	-	1	1	1	3	1	-	-	-	-	1	
Intensive livestock producers	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-		
Small crops / Market gardeners	-	1	1	-	-	-	-	-	1	-	2	-	-	-	-	-	-	1	-	-	1	-	1	-	-	-	1	
Sugar Cane farmers	2	1	-	2	2	1	-	-	-	2	2	-	1	1	-	2	-	-	1	-	1	1	2	2	1	-	-	
Other	1	-	4	-	1	-	-	-	1	1	1	-	2	2	-	-	-	1	-	1	1	1	1	2	-	-	1	
TOTALS	8	12	29	18	11	10	5	0	11	13	29	15	26	8	0	5	0	8	5	6	25	14	26	14	4	2	8	
	OCCUPATION, HEALTH AND SAFETY									OTHER									<i>Respondents per Industry group.</i>									
Irrigations Farmers	1	1	-	1	3	1	6	-	2	-	-	2	-	-	-	-	3	10	15									
Dryland farmers	1	1	-	2	2	4	10	-	2	1	-	2	-	-	-	-	6	13	22									
Horticulture (vineyards, orchards)	1	-	-	-	1	1	1	-	1	-	-	1	-	-	-	-	1	3	5									
Horticulture (Other)	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1									
Wool/sheep graziers	2	-	1	-	2	4	6	-	1	1	-	1	-	-	-	-	6	8	16									
Beef graziers	2	-	1	-	2	4	8	-	2	1	-	3	-	-	-	-	4	11	19									
Other extensive graziers	2	-	1	-	1	-	2	-	1	-	-	1	-	-	-	-	1	4	7									
Intensive livestock producers	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1									
Small crops / Market gardeners	1	-	-	-	-	-	1	-	1	-	-	1	-	-	-	-	1	1	3									
Sugar Cane farmers	1	1	-	-	2	1	3	-	-	-	-	1	-	-	-	-	-	7	8									
Other	-	-	-	-	-	1	5	-	1	-	-	-	-	-	-	-	4	3	7									
TOTALS	13	3	3	3	13	16	42	0	11	4	0	14	0	0	0	0	26	60										

Appendix D Table 2: Non Producer - Mapping software functions.

Function	Response Counts						Response as percentage					
	Yes	No	Maybe	Non Response	Not Mapping	Observed Use	% Yes	% No	% Maybe	% Non Response	% Not Mapping	% Observed Use
MAPPING												
M1	30	1	1	1	-	27	90.9	3	3	3		81.8
M2	31	1	-	1	-	25	93.9	3		3		75.8
M3	31	1	-	1	-	23	93.9	3		3		69.7
M4	31	1	-	1	-	23	93.9	3		3		69.7
M5	27	1	4	1	-	21	81.8	3	12.1	3		63.6
M6	28	1	2	2	-	15	84.8	3	6.1	6.1		45.5
M7	10	6	16	1	-	7	30.3	18.2	48.5	3		21.2
M8	28	1	3	1	-	19	84.8	3	9.1	3		57.6
M9	31	-	1	1	-	9	93.9		3	3		27.3
M10	32	-	-	1	-	13	97			3		39.4
M11	22	1	9	1	-	11	66.7	3	27.3	3		33.3
M12	29	-	3	1	-	13	87.9		9.1	3		39.4
M13	31	-	-	2	-	21	93.9			6.1		63.6
M14	31	-	-	2	-	19	93.9			6.1		57.6
M15	30	-	2	1	-	20	90.9		6.1	3		60.6
FINANCES, NATURAL RESOURCE MANAGEMENT, ENVIRONMENT												
F1	23	2	7	1	-	10	69.7	6.1	21.2	3		30.3
F2	20	3	9	1	-	6	60.6	9.1	27.3	3		18.2
N1	26	-	6	1	-	11	78.8		18.2	3		33.3
N2	27	1	4	1	-	8	81.8	3	12.1	3		24.2
E1	20	-	12	1	-	7	60.6		36.4	3		21.2
E2	17	2	13	1	-	7	51.5	6.1	39.4	3		21.2
E3	22	-	10	1	-	8	66.7		30.3	3		24.2
E4	17	4	11	1	-	4	51.5	12.1	33.3	3		12.1
PRODUCTION												
P1	19	5	5	1	3	8	57.6	15.2	15.2	3	9.1	24.2
P2	23	1	5	1	3	13	69.7	3	15.2	3	9.1	39.4
P3	25	1	3	1	3	13	75.8	3	9.1	3	9.1	39.4
P4	22	1	6	1	3	11	66.7	3	18.2	3	9.1	33.3
P5	24	1	4	1	3	12	72.7	3	12.1	3	9.1	36.4
P6	18	2	8	2	3	6	54.5	6.1	24.2	6.1	9.1	18.2
P7	20	1	6	3	3	9	60.6	3	18.2	9.1	9.1	27.3
P8	19	3	2	6	3	5	57.6	9.1	6.1	18.2	9.1	15.2
P9	18	1	10	1	3	3	54.5	3	30.3	3	9.1	9.1
P10	20	-	8	1	4	5	60.6		24.2	3	12.1	15.2
COMPLIANCE, SOCIAL												
C1	25	-	4	1	3	7	75.8		12.1	3	9.1	21.2
C2	23	-	6	1	3	6	69.7		18.2	3	9.1	18.2
C3	10	2	17	1	3	1	30.3	6.1	51.5	3	9.1	3
C4	21	1	7	1	3	3	63.6	3	21.2	3	9.1	9.1
S1	26	-	4	1	2	10	78.8		12.1	3	6.1	30.3
S2	19	1	10	1	2	5	57.6	3	30.3	3	6.1	15.2

Appendix D Figure 6: Non Producer - Software functions - Mapping category.

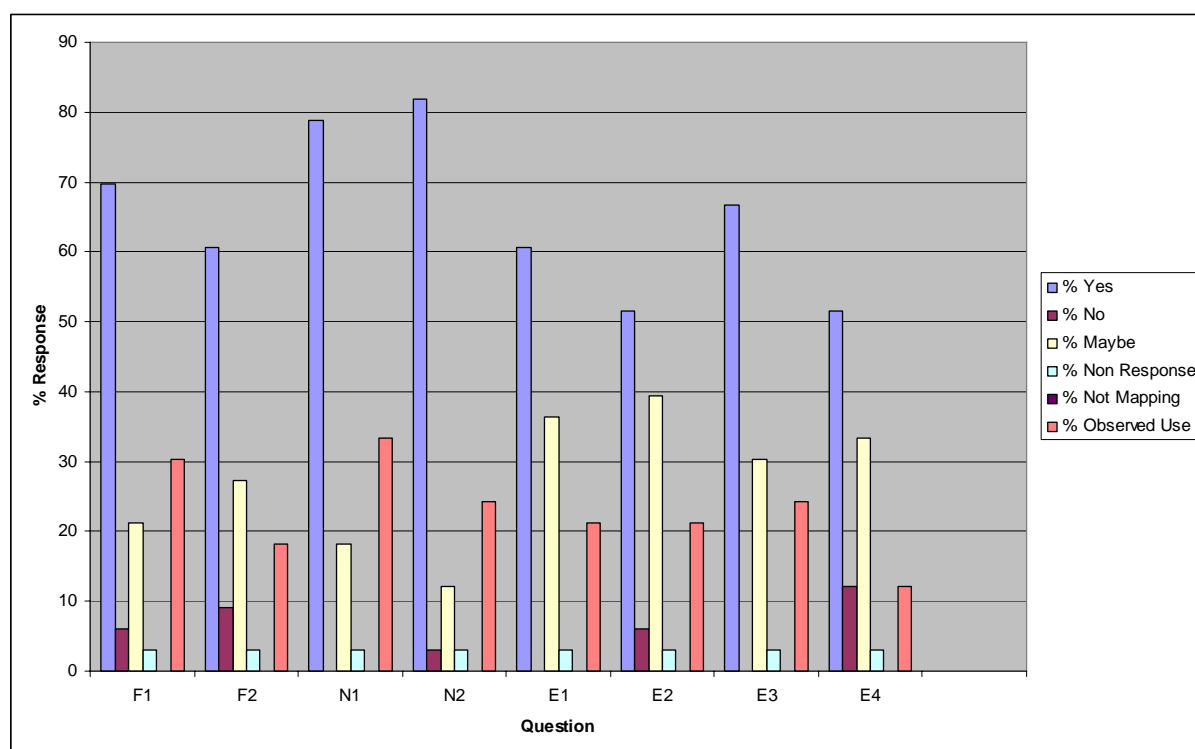


QUESTIONS

M1 – Display and aerial photo or image on a map
M2 – Draw lines
M3 – Draw locations of property features
M4 – Make measurements
M5 – Link or download data from a GPS
M6 – Import data from other agencies
M7 – Produce a map showing directions to the property
M8 – Print a paper map

M9 – Have easy to use software manuals
M10 – Have a good support mechanism
M11 – Other local users to assist with software
M12 – Detect changes over time in paddocks
M13 – Turn layers on and off
M14 – Overlay different data layers
M15 – Property planning

Appendix D Figure 7: Non Producer - Software functions - Finance, NRM, and Environment categories.



QUESTIONS

F1 – Calculate costs/paddock

F2 – Enter data for production, mapping and finance only once

N1 – Show catchment information

N2 – Locate and record natural resource monitoring

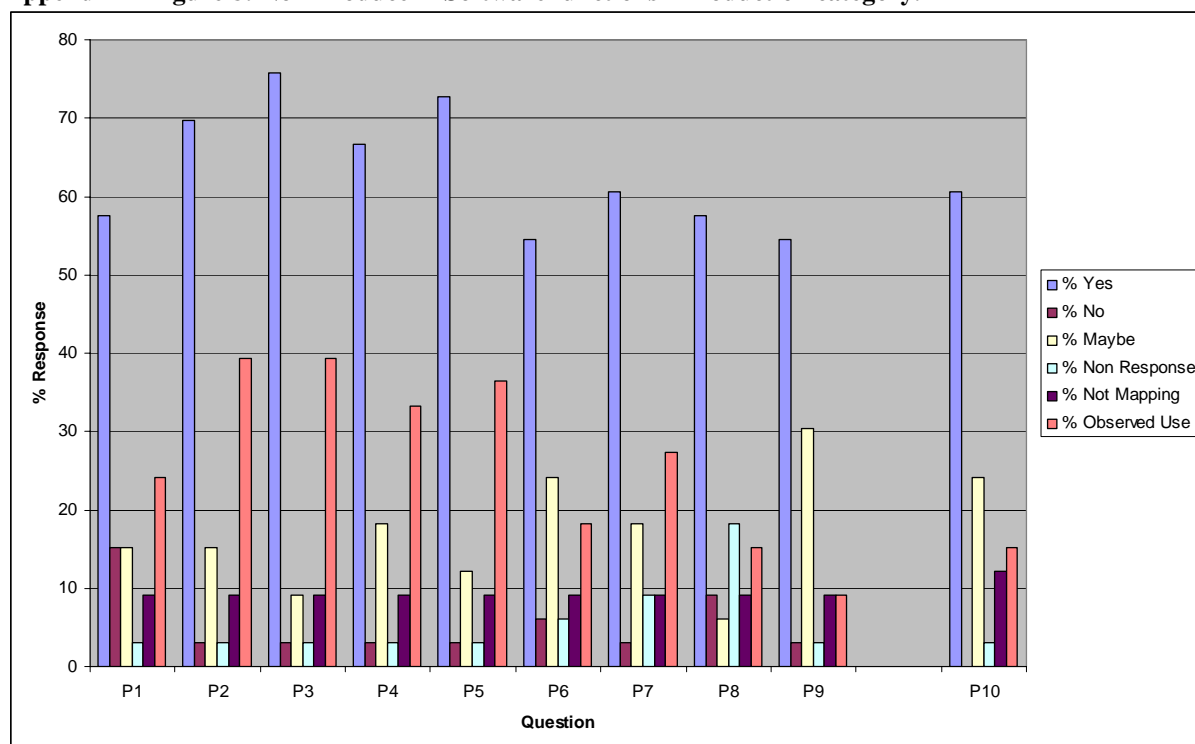
E1 – Record sampling such as water quality

E2 – Map changes in vegetation over time

E3 – Track pesticide use over time

E4 – Determine proximity to other properties/towns

Appendix D Figure 8: Non Producer - Software functions - Production category.



QUESTIONS

P1 – Calculate stocking rates

P2 – Record inputs

P3 – Record outputs

P4 – Record field operations

P5 – Produce a report on field operations

P6 – Output information to a vari-rate applicator

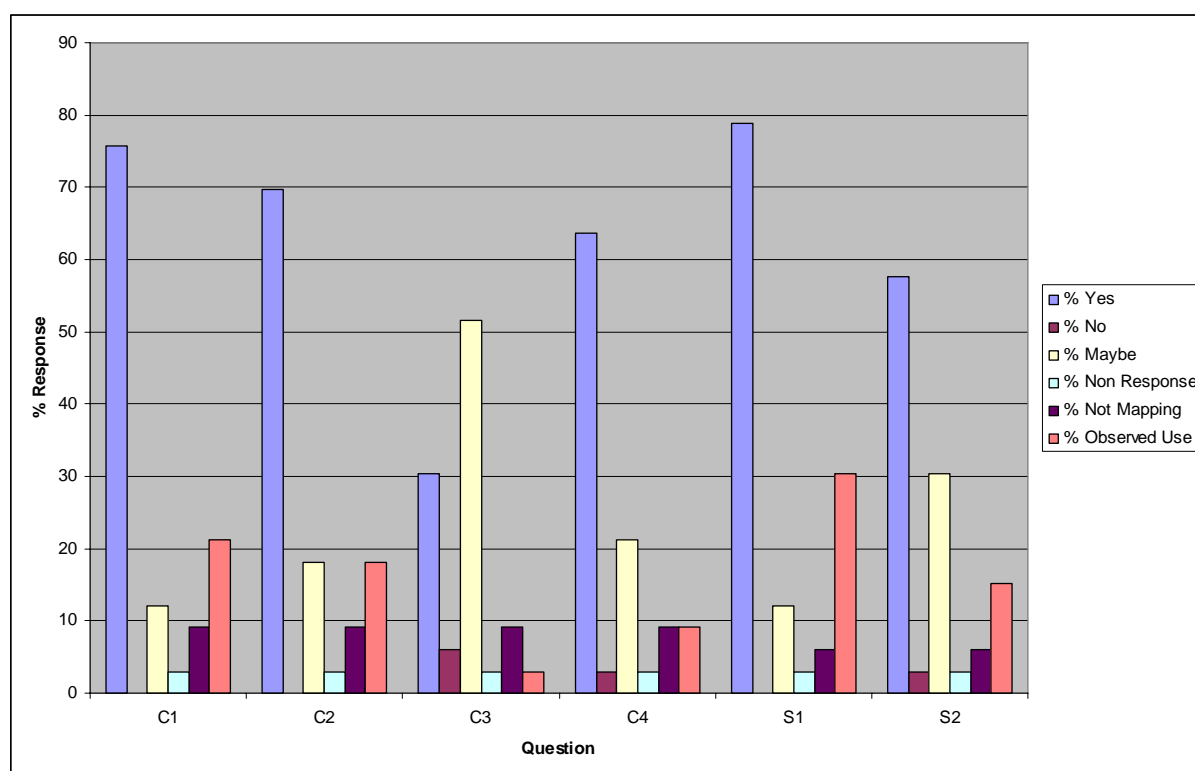
P7 – Input data from yield monitors

P8 – Analyse crop yield data or crop image data

P9 – Integrate with NLIS

P10 – Compare between different data layers

Appendix D Figure 9: Non Producer - Software functions - Compliance and Social categories.



QUESTIONS

C1 – output a map for compliance issues

C2 – map for EMS or FMS

C3 – Record water use against licence

C4 – Maps for land and water management plans

S1 – Map for contractors/employees

S2 – Other OH&S requirements

Appendix E: Selection of software for use.

1. AEMS Opsmanager
2. AGIS
3. AgLeader SMS
4. AgTrix (CHOMP)
5. ArcExplorer
6. ArcGIS
7. AutoCAD
8. Back Paddock Software
9. Case AFS
10. D-Log
11. EC38
12. Endeavour
13. ERDAS Imagine
14. PAM/GP Mapper
15. Farmap
16. FarmKeeper
17. Farmworks
18. Farmscan
19. FGIS
20. Fugawi
21. GBM Mobile
22. Geopdf
23. Google Earth
24. GTA100-400
25. iFarm
26. Instant Survey
27. JD Apex
28. JD Office
29. JUMP
30. Manifold
31. MapInfo
32. Mapsource
33. Map Tools
34. Ozi-explorer
35. PAM
36. PCI Geomatica
37. Phoenix Farms
38. PinPoint
39. Quest
40. RINEX
41. SGIS (GTA 500)
42. SST Toolbox
43. Streets ahead
44. Terra Tools
45. Trimble EZ-Map
46. Vesper
47. Viewpoint
48. VTP

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