

final report

Project code: B.ENV.0024

Prepared by: Prof. Jim Scott

University of New England

Date published: July 2007

PUBLISHED BY
Meat & Livestock Australia
Limited Locked Bag 991
NORTH SYDNEY NSW 2059

Development of Database for the Grazing Industry Environmental Stewardship Project

Meat & Livestock Australia acknowledges the matching funds provided by the Australian Government to support the research and development detailed in this publication.

This publication is published by Meat & Livestock Australia Limited ABN 39 081 678 364 (MLA). Care is taken to ensure the accuracy of the information contained in this publication. However MLA cannot accept responsibility for the accuracy or completeness of the information or opinions contained in the publication. You should make your own enquiries before making decisions concerning your interests. Reproduction in whole or in part of this publication is prohibited without prior written consent of MLA.

Abstract

This project was initiated at the request of the funding partners, Meat and Livestock Australia and Australian Wool Innovation, who wish to assist farmers in gathering and reporting on information about environmental stewardship, especially in grazing-based livestock industries.

The object was to develop a secure web interface, called Landleader, and link it to an electronic database which would allow farmers to trial a system of entering data and receiving reports on their environmental stewardship. It also aimed to enable reports of aggregated data to be supplied to industry specialists. Details of the survey content and report structures were provided by other parties.

The trial database and web interface which was developed was thoroughly specified and then successfully implemented through the trial survey process. The solution created demonstrated the functionality of the approach taken and hence will provide confidence that any further development is likely to be successful, provided that those carrying out the work are skilled in the design and administration of databases and web forms.

If and when a fully operational product is developed, robustly tested and released, the beneficiaries will be both livestock producers and the broader Australian community who will be provided with evidence of the level and trend of environmental stewardship in the livestock industries.

Executive Summary

Why work was done

This project was initiated at the request of the funding partners, Meat and Livestock Australia and Australian Wool Innovation who wish to assist farmers in gathering information about environmental stewardship, especially in grazing-based livestock industries. It aimed to develop a secure web interface, called Landleader, and link it to an electronic database which would allow farmers to trial a system of entering data and receiving reports on their environmental stewardship without having their privacy compromised.

What was achieved

The project was conducted over approximately 13 weeks and initially involved the rapid development of specifications for an appropriately designed database and its functions. Subsequent implementation of the trial database and web interface involved the writing of programming code, database development and testing. This necessitated frequent contact with project management and interactions with a number of other suppliers who provided content, reports, telephone survey data, and criteria for interpreting survey answers. The database was designed such that it could accept data from both comprehensive web and paper forms of the survey as well as a shortened survey conducted by other parties by telephone.

The web interface and database succeeded in collecting a small number (14) of completed and submitted surveys (i.e. all 11 sections of each survey completed), demonstrating the feasibility of this approach for collecting data. One of the sections gathered feedback on the user's impressions of the process involved in gathering the data which was subsequently delivered to a third party for evaluation. Data was entered into the database that arose from the completed telephone surveys (approx. 900) but the data from the completed paper surveys was not received by the extended end-date for this contract (July 31, 2007). Nevertheless, entry of the paper-based survey data should be feasible as the structure of that survey is the same as that conducted by the web interface.

The database was constructed using an SQL compliant database from which reports were extracted using XML and style sheets to HTML formatted reports. PDF versions of reports for printing were also developed during the project. The reports produced included draft versions of the following:

- Producer report on the information gathered about a particular farm and comparisons with data from a similar region with links to some Best Management Practices (BMPs)
- An industry report which is an aggregate of the data collected via web survey (will also serve to report on paper-based survey when data is entered). In addition, this report will serve as a template for the smaller (reduced number of questions) telephone survey.

Final reports suitable for immediate despatch were not able to be produced due to delays in the provision of many details of reporting requirements and links to BMPs; these were received within the last 18 days of the contract period. Whilst the data from the paper-based survey were not received by the end-date, the process for producing reports from the database was demonstrated to be functional and appropriately designed for the task.

When and how industry can benefit from the work

The livestock industries are likely to benefit from being better able to demonstrate their environmental stewardship in an ongoing fashion but that will only be feasible if this trial version is

followed by further development and testing through an implementation phase so that a fully functional and robustly tested system can be 'rolled out'.

This trial database and web interface has demonstrated the functionality of the approach taken and hence any further development is likely to be successful, provided that those carrying out the work are skilled in the design and administration of databases and web forms.

Who can benefit from the results

Livestock producers are likely to be substantial beneficiaries of this project if and when it becomes a fully operational source of trusted information on environmental stewardship.

In addition, the broader Australian community is likely to benefit through gaining confidence of the level and trend of environmental stewardship in the livestock industries.

Conclusions and recommendations

This project has resulted in the development of a major innovation in terms of gathering and reporting on survey data relating to environmental stewardship. It has clearly been well designed and has great scope for building on the robust platform which has been created into the future. It has the potential to assist in the gathering and reporting of other survey information as well.

We recommend that the trial system be further developed, tested and implemented to provide a functional system of monitoring environmental stewardship for Australia's grazing-based livestock industries. Further, we recommend that further development could greatly increase the impact and utility of the survey and reporting system as well as the satisfaction of respondents.

Contents

	Page
1	Background6
2	Project Objectives (from contract schedule)6
3	Methodology6
4	Results and Discussion7
5	Success in Achieving Objectives.....14
6	Impact on Meat and Livestock Industry – now & in five years time14
7	Conclusions and Recommendations.....14

1 Background

This project arose as a result of Meat and Livestock Australia and Australian Wool Innovation collaborating to create a system for assessing environmental stewardship under the Federal government's Pathways to Industry EMS Program.

They approached the database group within the University of New England's Centre for Sustainable Farming Systems to carry out a short-term, proof of concept project to develop a database component of their larger EMS project.

2 Project Objectives (from contract schedule)

To develop an electronic database linked to a secure web interface to receive input from and produce reports for farmers who participate in trials to capture data for environmental stewardship.

The database must have the capacity to:

- Accurately capture the information electronically via a web site;
- Accurately capture the information from the paper based formats;
- Accurately capture the information from the CATI survey;
- Store the information; interrogate and analyse the information;
- Be secure and retain confidentiality of individual data providers;
- Be transferable; and
- Prepare a range of prescribed reports.

Data is a combination of alpha and numeric, but largely the latter.

The types of reports that will be generated include but are not limited to:

- A customised individual producer report with an aggregate comparison (design to be refined with the Research Organisation)
- An aggregate comparison by enterprise type in table and chart format
- Overall aggregate data for all enterprise types in table and chart format

Deliver customised individual producer reports via email and/or paper-based as requested by the individual producers.

3 Methodology

The approach taken was to work iteratively on creating a Web page interface for the Landleader project in parallel with the development of a SQL Server Express database to handle the data storage requirements. Details of the database design and its functional specifications have been provided as separate reports, as they contain information of relevance to intellectual property developed within this project.

This project was carried out in conjunction with other persons contracted by MLA/AWI who provided management oversight, specialist industry expertise, communications expertise, survey design, conduct of telephone and paper-based surveys, data entry for paper-based surveys, design of reports and identified linkages and logic for links between report questions-answers and a series of

Best Management Practices identified by MLA and AWI. Thus, the success of this project depended significantly on the input of many other parties.

In brief, the database system employed the following technical solutions in terms of hardware and software:

- The servers used for development and production were VMWare virtual instances of Microsoft Server 2003. **NB. These servers are currently leased only to August 31, 2007.**
- Microsoft SQL Server Express 2005 is the database used throughout this project. The Express 2005 version has the following limitations:
 - 4GB database size
 - 1GB RAM utilisation
 - Will only use 1CPU for processing
 - The Concurrent User limitation that was relevant to the earlier MSDE SQL database version is no longer an issue
- The web site was developed using Visual Studio 2005
- A security certificate was purchased and implemented so that the web survey could be entered via a secure encrypted connection
- The reports are saved in an XML format. This allows for viewing via a web browser or converting to PDF.

4 Results and Discussion

The trial development of the web interface and electronic database was successful in entering, storing and querying data so that reports can be generated using computer code written to specifically meet the needs of the project, including the capacity to direct survey respondents to Best Management Practices developed by MLA and AWI (only some implemented thus far), depending on a range of complex criteria specified by the Project Management team.

The web survey was released for the trial period on July 2, 2007 and is to be closed at 7 pm on August 1, 2007. Thus far, a total of 14 surveys have been completed via the Web interface (i.e. respondents completed and submitted all 11 sections).

One major area for potential improvement identified by our team while developing the online survey is the need to take advantage of the ability of the web survey to be made interactive and dynamic. With further development, it would be feasible for the survey presented to a particular farmer to be modified, in real-time, in response to answers (e.g. to remove all cropping questions if the respondent answers that they have 0 ha of crops). This method could reduce the time needed to complete the survey and also give the respondent a more personalised survey experience, limiting the need to ask questions that do not apply and hence reducing frustration to the user.

The ability to develop a range of complex and intuitive help systems was also seen as an area where the system could help to gain further acceptance from respondents who know that useful help is provided as the survey report is viewed. The ability of the internet to engage different media types allows for many possibilities including video demonstrations, printable help sheets or even a range of descriptive images.

Reports

Wherever possible, reports have been constructed from the templates provided with modifications using, where appropriate, data fields from the database. To explain this approach, an example of a template used for Industry and Producer reports and coded solution are provided below:

- The static content for the reports (main paragraphs, headings, text, etc) were copied from the demonstration Word document into an XML (Extensible Markup Language) template file and given object tags.

For example, the template document provided by the client showed:

Landleader Report for:

Bill & Mary Farmer
RSD 111
Nyah
Victoria, 3333
<Insert name of survey/property e.g. Wollongong for email version only>

Your summary

Thank you for completing the Landleader survey. By doing so, you have told us about your current environmental and stock management practices.

Where applicable, we have compared your practice against industry "best practice". But please note that Best Practice can vary from region to region and enterprise to enterprise. Therefore, the following assessment is not precise but aims to be indicative to you.

This was converted to the XML template, thus:

```
<rpttitle>Landleader report for:</rpttitle>
<title4>Farm = [MyFarm]</title4>

<title2>Your summary</title2>

<para>Thank you for completing the Landleader survey. By doing so, you have told us
about your current environmental and stock management practices.</para>

<para>Where applicable, we have compared your practice against industry "best
practice". But please note that Best Practice can vary from region to region and
enterprise to enterprise. Therefore, the following assessment is not precise but aims
to be indicative to you.</para>
```

- Special items (e.g. Tables, images ...) were converted into code suitable for processing with XSL (Extensible Stylesheet Language). An example of the Farm Data table is provided below:


```

<farmData>
<fditem label="Total property area (Q1.5)" farmVal="[TPAfarm] Ha" distVal="[TPAdist] Ha ([CPAdist])"/>
<fditem label="Number of adult sheep (2006) (Q1.11)" farmVal="[NASfarm]" distVal="[NASdist] ([CASdist])"/>
<fditem label="Number of adult cattle (2006) (Q1.10)" farmVal="[NACfarm]" distVal="[NACdist] ([CACdist])"/>
<fditem label="Average stocking rate (derived from Q1.5, Q1.10 and Q1.11)" farmVal="[ASRfarm] /Ha" distVal="[ASRdist] /Ha"/>
<fditem label="Approximate average annual rainfall (Q1.6)" farmVal="[AAARfarm] mm" distVal="[AAARdist] mm ([CAARdist])"/>
<fditem label="Approximate total annual rainfall for 2005/06 (Q1.7)" farmVal="[AAARS6farm] mm" distVal="[AAARS6dist] mm ([CAARS6dist])"/>
<fditem label="Average stocking rate per 100ml rainfall (derived from ASR/Q1.7)" farmVal="[ASR100farm] /Ha/100ml" distVal="[ASR100dist] /Ha/100ml"/>
<fditem label="Any specific characteristics of your operation (Q1.13)" farmVal="[ASCO]"/>
</farmData>

```

- The dynamic content was identified and appropriate data place-markers inserted (e.g. '[MyFarm]' as found in the XML template image above)
- The report generator then:
 - imports the XML template,
 - replaces the data place-markers with data from the database for that farm or region, then
 - saves the content as an XML file for viewing, or into memory for generation of a PDF version of the report

The reports consist of:

1. An XML file created from the XML template with all the relevant data from the database inserted
2. An XSL file that converts the data into appropriate objects (e.g. tables, paragraphs, headings, etc.)
3. A CSS (Cascading Style Sheet) that defines the style format for those objects.

Producer Reports

The producer report contains a radar (spider) chart generated from calculated BMP (Best Management Practice) indices that are generated from a complex series of rules that are applied throughout the report. The variability in calculations that made up each BMP and the time available to generate them meant that each BMP calculation had to be 'hard coded'. This programming work is time consuming. For example, 700+ lines of code had to be written in order to populate the spider diagram with data.

During the project, a number of ambiguities were found in the proposed BMP calculations; the majority of these ambiguities have been resolved.

In the generation of the report, the following assumptions have been made:

1. The General Farm Data table states 'District/Region Average'. Due to the small 'volume' of data available for each 'region' (postcode), data for the Catchment was used.
2. The 'Number of adult cattle (Q1.10)' was calculated as the sum of 'Breeder cows' and 'Other cattle'. Similar for sheep.
3. Average stocking rate was calculated as head of sheep + 10 x head of cattle to account for DSE considerations.

Screenshots of elements of the web interface, reports, etc.

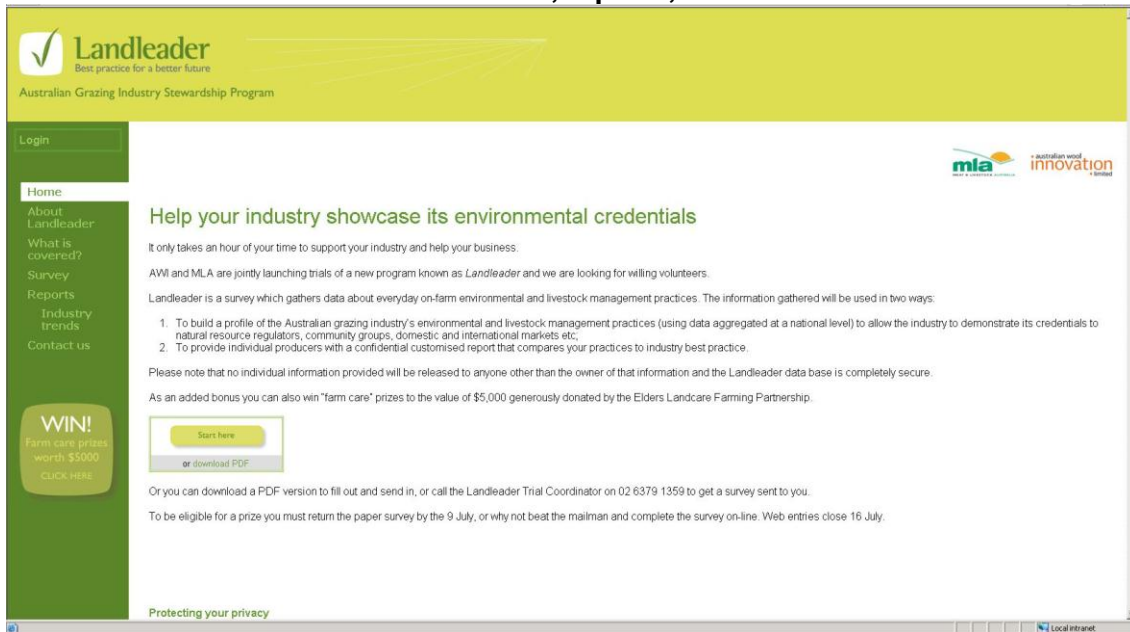


Figure 1. Screenshot of Landleader web site Home page.

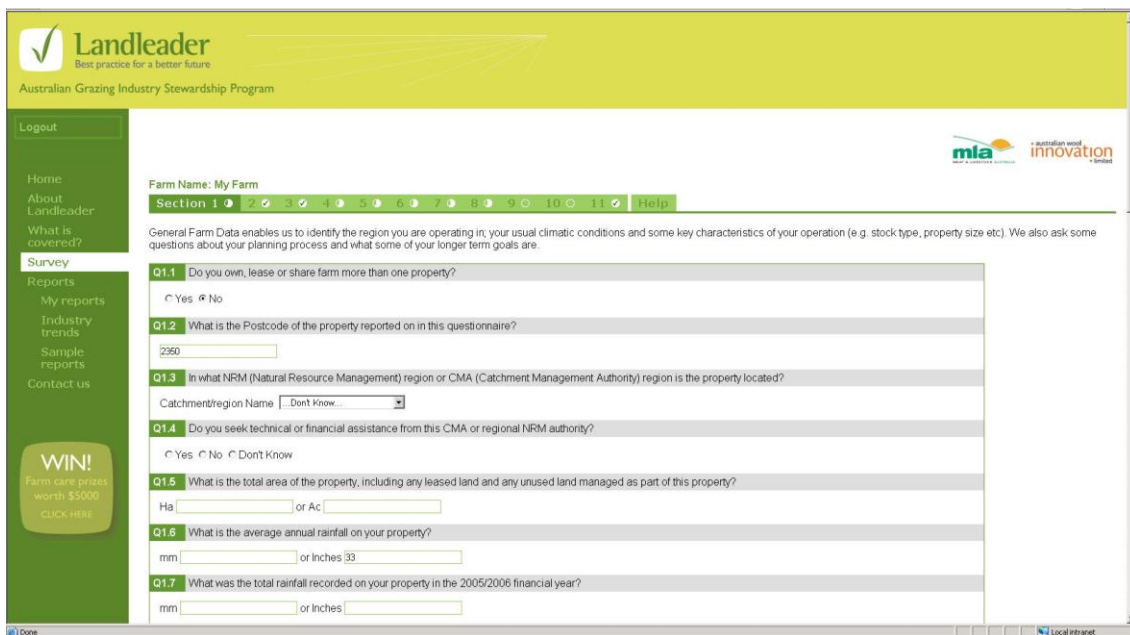


Figure 2. Screenshot of part of Web survey showing several questions in Section 1 of the web survey. Symbols adjacent to sections (above) indicate which sections have been completed (tick), partially completed (part filled circle) or not attempted (empty circle).

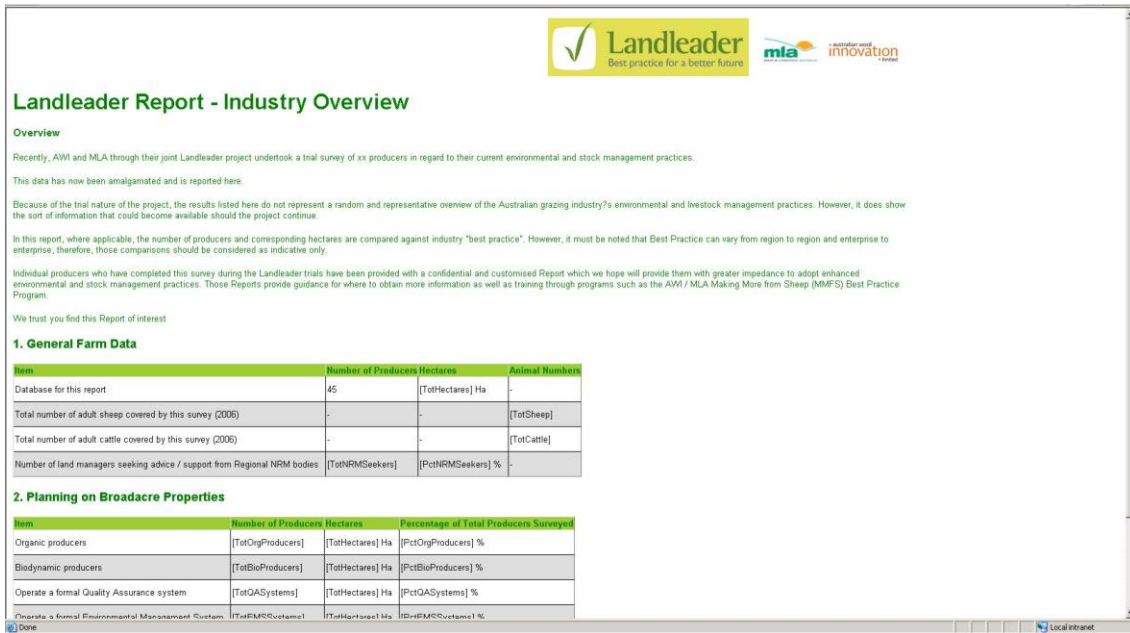


Figure 3. HTML version of draft Industry Report.

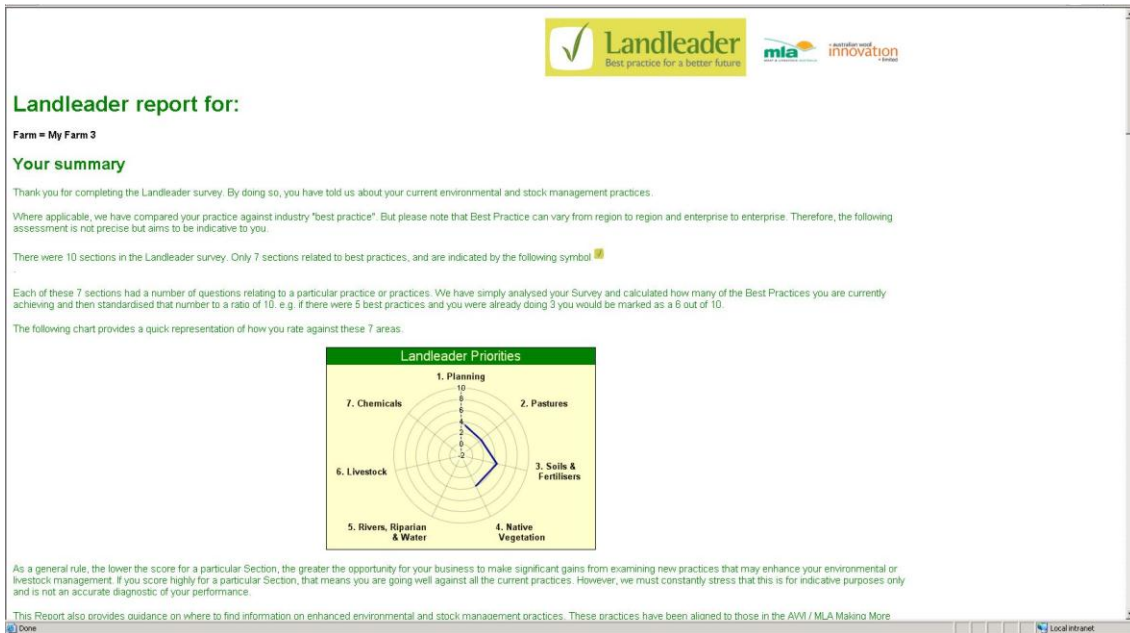


Figure 4. Screenshot of HTML version of part of draft Producer Report showing spider diagram.

1. General Farm Data

Your general farm data follows and a comparison is made with other similar broadacre land managers in your area.

Your region is: (Q1.2)

2343

Your Catchment is: (Q1.3)

Central West

	Your Property	District / Region Average
Total property area (Q1.5)	33 Ha	342 Ha (2)
Number of adult sheep (2006) (Q1.11)	88	94 (2)
Number of adult cattle (2006) (Q1.10)	77	88 (2)
Average stocking rate (derived from Q1.5, Q1.10 and Q1.11)	26 /Ha	2 /Ha
Approximate average annual rainfall (Q1.6)	638 mm	367 mm (2)
Approximate total annual rainfall for 2005/06 (Q1.7)	33 mm	342 mm (2)
Average stocking rate per 100ml rainfall (derived from ASR/Q1.7)	3.1 /Ha/100ml	0.5 /Ha/100ml
Any specific characteristics of your operation (Q1.13)	dfsgsdg	

2. Planning

Why is this important

At present, there are few things on a farm that have to be recorded, and yet when it comes to demonstrating environmental stewardship to the Australian community, it is the planning, monitoring, mapping and recording of information that underpins confidence.

This section is about assessing what you monitor on farm and your attitude to planning. It also identifies what current accreditation schemes you operate on your property.

Farm Accreditation (if any) (Q1.12)

- An organic farm
- A biodynamic farm
- A quality assurance scheme (e.g. Cattlecare)
- An Environmental Management System

Best Practices	Score
1 Documented farm plan	1

Figure 5. Screenshot of HTML version of part of draft Producer Report showing text and data table.

Viewing the above reports using Web Browser (Internet Explorer)

NB - we have renamed '.zip' files as '.zipp' files so they do not get trapped by email systems.

Rename the attached file called 'reports.zipp' to 'reports.zip'

Unzipping the report will create a directory called "reports"

Within that folder will be 2 XML files:

1. **industryRpt2007.07.31.15.02.27.xml** (industry HTML report)
2. **prodRpt2007.07.31.15.02.32.xml** (producer HTML report)

With Internet Explorer, choose File > Open > Browse to one of these files - you should then see the HTML report displayed.

PDF producer report

Landleader report for:

Farm = Casey

Your summary
 Thank you for completing the Landleader survey. By doing so, you have told us about your current environmental and stock management practices. Where applicable, we have compared your practice against industry "best practice". But please note that Best Practice can vary from region to region and enterprise to enterprise. Therefore, the following assessment is not precise but aims to be indicative to you. There were 10 sections in the Landleader survey. Only 7 sections related to best practices, and are indicated by the following symbol. Each of these 7 sections had a number of questions relating to a particular practice or practices. We have simply analysed your Survey and calculated how many of the Best Practices you are currently achieving and then standardised that number to a ratio of 10, e.g. if there were 3 best practices and you were already doing 3 you would be marked as a 6 out of 10. The following chart provides a quick representation of how you rate against these 7 areas.

Landleader Priorities

As a general rule, the lower the score for a particular Section, the greater the opportunity for your business to make significant gains from examining new practices that may enhance your environmental or livestock management. If you score highly for a particular Section, that means you are going well against all the current practices. However, we must constantly stress that this is for indicative purposes only and is not an accurate diagnostic of your performance. This Report also provides guidance on where to find information on enhanced environmental and

stock management practices. These practices have been aligned to those in the AWI /MLA Making More from Sheep (MMFS) Best Practice Manual. However, it's likely that to make further improvements, you'll need to seek more detailed information or other forms of assistance - each MMFS Module contains many tips, information sources and web links to help you do this.

1. General Farm Data

Your general farm data follows and a comparison is made with other similar broadacre land managers in your area.

Your region is: (Q1.2) 3634
 Your Catchment is: (Q1.3) Goulburn Broken

District / Region Average

Total property area (Q1.5) 180 Ha*** Ha
 Number of adult sheep (2006) (Q1.11) 0500 (1)
 Number of adult cattle (2006) (Q1.10) 080 (1)
 Average stocking rate (derived from Q1.5, Q1.10 and Q1.11) 0 /Ha*** /Ha
 Approximate average annual rainfall (Q1.6) 550 mm*** mm
 Approximate average annual rainfall for 2005/06 (Q1.7) 0 mm*** mm
 Average stocking rate per 100ml rainfall (derived from ASR, Q1.7) 0 /Ha/100ml*** /Ha/100ml
 Any specific characteristics of your operation (Q1.13) Your Property

Figure 6. Screenshot of PDF draft report for a Producer.

A copy of the report shown above in Figure 6 is attached as a separate file "prodRep.pdf".

Reporting issues remaining

1. A number of questions in the CATI survey contained different response types to the web/paper-based survey (e.g. multi-response in one but single in the other and *vice versa*).
2. The questions in the CATI survey predominantly asked for a percentage of the farm that met a certain criteria whereas the Web/Paper based surveys asked for the number of hectares/acres. This will necessitate an extra stage of processing to reduce them to all to an area measurement.
3. A number of the questions in the web/paper survey requested free text whereas the equivalent CATI questions contained multiple choice style answers. The former may need interpretation.
4. The 'Some practices you could look at:' segment under the BMP tables in the Producer Report has not been implemented. Suitable wording for these is still to be provided.
5. The Producer reports need to be tested against a greater number of responses in order to adequately test the reporting system.
6. The Producer reports from the CATI (telephone) survey requires implementation. BMP definitions have not been received for this survey.

Due to the compressed development time period available for the development and testing of reports and the great complexity of the calculations made, it is recommended that all reports need

further development and testing. Nevertheless, the underlying framework for creating these customised reports has been developed and tested on limited datasets.

Data downloaded from database

NB - we have renamed '.zip' files as '.zipp' files so they do not get trapped by email systems.

A separate Excel file (DBDownload.xls - 13 Megabytes) has been sent to MLA and AWI within a '.zipp' file (3 Meg) (DBDownload.zipp) containing all the data from the Production version of the SQL database. *Before opening this file, rename the file extension from .zipp to .zip and then unzip the file.* This file contains 3 worksheets called PhoneAnswers (all phone survey data), WebAnswers (all web survey data) and WebPhoneAnswers (all records where QID is matched for both web and phone surveys).

5 Success in Achieving Objectives

This project was a trial of a concept aimed at gathering, storing, querying and reporting on information relating to environmental stewardship.

The concept was proven to be functional and capable of gathering information, of storing the data, of querying the data and delivering reports, even though more development and quality assurance of the reports is required before they will be in an acceptable form for distribution to survey respondents.

6 Impact on Meat and Livestock Industry – now & in five years time

Provided the trial project is continued beyond the 'proof of concept' phase (this project) to an 'implementation' phase, the impact on the Meat and Livestock Industry is potentially large. The system developed has the potential to gather and store vast amounts of data via various formats, enabling delivery through cost-effective and secure means to a range of clients. Further development could increase uptake through increasing the satisfaction of survey respondents in filling out surveys, especially if original data is retained and built upon in the future.

Ultimately, if other farm data (e.g. farmer group benchmarking data) or scientific data about farm system performance (e.g. from Sustainable Grazing Systems or EverGraze) became available, it would be feasible to develop a more sophisticated system of providing timely and credible evidence of environmental stewardship. Such a system could have large potential impacts on Australia's livestock industries in terms of domestic and international markets for products from those grazing enterprises.

7 Conclusions and Recommendations

We conclude that the trial database has been very successful. The reporting functions still require further refinement and quality assurance before they can be considered accurate and unambiguous. This short project has proven the concept and thus provides MLA and AWI with the information they need as they consider the best way forward in order to enhance the environmental credentials of Australia's grazing-based livestock industries.

This project has involved the development of a major innovation in terms of gathering and reporting on survey data relating to environmental stewardship. The detailed design and functional specifications provided separately provide a clear description of the careful design of this survey and reporting database and interface. It has clearly been well designed and provides a robust platform upon which there is great scope for building into the future.

We recommend that a system such as that developed within this project be expanded upon in the future such that a fully functional and robustly tested system of monitoring environmental stewardship can be made available to Australia's grazing-based livestock industries. Further, we recommend that a series of innovations are considered for development and implementation in order to 'add value' to that which has already been developed. These may include the customisation of survey options in 'real time' in response to answers to questions and the ability to provide dynamic interaction with the provision of Best Management Practice information.