Spatial Recording of Land Management Practice Information (LMPI)

Documentation of the development and testing of methodologies used to collect LMPI in NSW

Spatial Recording of Land Management Practice Information (LMPI)

Documentation of the development and testing of methodologies used to collect LMPI in NSW.

Mr Nik Henry – Department of Environment and Climate Change
Project Officer, Hunter Region, Newcastle
Tel: (02) 4904 2608   **Fax:** (02) 4904 2501
Email: Nik.Henry@dnr.nsw.gov.au

Edited by Mr Keith Emery – Department of Environment and Climate Change

Contents

Figures

Tables

Photographs

Background

Recent projects to assess the current status of Australia's natural resources and the achievements of government sponsored programmes to improve these resources can only be completed if the necessary information is available for analysis. It's acknowledged that these assessments strongly depend upon a number of prime datasets for soils, water, flora, fauna, land cover, land use, land degradation and air quality.

With the current analyses using more detailed or complex modelling techniques, the basic data requirements are being expanded to provide more specific information on the type, extent and condition of individual resources. One particular data set of increasing significance is land management practice information.

Originally seen as a subset of land use, land management practice information is now taking on an expanded role in itself. Land management practice information has significance in explaining some of the variability within an individual land use. In New South Wales, this has been recognised in the STATE PLAN where the targets for 'better outcomes for vegetation, biodiversity, rivers, coastal waterways and land' indicate the important reliance on more detailed natural resource information. Where the targets for LAND indicate that:

- *By 2015 there is an improvement in soil condition*
- *By 2015 there is an increase in the area of land that is managed within its capability.* (State Plan 2006).

The emphasis is on the word 'managed'. The State Plan does not state solely the traditional concept of land being USED within its capability, but of being MANAGED within its capability. The statement inherently acknowledges the large range of land management practices that can occur within a single land use and therefore places the emphasis on the management practices and not just the land use when assessing resource condition.

Similar recognition of the need for land management practice information has been recognised in a number of theme areas for monitoring, evaluation and reporting (MER) programmes and in the emerging issues of climate change adaptation.

HOW IS LAND MANAGEMENT PRACTICE INFORMATION TO BE RECORDED?

Land management practice information can be recorded in text format such as that collected by survey techniques and, if required, depicted spatially at a very broad scale. Alternately, it can be described spatially at the property level and these results then amalgamated with broad scale information to show some representation at a local, regional or state level. Each method is valid, depending upon the intended use of the information.

Both methods are useful in a combined format – where the broad-scale survey procedures gather large quantities of information quickly and efficiently, then detailed property level information to provide a 'drill-down' option to assess the quality of the broad-scale data. This would also provide a detailed understanding of the individual land management practices and enable a quality assurance check of the data collected by surveys. Anecdotal information from western New South Wales suggests that farming respondents to survey conservation farming questionnaires have been optimistic in assessing their own land management practices and do not match the observations of land management experts (John Leys, pers. com.). An independent series of observations at the property level can provide a degree of qualification of survey techniques.

The survey technique is also recognised as providing more general information in land management practices because of the limitations of individual questionnaires. Specific industry-based

questionnaires may allow further teasing of information but the spatial component within a property may not available.

The NSW Department of Environment & Climate Change (DECC) has placed its initial emphasis on recording information at the property scale, recognising that other agencies have more experience with survey techniques and depicting the results at the broad scale. The project by DECC has four main objectives:

1. assess different techniques for collecting land management practice information at the property level
2. the spatial depiction of land management practice information at the property level
3. ensuring that the department's current classification is up-to-date by collecting information from innovative landholders
4. Input to the Land Use and Management Information System (LUMIS) currently being developed by the Bureau of Rural Sciences and various state agencies.

An important step in this regard is the development of a consistent standardised approach to the recording of land management practices information across New South Wales. Since 2000 the department has been developing a customised system to facilitate the spatial capture and attribution of resource management actions.

KEY CONCEPTS FOR LAND MANAGEMENT PRACTICE

A number of individual activities fall within the umbrella of the term land management practice. A general definition of land management practice is given in 'Land Use Mapping at Catchment Scale: Principles, Procedures and Definitions published by the Bureau of Rural Sciences in 2002.

'Land management practice is the means by which the land management objective is achieved, the 'how' of land use (eg cultivation practices such as minimum tillage and direct drilling). Patterns in land cover can relate to land management practice and land use.'

In the NSW context, DECC includes the following activities under the term of land management practices:
- All physical activities and all technical training programmes that impact on the land during the production of agricultural commodities
- All physical activities that impact on the land in its management for urban, commercial, industrial, military, mining, transport, power production, energy transfer, recreational, forestry, conservation, waste treatment and waste disposal uses.
- Activities involved in the storage, distribution, treatment, use and disposal of water
- Activities involved in the repair, rehabilitation or protection of environmental values. In this group, all land management treatments by catchment management authorities to repair or remediate land degradation problems or improve environmental values for vegetation, water or biodiversity are recorded.

NATURAL RESOURCE MANAGEMENT AGENCIES IN NSW

Government agencies in NSW are interested in the social, economic and management impacts associated with natural resource issues. This is expressed strongly through the planning and reporting roles of Catchment Management Authorities (CMAs), and the agencies that support them including the NSW Departments of Environment and Climate Change (DECC), Primary Industries (DPI), Lands(DoL) and Water & Energy (DWE)

DECC currently maintain a number of major spatial databases, which have multiple datasets relating to which year a dataset was updated. All these datasets play a major part in supporting the management of natural resources. These data sets include:

- Land use
- Soil landscapes
- Soil profile descriptions (stored in SALIS database)
- Native vegetation and associated databases
- Threatened Species database
- Land degradation
- Dryland salinity outbreaks.

In the current land use, land degradation and salinity outbreak data sets, some land management practice information has been collected, because they relate directly to the status, condition or impact of those features on the soil, water, vegetation and existing infrastructure.

The activities recorded in the older versions of these datasets have provided the initial process to develop the standardised list of descriptions for land management practices and on-ground works activities currently used by DECC.

THE NEED FOR SPATIAL LAND MANAGEMENT PRACTICE INFORMATION

The concept of spatially recording land management practice information at the property level has been developed by DECC as a one-step process for catchment management authorities and other natural resource management agencies to record the details of on-ground works or training programmes they have funded.

This spatial recording technique would form a logical standardised approach upon which to build natural resource management datasets, which in turn can be used to provide:

- Information linkages to other data sources, detailing management targets, financial responsibilities and outcomes of objectives
- Map products showing the location and extent of funded activities
- Precise information for compliance activities, using succeeding updates of imagery as background views to the digital data
- Project monitoring of works up to completion stage
- Output reporting against individual programmes
- Long term planning and project development using the spatial information to upgrade and update individual data sets.
- Inputs to spatial models, including groundwater, surface flow, and vegetation change
- Monitor changes relevant to climate change adaptation.

Unlike the general survey methodologies used in the national arena, this method of recording activities of land managers sets out to record "what is actually happening or happened at an accurate spatial location" not the perception of land managers within a district or sub-catchment.

1.   Project Objectives

The aims of this project are to document the development and testing of a methodology to collect land management practice information at the property level across different climate, commodity and landscape zones.   One of the main focuses of the project is the further development of a standardised attribute list to suit the needs of a wide range of clients where land management practice information data are required.

Together with the spatial outputs of this project, the project documents:
1. The resources and types of resources (funds, staff, vehicle etc.) needed to undertake the work;
2. The length of time it takes to complete the mapping for specific activities;
3. Training required to teach systems to other operators;
4. Problems of integrating and cleaning spatial property data from various sources.

The actions of the pilot project are coordinated for two main objectives; the first is the development of a standardised attribute list and the second is the spatial recording of land management practice information. The Department of Environment and Climate Change has a spatial attribution system called the Land Management Database (LMD) which contains the standardised attribute list.

DEVELOPING A STANDARDISED ATTRIBUTE LIST

The standardised attribute list is a logical classification for the description of all land management actions. It consists of the **types of actions taken** to manage natural resources, the **methods used** in these actions and then **details of the methods** used. The attribute list incorporates characteristics that make the classification system:

▪ **Scale independent,** meaning that the classes at all levels should be applicable at any scale or level of detail;

▪ **Source independent,** implying that it is independent of the means used to collect information, whether satellite imagery, aerial photography, field survey or some combination of them is used;

▪ **comprehensive, scientifically sound and practically oriented;**

▪ **capable of meeting the needs of a variety of users** (neither single-project oriented nor taking a sectoral approach); users can use a sub-set of the classification and develop from there according to their own specific needs;

▪ **facilitate comparisons** between classes derived from different classifications;

▪ **able to describe the complete range of features** with clear class boundary definitions that are unambiguous and unique;

▪ based on a **clear and systematic description of the class**, where diagnostic criteria used to define a class must be clearly defined.

This classification has three levels and can be used in the same manner as an identification key. The format consists of a category, activity and sub-type to form the three hierarchical levels.

CATEGORY	**ACTIVITY**	**SUB-TYPE**
- Generally the **action** taken	- Range of **methods** used to implement the action	- **Detail** of the particular method used

Figure 1. Definitions for each layer of the hierarchical classification used in the Land Management Database standardised attribute list.
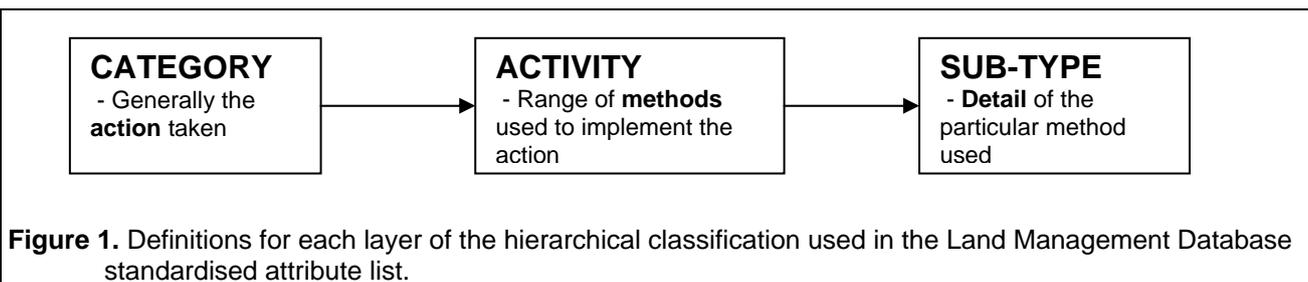
This hierarchy was based on the current attribution process used in the Land Management Database to spatially record existing and proposed land management activities across New South Wales. The hierarchy can be easily expanded to allow for more categories, activities or subtypes as new land management systems are developed or adopted.

FURTHER DEVELOPMENT OF THE STANDARDISED ATTRIBUTE LIST

Two actions listed under this objective are:
- Liaise with agency, local government and peak industry groups for input into the data base and its classification scheme to ensure that a sufficient range and classes of attributes are included for their needs.

- Inform the development of the Land Use and Management Information System (LUMIS), currently being developed by the Bureau of Resource Sciences with support from various state agencies.

SPATIAL RECORDING OF LAND MANAGEMENT PRACTICE INFORMATION

This component of the project aims to:
- Trial the methods being developed within DECC to spatially reference land management practice information.

- Trial the application of DECC's current classification scheme to describe a range of land management practices.

- Trial the importation of land management practice information from existing data sets such as the land use and salinity outbreak data sets into the Land Management Database.

THE NSW LAND MANAGEMENT DATABASE

The Land Management Database is a customisation of ArcMap developed for the recording of on-ground works with linkages to government funded projects. The application has been developed over six (6) years with the input of key user and stakeholder groups, including John Bickmore (HNCMA) and Gavin Doyle (HCRCMA) from the Catchment Management Authorities with Keith Emery (NSW DECC) and Nik Henry (NSW DECC) providing the standards for attribution.

The Land Management Database was development by Rod Waski (NSW DECC), Nick Sharp (NSW SCA) and Amanda Walmsley (formerly NSW Department of Infrastructure, Planning & Natural Resources), using high levels of automation within the ArcObjects library. Incorporating ESRI Geodatabases, the land Management Database supports many to many relationships and consists of a model with over 40 data tables.

Data are spatially recorded as points, lines or areas and stored locally in specifically designed ESRI Geodatabases. When mapping and attribution are completed, the attributed spatial feature classes are exported to the Department's Enterprise Database (EDB) comprising Oracle 10 and ArcSDE 9.1 elements.

Using Crystal Reports, reporting can be against a range management targets or output objectives, including native vegetation management and establishment, erosion control, weed and pest control and community capacity building. Various levels of reporting are available, either to catchment, State or Federal agencies responsible for natural resource investment.

Currently the primary users are the NSW Catchment Management Authorities who manage and control natural resource management investment strategies. Other natural resource groups across NSW are also looking to use the :and Management Database because it provides a standardised approach to mapping and recording of funded on-ground activities and reporting on project outputs.

2. Project Methodology

The testing and development of the standardised attribute list, together with ongoing developments to the Land Management Database software are important outcomes for this pilot project. They ensure the adaptability of the system to spatially record all the land management practice descriptions in detail.

It Is important to gather and collect land management practice information from a range sources to provide the greatest variability in types of descriptions needed. The range of sources used for the pilot project includes:

- **Landholder Described Management Practices** - range of land management practice information from surveys of properties within the Goulburn River Catchment, Litter River Catchment and various Districts across NSW.
- **Natural Resource Management Actions** - NSW Government funded activities for changes in land use, land management practices and specialised on-ground works, within the Boorowa River Catchment and the Central West Region - practices include grazing practice, cropping management and vegetation establishment.
- **Soil Conservation Works** – NSW Soil Conservations Service's past activities that include establishment of banks, waterways and areas treated for erosion control within the Goulburn River Catchment.
- **Hunter Valley Flood Mitigation Works** - bank stabilisation structures and establishment of vegetation within the Goulburn River Catchment.

The intention is to link the land uses and their particular management practices with a spatial reference. The use of the multiple attribution process in the LMD made the relationships between the land management practice information and a spatial reference possible.

2.1 LAND MANAGEMENT PRACTICE INFORMATION AT THE PROPERTY LEVEL

Right from the start, one of the underlying concepts of the project has been that information on land management practice for an individual property must come from the property owner or manager. It is important that precise information be supplied for all the land management activities on a property.

Government agency staff or industry consultants are not the best information sources owing to a number of circumstances:
- Often no long-term experience in the locality or with the industry

- Their current projects often have a very specific focus with precise targets and outcomes to be achieved

- Representatives are often focussed to specific industries

- Lack of familiarity with current and developing land management practices.

On the other hand however, farm management consultants could provide this information as they usually advise landholders on all on farm activities. Even if a landholder doesn't take the consultants initial advice, the consultant becomes aware of what the landholder eventually carried out.

The initial step is to contact landholders through staff of the local catchment management authority and then introduce the project staff to organise a suitable time to conduct an interview. The large numbers of projects being conducted by the catchment management authorities could provide the necessary range of landholder contacts. Moreover, these landholders would more comfortable with sharing information with government agencies particularly as the information is to be recorded spatially and made available across a range of state and federal agencies.

However, this process became time consuming, especially when local staff are unavailable or too busy with demanding day-to-day work loads. Other methods were then tried to broaden the net of and holder contacts.

In the end, the most effective method of establishing contact with potential landholders is to use the networks of landholders. After the first interview with a landholder in a locality, they are then asked to recommend the names of neighbours who may be interested in participating in such an exercise and in some cases to make the initial contacts. This method proved to be most successful and provided more landholder names than could be handled in this project. .

Four different approaches to interviewing landholders have been tried as part of this project, these being:

- **Landholder interviews over the telephone** – pilot project staff fill in the survey form talking over the telephone with the landholder. The best approach is for the person doing the interview to have an image of the property in front of them, preferably on screen and with a resolution comparable to SPOT 5 imagery or aerial photography. Other data sets of the property are essentially, principally the land use data set, but also soil erosion, soils and salinity outbreak information. Then the questioner can ask specific questions of management practices related to each land use on the property and also to the treatment of specific land degradation issues. A high resolution image or photograph of the property allows the questioner to direct the questions to particular sections of the property and to use reference information to help the landholder.
- **Self assessment survey** – the landholder is provided with the form and asked to fill it out as they see fit. This works well in Landcare groups where a Landcare coordinator or catchment manager is available to answer specific queries and provide with consent landholder's property boundary.
- **Third party information** - information about a landholders management practices are provided by family members, neighbours or the property agronomist.   This approach is simple, needing only the property boundary and the most current land use mapping. The LMPI is then applied according to the land use boundaries.
- **A face to face interview** – pilot project staff organise to meet the landholder other than on their property and fill in the survey form with the landholder. This approach should also include an image of the property, comparable to SPOT 5 imagery or aerial photography. Preferably a large printout so the landholder can see clearly specific parts of the property, another hard copy should be given to the landholder for their own records.
- **The property visit** – pilot project staff organise to visit the landholder's property and fill in the survey form with the landholder. The visit includes a tour of the property enabling staff to build a context to which the information is collected. I hard copy image of the property should be provided to the landholder for their own records.

While information from all interview procedures is quite sufficient there is a distinct difference to the amount of detail information recorded depending on the interview style.

2.2   LANDHOLDER SURVEY INFORMATION

Landholder interviews are recorded within a structured format based on the activities that are part of particular land use enterprise. The completed survey forms clearly summarise the responses from any landholder. The interview sheets record the following information:

Location Information:	Contact details (name(s) of individual(s) interviewed), property name, lot/DPs (main lots) and nearest town.
Property Details	Size (ha), numbers and average size of paddocks
General Land Use	Main enterprises eg: grazing, cropping, irrigation
Detailed Land Management Practice Information	Details of current land management practices
Past Projects and On-ground Works	Location, date of implementation, description, funding sources and status of previous works and possible linkages with current projects.

The detail of the landholder survey recording sheets can be seen in Appendix 7.1 Example Landholder interview for land management practice information.

Table 1. Summary of contacts involved in the process – name and local or regional location.

NSW Catchment or Region	Contact Name	Nearest Town or Location	Interview Type
Lachlan	Andrew Smith	Grenfell	Third party information
Lachlan	Barry Scott	Merriwa	Face to face
Lachlan	Bill Matchett	Grenfell	Face to face
Hunter-Central Rivers	Bob Telfer	Merriwa	Property Visit
Lachlan	Bret McKellar	Grenfell	Property Visit
Lachlan	Brett & Jane Fisher	Koorawatha	Property Visit
Lachlan	Brian Gavin	Woodstock	Property Visit
Lachlan	Bruce Weir	Cowra	Property Visit
Central West	Colin Sies	Nyngan	Self assessment
Hunter-Central Rivers	Darryl Hanckel	Merriwa	Property Visit
Lachlan	Dave Brown	Greenethorpe	Face to face
Lachlan	David Marsh	Boorowa	Property Visit
Central West	Don Bruce	Cumnock	Self assessment
Lachlan	Lochie MacSMith	Cudal	Property Visit
Murrumbidgee	Graham Parker	Henty	Property Visit
Hunter-Central Rivers	Hugh Kreafft	Merriwa	Property Visit
Lachlan	Ian Coolie	Cowra	Property Visit
Lachlan	Ian McColl	Koorawatha	Property Visit
Lachlan	Michael Chambers	Cowra	Self assessment
Hunter-Central Rivers	Noel Dorney	Merriwa	Property Visit
Lachlan	Paul Tognetti	Grenfell	Face to face
Hunter-Central Rivers	Peter Malone	Merriwa	Over the phone
Lachlan	Peter Nicholson	Grenfell	Face to face
Hunter-Central Rivers	Peter Walker	Merriwa	Property Visit
Lachlan	Richard Langley	Greenethorpe	Property Visit
Hunter-Central Rivers	Robert Gill	Merriwa	Over the phone
Lachlan	Robert Grimm	Grenfell	Face to face
Hunter-Central Rivers	Ron Campbell	Merriwa	Property Visit
Lachlan	Ron McLelland	Grenfell	Face to face
Lachlan	Stephen Pereira	Greenethorpe	Property Visit
Lachlan	Warwick Hodges	Greenethorpe	Third party information
Hunter-Central Rivers	Jim Morgan	Merriwa	Property Visit
Lachlan	John Niven	Grenfell	Third party information
Lachlan	John Nowlan	Grenfell	Third party information
Lachlan	Rob & Marli Bryer	Grenfell	Third party information
Lachlan	Andrew Wooldridge	Canowindra	Property Visit
Lachlan	Sean Nowlan	Grenfell	Face to face
Lachlan	Des Balcomb	Cudal	Property Visit

2.3   FUNDED NATURAL RESOURCE MANAGMENT

The range of actions funded by government agencies across New South Wales, gives further scope to the importance of a standardised attribute list for land management practice information. There has been a change in the types of natural resource management actions funded in NSW over the last ten years resulting in a more holistic approach to available incentives. Incentive programs have become focused on land management practice change rather than individual activities over the past 10 years and it has become a challenge to record these activities in a way that will best describe

This can be seen in the provided datasets, where the funding programs developed by landcare groups and government agencies include:

- **Boorowa Regional Landcare Group** – including Saltshaker (specific type of on-grounds works related to salinity management), Stage 3, Stage 4 and Stage 4 Pastures.

- **Mid Macquarie and Lachlan TARGET project** – range of incentive funded on-ground works prior to Catchment Management Authorities includes changes in management practice, establishment of vegetation corridors

- **Catchment Management Authorities Incentive Programs** – range of projects to support landholders to change specific land management practices.

2.4   SOIL CONSERVATION WORKS

The practice of mapping Land Use within the NSW government Department of Environment and Climate Change is based on remote sensing using a combination of aerial photo interpretation with a satellite imagery backdrop and validation using site visits with some local knowledge.

In 2007 a detailed update of the land use in the Upper Hunter Valley was carried out. This provides an opportunity to acquire more detailed information on land use especially when the update program uses SPOT5 satellite imagery with 2.5m by 2.5m pixel definition. The update program not only looks at general land use, but also records the location and size (length or area) of soil conservation banks, dams and waterways. These are common soil conservation works constructed to reduce the effects of water erosion. When areas or paddocks have these sorts of soil conservation works constructed, they are effectively "treated" for soil erosion.

2.5   HUNTER VALLEY FLOOD MITIGATION PROGRAM

Combining the techniques of aerial photograph interpretation with currently available datasets a comprehensive list of activities used by The Hunter Valley Flood Mitigation Program has been prepared. The program installed numerous river bank protection structures, weirs and vegetation blocks that are easily discernable on aerial photographs and satellite imagery. When combined with digital photo libraries, point location data and some descriptive information a dataset has been created that provides accurate locations (verified using SPOT5 imagery) and standardised descriptions of flood mitigation activities.

3.   The Range of Information Gathered

For this project, land management practice information has been recorded for thirty-nine (39) individual properties. All of these records are based around particular land use enterprises, the majority being grazing and cropping.

The standard attribution list used in the Land Management Database has more than 1900 elements. These are all descriptors for specific activities which when combined with other elements form the total information package for a particular farm enterprise.   Elements in the Land Management Database are organised according to what particular land management practices can be described and how. Although there are over 100 activities available to describe land management practices, not all of these are used in this pilot project.

3.1   DATASETS INCORPORATED

In NSW, data sets on land management practices are patchy. The Department of Environment and Climate Change has been collecting Land Management Practice Information as part of particular programs and projects. These principal datasets incorporated were:

Department of Environment and Climate Change
- Component elements of land use dataset for the upper Hunter River Catchment
- Landholder surveys of the Grenfell, Cowra, Boorowa, Yeoval and Merriwa districts
- Recharge Validation Project of the Waugoola Catchment near Cowra
- Historical inventory of funded works for the Boorowa River Landcare Group
- TARGET project funded works for the Central West Region.

Catchment Management Authorities
- Funded incentive activities and on ground works
- Historical inventory of on ground works for the Hunter Central Rivers CMA
- Flood mitigation works for the Hunter River Valley.

Because of the various methods by which these data sets are collected, the detail within these datasets also varies. Some data have only basic descriptions concerning the particular practice with other containing details of the quantities used for various chemicals, additives, fertilisers and plant materials.

3.2   LANDHOLDER DESCRIBED PROPERTY INFORMATION

When structuring the attribute list within the Land Management Database, there has been a deliberate emphasis to ensure that the attributes precisely record how landholders describe what they do on their properties. Because of this emphasis on landholder descriptions, it is important to record what happens on these properties in terms used by landholders. This approach eases communication between survey staff and landholders, in turn providing a clear indication about what activities are undertaken and when. Also, by not focusing on why a landholder was doing certain activities further eases communication by removing the perceptions of judgements.

Table 2 below shows which elements of the standardised attribution list were used for this part of the pilot project and at what frequency the data exist in the dataset.

Table 2. Land management practice attributes recorded for natural resource management incentives and their frequency of use.

Land Management Practice	Examples of Descriptions Used	Frequency
Application of Ameliorant	Biological additives, Fulvic acid, Humic acid	5
Buildings and Sheds	Machinery shed, House or Homestead and surrounds	10
Road or Track	Farm road	15
Existing Fences	Permanent, internal, boundary	7

Land Management Practice	Examples of Descriptions Used	Frequency
Current Water Supply	Trough, Tank, Pipe: standard	8
Commodity	Grapes: table, Olives: oil	1
Direct Drill	Ground disturbance	20
No Tillage	Distance between tynes	24
Minimum Tillage	Tyne: winged knife edge	4
Zero Tillage	Straight disc	2
Multiple Tillage	Tillages before sowing	2
Controlled Traffic	Distance between tracks	1
Crops Planted	Wheat, Barley, Canola	31
Fallow	BF: bare fallow, days before sowing	1
Incorporated Stubble	Days before sowing - 29	4
Bailed	Days before sowing	2
Stubble Burnt	Days before sowing - 3	23
Stubble Retained	Intact, Knocked over	20
Agronomic Advice	State Agency,	6
Computer and Software	Internet access, Farm management program	15
Breeding System	1st Cross ewes, X bred lambs	12
Crash Grazing	Days in paddock - 1	5
Rotational Grazing	Days in paddock - 2	13
Cell Grazing	Days in paddock - 2	2
Time Controlled Grazing	Days in paddock – 0.5	5
Set Stocking	Days in paddock - 240	3
Windrow and Rake		8

3.3   NATURAL RESOURCE MANAGEMENT ACTIVITIES

The spatial recording and attribution of actions by government agencies across New South Wales are driven by the need to report on particular outputs and catchment targets. All of the land management practice information within these datasets has been recorded by government employees using digital aerial photography or SPOT5 satellite imagery as backdrop images within a geographic information system.

The Land Management Database has been customised to allow users to tag each spatial feature to specific reporting outputs and catchment targets. Examples of these outputs (Table 3) and targets (Table 4) are shown below.

Table 3. Examples of the National Standard Outputs for reporting. This includes detailed descriptions of output codes for Capacity Building and On-Ground Works.

Old No	Output Code	Output Unit of Measure #1		Output Unit of Measure #2	Description
ON-GROUND WORKS OUTPUTS					
OG9 Works related to soil management and other soil treatments					
57	OG9.1	Area (ha) of land treated and/ or protected from soil erosion by engineering works			With work such as rehabilitation of gullies by filling in and reshaping of the sides, count the actual number of ha treated. With other works, such as the construction of contour banks, count the number of ha protected from erosion
58	OG9.2	Area (ha) of land treated for soil erosion through exclusion fencing			Includes areas fenced to control stock and/ or enable revegetation treatment
59	OG9.3	Area (ha) of acid sulphate soils identified and treated/protected			Includes areas mapped and/ or treated with soil ameliorants and/ or treated with works
60	OG9.4	Area (ha) of soil treatment for other than erosion or acid sulphate soils			Includes activities such as spreading lime, gypsum or clay
OG2 Native vegetation protected by fencing					

Old No	Output Code	Output Unit of Measure #1		Output Unit of Measure #2	Description
23	OG2.1	Area (ha) of coastal native vegetation protected by fencing			Coastal land is defined as land that is either within one kilometre: (a) landward of the open coast high water mark; or (b) around all bays, estuaries, coastal lakes, lagoons or islands; and tidal waters of coastal rivers to the limit of mangroves or the tidal limit whichever is closer to the sea. [Adapted from NSW coastal policy] Native vegetation is any vegetation species that existed before European settlement including trees, saplings, shrubs, scrub, understorey, groundcover or plants in a wetland [Adapted from the Native Vegetation Act 2003]
	OG2.2	Area (ha) of wetland native vegetation protected by fencing			Wetland is defined as land where "an excess of water is the dominant factor determining the nature of soil development and the types of plant and animal communities living at the soil surface" [Definition taken from DEH website] See above for definition of 'native'
24	OG2.3	Area (ha) of riparian native vegetation protected by fencing	**and**	Streambank length (km) of riparian vegetation protected	Measure both sides of the stream bank. Riparian land is defined as "any land which adjoins, directly influences' or is influenced by a body of water". [Land and Water Australia] See above for definition of 'native'. Measure both sides of the stream bank, if applicable
22	OG2.4	Area (ha) of terrestrial native vegetation protected by fencing			Terrestrial is defined as any land not included in the above three categories. See above for definition of 'native'
CAPACITY BUILDING OUTPUTS					
CB1 Awareness raising					
1-4	CB1.1	Number of awareness raising events such as demonstrations, field days or study tours conducted	**and**	Number of participants in person-days	An awareness-raising event is an event designed to pass on information and improve knowledge and understanding. To calculate person-days, multiply the number of participants by the amount of a day or days the event ran for (use only half day or full day units) and round totals to the nearest whole number
5, 6, 8	CB1.2	Number of written products such as brochures, newsletters, posters or fact sheets developed	**and**	Estimated number of recipients	Includes less formal written material such as brochures, newsletters, posters and fact sheets. Formal documents such as reports and plans should be reported under CB3.1 or the Planning or Resource Assessment categories
7	CB1.3	Number of displays for use at events such as regional meetings developed			Covers displays developed for use at events such as regional meetings, agricultural shows or other community events
9	CB1.4	Number of media opportunities resulting in articles in newspapers or on radio or television created			Includes articles in newspapers and magazines, items on radio or in television programs
10	CB1.5	Number of websites developed or significantly enhanced			Websites developed to provide information related to regional natural resource management
CB2 Skills and training					
17 19	CB2.2	Number of workbooks, course notes or other key materials developed	**and**	Quantity distributed	Use CB2.2 when materials are developed to be used by others or for training events to be run by your project in a future reporting period. If developed for a event you're currently running, use CB2.1
13 16	CB2.1	Number of training sessions, workshops, seminars or other skills and training events conducted	**and**	Number of participants in person-days	Structured activities designed to improve existing skills or develop new ones. Training sessions MAY lead to or contribute to formal qualifications like a TAFE certificate but need not necessarily do so. To calculate person-days see CB1.1

Table 4. An example list of the Catchment Targets used by the Southern Rivers Catchment Management Authority for reporting. It includes detailed descriptions of targets for biodiversity, soil and land capability.

BIODIVERSITY CATCHMENT TARGETS	
Biodiversity catchment target 1: By 2016 there is an improvement in native vegetation condition and an increase in connectivity and extent.	
Biodiversity catchment target 2: By 2016 the regional status of priority threatened and regionally significant species, ecological communities and populations within the Southern Rivers catchment is maintained or improved.	
BIODIVERSITY MANAGEMENT TARGETS	
Biodiversity management target B1 – community and landholder knowledge and skills	**B1** By 2016 there will be an increase in the number of land managers who adopt management practices that conserve biodiversity and promote sustainable production
Biodiversity management target B2 and B3 – native vegetation conservation	**B2** By 2016 through voluntary participation by land managers, the area of land actively managed to conserve priority vegetation types will increase from 11,000 hectares to at least 41,000 hectares.
	B3 By 2016 through voluntary participation by land managers, an additional 10,000 hectares of native vegetation will be actively managed to build a resilient landscape with good connectivity that conserves biodiversity
Biodiversity management target B4 – native species conservation	**B4** By 2016 the priority recovery actions identified in the Southern Rivers threatened species strategy will have been implemented
Biodiversity management target B5 and B6 – invasive species threats	**B5** By 2016 vertebrate pest species will be controlled in key locations
	B6 By 2016 priority weed species will be controlled in key locations
SOILS AND LAND CAPABILITY CATCHMENT TARGETS	
Soil and Land Capability catchment target: By 2016 the area of land that is managed within its capability and suitability is increased and the impacts of land degradation are systematically reduced on a priority basis.	
SOIL AND LAND CAPABILITY MANAGEMENT TARGETS	
Soils and Land Capability Management Target SLC1 – Land Manager Skills	**SLC1** There will be 300 land managers per year with increased skills, knowledge and support to manage land within its capability.
Soils and Land Capability Management	**SLC2** By 2008 there will be greater integration of natural resource management

Target SLC2 – Development Controls	with planning instruments and processes to ensure that land use change recognises land capability and suitability.
Soils and Land Capability Management Target SLC3 – Erosion	**SLC3(a)** - By 2016 300 kilometres of gully erosion will be stabilised including: • 125 kilometres of minor and moderate gully erosion • 175 kilometres of severe and very severe gully erosion.
	SLC3(b) - By 2016 a minimum of 10,000 hectares will be protected from the threat of erosion including land: • identified as having a severe or very severe wind erosion hazard; and • susceptible to severe and very severe sheet and rill erosion.
Soils and Land Capability Management Target SLC4 – Acid Sulphate Soils	**SLC4** - By 2016 manage according to best practice: • all land identified as having an active acid sulphate soil risk within its capability. • all exposed acid sulphate soils; and
Soils and Land Capability Management Target SLC5 – Salinity	**SLC5** - By 2016 manage at least 200 hectares of land affected by dryland salinity.
Soils and Land Capability Management Target SLC6 – Soil Health	**SLC6** - By 2016 an additional 10,000 hectares of land will be managed with appropriate soil and pasture management practices to improve soil health and productivity.
Soils and Land Capability Management Target SLC7 – Agricultural Weeds	**SLC7** - By 2016 an additional 50,000 hectares will be actively managed for invasive plant species that threaten agricultural sustainability.
Soils and Land Capability Management Target SLC8 – Pest Animals	**SLC8 -** By 2016 there will be a 20,000 hectare increase in the area of land actively managed to control pest animal species (and/or impact of these species) that threaten agricultural sustainability.

The Boorowa Regional Landcare Group and TARGET datasets were collected by going through old hard copy documents stored in filing cabinets. This method of collecting information for spatial recording is extremely time consuming and depends entirely on the quality of the records. In some cases the records were of no use, because an accurate location could not be obtained from descriptions contained in the documents. These digital records are created by the staff coordinating the various projects and as a consequence the collection of the data is as efficient as possible. The spatial records are then imported into the LMD central database for standardisation and storage.

Currently, the data sets for the Catchment Management Authorities Incentive Programs are collected in real-time by CMA staff, as specific activities are approved for funding. The digital data are spatially recorded, attributed and uploaded to a centralised database located with DECC at Parramatta (NSW). This ensures there is no need to go-back over hard copy records to build useful datasets and it also enables instant reporting.

Table 5. Range of Land Management Practice used for natural resource management incentives, including a summary of the information recorded in the dataset.

Land Management Practice	Examples of Descriptions Used	Frequency
Aquatic Weed Control	Glyphosate bioactive, w: Alligator Weed, w: Ludwigia	1
Crop Tillage Practices	Single pass, No-till (knife edge)	80
Current Water Supply	Trough, tank	12
Direct Seeding	Native to area, Canopy species, shrubs	91
Drainage System Treated	Riparian vegetation, Protection structure	351
Electric Fencing	Internal, permanent, temporary	13
Establish Vegetation	Native to area, mixed species, canopy species	2616
Extension Products	Brochures,	7
Fencing	Internal, Permanent, Steel posts, Plain wire	1775
Grazing Practice	Time controlled Maintain ground cover.	159
I.N.S. Management		4
Machinery Conversion or Purchase	Cost,	25
Management of Vegetation	Occasional grazing, Hazard reduction, Site fenced	1751
Native Pasture Establishment		8

Land Management Practice	Examples of Descriptions Used	Frequency
Native Pasture Management	C3 species, Exclusion of fertilisers	81
Pasture Establishment	Mechanically sown, mixed species	183
Pest Control	Goat	70
Protect Habitat	Site fenced	94
Protect Native Vegetation	Stock exclusion, Site fenced	144
Research Study	Carbon Percentage,	108
Resource Monitoring	Water Sampling, Groundcover Assessment	4
Skills and Training	Field day, Grazing for Profit,	16
Soil Testing	Tests: pH, Tests: ECw, Organic matter	109
Trap Yard	Gate: spear,	54
Tree and Shrub Control	Cut and paint, Spraying (includes species list)	1867
Vines and Groundcover Control	Spraying (includes species list)	1537
Water Delivery	Trough, Concrete, Plastic, Pipe: standard	557
Water Source	Bore, Well	30
Water Storage	Tank, Farm dam	109

3.4   SOIL CONSERVATION PRACTICES

A recent re-mapping of the land use information within the Hunter Valley region by the Department of Environment and Climate Change provides a comprehensive data set on land management practices implemented to control soil erosion.

Although these works have been constructed over a period of 50 years, they are still deemed to be effective if there are no observed breached in the structures. Using a combination of aerial photo interpretation and recent SPOT5 satellite imagery, the data set has a useful resolution of approximately 1:7500. At this resolution the occurrence of individual tree lots and distinct changes in terrain surface, such as paddock boundaries and contour banking systems and their condition can be determined. This project not only mapped specific land uses, but also the location of all active contour banking systems within the valley.

Although commissioned as a land use change program, only the line work for contour banks, dams and waterways has been imported into the Land Management Database for this specific project. The table below shows the different descriptions used to attribute the spatial soil erosion control features imported from the larger data set.

Table 6. Range of Land Management Practices used with soil conservation and erosion control works, including a summary of the information recorded in the dataset.

Land Management Practice	Examples of Descriptions Used	Frequency
Area Treated	Erosion control, Salinity	571
Bank	Contour, Diversion, Inlet bank	3643
Catchment Treated	Sediment control	3
Gully Stabilisation	Gully Control Structure	2102
Flume	Concrete, Rock, Geotechnically designed	26
Piping	Pipe: standard	10
Shaping Work	Gully filling,	257
Waterway	Geotechnically designed	94

3.5   FLOOD MITIGATION WORKS

The Hunter Valley Flood Mitigation Program commissioned the Department of Lands to compile a dataset of all associated bank protection works and bed stabilisation works along all tributaries within the hunter valley. Department of Lands staff survey along creeks and rivers to find these works, collecting point locations together with descriptions of construction methods, length of works, current effectiveness and estimated cost.

The problem with importing the data into the Land Management Database is the lack of spatial information, so other information had to be used in conjunction with the original dataset. The use of aerial photograph interpretation (API) at each point location for the dataset helps identify the accurate location and if other activities are part of the works. There is also photo point information available for each site, which helps to identify the location and types of works in more detail. The types of descriptions used for these management practices within the LMD are listed below.

Table 7. Range of Land Management Practices used with flood mitigation works, including a summary of the information recorded in the dataset.

Land Management Practice	Examples of Descriptions Used	Frequency
Bank Protection Structure	Rock wall, Mesh, Heavy duty	110
Exotic Vegetation	Willow, Poplar	48
Bed Stabilisation Work	Drop structure, groyne	58

4. Results from the Project

The testing and the resultant refinement of the standardised attribute list used in the Land Management Database have provided the Department of Environment & Climate Change with detailed data of the resources needed to undertake the collection and recording of land management practice information. For the past three years many officers have collected specific land management practice information relating to CMA-sponsored on-ground activities, the spatial recording of this information and the training of staff in the use of the Land Management Database.

As part of this Project Brief, a number of techniques for the collection and collating of land management practice information were trialled from different sources. A range of land management practice information was generated from several activities:

- Accessed and imported five digital datasets into the Land Management Database of past works carried out by groups prior to the formations of the CMAs in NSW. Further expansion of the attribute list was undertaken to accommodate the various management practices described in the datasets.
- Surveyed and imported 39 property records for land management practice information into the LMD. As part of this aspect of the project, the standardised attribute list has been modified to accommodate the large range of management practices used on these 39 properties.
- Liaised with five Catchment Management Authorities to customise the attribute list to accommodate their incentive funding activities and enable linkages to standard outputs and catchment targets for reporting.
- Liaised with three other agencies collecting land management practice information. Discussions were sought to look at the synergies between the attributes being collected and the standard attribute list in the LMD. The LMD attribute list has been modified to accommodate the practices being collect by the other agencies to ensure the capability of data sharing between these datasets. This aspect of the project provided substantial input to expand the attribute list for recording land management practice information and to inform LUMIS of additional descriptors that are needed for the national classification.

4.2 LANDHOLDER DESCRIBED PROPERTY INFORMATION

As part of the project, thirty-nine landholders have been interviewed to record their land management practice activities. Of these landholders there were 9 in the process of changing their management practices or have changed management practice in the last ten years, they had all attended some type of intensive training courses. These courses included "Grazing for Profit" and "Holistic Resource Management", in some cases landholder's attended both these courses. The sorts of on-farm changes land holders where implementing in order to change management practices for grazing and cropping enterprises included:

Grazing – implement changes in paddock composition reducing paddocks to approximately 10 ha and increasing the number of paddocks to more than 40 paddocks, installing a permanent reticulated stock watering system, enabling landholders to stock each paddock in rotation: change from self replacing flocks or stud enterprises to systems of buying and selling stock depending on available feed in the paddocks.

Cropping – implement changes to enlarge paddock sizes and in some cases remove farm dams or banking systems; reduce Livestock numbers and avoid stock are usually not allowed on cropping paddocks during wet periods; control the movement of machinery in paddocks to designated tracks that are at set distances from each other; install a GPS system to the machinery aid in auto steer or variable rate delivery of seeds and fertilisers.

When interviewing landholders for individual property information, it quickly became apparent that the information needed to be recorded at the sub-property or paddock level. In the specific instance of the wheat-sheep belt the range of commodities produced in any one year over the entire property involved a number of contrasting operations which could not be recorded in a composite summary for the property. Hence, the initiative to record the information at the paddock level turned out to be the correct decision.

Resource Needs
All methods used to collect landholder described management practices required a standard set of digital data to generate the property record and a standard set of software. These digital datasets and software programs included:
- Orthorectified SPOT 5 imagery or aerial photos for background imagery for digitising
- Land Information datasets for Rural Land Capability, Gully erosion and Land Use
- ESRI ArcGIS software bundle with ArcMAP version 9.2
- Land Management Database

These systems and data sets enabled project staff to effectively communicate with landholders especially when discussing management practices over the phone with landholders. Below is a table reviewing the resources and results from each collection method.

Table 8. Review of pilot project objectives: activities and principal components.

COLLECTION METHOD	RESOURCES	RESULTS
The property visit **12 properties visited**	Equipment: Laptop and mobile Preparation time: 60 minutes Interview time: 240 minutes Digitising time: 120 minutes Attribution time: 180 minutes Staff Required: 1 EFT	Possibility for most detail to be collected: ▪ Ability to check land management practices against rural land capability and resource condition (one of the indicators for soils in NSW). ▪ Ability to view current land use activities at the paddock level. ▪ Ability to check land condition features (gullies, salt outbreaks, tree cover) and query land holder for specific management practices. ▪ Interactions with landholder provide prompts to issues that may be overlooked in telephone or self-assessment techniques. ▪ Most difficult to arrange timetable to suit both parties.
Interviews over the telephone **2 surveys over the phone**	Equipment: PC and telephone Salinity and Land Use Preparation time: 15 minutes Interview time: 45 minutes Digitising time: 200 minutes Attribution time: 130 minutes Staff Required: 1 EFT	Similar to face to face interview: ▪ Identifies all land management practices for each land use enterprise ▪ Additional data sets provide a check on the questions to be asked of land holder ▪ Interviewer needs a questionnaire to ensure all aspects of land management activities are canvassed. ▪ There are time restrictions particularly during daylight hours in which to contact the landholder unless he/she has a mobile telephone. In this case, the interviews are best done early in the morning, or after dusk.
Self assessment survey **4 self assessments**	Equipment: PC and facsimile Preparation time: 15 minutes Interview time: 0 minutes Digitising time: 200 minutes Attribution time: 90 minutes Staff Required: 1 EFT	Least detail provided: ▪ Not all aspects of land management practice information provided in the one interview ▪ No prompts available to respondent so only part of the information may be provided. ▪ Data tend to be more general than specific information obtained from a direct interview. ▪ Information tends to have a more optimistic slant.
Face to face interview **9 face to face surveys**	Equipment: Laptop and mobile Preparation time: 60 minutes Interview time: 120 minutes Digitising time: 120 minutes Attribution time: 180 minutes Staff Required: 1 EFT	Similar to property visit, but no context gained. ▪ Depends on the availability of the landholder to attend the place where the interview is being conducted. ▪ As for property visits, the coordination of times that are mutually convenient to both parties is one of

		the major difficulties.
Third party information	Equipment: PC and telephone Preparation time: 15 minutes Interview time: 60 minutes	Although this method can provide information quickly about many properties, the range of information collected was mainly basic.
12 third party surveys	Digitising time: 120 minutes Attribution time: 120 minutes Staff Required: 1 EFT	▪ Identifies general details of land management practices for each land use enterprise but may miss specifics for each activity.

4.3   FUNDED NATURAL RESOURCE MANAGMENT

There have been dramatic changes to government funded programs over the last ten years in New South Wales. The funded on-ground works implemented by the Boorowa Regional Landcare Committee dataset concentrate on funded works based on specific actions, like pasture establishment and tree planting. For funding programs implemented later, a wider range of actions are funded based on changes in management practices, like converting machinery, splitting paddocks with fencing, paying for training courses and soil surveys.

Resource Needs
For each of the data sets mentioned below in the table, there was a great deal of preparation before importing could be done, this consisted of quality checking the available descriptions and location of each spatial feature. Requiring, a standard set of spatially datasets and software. These digital datasets and software programs included:
- Orthorectified SPOT 5 imagery or aerial photos for background imagery for digitising
- The original dataset used to generate the LMD spatial features for importing.
- ESRI ArcGIS software bundle with ArcMAP version 9.2
- Land Management Database

Table 9. A tabulated review of pilot project objectives, detailing the activities and important components for the NSW Pilot Project.

DATASET	RESOURCES	RESULTS
Imported Boorowa Regional Landcare Group Works	Equipment: PC Preparation time: 15 minutes Data trawl: 45 minutes Digitising time: 200 minutes Attribution time: 130 minutes Staff required: 1 EFT	▪ An understanding of the types of activities that were funded in the first round of the Natural Heritage Trust programme. ▪ Incomplete data set because of some missing records
Imported TARGET Works	Equipment: PC Preparation time: 15 minutes Data trawl: 0 minutes Digitising time: 200 minutes Attribution time: 90 minutes Staff required: 1 EFT	▪ Incomplete data set because of some missing records ▪ All activities had descriptions and extent already recorded due previous spatial recording efforts.
NSW Catchment Management Authorities	Equipment: PC or Laptop Imagery: 2.5m X 2.5m pixel size Interview time: 120 minutes Digitising time: 120 minutes Attribution time: 180 minutes Staff required: >100 EFT	▪ Potential problems because quality assurance was not carried out on the initial attribution of the data. ▪ Variation in standards and level of attribution amongst different NSW Catchment Management Authorities

4.4   SOIL CONSERVATION WORKS

From the collection of soil conservation activities in the districts of Merriwa and Muswellbrook, banks, farm dams and water way feature where spatially recorded. A review of the resources and results for this data set

is tabled below showing the preparatory work required for importing the data, including quality checking the attribution and location of the spatial features. As with the other techniques, a standard set of digital data and a standard set of software is required to generate the property record, these digital datasets and software programs include:

- Orthorectified SPOT 5 imagery as background imagery for digitising
- The updated land use mapping for trial area.
- ESRI ArcGIS software bundle with ArcMAP version 9.2
- Land Management Database
- API stand with mirrored stereoscope and aerial photographs

Table 10. The tabulated review of the pilot project objectives, detailing the activities and important components for the NSW Pilot Project.

DATASET	RESOURCES	RESULTS
Land Use Data Banks Dams Waterways	Equipment: PC Preparation time: 2 weeks Mapping time: 7 weeks Attribution time: 1 week Validation: 2 weeks Staff required: 2 EFT	▪ Features identified against recent SPOT 5 imagery and confirmed as still existing. ▪ Aerial photograph interpretation used to confirm features are intact and still operating. ▪ Direction of flow of water along banks also recorded.
Importing the dataset into the LMD	Equipment: PC Preparation time: 1 week Quality check: 3 weeks Digitising time: 7 weeks Attribution time: 2 weeks Staff required: 1 EFT	▪ Line work and point features imported with positional errors. ▪ Re-positioning and editing of features required for majority of dataset.

4.5   FLOOD MITIGATION WORKS

From the importing of flood mitigation works funded by the Hunter Valley Flood Mitigation Program, bank protection structures and vegetation works where spatially recorded. A review of the resources and results for this data set is tabled below showing the preparatory work required for importing the data, including quality checking the attribution and location of the spatial features. As with the other techniques, a standard set of digital data and a standard set of software are required, these digital datasets and software programs include:

- Orthorectified SPOT 5 imagery or aerial photos for background imagery for digitising
- The original dataset generated by Department of lands
- Photo point database of each located works
- ESRI ArcGIS software bundle with ArcMAP version 9.2
- Land Management Database

Table 11. The tabulated review of the pilot project objectives, detailing the activities and important components for the NSW Pilot Project.

DATASET	RESOURCES	RESULTS
Flood Mitigation Works database checking	Equipment: PC and API stand Preparation time: 1 week Data Trawl: 1 week Mapping time: 2 weeks Validation: 1 week Staff required: 2 EFT	▪ The original data set had only a point location with the extent of the works being stored in table format. ▪ Corrections were undertaken by plotting the data set onto SPOT 5 imagery and then using aerial photographs to locate and determine the full spatially extent of the activity.
Importing the dataset into the LMD	Equipment: PC Preparation time: 4 weeks Quality check: 2 week Digitising time: 6 weeks Attribution time: 4 weeks Staff required: 1 EFT	▪ Because of the descriptions in the original data set and the errors identified, sixteen weeks were needed to bring the data up to a standard consistent with other data sets. ▪ Photo point information was also used verify extent and description.

4.6   EXAMPLE DESCRIPTIONS OF MANAGEMENT PRACTICES

The involvement of a range of natural resource management agencies and groups in the collection of land management practice information has highlighted the enormous range of management practices being used in New South Wales. Some examples of how specific land management practice information has been recorded using the Land Management Database and the standardised attribution list are given below.

Photograph 1: Example of a grazing practice in the Boorowa district, Central West NSW.

Property Size: 1200 Ha
Number of Paddocks: 110
This Paddock: 8 Ha
Grazing Practice - **Time controlled grazing** -
Maintain groundcover 100%, Resting period per year 350 days.
Pasture Management - **Pasture Composition** -
mixture species, 6 perennial species, 2 annual species, IP: improved pasture, 2 native species, 6 exotic species.
Animal Management – **Livestock Type** –
Sheep: wool 2500.

Vegetation Species Assessment –
phalaris, tall fescue, chicory, redgrass, *Microlaena* sp., wallaby grass, balancia clover and white clover.

Photograph 2: Example of "white box" woodland in the Cowra district, Central West NSW

This Paddock: 43 Ha
Native Vegetation Management –
Management of Vegetation – occasional grazing, fuel reduction, hazard reduction.
Animal Management – **Livestock Type** – 240 Sheep: wool

Vegetation Species Assessment:
White Box - 25m high, 38% cover
Narrow Leaf Ironbark – 24m high, 25%
Wattle – 3m high, 15%
Kangaroo Grass – 0.8m high, 55% cover.
Weeping Grass – 0.6m high, 35% cover

Vegetation Community Assessment:
White Box - Narrow-leaved Ironbark grassy woodland

Photograph 3: Example of mixed farming north of Cowra, Central West NSW

Property Size: 840 Ha
Number of Paddocks: 78
This Paddock: 33 Ha
<u>Crop Management</u> – **Cropping Practice** – Alley Farming, Opportunity cropping
<u>Native Vegetation Establishment</u> – **Establish Vegetation** - mixed species, canopy, salinity tolerant, not endemic to area
<u>Grazing Practice</u> – **Set Stocking** - occasional grazing - crop stubble,

<u>Vegetation Species Assessment</u>:
Blakely's Red Gum – 12m high, 15% cover
Swampy She Oak – 16m high, 30% cover

<u>Activity Status</u> – **Works Completed**, September 1999

Photograph 4: Example of a controlled traffic copping practice in the Young district, Central West NSW.

Property Size: 630 Ha
Number of Paddocks: 26
This Paddock: 134 Ha
<u>Precision Agriculture</u> – **Controlled Traffic**
<u>Crop Management</u> - **Crop Rotations** – rotational, pasture phase 4 years, cropping phase 7 years, wheat 4 years, canola 2 years, lupins 1 year.
<u>Stubble Management</u> - **Stubble Retained**, knocking over and increasing carbon %.
<u>Crop Tillage Practice</u> – **No Tillage** – Single pass, Tyne: knife edge, Soil disturbance 15%, and maintain soil structure.

4.7   ALIGNMENT OF LMD AND LUMIS

With the similarities between the national Land Use Management Information System and the Land Management Database attribute list in the hierarchical nature of these systems, it became apparent that the majority of the standardised attribute list of the LMD can start at the 4th and 5th stages of the LUMIS hierarchy. An example of the relationship table that demonstrates how the two classification systems can be linked is shown below, using some of the LMD classifications demonstrated in the section above.

Table 12. The tabulated review of the pilot project objectives, detailing the activities and important components for the NSW Pilot Project.

LMD Category	LUMIS code	LMD Activity	LUMIS code	LMD Subtypes	LUMIS code
Grazing Practice	2214	Time Controlled Grazing	22142	350 days rest 100% ground cover	?
Precision Agriculture	3114	Controlled Traffic	3113		
Crop Tillage Practice	311	No Tillage	31123?	Single pass 15% soil disturbance	?

5. Conclusions

As stated in the Project Objectives of this report the aims of this project where to include:

- Document the development and testing of a methodology to collect land management practice information at the property level across different climate, commodity and landscape zones

- Further develop a standardised attribute list to suit the needs of a wide range of clients where land management practice information is required

- Document the:
    - o Resources and types of resources (funds, staff, vehicle etc.) needed to undertake the work
    - o Length of time it takes to complete the mapping for specific activities
    - o Training required to teach systems to other operators
    - o Problems of integrating and cleaning spatial property data from various sources.

1. Document the development and testing of a methodology

All the techniques trialled provide different levels of detail concerning land management practice information at the property level. Those techniques involving a direct face-to-face interview with the landholder or land manager provide the most detailed descriptions of land management practice, but require greater resources in time and organisation. This process enables the recording of all the land management practices associated with an individual commodity and to capture the information spatially using the land use layer as a backdrop.

For this project however, they have proved to be of great benefit particularly in the expansion and consolidation of the list of land management practices for DECC's Land Management Database and for reviewing the LUMIS classification.

2. Further develop a standardised attribute list

From the experience gained throughout this project it has also highlighted that the development of the attribute list is an on-going process. Recent emphasis on climate change and climate change adaptation issues highlights the importance of keeping an attribute list flexible enough to allow for expansion.

3. Documenting times, resources and problems.

The results are discussed in Section 4.2.

6.   Recommendations

The Land Management Database (LMD) and the standardised attribution list should be viewed as a unique opportunity for the collection and spatial recording of land management practice information to become part of state and federal agency activities. This pilot project highlights the ability to collect land management practice information on a regular basis, much like Land Use data sets, using integrated systems like the LMD.

The New South Wales Department of Environment and Climate Change recommends the following processes to begin the collection of land management practice information on district, regional or state wide scales:

1. This report is accepted as the documentation for the pilot project. The report highlights the potential for the spatial recording of land management practice information by New South Wales agencies, because of its relevance to issues such as land, soil and water management, biodiversity management, climate change adaptation and the whole suit of processes under the banner of monitoring, evaluation and reporting.

2. Expanding the recording of land management practice information across the whole of New South Wales, focusing on its potential to support and help interpret results obtained by census-type surveys. This would provide a validation of the more broad scale information collected by surveys, and would ensure that new or emerging techniques in land management are incorporate into census-styled questionnaires.

3. The further development of the Land Use Management Information System (LUMIS) classification system, should consider the results that are being obtained from the Land Management Database.

4. As an issue of high priority the adoption of the standardised methods and techniques documented in this pilot project to record land management practice information in a spatial format at regional, state and national levels.

5. Promote the concept of additional funding for agencies and community groups to collect information on land management activities and all past government funded activities.

6. Promote within the federal bureaucracy the concept that reporting on environmental projects requires an accurate spatial component as well as a detailed textual component. Information needs to be collected in a spatial format so that it can serve the purposes of detailed reporting of outputs and high level modelling of outcomes.

In New South Wales the use of Land Management Database by regional authorities which began with the Hawkesbury Nepean Catchment Management Authority has now expanded to other CMAs, including Southern Rivers, Western, Central West, Lachlan, Namoi, Murrumbidgee, Lower Murray Darling, Northern Rivers and Hunter Central Rivers. In addition, a number of other government agencies and community groups are starting to use the LMD.

6.   References

Bureau of Rural Sciences (2002) *Land Use Mapping at the Catchment Scale, Principles, Procedures and Definitions*, 13-25. February 2002, Bureau of Rural Sciences, Canberra.

Henry, N. (2005) State Wide Needs and Uses for Land Management Practice Information (LMPI), 5, 12-22. November 2005, NSW Department of Natural Resources, Parramatta.

Australian Government Monitoring and Evaluation. (2004) Standard Outputs for 2005-06 Reporting, 5-11. December 2004, AG Department of Agriculture, Fisheries and Forestry, Civic.

Southern Rivers Catchment Management Authority. (2004) Catchment Action Plan, extract of Management Targets. November 2004, Southern River CMA, Wooloogong.

7.   Abbreviations Used

BRS – Bureau of Rural Sciences

CMA – Catchment Management Authority

DoL – Department of Lands

DPI – Department of Primary Industries

DECC – Department of Environment and Climate Change

EMS – Environmental Management System

GIS – Geographic Information System

LMPI – Land Management Practice Information

NHT – Natural Heritage Trust

8. Appendices

7.1 EXAMPLE LANDHOLDER INTERVIEW FOR LAND MANAGEMENT PRACTICE INFORMATION

Nik Henry – Natural Resource Officer
Dept. Environment and Climate Change
Level 4, 26 Honeysuckle Drive
NEWCASTLE 2300 NSW

To Whom It May Concern,

Re: Spatial Recording of Land Management Practice Information

The Hunter Central River Catchment Management Authority (HCRCMA) is assisting the Department of Environment and Climate Change (DECC) in the collection of land management practice information on private farms.

DECC's project is part of a national study to determine the best methods of collecting and recording land management practice information. The information if used by the state and federal authorities, including groups such as the HCRCMA, could be used to identify the types of funding projects to develop for certain catchment areas.

Any information concerning the land management practice information that you supply to me will be recorded on a geographic information and mapping system. We are only interested in details of how you use the land and we will not be asking any financial or personal information.

If you are willing to participate and supply information to me, DECC has agreed to provide you with a large format satellite image of your property similar to the farm planning aerial photos that the Soil Conservation Service provided. For this to happen, I will also need to ask you to provide the boundaries of your property (if you haven't done so to the CMA in the past).

Yours Sincerely

Nik Henry

Property Details and Information

Landholder: Mike Chambers				Agreement?:
Property Name (s): Harcourt		**Nearest Town: COWRA**		**Lot//DP's?:**
Address: Grenfell Rd, Cowra 2794				

Current Land Use (Agricultural Enterprises) To record, please circle					**Details (area?), number of years**
Animal Production	Traditional grazing	self replacing	rotational grazing	Stud	
Intensive Animal	Piggery	Poultry	Feed lot		
Crop	Winter cereals	Summer cropping	Irrigated	Share farming	
Hay & Silage	Stubble	Legume	Lucerne	Other	
Orchards	Olives	Stone fruit	Citrus	Berries	
Vines	Grapes	Irrigated			
Contracted Services	Baling	Windrowing	Sowing	Spraying	
Irrigation Practice	Flood	Sub surface	Pivot	Travel	
Other:	Planned grazing	trading stock			640ha 5yrs

Animal Production Enterprises				
Activity	**Types of Information to Record** (please circle)			**Details (numbers?)**
Stock type Free range	cows	ewes	goats	alpacas	dse: 6000
	horse	pigs	poultry		
	wool	breeding	meat	dairy	No of mobs: 1 or 2
	steers				
Turn Off	Weaners	Vealers	Stores	Lambs	Numbers? 6000 dse
Grazing Practice	Set	Rotational	cell	EMS	Grazing days: per paddock 3 – 4 days /yr
	Time controlled		Pasture phases		
Grazing Practice	Set	Rotational	cell	EMS	Grazing days:
	Time controlled		Pasture phases		
Pasture type perennial annual	Cox foot	Plains grass	Lucerne	Oats	Years in pasture? 2 – 10yrs
	Clovers	Fescue	Phalaris	Barley	Salt/acid tolerant?
	Native	Clovers	exotic		
Pasture Establishment	Sown	volunteer	Broadcast seeding		
	aerial				
Pasture Management	Burn	spray	Crash grazing		Resting period? 30-180 days depending on season
			Maintain ground cover		
Application of Ameliorants	MO	Selenium	Super phosphate	nitrogen-based	Kg/Ha, type? DAP 50 hg/ha
	SF45				
Water Supply	stock	tanks	piping	pumping	Number and size?

	reticulated	Bore supply	troughs	dams	90000l tank 63 mm pipe, moveable poly troughs (300 l)
Supplementary Feeding	Molasses	fodder grain	Organic additives	Licks	NIL
	Cotton seed	Self feeder		Urea	
Weed Control Species?	burning	Spraying	grubs	chipping	cathead only
	Glyphosate				