DWLBC REPORT

Land management monitoring in the agricultural areas of South Australia: Report No 2

2008/29

Government of South Australia
Department of Water, Land and Biodiversity Conservation

Land management monitoring in the agricultural areas of South Australia: Report No 2

Giles Forward

Knowledge and Information
Department of Water, Land and Biodiversity Conservation

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Report DWLBC 2008/29

Government of South Australia
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FOREWORD

South Australia's unique and precious natural resources are fundamental to the economic and social wellbeing of the State. It is critical that these resources are managed in a sustainable manner to safeguard them both for current users and for future generations.

The Department of Water, Land and Biodiversity Conservation (DWLBC) strives to ensure that our natural resources are managed so that they are available for all users, including the environment.

In order for us to best manage these natural resources it is imperative that we have a sound knowledge of their condition and how they are likely to respond to management changes. DWLBC scientific and technical staff continues to improve this knowledge through undertaking investigations, technical reviews and resource modelling.

Scott Ashby
CHIEF EXECUTIVE
DEPARTMENT OF WATER, LAND AND BIODIVERSITY CONSERVATION

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1. INTRODUCTION

The first report produced for the Australian Collaborative Land Use Mapping Programme (ACLUMP) land management practices pilot project (McCord and Rix 2007) outlined the background, rationale and methodology of the land manager survey (LMS) program conducted in South Australia. It provided a range of example data from both the LMS and the complimentary 'windscreen' field survey (FS) program for wind and water erosion that are indicators of risk of land degradation.

This second report describes the potential for spatial presentation and combining of land management practices data from the LMS program with data from the FS program. It outlines the existing and potential future uses of the data, including scope for compatibility with the national Land Use and Management Information System (LUMIS) and the Australian Land Use Mapping (ALUM) classification systems.

2. LAND MANAGEMENT MONITORING IN SOUTH AUSTRALIA AND LUMIS

2.1 COMBINING LAND MANAGER SURVEY DATA WITH FIELD SURVEY DATA

As described in McCord and Rix (2007), the land manager surveys provide data on the use of tillage and residue management practices in cropping systems that are the key contributors to exposing soil to the risk of erosion. The 'windscreen' field surveys measure erosion risk (or protection) over time in the agricultural cropping regions as a surrogate to measuring actual erosion, which is technically impractical to do. As such, these land management practices are indicators of progress in improved land management, and provide valuable supporting information to the FS program.

Land management practice data from the LMS relating to soil erosion risk can be broadly compared to data from the FS at the state or regional level (where regional boundaries are common to both survey data sets). Although the FS data is collected and analysed at the sub-regional land zone level, the LMS data cannot be segregated at this level.

Table 1 summarises a range of land management practices from the LMS and their expected correlation with indices of erosion risk from the FS data.

Table 1. Expected correlation of relevant land management practices (land manager survey) with soil erosion risk (field survey program)

Land management practice	Likely impact on erosion risk of susceptible land	Expected correlation with erosion risk
Long cultivated fallow	Long (6–8 months) period of soil erosion risk prior to sowing[1]	Decreased use–reduced cumulative erosion risk
Direct Drill	Minimised period of soil erosion risk (e.g. 30 days between sowing and crop establishment)[2]	Increased use in place of conventional cultivation–reduced cumulative erosion risk
No-Till	Elimination of erosion risk of cropped land[2]	Increased use in place of other methods–reduced erosion risk at sowing, reduced cumulative erosion risk
Number of cultivations	Depends on number and timing of cultivations[1]	Reduced cultivations–reduced erosion risk
Preferred month for initial cultivation	Affects length of period of soil exposure prior to sowing[1]	Later timing of initial cultivation–reduced cumulative erosion risk
Burn stubble/residues	Can reduce vegetative cover to level that creates soil erosion risk	Reduced burning–reduced cumulative erosion risk
Remove livestock from paddock into feedlot	Retention of adequate vegetative cover to protect soil from erosion through autumn or drought conditions	Increased use of feedlots–reduced cumulative erosion risk

[1] assuming soil is put at erosion risk once cultivated

[2] erosion risk also depends on surface vegetative cover level

Figures 1–4 show examples of a key land management practice from the land manager surveys that potentially affects soil erosion risk, plotted with a cumulative yearly Erosion Risk Index (ERI) calculated from the field survey program data. This index represents the total number of days that an average hectare of cropping land is at risk of erosion within a year. Figure 1 shows an increasing trend in the proportion of crop sown using No-Till methods in South Australia, with a decreasing trend in annual ERI through this monitoring period. This is an example of land management practice data that is supporting evidence for the observed decline in erosion risk of agricultural cropping land in SA from 2000 to 2007. Figure 2 shows the corresponding data at the regional scale for the Eyre Peninsula region in South Australia.

Figures 3 and 4 similarly show the increasing trend in proportion of crop sown using No-Till methods in South Australia and in the Murraylands region, plotted against a declining trend in peak exposure, which is another indicator of erosion risk from the FS data. Peak exposure is the maximum proportion of agricultural land that is at risk of erosion at any time during the crop sowing period (when erosion risk normally peaks).

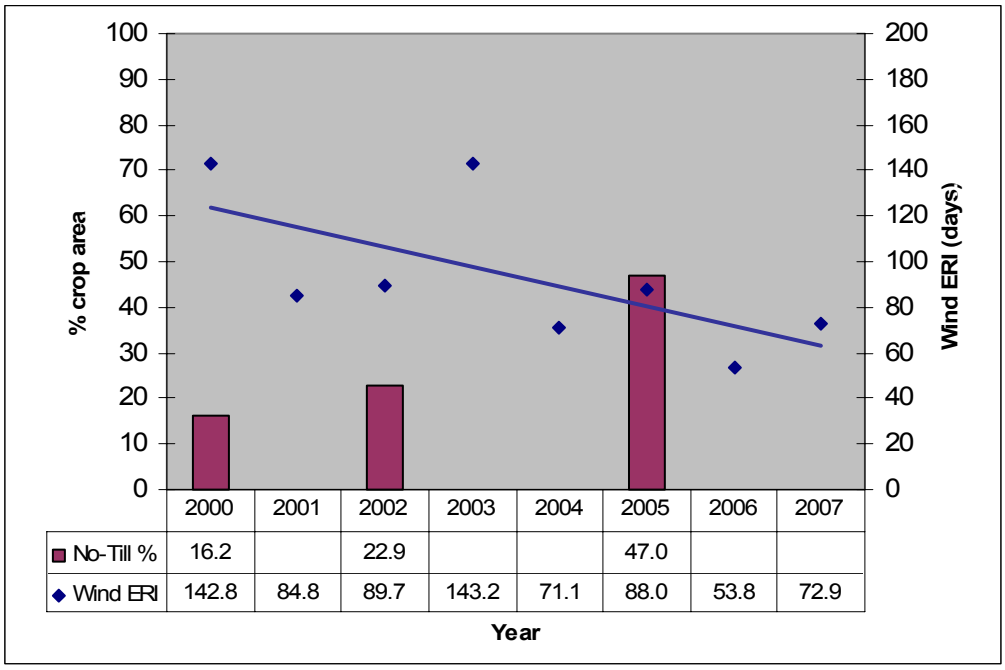

Figure 1. Annual Wind Erosion Risk Index vs. proportion (%) of crop area sown using No-Till methods in South Australia; land manager surveys 2000, 2002, 2005.

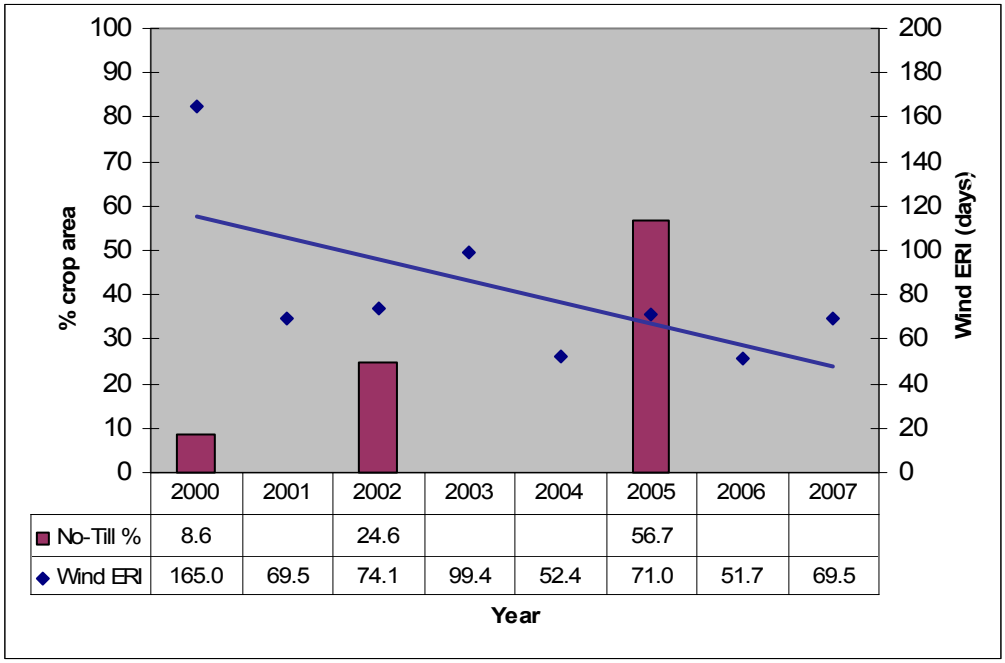

Figure 2. **Annual Wind Erosion Risk Index vs. proportion (%) of crop area sown using No-Till methods in the Eyre Peninsula region of South Australia; land manager surveys 2000, 2002, 2005.**

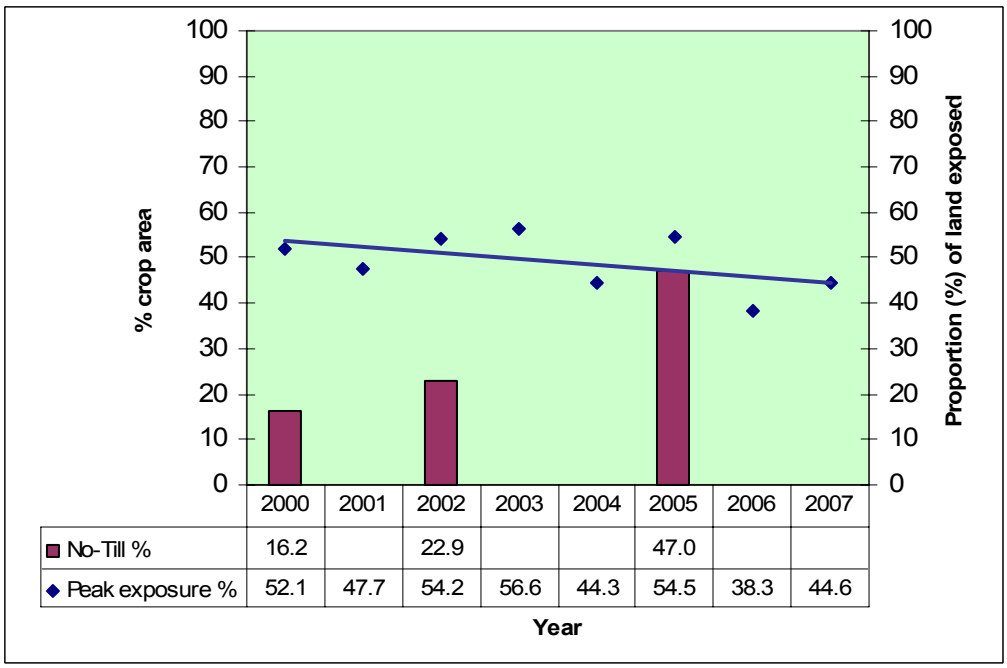

Figure 3. **Annual peak exposure (May–June) (%) of land vs. proportion of crop area sown using No-Till methods in South Australia; land manager surveys 2000, 2002, 2005.**

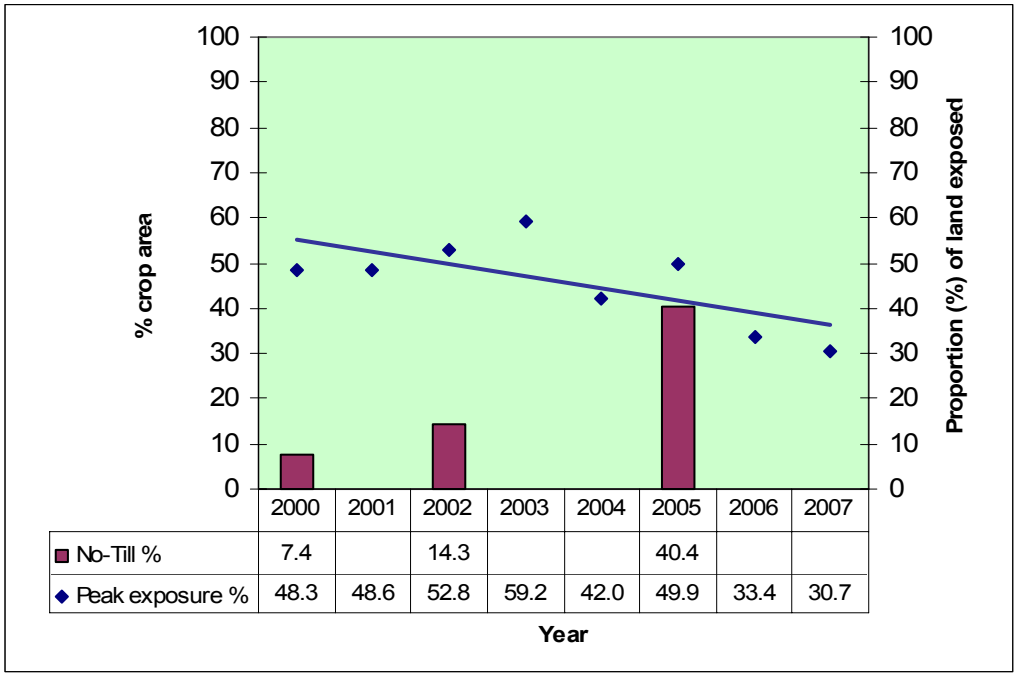

Figure 4. Annual peak exposure (May–June) (%) of land vs. proportion of crop area sown using No-Till methods in the Murraylands region of South Australia; land manager surveys 2000, 2002, 2005.

2.2 SPATIAL PRESENTATION OF LAND MANAGEMENT PRACTICES DATA

As described in McCord and Rix (2007), the land manager survey is a telephone survey where responses are collected from approximately 200 land managers in each of five major agro–ecological regions within the agricultural zone of South Australia. Postcodes are obtained from interviewees as the geographic identifier to match responses to these regions (and Natural Resources Management board regions) and broad rainfall zones (i.e. <325 mm p.a., 325–600 mm, >600 mm). The number of survey responses by region and by rainfall zone is designed to be sufficient to provide a reasonable sample size for credible statistical estimates of land management practice data at these geographic levels. The number of responses per postcode area is far too small (in the order of 0–5) for analysis at this geographic level. Even data segregation by rainfall zone *within regions* would not produce data with sufficient statistical soundness, particularly in the <325 mm zone that comprises only about 10% of survey responses. Unlike some land use and land management practice mapping activities in some other regions of Australia, the SA land manager survey was not designed to identify land management practices at fine scale geographic locations. The surveyees are treated as anonymous and no cadastral identification of surveyed establishments is sought.

Land management practice data (as well as other data collected) in the LMS can be spatially presented at a regional or rainfall zone level. For example, Figures 5–8 show the use of No-Till methods to sow crops, the same data that is shown in Figures 1–4 in section 2.1.

Figure 5 shows that in the 2005 LMS, the highest use of No-Till crop sowing methods (over 50% of the crop area) occurred in the Eyre Peninsula and Mt. Lofty Ranges/Kangaroo Island regions, with the lowest use in the South East region. Figure 6 shows that over the period from 2000 to 2005 of the land manager surveys, the highest uptake of No-Till methods occurred on Eyre Peninsula, and the lowest uptake in the Northern and Yorke region. However the overall net adoption of No-Till methods is high in all agricultural regions of SA for this relatively short five year period, indicating a strong positive trend in adoption of such practices that can potentially reduce the soil erosion risk.

Figures 7 and 8 display the corresponding use and uptake of No-Till sowing methods by rainfall zone in SA. As at 2005, the use of No-Till methods was lower in the low rainfall (<325 mm p.a.) zone than in the medium and high rainfall zones. The increase in use of No-Till from 2000 to 2005 surveys however, is high overall and of the same order (probably not significantly different) in each rainfall zone.

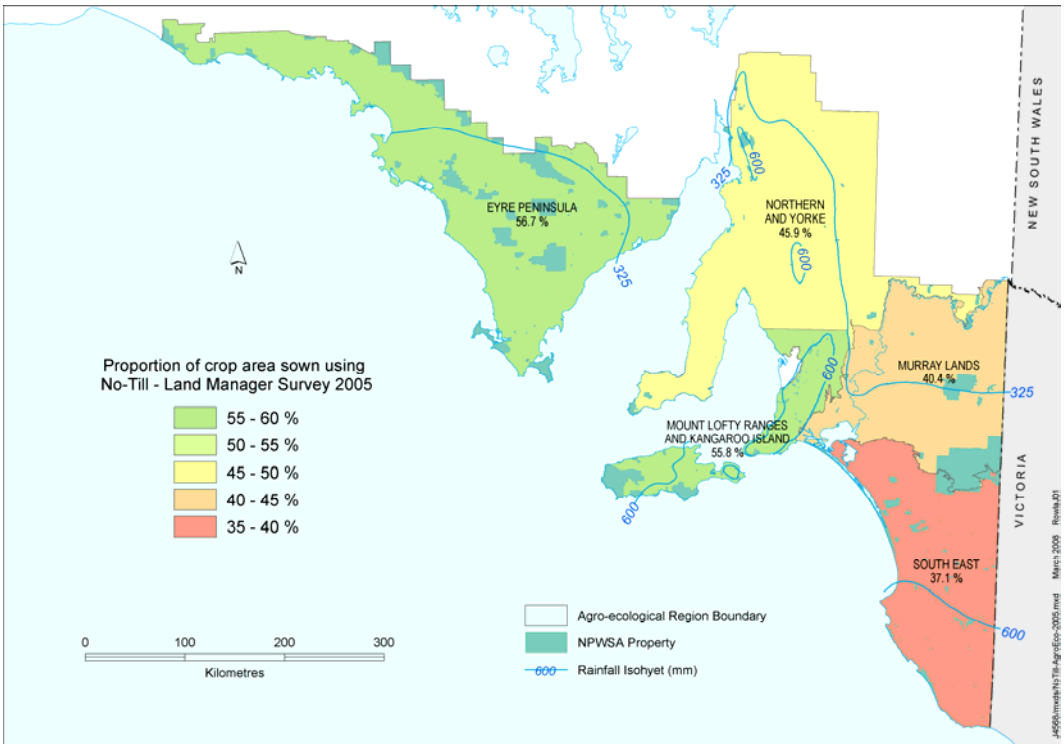

Figure 5. Proportion (%) of crop area sown using No-Till methods in agro–ecological regions of South Australia; land manager survey, 2005.

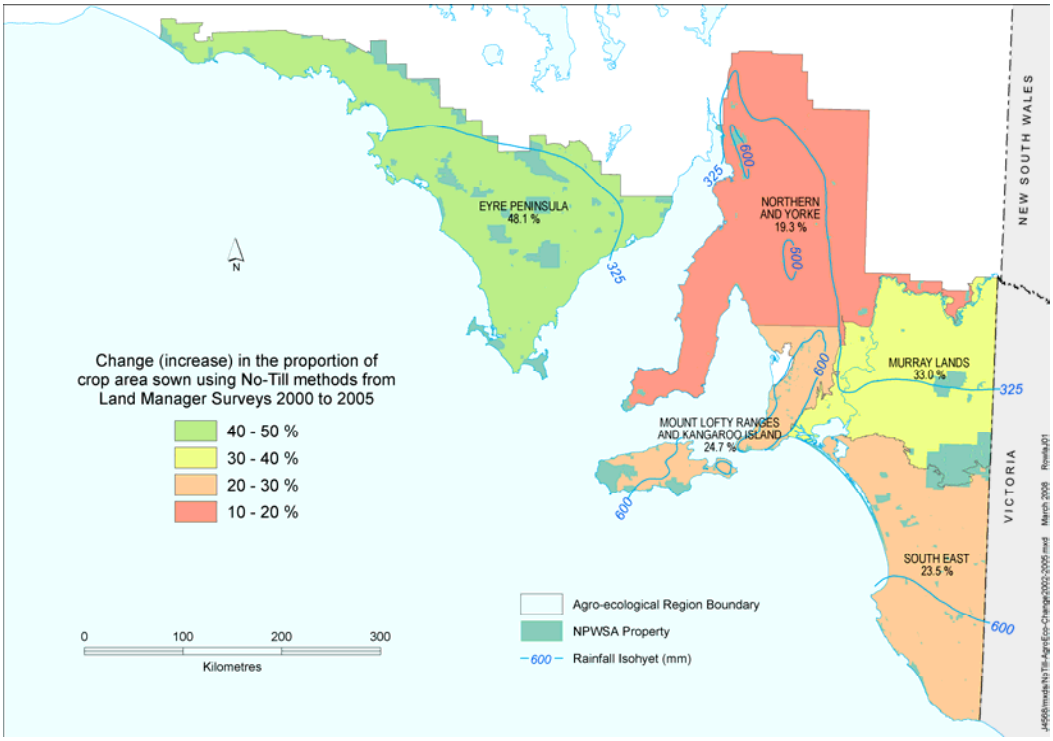

Figure 6. Change (absolute % increase) in proportion of crop area sown using No-Till methods between 2000 and 2005 land manager surveys, in agro–ecological regions of South Australia.

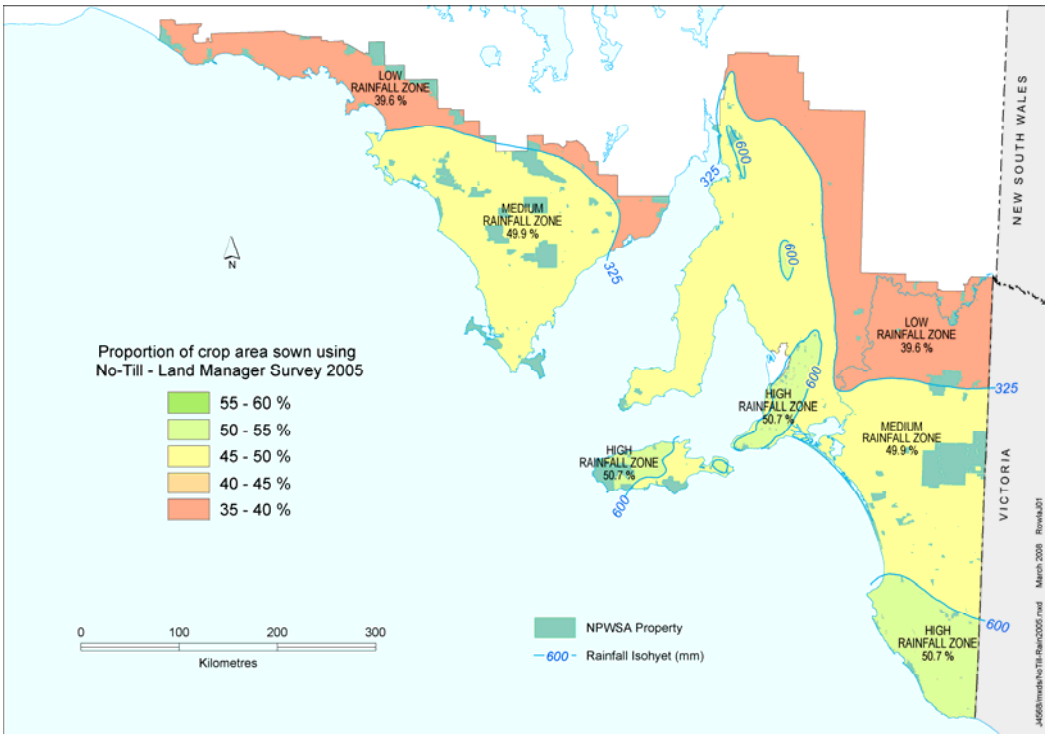

Figure 7. Proportion (%) of crop area sown using No-Till methods in rainfall zones of South Australia; land manager survey, 2005.

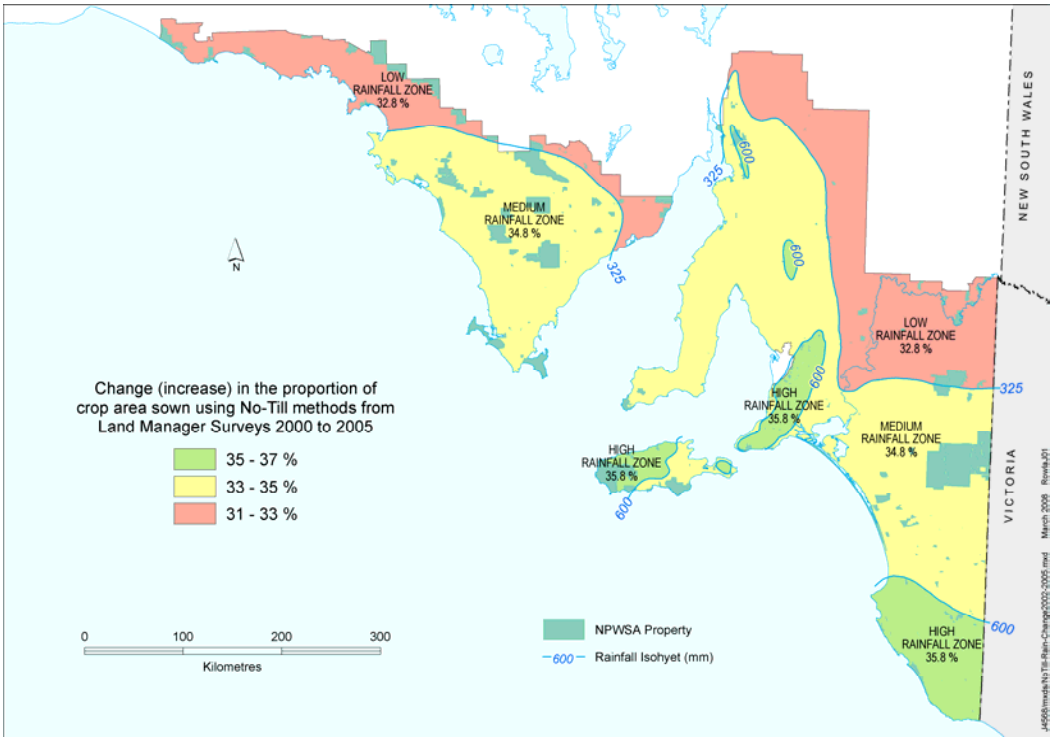

Figure 8. Change (absolute % increase) in proportion of crop area sown using No-Till methods between 2000 and 2005 land manager surveys, in rainfall zones of South Australia.

2.3 UTILISATION OF LAND MANAGER SURVEY DATA

The first land management practices pilot project report (McCord and Rix 2007) outlined the key strategic uses of data from the LMS and FS program at the state and regional levels in South Australia.

The DWLBC Land Management and Revegetation (LMR) Group now reports annually to the Minister against the Soil Protection Target 3.3 in the 2007 South Australian Strategic Plan (SASP) using the FS data, on which the target is based. The LMR Group conducted an implementation plan in 2006/07 and is developing a forward program plan to 2013–14 containing strategies that it will undertake, in collaboration with other parties, to achieve this target. It will use the LMS data together with the FS data to measure the impact of the program and progress towards the SASP Target.

The LMR Group is producing annual reports on the condition of agricultural land in NRM regions for NRM boards, which include all relevant data from the LMS and FS programs. These cover the range of land management issues for which monitoring data is available in the regions. This information is being used by NRM boards in development of their NRM Plans including setting soil/land condition targets (resource condition targets and management action targets), reporting against these targets, and developing strategies and programs to address these issues.

Regular seasonal reports of protection of agricultural land based on data from these surveys are now being provided to regional NRM boards, and are now available on the DWLBC website. These seasonal reports provide situational information that assists NRM boards to respond in a timely manner to any prevailing land and/or seasonal conditions (e.g. drought, erosion events) where they may take actions (e.g. media releases) to assist or influence land managers to respond to such conditions to minimise erosion risk or adverse impacts on soil condition. Similar reports are planned to be disseminated more widely to NRM/agricultural industry groups with interest in this type of information including the South Australian No-Till Farmers Association. This organisation conducts programs primarily to develop, and assist crop producers to adopt, crop sowing technology that minimises the risk of soil erosion.

It is intended that the LMR Group will produce an updated State Land Condition Report (first produced in 2004) following the completion of the 2008 land manager survey, which will compile the nine or so years of data that has now been collected in the Land Condition Monitoring Program.

2.4 SCOPE FOR LINKAGE OF LAND MANAGER SURVEYS WITH LUMIS AND ALUM

2.4.1 LUMIS

The land management practices in the LMS questionnaire were selected as key indicators of the degree to which land managers are managing soil erosion risk, soil condition (particularly soil pH/nutrition, physical condition), salinity and perennial vegetation. It is understood that LUMIS is a universal classification system for land management practices that categorises actions according to the primary target for action, and that this may not necessarily relate practices or actions to the multiple outcomes that they may be carried out for, nor the varying outcomes that apply to different land use systems.

Most of the land management practices in the LMS could be aligned to the existing LUMIS categories (see App. A). In a few cases, there was no action or practice in LUMIS that equated to the land management practices in the LMS, and possible terms for these practices have been added to the table in Appendix A (red text). Definitions of the land management practices in the LMS, including terms suggested as additions to LUMIS are given in Table 2.

Table 2. Definitions of land management practices in the land manager survey

Long cultivated fallow	Land prepared for cropping by cultivation where first cultivation is done in November or earlier the previous year
Direct Drill	One pass sowing without prior cultivation
No-Till	One pass sowing without prior cultivation, using narrow points or disc openers which result in a narrow band of soil disturbance along sown row
Contour banks	Graded banks with a design fall along the channel typically 0.5–0.7% slope
Feedlotting	Confinement feeding of livestock
Wetting agent	Surfactant applied to soil to reduce water repellence
Press wheels	Set of wheels attached to the rear of a sowing drill that pass along rows after sowing to compress soil around and/or over the seed
Furrow sowing	Sowing seed at base of furrow such as created by seeding implement
Clay spreading	Spreading and incorporation of clay (usually excavated from subsoil within pits) into surface/cultivated soil layer
Clay delving	Ripping up of subsoil clay into upper soil layer/surface, usually with incorporation into surface/cultivated soil layer

A small number of land management practices in the LMS did not clearly align with the LUMIS hierarchical structure, considering the most apparent target for action, for example:

- ‘feedlotting stock in autumn to retain adequate surface cover in paddocks’

The LUMIS classification for feedlotting is Target *2 ANIMALS - 2.2.1.3.1 Feedlotting* whereas a more intuitive target for the action is managing plant residues, hence Target *1 PLANTS/VEGETATION - 1.3.5.4.4 grazing management*.

- ‘control salinity–fencing’ / ‘protect or enhance native vegetation– fence off’

The LUMIS classification for fencing is *7 INFRASTRUCTURE – 7.2.2.4.1 Fencing* whereas a more intuitive target for these actions is protection/regeneration of vegetation which would align under LUMIS categories *1.1 Establishment and rehabilitation – 1.5 Regeneration* or *1.4 Protection*.

It is suggested that LUMIS should include clear definitions or explanations of the terms used. It may be necessary to do this for the range of land use systems to which these terms may apply, to document the variation that may occur in specific actions or practices. For example, the actions 1.3.4.5.1 cold burn and 1.3.4.5.2 hot burn may have different meanings for different land use systems. In the DWLBC FS program for erosion risk (McCord and Rix 2007), one of the categories for field observations is burning of stubbles/residues (minor burn / partial burn / complete burn). These classifications relate most closely to the resultant land surface condition (i.e. proportion of cover removed) and hence effect on erosion risk, thus is far more objective for this purpose than terms like cold burn/hot burn.

2.4.2 ALUM

As described in McCord and Rix (2007), the LMS includes commercial agricultural cropping, grazing and dairy cattle land managers within the agricultural zone of South Australia, and excludes horticulture and intensive animal industries and hobby farms. The survey gathers some information from each property such as area cropped/crop type, area of perennial pasture/lucerne, area of perennial vegetation etc. which are relevant to interpreting the land management practice data, but is not designed to directly identify land use information. A comprehensive land use mapping program (ALUM v4 categories) is currently underway in South Australia.

Among the agricultural establishments surveyed in the LMS, the majority of land is used for cropping (ALUM 3.3) and/or grazing modified pastures (3.2). A relatively small proportion of this land comprises managed resource protection and nature conservation e.g. Heritage Agreement areas (1.2, 1.1), grazing natural vegetation (2.1), land under rehabilitation due to salinity (1.3.4), plantation forestry (3.1), and irrigated modified pastures (4.2).

The more likely ALUM land use categories corresponding to the questions about land management practices in the land manager surveys are given in Appendix A.

3. CONCLUSIONS

The land manager surveys have been designed to obtain particular land management information at a regional scale to complement the ongoing field survey program for erosion risk in the agricultural region in South Australia. The survey data for each surveyed establishment is geographically located by postcode only for the purpose of data analysis at a regional (and rainfall zone) scale; the surveyees are treated as anonymous and no cadastral identification of surveyed establishments is sought. Disaggregation of the data at a finer geographic level such as postcode area is of no use as the survey sample size is grossly inadequate for analysis. This data cannot be spatially linked to the statewide land use survey data. As such, the LMS data appears to have limited applicability to the intended spatial representation for land management practices data proposed in LUMIS.

It is not envisaged in SA that land management practice surveying by government agencies would be funded at a finer scale unless a compelling need arises.

The land manager survey may provide a basis for some possible minor modifications to lower order terminology in LUMIS.

APPENDICES

A. ALIGNMENT OF LAND MANAGEMENT PRACTICES IN LAND MANAGER SURVEY WITH LUMIS AND ALUM

Land Manager Survey	*Practice category/purpose*	Erosion risk control
	Practice/Action	Cultivated long fallow - usually/occasionally
LUMIS	*Target*	3 SOIL
	Purpose	3.1 Site preparation/modification
	Method	3.1.1 Tillage/machine operations
	Practice	3.1.1.1 Conventional tillage
	Action	Cultivated long fallow
ALUM land use categories		3.3

Land Manager Survey	*Practice category/purpose*	Erosion risk control
	Practice/Action	Burn stubbles/pasture residues - usually/occasionally
LUMIS	*Target*	1 PLANTS/VEGETATION
	Purpose	1.3 Plant, product & waste removal
	Method	1.3.4 Handling residues
	Practice	1.3.4.5 Burnt
	Action	
ALUM land use categories		3.3

Land Manager Survey	*Practice category/purpose*	Erosion risk control
	Practice/Action	Preferred month to do initial cultivation
LUMIS	*Target*	3 SOIL
	Purpose	3.1 Site preparation/modification
	Method	3.1.1 Tillage/machine operations
	Practice	3.1.1.1, 3.1.1.2
	Action	
ALUM land use categories		3.3

Land Manager Survey	*Practice category/purpose*	Erosion risk control
	Practice/Action	Number of cultivations
LUMIS	*Target*	3 SOIL
	Purpose	3.1 Site preparation/modification
	Method	3.1.1 Tillage/machine operations
	Practice	3.1.1.1, 3.1.1.2
	Action	
ALUM land use categories		3.3

Land Manager Survey	*Practice category/purpose*	Erosion risk control
	Practice/Action	Use direct drilling to sow crop
LUMIS	*Target*	3 SOIL
	Purpose	3.1 Site preparation/modification
	Method	3.1.1 Tillage/machine operations
	Practice	3.1.1.2 Conservation tillage
	Action	3.1.1.2.2 Direct Drill
ALUM land use categories		3.3

Land Manager Survey	*Practice category/purpose*	Erosion risk control
	Practice/Action	Use No-Till to sow crop
LUMIS	*Target*	3 SOIL
	Purpose	3.1 Site preparation/modification
	Method	3.1.1 Tillage/machine operations
	Practice	3.1.1.2 Conservation tillage
	Action	No-Till
ALUM land use categories		3.3

Land Manager Survey	*Practice category/purpose*	Erosion risk control
	Practice/Action	Feedlot stock to retain adequate residues in paddock
LUMIS	*Target*	1 PLANTS/VEGETATION
	Purpose	1.3 Plant, product & waste removal
	Method	1.3.5 Removing unproductive biomass
	Practice	1.3.5.4 Other
	Action	1.3.5.4.4 Grazing management
	Target	2 ANIMALS
	Purpose	2.2 Growth and Development
	Method	2.2.1 Promoting growth
	Practice	2.2.1.3 Husbandry techniques
	Action	2.2.1.3.1 Feedlotting
ALUM land use categories		3.3, 3.2

Land Manager Survey	*Practice category/purpose*	Control water erosion
	Practice/Action	Install contour banks
LUMIS	*Target*	3 SOIL
	Purpose	3.2 Maintenance of soil condition
	Method	3.2.3 Protection
	Practice	Water erosion control structures
	Action	Contour Banks

	Target	4 WATER
	Purpose	4.1 Interception
	Method	4.1.1 Surface drainage
	Practice	4.1.1.1 Levees or graded banks
	Action	Contour banks
ALUM land use categories		3.3, 3.2

Land Manager Survey	*Practice category/purpose*	Control acidity
	Practice/Action	Apply lime or dolomite
LUMIS	*Target*	3 SOIL
	Purpose	3.2 Maintenance of soil condition
	Method	3.2.1 Amelioration
	Practice	3.2.1.1 Inorganic additives
	Action	3.2.1.1.6 Lime (liming product)
ALUM land use categories		3.3, 3.2

Land Manager Survey	*Practice category/purpose*	Ameliorate water repellent soil
	Practice/Action	Apply wetting agents
LUMIS	*Target*	3 SOIL
	Purpose	3.2 Maintenance of soil condition
	Method	3.2.1 Amelioration
	Practice	3.2.1.2 Organic additives
	Action	Wetting agent
ALUM land use categories		3.3

Land Manager Survey	*Practice category/purpose*	Ameliorate water repellent soil
	Practice/Action	Use modified tillage technology - press wheels, furrow sowing etc
LUMIS	*Target*	3 SOIL
	Purpose	3.1 Site preparation/modification
	Method	3.1.1 Tillage/machine operations
	Practice	Modified/specialised tillage/sowing
	Action	Press wheels / furrow sowing
ALUM land use categories		3.3

Land Manager Survey	*Practice category/purpose*	Ameliorate water repellent soil
	Practice/Action	Clay delving
LUMIS	*Target*	3 SOIL
	Purpose	3.2 Maintenance of soil condition
	Method	3.2.1 Amelioration
	Practice	3.2.1.1 Inorganic additives
	Action	Claying (delving)
ALUM land use categories		3.3, 3.2

Land Manager Survey	*Practice category/purpose*	Ameliorate water repellent soil
	Practice/Action	Clay spreading
LUMIS	*Target*	3 SOIL
	Purpose	3.2 Maintenance of soil condition
	Method	3.2.1 Amelioration
	Practice	3.2.1.1 Inorganic additives
	Action	Claying (spreading)
ALUM land use categories		3.3, 3.2

Land Manager Survey	*Practice category/purpose*	Control salinity - on site
	Practice/Action	Install drains
LUMIS	*Target*	4 WATER
	Purpose	4.1 Interception
	Method	4.1.1, 4.1.3
	Practice	
	Action	
ALUM land use categories		1.3.4, 3.2, 3.3

Land Manager Survey	*Practice category/purpose*	Control salinity - on site
	Practice/Action	Plant lucerne / other pasture species
LUMIS	*Target*	1 PLANTS/VEGETATION
	Purpose	1.1 Establishment and rehabilitation
	Method	1.1.4 Planting
	Practice	
	Action	
ALUM land use categories		1.3.4, 3.2

Land Manager Survey	*Practice category/purpose*	Control salinity - on site
	Practice/Action	Mounding
LUMIS	*Target*	4 WATER
	Purpose	4.1 Interception
	Method	4.1.1 Surface drainage
	Practice	4.1.1.3 Hump and hollow drains
	Action	
ALUM land use categories		1.3.4, 3.2, 3.3

Land Manager Survey	*Practice category/purpose*	Control salinity - on site
	Practice/Action	Mulch/manure
LUMIS	*Target*	3 SOIL
	Purpose	3.2 Maintenance of soil condition

	Method	3.2.1 Amelioration
	Practice	3.1.2.2 Organic additives
	Action	3.1.2.2.2, 3.1.2.2.4
ALUM land use categories		1.3.4, 3.2, 3.3

Land Manager Survey	*Practice category/purpose*	Control salinity - on site
	Practice/Action	Fencing / minimise use
LUMIS	*Target*	1 PLANTS/VEGETATION
	Purpose	1.4 Protection
	Method	Fencing / exclusion of livestock
	Practice	Fencing
	Action	
	Target	7 INFRASTRUCTURE
	Purpose	7.2 Construction
	Method	7.2.2 Building/facility construction
	Practice	7.2.2.4 Animal containment structures
	Action	7.2.2.4.1 Fencing
ALUM land use categories		1.3.4, 1.2

Land Manager Survey	*Practice category/purpose*	Control salinity - off site*
	Practice/Action	Manage native pasture
LUMIS	*Target*	1 PLANTS/VEGETATION
	Purpose	1.1 Establishment and rehabilitation
	Method	1.1.5 Regenerating ??
	Practice	
	Action	
	Target	1 PLANTS/VEGETATION
	Purpose	1.2 Maintenance of growth and condition
	Method	1.2.1 Promoting growth
	Practice	Grazing management
	Action	
ALUM land use categories		3.2

Land Manager Survey	*Practice category/purpose*	Control salinity - off site
	Practice/Action	Claying
LUMIS	*Target*	3 SOIL
	Purpose	3.2 Maintenance of soil condition
	Method	3.2.1 Amelioration
	Practice	3.2.1.1 Inorganic additives
	Action	Claying
ALUM land use categories		3.3, 3.2

Land Manager Survey	*Practice category/purpose*	Control salinity - off site
	Practice/Action	Low tillage techniques
LUMIS	*Target*	3 SOIL
	Purpose	3.1 Site preparation/modification
	Method	3.1.1 Tillage/machine operations
	Practice	3.1.1.2 Conservation tillage
	Action	
ALUM land use categories		3.3

Land Manager Survey	*Practice category/purpose*	Control salinity - off site
	Practice/Action	Improve water use efficiency (various practices)
LUMIS	*Target*	(various as listed under other salinity control practices)
	Purpose	
	Method	
	Practice	
	Action	
ALUM land use categories		3.3, 3.2

Land Manager Survey	*Practice category/purpose*	Protect/enhance native vegetation
	Practice/Action	Fence off remnant native vegetation
LUMIS	*Target*	1 PLANTS/VEGETATION
	Purpose	1.1 Establishment and rehabilitation, 1.4 Protection
	Method	1.1.5 Regenerating
	Practice	
	Action	
	Target	7 INFRASTRUCTURE
	Purpose	7.2 Construction
	Method	7.2.2 Building/facility construction
	Practice	7.2.2.4 Animal containment structures
	Action	7.2.2.4.1 Fencing
ALUM land use categories		1.2

Land Manager Survey	*Practice category/purpose*	Establish native vegetation
	Practice/Action	Plant native vegetation
LUMIS	*Target*	1 PLANTS/VEGETATION
	Purpose	1.1 Establishment and rehabilitation
	Method	1.1.4 Planting
	Practice	
	Action	
ALUM land use categories		1.2

Land Manager Survey	*Practice category/purpose*	Establish perennial vegetation
	Practice/Action	Plant fodder trees/shrubs
LUMIS	*Target*	1 PLANTS/VEGETATION
	Purpose	1.1 Establishment and rehabilitation
	Method	1.1.4 Planting
	Practice	
	Action	
ALUM land use categories		3.2 (possibly also 4.2)

Land Manager Survey	*Practice category/purpose*	
	Practice/Action	Plant product species - timber, broombush etc
LUMIS	*Target*	1 PLANTS/VEGETATION
	Purpose	1.1 Establishment and rehabilitation
	Method	1.1.4 Planting
	Practice	
	Action	
ALUM land use categories		3.1 (possibly also 4.1)

Land Manager Survey	*Practice category/purpose*	
	Practice/Action	Property plan
LUMIS	*Target*	6 BUSINESS
	Purpose	6.1 Business establishment
	Method	6.1.2 Business planning
	Practice	6.1.2.1 Resource management plan
	Action	
ALUM land use categories		various, mainly 3.3, 3.2

UNITS OF MEASUREMENT

Units of measurement commonly used (SI and non-SI Australian legal)

Name of unit	Symbol	Definition in terms of other metric units	Quantity
day	d	24 h	time interval
gigalitre	GL	10^6 m^3	volume
gram	g	10^{-3} kg	mass
hectare	ha	10^4 m^2	area
hour	h	60 min	time interval
kilogram	kg	base unit	mass
kilolitre	kL	1 m^3	volume
kilometre	km	10^3 m	length
litre	L	10^{-3} m^3	volume
megalitre	ML	10^3 m^3	volume
metre	m	base unit	length
microgram	µg	10^{-6} g	mass
microlitre	µL	10^{-9} m^3	volume
milligram	mg	10^{-3} g	mass
millilitre	mL	10^{-6} m^3	volume
millimetre	mm	10^{-3} m	length
minute	min	60 s	time interval
second	s	base unit	time interval
tonne	t	1000 kg	mass
year	y	356 or 366 days	time interval

EC	electrical conductivity (µS/cm)
pH	acidity/alkalinity
ppm	parts per million

GLOSSARY

ACLUMP. Australian Collaborative Land Use Mapping Programme.

ALUM. Australian Land Use and Management classification system

BRS. Bureau of Rural Sciences. Government of Australia.

Clay delving. Ripping up of subsoil clay into upper soil layer/surface, usually with incorporation into surface/cultivated soil layer.

Clay spreading. Spreading and incorporation of clay (usually excavated from subsoil within pits) into surface/cultivated soil layer.

Contour banks. Graded banks with a design fall along the channel typically 0.5 – 0.7% slope.

Direct Drill. Method of sowing a crop in a one-pass operation (without prior cultivation).

DWLBC. Department of Water, Land and Biodiversity Conservation. Government of South Australia.

ERI. Erosion Risk Indices.

Feedlotting. Confinement feeding of livestock.

Erosion. Natural breakdown and movement of soil and rock by water, wind or ice. The process may be accelerated by human activities.

FS. Field survey program for erosion risk

Furrow sowing. Sowing seed at base of furrow such as created by seeding implement.

GIS (geographic information system). Computer software allows for the linking of geographic data (for example land parcels) to textual data (soil type, land value, ownership). It allows for a range of features, from simple map production to complex data analysis.

GRDC. Grains Research and Development Corporation.

Intensive farming. A method of keeping animals in the course of carrying on the business of primary production in which the animals are confined to a small space or area and are usually fed by hand or by mechanical means.

Land. Whether under water or not and includes an interest in land and any building or structure fixed to the land.

LCMP. Land Condition Monitoring Program.

LM. Land Manager.

LMS. Land Manager Survey.

LMR Group. Land Management & Revegetation Group.

LMRP. Land Management and Revegetation Program within DWLBC.

Long cultivated fallow. Land prepared for cropping by cultivation where first cultivation is done in November or earlier the previous year.

LUMIS. Land Use and Management Information System.

Model. A conceptual or mathematical means of understanding elements of the real world which allows for predictions of outcomes given certain conditions. Examples include estimating storm runoff, assessing the impacts of dams or predicting ecological response to environmental change.

NLWRA. National Land and Water Resources Audit.

Natural Resources. Soil; water resources; geological features and landscapes; native vegetation, native animals and other native organisms; ecosystems.

GLOSSARY

Natural Resources Management (NRM). All activities that involve the use or development of natural resources and/or that impact on the state and condition of natural resources, whether positively or negatively.

No-Till. Method of sowing crop in a one-pass operation using narrow seeder points or disc openers.

NRM Plan. State Natural Resources Management Plan.

Pasture. Grassland used for the production of grazing animals such as sheep and cattle.

Press wheels. Set of wheels attached to the rear of a sowing drill that pass along rows after sowing to compress soil around and/or over the seed.

SA. South Australia.

SASP. South Australian Strategic Plan.

Wetting agent. Surfactant applied to soil to reduce water repellence.

REFERENCES

McCord, AK and Rix, R. 2007, Land Management Monitoring in the Agricultural Areas of South Australia, *First Report for ACLUMP Land Management Practices Pilot Project* Department of Water, Land and Biodiversity Conservation.