A LANDHOLDER'S MONITORING GUIDE FOR SUSTAINABLE NATURAL RESOURCE MANAGEMENT PRACTICE.

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Abstract
The management practices of land managers are subject to increasing: levels of scrutiny from the media, leading food corporations, and government regulators; and expectations that they can demonstrate the sustainability of their activities. Public debate on issues such as tree clearing, salinity, water quality and flow have stimulated the development of various responses including best management practice, Environmental Management Systems and Eco-labelling. Some Australian regulators now require land managers to meet environmental performance requirements. There is a need for a comprehensive suite of monitoring tools that enables land managers to publicly demonstrate their environmental performance and provides them with reliable information for continuous improvement of their practices. This paper describes some of the drivers for monitoring by land managers and outlines the Landholder's Monitoring Guide (LMG), one of the responses by the Queensland Government to these developments. The guide provides information on why it is important to monitor and how to develop a monitoring strategy. It includes a tool to assist in the selection of the most relevant indicators and will contain information on approximately 50 key natural resource monitoring indicators. The guide assists landholders by providing information about how to collect, interpret and share the data for each indicator. The guide is designed for property level monitoring by land managers for more sustainable decision-making and has broader regional, catchment, and national implications by encouraging consistency in information gathering techniques in relation to natural resource management indicators.

Additional Keywords: indicators, performance, data sharing, environmental management systems, best management practice

Introduction
The environmental impacts of the practices of Australian farmers and other land managers are becoming subject to increasing levels of scrutiny (ACF, 2003). For example, land use practices in northern Queensland are directly implicated in decline of the Great Barrier Reef as a consequence of increases in sediment, nutrients and pesticides in waterways flowing to the Reef (p3. CoAQG, 2004). The Queensland *Environmental Protection Act 1994* requires land managers to exercise due diligence by assessing environmental risk of their practice and managing to minimise their impact and this legislation initiated the need for agricultural and other industries to develop Codes of Practice that guide how land managers should meet their obligations under this legislation (QFF, 1998). However, a decade later, there is overwhelming scientific evidence of the causal relationship of land use practices and environmental impacts (p.1-2, QG, 2004), the recognition of the individual responsibility of land managers (p.6, O'Malley, 2003) and the role of government on private property (Madigan, 2003, p3). This has enabled the passage of legislation and regulation of the most significant threatening processes such as vegetation clearing (p.1-2, QG, 2004) and the development of policies that encourage and in some circumstances may require a farm management system or property management planning approach, premised upon the need to address the impact of the land management practices upon the natural resources (QDPC, 2003, QNRM&E, 2004, & QNRM&E, 2003a).

There have been various responses by: industries e.g. Cotton Best Management Practice, Canegrowers COMPASS (CA, 2004) (Canegrowers, 2002); farming corporations e.g. Grow Sustainably™, Unilever (p.1-11, West and McMasters, 2003); community groups e.g. LandPlus! (Griffith S, pers comm., 2003); government e.g. National EMS Policy (DAFF, 2003); and individual farmers e.g. Eco-Bananas and Abbotsleigh Citrus (Sciacca and Sciacca, 2003) (Carruthers, 2003), that include some monitoring of the environmental impacts of management practices. This monitoring activity has been largely developed as ad hoc responses to the particular context of the industry, community or location and varies in the indicators used, the biophysical parameters monitored, monitoring methods employed, quality assurance procedures applied, data management and analysis techniques used and whether the monitoring information is collected in a way that it may be shared with others. This paper describes the LMG that the Queensland Department of Natural Resources, Mines and Energy is developing in collaboration with Regional Natural Resource Management Bodies and a national Farmbis project managed by Synapse Research & Consulting Pty Ltd. The LMG provides a comprehensive suite of monitoring tools for land managers across all relevant agricultural sectors. This enables them to publicly demonstrate how they are performing against any given criteria

and provides reliable information on which the land manager may make decisions to facilitate continuous improvement of their management practices.

Key Drivers for Landholder Monitoring

There are many motivating factors or 'drivers' why a landholder may decide to monitor their environmental performance. There are internal drivers that arise from the individual, family, property or business circumstances or external factors such as legislation and strategies, market standards, and regional and industry expectations that may motivate landholders to monitor.

Internal drivers

Perhaps the most important driver is monitoring for management. Most businesses, farming families and land managers have (often unwritten) goals that they hope to achieve and some have strategies or plans of how they intend to do so. How does a land manager know that they have achieved their goals? What benchmarks are used by land managers to confirm their progress? If you are "managing towards a goal, you need to know what progress you are making" (Gleeson T, 2003, pers. comm.). Many landholders monitor what they do on an almost daily but ad hoc basis. They routinely observe and mentally note changes in the natural resource condition on their property. Landholders are in an excellent position to collect and manage information about what they are doing as they can observe changes soon after they occur. However, very few land managers undertake any formal monitoring or apply any consistent methods or document their observations. The lack of systematically recorded monitoring and analysis of the condition and depreciation of a fundamental asset is an important gap in the farm management process for you "can't manage what you don't measure" (West, pers comm.; McMasters, 2003).

Many land managers have used the Whole Farm Planning or Property Management Planning process and associated extension programs to more holistically manage their farm production system and natural resources. This process does not necessarily result in improved environmental performance. A management plan or system that includes natural resource monitoring will help a land manager assess whether they are reaching their own environmental performance goals.

Monitoring is one tool that enables a land manager to continually improve the environmental performance of the business (Table 1). After establishing a set of baseline information relating to their goals, monitoring lets the land manager know whether they are going in the right direction. Monitoring is an important component in achieving control of the environmental impacts of land management practices. It can show whether their management actions are restoring or depleting the natural capital on their property. It can provide an important trigger for a management response to an undesirable monitoring result. Maintaining good resource condition is essential for maintaining the long-term productivity of the property and recognising that monitoring the natural resources is good business, is a key personal driver.

Table 1. Location of monitoring activity in relation to farm management practices

		Environmental Risk Assessment		**Demonstrating Environmental Performance**		
		Aspect	Impact			
	Production System	**Management Activity**	**Landscape Impacts**	**Management Actions**	**Monitoring Activity**	**Possible Performance Standards**
Examples	Beef	Pasture management	Soil loss	Maintain ground cover	***% ground cover, soil loss***	>70% ground cover <1t/ha
			Invasive weeds	Fire, stock management	***Pasture species***	%3P + nil weeds
			Nutrient transport	Watering points	***Soil chemistry***	ANZECC standards
					Water nitrogen	< ## ppm nitrogen
			Human health	Riparian fencing	***Faecal coliform***	Most Probable Number FC

It can help establish a land manager's environmental credentials and provides evidence so they can tell others how they are going. For example monitoring for change in depth to groundwater in an area at risk of dryland salinity can produce information that farmers and others in the local community may wish to know. Monitoring may also fulfill legal or regulatory requirements that may apply to the particular enterprise, land tenure, or industry.

Land managers that monitor will own the most detailed information about environmental performance on their property. They can then choose to provide information to others such as industry groups, various levels of government, financiers, catchment groups or regional bodies. Having clear evidence of good environmental performance may provide a producer with market advantage if exporting or providing to niche markets (p.7-8, Twyford-Jones, Pahl and Sharp, 2003).

Monitoring can also influence property asset values. Production figures and business accounts provide short-term evidence of productivity and financial performance while natural resource monitoring provides information and a history for valuers and potential purchasers on the status of the natural capital. It provides information on how well the property has been managed for the long term.

Whether a property drains to the Great Barrier Reef, the Murray Darling Basin or a major urban centre, there are many perceived and actual natural resource management problems that can be attributed to land management practices. Monitoring gives the land manager ownership of the problems and the latest information to feed into the solutions. Monitoring trends in natural resources on the property will increase the manager's understanding of the impact of the farming system and the management options available.

External drivers

The external drivers include Environmental Management Systems, international food markets, national and state legislation and strategies, regional bodies and industry organisations (Figure 1). The now well-recognised environmental impacts of land management practices have stimulated governments and some land managers to support the ISO 14001 Environmental Management System approach. This system has been actively supported by the Australian Government (DAFF, 2003) and all State Governments (NRMMC, 2003), has been applied to the Australian sustainable land management context by the Australian Landcare Management System (p.4, Crawford, 2003), and in Queensland is being used as the foundation for a number of industry specific Farm Management Systems (QFF, 2004). This process relies on how well informed the land manager is of the potential environmental impacts of their enterprise and how comprehensively they choose to carry out their environmental risk assessment. The environmental risk assessment process is essential preparation for the setting of goals and subsequent monitoring of environmental impacts as part of continuous improvement of an Environmental Management System. The environmental risk assessment for adoption of an Environmental Management System is perhaps the

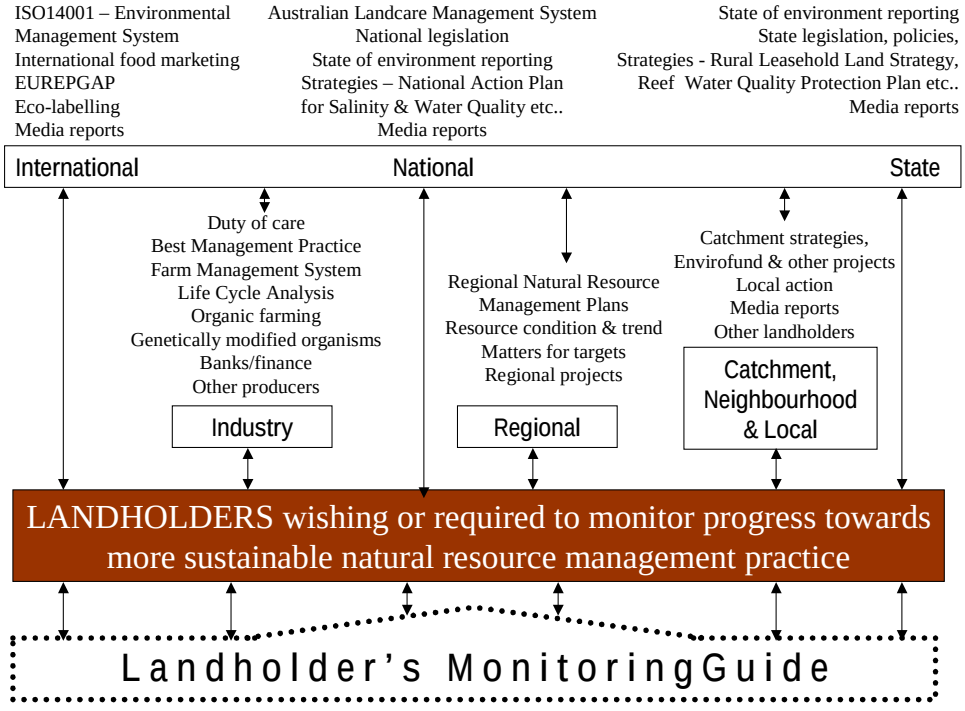

Figure 1. Some of the key drivers of landholder monitoring of environmental performance

most sophisticated assessment a land manager can undertake.

Some individual producers, producer groups and industries in Australia market directly to the international food industry and the rapidly increasing organic sector. In the United Kingdom leading supermarket chains now supply a significant proportion of their food lines as Certified Organic Produce (Sainsbury's, 2004a) (Tesco, 2004) (Waitrose, 2004). It is no longer a niche market and is growing at 40% per year (BBC, 2002). Sainsbury's provides full traceability on their website from the product code on the food label back to the producer (Sainsbury's 2004b). Fruit and vegetable producers that wish to export to major food distributors across Europe must now comply with a whole-of-food industry-driven EUREPGAP farm assurance scheme. Of the 13,009 growers across 41 countries only four Australian producers are currently registered (EUREPGAP, 2003).

The *Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC, 1999) and Queensland state legislation such as *Vegetation Management And Other Legislation Amendment Bill 2004* (QG, 2004) now provide for the protection of significant environmental assets with regimes for the conservation of biodiversity that include state government and private monitoring of biodiversity. Strategies such as the proposed Rural Leasehold Land Strategy 2003 and the Reef Water Quality Protection Plan 2003 will expect land managers to assess their potential environmental impacts and to monitor and manage to minimise these impacts (CoAQG, 2004)(QNRM&E, 2003a).

Fifteen Regional Natural Resource Management Bodies have been established across Queensland during 2002-2003 to develop Regional Natural Resource Management Plans and to implement the National Action Plan for Salinity & Water Quality (in six of these regions) and the second round of the Natural Heritage Trust fund. As part of these arrangements, the regional bodies are required to monitor the resource condition and trends in land, water, vegetation, biological and landscape health (QNRM&E, 2003b). At May 2004, these bodies are still developing their monitoring programs to meet these requirements.

Need for a Monitoring Guide

The goals of each land manager are unique and the natural resource condition and trends will be specific to the production systems, the landscape and history of the property. There are also different priorities confronting land managers by different industries and local and regional natural resource management groups. This diversity means that priorities and motivations to monitor any particular environmental parameter are also unique to the land manager's situation. Any materials developed to support land managers to monitor for management need to acknowledge this diversity. Attempts to reduce monitoring to a few universal indicators for an industry, a location or to simplify things assumes a homogenous context of land managers, denies the complexities and interconnectedness of landscapes and suppresses the strong individual motivations of land managers. The fundamental driving force for the need for the LMG is the implication for ecologically sustainable development. Landholders in the 21st century will more than ever be driven to work smarter *with* their natural resources to not only maintain but also increase the natural capital as reflected in the health and wealth of vegetation, water, soil, and ecosystem processes.

The LMG recognises that selection of what impacts to monitor should be a decision by the land manager and that each land manager's situation is unique. This requires the development of a comprehensive suite of monitoring tools that both enable land managers to publicly demonstrate how they are performing against any given criteria, and provides reliable information on which the land manager may make decisions to for continuous improvement of their practices. Any monitoring guide should act as an underpinning resource that supports the various initiatives associated with these internal and external drivers. It should also provide an agreed and consistent suite of indicators and monitoring techniques to facilitate the voluntary sharing of quality data (p.8. ACF-SA, 2003).

Overview of the Landholder's Monitoring Guide

The guide offers a suite of monitoring activities that are landholder-focussed to support property-level decision-making, inform management activity to mitigate environmental impacts, and demonstrate environmental performance. The first stage in the guide is scheduled for online and CD-ROM publication in June 2004.

Users of the guide can navigate through the content by industries, land practices, indicators and monitoring paths. The industries and land practices paths uses the key farming industries and the associated land management practices as entry points into a decision support tool. This tool is designed to make it easier for land managers to

select the indicators most relevant to their needs and uses information derived from the Human Effects on Landscape Processes Model (Gardiner & Eberhard, p.60-69, 2003). This section of the guide provides a series of cascading decision trees that demonstrate the causal relationship between land management practices that are associated with industries, the potential impact of these practices across the landscape, and the indicators that may be used to monitor the resource condition and trend of the particular environmental parameter. Land managers can go direct to the thematic lists to find information on each indicator. Approximately 50 key natural resource monitoring indicators (Figure 2) that address water quality, salinity, river health, fire, vegetation and biodiversity issues will be progressively published.

Figure 2. List of the indicators that are scheduled to be included in the Landholder's Monitoring Guide

Item	Indicator title	Item	Indicator title
	1.0 Water quality	3.10	Change in soil infiltration
1.1	Change in pH of water		***4.0 Salinity***
1.2	Change in electrical conductivity of water	4.1	Change in % area of deep-rooted perennials
1.3	Change in the clarity/turbidity of water	4.2	Change in extent of land salinised
1.4	Change in fine sediment transport	4.3	Change in depth to groundwater
1.5	Change in orthophosphates	4.4	Change in electrical conductivity of soil
1.6	Change in nitrate/nitrites		***5.0 Vegetation***
1.7	Change in dissolved oxygen	5.1	Change in native vegetation area – all strata
1.8	Change in faecal coliform levels	5.2	Change in vegetation density
1.9	Movement of farm chemicals in water	5.3	Change area:perimeter ratio of native vegetation
1.10	Movement of farm water - supporting data	5.4	Change in plant species composition
1.11	Rainfall for property - supporting data	5.5	Change in vegetation condition
	2.0 In-stream/riparian Zone/wetland	5.6	Monitoring impact of events on native vegetation
2.1	Change in fish presence & absence	5.7	Change in weed plant species composition
2.2	Change in riparian/wetland fauna	5.8	Change in extent of used exotic vegetation
2.3	Change in (benthic) macro-invertebrates		***6.0 Fire***
2.4	Change in microalgae presence & absence	6.1	Event monitoring of fire behaviour
2.5	Change in in-stream habitat structure		***7.0 Fauna - land***
2.6	Change in wetland area	7.1	Change in occurrence of native vertebrate land animals
2.7	Impact of events on wetlands	7.2	Monitoring impact of events on native fauna
	3.0 Soil	7.3	Change in fauna behaviour
3.1	Change in surface soil pH	7.4	Change in occurrence of exotic (pest) fauna
3.2	Change in subsurface soil pH (now 3.1)		***8.0 Greenhouse Accounting***
3.3	Change in soil structure	8.1	Change in energy use greenhouse gas emissions
3.4	Change in plant available water content	8.2	Change in carbon sequestration rates
3.5	Change in soil chemical analysis		***9.0 Production***
3.6	Change in biological activity	9.1	Change in pasture condition
3.7	Change in soil/ground cover	9.2	Monitoring annual use of pasture
3.8	Change in rill/gully/streambank erosion	9.3	Change in productivity
3.9	Change in soil loss from wind erosion		

The information for each indicator answers questions such as: What is it? What does monitoring this indicator tell me/ why monitor for this indicator? How to measure it and what tools are needed? How much does it cost? What do the data mean? What are the monitoring strategies? How does it relate to other indicators? What other information may be required and what are its limitations? What standards apply to this indicator? How to record and share the results?

For each indicator one or more standards of how to monitor for the indicator have been identified. For example "*Change in native vegetation area"* describes level one monitoring, for property monitoring use only, using aerial photographs or satellite images with hand drawn overlays and field ground truthing using tape measure, compass and vehicle trip meters. Level two monitoring for this parameter, is collected in a manner that may also be useful to others and is based upon the use of Geographical Information Systems with electronic satellite, aerial photograph or other layers and ground truthing and recording change in vegetation area with a Global Positioning System.

The monitoring path of the guide provides information on why it is important to monitor and how to develop a monitoring plan. It describes the principles of managing natural resources monitoring data and the need to use quality assurance processes if the land manager wants to share the data.

Conclusions

The environmental impact and scrutiny of land management practices is driving an increased expectation by governments and the community for land managers to monitor and demonstrate the sustainability of their activities. This has stimulated a need for a comprehensive suite of monitoring tools. The Landholder's Monitoring Guide is designed for property level monitoring by land managers for more sustainable decision-making.

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