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RANGELAND MONITORING – IT'S NOT AS SIMPLE AS 1, 2, 3.

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INTRODUCTION

Rangeland administrators, regional NRM bodies and pastoral managers need monitoring systems to meet a range of organisational objectives. Resource monitoring is an important component of land management *per se*, as well as being useful for assessing the impact of activities that address defined land management issues. Outcomes monitoring, a significant component of Commonwealth, state and regional NRM activities (Australian National Audit Office, ANAO 2008), is particularly relevant for NRM bodies either required to or desiring to measure project performance. Whatever the purpose, monitoring provides information on which to evaluate current practices, assist in modifying activities to achieve desired ends and to document change over time.

Objectives are the foundation of monitoring, and the user's specific objectives should drive the monitoring design, including operational aspects such as sampling strategies, site location and information recorded. However, objectives are often unclear, particularly as to whether monitoring is to provide information for tactical decision-making, to assess project outcomes or is required for regulatory purposes. Instead, monitoring techniques are often chosen that meet no purpose particularly well, with monitoring done for "monitoring's sake", and 'recipe' type systems implemented on the assumption they are suitable for all rangeland situations, independent of the user's particular needs. Considerations of "what to measure", where to monitor", "when to sample" and "how to interpret data", are often inadequately dealt with by the individual or group doing the monitoring because of the convenience of adopting a generic, "off-the-shelf" approach.

Implementation of generic monitoring systems inappropriate to the task can lead to measuring the wrong attributes in the wrong place at the wrong time, with wrong conclusions being drawn.

PURPOSE OF MONITORING

A common multi-purpose monitoring function is that of assessing trend in one or more variables at the paddock to lease scale. What potential objectives would warrant setting up a monitoring scheme at this level? It is probable that, if a technique was designed to meet the broad objective of "monitoring at the paddock to lease scale", for the range of potential uses, we would probably end up with not only at least six different techniques, but at least six different locations for the monitoring and at least six different networks of sites (Table 1). Note the strong scale-dependent interactions between the purposes/objectives, the variables assessed and the interpretation of data, an issue discussed by West (2003).

Among the issues to be considered, three points are particularly relevant. Firstly, one system will not suit everybody or every purpose, and the systems suitable for different objectives may be very different, even at a most general level (land manager versus land administrator). For example, fixed sites may be required for the administrator, but informal general areas may be sufficient for the manager. Secondly, where the data are collected within the paddock is fundamental *(*see Pringle *et al* 2006*)*. Thirdly, the data collected must relate to the question being asked or the objective of the system (particularly if using a surrogate).

Table 1. The effect of change in the purpose or objective of monitoring at the lease or paddock level on the characteristics of the most appropriate monitoring.

Purpose	User	Where	What & How	When
1) For use in tactical decision-making, for example to assist in assessment of whether stocking rates and grazing distribution are satisfactory.	Manager	On a vegetation type known to indicate current or recent grazing pressure or useful as an indication that grazing pressure is becoming excessive – probably directly beside a regularly used track. May be a, fixed site or a general location.	Forage biomass, plant utilization, species composition - visually, or possibly using a set of photo standards for comparison with previous years.	Variable, but especially in the lead up to decision-making and afterwards to see effect of management change.
2) To provide long-term evidence (mostly qualitative) of the impact of management at the property level, but different from (6) below because it would be a system tailored to the needs of an individual manager.	Manager and Administrator	Located to show long-term change of key species or habitats. Ease of access probably still important but less than for (1). The actual site would be on a patch of vegetation that the manager identifies with in terms of assessing land condition, i.e. manager's own selection criteria.	Species composition and some measure of abundance, frequency or cover – photographic record.	When species can be identified, therefore same 'seasonal' date rather than calendar date.
3) To document changes of interest to the lessee in specific areas, such as where a paddock has been spelled or where a paddock is known to be of some concern, or perhaps where grazing animals have changed from sheep to cattle.	Manager	The area of concern or interest.	Species composition and some measure of abundance, frequency or cover – photographic record.	As for (2).
4) To provide evidence of change in specific areas of concern, possibly highlighted as part of a regulatory reporting process.	Manager, but under direction from Land Administrator.	The critical area of concern.	Attributes tailored to the issue of concern, e.g. position of gully heads or erosion front – photographic record.	At the time relevant to the problem being addressed.
5) To provide a reality check (mostly informal) on management over the long term, at one or more fixed locations at which the manager assesses the current situation.	Manager	Dependent on manager's idiosyncratic ideas.	General observations visual assessment, but could include a photographic record.	Standard time(s) in production cycle, perhaps the end of the growing season and/or the end of the dry season (but probably opportunistic and idiosyncratic).
6) To provide a representative sample of sites to judge trend across the lease.	Administrator	Use site stratification and location criteria from formal land administration system.	Range of objectively measured attributes, dependent on a formal system.	Depends on formal system guidelines, but probably not seasonally dependent.

The system driven by the objective.
As an example, consider lease level monitoring. Two main types of information dominate for a manager, and one for the land administrator. A manager requires "managerial information" to make tactical decisions about stocking rates, the effect of spelling or similar factors. In the extensive rangelands, this will almost certainly require several locations per paddock (spatial scale, heterogeneity and variable animal distribution), and will need to be assessed at least annually, perhaps even more frequently. This suggests fast data capture (so a minimum amount of time is spent at each 'site' or area) and a direct link between the information collected and the decision to be made (e.g. available biomass and stocking rate) so that interpretation is not an issue. It may also mean a more informal type of site rather than a fixed point, such as a general location in a paddock ("about a kilometre from the waterpoint") or could even be anywhere on the property, as used by Purvis (2004).

The second type (perhaps less of a priority for many managers) is "stewardship information" whereby the manager can demonstrate that the area under management has a stable or improving trend. This probably suggests fewer sites or locations but some means of recording information for the long term and for potential external audit. It is unlikely a manager would collect quantitative data, although he/she may pay someone else to do so. More likely, the manager will use photographs, showing a standard scene perhaps annually, perhaps every few years.

A land administrator requires information about what is happening in and to the rangelands, with a capacity to discriminate between managerial and climatic drivers, and of sufficient rigour to initiate ameliorative actions, or to defend the conclusions if regulatory issues become paramount. This implies consistency across properties, between years, and across operators (data collectors) and a significant investment in data storage and interpretation. This rigour implies more time at individual sites, probably quantitative information and a network encompassing all leases under consideration. Funding realities suggest that the sampling intensity most useful to a manager (e.g. multiple sites per paddock, all paddocks, annual assessments) will almost certainly be impossible for the administrator, although self-assessment may enable this to happen in the future.

Where to monitor?
Should sites be placed in the middle of representative areas of vegetation or placed on the margins, placed where trend is dynamic or representative? Are sites located to meet the objectives of each *individual* lessee (who might be different over time on the one property) or should they be compatible across leases? If not compatible, how will different types of sites be used for regulatory purposes? There is no 'right' answer or even one answer for each monitoring system, and for every system there is some constraint that limits where to monitor (access, time to get there, too many locations costs too much time and money). However, wherever monitoring takes place, it is imperative to relate the conclusions to where the monitoring sites are located and why they were located there.

Data collection and interpretation
Many conclusions drawn from monitoring data are derived variables where what is actually measured is not what is reported (such as range condition). Moreover, since many of the performance indices related to the objectives are difficult to articulate or simply difficult to measure, surrogates are common. However, surrogates are often chosen more for their ease of measurement rather than their strict linkage to the monitoring objective. For example, in a project directed towards sustainable land management, where an activity is to provide better management tools to land managers through training, should land condition variables be monitored, or the number of managers (i) attending a training course and (ii) implementing some form of recommended action subsequently? Often, it is simply the number of managers attending the course because this is a straightforward and relatively simple variable to record. However, if a variable proportion of the participants at each training event continue in the same manner as before, will attendance truly act as a surrogate for improved land management? In a similar way, the success of a

photo monitoring system is, at a minimum, dependent on how many producers actually use the site information in their decision-making, leading to better decisions. Such systems are meaningless unless actually used.

IMPLICATIONS FOR DECISION MAKING

Too often, we get it wrong. Too often, monitoring systems are installed (at great expense) but they do not deliver what is needed. Too often, there is a risk that conclusions will be drawn that are not really supported by the data, in fact, may not even relate to the data. Certainly, sometimes it is because of an administrative pressure to 'go forth and monitor'. Sometimes it is because a particular technique can produce information relatively easily and cheaply – without considering whether the information is particularly appropriate.

The consequences of getting it wrong are threefold. Firstly, monitoring personnel (administrators or managers) may reach erroneous conclusions concerning management impact if the monitoring results are used within an adaptive management cycle, leading to ineffective or even counterproductive responses. Secondly, the existence of an established monitoring system is often a barrier to the implementation of a new one even when the existing one is recognised as inappropriate for the new task. Finally, enormous resources are put into designing and installing systems that do not deliver what the end user requires.

CONCLUSIONS

Argument continues as to the condition and trend of Australia's rangelands, not only from an ideological viewpoint, but also from those possessing data from a range of monitoring activities (see Bastin *et al*, 2008). Meanwhile, the ANAO (2008) report on the Natural Heritage Trust and the National Action Plan stated *"Overall, the ANAO considers the information reported in the DAFF and NHT Annual Reports has been insufficient to make an informed judgement as to the progress of the programs towards either outcomes or intermediate outcomes"* (pg. 16), although eight of the nine regional bodies interviewed during the audit engaged in some form of validation activity. Much of this argument and uncertainty may be related to the use of inappropriate monitoring systems, a sense that a "one-size-fits-all" approach is appropriate, or to a monitoring system without clear definition of objectives.

Inappropriate monitoring may not only provide misleading information, it may also inhibit the development of a more appropriate system on the basis that "there is already a monitoring system in place". Until these points are addressed and both those requiring (or even demanding) the installation of a monitoring system and those actually conducting the monitoring understand the pitfalls, the appropriate returns from monitoring will not be achieved, and the capacity to fully understand the impact of decision making and management activities on Australia's rangelands will remain limited.

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