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The importance of long-term flora monitoring across Australia's Rangelands

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Abstract
Flora monitoring throughout the Australian rangelands has been intrinsically linked to rangeland management throughout grazing history. Although this monitoring is often carried out daily on an informal scale by land managers, broadscale monitoring that attempts to capture long-term change has been the responsibility of government departments. The Rangeland Assessment Program (RAP) has been monitoring 163 sites across the Western Catchment of New South Wales (NSW) since 1989. During this time valuable data has been collected from across the Catchment generating information on biomass changes, species mixes, groundcover and woody species dynamics. This data is provided to landholders throughout the Catchment on an annual basis.

Whilst data has been collected over the past 22 years, little has been done to liberate this data for state-wide reporting requirements. This paper seeks to outline the importance of data liberation of long term flora monitoring throughout Australia's rangelands, using the Rangeland Assessment Program as a case study. These trends will become an important part of setting management targets for the Western Catchment's looming Catchment Action Plan (CAP) reporting requirements.

Introduction
Australia's rangelands are vast and diverse places, covering 75% of the country (Foran *et al.* 1990). They play host to a vast array of native species; 67% of Australia's reptiles, 62% of Australia's birds and 33% of Australia's mammals all reside within the part of Australia that are termed rangelands.

Alongside the fauna is a myriad of flora. This flora is often the focus of monitoring programs as it is the lifeblood of those who inhabit the rangelands. Pastoralists rely upon various annuals and perennials to fatten stock and profit from grazing these landscapes.

Monitoring change has always been a common theme of rangeland management (Smith, 1984). Monitoring changes within rangelands is a difficult process; not only is it resource intensive, but there are many variables that can be attributed to causing change. Accurately accounting for these variables and assigning causality is challenging.

The Rangeland Assessment Program (RAP) first commenced in 1989. The program, initiated by the Soil Conservation Service, began with the objective of preventing land degradation within the rangelands of Western NSW.

It was envisioned that as a result of the program, through a partnership between public servants and landholders, both parties would be able to develop sustainable rangeland management practices (Green, Hart & Prior, 1994).

Program Methodology
The Rangeland Assessment Program was developed in the mid 1980s based on best science available at the time. CSIRO research and satellite imagery were combined to ensure minimisation of error and adequate sampling of patchy landscapes.

Site Selection

Site selection was based around choosing a set of sites that best represented the full variation in rangeland condition and management practices within a given district. Five selection criteria were implemented in the program: selection of rangetypes, selection of landsystems, selection of properties, selection of paddocks and selection of sites within a paddock; each representative of the last.

Site Layout

The site plot measures 500m x 500m, consisting of 4 parallel transects each 300m long, separated by 100m. The sites are setup to have a 100m 'buffer' surrounding the transects. Adjacent transects are read in opposite directions. Sampling of transects always takes place in the same direction.

Vegetation and Soil Measurement Procedures

On each visit vegetation and soil surface are measured using a number of techniques, these being belt transect (chenopod cover), step pointing (woody cover), soil surface rank, dry weight rank and comparative yield.

A belt transect is 1m wide and 300m long. The observer walks along continually recording vegetation along the length of a transect. Step pointing is conducted as described by Cunningham (1975).

Dry Weight Rank (DWR), Comparative Yield (CY) and Soil Surface Rank (SSR) are referred to as quadrat techniques. The quadrats used are 70.7cm square, with an area of 0.5 square metres. Placing the quadrat at 25m intervals results in 13 measurements along each transect. The DWR method is used as described by Jones & Hargreaves (1979).The SSR is conducted in a similar way, that is, soil surface features are ranked according to the proportion of the quadrats area that they occupy.

The CY method is used as described by Haydock and Shaw (1975).

Management Actions and Environmental Events

Landholders provide information on monthly rainfall, stock movements, paddock management, environmental events such as fire or flood, production information and any additional observations. Landholders provide this information given that they have the most intimate connection with the land surrounding the site.

Site Condition Assessment and Landholder Reports

After methodically recording vegetation and soil features at a site and observing its condition, assessors make a condition assessment of the site. Once the data has been collated, the assessor's comments, plus a summary of the soil and vegetation measurements, and a photograph of the site are provided to the landholder.

The data collected is aggregated into a database where information can be extracted on a site-by-site level or by an IBRA bioregion level.

Results

A brief selection of data obtained through the Rangeland Assessment Program has been included in this section.

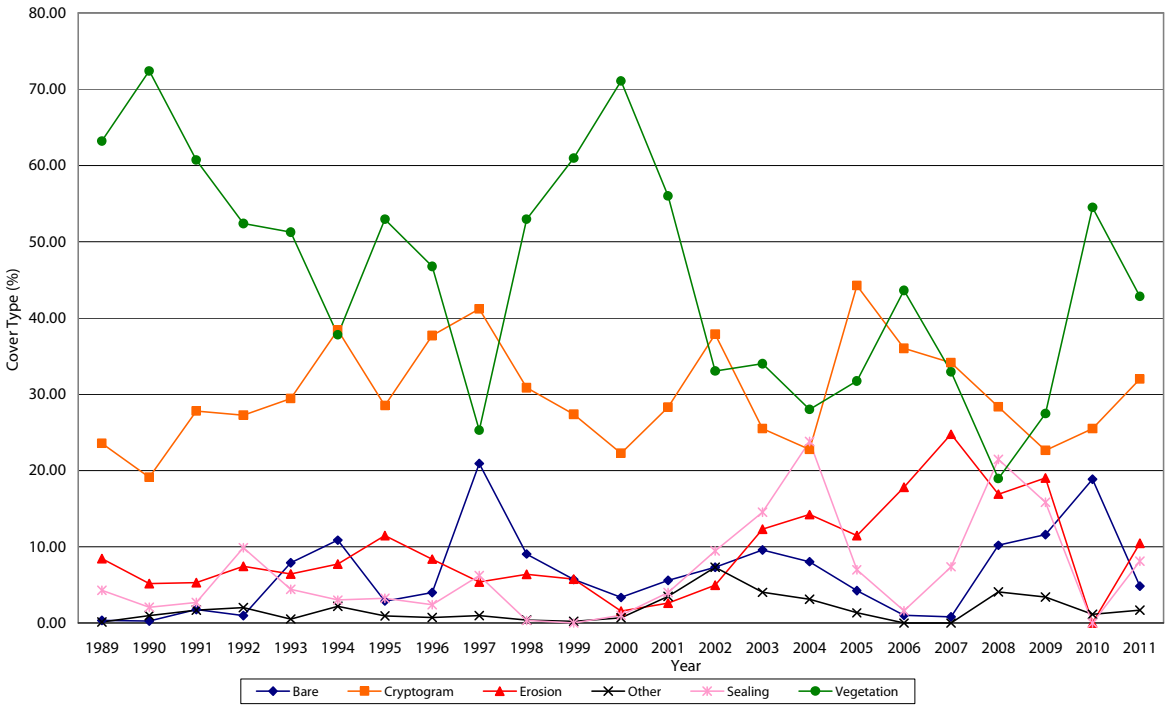

Figure 1 Cobar Peneplain bioregion average surface cover between 1989 and 2011.

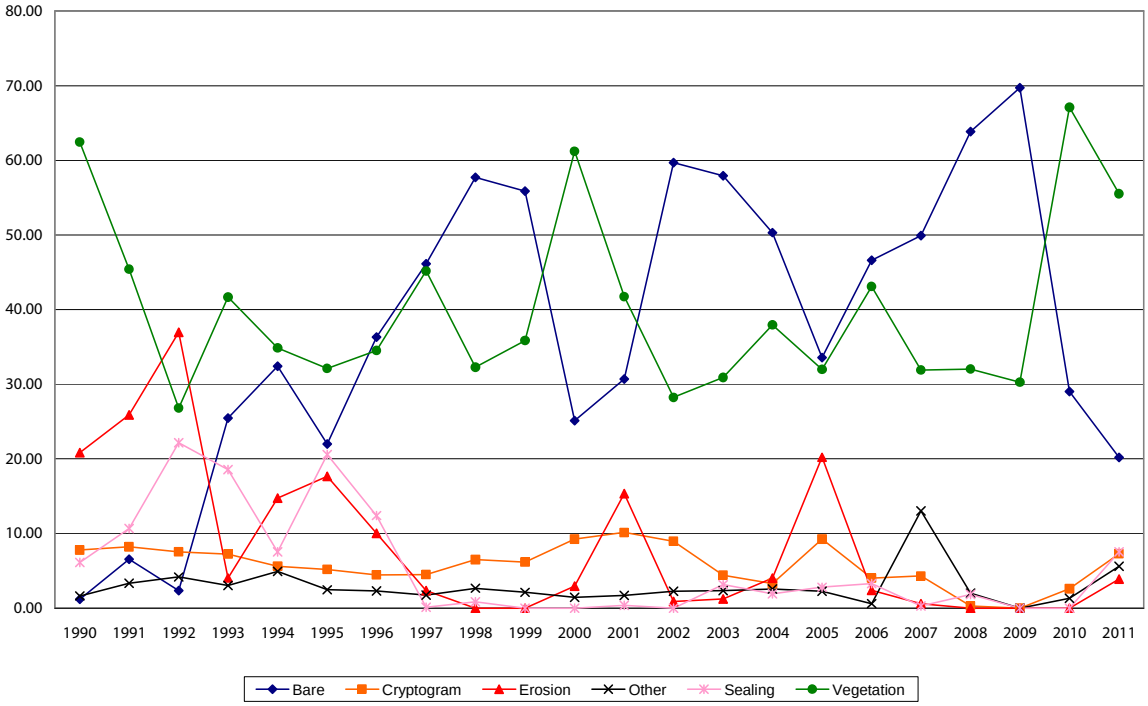

Figure 2 Mulga Lands bioregion average surface cover between 1990 and 2011.

Discussion

Since the inception of the 13 Catchment Management Authorities (CMAs) in 2004, each organisation has been striving to meet targets set in their Catchment Action Plan (CAP), a strategic regional NRM plan. The majority of these plans set specific targets relating to issues commonly faced within the designated locality of the CMA.

As it currently stands, the Western CMA's Catchment Action Plan defines a catchment-wide groundcover target of 40%. This target was set on the best available data at the time, from previous agencies such as the Soil Conservation Service.

Catchment Target 1 Quality and quantity of vegetation managed to maintain and/or improve designated cover capable of preventing soil erosion (i.e. designated cover greater than or equal to 40%).

The figure of 40% reflected a minimum achievable standard across the Catchment. It was not a level down to which groundcover could be utilised should it have exceeded 40%. The target was also devised with the proviso that, for periods of time, cover levels may fall below 40%.

This target was set at a time before the Western CMA was able to provide funding for Total Grazing Pressure (TGP) fences and other on ground works to improve land condition by managing grazing pressure.

Recent analysis of data obtained through the RAP reveals that this target is fairly modest; especially when considering that none of the RAP sites have been managed using TGP grazing control techniques. These innovations have only been implemented within the past 5-10 years.

The data in Figures 1 and 2 show RAP soil cover values for the Mulga Lands and Cobar Peneplain IBRA regions. Whilst the two bioregions are geographically in close proximity, there are significant differences in groundcover dynamics. The differing proportions of cover type are of most interest. For example the Cobar Peneplain has much greater levels of cryptogamic cover compared to the Mulga Lands bioregion. Ultimately this means that a 'one size fits all' groundcover target is unlikely to be appropriate when developing Catchment Action Plan targets. .

Whilst a revised minimum vegetative groundcover target of 45-50% for the Cobar Peneplain could be considered appropriate it would be unwise to adjust the groundcover target for the Mulga Lands bioregion; the average groundcover in this area rarely exceeds 40%.

There are other considerations that should be taken into account when setting groundcover targets. Whilst the monitoring data shows that, on average, some of the poorest sites in the Catchment are capable of maintaining groundcover levels of 45%, these can only be achieved if improved grazing management principles are adopted Specifically, Western CMA funded project adoption rates play a major part in developing achievable targets.

Conclusion

Currently, 2011 was the final year of monitoring under the Rangeland Assessment Program.

The Western Catchment is considered to be a 'data poor' catchment. The Catchment covers an area of 230,000 square kilometres, approximately 29% of NSW. Providing services to such a large area with limited resources results in dispersed monitoring and research capacity and a paucity of data.

The process of RAPdata liberation and analysis has generated useful information for shaping the new CAP. The results that have been extracted from the data clearly show these type of programs are worthy of continued government investment, especially at a time when both NSW and Federal Governments are heavily investing in NRM. To determine if these investments represent good value for money, the importance of long- term regional cannot be overstated.

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