Southern Australian feed-base pasture audit

Graham Donald[1,2], Stuart Burge[3] and Cameron Allan[4].

[1] Agricultural Consultant, Port Macquarie, NSW 2444, Australia Email gdonald@bigpond.net.au
[2] Precision Agriculture Research Group, University of New England, Armidale, NSW 2351, Australia Email gdonald2@une.edu.au.
[3] Agricultural Consultant, PO Box 219, Cooma, NSW 2630, Australia Email stuartburge@bigpond.com
[4] Meat and Livestock Australia, PO. Box 1090, Orange, NSW 2800, Australia Email callan@mla.com.au

Abstract
A feed-base pasture audit was carried out throughout southern Australia commencing mid year 2011. The purpose of the audit was to map and analyse information obtained about the pasture feed-base for livestock production by surveying Statistical Local Areas (SLAs) across the southern states. Information on pasture types, composition and associated attributes were collated on the 404 Statistical Local Areas surveyed. This survey provided estimates of the percentage of each pasture type and distribution based on species, botanical composition, estimated carrying capacity, condition of pasture and details on whether in decline, stable or improving. Some observable trends included an increase in the abundance and distribution of lucerne across the region and a decline in the condition of unimproved and native pasture types in NSW and Victoria. It is anticipated the database will be made available on the internet to assist plant breeders, researchers and farmers develop and improve the Australian pasture feed-base.

Key words
Pasture survey, pasture composition, pasture species, Southern Australia Feed-base audit.

Introduction

This collaborative project between the State Department of Primary Industries and agricultural consultants collated opinions of experienced researchers and agronomists regarding the current status of pastures in Southern Australia in 2011. This audit followed a similar study conducted in 1993 under the guidance of the National Pasture Improvement Committee. This earlier survey by Pearson et al. (1997) and the accompanying data were compiled into a database with major pasture species and adaptation zones subsequently mapped (Hill and Donald 1999). The purpose of this Feed-Base Audit was to survey pastures within the agricultural SLAs (SLA boundaries, Australian Bureau of Statistics, 1270.0.55.001, 2011) in NSW, Victoria, Tasmania, South Australia and southern Western Australia, collate these data into an organised data base structure and prepare a short report and summarise by tabulating and mapping pasture species abundance and distribution. Also, these data will provide the basis for further analysis. The study region encompasses the agro-ecological Southern Australian zone (MLA 2011) (Figure 1). This region supports approximately 10 M cattle and 70 M sheep (MLA 2011).

Methods

After a preliminary survey form was evaluated by selected agronomists who contributed feedback on the form design, relevance, content and structure, the survey commenced throughout southern Australia in June 2011. Encompassing 404 SLAs in NSW, Victoria, Tasmania, South Australia and southern Western Australia (Figure 1), information was collected on pasture types including their composition and associated attributes including forage crops for livestock production. The pasture types were then described in terms of their botanical composition, varieties, use in crop rotation, re-sowing interval, carrying capacity, condition of pasture and whether in decline, stable or improving (Table 1). Within each pasture type the dominant pasture species were listed with their proportional composition and whether they were sown, a weed or a volunteer. Pasture varieties associated with each pasture type and species were recorded if known. Where possible, it was noted if the pasture type was in a crop rotation and an indication of the rotation sequence. Information relating to the stand life or the re-sowing interval of the pasture type was included as well as the actual and potential carrying capacity as an observed average and range value. Pasture condition was noted as deteriorating, stable or improving and a score (1-10) given to the current condition of the pasture. SLA total and grazed areas were derived from the Australian Bureau of Statistics (Agricultural Commodities: Small Area Data, 2005-06). However, the Department of Agriculture and Food Western Australia (DAFWA) provided, from their experience, a more recent assessment of SLA grazed areas.

Data collected were based on “desk-top estimates” by State District Agronomists and Agricultural

consultants. Any outstanding, missing or incomplete data were referred to the state coordinators for further comment. An example set of standard dominant pastures types were provided (from 1993 survey) with the understanding that this list would be broadened to encapsulate other prevalent pasture types. The surveyed forms from each state were initially entered into a Microsoft Excel worksheet then into a Microsoft Windows 7 Access relational database schema of approximately 26,000 records.

Pasture content and distribution were tabulated and mapped (ARC/GIS, ESRI, Sydney) by State where non-agricultural land was masked using the Australian Land Tenure map (Department of Agriculture Fisheries and Forests, Australian Bureau of Agriculture and Resource Economics and Science 2010). These data provided pasture distribution for the processes of mapping the content and each of the major pasture species, for example subterranean clover (Figure 1). The pasture content maps were returned to the state coordinators for validation and to provide a consensus assessment in keeping with the fact that the survey was a "desk-top based" audit based on the informed opinions of professional agriculturalists rather than objective measurements.

Total pasture species content was calculated by applying:
Total area of pasture species (ha) = proportion of pasture type within SLA X area of SLA grazing area (ha) X proportion of pasture species within SLA unit. Equation 1.

Areas for pasture species were expressed as the proportion of coverage within the SLA, noting that a specific pasture species can occur within many pasture types e.g. phalaris/white clover, ryegrass/white clover etc. The surveyed information submitted by the states often described the abundance of annual or perennial plants. These were not specific and may refer to many pasture species. Legumes were described, and can loosely refer to many varieties; likewise medics refer to a number of varieties. However, where possible they were defined to a pasture species or variety. In South Australia, in particular, an effort was made to describe medics by their variety. A pasture was only included if it contributed to more than 1% of the SLA, therefore, some pasture types/species may not be included but could still exist within the SLA albeit insignificant.

Results and discussion
The most significant pasture types that existed within each state at the time of the pasture audit in June 2011 are listed in Table 2. NSW had a disproportionately high amount of unimproved native pasture due largely to the inclusion of the far west of NSW (Figure 2).

From Equation 1, the proportion of subterranean clover was highest in Western Australia, and a band of high-rainfall in South Australia, Victoria and New South Wales (Figure 1). Significant pasture species within the State were mapped to show the distribution of the proportion of pasture content within each SLA across each state (Figure 1). The accuracy of the information in the data base depended on the experience and knowledge of the respondents.

The database will provide useful detailed information on unimproved, over-sown and improved native pastures and generalised information on weed content and species and their spatial distribution. As irrigated pasture types were often mentioned, recognised state irrigation areas were mapped in conjunction with the content and distribution of lucerne. The number of SLAs surveyed in South Australia was less in 2011 than those recorded in 1993 as a few northern marginal grazing land are now classified by the South Australians as rangeland.

The production of summary tables and spatial maps has been the only synthesis of these at the present time.

Table 1. The number of SLAs where the unimproved native pasture type condition was recorded as in decline.

State	SLAs in decline	Total SLAs surveyed
NSW	38	123
Victoria	21	120
South Australia	31	51
Tasmania	6	26
Western Australia	none	84

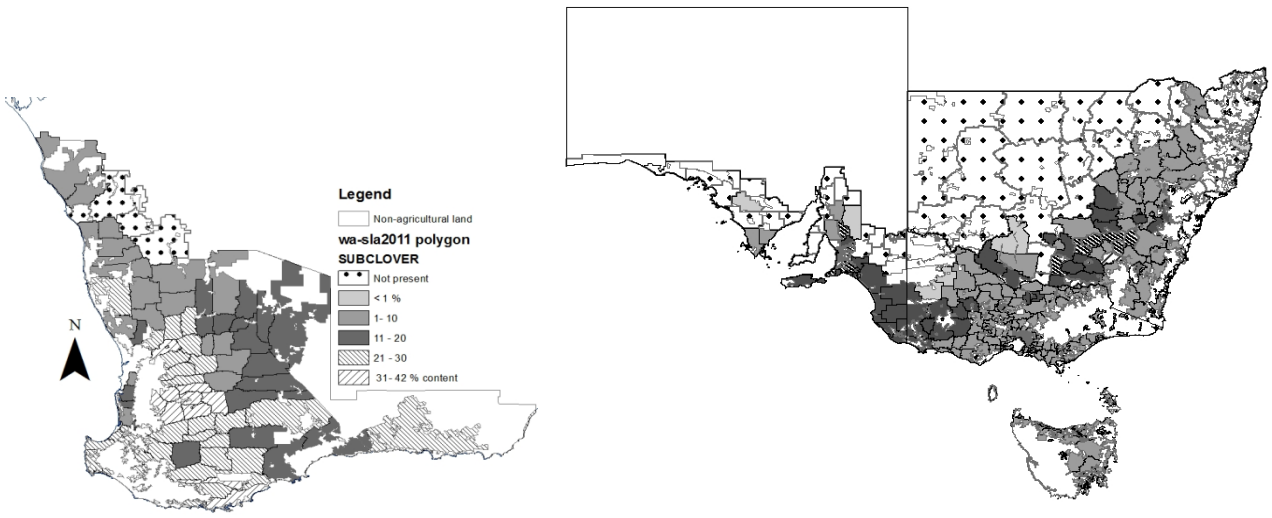

Figure 1. Distribution and content of subterranean clover by SLA.

Table 2. The percentage of total grazing area (%) of the major pasture types for each State.

State	Pasture Type	Percentage of State total grazing area	State	Pasture Type	Percentage of State total grazing area
NSW	Unimproved native pasture	44.2	Western Australia	Annual medic	4.5
	Fertilised over-sown native	2.7		Sub clover*/annual grass	11.6
	Fertilised native pasture	2.0		Sub clover	9.3
	Lucerne	4.9		Annual ryegrass/sub clover	11.2
	Cocksfoot/sub clover*	0.8		Serradella	1.5
	Phalaris/sub clover	1.3			
Victoria	Unimproved native pasture	5.9	Tasmania	Unimproved native pasture	12.5
	Fertilised native pasture	0.8		Cocksfoot/sub clover	5.8
	Lucerne	3.1		Cocksfoot/white clover	4.0
	Cocksfoot/sub clover	2.4		Perennial ryegrass/sub clover	11.4
	Phalaris/sub clover*	16.9		Perennial ryegrass/white clover	17.9
	Perennial ryegrass/sub clover	10.5		Sown annual ryegrass	4.4
	Perennial ryegrass/white clover	8.7			
South Australia	Unimproved native pasture	17.0			
	Fertilised native pasture	2.5			
	Annual medic	9.5			
	Lucerne	6.6			
	Phalaris/sub clover	2.3			
	Perennial ryegrass/sub clover	1.0			

* subterranean clover

Despite this there are a number of noteworthy features:-

- Across southern Australia the abundance and distribution of lucerne has increased and so has, for example, the area of fescue in Victoria, burr medic in South Australia, serradella in Western Australia and cocksfoot in Tasmania. By contrast balansa clover content since the 1993 study has decreased.
- In all states a significant area sown to crops primarily for livestock production was recorded (although some these may be dual purpose); this feature was not as apparent in the 1993 survey.
- Most states and in particular NSW and Victoria have an abundance of pasture types where their condition was recorded as in decline. For example, in both states the unimproved native pasture type (Figure 2) followed by fertilised and over-sown native in NSW and naturalised perennial weeds followed by annual medics in Victoria were recorded as in decline.

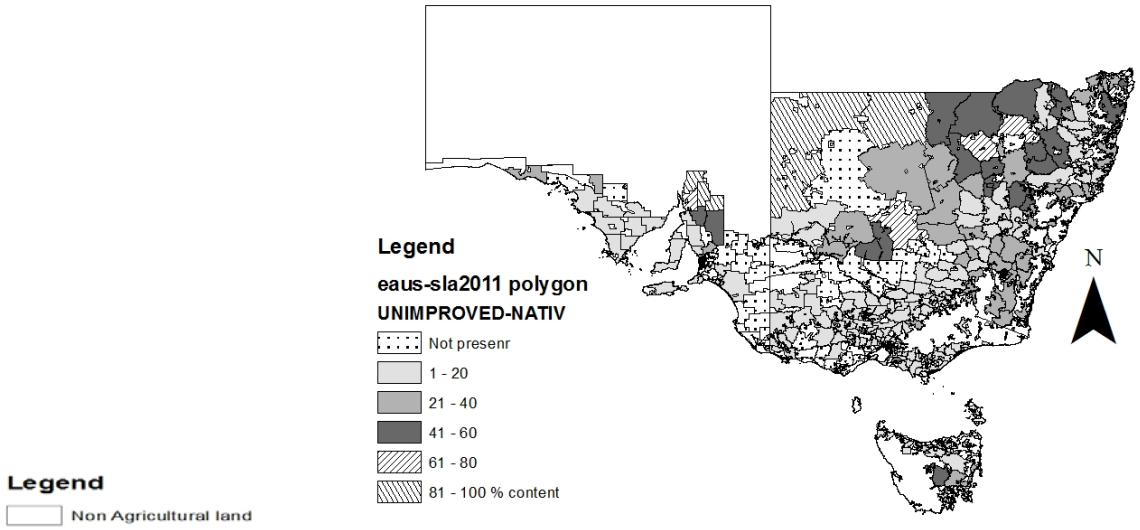

Figure 2. Distribution and content of unimproved native pastures in south eastern Australia.

Some provisional analysis has been performed on the recent data collected. As an example, the distribution of lucerne agrees well with its hypothetical modelled adaptation area (Hill and Donald 1999). Although serradella has increased its distribution in Western Australia it has not in eastern Australia, in particular central NSW. Further investigations are required to highlight the factors explaining why a number of pastures are in decline; apart from recent prolonged drought. Although there are levels of accuracy within the 1993 and 2011 data, both have the potential to create additional invaluable information.

Opportunities for further investigation for these data, for example include, (a) prepare potential adaptation zone maps of significant pasture species based on contemporary perturbed climatic conditions and compare these to the current survey, (b) examine differences between current and potential distribution of significant pasture types as a criteria to improve livestock productivity and (c) prepare economic assessments. It has been shown (Donald et al. 2010) that livestock movements are greatly influenced by rainfall and pasture availability but how does the distribution and content of pastures alter production sectors within the farm enterprise. It is also envisaged that these data will be statistically and spatially assessed to assist with plant breeders, researchers and farmers develop and improve the Australian pasture feed-base.

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References

Donald GE, Miron DJ, Dyall T and Garner MG (2010). "Temporal and spatial regional cattle farm turn-off patterns in Eastern Australia", Australian Society of Animal Production 28th Biennial Conference, Journal of Animal Prod Science 50, 359-362

Hill MJ and Donald GE (1999) "Australian Temperate Pastures Database", CD-ROM, National pastures improvement coordinating committee. Final report for Meat Livestock Australia.

Mason W and Allan C (2011). Feedbase Investment Plan. R, D & E priorities for the Southern Australian. MLA report, Jan. 2011. MLA, North Sydney.

Pearson CJ, Brown R, Collins WJ, Archer KA, Wood MS, Petersen C and Bootle B (1997). An Australian temperate pastures database. Australian Journal of Agricultural Research 48, 453:466