Tasmanian pasture resource audit: Snapshot of functional group composition in 2011

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Abstract

Industry experts and stakeholders, including the State Government, have expressed concern regarding the productivity and quality of improved pastures in Tasmania. A study was conducted in 2011 using a novel sampling technique to provide a snapshot of the functional group composition of improved pastures across the state. We surveyed 846 pastures, that were sampled along 116 roadside transects, across 20 of Tasmania's 29 Local Government Areas (LGAs). Individual pastures were assessed on the basis of percentage cover ascribed to each species and functional group. On a survey-wide basis, improved perennial grasses made up just 33% of the pasture cover, and this varied significantly between LGAs, while the cover of perennial legumes was just 7.5%. Increasing the content of improved perennial pasture species in all regions, but particularly the low-medium rainfall regions, should remain a priority for research and extension projects. There is also considerable potential to increase the area and use of lucerne as an alternative feed supply in the extensive grazing regions of Tasmania, and to improve legume content more generally. This survey has developed a manageable, low cost but appropriate methodology, allowing the assessment of regional functional group composition.

Key Words

Pasture survey, composition, plant cover, perennial pastures, Tasmania

Introduction

There is anecdotal evidence from agronomists and industry experts that the pasture resource decline in Tasmania is continuing. The perception of productivity decline in temperate pastures is not limited to Tasmania, but has been observed across much of south-eastern Australia for over 20 years (Hutchinson and King, 1999, Reeve *et al.*, 2000, Vere *et al.*, 2001). A decline in the proportion of improved perennial grass species is seen as a major factor in the decline in productivity and sustainability (Kemp and Dowling, 2000). In 1992 the Temperate Pasture Sustainability Key Program (TPSKP) was established to address the degraded state of pastures in the high rainfall zone of southern Australia through predominantly grazing management. Together with the subsequent Sustainable Grazing Systems (SGS) program, these programs influenced significant changes in productivity and sustainability (Allan *et al.*, 2003). In the early 1990s Friend *et al.* (1997) undertook a study assessing the condition of pastures in the Midlands and Derwent Valley regions of Tasmania. They found that improved pastures in these regions were dominated by annual clovers, and annual and perennial weed species. In addition, a high proportion of pastures contained less than 5% cover of the improved species, perennial ryegrass *Lolium perenne* or cocksfoot *Dactylis glomerata* and that phalaris *Phalaris aquatica* and tall fescue *Festuca arundinacea* were only minor species. The study by Friend *et al.* (1997) was one of the few broad scale studies on the condition of improved

pastures reported in Tasmania. It is currently believed that a large proportion of pastures remain dominated by weedy annual and perennial grasses and broadleaf weeds in Tasmania. The recent rainfall deficiencies and drought during the 2000's (National Climate Centre, 2008) may have put further stress on an already depleted pasture resource. However, there is a paucity of scientific evidence to back up these claims. During November and December 2011 the Tasmanian Institute of Agriculture (TIA) embarked on a Tasmania-wide survey of pasture condition that involved 846 road-side assessments along 116 transect journeys, across 20 Local Government Areas (LGAs). Each roadside assessment included a visual estimation of the functional group composition of each pasture. The objective of this survey was to provide a broad scale snapshot of pastures across the State.

Methods

Tasmania is divided administratively into 29 LGAs and the area of pasture within each LGA was sourced from the 2009/10 land use dataset (Department of Primary Industries Parks Water and Environment, 2009). The types of pastures of interest that were selected consisted of: 'grazing irrigated modified pastures'; 'grazing modified pastures'; 'irrigated pasture legumes'; 'pasture legume/grass mixtures'; and 'pasture legumes'. These, in this instance, can be referred to as improved pastures. Local Government Areas that contributed less than 1% to the overall area of pasture in Tasmania were omitted, while LGA's that contributed greater that 1% were retained. A pre-determined total effort expressed as distance travelled in a series of journeys was allocated across the LGAs based in proportion to area (ha) of pasture. During the progress of each journey, roadside assessments of pastures were made every 2 km. The distance driven was pre-determined by the amount of sampling effort allocated to each LGA. Local Government Areas with larger areas of pasture were allocated a greater number of journeys. Towns were used as starting points of the journeys with a list of towns generated from The LIST (Land Information System Tasmania (The LIST, 2009)). Towns were randomly selected for each LGA based on the number of journeys required. The first pasture assessment on each journey was taken at a random point 0.5 - 1.0 km from the town's boundary. Journeys were mapped through areas where the majority of the pasture was contained for each LGA. At each assessment point pasture was viewed from the fence by stepladder and the following was recorded: a GPS waypoint; photos of the pasture; overall estimate of the canopy cover of vegetation over bare ground as a score out of 100%; an estimate of the amount of cover that each plant species contributed to the sward (these added up to 100%). Species were analysed in functional groups such as; improved perennial grasses (e.g. perennial ryegrass, cocksfoot and phalaris); weedy perennial grasses (e.g. Yorkshire fog, sweet vernal grass and browntop); weedy annual grasses (e.g. barley grass, soft brome and *Vulpia* sp.) and perennial legumes (e.g. lucerne, white clover and red clover). A dry-weight rank method was also used, but space prohibits the presentation of those results here. For consistency, one technical officer with experience in pasture species identification surveyed every pasture

Results

Improved perennial grasses contributed 33% of the overall cover of plant species in the pastures surveyed (Table 1). Perennial and annual legumes combined for a cover percentage of only 12%. Weedy perennial and annual grasses were major contributors combining for 37% cover of pastures surveyed. The cover of functional groups varied across LGAs (Figure 1). Cluster analysis of mean covers showed some strong associations between LGAs (Figure 2). The functional group compositions of Central Coast, Circular Head and Waratah-Wynyard were strongly associated. These LGAs were characterised by above average cover of improved perennial grasses, improved short-lived grasses, perennial legumes, and dicot weeds, and an average cover of weedy perennial

grasses. The LGAs of Derwent Valley, Central Highlands and Southern Midlands, were also closely associated. Pastures in these LGAs contained high proportions of weedy annual grasses and low proportions of improved perennial grasses. However, examples of highly desirable pastures were evident across all regions and rainfall zones.

Table 1 Total mean percentage cover of plant functional groups across all LGAs and all assessments in Tasmania (n=846).

Plant group	Mean (%)	StdErr	Lower CLMean	Upper CLMean
Improved perennial grasses	32.8	1.40	30.1	35.6
Weedy perennial grasses	27.1	1.47	24.2	30.0
Weedy annual grasses	10.3	0.73	8.86	11.8
Perennial legumes	7.46	0.43	6.60	8.32
Dicot weeds	5.91	0.38	5.17	6.66
Improved short-lived grasses	5.48	0.79	3.91	7.04
Annual legumes	4.60	0.38	3.85	5.35
Native grasses	4.55	0.73	3.10	6.00
Sedges & Rushes	1.27	0.19	0.88	1.65
Other weeds	0.48	0.13	0.21	0.74
Native dicots	0.03	0.02	0.00	0.1

Discussion

In Tasmania it has been widely suggested that perennial pastures should contain 60-70% of improved perennial grasses with the remainder made up of a suitable legume for optimum productivity. With this in mind, the level of cover of improved perennial grasses in pastures assessed in this survey is low. The same could be said for legume composition. Bowcher and Virgona (1997) surveyed pastures in areas of southern NSW and reported that fewer than 25% of pastures contained perennial species that totalled more than 20% of the botanical composition. In the current study, there were a number of LGAs with less than 30% cover of improved perennial grasses. However, the Southern and Northern Midlands LGAs are the most concerning given that they alone combine for 34% of the improved pastures in Tasmania. In addition, the relatively lower amounts of weedy perennial grasses in these LGAs would indicate that perennial grasses are less suited to these areas and that there is a need to find improved perennial grasses that are better adapted to these conditions. Kemp and Dowling (1991) found that perennial grasses and legumes were replaced by annual grasses and legumes in a linear relationship at lower rainfall. High levels of cover of improved perennial grasses were found in the north-west LGAs, including King Island. These LGAs are characterised by high rainfall (>875 mm) and fertiliser inputs, typical of intensive dairy and beef production. The low level of legumes recorded in this survey could be partly attributed to the survey method that may underestimate prostrate growing species, particularly during spring when standing feed on offer is high. Further development of this technique requires defining the level of underestimation of prostrate growing species such as clovers at differing pasture heights. In addition, assessing variation between pasture assessors may be important if more than one assessor is to be used. Only 11 of the 846 pastures surveyed contained lucerne, and of that only seven could be termed productive lucerne swards. With increased irrigation development in the midlands the potential to increase the area under lucerne as a high quality feed source is considerable. Numerous techniques have been used for measuring botanical composition in grasslands and pastures including rod point techniques used by

Bowcher and Virgona (1997) and recommended by Little and Frensham (1993). The length and tediousness of many botanical survey methods (Theau *et al.*, 2010) restricts the capacity to assess pastures over large regions with limited resources. Thus, due to the scale of this survey and to avoid entering private property, a novel method of estimating functional group composition was required to cover a large area in a short timeframe and allow comparison between LGAs.

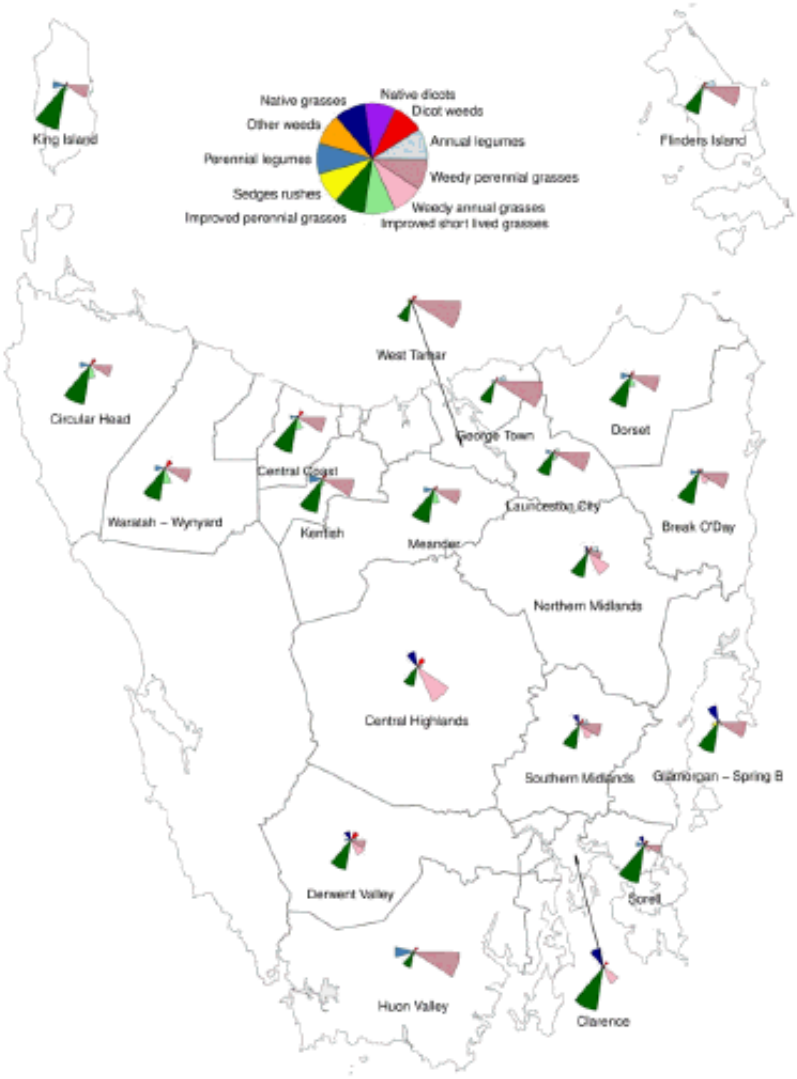

Figure 1 Visual representation of functional group cover by local government area.

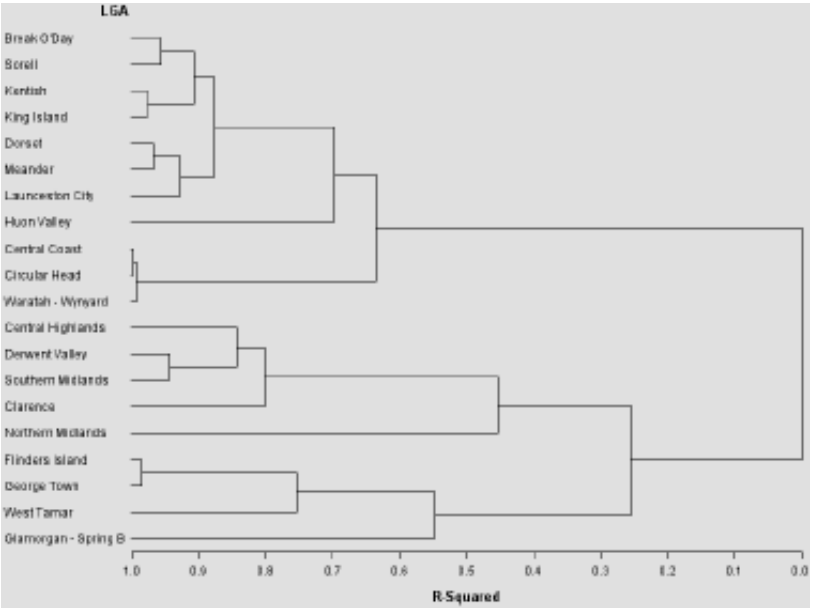

Figure 2 Association between LGAs based on cover, by cluster analysis of LGA mean coverage using Ward's method based on Euclidean standardised distance (Ward, 1963).

We acknowledge that this method is not the most rigorous but is a systematic, cost-effective means of getting worthwhile data relatively quickly. Extension activities focussing on a range of best management practices such as activities from the TPSKP and SGS, have proved most effective at generating change, and enhancing productivity and sustainability in grazing enterprises (Allan *et al.*, 2003). One of the opportunities learnt from the TPSKP was that producers require ongoing learning and training opportunities to increase skills in assessing pasture and animal performance (Mason and Kay, 2000). Extension packages such as PROGRAZE have generated change by increased knowledge of the effects of different grazing management decisions on pastures (Bell and Allan, 2000) and should continue to be promoted.

Conclusion

This survey method has provided evidence that the composition of pastures in many LGAs in Tasmania is below optimum for high productivity, but highlights opportunities for production gains to be made by renovating and managing new pastures for continued high quality botanical composition. The study also highlights the importance of continuing the development of improved perennial grass and perennial legume options for the medium to low rainfall zones, and the need for increased extension and adoption of strategies that can manipulate and maintain desirable composition.

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References

Allan CJ, Mason WK, Reeve IJ and Hooper S (2003). Evaluation of the impact of SGS on livestock producers and their practices. Australian Journal of Experimental Agriculture, 43, 1031-1040.

Bell AK and Allan CJ (2000). PROGRAZE - an extension package in grazing and pasture management. Australian Journal of Experimental Agriculture, 40, 325-330.

Bowcher A and Virgona J. (1997). Pasture composition survey of southern NSW. *In:* Bowman, A. & Michalk, D., eds. The Grassland Society of NSW 12th Annual Conference Proceedings 'Pastures under adverse conditions', 1997 Dubbo, NSW. Grassland Society of NSW, 121.

Department of Primary Industries Parks Water and Environment (2009). Land use dataset of Tasmania, Hobart, Tasmania, Land Conservation Branch, Resource Management and Conservation.

Friend DA, Thompson RP and Ball PD (1997). The pastures of the Midlands and Derwent Valley, Tasmania - Relationships to environment and management factors. IWS Final Report: Project DAT 44.

Hutchinson KJ and King KL. (1999). Sown temperate pasture decline - fact or fiction. *In:* Fourteenth Annual Conference of the Grassland Society of NSW, 1999. 78-86.

Kemp D and Dowling P (1991). Species distribution within improved pastures over central N.S.W. in relation to rainfall and altitude. Australian Journal of Agricultural Research, 42**,** 647-659.

Kemp DR and Dowling PM (2000). Towards sustainable temperate perennial pastures. Australian Journal of Experimental Agriculture, 40**,** 125-132.

Little DL and Frensham AB (1993). A rod-point technique for estimating botanical composition of pastures. Australian Journal of Experimental Agriculture, 33**,** 871-875.

Mason WK and Kay G (2000). Temperate Pasture Sustainability Key Program: an overview. Australian Journal of Experimental Agriculture, 40**,** 121-123.

National Climate Centre (2008). Long-term rainfall deficiencies continue in southern Australia while wet conditions dominate the north. http://www.bom.gov.au/climate/current/special-statements.shtml, Melbourne, Victoria, Bureau of Meteorlogy.

Reeve IJ, Kaine G, Lees JW and Barclay E (2000). Producer perceptions of pasture decline and grazing management. Australian Journal of Experimental Agriculture, 40**,** 331-341.

The LIST (2009). Town Locations of Tasmania, Hobart, Tasmania, Department of Primary Industries, Parks, Water and Environment http:www.thelist.tas.gov.au.

Theau JP, Cruz P, Fallour D, Jouany C, Lecloux E and Duru M (2010). A simplified method of botanical surveys for the agricultural assessment of permanent pastures. FOURRAGES**,** 19-25.

Vere DT, Jones RE and Campbell MH (2001). Long-term change in the economic productivity of four major pasture categories on the south-eastern Tablelands of New South Wales. The Rangeland Journal, 23**,** 148-158.

Ward JH (1963). Hierarchical Grouping to Optimize an Objective Function. Journal of the American Statistical Association, 58**,** 236-244.