SHORT COMMUNICATION

Bothriochloa biloba (Poaceae) in natural grasslands on slopes of the Liverpool Plains, New South Wales

J.M. Bean

Department of Botany, University of New England, NSW 2351
Present address : Trangie Agricultural Research Centre, PMB 19, Trangie NSW 2823

Introduction

The grass *Bothriochloa biloba* S.T. Blake is listed in Schedule 2 of the *NSW Threatened Species Conservation Act* (1995) as a Vulnerable species. In the national ROTAP listing (Briggs & Leigh 1996) it is also given Vulnerable status with Risk Code of 3V (geographic range in Australia > 100 km). As a vulnerable taxon the species is regarded as at risk, over a period of 20 to 50 years, of disappearing from the wild through continuous depletion, or likely change in land use which would threaten its survival.

Yu et al. (1997) found that, compared to *Bothriochloa macra*, *Bothriochloa biloba* has abnormal embryology with greater apomictic development and degeneration at various stages of development. Based on more detailed work, Yu (pers. comm.) concludes that apomixis markedly reduces seed production in *Bothriochloa biloba*.

Data on the occurrence of *Bothriochloa biloba* in a range of grassland associations on slopes in the Garrawillie Creek sub-catchment of the Liverpool Plains, New South Wales are presented here. Sites were selected on two contrasting rock types and two aspects, providing the opportunity to delineate preferences of the species. All sites had been grazed over many decades by domestic and native herbivores, and the topography and rocky nature of the slopes had prevented soil disturbance by humans. Thus the data are relevant to defining the effect of grazing on maintenance of the species.

Methods

Sixteen sampling sites were selected in natural grasslands on the slopes of the Garrawillie Creek sub-catchment at the western margin of the Liverpool Plains. The sites were chosen to represent contrasting lithological types and aspects, no known history of cropping, and as high a degree of structural and floristic homogeneity as possible. Eight sites were on terraced slopes formed from basaltic rocks of the Garrawilla Volcanics, and eight were on scree slopes at the base of domes of phonolite (Bean 1974). The latter is a magnesium-, iron-, calcium-poor, sodium-, potassium-rich rock producing a light-textured soil. On each rock type half the sites were on NW slopes and half on SE slopes. Latitude, longitude, rock type, aspect, altitude and general comments at each site are listed in Table 1.

Table 1 Sites at which *Bothriochloa biloba* occurred.

Site no.	Latitude/ longitude	Distinctive species of grassland association	Rock type	Aspect	Altitude (m asl)	Comments
11	31°12'18'' 149°46'49''	*Aristida ramosa*	Garrawilla Volcanics	NW	440	Site on gentle slope of top portion of terrace & steeper front of terrace
10	31°12'02'' 149°46'43''	*Bothriochloa macra/ decipiens*	Garrawilla Volcanics	SE	435	Site on steep slope with large boulders ≥ 0.5 m embedded in the soil
12	31°12'10'' 149°46'40''	*Bothriochloa macra/ decipiens*	Garrawilla Volcanics	NW	430	Site on gentle slope on top portion of terrace & steeper front of terrace; scattered rock fragments (av. diam. 15 cm) to prominent boulders embedded in the soil
13	31°12'15'' 149°46'44''	*Bothriochloa macra/ decipiens*	Garrawilla Volcanics	SE	430	Site mainly on steep front of terrace; scattered rock fragments (av. diam. 15 cm) to prominent boulders embedded in soil
14	31°12'23'' 149°45'23''	*Dichanthium sericeum*	Garrawilla Volcanics	NW	420	Site on very gentle slope on top of terrace; scattered small rock fragments av. 10 cm diameter
15	31°12'37'' 149°45'32''	*Dichanthium sericeum*	Garrawilla Volcanics	SE	410	Site on almost flat top of terrace; small very minor rock fragments and deeply cracked soil
16	31°12′15″ 149°44′37″	*Stipa aristiglumis*	Garrawilla Volcanics	SE	380	Site on front of upper terrace & very gentle slope of top portion of lower terrace
6	31°13'10'' 149°46'36''	*Dichanthium sericeum*	phonolite scree	SE	450	Site on even 15–16° slope; scattered small fragments & larger boulders embedded in soil

Sampling was carried out from late January to the end of April 1996. Species composition and abundance (frequency) were determined using a compound series of variable-sized concentric subquadrats (Outhred 1984). At sampling sites on the phonolite scree, 8 subquadrats with areas of 2, 4, 8, 16, 32, 64, 128 and 256 square metres were established using one central iron stake and 4 diagonal cords leading outwards to 4 stakes at the corners of the quadrat. The limits of each subquadrat within the quadrat were defined by markers attached to the diagonal cords. At sampling sites on the Garrawilla Volcanics, ten subquadrats with areas of 2, 4, 8, 16, 32, 64, 128, 256, 512 and 1024 square metres were established.

Frequency and importance scores (Outhred 1984) were calculated for 116 species. The frequency score indicates the total number of nested subquadrats in which a particular species occurred. The importance score was determined by searching each subquadrat consecutively, starting with the central smallest subquadrat and proceeding to the largest. Each species was given the score associated with the subquadrat in which it was first found. The smallest subquadrat (2 square metres) was given the highest score (equal to the number of subquadrats at each site; eight for the eight sites on phonolite scree and ten for the eight sites on Garrawilla Volcanics) and the largest subquadrat was given a score of 1. The frequency scores were subjected to cluster analyses using PATN (Belbin 1991).

Results

Of the seven grassland associations indicated by the cluster analyses (Bean 1996), five included plants of *Bothriochloa biloba*. Only the *Sporobulus creber* and *Eriochloa pseudoacrotricha* associations, which were restricted to light-textured soils on the phonolite scree, did not include plants of *Bothriochloa biloba*. Table 1 lists the grassland association at each of the eight sites in which the species was identified, and Table 2 lists the frequency and importance scores of *Bothriochloa biloba* with total number of species, and numbers of native, exotic, perennial and annual species at the same sites. The grassland sampled at site 16, with its high proportion of exotic and annual species, was assessed as a community with a high level of disturbance.

Table 2. Frequency (FS) and importance (IS) scores of *Bothriochloa biloba*, total number of species, and numbers of native, exotic, perennial and annual species for the eight sites at which *Bothriochloa biloba* occurred. The scores for site no. 6 are out of 8 and for the other sites out of 10. Available plant material for some individual plants was inadequate to allow identification to species level; thus the total number of species listed for some sites is higher than the sum of the number of natives plus exotics and/or the number of perennials plus annuals.

Site No.	FS	IS	Total no. species	No. of natives	No. of exotics	No. of` perennials	No. of Annuals
11	5	7	39	31	7	27	6
10	2	5	42	30	11	30	6
12	3	3	47	37	9	36	5
13	1	1	36	31	4	31	2
14	5	5	44	31	12	29	9
15	7	8	33	24	9	21	7
16	1	1	40	17	22	16	15
6	1	3	45	36	8	32	6

Bothriochloa biloba showed a distinct preference for the heavier-textured soils formed from the Garrawilla Volcanics. Of eight sites on these soils, seven included *Bothriochloa biloba*. The one site in which *Bothriochloa biloba* was not identified was an *Aristida ramosa* association site. This site was characterised by rank growth of *Aristida ramosa*, Wire Grass, and a low total number of species (33). Abundant *Tribulus terrestris*, with its hard sharp-pointed burrs detrimental to the mouths, intestines (Cunningham et al. 1981) and feet of grazing animals, was assessed as the main reason for almost total lack of grazing at this site. The low number of native perennial species at this site correlated with the rank growth of *Aristida ramosa* which had developed under the restricted grazing (Dadd et al. 1989).

In contrast, of the eight sites on the light-textured soils of the phonolite scree, only one included *Bothriochloa biloba* at frequency and importance scores of only 1. In the Garrawillie Creek sub-catchment, the most abundant *Bothriochloa biloba* occurs on the low-lying alluvial flats of the sub-catchment. It is concluded that the preference of *Bothriochloa biloba* for heavier-textured soils is inherent in the species and not the result of grazing out of the species from grasslands on the light-textured soils.

No preference for a particular aspect, altitude or microhabitat was evident. At all sites the *Bothriochloa biloba* plants were taller and displayed coarser culms than plants of the associated *Bothriochloa macra*, *Bothriochloa decipiens* and *Dichanthium sericeum*.

All sampling sites had, for many decades, been located within paddocks subject to grazing by both domestic and native animals. In addition to grazing, sites 12, 13 and 16 were located within paddocks, the lower portions of which had also been cropped for at least 30 years. Even though many of the paddocks were carrying stock at the time of sampling, there was no visual evidence of grazing of individual plants of *Bothriochloa biloba*. Graziers in the area have also observed that, if other grasses are available, stock do not graze plants of *Bothriochloa biloba*; grazing animals appear to selectively leave material of the coarser *Bothriochloa biloba* plants.

Outside the study area, along sections of the Oxley Highway east of Mullaley, and on the stock route running from 'Lambrook' (latitude 31°06'16'', longitude 149°56'20'') towards Curlewis, *Bothriochloa biloba* is a dominant species. These areas on heavier-textured soils are at the lower altitude of 300–340 m asl. In the parking area adjacent to the Mullaley Anglican church, an area which is regularly mown, *Bothriochloa biloba* is a significant species. Areas on properties that have been slashed to remove weeds also continue to contain the species.

Conclusions

This work indicates that *Bothriochloa biloba* shows a strong preference for heavier-textured soils. On these soils the species, despite its known poor seed production, has been maintained under grazing over long periods of time. It is concluded that normal levels of grazing do not lead to elimination of *Bothriochloa biloba*, and in fact may enhance maintenance of the species. By contrast, at restricted levels of grazing, rank growth of *Aristida ramosa* causes reduction in total number of species and exclusion of

Bothriochloa biloba. In grasslands grazed at an unrestricted level, stock selectively grazed other species of grass, giving *Bothriochloa biloba* a competitive advantage. Mowing and/or slashing also appeared to maintain the species.

It would be interesting, if further work could be carried out at the sites used in this study, to test whether *Bothriochloa biloba* is a native grass species favoured by normal levels of grazing similar to *Bothriochloa macra* (Prober & Thiele 1995). Further work is required to assess the effect of soil disturbance and fire on *Bothriochloa biloba*.

It is concluded that *Bothriochloa biloba* would be most effectively maintained in grasslands on heavier-textured soils under normal levels of grazing. Thus it would not be constructive to set up a Conservation Reserve of even category IV (Habitat/Species Management Area) to include the species. It is unlikely that any management practice could be devised to encourage *Bothriochloa biloba* to appear or increase on light-textured soils.

Acknowledgements

Landowners whose properties were used as sampling sites are thanked for their agreement to and interest in the carrying out of the work. The assistance of Associate Professor R.D.B. Whalley, and other members of staff of the Department of Botany of the University of New England, is gratefully acknowledged. D. Beckers of NPWS and an unnamed referee are thanked for helpful comments on the manuscript.

References

Bean, J.M. (1974) The geology and petrology of the Mullaley area of New South Wales. *Journal Geological Society of Australia*, 21:63–71.

Bean, J.M. (1996) Characteristics of some grasslands in the Garrawillie Creek subcatchment of the Liverpool Plains New South Wales. Thesis, Graduate Diploma of Natural Resources (University of New England).

Belbin, Lee (1991) The analysis of pattern in bio-survey data. In N*ature conservation: cost effective biological surveys and data analysis*, (eds) Margules, C.R. & Austin, M.P., pp. 176–90 (CSIRO: Australia).

Briggs, J.D. & Leigh, J.H. (1996) *Rare or threatened Australian plants* (CSIRO: Canberra).

Cunningham, G.M., Mulham, P.L. & Leigh, J.H. (1981) *Plants of western New South Wales*. (D. West: Government Printer).

Dadd, C.P., McCormick, L.H. & Lodge, G.M. (1989) Wire Grass Control, NSW Agriculture and Fisheries, Agfacts P2.5.28.

Outhred, R.K. (1984) Semi-quantitative sampling in vegetation survey. In *Survey methods for nature conservation*, (eds) Myers, K., Margules, C.R. & Musto, I., pp. 87–100 (CSIRO: Canberra).

Prober, S.M. & Thiele, K.R. (1995) Conservation of the grassy white box woodlands: relative contributions of size and disturbance to floristic composition and diversity of remnants. *Australian Journal of Botany* 43: 349–66.

Yu, P., Prakash, N. & Whalley, R.D.B. (1997) *Bothriochloa macra*, *B. biloba*, why is one common and the other rare? some embryological evidence. *Proceedings of 12th Grassland Society of New South Wales Conference*, 28–30 July 1997, Dubbo NSW, (eds) Bowman, A. & Michalk, D.