

Distribution and importance of Noogoora and Bathurst burrs in eastern Australia

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Summary

Noogoora burr (*Xanthium occidentale*) and Bathurst burr (*X. spinosum*) are serious and widespread weeds in eastern Australia due to contamination of wool by burrs and competition with pastures and crops. Results are presented of a survey of these species in New South Wales shires and of an analysis of wool contaminated by both species in eastern Australia. Noogoora burr was associated with flood prone areas with good soil moisture availability, while Bathurst burr was associated with disturbed soils of heavy texture and high fertility.

Penalties imposed for wool contaminated by Noogoora burr in eastern Australia were estimated at around \$1.7 million for the 1978-79 season, \$1.2 million of which was incurred in Queensland. The incidence of Noogoora burr in the Western Division of New South Wales has increased since a series of floods between 1973 and 1976, resulting in a corresponding increase in the proportion of properties selling contaminated wool. The currently recommended herbicides 2,4-D and MCPA are effective and widely used but stock movement during droughts, neglect on some properties, difficulty of access and cost of control militate against their effective use.

Introduction

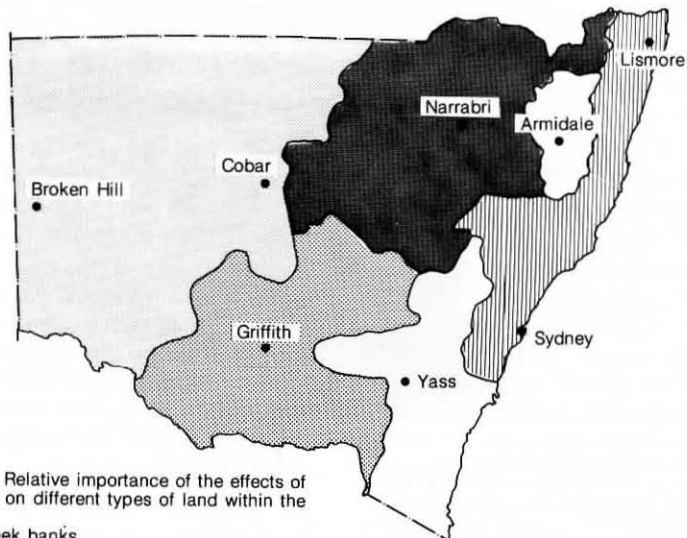
The genus *Xanthium* is represented in Australia by five taxa (Hartley, 1979), of which Noogoora burr (*X. occidentale* Bertol. = *X. pungens* Wallr.) and Bathurst burr (*X. spinosum* L.) are the most serious and widespread weeds. Both contaminate wool with their burrs.

Bathurst burr was first recorded at Twofold Bay in the 1840s, but soon became established at Bathurst and has spread from there to all States (Maiden, 1920). Noogoora burr first came to notice in 1879 at Noogoora Station near Ipswich in Queensland, whence it spread rapidly throughout Queensland and northern New South Wales until 1930 when it had been recorded over most of its current range

(White-Haney, 1930). Movement of sheep on agistment from Queensland was believed to have caused significant infestations of Noogoora burr near Broken Hill as early as 1939 (Condon and Alchin, 1981). In South Australia, Noogoora burr came to notice after the 1959 drought when large numbers of burr infested stock were brought from interstate to replenish the flocks (Tide-man, 1964). Entry of burr infested stock to South Australia is now prohibited and the outbreaks have been contained. Flooding combined with unprecedented rains resulted in consolidation and further spread of Noogoora burr in the West Darling region of New South Wales between 1973 and

1976, and control in a 'bad burr year' is now out of the question on many properties (Condon, pers. comm. 1978). Published distribution maps (McMillan, 1975; Moran and Marshall, 1978) do not indicate the current extent of Noogoora burr or its potential to spread into suitable habitats of the arid zone of eastern Australia.

The drier part of the range of both *Xanthium* species coincides with wool growing areas in Australia, and contamination of wool by 'hardheads' (which include the fruits of Noogoora burr, Bathurst burr and galvanized burr (*Sclerolaena birchii*)) is an important economic problem. Wool contaminated by Noogoora burr is identified in sale catalogues and commonly reduced in value by penalties of 5 to 15 cents kg⁻¹ greasy wool depending on the degree of contamination, with Queensland wool being the worst affected. Wapshere (1974) found that the greatest degree of contamination of wool by Noogoora burr was in a 300 km wide band to the west of the Great Dividing Range from Hughenden in the north to Moree in the south, with little contamination further south.



Histogram a Relative importance of the effects of Noogoora burr on different types of land within the region

- 1 river and creek banks
- 2 floodouts or flood plains
- 3 lakes, dams or tanks
- 4 irrigated crops or channels
- 5 crop or disturbed area in pasture
- 6 undisturbed natural pasture

□ Northern and Southern Tablelands and South Coast (rare — not a problem)

Histogram b Relative effect of Noogoora burr on agricultural production within the region

- 1 contamination of wool
- 2 competition with crops

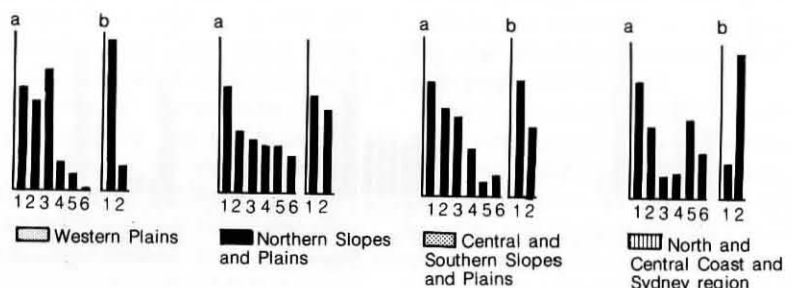


Figure 1 Type of land infested and effect on agricultural production of Noogoora burr in New South Wales

Alchin (pers. comm.) estimated that in 1976 about 10% of wool from the Western Division of New South Wales received price penalties of 5 cents kg⁻¹ due to contamination by Noogoora burr. This estimate is a reflection of the spread of Noogoora burr in western New South Wales following the 1973–76 floods.

Bathurst burr is also a major wool contaminant, but because it can be removed easily no price penalties are imposed. Although Bathurst burr is proclaimed a Noxious Plant in all States, its distribution and effect on agricultural production in eastern Australia have not been studied previously.

This review outlines the current distribution and economic importance of both Noogoora and Bathurst burr in eastern Australia, by presenting the results of a survey of these species in New South Wales shires and of an analysis of wool contaminated by both species in eastern Australia. A more detailed treatment of these results is given by Martin (1981).

Methods

Shire survey

A mail survey was distributed to the 124 Shires of New South Wales to determine the geographic range, preferred habitat and economic importance of *Xanthium* species in the State. The survey consisted of an introductory letter, a questionnaire and a photographic aid for identification of the species. Weed inspectors were asked to indicate the area and density of *Xanthium* species by shading on a Shire map. Three categories of density were specified: large dense infestations, scattered patches with isolated individuals between, and scattered individual plants.

The weed inspectors were also asked to indicate which of the six types of land listed in Figures 1 and 2 were infested with which species of burr, and whether they reduced returns for wool and animal products or reduced crop yields and returns, in order of importance for each species. Scores were obtained by giving the rankings numerical values (from least to most im-

portant) for types of land infested (categories 1 to 6) and for the effect on agricultural production (categories 1 and 2). Scores for category items for each Shire were totalled for each Statistical Area of New South Wales, and the area scores were expressed as percentages of the total scores for the State.

Wool survey

Wool brokers publish catalogues of the wool offered for sale prior to auctions and the wool is identified by a farm brand and the region of origin. Discounts are applied in proportion to the percentage of vegetable matter present, which is shown in sale catalogues and is subdivided into percentage burr (fruits of *Medicago* spp.), shive (grass fruits), and hard heads (woody material). Fruits of Noogoora burr, Bathurst burr, galvanized burr (*Sclerolaena birchii*) and other woody materials are classed as hard heads. In addition to the discount applied for vegetable matter contamination, special discounts of 2, 5, 10 and 15 cents kg⁻¹ greasy wool are applied to cover costs of removing Noogoora burr from wool.

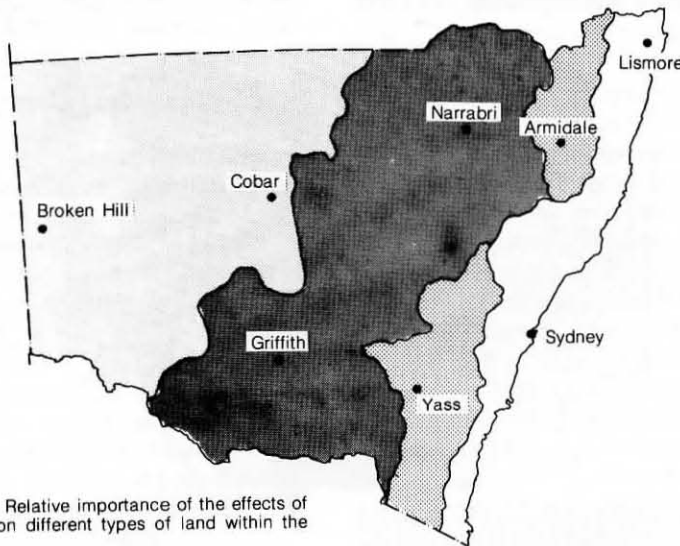
The number of holdings in each region which sold wool contaminated with Noogoora burr during 1978–79 was determined by examining the Australian Wool Corporation records in Melbourne for those years, and the total number of holdings and quantity of wool sold in each region were obtained from Australian Bureau of Statistics records for 1978–79.

No special discounts apply to fleece contaminated by Bathurst burr and no records of such contamination are kept by the Wool Board. An estimate of Bathurst burr contamination was made at four wool auctions in late 1979 and the results expressed as the percentage of holdings selling wool contaminated with Bathurst burr in each area (Figure 4). It was not possible to determine the quantity of wool affected.

Results and discussion

Shire survey

A 68% response was obtained to the questionnaire, and no attempt was made to secure replies from the remaining Shires in case bias was introduced into the results. Weed inspectors were generally unable to distinguish between Noogoora burr, Hunter burr (*X. italicum*), Californian burr (*X. orientale*), and South American burr (*X. cavanillesii*), whilst in Shires with no weed inspector, the correspondents



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Histogram b Relative effect of Bathurst burr on agricultural production within the region

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□ North, Central and South Coast and Sydney region (rare — not a problem)

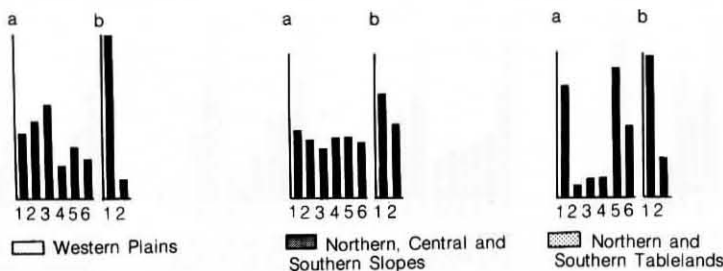


Figure 2 Type of land infested and effect on agricultural production of Bathurst burr in New South Wales

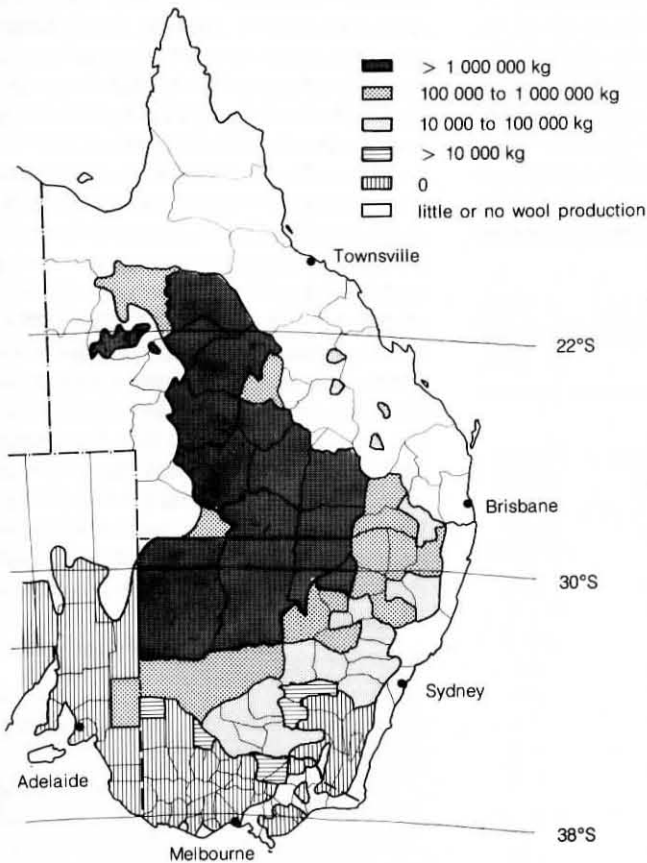


Figure 3 Zones of eastern Australia showing the estimated weight of wool per wool area penalized at wool auctions during 1978-79 for contamination with Noogoora burr

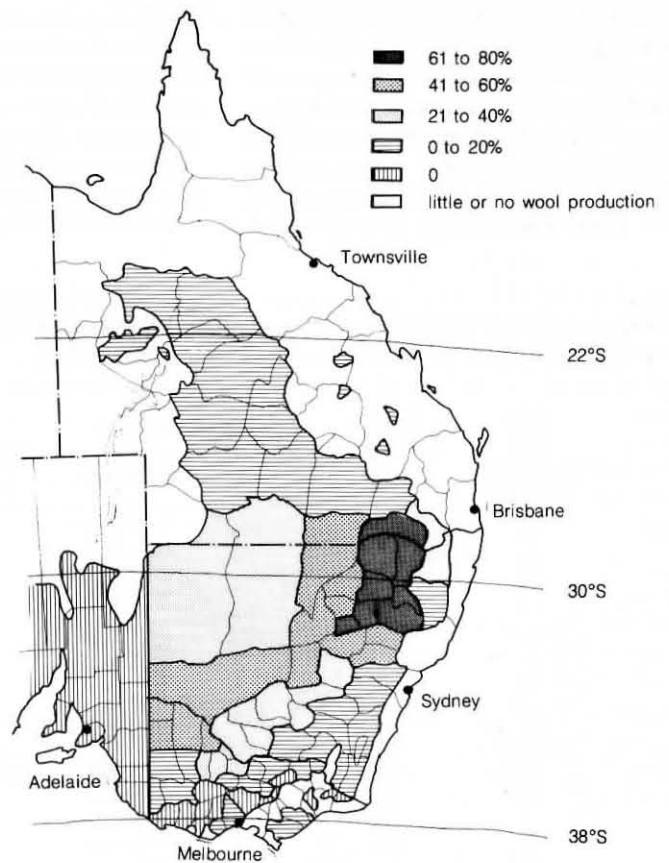


Figure 4 Zones of eastern Australia showing the percentages of holdings which sold wool contaminated with Bathurst burr at auction during December 1979

were often unable to distinguish between Noogoora and Bathurst burr and gave replies for total *Xanthium* species.

Lack of effort and low priority compared with other farm operations were the reasons most frequently given for failure to control *Xanthium* species. On the Northern Slopes and Plains, the proximity of 2,4-D sensitive crops such as cotton was cited as a further factor restricting control of both *Xanthium* species in cropping areas. In western areas difficulty of access to Noogoora burr infestations (particularly on river bends and islands) was regarded as a major factor restricting their control, as well as the widespread and scattered nature of their infestations. It was therefore predictable that some weed inspectors emphasized the need for biological control investigations in the hope of overcoming these problems.

The analysis of the survey identified five regions of Noogoora burr and four of Bathurst burr on the basis of types of land infested and effect on agricultural production (Figures 1 and 2). The following sections were compiled from weed inspectors' comments and should be read in conjunction with Figures 1

and 2 which show the regions and relative scores given for types of land infested and effect on agricultural production.

In the North and Central Coast and Sydney regions, Noogoora burr was found mainly on river and creek banks and flood plains but extended into adjacent summer crops, sown and natural pastures (Figure 1). The major economic problems occurred due to competition with crops and pastures. Noogoora burr was rare to absent on the Northern and Southern Tablelands and South Coast and was not an economic problem. On the Central and Southern Slopes and Plains, Noogoora burr was mainly found on river and creek banks and flood plains after flooding but also extended into irrigated cropland. The main economic effect on agricultural production was contamination of wool, although there was also serious competition with crops and pastures. On the Northern Slopes and Plains the weed occurred along rivers, creeks and flood plains after flooding or summer rains and also extended into dryland summer crops on the plains. It was an important economic problem, and returns for wool

and crop yields were reduced. Irregular but serious outbreaks of Noogoora burr occurred on the Western Plains on river and creek banks and on floodouts and flood plains after flooding, whilst smaller but more regular infestations occurred around lakes and stock watering points. It was an important economic problem, principally due to reduced returns for wool and animal products.

In the North, Central and South Coast and Sydney regions Bathurst burr occurred only as isolated plants, usually around piggeries or other farm buildings where it was often believed to be introduced with stock feed from other areas (Figure 2). Light to mild infestations of Bathurst burr occurred on the Northern and Southern Tablelands in wet summers, with a localized but occasionally serious effect on agricultural production.

Locally disturbed sites of high fertility were preferred, and infestations were most likely to be found in pasture on the heavier, more fertile soils of basaltic origin, in sheep camps, along rivers and creeks and around piggeries and poultry runs. The Northern, Central and Southern Slopes and Western

Plains experienced light to mild infestations of Bathurst burr throughout grazing and cropping lands depending on summer rainfall, and all types of land were infested to a similar degree. Local infestations occurred mainly in disturbed areas, sheep camps, along rivers, creeks and irrigation channels, on flood plains and around stock

watering points. Contamination of fleece was an important problem, as was localized competition with crops. As the reliability of summer rainfall decreased to the south and west, Bathurst burr infestations became more common around permanent water supplies such as stock watering points and lake shores, although under favourable

conditions scattered plants occurred over large areas, making control impractical. Heavier infestations occurred in areas of disturbance, and the principal effect on agricultural production was contamination of wool.

The main conclusions to be drawn from the Shire survey were that both species of *Xanthium* were of little overall economic importance in coastal and tableland areas of New South Wales, whilst on the slopes and plains both species were major contaminants of wool and were important economic problems. The species differed in their habitat preferences in that Noogoora burr was associated with flood prone areas of good moisture availability, while Bathurst burr was associated with soil disturbance and preferred heavy textured soils of high fertility.

Wool survey

Separate surveys were carried out for Noogoora and Bathurst burrs (Tables 1 and 2).

During 1978–79 an estimated total of 33 627 000 kg (7 to 8%) of wool sold at auction in eastern Australia was contaminated by Noogoora burr. Seventy per cent of this came from Queensland, where 31.5% of holdings sold wool with Noogoora burr fault compared with 3.6% in New South Wales (figures derived from Table 1). Deductions for Noogoora burr were estimated at \$1 232 000 in Queensland and \$478 600 for New South Wales, based on a deduction of 5 cents kg⁻¹ of greasy wool. The estimated cost of Noogoora burr fault for the Western Division of New South Wales was \$141 500, which was close to the \$150 000 estimated for that region for wool sold during the 1976–77 season (Condon and Alchin, pers. comm. 1978).

The total estimated cost of \$1 711 100 for eastern Australia during 1978–79 was only a part of the total cost of Noogoora burr to the wool industry, which also includes the cost of control, extra stock management and reduced pasture availability. On the larger holdings in the Far West of New South Wales lessees are prepared to pay \$2 000 or more to control Noogoora burr outbreaks after summer floods; autumn rain and floods prevented spraying operations after Noogoora burr outbreaks in 1976. Other losses are associated with suppression of more edible pasture plants and the cost of fencing sheep from Noogoora burr infestations.

The data collected during the wool survey were used to prepare a map of

Table 1 Contamination by Noogoora burr of wool sold during 1978–79 in the wool growing areas of Queensland and New South Wales

State	Wool Area (Figure 5)	Total holdings	Holdings penalized	Wool shorn ('000 kg)	Wool contaminated ('000 kg)	Penalty ('00 \$)
Qld	12	252	145	7 760	4 465	2 233
	18	110	69	4 219	2 647	1 323
	14	129	78	4 220	2 552	1 276
	6	137	101	2 989	2 202	1 102
	20	164	101	3 288	2 025	1 013
	17	68	33	3 994	1 938	969
	23	253	88	5 004	1 741	870
	22	432	136	4 518	1 422	711
	21	169	43	5 433	1 383	691
	15	106	41	3 085	1 193	600
	13	58	27	1 575	733	367
	5	72	25	1 851	643	321
	27	390	54	4 323	599	299
	19	22	6	1 223	334	167
	16	23	10	712	310	155
	26	409	43	2 656	279	140
	28	470	29	1 508	93	47
	10	11	7	63	40	20
	11	14	7	45	23	11
	9	47	10	83	18	9
7	6	1	6	1	1	
NSW	12/40	558	126	11 990	2 707	1 354
	9	390	69	9 159	1 620	810
	10	287	30	10 962	1 146	530
	13	483	55	8 288	944	472
	7	366	77	4 283	901	450
	34	336	36	4 214	452	225
	4	559	69	2 534	313	156
	8	368	58	1 552	245	122
	2	859	41	4 858	232	116
	6	510	32	2 686	169	84
	11	258	6	6 516	152	75
	14	632	27	2 540	109	54
	15	1 710	14	11 885	97	49
	35	635	9	5 184	74	37
	17	1 057	9	8 509	73	36
	39	252	4	4 297	68	34
	36	337	11	1 773	58	29
	19	1 534	5	15 257	50	25
	16	507	7	3 565	49	25
	5	849	14	2 660	44	21
31	559	5	3 837	34	17	
3	1 230	3	11 689	29	14	
33	313	8	1 122	29	14	
28	715	2	6 321	18	9	
30	1 649	2	10 762	13	7	
18	440	3	1 922	13	7	
37	302	2	1 854	12	6	
25	1 143	1	8 081	7	4	
29	1 137	2	4 277	8	4	
Qld Total		3 342	1 054	58 555	24 641	12 325
NSW Total		19 975	727	172 577	8 986	4 786
Grand Total		23 317	1 781	231 132	33 627	17 111

the wool areas in eastern Australia showing the regions affected by Noogoora burr contamination (Figure 3). Price penalties were incurred for wool from all Queensland wool areas and for all New South Wales wool areas except those of the Southern Tablelands. In Victoria and South Australia contaminated wool was recorded only from nine holdings adjacent to the Murray River in the Mildura, Swan Hill and Goulburn Valley areas. Noogoora burr contamination of wool was most serious in a region which extended from the Richmond, Flinders and Boulia areas in north-western Queensland to the Northern Plains, Upper Darling and Far West of New South Wales. To the south of the region the level of contamination declined and the zones extended in a south-westerly direction through New South Wales to the Murray River.

The main region of wool contamination by Noogoora burr in Queensland corresponded approximately to that shown by Wapshere (1974), with one important difference. Wapshere's map showed the Clermont-Emerald area to have the highest level of Noogoora burr fault, whilst this survey showed that this area has only a small population of sheep and that the total amount of wool contaminated by Noogoora burr is small compared to that of wool areas west of the Great Dividing Range. This survey also indicated much more widespread contamination by Noogoora burr in New South Wales than the previous survey which was based on wool sold between 1953 and 1965, and it appears that Noogoora burr contamination has become more serious since then, particularly in the Upper Darling and Far West of New South Wales. Between 10% and 20% of properties in these areas were affected by Noogoora burr contamination after widespread flooding between 1973 and 1976 (Condon, pers. comm.). According to landholders in this region the sequence of drought, stock movement and heavy summer rains with flooding has been followed by a sudden and dramatic spread of Noogoora burr and consolidation of existing infestations. Such sequences may occur about once a decade (Martin, 1981) and, if left unchecked, Noogoora burr will probably continue to spread until all favourable habitats have been occupied in the semi-arid areas of New South Wales.

The areas most seriously affected by Noogoora burr contamination of wool should receive priority for research into the biology of the weed which may

lead to development of better biological or managerial control strategies. Insufficient research has been carried out on the biology of the weed in the inland areas, and this may have contributed to the lack of success of previous biological control programmes.

Bathurst burrs were found in wool samples from all wool areas of New

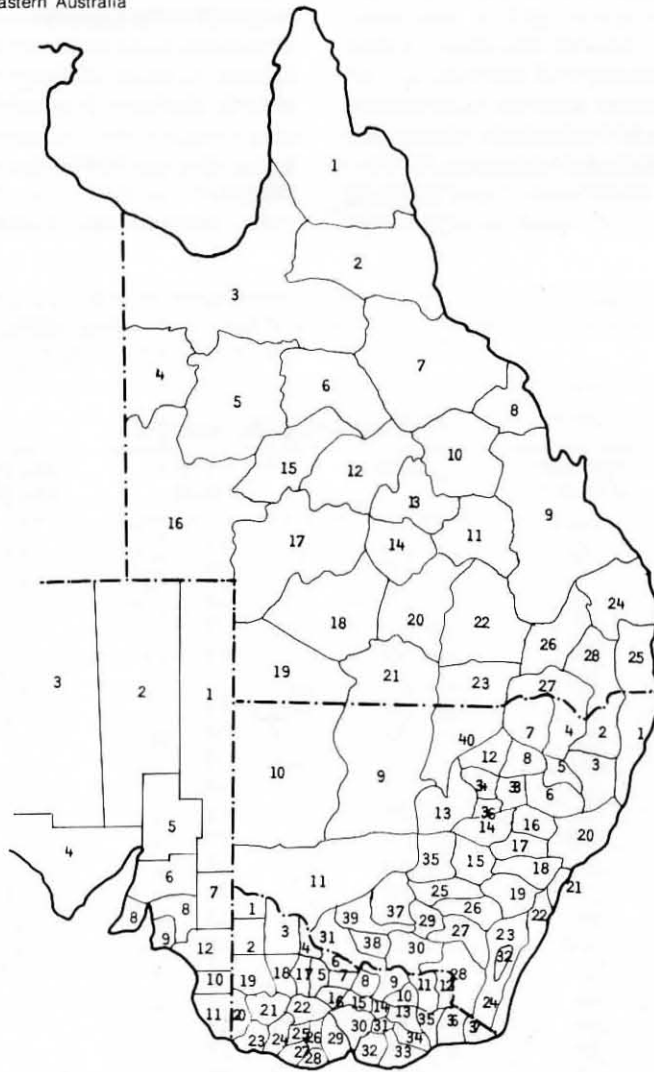
South Wales and northern Victoria (Table 2). The sample obtained in the survey may have been too small to give a valid measure of contamination of wool by Bathurst burr in South Australia, since it is known to occur throughout the settled districts (Black, 1965).

The proportion of holdings in the

Table 2 The percentage of holdings in the wool areas of south-eastern Australia which sold wool contaminated with Bathurst burr at auctions during December 1979

State	Wool Area (Figure 5)	Number of holdings per wool area		
		Total	With Bathurst burr fault	Percent of holdings with Bathurst burr
NSW	4	22	17	77
	5	34	26	77
	6	30	22	73
	36	12	8	67
	7/8	30	19	63
	33	13	8	62
	13	21	11	52
	11	12	6	50
	12/40	12	6	50
	14	39	18	46
	35	22	10	46
	16/17	79	37	44
	34	22	9	41
	2	40	16	40
	9/11	38	15	39
	29/37/38/39	43	16	37
	20	11	4	37
	15	120	37	31
	31	60	18	30
	25	56	13	23
	3	108	15	14
	26	95	13	14
	30	56	7	13
18	41	4	10	
27	48	5	10	
28	40	3	8	
24	82	6	7	
19	109	6	6	
23/32	143	8	6	
NSW Total		1 438	387	27
Victoria	4	35	17	49
	1/2/3	32	13	41
	5	31	8	26
	6/7	99	20	21
	17	24	5	21
	8	15	3	20
	28/29	24	3	12
	14	19	2	11
	9	89	9	10
	11/12	14	1	7
	16	27	2	7
	19	74	4	5
	15	59	3	5
	33/34	24	1	4
	18	41	1	2
20/21	46	1	2	
10	23	0	0	
22/26	81	0	0	
35/37	8	0	0	
Vic. Total		765	93	8
S.A. Total		109	0	0
SE Aust. Total		2 312	480	21

Figure 5 Australian Wool Corporation Wool Areas in eastern Australia



wool areas of eastern Australia which sold wool contaminated by Bathurst burr are shown in Figure 4. Although Bathurst burrs were found in wool samples from all wool areas of Queensland, the number of samples was too small to allow determination of the degree of contamination in that State, and the indications for Queensland wool areas are based on advice from Queensland wool brokers. Contamination in southern Queensland wool areas was at a similar level to adjacent wool areas in northern New South Wales, and the regions of greatest contamination were in mixed cropping and grazing areas on heavy textured soils in the south of Queensland. The level of contamination in the remaining Queensland wool areas was light.

In south-eastern Australia the heaviest contaminations of Bathurst burr were from the Northern Slopes, North Central Plains and Central Macquarie areas of northern New South Wales (Figure 4), and wool from 61 to 80% of holdings was contaminated. On the plains of the west and south

west of this area, wool from 41 to 60% of holdings was contaminated. This area extended from the Macquarie-Barwon in the north through the Lachlan and Murray-Darling areas of New South Wales into the Mallee region of north-western Victoria. Contaminated wool was recorded from 21 to 40% of holdings in the Upper Darling Far West and Inverell areas in north-western New South Wales and from the Central Slopes through the Lower Murrumbidgee and Central Murray into the Loddon-Campaspe area of Victoria. The lightest category of Bathurst burr contamination (0 to 20%) was recorded for wool grown in the Southern Tablelands, Central Murrumbidgee and Upper Murray areas of New South Wales and in the Goulburn Valley, North-east Wimmera, Upper South Western, Lower East Gippsland and Barwon areas of Victoria. The wool areas free of contamination by Bathurst burr were all in the lower South Western and Central Highlands of Victoria and in South Australia.

The wool areas with the greatest

degree of contamination by Bathurst burr were those where heavy textured soils were coincident with large areas of cultivated crop-land. This is in agreement with the Shire survey where weed inspectors emphasized the importance of soil disturbance and heavy soil texture in favouring Bathurst burr. Lower levels of Bathurst burr in the western wool areas were associated with less reliable rainfall, lighter textured soils and less soil disturbance.

Acknowledgements

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