Distribution, economic impact and attitudes towards Chilean needlegrass (*Nassella neesiana* (Trin. & Rupr.) Barkworth) in Australia

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Summary A national mail survey of 1000 land managers shows that Chilean needlegrass (*Nassella neesiana* (Trin. & Rupr.) Barkworth) has spread widely throughout Victoria, NSW and the ACT. Only 5% of respondents considered *N. neesiana* a beneficial plant while 79% believed it would be financially detrimental to them in the future. On average, *N. neesiana* costs from $64.50 ha^{-1} to $118.75 ha^{-1} to control on grazing lands, depending on whether the infestation is scattered or dense. The survey has highlighted support for a biological control program and the need to control this Weed of National Significance.

Keywords Survey, *Nassella neesiana*, economic impact, biological control.

INTRODUCTION

Chilean needlegrass (*Nassella neesiana* (Trin. & Rupr.) Barkworth) is a tufted perennial that is becoming a serious pasture and environmental weed in south eastern Australia (McLaren *et al*. 1998). It tolerates drought and heavy grazing, giving it huge potential to spread and overrun existing vegetation. Its competitive ability and the efficient reproductive mechanisms have enabled this grass to dominate large areas of highly productive pastures on the Northern Tablelands of New South Wales and on the Volcanic Plain of Victoria (Gardener 1998). During the warmer months this species produces large amounts of unpalatable flower stalks and very little leaf material resulting in a severe reduction of summer stock carrying capacity (Gardener 1998). The vigour of *N. neesiana* can be partly explained by its efficient system of seed production. As a result, up to 15,000 seeds per square metre can be found in the seed bank beneath infestations (Gardener 1998). *N. neesiana* seeds have very sharp points that reportedly penetrate and damage the fleece, skins and eyes of livestock (Bourdot and Ryde 1986).

In NSW the species is declared a noxious weed in the New England tablelands, Severn Shire County and the Glen Innes municipality, while it has yet to be declared in Victoria (McLaren *et al*. 1998). However, *N. neesiana* has been identified as a priority weed in the regional weed action plans for the Port Phillip, Northeast, Goulburn-Broken, North Central, Wimmera, Corangamite and Glenelg-Hopkins Catchment Management Authorities. These Catchment Management Authorities represent more than half the area of Victoria. The potential distribution of *N. neesiana* in Australia has been estimated at 41 million ha with substantial areas of Victoria and New South Wales at risk (McLaren *et al*. 1998).

Nassella neesiana has been described as being potentially the worst environmental weed of indigenous grassland in Victoria (McLaren *et al*. 1998). Carr *et al*. (1992) classified *N. neesiana* as a very serious environmental weed that invades lowland grassland, grassy woodland and rock outcrop vegetation. *N. neesiana* has been identified as a Weed of National Significance (Thorp and Lynch 2000).

A biological control program was initiated to investigate potential pathogens for control of *N. neesiana* and *N. trichotoma* (Nees) Arech. in 1998 (Briese *et al*. 1999). An application to have *N. neesiana* declared a target for biological control has been submitted to the Australian Weeds Committee. The survey reported here will enable information to be provided to the Weeds Committee to help make its decision on declaration.

To date there are no published estimates of the area infested with *N. neesiana* from any of the States and Territory where it occurs. Likewise there have been no estimates of the potential economic impact that this weed may cause. No formal assessment has been done of Australian community attitudes towards this weed and the likely support for a biological control program to manage it. This paper seeks to fill some of these information gaps by reporting on the results of a national mail survey conducted to assess the distribution and economic impact of *N. neesiana* and evaluate land manager attitudes towards a biological control program to manage it in Australia.

MATERIALS AND METHODS

In November 2001 a tick-box questionnaire was sent out to land managers in Victoria, NSW and the ACT. Catchment Management Officers (Victoria) and Weeds Inspectors (NSW, ACT) were used to distribute the surveys to land managers in their districts. The surveys

were targeted to regions thought likely to be infested by *N. neesiana*. A total of 1000 surveys were sent out (450 to Victoria, 450 to NSW and 100 to ACT). To help with recognition of the plant, a colour identification brochure was included with the questionnaire.

Respondents were requested to provide information on the land that they manage and the extent of *N. neesiana* infestation on their land. The infestations were categorised either as 'scattered' or 'dense', and further divided into sub-types according to the size of infestation viz, less than one ha ('small'), greater than one ha but no more than 50 ha ('medium'), and greater than 50 ha ('large'). Respondents were also asked to indicate the cost they incur to control *N. neesiana* infestations. They were given a range of values to choose from viz., \$5 ha^{-1}, \$20 ha^{-1}, \$50 ha^{-1}, \$100 ha^{-1}, and greater than \$500 ha^{-1}. Their perceptions on whether or not *N. neesiana* would cost them money in the future if left uncontrolled were also sought. Likewise, respondents were asked to gauge whether *N. neesiana* is a beneficial plant and whether they would support a biological control program to manage it.

RESULTS AND DISCUSSION

Areas infested A response rate of about 16% (157) was obtained with 96% (150) of the surveys returned considered useable for further analysis. The respondents reported on a total area of approximately 3.9 million ha consisting of grazing lands, parks and roadsides across Australia. Of this total, some 3.3 million ha in NSW, 0.4 million ha in Victoria and about 0.2 million ha in ACT (Table 1). The figures indicated in Table 1 are highly conservative as 28% of the respondents acknowledged the location of the land they managed but did not provide area estimates.

Distribution and type of infestation Twenty nine per cent of respondents reported an absence of *N. neesiana* infestation on the land they manage (Figure 1, Table 2). Nearly half (49%) of the land managers surveyed indicated that scattered infestations occur on their land whilst 22% of the respondents mentioned the presence of dense infestations of *N. neesiana*. Some 14% of the respondents reporting an absence of *N. neesiana* were from the ACT while the majority reporting scattered infestations (30%) were from Victoria. The greatest proportion (12%) of respondents reporting dense infestations were from NSW (Table 2).

Low density (scattered) *N. neesiana* was most commonly reported as occurring in small and medium sized infestations in Victoria (Figure 2). However, the greatest overall proportion of low density infestations were reported from medium sized infestations across Australia (Figure 2). Similarly, high density (dense)

Table 1. Minimum, maximum, average and total area of lands being managed by respondents.

State/ Territory	Minimum (ha)	Maximum (ha)	Average (ha)	Total (ha)
Vic	1	270,000	2,677	417,652
NSW	14	1,800,000	21,072	3,287,191
ACT	4	180,300	1,278	199,318
Australia	1	1,800,000	8,342	3,904,161

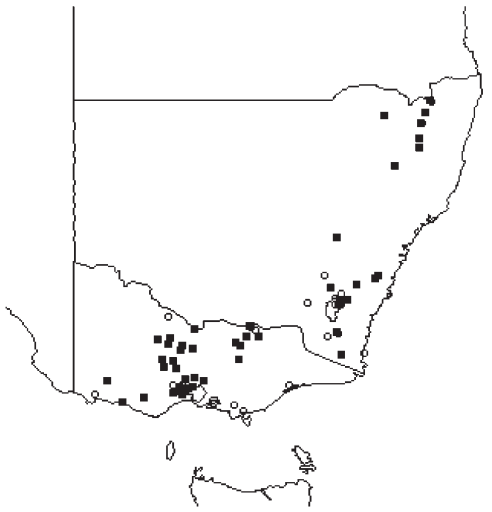

Figure 1. Distribution of *N. neesiana* from survey respondents. ■ *N. neesiana* present ○ *N. neesiana* absent.

Table 2. *N. neesiana* infestation density by State (per cent of land managers surveyed).

State/ Territory	None % (n)	Scattered % (n)	Dense % (n)
VIC	5 (8)	30 (44)	9 (14)
NSW	10 (15)	13 (20)	12 (18)
ACT	14 (20)	6 (9)	1 (1)
Australia	29 (43)	49 (73)	22 (33)

N. neesiana were more commonly reported from large than from small sized infestations across Australia (Figure 3). The distribution data collected shows that *N. neesiana* has dispersed widely in Australia and is particularly well established over large areas in NSW and the ACT (Figure 1). In Victoria, the presence of a higher proportion of low and medium sized infestations of both low and high density *N. neesiana* suggests that this plant is still actively dispersing.

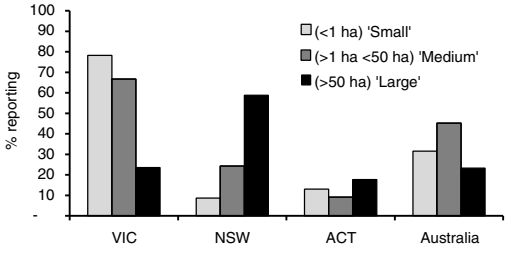

Figure 2. The distribution of low density (scattered) *N. neesiana* compared by infestation size and state.

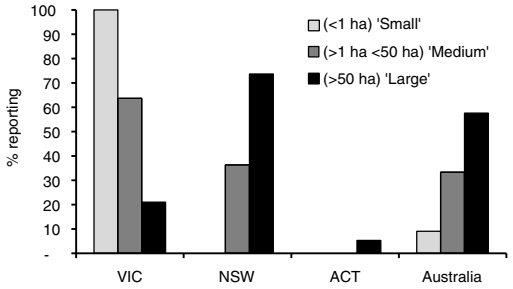

Figure 3. The distribution of high density (dense) *N. neesiana* compared by infestation size and State.

Economic impact Table 3 lists the minimum, maximum and average costs incurred to control *N. neesiana* by respondents. On grazing lands, the average cost of control is \$64.50 ha^{-1} for a scattered infestations and \$118.75 ha^{-1} for dense infestations. Scattered infestations of this weed are relatively more expensive to treat in NSW (\$101.10) than in Victoria (\$50.25) and ACT (\$35.00). On the other hand, dense infestations are nearly twice as expensive to control in Victoria (\$175.15) than in NSW (\$88.90). Perhaps these differences can be explained by examining the size of the infestations in the respective states. In Victoria, the majority of both low density and dense infestations are small which would require spot spraying which is more expensive than broad acre spraying. Conversely, NSW has large areas of low density *N. neesiana* which if treated by spot spraying is likely to be more expensive due to the increased labour incurred by travelling from one *N. neesiana* patch to another.

In Victoria, the average cost of controlling dense infestations of *N. neesiana* was reported as being approximately three times (\$157.15 ha^{-1}) that of treating scattered infestations (\$50.25 ha^{-1}). Conversely, graziers from NSW on average reported higher costs (\$101.10 ha^{-1}) to treat scattered infestations than heavy infestations (\$88.90 ha^{-1}).

Limited economic data was available for *N. neesiana* infestations on public land (Table 4). However, roadside management costs can be substantial (\$50,000 per year), as can costs for individual parks.

The majority of the land managers (79%) surveyed in all areas believe that *N. neesiana* is likely to cause economic impact in terms of future control costs or production loss if left uncontrolled (Figure 4). All respondents from Victoria indicated that *N. neesiana* is likely to cause a negative or unknown economic impact in the future whilst 13% in NSW and 3% in ACT believe otherwise. A considerable proportion of the respondents from the ACT were undecided (37%) on this particular issue, primarily due to the

Table 3. Minimum, maximum and average cost of control on grazing lands, by type of infestation.

State/ Territory	(n)	Minimum \$	Maximum \$	Average \$
	Scattered infestations – grazing lands (\$ ha^{-1})			
VIC	19	5	100	50.25
NSW	9	5	500	101.10
ACT	2	20	50	35.00
Australia	30	5	500	64.50
	Heavy infestations – grazing lands (\$ ha^{-1})			
VIC	7	100	500	157.15
NSW	9	5	500	88.90
ACT	0	–	–	–
Australia	16	5	500	118.75

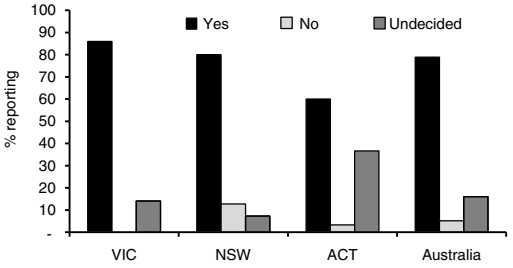

Figure 4. Land managers' general assessment of the likely future economic impact of *N. neesiana*.

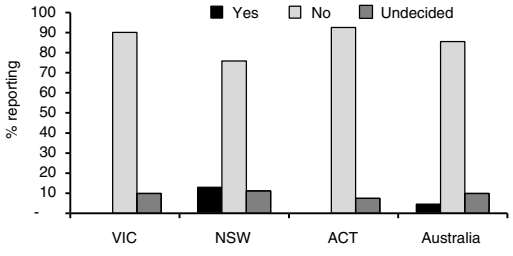

Figure 5. Land managers' assessment of whether *N. neesiana* is a beneficial plant.

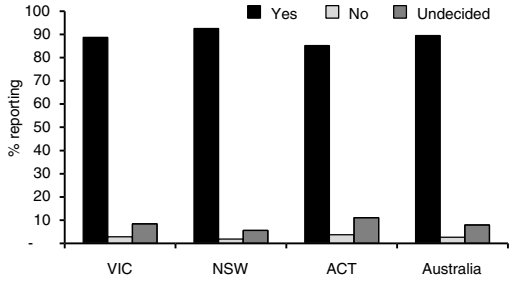

Figure 6. Land managers' attitude towards supporting a biological control program to manage *N. neesiana* in Australia.

lower level incidence of infestation relative to that in Victoria and NSW.

Attitudes The majority of land managers surveyed (86%) did not consider *N. neesiana* a beneficial plant (Figure 5). Only 5% of respondents thought *N. neesiana* a beneficial plant and all these came from NSW. Interestingly, most (71%) of the respondents who considered *N. neesiana* a beneficial plant also supported a biological control program to manage *N. neesiana*.

Nearly nine in 10 respondents support a biological control program to attempt to control *N. neesiana* (Figure 6). In the States/Territory surveyed, the highest support came from NSW (93%), followed by Victoria (89%) and the ACT (85%). Only 3% of the land managers surveyed did not support a biological control program for *N. neesiana* whilst 8% were undecided. Of those who were against biological control, their explanation was that they didn't believe it to be an effective control measure.

Nassella neesiana has spread widely throughout Victoria, NSW and the ACT. Land managers overwhelmingly consider it a weed and, if left uncontrolled, *N. neesiana* will continue to cause further economic and environmental damage. This survey has highlighted support for a biological control program and the need to control this Weed of National Significance.

Table 4. Indicative yearly cost incurred to control *N. neesiana* on public lands in Australia. Public lands ($ y^{-1}).

State/Territory	(n)	$ cost of control per year
	Parks	
VIC	1	2000
NSW	0	No data
ACT	2	500
Australia	3	1000
	Roadsides	
VIC	2	100 to 50,000
NSW	1	2000
ACT	0	No data
Australia	3	17,367

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