Putting fireweed on the front burner: improving management and understanding impact

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Summary Fireweed (*Senecio madagascariensis*) continues to spread in coastal pastures in south eastern Australia, as well as onto the Northern and Southern Tablelands of NSW and in South-East Queensland. This paper details the key findings of a national survey of landholders conducted in late 2011 to evaluate fireweed impact and management options.

Fireweed was less likely to be considered a problem in areas where it had spread recently, or where it had a long history of infestation. It was considered the 'worst weed on property' by about one third of respondents. Over 80% of respondents attempted to control fireweed. Many use a mixture of methods, amongst which the more successful appeared to be hand weeding, grazing with sheep or goats, herbicide and promoting competitive pasture. The most significant economic impacts of fireweed included lack of time to devote to other farm tasks, and impact on farm profitability. Even landholders who considered fireweed under control on their farm spent considerable time and money managing the weed. Fireweed remains a considerable concern for landholders along the south-eastern Australian coast and hinterland.

Keywords Fireweed, spread, occurrence, control methods, impact.

INTRODUCTION

Fireweed is one of the worst weeds of coastal pastures in south-eastern Australia. It contains toxic pyrrolizidine alkaloids that, if consumed, cause liver damage in livestock, leading in some cases, to death (Walker and Kirkland 1981). It is thought to have been introduced to Australia from Southern Africa in shipping ballast, with the earliest recorded specimen having been collected near Raymond Terrace, NSW, in 1918 (Sindel 1996). Fireweed is now widespread in coastal pastures from South-East Queensland to Bega in Southern NSW, and has established in higher altitude locations such as the Dorrigo, Tenterfield and Nowendoc districts in the NSW Northern Tablelands, and the eastern Monaro region of the Southern Tablelands.

Fireweed is therefore of considerable concern to farmers and rural communities in impacted areas. Its significance was confirmed in April, 2012, when it was named as one of twelve new Weeds of National Significance (AWC 2012). A joint University of New England and CSIRO research project sought to address gaps in knowledge relating to fireweed ecology, impact and management, through field trials and survey of landholders, and commenced research into biological control options in the native range for fireweed in South Africa. In this paper we focus on the landholder survey findings, and the implications for improving fireweed management.

MATERIALS AND METHODS

Survey design The questionnaire form was based on an earlier fireweed survey conducted in 1985 (Sindel 1989). Nearly all questions from the original survey were included unchanged in the new form to be able to observe changes that may have occurred in the fireweed situation over the last 25 years or so. New questions were also added. The draft questionnaire was evaluated by project steering committee members, landholders, and NSW and Queensland (Qld) government staff, to ensure the questionnaire addressed the most topical issues.

Distribution Current distribution data were used to identify post codes representing the known current extent of fireweed spread. As in the 1985 survey, post codes were grouped into a number of regions to allow comparisons between regions, and regional comparisons between the 1985 and 2011 surveys (Figure 1).

Postal distribution focused on dairy and beef grazing properties, though other producers were welcome to contribute. A number of producer groups distributed the survey to their members. Additional graziers and dairy farmers were identified in the Yellow Pages. A final mailout of 1764 surveys occurred in November 2011.

A concurrent internet survey was developed to supplement the mail survey in the event of a lower than expected response. This survey was promoted through a number of producer group and natural resource management email lists and e-newsletters.

Analysis Survey respondents were grouped into regions based on post code, where a post code was provided (Figure 1). A number of new regions were included in the 2011 survey, as fireweed had expanded

its range since 1985. Analysis was conducted using SPSS 20 (IBM 2011).

Comparative regional analysis between the 1985 and 2011 results was conducted where questions were identical. Statistically significant changes between the two data sets were identified using the binomial test for nominal variables, and the Mann-Whitney U test for ordinal variables.

RESULTS

A 30% response rate was obtained from the mail survey (528 responses), with a further 403 responses made to the online survey, comprising a total of 931 responses. Not all 931 respondents, however, had fireweed on their property, and so were not required to complete all questions.

Figure 1. Regions sampled in the survey 2011.

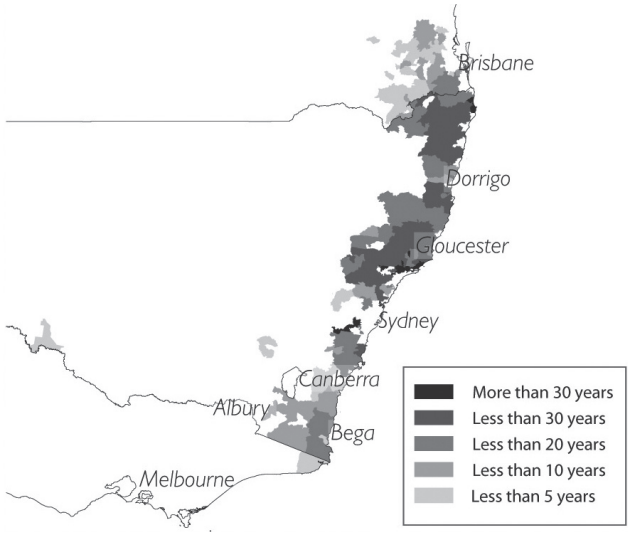

Figure 2. Duration of fireweed presence, mean by post code.

Occurrence and spread Fireweed has continued to spread into new regions. It appears to be a relatively recent arrival in the NSW Northern and Southern Tablelands, parts of the NSW Mid-North Coast, and South-East Qld. Severe fireweed infestations have become more common in Bega, Shoalhaven, Lismore, NSW Mid-North Coast and South-East Qld. It has been present for longer in parts of the NSW far north coast, around Port Macquarie and Wauchope, the Gloucester/ Taree region, the lower Hunter Valley, and the south-west fringe of Sydney (Figure 2).

Fireweed was less likely to be considered a major problem in some regions where it has only spread most recently (such as the NSW Northern and Southern Tablelands, and South-East Qld), or where it had occurred for the longest (such as Muswellbrook and Gloucester) (Table 1).

It may be that respondents from the former were not yet fully impacted by fireweed, and those from the latter had learnt to manage the weed more effectively.

Fireweed was the worst weed for about a third of respondents, and was more likely to be considered the worst weed in Bega, Shoalhaven, Hexham and the Mid-North Coast, and least likely in Muswellbrook and Gloucester.

Control methods Over 80% of respondents attempted to control fireweed using one or more methods. Approximately 12% no longer controlled the weed, for reasons including: that it was a losing battle, that control had proven ineffective, that it took too much out of farm finances, and that it was not worth doing when neighbours were not acting to manage the weed.

Since 1985, slashing and cultivation were significantly less likely to be used, while the use of herbicides and grazing with sheep or goats appeared to have increased, though the latter result may in part be due to the inclusion of non-beef and dairy landholders in the more recent survey (Table 2).

Hand weeding remained the most common and one of the most successful control methods, though it is time-consuming and physically demanding. It is particularly favoured for targeted control on specific areas of the property, or smaller outbreaks. Those respondents from regions which had experienced less fireweed pressure were more likely to remove it by hand.

Despite the ongoing relative popularity of slashing, many respondents suggested it makes the fireweed problem worse by spreading seed.

Table 1. Size of the fireweed problem as perceived by farmers, as a percentage of respondents with fireweed 2011.

Region	No/ minor problem	Moderate/ major problem	n
Overall survey*	52	48	788
Cumberland	65	35	29
Hexham	49	51	45
Muswellbrook	63	37	35
Northern Tablelands/ NW Slopes	68	32	25
Gloucester	65	35	20
Taree/ Wauchope	49	51	70
Mid-North Coast	49	51	80
Lismore	43	57	83
Shoalhaven	46	54	106
Bega	45	55	128
Southern inland NSW	73	27	11
South-East Qld	62	38	125

* includes those who did not provide a post code.
chisq = 23.1, df = 12, p = 0.027.

Table 2. Use and success of fireweed control methods, as a percentage of respondents with fireweed 2011 *(1985)*.

Method	Level of use*	Level of success "high"**	n (2011 only)
Hand weeding†	81 *(74)*	53 *(34)*	570
Slashing†	36 *(68)*	13 *(13)*	274
Cultivation†	4 *(19)*	18 *(13)*	62
Herbicides†	38 *(12)*	41 *(41)*	259
Grazing with sheep or goats†	11 *(5)*	54 *(67)*	78
Reduced stocking rates	9 *(n/a)*	22 *(n/a)*	82
Promoting competitive pasture	35 *(35)*	32 *(42)*	234

* % respondents who attempt fireweed control.
** % respondents using that method.
† Binomial test p = 0.

The proportion of farmers controlling fireweed with herbicide increased significantly, particularly in the Cumberland, Mid-North Coast, South-East Qld, and Shoalhaven regions. Those who had a moderate to large fireweed infestation on their property were more likely to favour herbicide use than those who only had a small infestation.

While promoting competitive pasture is an important longer term control method for fireweed, it appeared that the use of this method had not increased (Table 2). Where pasture improvement was used successfully to reduce the intensity of fireweed, healthy pastures were encouraged through application of fertiliser and lime, promotion of native and introduced pasture species, and reduced grazing pressure or grazing rotation strategies.

Grazing with sheep or goats was considered to be the most successful fireweed control method overall, though was still only used by a relatively small proportion of respondents. Sheep or goat producers spent less time and money on fireweed control, and were less likely to consider fireweed to have an impact on farm profitability. However, establishing sheep or goats on a cattle property can involve significant infrastructure outlays.

Those who had successfully reduced the fireweed on their property were most likely to credit their success to one, or a mixture, of hand weeding, pasture competition, and herbicide application. Often these and other approaches were successfully used together as part of an integrated strategy.

Over 50% of respondents considered that a biological control option for fireweed would be a 'very important' development. Those most likely to support biological control appeared to have had fireweed on their property for longer, and larger infestations.

Over 60% of respondents believed fireweed should be declared noxious or prohibited under legislation. Those who had fireweed on their farm for longer, or who had larger infestations, often found it an intractable farm management issue, and were less likely to support declaration or prohibition. Those facing fireweed incursion for a shorter time, or with a smaller infestation, were more likely to support declaration or prohibition.

Economic impact The most significant economic impacts of fireweed included lack of time to devote to other activities, and overall farm profitability. Nearly 50% of respondents estimated spending over 50 hours each year controlling fireweed, while nearly 40% estimated spending $1000 or more on control activity. Of those who considered fireweed to be under control, approximately 50% spend more than 50

hours *and* more than $1000 per year. This suggests that keeping fireweed at a manageable level on farm can be a significant ongoing cost to farmers in both time and money.

Fireweed control appeared to be particularly time consuming in the Shoalhaven, Bega and Mid-North Coast regions, and it was notable that these regions were amongst those where fireweed was more likely to be considered a moderate or major problem. Nearly 20% of respondents considered that fireweed impacted negatively on livestock health.

DISCUSSION

Fireweed remains a considerable concern for landholders. It is highly invasive, and has had a significant economic impact in affected regions.

It is particularly notable that fireweed was often less likely to be considered a moderate or major problem in those regions where the weed appeared to have spread more recently, as well as regions where the weed had been present for a longer time. In areas with a long history of infestation, fireweed spread from one farm to the next has largely ceased (Sindel 2009). In parts of the Bega Valley, Shoalhaven, and Mid-North Coast of NSW, however, the weed appeared to have been present on many properties for between 20 and 30 years. It was generally in these areas where fireweed has caused the greatest concern and continues to spread rapidly.

Although fireweed can be particularly difficult to control for many landholders, this research suggests that effective management is possible using an integrated approach that may incorporate hand weeding, herbicide application, and in some circumstances grazing with sheep or goats. Underpinning a successful longer term fireweed management strategy on farm will be maintaining a vigorous, competitive pasture (Launders 1986).

Landholders need to be made aware through extension of how to improve their capacity to successfully manage fireweed. Of particular importance will be extending best practice control to those landholders who currently show little interest in controlling fireweed. Extension must highlight the need for vigilance and long-term dedication in monitoring and management of fireweed, as many respondents suggested these were important elements behind their success.

Fireweed appears to have a significant economic impact on farmers, including those who are managing the weed with some success. Recent research conservatively estimated that fireweed had the capacity to reduce the output of broadacre, low input grazing systems in the South Coast region of New South Wales by 20% (Madden 2008). More detailed information is required to quantify the economic impact of fireweed on agricultural production, including identifying the practical level of tolerance farmers can assume for fireweed, benefit/cost analyses of its impact on pasture production, economic impact on a national scale, and impact on individual farmer livelihoods.

As this research has shown, fireweed may be managed with some success using a range of control methods. However, many landholders expressed discouragement about their ongoing or future capacity to manage it, considering a successful biological control agent to be of the utmost importance. Biological control research is therefore a high ongoing priority for fireweed management.

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