



The **thinking** behind  
our everyday essentials

## Landholders and the management of weeds: blackberry and serrated tussock

**Service Design Research  
Working Paper 03-11**

Geoff Kaine and Natalie Tostovrsnik



Published by the Victorian Government Department of Primary Industries  
East Melbourne, June 2011.  
© Copyright State of Victoria, 2011

ISBN 978-1-74264-846-0 (print)

This publication is copyright. No part may be reproduced by any process except in accordance with the provisions of the Copyright Act 1968.

**Authors:**

Dr Geoff Kaine and Natalie Tostovrsnik  
Farm Services Victoria Division  
Department of Primary Industries  
Ferguson Road  
TATURA, Victoria

**Acknowledgments:**

The authors would like to thank their colleagues Lisa Cowan, Ruth Lourey, John Ford, Megan Hill, Chris Linehan, Samantha Longley, Jean Sandall and Helen Murdoch for their advice, assistance and support, especially in the design of the scales. We would also like to thank the staff of Biosecurity Victoria for their advice. We are indebted to the landholders we interviewed; they gave generously of their time.

The research was funded by the Department of Primary Industries under the Future Farming Statement, Action 1.2 “State of the Art Services to Farm Businesses”.

**Disclaimer:**

This publication may be of assistance to you but the State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.

---



## ***Table of Contents***

Executive summary .....	i
1. Introduction .....	1
2. Public investment in weed management .....	2
2.1 Regulation, coordination and the community .....	2
2.2 Serrated tussock and blackberry .....	3
3. Predicting compliance behaviour .....	4
3.1 Theoretical framework.....	4
3.2 Measuring involvement .....	6
3.3 Sampling .....	8
Figure 2: Landholder sample .....	9
4. Analysis .....	10
4.1 Scale reliability .....	10
4.2 Correspondence of scales and impressions.....	10
4.3 Involvement scores and presence of weeds.....	14
4.4 Involvement profiles.....	15
4.5 Level of involvement .....	23
5. Discussion.....	33
7. References.....	39

---

## ***Executive summary***

In this study we employed a model of compliance behaviour for landholders proposed by Kaine *et al.* (2010) to investigate landholder attitudes to weed control as an issue, and their attitudes towards two different policy measures – regulation and voluntary coordination for serrated tussock and blackberry.

Scales to measure each the five antecedents of involvement were constructed based on Laurent and Kapferer (1985). A questionnaire containing the scales was designed and administered to 34 Victorian landholders near Geelong and Rutherglen

The following are the key findings were:

1. That the scales have merit as a means of reliably measuring the source and intensity of involvement of landholders in policy issues and program interventions.
2. In principle, the methods that have been applied here could be used to assess the extent of landholder support for a management program; and identify landholders that may be willing to be involved in developing and implementing weed control programs.
3. Landholder involvement in the issue of preventing the spread of weeds may be generally high. This means landholders are likely to be predisposed participate in the control of most weeds. It also suggests that community-led control programs, such as the Community Weeds Model, could be extended to other weeds. However, the potential to establish new Community Weed Models, and their effectiveness, will vary depending on the proportion of landholders that exhibit high involvement with that issue of preventing the spread of the weed of interest.
4. The success of coordinated programs and regulations will depend critically on the extent to which these are designed and administered with as much flexibility as possible in order to accommodate differences in landholders' knowledge, expertise and circumstances.
5. Enforcement policies and procedures need to be sensitive to the possibility that landholders may be uninformed about their precise obligations in regard to weed control and are likely to believe that, in keeping infestations to a tolerable and practical threshold for their farm business, they are meeting their obligations. In these circumstances aggressive efforts to enforce regulations are likely to be counter-productive
6. Landholders are likely to react unfavourably to efforts to enforce regulations prescribing what or when control activities should be undertaken if such prescriptions do not align with their views as to which control activities will work best, and when, given their farm circumstance.
7. Landholders that are willing to participate in decision-making about weed control activities through mechanisms such as community weeds groups will expect to have influence on decisions about the design and implementation

of control programs. They will expect to have some influence over the allocation of program funds and other resources. If these expectations are not met then these landholders are likely to become disillusioned and may become outspoken critics of government policy and programs.

8. Pressures to conform to social norms are unlikely to strongly influence landholders' willingness to undertake weed control activities, and coordinate their activities with the activities of others. If landholders are more responsive to the efforts of community-led programs it is because those members are more likely to appreciate the context within which landholders operate, and be sensitive to the costs that changing the timing of control activities may impose.

These findings are based on analyses of a survey of a small sample of landholders. Consequently, the extent to which they can be generalised to all Victorian primary producers, and to other weeds, is unclear. The surveying of a larger, statistically representative sample of producers would be required to confidently draw conclusions about all primary producers.

## 1. Introduction

Weeds are plants that are considered harmful, dangerous or economically detrimental. Weeds are a serious threat to primary production and biodiversity in Victoria. Despite considerable public and private expenditure weeds continue to be a major threat to both the productive capacity of land and water and the integrity of natural ecosystems. Weeds reduce farm and forest productivity, displace native species and contribute significantly to land and water degradation (Department of Primary Industries 2011a).

Governments have invested in numerous studies into the attitudes and behaviours of landholders in relation to pest management in order to improve the design of public pest control programs. Lourey *et al.* (2006), Gossum *et al.* (2010) and others have found that studies into regulation design have provided only limited guidance to policy makers. This is at least partly because they have failed to properly account for the influence of landholders' attitudes towards the issue of managing pests and their attitudes towards specific measures for managing pests on their behaviour. For example, while studies have advocated a participatory approach to improving compliance among landholders in pest management they have failed to identify the specific circumstances under which participatory approaches can be expected to be successful (Lourey *et al.* 2006; Braithwaite 1995).

In this study we employed a model of compliance behaviour for landholders proposed by Kaine *et al.* (2010) to investigate landholder motivation to prevent the spread of weeds as an issue, and their involvement and attitudes towards two different policy measures – regulation and voluntary coordination. The objectives of the study were (i) to develop scales for quantifying landholders' motivation to control weeds, specifically serrated tussock and blackberry; and (ii) suggest how the implementation of the Community Weeds Model (CWM), a participatory approach to weed compliance, might be supported for serrated tussock and blackberry.

In the next section we outline the principles underpinning public investment in weed management in Victoria. We then describe the compliance model proposed by Kaine *et al.* (2010) in some detail. This is followed by a description of the methods used to measure landholder motivations and attitudes in regard to control of serrated tussock and blackberry.

Estimates of landholder motivations and attitudes in regard to control of serrated tussock and blackberry are then reported. These are interpreted using the compliance model proposed by Kaine *et al.* (2010). The implications of the results for compliance with weed regulations and the implementation of the Community Weeds Model are then considered in the discussion. Finally, the findings of the study are summarised in the conclusion.

## **2. Public investment in weed management**

Biosecurity Victoria (BV), a division of the Victorian Department of Primary Industries (DPI) is the primary public body responsible for pest plant and animal management in Victoria. BV develops and implements policies, standards, legislation and programs to reduce the threat of invasive plants and animals to the productivity of Victoria's primary industries and to biodiversity and the natural environment. The division relies on a range of measures such as incentives, statutory planning, media, enforcement and stakeholder analysis and engagement to improve pest management in Victoria.

### **2.1 Regulation, coordination and the community**

Historically BV has relied on a regulatory approach to reduce weeds on private land. Under the *Catchment and Land Protection Act 1994* certain plants in Victoria are declared noxious weeds. There are four categories of noxious weed depending on location, rate of distribution and threat to primary production, the environment or community health, each imposing different obligations on landholders in terms of eradication and control. These are State Prohibited Weeds, Regionally Prohibited Weeds, Regionally Controlled Weeds and Restricted Weeds (DSE and DPI 2006).

During compliance campaigns officers authorised by BV visit a landholder's property. If a noxious weed is identified, the officers will give advice about controlling the weed and will seek to reach an agreement with the landholder on a program of works and timeframe to control the weed. An authorised officer may return to the property to check progress. If the program has not been carried out by the agreed date, a Land Management Notice may be issued. This notice will set out a date by which the program of works must be carried out. The landowner must then notify the Department when they have complied with the notice. It is an offence to disobey a Land management Notice. Failure to comply may result in prosecution and fines of up to \$24,000 may apply.

More recently, BV has increasingly relied on a participatory approach to reducing weeds on private land, using the Community Weed Model. This model seeks to encourage compliance through a partnership approach. Under the Model, groups of landholders are established to collaborate with BV in the design and implementation of weed control programs. The Model is based on three broad principles from which individual groups frame their approach:

1. Community and stakeholder take ownership of pest issues leading to on ground management and actions and subsequent implementation
2. Strong partnerships between communities and agencies
3. Increased social cohesion and capacity of group members

The groups use a mix of information, incentives, advice, management contracts and coordinated approaches to encourage landholders to manage the noxious weed of

interest on their property (Raetz *et al.* 2009). If landholders fail to cooperate then enforcement measures may be instituted, possibly at the request of a group.

The expectation is that this approach will reduce the level of enforced compliance as more land managers undertake voluntary action (Raetz *et al.* 2009).

## 2.2 Serrated tussock and blackberry

### **Serrated tussock**

Serrated tussock is a South American perennial grass which can grow in a range of soil types where annual rainfall is between 450 and 1000 mm. Resembling native tussock grasses this weed is difficult to identify, highly invasive and can infiltrate healthy pastures and grasslands. Being a weed spread by the wind it is easily dispersed between paddocks and properties. Once established, sustained effort is required to control the weed (DSE and DPI 2004a).

Serrated tussock is a Regionally Prohibited Weed in the Mallee, Wimmera, North Central, Glenelg Hopkins, Goulburn–Broken, North East and East Gippsland Catchments (DPI 2011b). This means that it is a regulatory requirement that landholders take all reasonable steps to *eradicate* serrated tussock from their property (DPI 2011a). In Corangamite, Port Phillip and Westernport and West Gippsland Catchments serrated tussock is a Regionally Controlled weed (DPI 2011b). In these regions landholders have the responsibility to take all reasonable steps to *control* and prevent the spread of these weeds on their land and roadsides that adjoin their land (DPI 2011a).

### **Blackberry**

Blackberry grows in temperate climates where rainfall is above 700 mm. There are an estimated 8.8 million hectares of blackberry in Australia (DSE and DPI 2004b). In Victoria, blackberry is considered one of the most environmentally damaging weeds. It is invasive and infests productive land, watercourses and the understorey of large areas of native bushland often creating impenetrable thickets and barriers.

Blackberry provides shelter and food for pest animals such as foxes and rabbits and dead, dry thickets of blackberry are a fire hazard (DSE and DPI 2004b). Blackberry is a Regionally Controlled Weed in all Victorian catchments, except the Mallee (DSE and DPI 2004a). In these regions landowners must take all reasonable steps to prevent its growth and spread (DSE and DPI 2004b).

### 3. Predicting compliance behaviour

#### 3.1 Theoretical framework

Murdoch *et al.* (2006) and Kaine *et al.* (2010) proposed a model of compliance behaviour based on social psychology; the I<sub>3</sub> Response Framework.<sup>1</sup> The Framework was developed to predict how landholders may respond to a policy intervention or measure. The premise of the model was that landholder compliance with policy interventions can be predicted based on their involvement with the relevant policy issue and their involvement with, and attitude toward, the relevant policy intervention.

##### **Involvement**

Involvement is a causal or motivating variable with a number of consequences on a person's decision making behaviour (Derbaix and Vanden Abeele, 1985; Laurent and Kapferer 1985; Mittal and Lee 1989). Involvement stems from the anticipated consequences a stimulus may have for an individual's utilitarian, hedonic and social goals. Involvement has been shown to be associated with extensiveness of decision-making, interest in communications about an activity, commitment to an activity, and social observations about the activity (Mittal and Lee 1989). Rothschild (1984, 216) states:

*"...involvement is a state of motivation, arousal or interest. This state exists in a process. It is driven by current external variables (the situation; the product; the communications) and past internal variables (enduring; ego; central values). Its consequents are types of searching, processing and decision making."*

The involvement of an individual with a stimulus provides a basis for predicting how that individual is likely to behave (Laurent and Kapferer 1985). For example, individuals who are highly involved with a decision are more likely to search for information from a range of sources, consciously process information and compare various options, while people with low involvement do not (Assael 1998).

Laurent and Kapferer (1985) proposed five causes or antecedents of involvement. These were:

1. Interest (personal meaning)
2. Hedonic (emotional appeal, ability to provide pleasure and enjoyment)
3. Sign (ability to express self, status, personality, identity)
4. The perceived importance of the negative consequences of making a poor choice (consequence)
5. The perceived likelihood of making a poor choice (probability)

---

<sup>1</sup>The term "I<sub>3</sub>" stands for involvement with the issue and the intervention.

The first, second and third antecedents are sources of involvement and correspond to the three kinds of goals individuals can pursue. The fourth and fifth antecedents combine to define the perceived risk. Perceived risk is an intensifier rather than a source of involvement. Kaine (2008, 57) argues:

*“... perceived risk is an outcome of involvement because, for risk to be a concern to the consumer, they must be aware of the potential for the product to prevent the achievement of one or more utilitarian, social or hedonic goals. Consequently, in the absence of at least one of the three fundamental sources of involvement, perceived risk is unlikely to give rise to involvement per se. On the other hand, given that a product is involving then the presence of perceived risk may at least add to the processing effort made by the consumer and possibly heighten interest in the purchase if not the product itself”.*

Knowing the combination of antecedents that constitute overall involvement is valuable as differences in antecedents can result in different behaviours. For example, differences in antecedents will result in individuals being responsive to different types of messages about a product or activity. As Laurent and Kapferer (1985, 52) state:

*“Looking at the [antecedents], one may understand better where involvement originates, which provides clues as to what type of appeals would be used in communication...”*

### **Compliance behaviour**

In the I<sub>3</sub> Response Framework Murdoch *et al.* (2006) and Kaine *et al.* (2010) hypothesised that an individual's level and antecedents of involvement will critically influence their motivation in regard to awareness of, attitude towards, and decision-making with respect to a regulation. They propose compliance behaviour may be predicted by distinguishing between two key dimensions of involvement. These two dimensions are involvement with the issue and involvement with the intervention.

The issue is the policy objective that provides the immediate justification for prescribing or influencing the behaviour of individuals. An intervention or measure is a method of prescribing or influencing the behaviour of individuals in order to address the policy issue.

Involvement with the issue represents the level of personal relevance of the policy objective. Issue involvement signals the degree to which the policy objective itself is a source of motivation for the individual, irrespective of any policy intervention or measure (Kaine *et al.* 2010). This allows for individuals to be motivated to take action in response to an issue, even though the associated intervention does not impact on them directly (Kaine *et al.* 2010).

Involvement with the intervention represents the level of personal relevance created by the regulation. Intervention involvement signals the degree to which the

intervention is a source of motivation for the individual, irrespective of the issue (Kaine *et al.* 2010). This allows for individuals to be motivated and take action in response to an intervention even though the issue the intervention addresses is not perceived to be directly relevant to them.

The two dimensions of involvement can be combined to predict four main involvement profiles which make up the I<sub>3</sub> Response Framework. The relationships between the two dimensions of involvement, the forming of an attitude (favourable or unfavourable), and the types of likely behavioural responses are summarised in Figure 1. The horizontal axis in the figure represents a continuum from low involvement with the intervention on the left-hand side to high involvement with the intervention on the right-hand side. The vertical axis in the figure represents a continuum from low involvement with the issue at the bottom to high involvement with the issue at the top. Four quadrants are formed by the intersection of these two involvement axes. These quadrants represent types of likely behavioural responses to interventions. The types of behaviours are summarised in the figure. A more detailed description and explanation is available in Kaine *et al.* (2010).

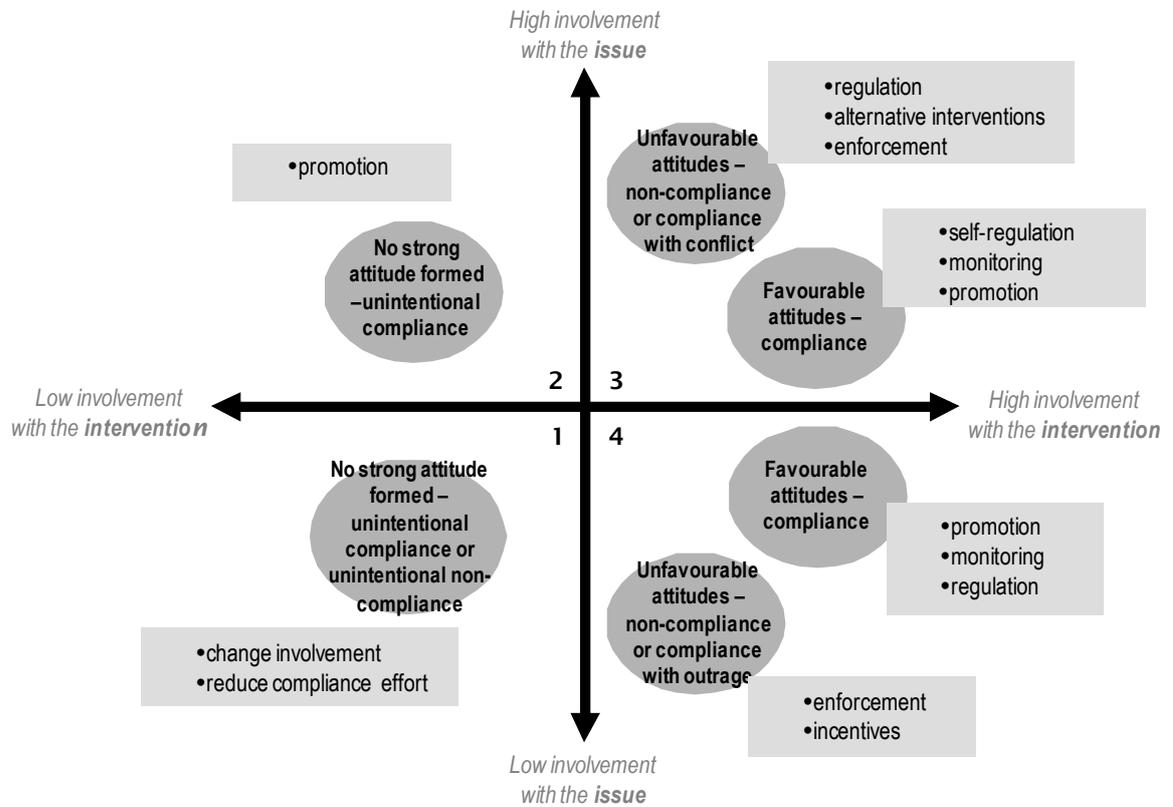
Given the predictions of likely behavioural responses strategies can be suggested to maintain existing behaviour that is in line with an intervention or to promote compliance with the intervention. There are two options for increasing compliance, strategies that change behaviour by changing involvement or strategies that work with the existing level of involvement. These strategies are summarised in the figure. Again, a more detailed description and explanation is available in Kaine *et al.* (2010).

### 3.2 Measuring involvement

The first objective of the study was to quantify landholder involvement in the policy issues of preventing the spread of blackberry and serrated tussock and their involvement in two interventions; regulation and coordinated control.

Involvement cannot be inferred from the actions of individuals. Individuals may have high involvement in a stimulus but if that stimulus does not require them to take action. For instance, a landholder may have high involvement in the issue of preventing the spread of a weed but may not need to take action because the weed has not infested their property. Alternatively, mediating factors may prevent an individual from responding to a stimulus that is highly involving. For example, a landholder may have high involvement in eradicating a weed from their property but time, disability or resource constraints may prevent them from taking action.

Furthermore, differences in may arise among individuals in terms of the nature and extent of action that high involvement may invoke. For example, a landholder may have involvement in the issue of preventing the spread of a weed and are motivated to regularly undertake action to suppress weed infestations on their property. Such a landholder, because they are suppressing infestations of weeds on their property, may not be motivated to seek information on their obligations to control weeds, or even be aware that they are obliged to control certain weeds.



**Figure 1:** I<sub>3</sub> Response Framework

Source: Adapted from Kaine *et al.* (2010)

Since the level of involvement cannot be inferred from observation of actions it must be measured using psychometric scales (Laurent and Kapferer 1985; Zaichkowsky 1985). Consequently, a survey questionnaire was developed which consisted of a series of structured questions to measure issue and intervention involvement with blackberry and serrated tussock, and a series of open-ended questions to elicit beliefs, attitudes and behaviours in regard to control of blackberry and serrated tussock. The responses to the open-ended questions were intended to provide a qualitative validation of the estimates of involvement.

Scales to measure each the five antecedents of involvement (interest, sign, hedonic, probability and consequence) were constructed based on Laurent and Kapferer (1985). Each of the five scales was composed of three items or statements and respondents scored their agreement with each statement in a scale using a five point Likert rating. A score of 1 represented strong disagreement with a statement while a score of 5 representing strong agreement. The wording of the statements in each scale was finalised after piloting with landholders.

The questionnaire was administered by personal interview at a location chosen by the landholder, usually their property. Two interviewers were present at most interviews which provided a means for comparing and checking interpretations of responses to the open-ended questions.

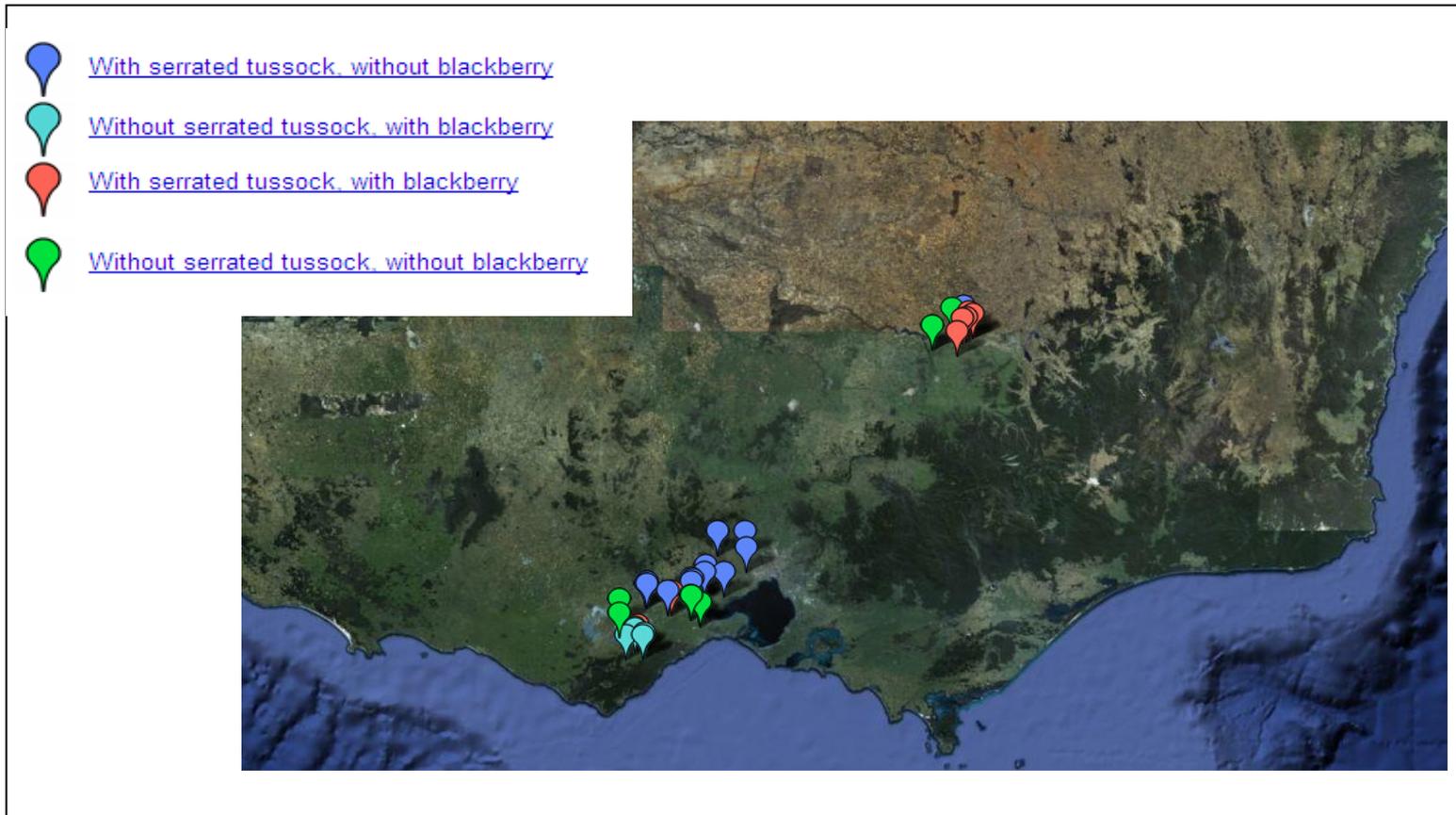
The questionnaire was divided into three sections. The first section contained the scale questions on involvement with the policy issues of preventing the spread of blackberry and serrated tussock. Involvement with regulation of blackberry and serrated tussock was the focus of the second section while involvement with coordinated control of blackberry and serrated tussock and blackberry was the focus of the third section.

The questionnaire is available on request from the authors.

### 3.3 Sampling

Thirty-four (34) Victorian landholders from the North East, Corangamite, and Port Phillip and Westernport catchments were interviewed (see Figure 2). Landholders were selected for interviewing on the basis of differences in their exposure to, and experience with, blackberry and serrated tussock, including compliance and coordination activities.

Serrated tussock is a Regionally Prohibited Weed in the North East which means that it is a regulatory requirement that landholders take all reasonable steps to eradicate serrated tussock from their property. In Corangamite, Port Phillip and Westernport serrated tussock is a Regionally Controlled weed which means landholders have a responsibility to take all reasonable steps to control and prevent the spread of blackberry on their land and adjoining roadsides. Blackberry is a Regionally Controlled Weed in the catchments where we interviewed which means landowners must take all reasonable steps to prevent its growth and spread.



**Figure 2:** Landholder sample

## **4. Analysis**

### **4.1 Scale reliability**

Reliability analysis (Carmines and Zeller 1979) was conducted to assess the internal consistency of landholders' responses to the statements in the involvement scales. The results are reported in Table 1 and indicate that the internal reliability of the scales measuring the interest, sign, and the probability and consequence antecedents of involvement were satisfactory while the reliability of the scale measuring the hedonic antecedent was unsatisfactory.

Subsequent analysis revealed that responses to the statement containing the term 'frustrating' tended to be weakly correlated with responses to the other two statements in the hedonic scale. While the statements in the scale require improvement to improve reliability we used ratings on all three statements to measure hedonic involvement as, given the small number of statements in the scale, satisfactory reliabilities were obtained in three of six instances.

We also found that the specific context influenced the reliability of scales. For example, the reliabilities for risk consequence differ substantially depending on whether the statement context was regulation or coordinated control.

### **4.2 Correspondence of scales and impressions**

The interviewees formed a number of impressions about the involvement of landholders with regard to blackberry and serrated tussock based on their responses to open-ended questioning. These impressions provided a simple, albeit subjective, criterion for testing the validity of the scales.

In this section we describe the impressions in regard to the policy issue, coordination and regulation and compare them with scores obtained for the corresponding scales. The sample means for each scale in regard to issue, coordination and regulation are reported in Table 2.

#### **Policy issue impressions**

The impressions about the issue of preventing the spread of serrated tussock and blackberry from the interviews were that:

1. Interviewees believed that serrated tussock posed a greater threat to farm productivity than blackberry, and that serrated tussock was harder and costlier to control because of the manner in which it spreads. This created a sense that interest involvement in the policy issue of preventing the spread of serrated tussock was higher than for blackberry. The mean scores on the interest scale for the issue of preventing the spread of blackberry and serrated tussock were consistent with this impression.

**Table 1:** Reliability analysis of involvement scales

<b>Antecedent</b>	<b>I<sub>3</sub> Component</b>	<b>Serrated Tussock</b>	<b>Blackberry</b>	<b>Total</b>
Interest	<i>issue</i>	0.90	0.87	
	<i>coordination</i>	0.86	0.82	
	<i>regulation</i>	0.87	0.65	
Sign	<i>issue</i>	0.79	0.61	
	<i>coordination</i>	0.96	0.88	
	<i>regulation</i>	0.91	0.87	
Hedonic	<i>issue</i>	0.72	0.85	
	<i>coordination</i>	0.57	0.70	
	<i>regulation</i>	0.63	0.36	
Probability	<i>issue</i>	0.84	0.76	
	<i>coordination</i>	0.71	0.60	
	<i>regulation</i>	0.79	0.66	
Consequence	<i>issue</i>	0.74	0.74	
	<i>coordination</i>	0.79	0.90	
	<i>regulation</i>	0.57	0.63	

Notes: The values in the table are Cronbach's alpha (Carmines and Zeller 1979). Given the small number of statements in each scale a score of 0.7 or higher was regarded as satisfactory.

**Table 2: Mean scores on antecedents of involvement**

<b>Antecedent</b>	<b>I<sub>3</sub> Component</b>	<b>Serrated Tussock</b>	<b>Blackberry</b>	<b>Paired t-test</b>
Interest	<i>issue</i>	4.55	3.71	3.83, p=0.00
	<i>coordination</i>	3.77	3.35	1.61, p=0.12
	<i>regulation</i>	3.93	3.58	2.58, p=0.02
Sign	<i>issue</i>	3.67	3.49	1.59, p=0.12
	<i>coordination</i>	3.53	3.28	1.79, p=0.09
	<i>regulation</i>	3.51	3.41	1.20, p=0.24
Hedonic	<i>issue</i>	4.02	3.44	3.35, p=0.00
	<i>coordination</i>	3.79	3.56	1.42, p=0.17
	<i>regulation</i>	3.42	3.37	0.56, p=0.58
Probability	<i>issue</i>	2.47	2.48	0.06, p=0.95
	<i>coordination</i>	2.08	2.08	0.00, p=1.00
	<i>regulation</i>	2.61	2.50	0.81, p=0.43
Consequence	<i>issue</i>	4.57	4.08	3.00, p=0.01
	<i>coordination</i>	3.55	3.21	1.84, p=0.08
	<i>regulation</i>	4.06	3.53	3.50, p=0.00

Notes: The values in the second and third columns are sample means based on the average of interviewee's rating of the three statements in each scale. See Tabachnick and Fidell (1989) for a description of paired sample, or within-sample, t-tests reported in the fifth column.

2. Interviewees believed that serrated tussock to be more difficult to control than blackberry and a correspondingly greater sense of achievement associated with controlling serrated tussock. This created the impression that hedonic involvement in the issue of preventing the spread of serrated tussock was higher than for blackberry. The mean scores on the hedonic scale for the issue of preventing the spread of blackberry and serrated tussock were consistent with this impression.
3. Interviewees preferred not to make judgements of others in regard to weed management without detailed knowledge of the circumstances of others (e.g. health, financial situation). However, a number of interviewees did feel they were judged by others on the basis of the way they controlled weeds on their property. This created a sense that sign involvement in the issue of preventing the spread of serrated tussock and blackberry would be similar. The mean scores on the sign scale for the issue of preventing the spread of blackberry and serrated tussock were consistent with this impression.
4. Interviewees believed that the consequences of failing to prevent the spread of serrated tussock would be greater than for blackberry due to the potential for serrated tussock to rapidly infest highly productive land, and its impact on the environment. Blackberry was perceived to be easier to control as it spreads relatively slowly even after years without management. This created a sense that risk consequence involvement in the issue of preventing the spread of serrated tussock would be greater than for blackberry. The mean scores on the risk consequence scale for the issue of preventing the spread of blackberry and serrated tussock were consistent with this impression.

### **Policy intervention impressions**

The impressions about regulation and coordinated control from the interviews were that:

1. Interviewees believed that coordination was probably more important in preventing the spread of serrated tussock than blackberry. This was because the potential for new infestations of serrated tussock to occur as a result of seed dispersal by wind. This created a sense that interest involvement in coordination to prevent the spread of serrated tussock would be greater than for blackberry. The statistical results were not consistent with this impression. No significant differences were found between serrated tussock and blackberry on any of the involvement scales for coordination.
2. Interviewees concern about the potential for serrated tussock to rapidly infest productive pasture created a sense that involvement in regulation to prevent the spread of serrated tussock would be greater than for blackberry. Interviewees also reported that enforcement activity was also higher for serrated tussock than for blackberry. The mean scores on the interest and risk consequence scales for regulation of blackberry and serrated tussock were consistent with this impression.

3. Interviewees that had experience with serrated tussock appeared more likely to express the opinion that the likelihood of making a mistake in controlling the spread of serrated tussock was low. This created a sense that interviews with serrated tussock were would rate risk probability for serrated tussock lower than would interviewees without serrated tussock. The differences in the mean scores on the risk probability scale for serrated tussock were consistent with this impression.<sup>2</sup>

These results indicate there was a good correspondence between the scoring of scales by interviewees and the impressions interviewers formed about the relative involvement of interviewees in blackberry and serrated tussock. This provides some initial confidence in the predictive validity of the scales.

### 4.3 Involvement scores and presence of weeds

Generally speaking, we expected that interviewees that had experience with blackberry or serrated tussock would exhibit a higher degree of involvement than those who had not because those with the weed were forced by circumstance to make decision about managing these weeds. We found that interest and sign involvement with the issue of preventing the spread of serrated tussock were higher for those who had serrated tussock compared to those who did not.<sup>3,4</sup> As reported above, as expected, we found that risk probability involvement with the issue of preventing the spread of serrated tussock was lower for those who had serrated tussock compared to those who did not.

We also found that sign involvement with regulation of serrated tussock was higher for those who had serrated tussock compared to those who did not.<sup>5</sup> No other statistically significant differences were found in involvement between those who had serrated tussock and those who did not.

We found that hedonic involvement with the issue of preventing the spread of blackberry was higher for those who had blackberry compared to those who did not have blackberry.<sup>6</sup> We also found that interest involvement with both coordination and regulation of blackberry was higher among those who had blackberry than those who did not.<sup>7,8</sup> No other statistically significant differences were found in involvement between those who had blackberry and those who did not.

---

<sup>2</sup> Mean scores on risk probability for those with and without serrated tussock were 2.27 and 3.17 respectively ( $F=3.70$ ,  $p=0.06$ ).

<sup>3</sup> Mean scores on interest for those with and without serrated tussock were 4.66 and 3.81 respectively ( $F=8.17$ ,  $p=0.01$ ).

<sup>4</sup> Mean scores on sign for those with and without serrated tussock were 3.81 and 3.00 respectively ( $F=3.94$ ,  $p=0.06$ ).

<sup>5</sup> Mean scores on sign for those with and without serrated tussock were 3.76 and 2.38 respectively ( $F=9.45$ ,  $p=0.01$ ).

<sup>6</sup> Mean scores on hedonic for those with and without blackberry were 4.00 and 3.10 respectively ( $F=6.08$ ,  $p=0.04$ ).

<sup>7</sup> Mean scores on interest in coordination for those with and without blackberry were 3.88 and 2.87 respectively ( $F=3.87$ ,  $p=0.06$ ).

We did not find any statistically significant differences in any of the antecedents of involvement between the districts.

#### 4.4 Involvement profiles

The involvement profile is the pattern of interviewee involvement across the antecedents of involvement; that is interest, sign, hedonic, risk probability and risk consequence. Differences in profiles indicate individuals may seek different features in, and respond to different messages about, products and services (Laurent and Kapferer 1985). In the context of compliance, differences in profiles may result in different in attention to regulatory requirements and differential responses to policy measures (Kaine *et al.* 2010). Consequently, determining whether there are differences among landholders in their involvement profiles is crucial to establishing whether landholders can be expected to respond similarly or not to a particular policy measure.

Cluster analysis (Aldenderfer and Blashfield (1984) was used to classify interviewees into groups based on the similarity of their involvement profiles to explore the potential for differences to exist among landholders in their involvement profiles. Separate analyses were conducted for serrated tussock and blackberry in respect of issue involvement, coordination involvement and regulation involvement.<sup>9</sup>

Given the small size of the sample the maximum number of groups was restricted to three.

##### **Serrated tussock**

The group profiles for involvement with the issue of preventing the spread of serrated tussock are reported in Figure 3 and Table 3. These results indicate that while most interviewees were highly involved with preventing the spread of serrated tussock, there was some variation in involvement profiles. Interviewees were classified into a group with high scores on all antecedents of involvement; another group with high scores on all antecedents except risk probability; and a third, small group with low scores on all antecedents.

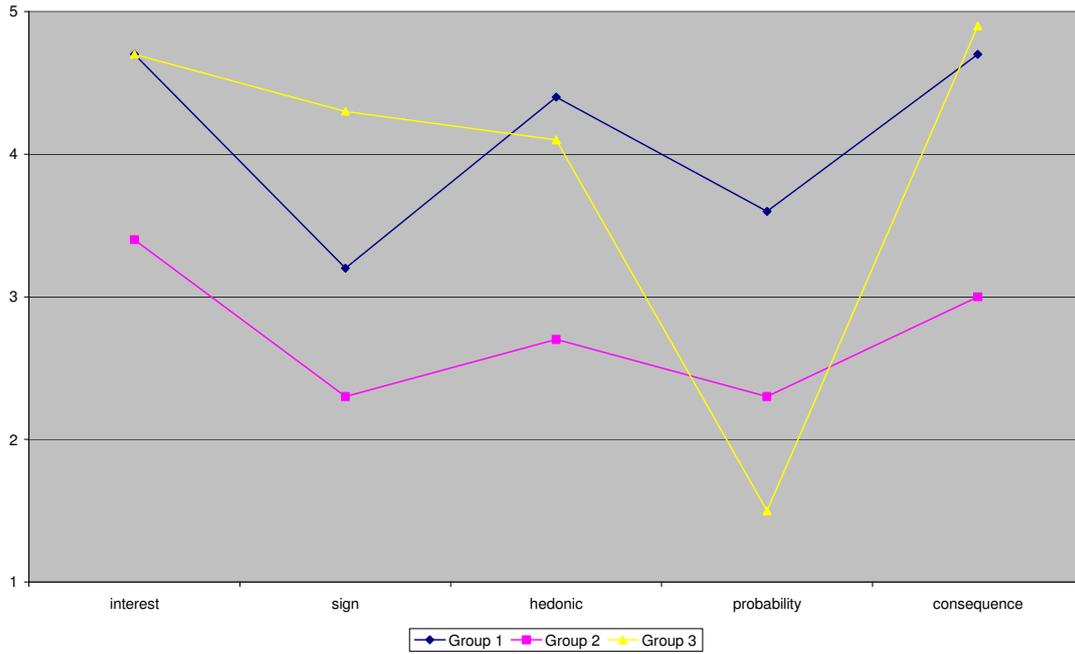
The first group contained a relatively high proportion of interviewees without serrated tussock while the third group contained a relatively high proportion of interviewees with serrated tussock.<sup>10</sup> These results suggest that interviewees that were experienced with serrated tussock were quite confident that they could manage serrated tussock without making mistakes.

---

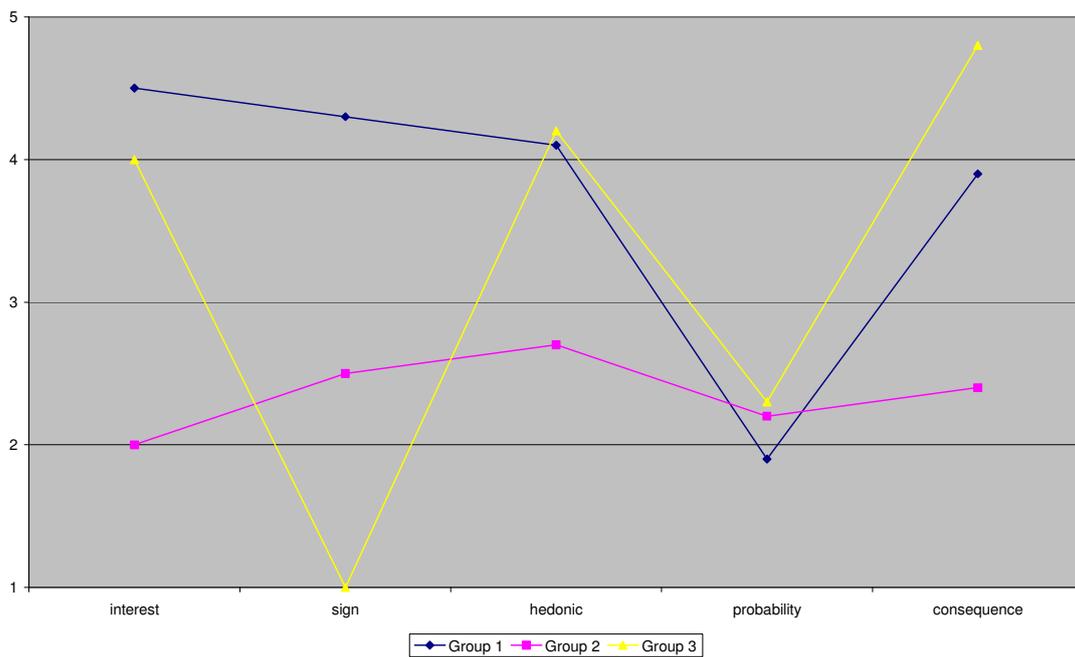
<sup>8</sup> Mean scores on interest in regulation for those with and without blackberry were 3.97 and 3.26 respectively (F=4.13, p=0.05).

<sup>9</sup> We used Wards method with squared Euclidean distance as the similarity measure.

<sup>10</sup>  $\chi^2=6.09$ ,  $p=0.05$



**Figure 3:** Involvement with the issue of preventing the spread of serrated tussock



**Figure 4:** Involvement with coordinated control of serrated tussock

**Table 3:** Mean scores on antecedents of involvement for serrated tussock

<b>Dimension</b>	<b>Antecedent</b>	<b>Group One</b>	<b>Group Two</b>	<b>Group Three</b>
Issue	% of sample	39	13	48
	Interest*	4.69	3.42	4.70
	Sign*	3.23	2.25	4.42
	Hedonic*	4.36	2.67	4.12
	Probability*	3.60	2.25	1.52
	Consequence*	4.74	3.00	4.85
Coordination	% of sample	64	28	8
	Interest*	4.50	2.02	4.00
	Sign*	4.33	2.48	1.00
	Hedonic*	4.15	2.67	4.17
	Probability	1.87	2.24	2.33
	Consequence*	3.85	2.40	4.83
Regulation	% of sample	59	18	23
	Interest*	3.25	4.94	4.81
	Sign*	2.79	4.39	4.50
	Hedonic*	2.84	4.44	3.94
	Probability*	2.85	3.61	1.29
	Consequence*	3.73	4.78	4.42

Notes: An asterisk indicates statistically significant differences across groups in means scores on the antecedent.

The group profiles for involvement with coordinated control of serrated tussock are reported in Figure 4 and Table 3. These results indicate that there was some variation in profiles, particularly in regard to sign involvement which points toward substantial differences among interviewees in the extent to which they believed participation in coordination could be interpreted as communication something about self-identity. Interviewees were classified into a large group with high scores on all antecedents of involvement except risk probability; another group with low scores on all antecedents; and a third, very small group with high scores on all antecedents except sign and risk probability.

The group profiles for involvement with regulation of serrated tussock are reported in Figure 5 and Table 3. These results indicate that most interviewees were moderately involved with regulation of serrated tussock; however there was some variation in profiles. Interviewees were classified into a large group with moderate scores on all antecedents of involvement; another group with high scores on all antecedents; and a third group with high scores on all antecedents except risk probability.

The first group, those with moderate involvement, contained a relatively high proportion of interviewees without serrated tussock while the second group, those with high involvement, contained a relatively high proportion of interviewees with serrated tussock.<sup>11</sup> The impression of interviewers was that the members of the second group tended to have a good understanding of pest plant regulations and felt that there was a need for more enforcement in their area. Again, interviewees with serrated tussock were more likely to be members of the group that rated risk probability as low, group three. This result reinforces the impression that interviewees who were experienced with serrated tussock were confident that serrated tussock could be managed without making mistakes.

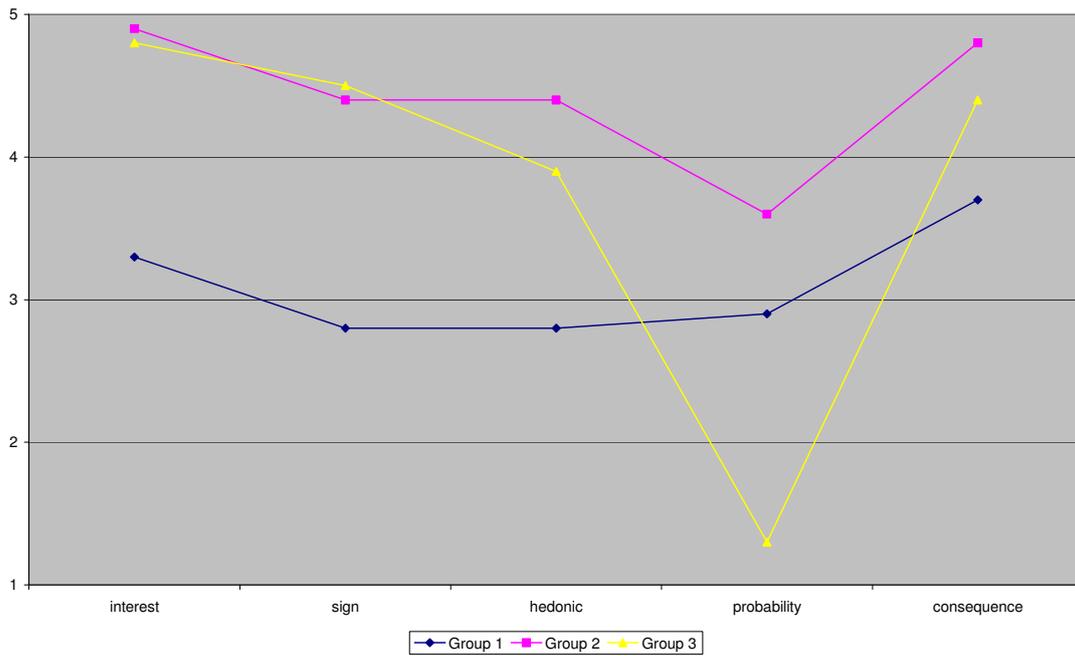
Finally, note the proportion of interviewees exhibiting high involvement was substantially lower for regulation of serrated tussock (41 per cent of interviewees) than for preventing the spread of serrated tussock (87 per cent of interviewees) or for coordinating control (72 per cent of interviewees).

### **Blackberry**

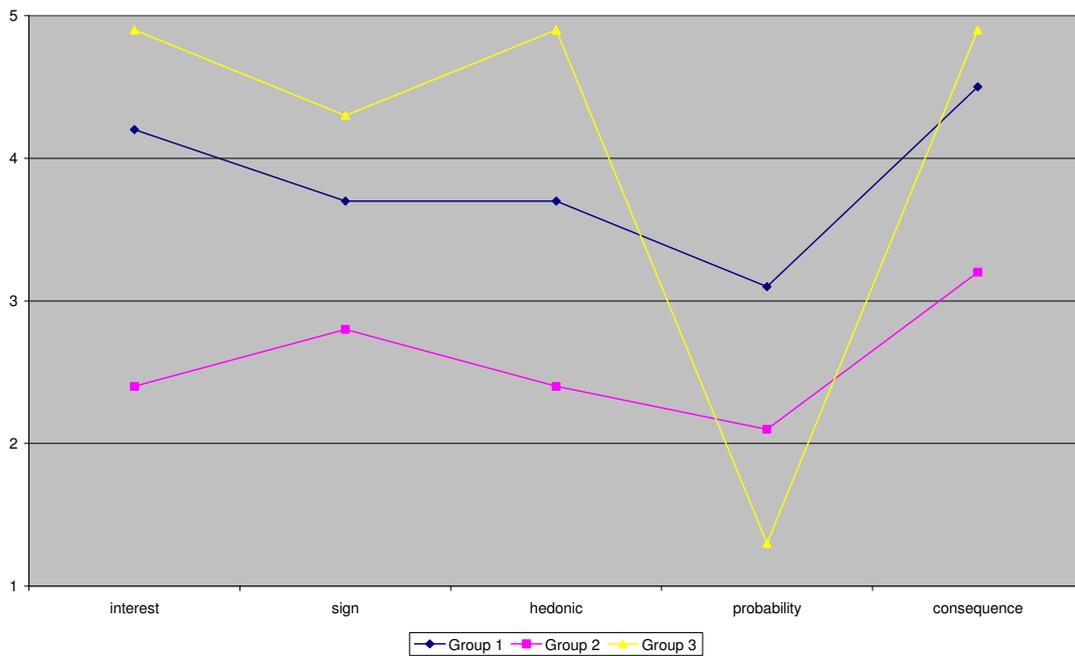
The group profiles for involvement with preventing the spread of blackberry are reported in Figure 6 and Table 4. These results indicate that while there was some variation in profiles most interviewees were highly involved with preventing the spread of blackberry. Interviewees were classified into a group with high scores on all antecedents of involvement; another group with low scores on all antecedents; and a third, small group with high scores on all antecedents except risk probability.

---

<sup>11</sup>  $\chi^2=7.34$ ,  $p=0.03$



**Figure 5:** Involvement with regulation of serrated tussock



**Figure 6:** Involvement with the issue of preventing the spread of blackberry

Finally, note the proportion of interviewees exhibiting high involvement was substantially lower for regulation of serrated tussock (41 per cent of interviewees) than for the issue of preventing the spread of serrated tussock (87 per cent of interviewees) or for coordinating control (72 per cent of interviewees).

## **Blackberry**

The group profiles for involvement with the issue of preventing the spread of blackberry are reported in Figure 6 and Table 4. These results indicate that while there was some variation in profiles most interviewees were highly involved with preventing the spread of blackberry. Interviewees were classified into a group with high scores on all antecedents of involvement; another group with low scores on all antecedents; and a third, small group with high scores on all antecedents except risk probability.

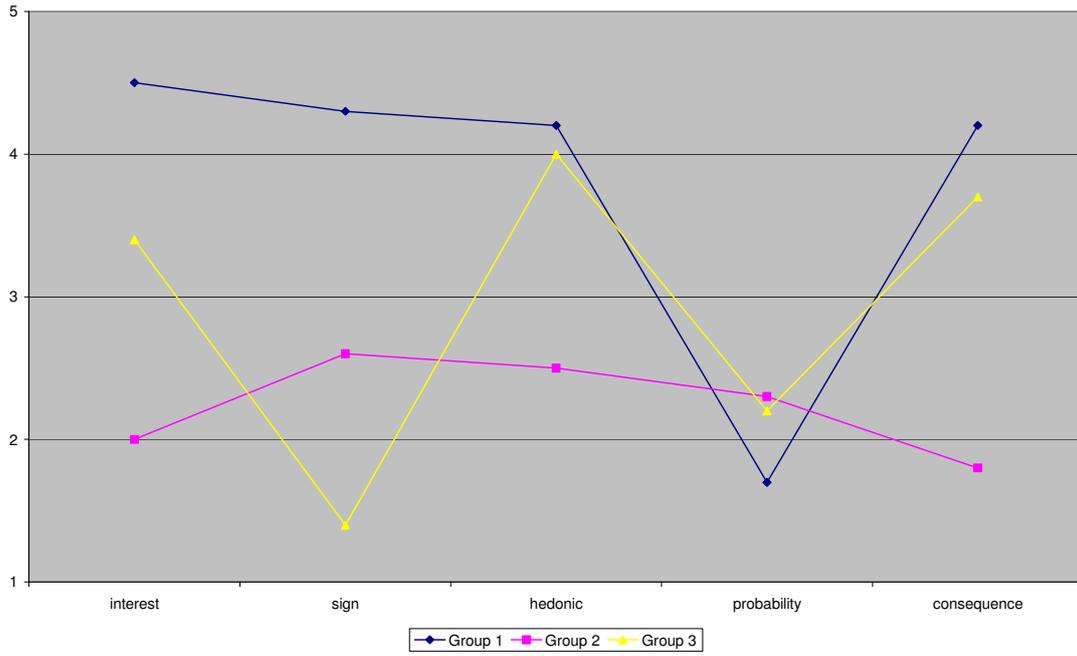
The group profiles for involvement with coordinated control of blackberry are reported in Figure 7 and Table 4. As was the case with coordinated control of serrated tussock, these results indicate that there was some variation in profiles, particularly in regard to sign involvement which points toward substantial differences among interviewees in the extent to which they believed participation in coordination could be interpreted as communication something about self-identity. Interviewees were classified into a large group with high scores on all antecedents of involvement except risk probability; another group with low scores on all antecedents; and a third, very small group with high scores on all antecedents except sign and risk probability.

The group profiles for involvement with regulation of blackberry are reported in Figure 8 and Table 4. These results indicate that the majority of interviewees were moderately involved with regulation of blackberry; however there were substantial differences in profiles. Interviewees were classified into a group with high scores on all antecedents of involvement; a smaller group with low scores on all antecedents; and a small group with high scores on interest and consequence antecedents and low scores on the other antecedents.

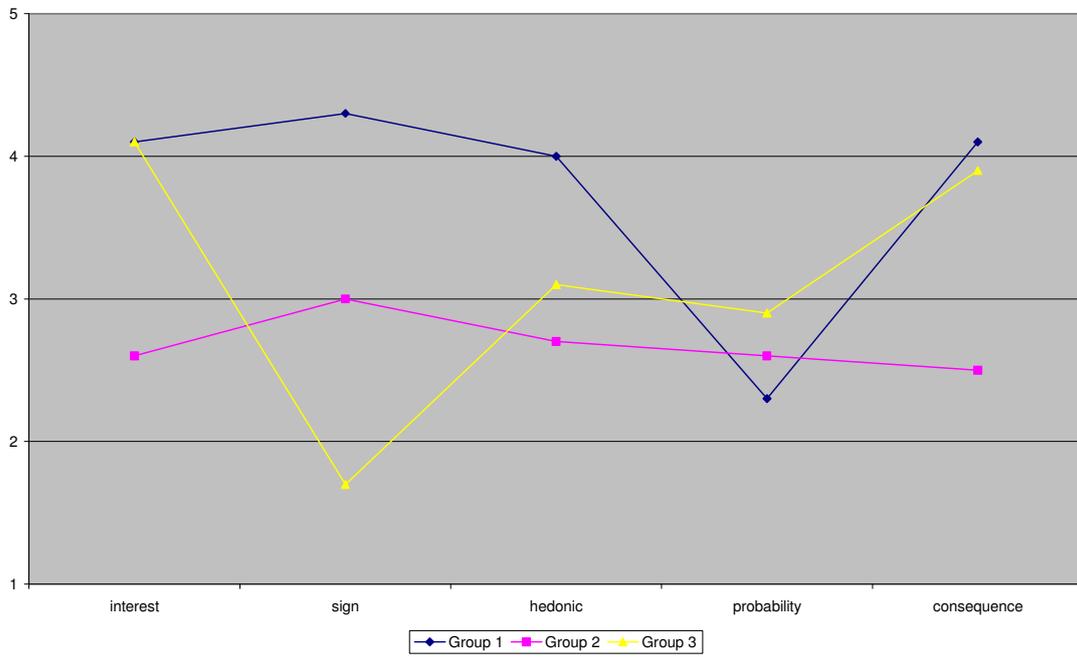
Seven of the ten interviewees that were identified as publicly active in some way in weed control were members of the group with high scores on all antecedents of involvement.

## **Summary**

Overall, the results reported here show that there was substantial variation in the involvement profiles of interviewees with regard to the issue of preventing the spread of serrated tussock and blackberry, and the coordinated control and regulation of serrated tussock and blackberry. This is evidence to suggest that the nature of the involvement of landholders in weed control can differ as well as the level or intensity of involvement.



**Figure 7:** Involvement with coordinated control of blackberry



**Figure 8:** Involvement with regulation of blackberry

**Table 4:** Mean scores on antecedents of involvement for blackberry

<b>Dimension</b>	<b>Antecedent</b>	<b>Group One</b>	<b>Group Two</b>	<b>Group Three</b>
Issue	% of sample	47	37	16
	Interest*	4.18	2.42	4.93
	Sign*	3.73	2.85	4.27
	Hedonic*	3.69	2.42	4.87
	Probability*	3.12	2.08	1.27
	Consequence*	4.48	3.18	4.93
Coordination	% of sample	46	46	8
	Interest*	4.48	2.05	3.50
	Sign*	4.33	2.64	1.00
	Hedonic*	4.24	2.64	4.17
	Probability	1.70	2.27	2.33
	Consequence*	4.15	2.65	4.83
Regulation	% of sample	48	36	15
	Interest*	4.11	2.56	4.07
	Sign*	4.27	2.96	1.73
	Hedonic*	3.96	2.65	3.07
	Probability	2.25	2.64	2.87
	Consequence*	4.13	2.47	3.87

Notes: An asterisk indicates statistically significant differences across groups in means scores on the antecedent.

## 4.5 Level of involvement

### Calculating level of involvement

To place interviewees in the appropriate quadrant of I<sub>3</sub> Response Framework a measure of involvement level or intensity is required that aggregates the antecedents of involvement for each dimension of the Framework. The argument advanced earlier was that perceptions of risk intensify involvement arising from the three source antecedents (interest, sign and hedonic). The first is that the level of involvement should be the product of the three sources of involvement and risk probability.

The second implication is that risk consequence should be an indicator of level of involvement and should be correlated with the three source of involvement (interest, sign and hedonic). Consequently, the intensity of involvement of interviewees was calculated as the average of the ratings for the three source antecedents, multiplied by the ratings for risk probability which is a measure of the likelihood of making a mistake. This argument has two implications.

The calculation is summarised in the following expression:

$$(1) \quad TI = SI + SI * R_p$$

$$(2) \quad SI = (I_{interest} + S_{ign} + H_{edonic}) / 3$$

Where TI denotes intensity of involvement, SI denotes mean source involvement;  $I_{interest}$ ,  $S_{ign}$ , and  $H_{edonic}$  denote scores on the interest, sign and hedonic scales; and  $R_p$  denotes scores on the risk probability scale.

Alternatively, the expression for involvement intensity can be written in full as:

$$(3) \quad TI = ((I_{interest} + S_{ign} + H_{edonic})/3)*(1.0 + R_p)$$

Expression (3) has the following useful properties:

- (i) A minimum of 2 for the minimum possible scores for source involvement and risk
- (ii) A score of 6 for the minimum possible score for source involvement and maximum possible score for risk
- (iii) A score of 10 for the maximum possible score for source involvement and minimum possible score for risk
- (iv) A maximum of 30 for the maximum possible scores for source involvement and risk

To assist interpretation of results we interpreted scores equivalent to (iii) above as moderate involvement. That is, the score obtained from the combination of maximum source involvement and minimum risk. Consequently, the intersection of the involvement axes in graphs of the I<sub>3</sub> Response Framework set at an involvement intensity score of ten (10). Hence, interviewees with scores above 10 were deemed to

have moderate to high involvement while those with scores below 10 were deemed to have low to moderate involvement.

### **Involvement with serrated tussock and blackberry**

We found that, although scores on level or intensity involvement were the same or higher for serrated tussock than for blackberry, the scores for blackberry and serrated tussock were correlated. This means that, broadly speaking, an interviewee's level of involvement with serrated tussock tended to be similar to their involvement with blackberry (and *vice versa*). This is demonstrated in Table 5 where correlations on involvement for blackberry and serrated tussock are reported.

Inspection of the table reveals that:

- The level of issue involvement was correlated with the level of intervention involvement. This means, for example, interviewees with a high level of involvement with the issue of preventing the spread of serrated tussock issue tended to have a high level of involvement with coordinated control and regulation of serrated tussock.
- The level of involvement in the issue tended to be the same for both weeds. This means, for example, interviewees with a high level of involvement in preventing the spread of blackberry tended to have high involvement with preventing the spread of serrated tussock.
- The level of involvement in the interventions tended to be the same for a particular weed. This means, for example, interviewees with a high level of involvement in coordinated control of serrated tussock tended to have high involvement in regulation for serrated tussock.
- The level of involvement in coordination tended to be the same for both weeds. This means interviewees with a low level of involvement in coordinated control of blackberry tended to have low involvement in coordination for serrated tussock.
- The level of involvement in regulation tended to be the same for both weeds. This means interviewees with a low level of involvement in regulation of blackberry tended to have low involvement in regulation of serrated tussock.

These results suggest that interviewee's level of involvement in the issue of preventing the spread of weeds and their level of involvement in interventions to control weeds were similar for blackberry and serrated tussock. This suggests that landholders' level of involvement with the issue of preventing the spread of weeds and their level of involvement interventions to control weeds tends to be the same across different weeds.

In table 6 the correlations between scores on the risk consequence scales and scores on the three sources of involvement, and the calculated levels of involvement, are presented. As expected the results indicate that most of the correlations are high and statistically significant.

**Table 5:** Correlations in level of involvement

	<b>Serrated Tussock</b>			<b>Blackberry</b>		
<b>Serrated Tussock</b>	Issue	Coordination	Regulation	Issue	Coordination	Regulation
Issue	-					
Coordination	0.46*	-				
Regulation	0.71*	0.55*	-			
<b>Blackberry</b>						
Issue	0.76*	0.41*	0.59*	-		
Coordination	0.35	0.49*	0.28	0.53*	-	
Regulation	0.57*	0.33	0.70*	0.69*	0.56*	-

Notes: An asterisk indicates statistically significant correlation.

**Table 6:** Correlations of risk consequence with sources and level of involvement

<b>Serrated Tussock</b>	Interest	Sign	Hedonic	Involvement
Issue	0.71*	0.38*	0.62*	0.34
Coordination	0.66*	0.25	0.65*	0.51*
Regulation	0.61*	0.30	0.62*	0.44*
<b>Blackberry</b>				
Issue	0.72*	0.23	0.49*	0.33
Coordination	0.85*	0.38	0.75*	0.69*
Regulation	0.72*	0.24	0.72*	0.44*

Notes: An asterisk indicates statistically significant correlation with risk consequence.

## **Involvement with the issue and coordination for serrated tussock**

The scores for interviewee's level of involvement in the issue of preventing the spread of serrated tussock and their level of involvement in a program to voluntarily coordinate control of serrated tussock were used to place interviewees in the I<sub>3</sub> Response Framework. The placement of interviewees in the Framework is shown in Figure 9.

Generally speaking, most interviewees exhibited a moderate to high level of involvement in the issue of preventing the spread of serrated tussock issue and a low to moderate level of involvement in the coordination program.

Five interviewees were placed in the lower left quadrant of the Framework (quadrant one) indicating low involvement in the issue of preventing the spread of serrated tussock and in the coordination program. This location in the Framework leads us to predict that these interviewees would have limited interest in, and knowledge about, a coordinated program to prevent the spread of serrated tussock. These interviewees felt that the spread of serrated tussock was under control or that they were not at risk of serrated tussock infestation. One stated...

*'It [serrated tussock] won't get any worse'*

These interviewees did not express strong opinions on coordination. For example, one of these interviewees commented that coordination was a good idea but...

*'I would not go out of my way to participate.'*

Most of the interviewees with serrated tussock had low to moderate of involvement in the issue of preventing the spread of serrated tussock and low to moderate levels of involvement in the coordination program. Many of these interviewees had spent a lot of time and money dealing with infestations of serrated tussock.

Most of these interviewees felt that coordination was a good idea, but that problems might arise in the timing of a program because of their limited availability to undertake control activities, difficulties in integrating a program into existing farm operations, possible differences in appropriate time to undertake control activities, differences in the effectiveness of control activities. Some interviewees stated...

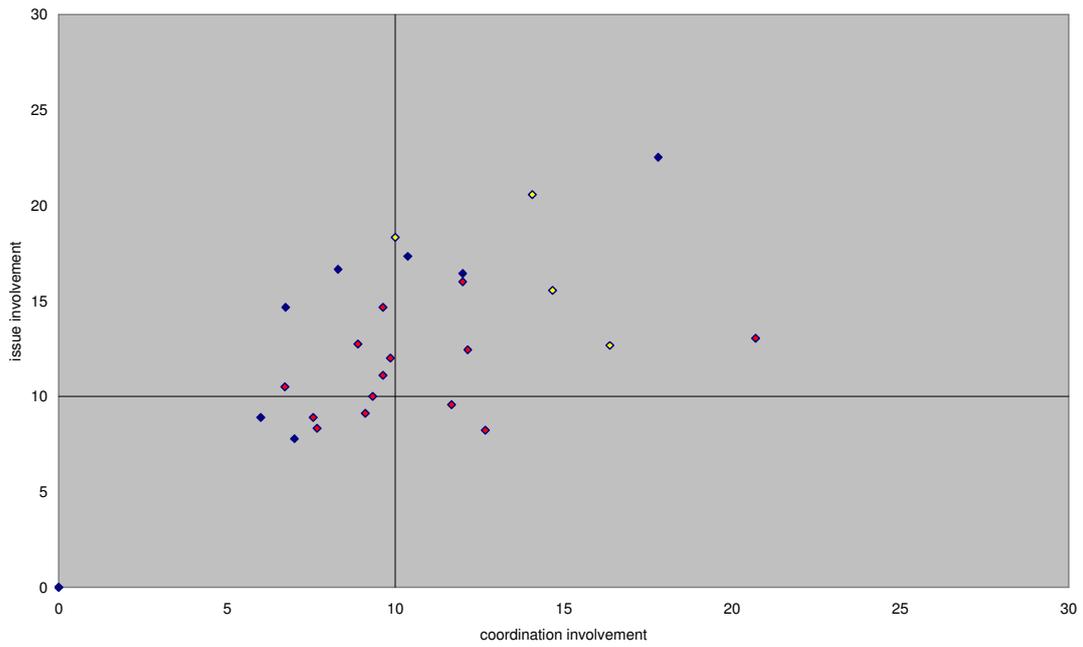
*'It takes more time than doing it yourself'*

*'Getting the timing right with other farm operations is important'*

Most interviewees without serrated tussock were placed in the upper right quadrant of the Framework. These interviewees had moderate to high levels of involvement in the issue of preventing the spread of serrated tussock and moderate to high levels of involvement in the coordination program. They included all the interviewees that were publicly engaged in weed management. These interviewees had a favourable attitude towards a coordinated approach to controlling serrated tussock; making statements such as...

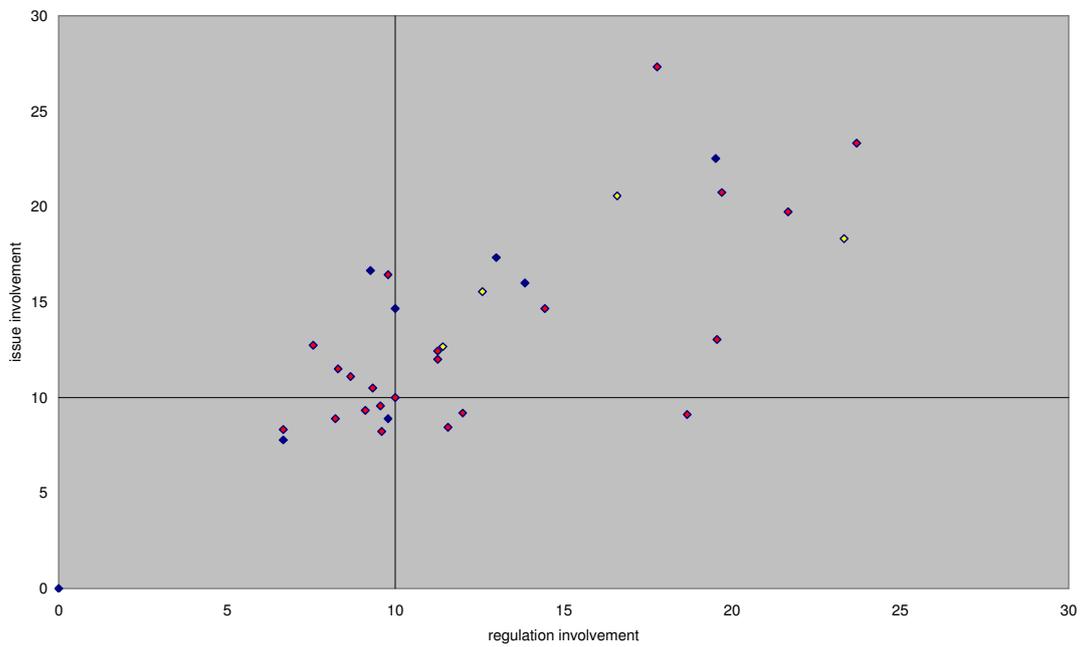
*'We need a community response'*

*'It would make me feel that the community was on board'*



**Figure 9:** Issue and coordination involvement for serrated tussock

Note: Red denotes interviewees with serrated tussock, yellow those at risk of infestation



**Figure 10:** Issue and regulation involvement for serrated tussock

Note: Red denotes interviewees with serrated tussock, yellow those at risk of infestation

One interviewee with particularly high levels of involvement in preventing the spread of serrated tussock and in a coordinated program had experienced difficulties in managing serrated tussock due to the number and diverse nature of neighbouring landholders. This interviewee expressed a favourable attitude towards coordination.

Another interviewee with particularly high levels of involvement in preventing the spread of serrated tussock and in a coordinated program had an unfavourable attitude towards a coordinated program. This reflected their view that a coordinated program would be ineffective because absentee and residential landholders adjoining their property would be unlikely to participate in such a program.

Overall, there was consistency between interviewees' awareness and views about a coordinated program to control serrated tussock and their placement in the I<sub>3</sub> Response Framework based on their level of involvement. Interviewees that believed they were at little risk of serrated tussock infestation had relatively low levels of involvement with the issue of preventing serrated tussock and participating in a coordinated control program. Those with serrated tussock had higher levels of involvement but were concerned about the practicality of a coordinated program. Interviewees without serrated tussock who were concerned about the potential for infestation to occur on their properties had the highest levels of involvement and had favourable attitudes towards a coordinated program of control.

These results suggest that most interviewees had favourable attitudes towards a coordinated program of control for serrated tussock but participation could be heavily constrained by practical considerations.

### **Involvement with the issue and regulation of serrated tussock**

The scores for interviewee's level of involvement in preventing the spread of serrated tussock and their level of involvement in regulations to control serrated tussock were used to place interviewees in the I<sub>3</sub> Response Framework. The placement of interviewees in the Framework is shown in Figure 10.

Generally speaking, the interviewees exhibited a moderate to high level of involvement in the issue of preventing the spread of serrated tussock issue and in regulations for controlling serrated tussock.

Seven interviewees were placed in the lower left quadrant of the Framework indicating low involvement in preventing the spread of serrated tussock and in regulation. This location in the Framework leads us to predict that these interviewees have low to moderate involvement in the issue of preventing the spread of serrated tussock and in regulated control. These interviewees should have limited interest in, and knowledge about, regulations to prevent the spread of serrated tussock. Most of these interviewees felt that the spread of serrated tussock was under control or that they were not at risk of serrated tussock infestation. Interviewees stated...

*'You think serrated tussock management would be pretty straightforward'*

*"They're [serrated tussock] are not going to take over the world"*

None of these interviewees had had any experience with enforcement of pest plant regulations and most were not aware of the details of the relevant regulations. Interviewees stated...

*'Don't know what the [regulations] are, probably as long as trying [to control] you should be pretty right.'*

*'I would think we try our best, so if we got in trouble for not managing it 100 per cent I would be upset'*

Interviewees with serrated tussock were quite variable in their level of involvement with regulation. While most exhibited low to moderate involvement with regulation to control the spread of serrated tussock, a few exhibited high to very high levels of involvement. The interviewees that had very high levels of involvement in the issue of preventing the spread of serrated tussock and in regulation to control serrated tussock included all those that were publicly engaged in weed management.

We expected these interviewees would strong opinions on how to control serrated tussock, on regulation to control serrated tussock, and on how regulations should be enforced. For instance, some had unfavourable attitudes towards regulation; associated with unpleasant experiences with enforcement activities. These interviewees felt that the implementation of enforcement activities was poor. For example, they believed that regulations lacked the flexibility necessary to ensure proper management of weeds given the conditions on their property. They stated that they had been forced to undertake control activities at an inappropriate time due to a compliance request and that...

*'Even if you meet the requirements, you might not manage the weed'*

Another said...

*'Most of the people in the area have been hurt or treated badly by DPI'*

They explained that after spending a lot of money on controlling serrated tussock a new enforcement officer visited their property. Instead of recognising the work, the officer criticised them and began the next stage of the compliance process. The interviewee expressed their frustration, arguing...

*'...eradicating serrated tussock here is not realistic'*

A number of interviewees were uncomfortable or unhappy with the attitude of enforcement officers. Some mentioned that the force of the letter which is sent prior to inspection, as well as the attitude of enforcement officers, made them defensive and uncooperative even though they had controlled their serrated tussock.

Others mentioned that the high turnover of staff had caused a lack of historical understanding of properties, a lack of recognition of previous work and a need to re-educate new enforcement officers. These interviewees often expressed the opinion there was a lack of clear communication about the compliance process. For example:

*'The information DPI provides on compliance is not clear. For example, the date you need to comply by can be extended'*

Some interviewees with very high levels of involvement with regulation expressed favourable attitudes towards regulation; they were of the opinion that not enough enforcement was being done in their region, where the risk of infestation was high. They also argued that there was a failure to enforce regulations consistently across different land use activities. They believed that farmers were subject to inspections but neighbouring residential land owners were not.

Overall, there was consistency between interviewees' awareness and knowledge of pest plant regulations and enforcement activities and their placement in the I<sub>3</sub> Response Framework based on their level of involvement. Interviewees that believed they were unlikely to experience serrated tussock infestation had relatively low levels of involvement with preventing serrated tussock and regulation to control program. These interviewees had little knowledge of pest plant regulation. Interviewees with serrated tussock had higher levels of involvement with regulation. Interviewees with the highest levels of involvement with regulation had strong views on the design and implementation of regulations to control serrated tussock.

These results suggest that while most interviewees may be predisposed to comply with regulations, compliance would be strongly influenced by individual, practical considerations about the control of serrated tussock, and by the attitudes and behaviour of enforcement officers.

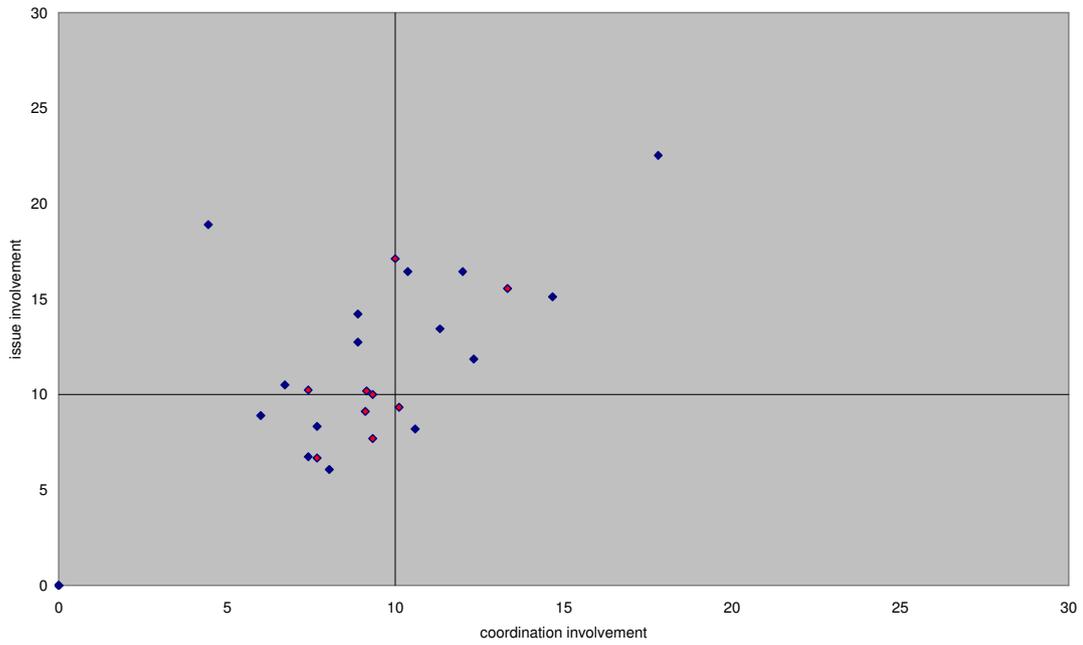
### **Issue and coordination involvement for blackberry**

The scores for interviewee's level of involvement in the issue of preventing the spread of blackberry and their level of involvement in coordination to control blackberry were used to place interviewees in the I<sub>3</sub> Response Framework. The placement of interviewees in the Framework is shown in Figure 11.

Generally speaking, the interviewees exhibited a low to moderate level of involvement in the issue of preventing the spread of blackberry and in the coordination program.

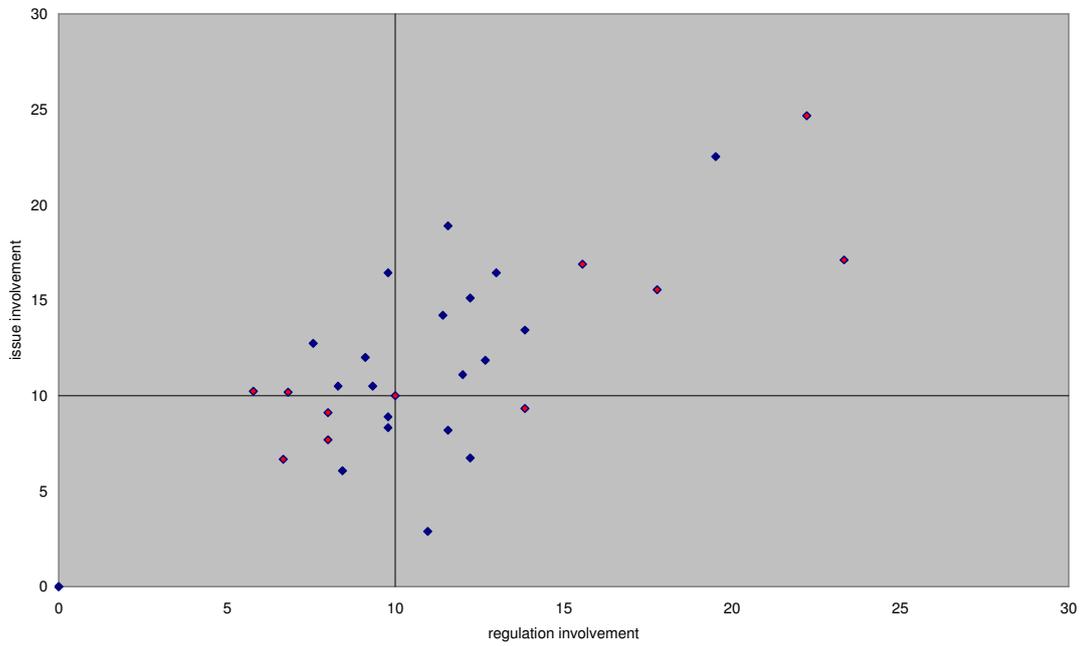
A number of interviewees were placed in the lower left quadrant of the Framework indicating low involvement in the issue of preventing the spread of blackberry and in the coordination program. Given this location in the Framework we predict that these interviewees would have limited knowledge about, and interest in participating in, a coordinated program. Most of these interviewees believed that blackberry would be, or was, easy to control compared with serrated tussock.

Some interviewees with moderate to high levels of involvement in the issue of preventing the spread of blackberry and in participating in a coordinated control program were placed in the top right quadrant of the Framework.



**Figure 11: Issue and coordination involvement for blackberry**

Note: Red denotes interviewees with blackberry



**Figure 12: Issue and regulation involvement for blackberry**

Note: Red denotes interviewees with blackberry

Given this location in the Framework we predict that these interviewees would be predisposed to participate in a coordinated program. These interviewees commented that there was value in coordinated control methods, but that a number of factors would need to be right for them to participate. For example:

*'The costs, timing and time availability can make coordination difficult'*

*'Farmers would need input into how it was run to make it more effective'*

*'Getting the right timing with farm operations is important'*

These results suggest that most interviewees might favour a coordinated program of control for blackberry but participation would be heavily influenced by practical considerations.

### **Issue and regulation involvement for blackberry**

The scores for interviewee's level of involvement in the issue of preventing the spread of blackberry and their level of involvement in regulations to control serrated tussock were used to place interviewees in the I<sub>3</sub> Response Framework. The placement of interviewees in the Framework is shown in Figure 12.

Generally speaking, the interviewees exhibited a moderate level of involvement in the issue of preventing the spread of serrated tussock issue and moderate involvement with regulations to control blackberry.

A number of interviewees with low involvement in the issue of preventing the spread of blackberry and in regulation were placed in the lower quadrants of the Framework. Given this location in the Framework we predict that these interviewees would have little knowledge about, and may even be unaware of, regulations in regard to blackberries. Importantly, we predict that landholders in these quadrants might not be strongly motivated to comply with regulations. For example:

*'Don't want DPI coming here and telling me how to get rid of weeds'*

*'Regulations [are] of little importance. I would be getting rid of it for myself'*

Some interviewees with high involvement in preventing the spread of blackberry and in the regulated control of blackberry were placed in the top right quadrant of the Framework. One of these interviewees was heavily engaged in community activity on weed control. A second interviewee, who faced unusual challenges with controlling blackberry, expressed a very unfavourable attitude towards regulation because they believed the regulations did not adequately allow for their circumstances.

These results suggest that while most interviewees may be predisposed to comply with regulations, compliance would be strongly influenced by individual circumstances, and by the attitudes and behaviour of enforcement officers.

## 5. Discussion

One objective for this study was to develop scales for quantifying landholders' motivation to control weeds, specifically serrated tussock and blackberry, with a view that such scales could be employed to understand and predict the compliance behaviour of landholders using a model of compliance behaviour for landholders proposed by Kaine *et al.* (2010). The correspondence between the quantitative and qualitative results obtained from the interviews indicates that the scales have merit as a means of reliably measuring the source and intensity of involvement of landholders in policy issues and program interventions.

Generally speaking, the statistical reliability of the scales was satisfactory. The reliability of some scales was unsatisfactory in some instances. A systematic pattern was not evident in the instances where reliability was unsatisfactory. This suggests that the meanings of statements can be changed unpredictably by the specific context in which they are being used. This means that it may not be possible to develop a standard phrasing for all the statements in each scale. If this is the case, this would add somewhat to the effort and cost of applying the I<sub>3</sub> Response model.

A second objective for this study was to suggest how the implementation of the Community Weeds Model might be supported for serrated tussock and blackberry. Generally, the results indicate the involvement of interviewees in the issue of preventing the spread of serrated tussock and blackberry was moderate to high. Their involvement in with a coordinated program, or regulations, to control the spread of serrated tussock and blackberry tended to be low to moderate. These results have the following implications.

First, the moderate to high involvement in the issue of preventing the spread of serrated tussock and blackberry suggests that interviewees will have a favourable attitude towards controlling these weeds and will be predisposed to participate in coordinated control programs and to comply with regulations.

Second, the high involvement of interviewees in the issue of preventing the spread of serrated tussock and blackberry means they will have devoted time effort to considering measures to control these weeds. Consequently, we predict they will have well-developed opinions about how best to control these weeds, especially if the weeds are present on their properties. This will influence their readiness to participate in coordinated programs and to comply with regulations. If the views of landholders about control measures, and when they should be implemented, are different from those of the Department then landholders will be less likely to participate in a coordinated program, or comply with regulations about which control measures should be used and when. Given the views of landholders are well-established because their involvement in the issue of preventing the spread of serrated tussock and blackberry is high, it would be difficult to change their views.

The involvement profiles of interviewees were generally consistent with the proposition that landholders see themselves as experienced in weed management and therefore rightly confident in their views on the control of serrated tussock and blackberry. We obtained high scores on risk consequence but low scores on risk

probability for most interviewees suggesting they recognised the serious consequences of not managing the spread of these weeds but they were confident in their ability to control the weeds.

This is consistent with earlier studies such as University of Ballarat (2001, 48) which found that:

*‘Most landowners believe they are knowledgeable and capable of making the decision on when and how to control weeds’*

This suggests that to maximise participation and compliance then coordination programs and regulations should be designed and administered with as much flexibility as possible in order to accommodate differences in landholders’ views and circumstances.

Third, the high involvement of landholders in the issue of preventing the spread of serrated tussock and blackberry means they will have devoted considerable time and effort to measures to control these weeds. This effort will be tempered by their perception of the threat that an infestation poses for them and their livelihood, and by labour and other constraints. This means landholders are more than likely to assume that they are complying with regulations because the control activities they implement limits the infestations to a practical level they can tolerate. Given this assumption, landholders may not be motivated to become familiar with the regulations. In short, landholders may assume that, because they keep infestations to tolerable levels, they are probably complying with regulations.

And with Lourey *et al.* (2006, 5) who found that:

*‘Generally landholders’ approach to pest management was not driven by the ‘threat’ of prosecution.... Meeting pest obligations was more about good management rather than the threat of prosecution’.*

Unfortunately, since there may be a difference in the level of infestation that government allows, and the levels of infestation landholders may tolerate, landholders may only coincidentally be compliant, and unaware that they are non-compliant despite their control activities. This suggests that enforcement policies and procedures need to be sensitive to the possibility that landholders may be uninformed about their precise obligations in regard to weed control but are likely to believe that in keeping infestations to a tolerable and practical threshold for their farm business, they are meeting their obligations. As Lourey *et al* (2006, 12) stated:

*‘[If] landholders believe they are acting faithfully given their pest management priorities and their resource constraints, increasing the rate of prosecutions may not alter compliance rates at all. Increasing the rate of prosecutions may even be counter-productive if landholders begin to believe they are being treated unfairly relative to the rest of the community.’*

Fourth, and following from the preceding points, landholders are likely to react unfavourably to efforts to enforce regulations prescribing what or when control

activities should be undertaken if such prescriptions do not align with their opinions as to which control activities will work best, and when, given their farm circumstance. This means enforcement officers need to be sensitive to the knowledge and opinions of landholders and the constraints under which they operate. Officers should seek to accommodate landholders' knowledge, opinions and constraints as much as possible when enforcing regulations. To do otherwise is likely to undermine the willingness of landholders to comply with regulations.

This is consistent with the following observations interviewees made about enforcement:

- The lack of continuity in authorised officer personnel meant personnel did not have an understanding of historical context and consequently interviewees were forced to repeatedly communicate information
- A confrontational attitude from officers as well as in print communications provoked a defensiveness in interviewees
- There was a lack of flexibility in prescribed compliance measures (e.g. in response to weather factors, long term strategy for weed control)
- There was an unfair focus on farming compared to other landowners such as absentee and residential landholders.

Fifth, the high involvement of landholders in the issue of preventing the spread of serrated tussock and blackberry means that there will be landholders that are willing to participate in decision-making about control activities through mechanisms such as community weeds groups. Indeed, the interviewees in the sample that recorded the highest levels of involvement were, or had been, members of community weed groups or similar bodies.

As described above, such landholders are likely to have devoted considerable time and effort to developing views about the issue and control activities, and see themselves as having expertise. This means these landholders will expect to have influence on decisions about the design and implementation of control programs. In other words, they will expect to be included in decisions about strategic and operational matters, and so expect to have some influence over the allocation of program funds and other resources. This is consistent with interviewees' favourable observations on the employment of an extension officer directly by the Serrated Tussock Working Party. The employment of this officer gave the Party control of some funds and the manner in which the officer conducted their activities.

If these expectations are not met then these landholders are likely, at best, to become disillusioned and resign. The more involved in the issue the more likely they are to become outspoken critics of government policy and programs, and seek to influence policy and programs by other means; such as the political process.

The sixth implication we will consider concerns landholder responsiveness to community-led weed control programs. To reiterate, the high involvement of interviewees in the issue of preventing the spread of serrated tussock and blackberry means that they will be predisposed to control blackberry and serrated tussock. The

University of Ballarat (2001) also found that a cooperative approach that involves consideration of the landholders' circumstance and ability to undertake control measures would be preferred by them, and would be more effective than threats and ultimatums.

However, the average score for the social antecedent of involvement was low. This means that pressures to conform to social norms are unlikely to strongly influence landholders' willingness to undertake control activities, and coordinate their activities with the activities of others. This suggests that involving community members in efforts to promote activities are unlikely to succeed because of pressure to conform to social norms. Rather, landholders may be more responsive to the efforts of community members because those members are more likely to appreciate the context within which landholders operate and be sensitive to the costs that changing the timing of control activities may impose. This is consistent with Lourey *et al.* (2006, 4) who found

*'landholders were generally only concerned with pest management activities occurring outside their property if they perceived them to be a source of infestation on their land or if they believed other landholders were being treated differently by government'.*

Finally, there was a high correlation in the involvement of interviewees in the issue of preventing the spread of serrated tussock and in preventing the spread of blackberry. This suggests that involvement in the issue of preventing the spread of weeds may be generally high. This has the implication that landholders are likely to be predisposed participate in the control of most weeds. It also suggests that community-led control programs, such as the Community Weeds Model, could be extended to other weeds.

The correspondence between interviewees' scores on the intensity of involvement, and interviewees' participation in community activities concerning weed control suggests scale scores could be used to assess the likelihood that landholders could be successfully recruited to participate in the Community Weeds Model.

However, involvement in preventing the spread of blackberry and serrated tussock, and in the coordination and regulation, varied both in source and intensity among the interviewees in our small, limited sample. This suggests that involvement in preventing the spread of a particular weed is likely to vary markedly across landholders. This means that the potential to establish new Community Weed Models, and their effectiveness, will vary depending on the proportion of landholders that exhibit high involvement with that issue of preventing the spread of the weed of interest.

In principle, the methods that have been applied here could be used to assess the extent of landholder support for a management program; and identify landholders that may be willing to be involved in developing and implementing weed control programs.

## 6. Conclusion

In this study we employed a model of compliance behaviour for landholders proposed by Kaine *et al.* (2010) to investigate landholder attitudes to weed control as an issue, and their attitudes towards two different policy measures – regulation and voluntary coordination. The objectives of the study were: (i) to develop scales for quantifying landholders' motivation to control weeds, specifically serrated tussock and blackberry; and (ii) suggest how the implementation of the Community Weeds Model might be supported for serrated tussock and blackberry.

Scales to measure each the five antecedents of involvement were constructed based on Laurent and Kapferer (1985). A questionnaire containing the scales was designed and administered to 34 Victorian landholders by personal interview at a location chosen by the landholder, usually their property. Two interviewers were present at most interviews which provided a means for comparing and checking interpretations of responses to the open-ended questions.

The following are the key findings from our analysis.

First, the correspondence between the quantitative and qualitative results obtained from the interviews indicates that the scales have merit as a means of reliably measuring the source and intensity of involvement of landholders in policy issues and program interventions.

Second, landholder involvement in the issue of preventing the spread of weeds may be generally high. This has the implication that landholders are likely to be predisposed participate in the control of most weeds. It also suggests that community-led control programs, such as the Community Weeds Model, could be extended to other weeds. However, involvement in preventing the spread of a particular weed is likely to vary markedly across landholders. This means that the potential to establish new Community Weed Models, and their effectiveness, will vary depending on the proportion of landholders that exhibit high involvement with that issue of preventing the spread of the weed of interest.

Third, scale scores could be used to assess the potential to establish the Community Weeds Model for other weeds. In principle, the methods that have been applied here could be used to assess the extent of landholder support for a management program; and identify landholders that may be willing to be involved in developing and implementing weed control programs.

Fourth, landholders are likely to be predisposed to participate in coordinated control programs and to comply with regulations efforts to prevent the spread of blackberry and serrated tussock. However, the success of coordinated programs and regulations will depend critically on the extent to which these are designed and administered with as much flexibility as possible in order to accommodate differences in landholders' knowledge, expertise and circumstances.

Fifth, enforcement policies and procedures need to be sensitive to the possibility that landholders may be uninformed about their precise obligations in regard to weed control but are likely to believe that in keeping infestations to a tolerable and

practical threshold for their farm business, they are meeting their obligations. In these circumstances aggressive efforts to enforce regulations are likely to be counter-productive, especially as landholders are likely to react unfavourably to efforts to enforce regulations prescribing what or when control activities should be undertaken if such prescriptions do not align with their views as to which control activities will work best, and when, given their farm circumstance.

Sixth, landholders that are willing to participate in decision-making about control activities through mechanisms such as community weeds groups will expect to have influence on decisions about the design and implementation of control programs. They will expect to have some influence over the allocation of program funds and other resources. If these expectations are not met then these landholders are likely, at best, to become disillusioned and resign. The more highly involved are likely to become outspoken critics of government policy and programs, and seek to influence policy and programs by other means; such as the political process.

Finally, pressures to conform to social norms are unlikely to strongly influence landholders' willingness to undertake weed control activities, and coordinate their activities with the activities of others. If landholders are more responsive to the efforts of community-led programs it is because those members are more likely to appreciate the context within which landholders operate, and be sensitive to the costs that changing the timing of control activities may impose.

These findings are based on analyses of a survey of a small sample of landholders. Consequently, the extent to which they can be generalised to all Victorian primary producers, and to other weeds, is unclear. The surveying of a larger, statistically representative sample of producers would be required to confidently draw conclusions about all primary producers.

## 7. References

- Aldenderfer, M. S. and R. K. Blashfield (1984) *Cluster Analysis*, Sage, Newbury Park
- Assael, H. (1998) *Consumer Behaviour and Marketing Action*, South Western College Publishing, Cincinnati
- Braithwaite, V. (1995) Games of Engagement: Postures within the Regulatory Community, *Law & Policy*, vol. 17 (3), pp. 225–255
- Carmines, E. G. and R. A. Zeller (1979) *Reliability and Validity Assessment*, Sage, Newbury Park
- Department of Primary Industries (2011a) Invasive plant classification. Viewed at [\[http://new.dpi.vic.gov.au/agriculture/pests-diseases-and-weeds/weeds/invasive-plants\]](http://new.dpi.vic.gov.au/agriculture/pests-diseases-and-weeds/weeds/invasive-plants) on 27/06/11
- Department of Primary Industries (2011b). Serrated tussock. Viewed at <http://new.dpi.vic.gov.au/agriculture/pests-diseases-and-weeds/weeds/other-declared-weeds/serrated-tussock> on 27/06/11
- Department of Sustainability and Environment and Department of Primary Industries (2004a) *Fact Sheet: Serrated Tussock*. Department of Sustainability, Melbourne
- Department of Sustainability and Environment (DSE) and Department of Primary Industries (2004b) *Fact Sheet: Blackberry (Rubus fruticosus aggregate)* Department of Sustainability and Environment, Melbourne
- Derbaix, C. and P. Vanden Abeele (1985) 'Consumer inferences and consumer preferences: The status of cognition and consciousness in consumer behaviour theory,' *International Journal of Research in Marketing*, vol. 2, pp. 157–174
- Gossum, P. V., B. Arts and K Verheyen (2010) 'From "smart regulation" to "regulatory arrangements"', *Policy Sciences* vol. 43, pp. 245–261
- Kaine, G. (2008) *The Adoption of Agricultural Innovations* Unpublished doctoral thesis, University of New England, Armidale
- Kaine G, Murdoch H, Lourey R and D Bewsell (2010) A framework for understanding individual response to regulation, *Food Policy*, vol. 35, pp. 531–53

- Lourey, R. Kaine, G. and Murdoch, H. (2006) *Understanding private landholders' decisions about pest management*, Victorian Department of Primary Industries, Tatura
- Laurent, G., and J-N. Kapferer (1985) 'Measuring consumer involvement profiles,' *Journal of Marketing Research*, vol. 22, pp. 41–53
- Mittal, B. and M. Lee (1989) 'A causal model of consumer involvement,' *Journal of Economic Psychology*, vol. 10, pp. 363–389
- Murdoch, H., Bewsell D., Lourey R. and G. Kaine (2006) 'Understanding people's response to biosecurity regulation', paper presented to *New Zealand Society for Risk Management Inc: Decision Making in Uncertain Time, 3rd National Conference on Risk Management, Auckland*
- Raetz, S., Campbell, J. Roberts, J. and Roberts, K. (2009) *Supporting Community-led Action on Pests through Voluntary Compliance*, Department of Primary Industries, Melbourne
- Rothschild, M. L. (1984), "Perspectives On Involvement: Current Problems And Future Directions", in *Advances in Consumer Research Volume 11*, pp: 216–217
- Tabachnick, B. G. and L. S. Fidell (1989) *Using Multivariate Statistics*, Harper and Row, New York
- University of Ballarat (2001) 'Report on the Effect of Prosecution under the CaLP Act on Changing Behaviours in the South West Region of the Department of Natural Resources and Environment', Department of Natural Resources and Environment, South West Region
- Zaichkowsky, J. L. (1985) 'Measuring the involvement construct,' *The Journal of Consumer Research*, vol. 12, no. 3, pp. 341–352