AN EXAMINATION OF THE USE OF A HUMAN BEHAVIOUR MODEL FOR NATURAL RESOURCE POLICY DESIGN AND IMPLEMENTATION BY GOVERNMENT (CENTRAL AND REGIONAL) AGENCIES

A thesis submitted for the degree
of
Doctor of Philosophy in Management Systems
at
The University of Waikato
by
TERRY GRAHAM PARMINTER

The University of Waikato
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In academic articles a number of behaviour models from social psychology have been used to explain and predict human behaviour. One of those, the Theory of Reasoned Action (TRA) has a long history of use in research and application. It has been adapted to suit the needs of policy makers in human health, marketing, and education. Applications of the TRA have been reported to have achieved coefficients of determination for behaviour of on average, 53% in one study and 71% in another. Some of the modified models based upon the Theory such as the

Theory of Planned Behaviour, have in themselves been able to make additional contributions to peoples' understanding of how to explain and predict human behaviour in more complex situations. In this report, unless otherwise stated, references to the TRA are inclusive of all associated models, such as the Theory of Planned Behaviour.

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explanation increased to 10 – 17%. The results may have been lower than expected from other examples in the literature due to poorly specified measures of behaviour relative to the measures used for intentions.

When it came to estimating intentions (rather than the actual behaviours), the TRA variables in regression equations achieved coefficients of determination of 55 – 75% and these provided a measure of how well the underlying values, attitudes and beliefs could have given policy makers an understanding of peoples' behaviour. Comparing the beliefs of people with high and low intentions to perform the behaviours, clear differences have been identified that could have been the basis of policy strategies for behaviour change.

After analysing and considering these examples, this thesis has argued that the TRA could be used in the future to provide policy agencies with an increased level of understanding of human behaviour and so enable them to formulate policy interventions for achieving predictable levels of behaviour change.

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Chapter 1. Introduction

Natural resource policy in New Zealand has addressed environmental issues on private as well as publicly owned land. The focus upon private land has been necessary because over three quarters of the country's land area has been under private ownership including most of the lowland and coastal ecosystems.

Vegetation removal, destruction and modification has been an intrinsic part of the inhabitation of New Zealand since it was first colonised by early Polynesian pioneers in the 1300s. The pace of vegetation removal rapidly escalated with the arrival of European (pakeha) settlers in the 1800s. Legislation early last century by the New Zealand Government recognised that in the drive for economic development, vegetation unique to the country (such as kauri trees) could have been lost forever, so they introduced a government bill to establish the country's first national parks.

The ways that private landowners have affected natural resources has been the result of a range of factors, some unrelated to the environmental issues of public concern, but significant to landowners. To design policy interventions for encouraging voluntary changes in landowner practices, policy makers have had to try to understand how landowners' behaviours might have developed, been maintained and may have been able to be modified over time. The research objective for this study was to evaluate the potential contribution of the Theory of Reasoned Action model of human behaviour (including its later variants, such as the Theory of Planned Behaviour) to natural resource policy and how it might have been used to inform the design of environmental policy interventions. A social psychological model was developed and empirically tested in this research project to establish the potential application of such a model to assist policy makers to address the natural resource issues of concern.

Overall, this study has taken a positivist theoretical perspective to address environmental issues by seeking to identify cause and effect relationships in the data. However, it has also incorporated some constructivist methods such as focus groups and a cross-sectional survey to derive data through localised knowledge and experience.

The study has been carried out in five stages, each of which has been able to be aligned with the policy making process itself (Figure 1). In the first stage, the policy issue has been identified as the loss of indigenous vegetation on private land. The required human behaviour changes have also been identified and the stakeholders decided upon.

Those behaviours were:

1. To encourage rural landowners and farmers on private land to protect indigenous forest remnants

2. For rural landowners and farmers to plant riparian areas with indigenous vegetation

3. For rural landowners and farmers to establish woodlots of indigenous trees

The selection of a suitable topic for this study was a social and political process that involved negotiations with natural scientists, local authority staff and research investors (Chapter 1).

Also in the first stage of this project, a literature review (Chapter 2) was carried out into human behaviour and the underlying principles contained within the Theory of Reasoned Action. The review of the Theory of Reasoned Action has described its history since it was first published in the 1970s and especially included developments that had been made from applying the Theory over the last ten years. A similar review was undertaken into the policy making process and theoretical descriptions provided of policy decision making (Chapter 4). The review of policy theory considered a range of approaches to policy formulation associated with differing world-views and traditions; from economics to sociology. Those reviews established that very few policy interventions on natural resource issues in New Zealand have been based upon theoretical principles of human behaviour. The use of the Theory of Reasoned Action in policy making had the potential to improve policy analysis and design, evaluation and adaptation.

The methodological approach to this study has been contained in the chapters on research questions and methods (Chapters 4 and 5). The background material in those chapters, about survey methods and their analysis assisted the project design to ensure that appropriate levels of internal and external validity were reached.

In the second stage of this project, after the reviews and methodology had been established, a qualitative study was carried out with focus groups of landowners to obtain a generalised description of the decision making processes used by landowners for each of the practices being researched (Chapter 6). The qualitative study was especially important for providing an understanding of the behavioural context for each of the research topics and described the specific beliefs associated by landowners with each of the environmental practices. Salience and repetition were used to establish which concepts were significant in landowner decision making and those subsequently contributed to the third stage of the research, the quantitative parts of this study.

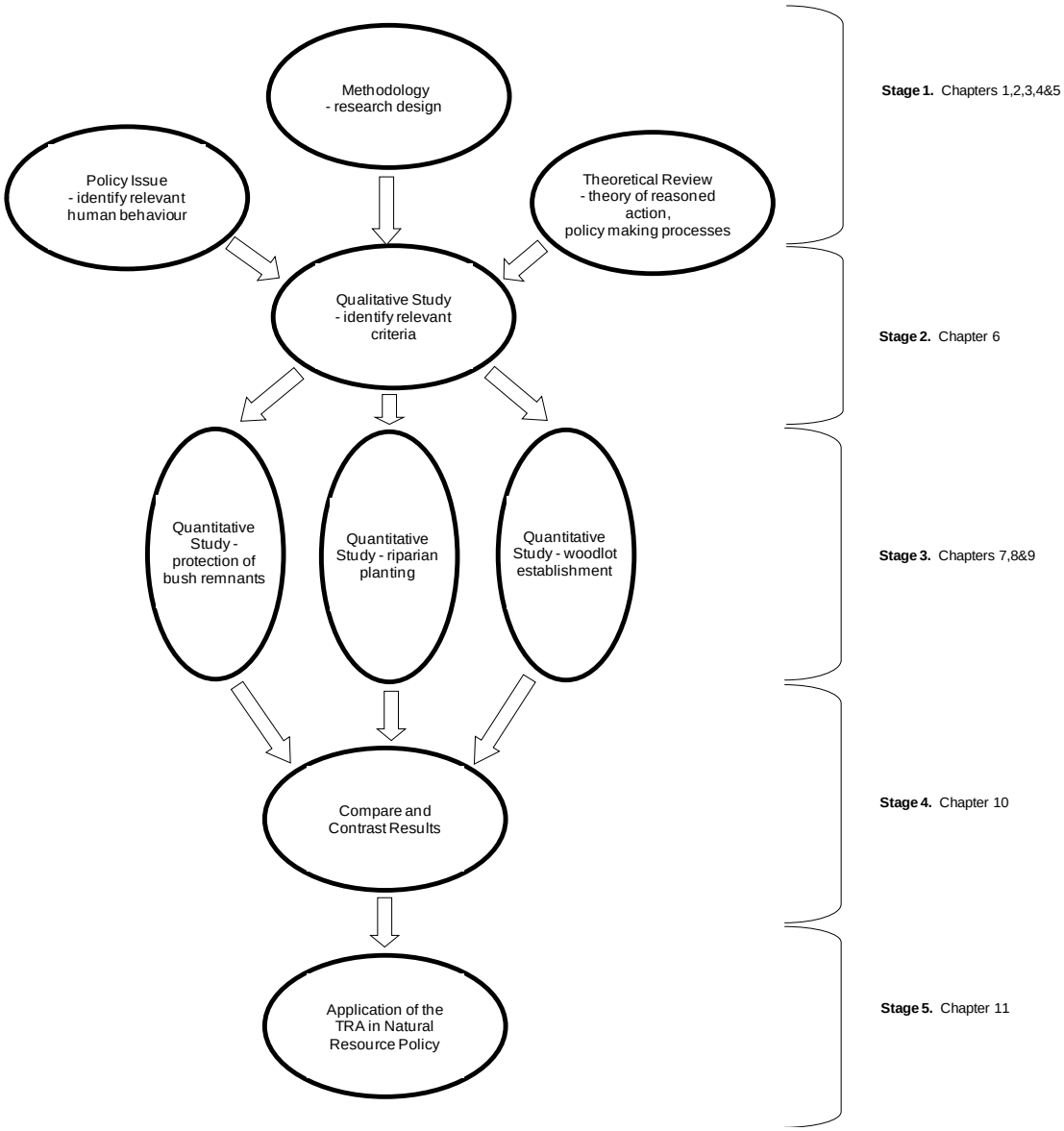
In the third stage, surveys of landowner behaviours were carried out and statistical analyses of hierarchical regression analyses were used to establish significant relationships and compare multi-variate models of human behaviour (Chapters 7, 8 and 9).

In the final stages of this study, the results were brought together and used to evaluate the five initial research questions for the project, along with additional learning and guidance for future users of the Theory of Reasoned Action to provide an interim conclusion (Chapter 10). Having considered their research application, in Chapter 11 the behavioural models have been applied to a policy example to draw out their implications in developing a regional policy statement for a particular region.

The strengths and weaknesses of applying the approach to policy making and any deficiencies apparent in carrying out this study have then been described along with future research opportunities (Chapter 12).

The appendixes contain background data to the main thesis and go from A to Q. In particular, they contain the questionnaires and supplementary results from Chapters 7-9.

Figure 1: An overview of the stages in the research programme on a human behaviour model for natural resource policy design and implementation



Chapter 2. Literature Review of the Theory of Reasoned Action (and its Variants)

Introduction to the Theory of Reasoned Action

An application of the Theory of Reasoned Action to environmental policy will have made the general assumption that the Theory could provide plausible models of landowners' environmental behaviour. Using the Theory of Reasoned Action (including variations such as the Theory of Planned Behaviour), policy agencies should therefore have been able to design and predict likely responses to policy intervention. A key component in the Theory has been the role of intentions or people's level of motivation to perform a behaviour. Thus, environmental behaviour has been assumed to be associated with peoples' intentions and their ability to act upon them. In turn, the Theory has indicated that intentions were expected to correlate with attitudes, norms, and perceived behavioural control and that in turn, those norms and attitudes were correlated with their indirect, belief-based components.

Other social cognition theories from psychology were also considered in this study prior to deciding upon the Theory of Reasoned Action. Those theories described how people's beliefs (their perceptions and representations) about their behaviour in a social and physical context, could provide the basis for understanding their behaviour. The earliest such model was the Health Belief Model (HBM), which was developed in the early 1950s in order to understand more about why people in the United States without any apparent symptoms, were avoiding the health screening programmes provided for their own well-being (Shumaker et al., 1998, p. 8). That model has now been widely used in health policy (Donovan and Henley, 2003, p. 92), but has been shown to lack generalised explanatory power and its procedures have not been sufficiently developed for its widespread operationalisation (Quine et al., 2000, p. 90).

Another model considered was Bandura's self-efficacy model (1977) where peoples' behaviour was understood to follow their desires to realise their outcome expectancies and their efficacy beliefs (Bandura, 2000, p. 306). That model again lacked generalised explanatory power due to having included a limited number of variables (ibid), but it has provided the concept of self-efficacy which has

subsequently been included in other models such as the more recent modifications to the Health Belief Model and the Theory of Reasoned Action (ibid).

An initial examination of the Theory of Reasoned Action suggested that it had been widely applied across a number of behavioural domains and that it was both sufficient and parsimonious for use in policy design (Ajzen and Fishbein, 1980, p. 91).

The purpose of the review in this study was to identify from the literature, an accepted and coherent description of the fundamental and operational theory forming the Theory of Reasoned Action, including the incorporation of a range of significant developments subsequent to its original inception. The Theory of Reasoned Action and the associated quantitative models have been featured in a number of social psychology publications since it was introduced by its main contenders (e.g., Fishbein, 1967, p. 478). Over the last 40 years it has undergone some changes in theory, model construction and applied interpretation. Beginning with the first substantive publication of the Theory of Reasoned Action (Fishbein and Ajzen, 1975, p. 301), this chapter has described its development in the social psychology literature and by accounting for its acknowledged strengths and limitations, has gone on to describe how the theory has now been applied to help increase understanding of social behaviour.

In a management systems study, it would not have been appropriate to utilise social psychology theories that were not going to be accepted by academics in that discipline. The use of the Theory in natural resource management has provided a novel context for it and so some modifications to standard practice might have been acceptable to cognitive social psychologists, as long as any adaptations could have been adequately justified in the academic literature. This chapter has provided background material so that both those objectives could be addressed.

The papers for the report were selected from English speaking journals in Europe, America, Asia and Australasia on social psychology, environmental behaviour, and human health, from journals that had been published since 2001 (inclusive). In those journals were almost 1,000 articles that included the Theory of Reasoned Action (TRA) in their titles and key words. A further 5,000 articles in the same publications included environment or agriculture in their titles and key words.

From the list, a number of papers were selected that fulfilled one or more of the following criteria:

- They were written by the Theory's originators – Ajzen and Fishbein
- They challenged the underlying theory behind the TRA and its model in a substantive way
- They developed new theory for applying the model
- They reviewed previous publications on the model
- They provided meta-analyses of the Theory or it's applications
- They applied the model in new and novel situations

To the amended and reduced list of articles was added additional material that appeared salient in the reviewed literature. In total, a final list of 359 articles was selected for the review (Table 1). A number of the articles (48) had been written by the main advocates of the Theory of Reasoned Action – Ajzen (19), Conner (10), Sheeran (8), Armitage (6) and Terry (5). They described the essential components of the Theory and how the Theory has been adapted to different applied contexts. The majority of the articles have been applied papers dealing with leisure and exercise (33), safe sex (42), food (20), cancer screening and health (79), smoking, alcohol and drug abuse (22), conservation (21), teaching, and information technology (3), and dishonesty (2).

History of the Theory of Reasoned Action

The Theory of Reasoned Action had its origins in attitude behavioural studies in the middle of the 20th Century (Ajzen and Fishbein, 1977). In those studies, attitudes were examined as a possible basis for explaining the processes of rational decision making as the direct antecedents of human behaviour (Aarts et al., 1998). Results from those studies have indicated that although attitudes tended to influence the overall pattern of a behaviour associated with a general attitude object (such as conservation), the relationship was highly variable when

applied to specific behaviours such as recycling paper (ibid). This has led to a widely quoted conclusion by Wicker (1969), "it is considerably more likely that attitudes will be unrelated or only slightly related to overt behaviours than that attitudes will be closely related to actions" (Sparks et al., 1995; Terry et al., 2000; Armitage and Connor, 2001).

Table 1: The TRA articles in the review (includes a range of associated models, such as the Theory of Reasoned Action)

Type of Article Reviewed	Number of Articles Reviewed
Narratives about TRA	3
Theoretical development	59
Review of theory	32
Review of applications	29
Meta-analyses – general	2
Meta-analyses – applications	3
Applied papers	229

A significant development in understanding the attitude-behaviour relationship has been the inclusion of 'intentions' as a mediating component, linking attitudes to behaviour (Sheeran et al., 2002; Fishbein and Ajzen, 1975, p. 292; Eagly and Chaiken, 1993, p. 168). Incorporating intentions has provided greater understanding about the influence of attitudes and a mechanism for integrating other psychological concepts into an overarching model of human behaviour – first as the Theory of Reasoned Action (TRA) and then as the Theory of Planned Behaviour (TPB). The TRA was developed as a model of volitional behaviour, for situations when people were able to act directly on their intentions without any apparent hindrance to their actions (Fishbein and Ajzen, 1975, p. 371). Volitional (i.e. voluntary) behaviour theory generally applied to simple actions such as product selection in a supermarket or deciding about whether or not to go for a swim while at the beach. In contrast, the TPB which evolved out of the TRA was

for behaviours that might have been constrained by a lack of behavioural control or implementation difficulties[1].

If a measure of the success of a model has been its longevity, then the TRA has been highly successful. It has been the fundamental model for explaining psychological influences upon social action for over 25 years (Bagozzi, 1992). During that time it has been adapted to a range of social issues from voting (Ajzen et al., 1982) to conservation tillage (Goddard, 1993, p. 5) and from household recycling in Europe (Taylor and Todd, 1995a) to condom use in Ghana (Bosompra, 2001). A number of other models have been developed from the Theory of Reasoned Action such as: the Theory of Trying (Bagozzi and Warshaw, 1990), and Triandis's Theory of Interpersonal Behaviour (Triandis, 1977), each of which introduced additional variables into the original TRA.

The following section describes the TRA and the models of human behaviour that it has been associated with and that provide for its operationalisation.

Description of the Theory of Reasoned Action and its Relationship with Understanding Human Behaviour for Designing Policy Interventions and Behavioural Change

The TRA has been one of a number of goal-directed human behaviour models that have relied on an expectancy-value relationship between the psychological processes of decision making and behaviour (Aarts et al., 1998). Early models that were based primarily upon attitudes had highly inconsistent relationships between attitudes and behaviour (Ajzen and Fishbein, 2000). In part, that may have been due to general attitudes having been used to predict specific actions, and in part it may have been the result of the complexity of the behaviours involved. Ajzen and Fishbein introduced the notion of intentions as the element linking attitudes with behaviour (Eagly and Chaiken, 1993, p. 168), it also enabled

[1] Unless otherwise stated in this report, any reference to the Theory of Reasoned Action (TRA) is used inclusive of the Theory of Planned Behaviour (TPB) and any other variants. The use of the initial theory as a label for all its subsequent behavioural models has been done to avoid creating possible confusion for readers by referring to a range of behavioural models all derived from the initial social psychology theory.

other psychological concepts to have been included along with attitudes (Fishbein and Ajzen, 1975, p. 344). Distinctively, the TRA has provided a model that has integrated behavioural beliefs using a range of recognised psychological concepts to represent the formation of peoples' intentions to act. The model has specified a role for attitudes, subjective norms, perceived behavioural control, and external variables as they have related to personality, age, gender and the effects of behavioural context (White et al., 1994). It has also been possible to add contributions from self-efficacy (Sheeran, 2002), social identity (Terry and Hogg, 1996), self-identity (Sparks et al., 1992), and past behaviour (Bagozzi, 1992).

The Theory of Reasoned Action has not described the processes relating to the length of time that it could take for intentions to have been turned into action, or the processes responsible for ensuring that any behaviour change was on-going (Mischel et al., 1996). The Theory has been a model of intention formation, rather than a model to explain the translation of intentions into action (Sheeran et al., 2001).

Behaviours have best been predicted in the TRA when they have been specified as observable acts in a specific time and place in order to achieve an established outcome (Sparks et al., 1995, p. 292, Ajzen and Fishbein, 1977, Fishbein and Ajzen, 1975, p. 297, Bentler and Speckart, 1979). Intentions and other model components have needed to have been similarly specified. The TRA was initially developed for explaining single actions (e.g., Fishbein and Ajzen, 1975, p. 369) that could have been performed concurrently with other activities in peoples' lives. In such cases, it has been used, and continued to have been used to compare the behavioural choices of different individuals.

When a behaviour has been of a general nature, or made up of a series of related, but not singular actions e.g. weed control on farms, the observable activity has been more difficult to specify. For example, condom use has been described as a behaviour (having high volitional control) for a man, but as a goal (with relatively low volitional control) for a woman (Chan and Fishbein in Sutton et al., 1999). In situations of non-specific behaviour, multiple act criteria or behavioural indexes, have been developed for generalising across actions (e.g., environmental behaviour; Carr and Tait, 1990, Goddard, 1993, p. 8). Using indexes created a better fitting explanatory model and has been preferred to developing a TRA

model around a generalised description of a behaviour (Eagly and Chaiken, 1993, p. 159). Despite that constraint on the TRA, in many situations the need has been for the TRA to have been applied to a general behaviour situation (Ajzen, 1988, p. 95), and sometimes that has been done directly with useful results (Sparks et al., 1997). In other situations (e.g. condom use) respondents have been asked to imagine themselves in a standardised scenario to limit their options for time, place, and context, and then they have been asked to answer a TRA questionnaire (Conner and Flesch, 2001).

In predictions of consumer behaviour relating to environmental issues, demographic variables have on their own been shown to be not as good as personality variables even though educational level and liberal ideology had some association with environmental concern (Aragon-Correa and Llorens-Montes, 1997). The TRA results above have suggested that predictions using personality variables have been improved by including psychometric variables in the analyses as well.

The TRA has also been used for choice behaviour, where people have selected between mutually exclusive options e.g. the type of transport to take them to work. If the model has been used to explain the results of people choosing between alternatives, then it seems to have been best analysed by comparing results from the same respondent rather than between respondents (i.e. by using within subject data rather than between subject data). A review of TRA work (Sheppard et al., 1988) has suggested that the presence of behavioural alternatives has strengthened rather than weakened TRA models. This may have been because it caused people to consider their options more carefully.

The TRA has been used in projects to predict human behaviour and alternatively, used to explain human behaviour. Predictive models on their own may have been useful for targeting policy interventions, whereas explanatory models have assisted policy agencies to also decide the nature and content of an intervention program (Sheeran, 2002). Explanatory models should have had wider implications and greater strategic value than a purely predictive model. Although prediction and explanation have not been the same, the first has been a necessary condition for the second. A model that could not provide a prediction of behaviour would have been unlikely to have been useful as an explanatory model

(Sutton, 1998). If the TRA had been used primarily to predict behaviour, then the determinants of the model would have not been especially important and nor would its specific causal processes (although a causal model could have assisted in selecting suitable predictor variables; Sheeran et al., 2002). In contrast, if the primary purpose has been to provide an explanation of human behaviour, then the determinants of intentions and behaviour would need to have been carefully identified along with specifying how they combined and influenced other variables and with the processes of their actions (ibid). With an explanatory model, prediction has become a means of confirming the degree of understanding that has been achieved.

A review by Ajzen found that applications of the TRA (including perceived behavioural control) to predict a range of behaviours achieved R^2 of 0.43 – 0.94 with an average of 0.71 (based upon 16 studies of eating, driving, exercise and leisure behaviours; Ajzen, 1991). Another study by Sheeran (2002) found correlations between behavioural intentions and behaviour of 0.47 – 0.82 with a weighted average of 0.53. To achieve satisfactory correlations between intentions and behaviour people were required to have a high degree of control over acting upon their intentions, and their intentions and behaviours needed to have been framed within the same time period (e.g., 12 months; Albarracin et al., 2001). With behaviours such as cancer screening (which has been given a correlation in one study of 0.03) that may have been difficult to achieve (Sheeran et al., 2002), with other behaviours such as illicit drug use it may have been more likely (such as a correlation between intention and behaviour of 0.84; Sheeran, 2002). The TRA may have been able to provide policy agencies with predictions about future behaviour (Smith and Biddle, 1990; Barker, 2001; Goldenhar and Connell, 1993) but the results would have been most reliably applied in conditions undifferentiated from the conditions under which peoples' intentions were originally collected.

Although the TRA was developed as a model of future behaviour it has sometimes been used to analyse past or current behaviour (Armitage and Connor, 2001, Schlegel et al., 1992). Research about future behaviour has required longitudinal studies and if self-reports were used then they were best supplemented and cross-validated by non-verbal measures (ibid; Ajzen and Driver, 1991, Hessing et al., 1988). Most TRA studies have relied upon self-

reported behaviour. Contemporaneous measures of behaviour undertaken in cross-sectional studies have been used to represent peoples' expression of 'past behaviour' and so have not really been suitable for TRA models that have been developed to represent future behaviour.

Self-reported behaviour has been vulnerable to self-presentational biases (Gaes et al., 1978) that might have added an additional 5% to behaviours that were socially desired (Beck and Ajzen, 1991). If the behaviour was complex, self-reports were also dependent upon how the measures of behaviour were interpreted by respondents and so should have been calibrated with observed measures before they were applied. In a study of food choice behaviour Armitage asked how strongly respondents agreed or disagreed with the statement that they had "eaten a low-fat diet in the last month" and the second question was about how frequently they had "eaten a low fat diet in the last month?" He found that the two separate measures of his target behaviour correlated only moderately ($r= -0.37$, $p<0.01$; Armitage and Connor, 1999a) although ostensibly they were measuring the same item. More recent studies have suggested that self-reports have been better predicted by the TRA than objective measures (Armitage and Connor, 1999b) and that may have been due to dissimilar definitions of the target behaviour affecting the intention-behaviour relationship (Conner et al., 1999). In some cases, people may have used their past behaviour as a basis for predicting their future behaviour (Albarracin et al., 2001), particularly where they have had limited insight into their own motivations for what might have determined their future actions (Albarracin et al., 2001; Beck and Ajzen, 1991). Extrapolating from past behaviour may have involved less cognitive work by respondents than generating fresh assessments of behavioural intentions and so provided them with a judgement heuristic for answering surveys in situations where their intentions were uncertain (Sutton et al., 1999).

The expression of some complex behaviours sometimes may have been dependent upon the completion of key instrumental acts linked to but not isomorphic with, the ultimate behaviour (Bagozzi, 1992). For example, purchasing fencing materials may have been required before a fence could have been erected by a farmer. If one or more preparatory behaviours linked intentions with the ultimate behaviour, then the preparatory behaviours could also have been used as alternative outcome measures (Bryan et al., 2002). This may have been useful

when the ultimate behaviour was less controllable than a preparatory behaviour or took place over a longer time period.

A number of studies have understood behavioural change as a two stage adoption process, from not adopting to adopting (Courneya et al., 2001). Some behaviours have been more likely to involve transitions through a series of stages (rather than just two), and at each of those stages a new intention may have been needed to have been formed before people could proceed on to the next stage (ibid). The Stages of Change model (SOC; Prochaska and Velicer, 1997) proposed five stages of change, related to the transtheoretical model of behavioural change (ibid) that reflected the temporal dimension of change in health behaviour and indicated a person's motivational readiness for change (ibid). In the first stage of the SOC model, *precontemplation*, individuals were not involved in the behaviour and had no intention of changing in the foreseeable future. In the *contemplation* stage, individuals had formed an intention to change in the near future but were still not performing the behaviour. In the third stage of *preparation*, individuals had an intention to take immediate action or had a detailed plan for taking action or had taken some initial steps towards behaviour change. The *action* stage was achieved when a behaviour had been changed to the target action. Once the behaviour had been maintained for some time, the person was considered to have been in the *maintenance* stage. When the TRA has been applied to modelling health behaviour through the SOC (Courneya et al., 2001), peoples' intentions and attitudes have been significant predictors of transitions at all stages. Subjective norms have been an additional factor for predicting transition from the precontemplation stage and perceived behavioural control from the contemplation stage. Social support has been an additional factor for predictions at the preparation and action stages.

In some studies, distinctions have been required to have been made about 'patterns of behaviour', or the frequency of performing a behaviour, as well as the 'stages of behaviour'. Attending a medical clinic for cancer screening tests regularly every twelve months could have been considered a pattern of behaviour rather than the performance of a behaviour. With patterns of behaviour there may have been differences between people who showed initial verses non-behaviour, and consistent verses regressed or delayed behaviour. In a study by Sheeren, Conner and Norman (2001) of patients attending a cervical cancer screening

programme, the TRA could not distinguish between initial, consistent, and delayed patterns of attendance. It was effective at discriminating between those that had never attended and those that had attended at least once, and the frequency of people's attendance when they did start going.

Relationship Between the Theory of Reasoned Action and Decision Making

Decision making has usually been described as comparing and making choices, with the most preferred alternative selected on the basis of their sets of attributes (Aarts et al., 1998, Sheppard et al., 1988). When people have been put under pressure to change their behaviour, they have been observed to assess the congruence of the changed behaviour with their goals, reconsider their level of ego-involvement, and then evaluate their level of resources (Bagozzi, 1992). The emotional response to their assessment has led to either problem focussed coping or emotion focussed coping (Lazarus, 1991, p. 39). It has been the deliberative cognitive strategies that people have taken to address problem solving that have been well represented by the TRA rather than the emotional responses of reconceptualising the sources of dissonance and their meaning (Terry et al., 2000, Bagozzi, 1992).

The precision of TRA predictions have been improved as respondents have become more experienced in their own lives with making the same sorts of choices over a number of occasions and when there have been no serious limitations in their ability to express their intentions (e.g. voting behaviour had intention-behaviour correlations of 0.75-0.80; Ajzen, 1991).

Ajzen and Fishbein (1980, p. 35) did not include the possibility of choice in their original development of the TRA model. That decision may have been appropriate for mutually exclusive options when selecting one alternative meant that other alternatives were no-longer possible (e.g. planting one area in trees would automatically have excluded it from other forms of landuse such as livestock grazing). Field studies have shown that in the presence of choices, people have tended to make more deliberate decisions and the results of the

quantitative TRA model may have actually been improved (Sheppard et al., 1988).

Ajzen and Fishbein (1980, p. 35) assumed that a person making a choice decision would have formed a different intention toward each alternative and that the dominant intention would have determined their behaviour, i.e. that there would have been a choice between intentions. Another suggested theory has been that people would have been guided by having different attitudes and other psychological predeterminants of intentions (Sheppard et al., 1988) and that those influenced the most likely intention being considered and so the subsequent behaviour.

It has been apparent that the latter theory has usually been the case and that people have not formed explicit intentions about each choice alternative. Instead, people have usually taken into account their attitudes, subjective norms, etc. towards all the alternatives available, although not necessarily in a formed choice process (Sheppard et al., 1988). When people have decided to realise a particular goal, the first stage of goal pursuit has been an appraisal of the means of achieving it. Their degree of self-efficacy has been considered with respect to the implementation requirements of each of the options. From that, people have formed their instrumental beliefs by making judgements about the likelihood that each of the means would have led to a goal's achievement. Finally, decision makers have considered the attractiveness (emotionally and ethically) of each means of achieving their goals. So, in that decision making process, people have started with an assessment of self-efficacy, then instrumental attitudes, and then their affective attitudes (Bagozzi, 1992).

Attitudes have been guided by the beliefs accessible in the context in which they have been expressed. Any change in the set of accessible beliefs or in the evaluations associated with them, has been found to lead to changes in attitude and generally behaviour (Ajzen and Fishbein, 2000).

For those behaviours that could have been specified with the necessary level of precision, the more favourable peoples' attitudes were towards them and the more positive their subjective norms, and the greater their perceived control over the behaviour, then the stronger their intentions were towards performing the behaviour. Those psychological influences, how they interacted, and how they

may have been measured, have been the focus of the rest of the chapter, starting with the components most significant in early developments of the Theory of Reasoned Action.

Intentions about Behaviour

Measurements of intentions have provided an assessment of how much people have been motivated to perform a particular behaviour (Eagly and Chaiken, 1993, p. 168). If people were sufficiently motivated and if they had adequate levels of control over exhibiting that behaviour, then they were likely to perform the desired action in order to achieve their behavioural goal (Bagozzi, 1992). If the behaviour was fully under volitional control, then intentions could often have been predicted from attitudinal beliefs, and normative beliefs (Armitage and Connor, 2001, figure 1). People's level of control contributed to their intentions and directly interacted with intentions to influence the expression of a behaviour (ibid).

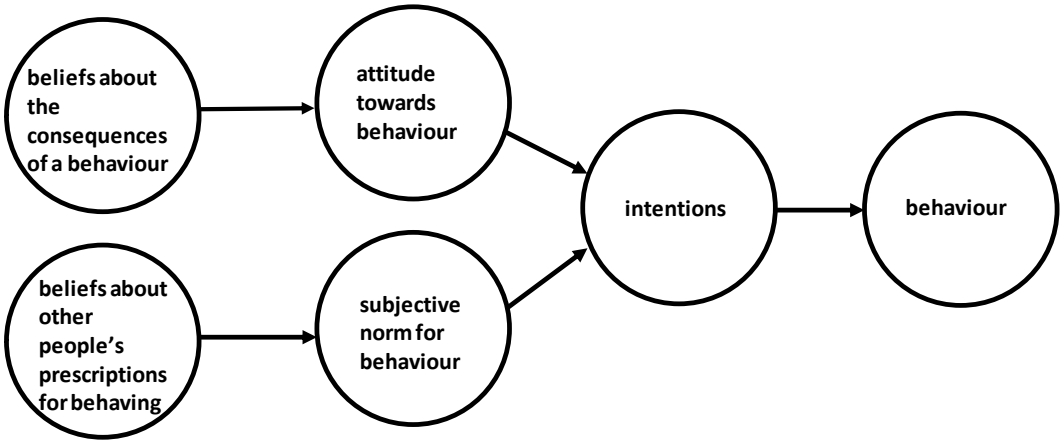
As well as the motivational phase during which decisions were made to perform a behaviour, there was likely to have been a volitional phase during which plans were made to implement intentions (Sheeran and Orbell, 2000). Present-orientated intentions have represented personal decisions to act immediately and future orientated intentions have been a commitment to act at some time in the future. Future orientated intentions may have been noncontingent (in which case they were a definite commitment to act in the future), or they may have been contingent (depending upon certain conditions having been present before the intentions were expressed).

In Figure 2, attitudes and subjective norms have provided global measures of people's 'beliefs about the consequences of a behaviour' and their 'beliefs about people's prescriptions for behaving' (Ajzen, 2002a). Intentions that have been formed from attitudes and subjective norms have been shown to be the direct antecedents of behaviour. If the level of control has been uncertain then a measure of control was also required along with intentions, before the behaviour was operationalised (ibid). Other global measures such as self-efficacy have not been included in the diagram for clarity sake but would follow the same form as

attitudes and subjective norms. Feedback interactions have also been left out for clarity. In general, intentions based upon attitudes have tended to predict the performance of everyday behaviours better than intentions based on subjective norms (Sheeran et al., 1999a).

Sheeran and Orbell (1999) proposed that anticipating regret about performing a behaviour might be required in order to commit people to their intentions. Therefore, people who both intended to perform a behaviour and anticipated considerable regret if they did not perform it, would exhibit greater consistency between their intentions and their behaviour, than people with equivalent intentions who had not anticipated any regret.

Figure 2: Representation of the Theory of Reasoned Action



Adapted from Eagly and Chaiken 1993, p179

One possibility could be that intention formation, self schemas and anticipated regret have affected the implementation of behavioural intentions by influencing their temporal stability, accessibility, or certainty. Previous research has indicated that intentions that were stable (Sheeran et al., 1999b), accessible in memory (Bassili, 1993; Bassili, 1995), or certain (Pieters and Verplanken, 1995; Bassili, 1993) were more likely to have been enacted. Anticipated regret may have bound people to their intentions so that they engaged in greater planning about when and how they would enact their intentions, increasing the likelihood of action (Sheeran and Taylor, 1999; Orbell et al., 1997; Sheeran and Orbell, 1999).

Other anticipated emotions that might have influenced intentions include anticipation of guilt and anger (Baron and Kenny, 1986) or embarrassment and pride (Simonson, 1989).

A prior determinant found to have motivated people into taking action on health issues has been if they regarded themselves susceptible to a specific condition, and if they believed that the condition could have had serious consequences for them. This has suggested another moderator of intentions that might have determined how close to intention formation implementation might have been and therefore how much inconsistency might have occurred between espoused intentions and practice (Strecher and Rosenstock, 1996).

According to Sheppard et al (1988), the main limitation of the TRA model has been that it has focussed upon behaviours rather than behavioural outcomes or events arising from behaviours. For example, the Theory might have helped people to understand the act of 'fencing off streams' to protect waterway banks, but it hasn't been able to assist people understand what had motivated landowners to keep sediment out of streams. That would have been the case even though the action of fencing may have been intended to reduce the amount of stream sediment. As a result of that gap, the model seems unlikely to have accounted for people who may have avoided performing a behaviour, even when a successful outcome seemed likely because the costs of outcome failure in terms of self-esteem, social approbation, time and resources, seemed to them too high (Sheppard et al., 1988).

Fishbein and Ajzen (1975, p. 372) assumed that generally people's concerns about outcomes would have little influence because people did not intend to perform behaviours that they considered would not work.

Other researchers have analysed their collected belief measures in a range of ways different from that proposed by Fishbein and Ajzen (1975) avoiding the need to determine intentions. Carr and Tait (1990) developed an index of conservation-mindedness, incorporating instrumental beliefs and normative beliefs. The index addressed attitudes towards the behavioural object ("conservation"), rather than the behaviour themselves. To avoid any conflicts in the analysis from non-corresponding beliefs, Ajzen and Fishbein (1980, p. 77) warned against taking such approaches that directly rated beliefs to behaviours.

Relationship of Intentions to Behaviour

In the TRA, intentions have been formed from the interactions of attitudes, subjective norms and control factors. Those interactions have been measured in empirical research studies but there have been (as yet) no theoretical guidelines on how they should have actually been determined. "The TRA contains an element of indeterminacy" – Bagozzi (1992). Bagozzi has described intentions as a reasoned assessment that a behaviour would have been advantageous, that the behaviour was socially desirable, and that people could take action on it themselves. Although the concept of intentions has been useful, Bagozzi felt that intentions required the subjective experience of desiring to take action before there would have been enough motivation for action.

A number of reasons have been suggested on why some TRA models have had a lower than expected predictive ability about certain behaviours (Sutton, 1998; Eagly and Chaiken, 1993, p. 177; Ajzen, 1991):

- Delayed time between measuring intentions and the behaviour measurement (Albarracin et al., 2001). In order to have used measures of intentions for predicting behaviour, both intentions and behavioural control needed to have been stable over time (Aarts et al., 1998; Ajzen, 2002a). Unstable intentions would have reduced behavioural correspondence (Conner et al., 2002; Sheeran and Taylor, 1999; Ajzen et al., 1996; Beck and Ajzen, 1991; Conner et al., 2000; Sheeran et al., 2001). The formation of simple plans congruent with people's expressed intentions to achieve a goal has provided a self-regulatory tool reinforcing its desirability and making the implementation of intentions fairly automatic when a specific context was encountered (Ajzen, 2001; Gollwitzer, 1996). If intentions have been unstable, then past behaviour has had a greater influence upon the intention-behaviour association than when intentions were more stable (Conner et al., 2000; Sheeran et al., 1999b). In longitudinal studies, intention stability has been able to be added as a moderating variable by multiplying intentions by behavioural-intentions-stability and also by including past behaviour multiplied by behavioural-intention-stability (Conner et al., 2002). Having definite plans for bringing together the resources required for implementation has helped to self-regulate actions leading to implementation.

Lack of experience with a behaviour has also been associated with less stable intentions (Sheeran et al., 2001; Kashima et al., 1993; Sheeran et al., 1999b). Stability of intentions seemed to have been important for respondents who were performing infrequent behaviours that were consciously controlled. If it was desired to make a break with a behaviour that was repeated frequently, then self-efficacy may have been important along with stable intentions to break the link with past behaviour. Sometimes intentions may have appeared to have been unstable if, when individuals were asked to predict their own future behaviour, they based their judgments on their recent behaviour, extrapolating from the past to the future.

- Behavioural contexts may have changed over time (Ajzen et al., 1996; Sutton, 1996). For example, when forming an intention to use a condom, a person may have failed to accurately predict the circumstances of their next sexual encounter (Sutton, 1998). Intentions measured at two different points in time (such as in a study relating to eating a low-fat diet) have been shown to predict behaviour independently of each other (Armitage and Connor, 1999b).

- Intentions may have been contrived by people responding to a questionnaire because they have not been in a position to actually engage in decisions for themselves. The more involved that people have been in making and planning their decision prior to responding to a questionnaire, the better the relationship between intentions and behaviour (Ajzen and Driver, 1992a; Beck and Ajzen, 1991).

- Violation of the principle of descriptive correspondence for compatibility (Sheeran et al., 2001). Attitudes will have been guided by beliefs accessible in the context in which the attitudes were expressed. Behaviours will then have been guided by the beliefs expressed in the context in which they were performed. Ajzen (1996) expected a strong attitude-behaviour relation only if the beliefs that were salient in the two contexts were the same or similar.

- Lack of scale correspondence between the different measures that have been used (Sheeran, 2002).

- Restricted respondent range or a lack of variance in intention or behaviour. This may have been the result of issues that have naturally polarised a population,

overestimating the results, e.g. genetic engineering (Small et al., 2002). Maybe only the people with very strong intentions have been prepared to respond to such surveys and so there has been an underestimate of the relationships involved e.g. greenhouse gases (Parminter and Wilson, 2003).

- Even if the number of categories used to measure both intentions and behaviour were the same, the marginal distributions of both of the measures would have needed to have been equal before it would have been theoretically possible to explain fully 100% of a behaviour (Sheeran, 2002).

- Low levels of behavioural control (Terry and Hogg, 1996), and differences between perceived behavioural control and actual behavioural control. If the actual level of control has matched peoples' perceptions of control then people could have been expected to have carried out their intentions when the opportunity first arose (Ajzen et al., 2000).

- Other factors that have been found to have mediated the intention-behaviour relationship have included peoples' intentions to act upon their declared intentions. The Health Belief Model (HBM) has integrated a number of possible factors that have previously been measured influencing peoples' preventative behaviours (Chew et al., 1998). These have included their perceived susceptibility about getting a disease or being harmed by a condition, and the perceived seriousness to them of the consequences of the disease or condition. The HBM has also included the presence of cues to action such as their physician's advice, an advertisement, or an article that triggers their readiness to apply preventative health behaviours.

- Random error measurement, often contributed to studies where researchers have only included single item measures of the main variables.

If all the factors influencing a behaviour have been accounted for and if all those factors have remained unchanged over time, then within measurement limits, behaviours would have been able to be predicted and past behaviour would have predicted future behaviour (Beck and Ajzen, 1991). In a meta-analysis of 185 studies carried out before 1998 using the TRA, Armitage and Conner (2001)

found that their analysis of self reported behaviour had an $R^2 = 0.31$ and objectively measured behaviour had an average $R^2 = 0.2$ ($p<0.01$). The latter result may have been the effect of people attempting a behaviour but then having not quite been successful.

Beliefs and Behaviour

People's beliefs have been the basic elements indirectly influencing their behaviour (Conner and Armitage, 1998). Peoples' beliefs have associated a particular behaviour to a range of possible consequences for them and that could have been instrumental, affective, normative, or performance related (Ajzen, 2002b, p. 214; Fishbein and Ajzen, 1975, p. 133). The sets of beliefs that people have held about an object has represented that object in their decision making (Aarts et al., 1998). Peoples' beliefs would have been formed automatically and subconsciously from information, experience, and inference (Ajzen and Fishbein, 2000; Fishbein and Ajzen, 1975, p. 133). As their beliefs have been formed, people have subjectively assigned to them a value in relation to the target object or behaviour result.

The range of beliefs that could have been formed about an object may have appeared to have been limitless, but only a few beliefs about an object (up to 8-9) would have been salient for an individual at any particular time (Ajzen and Driver, 1991; Miller, 1956). It was those salient beliefs that would have most influenced peoples' concurrent behaviour, and so have been of the greatest interest to researchers. Salience has usually been measured by belief accessibility, as the most accessible beliefs about an object have been expected to have been the most salient (Ajzen, 2002a). However, over time, the content and value of peoples' beliefs may have changed with changes in context and experience (Ajzen and Fishbein, 2000; Chew et al., 1998; Armitage and Connor, 1999b). Abstract beliefs associated with a behavioural goal i.e. its desirability, will have been more accessible the further away a person was from realising their goal. The concrete parts of a goal, such as its attainability, will have become more accessible as realising the goal was made more immediate. So the temporal distance between belief measurement and goal realisation will have influenced which beliefs were salient (Ajzen, 2001). Morality beliefs that have tended to have been more

abstract have been generally more accessible than technical beliefs about issues not of immediate concern to an individual (ibid). Beliefs have also become more salient in the evaluation of target objects the more often that individuals had previously accessed their beliefs about those objects (ibid). For instance, continued TV viewing of programmes related to a particular social issue (e.g. nutrition behaviour) has been found to improve efficacy, health motivation, salience, confidence in information, and behaviour (Chew et al., 1998). In the same studies, the salience of the issues was not found to have been mediated by any demographic measures (e.g. peoples' age).

In research about the behaviour of groups or populations of people, it has been common to develop a list of salient beliefs standardised to one population and associated with that one behaviour, rather than provide a different list for each individual. Such modally accessible beliefs have contrasted with, but needed to encompass, the personally accessible beliefs that have been unique to each participant (Ajzen, 2002b).

In a study about exercise behaviour, Blue and team (Blue et al., 2001) identified modal beliefs for a population of university labourers. They found that constructing the list of beliefs in that way provided them with a useful TRA model, but they expressed concern about their application of the results. Their TRA model was intended to assist with the design of interventions for increasing the amount of exercise that was undertaken by the participants. Blue concluded that it would have been particularly important that the beliefs used in similar research were specific to each person and the behaviour that was being studied, rather than using any general set of beliefs (Blue, 1995). That was not the view of Taylor (1995a) who sourced her beliefs from the innovations literature (such as Gillmore et al., 2002) and technology adoptions literature (e.g., Davies, 1979). Taylor felt that there was a need to establish a stable set of general beliefs relevant to the use of information technologies and that that was proving very difficult to achieve (Taylor and Todd, 1995b). In her mind, that need and its associated difficulties, was probably resulting in researchers developing their own behavioural models rather than continuing with the TRA (ibid). As described above, it has been intrinsic to most understanding of beliefs that they have been idiosyncratic to individual people and the situations in which they were making their decisions. Therefore, the development of generalised sets of beliefs across

both behaviours and populations was not expected by some researchers to have been possible. However, nor was it practically possible to carry out studies of populations of people at an individual level and so some process of developing modal beliefs for population segments has been required (Donovan and Henley, 2003, p. 213).

Although most researchers have not reported any difficulties with eliciting beliefs for their projects e.g. Christian and Armitage (2002) studying homeless people, or Conn, Tripp-Reimer, and Maas (2003) working with older women in a study about their exercise behaviour, a range of studies have highlighted that there have been variations between researchers of the same subject in the salient beliefs that they associated with their target behaviour (Ajzen and Driver, 1991). Some researchers have found it difficult to elicit beliefs for their projects (Beedell and Rehman, 1999; Budd, 1986) and in Beedell's experience it was, "not straight forward, was time consuming, and involved". Those variations in identified beliefs may have been able to be reduced by comparing the results of a number of approaches and selecting the most consistent beliefs from all of them (Ajzen and Driver, 1991). Alternatively, beliefs may have been identified with one group of decision makers, and then measured with another (Bagozzi, 1984).

If beliefs have provided the way that individuals expressed their uniqueness and organised their past experience so that it has been more accessible to them in future decision making, then direct psychological measures (such as attitudes) provided the way in which the common elements in peoples' beliefs could have been studied, understood, and applied to larger groups and populations.

People have formed their attitudes from the strength and the value of their most salient beliefs (the 'expectancy-value' principle). The influence upon attitudes of the strength with which an instrumental belief has been associated with an object, has been moderated by the evaluation of how much an individual's behaviour has been influenced by that belief (Ajzen, 1991). Similarly, the effects of normative beliefs and control beliefs has been moderated by peoples' desire to comply and the influence or power, of those beliefs respectively. The beliefs most influencing attitudes have tended to relate to the costs and disadvantages of a behaviour as well as its benefits and advantages (Conner et al., 1999). Beliefs underpinning subjective norms have been formed in relation to the social referents that would

have approved or disapproved of a behaviour. Control beliefs have related to the factors that may have made a behaviour more difficult to perform or that may have required the cooperation of others (Albarracin et al., 2001). Control beliefs have included internal factors resulting from a lack of information, skills, abilities, and emotions, and external factors such as a lack of opportunities, resources, and dependence upon others (Conner and Armitage, 1998).

Applying the principle of expectancy-value to belief sets (e.g. strength and evaluation), has meant that the influence of beliefs upon attitudes has been determined by the strength of their association with the attitude object in direct proportion to the subjective value of the given consequence or outcome of that belief (Armitage and Connor, 2001). Although it has been expected that attitudes would have been able to be predicted from their underlying beliefs, it has only proved to have been the case if both the beliefs and the attitudes had been expressed in the same context and point in time (Ajzen and Fishbein, 2000; Armitage and Connor, 1999b). Beliefs have generally provided an indirect measure of attitudes and so their expectancy-values should have been well correlated with direct measures of attitudes. Belief measures will generally have been less well correlated with intentions, which instead should have been more strongly correlated with direct attitude measurements (Sheeran and Taylor, 1999; Ajzen, 2002a). However some studies have found only low or moderate correlations between beliefs and attitudes (e.g. 0.25 for teenage sexual behaviour). Ajzen (1991) considered that those could have been the result of poorly selected beliefs or ill-fitting measurement scales.

The results of applying the expectancy-value process to the TRA has been very robust in predicting attitudes but it has been considered by some researchers to over-simplify the underlying decision making processes (Armitage and Connor, 1999b; Conner and Norman, 1996). Ajzen (Ajzen and Fishbein, 2000) has emphasised that he has not been proposing that people actually computed the expectancy-value relationships in their heads "but rather that the TRA was a model of the psychological processes that people used to take account of both belief strength and attribute evaluation". That has been considered further here in a later section on carrying out analyses using the TRA model.

Attitudes

Attitudes have been used as a measure of peoples' predisposition towards specific behaviours (Eagly and Chaiken, 1993, p. 2). These predispositions will have been formed as a result of people evaluating possible behaviours and their consequences (Ajzen and Fishbein, 1977; Beck and Ajzen, 1991; Eagly and Chaiken, 1993, p. 3). Most researchers have considered that attitudes have represented an internal state that has lasted for a short period of time to instigate and direct behaviour (Sparks et al., 1992). However, for some researchers, attitudes have only been a hypothetical construct created for carrying out exploratory research (Eagly and Chaiken, 1993, p. 7).

Early attitudinal research considered that attitudes were directly formed from information about an attitude object and it was expected that to change attitudes, people would have to have been provided with new and different information (Hovland et al., 1953, p. 8). That principle has now generally been accepted as having been over simplified (Ajzen and Driver, 1992a; Petty and Cacioppo, 1986). It has been replaced by an understanding that cognitions (or beliefs) have been the antecedent of attitudes and that attitudes have only been one of a number of influences upon human behaviour. So although attitudes may have influenced the overall pattern of responses to an object they could not have been used to predict any given action (Ajzen and Fishbein, 1977). In most studies subjective attitude strength has been assessed in terms of its importance, intensity, and certainty. Less useful have been measures using frequency of thinking or knowledge concerning an issue. Attitude strength has also been related to the extremity of an issue, people's vested interest, and their level of involvement (Ajzen, 2002a).

Researchers have found that the level of knowledge and expressed beliefs about a particular behaviour may have been positively consistent with that behaviour but that the behaviour still may not have actually happened (White et al., 1994). Similarly, numerous studies of attitude-behaviour relations have demonstrated that people's attitudes have often been incongruent with their behaviour (Fishbein and Ajzen, 1975, p. 291; Wicker, 1969). That has led researchers (such as Ajzen and Fishbein) to develop models incorporating other psychological precursors to

behaviour along with attitudes in order to better understand the influences operating on an individual's behavioural decision making.

Goal compatibility theory has suggested that people would have evaluated attitude objects in relation to their currently active goals (Ajzen, 2002a). When consistent links have been found between the information that people have held about an object and their attitude toward that object this has sometimes been construed to imply that people have only formed attitudes after consciously applying themselves to a comprehensive assessment of their behavioural options (Ajzen and Fishbein, 2000). The work of Ajzen (2001) has instead indicated that as beliefs have been formed about an attitude object, attitudes have emerged automatically from affect (moods, emotion and arousal; Ajzen and Fishbein, 2000) as well as cognition (Eagly and Chaiken, 1993, p. 11). When a person has responded to an object they have immediately drawn upon their spontaneously realised attitudes. That has been no different from people's ability to draw upon other forms of meaning when they have been confronted with familiar objects. It has only been when they were confronted with an unfamiliar attitudinal object that people have considered new information, or have addressed an issue that they have not thought through before. Then, people have had to engage in a conscious review of their relevant beliefs (Ajzen and Fishbein, 2000). Automatic processes such as object evaluation leading to attitude formation have been considered as unintentional because they have been outside of peoples' awareness and have not required an act of the will to initiate them. They could not have been made to stop and they were made effortlessly and efficiently without interfering with other cognitive processes (ibid). So, although some people have assumed that the TRA required a reasoning process for the model to have been predictive, the Theory was actually based upon people having 'reasonable' attitudes rather than necessarily having to have been 'reasoned' in their decision making (Ajzen and Fishbein, 1980, p. 5).

If an issue has had high personal relevance for the people who have been deeply involved in it, it will have increased their information processing, which will have strengthened their attitude. The considered and accessible beliefs of strong attitudes will have meant that they were more easily recalled and stable than weakly held attitudes (Ajzen, 2001, Ajzen and Fishbein, 2000). If an issue has had a low degree of personal relevance or seemed too complex for them to deal

with, then the processes of evaluation and attitude formation might have occurred even without people having been consciously aware of it taking place (Ajzen, 2001). That could have been through peripheral modes of information processing (Ajzen and Driver, 1992b, Petty and Cacioppo, 1986). Weakly held attitudes may not have been very accessible to people and may not have been very closely linked to their behaviour.

People may take a shorter length of time to evaluate a behavioural option than to think of all its possible consequences for them and so people's beliefs may initially not be fully understood even by them; although their attitudes might have been already clear (Bassili and Roy, 1998). Thinking of the consequences first, has been shown to speed up evaluation and attitude formation, but evaluating a behavioural option has only speeded up thinking about the consequences for strongly held attitudes, not weak ones (Ajzen, 2001).

Broad socio-political attitudes have been quite stable over extended periods of time. However a number of contextual factors at the time of measurement may have been able to affect the strength of attitudes expressed by modifying the accessibility of the beliefs as well as their number, their strength, and their evaluative implications (Ajzen and Fishbein, 2000).

People have been known to hold two different attitudes towards a given object in the same context. One attitude may have been implicit or habitual, and the other explicit. Which attitude has been expressed has depended upon the context and the relevance of the issue. If a person has been motivated enough and has had the capacity to do so, then they would have been more likely to express the explicit attitude ahead of the implicit one (Ajzen, 2001).

People with univalent attitudes have shown consistency between their affect and cognitive evaluations and both affect and cognition have contributed strongly and equally to their intentions. Food behaviours may have been one that has encouraged ambivalent attitudes. On the one hand it may have been considered sensorially nice, on the other it may have involved increasing health risks (Sparks et al., 1992).

Compared with univalent attitudes, people with ambivalent attitudes have been shown to have an opposite tendency, e.g. they may had positive feelings towards

an object but associated it with negative characteristics. When they have been ambivalent, peoples' feelings have tended to have been the primary influence upon their actions (Lavine et al., 1988). Some people may have been more likely to have been ambivalent because they tended to have been "feelers" rather than "thinkers" (Haddock and Zanna, 1998). Some attitude objects may also have been more likely to engender affect rather than cognition (Kempf, 1999). Studies with different levels of ambivalence have suggested that people with high levels of ambivalence have had lower correlations between attitudes and intentions than people with low levels of ambivalence or univalence (Sparks et al., 1992). There have been important implications for interventions based upon attitudinal research because to encourage positive attitudes toward behaviour change amongst people who have ambivalent attitudes required interventions based on direct experience to provide positive affects (e.g., Tanner and Pollock, 1988). If people have had univalent attitudes they have been more likely to respond to persuasive communications that have attempted to alter beliefs about the consequences of a behaviour (cognition).

Beliefs have provided indirect measures of attitudes, although some studies have included beliefs that have been only moderately correlated with attitudes (0.25 in Krahe and Reiss, 1995; 0.38 in Agnew, 1998). Those findings have suggested that attitudes and beliefs about behavioural consequences have not always been equivalent constructs (Ajzen, 1991). One possible reason why behavioural beliefs could have had small correlations with attitudes has been that the attitude measures could have captured both affective (i.e., feeling, e.g., 'using a condom would make me feel good/bad") and cognitive (i.e., utilitarian; e.g., "using a condom would a good/bad thing to do") components of attitudes, whereas beliefs have captured only the cognitive component (Sheeran and Taylor, 1999), although not always (Breckler and Wiggins, 1989).

As a result of attitudes having been formed from beliefs, any change in the set of accessible beliefs available to people, or in the evaluations associated with them, leads to changes in attitude. Attitudes have been developed and kept evolving as existing beliefs have changed and new beliefs have been formed (Ajzen and Fishbein, 2000). Experience, information and inference, all have affected people's beliefs; however, if new information has largely been negative it has

been shown to have had a greater impact upon overall evaluations than the comparable positive information (Ajzen, 2001).

If there have been no disruptions to beliefs over time, people's attitudes that may initially have been positive will have been likely to have become more favourable and those attitudes that might have been initially negative have been more likely to have become more unfavourable (Ajzen et al., 2000). That may have happened when thinking about attitude objects has strengthened people's existing beliefs and made their attitude-consistent beliefs more accessible. Such results can occur when peoples' existing attitudes have meant that they were more likely to have biased information processing and memory in favour of incorporating more attitude-consistent material (Ajzen, 2001).

Attitudes have been able to be assessed, as they have been in the TRA, using belief measures. Although Ajzen and Fishbein have favoured the use of globally defined beliefs to determine attitudes, other researchers (e.g., Budd, 1986) have preferred people to select the most salient beliefs from a global list and then they have calculated more personal measures of their attitudes.

A number of contextual factors such as people's mood at the time of measurement have been shown to have affected their attitude measurements. If people have been asked to think about their attitudes and provide reasons about why they have held them, the extra effort has been able to distort their attitudinal judgements and has disrupted the relationships between their attitudes and their behaviour. Thinking about only positive outcomes has created more positive attitudes and the reverse has also applied (Ajzen, 2001). More commonly with mood changes, attitude differences may have been measured due to differences in the accessibility of people's beliefs - their number, their strength, and their evaluative implications, e.g. favourable beliefs about an attitude object have increased in likelihood under a positive mood. Survey construction that has encouraged selective scanning of past behaviour, directed thinking, and linguistic context, may all have influenced attitude measures. Sometimes that may have been due to the way that an attitude object was represented e.g. as gains or as losses (Ajzen and Fishbein, 2000). Questions may have been used to ascertain the degree of attitude variability and those could have been included as another variable in a study (Sparks et al., 1992).

Attitudes have only been used to predict behaviour to the extent that they have both been able to be related to the same underlying evaluative disposition. Therefore, the principles of compatibility and belief correspondence have applied (Ajzen, 2001). Compatibility implies that there has been a similar level of situational specificity for both the attitude and the associated behaviour. So that if a study was intended to assess the relationship with general attitudes towards an object it has needed to have included multiple-act measures (ibid). Belief correspondence has implied that both were associated with beliefs made salient in the same context (including time, action and target; Sparks et al., 1995). Attitudes needed to have been guided by the beliefs accessible in the context in which the attitudes were expressed and the behaviours needed to similarly have been consistent with the beliefs expressed in the context in which they were performed. No studies have examined directly whether attitude accessibility has mediated the effect of attitude strength on attitude-behaviour association (Doll and Ajzen, 1992). Carr (1990) felt that too much significance had been attached in many studies to farmers' statements about their attitudes without relating them to actual behaviours.

According to Fishbein and Ajzen (1975), the attitudinal and normative components of the Theory of Reasoned Action have been cognitively independent, based upon different sets of beliefs. Studies by Armitage (Armitage and Arden, 2002) have shown that repeated performance of pro-social behaviour has been able to decrease the relationship between attitude, intention and behaviour. If people belonged to a social group with a group norm congruent with their own attitude, then that social alignment should have strengthened their attitude-behaviour consistency because it validated the attitudinally congruent behaviour as appropriate for group members (Terry et al., 2000). The research by Terry et al. (ibid) has suggested that the amount of group influence upon the expression of attitudes depended upon whether people were high group-identifiers or low group-identifiers (when personal identity might have been more important).

If people who were high group-identifiers perceived their attitudes to have been consistent with the group norm, their intentions will have been strongly associated with their attitudes and perceived behavioural control will have had a lower level of influence. The reverse will have applied for people who were low group-

identifiers. The moderating effect of group norms on the consistency of attitude-behaviour relationships should have only applied if the norms have emanated from a self-inclusive membership group. If membership to a particular group has not provided the basis for someone's self-concept, then that group's norms should have had no impact on behavioural outcomes (Terry et al., 2000).

A possible model describing the influence of group norms has been that:

- A person's context may have suggested to them a particular social category to which they might have belonged

- That may have triggered typical attitudes, norms, feelings and behaviours that they associated with having been members of that group

- Those would have become a template for their selective perception and definition of a situation

- Attitudes and behaviours will then have tended to become consistent when they were normative for the salient ingroup, and inconsistent when the group was not salient in the behavioural context.

People with a strong sense of group membership generally will have taken action according to their attitudes and group norms, to reduce their own uncertainty about selecting a more appropriate response to an external pressure and to strengthen their own self-evaluation or self-esteem (Terry et al., 2000).

Bagozzi and Yi (1989) found that the degree of intention formation moderated the intention-behaviour and attitude-behaviour relationships. They considered that intentions were modified by another variable. The TRA has not suggested that attitudes influence intentions on their own, but that they were contingent upon there having been sufficient levels of social support, personal ability, and opportunity available. Bagozzi (1992) has been concerned that there was a lack of theory on the degree of influence upon intentions of all of those variables, leaving it to empirical studies to determine the likely combination required. Bagozzi's concerns have been that the relationship between attitudes and intentions has been unclear. He suggested that with positive attitudes and social norms people may

still not have formed intentions because they had no subjective 'desire' (or motivation) to act. Their desires might have been appetite desires to consume things (and so not subject to reason) or volitive desires based upon reasons and encompassing a motivational commitment. Bagozzi (1992) has suggested that attitudes had the effect of stimulating a volitive desire or freeing up an appetitive desire, and that those desires determined intentions. Ajzen addressed some of the concerns of Bagozzi by including perceptions of behavioural control in a later version of the TRA. Perceived behavioural control could have been used to mediate the effects of attitude and subjective norms upon intentions and also intentions upon behaviour. Bryan (Bryan et al., 2002) in a study of teenage sexual behaviour found that their attitudes and norms were sufficient to predict their intentions, but to predict behaviour, perceived behavioural control needed to have been included. A similar situation existed for predicting the sexual behaviour of university students except that perceived behavioural control contributed to their intentions but not their behaviours.

The TRA started out as an attitude measure, and generally evaluating intentions based upon attitudes has predicted the performance of everyday behaviours better than calculating intentions based on only either subjective norms or perceived behavioural control (Ajzen, 2001; Sheeran et al., 1999a).

Subjective Norms

Subjective norms have been used to describe the pressure that people have felt to conform their behaviour to the expectations of other people important to them (Ajzen and Driver, 1991). There have been three main contexts within which people have experienced subjective norms (Bagozzi, 1992). In some situations people may have considered themselves relatively independent agents and were unaware of any links to people significant to themselves and independent of any other interconnections. In other situations, people have been highly aware of the inter-relationships operating within the groups to which they belonged. They have taken into account the possible expectations of multiple actors relating to their interconnected roles and meanings. In other situations, people have been part of formal organisations with formal relationships related to structures and decision making influence (ibid). People high in the subjective norm component

have appeared to have had low control over a behaviour which has been consistent with them having an external (rather than internal) locus of control (Sideridis, 2001).

Implicit in Fishbein and Ajzen's (1975) conceptualization of subjective norms has been a social influence process through which people conformed to the behavioural expectations of others to the extent that those specific others were valued and important. The underlying influence process has probably been one of conscious or subconscious observation leading to public compliance, based on a need for social approval and acceptance (Terry and Hogg, 1996).

As people have defined themselves in terms of a social group and learnt the stereotypic norms of the group, they have assimilated those norms with themselves and, as a consequence, their attitudes and behaviour has agreed more and more with the in-group norms. Those norms have included perceptions about the referent group's general attitude toward performing a behaviour (group attitude) and their expectations that significant others in the group will have performed the behaviour themselves (behavioural norm). The more a person identified with the referent group, the greater the vested interest that they had in behaving consistently with perceived group attitudes and norms (White et al., 1994).

The impact of group norms on behaviour has depended on the extent to which group membership has been a salient basis for self-conception. If people considered that their attitudes and their social referent group norms were similar, their behaviour has been more highly consistent with their attitudes. If their attitudes and their social referent group norms have been different, then attitude-behaviour inconsistency may have resulted, as they sought to gain social validation for their behaviour. (Terry et al., 2000) Comparisons by Terry (1996) of regression analyses between low and high group identifiers have shown that only high group identifiers have had a big influence from group norms. Low identifiers had more influence from perceived behaviour control.

If people belonging to a minority group have been distinctive from other social groups around them, their awareness of subjective norms has been more heightened (Armitage and Arden, 2002). "It seems likely that when behaviour has significant social implications, such as the potential to gain or lose social

relationships by participating or withdrawing from social settings, normative and identity considerations may be particularly relevant" (ibid).

Descriptions of people's norms have been personal, descriptive or injunctive. Personal norms have been those norms that people have used to define and evaluate themselves as part of their self inclusive categories (Turner et al., 1987, p. 42). Descriptive norms have been the norms that people have been observed to have been following. Injunctive norms have been the norms that people have thought that they ought to observe. For some researchers, Ajzen's concept of subjective norms combined all three types of norms (e.g., Armitage and Connor, 2001). Other researchers have considered that the concept only related to injunctive norms because it was only when people were pressured by norms that it was included in the Theory (Sheeran and Orbell, 1999; Terry et al., 2000).

Subjective norms have motivated behaviour through the possibility of gaining approval or disapproval from significant others for a person's intentions and actions. The behaviour of significant others has motivated people by demonstrating the expected or normal thing to do, and what was likely to have been an acceptable decision. In TRA models, descriptive norms have been represented by the attitudes that a person's peers might have towards a behaviour and their actual level of use of that behaviour (Sheeran and Taylor, 1999).

In results reported by Sheeran (1999) the influence of descriptive and injunctive norms have been contrasted in littering behaviour experiments where descriptive norms were manipulated by comparing people's behaviour on littered versus clean areas, and injunctive norms were manipulated by letting people observe someone picking up litter or not picking up litter. Both types of norms have been shown to have had effects on participants' litter behaviour, but injunctive norms appeared to have been more powerful than descriptive norms. Importantly, subjective norms influenced littering behaviour when descriptive norms have been kept constant, and descriptive norms have influenced littering when subjective norms have been kept constant, supporting the view that they were distinct sources of social influence. The effects of subjective norms and descriptive norms have been shown in a number of other studies to have independent affects upon behaviour and Sheeran suggests that both should have been included in TRA models (Sheeran and Taylor, 1999, White et al., 1994).

By restricting it to a pressure-reaction relationship Ajzen's original concept of subjective norms seems to have neglected the social processes that people have used to co-ordinate their activities with others including any emotional links to other people and their ways of behaving (Bagozzi, 1992). When people have coordinated their behaviour together as part of a social group, it has involved adjusting relationships of cooperation, competition, and conflict so that they didn't just react to any specific pressures that may have become apparent to them. People's adjustments have taken into account their own expectations and feelings as well as those of significant others, around the shared social and moral meaning behind behaving in particular ways (Bagozzi, 1992).

A well developed sense of self-identity has helped people with their personal norms and some studies have shown that self-identity provided more explanatory power in predicting intentions than did attitudes and subjective norms (Armitage and Connor, 1999b). It has appeared useful to consider self-identity in conjunction with other normative influences, to assess how large such differences might have been (ibid).

Fishbein and Ajzen (1975) considered that the process involving subjective norms in decision making has been similar to attitude formation and the input of other TRA variables. In behaviour models, subjective norms have been expected to have been correlated with, but independent of attitudes. In a number of studies one of the expected consequences of performing a behaviour has included 'pleasing others'. That consequence or belief has then contributed to the attitudes that people have held about that particular behaviour (Terry et al., 2000; Fishbein and Ajzen, 1975, p. 304). A link like that has indicated that there may have been some crossovers between attitudes and social norms (Terry et al., 2000), although if it was assumed that subjective norms and attitudes were correlated but conceptually independent, such a link could still have been consistent with Fishbein and Ajzen (1975).

Social identity theory has provided a general theory of group processes and relationship formation (Hogg and Abrams 1988 in Terry et al., 2000). Establishing social identity has involved two processes. One process has been a process of categorisation that has enabled people to distinguish between those people that belonged to an in-group (including self) and those who didn't (the out-

group). The second has been a process of self enhancement by which people have acted to favour the behaviours and norms of the in-group over the out-group (ibid).

It has been suggested by Terry, drawing upon research of Abrams and Hogg (1990) and Turner (1991), that there has been a single process of social influence relating group norms to attitude formation and expression (ibid). According to Terry, when social identity was salient, people have constructed beliefs and attitudes that minimised their in-group differences and maximised intergroup differences. Particular contexts have provided triggers with associated groups and their group norms. As long as an association has previously been made, a particular set of norms will have continued to determine peoples' behaviour through a pathway that combined the influence of attitudes with those of subjective norms. Behaviour intentions may not have been enacted by people unless they became critical to their in-group position. Therefore, it has not been that people have been seeking social approval, or had been directly influenced by what others have been saying or watching, but rather that in certain contexts, group membership has provided the dominate basis that determined their self-definition and reduced their level of social uncertainty.

In some studies, subjective norms have appeared to have had little or no significant ability to predict intentions – for some people, they may have been "the weakest link" in the Theory (Conn et al., 2003; Terry et al., 1999; Armitage and Connor, 1999b; Terry and Hogg, 1996; Sparks et al., 1992; Sheeran and Orbell, 1999; Armitage and Connor, 2001). Steadman (2002) was concerned that if subjective norms were not well defined they might have contributed to the poor relationships that she found between intentions and breast screening behaviour. A global measure of subjective norms based upon a person's significant referents in many cases may not have been discriminatory enough to have indicated the actual normative pressures operating in a person's life (Sparks et al., 1992). For instance a global measure that indicated little influence from subjective norms could have been the result of a person with weak interpersonal connections or could have resulted from strong contradictory external influences that might have cancelled each other out (Taylor and Todd, 1995a). Maybe subjective norms have had little influence upon intentions for behaviours that were expected to have little effect upon other people and social relationships (Terry and Hogg, 1996)?

People don't seem to have been very good judges of the social norms that have influenced them. Giving people feedback about how other people important to them have participated in a behaviour might have assisted them to have been more conscious of social norms. For instance, with young people, safe-sex and condom use, a person's existing partner and prospective new partners have usually provided the key referents whose norms influenced likely use of condoms. To assist at-risk young people, interventions that increased their self esteem and self-efficacy have been effective at reducing their desire to conform to the expectations of others.

Like attitudes, subjective norms have been based on people's beliefs, but in that case about the extent to which particular others wanted them to perform a behaviour (Terry and Hogg, 1996). Subjective norms have represented the norms that people perceived referents would have wanted them to comply with and their desire to have met the expectations of those referents (Ajzen, 1991).

Perceived Behavioural Control

A number of authors have expressed concern that people could have a positive attitude towards a behaviour but still have not acted upon it (Bagozzi 1992; Sheeran et al., 2002; Liska, 1984). It has been possible that people might have had no opportunity to express the behaviour or they might have lacked some essential ability, or they might have considered the means of carrying it out to have been noxious or immoral. The relationship between behavioural intentions and actual behaviour has appeared stronger when levels of perceived behavioural control have been high, rather than when they have been low (Armitage and Connor, 2001; Ajzen and Madden, 1986; Terry and O'Leary, 1995). If there has been complete volitional control over a behaviour, then the intention-behaviour relationship has been optimal and it has been unlikely that there would have been any influence from any other factor. However, if a behaviour has not been under complete volitional control, then the level of control appeared to have moderated the relationship between people's intentions and their behaviour (Ajzen, 1991; Armitage and Connor, 2001). For instance, in a study amongst senior doctors (who had high perceived and actual behavioural control) their perceived behavioural control was shown not to influence their predicted intentions to

request autopsies. In contrast, junior doctors who had low perceived behavioural control and low actual control, showed that perceived behavioural control was a significant predictor of intentions and their behaviour (Armitage and Connor, 2001). Eagly and Chaiken (1993, p. 189) have suggested that perceived behavioural control should only have been related to intentions for positively evaluated behaviours. If a behaviour has been negatively evaluated, then having greater behavioural control would have led to lower intentions for people to engage in the behaviour. Armitage (1999b) also has found that lower control led to more frequent expression of negatively evaluated behaviour.

People who increased their perceptions of control in dealing with a situation have strengthened the relationships between their intentions and performing the behaviour. Given sufficient actual control, people have been expected to carry out their intentions fully (Conner and Armitage, 1998; Eagly and Chaiken, 1993, p. 188; Sparks et al., 1992). For people that have had realistic judgements about their behaviour, their perceptions of control could have served as a proxy for actual control (Ajzen and Fishbein, 2000; Ajzen, 2001). Perceptions of control have been based upon past experience, second hand information, and the experience of others (Ajzen, 1991). People with high levels of perceived control have felt that they were able, capable and confident about implementing their intentions (Armitage et al., 2002), i.e., it reflected the ease or difficulty of performing a task (Sparks et al., 1997; Beck and Ajzen, 1991).

Goden and Kok (1996) found perceived behaviour control accounted for 41% of variance in intentions in 76 applications of the TRA. Intentions and perceived behavioural control accounted for 34% of variance in behaviours in 35 applications. The average additional variance in intentions over and above attitudes and subjective norms attributable to perceived behavioural control was 13%. Similarly, meta-analyses by Sheeran and Taylor (1999) and Armitage and Conner (2001) found that after other TRA variables had been taken into account, perceived behavioural control contributed increments of 5% and 6%, in the explanation of variance in intentions and behaviour respectively (Sheeran et al., 2002).

Comparisons of regression analyses between low and high group identifiers has identified that only high group identifiers have been strongly influenced by group

norms. Low identifiers have been more influenced by perceived behavioural control (Terry and Hogg, 1996).

When it was introduced into the literature, perceived behavioural control was conceptualised to encompass both internal control factors such as personal skills, familiarity, knowledge, inconvenience, abilities, emotions, time to think about it (rumination), other priorities, relative size of the problem, adequate planning and will power; as well as external control factors such as suitable operating conditions, availability of other people, and availability of resources (time and cost; Conner and Flesch, 2001; Armitage and Connor, 1999b; Aarts et al., 1998; Sparks et al., 1997). Although social support was not generally considered a part of perceived behavioural control, it could have been important for behaviours such as exercising where people often have had difficulty attempting to initiate and maintain the intended behaviour change (Courneya et al., 2001). When people have had high levels of perceived behavioural control they have felt capable and confident with their own abilities, they have been able to overcome inhibiting factors and they have been able to facilitate their behaviour (Armitage et al., 2002; Armitage and Connor, 1999a). Such factors have provided the elements needed for measuring behavioural control beliefs and when combined with a measure of their perceived power to inhibit or facilitate performance of that behaviour, they have provided an indirect assessment of perceived behavioural control (Ajzen, 1991; Conner et al., 1999).

Perceived behavioural control has contributed to intentions directly along with attitudes and subjective norms, and indirectly as a moderator of intentions upon behaviour. Its direct contribution has been based upon the assumption that if a person has had doubts about the extent to which a behaviour was controllable, then that person would have been unlikely to have been motivated to perform the behaviour. The direct effect of perceived behavioural control on actual behaviour has therefore been mediated via its effect on intentions. In the second role for perceived behavioural control, the performance of a behaviour has been dependent upon intentions and also on the extent to which no actual barriers have been encountered when the behaviour was implemented. In that role, perceived behavioural control has been used as a proxy measure for actual control. For Ajzen (Ajzen and Madden, 1986), that second role has only had a direct effect on behaviour when the behaviour has not been completely under a person's volitional

control, and when the measure of perceived behavioural control has been an accurate reflection of the degree of actual control that the person has had over performing the behaviour.

Typically, questionnaire items on perceived behavioural control have included an assessment of people's perceptions of how much control they had over whether they performed a behaviour (a measure of perceived control), as well as their assessments of how easy or difficult it would have been for them to do so (their efficacy expectancies; Terry and O'Leary, 1995). Some respondents in surveys haven't identified themselves with having a low level of control, and especially if they have had moderate to high intentions (Sheeran, 2002). There may have been an element of social desirability in the way that such people have responded, since it might have been interpreted that not being able to control one's behaviour was a sign of weakness. It could also have been that some people were just optimists when it came to their assessment about the extent to which performing behaviours was under their voluntary control (Towler and Shepherd, 1992). If survey respondents have had inaccurate perceptions of control they would have tended to reduce the ability of the model to predict their behaviour but it shouldn't have affected the model's ability to predict intentions (Beck and Ajzen, 1991).

As an alternative to perceived behavioural control, it has been suggested that familiarity with a behaviour could have had a significant moderating effect upon intentions. Findings in the expert-novice literature (e.g., Albarracin et al., 2001) has indicated that experts have had a greater awareness of the difficulties of performing a behaviour and have had less optimistic estimates of perceived behavioural control (Sheeran et al., 2002). Most researchers have not really considered that to have been a sufficient alternative to perceived behavioural control but it has been a reflection that practice has been able to increase people's self-confidence in being able to determine their own performance (Albarracin et al., 2001).

Armitage (Armitage and Connor, 1999b) has compared perceived behavioural control focussed upon external control factors with the external locus of control concept of Bandura (1982). However, Ajzen considered that the locus of control concept was a personality attribute generalised across situations and actions and not specific to particular behaviours (Ajzen and Driver, 1991). Ajzen felt that

people could have had an internal locus of control, but in a particular situation still not have felt that they had a high perceived behavioural control (Ajzen, 1991). It was therefore, not suitable for adding to the general TRA (Ajzen, 2002b).

Perceived behavioural control has sometimes been taken to mean control over the attainment of the outcome of people's behaviour, but that was not what was intended by Ajzen (1991). For instance, with a behaviour such as sitting an exam, the behaviour in itself has had little influence over whether a person passes their course or not (the outcome). Rather than outcomes, perceived behavioural control has always been restricted to the performance of an actual behaviour itself. In the example above, that would have meant sitting or not sitting the exam. That would have been consistent with the principle of 'descriptive correspondence' (Ajzen, 2002b).

Perceived behavioural control has been considered by Ajzen (2002b) to have included aspects similar to the 'barriers' included in the Health Belief Model (Strecher and Rosenstock, 1996) and to self-efficacy or beliefs that people had about their own capability to organise and execute courses of action to achieve given levels of attainment (Bandura, 1998, p. 624).

Although perceived behavioural control has been an essential component in the Theory's later developments (e.g., Ajzen, 1991), some researchers have still considered that there was a lack of clarity concerning how to interpret perceived behavioural control (Trafimow and Finlay, 2002; Armitage and Connor, 1999b; Terry and O'Leary, 1995). Ajzen (1991, Ajzen and Madden, 1986) described it as an estimate of both the extent to which a person thought that they could perform the behaviour as well as their self-efficacy. Sparks (1997) and Trafimow (2002) used perceived behavioural control to refer to the extent to which a behaviour was perceived to have been easy or difficult for a person to perform. Although Trafimow defended Ajzen's definition of perceived behavioural control; in his empirical studies, people have tended to cluster 'control' and 'difficulty' beliefs differently, reinforcing the idea that perceived behavioural control combines two quite different concepts (ibid). Other researchers have used the term 'perceived behavioural control' to refer to the extent to which a behavioural outcome could have been achieved, or a behaviour was under voluntary control, or the ease or

difficulty of performing the behaviour, and some have even restricted perceived behavioural control to only the external constraints on a behaviour (ibid).

As well as theoretical concerns about how to interpret perceived behavioural control, there have also operational difficulties reported (Terry and O'Leary, 1995). People have sometimes conceptualized the notions of control and difficulty in different ways and so have created problems for themselves with inter-item reliability. They have sometimes focussed more upon either the internal or external factors of control and when these were combined, found them confusing (Armitage and Connor, 1999a). For instance, if a person's performance of a behaviour had been limited by 'time'; would that have been due to their ability to organise time (internal), or the demands on their time made by others (external; ibid)? People that responded to perceived behavioural control questionnaires feeling that an action was either controllable or uncontrollable, could view control as a dichotomous issue, reducing its variance (Sparks et al., 1997). That has not occurred to the same extent with survey questions about 'difficulty' (Towler and Shepherd, 1992). For example, people have sometimes interpreted control in terms of its physical possibilities and have not also considered the social and affective difficulties that might have been associated with a course of action (Chan and Fishbein, 1993).

In general, people may have based their responses to questions asking them about their behavioural intentions on the assumption that the external environment would have already favoured the performance of the behaviour (Terry and O'Leary, 1995). In such cases, their perceptions of perceived behavioural control would have been likely to moderate the strength of the relationship between intentions and behaviour, because such perceptions reflected the extent to which people were able to enact their intentions.

Terry has supported the practice of splitting the two components of behavioural control into 'self-efficacy' and 'external control'. On the one hand, individuals could appraise the extent to which they had control over whether they performed the behaviour, while on the other hand, they could appraise the behaviour in terms of their capability of performing it (Terry and O'Leary, 1995). In Terry's definition of self-efficacy, it has referred to the internal constraints of a behaviour (i.e., confidence, skills and ability; Armitage and Connor, 1999b), a more specific

use of the term than Bandura (1977, 1982) who included external factors as well. Empirical support for separating internal and external control has been provided by factor analyses of questionnaire results that has shown them to have been two different constructs (Terry and O'Leary, 1995).

Although Terry has made a distinction in theory and operation between perceived behavioural control and self-efficacy (Terry and O'Leary, 1995), Sparks was not happy with Terry reconceptualising perceived behavioural control in that way (Sparks et al., 1997). Firstly, because it indicated to him that perceived behavioural control should have been used only for describing external influences without providing sufficient evidence to show why it should have been so restricted. Secondly, Sparks considered that it represented Bandura's concept of "outcome expectancies" as equivalent to perceived behavioural control, when it should have been more like behavioural beliefs. Thirdly, because the claim that the internal and external factors were intrinsically incompatible in the same concept seemed unjustified to him. And fourthly, because self-efficacy itself could have been measured a number of ways and so was applied no more consistently than perceived behavioural control (Gist and Mitchell, 1992; Lust et al., 1993).

Despite these concerns, a range of factor analytic techniques (e.g. confirmatory factor analysis, principal components analysis) have indicated that 'under my control-outside my control' and 'up to me-not up to me' items have all loaded on one factor, whereas items such as 'easy-difficult' and 'confident-unconfident' have tended to load on a second factor (Manstead and Eekelen, 1998; White et al., 1994; Sparks et al., 1997; Terry and O'Leary, 1995). A behaviour that has been deemed impossible to perform (i.e. had low perceived control) may have been very likely to also have been deemed difficult to perform (i.e. had high perceived difficulty). In contrast, a behaviour that has been deemed possible to perform (high perceived control) may also have been deemed easy or difficult to perform (high or low perceived difficulty). Therefore the relationship between perceived control and perceived difficulty may partially have been determined by the relevant role of the perceived control construct. The relationship between perceived control and perceived difficulty was likely to have been stronger for behaviours that have been low in perceived control, and may have been weaker for behaviours that have been high in perceived control (Trafimow and Finlay,

2002). Correlations between 'control', 'difficulty' and other variables has also seemed to have supported the distinction between those concepts (ibid). When studies showed measures of perceived difficulty and perceived control to have different levels of relationship with intentions and behaviours they further supported the validity of making a distinction between them (ibid).

In contrast to perceived behavioural control, self-efficacy should have influenced actual behaviour only through its effects on behavioural intentions without directly impacting upon an actual behaviour (Terry and O'Leary, 1995, Bandura, 1977).

Unconfounded with efficacy expectancies, a refined and separate measure of perceived behavioural control has been used to reflect the extent to which people have perceived that external factors could interfere with the performance of their behaviour. "That clearly improved the conceptual clarity of the Theory" as well as its operationalisation (in Terry and O'Leary, 1995, also see Smith and Biddle, 1990; and White et al., 1994).

Stable intentions (over time) seem to have been needed if people were to change an infrequently occurring behaviour. If intentions were stable, the stability of perceived behavioural control has been less important. If a behaviour has been performed frequently (and perhaps habitually), a stable perceived behavioural control has been needed to overcome the influence of past behaviour upon future behaviour (Conner et al., 2002). If perceived behavioural control has not been stable, then how a person has behaved in the past has been more likely to have determined how they might have behaved in the future (Conner et al., 2002; Sheeran and Taylor; 1999; Sheeran, 2002).

Measuring perceived behavioural control has sometimes been difficult. Even if people have been aware of events that could have prevented them from performing a behaviour, they have often had a poor ability to make global assessments of how that has affected their overall level of control. A planning index might have provided a more accurate estimate of actual control, to the extent that it assessed whether people had satisfied the necessary preconditions of performing a behaviour rather than requiring people to make global estimates of behavioural control e.g., for safe-sex behaviour, obtaining a condom or making an agreement with a partner to use a condom (Kashima et al., 1993). Studies

reviewed by White et al (1994) found that the extent to which a person has planned to perform a behaviour has had an impact upon both their behavioural intentions (Netemeyer and Burton, 1990) and their actual behaviour (Schifter and Ajzen, 1985). In the research by White et al (ibid) having a measure of planning provided a more accurate measure of actual control to predict both intentions and behaviour than global perceptions of behavioural control.

Bagozzi would have liked to have seen perceived behavioural control more outcome based, describing people's expectations of success and failure (Bagozzi, 1992; Bagozzi and Warshaw, 1990). That would have been closer to his perception of Bandura's original definition of self-efficacy. It was apparent from Sutton's work on safe sex that using a condom could have been regarded as a behaviour for a man (with relatively high volitional control), but as a behavioural outcome or goal for a woman (with relatively low volitional control; Sutton et al., 1999; Chan and Fishbein, 1993). As a result, perceived behavioural control has generally been a more important predictor of intentions to use condoms amongst women than amongst men.

Ajzen and Madden (1986) found perceived behavioural control to have been important in predictions of course outcomes (i.e. grading) as well as for predicting a behaviour (i.e. class attendance). For Towler, that has indicated that the concept of perceived behavioural control has been flexible enough to have been applied to "goals, outcomes, or non-volitional behaviours" (Towler and Shepherd, 1992).

Conner (2002, citing Bandura 1986) referred to there having been four main interventions to overcome peoples' limitations in behavioural control (also in Towler and Shepherd, 1992). These were:

- An increased personal mastery over a situation by helping people to set and achieve subgoals.
- Enabling them to observe the successful application of the behaviour by other people.
- Persuading them to take personal risks.
- Encouraging them to use relaxation techniques to reduce fear and anxiety about a situation.

Other Behavioural Determinants

While the TRA based upon attitudes, subjective norms and perceived behavioural control has been considered to have been a complete and sufficient model of the proximal determinants of behaviour (i.e., all other influences have been assumed to exert their impact on behaviour via changes in components of the model), a number of additional predictors of intentions have also been reported in the literature (Conner and Armitage, 1998). Five additional variables have been examined in the section: goals; self-identity; self-efficacy; habits and past behaviour; and morality.

Goals

Goals have been used to represent behaviours where the ability to realise success was expected to have been problematic (Bagozzi, 1992). A number of behaviours may have been required to achieve a particular end-state, and if the results of those were also problematic; the results would have been considered to have been a goal or an outcome (ibid). Focussing on goals and outcomes could make the TRA more similar to actual decision making about behaviour (ibid), however, the early TRA (Fishbein and Ajzen, 1975, p. 369) specifically excluded goals. By introducing perceived behavioural control (in the Theory of Planned Behaviour; Ajzen, 1991), the revised theory has been more able to describe the factors associated with attaining goals, although still not as outcomes.

In the TRA, people's intentions and perceived behavioural control have provided a measure of their motivation to perform a specific behaviour (Gollwitzer and Oettingen, 2000, p. 230). The stronger the measured intention, the greater the likelihood that a behaviour would have been expressed (Ajzen and Fishbein, 1980, p. 110). Some behaviours may not have been associated with high levels of motivation, for instance lifestyle behaviours such as reducing alcohol consumption, and so self-regulation by people who have implemented such goals have become an important part of their goal realisation (Gollwitzer and Oettingen, 2000, p. 230). As a result, research into goal directed behaviour has tended to focus upon two different aspects – goal content and self-regulation.

Goal content studies have examined how different types of goals have influenced their attainment. Although generally problematic, goals have had varying degrees of difficulty associated with them. When goals have been important as well as difficult, they have been able to motivate task performance (Sideridis, 2001). People who have had unsuccessful experiences in the past may have placed reduced importance on similar goals in the future and so have realised more limited levels of performance with them. Goal importance has been studied in a variety of guises such as: goal valence, need for achievement, willingness, commitment, and importance certainty (ibid). Measurement of the priority of a goal has gone beyond the measurement of level of interest or desire in order to capture the importance of accomplishing a particular task relative to other activities.

Self-regulation studies about "goal striving" have examined how people have addressed or overcome implementation difficulties (Gollwitzer and Oettingen, 2000, p. 231). Those difficulties have included: distractions, inadequate planning, insufficient effort, unexpected negative consequences, negotiation conflict and lack of priority.

An outcome may have taken some time to achieve, and over that time people's evaluation of its desirability and attainability may have changed. The desirability of an outcome has tended to have been thought of in abstract terms, whereas its attainability has usually been understood more in concrete terms (Liberman and Trope, 1998). While realising an outcome may still have been some time-distant, the positive beliefs associated with the abstract components (i.e. its desirability) would have been highly accessible. When realising an outcome has become closer, the negative beliefs associated with its concrete aspects have become more accessible and so more influential upon attitudes (Ajzen, 2001).

Although not expected to have been so, in some situations, the TRA may have been useful for predicting outcomes as well as behavioural goals. For instance, Ajzen and Madden (1986) found that they could predict behaviour (i.e. class attendance) as well as the associated outcome (i.e. academic grades).

Ajzen and Fishbein (1980, p. 51) recognised the importance of goal seeking behaviour to human decision making, however, rather than investigating actual outcomes, they advised studying the associated behaviours. Unfortunately, as was

recognised by Fishbein and Ajzen (1975), there may have been a range of behaviours to achieve the same outcome e.g. to enhance kiwi habitat landowners may plant native trees, trap and kill pests, or muzzle dogs. It may not have been practically possible to evaluate all the behaviours involved in an outcome and selecting only one or two could have attenuated the results (Sheppard et al., 1988). Combining behaviours in an index as suggested by Ajzen and Fishbein (1980, p. 89) to predict an outcome has been more difficult when some behaviours may have been interchangeable and some may have been interdependent.

Earlier work by Parminter established a range of ten farming goals satisfying to landowners earning their living from livestock enterprises (Parminter and Perkins, 1997). The set of goals may have excluded some personal and family goals but has been shown to have been associated with many farming decisions (Parminter et al., 2001).

Self-Identity

Self-identity develops from people's feelings of group identity, role identity and personal identity (Stets and Burke, 2005, p. 145). Group identity has been used by people to identify with certain groups in society (their in-groups) and exclude themselves from other groups (their out-groups). Intergroup relationships have been used to answer questions about what sort of people they were, and have influenced peoples' levels of self-esteem i.e. their belongingness and self-worth. Within groups, role identity has been able to provide a way in which people distinguished between their contribution to group function and the contribution of others. The type and strength of intragroup relationships has provided a basis for determining people's self-identity.

In the TRA, self-identity has been considered as the extent to which people saw themselves fulfilling the criteria for a particular group role (Armitage and Connor, 1999a). For example: a person may have felt that supporting organically produced food has been part of their self-identity as an environmentalist. Role identity and personal identity have probably overlapped considerably through the sharing of similar concepts (Stets and Burke, 2005, p. 146). That may particularly have applied in situations where strong and negative emotions existed, increasing

a person's use of stereotypical thinking or group prototypes in their decision making (Stoll-Kleemann, 2001, Stets and Burke, 2005, p. 145).

If people's intentions to behave in certain ways have been linked to their concepts of self-identity, then over time the influence of individual attitudes and their responsiveness to social pressures (subjective norms) will have decreased as they became more sensitive to the need for them to maintain their self concepts (Armitage and Connor, 1999b). In such situations, the contribution of self-identity to predictions of repeated behaviour increased (ibid), possibly to mediate the contribution of past behaviour (Conner et al., 1999, Sparks, 1994).

Self-Efficacy

Ajzen's concept of perceived behavioural control represented an appraisal of how much people controlled whether or not they performed a behaviour, as well as their capability (the ease or difficulty) of performing it (Sparks et al., 1997, Ajzen, 1991). It has included the presence of both internal and external constraints upon performing a behaviour. Some people have said that the definition of perceived behavioural control has been too general to have been useful in practice (Terry et al., 1993, p. 25) and that separating it into two dimensions would have provided more information about people's motivation to perform a behaviour. Internal constraints to behaviour have been often related to Bandura's definition of self-efficacy (Terry and O'Leary, 1995) showing how much people have felt that they themselves were in control of organising resources and executing actions for achieving their goals (Bandura, 1998, p. 624). In that definition, self-efficacy has not been about people's competencies in relation to a task, their general skills or abilities (Maddux and Gosselin, 2003, p. 219) or locus of control (Ajzen and Driver, 1991). Rather, self-efficacy has been more about the behaviour people believed that they were capable of realising in a particular set of circumstances (ibid).

Bandura's definition of self-efficacy distinguished between people's efficacy and outcome expectancies. Outcome expectancies about whether or not behaviours would have contributed to achieving certain outcomes or were limited by environmental conditions, were more related to perceived behavioural control (Bandura, 2000, p. 306; White et al., 1994).

In her applications of self-efficacy in the TRA, Terry (1995) used self-efficacy as a measure of the internal constraints on peoples' intentions to perform a behaviour. Perceived behavioural control measured people's external constraints and acted as a moderator upon the effects of intention upon behaviour. That appeared to have been consistent with Bandura's description that self-efficacy expectancy has worked primarily through people's motivation (similar to intention) to perform certain behaviours. Correlations between perceived behavioural control and self-efficacy may have occurred because the distinctions between internal and external constraints on behaviour have not always been clear to respondents (ibid).

A person considering their goals and determining which action would have been the best one to take, would first have to assess whether or not they could have successfully performed all the actions associated with each option (Bagozzi, 1992). Based upon that, they could then have formed their beliefs about the expected consequences of each option and then their attraction to each of the options.

In the Transtheoretical Model of Change (Prochaska and Velicer, 1997, p. 277) self-efficacy has been expected to have been low during the early stages of behaviour change and to increase as the process of change continued.

Researchers who have included self-efficacy in TRA models have generally reported that it was conceptually different from the other variables. It has made a unique contribution to regression calculations and has been operationalised successfully (Sheeran et al., 2002; Tedesco et al., 1991; Terry and O'Leary, 1995; Strecher and Rosenstock, 1996).

Habits and Past Behaviour

Habits may be considered frequently repeated behaviours, or alternatively as behaviours that are largely automatic, so that the people expressing them have no longer been aware that they were doing so (Towler and Shepherd, 1992). Although frequency of past behaviour has been relatively easy to measure, on its own it has not indicated that people have been unaware of their actions and so has been different from an assessment of their subconscious habits. That distinction has not always been made apparent in the literature. For instance, although

Triandis (1980) argues that the key concept of a habit was that it was not consciously controlled, the measures that he used related to frequency of past behaviour and so did not include the concept of automaticity (Towler and Shepherd, 1992). If a behaviour was considered to have been automatic and outside of awareness it may also have implied that it was less under people's control (ibid). Some habits may have been a part of peoples' self-identity as taken-for-granted ways of behaving to perform particular roles in society (Conner et al., 1999).

Changing an habitual behaviour has required strong intentions and maintaining their stability over time has been the best measure of strong intentions (Ouellette and Wood, 1998). In contrast, for behaviours that were infrequently performed and so were not well learned, or that were performed in unstable or difficult contexts, the impact of past behaviour on current behaviour has been assumed to have been mediated by intentions (i.e. they were consciously controlled behaviours; Conner et al., 2000).

Early on in its development, users of the TRA assumed that people's choices had to have been made consciously as a result of a behaviour having been associated both with having more favourable than unfavourable consequences, and the opportunities and skills to implement a behaviour, so that the desired consequences were able to have been realised (Aarts et al., 1998). Rather than such a deliberate process, it has been shown that people's decision making in many situations has been limited by bounded rationality (Simonson, 1989) and people have taken intuitive shortcuts to arrive at their judgements and decisions. That has meant that in practice, the level of consciously contrived rational decision making may have been extremely limited. The choice process underlying behavioural decisions generally has become less elaborate as habits have become more established (Aarts et al., 1998). When people's habits have been strong, their decisions have been guided by simple, heuristic rules. Heuristic approaches to decision making have usually rejected many of the alternatives relatively early on in the decision process. When habits have been weak, decision makers have used more cognitively demanding decision rules. Complex behaviours have not been able to become habitualised because they have required an act of conscious decision-making to perform. Unlike habitual behaviour, when people have been more aware of performing complex behaviours, they have been

able to stop them even after they had been started, and decision making about them has been able to have been in conflict with other decision making processes.

Past behaviour has been observed to have been influential upon current behaviour when it has reflected the operationalisation of the same internal and external factors controlling the behaviour. When later behaviour has been controlled by the same set of beliefs it has been known to resemble previous behaviour. If a person had a low level of motivation or opportunity or unstable intentions then the frequency of their past behaviour has been able to predict their future behaviour better than their actual intentions at the time of measurement (Sheeran, 2002; Ouellette and Wood, 1998; Bagozzi and Kimmel, 1995). If people's intentions are stable, then over time, perceived behavioural control will become less significant and past repetitions of the behaviour will grow in influence (Conner et al., 2002).

In an unpublished study (Ajzen and Fishbein, 2000), predictions about student's use of buses in one year required a measure of both their intentions and past bus use. The following year, the university provided concession tickets and past behaviour no longer improved prediction. So creating a new set of conditions was able to break people's links to their previous behaviour.

In a meta-analysis reported by Conner and Armitage (1998), past behaviour accounted for on average, an additional 7% of the variance in intentions over and above attitude, subjective norm and perceived behavioural control. In other studies, if adding past behaviour was able to improve a TRA model, then it has usually indicated that the model was insufficiently conceptualised in the first place (Conner et al., 2000). In such situations, past behaviour should have been mediated by the existing cognitive and affective elements in the model. If it wasn't, there may have also been methodological reasons why past behaviour remained significant, e.g., if both past and later behaviour have been collected in the same way and changes over time have not been able to have been detected (e.g. by using observations rather than self-reports; Beck and Ajzen, 1991). If changes happened slowly, then some cross-sectional studies have found perceived past behaviour to have been more predictive of intentions than if prospective, longitudinal studies had been used (Conner et al., 2000).

Habitual behaviours as distinct from repeated behaviours, have usually arisen and proceeded efficiently and effortlessly. Although their control may have been unconscious, they can show automaton like goal direction. For example, an habitual behaviour such as casting a fly-line wouldn't normally have been developed unless there existed a goal of fish catching. Satisfactory experiences in the past have been shown to enhance the repetition of behaviours in the future (Tesser and Shaffer, 1990). The more that they have been reinforced over time, the greater the association between a goal and the instrumental actions linked to it and the more control that people will have felt that they had over their future performance (Albarracin et al., 2001). Frequent coactivation of recognised situational cues and a particular behavioural choice has been found to increase the strength and accessibility of that association. The sources of habitual responses will have been cognitive structures learned, stored, and readily retrieved from memory after the appropriate environmental stimuli have been recognised.

In the TRA, positive correlations that have been found between past behaviour and future behaviour that may have indicated the operation of habits (e.g., Ouellette and Wood, 1998). Such automatic elicitation may have occurred because of the strong cue-response produced by repeated performance of a behaviour in a particular context.

For behaviours that have been infrequently performed in unstable contexts (contexts less likely to result in habit formation), intentions have predicted future behaviour better than past behaviour. That has suggested that another "behaviour type" distinction has been able to have been made on the basis of the frequency and stability of the context of the performance of behaviours (Sheeran, 2002). That concept may have been difficult to assess without resorting to using frequency as the measure of habit. Intention stability may have been a useful guide to the presence of habit, but it will not have indicated the strength of its influence upon behaviour (ibid).

Morality

People's performance when compared with moral standards about right and wrong behaviour has related strongly to their feelings of social acceptability and self-worth (Tangney, 2003, p. 385). When they personally have violated those

standards they have been likely to experience shame, guilt and embarrassment, and when they met or exceeded them, pride (ibid). People may have had similar feelings when someone closely connected to them (e.g. a family member) also has engaged in such behaviour (Tangney, 2003, p. 384).

Moral behaviour has been guided by three broad classes of factors — moral standards, moral reasoning, and moral affect. Moral standards have represented the culturally defined moral norms and conventions known by individuals. Through their moral reasoning, people have thought about the implications of alternative behaviours upon their measure of moral standards. People have often been faced with competing moral considerations, and they have learnt to manage those in different ways (Tangney, 2003, p. 385). Moral emotions have provided people's motivation to do good and avoid doing bad. As people have reflected upon their own behaviour, their moral "self-conscious" emotions have provided them with immediate punishment (or reinforcement) of that behaviour. Of those three mechanisms, it has been their moral emotions that have exerted the strongest influence on moral choice and behaviour by providing people with critical feedback regarding both anticipated and actual outcomes (Tangney, 2003, p. 384).

Not many researchers have addressed moral determinants of human behaviour (Abraham and Sheeran, 2000, p. 11), although when considering behaviours with an explicitly moral dimension (e.g. consuming genetically engineered food) some researchers have suggested including in the TRA a measure of 'moral (or ethical) obligation' (e.g., Beck and Ajzen, 1991; Conner and Flesch, 2001). Accounting for morality effects upon intentions in a TRA model has so far only produced small, although significant affects (Beck and Ajzen, 1991; Sparks et al., 1995).

Summary of Review of the Theory of Reasoned Action

The chapter has described how the Theory of Reasoned Action has been useful in studies of human behaviour, how it was developed, and how it has been operationalised. Each of the components of the Theory have been described, how these have been defined for modelling human behaviour (Table 2), their strengths and limitations, and how they have been applied by different researchers in the field.

Over the thirty years of its development, the Theory of Reasoned Action has been able to explain the psychological determinants for a range of human behaviours from exercising to conservation. Although the TRA has generally predicted intentions well, sometimes there has been a poor relationship between intentions and their associated behaviours. In part that has been due to a lack of comparable specicificity between the measures of intention and behaviour. It has also been influenced by the stability of intentions, the level of behavioural control exercised by decision makers and how well both of these concepts have been measured in particular studies.

Amongst social psychology practitioners of the TRA, their concerns in applying the theory have mostly been about the sufficiency of the core psychology concepts – intentions, attitudes, subjective norms and behavioural control, and how these may have been interpreted. Such concerns have been addressed in subsequent studies by researchers suggesting adding and reinterpreting additional or alternative concepts from social psychology that could increase the theory's explanatory power. Ultimately, the efficacy of such developments has been tested through empirical studies using factor analyses to verify their powers of discrimination, and regression analyses to verify their explanatory contribution. This could be described as a "suck it and see" approach to theory building that has advantages of adapting a theory to the complexity of a range of human behaviours and the disadvantages of requiring each application to be customised to the particular social group and their situation being studied.

Taking into account the complexity and the practical behaviours involved in this study, the variables selected for the TRA model development have included: intentions, instrumental attitudes, affective attitudes, subjective norms, self-efficacy, perceived behavioural control, self-identity and past behaviour (Table 2). Morality measures have not been included because it was not considered likely that they would have been associated with the particular practices that were the focus of the project and they had only contributed small effects in other studies. The goal measure developed by Parminter and Perkins was also included alongside some of the non-specific variables (e.g., gender and age).

Table 2: A summary of TRA variables and their meaning

TRA Variable	Meaning
Behavioural outcome	the targeted result or purpose of carrying out a behaviour e.g., sitting an exam would have been a behaviour, passing an exam would have been a behavioural outcome
Behaviour	a specific set of observable actions carried out by individuals
Intention	the level of motivation that people have had about acting upon a particular behaviour
Instrumental attitudes	the material evaluation of a behaviour in terms of its desirable or undesirable consequences
Affective attitudes	the emotional evaluation of a behaviour in terms of whether or not it engendered favourable feelings towards it
Subjective norms	pressure felt about the types and standards of behaviour expected by significant others in a person's life
Self-efficacy	perceptions about how easy or difficult it would be to perform a behaviour that was under their control
Perceived behavioural control	perceptions about the availability and accessibility of external resources critical to the performance of a behaviour
Self-identity	the degree to which people saw themselves as fulfilling the role for a specific group in society
Past behaviour	previous conscious or subconscious expressions of a behaviour, if that had become automatic it may have been considered a habit
Beliefs	the association of a behaviour to positive or negative consequences, attributes or conditions, used to form attitudes, subjective norms, self-efficacy, etc.

After carrying out the review, the TRA was considered able to provide a useful framework for the research project for understanding how the design of policy interventions could address landowner's behaviour to achieve environmental outcomes.

Chapter 3. Literature Review of Policy Theory and its Application to (New Zealand's) Resource Management

Introduction to Policy Review

The chapter has described from contemporary literature, the commonly used approaches to public policy making that have expressed how socially significant knowledge has been acquired (its epistemology) and the principles of its use in decision making (its methodology). It starts with an introduction to the policy making process and then it describes in more detail how policy agendas have been established, policies analysed and formulated and finally, how decisions have been made about the selection of policy instruments. The chapter finishes by examining the Resource Management Act (New Zealand Government 1991) and its approach to policy formulation and examples of applications of the Theory of Reasoned Action for policy development.

Definitions of public policy making have varied from the very simple (Dye, 1987, p. 2) to the more complex (Howlett and Ramesh, 2003, p. 7). In this study, policy making has been considered as:

- Government activity to achieve public goals and/or address societal issues
- In a process or conjunction of ideas and self interest
- Involving groups of political actors,
- And constrained by personnel, financial and informational resources

So government activity, both local and central, has been the focus of public policy, although other social groups, institutions and organisations have been very much involved in the policy process (Howlett and Ramesh, 2003, p. 5, Hanney et al., 2003). Aside from the public arena, policy frameworks may have been included as a component in the strategic planning of private companies in order that "strategically managed companies [could] link strategic planning decisions directly to operational decisions by designing structures and systems that integrated strategic thinking with operational decisions" (Lyster, 1985, p. 18-7).

In this study, approaches to policy design in the commercial sphere have been specifically excluded, although many of the principles described might still have applied and some of the theories have been originally developed for commercial applications (e.g. Lyster, 1985, p. 18-1).

Public policy has been considered a loosely connected process that may have no clear starting or finishing point and only indistinct intermediate steps (March, 1994, p. 101). The initiation of a programme of policy making may be in order to achieve particular social goals (Howlett and Ramesh, 2003, p. 7) or to address concerns for which no clear goals may have been apparent (March, 1994, p. 18). Although policy making may often have been described imprecisely, sometimes it has been given an explicit form along the lines of: analysing a selected problem or issue, designing a strategy that would best contribute towards resolving that issue, formulating a plan for implementing the strategy and learning from the results about how to improve similar policies in the future (Parliamentary Commissioner for the Environment, 2004b, p. 91).

The choices about policies and how to implement them can be constrained by the resources available both internally and externally to policy makers (Howlett and Ramesh, 2003, p. 9). A lack of funding, people skills or technical knowledge has sometimes limited what would otherwise have been effective policies. Policy making has involved policy makers working with a number of social groups who might have wanted to participate in or influence the political process or who may have been affected by its results. The level and type of their involvement in policy making has been known to have significantly affected the policies that resulted (Howlett and Ramesh, 2003, p. 8, Kilvington et al., 1999, p. 11). Advocacy to groups within a policy organisation itself has been one of the initial steps needed for implementation in order to obtain necessary political commitments and resources (Howlett and Ramesh, 2003, p. 11). How well the final policy mix produced matched the previously expressed policy needs of the public will have provided the public with a means for them to assess the effectiveness of the overall policy making process.

As policy decision making has progressed on an issue, it has generally proceeded through a number of stages (Table 3), and as it has done so, there may have been changes in participants with differing levels of decision making authority

(Howlett and Ramesh, 2003, p. 162). Usually as the stages progressed, less people will have been required at increasingly operational levels in an organisation. At agenda setting, a range of people from both within the policy organisation and amongst the general public are likely to have been involved. During policy analysis and formulation, the number of those involved will have been reduced to the government and society participants with particular policy responsibilities themselves. Authorising a policy intervention will usually have been left to those with sufficient authority to publicly make binding commitments (e.g. the elected leaders; Howlett and Ramesh, 2003, p. 162).

The policy process has been characterised as a cycle of seven stages by Lasswell (1971 in Howlett and Ramesh, 2003, p. 11). Six stages were identified by Brewer (1974 in Howlett and Ramesh, 2003, p. 12), and five by both Dye (1987, p. 24) and Howlett and Ramesh (2003, p. 13). The Parliamentary Commissioner for the Environment (2004b, p. 91) also identified a six to seven stage process. All of those policy processes have tended to follow the normative problem solving steps that have also been described as having six stages (Kolb, 1984, p. 32). Describing the policy process as a number of stages by these authors, might have created the impression that they intended a linear process that had an invariable pattern of policy development, but generally that was not what they had in mind (Howlett and Ramesh, 2003, p. 13). Describing the process in stages could also have had practical limitations for situations when people were not able to recognise the boundaries between the different stages. It may not have been clear how policy development moved from stage-to-stage, and it may also have not been clear what might have caused the cycle to stop or modifications to occur, and what effects modifications within stages might have had upon the overall cycle (ibid). Although all those policy models might have appeared similar, as if to indicate the merits of taking a staged process through policy development, there has been no evidence that any particular process has produced any better (or worse) policy than any other process (March, 1994, p. 2).

Table 3: Steps in a policy making process

Problem Solving Steps[2]	**Howlett**[3]	**Lasswell**[4]	**Dye**[5]	**Brewer**[6]	**PCE**[7]
Goal setting Problem recognition	Agenda setting Policy analysis	Intelligence	Problem identification	Invention	Issue identification Significance assessment
Proposed solution	Policy formation		Policy formulation Legitimating	Estimation Selection	Outcomes sought Policy decisions
Choice of solution	Decision making	Promotion			
Implementation	Implementation	Prescription	Implementation	Implementation	
		Invocation			
		Application			
Monitoring results	Evaluation		Evaluation	Evaluation	Monitoring Evaluation
		Termination		Termination	
		Appraisal			

[2] KOLB, D. A. (1984) *Experiential learning,* Englewood Cliffs, NJ, Prentice Hall.
[3] HOWLETT, M. & RAMESH, M. (2003) *Studying public policy: policy cycles and policy subsystems,* Ontario, Oxford University Press.
[4] LASSWELL, H. D. (1956) *The decision process: seven categories of functional analysis,* College Park, Maryland, University of Maryland Press.
[5] DYE, T. R. (1987) *Understanding public policy,* New Jersey, Prentice-Hall, Inc.
[6] BREWER, J. L., BLAKE, A. J. & DOUGLASS, L. W. (1999) Theory of reasoned action predicts milk consumption in women. *Journal of the American Dietetic Association,* 99**,** 39-44.
[7] PARLIAMENTARY COMMISSIONER FOR THE ENVIRONMENT (2004b) Missing links: connecting science with environmental policy Wellington, Parliamentary Commissioner for the Environment

In Howlett's (2003, p. 12) model:

- Agenda setting was the process by which problems come to the attention of governments and policy goals were able to have been established and aligned
- Policy analysis described possible policy options and how they related to the policy problems
- Policy formulation referred to the process by which selected policies were designed and put together by officials
- Instrument selection has then been needed to make choices about preferred policy interventions, including the option of non-intervention
- Implementation has been the process by which non-government organisations have been encouraged to align themselves with the policy proposal and the policy has actually been introduced and put in place in the community
- Policy evaluation has described the process for monitoring and learning from results and possibly developing further policy making opportunities.

Setting the Policy Agenda

The policy agenda has been an organisation's response to the demands of political representatives, the expectations of special interest groups, the changing circumstances of communities and organisations, and the needs of policy makers themselves (Howlett and Ramesh, 2003, p. 8, Kingdon, 1995, p. 230). Some situations will have been identified from environmental indicators, and focussing events, or from feedback. Extremes in indicator measures and rapid changes in indicator measures may both have tended to attract attention (Kingdon, 1995, p. 197). Focussing events such as natural disasters when combined with parallel concerns in similar policy domains may have drawn attention to particular conditions e.g. floods linked to rising riverbed levels, which might otherwise have been missed or ignored. Feedback from existing programmes may have alerted officials to the need for making policy changes (Kingdon, 1995, p. 197). Policy makers may have learnt about those issues and identified the priority problems, in

a socially constructed process that influenced certain situations so that they became more salient than others (ibid).

The issues that have become priorities for policy makers will have reflected the ambitions and values of the responsible political agency and its relevant policy staff (Howlett and Ramesh, 2003, p. 121). That was what has changed a situation from being a condition that people might just have been prepared to put up with, to a problem that needed have been given policy priority (Kingdon, 1995, p. 198). The processes used to establish priorities have not usually followed any technical design, but instead have been the result of a public-private discourse defining what was "normalcy" and what constituted "unacceptable deviations from desired social behaviour" (ibid). Public involvement in agenda-setting has been able to provide an opportunity for policy makers to directly engage with communities in open-ended semi-structured discussions and so they have become more sensitised to the issues relevant then and potentially in the future. It has only been after a government agency has decided to attend to an issue raised through their discussions that the policy process led by responsible agencies, will have actually begun (Howlett and Ramesh, 2003, p. 133). Even when an issue has made it onto a policy agenda, how it has been dealt with has varied with the type of agenda that it became attached to. For instance, a new roading proposal may have been dealt with as an economic policy priority or an environmental issue. Just which one it was, was likely to significantly affect the resulting policy programme (Kingdon, 1995, p. 198).

Agenda setting might not have been as simple as the two stage process (moving issues from the social to the institutional agenda) described above, and an alternative four stage process has also been suggested, although with less academic support. In the alternative process, an issue that was first raised in public discussion, then would have had possible solutions described, it would then have been internally advocated, before it was prioritised in the institutional agenda (ibid).

Policy Analysis

Policy analysis has involved describing and linking possible policy options with identified problems or issues (Weimer and Vining, 2005, p. 1). The issues might already have been well specified during the agenda setting process and the options available very limited, or possibly the issues might still have been quite nebulous and confounded by people seeking multiple outcomes (Howlett and Ramesh, 2003, p. 143). Policy analysis has been differentiated from policy planning where only one option has been considered (Weimer and Vining, 2005, p. 27). Policy issues might have been technical or institutional in nature, or a combination of both. Resolving technical issues such as water quality has required developing ways in which stakeholders can be encouraged to change their behaviour relating to that issue. In contrast, resolving an institutional issue has required addressing relationships of rights and responsibilities between stakeholders (Howlett and Ramesh, 2003, p. 146).

Policy scientists have long called for policy analysts to put less emphasis upon instruments and techniques and more upon considering and reflecting upon their decision making approaches (Bobrow and Dryzek, 1987, p. 3; Weimer and Vining, 2005, p. 333). The field has had a range of approaches developed by a number of social science disciplines (Bobrow and Dryzek, 1987, p. 5), the only one of those showing any internal consensus about policy analysis has been economics resulting in its approaches being more generally widely known than those of other disciplines (ibid).

Analysis has generally followed a research process of systematically designing, implementing and evaluating policies (Weimer and Vining, 2005, p. 1). Although Dye (1987, p. 7) excluded from an analysis the selection, promotion and implementation of solutions. For Dye, policy analysis was an explanatory process and policy formulation was a selection process, each requiring different procedures. Dye was concerned (1987, p. 7) that in developing the advice to be provided, analysis should not have been subordinated to policy advocacy and so its value diminished in both its explanatory power and problem understanding.

Meltsner (1972) has distinguished between a systems analyst and a policy analyst. For him, systems analysts dealt with the technical issues associated with policy making, but policy analysts that expected their work to have been relevant to

politicians would have also accounted for the political aspects of policy decision making. That has meant that analysts had to identify and address factors associated with political feasibility as well as practicality in their analyses.

Conceptual models used to study policy making have helped to simplify and clarify potential issues, they have provided a framework for making decisions about important (and unimportant) aspects, found explanations, and predicted the consequences of taking or not taking action (Dye, 1987, p. 20). Unfortunately, many issues have been so complex and people so variable that generally no single model has been adequate (Dye, 1987, p. 17).

Five contrasting models of policy analysis have been commonly referred to in the literature:

- Prescriptive decision making
    - Rational choice theory
    - Actor-centred institutionalism
    - Systems policy thinking
- Naturalistic decision making
    - Incremental theory
    - Garbage Can theory

Although those models have been commonly reported in a number of papers and books they have generally been illustrated with examples from the United States (Kingdon, 1995, p. 222) and occasionally Europe (Kirschen et al., 1964). None of the references accessed on theoretical development included Australasian examples. In New Zealand, most of our development of policy theory has been based upon Rational Choice theory (Boston et al., 1996), it therefore did not seem useful in this project to cover anything other than the more common alternative theories. That has not been to say that a range of theoretical models could not also have been applied in New Zealand. Nor did it mean that they were not

applicable, "lack of use of an approach was no proof of its failure" (Bobrow and Dryzek, 1987, p. 14).

The policy analysis models that have been considered have each had different decision making styles reflecting the nature of the policy problem, the number and type of actors involved, the pre-existence of decision making frames, and the nature of constraints (e.g. information, time, institutional). Each model has been based upon alternative sets of principles about decision making and the primary constituents of effective policy. However none of the models has been mutually exclusive of any of the others and in practice they might all have been useful for different parts of an analysis (Hanney et al., 2003).

Early research into policy making developed rational and incremental models as descriptions of policy best practice. People have only started to understand how policy making behaviour has actually been influenced in later developments with systems thinking, organisational relationships and loosely coupled decision making (Howlett and Ramesh, 2003, p. 178). Each of the models described in this study has provided an alternative frame of reference for analysing policy issues (Bobrow and Dryzek, 1987, p. 8). Choosing a particular frame of reference has had important consequences in policy because it:

- Made some aspects of an inquiry more salient than others
- Ruled out certain policy instruments
- Made it more likely that they would receive political and social support from particular sections of the community

Applying a model to any particular policy issue has included having an implied set of values that have been implicit with each model and therefore there have been ethical as well as technical consequences to consider (ibid).

Alternative policy models might have been ignored in policy agencies through ignorance, intellectual prejudice, or normative pressures, so even models that have been seldom used might still have had the potential to guide policy analyses in particular circumstances (Bobrow and Dryzek, 1987, p. 14)

Rational Choice Theories of Policy Making

Rational Policy Choices (RPC) have been considered "rational" in the sense that they have provided the most resource efficient way available of achieving identified policy goals. They have also been described as "scientific", "engineering" or "managed policies". Sometimes when people have described policy making as particularly "rational", they have meant that the results of the policy process have been beneficial in providing distinct advantages to sections of society (March, 1994, p. 223). At other times, when people have described policy making as particularly rational they have meant the process of analysing and formulating policy interventions had logically compelled them into believing that the results would have been beneficial (ibid). However, there have been many examples where following a particularly rational decision making procedure has not led to beneficial outcomes and vice-versa (March, 1994, p. 223). Despite widespread experience to the contrary, people have still tended to expect positive outcomes from policy processes that were particularly rational and formulaic.

A more scientific approach to developing strategies in business has been suggested by reviewers as a way to reduce what they have described as "poorly based", "illogical", "error filled decision making" (Schoeffler, 1985, p. 4, p. 9). If it had such clear advantages, why hasn't it been used more in policy making? Corner, Buchanan et al (2001) considered that generally, strategic decision making has had a failure rate of around 50% and that applications would have been improved by modifying the decision making structure through the use of a more "dynamic rationality". According to the Parliamentary Commissioner for the Environment, one reason that a scientific approach has not been used more widely in strategies has been that a scientific approach to policy making has remained dominated by the constraints of disciplinary paradigms of inquiry and problem solving (2004b, p. 37). They both may have been highlighting a similar issue. The Parliamentary Commissioner has then considered that greater recognition should have been given by policy makers to the complexity inherent in environmental issues and the multiple scales and disciplines required for decision making and therefore the need for scientists and rational thinking to have been more involved in its formulation.

Rational choice theory generally has used neo-classical economic models to explain human behaviour. Indeed for some people, policy analysis and economic analysis have been practically synonymous (Bobrow and Dryzek, 1987, p. 30). The main driver behind such models has been that people would act rationally in order to maximise their personal utility (Weimer and Vining, 2005, p. 55). The RPC theory has provided policy makers with a clear and consistent prescription for policy analysis based upon the principle that people would have behaved in ways that served their greatest self-interest (March, 1994, p. 1; Howlett and Ramesh, 2003, p. 23).

To find the best possible outcomes from their decisions, rational decision makers have been assumed to gather and organise all the information required for comparing the complete range of policy options against all their decision preferences (Howlett and Ramesh, 2003, p. 167; Ostrum, 1997; Weimer and Vining, 2005, p. 27). Their most efficient decision process has been to:

1. Establish a policy goal or problem-solving outcome

2. Identify and develop all the alternative policy strategies for achieving the goal

3. Identify all the possible consequences from making the decision and develop those into decision criteria

4. Compare each of the alternatives against the criteria and select the one that was calculated to have the greatest likelihood of generating the most advantages

In RPC, the type of policy interventions required to address policy issues has been deemed by economists to have been largely a technical exercise. They have analysed policy problems to develop specifications for evaluating and determining the most suitable interventions. In the past, that analysis has been problem focussed, largely independent of any political and social context (Weimer and Vining, 2005, p. 29). To ensure that the advice of analysts was more likely to have been adopted, increasingly the external conditions around an issue have been an accepted part of the analysis for RC practitioners and they have been expected

to have been less constrained by their objectivity (Weimer and Vining, 2005, p. 37 and p. 261).

Political scientists have found no technical rationale for preferring one instrument over another in any particular policy situation and have tended to select the instruments that were the most politically and socially acceptable (Howlett and Ramesh, 2003, p. 197). Political desirability generally has reflected the least coercive way of achieving any particular outcome, so voluntary mechanisms have always been preferable to regulations (Howlett and Ramesh, 2003, p. 198). There have also been a growing interest amongst policy agencies for using financial and organisational incentives in preference to information based instruments (Howlett and Ramesh, 2003, p. 199). Socially, if the target group of people have been large and well organised, then the government has been likely to prefer persuasion and financial incentives. Rules and coercion have only tended to have been used if governments have also been concerned with redistributing resources and political power (Howlett and Ramesh, 2003, p. 199).

So that they have been amenable to a rational choice process, policy issues have needed to have:

- A limited and consistent set of policy decision makers, for whom the issue was important and worth expending some effort upon
- An organisational context where the policy making process on the issue was given sufficient priority
- A well defined and understood policy problem
- The information about decision making alternatives has been complete, accessible and comprehensible
- Sufficient time available for carrying the analysis to completion and the capability having been available to produce defendable results

Applying the RPC has required a considerable degree of collecting and analysing information. It needed the value preferences of every group in society to have been known and weighted, all the decision alternatives to have been identified,

with all their cost-benefit ratios calculated (Dye, 1987, p. 31; Bobrow and Dryzek, 1987, p. 11). That has been made more difficult by having uncertain futures, noncommensurate units, contextual interactions, and nonlinear benefits (Howlett and Ramesh, 2003, p. 169; Bobrow and Dryzek, 1987, p. 32). If the required level of information management was to have been carried out for each decision alternative, quite a bit of time would have been involved (Howlett and Ramesh, 2003, p. 168). The amount of information and time needed has meant that fully rational decision making has quickly been recognised as unattainable (Scharpf, 1997, p. 21). Instead, bounded rationality has been used to describe the way that people have used limited information, time and attention to approximate actual full rationality. Bounded rationality has assumed that people made predecisional choices on all sorts of bases. It may have reduced decision making efficiency but it decreased the amount of decision making computation to more manageable proportions.

Some researchers have considered the development of decision making heuristics as a way that policy makers commonly have simplified their decision making and managed uncertainty (Ostrum, 1997). Those have been likened to "second best" maximising rational models because they have still relied upon utility maximising processes within practical information management limitations (Howlett and Ramesh, 2003, p. 169).

When rational choice theory has been applied as a public choice theory, the principle of self-interest has meant that voters have become "consumers", councillors have become "entrepreneurs" offering competing products and services in return for votes, and government organisations have become "firms" that had to obtain sufficient money in their budgets to grow their business (Howlett and Ramesh, 2003, p. 23).

RPC has been made more difficult by multiple actors, complex settings, and vague policy problems. When policy makers have had insufficient or distorted technical information available for using in decision making, or when they had insufficient time to develop a clear issue for their policy to focus upon, they have been likely to fall back upon bargaining and negotiation to develop policy (Forester, 1984). They may no longer have considered rational choices, but by using Actor Centred Institutionalism and Garbage Can theories they have still

been able to resolve policy issues to a level that was sufficiently politically and socially acceptable. In situations when their client's goals have been unclear or undeclared, other papers have invited policy makers to retrospectively develop and fit their ideas on goals to the policy choice. In the RPC paradigm the range of possible policy goals has been extremely limited and all of them have included aspects of economic efficiency as their primary element (Weimer and Vining, 2005, p. 338).

For some critics, the fact that RPC was derived from economics and consumer choice studies has meant that it has over-simplified human psychology and behaviour (Howlett and Ramesh, 2003, p. 24; Ostrum, 1997; March, 1994, p. 1). The theory assumed that the expansion of Government into services that could have been supplied by the market was "parasitic" upon society, and that growth in the role of Government could not be justified without strong evidence that other more suitable alternatives were not available (Howlett and Ramesh, 2003, p. 25). In its defence, RPC has still been an important basis for the development of policy because it has provided a socially and politically acceptable way of explaining policy decisions and desired behaviour changes. No matter what process has been used to actually make policy decisions, after they have been made, they have generally required a rational logic to have been developed around them if they were to proceed further and have been implemented (March, 1994, p. 3).

RPC has been limited by its assumptions that people would always act to maximise their self-interest and that that self-interest would also have been the mechanism for maximising the benefits to society. The only exception to that assumption has been the State itself, which has always been assumed to have been interested only in the well-being of society as a whole (Bobrow and Dryzek, 1987, p. 31). The tragedy of the commons (Ostrum, 1990, p. 2) was that when wealth was 'free for all' it was valued by no-one because people maximised their individual advantage through consuming as much as they could, when they could. It was a sub-Pareto optimum because other solutions existed that could have been equally good for the other players (ibid; Weimer and Vining, 2005, p. 71). When people have had to choose between individual advantage or collective good as in the 'prisoners' dilemma'; according to RPC, they would have tended to have chosen a result that was best for them individually but that was expected to have been sub-Pareto optimum for society as a whole (Ostrum, 1997).

Actor-centred Institutionalism

Actor Centred Institutionalism (ACI) was developed by combining the economics of RPC theories with the sociology of organisational culture (Bobrow and Dryzek, 1987, p. 49). It has generally been assumed in the theory that if everyone in an institution or community group had some interest in common with each other, then everybody in that group would tend to act to further their common interest (Mancur, 1982, p. 17; Scharpf, 1997, p. 1). Governmental institutions have been able to give public policy legitimacy, universality, and coercion (Dye, 1987, p. 21). Therefore, by working with government agencies, civic groups have been able to obtain recognition for their preferences and have them imposed upon the rest of society, by force if necessary.

The theory has been primarily concerned about the way that institutions have been organised internally and in relation to each other. It has taken into account formal organisational structures, exchange networks, and markets as well as their codes, rules, norms and political symbols (Gorringe, 2001, pxiii; Howlett and Ramesh, 2003, p. 29). ACI assumes that government institutions have been relatively autonomous from the other sections of society on whom they are dependent, and so have been able to act unilaterally. ACI emphasises the strategic interactions among constituents rather than expecting them to be unitary decision makers such as might have been the case with RPC.

With ACI, people in communities, organisations and countries, have been considered to pursue their specific interests within the context of the organisations to which they belonged. Their organisations would have endorsed, modified, or rejected their personal interests and influenced how much of their expectations they could realise (Howlett and Ramesh, 2003, p. 29). Policy making could have influenced the functions of institutions so that by maximising the utility of individuals within them, they would further enhance the interests of their group and contribute to socially desired outcomes (Howlett and Ramesh, 2003, p. 24). In some situations the political process has been manipulated by dominant or elite groups for their own ends (Dye, 1987, p. 29). Such groups have been able to articulate their interests in a logical compelling way and impose their desires upon passive, apathetic and ill-informed masses (ibid). If the structure of government institutions has been changed then new groups might have been able to come into

power exercising their own forms of influence upon political processes (Dye, 1987, p. 21).

Like RPC theory, ACI has supported market-based policy instruments as the best way of providing checks and balances to minimise the self-interest of policy makers and avoid rent seeking amongst constituency groups (Bobrow and Dryzek, 1987, p. 54).

Four types of markets have been described in a typology to determine the appropriate role of government. In the typology, markets have been described in terms of the types of transactions that they entailed – their excludability and their consumability (Table 4).

Some goods and services have been able to have been supplied in units to individual customers (e.g. butter) but others such as national parks, have generally been indivisible. The ability to control the distribution or availability of such goods or services has determined their level of excludability (Weimer and Vining, 2005, p. 72). Some goods and services when they have been consumed by one customer (e.g. shoes) have then been unavailable to any other customer; others would still have remained undiminished and equally available e.g. solar power. The degree to which a good or service when used by one customer has become unavailable to any other customer has determined its level of consumability (ibid).

Public goods and services have been those that could not have been supplied through transactions with individual consumers and like air, appeared to have been inexhaustible.

Toll goods have occurred when they could have been subdivided for individual consumers but when in general use, their consumption by individuals would not have limited their consumption by others e.g. roadways and electricity.

Table 4: A typology of goods and services based upon their excludability and consumability

	Excludability	
Consumption	Nonexcludable	Excludable
Inexhaustible	public good	toll good
Exhaustible	common-pool good	private good

Excludability: capability of controlling the access of individual people
Exhaustability: when consumption by one person reduces availability to others

Common-pool goods have not been easy to subdivide for individual acquisition and once consumed they have then become unavailable to others e.g. the water in natural waterways. As well as taking a general population approach to those issues, such as by introducing a tax to reduce the consumption of common-pool goods, it has also been possible to develop a virtual market in them e.g. by allocating to farmers around a lake the rights to use and trade in nitrogen leaching while capping the overall amount of nitrogen entering the lake system.

Pure private goods and services have been the bulk of market activities in society. They have been able to have been subdivided into units for sale to individual customers, and then once consumed became no longer available to others (Howlett and Ramesh, 2003, p. 31).

The costs of doing business (transaction costs) have been kept to a minimum in free markets where there has been no government interference, as long as the availability of decision making information was also unimpeded (Howlett and Ramesh, 2003, p. 31). Transaction costs have also been minimised in a public-good bureaucracy if it has been fully open and transparent about its costs of operation and its decision making processes (ibid).

Under certain conditions though, the market has not been particularly efficient at aggregating individual utilities into an overall optimum for social utility. When that has occurred, a market failure has been considered to exist, possibly requiring corrective action by political institutions (Howlett and Ramesh, 2003, p. 33).

Conditions of market failure have included the existence of:

- Monopolies
- Inadequate information for decision making
- The presence of externalities
- Social inequity

Government failures have also been known to occur under ACI (Howlett and Ramesh, 2003, p. 35; Bobrow and Dryzek, 1987, p. 50). Those have included the presence of:

- Displaced private organisations
- Increased costs
- Derived externalities

With ACI, groups and networks have provided the means for individuals and policy institutions to interact. The political influence of different groups has been determined by their numbers, wealth, degree of organisation, internal cohesion, leadership and their interconnection with policy decision makers. Public policy has been expected to change towards aligning with the groups of influence and away from the groups losing their influence (Dye, 1987, p. 27). The main role of government has been to establish the rules governing the struggles between different social groups e.g. by allocating property rights to provide for excludability, so that a market could function freely (Weimer and Vining, 2005, p. 73). It has also been important for government to enforce ethical principles in markets and curb criminal behaviour. Governments have been expected to avoid developing policies that treat toll goods and common-pool goods as public goods as that would lead to social inequity and over consumption respectively. Government policy makers have managed the tension between group expectations by continually bargaining, negotiating and building compromises (Dye, 1987, p. 28).

The ACI has been challenged because in large groups, rationally behaving individuals have not found that their best advantage comes from behaving cooperatively. Instead, it has been advantageous to either holdout for a better position e.g. nonunionised labour, or free-ride on the benefits created by others e.g. the spillover of new technology from its original developers (Mancur, 1982, p. 17; Gorringe, 2001, p. 153). However, maintaining some ability to free-ride in the market has also been able to reduce a potential hold-out problem, and some ability to hold-out has reduced a potential free-ride problem (Gorringe, 2001, p. 154). The difficulties of having some people that have been free-riders or hold-outs have been especially problematic from within the political process (Howlett and Ramesh, 2003, p. 47).

Evaluating the markets for goods and services that have been the focus of policy making has sometimes been difficult to measure and has sometimes been subject to random sources of bias (Gorringe, 2001, p. 150). For instance the number of pupils that have been taught in schools has been a lot easier to measure than the quality of the education that they have been taught. And, whilst the number of criminal acts that have been carried out in a community may have been relatively easy to measure, it may not have been entirely under the control of the police force and so would not have been a useful indicator of their effectiveness. When strong political interventions have been linked to weak performance indicators, the risk of creating significant unintended side effects from policy has greatly increased. When indicators have been known to include established biases it may have been preferable to have:

- Replaced them with less biased indicators, even if those were less precise in their measurements
- Used policy instruments with a reduced intervention role for government e.g. replaced rules with education
- Contracted policy delivery to partners that could have been relied upon, even if they costed a little more
- Addressed issues relating to inputs as well as outputs, e.g. dealt with animal stocking rates as well as agricultural water contamination in policies relating to water quality

Much of economics has been used to compare what was happening in the "real world" with what should have happened in an "ideal world". Ideal world expectations have often been unrealistic and trying to achieve them has led to unnecessary government interventions. Such policies have recognised instances of market failure but they have not addressed issues of government failure. Instead, the contribution of economics to policy making has been enhanced, when comparative economics has been used to contrast the results from one real world process with another (Gorringe, 2001, p. 2).

The main role of traditional economics in policy has been to predict social responses to government interventions even if the underlying assumptions had no relationship to actual decision making or behaviour (Gorringe, 2001, p. 233). Having been able to make predictions has been the purpose of many economic models used in policy making. If the models were used for the purposes for which they have been developed, there would have been no problem, but if the policy decisions depended upon having been able to understand how policy instruments would have worked, personal judgement would probably have been more reliable (ibid).

Systems Policy Thinking

Systems Policy Thinking (SPT) evolved in the last decades of the twentieth century building on the works of Churchman and others (Churchman, 1971; Parminter, 2004, p. 8). However, identifying a coherent systems approach to policy formulation has been made more obscure by the association of 'hard-system' models with Rational Choice Theory and by the popular use of the term in general policy literature (Checkland, 2005; Weimer and Vining, 2005, p. 28; Bobrow and Dryzek, 1987, p. 10; Linder and Peters, 1998). The distinctiveness of SPT has been that it has rejected reductionist analyses of policy issues (particularly those formulated around scientific principles) and the simple cause-and-effect matches between policy problems and policy instruments. According to Senge (1992, p. 65) systems thinking has been called by others a 'dismal science' because it has made what would otherwise have been simple policy

issues more “complex” and turned apparently efficient solutions into ones that have been “short term and ineffectual”.

SPT has included in decision making a range of perspectives about any particular policy issue, reflecting the range of cultural backgrounds, practical experience, applied context and norms and values contained by any society or group of peoples (Midgley, 2000, p. 174). Systems policy approaches have also included the means to adapt over time a policy intervention as the policy situation progressed and as peoples’ understanding developed (ibid). Policy issues from a systems perspective have been understood as existing in a hierarchy of inter-related supra-systems and subsystems. The actual unit of analysis for any particular policy issue and the system boundaries have been recognised as resulting from a process of human judgement reflecting particular world views (Anderson and Veronica, 1994, p. 47).

SPT has been a way of making sense of peoples’ experience (as an epistemology). It has provided a framework for reflection prior to real-world events and a way to review actual experiences after events. However, it has not created a structure or guidelines that could have been followed as a formula into the future. It has therefore been considered by some authors to have been an insubstantial approach, very dependent upon the adaptive capabilities of its practitioners (Bobrow and Dryzek, 1987, p. 10). The process of sense making has been described in the appreciative system of Vickers (1970) which has been used as a sense making framework for managing complex policy issues. Using the appreciative system framework (Prapavessis et al., 2005), a knowledge of systems has relied upon:

- A cycle of judgements and actions interacting as a system with peoples’ experience of events and ideas
- Separation of judgements about our “reality” from our value judgements about whether it was “good or bad”.
- Reality and value judgements forming our action judgements
- Growing and strengthening relationships having been more important to people than seeking and achieving goals

The 4 Windows strategy originally developed by Flood (1999) has provided a framework that has brought together different systems paradigms and methodologies in policy formulation. It has been used to help explain how policy decision making could have been enhanced by SPT and to make system principles more accessible to policy makers outside the system tradition (Parminter, 2005, p. 6). Each of the four windows has been used for examining a particular type of policy question about a common issue, with unique interrogative methods, approaches to assessing validity, and ways of comparing and interpreting information from different sources.

- Window 1 has been used to examine and describe the physical functions of biological or management systems

- Window 2 has been used to examine and describe environmental forces and drivers that directly influence the stability (and instability) of production or management systems. That window has been used for exploring the economic and environmental effects of possible social changes

- Window 3 has been used to examine and describe the range of social constructs associated with particular policy issues. These have included peoples' values, norms, ideologies, beliefs, and emotions

- Window 4 has been used to examine the distribution of decision-making power, and the social as well as equity consequences of current practices and possible social change. That window has been used to assess and address the fairness to different social groups of changes to policy, regulation and industry structure

In policy decision making, no window was intended to dominate any other window and all were to be used to bring together new insights into different world views and provide ways of incorporating those in developing policy (ibid).

Incremental theory

'Muddling through' emerged in the late 1950s as disillusionment with rational theories of decision making was increasing (Lindblom, 1959). The Muddling Through Model (MTM) was designed to approximate the actual decision making of policy organisations, also known as incremental decision making (Kingdon, 1995, p. 79). One of the major advantages of using a muddling through approach has been its political expediency, and it has been used to reduce conflict in negotiations, maintain stability, and help to preserve the political system itself (Dye, 1987, p. 37). Political agreement and budget support has been a lot easier to achieve with muddling-through, because only minor modifications have been made to existing programmes. Political agreement in other areas has been harder to achieve if it involved major changes or dichotomous (rather than incremental) choices.

The MTM itself has taken into account the bounded rationality and satisficing ideas of later rational theory developments and applied them to observed practice (Dye, 1987, p. 36). It has reduced large and complex policy issues into a series of small steps linked to and informed by mechanisms for rapid feedback (Scharpf, 1997, p. 246). MTM has also been different from Garbage Can Theory which has emphasised the uncertainty and randomness of events (Kingdon, 1995, p. 222). MTM has recognised that participants have been invited, issues may have been addressed over a specific time period, and political priorities able to have been ranked. Each of those has not been an open-ended possibility, but rather has reflected deliberate organisation of decision making environments to reduce risks from poor information and any inadequacies in decision making (Kingdon, 1995, p. 222; Scharpf, 1997, p. 246).

Charles Lindblom (1979) has identified three types of MTM in decision making:

- Simple incremental decisions where alternative policies have been compared to existing policies
- Disjointed incrementalism focussed upon a limited set of policy attributes for selecting a preferred policy option
- Strategic incrementalism when simplifying heuristics have been used to resolve complex decision choices

The last of those – strategic incrementalism, has had the most resemblance to rational choice theories of policy making.

In some areas of policy making, the content of policy goals has not been able to have been separated from the mechanisms of implementing policy. It has been no use having policy goals when the policy makers had no idea how they should have been addressed. The resulting MTM has been more about developing feasible policy rather than trying to achieve what could have been the most desirable policy, and more about recognising what was possible rather than seeking a maximal set of benefits. It has been assumed that policy decision makers would have used a set of simplifying and focussing strategies that included (Howlett and Ramesh, 2003, p. 171):

1. Limiting the analysis to a few familiar alternatives
2. Accommodating the interactions between policy goals and policy tools (ie "means and ends") during the policy making process
3. A greater preoccupation with defining the policy issue than in setting policy goals
4. A policy making process of trial, error and revision
5. Focussing analyses on salient consequences rather than an exhaustive list of costs and benefits
6. Incorporating in the analyses contributions from a range of participants, representing a variety of world views

Applying those strategies in policy development has created policies that have built on already existing policies and used people's previous experience to evolve new policy in incremental steps. The incremental process has been useful in policy making, avoiding having to challenge existing power structures, property rights and resource allocations. The operating procedures that have already existed, along with established skills and capabilities have all been able to have

been utilised without creating extra costs from disrupting and rebuilding institutional arrangements (Dye, 1987, p. 36).

By focussing upon the structure of existing programmes there has been a minimal need to have established any policy goals. In a pluralistic society, that approach to strategy has enabled policy makers to accommodate widely diverging views on what their goals should have been – they have been able to have been left open. However the lack of goal orientation has been one of MTM's main criticisms as it has been considered to reduce innovation and development in policy making. The MTM has included only limited public participation in policy making by restricting decision making to the parties and individuals already engaged in existing policy delivery. MTM has also been criticised for encouraging policy makers to focus upon short term localised planning horizons rather than dealing with problematic large scale issues, such as climate change (Bendor, 1995). It has been considered to most suit stable environmental conditions where policy problems and available solutions have tended to change over time very slowly, if at all (Howlett and Ramesh, 2003, p. 171).

Garbage Can Theory

A lack of time available to policy makers, a lack of technical expertise about all the issues, and a lack of information about all the topics involved, has meant that policy makers have taken apparent short-cuts in their decision making (Sterner, 2003, p. 195). They may have relied upon the advice of consulting experts, applied rules-of-thumb, learnt from experience, or conformed to established ideologies (ibid).

The manner in which policy-makers actually made their decisions under pressure has led to the development of the Garbage Can Theory (GCT) of decision making (Cohen et al., 1972). Midgley (2000, p. 174), has been concerned that policy development constrained by an established and singular set of procedures would have lost the confidence of those members of the public that were needed to implement it and who may have rejected themselves commonly used approaches in policy decision making, such as using cost-benefit analyses for environmental tradeoffs. In such situations, policy making procedures may have been needed

that could have been adapted to suit the thinking and decision making of policy constituents rather than the government officials involved (ibid).

If policy problems have evolved over time, the more limited policy making approaches may not have been able to recognise and sufficiently deal with the changes as they have occurred. The result sometimes has been "good" policy developed to solve the "wrong" problem (Midgley, 2000, p. 174). Another policy making problem has been that a singular policy making procedure has tended to develop similar policy solutions even when those may not have been appropriate e.g. catchment plans when property plans were needed, or vice-versa. The GCT has been used to accommodate multi-procedural approaches in decision making and policy development.

Originally put together to explain decision making in academic institutions, GCT has described the characteristics of most organisations, at least in part and for at least part of the time (Cohen et al., 1972; Padgett, 1980). The GCT rejected the formalised rationalism that policy makers have still been encouraged to aspire to (Howlett and Ramesh, 2003, p. 175; Kingdon, 1995, p. 221). Instead of the rationality of the "economic-man", the Theory has described decision making as the unpredictable linking of problems and solutions until a satisfactory (but not necessarily optimal) solution has been found (March, 1994, p. 18). Most policy makers in GCT have preferred to exploit and develop opportunities of inconsistency and ambiguity rather than constrain them by using formal approaches (March, 1994, p. viii).

Garbage Can Theory has not used a two-stage process to separate policy analysis decisions from policy implementation decisions (or for that matter business strategy from operational decision making, or norms from behaviour) instead; all of those stages have become intermeshed in each choice opportunity (Kingdon, 1995, p. 229). Policy makers were considered to have been semiautonomous, more interested in making sense of their environment and finding meaning both individually and socially, than in solving practical problems (March, 1994, p. 37). In GCT they were not considered automatons for either the electorate or politicians (Kingdon, 1995, p. 230), instead they were more likely to have become involved in issues that could assist them to create, maintain and act within self concepts that might have been multiple and sometimes unclear or conflicting.

They were likely to have followed decision rules that built upon experiential learning in the past and environmental selection at the time of decision making. As a consequence, the decisions made by policy makers have been assumed to not so much reflect the issues that they were dealing with, as the ecology of the situation within which they have operated (March, 1994, p. viii).

In a GCT of policy making, policy instruments have not been selected on the basis of their attributes and fitted with particular policy problems. Instead, policy makers have been expected to follow rules of appropriateness, matching familiar policy instruments to situations that they recognised, in ways that supported their own (usually undeclared) self-identity and roles within the organisation and within society (March, 1994, p. 101). The form of the linkage between policy problems and their solutions has depended upon the decision context, the time allocated for decision making and the number and energy level of the participants (Howlett and Ramesh, 2003, p. 175). In the GCT there have been no over-arching goals and no under-lying problem-solving process and no expectation that the best or optimal solution has ever been required (Cohen et al., 1972; Weimer and Vining, 2005, p. 332). Instead of peoples' actions having been directed to achieve goals and conform to decision processes, "what actually happened" was that people were more likely to identify their goals and construct processes as they took action to address the issues of importance to them (Cohen et al., 1972). That has inverted the more rational models of policy making.

There have been no particular organisational boundaries operating in decision making using GCT, although it seems to still have been quite explanatory where those have existed (Kingdon, 1995, p. 207). Most of "today's' problems" have arisen from "yesterdays' solutions" and so every solution has had to have been able to be adapted when and as required (Senge, 1992, p. 57).

Policy analysis and decision making has been described (according to the GCT) as an organised anarchy of four independent conceptual streams consisting of problems, solutions, participants, and choice opportunities. In most cases, those streams have all operated independently of each other or, were at best, loosely coupled in policy makers' decision making (Kingdon, 1995, p. 200; March, 1994, p. 200).

- Policy problems reflecting performance gaps or uncertainty about the future were attended to when they became important enough to attract the attention of somebody of influence. They might have originated from inside or outside of the organisation as a result of media attention, family issues, career development or relationship frustrations. At a certain point the problems have triggered the attention of decision makers (Cohen et al., 1972)

- Problem solutions have had a life of their own, distinct from any particular problems, and have been able to have been put aside (in metaphorical garbage-bins) until they might have been needed. Solutions have not been formed from expected consequences. The most preferred policy solutions have probably already existed prior to any particular problem having been present, and advocates of particular forms of policy intervention have tried to relate them to any form of problem or decision opportunity that could enhance the likelihood of their adoption (Cohen et al., 1972)

- Participants would come and go from a decision environment depending upon the relative importance to them of the policy issue that has been decided upon. Their participation has been more related to the other demands upon time in their lives than upon the needs of the policy problem in question (Cohen et al., 1972)

- Choice opportunities have provided policy makers with the organisational space to redirect organisational behaviour. Such opportunities have arisen independently of any specific problems or solutions, providing participating policy makers with unique opportunities to promote the issues of importance to them. Maybe a particularly pressing problem has arisen (creating a problem opportunity), or maybe there was a change in the political administration (creating a political opportunity; Kingdon, 1995, p. 201)

Political advocates and entrepreneurs have tried to identify and take advantage of apparent choice opportunities as they have arisen, coupling together problems, solutions, and participants to try and improve the likelihood that their ideas would have been progressed (Kingdon, 1995, p. 202). Many partial couplings would have occurred during the resolution of any particular issue, but complete

couplings have been likely to have been the most successful for policy making (ibid). Addressing policy issues within a choice opportunity has usually relied upon simple trial-and-error pathways developed from past experience with pragmatic adaptations to surrounding conditions (Cohen et al., 1972). Policy makers have selected from past experience, rules and procedures that seemed appropriate to the decision making environment (March, 1994, p. 57). Participants have usually matched problem situations and procedures together by anticipating and evaluating future consequences, bargaining and negotiating with other decision makers, imitating the example of others, selecting a suitable mix of procedural steps developed in a range of other contexts, and making inferences from their own experience (March, 1994, p. 78).

Decision makers using GCT have applied a systematic reasoning process that has fitted their situation to a typology of similar situations and then compared and identified options that matched their perceived self-identity. The selected policy making solutions have matched their assessment of how people like them would have behaved in such situations. So the decision making process has been: situation, self-identity, and then decision making procedures. If the decision making procedures (i.e. heuristics or rules-of-thumb) were followed sequentially, they may have approached models of rationality in their logic. However, it has been the appropriateness of an established procedure to their self-identity that has been sought, not their rationality (March, 1994, p. 59).

Policy choices have been made with three different results:

- Oversight, in situations where no particular problems needed to have been addressed, or at least, not just yet
- Resolution where solutions were chosen to resolve particular problems
- Avoidance when the number and size of the problems overwhelmed the energy available and so decisions were deferred to another choice opportunity

In simulations, most choice opportunities have involved either flight or oversight (March, 1994, p. 202). Policy making that has followed the process of situation, self-identity and decision making procedures have not avoided the sources of

ambiguity described earlier. It has still required capabilities in recognition and classification, self awareness to clarify identities, and search and recall, to match these together (March, 1994, p. 61). Achieving organisational success in one policy area have encouraged the application of similar policies in other areas (e.g. from roading to the environment; Kingdon, 1995, p. 203).

Managing the policy making process in an ambiguous decision environment has been shown to require "unobtrusive" guidance by senior staff to bring together for decision making the parties able to provide a balance of conservatism and innovation (Padgett, 1980). The GCT has been challenged about only reflecting decision making in extremely unstructured policy organisations that have had very decentralised management strategies (ibid). From that point of view, it has appeared to have been so generally unmanageable and contextually dependent as to make it look capricious (Padgett, 1980). However, based upon his simulation modelling, Padget (1980) believed that it did provide an opportunity for policy managers within hierarchical organisations to strengthen the policy making process while they still obtained the benefits of "organisational anarchy". The effectiveness of GCT processes has been examined in three ways (March, 1994, p. 202).

- Problem latency, that reflected the amount of time between a problem having been raised and it being brought to a decision making opportunity
- The amount of problem solving activity required to address internal conflicts that may have been present and the time needed to resolve decision making difficulties
- The amount of time taken to achieve problem resolution

Policy managers working in GCT situations have needed to have made only a few limited technical decisions themselves to have avoided becoming involved in the tactical machinations of their staff. Instead they have developed appropriate organisational structures and appointed staff based upon their practical experience and complimentary decision making styles. They should have developed opportunities for experiential learning (March, 1994, p. 70), reduced staff competition and encouraged risk taking (ibid) and sharing about experience

(March, 1994, p. 99). Incentives have not been found to have encouraged decision making partnerships for effective GCT, rather what has been required has been the provision of enough information, personal honesty and secure roles and identities (March, 1994, p. 126).

Analysts operating within ambiguous situations (the basis of the GCT) have been at their best when they have been extremely unconfident about new and unfamiliar issues and very reliant upon external information (Padgett, 1980). If analysts have instead been dealing with well established programmes or with issues for which they have been very experienced, they have been best to have limited the amount of new information that they have had to deal with, and to rely upon their experience. In either situation, increasing central control has not improved decision making in GCT situations, as the central authority has lacked sufficient local knowledge and experience to improve outcomes. Instead, policy makers have been best when they have combined in policy making, groups within the organisation that were known to have been conservative with other groups known to have been more radical about an important issue (Padgett, 1980).

Supporters of GCT have rejected that the more widespread use of rational theories indicated that those theories have been better at predicting and understanding organisational decision making (March, 1994, p. 8). Their main criticism of rational theories has been their poor correspondence to individual behaviour (ibid). In order to accommodate the limitations of bounded rationality, researchers have had to include constraining elements in their models. Those may have included limited attention, poor memory and lack of records, limited capacity for comprehension, and miscommunication (March, 1994, p. 10). However, for GCT supporters, the rational models still haven't addressed the underlying psychological determinants that have influenced peoples' behaviour in the presence of such cognitive constraints (ibid).

Policy Formulation

As policies progress through organisations they increasingly become less abstract (more concrete) and more practical (Howlett and Ramesh, 2003, p. 147, p. 162). Formulation has been considered the process by which alternative policy

interventions have been finally considered, compared and decided upon to address a particular policy issue. The process has been completed when a policy has been adopted by the political organisations involved (Weimer and Vining, 2005, p. 261). The adoption step has not necessarily been a stand-alone or sequential step in the process, and may have occurred whilst policy makers have also been agenda-setting or even during policy analysis. That might especially have been the case if policy makers have been using incremental or naturalistic approaches of decision making. If a rational approach has been used, then policy formulation has been likely to have occurred after policy analysis has been completed (Howlett and Ramesh, 2003, p. 143).

Policy formulation has involved addressing the technical opportunities as well as the political and organisational constraints for taking action (ibid). Such policy constraints may have been substantive if the actions that people could take have been uncertain, or the constraints may have been procedural if institutional and organisational barriers have existed to people taking action. Substantive policy constraints may have resulted from technical or psychological limitations having been present. The technical constraints may have been a lack of necessary technologies or management practices or the technologies that may have been available, were lacking in known effectiveness e.g. the technologies needed to reduce local contributions to global warming (Howlett and Ramesh, 2003, p. 145). Substantive constraints have been influenced by psychological determinants of peoples' existing behaviour e.g. by their beliefs, and by the variable influence upon those of the decision makers' experience and context. Addressing those substantive constraints has made policies more applicable as well as more relevant (Bobrow and Dryzek, 1987, p. 13). Increasing relevance has meant that the level of people's understanding about an issue has increased, and increasing applicability has meant that people have been becoming more capable of resolving an issue. Practical policies have needed to have been analysed for their applicability as well as their relevancy.

Just as there have been instances of 'market failure' with environmental goods and services there have also been instances of 'government failure' in policy formulation and implementation. Natural resource policy has been one of those areas, and new approaches have been needed to enable individuals to sustain long-term "productive use of natural resource systems" (Ostrum, 1990, p. 1).

Procedural policy constraints have existed as well as substantive constraints, and have been able to create institutional or tactical limitations to achieving policy goals. Determining the political feasibility of policy has involved considering expected support, balancing between contradictory goals, and taking into account a diversity of values. Institutional constraints have sometimes been created by the relationships amongst and between government organisations and between them and civil organisations. For instance, the Ministry of Agriculture and Forestry have administered policies affecting (amongst other things) farming practices in New Zealand. The cooperation or antagonism of farming organisations such as Federated Farmers has had a big influence upon the policy outcome e.g. demonstrations against the agriculture emissions levy (Welch, 2003). Tactical constraints have resulted when there have been limitations in the knowledge, skills, and resources available for policy implementation (Howlett and Ramesh, 2003, p. 145, Sterner, 2003, p. xiii). Analysts have tended to learn about how to manage the political context to policy "on the job" from colleagues and clients (Meltsner, 1972). Trial-and-error has soon turned them into experts (ibid). However, learning that has been restricted to opportunities arising from work experience alone has had a tendency to also reduce creativity and to encourage actions that preserved the status quo (ibid).

When substantial and procedural constraints to policy implementation have been known to exist, they usually have been dealt with sequentially in the order given here, but it may have been better to have managed them in synchrony (Meltsner, 1972).

Instrument Selection

The term 'policy instruments' has been used to describe the management practices (a collection of activities, guidelines and skills) that have been available for use by policy makers to achieve certain policy effects or objectives (de Bniijn and Hufen, 1998, p. 13). A large number of substantive policy tools have been available to policy makers (Howlett and Ramesh, 2003, p. 90), associated with the three "methods of influence [available to governments:] persuasion, exchange and authority" (Figure 3), to legally require changes in public behaviour, or to persuade or incentivise selected behaviours, or to establish new organisational

structures (Sterner, 2003, p. 195). Alternatively, policy influences have been described as "normative, suasive or informative"; "enforcement, inducement or benefaction"; or "sticks, carrots, or sermons" by Sterner (ibid, p. 194). Selecting the policy instruments to use has depended upon the issue being addressed as well as the availability of budgeted money, political support, administrative capability and policy advocacy (ibid, p. 195).

There have been at least 69 types of policy instruments described in the economics literature alone (Kirschen et al., 1964, p. 28 to 131)[8].

When a range of policy instruments have been considered, policy makers have taken one of a number of perspectives to select their preferences: instrumentalist, proceduralist, contingentist and constitutivist, depending upon the importance of the technical attributes of the instruments compared to their political and social context.

Usually, examinations of policy instruments during formulation have tended to focus upon comparisons between the objective characteristics of the different alternatives and especially their associated economic strengths and weaknesses (Linder and Peters, 1998, p. 36; Parminter, 2003). That has very much been taking a simple "tool" approach to policy instruments, considering them just like building tools such as hammers and saws, with attributes that were independent of their goals and context. People taking such an instrumentalist's approach have usually sought to refine selected policy instruments to optimise their application and the range of circumstances under which they could have been employed. An instrumentalist's approach has been particularly suited to people that have been applying RPC (Linder and Peters, 1998, p. 37). One way for people to have assessed the potential contributions of different instruments was for them to have considered the instruments in a typology based upon their most salient characteristics (de Bniijn and Hufen, 1998, p. 16). Each instrument has been defined and fitted into the typology in terms of its subprocesses, central activities and implementation effects. Selected instruments have then been deployed

[8] Some more general examples from HOWLETT, M. & RAMESH, M. (2003) *Studying public policy: policy cycles and policy subsystems*, Ontario, Oxford University Press. Information monitoring and release; Command and control regulation; Grants and loans; Direct provision of goods and services; Public enterprises; Advice and exhortation; Self-regulation; Surcharges; Use of family, community, and voluntary organizations; Advertising; Standard setting and delegated regulation; Taxes and tax expenditures; Market creation; Commissions and inquiries; Advisory committees and consultations; Interest group creation and funding; Government reorganization.

irrespective of differences in their operating environment. The result has been that policy practices were selected that have been likely to have encouraged increased stability and expediency but that have made only short term gains in policy outcomes. They have also been less likely to have encouraged increased analysis and creativity needed for greater long-term results from policy interventions (Peters and van Nispen, 1998, p. 2).

Proceduralists have placed more emphasis than instrumentalists upon the process of developing and applying the policy tools than upon considering their characteristics. For proceduralists, even inappropriate tools might have been made effective if they had enough community support. For proceduralists, the political process was central and the instruments have been secondary – exactly the opposite of instrumentalists and consistent with ACI policy analysis (Linder and Peters, 1998, p. 38). For proceduralists, even if incentives had been supplied by policy makers to increase the payoffs for self-interested individuals, the institutional characteristics (rules, systems of meaning and norms) would have determined how people understood the purpose and meaning of the intervention, constrained their choices for taking action, and limited the policy outcomes that could have been achieved (Scharpf, 1997, p. 39).

People applying a contingentists approach to selecting policy instruments have based their decisions upon how well the characteristics of the instruments have matched a particular problem or context, in other words its "goodness of fit" (Scharpf, 1997, p. 36). Those approaches aimed to bring together action and theory and instrumentalist and proceduralist paradigms (Scharpf, 1997, p. 37, Corner et al., 2001). What contingentists might have lost was the simplicity and pragmatism of either of the two other approaches (ibid). Contingentists have relied upon having more empirical information than instrumentalists and more systemisation of relationships and activities than proceduralists (Scharpf, 1997, p. 37 and p. 38). Some have followed SPT approaches for policy analysis and used objective measures of policy fit (Linder and Peters, 1998, p. 40). Policy instruments have been selected by them for two different purposes (Howlett and Ramesh, 2003, p. 91). They might have considered some to directly address specific policy issues – i.e. they were "substantive instruments", and they might have considered some as mechanisms for providing societal contributions into the development of policy – i.e. they were "procedural instruments". Those

distinctions (in Figure 3) have not always been so clear especially during policy implementation.

To achieve a goodness-of-fit some policy makers have combined technical and non-technical parts of instrument selection by considering the following decision making framework (Linder and Peters, 1989):

- Resource intensiveness, management demands, and operational simplicity
- Relative targeting precision and selectivity
- Level of associated political risk including the amount and type of public support and community cohesion
- Institutional fit to the governing ideological principles and previous history of the organisation
- Nature of the policy problem and its social context
- Required attributes of possible policy instruments
- Policy experience and preferences

Constitutivists consider the subjective and symbolic meanings of policy instruments and their associated values to be primary. For them objective characterisation has not been possible and rational approaches to instrument assessment based upon the objective knowledge of experts should not have been privileged over the experience and perceptions of other stakeholders (Linder and Peters, 1998, p. 41).

Figure 3: A range of procedural and substantive policy instruments arranged according to the level of institutional control involved (high to low)

Procedural Instruments

commissions	advisory committees		consultation		participation

Substantive Instruments

authoritative	economic		communication		
rules and regulations	payments and charges	incentives	persuasion	education	information

Top-down and Highly coercive — Bottom up with Minimal coercion

They have often considered that the application of particular instruments was more important for their contribution to social learning than to solving particular policy problems (de Bniijn and Hufen, 1998, p. 27). Constitutivists have considered policy instruments to have been embedded in the institutions of the policy community and associated with their legitimacy, trust and confidence in the eyes of their public (Bagchus, 1998, p. 56). The choice of instrument then has been strongly determined by the existing behaviour patterns and routines of that policy community. Kingdon has compared policy instrument selection to the process of natural selection. In both cases the primeval material was randomly generated in an uncontrolled way but the subsequent process of selection could bring "order from chaos [and] pattern from randomness" (Kingdon, 1995, p. 222). During the selection process, being able to recombine and reconfigure familiar elements to engender familiarity and receptiveness has been more important than invention and radical change (ibid).

As researchers have moved from considering instruments in isolation, towards considering instruments as contextually dependent, they have provided more and more understanding for policy makers about the practical application of those instruments and less and less direction on how they should have been employed for achieving meaningful change (de Bniijn and Hufen, 1998, p. 28)

In practice, policy makers have been observed to take a range of approaches in selecting the particular policy instruments to deliver their policy. Sometimes they have appeared to rely upon intuition, or guessing, common sense, previous decisions or experience with similar issues (Peters and van Nispen, 1998, p. 2; Manfredo, 1992, p. 37; Weimer and Vining, 2005, p. 266 and p. 349; Linder and Peters, 1998, p. 36). The actual mix of policy instruments in use has been considered by Sterner to have mainly reflected the political institutions involved and the characteristics of the decision makers, rather than any technical analysis that might have been carried out (2003, p. 195). There has been little evidence to date of considerations given by policy makers to the interactions between the various policy instruments and their political context, and with the decision making heuristics of decision makers (ibid). Little account in the literature has apparently been taken of likely social and political responses to particular instruments and instead most published decision making processes have been dominated by their relative economic costs and their degree of public intrusiveness. The relationships underlying relevant policy networks have been shown to have a significant effect upon how specific instruments function and their degree of effectiveness (Peters and van Nispen, 1998, p. 5). It has been understandable then that policy organisations have tended to prioritise policy issues that they considered to have been the most easy to solve using their existing selection of policy instruments. They may have also preferred policy instruments that had minimum conflict with, and the greatest acceptability to the existing policy environment.

Value conflicts arising during public consultation and instrument selection have been handled in a number of ways. Alternatives have included (1) attempting to integrate conflicting values in some way—for example, with reference to a single metric provided by some higher value; (2) making explicit the performance of policy options according to a number of criteria and leaving the problem of value weighting to an external decision maker; (3) ignoring the problem; and (4) specifying rules for normative discourse (Bobrow and Dryzek, 1987, p. 15).

Once the appropriate instrument or instruments has been selected, implementation has required further operational decisions to cash-flow the budget, allocate staff responsibilities, and organise work plans. The approach taken when planning for

implementation has depended upon a number of societal characteristics (Howlett and Ramesh, 2003, p. 192):

- The complexity of the policy problem – for instance, reducing regional driving fatalities has been associated with multiple behavioural issues compared to closing down some illegal sales outlets

- Heterogeneity and visibility of the target group – from a group that may have been almost invisible and highly varied e.g. car drivers who listened to the radio, to a more similar and visible group e.g. drivers of Ferrari cars

- The type of behaviour change required – from a utilitarian change, such as using acrylic instead of enamel paint compared with value-based changes such as gazetting a favoured fishing ground as a new nature reserve

- Social conditions during the life of the programme – e.g. from an economic down-turn to the immigration of a new ethnic group or an aging population

- Technology innovations – so that people could avoid their responsibilities or achieve more beneficial outcomes

- The level of political insecurity – for instance from having possible changes in government administration or a period of parliamentary stability

The Resource Management Act and Policy Formulation and Implementation

The Resource Management Act (New Zealand Government, 1991) has been New Zealand's primary policy instrument for determining the sustainable management of the country's natural and physical resources (ibid, part 2, section 5). The Act has identified for local authorities several environmental issues of national importance and a number of principles for guiding the development and content of natural resource policies.

In the Act, the Minister for the Environment has been made responsible for national policy statements, monitoring implementation of the Act and carrying out investigations into the use of economic instruments as policy mechanisms (ibid, part 4, section 24). Regional Councils have been required to prepare for their regions "objectives, policies and methods to achieve integrated management of the natural resources of the regions" (ibid, part 4, section 30). Regional Councils have also been required by the Act to prepare an evaluation of the efficiency and effectiveness of any proposed policy intervention taking into account their "benefits and costs" and "the risk of acting or not acting …" Those factors affecting effectiveness have had to have been identified, monitored and regularly and publicly reported. Any rules developed by local authorities must have been shown to have been "the most efficient and effective means of preventing or minimising those adverse effects on the environment" (ibid, part 5, section 70).

The emphasis in the Act upon the use of economic instruments, establishing objectives, and systematic evaluation has suggested that it was largely written to support Rational Choice and Actor-Centred decision making during policy design. The emphasis in the Act upon the technical efficiency and effectiveness of selected policy instruments rather than relationships and negotiation has supported the use of instrumentalist and contingentist approaches in determining the choice of policy instruments, rather than constitutivist and proceduralist approaches.

Reviews by the Parliamentary Commissioner for the Environment, into the application of the Act have provided evidence that it has not been applied to achieve desired environmental outcomes, as well as was intended (Ericksen et al, 2003, p. xii). The lack of results has been related to the inadequate quality of statutory plans developed to address environmental issues rather than a lack of

recognition of the issues themselves (ibid). In their review, Ericksen et al. (2003, p. 31) described resource management planning as "rational-adaptive". "In this model, plan making is primarily a rational analysis and design activity, whereas plan implementation has been primarily an incremental administrative and political based activity." The inclusion of section 32 in the Act required councils to examine "the extent to which each objective [was] the most appropriate way to achieve the purposes of the Act" and the "efficiency and effectiveness" of their policies (New Zealand Government, 1991, part 4, section 32.3). The inclusion of section 32 suggests that it was the intention of those developing the Act to be much more objective and analytical in their implementation of policy than Erickson et al. have described.

The Theory of Reasoned Action has not been a human behaviour theory derived from economics. Where economists might have particularly focused upon material costs and benefits the TRA has included those as well as peoples' self concepts, social expectations, personal confidence and emotional experiences. However, the Theory has been developed from principles of reasoning and cognition about behavioural choices and it has relied upon evaluating behavioural choices through comparing consequences. It has been possible to use the TRA to complement economic analyses of market dynamics as part of Rational Choice, Actor-Centred and Systems Policy Thinking. Alternatively, the TRA has been able to have been used on its own to guide policy making using these approaches. The TRA has also been suited to selecting policy instruments using instrumentalist and contingentists selection criteria.

Applications of the Theory of Reasoned Action in Policy Formulation and Implementation

Attempts by government agencies to influence public behaviour have often been only partially successful and sometimes they have failed entirely. The lack of a theoretical understanding about human behaviour has been part of the reason for these limited successes (Manfredo, 1992, p. viii). Communication of policies has also often been restricted to verbal messages based upon reasoning and force of arguments rather than any in-depth understanding of how to motivate behaviour change (ibid, p. 2).

The examples of the TRA used in Chapter 2 includes studies where the behavioural model used by researchers have been able to assist policy makers by providing new insights into people's behaviour and the psychological drivers of performance. Generally in those studies however, the TRA has not been actually applied to determine the nature and content of any specific behavioural interventions by policy agencies. There have not been enough published reports in the literature with examples of how the TRA has been used and evaluated as a behavioural model, to guide the design and implementation of policies for achieving some public-good outcomes (Parker, 2002, p. 141).

In some studies, the TRA has been used to identify the particular sets of beliefs that could have been targeted by information campaigns (Kilvington et al., 1999, p. 4). However, even in those cases, the Theory has still not been used to identify how to address a set of identified beliefs in order to achieve a desired behaviour change. Generally studies using the TRA have created the opportunity for implementing a policy intervention but have not themselves included applying any of the results (Terry et al., 1993, p. 36). In some ways that has been understandable as such studies would have required researchers to engage in designing and implementing an intervention for which they may have been inadequately skilled and resourced. Including an intervention in a research study has been a way to introduce additional sources of confounding and make attribution of the results more difficult to define. That may have dissuaded some researchers from carrying out more of such studies.

In research that has been designed specifically to judge the effectiveness of applying the TRA in policy design, it would have been inappropriate to compare an intervention group with a non-intervention group. Rather, it has been more useful to have studies where the available technical information about an issue has been used in a targeted way, based upon the TRA, and compared with the same information used in an untargeted campaign. In those research studies, the results have not always been consistent.

For example, in a study about in-home environmental testing, the TRA was successfully used to develop targeted information for a staged process of behaviour change (Myers and Frost, 2002, p. 76). At the beginning of the process, information based upon attitudes and beliefs was prepared by focussing

upon increasing people's awareness of the risks from specific environmental threats, later; the information was focussed upon improving peoples' confidence about the ease of taking action. Over a 12 month period people not exposed to any project information (the control) had 25% carry out an environmental test of their home, people receiving untargeted information had 50% test their home and people receiving the targeted information had 75% test their home.

Another study, with mixed results looked at reducing fat intake in people over a 5 month period by giving them three different types of information in 4-page leaflets. One leaflet provided technical information about the effect of having high fat levels in the diet. One leaflet encouraged an attitude change by strengthening positive beliefs and refuting negative beliefs. A third leaflet was intended to increase self-efficacy by providing advice for simplifying the process of change. All the leaflets tended to improve peoples' attitudes towards eating a low-fat diet. The theory designed leaflets had the most significant improvement, but were not significantly different amongst themselves. As a result of receiving the targeted information, people improved their attitudes towards fat intake, and total fat intake decreased, although the percentage of fat in their diets didn't change.

In the latter case, the lack of difference from applying a targeted campaign was put down to poorly designed presentation of the information, lack of personal intensity in the campaign and a lack of time for the campaign to have been carried out (Armitage and Connor, 2002, p. 99).

New Zealand agencies have designed policy interventions to increase helmet wearing by cyclists through strategies aimed at school children. The strategies were based upon "common sense" incentives rather than "using a theory-driven approach"(Quine et al., 2000, p. 173). Having education-only increased helmet usage from an initial 3.5 to 14.4%. Adding prizes for compliance increased that to 23.0%, and having a serious bike accident occur nearby increased it to 33.3%. In Canada, education increased helmet wearing amongst school children from 0.75% to 12.8%, and having a fatal accident nearby increased that further to 51% (ibid, p. 174).

There have only been a limited number of studies using the TRA in environmental policy. In Utah, participation by landowners in government run riparian

management programmes was considered to have been very low (Corbett, 2002). The low participation rate was mainly considered to have been due to a lack of a theoretical basis for their strategies. In a research study of the Theory of Planned Behaviour plus past behaviour, moral norms, self-efficacy, information and financial factors were all tested. The behaviour that was studied was the participation by landowners in a government-sponsored riparian programme and the researchers achieved a coefficient of determination for their intentions (R^2) of 29%. The researcher in that study used financial motivation, past behaviour, exposure to government campaigns and self-efficacy as independent variables. The paper included results showing that respondents that had participated in government programmes in the past were unlikely to participate in more recent ones.

In Australia a study carried out in Queensland examined landowners' intentions towards fencing-off the riparian area and establishing off-river watering points (Fielding et al., 2005). In that study the coefficient of determination for intentions was 54%. The explanatory model included past behaviour, behaviour benefits, costs and willingness to comply with social referents. In contrast to the study in Utah, strong intenders in Queensland had previously engaged in riparian zone management.

In New Zealand, Jay (2004) identified in her study that the country's environmental planning tended to have been very normative and there was a need to reward landowners' nonproduction values (ibid, p. 11). Jay considered that protecting bush on private land was more than "a straight forward economic or utilitarian issue". She felt that landowner's decision-making resulted from their attitudes and values, the influence of other people significant to them and the availability of labour, information and knowledge (ibid, p. 59). However, Jay was not able to find clear differences in those potential drivers for landowners protecting or not protecting their bush (ibid, p. 181).

Bewsell et al (2007) interviewed 30 dairy farmers from four catchments in New Zealand about their riparian management practices. Although the data was not quantitative and was limited to the catchments sampled, the authors identified four different decision making rationalities determining farmer behaviour. Farmer decision making appeared to have been mainly influenced by beliefs about

livestock management and how that could have been affected by riparian fencing, and from normative pressures, rather than water quality or other environmental issues. For Bewsell the most effective policy interventions were expected to have been those providing benefits to landowners as well as to the environment. Rhodes et al (2002) surveyed farmers from Southland and Otago and found that farmers implementing riparian practices had greater access to riparian information and were more aware of local government financial incentives. However, the study lacked a theoretical framework for developing the results into a policy intervention.

Despite the potential contribution of the TRA to New Zealand policy making, models based upon it elsewhere have not been developed to the point where they could have been readily taken up and applied in natural resource policy formulation and implementation. Policy makers in New Zealand still have not been able to know how much explanatory capability the Theory had for local policy issues and how much flexibility there might have been for applying the same model to similar policy issues. It has been unclear in the literature so far, how the information contained in a TRA model might have been applied in the construction of natural resource policy strategies.

Summary of the Review of Policy Theory

The review of publications about policy making theories in the chapter suggested six steps or types of contributions to the policy making process:

- Agenda setting
- Policy analysis
- Policy formulation
- Instrument selection
- Implementation
- Evaluation

In practice, the distinctions between each of these steps may not have been as apparent as they might have appeared in theory and for expediency some may have been conflated together. The different underlying concepts about the management of knowledge and institutional relationships in the process of decision making has become most apparent during policy analyses and has been described as:

- Rational choice theory
- Actor-centred institutionalism
- Systems policy thinking
- Incremental theory
- Garbage Can theory

In Table 5 each form of policy analysis has been positioned according to its emphasis upon realising predetermined goals and the degree of formalised structure in the analytical process. Rational Choice and Actor Centred Institutionalism have both required goals to work towards and have been the most systematic of any of the approaches.

Table 5: Forms of policy analysis decision making

		Structure	
		Systematic	Loosely Coupled
Goals	Goals absent	Systems policy thinking	Garbage Can theory
	Goals present	Rational choice and Actor-centred	Incremental theory

Systems Policy Thinking and Garbage Can Theory have not initially required any particular policy goals and Incremental Theory and Garbage Can Theory has not required formal analytical processes or frameworks. Policy formulation and instrument selection have dealt with more practical steps of policy making. The underlying theories have been less well developed for those as researchers have been more problem solving and issue specific in their research. Although they may have used different terms in their respective studies, a number of researchers have described decision making as either:

- Instrumentalist
- Proceduralist
- Contingentist
- Constitutivist

In Table 6, instrumentalists have been described as approaching the selection of policy instruments (or tools) as a technical exercise to achieve predetermined goals and conducted independently of the political and social context. Proceduralists have placed more importance upon establishing a political process for negotiating with stakeholders then goals and have tended to select instruments that have had a widespread political support irrespective of their technical efficiency. Contingentists have strived for 'goodness-of-fit" by fulfilling a mix of technical and procedural requirements. Constitutivists have placed a low value upon technical efficiency and procedural negotiations because those tended to have been artefacts of existing social relationships and power structures. Instead they have placed more emphasis upon using instruments to create opportunities for social learning and capability building.

The combination of policy analysis approaches and types of instrument selection decisions described has provided the range of epistemologies and paradigms that have guided natural resource policy making overseas and in New Zealand.

Table 6: Forms of policy instrument decision making

		Emphasis upon Instrument Attributes		
		High	Moderate	Low
Goals	High	instrumentalist		constitutivist
	Moderate		contingentist	
	Low			proceduralist

The Resource Management Act has been the main basis of New Zealand's natural resource policy since 1991. Largely policy has been developed by local authorities working in the regions. The Act has encouraged them to take a very systematic and goal driven approach to the development of policy and most have readily aligned themselves with policy decision making based upon Rational Choice Theory and Actor-Centred Institutionalism. The selection of policy instruments in the Act has mainly been guided by principles consistent with instrumentalist and contingentist criteria.

Those results have suggested that the Theory of Reasoned Action could potentially contribute to natural resource policy making. Applications of the TRA in a range of policy contexts have highlighted that its use has not always guaranteed levels of behaviour change that could not have been achieved through relatively uninformed strategies anyway. In natural resource policy the published studies have suggested that people have had complicated motives for what they did or didn't do. Further development of the TRA might assist policy makers to better understand the ways that peoples' behaviour reflects the interactions between them and their life-context and the influence of various policy instruments upon those.

Chapter 4. Research Questions to Advance the Formulation of Natural Resource Policy in New Zealand

Introduction to Research Questions

The research study has examined the use of principles from management systems and cognitive social psychology in the analysis and formulation of public policy for environmental outcomes. It was intended that the theories and tools developed in this study could be applied by policy makers working in relevant local authorities and government departments. In the current chapter of the thesis, the material presented in previous chapters has been drawn upon to identify the research questions that were then used to guide the rest of the project.

The selected questions have been designed to (Conner et al., 2001, p. 26):

- Be interesting and feasible
- Be able to be operationally defined and empirically testable
- Clearly state their context, their subjects, and the conditions under which they would be tested

Considering the Theory of Reasoned Action

There have been a number of cognition theories from social psychology that have been used to inform policy making processes (Clark and Becker, 1998, p. 26). Those theories have provided an understanding of peoples' activity and relationships, through knowledge of their beliefs and how they related to the expected behavioural consequences, social context and experience (Rutter and Quine, 2002, p. 1). Models such as the health belief model (Strecher and Rosenstock, 1996), and the self-efficacy model (Bandura, 1977) were initially considered for this study, along with later developments in the Theory of Reasoned Action (TRA; Ajzen, 1991). When compared with each other, the former theories have lacked the developed processes of implementation and extensive explanatory power (Quine et al., 2000, p. 90) that the TRA had and so the TRA has been selected for this project as a model to test the potential application of social psychology theory to the practice of policy making.

The Theory of Reasoned Action (TRA) has been developed in social psychology as a sufficient yet parsimonious model of individual behaviour. Originally the TRA has been applied only to behaviours that were completely volitional, i.e. their expression was fully under peoples' own control. By including a measure of behavioural control in the model, it has been expanded to explain behaviours that were only partially volitional. By utilising beliefs salient in a population rather than just pertaining to individuals the model has been applied to different social groups and a range of policy applications (R^2 = 0.4-0.8; Ajzen, 1991). However, in some cases the model has achieved only a low level of explanatory power (Prapavessis et al., 2005), it has therefore been important for this study to test the model using actual examples in order to show that it could have been applied to environmental behaviours such as planting and restoring areas of indigenous trees.

Research Question 1: *Could a human behaviour model based upon the TRA be developed sufficiently for environmental policy makers to explain landowner behaviour associated with managing indigenous vegetation?*

Considering Policy Making

Policy making has been described as essentially linking two different processes of management decision making together to enable policy organisations to achieve public goals and address societal issues (Parliamentary Commissioner for the Environment, 2004a, p. 91). Decision making has involved developing an overall strategy or framework for action and then designing the specific steps for planning, implementing and evaluating the strategy (Sparks et al., 1997, p. 1 to 9). Strategic decision making has been used to ensure that a policy intervention addressed issues of concern and achieved desired public outcomes important to political and social groups and to policy agents themselves (Kingdon, 1995, p. 197). Implementation of interventions has required that strategies have been developed through largely operational decision making, so that the strategic framework could have been applied in a coordinated, purposeful and efficient manner (Sterner, 2003, p. 195).

Some policy issues may have been technical in nature, arising from human behaviour that was perceived to have been exploiting an uncontrolled resource or relationship. In contrast, other issues may have been institutional and concerned

with the rights and responsibilities of stakeholder groups. Generally, although dominated by one of those, policy issues have involved some combination of them both (Howlett and Ramesh, 2003, p. 146). However, not all policy issues have a predetermined personal or social goal for behaviour change as the basis of operational planning and it may sometimes have been that negotiation and relationship building has actually taken precedence over other policy outcomes.

Policy Programme Strategies

At the strategic level, policy making has been viewed through five paradigms – rational choice, institutionalism, systems thinking, incrementalism and garbage-can theory (Dye, 1987, p. 20). Rational Choice and institutionalism have been the most likely processes to generate predetermined operational goals for changing behaviour. Systems thinking and incrementalism may also have been used that way. Quite complex goals may have been produced from systems thinking where as usually only marginal changes have been required from incremental decision making. A human behaviour model could have been used in the establishment of operational behaviour goals by assisting policy makers to define in their programme strategy the behaviours that required changing. A suitable model could also then have helped them to establish whether or not a policy agency was the best agency for directing and encouraging the identified changes.

Policy Operational Planning

The selection and adaptation of particular policy instruments for an operational plan so that they matched the requirements for achieving behavioural change has been fundamental to goal based operational planning. However, most research on policy instruments seemed to have been focussed upon developing the technical efficiency of various instruments', taking a "tool-box" approach. In contrast, this study has been intended to develop from social psychology theory a model of human behaviour that could have been used by policy makers to compare and select policy instruments based upon their ability to achieve predictable behavioural outcomes (Howlett and Ramesh, 2003, p. 89; Linder and Peters, 1998, p. 36).

Instrumentalist approaches to operational planning have been the most likely to use information about the technical efficiency of various policy 'tools' to decide which instruments to use. A technical typology of instruments that defined their

objective attributes has commonly been used in instrumentalist approaches for planning. A human behaviour model could have assisted instrumentalists if it could have provided them with a way of predicting their level of achieving predetermined policy goals from matching the capability of particular policy instruments to drivers of behaviour change leading to the next research question.

Research Question 2: *How well could a social psychology model of human behaviour, based upon the TRA, have predicted public responses to a policy programme?*

Proceduralist approaches to operational planning have been intended to create institutional change through negotiation with stakeholders and by building public consensus. If it resolved the following research question, a human behaviour model could have assisted proccedurallists identify the different stakeholder groups with different behaviours to change, the different motivations for their behaviour and their differing normative influences.

Research Question 3: *How well could a social psychology model of human behaviour based upon the TRA, have distinguished between the policy intervention needs of different stakeholder groups?*

Constitutivists considered that it would have been necessary for policy inventions to have used local knowledge and experience in order for them to have adequately resolved policy issues. A human behaviour model could have provided constitutivists with information about the values, attitudes and beliefs of different stakeholder groups and how those could have been influenced by peoples' knowledge and experience.

Research Question 4: *How much have peoples' values, attitudes and beliefs affected their behaviour?*

Contingentists have relied upon empirical information about public behaviour and an understanding of stakeholder relationships to select policy instruments and develop operational plans for intervention. A human behaviour model could have assisted contingentists plan policy interventions based upon an understanding of

how they could affect the external environment of decision making to influence their behaviour.

Research Question 5: *What have been the immediate antecedents to peoples' behaviour and how have they led to behaviour change?*

Natural Resource Policy Focus

After the arrival in New Zealand of Maori people from Polynesia about one third of the original forest was burned repeatedly and replaced with grasslands. About one quarter of the land-based birds were hunted to extinction. Since European settlement in the mid nineteenth century, a further one third of New Zealand has been converted from indigenous forest to farmland, in the process many ecosystems have been dramatically changed and many more species have became extinct (Department of Conservation and Ministry for the Environment, 2000). Current government programmes to reverse that decline have been considered to have been insufficient on their own unless private landowners have also taken steps to protect and enhance any areas of remnant indigenous vegetation remaining on their land. "Sympathetic management" of private land could have provided much needed habitats for New Zealand's native species (Department of Conservation and Ministry for the Environment, 2000). In section six of the Resource Management Act (New Zealand Government, 1991) it has identified "the protection of significant indigenous vegetation …" as one of the matters of national importance that must be addressed in all policy strategies relating to the Act. In this study the research has focussed upon three behaviours that might have been undertaken by landowners and that might have been of interest to policy makers dealing with natural resource issues:

- Protected and conserved bush remnants currently found on private land
- Fenced and planted riparian (stream-bank) margins with indigenous trees
- Established and maintained indigenous woodlots on farms

Summary of Research Questions

This study has examined the process of developing policy interventions that encouraged people to change their environmental behaviour. It has brought together principles from management systems, political science and social psychology to develop new theory in strategic planning for natural resource policy. To do so this study has addressed the five research questions described below:

1. Could a human behaviour model based upon the Theory of Reasoned Action be developed sufficiently for environmental policy makers to explain landowner behaviour associated with managing indigenous vegetation?

2. How well could a social psychology model of human behaviour based upon the TRA, have predicted public responses to a policy programme?

3. How well could a social psychology model of human behaviour based upon the TRA, have distinguished between the policy intervention needs of different stakeholder groups?

4. How much have peoples' values, attitudes and beliefs affected their behaviour?

5. What have been the immediate antecedents to peoples' behaviour and how have they led to behaviour change?

The next chapter has described the methods used to address these research questions with a focus upon the issue of rural landowners' actions to preserve indigenous vegetation on privately owned land.

Chapter 5. Methodology Used to Test the Application of the Theory of Reasoned Action to Natural Resource Policy

Introduction to Methodology

This chapter first presents some background information about research methodologies for examining relevant social psychology research issues. Then the chapter describes how some of the principles that have been developed might be applied in a study based upon the Theory of Reasoned Action. Lastly it has provided an outline of the research method that was employed in this study.

Appendices at the end of this report contain copies of the letters sent to prospective respondents and the questionnaires used in this study.

Research Methodology

Methodology Overview

Five research methods from social science could have been applied to study the research questions considered in this project. They included: experiments or quasi-experiments, surveys, observational studies, case studies and analysis of archival information (McBurney and White, 2004, p. 214, p. 238, p. 265 and p. 330). The decision about which method to use depended upon how much control the researcher could have over the activities being studied, and how contemporary their expression might have been (ibid, p. 189).

The five research questions have not required any extended explanation of why certain behaviours have occurred, although a degree of explanation has been embedded in the first question i.e. "explain landowner behaviour" and the last question, "how have they lead to the behaviour change". Instead the overall questions have been mainly concerned with measurement, i.e. the "sufficiency' of the explanation, the "level of prediction", "how well" the TRA could distinguish between different groups of people, "how much" psychological variables affected behaviour and the "immediacy" of the antecedents.

Experiments could have been used to quantify the relationships between the variables and could have provided a very clear test of the underlying cause and effect relationships in our research questions (Fife-Schaw, 2000a, p. 75). Unfortunately, they would have required too much control over the institutional actions to have been used in this study. The information in histories and archival analyses would have been too historical for what was required. Therefore, surveys have been considered the best method to use for quantifying information about current landowner protection and management of indigenous trees. In other research studies, survey results have been able to provide data for correlational analyses and established theory from social psychology has been used to indicate the presence and direction of likely causes and effects in the results.

The research questions in this study have focussed upon the relationships between policy interventions and behaviour. These would best have been examined by observing over time the effect of interventions upon the behaviour of individual landowners' (Fife-Schaw, 2000b, p. 90). However, sufficient individuals have not been available for long enough to provide significant results in this study. Therefore, cross-sectional surveys have been used as a way of providing more data at a cheaper cost over a shorter time period than longitudinal studies (Fife-Schaw, 2000b, p. 89).

Survey Administration

Types of Surveys

Surveys have been administered in other studies in four different ways: personal interviews, telephone interviews, mail-out questionnaires or web-based questionnaires.

Personal Interviews

One of the main advantages of face to face methods of surveying has been that they typically have a low level of non-responses. It has been generally accepted that face to face methods of survey administration can have a non-response rate of around 10%, the lowest rate that can be achieved and the best for any method (that means 90% of contacted participants will have agreed to take part; Neuman, 1999, p. 272).

For face to face surveys, the two main sources of nonresponses have been those people refusing to take part and those people absent when the interviewer has called (Schuman and Kalton, 1985, p. 676). While there have been other reasons, those other reasons have generally been considered of little significance (ibid).

With personal interview methods, both advantages and disadvantages have come from having a high level of interaction between respondent and interviewer. The presence of an interviewer has not only been able to encourage respondents to initially begin the survey but have also allowed maximum motivation of participants to have been sustained throughout entire interviews (Schuman and Kalton, 1985, p. 677). Interviewers have been in a position to notice when a person has not understood questions and have immediately been able to clarify them rather than having ineffectual and confusing data (as would occur in self-administrating surveys) with the same set of questions. Also, brief answers to open ended questions have been able to have been prompted or "probed" and thus a fuller understanding has been gained from each participant (McBurney and White, 2004, p. 244).

If interviewing a specific respondent has been important, then that method, through the use of a physically present interviewer has gained the benefit of allowing the highest degree of assurity over all survey methods that the answers were coming from the desired target (Neuman, 1999, p. 267).

Through the use of an interviewer, the question sequence in personal interviews has been easy to control and of any survey administration method, the amount of intended questions for respondents to have been happy to answer, has been the longest (Neuman, 1999, p. 265). One could surmise that that benefit has again related to the physical presence of an interviewer and perhaps has led back to the motivation that the presence of interviewers has been able to provide. In addition, if the questions asked within a survey have been of a high level of complexity or if the survey was composed of mainly open-ended questions, then face-to-face interviewing methods have been considered the best (Neuman, 1999, p. 255).

Unfortunately, interviewers have been known to affect responses through their own biases (Neuman, 1999, p. 279). What is more, the presence of an interviewer has created what could have been considered the face-to-face methods greatest disadvantage; increases in both time and cost. Not only have the interviewers had

to have been paid but also their travel expenses covered, making face-to-face interviewing the most expensive method of survey administration (McBurney and White, 2004, p. 244). The efficiency between those two variables has often been low; with interviewers possibly spending more time travelling and recruiting participants, than actually interviewing them. The social desirability of some answers has affected face-to-face methods the most of any form of administration (Neuman, 1999, p. 258). However, it has also been shown that through the training and scripting of interviewers it has still been possible to obtain reports of detailed autobiographical events and socially undesirably behaviour (Schuman and Kalton, 1985, p. 653).

Telephone Interviews

Telephone surveys have been the most common method of administering surveys (Schuman and Kalton, 1985, p. 679). Therefore one could have surmised that telephone surveying was the best method to use, however, on closer examination it has appeared to have been more likely that rather than having the most benefits, that method has minimised the main disadvantages of face-to-face methods (i.e. the cost) while still reaping a high percentage of its advantages.

To its detriment, telephone surveys have had a higher non-response rate than face-to-face surveys; with research showing the level to have been about 20%, so it has generally been expected that only 80% of those contacted would agree to take further part (Neuman, 1999, p. 267). The lower response rate with telephone surveys may have been in part due to it having been "easier for potential respondents to hang up on someone than to close the door in their face" (Schuman and Kalton, 1985, p. 679).

The 'relative ease' of breaking contact has been extended to people starting but then not finishing their telephone interviews. Close to five percent of participants have been known to begin to respond to a survey but partway through – have hung up (Schuman and Kalton, 1985, p. 677).

Non-responses in telephone surveys have tended to have an unproportionally high level of the elderly, perhaps in part because hearing difficulties have increased as people have got older, especially for certain frequencies, although others have speculated that "with the current cohort of the elderly" there has been a tendency

for them to have been uncomfortable about using the "telephone for extended conversations with strangers" (Schwarz et al., 1998, p. 166).

With telephone surveys, coverage relative to face-to-face has been slightly lower (Schuman and Kalton, 1985, p. 679) but with the number of households in highly westernised countries having phones at around 90%, and the use of Random Digit Dialling (RDD) to avoid the problem of unlisted numbers; the lower coverage range has not typically been considered a big issue (Schuman and Kalton, 1985, p. 679).

Like face-to-face surveys, the disadvantages for telephone methods have been mainly created through the presence of the interviewers administering the surveys. However unlike face-to-face, telephone methods have suffered considerably from time pressure. As a result, respondents have been known to have shortened or simplified their thinking time or responses because they felt that the interviews were taking too long. Research has suggested that the time pressure of telephone interviews has been the result of the silence while people have been reflecting or deep in thought and not able to have been "bridged by non-verbal communication to indicate that the respondent has still been paying attention to the task" (Schwarz et al., 1998, p. 168). It has been found that time pressure interacts negatively with "extensive recall processes" (Schwarz et al., 1998, p. 169) and fosters the use of strategies that shorten processing time and effort (ibid).

Just like face-to-face interviews, in telephone administration there has remained an interviewer so a social situation has been created – it has allowed relatively less but still some, interviewer motivation and ability to clarify misunderstandings. Likewise, if a specific participant was desired, then the telephone method has provided a high level of verification (Neuman, 1999, p. 268). As long as the interviewer has known the phone number of the desired participant, then there has been a high likelihood, helped by differences in voice and tone across different ages and gender, that they were talking to the person that the individual said they were.

Through the use of a telephone interviewer the question sequence has been able to have been controlled, making sure that the questions have been answered in the desired order (Neuman, 1999, p. 272).

Some research studies have concluded that respondents have not been prepared "to answer sensitive questions on the telephone" compared to face-to-face methods (Schuman and Kalton, 1985, p. 679). Possibly that reluctance could have stemmed from telephone surveys that have been perceived as "less anonymous than mail or web-based surveys" (McBurney and White, 2004, p. 246).

Surprisingly perhaps, the social desirability bias of answers within telephone interviews has been lower than face-to-face methods (Neuman, 1999, p. 258). Moreover, interviewer biases have also been reduced through the telephone method (Neuman, 1999, p. 272).

Telephone surveys have been much quicker and relatively cheap to complete, and generally they have cost "half or less" than that of "similar quality" face-to-face interviews (Schuman and Kalton, 1985, p. 679; Neuman, 1999, p. 274). Both benefits have been interdependent; because interviewers in telephone surveys haven't travelled and instead they have carried out their interviews in a central location, so additional travel time and costs have not have been required (McBurney and White, 2004, p. 246). With no travel times to worry about and by making use of the "nearly round-the-clock interviewing possibilities allowed by different time zones" the time required to complete surveys has been able to have been condensed into months or even weeks (Schuman and Kalton, 1985, p. 679). Therefore telephone surveys have been considered a speedier method of administration than mail or face-to-face methods (Neuman, 1999, p. 272).

Complex and open-ended questions may have been able to have been asked in phone based surveys but "it has been more difficult to ask complicated or open-ended questions over the telephone" compared to face-to-face and mail-based questionnaires (McBurney and White, 2004, p. 246). The length of questions in telephone surveys has had to have been kept to a minimum as telephone surveys had to be the shortest of all questionnaires to avoid impatience or non-responses (Neuman, 1999, p. 265), although there has been some debate on that with others believing that they could "be nearly as long as most face-to-face interviews" (Schuman and Kalton, 1985, p. 679).

Both interviewers and respondents have reported finding telephone based surveys the least enjoyable of all the methods of survey administration. One of their

disadvantages have been that while face-to-face surveys have all channels of communication open to them, only the verbal ones have been able to have been included in telephone surveys (Neuman, 1999, p. 272). For studies of more complex issues, that has made them less suitable than the other methods of surveying.

Mail Questionnaire

Mail surveys have often been called self-administered surveys, because no interviewers have been involved in the administration of them. Mail surveys have had a tendency to have been the slowest method of survey administration (Neuman, 1999, p. 272), and as participants have had time to analysis the questions they will have been self-selected rather than randomized (Schwarz et al., 1998, p. 166).

The main disadvantage of mail surveys has been their high level of non-response, typically anywhere from 50 to 90% (i.e., only 50-10% of recruited participants will have agreed to take part; Neuman, 1999, p. 272). Mail surveys have mostly avoided the problem of 'not at home' non-responses that reduce the external validity of face-to-face and phone-based methods. But these may still have occurred if an individual has not opened their mail for the entire period of survey collection (Schuman and Kalton, 1985, p. 680). Non-responses have mainly arisen through either dated address listings or people refusing to complete or send back their completed surveys (Schuman and Kalton, 1985, p. 677).

Mail surveys have also been prone to a different type of non-response; that of individual item non-responses. Because face-to-face and phone-based methods both have had an interviewer present, responders have not, in general, been able to avoid answering each of the questions. With mail surveys, responders may have accidentally missed or purposefully skipped a question affecting the external validity, with no effort or any other effect on them (Schuman and Kalton, 1985, p. 678).

Another idiosyncratic form of non-response in mail surveys has resulted from their reliance upon competent levels of literacy in their intended respondents (Neuman, 1999, p. 272). If people have not been able to comprehend or have felt

they would struggle to understand the questions then some respondents have refused to take part in a survey (Schwarz et al., 1998, p. 166).

Surveys can have been completed by someone else other than the intended recipient. Whether that has been by an assistant who may have intercepted the survey (Neuman, 1999, p. 272), or by the intended recipient giving it to a family member to fill it out (McBurney and White, 2004, p. 245), both have affects upon its external validity. Research has suggested that up to 14% of some returned questionnaires may not have been filled in by the intended recipient (Scott, 1961). Generally however, that has not been measured or reported on.

Mail surveys have no interaction between the researchers and their respondents, except through the survey instrument itself, which has a number of disadvantages. If a misunderstanding has occurred then the participant would not have been able to seek clarification, or in some cases even realise that the mistake had been made (McBurney and White, 2004, p. 245). Such a possibility increases participants "reliance on contextual information" (Schwarz et al., 1998, p. 161) and logically the influence of surrounding questions (ibid). In addition, the later questions have been shown to have an effect on previous questions. Therefore, if there has been a desired question order or sequence, it cannot have been maintained with mail administration (ibid).

The lack of an interviewer having been present has meant that it has been difficult to motivate people to begin or complete and return a survey unless incentives have been provided (Dillman, 1978, p. 12). Without the interviewer supplied motivation found in face-to-face interviews, questionnaires have best been kept to a moderate length (Neuman, 1999, p265).

Without the presence of an interviewer there has been only a limited scope within mail-based surveys for complex and open ended questions (Neuman, 1999, p. 272). However, mail surveys have generally been considered to have been better than telephone-based methods (though not face-to-face interviews) for asking such questions (McBurney and White, 2004, p. 240). Moreover mail surveys have generally been the most preferable when sensitive questions have been asked and there has tended to have been more disclosure on awkward topics (Schwarz et al., 1998, p. 168). That has been reported to have resulted from the absence of an interviewer creating more perceived anonymity than any other method (Dillman,

1978, p. 63). Because there has been no perceived social interaction involved in the survey process, there has tended to have been no interview bias and less effect of social desirability affecting respondent's answers (Schwarz et al., 1998, p. 167). In addition, there has been the advantage of questionnaires having been completed by people at their "leisure" (McBurney and White, 2004, p. 245) and so mail surveys have been associated with the "lowest degree of time pressure" (Schwarz et al., 1998, p. 167).

Self-reports of peoples' behaviour in mail surveys have often been used in personality and social psychology studies (Beck and Ajzen, 1991) although they have also been criticised for containing respondent self-perception bias's (Sutton et al., 1999). There have been few alternatives, even though it has well been recognised that such biases commonly have occurred because of a tendency for people to provide socially desirable responses and deny holding socially undesirable attitudes or performing undesirable behaviours. In a study of dishonest behaviour, Beck (1991) found that those expected biases did not limit the responses received and that people had a greater tendency to have been truthful in their answers. It has still been preferable though for non-verbal measures of behaviour to be obtained to supplement and calibrate the use of self-reports (Ajzen and Driver, 1991) Independent behaviour measures have not always been able to have been taken because of a lack of resources or difficulties of getting access to respondents at the appropriate time (Beck and Ajzen, 1991). That same study has also found no differences between the anonymous and nonanonymous groups on their level of truthfulness.

The main advantage of mail surveys has been that they have been the cheapest survey to administer, without any interviewers and with only the cost of postage to cover (McBurney and White, 2004, p. 245).

Web-based Questionnaire

Research into web-based surveys has shown that they have had a higher non-response rate than mail surveys, and therefore that they have had the lowest participation level of any administration method (Solomon, 2001). However Solomon (2001) did find that there were a number of approaches that could have been used to increase participation, including; "personalized email cover letters,

follow-up reminders, pre-notification of the intent to survey and simplifying the survey formats".

One reason for a high non-response rate has been people reaching a state of "information overload" on their computers. Surveys have had a tendency to become "marginalised" among website information, email messages and other email surveys, into a form of electronic junk that barely registers attention (Selwyn and Robson, 1998). Personal security has been another reason for low response rates, people have been able to have been anyone on the net, and what may have seemed like a survey may have actually have been from an unscrupulous character or masquerading sales company. So, not only has there been more anonymity for the researcher, but in some ways there has been less anonymity for the participant. However, some people may have found their interactions with computers to have been more "impersonal" and therefore they have been relaxed about sharing sensitive information. For such respondents the 'social desirability' of certain responses has been less of an issue (McBurney and White, 2004, p. 245). Other respondents may have felt unsafe about a perceived inadequate level of privacy for their responses, as "information could have been collected about respondents without their knowledge or permission" (Zanutto, 2001). It may have been an advantage with web-based surveys that researchers have been able to find out what time the surveys have been completed, how long it has taken to finish each answer, the length of time taken to complete the entire survey, what type of browser the survey has been viewed on, and the "respondent's IP address" (Zanutto, 2001). Conversely, anonymity on the net has also allowed respondents to have been more anonymous so that the researcher could never know if the desired person has really been filling out the form, and "people taking an anonymous web-based survey might not have been honest about their ages or genders" (McBurney and White, 2004, p. 246). For example, what on 'paper' may have looked like a wealthy vegan non-smoking male Thai doctor on holiday, may in fact have been a bored Caucasian New Zealand woman who has been a poor overweight chain smoking toilet cleaner and who has never set foot out of the country in her life.

A practical problem with internet surveys has been that they could never have been truly random; there have always been "wide disparities in internet access among ethnic and socioeconomic groups" (Selwyn and Robson, 1998) and like

mail surveys, those that have participated have been self selected (Azar, 2000, Solomon, 2001).

The many advantages to web-based surveys have included greater completion rates and greater cost and time effectiveness (Schwarz et al., 1998, p. 169). Time-wise they have been administratively efficient because internet surveys have always been accessible to respondents at any time of the day and night independently of time zones (McBurney and White, 2004, p. 246). Therefore, they have made a large number of participants possible without the costs associated with large participant levels found in the other methods of surveys (ibid).

Akin to mail based surveys, illiterate or untruthful participants may have supplied meaningless or confusing data (McBurney and White, 2004, p. 246) and some serious errors may have gone undetected (Neuman, 1999, p. 463). However, an advantage for web-based surveys has been that they have been able to check the more obvious errors in real time and make corrections (Solomon, 2001). Unlike mailed surveys, computers have been able to be programmed to detect unlikely responses and prompt the recheck of answers, such as a sixteen year old who says he's 'retired' (McBurney and White, 2004, p. 245; Solomon, 2001). as well as having the ability to branch and prompt without the presence (and cost) of a paid interviewer (Schwarz et al., 1998, p. 169).

The Suitability of Surveys for the TRA

Four possible survey methods have been considered and evaluated for use in this research study; personal interviews, telephone interviews, a mail questionnaire, and a web based questionnaire. The TRA has generally been carried out using mail surveys (Ajzen, 2002a). For a policy application it would have been desirable that a TRA survey sample would have been representative of the population that has been focussed upon so that it could describe their behaviour and how it would best have been influenced. If the survey method chosen could have acted as a filter on the responses able to have been collected then the interpretation of those results might have misrepresented the population and misdirected any intervention that were designed.

The attributes of each of the survey methods has been summarised in Table 7.

Table 7: Comparison between survey methods using selected criteria

Criteria	Personal Interview	Telephone Interview	Mail Questionnaire	Web-based Questionnaire
Expected response rate	90%	80%	50-90%	<50%
Accuracy of sampling	sampling highly reliable	sampling dependent upon access to a phone	biases due to respondents being self-selective	biases due to access to medium as well as self-selection
Respondent understanding	Immediate clarification of difficult questions	immediate clarification of difficult questions	researcher not present to clarify questions	researcher not present to clarify questions
Length of questionnaire	the longest option	the shortest of all survey types	moderate length questionnaire	moderate length questionnaire
Social desirability	greatest opportunity for socially desired responses	greatest opportunity for socially desired responses	least opportunity for socially desired responses	minimal opportunity for socially desired responses
Time and cost to access respondents	the mostly costly in research time and travel	moderate costs for accessing respondents	minimal costs for accessing respondents	least cost for accessing respondents
Complexity of questions	can explain complex questions to interviewee	can explain complex questions to interviewee	not able to explain complex questions	limited ability to explain complex questions
Sequencing of questions	controlled	controlled	uncontrolled	controlled
Communication difficulties	can overcome communication difficulties directly	some people uncomfortable with extended discussions by phone	can be limited by being impersonal	can be limited by low computer skills and being impersonal
Time pressures for completion	moderate flexibility in time to complete	induced urgency to complete quickly	no time pressure	moderate time pressure
Administration flexibility	has to fit an interview schedule but minimal response period	moderate flexibility with long response period	complete flexibility but requires a long response period	complete flexibility in questionnaire delivery and response period
Incomplete responses	low	minimal	high	low
Level of literacy and numeracy required	low levels of literacy and numeracy required	low levels of literacy but moderate levels of numeracy	high levels of literacy and numeracy	moderate levels of literacy and high levels of numeracy
Respondent motivation required for completion	low	minimal	high	minimal

A survey based upon a mail questionnaire (paper-and pencil format) was finally selected for this project for the following reasons:

- It has been well supported in social psychology literature applying the Theory of Reasoned Action
- It would enable a high sample number to be obtained relatively cheaply
- A moderately long questionnaire would be possible
- Respondents would have the flexibility to make considered responses
- There would be minimal social pressure to provide socially desired answers

Such a survey could have been quite lengthy to administer. A survey designed around the TRA can have high variances in its responses (Sutton et al., 1999), and so a high number of completed questionnaires have usually been required (up to 200 or more). If there have been six super ordinate variables to consider and they each have had six indirect variables (beliefs) and each indirect variable has been calculated from three different measures that would mean a total of 108 questions. At 3 questions a minute it would still have taken a typical respondent over 30 minutes to complete such a questionnaire.

TRA questionnaires have appeared complex for some respondents unused to associating abstract concepts with numerical scales. For people unfamiliar with that, it has been desirable to provide them with early feed-back encouraging them that they have been 'on the right track'.

Survey Response Rates

Response rates to surveys in New Zealand and throughout the world, have been dropping over time (Schwarz et al., 1998, p. 146, Cook et al., 2005). Response rates have varied in part depending upon the method of administration. Mail surveys have been reported as having return rates of 10 – 50%, telephone surveys of 60 – 80% and face-to-face surveys have reached 90% or more (McBurney and

White, 2004, p. 247). Over time researchers have had to make greater efforts to try and maintain response rates in the face of:

- High numbers of surveys that have been received by individuals
- The attention obtained by carrying out a survey being used to market products and services
- Surveys having been used to assist fund raising
- Reduced public confidence in the objectivity of survey organisations
- People having less discretionary time available for participating in surveys
- Greater difficulties in contacting people that have become more mobile
- People only involving themselves in surveys covering issues of high self-interest

(Schwarz et al., 1998, p. 146)

Sampling for Surveys

Surveys have differed greatly in their ability to address particular research questions, depending upon how well their sampling has been organised. Four types of sampling have commonly been used: haphazard samples, purposive samples, convenience samples, and probability samples. The first three have required researchers to subjectively compare the sampled population with the full population before making inferences beyond the sample. Probability samples have been able to use statistics to estimate the level of representativeness of the data (McBurney and White, 2004, p. 247).

Haphazard samples have generally been used to minimise costs or time. The pool of respondents in a haphazard sample will not reflect any deliberate pattern although they may have been selected individually (McBurney and White, 2004, p. 247). For example they may have been selected from people that the researcher has met on a particular street at a specific time and place.

If a researcher has selected people for a survey sample to fit a particular description, then they have created a purposive or quota sample. It will have been

nonrandom but selected to match some characteristic in the research question. For example a sample of paraplegics may have been chosen for a question about wheel-chair facilities (Schwarz et al., 1998, p. 145).

A convenience sample may have been selected to reflect a whole population but have been restricted to a group of people most accessible to the researcher. For example they may have been selected from a nearby region in the expectation that the people in that region were similar to those in other New Zealand regions (McBurney and White, 2004, p. 248).

When any individual has had an equal probability of having been in a sample, it would have been a probability sample. Therefore, a wide range of statistical tests will then have been available to determine the reliability and generalisability of the results (Schwarz et al., 1998, p. 145).

Sampling Frame for Surveys

Research samples have usually been created for a project without the involvement of the respondents themselves. A sampling frame will have defined the boundary between the people included in a sample population and those missing out (McBurney and White, 2004, p. 249; Schwarz et al., 1998, p. 145). For instance, the sampling frame for a population of landowners might have been all those people registered on the Electoral Roll and who have been listed as "farming". Such a sampling frame would have excluded those farmers who had not been registered at all and those farmers who may have used another professional name e.g. "rancher", "shearer" or "home-maker".

Using the sampling frame, a probability sample may have been selected systematically, basic randomly, stratified randomly, or clustered.

A systematically selected sample will have resulted from applying a predefined selection process to the population e.g. when every fifth person on an alphabetical list has been selected. Creating a systematically selected sample will have required less work than other randomised selection procedures but it has assumed that the results will not have been affected by any underlying structure (McBurney and White, 2004, p. 249).

If a population has been relatively homogeneous with respect to the research question, a basic random selection of respondents will have been able to have been used (McBurney and White, 2004, p. 250). However, if there were known to have been subgroups in the population then each subgroup will have needed to have a separate random sample selected (McBurney and White, 2004, p. 251). It may have been that one or more of the subgroups should have been sampled at a greater frequency than they might have appeared in the overall population (i.e. over-sampled) to enhance any significant differences that might otherwise have been missed (McBurney and White, 2004, p. 252).

In some situations it may not have been practical to sample from the entire population. In that case a sample could have been taken from clusters of the target population (Schwarz et al., 1998, p. 146). For example it might have been too hard to arrange a random sample from every 12 year old child in the country when no such list was available. However instead, a sample could have been taken of every pupil in a random sample of Year 8 classes from all the schools in the country.

Selection of Belief Items

People may have a large numbers of beliefs about any particular attitude object, however it would have been unlikely that for any individual person more than 8-9 beliefs will have been the main determinants of their specific attitude at any point in time (Ajzen and Driver, 1991). Those salient beliefs could change over time and as a person's circumstances changed, therefore they should have been collected in the same context as the survey in which they were going to be used was going to be completed. Generally, that has meant that the salient beliefs must be identified and selected as close to delivering a survey as possible (Ajzen and Fishbein, 1980, p. 67). The simplest and easiest approach to take in obtaining salient beliefs has been to ask people directly in a free-response format about the attributes of an object or the expected consequences of a behaviour (Ajzen and Fishbein, 2000).

Each person has their own sets of beliefs and they may have been similar to others in the population (Ajzen, 2002b). The population set of beliefs would have provided the modally salient beliefs. Modal beliefs could have been gathered in

qualitative interviews using the same open-ended questions as those used for individuals (Conn et al., 2003).

Modal beliefs may have been collected in focus groups (group interviews) to provide indefinite triangulation of results (Fontana and Frey, 2003, p. 70). Group interviews generally have been semistructured and exploratory, and have had the advantage of providing collective responses from individuals considering the topic in the same context. By having been personally present, researchers have been able to explore how people have constructed their views of reality from experience and reflection (Denzin and Lincoln, 2003, p. 13).

In surveys, modal beliefs have generally been applied in questionnaires to each individual, although they may not always have been applicable (Budd, 1986). For their questionnaires, TRA researchers have usually selected a smaller group of beliefs based upon the apparent importance of each belief to the larger population (Steadman et al., 2002).

Scale Construction

The quantitative measures of the concepts that people have been asked to associate with their behaviour have usually been based upon fixed interval rating scales such as Likert scales (Ajzen, 1991). Based upon empirical studies Ajzen (1991) has advised that generally belief strength and attributions scales should have been bipolar so that people could use negative values for those beliefs that did not match their own salient set. With normative concepts, beliefs have been expected to have been measured on bipolar scales for the same reasons but the motivation-to-comply measures should have been on a unipolar scale because it will have been unlikely that there were people in a population that would have been motivated by opposing the generally accepted normative influencers.

In some circumstances it may have been important to reduce respondent burden by shortening the length of a questionnaire. One way to do that has been to take out some of the product-sum terms (e.g. weighting behavioural beliefs by outcome evaluations and weighting normative beliefs by motivations to comply). Sutton (1999) found no reduction in predictive power when the product-sum terms (attitude and subjective norm) were replaced by the simple sums of the behavioural beliefs and the normative beliefs in his study of condom use. That

finding has been repeated with other applications of the TRA and the TPB and with using a similar subjective expected utility model (e.g. Sutton, 1979; Rise, 1992). Sutton surmised that, "it might reflect relatively low variance in measures of values in comparison with expectancies". Such a result has given confidence to some TRA researchers to simplify their questionnaires by dropping outcome evaluations and motivations to comply without them expecting to have lost much predictive power. It has meant that TRA models have been able to have been operationalised with fewer measures and shorter questionnaires. An additional advantage has been the ability to eliminate any scaling issues arising from the use of multiplicative composites if those have raised any concerns.

Likert scales have been used and people asked to choose a position on the scale depending upon how much they have agreed with or disagreed with a concept item (Eagly and Chaiken, 1993, p. 53). Often the scales have been from 1 – 5, but sometimes they have been decreased or increased and may have included a negative as well as a positive pole.

Semantic differentials have also been used in attitude surveys. These differentials have had contrasting adjectives separated by a number (often seven) of steps along a scale, and people been asked to indicate where on the differential they might have positioned an attitude object (Eagly and Chaiken, 1993, p. 55). With Likert scales there have been no checks for their internal properties and so researchers have not been completely certain whether they have provided interval or ordinal data.

With either Likert or semantic scales there has been no certainty about their dimensionality. Although both scales commonly assumed unidemensionality, that would have required further statistical testing to substantiate, for instance by using factor analysis.

Although numerical scales may have been widely used in psychometric surveys such as the TRA (Eagly and Chaiken, 1993, p. 23) there has been some ambiguity about what they have actually represented to respondents (Schwarz et al., 1998, p. 185). The properties of numerical scales have needed to have been clearly defined for respondents before they could be interpreted with any certainty. Numerical scales and their explanations exclude people with low levels of literacy or numeracy and this can affect survey results (McBurney and White, 2004, p.

245). Carefully presented nonnumerical descriptions may at times have been more readily understood, and their depictions more easily interpreted from simple observation (Schwarz et al., 1998, p. 185; McBurney and White, 2004, p. 245).

Analytical Method

Analysis of TRA Models

In studies involving the Theory of Reasoned Action it has been assumed that the linkages between the model's predecisional beliefs would have reflected the decision making strategies used by people in selecting between alternative choices of action (Aarts et al., 1998). Conclusions within the TRA about the nature of causality in the influence of beliefs upon behaviour have been based on a theoretical understanding of expected cause and effect relationships and the statistical results for the measured constructs (Aarts et al., 1998, Ajzen and Driver, 1991). The experimental design of any research should have been consistent with the theory to have been able to deduce likely causal relationships (Courneya et al., 2001).

The actual analytical approach that has been used in a study has depended in part upon the relative importance to the researcher of emphasising the model's predictive ability or obtaining an understanding of the determinants of behavioural processes. The analytical approach has also depended upon whether the researcher wanted to create a "molar model" of human behaviour from the sum of its components, or have a "molecular model" that provided additional detail for explaining predicted behaviour (Bagozzi, 1984).

Analysing TRA data has been a balance between including sufficient variables and psychological relationships for predictive accuracy and achieving a practical level of parsimony. It has been important that complexity has not been added for its own sake (Kazdin, 2003, p. 5). "Although complex designs and state-of-the-art methods have sometimes been necessary to address research questions effectively, simpler classical approaches have often provided elegant and sufficient answers to important questions" (Wilkinson, 2003, p. 822).

In most cases, TRA analyses have been conducted in three stages. Firstly the adequacy of the concept measures was tested, then the relationships between each

of the global measures and their components has been analysed, and lastly, the predictive ability of the structural model has been calculated (Terry and O'Leary, 1995).

Use of Multiple measures

The consistency of the belief based measures used in a questionnaire has usually been tested using Cronbach's Alpha Coefficients to assess their discriminant ability (Ajzen, 2002a). A Cronbach's Alpha of 0.7 has generally been considered to have been acceptable for an immature scale and 0.8 has been acceptable for a mature scale (Nunnally, 1978, p. 230; 0.6 and 0.7 in Hair et al., 1998, p. 88). It has been common though for belief based measures of the global variables in a study (e.g. attitude and subjective norms) to lack high internal consistencies in a study. That has occurred when respondents have held individual sets of salient beliefs markedly different from the other people in the study and they have all been presented with the same set of beliefs for evaluation. It has also been possible to generate low alpha correlations between belief items (e.g. <0.4) but then find that when these were analysed separately they generated similar relationships with the global measures (Ajzen and Driver, 1991). In those cases it may still have been justified to combine their results as an average for the analyses because of their similar relationships to the global measures. If some terms had low Cronbach's Alpha it may have been that their measures were unreliable but that the variable itself had an important contribution to make to any behavioural model. If it was suspected that the terms may indeed have represented an important (but unreliably measured) variable, the individual measures may have been able to have been separately added into a regression to identify any that were significant (Sheeran and Orbell, 1999).

Inter-item correlations may have been used to identify highly correlated items so that any that appear to have been unnecessary could have been discarded to avoid redundancy and artificially high Alpha Coefficients (Conn et al., 2003). Any correlations between belief items above 0.6 may have been able to have been discarded (ibid) for those reasons (0.7 in the case of Sheeran et al., 2001).

Expectancy Value

The TRA has used an expectancy value approach to bring together the degree of association between a person's belief and a behaviour (belief strength) and between someone's self concept and their belief (belief evaluation).

Using expectancy-value approaches has required that the two belief measures have been multiplied together to obtain an overall assessment of the contribution of that belief to a person's attitude. That has assumed that the belief measures obtained have been ratios of each other with their point of origin in common (Bagozzi, 1984). If instead of having been a ratio scale, one or both measures have been interval scaled, then generally a different and restricted set of mathematical transformations could have been used. Interval scaling results may have had linear transformations e.g. by adding or subtracting a constant, but those would have changed the relationship of a product term. Given that the TRA only has interval scaled measures for carrying out its expectancy-value calculations, there has been a great deal of importance placed upon making the prior conceptual framework and criteria reliable enough to ensure the acceptability of any product results calculated. Therefore it has been recommended that cross-validation be used to increase confidence in the results (Bagozzi, 1984).

Some other approaches to overcoming scaling issues have been used but those have been complex and time-consuming (Parminter et al., 1996). Others such as conjoint analyses have used factorial experimental design but that has been very demanding upon survey respondents.

One of the more intriguing aspects of the TRA's expectancy-value logic has been the application of the double negative (Trafimow and Finlay, 2002). If a behaviour was thought to have been unlikely to have resulted in a negatively evaluated consequence (or belief), then the product of the two negatives (an unlikely consequence that was also negatively valued) would have actually contributed to a positive attitude towards the behaviour (Ajzen and Fishbein, 1980, p. 71). That has suggested that whether a belief was negatively or positively framed in a questionnaire should not have affected its evaluation. However work by Trafimow (2002) has suggested that sometimes that has not been the case.

Longitudinal studies

In longitudinal studies, a common measure of concept stability has been the correlation coefficients between answers to repeated questions over the time-period that was examined; in other words, their test-retest correlations. To compute an individual difference measure that correlation needed to have been a within-subject correlation (Sheeran et al., 1999b). Longitudinal studies may also have created apparently significant differences in results due to differences in sample sizes. Standardised effect sizes have been considered low if they have been below 0.2, up to 0.5 were of moderate size and over 0.8 to have been considered to have been large (Courneya et al., 2001).

Within the data collected at any time point there may have been a lack of variability in peoples' responses and therefore by using a correlational measure to analyse differences over time some of the information that has been contained in the data may have been lost. There have been three alternative approaches that could have been used to overcome that condition (Connor et al., 2002) the sum of absolute differences between the repeated items at the different time points, the average absolute difference adjusted for maximum possible change, and the number of items exhibiting any change. Conner *et al* (2002) found those three measures to have good internal reliability (a Cronbach's Alpha of 0.94) and a moderately strong correlation with the within-subject correlation measure (a correlation of -0.42, $p < .01$).

Correlations with Global Measures

Simple zero-order correlations have been used to test that expected relationships have existed between the belief based measures and the global constructs (e.g. attitudes; Ajzen and Driver, 1991). In some studies (e.g. Brubaker and Fowler, 1990) those relationships may have been influenced by belief salience. In their study of testicular self-examination they found significant differences between the correlations of salient beliefs and non-salient beliefs (using expectancy value results) with attitudes. Whilst differences in belief salience have been identified in other studies (e.g. Ajzen, 2001) researchers usually have made no distinction between them in their analyses.

The relationships between each of the global measures (e.g. attitudes and subjective norms) and between them and the non-applying belief measures (e.g. attitudes and normative beliefs) has generally been tested to ensure that the correlations have been less than the theoretically derived relationships as an indicator of the model's discriminant validity (Ajzen and Driver, 1991). For a similar reason, correlations between the belief based measures and the behaviour has also been tested (ibid). If possible, non-verbal measures of behaviour should have been used to supplement and cross-validate any self-reports (ibid).

With long surveys it may have been possible for the placement of questions within the survey to have affected the results and so later questions have had lower scores. To check the importance of question placement a multivariate analysis of variance has sometimes been performed for each of the variables (Beck and Ajzen, 1991).

Hierarchical Regression

A hierarchical regression has been considered an appropriate test of the multiplicative terms in a TRA model even though the variates have not been explicitly measured using ratio scales (Bagozzi, 1984). When models have been examined across a wide range of transformations the coefficient of determination (R^2) and regression coefficient items have remained relatively constant highlighting the robustness of the model's underlying theory (ibid).

The most common way of comparing regression models has been to compare their predictive fit by calculating the coefficient of determination. The coefficient has been used as an indicator of the proportion of variance in the outcome variable explained by the regression model (Tabachnick and Fidell, 2001, p. 124; Hair et al., 1998, p. 143). As more variables have been added to a regression equation the R^2 value has generally increased, so that the maximum R^2 has been achieved when all the variables have been included. Adding variables in a hierarchical regression generally has improved the R^2, but part of that has been an effect simply from using increased data irrespective of their actual contribution and explanatory power. To take that into account adjusted R^2 have been calculated (Hair et al., 1998, p. 182). The adjusted R^2 may have a decreased value relative to the standard R^2 if the additional variables have had little explanatory power or if

the degrees of freedom have become too small. To have been useful, a regression analysis should have explained a significant portion of the between respondent variance. A coefficient of determination of up to 0.1 has been considered a small effect, up to 0.3 a medium effect, and up to or over 0.5 has been described as a large effect (Cohen, 1992).

Prior to running a regression, the normality and linearity of the data should have been checked. To identify departures from normality researchers have scanned histograms for: (1) skewness, (2) uniformity, and (3) large gaps in the data. Departures from linearity have been identified from observed curvilinear patterns in scatter plots.

One advantage of using multiple regressions has been that they have enabled researchers to improve their explanatory power from the combined effects of a number of predictors. However, causal relationships have not been able to have been determined from multiple regressions and have required other statistical approaches. A general goal of regression analyses has been to identify as few predictor variables as possible to predict the outcome variable, and to only include predictor variables that have predicted a substantial and independent portion of variability. If the researchers have been using a standard approach to step-wise regression then the order of predictor variable entry would have been based upon statistical criteria, with the choice of entry determined by the correlation between the predictor and outcome variables. With forward selection, once entered a variable has been left in even if it was no longer significant. With backward selection all the variables have been entered first and removed if they have been found to have been no longer significant.

Hierarchical regressions, in contrast have been used when the entry order has been determined *et priori* by the researcher based upon the theoretical presence of mediating variables between external conditions and behaviour. For the TRA, entry order into a hierarchical regression has been based upon the Theory's constructs. Variables have been entered singly or as a block depending upon the emphasis upon understanding or prediction. An acceptable level of significance e.g. 0.05, has been used to determine a variables' subsequent entry into the regression (Conn et al., 2003).

In the TRA it has been expected that any external and general psychological influences upon behaviour would have been mediated by TRA variables. Therefore, any demographic variables that have been measured should have been added first (Armitage et al., 2002) after that past behaviour (Aragon-Correa and Llorens-Montes, 1997), intentions and control, and then the others (Ajzen and Driver, 1992a); but see (Crawley, 1990 for an alternative approach). At each step in the regression, the significance of any additional improvement in the multiple correlation (R) would have been checked. The value of first including demographic variables and past behaviour in TRA analyses has then been that they could have provided a test of the sufficiency of the behavioural model that was generated.

In studies where the research hypothesis has been concerned with evaluating psychological moderating influences upon peoples' behaviour, it may have been desirable to have reversed the entry of TRA variables (Connor et al., 2002, Christian and Armitage, 2002) and to again have used mean-centred variables to minimise problems of collinearity. For example by adding in intentions and perceived behavioural control in step1, past behaviour in step2, and interaction terms in step3.

It has been possible for variables measured using the same method to have similar variance produced (common method variance) and so have been artificially associated in a regression (Connor et al., 1999). Any unexpected influences e.g. from past behaviour on intended behaviour should have been checked for that possibility.

To test the influence of any interactions the multiplied terms of the global measures (e.g. attitudes and subjective norms) should have been calculated and added last (Ajzen and Driver, 1992a). Interactions or moderating effects between variables has generally been examined by multiplying two of the predictor variables together to get an interaction term, and including that term in the model to measure the significance of its contribution. Other interactions between TRA variables and external factors expected to have been moderators (e.g. subjective norms and alcohol availability) may have been examined in a similar way (Connor and Flesch, 2001). There may also have been three way interactions between TRA variables and external factors. In a similar way, those have

sometimes been examined by multiplying the terms together and introducing them into the TRA (Connor and Flesch, 2001). Using mean-centred scores will have minimised their potential collinearity (Bagozzi and Yi, 1989).

After the regression model has been run, there should have been checks for its homogeneity and the presence of important outliers using scatter plots of the residuals to check for curvilinear or fan-like patterns, and residual summaries. The residuals should have been found to have been normally distributed and any cases with residuals greater than three z-scores excluded.

Cross validation of regression models have been achieved by drawing new samples from the general population or if the original sample was big enough, by dividing the sample in two (Hair et al., 1998, p. 209). One of the sub-samples may then have been used to create the regression equation the other used to confirm it. Alternatively, a Predicted Residual Sum of Squares (PRESS statistic) has been able to have been calculated by separately validating the model against each individual observation (ibid).

Sutton *et al* (1999) tested the direct contribution of beliefs to a TRA model of condom use and how well they had been mediated by the global measures. They took the final regression relationship and replaced the global terms it contained with their corresponding sum of beliefs (and belief by evaluation products). They found no difference in the amount of variance explained. Similar results have been reported by Terry and O'Leary (1995).

Subgroups within a sample that have different behaviours may have been identified and the results of ANOVA analyses compared for significant differences in their beliefs (Ajzen and Fishbein, 1980, p. 73). Correlations between belief strength and outcome evaluation and a behaviour have sometimes provided an indication of how much changes in beliefs might have been associated with changes in behaviour (Sutton et al., 1999; Ajzen and Driver, 1991). A dummy variable may have been used to represent different behavioural groups (e.g. adopters and non-adopters) and a regression calculated for each group to examine how predictive each of the groups was in the TRA model (Schlegel et al., 1992).

Multicollinearity and Suppressor Variables

When the zero-order correlations of specific predictors have been compared to their contribution to a multiple regression, there are nine possibilities that needed to have been considered (Table 8). Multicollinearity has occurred when some of the independent predictor variables have been correlated. It will have made determining the importance of individual variables more difficult and increased the variance of the regression coefficients. If multicollinearity had occurred, standard errors may have been inflated, beta values underestimated, and t-ratios become less significant. To assess the importance of multicollinearity after a regression has been run, a Tolerance Statistic (TS) for each of the predictor variables may have been calculated ($TS = 1-R^2$). Determining that requires a coefficient of variation to have been calculated by separately regressing each of the predictor variables on all the others. A TS of close to one has been considered to have been more desirable than a TS close to zero. In TRA studies it has generally been accepted that some collinearity may have existed between predictors because they have all been conceptually related in the theory.

Table 8: Combinations of correlations and regression coefficients resulting from the presence or absence of suppressor effects

	Correlation		
Multiple Regression Weight	Significant (-)	Non-significant	Significant (+)
Significant (-)	good correlation and direct contributor	suppressor effect	suppressor effect
Non-significant	good correlation, but collinear with other predictors	poor correlation and no predictor contribution	good correlation, but collinear with other predictors
Significant (+)	suppressor effect	suppressor effect	good correlation and direct contributor

If the collinearities have been as large as or larger than the validities (i.e. the size of the zero-order correlations) then a problem has generally been considered to have existed. Reversing the entry order of predictors has been one way of providing a comparison with the strength of the predictors when they have been

entered first. A collinearity may have been the result of related predictor variables or their measures having overlapping elements. Factor analyses sometimes have been used to improve test differentiation by combining a number of overlapping variables into a single index.

A suppressor variable has been found to exist when one (or more) of the predictor variables masked the relationship between two other variables. With TRA calculations sometimes there have been negative beta weights when a zero-order correlation indicated that a positive weight should have been expected.

A similar problem has been found when a beta weight was greater than the corresponding zero-order correlation (Armitage et al., 2002). The cause of those unexpected results again may have been the presence of suppressor variables. To check for a suppressor effect, correlations among the predictor variables would have needed to have been examined. If any had the reverse sign they may have been the cause of the suppressor effect. If the cause has not been apparent from the simple correlations then the multiple regression model should have been simplified (whilst retaining the variable of concern) until the cause of the suppressor effect has been able to have been identified. It may have been that the variable of concern has been weakly (but significantly) correlated with the outcome variable and sufficiently collinear with other variables that when they have been placed in a model with it there has been no suppressor effect (e.g. beta weights have been nonsignificant). In such a case the variable of concern may have been described as having a weak positive correlation with the outcome variable, but once the variables creating the suppressor effect have been taken into account, higher variable scores that have predicted lower outcome variables will have resulted.

It may also have been possible to use simple slope analyses to examine significant interactions in the model (Connor et al., 2002). To carry those out has required regression lines that have been calculated for three different levels of the moderating variable e.g. at the mean level, and at one standard deviation above and below the mean. Coefficients of the moderated variables for each level would then have been calculated and compared.

Factor Analyses

Some of the variables that have been measured in a TRA model may have been conceptually related (e.g. instrumental attitudes and affective attitudes) and some variable measurements may have appeared to respondents to have involved analogous concepts e.g. different questions about "education" and "learning". Factor analyses could be used to check that adequate distinctions have existed between model variables and that the measures for each variable were indeed measuring a similar construct (but different from those of the other variables). Factor analyses have been used to carry out such checks and provide evidence for convergent and discriminant validity (Armitage and Connor, 1999b).

Generally with the TRA, factor analyses have been used as an exploratory technique to reduce a large number of correlated variables to a few latent variables, although they may also have been used as a confirmatory technique for testing hypotheses. Exploratory factor analyses (EFA) have separated variable measures into those that were orthogonal (and so independent from each other) and those that were correlated by each having been linked to another super-ordinate variable, or factor and so sharing some variance between them. The success of an EFA then has been dependent upon the measured variables having been theoretically related with a number of strong correlations in their correlation matrix (Sparks et al., 1997).

Patterns in an EFA may have been apparent if each of the variables had a high loading (>0.3; Brubaker and Fowler, 1990 used 0.4) or very high loading (>0.6) on a single factor and low or zero loadings on all the others (Bowen et al., 2001). That would have been considered a 'simple structure'; and sometimes a rotation may have been required to obtain a simple structure. Applications of orthogonal rotation will have assumed that the factors were not correlated with each other and so the axes have been kept at 90 degrees to each other in factor space. For many of the concepts in psychology there will have been some correlation between them and so it would have been more likely that an oblique rotation would have been the most suitable to use. Sheeran and Orbell (1999) used an oblique rotation when it was suspected that factors might have been correlated above 0.3. The results of the two approaches may well have been similar in many situations. With an orthogonal rotation the results for interpretation will have been in the

rotated factor matrix, whereas with an oblique rotation a pattern matrix will have been used.

Every related variable in an EFA will have had some variance that it shared with the others, and that would have been its 'commonality'. A very low commonality (close to zero) will have indicated that the variable had so little variance in common that it should not have been included with the others. A large commonality (above 0.1 and preferably close to one) will have indicated that the variances have been highly overlapping. The sum of the commonalities present will have represented the variance in the data that has been distributed among the factors. That will have excluded any unique variance or error. Some of the collected data will not have fitted the identified dimensions of a factor and so will have appeared in a matrix of residuals. Those will have been the differences between the predicted correlations and observed correlations. A good fit will have been indicated if the residual correlation matrix values were less than 0.05. Eigenvalues have also been used to report the amount of variance in the data accounted for by a particular factor. Eigen values should preferably have been over 1.0, low values will have suggested that the factor did not help explain much of the variance and should have been ignored.

Structural Equations, Path Analysis

Structural equation modelling has been developed from factor analysis techniques and has provided a way of calculating multiple regression equations containing variables with complex multidimensional relationships. Structural equation modelling has also been referred to in the literature as causal modelling, causal analysis, simultaneous equation modelling, analysis of covariance structures, path analysis, or confirmatory factor analysis. Its advantages have been that it has combined exploratory and confirmatory factor analysis in one technique (Tabachnick and Fidell, 2001, p. 653). Sequential analysis of variable relationships (as in multiple regression approaches) has been known to underestimate the interactions between variables; structural equation modelling has been able to overcome that limitation by solving multiple relationships simultaneously (Holmbeck, 2003, p. 83). In addition, structural equation modelling has enabled researchers to assess the fit of structural models after controlling for measurement error (Tabachnick and Fidell, 2001, p. 656). Like

multiple regression analyses, structural equation modelling has not in itself been able to establish causal relationships unless those have been part of the underlying theory (Sideridis, 2001). "Attributing causality has been a design issue, not a statistical issue" (Tabachnick and Fidell, 2001, p. 659). However, structural equation modelling has required larger sample sizes than multiple regressions. Larger samples have been needed to generate the covariance matrix, parameter estimates and chi-square tests of fit. The technique has been more complex than multiple regression analyses and so has been more prone to operating error (Tabachnick and Fidell, 2001, p. 656) leading to over-fitting data, and low generalisability (Hair et al., 1998, p. 590). Results have been guided more by theory than empirical results and they tended to have a confirmatory bias (ibid).

A structural equation analysis has consisted of two components – a structural model and a measurement model (Blue et al., 2001). To construct the structural model (or models) linking predictor and outcome variables have relied upon prior theory (Tabachnick and Fidell, 2001, p. 659). A model could then have been able to be estimated, evaluated and modified. The best test in structural equation analyses has been to compare the fit of competing models representing different hypothesised structural relationships (ibid; Albarracin et al., 2001), rather than making marginal modifications to a single theory such as the TRA (Hair et al., 1998, p. 592). To assess the overall fit of a structural equation model to the data, researchers have used chi square (χ^2), goodness of fit index (GFI), adjusted goodness of fit index (AGFI), root mean square residual (RMSR), and the standardized root mean square residual (SRMSR; Blue et al., 2001).

Questionnaire Design

Application of Research Methodology in a TRA Survey

Survey Type

A mailout survey was decided upon for this research. It has been the standard survey type for TRA research and would minimise the costs of contacting people. A mailout survey has enabled data collection to have been restricted to a two month period or less. Three mailout surveys have been designed to obtain data about landowners' tree protection behaviour. Technical and ethical approval for the surveys was obtained from the AgResearch Social Research Team Leader and

the Foundation of Research Science and Technology. In 2002, a questionnaire was sent to 1500 landowners for information about their riparian management – including planting indigenous trees. Also in 2002, a questionnaire was sent to a different sample of 2300 landowners for information about their bush-block management practices. And a further 1600 landowners received a questionnaire about establishing indigenous woodlots on their properties. In this research each of the practices needed to be clearly defined for respondents.

- Riparian protection and planting was defined as: "The area 5 to 50 meters wide either side of a stream … where water was flowing all year round ... fenced (to boundary fence standard) and between the fence and the water, planted or allowed to grow native (indigenous) plants."

- The preservation and conservation of bush remnants was defined as:

  "To restore and protect … areas of trees, small patches of vegetation, scattered native trees, and areas of scrub."

- Woodlots of native trees were defined as areas "grown for timber production" and "harvested if maintained on a sustainable basis."

Sampling for the TRA survey

The research had a random sample made available from the population of all New Zealand rural landowners. For that, a database held by Agri-quality New Zealand had been purchased. The database had been collected mainly for the purposes of national disease control and access to it was able to be arranged for research purposes. One limitation of using the database was that some of the small farming properties of 50 hectares or less have possibly been missing from the database, particularly if they contained no cattle or deer. In addition, cropping and horticultural properties have been unlikely to have been on the database unless they also had livestock on their properties. Finally, farmers have been able to exclude themselves from any use of their information by Agri-quality for anything other than disease control. However, the database represented the most extensive and up-to-date description of livestock farming available currently to the researchers. The request for access to the database included asking Agri-

quality to provide a random sample of names and addresses from all types of livestock enterprises (e.g. dairying) and across all sizes of property down to 20ha.

Belief Elicitation for the TRA Survey

To identify the beliefs associated with riparian management and indigenous tree planting, a total of 60 landowners have been surveyed from the King Country and Hawkes Bay electorates. The landowners have been randomly selected from a list of people who had listed themselves as "farmers" in the relevant electoral rolls, and who had addresses able to have been identified by the researchers. Two survey instruments have been used:

1. Respondents were asked to complete a questionnaire on demographic information in preparation for a personal interview.

2. An interview with open questions has been used to obtain full and personal responses about riparian management decision making.

In the personal interview, a semi-structured approach with probe questions has been used to ensure the questioner fully understood the answers, and to allow the respondents full expression of their points of view. Whilst some variation in the questions was allowed for, the questions remained consistent with those contained in an interview guide. Summaries of the results were recorded by the interviewer on audio-tape at the end of each interview.

Survey results and summaries have been analysed in separate data bases. The survey results have been analysed in an EXCEL data base using pivot tables. The summaries have been analysed using a Non-numerical Unstructured Data Indexing Searching and Theorising (NUD.IST©) computer programme, to code and link decision criteria. Coding has been developed using a grounded theory approach to sequentially add codes as they have been "discovered" in the text. The process of coding has been made more rigorous by having two other researchers (colleagues of the author) independently coding and interpreting the same material. The beliefs identified in the summary texts by the researchers

have been examined further for analogous terms, sub-categories, clusters, and linkages, using NUD.IST.

To identify beliefs associated with preserving bush remnants and indigenous woodlots, a two stage approach has been used to explore landowners' views on how the specified biodiversity practices would fit their management systems. The first stage involved individual interviews with a convenience sample of eight farmers to define the management systems involved in implementing the practices. Interviews generally lasted 30-90 minutes and followed a semi-structured questioning process. The questions focussed upon the activities, steps, sequences, and decisions associated with each practice.

The second stage consisted of three focus group meetings of 4-8 farmers for up to 2 ½ hours to explore the consequences that introducing the practices would have had on property owners and their management of livestock systems. An effort has been also made to understand the types and sources of information used to implement the practices.

The focus groups were asked three questions and the results recorded on flip-sheets with the group:

- What have been the possible benefits and problems that you associated with [this practice] in this management system?
- Who have been the people who had encouraged or discouraged "people like you" from applying [this practice]?
- What have been the key resources necessary for "farmers like you" to have easily implemented [this practice] in the management system?

Those questions have been used to identify indirect (belief) measures for attitudes, subjective norms and perceived behavioural control respectively.

The behavioural measures needed to have been specific, time bound and practical for respondents (Ajzen and Fishbein, 1980). In this study a further limitation has been that it was intending to use cross-sectional data to establish a link between the predictive variables and respondents' behaviour. Therefore, the behaviour

measure had to provide results at the same time as the predictive information was being gathered.

The measure of behaviour used in this study of bush remnants and the outcome (dependent) variable in the behavioural regression analysis has been the percentage of bush remnants that have been protected and conserved. The outcome variable in the behavioural intentions regression analysis for the same study has been "protecting and conserving bush remnants on my farm … over the next year".

With the survey on management of the riparian area the measure of behaviour has been the percentage of the waterway banks that had "been fenced and planted in native trees". The intention measure has been focussed on "fencing the streambanks and planting native trees".

For the survey on farm woodlots the behavioural measure has been the area of woodlots that landowners had already established. The intention measure was about "establishing and maintaining nativetree woodlots … over the next year".

In all those surveys, the behaviour measure and the intention measure did not match in the way prescribed by Ajzen and Fishbein (1980). In particular, an historical measure of behaviour was used. However, in a cross-sectional study, an actual expression of behaviour seemed the most reliable and practical to use and the information required to answer the questions was considered in the pilot study to have been readily accessible to most respondents.

Questionnaire Design for the TRA Survey

To address some of the limitations of mail surveys a number of steps have been taken:

- Based upon previous projects a response rate of 20-30% has been planned for (Cook et al., 2005). Demographic information was used to help identify any representative biases that might have resulted from having self-selected respondents.

- To reduce complexity it was planned that the questions would follow a specific format so that people could quickly learn the questionnaire process and the questionnaire was pilot tested first before it was finalized.

- A questionnaire designed so that trained or supervised people could take 30 minutes or less to complete was desired in recognition that in an unsupervised situation it would probably have been extended to 40 minutes or more (based upon unpublished results to previous surveys eg (Parminter et al., 2001). Pilot surveys with 6 or more people have been undertaken to check the timing.

- To encourage greater motivation for people to participate, it was decided to provide prizes to three randomly selected respondents who had returned their questionnaires in the required time period. The prizes have been based upon the alternative costs of organizing follow-up phone calls. First prize was for $1000.00 and runner-ups received $500.00 each. Prizes required the researcher to work with an organisation that had a permit for administering a public competition.

- A response time of four weeks was provided for and then re-assessed. Roughly that was: one week for respondents to receive the questionnaire through rural delivery; two weeks for them to think about, forget, rediscover and complete the questionnaire and the last week for them to return the questionnaire through rural delivery. If a low response level resulted, it was possible to extend the return interval and remind people to complete the questionnaire.

- Some people were expected to have been unfamiliar with conceptual measures, and to reduce the requirement to confront them with a fixed interval scale, a visual scale has been used where distances between semantic descriptions replaced numbers. That was intended to simplify the survey for those respondents who would otherwise have had difficulty with reading the survey and calculating their answers (McLeod, 2006). A 20 point scale has been used based upon the use of subjective visual scales in other decision making environments (Guagnano et al., 1995; Parminter et al., 1997)

Each of the surveys contained the minimum of demographic questions needed in order to assist in measuring the representativeness of the final result. Farming-goal focussed questions have been included to relate the survey results to previous studies and explore the relationship between farming goals and the specified practices. The rest of the questionnaires concentrated upon developing a TRA model of the desired behaviour and peoples' intentions towards it.

The Riparian survey contained 135 questions and was expected to take less than 40 minutes to complete. There were four sections to the survey. Section A contained nine demographic questions. Section B contained twelve questions on farmers' farming goals. Section C had 10 questions on the relationships between riparian management and the farmers' goals. Section D had one hundred and four questions on their attitudes and beliefs. The content of the questions and the mean responses have been attached in Appendix A.

The Bush-block and the Woodlot surveys contained 90 questions and it was expected to also take less than 40 minutes to complete. Like the riparian survey, there were four sections to these surveys, except that Section D had fifty-nine questions on their attitudes and beliefs. The content of the questions and the mean responses have been attached in Appendixes B and C.

TRA Survey Administration

The three questionnaires were piloted progressively to utilise the results from each survey in the design of the subsequent pilot questionnaire. The questionnaire for the riparian survey was first circulated to AgResearch staff with farming experience. Their feedback was used to clarify the meaning of some questions and improve their general comprehension. Four farmers known to the researcher were given a penultimate draft of the questionnaire to complete and observed while they worked on it. The subsequent debriefing was used to obtain feed-back on the time taken for each section and the level of respondent burden. The four farmers could complete the questionnaire in 25-35 minutes. They considered the questionnaire to be lengthy but reasonable to answer. The use of the non-numerical scale was judged by them to have reduced the effort for them in answering some of the questions.

The first survey on riparian management was sent out to rural landowners in February 2002. The second and third surveys on conservation of bush remnants and establishing woodlots, were both sent out to rural landowners in May 2002. Two sorts of changes were made between these dates: - the number of measures used to estimate some variables was reduced and the types of measures used to estimate some of the variables were changed.

- To try and minimise the number of questions and so respondent burden, the intention measures were reduced from three to two, but the form of them remained consistent with the literature. Also, the subjective norms measures were reduced from four to three, but the form of them again remained consistent.

- The self-identity measures were reduced from eight to two. The main change though was a change in their structure to conform more to theoretical guidelines.

A 'blind posting' was done to send the questionnaires to participants and ensure the confidentiality of respondents. Numbered questionnaires with covering letters were posted by NFO and then responses returned to them. NFO also carried out the survey competition. NFO then forwarded the questionnaires to AgResearch for analysis. See Appendix A for a copy of the letter to NFO clarifing NFO and AgResearch responsibilities. Appendix A applied to the riparian survey only. The responsibilities were the same for the other two surveys, only the numbers and dates were different.

TRA Survey Analysis

- Data has been checked for normality, and gaps in distributions.

- Correlations have been calculated between predictor variables and between predictor and outcome variables. Any apparent collinearity in predictor variable measures ($r>0.9$) has led to them being discarded.

- The convergent validity of the concept measures has been tested by calculating their Cronbach's Alpha Co-efficient. That figure needed to be greater than 0.7 (Nunnally, 1978, p. 230); or in some circumstances at least over 0.6 (Hair et al., 1998, p. 88).

- Discriminant validity has been tested by using exploratory factor analysis to look for differences between similar measures for different concepts. The measures for a single concept should have had a loading greater than 0.4 on one of the factors (Brubaker and Fowler, 1990) and the measures for any different concepts should have loaded less than 0.3 on the same factor (Bowen et al., 2001).

- Correlations have been calculated between indirect (molecular) and global (or molar) measures ($r>0.5$ was considered to have been high).

- Hierarchical regression analysis have been applied by adding TRA variables sequentially until adjusted R^2 have been maximised for significant predictor variables ($F <= 0.05$). To test pairs of interaction terms, they have been added using mean centred scores to minimise potential collinearity.

- Residuals have been checked for normality and homogeneity. If necessary, some respondents have been excluded or calculated separately, and the regression analysis re-run.

- Multicollinearity has been checked (using a tolerance statistic) along with suppressor variables (comparison with zero-order correlations).

- The regression model has been tested (i) firstly, against subgroups e.g. adopters verses nonadopters and (ii) secondly with the calculated a PRESS statistic, and (iii) thirdly using the belief based (molecular) measures to replace the global measures.

Summary of Methodology

The results of the three surveys have been independently used to address the following questions:

1. *Could a human behaviour model based upon the TRA, be developed sufficiently for environmental policy makers to explain landowner behaviour associated with managing indigenous vegetation?* For this question, a number of hierarchical regression models were compared for each behaviour using a range of psychological variables compatible with the TRA. The

models selected as the most sufficient were those with the greatest coefficient of determination. The models for each of the three similar behaviours were then compared to identify how consistent they had been in describing different landowner outcomes (the management of riparian areas, bush remnants, and indigenous woodlots).

2. *How well could a social psychology model of human behaviour based upon the TRA, predict public responses to a policy programme?* The coefficients of determination were calculated for each model as a measure of their predictive ability for landowners' intentions and behaviour.

3. *How well could a social psychology model of human behaviour based upon the TRA, have distinguished between the policy intervention needs of different stakeholder groups?* Models for landowners with different livestock enterprises, property sizes and age groups were compared.

4. *How much have peoples' values, attitudes and beliefs affected their behaviour?* This question was addressed by calculating the regression coefficients (or weightings) for the different psychological variables associated with peoples' intentions.

5. *What have been the immediate antecedents to peoples' behaviour and how have they led to behaviour change?* The most significant antecedents were identified in the regression equations for landowners with complying and non-complying behaviour. They were then compared to identify the differences most associated with complying behaviour.

Chapter 6. Qualitative Research Results on beliefs about Protecting and Conserving Bush Remnants, Riparian Management, and Establishing and Maintaining Woodlots

Introduction to Qualitative Study about Beliefs

Part of the TRA methodology described in an earlier chapter included the need to identify for a specific behaviour the salient beliefs present in the target population. Qualitative studies were undertaken in this project to provide these. Landowners' riparian management systems and associated beliefs had been first examined in a study in 1998. The study of bush remnant beliefs and woodlot beliefs was delayed until 2001. The delay enabled the focus group approach to be further developed but could have introduced some additional errors in belief descriptions due to the passage of time and a possible loss of correspondence between measures. Discussions with landowners during piloting indicated that for riparian management the same set of beliefs were still salient although their relative importance may have changed over the period of delay. The critical policy pressures for landowners to adapt their riparian practices remained consistent between 1998 and 2002.

Bush Remnant Management Systems and Associated Beliefs

The focus group meetings had two stages.

(a) The first stage involved individual interviews with eight landowners to define a management system for addressing bush remnant issues on farms. A total of four biodiversity issues were studied in that way, but only the results for bush remnants and woodlots have been reported here.

    Bush remnants were being protected by five of the eight landowners. Their main objectives were to 'improve the landscape value of the farm' (its aesthetic qualities) and to 'improve the habitats of native birds on the farm'.

Figure 4 describes the decision-making context for these farmers. Each of the boxes in the figure has identified a decision domain within which decisions contributed to implementation of the practice. Within the boxes were identified some of the factors associated with soundly based decisions during those stages.

It was apparent that protecting and conserving bush remnants was not a simple single-action behaviour. It involved a mix of actions very situationally dependent.

(b) The second stage in the qualitative research had three focus groups identify their salient beliefs. The groups explored the impact that the practices had been having on landowners (as defined in a diagram of the management system).

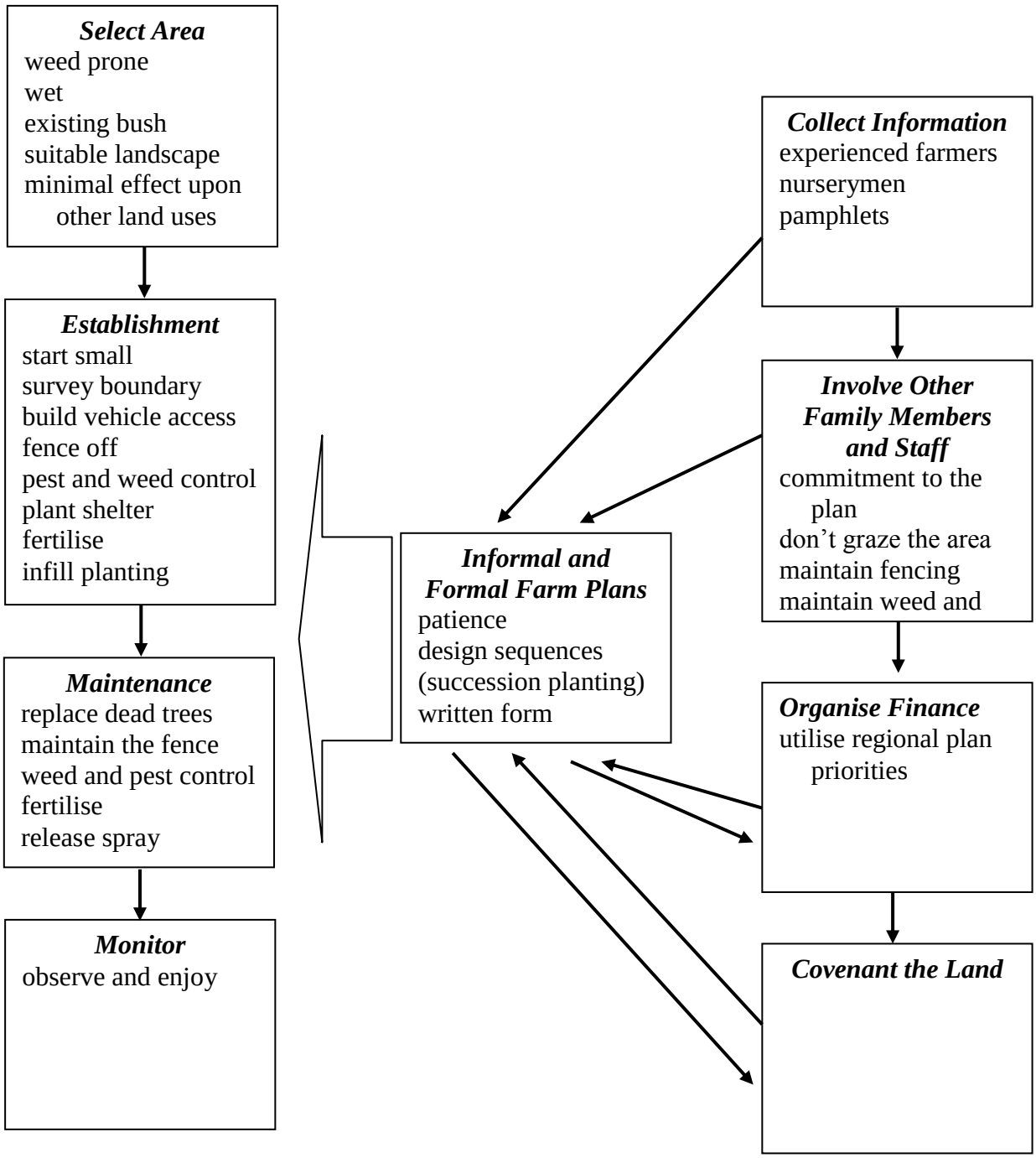
First, focus group participants were asked to assess in their situation, the applicability of the diagram of the management system for each practice. Then they were asked to think about the practice and consider their various consequences for them. Group members were then asked a series of questions to prompt discussion about each of the practices. Notes were taken on a flipchart as a record the group's discussion. The questions were:

- What were the possible benefits and problems that you associated with [this practice] in this management system?
- Who were the people who had encouraged or discouraged "people like you" from applying [this practice]?
- What were the key resources necessary for "farmers like you" to have easily implemented [this practice] in the management system?

After the initial ideas had been gathered from each question, the group was prompted for their additional ideas by referring to the box diagram parts and to their actual contacts and management practices.

An effort has also been made to understand the sources of information used as part of making decisions about bush remnant issues.

Figure 4: A management system for the practice of protecting and conserving indigenous forest remnants



The landowners in the focus groups described how their bush areas were usually considered a waste of good pasture. They had been used in the past as indicators of people who might have been considered "lazy farmers" for not having cleared them. Now, it was usually recognised that there was a moral obligation for landowners to protect any bush remnants and an expectation that they were responsible for looking after a finite resource. However, group members were aware that small patches of bush may still have been left unprotected if fencing them out would have excluded large areas of grazing land. For some of the farmers the capital costs of starting a strategy of fencing areas out of production could have been quite daunting.

The primary benefits identified by all three focus groups were that conserving bush remnants encouraged forest regeneration, provided a habitat for bird life and improved the aesthetic appeal of their farm (Table 9). The main problems resulting from taking steps to conserve bush remnants were the large cost and time spent on maintenance associated with having fenced, controlling weeds and pests and loss of income from previously productive areas.

The main sources of influence to protect bush remnants were other farmers, particularly those that had taken action and done something about it themselves (Table 10). Regional Council staff were a source of encouragement for farmers, although one focus group felt that they only contributed to the protection of indigenous forest areas through articles and written material and another group felt that when a council contributed they also wanted to control what was being done. Landcare type organisations and groups were mentioned by two of the focus groups as was the organisation of Forest and Bird.

The main social group deterring farmers from protecting bush remnants was felt to be Fish and Game because they appeared to them to have been so anti-farming. The other groups mentioned ranged from bankers and accountants through to 'greenies' who were considered to have been impractical and too demanding of farmers.

Table 9: Beliefs about protecting and conserving bush remnants

Beneficial Consequences	Problematic Consequences
• Aesthetic appeal (3 groups) • Provide habitat for birds (3 groups) • Improved water quality from restricted stock (2 groups) • Sediment and nutrient filter for gully (2 groups) • Minimised erosion (2 groups) • Made grazing management easier (2 groups) — got rid of gullies where stock got caught — difficult mustering country — got rid of bluffs — increased internal subdivision — flexibility of grazing • On flat areas can provide stock shelter (2 groups) • Shade provided around the edges(2 groups) • Farm made easier to sell, if it had a bush block • Tax deductions (could be?) • Minimised floods	• Increased weeds and pests (3 groups) • Costs for fencing, weed control and planting of unproductive land (3 groups) • Extra work time (2 groups) • Reduced grazing area (2 groups) • Difficult to establish new plants • Shaded out nearby pasture • Animals congregate around these areas and 'pugged' it in a storm • Lack of community support for bush blocks • Extra planning to monitor, tend, and plant • Conflict with rest of farm e.g. spray damage • Lack of community commitment so that neighbours all worked together • Got more tresspassers

The key resources required by landowners considering protecting bush remnants were information and advice so that they could know how to manage and what to plant in different situations. One group specified the need for tree consultants to have been involved. Regional Council field officers were identified as a key resource by one group. Funds were a limiting resource for people in all the groups. Lack of time was considered a key limitation because protecting and re-establishing bush remnants was such a labour intensive practice. The fear of trying something new was a hurdle for people taking their first steps towards protecting and enhancing bush remnants.

Table 10: People and resources that can encourage the protection and conservation of bush remnants

Supportive Groups

- Other farmers who were doing it (3)
- Landcare type organisations (2)
- Fish & Game
- Regional Council staff
- Forest & Bird
- QE II trust
- Farm advisors
- Tourist operators – ($ benefits)
- DoC
- Urban dwellers/townies
- NZ Farm Forestry Association
- Government Depts – MAF, MfE

Deterring Groups

- Accountants
- Bankers
- Traditional farmers
- Fish and Game
- Anti-farming lobby
- Forest & Bird
- Fish & Game
- DoC
- Greenies – impractical and demanding
- Tourist operators – ($ benefits)
- Dairy companies
- Meat companies

Limiting Resources

- Funds to pay for it
- The time required
- Appropriate Information
- Plants and spray
- Field officers who provided advice

Riparian Management Systems and Associated Beliefs

The main motivating benefits of landowners making changes to their riparian management shown in Table 11, was for them to achieve visible benefits to water quality. The main limitations to making changes were their perceptions that they would decrease farm production or add to their costs.

Table 11: Beliefs about riparian management

Beneficial Consequences	Problematic Consequences
• Reduced bank erosion	• Difficult stock management
• Less boggy messes	• Drinking water restricted
• Increased stock safety	• Costs of establishment
• Less sediment	• More weeds and pests
• Animal performance	• Costs of maintenance
• Council subsidies	• Some feed lost
• Less waterway contamination	• Restrictions on stock and machinery crossing
• Increased aesthetic value	• Trees collapsed across the waterway
• Difficult regulations	• Decreased flood control
• Cooler water	• More bureaucracy to report on
• Improved wild life	• Drain cleaning more difficult
• Better duck shooting	• More work
• Better fishing	• More difficult stock mustering
• Regional Council approval	• Greater fire risk

Woodlot Management Systems and Associated Beliefs

Establishing and maintaining indigenous woodlots for timber production was practiced by seven landowners in the focus group. The eighth landowner was planting specimen trees in paddocks for their aesthetic value.

The main objectives of landowners with woodlots have been to ‘increase the capital value of the farm’ and to ‘develop a waste area’. As before, Figure 5 displays a description of the factors that influenced decision-making on that practice.

The decision model for planting indigenous trees (Figure 5) was similar to that for preserving indigenous forest fragments (Figure 4). One difference has been that it incorporated decision domains that dealt with landuse planning to achieve best farm returns, plant selection, and included financial budgeting (to ensure that the resulting cashflow would have been profitable). The extra domains shown in Figure 4 of land covenanting and intrinsic appreciation were not associated with woodlots.

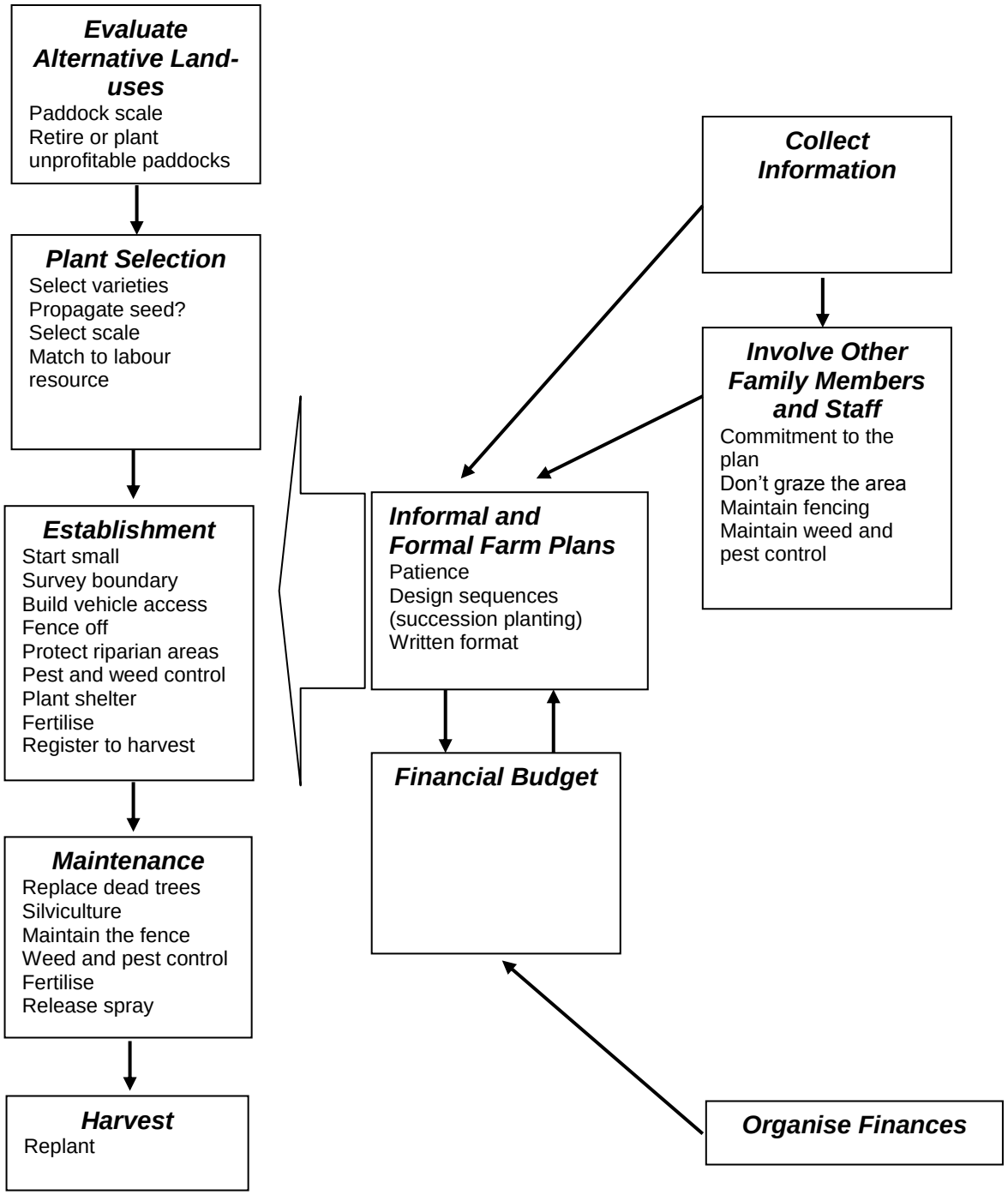
Two of the farmers in the group fully expected that by the time it came for them to harvest they might no longer have felt like felling the trees. As a result, areas planted as indigenous woodlots may have been treated no differently from areas of indigenous habitat by landowners until an actual 'harvest decision' was made. So, planting indigenous trees in a potential woodlot has not automatically included decisions about felling those trees at maturity.

Within the existing decision domains some extra outputs have included registering with the Regional Council the area to have been harvested, and carrying out silviculture operations (e.g. pruning and thinning) for maintenance.

The woodlot focus groups felt that it might not have been necessary to have done a financial budget because the timeframes from planting to harvest were so long. For them, establishing an indigenous woodlot was really something to do for a future generation and they were not expecting to have been around themselves to benefit from the results.

Additional benefits to landowners planting native trees were expected from an improvement in the look of an area, and the new habitats provided for insects and birds (Table 12).

Figure 5: A management system for the practice of establishing and maintaining indigenous woodlots for timber production



A problem for indigenous woodlots was the uncertainty landowners had about whether or not they might be allowed to harvest the trees by the time that they were mature. If such a thing happened, it would have made their whole exercise (and extra effort with silvicultural management) futile. Another problem for them was the long timescales involved making it difficult for them to even imagine what future wood markets would be like.

All the farmer groups felt that information and advice about the best indigenous varieties to plant as well as their on-going management was important. As a type of crop, indigenous woodlots have a very long time to wait before people were able to identify that they had made mistakes so that they could learn from them.

The people with the most influence over landowners on whether to establish indigenous woodlots have been Regional Councils, Maori groups and Government agencies (Table 13). Other farmers with experience were influential also. Tree consultants have provided knowledge and expertise, as have the Farm Forestry Association or people that have already made money out of forestry.

People that were in a position to discourage farmers from that practice have been extremist environmental groups such as the "Maruia Society". Farmers felt that their financial advisors and bankers were also sometimes discouraging about the practice because of the long timeframes and risks involved. The changes in landowners' property rights on the West Coast of the South Island were referred to in discussions as an example of the threat to the future decisions of landowners to establish indigenous woodlots.

Resources that landowners expected to have when decision making, included the availability of appropriate information and advice, especially about the most suitable tree types, their establishment, management and fertiliser. Other key resources they needed were time, money and patience.

Table 12: Beliefs about the establishment and maintenance of woodlots

Beneficial Consequences	Problematic Consequences
• Aesthetic improvements (2 groups) • No allergic reactions to native tree pollen • Seeing native trees where didn't have them before • Native trees are more hardy and naturally adapted to the environment • New habitats e.g. insects and birds • Break up pine monoculture • Higher overall returns • Reduce wilding-pines • Could be a use for an awkward part of farm	• Getting silviculture advice (2 groups) • Such long time scale makes it hard to plan (2 groups) • Potential loss of harvesting rights • Intergenerational control not an issue with pine trees • Too long a lifecycle for family farming on a typically sized farm • Access to financial tools for land use analysis • Cattle push down seedlings/young plants • Damage when harvesting to habitats • Erosion when harvesting • Bring in pests and weeds • Lack of information and research on most productive cultivars • Extra costs • Financial returns too slow

Table 13: People and resources that could encourage the establishment and maintenance of woodlots

Supportive Groups

- Regional Councils (3 groups)
- Sympathetic farmers (2 groups)
- Good consultants
- Those without a financial interest in the venture
- Government officers
- Farm Forestry Association
- Forest & Bird
- Maori groups

Deterring Groups

- Environmentalists (2 groups)
- Environmental fundamentalists
- Maruia Society
- Financial advisors

Limiting Resources

- Greater commitment to allow harvesting
- Appropriate information
- Enough time
- Minimal bureaucracy

Application of Beliefs to TRA Research

In each of the tables (from 9-13), the number of focus groups that provided similar classes of ideas has been listed. The rest of the concepts have been listed in approximately priority order based upon how much discussion the different ideas engendered at the time. There was quite a bit of diversity between groups reinforcing that what was salient across groups may not have been salient for individuals within groups.

The information above was then used in designing the questionnaires for the surveys. Table 14 lists the variables relevant to the Theory of Reasoned Action and the concepts in the qualitative research used to measure those variables. The Table has also identified the questions in the different surveys aligned to those concepts.

Table 14: Beliefs and decision making concepts listed and linked to research questionnaires

Psychological Variable	Beliefs and Decision Making Concept	Remnant Bush Questions	Riparian Questions	Woodlot Questions
Intentions	Intentions	48	58	84
	Planning	63	47	
	Want		59	58
Instrumental Attitudes				
	A good thing to do	56	50	46
	A useful thing to do	76	61	31
	A wise thing to do	90		67
	A valuable thing to do		70	
Instrumental Beliefs				
	Solving areas that are difficult to graze	34 and 35		
	More weed & pest problems	41 and 42	113 and 35	
	Increase wildlife habitat	43 and 44	123 and 52	52 and 53
	Increased costs	49 and 50	120 and 65	61 and 62
	Controlling erosion	51 and 52	125 and 67	
	Creating extra work	53 and 54		33 and 34
	Improve aesthetic value	59 and 60	126 and 69	48 and 49
	Increased farm value	64 and 65		70 and 71
	Property rights	71 and 72		
	Land utilisation	85 and 86	131 and 73	35 and 36
	Animal shelter	87 and 88		
	Responding to community	74 and 75		
	Waterway health and cleanness		115 and 41	
	Animal management problematic		112 and 39	
	Flood control		132 and 48	
	Reduced sediments		124 and 32	
	Reduced temperature		133 and 44	
	Reduced nutrients		116 and 37	
	Reduced bugs		130 and 57	
	Produce quality wood			80 and 81
	Increased profitability			54 and 55

	Useful to generation			68 and 69
	Risk of loss			41 and 42
Affective Attitudes				
	Anxious	84		72
	Feeling frustrated	39		75
	Pleasant		42	
	Enjoyable		66	
Affective Beliefs	N/A			
Subjective Norms				
	Behaviour of people important to me	38	40	32
	Approval of important people	57	60	76
	What people important to me think	83	64	64
	Expected of me		36	
Normative Beliefs				
	Responding to friends	58 and 69	135 and 51	66 and 77
	Responding to government experts	67 and 73	121 and 71	56 and 63
	Responding to family	80 and 89	119 and 72	78 and 83
Perceived Behavioural Control				
	I have control	82	62	59
	Its up to me	78	63	45
Control Beliefs				
	Time available	36	46	50
	Enough encouragement	40		79
	Abilities	45	68	57
	Funds	61	49	74
	Information	81		
	Skills		43	
	Knowledge		33	43
Self-Efficacy				
	Complexity	46		39
	Effort	68		38
	Easy		34	
	Capable		55	

Efficacy Beliefs				
	Confidence in my own abilities	47	45	40
	Often think about	70	38	47
	Supportive in principle	55	53	82
	Fits farming sustainably	77	54	65
Self-identity				
	Better than other farmers	66		85
	A concerned person	91		60
	Waterway health		111	
	Sustainable production		129	
	Erosion control		134	
	Developing nature areas		128	
	This is a difficult issue		114	
	I am concerned about the issue		117	
	I have already done more than most other people		122	
	My management is already good		127	
Objectives	Making use of uneconomic areas	33		
(important to me)	Creating wildlife habitat	37		44
	Benefiting future generations	62		37
	Beatifying the farm	79		73
	Increased profitability			51

Chapter 7. Research Results from Testing the Application of the Theory of Reasoned Action to the Act of Protecting and Conserving Bush Remnants on Farms

Introduction to Results on Protecting and Conserving Bush Remnants

In this chapter of the thesis, the quantitative results of applying the research methodology and the Theory of Reasoned Action to behaviour associated with protecting and conserving bush remnants has been described. A description of the terms used and the subjects that they referred to has been shown in Table 15 and that should be used throughout the chapter to interpret the symbols (e.g. BI_2 represents behavioural intention two, a question about the level of planning that has been undertaken).

The first step in this part of the research was to screen the collected survey results for normality and to detect any outlier data sets. Then the results for the behavioural outcome measures were examined and the other research measures tested for their convergent and discriminant validity.

Following the initial data examination, the relationships between variables has been analysed as correlations and as regressions. The predictive power of regression results were assessed by adding in interactive terms, considering residual terms, and testing for consistency between molar (direct) and molecular (indirect) regression results.

In the last section of this chapter, comparisons have been made between the beliefs of respondents with high verses low intentions to protect and conserve bush remnants.

Table 15: Definition of questionnaire terms for protecting and conserving bush remnants

Initials	Variables	TRA Construct	Question Subject
BI_1	intentions	molar variable	Intend to do
BI_2	intentions	molar variable	Plan to do
BI_m	intention mean	molar variable	
IA_1	instrumental attitude	molar variable	A good thing to do
IA_2	instrumental attitude	molar variable	A useful thing to do
IA_3	instrumental attitude	molar variable	A wise thing to do
IA_m	instrumental attitude mean	molar variable	
AA_1	affective attitude	molar variable	Feeling frustrated
AA_2	affective attitude	molar variable	Anxious
AA_m	affective attitude mean	molar variable	
SN_1	subjective norm	molar variable	What people important to me think
SN_2	subjective norm	molar variable	Approval of important people
SN_3	subjective norm	molar variable	Behaviour of people important to me
SN_m	subjective norm mean	molar variable	
SE_1	self-efficacy	molar variable	Effort
SE_2	self-efficacy	molar variable	Complexity
SE_m	self-efficacy mean	molar variable	
BC_1	perceived behavioural control	molar variable	Its up to me
BC_2	perceived behavioural control	molar variable	I have control
BC_m	perceived behavioural control mean	molar variable	
SI_1	self-identity	molar variable	A concerned person
SI_2	self-identity	molar	Better than other farmers

		variable	
SI_m	self-identity mean	molar variable	
IAB_{1a} and IAB_{1w}	instrumental attitude beliefs	molecular variable	Solving areas that are difficult to graze
IAB_{2a} and IAB_{2w}	instrumental attitude beliefs	molecular variable	Animal shelter
IAB_{3a} and IAB_{3w}	instrumental attitude beliefs	molecular variable	Controlling erosion
IAB_{4a} and IAB_{4w}	instrumental attitude beliefs	molecular variable	Improve aesthetic value
IAB_{5a} and IAB_{5w}	instrumental attitude beliefs	molecular variable	Increase wildlife habitat
IAB_{6a} and IAB_{6w}	instrumental attitude beliefs	molecular variable	More weed & pest problems
IAB_{7a} and IAB_{7w}	instrumental attitude beliefs	molecular variable	Increased costs
IAB_{8a} and IAB_{8w}	instrumental attitude beliefs	molecular variable	Creating extra work
IAB_{9a} and IAB_{9w}	instrumental attitude beliefs	molecular variable	Land utilisation
IAB_{10a} and IAB_{10w}	instrumental attitude beliefs	molecular variable	Property rights
IAB_{11a} and IAB_{11w}	instrumental attitude beliefs	molecular variable	Responding to community
IAB_{12a} and IAB_{12w}	instrumental attitude beliefs	molecular variable	Increased farm value
IAB_m	instrumental attitude belief products mean	molecular variable	
NB_{1a} and NB_{2c}	subjective norm beliefs, association and willingness to comply	molecular variable	Responding to family
NB_{3a} and NB_{4c}	subjective norm beliefs, association and willingness to comply	molecular variable	Responding to friends
NB_{5a} and NB_6	subjective norm beliefs, association and willingness to comply	molecular variable	Responding to government experts
NB_m	subjective norm belief products mean	molecular variable	
SEB_1	self-efficacy beliefs	molecular variable	Often think about
SEB_2	self-efficacy beliefs	molecular variable	Supportive in principle
SEB_3	self-efficacy beliefs	molecular variable	Fits farming sustainably
SEB_4	self-efficacy beliefs	molecular variable	Confidence in my own abilities

SEB_m	self-efficacy beliefs mean	molecular variable	
CB_1	control beliefs	molecular variable	Time
CB_2	control beliefs	molecular variable	Funds
CB_3	control beliefs	molecular variable	Enough encouragement
CB_4	control beliefs	molecular variable	Abilities
CB_5	control beliefs	molecular variable	Information
CB_m	control beliefs mean	molecular variable	

Survey Response Rate

The survey was sent out to 2300 respondents on the 24th May 2002 by NFO[9]. Respondents had until the 21st June to complete the survey, and they were all returned again by the 30th June 2002. The survey had a response rate of 28% (631 survey responses received) and a statistical power of 87%. Statistical power has been used to indicate the probability that the research would have been able to identify that a hypothesised relationship actually existed (Hair et al., 1998, p. 12). The statistical power depended upon: effect size, level of statistical significance, and sample size. In this study the statistical power has been calculated to assess the ability to detect a change in means of 1.0 at a significance level of 0.05 and a standard deviation of 7.0 units. A level of over 80% was considered acceptable (ibid).

Respondent Demographics

The average results from the demographic section of the survey have been shown in Table 16. The respondents were a typical cross-section of a New Zealand livestock farming community although they were slightly older and had a lower proportion of females. The average farm size (Statistics New Zealand, 2003, p. 13) for New Zealand properties over 20ha, was 320ha compared to the 343ha in this survey. The survey results have come from a larger average farm size than would have been expected in a completely random survey.

[9] NFO since 2003 has operated as TNS market research company. See Appendix A.

The proportion of dairy farmers in the survey was 36%, a result above the national average of 27%. Dairy farms in New Zealand have generally been smaller than sheep and beef farms and so it should have been expected in this study, that if the respondents to the survey included a greater than expected proportion of dairy farmers, then the average farm size should have been smaller than the population average. The opposite effect actually occurred.

Although when the sample was selected it had not deliberately been intended to include part-time farmers, 18% of respondents identified themselves in that category. In the NZ statistics for 2002, 12% of farmers were in the "other" livestock class. That may have provided a rough estimate of non-farmers with livestock but it would not have included part-time farmers.

Table 16: Demographic survey results for protecting bush remnants

Demographic Variable	Result	New Zealand Statistics for 2002
Percentage of Full-time Farmers	82%	unknown
Average Age	50 years	44 years
Percentage Female	18%	33%
Percentage Non-European	5.0%	5.3%
Average Property Area	343 ha	320 ha
Proportion of Dairy Farms	36%	27%
Proportion with farm forestry or woodlots	19%	17%

Screening Data for Normality

Hierarchical regressions and their tests of significance have assumed multivariate normality (Tabachnick and Fidell, 2001, p. 72). If the data for a number of variables have not been normally distributed, then the relationships calculated for pairs of variables may not have applied consistently throughout their distributions. Applying a range of tests for calculating univariate normality was able to assist in assessing how serious any violation of normality might have been, but the tests that have been available were likely to have been overly sensitive for the sorts of multivariate analyses that were carried out here (Tabachnick and Fidell, 2001, p. 72).

In Table 75 of Appendix I, the mean and distributions of the collected data has been shown. The overall mean for all the variables using a 20 point scale was 13.5 and the standard deviation was 5.4. In the Table, the goal products represented how important the different farming goals have been to landowners and how much they associated (positively or negatively) protecting and conserving bush blocks to their goals. Protecting bush blocks was most consistent with landowners' wanting to "look after nature" as one of their farming goals. It also fitted with landowner goals of "having variety in work" and "maintaining a stable farming system". Those two latter goals provided alternatives to the more production or business goals such as "produce to maximise farm profites". The behaviour was most in conflict with those farmers wanting to "pay off debts". The ability to provide animals with shelter (IAB4) had the highest mean of 17.3 (along a scale of 0-20). The ability to increase a farm's value and identifying with people supportive of bush protection also scored highly (both IAB24 and SEB2 had means of 16.7 out of 20). Those variables had moderate standard deviations of less than 4.0. Some variables have had wide variations in responses with coefficients of variation greater than 50%. Those included that protecting bush remnants would decrease land utilisation (IAB17; mean of 10.8 and standard deviation of 6.2) and respondents' assessment of the degree to which bush remnants provided erosion control (IAB5; mean of 12.7 and standard deviation of 6.3).

Generally the median had the same value as the mean or slightly higher indicating that most people made their responses around the mean or higher. Often the mode was 1, 11, or 20 on the 20 point scales suggesting that generally quite a simplified system of scoring has been used. It has also suggested that the visual scale was effective in encouraging full use of length of the scale in scoring responses to questions.

The mode for the intention and attitude questions was 11 (also subjective norms and self-efficacy) so perhaps many people felt ambivalent about the topic. An exception has been the question about whether protecting bush was bad or good (IA1) where the mode was good (20) and whether people important to them would approve of them protecting bush (SN2), where again it was considered highly positive (20). The behavioural control and self-identity questions had a

mode of 20 except for the question about how well people considered that they had protected their bush compared with other farmers, where the mode was 11.

Generally the results collected from questionnaires when compared to a 'normal' distribution, have been a mixture of more or less peaked than we would have expected to have found (i.e. positive or negative kurtosis respectively). The kurtosis was more likely to have been peaky with the global measures such as intentions, attitudes and subjective norms. Generally there was a negative skewness to the distributions. That has reflected that although the peak in distribution tended to have been between 10 and 20 on the scale, a greater number of responses were below 5 than above 15.

The Shapiro-Wilk test is a powerful and sensitive test of univariate normality, particularly with small samples. It relies upon the variables having been independent without any correlations; otherwise it has been known to fail to control type 1 errors unless the data were transformed first. In Appendix I, Table 75 the Shapiro-Wilk test results have been very small (<0.05) reinforcing earlier results indicating non-normal data.

Although the data appears to have been non-normal, that may not have disrupted the results because most of the distributions have been aligned the same way along the scales and large numbers of observations have been involved (Tabachnick and Fidell, 2001, p. 72)

Existing Farmer Behaviour

Respondents were asked if they had any bush remnants on their properties and 68% in total did have. Most farms with bush had 3 or more patches of remnants covering about 6 hectares (Table 17). Of these, just over half of them were already protected and conserved.

The measure of behaviour used in this study and the outcome (dependent) variable in the behavioural regression analysis was the percentage of bush remnants that had been protected and conserved on individual properties. That has been indicated by respondents answering a question on the "percentage of bush remnants conserved" which, when there were only three remnants on a typical property, has a limited possible variance.

Table 17: Mean percentage of properties with bush remnants and the proportion that has been protected

	Sheep	Dairy	Total
Properties with no bush present	32%	35%	32%
Average percentage of bush remnants preserved	43%	63%	54%
	Median	Median	Median
Number of bush remnants per property (excluding zero)	4	3	3
Area of bush remnants (ha) per property	12	3	6

The outcome variable in the behavioural intentions regression analysis was "protecting and conserving bush remnants on my farm". The behavioural measure and peoples' intentions had a correlation of 0.39 which was moderate, but not high. In theory, the behaviour measure used here and the intention measure may not have matched closely enough for reliable determinations of the relationship between the psychological determinants and the behaviour. To accommodate this disparity in the study, the calculations for developing behavioural models retained the available behavioural measure as a proxy for the outcome variable. In subsequent analyses of intentions the behaviour measure was used (more properly) as a measure of past behaviour, rather than predicted behaviour.

Test of Convergent Validity

Calculations of Cronbach Alpha Coefficients (CA or C.Alpha in the tables) have been used to test the convergent validity of the concept measures. That assisted in ensuring that all the related questionnaire items were measuring the same construct. It was desirable that all Cronbach Alpha results should have been greater than 0.7; or in exploratory studies, at least over 0.6 (Hair et al., 1998, p. 88). Table 18 has a list of the CA results for this study. For landowners protecting and conserving bush remnants, they have been generally satisfactory, except for the two self-identity questions which appeared to have been measuring different concepts.

Test of Discriminant Validity

Factor analyses were used to test for differences between similar measures of the predictor variables and identify any different concepts that they might contain. It was desirable that each concept in a similar group had a loading of greater than 0.4 on the one factor that they had in common, and the measures for any other concept from outside that grouping was loaded less than 0.3 on the same factor (Bowen et al., 2001; Brubaker and Fowler, 1990).

Table 18: Cronbach Alpha coefficients for bush remnant concepts

Variables	C.Alpha
BI1, BI2	0.86
IA1, IA2, IA3	0.87
AA1, AA2	0.73
SN1, SN2, SN3	0.77
SE1, SE2	0.61
BC1, BC2	0.74
SI1, SI2	0.46
Ob1, Ob2, Ob3, Ob4	0.83
SEB1, SEB2, SEB3, SEB4	0.70
CB1, CB2, CB3, CB4, CB5	0.81
Goals (10 products)	0.90

In Table 19 all the concepts loaded on to the same factors as their theoretical complimentary concepts. The amount of shared variance that they had was moderate to high (0.44 to 0.82), and therefore the means for all of them were included in further multivariate analyses. Self-identity concepts had the weakest link to a common factor. In other research studies, the self-identity question asked most consistently was the one used here in SI1, "I think of myself as someone …" (Armitage and Connor, 1999b). Conner et al (1999) has also related self-identity to past behaviour and that link was intended in SI2 "I have done more than most …". Maybe the connection between SI1 and SI2 was not strong enough for the respondents involved in this study.

The molecular variables were measures of concepts that were related to each other, but it has not been necessary for them to have been as similar with each

other as the molar concepts needed to have been (Table 20), and therefore, they did not need to all load onto the same factors.

Table 19: Factor loadings for molar (direct) TRA measures of bush remnant concepts

Variable	Factor 1			Communality
Behavioural Intentions				
BI1	0.82			0.67
BI2	0.82			0.67
% var	100			
Instrumental Attitudes				
IA1	0.81			0.65
IA2	0.79			0.63
IA3	0.81			0.66
% var	100			
Affective Attitudes				
AA1	0.68			0.46
AA2	0.68			0.46
% var	100			
Subjective Norms				
SN1	0.66			0.44
SN2	0.74			0.55
SN3	0.66			0.44
% var	100			
Self-Efficacy				
SE1	0.56			0.31
SE2	0.56			0.31
% var	100			
Perceived Behavioural Control				
BC1	0.69			0.47
BC2	0.69			0.47
% var	100			
Self-Identity				
SI1	0.44			0.19
SI2	0.44			0.19
% var	100			

Table 20: Factor loadings for non-specific and molecular (indirect) measures of bush remnant concepts

Variable	Factor 1	Factor 2	Factor 3	Communality
Farming Goals Bush Remnant Products				
ProdBus	0.49	0.22	0.52	0.56
ProdProf	0.28	0.54	0.54	0.67
ProdSelf	0.35	0.49	0.45	0.57
ProdNat	0.73	0.08	0.27	0.62
ProdVal	0.58	0.29	0.13	0.43
ProdFut	0.50	0.45	0.23	0.51
ProdVar	0.64	0.36	0.21	0.58
ProdDebt	0.14	0.69	0.21	0.53
ProdSys	0.60	0.46	0.26	0.64
ProdSoc	0.31	0.64	0.13	0.52
%var	84.1	10.1	4.0	
Intrinsic Attitude Belief Products				
IAB1prod	0.51	0.06	0.18	0.27
IAB3prod	0.52	0.11	0.21	0.28
IAB5prod	0.43	0.07	0.24	0.19
IAB7prod	0.68	0.00	0.28	0.48
IAB9prod	0.58	0.07	0.30	0.34
IAB11prod	0.27	0.33	0.46	0.23
IAB13prod	0.14	0.66	0.41	0.44
IAB15prod	0.06	0.64	0.39	0.41
IAB17prod	0.16	0.28	0.44	0.20
IAB19prod	0.20	0.27	0.43	0.18
IAB21prod	0.39	0.06	0.20	0.15
IAB23prod	0.59	0.13	0.29	0.35
% var	63.0	28.2	4.7	
Normative Beliefs				
NB1prod	0.54			0.29
NB3prod	0.62			0.38
NB5prod	0.50			0.25
% var	100			

Self-Efficacy Beliefs				
SEB1	0.47	0.03		0.33
SEB2	0.56	0.08		0.53
SEB3	0.56	0.08		0.54
SEB4	0.22	0.10		0.12
% var	99.7	0.3		
Control Beliefs				
CB1	0.87	0.47		0.76
CB2	0.57	0.51		0.37
CB3	0.69	0.52		0.49
CB4	0.70	0.62		0.56
CB5	0.43	0.69		0.48
% var	99.0	1.0		

In this study, the farming goals have loaded on to five different factors, although the first three factors were able to explain over 90% of the variation in the scoring.

The same situation existed with instrumental attitude beliefs. Beliefs about bush protection and grazing management, weed and pest control, farm costs and erosion control all tended to load on to a farming factor that included enhancing wildlife habitat and community responsibility. Property values and improving farm aesthetics tended to load together on a different factor, as did land utilisation, property rights and creating extra work. Beliefs about animal shelter were not well explained by any of the other three factors.

Normative beliefs and self-efficacy beliefs have tended to load onto one factor each, although SEB4 did not fit the same factor as the other three efficacy beliefs. Control beliefs have tended to load onto two factors, although most of the loading was on the first factor and so they have been kept together in subsequent analyses. This has suggested that the salient beliefs for subjective norms, self-efficacy and perceived control were highly consistent across the sample.

Molar Correlations within the Data

Behavioural intentions in Table 21 had the highest correlations with existing protection of bush remnants (0.36 – 0.40), consistent with the TRA. The correlations with self-efficacy and self-identity were also relatively high.

Many of the correlations amongst the predictor variables in the Table were above 0.5 (e.g. 0.66 between IA1 and IA3). Some of the correlations between predictor and outcome variables were also high (e.g. 0.5 between IA1 and BI1). None of the correlations though were above 0.9 and so none of them has seemed to have indicated any problem with collinearity (Hair et al., 1998, p. 191). Self-efficacy and perceived behavioural control have been similar social psychology concepts but there seems little similarity in the measures used here because the correlations have been small, varying between 0.04 and -0.11. Instrumental attitudes and affective attitudes have also been considered similar concepts and although they were highly correlated here (from 0.55 to 0.66) it was not enough to suggest that there was a problem with collinearity.

Table 21: Correlations between molar and outcome variables for protecting bush remnants

BI2	0.36 ***	0.76 ***	1													
IA1	0.30 ***	0.50 ***	0.49 ***	1												
IA2	0.26 ***	0.44 ***	0.48 ***	0.65 ***	1											
IA3	0.22 ***	0.45 ***	0.48 ***	0.66 ***	0.65 ***	1										
AA1	0.25 ***	0.48 ***	0.49 ***	0.58 ***	0.56 ***	0.66 ***	1									
AA2	0.20 ***	0.42 ***	0.43 ***	0.55 ***	0.58 ***	0.60 ***	0.60 ***	1								
SN1	0.21 ***	0.39 ***	0.39 ***	0.49 ***	0.47 ***	0.52 ***	0.48 ***	0.47 ***	1							
SN2	0.21 ***	0.32 ***	0.33 ***	0.62 ***	0.53 ***	0.55 ***	0.58 ***	0.46 ***	0.53 ***	1						
SN3	0.17 ***	0.31 ***	0.28 ***	0.40 ***	0.42 ***	0.41 ***	0.54 ***	0.38 ***	0.47 ***	0.58 ***	1					
SE1	-0.24 ***	-0.28 ***	-0.24 ***	-0.02 ns	-0.14 *	-0.09 #	-0.13 #	-0.07 ns	-0.06 ***	-0.01 ns	-0.05 ns	1				
SE2	-0.37 ***	-0.33 ***	-0.31 ***	-0.16 *	-0.24 ***	-0.24 ***	-0.26 ***	-0.20 ***	-0.18 **	-0.13 *	-0.16 **	0.50 ***	1			
BC1	0.05 ns	0.05 ns	0.09 #	0.16 *	0.10 #	0.13 #	0.16 *	0.11 #	0.11 #	0.21 ***	0.14 *	0.04 ns	-0.10 #	1		
BC2	0.07 ***	0.08 #	0.09 #	0.23 ***	0.18 ***	0.23 ***	0.18 **	0.19 ***	0.18 **	0.28 ***	0.11 #	-0.01 ns	-0.11 #	0.56 ***	1	
SI2	0.24 ***	0.38 ***	0.41 ***	0.55 ***	0.48 ***	0.57 ***	0.58 ***	0.44 ***	0.45 ***	0.47 ***	0.43 ***	-0.05 ***	-0.18 ***	0.10 #	0.18 **	1
SI3	0.33 ***	0.37 ***	0.31 ***	0.19 ***	0.20 ***	0.19 ***	0.16 ***	0.13 ***	0.18 ***	0.16 ***	0.07 ***	-0.03 ns	-0.17 **	0.11 #	0.06 ns	0.24 ***
	Behaviour	BI1	BI2	IA1	IA2	IA3	AA1	AA2	SN1	SN2	SN3	SE1	SE2	BC1	BC2	SI2

*Significance of differences between groups, p=<0.0001 ***, p=<0.001 **, p=<0.01 *, p=<0.1 #, not significant = ns*

Molecular Correlations within the Data

Table 76 of Appendix J has a Table of all the molecular correlations. They were all below 0.5 except for the correlation between the two intention measures. The highest correlations were between the measures of behavioural control beliefs and behavioural intentions (0.35 to 0.53). That relationship was consistent with the Theory of Planned Behaviour version of the TRA (Ajzen, 1991).

Correlations between Molar and Molecular Variables

Appendix J, Table 77 has the correlations between molar (direct) and molecular (indirect) measures of the predictor variables. If we look at the attitude variables, those correlations have varied between very low (e.g. 0.06 between the product of IAB13 and IA1) and quite high (e.g. 0.57 between the product of IAB7 and IA1). It has been similar for subjective norms, self-efficacy and perceived behavioural control. None of the items with high correlations have done so consistently enough to have created a concern about collinearity.

Correlations between TRA Variables

The TRA molar predictor variables have been moderately to highly correlated with each other and with people's intentions (Table 22). Behavioural control had low correlations with intentions and with protection behaviour. The results for the self-efficacy measures have been reversed from a negative to positive direction so that they were more consistent with the other measures in the Tables. As a result, high scores for self-efficacy have meant that the behaviour was associated with less complexity and a reduced effort was required for implementation.

With the TRA molecular predictor variables in Table 23, the correlations have been generally lower than the molar variables as would have been expected. Correlations between these variables and behavioural intentions varied between 0.28 and 0.65.

The correlations with self-efficacy were already positive because the self-efficacy belief questions were written in the questionnaire in the same direction as the other predictor variables. The high scores have meant a greater amount of

confidence by landowners in taking action and a greater time during which they were already thinking about the topic. The perceived control beliefs had a much higher correlation with behavioural intentions than did the molar measure of perceived behavioural control.

Table 22: Correlations between TRA molar (direct) variables for protecting bush remnants

BIm	0.40 ***						
IAm	0.29 ***	0.58 ***	1				
AAm	0.25 ***	0.54 ***	0.75 ***	1			
SNm	0.24 ***	0.44 ***	0.67 ***	0.65 ***	1		
SEm	0.35 ***	0.36 ***	0.21 ***	0.22 ***	0.15 *	1	
BCm	0.07 ns	0.09 #	0.22 ***	0.21 ***	0.23 ***	0.06 ns	1
SIm	0.38 ***	0.51 ***	0.62 ***	0.52 ***	0.55 ***	0.17 **	0.22 ***
	Protection Behaviour	**BIm**	**IAm**	**AAm**	**SNm**	**SEm**	**BCm**

Table 23: Correlations between TRA molecular (indirect) variables for protecting bush remnants

BIm	0.41 ***				
IABm	0.24 ***	0.49 ***	1		
NBm	0.19 ***	0.33 ***	0.27 ***	1	
SEBm	0.13 #	0.07 ***	0.22 ***	0.09 #	1
CBm	0.28 ***	0.65 ***	0.56 ***	0.34 ***	0.07 ns
	Protection Behaviour	**BIm**	**IABm**	**NBm**	**SEBm**

That was unexpected from theory and from previous applications of the concepts used in perceived behavioural control questions (Aarts et al., 1998). It may have indicated that respondents had difficulty conceptualising how their behaviour was affected by specific control beliefs, or maybe that people avoided indicating that they had a low level of behavioural control. Sheeran et al (2002; Armitage and Connor, 2002) also had respondents that seemed to want to avoid creating an impression of low behavioural control, see Sparks et al (1997) for further discussion on similar problems.

Hierarchical Regression Analysis for Behaviour

An initial predictive model was constructed using the non-specific variables collected (see Table 24) to explain the proportion of bush protected. These included demographic information, farming goals and their relationship to protecting and conserving bush remnants, and people's environmental objectives relating to biodiversity. They have all been considered non-specific variables because they were not directly related to performing the behaviour – protecting and conserving bush remnants. The dataset that has been analysed was restricted to only those landowners that had bush remnants on their properties (Table 17).

Table 24: Non-specific behavioural variables of bush remnant protection and conservation

Variable	Description
Occupation	1 = full-time farmer 2 = part-time and other
Gender	1 = male 2 = female
Age	Years
FarmArea	Hectares
Livestock Type	1 = dairy 2 = sheep and/or beef (no dairy) 3 = other (no dairy)
Obm	Mean of Objectives 1…4
Goalsm	Mean of Goal products 1…10

Regression results have been shown in Table 25. From the first column with model 1 until model 9 additional variables have been added at each step. The predictive variables were added in order of enterprise variables, personal variables, non-specific psychology variables and then TRA variables last. In models 8 and 9 there were some non-significant variables and they were removed

for models 10, and 11 without reducing the explanatory capabilities of the model. Each row in the Table has reflected the results for each new variable added at that step. Below that a standard coefficient of determination has been calculated along with an adjusted coefficient so that the results of each step have been able to have been compared. The change in adjusted coefficient has been shown along with its significance and that was used to identify the most parsimonious and effective model. At the bottom of the Table the F-test statistic for the regressions and their degrees of freedom has been calculated.

In Table 25, the models have R^2 remaining below 10% until models 8 and 9 when the TRA variables were included and the R^2 increased to over 15%.

In the Table, as farming occupation, farming goals and environmental objectives have been added, they initially made a significant additional contribution to R^2. The effects of respondent gender have been moderate and age generally small, both remained non-significant in all the models. Before the TRA variables were included, livestock class (dairy farmers were more supportive), and having biodiversity objectives were the most influential and significant variables.

The model using non-specific variables with overall the greatest significant change in adjusted coefficient of determination (R^2) for significant predictor variables was model 7 in the Table. Removing the non-significant variables and using only the intention measure (model 9) increased the adjusted R^2 to over 16%. Adding control beliefs to intentions (model 12) increased the model's predictive ability but the improvement was insignificant compared to using intentions on their own. Including the type of livestock enterprise has added a significant variable but the improved predictive ability was insignificant (model 13).

The results have indicated that the implementation of the behaviour was mostly determined by landowner's intentions and that a Theory of Reasoned Action (TRA) model structure would provide sufficient understanding of behaviour rather than using a Theory of Planned Behaviour (TPB) model structure.

In equation 1 the best fitting and most parsimonious non-specific model (model 8) from Table 25 has been displayed.

Equation 1. Regression model for non-specific variables and land owner's bush preservation behaviour

B = -9.31*livestock class + 3.49* environmental objectives + 13.73

adjusted R2 = 7.77%, $F(2, 403) = 18.07$, $p<0.0001$

The regression model in equation 1 had a coefficient of determination of under 10% with high explanatory power using the existing data set (a high and significant F-test result), but low generalisability (two was a low degree of freedom for the regression).

Table 25: Behavioural regression results for non-specific variables of bush remnant protection and conservation

Variable	r	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13
Occup **t-test**		10.22 .077	9.22 .1013	11.95 .0381	12.49 .0309	12.40 .0324	11.17 .0530	8.26 .1484		5.87 .2819	5.48 .3198			
FarmArea	0.08		-0.003 .1375	-0.002 .2567	-0.002 .2300	-0.002 .2232	-0.002 .2910	-0.002 .2011		-0.002 .2642	-0.002 .2696			
Livestock				-00.69 .0037	-12.16 .0025	-12.13 .0030	-12.06 .0029	-11.38 .0043	-9.31 .0134	-9.55 .0122	-9.54 .0129			-7.86 .0282
Gender					-7.00 .1925	-7.21 .1845	-6.63 .2208	-6.94 .1929		-7.73 .1290	-7.73 .1319			
Age	0.02					-0.05 .8140	-0.000 .9990	-0.002 .9935		-0.10 .5880	-0.10 .6004			
Goalsm	0.16						0.12 .0015	0.02 .6840		-0.03 .5378	-0.03 .4714			
Obm	0.26							2.99 .0003	3.49 <.0001	1.00 .2322	0.90 .2894			
BIm	0.40									2.74 <.0001	2.79 <.0001	3.06 <.0001	3.08 <.0001	3.02 <.0001
CBm	0.28										-0.04 .959		0.09 .8868	
Constant		41.88 <.0001	44.23 <.0001	60.76 <.0001	69.54 <.0001	72.12 <.0001	65.17 <.0001	24.59 .1808	13.73 .2502	28.49 .1039	30.30 .0881	14.42 .0027	12.98 .0183	28.368 .0003
R^2 %		0.82	1.39	3.46	3.91	3.97	6.40	9.39	8.23	18.34	18.12	16.21	16.84	17.09
R^2 adj %		0.58	0.89	2.72	2.93	2.73	4.92	7.70	7.77	16.59	16.12	16.01	16.42	16.68
ΔR^2 adj **F-test** **Models**			0.31 ns 1->2	1.83 <.01 2->3	0.21 ns 3->4	-0.20 ns 4->5	2.19 <.01 5->6	2.78 <.01 6->7	0.07 ns 7->8	8.89 <.01 7->9	-0.47 ns 8->10	0.58 ns 8->11	0.17 ns 8->12	-0.09 ns 8->13
F **regression**		3.35 .077	2.81 .0614	4.70 .0031	3.98 .0035	3.21 .0075	4.34 .0003	5.58 <.0001	18.07 <.0001	10.47 <.0001	9.07 <.0001	78.77 <.0001	40.69 <.0001	41.13 <.0001
Regression **DF**		1	2	3	4	5	6	7	2	8	9	1	2	2
Residual **DF**		406	400	394	391	388	381	377	403	373	369	407	402	399

For Model 8 PRESS was 641242.3 and PRESS RMSE was 39.74 compared to SSE of 631858 and RMSE of 39.60.

Hierarchical Regression Analysis for Intentions

To determine how much explanatory and predictive power a TRA model would have of landowners' intentions towards protecting and conserving bush remnants a number of intention models were analysed (Table 26). The intention models were begun with the existing percentage of bush that was already protected, representing landowners' past behaviour. TRA variables were added, until the adjusted R^2 has no longer been able to have been significantly improved. The TRA variables were added in the following order: instrumental attitudes, affective attitudes, subjective norms, self-efficacy, perceived behavioural control (beliefs) and self-identity. In the Table, the F-test for the changes in adjusted R^2 evaluated whether by adding variables to the previous column's model there was a significant improvement in R^2.

In Table 26, subjective norms were added to the regression (in Model 4), but it did not make any significant contribution to the models. Affective attitudes made an initial contribution (in Model 3) but it was then replaced by the self-efficacy and control beliefs, when these were added. Although a high level of additional prediction was achieved (over 40% was added to the adjusted R^2) the influence of past behaviour (% of bush protected) remained a significant variable in all the models and was never fully mediated by the addition of the TRA variables.

The best fitting model of landowners' intentions was model 10. The model indicated that landowners' intentions have been highly influenced by their instrumental attitudes, control beliefs and their self-identity with a lesser contribution from self-efficacy (equation 2).

Equation 2. Regression model for land owner's bush preservation intentions including TRA molar variables

BI = 0.02%protected + 0.55CBm + 0.36IAm + 0.22SIm + 0.10SEm - 1.92

adjusted R^2 = 56.31%,

$F(5, 399) = 105.14$, $p<0.0001$

Table 26: Behaviour regression results for TRA molar variables of bush remnant protection and conservation

Variable	r with BIm	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
% Protected	0.40	0.05 <.0001	0.03 .295	0.03 <.0001	0.03 <.0001	0.03 <.0001	0.03 <.0001	0.02 <.0001	0.02 <.0001	0.02 <.0001	0.02 .0001
IAm t-test	0.62		0.76 <.0001	0.50 <.0001	0.49 <.0001	0.47 <.0001	0.49 <.0001	0.40 <.0001	0.44 <.0001	0.33 .0001	0.36 <.0001
AAm	0.58			0.70 <.0001	0.67 .0002	0.60 .0007	0.63 .0002	0.22 .1178		0.22 .186	
SNm	0.52				0.02 .723	0.04 .588		-0.06 .430		-0.09 .188	
SEm	0.32					0.21 <.0001	0.21 <.0001	0.09 .025	0.10 .021	0.10 .014	0.10 .011
CBm	0.65							0.55 <.0001	0.57 <.0001	0.54 <.0001	0.55 <.0001
SIm	0.56									0.25 .004	0.22 .009
Constant		9.93 <.0001	-0.99 .285	-1.77 0.059	-1.85 0.056	1.52 .198	1.64 .159	-0.32 .771	-0.29 .788	-1.99 .108	-1.92 .116
R^2		16.21	40.21	42.51	42.52	45.56	45.52	55.86	56.10	56.76	56.85
R^2 adj		16.01	39.92	42.08	41.95	44.88	44.97	55.19	55.66	56.00	56.31
ΔR^2 adj F-test Models			23.91 <.01 1->2	8.16 <.01 2->3	-0.13 ns 3->4	2.93 <.01 4->5	-0.09 ns 6->5	10.31 <.01 5->7	-0.47 ns 8->7	0.81 <.01 8->9	-0.31 ns 10->9
F regn		78.77 <.0001	131.53 <.0001	99.32 <.0001	74.36 <.0001	67.11 <.0001	83.96 <.0001	83.72 <.0001	127.77 <.0001	74.27 <.0001	105.14 <.0001
Regn DF		1	2	3	4	5	4	6	4	7	5
Resid DF		407	406	403	402	401	402	397	40	396	399

For Model 10 PRESS was 5239.32 and PRESS RMSE was 3.60 compared to SSE of 5069.48 and RMSE of 3.56.

Interactions between TRA Predictor Variables

To test for the presence of interactions in the selected regression model shown in equation 2, partial products of the TRA variables were mean centred and included in the full regression model one at a time (in Table 27). There were no significant interactions indicating that the variables already included in the model (Equation 2) were each distinctively unique. The interaction models were not able to increase their predictive ability above that for model 10 in Table 26 and so there was no justification for including any interaction as a moderator of the final predictive variables.

Table 27: Regressions with interactions for bush remnant protection and conservation

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
% Protected	0.02 .0001	0.02 .0002	0.02 <.0001	0.02 <.0001	0.02 <.0001	0.02 <.0001	0.02 .0002	0.02 .0001
IAmc	0.39 <.0001	0.36 <.0001	0.38 <.0001	0.37 <.0001	0.35 <.0001	0.35 <.0001	0.36 <.0001	0.36 <.0001
SEmc	0.09 .033	0.09 .036	0.09 .036	0.17 .005	0.09 .041	0.09 .037	0.09 .034	0.09 .038
CBmc	0.55 <.0001	0.54 <.0001	0.56 <.0001	0.54 <.0001	0.73 <.0001	0.54 <.0001	0.54 <.0001	0.54 <.0001
SImc	0.22 .012	0.23 .007	0.23 .007	0.21 .017	0.19 .024	0.31 .006	0.23 .008	0.22 .010
Protected*IAmc	-0.001 .447							
Protected*AAmc		-0.000 .838						
Protected*SNmc			-0.002 .104					
Protected*SEmc				-0.002 .061				
Protected*CBmc					-0.004 .001			
Protected*SImc						-0.002 .216		
IAmc*AAmc							0.01 .597	
IAmc*SNmc								0.002 .821
Constant	-0.85 .008	-0.83 .009	-0.84 .008	-0.78 .016	-0.68 .032	-0.81 .011	-0.92 .010	-0.90 .011
R^2	55.12	54.65	55.35	55.45	56.27	55.22	54.68	55.06
R^2 adj	54.44	53.97	54.68	54.78	55.61	54.55	53.99	54.38
ΔR^2 adj **F prob** **Models***	- 0.0187 ns E2-1	- 0.0234 ns E2-1-2	- 0.0167 ns E2-1-3	- 0.0153 ns E2-1-4	- 0.0070 ns E2-1-5	- 0.0176 ns E2-1-6	- 0.0232 ns E2-1-7	- 0.0193 ns E2-1-8
F regn	81.66 <.0001	79.94 <.0001	82.43 <.0001	82.76 <.0001	85.56 <.0001	82.01 <.0001	80.02 <.0001	81.46 <.0001
Regn DF	6	6	6	6	6	6	6	6
Resid DF	399	398	399	399	399	399	398	399

** E2 = equation 2 in the text*

Table 27 continued

Variable	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16
% Protected	0.02 .0002	0.02 .0001	0.02 .0001	0.02 .0001	0.02 .0002	0.02 .0002	0.02 .0001	0.02 .0001
IAmc	0.37 <.0001	0.37 <.0001	0.37 <.0001	0.34 <.0001	0.37 <.0001	0.036 <.0001	0.36 <.0001	0.37 <.0001
SEmc	0.08 .071	0.09 .036	0.09 .035	0.10 .025	0.09 .031	0.09 .034	0.09 .041	0.09 .037
CBmc	0.54 <.0001	0.53 <.0001	0.54 <.0001	0.54 <.0001	0.53 <.0001	0.53 <.0001	0.54 <.0001	0.53 <.0001
SImc	0.22 .010	0.22 .010	0.23 .009	0.24 .006	0.23 .008	0.24 .006	0.22 .010	0.22 .010
IAmc*SEmc	0.005 .599							
IAmc*CBmc		0.005 .661						
IAmc*SImc			0.01 .414					
AAmc*SEmc				-0.02 .220				
AAmc*CBmc					0.01 .516			
AAmc*SImc						0.02 .619		
SNmc*SEmc							0.000 .967	
SNmc*CBmc								0.007 .514
Constant	-0.89 .006	-0.92 .008	-0.98 .005	-0.77 .017	-0.91 .007	-0.90 .009	-0.86 .007	-0.93 .006
R^2	55.08	55.07	55.13	54.82	54.69	54.67	55.05	55.10
R^2 adj	54.41	54.40	54.45	54.14	54.01	53.99	54.37	54.42
ΔR^2 adj **F prob** **Models**	-0.0190 ns E2-9	-0.0191 ns E2-10	-0.0186 ns E2-11	-0.0217 ns E2-12	-0.0230 ns E2-13	-0.0232 ns E2-14	-0.0194 ns E2-15	-0.0189 ns E2-16
F regn	81.55 <.0001	81.51 <.0001	81.69 <.0001	80.48 <.0001	80.08 <.0001	80.01 <.0001	81.44 <.0001	81.60 <.0001
Regn DF	6	6	6	6	6	6	6	6
Resid DF	399	399	399	398	398	398	399	399

Table 27 continued

Variable	Model 17	Model 18	Model 19	Model 20
% Protected	0.02 .0001	0.02 .0002	0.02 .0002	0.02 .0002
IAmc	0.37 <.0001	0.37 <.0001	0.36 <.0001	0.36 <.0001
SEmc	0.09 .036	0.09 .031	0.09 .032	0.09 .043
CBmc	0.54 <.0001	0.52 <.0001	0.54 <.0001	0.56 <.0001
SImc	0.23 .008	0.22 .010	0.22 .012	0.20 .022
SNmc*SImc	0.01 .475			
SEmc*CBmc		-0.02 .028		
SEmc*SImc			-0.01 .608	
CBmc*SImc				-0.01 .473
Constant	-0.95 .005		-0.84 .009	-0.78 ..020
R^2	55.11	55.59	55.08	55.11
R^2 adj	54.43	54.92	54.40	54.43
ΔR^2 adj **F prob** **Models**	-0.0188 ns E2-17	-0.0139 ns E2-18	-0.0191 ns E2-19	-0.0188 ns E2-20
F regn	81.63 <.0001	83.24 <.0001	81.54 <.0001	81.63 <.0001
Regn DF	6	6	6	6
Resid DF	399	399	399	399

Multicollinearity and Suppressor Check

The presence of suppressor variables has been checked by comparing the multiple regression coefficients with the zero-order correlations in Table 22. In all cases the coefficients were smaller than the correlations indicating that the presence of suppressor variables was unlikely.

Collinearity was tested by regressing in turn each predictive variable in the TRA against all the other predictive variables and calculating the tolerance value (Hair et al., 1998, p. 191). A tolerance threshold of 0.19 was suggested by Hair as the point where multiple correlations between one predictive variable and all the others were likely to exceed 0.9. That value was consistent with the value used to assess the presence of multicollinearity in Table 21. The results of Table 28 suggest that very little collinearity was likely.

Table 28: Tolerance values for predictive variables of bush remnant protection

Variable	Tolerance
IAm	0.28
AAm	0.37
SNm	0.46
SE	0.95
BCm	0.93
SIm	0.40

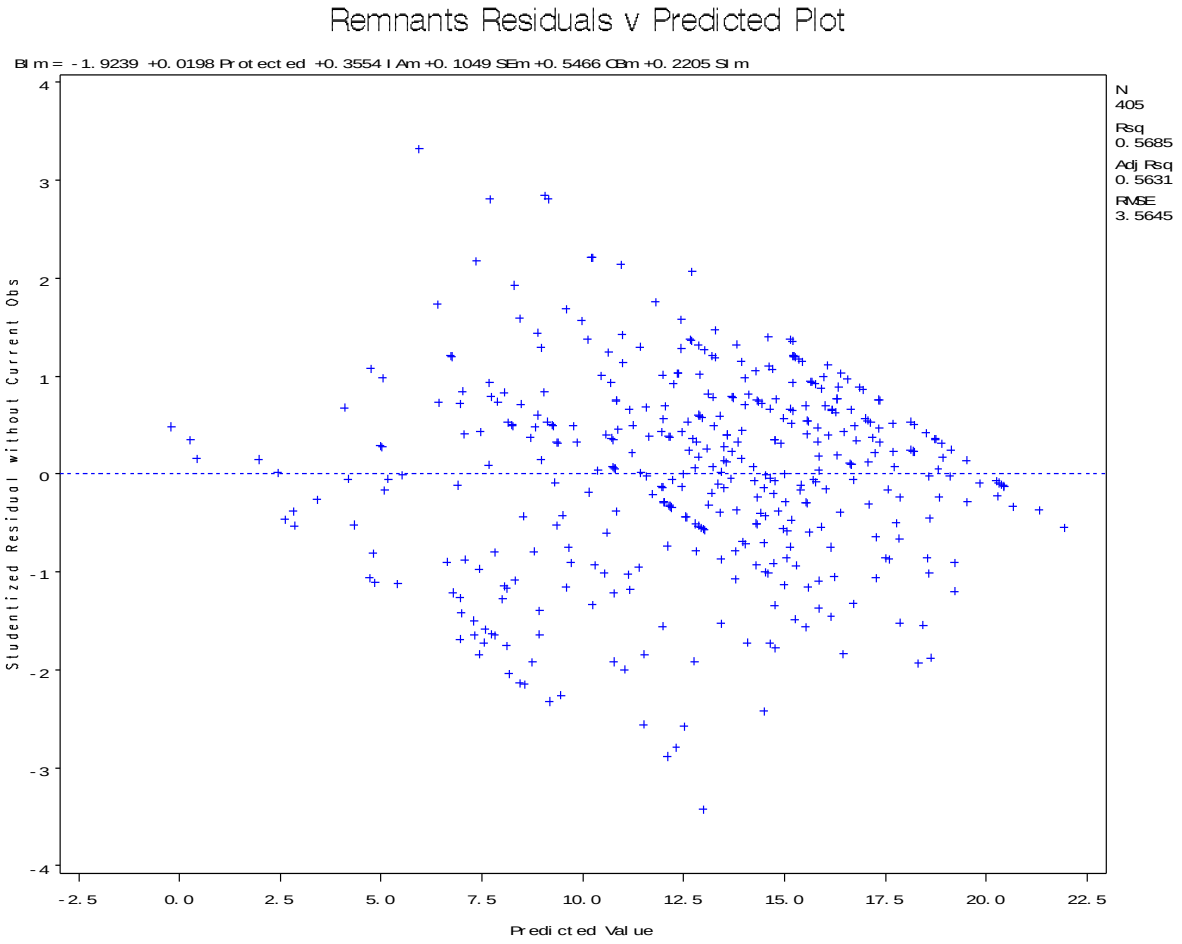
Multiple Regression Residuals

Regression residuals from equation 2 were plotted against predicted outcome results (Hair et al., 1998, p. 173). Two outliers with large standardised residuals (-3.85, -3.87) were identified and excluded from the analyses. Those were IDs 2364 and 2368.

In Figure 6, the residuals have not been evenly spread across the range of the independent variable and reflect a consistently non-normal distribution. The graph results show a ‘diamond’ pattern representing a greater variation for results in the middle range of the regression than at either end. It was already known that the data collected for each of the regression predictive variables was non-normal

as described earlier (Table 75 of Appendix I) and so this result was expected if the overall regression equation was still assumed to be linear.

Figure 6: Scatter plots of residuals (studentized) against independent variables and fitted values for bush remnant protection and conservation



Molecular Regression Model for Intentions

To examine how well the molar TRA model in equation 2 explained the behaviour, molecular TRA variables have been used to replace molar variables and the regression equations retested. The results have been shown in Table 78 of Appendix K.

The most successful model was model 4. That was despite the coefficient for SEB having been nonsignificant. The coefficient of variation for the molecular model was less than the molar model which was expected from theory. The regression coefficients were less than the single order correlations (Table 23), indicating that there were unlikely to have been any suppressor variables.

Equation 3. Regression model for land owner's bush preservation intentions including TRA molecular variables

BI = 0.64CBm + 0.06*IABm + 0.02*NBm + 0.0006SEBm + 4.4

adjusted R^2 = 47.12%,

F(4, 400) = 130.64, p<0.0001

Comparison between Landowners Likely or Unlikely to Preserve Bush Fragments

Non-specific Variables Associated with Protecting Bush Remnants

To understand how policy interventions may have affected peoples' intentions and so their behaviour, the sample of landowners with bush remnants on their properties was analysed as two groups (shown in Table 29). Group 1 included those landowners likely to preserve their bush fragments, with intentions above the mean for intentions. Group 2 was those landowners unlikely to preserve their bush fragments, with intentions equal to or below the mean for intentions. The past behaviour of the two groups reflected their current intentions, with Group 1 having the highest proportion of protected bush and the greatest likelihood of expanding that in the future.

Part time and nonfarmers have been more likely to have been in the high-intending than the low-intending group (20.6% and 11.5% of the groups respectively, p<0.01). The high-intending and low-intending groups have shown no significant differences in their farming area, and livestock enterprise. They have also had no significant differences in gender or age.

Table 29: Numbers of respondents likely or unlikely to preserve bush remnants

	Group 1	**Group 2**
Selection Criteria	Above the mean for intentions	Below the mean for intentions
Number of Respondents	284	313
Mean for Intentions (20 point scale, 20 was high)	16.4	8.0
t Value for the difference in intentions between Groups 1&2	32.1 ***	
Percentage of bush remnants that have been protected (%)	65.8	36.5
t Value for the difference in remnants protected between Groups 1&2	7.5 ***	

Both groups have had similar sets of farming goals (see Table 30), the only significant differences have been that landowners with lower intentions to protect bush remnants were more "business" orientated and placed less importance upon "looking after nature". The groups have differed significantly in the degree of association between their goals and protecting bush remnants. The greatest differences between the groups were that for high-intention land owners, protecting bush remnants could have contributed more to their goals of "looking after nature", "building a valuable farming business" and "maintaining a stable farming system". So that not only have low-intention landowners considered their business goals to have been more important, but they also did not think that protecting bush remnants would have made much of a contribution to them anyway.

Table 30: Farming goals associated with the protection of bush remnants

	Weights		Association		Overall Influence	
	Intentions		Intentions		Intentions	
	High	Low	High	Low	High	Low
Build a valuable farming business	16.5	17.2 #	4.1	1.5 ***	68.1	25.4 ***
Produce to maximise farming profits	16.4	16.8 ns	1.8	-0.1 ***	31.6	-1.9 ***
Be self-reliant in decision-making	17.2	17.2 ns	2.6	0.6 ***	46.8	11.4 ***
Look after nature	17.7	16.4 ***	6.8	4.1 ***	123.5	71.2 ***
Be valued in my community	14.8	13.9 #	3.6	1.6 ***	59.4	27.9 ***
Create increased opportunities for future farmers	15.5	15.3 ns	3.0	0.9 ***	50.7	17.5 ***
Have variety in my work	16.6	16.4 ns	4.1	2.2 ***	71.3	38.7 ***
Pay off debts	16.5	16.8 ns	-0.3	-1.8 ***	-1.8	-29.0 ***
Maintaining a stable farming system	17.7	17.6 ns	4.1	1.5 ***	75.0	26.7 ***
Have time available for socialising with family and friends	17.3	17.1 ns	1.6	-0.1 ***	30.8	0.3 ***
Scale	*0-20*	*0-20*	*0-10*	*0-10*	*0-200*	*0-200*

*Significance of differences between groups, p=<0.0001 ***, p=<0.001 **, p=<0.01 *, p=<0.1 #, not significant =* ns

Similarly low-intention groups thought that their nature goals were less important and that protecting bush remnants would not make much of a contribution there either. The goals providing the greatest overall influence on landowners' behaviour were: "looking after nature", "maintaining stable farming systems", and "building valuable farming businesses". The goals with the least influence were: "paying off debts", "having time to socialise", and "being valued by local communities". Both groups considered that protecting bush remnants would have conflicted with their ability to pay-off debt.

Instrumental Beliefs Associated with Protecting Bush Remnants

Table 31 has listed all the instrumental beliefs included in this study and has compared their influence upon landowners with low and high intentions. The scales have been converted to bipolar scales for that comparison as has been standard TRA practice. The attitudes of landowners were (not surprisingly) significantly different between those likely to protect bush remnants and those unlikely to. In a similar way, high intention landowners have had more affective attitudes (i.e. less anxious and frustrated, and more confident and contented) and feelings of self-identity consistent with the desired behaviour (i.e. having been a concerned person already taking more action than most other landowners).

The list of beliefs in the Table has been presented in order of their overall influence on landowner behaviour from highest to lowest. The greyed out rows have represented beliefs about the negative consequences associated with the behaviour. The beliefs that had the greatest overall influence upon bush protection behaviour were "improving the aesthetic value" of the area, "improving wildlife habitat" and "increasing costs". The beliefs that had the least overall influence were the effects upon "land utilisation", "property rights" and "weed and pest problems".

Landowners that intended to protect bush remnants placed more weight than low-likelihood landowners upon the possible positive effects of new practices such as increasing wildlife habitats and solving areas of the farm that could have been difficult to graze. They also placed less weight upon possible negative consequences such as having an increased workload, and increased costs.

Landowners that intended to protect bush remnants differentially associated the practice with improved aesthetics, solutions for difficult to graze areas, responding to the local community and improved farm value. Both groups similarly associated protecting bush remnants with increased costs and increased workload – those were two characteristics of high relative importance to low-likelihood landowners.

The beliefs with the greatest overall differences between those people that intended to protect and conserve bush remnants on their properties and those people unlikely to have intended to protect and conserve bush remnants on their properties were "improving aesthetic value", "increasing farm value" and "increasing wildlife habitat".

To encourage behaviour change these results could be used to develop policy interventions that increased the decision making weight upon increasing wildlife habitats. In addition, interventions could have worked by increasing the association between protecting and conserving bush remnants on landowner's properties and improving their aesthetic value and their farm value.

Normative Beliefs Associated with Protecting Bush Remnants

Landowners with high-intentions have been influenced by subjective norms for protecting bush remnants more than landowners with low intentions (Table 32). The scales for the concept weights only have been converted to bipolar scales for that comparison as has been standard TRA practice. The bush-protection behaviour of low-intention landowners was only slightly influenced by their family and technical experts - at least consciously. They have also tended to ignore or reject any influence from their friends about whether or not they should have protected bush remnants. Both groups and particularly those with high intentions, considered that the protection of bush remnants was viewed positively by family, friends and experts. The greatest influence upon landowner behaviour was likely to come from having family members who evaluated the practice favourably.

Table 31: Instrumental beliefs associated with intentions towards the protection of bush remnants

Instrumental Beliefs	Weights		Association		Overall Influence	
	Intentions		Intentions		Intentions	
	High	Low	High	Low	High	Low
Instrumental Attitudes towards protecting bush remnants					17.0	12.7 ***
Affective Attitudes towards protecting bush remnants					8.0	6.2 ***
Self-Identity about protecting bush remnants					16.7	13.8 ***
Scale for attitudes					*0-20*	*0-20*
Improving aesthetic value	6.7	5.3 ***	6.7	3.3 ***	48.9	24.0 ***
Increasing wildlife habitat	5.7	3.2 ***	6.0	3.4 ***	41.3	20.9 ***
Increasing costs	3.7	5.5 ***	-4.7	-4.6 ^{ns}	-17.7	-29.5 **
Solving areas that are difficult to graze	5.1	3.4 ***	4.2	1.2 ***	30.7	12.6 ***
Providing animal shelter	7.0	6.4 $^{\#}$	3.7	1.2 ***	30.5	10.7 ***
Controlling erosion	4.6	4.1 ^{ns}	3.6	0.9 ***	25.9	12.9 **
Creating extra work	2.7	4.7 ***	-4.8	-4.1 $^{\#}$	-15.4	-19.2 ^{ns}
Increasing farm value	6.1	6.2 ^{ns}	3.1	-0.5 ***	21.2	-3.0 ***
Responding to local community	2.6	1.5 ***	3.8	0.9 ***	15.1	4.7 ***
More weed & pest problems	6.4	6.9 ^{ns}	-0.1	-1.9 **	3.1	-13.7 ***
Decreasing property rights	5.7	5.9 ^{ns}	1.4	-0.4 **	8.3	-5.8 **
Decreasing land utilisation	3.3	4.7 **	0	-0.5 ^{ns}	4.2	-4.0 $^{\#}$
Scale for Beliefs	*0-10*	*0-10*	*0-20*	*0-10*	*0-100*	*0-100*

*Significance of differences between groups p=<0.0001 ***, p=<0.001 **, p=<0.01 *, p=<0.1 $^{\#}$, not significant = ^{ns}*

Table 32: Normative beliefs associated with intentions towards the protection of bush remnants

	Weights		**Association**		**Overall Influence**	
	Intentions		Intentions		Intentions	
	High	Low	High	Low	High	Low
Subjective Norms					15.9	12.7 ***
Scale for Subjective Norm					*0-20*	*0-20*
Influence of family	5.3	1.2 ***	10.9	9.3 **	63.8	19.9 ***
Influence of friends	1.5	-1.3 ***	6.0	4.8 *	15.7	1.2 ***
Influence of government experts	2.1	0.6 **	7.7	6.1 **	17.7	5.7 **
Scale for Beliefs	*0-10*	*0-10*	*0-20*	*0-20*	*0-200*	*0-200*

*Significance of differences between groups, p=<0.0001 ***, p=<0.001 **, p=<0.01 *, p=<0.1 #, not significant =* ns

Control and Self-Efficacy Beliefs Associated with the Protection of Bush Remnants

Both groups of landowners had high levels of perceived behavioural control (>10 in Table 33) and low levels of self-efficacy (<10 in Table 33). Therefore, they considered they were in control and responsible for their decisions and behaviour towards bush remnants, although they also thought that having protected bush remnants would have been relatively complex and required a lot of extra effort. The key differences between the two groups has been that low-intention landowners thought that they had insufficient time, funds and abilities to do the work. Low-intention groups were also more likely to think that their efforts would have been ineffective anyway and that it would not improve the sustainability of what they were doing.

Table 33: Control and self-efficacy beliefs associated with intentions towards the protection of bush remnants

Concepts	**Association**	
	Intention	
	High	Low
Perceived Behavioural Control	16.9	15.6 **
Enough time available	13.0	8.8 ***
Enough funds	13.5	9.4 ***
Enough abilities	13.5	9.5 ***
Enough encouragement	10.7	7.0 ***
Enough information	12.0	9.1 ***
Self-Efficacy (reversed)	9.2	7.4 ***
I am confident of the result	15.7	12.0 ***
It fits with my ideas of sustainability	16.4	12.9 ***
I often think about it	15.1	12.0 ***
I am very supportive	17.9	15.7 ***
Scale for beliefs	*0-20*	*0-20*

*Significance of differences between groups, p=<0.0001 ***, p=<0.001 **, p=<0.01 *, p=<0.1 #, not significant =* ns

Summary of Research from Protecting and Conserving Bush Remnants

In 2002, a survey on the protection and conservation of bush remnants was sent to 2,300 farmers. It had a 28% response rate which provided enough statistical power for testing the hypothesised relationships. Respondents included a higher proportion of dairy farmers than expected from national statistics and they had a higher than average farm size.

Most respondents felt that preserving bush remnants was a good thing to do and that the people important to them would approve of them doing that. Over 65% of landowners had bush remnants on their properties and over 50% of these were already protecting them in some way.

Almost all the concept measures had good convergent validity (C.Alpha >0.7) except for self-identity (C.Alpha =0.46). Discriminant validity was moderate to good for all the variables (loading on to one factor) except for self-identity again. In most cases, the molar concepts (direct measures of the psychological variables) were more highly correlated with intentions than the molecular concepts (the beliefs or indirect measures). This was expected from theory. The exception was self-efficacy, where it may be that the questions in the survey created a social bias. With self-efficacy the molecular measures had a higher correlation and were used in place of the molar measure of self-efficacy in the regression analyses.

The regression analysis of behaviour using only the demographic and system variables selected two significant variables. These were the livestock class being run on the property (dairy farmers were more supportive) and the strength of the relationship between preserving bush remnants and their environmental objectives. The adjusted coefficient of variation was 8%. Intentions provided a better explanatory variable of behaviour on its own without any additional variables (R2=16%).

When regressions of intentions were developed the most explanatory model included the proportion of bush already protected, perceived control beliefs, instrumental attitudes, self-identity, and self-efficacy (R2=56%).

Analysis of the regression results suggest that little multicollinearity was present and that suppressor effects were unlikely. Although the data was non-normal the consistency of the regression results and their residuals suggest that the regressions described a linear relationship in the data.

When the beliefs of people likely to protect and conserve bush remnants were compared with those unlikely to do the same, it was apparent that beliefs about wildlife habitats, aesthetics and property values were very influential. Family members could influence the behaviour of landowners as could improving their self-efficacy.

Chapter 8. Research Results from Testing the Application of the Theory of Reasoned Action to the Act of Fencing and Planting Native Trees in Riparian Areas (Streambanks) on Farms

Introduction to Results on Fencing and Planting Riparian Areas

This chapter of the thesis describes the quantitative results of applying the research methodology and the Theory of Reasoned Action to behaviour associated with riparian management on farms. The particular riparian management actions that this study has focused on were: fencing-off riparian areas and planting native trees. For the purposes of this study they have been treated as one act or action complex. A description of the terms used and the subjects that they have referred to have been listed in Table 34 and that should be used throughout the chapter to interpret the symbols.

The first step in this chapter has been to describe the screening of the collected survey data for normality and identify any outlier data sets. Then the results for the behavioural outcome measures have been described and the other research measures have been tested for their convergent and discriminant validity.

Following the initial data examination, the relationships between variables has been analysed as correlations and as regressions. The predictive power of regression results has been assessed by adding in interactive terms, considering residual terms, and testing for consistency between molar (direct) and molecular (indirect) regression results.

In the last section of this chapter, comparisons have been made between the beliefs of respondents with high verses low intentions to fence-off and plant native trees in riparian areas.

Table 34: Definition of questionnaire terms for fencing and planting native trees in riparian areas

Initials	Variables	TRA Construct	Question Subject
BI_1	intentions	molar variable	Intend to do
BI_2	intentions	molar variable	Plan to do
BI_3	intentions	molar variable	Want to do
BI_m	intention mean	molar variable	
IA_1	instrumental attitude	molar variable	A good thing to do
IA_2	instrumental attitude	molar variable	A useful thing to do
IA_3	instrumental attitude	molar variable	A valuable thing to do
IA_m	instrumental attitude mean	molar variable	
AA_1	affective attitude	molar variable	Pleasant
AA_2	affective attitude	molar variable	Enjoyable
AA_m	affective attitude mean	molar variable	
SN_1	subjective norm	molar variable	What people important to me think
SN_2	subjective norm	molar variable	What is expected of me
SN_3	subjective norm	molar variable	Approval of people important to me
SN_4	subjective norm	molar variable	Behaviour of people important to me
SN_m	subjective norm mean	molar variable	
SE_1	self-efficacy	molar variable	Easy
SE_2	self-efficacy	molar variable	Capable
SE_m	self-efficacy mean	molar variable	
BC_1	perceived behavioural control	molar variable	Its up to me
BC_2	perceived behavioural control	molar variable	I have control

BC_m	perceived behavioural control mean	molar variable	
SI_1	self-identity	molar variable	I'm concerned about water quality
SI_2	self-identity	molar variable	My management is already good
SI_3	self-identity	molar variable	I've already done more than most …
SI_4	self-identity	molar variable	Water quality
SI_5	self-identity	molar variable	Waterway health
SI_6	self-identity	molar variable	Sustainable production
SI_7	self-identity	molar variable	Erosion control
SI_8	self-identity	molar variable	Nature areas
SI_m	self-identity mean	molar variable	
IAB_{1a} and IAB_{1w}	instrumental attitude beliefs	molecular variable	Controlling erosion
IAB_{2a} and IAB_{2w}	instrumental attitude beliefs	molecular variable	Waterway health and cleanliness
IAB_{3a} and IAB_{3w}	instrumental attitude beliefs	molecular variable	More weed & pest problems
IAB_{4a} and IAB_{4w}	instrumental attitude beliefs	molecular variable	Increase wildlife habitat
IAB_{5a} and IAB_{5w}	instrumental attitude beliefs	molecular variable	Increased costs
IAB_{6a} and IAB_{6w}	instrumental attitude beliefs	molecular variable	Land utilisation
IAB_{7a} and IAB_{7w}	instrumental attitude beliefs	molecular variable	Animal management problematic
IAB_{8a} and IAB_{8w}	instrumental attitude beliefs	molecular variable	Improve aesthetic value
IAB_{9a} and IAB_{9w}	instrumental attitude beliefs	molecular variable	Flood control
IAB_{10a} and IAB_{10w}	instrumental attitude beliefs	molecular variable	Reduce sediments
IAB_{11a} and IAB_{11w}	instrumental attitude beliefs	molecular variable	Reduced nutrients
IAB_{12a} and IAB_{12w}	instrumental attitude beliefs	molecular variable	Reduced temperature
IAB_{13a} and IAB_{13w}	instrumental attitude beliefs	molecular variable	Reduced "bugs"
IAB_m	instrumental attitude belief	molecular	

	products mean	variable	
NB_{1a} and NB_{2c}	subjective norm beliefs, association and willingness to comply	molecular variable	Responding to family
NB_{3a} and NB_{4c}	subjective norm beliefs, association and willingness to comply	molecular variable	Responding to friends
NB_{5a} and NB_6	subjective norm beliefs, association and willingness to comply	molecular variable	Responding to government experts
NB_m	subjective norm belief products mean	molecular variable	
CB_1	control beliefs	molecular variable	Time available
CB_2	control beliefs	molecular variable	Funds
CB_3	control beliefs	molecular variable	Skills
CB_4	control beliefs	molecular variable	Abilities
CB_5	control beliefs	molecular variable	Knowledge
CB_m	control beliefs mean	molecular variable	
SEB_1	self-efficacy beliefs	molecular variable	
SEB_2	self-efficacy beliefs	molecular variable	
SEB^3	self-efficacy beliefs	molecular variable	
SEB_4	self-efficacy beliefs	molecular variable	
SEB_m	self-efficacy beliefs mean	molecular variable	

Survey Response Rate

The riparian survey was sent out to 2,900 respondents on the 1st Feb 2002 by NFO[10]. Respondents had until the 1st March to complete the survey, and they were all received at Ruakura by the 11th March 2002. The survey had a response rate of 21% (619 completed survey responses received) and a statistical power of 94% (at a 95% confidence level) and a sampling error of 3.9%. The level of statistical power achieved was considered satisfactory for indicating the probability that the research could identify that a hypothesised relationship actually existed (Hair et al., 1998, p. 12).

[10] NFO since 2003 has operated as TNS market research company. See Appendix AA.

Respondent Demographics

The average results from the demographic section of the survey have been shown in Table 35. The respondents were a typical cross-section of a New Zealand livestock farming community although they were on average older and had a lower proportion of females. The average farm size (Statistics New Zealand, 2003, p. 13) for New Zealand properties over 20ha, was 320ha compared to the 510ha in this survey. The survey results came from a larger average farm size than would have been expected in a completely random survey.

Table 35: Demographic survey results for planting riparian areas

Demographic Variable	**Result**	**New Zealand Statistics for 2002**
Percentage of Full-time Farmers	82%	unknown
Average Age	50 years	44 years
Percentage Female	17%	33%
Percentage Non-European	4.4%	5.3%
Average Property Area	510 ha	320 ha
Proportion of Dairy Farms	37%	27%
Proportion with farm forestry or woodlots	20%	17%

The proportion of dairy farmers in the survey was 37%, which was above the national average of 27% despite the sample properties being larger on average than the population.

Although the sample was not expected to include part-time farmers, 18% of respondents identified themselves in that category. A group of 20% of farmers identified forestry and woodlots as having been one of their "main farming types".

Screening Data for Normality

In Table 79 of Appendix L, the mean and distributions of the collected data has been shown. The overall mean for all the variables using a 20 point scale was 12.7 and the standard deviation was 7.9. In the Table, farmers' goals represented farmers' aspirations for their farming businesses. The highest rated goal was "maintaining a stable farming system", followed by "being self reliant" "looking

after nature", and "socialising with family and friends". The goal products combined the importance of the different farming goals with how much farmers associated (positively or negatively) fencing and planting their riparian areas to the attainment of those goals.

Fencing and planting riparian areas was most consistent with landowners' that wanted to "look after nature" as one of their farming goals. It also fitted with landowner goals of "creating … opportunities for future farmers" and having a "stable farming system". The behaviour was most in conflict with those farmers that wanted to "pay off debts" and spend time "socialising with family and friends", as their farming goals.

The raw measures for belief outcomes and belief strength have been shown initially in Table 78 followed by the belief products. The belief products included converting both measures to a bipolar scale. With subjective norms, only the normative beliefs have a bipolar scale.

Beliefs about being able to reduce streambank erosion and slips (IAB1) had the highest mean of 15.9 and the lowest coefficient of deviation (along a scale of 0-20; 26%). Also with a high mean was the self-identity question regarding people who think of themselves as "concerned about water quality".

Respondents scored particularly low the questions relating to the desirability of more weedy and less tidy properties (IAB3), the desirability of increasing farming costs (IAB5) and the desirability of more flood control (IAB9). Those results also had high coefficients of variation from 82-92%.

Generally the median had the same value as the mean or sometimes slightly higher indicating that most people made their responses around the mean value. Often the mode was 1, 10, or 20 on the 20 point scales suggesting that generally quite a simplified system of scoring was used. It also suggested that the visual scale was effective in encouraging the full use of the length of the scale for scoring responses to questions.

The mode for the intention questions was 1, the low score indicated that most people were unlikely to increase the riparian area that they had already fenced and planted in native trees. The questions about the molar TRA variables had equal

numbers of positive and negative values, and indicated that people had mixed psychological drivers that affected their decisions.

Generally the results collected from questionnaires when compared to a 'normal' distribution, were a mixture of being more or less peaky than we would have expected to find (i.e. positive or negative kurtosis respectively). The kurtosis was likely to have been flatter with the global measures such as intentions, attitudes, subjective norms and self-identity. That has been consistent with the results obtained for bush remnants but was in contrast with those for farm woodlots. Generally there was a negative skewness to the distributions. That reflected that although the peak in distribution tended to have been between 10 and 20 on the scale, a greater number of responses were below 5 rather than above 15.

In Appendix L, Table 79 the Shapiro-Wilk test results (for univariate normality) were very small (<0.05), they reinforced the earlier results with bush remnants that indicated non-normal data was being collected.

Although the data appeared to have been non-normal that may not have disrupted the results because most of the distributions have lain the same way along the scales and large numbers of observations have been involved (Tabachnick and Fidell, 2001, p. 72)

Existing Farmer Behaviour

Most landowners (91%) had at least one waterway on their property. About 84% of respondents already had some of the waterway banks on their properties fenced and planted in native trees (Table 36). On the average property, 19% of their waterways were protected in that way. That compared with 18% of stream lengths having been fenced amongst farms in Southland and Otago (Rhodes et al, 2002).

Landowners without any waterways on their properties or who had not answered the question, were excluded from further analyses.

Test of Convergent Validity

Calculations of Cronbach Alpha Co-efficients (C.Alpha) were used to test the convergent validity of the concept measures. The Cronbach Alpha results for this study have been shown in Table 37. They were all generally satisfactory including the self-identity questions. The C.Alpha's for self-efficacy was the lowest result (0.64) and only marginally acceptable.

Table 36: Properties with waterways fenced and planted in native trees

Width of the largest waterway on their property	**Small (<2m)**	**Medium (2-10m)**	**Large (>10)**	**Waterways not present or size not given**
Number of respondents	218	276	104	65
Number of respondents with unfenced waterways	34	29	13	2
Number of respondents with waterways fenced and planted in native trees	181	234	88	4
Average percentage of waterway banks that have been fenced and planted in native trees	19	19	17	-

Test of Discriminant Validity

Factor analyses were used to test for differences between similar measures of the predictor variables and identify any different concepts that they might have contained.

Table 37: Cronbach Alpha coefficients for concepts associated with planting riparian areas

Variables	C.Alpha
BI1, BI2, BI3	0.93
IA1, IA2, IA3	0.93
AA1, AA2	0.89
SN1, SN2, SN3, SN4	0.84
SE1, SE2	0.64
BC1, BC2	0.89
SI1, SI2, SI3, SI4, SI5, SI6, SI7, SI8	0.79
SI1, SI2, SI3, SI5, SI6, SI7, SI8	0.84
IAB1prod … IAB13prod	0.85
NB1prod, NB2prod, NB3prod	0.76
CB1 …CB5	0.85
SEB1 … SEB4	0.86
Goals (10 products)	0.91

In Table 38 all the concepts loaded on to the same factors as their theoretical complimentary concepts. The amount of shared variance that they had was moderate to high (0.50 – 0.94), and above that obtained for either preserving bush remnants or growing indigenous woodlots.

The exception to that was the self-identity measure about finding "water quality a difficult issue to deal with" (SI4), it appeared to have been unrelated to the other self-identity measures (factor loading of 0.04). Excluding SI4 from the calculations of Cronbach Alpha coefficients for self-identity in Table 37 improved the Cronbach Alpha for self-identity from 0.79 to 0.84. Therefore, SI4 has been excluded from the regression analyses later on in this chapter.

The self-identity measures used in this survey were quite different from the other two surveys that were carried out later in the year. With the riparian topic the questions related to the area being one of personal importance, e.g. "I am concerned about water quality …". These questions may have represented an attitude towards water quality rather than identifying and fulfilling a group role – the technical definition of self-identity. And so, the self-identity questions in the subsequent surveys were changed.

Table 38: Factor loadings for molar (direct) TRA measures of concepts associated with planting riparian areas

Variable	Factor 1	Communality
BI1	0.92	0.84
BI2	0.87	0.76
BI3	0.87	0.75
% var	100.0	
IA1	0.88	0.78
IA2	0.89	0.79
IA3	0.87	0.76
% var	100.0	
AA1	0.85	0.73
AA2	0.85	0.73
% var	100.0	
SN1	0.85	0.73
SN2	0.61	0.37
SN3	0.78	0.61
SN4	0.72	0.51
% var	98.9	
SE1	0.59	0.34
SE2	0.59	0.34
% var	100	
BC1	0.85	0.73
BC2	0.85	0.73
% var	100	
SI1	0.53	0.28
SI2	0.81	0.65
SI3	0.51	0.26
SI4	0.04	0.0
SI5	0.78	0.62
SI6	0.60	0.37
SI7	0.70	0.49
SI8	0.63	0.40
% var	82.6	

The molecular variables as described in Chapter 7 did not need to all load onto the same factors (Table 39).

Table 39: Factor loadings for non-specific and molecular (indirect) measures of concepts associated with planting riparian areas

Variable	Factor 1	Factor 2	Communality
ProdBus	0.75		0.56
ProdProf	0.76		0.58
ProdSelf	0.73		0.54
ProdNat	0.70		0.49
ProdVal	0.60		0.36
ProdFut	0.75		0.56
ProdVar	0.70		0.49
ProdDebt	0.67		0.45
ProdSys	0.77		0.60
ProdSoc	0.61		0.37
% var	84.1		
IAB1prod	0.69	0.44	0.51
IAB2prod	0.79	0.37	0.65
IAB3prod	0.32	0.61	0.41
IAB4prod	0.61	0.37	0.38
IAB5prod	0.18	0.42	0.19
IAB6prod	0.21	0.55	0.34
IAB7prod	0.34	0.50	0.27
IAB8prod	0.74	0.47	0.57
IAB9prod	0.29	0.49	0.25
IAB10prod	0.73	0.39	0.54
IAB11prod	0.75	0.25	0.58
IAB12prod	0.51	0.18	0.27
IAB13prod	0.58	0.33	0.34
% var	75.4	15.8	
NB1prod	0.75		0.57
NB2prod	0.66		0.44
NB3prod	0.62		0.38
% var	100		
CB1	0.68		0.46
CB2	0.65		0.42
CB3	0.79		0.63
CB4	0.77		0.60
CB5	0.74		0.54
% var	94.2		
SEB1	0.75		0.56
SEB2	0.86		0.73
SEB3	0.86		0.74
SEB4	0.62		0.38
% var	100		

Despite that, in this study, the farming goals loaded predominantly onto one factor, explaining over 80% of the variation.

Normative beliefs, control beliefs and self-efficacy beliefs loaded onto one factor each. Instrumental attitude beliefs loaded on to two factors. Beliefs about the attractiveness of the riparian area, bank erosion, waterway health, sediment, nutrients, temperature and 'bugs' tended to load onto an 'environmental' factor. Beliefs about land for production, stock management, weediness and flood control tended to load onto a 'production' factor.

Molar Correlations within the Data

Many of the correlations amongst the predictor variables in Table 40 were above 0.5 (e.g. 0.72 between IA1 and IA2). Some of the correlations between predictor and outcome variables were also high (e.g. 0.69 between SI2 and BI2). None of the correlations though were above 0.9 and so none of them seem to indicate any problem with collinearity (Hair et al., 1998, p. 191). Behavioural control tended to have very low or negative correlations with the other variables (e.g. 0.06 between BC1 and BI1). Self-efficacy and perceived behavioural control may have been similar social psychology concepts but there seemed little similarity in the measures used here because the correlations between them were so small. This is a similar effect to that observed for bush remnants in Chapter 7. Instrumental attitudes and affective attitudes were also similar concepts and although they were highly correlated (from 0.55 to 0.70) it was not enough to suggest that there was a problem with collinearity.

Molecular Correlations within the Data

Appendix M, Table 80 has a Table of all the molecular correlations. Most were below 0.5 except for correlations between the three intention measures, some instrumental beliefs, control beliefs and a normative belief (NB1).

Table 40: Correlations between molar and outcome variables of concepts associated with planting riparian areas

BI1	0.32 ***														
BI2	0.32 ***	0.83 ***	1												
BI3	0.28 ***	0.83 ***	0.77 ***	1											
IA1	0.27 ***	0.58 ***	0.59 ***	0.69 ***	1										
IA2	0.25 ***	0.63 ***	0.60 ***	0.71 ***	0.82 ***	1									
IA3	0.25 ***	0.59 ***	0.58 ***	0.67 ***	0.79 ***	0.81 ***	1								
AA1	0.20 ***	0.55 ***	0.55 ***	0.63 ***	0.71 ***	0.66 ***	0.70 ***	1							
AA2	0.22 ***	0.61 ***	0.61 ***	0.67 ***	0.72 ***	0.72 ***	0.73 ***	0.81 ***	1						
SN1	0.23 ***	0.61 ***	0.61 ***	0.64 ***	0.63 ***	0.65 ***	0.63 ***	0.56 ***	0.62 ***	1					
SN2	0.15 ***	0.43 ***	0.43 ***	0.47 ***	0.42 ***	0.46 ***	0.43 ***	0.39 ***	0.40 ***	0.55 ***	1				
SN3	0.24 ***	0.52 ***	0.52 ***	0.61 ***	0.70 ***	0.68 ***	0.67 ***	0.60 ***	0.62 ***	0.74 ***	0.43 ***	1			
SN4	0.22 ***	0.50 ***	0.49 ***	0.52 ***	0.51 ***	0.52 ***	0.54 ***	0.52 ***	0.53 ***	0.62 ***	0.49 ***	0.57 ***	1		
SE1	0.41 ***	0.46 ***	0.49 ***	0.42 ***	0.44 ***	0.39 ***	0.44 ***	0.52 ***	0.53 ***	0.41 ***	0.30 ***	0.38 ***	0.43 ***	1	
SE2	0.38 ***	0.39 ***	0.41 ***	0.39 ***	0.42 ***	0.41 ***	0.44 ***	0.43 ***	0.48 ***	0.38 ***	0.24 ***	0.43 ***	0.38 ***	0.49 ***	1
	Behaviour	**BI1**	**BI2**	**BI3**	**IA1**	**IA2**	**IA3**	**AA1**	**AA2**	**SN1**	**SN2**	**SN3**	**SN4**	**SE1**	**SE2**

*Significance of differences between groups, p=<0.0001 ***, p=<0.001 **, p=<0.01 *, p=<0.1 #, not significant =* ns

Table 40 continued

BC1	0.03 ns	0.06 ns	0.07 #	0.04 ns	0.03 ns	0.03 ns	0.04 ns	0.06 ns	0.03 ns	0 ns	0.01 ns	0.08 #	0.03 ns	0.05 ns	0.18 ***
BC2	0.04 ns	0.10 *	0.11 *	0.10 #	0.07 #	0.09 #	0.08 #	0.09 #	0.09 #	0.06 #	0.02 ns	0.15 **	0.06 ns	0.11 *	0.20 ***
SI1	0.09 #	0.05 ns	0.07 #	0 ns	-0.07 #	-0.02 ns	-0.05 ns	0.02 ns	0.02 ns	-0.01 ns	-0.03 ns	-0.04 ns	0.02 ns	0.09 #	0.13 *
SI2	0.09 #	0.21 ***	0.18 ***	0.25 ***	0.22 ***	0.22 ***	0.21 ***	0.23 ***	0.27 ***	0.21 ***	0.12 *	0.23 ***	0.22 ***	0.14 **	0.22 ***
SI3	0.25 ***	0.13 ***	0.17 ***	0.09 #	0.02 ns	0.06 #	0.09 #	0.08 #	0.09 #	0.03 ns	0.02 ns	0.04 ns	0.09 #	0.08 #	0.08 #
SI4	0.01 ns	0.06 ns	0.09 #	0.12 ***	0.16 ***	0.14 ***	0.16 ***	0.11 **	0.13 **	0.17 ***	0.14 **	0.16 ***	0.13 *	0 ns	0.01 ns
SI5	0.14 **	0.32 ***	0.33 ***	0.37 ***	0.45 ***	0.42 ***	0.38 ***	0.39 ***	0.41 ***	0.35 ***	0.24 ***	0.39 ***	0.34 ***	0.23 ***	0.25 ***
SI6	0.03 ns	0.11 *	0.11 *	0.12 *	0.15 ***	0.20 ***	0.16 ***	0.17 ***	0.16 ***	0.16 ***	0.13 *	0.14 **	0.21 ***	0.16 ***	0.20 ***
SI7	0.12 *	0.24 ***	0.23 ***	0.27 ***	0.31 ***	0.32 ***	0.27 ***	0.29 ***	0.28 ***	0.30 ***	0.19 ***	0.30 ***	0.23 ***	0.21 ***	0.22 ***
SI8	0.21 ***	0.46 ***	0.44 ***	0.51 ***	0.58 ***	0.55 ***	0.54 ***	0.53 ***	0.56 ***	0.46 ***	0.28 ***	0.48 ***	0.41 ***	0.34 ***	0.33 ***
	Behaviour	**BI1**	**BI2**	**BI3**	**IA1**	**IA2**	**IA3**	**AA1**	**AA2**	**SN1**	**SN2**	**SN3**	**SN4**	**SE1**	**SE2**

Table 40 continued

BC1	1								
BC2	0.80 ***	1							
SI1	0.15 ***	0.19 ***	1						
SI2	0.16 ***	0.15 **	0.48 ***	1					
SI3	0.14 **	0.13 **	0.50 ***	0.42 ***	1				
SI4	-0.05 ns	-0.02 ns	-0.17 ***	0.01 ns	-0.02 ns	1			
SI5	0.11 **	0.11 *	0.28 ***	0.66 ***	0.29 ***	0.10 #	1		
SI6	0.10 #	0.11 *	0.35 ***	0.49 ***	0.29 ***	0.01 ns	0.47 ***	1	
SI7	0.10 #	0.10 #	0.30 ***	0.55 ***	0.31 ***	0.06 ns	0.62 ***	0.48 ***	1
SI8	0.08 #	0.06 ns	0.23 ***	0.53 ***	0.26 ***	0.15 **	0.60 ***	0.34 ***	0.43 ***
	BC1	**BC2**	**SI1**	**SI2**	**SI3**	**SI4**	**SI5**	**SI6**	**SI7**

Correlations between Molar and Molecular Variables

In Appendix M, Table 81 the correlations between molar (direct) and molecular (indirect) measures of the predictor variables have been shown. The correlations were generally consistent; IAB1, IAB2, IAB4, IAB8 and IAB10 were all highly correlated with the attitude measures and NB1 with the subjective norm measures.

Those results were similar to the results in the last section on factor analyses and they suggest that some collinearity should have been expected. Any collinearity was only likely to have affected regression results for the molecular variables.

Correlations between TRA Variables

A low correlation was found to exist between peoples' future intentions towards establishing riparian strips with native trees and their past behaviour (0.38 in Table 41). A relatively high proportion of landowners (84%) had already fenced-off some riparian areas and established native trees along them. However on average, only a small proportion of the potential riparian area had yet been planted (17%). So possibly, two different types of intentions have been involved and they may have been unable to be separated in this study. One intention was for those people who had never before fenced and planted their riparian area to start doing so. The other intention was for those people who had already begun to manage their riparian areas to continue applying the practice further.

Table 41: Correlations between TRA molar (direct) variables associated with planting riparian areas

BIm	0.38 ***	1					
IAm	0.29 ***	0.74 ***	1				
AAm	0.24 ***	0.68 ***	0.80 ***	1			
SNm	0.26 ***	0.70 *	0.74 ***	0.68 ***	1		
SEm	0.19 ***	0.52 ***	0.50 ***	0.57 ***	0.50 ***	1	
BCm	0.05 ns	0.07 #	-0.03 ns	0.01 ns	0.00 ns	0.12 *	1
SIm	0.21 ***	0.39 ***	0.37 ***	0.39 ***	0.36 ***	0.31 ***	0.08 *
	Riparian Behaviour	**BIm**	**IAm**	**AAm**	**SNm**	**SEm**	**BCm**

In the same Table (Table 41), the TRA molar predictor variables were moderately to highly correlated with each other and with people's intentions. As in the other chapters, the results for the self-efficacy measures have been reversed from a negative to positive direction so that they have become more consistent with the other measures in the Tables. As a result, any high scores for self-efficacy have now meant that the behaviour was associated with less complexity and a reduced effort was required for implementation.

The correlation of behavioural control with the other molar variables was generally low and generally not significantly different from zero.

The TRA molecular predictor variables in Table 42, had similar sized correlations to the molar variables (Table 41). Correlations between these variables and behavioural intentions varied between 0.39 – 0.76. The perceived control beliefs (CBm) had a much higher correlation with behavioural intentions than did the molar measures of perceived behavioural control (BCm) and self-efficacy (SE). It again may have indicated (as with conserving bush remnants) that the respondents had difficulty conceptualising how their behaviour was affected by specific control beliefs, or maybe that people avoided indicating that they had a low level of behavioural control. The mean of self-efficacy beliefs also had a greater correlation with behavioural intentions than the molar measure of self-efficacy.

Table 42: Correlations between TRA molecular (indirect) variables associated with planting riparian areas

BIm	0.39 ***	1				
IABm	0.30 ***	0.67 ***	1			
NBm	0.23 ***	0.68 ***	0.65 ***	1		
SEBm	0.32 ***	0.76 ***	0.76 ***	0.64 ***	1	
CBm	0.30 ***	0.70 ***	0.61 ***	0.53 ***	0.72 ***	1
	Riparian Behaviour	**BIm**	**IABm**	**NBm**	**SEBm**	**CBm**

This was quite different from the situation with conserving bush remnants, but consistent with the results for establishing woodlots (Table 61 in Chapter 9).

These result were unexpected from theory and from previous applications of the concepts used in perceived behavioural control and self-efficacy questions (Aarts et al., 1998). As a consequence, the means for control beliefs and self-efficacy beliefs were used to replace the molar variables in the following analyses.

Hierarchical Regression Analysis for Behaviour

An initial predictive model was constructed using the non-specific variables collected (see Table 43) to explain the proportion of riparian areas protected by fencing and planted with native trees. That included demographic information, farming goals and their relationship to protecting riparian areas and planting with native trees.

Table 43: Non-specific behavioural variables associated with planting riparian areas

Variable	Description
Occupation	1 = full-time farmer 2 = part-time and other
Gender	1 = male 2 = female
Age	Years
FarmArea	Hectares
Livestock Type	1 = dairy 2 = sheep and/or beef (no dairy) 3 = other (no dairy)
Waterways	Percentage of waterways with riparian protection
Goalsm	Mean of Goal products 1…10

The regression results have been shown in Table 44. From the first column with model 1 until model 12, additional variables have been added at each new model. The predictive variables have been added in order of enterprise variables, personal variables, non-specific psychology variables and then TRA variables last. In models 8 and 11 there were some non-significant variables and those were removed for models 9 and 12. Each row in the Table has reflected the results for each new variable added at that step. Below that a standard coefficient of determination has been calculated along with an adjusted coefficient so that the results of each step have been able to be compared. The change in adjusted coefficient has been shown along with its significance and that has been used to identify the most parsimonious and effective model. At the bottom of the Table was calculated the F-test statistic for the regressions and their degrees of freedom.

Table 44: Behavioural regression results for non-specific variables and the planting of riparian areas

Variable	r	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Occupation		7.04 .0130	7.05 .0127	8.54 .0031	8.56 .0030	8.52 .0033	8.33 .0048	8.29 .0050	8.92 .0024	9.23 .0013	4.19 .1304	4.11 .1395	
FarmArea	- 0.04		-0.0004 .2673	-0.0003 .3358		-0.0003 .3467	-0.0003 .3703	-0.0003 .3877	-0.0003 .4082		-0.0001 .8274	-0.0001 .8659	
Livestock				-4.65 .0152	-4.76 .0127	-4.65 .0152	-4.37 .0254	-4.45 .0230	-4.52 .0209	-4.81 .0118	-2.83 .1243	-3.16 .0912	
Width						-0.15 .9144	0.04 .9786	-0.002 .9987	-0.44 .7648		-0.20 .8799	0.13 .9243	
Gender							3.50 .2228	3.99 .1675	3.31 .2501		2.50 .3486	2.85 .2934	
Age	0.04							0.13 .1385	0.13 .1231		0.14 .0794	0.17 .0368	
Goalsm	0.10								0.04 .0093	0.04 .0074	0.005 .6957	0.004 .7776	
BIm	0.37										1.60 <.0001	1.37 <.0001	1.61 <.0001
CBm	0.70											0.45 .1312	
Constant	0.75	7.66 .0267	7.86 .0232	13.90 .0011	13.88 .0011	14.21 .0056	9.57 .1216	3.05 .6868	2.06 .7857	11.47 .0078	-6.74 .3497	-11.11 .1447	3.13 .0544
R^2		1.04	1.24	2.23	2.07	2.23	2.38	2.75	3.94	3.37	15.34	16.05	13.10
R^2 adj		0.87	0.91	1.73	1.74	1.56	1.54	1.75	2.76	2.87	14.13	14.68	12.95
ΔR^2 adj F-test Compare			0.04 ns 1->2	0.86 <0.10 1->3	-0.01 ns 3->4	-0.17 ns 3->5	-0.19 ns 3->6	-0.02 ns 3->7	1.03 <0.025 3->8	-0.11 ns 8->9	11.37 <0.01 8->10	0.55 <0.10 10->12	1.73 ns 11->12
F regn		6.21 .0130	3.72 .0247	4.48 .0040	6.26 .0020	3.36 .0099	2.83 .0155	2.73 .0127	3.34 .0017	6.76 .0002	12.73 <.0001	11.72 <.0001	89.25 <.0001
Regn df		1	2	3	2	4	5	6	7	3	8	9	1
Resid df		592	591	590	591	589	579	578	569	582	562	552	594

In Table 44, the models have R^2 remaining below 10% until models 10 to 12 when the TRA variables have been added, and even then, the adjusted R^2 remains low.

In model 9, farming occupation, and livestock class made a significant additional contribution to R^2 so that lifestyle properties and non-dairy enterprises were more likely to have their riparian areas protected and planted. When a strong link existed between farming goals and riparian objectives, there was an increased likelihood of greater riparian protection. Property area had an insignificant but negative relationship with riparian behaviour, probably associated with lifestyle property owners also having smaller properties. The effects of owner age and gender were small and not significant. For comparison purposes, model 9 has been described in equation1.

Adding behavioural intentions significantly improved the model's fit but there was no improvement from adding behavioural control. That suggested that the early form of the TRA has provided a satisfactory model structure.

The model using non-specific variables with the greatest significant change in adjusted coefficient of determination (R^2) for significant predictor variables was model 12 in the Table. That has indicated peoples' past implementation of the behaviour relates most strongly to their future intentions.

Equation 1. Regression model for non-specific variables and land owner's riparian protection behaviour

$B = 9.23*\text{occupation} - 4.81*\text{livestock class} + 0.04*\text{goals} + 11.47$

adjusted $R^2 = 3\%$, $F(3, 582) = 6.76$, $p<0.0001$

The regression model in equation 1 had a coefficient of determination of under 5% with moderate explanatory power using the existing data set (a low but significant F-test result), and low generalisability (three was a moderate degree of freedom for the regression).

Hierarchical Regression Analysis for Intentions

To determine how much explanatory and predictive power a TRA model would have of landowners' future intentions about fencing and planting native trees, a number of intention models were analysed (Table 45). The intention models were begun with the existing proportion of riparian area fenced and planted as a representation of landowners' past behaviour. Then the TRA variables were added, until the adjusted R^2 could no longer be significantly improved. The TRA variables were added in the following order: instrumental attitudes, affective attitudes, subjective norms, self-efficacy, perceived behavioural control (beliefs) and self-identity. In the Table, as before, the F-test for the changes in adjusted R^2 evaluated whether by adding variables to the previous column's model there had been a significant improvement in R^2.

With riparian management, previous practice continued to make a contribution towards explaining future intentions in all the TRA models shown in Table 45. That was in contrast to the other TRA results for bush protection and woodlots. The contribution was small but significant, and may have indicated the presence of another variable such as "habit" or "environmental values".

As each TRA variable has been added to the regression model, the amount of variance in intentions able to be explained has increased. In model 8 most of the TRA variables have been included but the terms for affective attitudes and self-identity were not significant. When those terms were removed there was no significant decrease in predictive power. Model 9 was the most parsimonious explanatory model to use.

The variables included in model 9 indicated that landowners' intentions were highly influenced by their control beliefs, instrumental attitudes and subjective norms, as well as their self-efficacy (equation 2).

Equation 2. Regression model for land owner's fencing of riparian areas and planting in native trees including TRA molar variables

BI = 0.03*existing riparian planting + 0.28*CBm + 0.27*IAm + 0.26*SNm + 0.18*SEBm - 3.17

adjusted R^2 = 66.54%, $F(5, 575) = 231.72$, $p<0.0001$

Table 45: Behaviour regression results for TRA molar variables and the planting of riparian areas

Variable	r (BIm)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Percentage riparian area protected	0.37	0.08 <.0001	0.04 <.0001	0.04 <.0001	0.04 <.0001	0.03 <.0001	0.03 <.0001	0.03 <.0001	0.03 <.0001	0.03 <.0001
IAm **t-test**	0.74		0.66 <.0001	0.46 <.0001	0.33 <.0001	0.24 <.0001	0.27 <.0001	0.25 <.0001	0.25 <.0001	0.27 <.0001
AAm	0.69			0.26 <.0001	0.18 <.0001	0.07 .1162		0.06 .2107	0.06 .2249	
SNm	0.70				0.36 <.0001	0.26 <.0001	0.27 <.0001	0.26 <.0001	0.26 <.0001	0.26 <.0001
SEBm	0.74					0.34 <.0001	0.38 <.0001	0.15 .0211	0.14 .0342	0.18 .0046
CBm	0.70							0.26 <.0001	0.27 <.0001	0.28 <.0001
SIm	0.39								0.06 .3369	
Constant		6.43 <.0001	-0.66 .0584	-1.31 .0002	-2.06 <.0001	-2.81 <.0001	-2.77 <.0001	-3.20 <.0001	3.86 <.0001	-3.17 <.0001
R^2		13.10	56.2	58.57	62.66	65.06	64.91	66.92	66.90	66.83
R^2 adj		12.95	56.07	58.36	62.40	64.76	64.67	66.58	66.49	66.54
ΔR^2 adj **F-test** **Compare**			43.12 <.01 1->2	2.29 <.01 2->3	4.04 <.01 3->4	2.36 <.01 4->5	0.09 ns 5->6	1.82 <.01 5->7	-0.09 ns 7->9	0.04 ns 7->8
F regn		89.25 <.0001	378.19 <.0001	277.11 <.0001	244.99 <.0001	214.51 <.0001	266.84 <.0001	193.55 <.0001	164.26 <.0001	231.72 <.0001
Model df		1	2	3	4	5	4	6	7	5
Resid df		592	589	588	584	576	577	574	569	575

For Model 9 PRESS has been 6332.08 and PRESS RMSE has been 3.30 compared to SSE of 6180.26 and RMSE of 3.28, so the model has been a good fit.

Interactions between TRA Predictor Variables

To test for the presence of interactions in the selected regression model shown in equation 2, partial products of the TRA variables were mean centred and included in the full regression model one at a time. Interactions of significance resulted from combinations of instrumental attitudes, subjective norms and control beliefs (Table 46). Although the interactions were significant, they made only a small improvement (2-3%) to the explained variance in equation 2. That suggested that the amount of confidence that people could have about obtaining their desired result from establishing native tree woodlots was also associated with how they felt emotionally towards them, the likely benefits that were to have been had and the amount of control they had over their actions.

Table 46: Regressions with interactions for the planting of riparian areas

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Bnc	0.03 <.0001	0.03 <.0001	0.03 <.0001	0.02 <.0001	0.02 .0021	0.03 <.0001	0.03 <.0001	0.02 <.0001
IAmc	0.27 <.0001	0.28 <.0001	0.27 <.0001	0.27 <.0001	0.27 <.0001	0.31 <.0001	0.30 <.0001	0.32 <.0001
SNmc	0.25 <.0001	0.25 <.0001	0.25 <.0001	0.25 <.0001	0.25 <.0001	0.23 <.0001	0.24 <.0001	0.23 <.0001
SEBmc	0.18 .0046	0.18 .0041	0.18 .0041	0.19 .0028	0.20 .0017	0.20 .0017	0.22 .0004	0.19 .0014
CBmc	0.28 <.0001	0.27 <.0001	0.28 <.0001	0.27 <.0001	0.27 <.0001	0.27 <.0001	0.26 <.0001	0.28 <.0001
Bnc*IAmc		0.002 .1857						
Bnc*SNmc			0.001 .4426					
Bnc*SEmc				0.002 .1182				
Bnc *CBm					0.004 .0010			
IAmc *SNmc						0.02 .0001		
IAmc*SEmc							0.03 <.0001	
IAmc*CBmc								0.04 <.0001
Constant	-0.008 .9536	-0.07 .6347	-0.04 .7853	-0.08 .5774	-0.14 .3138	0.42 .0153	-0.72 <.0001	-0.69 <.0001
R^2	66.69	66.79	66.72	66.83	67.32	67.56	68.83	70.15
R^2 adj	66.39	66.44	66.37	66.48	66.97	67.22	68.49	69.83
ΔR^2 adj **F prob** **Models**		0.05 <ns 1->2	-0.02 <ns 1->3	0.09 <ns 1->4	0.58 <0.01 1->5	0.82 <0.01 1->6	2.10 <0.01 1->7	3.44 <0.01 1->8
Regn F prob	225.44 <.0001	188.41 <.0001	187.85 <.0001	188.76 <.0001	192.98 <.0001	195.10 <.0001	206.81 <.0001	220.15 <.0001
Df	5	6	6	6	6	6	6	6
Resid df	563	562	562	562	562	562	562	562

Table 46 continued

Variable	Model 9	Model 10	Model 11
Bnc	0.03 <.0001	0.02 <.0001	0.03 <.0001
IAmc	0.29 <.0001	0.28 <.0001	0.28 <.0001
SNmc	0.22 <.0001	0.21 .0081	0.25 <.0001
SEBmc	0.23 .0003	0.22 .0003	0.23 .0002
CBmc	0.27 <.0001	0.29 <.0001	0.27 <.0001
SNmc*SEmc	0.03 <.0001		
SNmc*CBmc		0.04 <.0001	
SEmc*CBmc			0.04 <.0001
Constant	-0.53 .0018	-0.53 .0006	-0.71 <.0001
R^2	68.17	69.14	69.47
R^2 adj	67.83	68.81	69.15
ΔR^2 adj **F prob** **Models**	1.44 <0.01 1->9	2.41 <0.01 1->10	2.75 <0.01 1->11
Regn F prob	200.60 <.0001	209.83 <.0001	213.17 <.0001
Df	6	6	6
Resid df	562	562	562

Multicollinearity and Suppressor Check

The presence of suppressor variables was checked by comparing the multiple regression coefficients with the zero-order correlations in Table 41 and Table 42 for control beliefs. There did not appear to have been any suppressor variables.

Collinearity was tested by regressing in turn each predictive variable in the TRA against all the other predictive variables and calculating the tolerance value (Hair et al., 1998, p. 191). The results of Table 47 suggested that some collinearity was likely to exist with self-efficacy. In the correlation results (Table 41) self-efficacy showed high correlations (0.75-0.80) with the other TRA variables. In the molar TRA regressions there did not appear to have been much of a sign of instability when self-efficacy was added.

Table 47: Tolerance values for predictive variables and the planting of riparian areas

Variable	Tolerance
Riparian planting	0.89
IAm	0.26
AAm	0.29
SNm	0.38
SEBm	0.20
CBm	0.45
SIm	0.79

Multiple Regression Residuals

Regression residuals from equation 2 were plotted against predicted outcome results (Hair et al., 1998, p. 173). No outliers were detected.

In Figure 7, the results indicated a non-normal distribution. The results have however; been consistent with the non-normal data collected for each of the regression predictive variables and described earlier (Table 79 of Appendix L). The overall regression equation was still assumed to have been linear.

Molecular Regression Analysis for Intentions

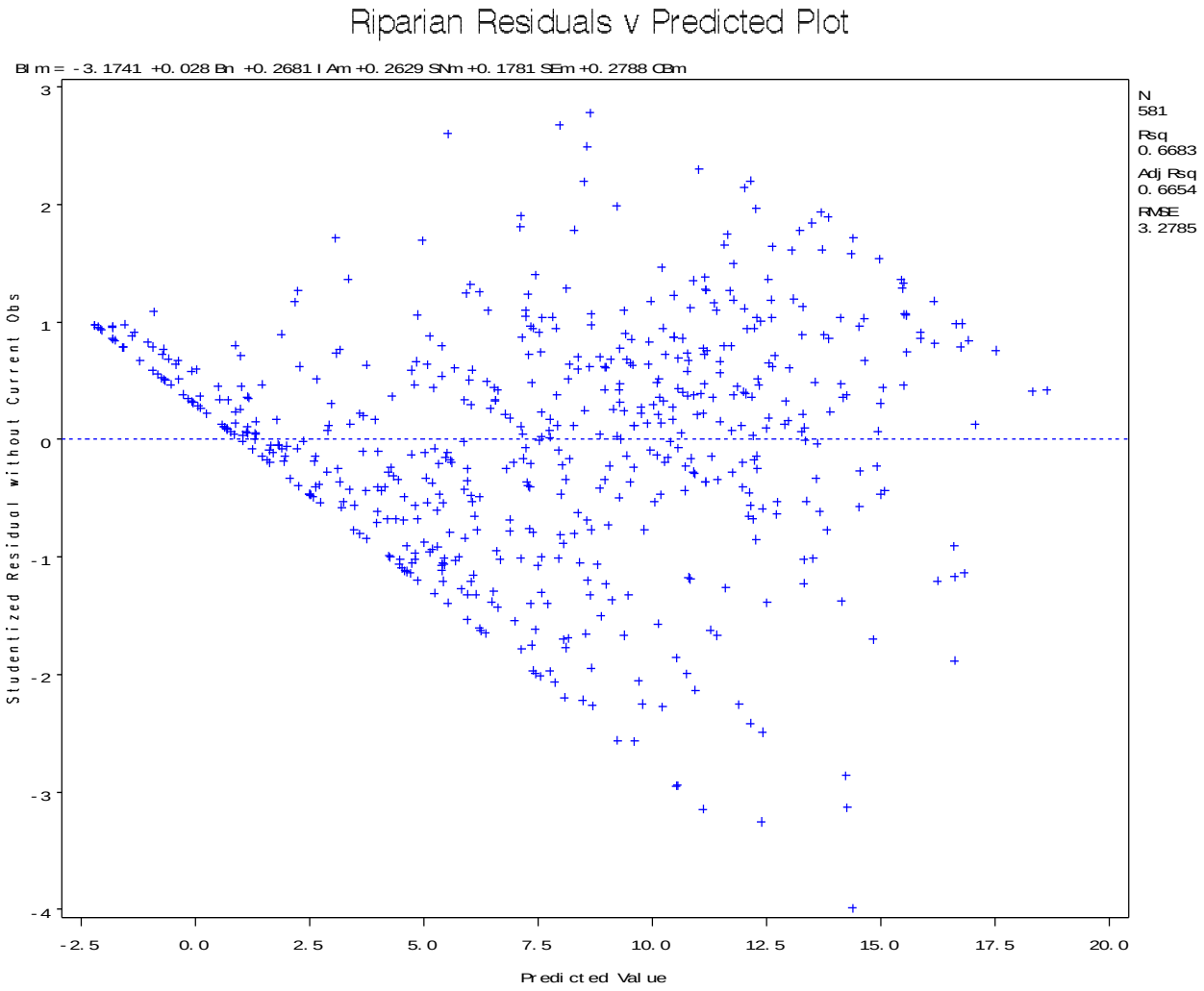
To test the TRA regression in equation 2, the molecular (indirect) measures were used in place of the molar variables. The results have been included in Appendix N Table 82. The best fitting model was model 5 (equation 3). In most cases, the range of coefficients of determination have been below those for the molar model. The exception was when self-efficacy and the control beliefs were both included (compare equations 2 and 3). That equation may have been showing some of the collinearity effect of self-efficacy identified earlier as the coefficients for attitude beliefs and normative beliefs were much lower than those in equation 2.

Equation 3. Regression model for land owner's intentions for fencing the riparian area and planting native trees, including TRA molecular variables

BI = 0.03*%riparain protection + 0.26*CBm + 0.02*IABm + 0.03*NBm + 0.34SEBm + 0.7

Adjusted R^2 = 68.34%, F(5, 544) = 238.01, p<0.0001

Figure 7: Scatter plots of residuals (studentized) against independent variables and fitted values and the planting of riparian areas



Comparison between Landowners Likely or Unlikely to Fence and Plant Native Trees in Their Riparian Areas

Non-specific Variables Associated With Fencing and Planting Native Trees along Riparian Areas

To understand how policy interventions may have affected peoples' intentions and so their behaviour, the complete sample of landowners was separated into two groups (shown in Table 48). Group 1 included those landowners likely to fence and plant native trees in their riparian area, with their score for intentions above the sample mean (BIm = 7.7). Group 2 was those landowners unlikely to fence and plant native trees in their riparian area, their scores for intentions have been equal to or below the overall mean for intentions. The landowners most likely to fence and plant native trees in their riparian area (i.e. in Group 1) had the highest proportion of their riparian areas already protected.

Table 48: Numbers of respondents likely or unlikely to fence and plant native trees in their riparian area

	Group 1	**Group 2**
Selection Criteria	Above the mean for intentions	Below the mean for intentions
Number of Respondents	276	318
Mean for Intentions (20 point scale, 20 was high)	13.0	3.1
t Value for the difference in intentions between Groups 1&2	42.35***	
Percentage of riparian areas already fenced and planted in native trees	24.1	8.1
t Value for the difference in the area between Groups 1&2	7.91***	

High intention respondents included 20% part time or non-farmers, that was almost double the proportion in Group 2 which had only 12% (Chi-square value = 8.7, df = 1, P<0.01). High intention landowners included a higher proportion of dairy farmers than the other group (42% compared with 17%; Chi-square value = 5.9, df = 2, P<0.1). It has been no surprise then, that the group with the lowest intentions (mainly sheep and beef farmers) had larger property sizes than the high intention group (745ha compared with 308ha, P<0.1). The differences in intentions between farmers with differing livestock classes may have reflected the effects of local government and industry media-campaigns that have deliberately targeted dairy farmers (TVNZ 2002).

Both groups of landowners indicated that they were seeking similar levels of satisfaction from their farming goals (Table 49). Farmers most likely to fence and plant native trees in their riparian area rated "looking after nature" more highly, also "having time available for socialising with family and friends".

Both groups of landowners considered that fencing and planting their riparian areas would contribute little to fulfilling their farming goals (scores <5), except for "looking after nature" which was scored higher. However, the low intention farmers in Group 2 considered that riparian protection would have conflicted with a goal such as "paying-off debts". It was less likely for Group 2 landowners to invest in "maintaining a stable farming system", having "variety in work", and "looking after nature" and overall those goals were the most associated with differences in landowners' intentions. The landowners most likely to fence and plant native trees in their riparian area were those that were able to identify how doing so could have contributed to realising their most desired farming goals. The landowners least likely to fence and plant native trees in their riparian area considered that they would have taken their focus away from farming, farm profits and debt repayment.

Table 49: Farming goals associated with fencing and planting native trees in their riparian areas

	Weights		Association		Overall Influence	
	Intentions		Intentions		Intentions	
	High	Low	High	Low	High	Low
Build a valuable farming business	16.5	16.7 ^{ns}	3.5	1.7 ***	61.9	32.2 ***
Produce to maximise farming profits	16.3	16.5 ^{ns}	2.2	1.3 $^{\#}$	38.5	22.8 $^{\#}$
Be self-reliant in decision-making	17.0	17.2 ^{ns}	2.4	0.9 ***	43.2	17.1 ***
Look after nature	17.3	16.5 **	6.3	4.3 ***	111.7	75.4 ***
Be valued in my community	14.7	14.1 ^{ns}	3.2	1.7 ***	53.7	30.3 ***
Create increased opportunities for future farmers	15.2	15.2 ^{ns}	4.1	2.3 ***	69.6	38.6 ***
Have variety in my work	16.3	15.9 ^{ns}	3.8	1.3 ***	64.8	24.9 ***
Pay off debts	16.5	16.0 ^{ns}	0.1	-0.7 $^{\#}$	4.5	-9.1 $^{\#}$
Maintaining a stable farming system	17.5	17.3 ^{ns}	4.6	2.3 ***	83.8	42.3 ***
Have time available for socialising with family and friends	17.0	16.3 $^{\#}$	1.3	0.2 **	24.1	6.2 *
Scale	*0-20*	*0-20*	*0-10*	*0-10*	*0-200*	*0-200*

*Significance of differences between groups, p=<0.0001 ***, p=<0.001 **, p=<0.01 *, p=<0.1 $^{\#}$, not significant = ^{ns}*

Instrumental Beliefs Associated With Fencing and Planting Native Trees in Riparian Areas

Table 50 has listed all the instrumental beliefs included in this study and compared their influence upon landowners with low and high intentions. The scales have been converted to bipolar scales for that comparison as has been standard TRA practice. The attitudes of landowners were (not surprisingly) significantly different between those likely to protect riparian areas and those unlikely to protect them. In a similar way, high intention landowners had more affective attitudes (i.e. less anxious and frustrated, and more confident and contented) and feelings of self-identity consistent with the desired behaviour (i.e. being a concerned person already taking more action than most other landowners).

The list of beliefs in the table has been presented in order of their overall influence on landowner behaviour from highest to lowest. The greyed out rows have represented beliefs about the negative consequences associated with the behaviour. The beliefs with the greatest overall influence upon riparian management behaviour were, "reduced costs and management time", "increased attractiveness of the waterway bank" and "increased wild-life habitat". The beliefs with the least overall influence were, "reduced harmful bugs", "easier flood control" and "reduced waterway temperatures". Of those latter three, flood control and harmful bugs had some importance in decision making, but were not strongly associated with the effects of riparian fencing and planting.

Landowners likely to have fenced and planted their riparian areas placed a lot of their decision making weight upon the improved "attractiveness of waterway banks" and on reduced "erosion and slips". Landowners with the least intention to fence and plant native trees in their riparian area based more of their decision making upon "tidiness and weed control" and "costs and management time".

Both groups of landowners considered that the characteristics most associated with fence and plant native trees in their riparian area were "increased attractiveness of waterway banks" and "increased wildlife habitats". The landowners with the lowest intentions considered that for all the other attributes protecting riparian areas would have neutral to negative consequences, except some improvement in waterway temperatures might have been possible.

Table 50: Instrumental beliefs associated with fencing and planting native trees in their riparian area

Instrumental Beliefs	Weights		Association		Overall Influence	
	Intentions		Intentions		Intentions	
	High	Low	High	Low	High	Low
Instrumental Attitudes towards the riparian area					15.8	8.3 ***
Affective Attitudes towards protecting the riparian area					14.9	8.4 ***
Self-Identity about protecting the riparian area					15.6	13.9 ***
Scale for attitudes					*0-20*	*0-20*
Increased costs and management time	4.0	5.5 ***	-4.4	-6.2 ***	-21.8	-40.2 ***
Increased attractiveness of the waterway bank	6.4	3.1 ***	6.7	1.2 ***	47.9	10.5 ***
Increase wildlife habitat	5.6	2.1 ***	6.6	1.7 ***	43.6	10.6 ***
Reduce erosion and slips	6.3	5.4 ***	5.1	-1.4 ***	39.6	-1.9 ***
Improve waterway health and cleanliness	5.9	3.9 ***	5.3	-0.3 ***	35.0	3.5 ***
Reduced nutrient contamination of the waterway	5.8	3.9 ***	4.6	-0.6 ***	31.3	1.8 ***
Decreased land for production	3.1	4.7 ***	-1.5	-3.1 *	-7.9	-23.7 ***
Reduced sediment in the waterway	6.0	4.1 ***	3.9	-1.5 ***	28.0	-0.6 ***
Increased untidiness and weediness	5.1	6.1 *	1.1	-2.4 ***	8.3	-19.8 ***
Difficult stock water, animal safety and animal management	3.0	5.0 ***	2.8	-2.1 ***	12.1	-16.0 ***
Reduced waterway temperatures	3.5	1.4 ***	3.5	0.1 ***	20.1	6.6 ***
Difficult flood control	4.1	5.1 *	1.7	-1.9 ***	4.9	-19.3 ***
Reduced harmful “bugs”	5.7	4.3 ***	1.2	-3.5 ***	11.2	-12.0 ***
Scale for Beliefs	*0-10*	*0-10*	*0-10*	*0-10*	*0-100*	*0-100*

*Concepts in grey boxes have been reversed along with the scores. Significance of differences between groups p=<0.0001 ***, p=<0.001 **, p=<0.01 *, p=<0.1 #, not significant = ns*

The main differences between the two groups were that landowners most likely to fence and plant native trees in their riparian area considered them to "improve waterway health and cleanliness", "reduce erosion and slips" and "make waterways more attractive".

Both groups of landowners considered that changing their riparian management would have increased their costs and made demands upon their management time, and reduced their area of productive land, but those were overall more significant consequences for landowners with the lowest intentions to change. The beliefs that had the most overall influence in changing landowners' intentions were the expected ability of fencing and planting native trees in the riparian area to "reduce erosion and slips", and "increased attractiveness of the waterway bank" and "increased wildlife habitat". Waterway bank erosion was a highly weighted decision criteria for both groups, but people with high intentions differed from people with low intentions as to whether riparian protection would have had much positive effect upon it or not.

To encourage behaviour change, policy interventions could have been developed that act by increasing landowner's decision making weight upon the attractiveness of farm waterways and increasing wildlife habitat. In addition, policy interventions could be implemented to increase the association between riparian fencing and planting native trees and being able to increase the attractiveness of waterways, reduce bank erosion and increase wildlife habitats.

Normative Beliefs Associated With Fencing and Planting Native Trees in Riparian Areas

Landowners with high-intentions were influenced by the subjective norms concerning fencing and planting native trees in their riparian areas more than landowners with low intentions (Table 51). Only the scales for the concept weights have been converted to bipolar scales for that comparison as has been standard TRA practice.

Landowners intending to fence and plant native trees in their riparian area considered that their actions would have been supported by all their most influential reference groups i.e. their families, friends and government experts. Landowners unlikely to fence and plant native trees in their riparian area

considered that their actions were consistent with the expectations of family, friends and experts who were all expected to oppose them taking such actions.

Control and Self-Efficacy Beliefs Associated With Fencing and Planting Native Trees in Riparian Areas

Both groups of landowners considered that they had high levels of control over their actions (>10 in Table 52). In the analyses, the control beliefs were more predictive than peoples' perceptions of their overall control. The differences in control beliefs affecting landowners unlikely to protect their riparian areas were that they did not have enough time and personal skills to make a successful change in their behaviour.

Landowners with high intentions to protect their riparian areas had greater perceptions of self-efficacy – feeling supported, confident and capable of achieving the desired results. For them riparian protection fitted their ideas of farming sustainably, they agreed with the principles involved and they had often thought about such issues. Landowners unlikely to protect their riparian areas were not confident about the practice, they did not understand the principles and they did not consider riparian protection to fit their way of farming.

Table 51: Normative beliefs associated with intentions towards fencing and planting native trees in their riparian area

	Weights		Association		Overall Influence	
	Intentions		Intentions		Intentions	
	High	Low	High	Low	High	Low
Subjective Norms					12.2	6.5 ***
Scale for Subjective Norm					*0-20*	*0-20*
Influence of family	12.8	11.4 **	2.7	-4.8 ***	39.4	-53.3 ***
Influence of government experts	10.8	8.7 ***	3.4	-2.2 ***	41.3	-19.1 ***
Influence of friends	9.9	7.6 ***	1.1	-5.0 ***	16.1	-33.6 ***
Scale for Beliefs	*0-20*	*0-20*	*0-10*	*0-10*	*0-200*	*0-200*

*Significance of differences between groups, p=<0.0001 ***, p=<0.001 **, p=<0.01 *, p=<0.1 #, not significant =* ns

Table 52: Control and self-efficacy beliefs associated with intentions towards fencing and planting native trees in their riparian area

Concepts	**Association**	
	Intentions	
	High	Low
Perceived Behavioural Control	16.3	16.0 ^{ns}
Enough time available	12.3	5.0 ***
Enough ability	13.1	7.8 ***
Enough funds	10.4	5.5 ***
Enough skills	14.3	9.6 ***
Enough knowledge	14.3	9.6 ***
Self-Efficacy	14.7	8.5 ***
Fits with my ideas of farming sustainably	15.8	8.8 ***
Generally supportive of the principles	16.4	9.8 ***
Often think about the issue	14.9	8.9 ***
Confident in my abilities	14.2	8.5 ***
I would find it easy	10.7	5.8 ***
I have enough capability	9.8	5.2 ***
Scale for beliefs	*0-20*	*0-20*

*Significance of differences between groups, p=<0.0001 ***, p=<0.001 **, p=<0.01 *, p=<0.1 $^{\#}$, not significant = ^{ns}*

Summary of Research from Fencing and Planting Native Trees in Riparian Areas

In 2002, a second survey on fencing and planting riparian areas was sent to 2,900 respondents. It had a 21% response rate, which provided enough statistical power for testing the hypothesised relationships. Respondents included a greater proportion of dairy farmers and the average property size was greater than expected from population statistics. This type of response was similar to that obtained in the previous survey on farmers protecting and conserving bush remnants.

Most respondents were unlikely to increase their level of riparian protection and planting. Although 84% had already fenced and planted some of their riparian area, this only applied to 17% of the potential streambanks on the average property. There were a mixture of negative and positive concepts that respondents associated with riparian protection and the issue was not clear-cut for them.

Most of the concept measures (except self-efficacy) had good convergent validity (C.Alpha > 0.75). Discriminant validity was good (single factor loading > 0.5) except for one self-identity measure that was subsequently excluded from further analyses. None of the correlations of molar concepts indicated a potential problem caused by collinearity ($r < 0.9$), but some collinearity was indicated for the molecular (belief) concepts. Again the data was non-normal, but the consistency of the regression residuals, suggests that the regressions described linear relationships in the data.

In the regression analyses of behaviour without the TRA variables, the significant concepts were the occupation of the landowner (part-time farmers were more favourable), livestock class (dairy farmers were more favourable), farming goals (a closer relationship between famers' goals and the riparian objectives made the practices more favourable). The regression had a coefficient of variation (R^2) of 3%. Intentions provided the best predictor of the behaviour measure ($R^2 = 13\%$) and including behavioural control as a moderator did not improve this any further.

When a regression was developed for intentions, the most explanatory model included landowners' existing implementation of riparian practices, perceived control beliefs, instrumental attitudes, subjective norms and self-efficacy.

There were some interactions between instrumental attitudes, subjective norms and control beliefs. Although there was no indication of suppressor variables, a small amount of collinearity may have been associated with self-efficacy beliefs, and may have affected the molecular model.

When the beliefs of landowners likely to protect and plant their riparian areas were compared to those unlikely to do so, it appeared that their beliefs about waterway attractiveness, wildlife habitat, and bank erosion were very influential. Landowners with intentions to take action on their riparian area were more likely to consider that their actions would have been favourably regarded by influential others around them. They also had greater levels of self-efficacy about realising desired results from their actions.

Chapter 9. Research Results from Testing the Application of the Theory of Reasoned Action to the Act of Establishing and Maintaining Indigenous Woodlots on Farms

Introduction to Establishing and Maintaining Wood lots

In this chapter of the thesis has been described the quantitative results of applying the research methodology and the Theory of Reasoned Action to behaviour associated with establishing and maintaining indigenous (or native tree) woodlots on farms. A description of the terms used and the subjects that they have referred to has been shown in Table 53 and can be used throughout the chapter to interpret the symbols.

The structure of this chapter is the same as that for Chapters 7 and 8. First the collected survey results were screened for normality and to detect any outlier data sets. Then, the results for the behavioural outcome measures have been described and the other research measures tested for their convergent and discriminant validity.

Following the initial data examination, the relationships between variables has been analysed as correlations and as regressions. The predictive power of regression results have been assessed by adding in interactive terms, considering residual terms, and testing for consistency when either molar (direct) or molecular (indirect) terms were used.

In the last section of this chapter, comparisons have been made between the beliefs of respondents with high verses low intentions to establish and maintain indigenous woodlots.

Table 53: Definition of questionnaire terms for establishing and maintaining woodlots

Initials	Variables	TRA Construct	Question Subject
BI_1	intentions	molar variable	Intend to do
BI_2	intentions	molar variable	Plan to do
BI_m	intention mean	molar variable	
IA_1	instrumental attitude	molar variable	A good thing to do
IA_2	instrumental attitude	molar variable	A useful thing to do
IA_3	instrumental attitude	molar variable	A wise thing to do
IA_m	instrumental attitude mean	molar variable	
AA_1	affective attitude	molar variable	Feeling frustrated
AA_2	affective attitude	molar variable	Feeling anxious
AA_m	affective attitude mean	molar variable	
SN_1	subjective norm	molar variable	What people important to me think
SN_2	subjective norm	molar variable	Approval of important people
SN_3	subjective norm	molar variable	Behaviour of people important to me
SN_m	subjective norm mean	molar variable	
SE_1	self-efficacy	molar variable	Requires effort
SE_2	self-efficacy	molar variable	Is complex
SE_m	self-efficacy mean	molar variable	
BC_1	perceived behavioural control	molar variable	Its up to me
BC_2	perceived behavioural control	molar variable	I have control
BC_m	perceived behavioural control mean	molar variable	
SI_1	self-identity	molar variable	A concerned person
SI_2	self-identity	molar	Better than other farmers

		variable	
SI_m	self-identity mean	molar variable	
IAB_{1a} and IAB_{1w}	instrumental attitude beliefs	molecular variable	Produce quality wood
IAB_{2a} and IAB_{2w}	instrumental attitude beliefs	molecular variable	Increase profitability
IAB_{3a} and IAB_{3w}	instrumental attitude beliefs	molecular variable	Improve aesthetic value
IAB_{4a} and IAB_{4w}	instrumental attitude beliefs	molecular variable	Increase wildlife habitat
IAB_{5a} and IAB_{5w}	instrumental attitude beliefs	molecular variable	Risk of loss
IAB_{6a} and IAB_{6w}	instrumental attitude beliefs	molecular variable	Increased costs
IAB_{7a} and IAB_{7w}	instrumental attitude beliefs	molecular variable	Creating extra work
IAB_{8a} and IAB_{8w}	instrumental attitude beliefs	molecular variable	Useful to the next generation
IAB_{9a} and IAB_{9w}	instrumental attitude beliefs	molecular variable	Improve land utilisation
IAB_{10a} and IAB_{10w}	instrumental attitude beliefs	molecular variable	Increased farm value
IAB_m	instrumental attitude belief products mean	molecular variable	
NB_{1a} and NB_{2c}	subjective norm beliefs, association and willingness to comply	molecular variable	Responding to family
NB_{3a} and NB_{4c}	subjective norm beliefs, association and willingness to comply	molecular variable	Responding to friends
NB_{5a} and NB_6	subjective norm beliefs, association and willingness to comply	molecular variable	Responding to government experts
NB_m	subjective norm belief products mean	molecular variable	
SEB_1	control beliefs	molecular variable	Often think about it
SEB_2	control beliefs	molecular variable	Supportive in principle
SEB_3	control beliefs	molecular variable	Fits farming sustainably
SEB_4	control beliefs	molecular variable	Confidence in my own abilities
SEB_m	control beliefs mean	molecular variable	
CB_1	control beliefs	molecular variable	Time available

CB_2	control beliefs	molecular variable	Funds
CB_3	control beliefs	molecular variable	Enough encouragement
CB_4	control beliefs	molecular variable	Abilities
CB_m	control beliefs mean	molecular variable	

Survey Response Rate

The woodlot survey was sent out to 1600 respondents on the 13th May 2002 by NFO[11]. Respondents had until the 21st June to complete the survey, and they were all received at Ruakura by the 30th June 2002. The survey had a response rate of 30% (475 survey responses received) and a statistical power of 90%. This was considered high enough (>80%) to identify that a hypothesised relationship in the data might have actually existed (Hair et al., 1998, p. 12).

Respondent Demographics

The average results from the demographic section of the survey have been shown in Table 54. The respondents were a typical cross-section of a New Zealand livestock farming community although they were slightly older and had a lower proportion of females. The average farm size (Statistics New Zealand, 2003, p. 13) for New Zealand properties over 20ha, was 320ha compared to the 398ha in this survey. The survey results came from a larger average farm size than would have been expected in a completely random survey.

The proportion of dairy farmers in the survey was 36%, which was above the national average of 27%. The higher than average farm size and greater proportion of dairy farming respondents also occurred in the two previous surveys described in earlier chapters. Although when the sample was selected it was not deliberately intended to include part-time farmers, 14% of respondents identified themselves in that category.

A total of 84 farmers identified farm forestry as having been one of their "main farming types".

[11] NFO since 2003 has operated as TNS market research company. See Appendix A.

Table 54: Demographic survey results for woodlots

Demographic Variable	Result	New Zealand Statistics for 2002
Percentage of Full-time Farmers	86%	unknown
Average Age	49 years	44 years
Percentage Female	17%	33%
Percentage Non-European	5.0%	5.3%
Average Property Area	398 ha	320 ha
Proportion of Dairy Farms	39%	27%
Proportion with farm forestry or woodlots	18%	17%

Screening Data for Normality

In Table 83 of Appendix O, the mean and distributions of the collected data has been shown. The overall mean for all the variables using a 20 point scale was 13.5 and the standard deviation was 5.4. In the Table, farmers' goals represented farmers' aspirations for their farming businesses. The highest ranked goal was "maintaining a stable farming system", closely followed by "looking after nature", "building a valuable farming business" and "being self reliant". The goal products have combined the importance of the different farming goals with how much farmers have associated (positively or negatively) establishing and maintaining native woodlots to the attainment of those goals.

Establishing woodlots was most consistent with landowners' wanting to "look after nature" as one of their farming goals. It also fitted with landowner goals of "having variety in work" and "creating … opportunities for future farmers". The behaviour was most in conflict with those farmers wanting to "pay off debts" and spend time "socialising with family and friends", as their farming goals.

The raw measures for belief outcomes and belief strength have been shown initially in Table 82 followed by the belief products. The belief products have included converting both measures to a bipolar scale. With subjective norms only the normative beliefs had a bipolar scale.

Beliefs about being able to improve their farm's profitability (IAB4) had the highest mean of 17.1 and the lowest coefficient of deviation (along a scale of 0-20; 18%). Also high were scores for increasing the farm's value (IAB20) and the responses to behavioural control questions (BC1 and BC2). So, farmers felt that they were very much in control of their own decision making in that area.

Respondents scored particularly low the questions relating to whether or not they did what "their friends suggested" (NB4) and the desirability of "increasing farming costs" (IAB12). The amount of variation in the influence of friends (standard deviation of 3.9) was particularly high with a coefficient of variation around the mean greater than 100%. Many variables had wide variations in responses with coefficients of variation greater than 50%. Those included their behavioural intentions (BI1; mean of 7.4 and standard deviation of 5.9) and respondents' assessment of the degree to which they had already done more than most farmers to establish native woodlots (SI2; mean of 8.5 and standard deviation of 6.3).

Across all the results the medians have had the same values as the corresponding means or slightly higher indicating that most people made their responses around the means or higher. Often the mode was 1, 11, or 20 on the 20 point scales, which again suggested that generally quite a simplified system of scoring has been used and that the visual measurement scale was effective.

The mode for the intention questions was 1 suggesting that most people were unlikely to increase the area that they had in native woodlots. The questions about the molar TRA variables, mostly had modes of 11 so respondents appeared to have been generally ambivalent in their responses. The high mode values for self-efficacy and behavioural control have indicated that respondents consistently thought that establishing and maintaining native woodlots was fully their own decision and would have required a lot of effort if they chose to implement it.

Generally the results collected from questionnaires when compared to a 'normal' distribution, were a mixture of being more or less peaky than we would have expected to find (i.e. positive or negative kurtosis respectively). The kurtosis was more likely to have been peaky with the global measures such as intentions, attitudes and subjective norms; also normative beliefs and control beliefs. That result contrasted with the results previously obtained for bush remnants.

Generally with woodlots, there was a negative skewness to the distributions. That reflected that although the peak in distribution tended to have been between 10 and 20 on the scale, a greater number of responses were below 5 than above 15.

In Appendix O, Table 83 the Shapiro-Wilk test results were very small (<0.05) reinforcing earlier results that indicated non-normal data.

Existing Farmer Behaviour

Respondents were asked about the area of any native woodlots that they might have had on their properties and 52% in total did have some (Table 55). Those with woodlots were maintaining average areas of just over 22 hectares. Landowners that had previously identified one of their main farming types to have been forestry or woodlots have been identified in that Table as "farm foresters". A similar proportion of farm foresters had native tree woodlots compared to the total sample of respondents, but they tended to have a larger area in native woodlots than other landowners.

Table 55: Properties with native tree woodlots and the area that has been managed

	Number of properties with native tree woodlots	**Percentage**	**Average area of native woodlots (ha)**
Total respondents	244	52% of the total number of respondents	22 hectares
Landowners with farm forestry	52	62% of the total number of farm foresters	37 hectares
Landowners without farm forestry	192	50% of the total number of non farm foresters	18 hectares

The measure of behaviour used in this study and the outcome (dependent) variable in the behavioural regression analysis was the area of native woodlots that had been established and maintained on individual farm properties. That was indicated by respondents answering a question on the "area of native tree woodlots" which they had. The intention measure was "establishing and maintaining woodlots [on their farm] over the next year". In calculations for developing behavioural models, the behavioural measure was retained as the outcome variable. However, in subsequent analyses of intentions the behaviour

measure was used as a measure of past behaviour, rather than predicted behaviour, for reasons stated in the chapter on bush remnant behaviour.

Test of Convergent Validity

Calculations of Cronbach Alpha Coefficients were used to test the convergent validity of the concept measures. That has assisted in ensuring that all the related questionnaire items were measuring the same construct. Cronbach Alpha (C.Alpha) results should have been greater than 0.7; or in some exploratory studies, at least over 0.6 (Hair et al., 1998, p. 88). In Table 56 the C.Alpha results have been shown for this study. They were generally satisfactory except for the two self-identity questions which have appeared to have been measuring slightly different concepts from each other. Similar results were found in the bush-remnant study.

Table 56: Cronbach Alpha coefficients for woodlot concepts

Variables	C.Alpha
BI1, BI2	0.86
IA1, IA2, IA3	0.88
AA1, AA2	0.79
SN1, SN2, SN3	0.71
SE1, SE2	0.70
BC1, BC2	0.73
SI1, SI2	0.62
Ob1, Ob2, Ob3, Ob4	0.75
SEB1, SEB2, SEB3, SEB4	0.71
CB1, CB2, CB3, CB4, CB5	0.81
Goals (10 products)	0.90

Test of Discriminant Validity

Factor analyses have been used to test for differences between similar measures of the predictor variables and to identify any different concepts that they might have contained.

In Table 57 all the concepts loaded on to the same factors as their theoretical complimentary concepts. The amount of shared variance that they had was moderate to high (0.33 to 0.73), and above that obtained for preserving bush remnants. Therefore, the means for all the variables were included in further multivariate analyses. Self-identity concepts had the weakest link to a common factor, although they were still above that found in the study of bush remnants.

Table 57: Factor loadings for molar (direct) TRA measures of woodlot concepts

Variable	Factor 1			Communality
Behavioural Intentions				
BI1	0.82			0.67
BI2	0.82			0.67
% var	100			
Instrumental Attitudes				
IA1	0.86			0.73
IA2	0.78			0.60
IA3	0.83			0.69
% var	100			
Affective Attitudes				
AA1	0.73			0.54
AA2	0.73			0.54
% var	100			
Subjective Norms				
SN1	0.68			0.46
SN2	0.58			0.33
SN3	0.64			0.41
% var	100			
Self-Efficacy				
SE1	0.64			0.41
SE2	0.64			0.41
% var	100			
Perceived Behavioural Control				
BC1	0.67			0.45
BC2	0.67			0.45
% var	100			
Self-Identity				
SI2	0.57			0.33
SI3	0.57			0.33
% var	100			

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It has not been necessary for the molecular concepts to be as similar to each other as the molar concepts needed to have been (Table 58), and indeed, they did not all load onto the same factors.

In this study, the farming goals loaded on to three different factors, although the first two factors could explain over 90% of the variation.

The same situation existed with instrumental attitude beliefs. Beliefs about aesthetic quality, providing wildlife habitat, improving land-use and increasing property value tended to load onto a 'property factor', as did a lot of the variance in beliefs about farming profitability. Beliefs about costs and work tended to load onto a 'costs factor'. Beliefs about profit mainly loaded separately onto a third factor. Beliefs about technical issues such as wood quality, risk of harvest, and usefulness to the present generation did not load much on to any of the three other factors.

Self-efficacy beliefs and control beliefs both could have been loaded onto one factor each, but normative beliefs could not. After the study on preserving bush remnants the latter result was unexpected. The results for their normative beliefs may have indicated that farmers' beliefs about the influence of "government experts" was considered quite differently from the influence of friends and family when it came to making decisions about woodlots. Control beliefs have tended to load onto two factors, although most of the loading was on the first factor and so they have been kept together in subsequent analyses.

Table 58: Factor loadings for non-specific and molecular (indirect) measures of woodlot concepts

Variable	Factor 1	Factor 2	Factor 3	Communality
Farming Goals Bush Remnant Products				
ProdBus	0.35	0.71	0.25	0.69
ProdProf	0.25	0.68	0.40	0.69
ProdSelf	0.41	0.41	0.38	0.47
ProdNat	0.63	0.31	0.12	0.51
ProdVal	0.60	0.14	0.30	0.47
ProdFut	0.56	0.37	0.34	0.56
ProdVar	0.62	0.26	0.30	0.55
ProdDebt	0.20	0.33	0.57	0.47
ProdSys	0.44	0.40	0.45	0.55
ProdSoc	0.33	0.22	0.58	0.49
%var	86.1	7.5	4.8	
Instrumental Attitude Belief Products				
IAB1prod	0.25	-0.06	-0.01	0.07
IAB3prod	0.42	0.22	0.48	0.45
IAB5prod	0.64	0.12	0.15	0.45
IAB7prod	0.56	0.09	0.07	0.33
IAB9prod	0.03	0.20	0.24	0.10
IAB11prod	0.11	0.50	0.24	0.31
IAB13prod	0.12	0.49	0.11	0.27
IAB15prod	0.02	-0.12	0.00	0.01
IAB17prod	0.51	0.11	0.27	0.34
IAB19prod	0.55	0.02	0.41	0.47
% var	72.3	17.5	4.8	
Normative Beliefs				
NB1prod	0.53			0.28
NB3prod	0.52			0.27
NB5prod	0.29			0.09
% var	100			
Self-Efficacy Beliefs				
SEB1	0.74			0.54
SEB2	0.41			0.16

SEB3	0.70			0.49
SEB4	0.56			0.32
% var	99.9			
Control Beliefs				
CB1	0.66			0.43
CB2	0.59			0.35
CB3	0.66			0.44
CB4	0.78			0.61
CB5	0.65			0.42
% var	92.1			

Molar Correlations within the Data

Many of the correlations amongst the predictor variables in Table 59 were above 0.5 (e.g. 0.72 between IA1 and IA2). Some of the correlations between predictor and outcome variables were also high (e.g. 0.69 between SI2 and BI2). None of the correlations though have been above 0.9 and so none of them seemed to have indicated any problem with collinearity (Hair et al., 1998, p. 191). Behavioural control tended to have very low or negative correlations with the other variables (e.g. 0.08 between BC1 and BI1). The low correlations between self-efficacy and perceived behavioural control found here were also found in the results of the bush remnants and riparian surveys.

As before, instrumental attitudes and affective attitudes were not correlated sufficiently to expect any problems from collinearity.

Table 59: Correlations between molar and outcome variables of woodlot concepts

BI1	0.02 ns	1														
BI2	-0.01 ns	0.75 ***	1													
IA1	0.04 ns	0.58 ***	0.66 ***	1												
IA2	0.07 ns	0.59 ***	0.63 ***	0.71 ***	1											
IA3	0.01 ns	0.60 ***	0.68 ***	0.75 ***	0.67 ***	1										
AA1	0.00 ns	0.58 ***	0.63 ***	0.69 ***	0.58 ***	0.69 ***	1									
AA2	0.00 ns	0.58 ***	0.55 ***	0.58 ***	0.55 ***	0.64 ***	0.65 ***	1								
SN1	0.03 ns	0.50 ***	0.57 ***	0.43 ***	0.39 ***	0.50 ***	0.40 ***	0.38 ***	1							
SN2	0.04 ns	0.40 ***	0.50 ***	0.54 ***	0.48 ***	0.57 ***	0.57 ***	0.45 ***	0.44 ***	1						
SN3	-0.04 ns	0.43 ***	0.44 ***	0.42 ***	0.51 ***	0.42 ***	0.37 ***	0.37 ***	0.51 ***	0.37 ***	1					
SE1	0.08 #	-0.19 ***	-0.16 **	-0.17 **	-0.25 ***	-0.18 **	-0.22 ***	-0.18 ***	-0.12 *	-0.17 **	-0.21 ***	1				
SE2	-0.05 ns	-0.31 ***	-0.32 ***	-0.32 ***	-0.33 ***	-0.33 ***	-0.34 ***	-0.29 ***	-0.16 **	-0.25 ***	-0.21 ***	0.53 ***	1			
BC1	-0.02 ns	0.08 #	0.04 ns	0.10 #	0.05 ns	0.11 #	0.10 #	0.01 ns	-0.01 ns	0.03 ns	-0.03 ns	0.12 #	-0.05 ns	1		
BC2	0.03 ns	0.03 ns	-0.02 ns	0.02 ns	0.00 ns	0.03 ns	0.03 ns	0.00 ns	-0.02 ns	0.03 ns	-0.03 ns	0.02 ns	-0.07 ns	0.58 ***	1	
SI1	0.08 #	0.59 ***	0.68 ***	0.58 ***	0.55 ***	0.62 ***	0.58 ***	0.46 ***	0.49 ***	0.49 ***	0.37 ***	-0.14 *	-0.28 ***	0.08 #	0.06 ns	1
SI2	0.26 ***	0.42 ***	0.36 ***	0.32 ***	0.30 ***	0.33 ***	0.35 ***	0.27 ***	0.34 ***	0.27 ***	0.20 ***	-0.14 *	-0.21 ***	0.06 ns	0.07 v	0.46 ***
	Behaviour	**BI1**	**BI2**	**IA1**	**IA2**	**IA3**	**AA1**	**AA2**	**SN1**	**SN2**	**SN3**	**SE1**	**SE2**	**BC1**	**BC2**	**SI2**

*Significance of differences between groups, p=<0.0001 ***, p=<0.001 **, p=<0.01 *, p=<0.1 #, not significant =* ns

Molecular Correlations within the Data

All the molecular correlations have been contained in Appendix P Table 84. Most were below 0.5 except for correlations between the two intention measures, some control beliefs, self-efficacy beliefs and an instrumental attitude belief (IAB5).

Correlations between Molar and Molecular Variables

Appendix P, Table 85 has the correlations between molar (direct) and molecular (indirect) measures of the predictor variables. The correlations have varied quite a bit, especially for the relationships between instrumental attitudes and instrumental beliefs. From a correlation of 0.58 between IAB5 and the first attitude question to -0.01 between IAB15 and the second attitude measure.

A similar range in correlations existed for subjective norms. Perceived behavioural control and self-efficacy and their associated beliefs have had low to very low correlations. None of the items with high correlations in the Table did so consistently enough to create a concern about collinearity.

Correlations between TRA Variables

No correlated relationship was found to have existed between peoples' future intentions towards native woodlots and their past behaviour (Table 60). The high proportion of landowners already with native tree woodlots (52%) suggested that many of those people may well have been behaving opportunistically towards the existing bush remnants on their properties rather than deliberately planting and establishing new native woodlots.

The TRA molar predictor variables were moderately to highly correlated with each other and with people's intentions (Table 60). The results for the self-efficacy measures have been reversed from a negative to positive direction so that they have been more consistent with the other measures in the Tables. High scores for self-efficacy has now meant that the behaviour was associated with less complexity and a reduced effort was required for implementation.

Table 60: Correlations between TRA molar (direct) variables

BIm	0.0 ns						
IAm	0.74 ***	0.74 ***					
AAm	0.69 ***	0.69 ***	0.76 ***				
SNm	0.64 ***	0.64 ***	0.67 ***	0.59 ***			
SEm	0.30 ***	0.30 ***	0.34 ***	0.33 ***	0.27 ***		
BCm	0.04 ns	0.04 ns	0.07 ns	0.05 ***	-0.01 ns	0.0 ns	
SIm	0.63 ***	0.63 ***	0.58 ***	0.53 ***	0.53 ***	0.26 ***	0.08 #
	Area in Woodlots	**BIm**	**IAm**	**AAm**	**SNm**	**SEm**	**BCm**

The correlations of behavioural control with the other molar variables have been generally low and not significant from zero.

As would have been expected, the TRA molecular predictor variables, had correlations generally lower than the molar variables (Table 61). Correlations between these variables and behavioural intentions varied between 0.49 and 0.74. The correlations with self-efficacy were already positive because the self-efficacy belief questions were written in the same direction as the other predictor variables. Therefore high scores meant greater confidence and a greater time thinking about the topic. The perceived control beliefs and the self-efficacy beliefs had a much higher correlation with behavioural intentions than did the molar measures of perceived behavioural control and self-efficacy. That was unexpected from theory and from previous applications of the concepts used in perceived behavioural control questions (Aarts et al., 1998). It may have indicated that respondents had difficulty conceptualising how their behaviour was affected by specific control beliefs, or maybe that people avoided indicating that they have a low level of behavioural control. A similar response has previously been identified by Sheeran et al (2002, Armitage and Connor, 2002), see also Sparks et al (1997) for further discussion on similar problems.

Table 61: Correlations between TRA molecular (indirect) variables for woodlots

IABm	0.65 ***			
NBm	0.48 ***	0.32 ***		
SEBm	0.70 ***	0.65 ***	0.45 ***	
CBm	0.75 ***	0.59 ***	0.40 ***	0.60 ***
	BIm	**IABm1**	**NBm**	**SEBm**

Hierarchical Regression Analysis for Behaviour

An initial predictive model was constructed using the non-specific variables collected (see Table 62) to explain the proportion of bush protected. Those included demographic information, farming goals and their relationship to protecting and conserving bush remnants, and people's environmental objectives relating to biodiversity. They have all been considered non-specific variables because they were not directly related to performing the behaviour – establishing and maintaining native woodlots. The full dataset was used and those landowners with no native woodlots were assumed to have zero area (Table 55).

Table 62: Non-specific behavioural variables for establishing and maintaining woodlots

Variable	Description
Occupation	1 = full-time farmer 2 = part-time and other
Gender	1 = male 2 = female
Age	Years
FarmArea	Hectares
Livestock Type	1 = dairy 2 = sheep and/or beef (no dairy) 3 = other (no dairy)
Farm Forestry	1 = farm forestry 2 = livestock (including dairy) 3 – other (no livestock)
Obm	Mean of Objectives 1…4
Goalsm	Mean of Goal products 1…10

Regression results have been shown in Table 63. From the first column with model 1 until model 9 additional variables have been added at each step. The predictive variables have been added in order of enterprise variables, personal variables, non-specific psychology variables and then TRA variables last. In model 9 there have been some non-significant variables and these have been removed in model 10. Each row in the Table has reflected the results for each new variable added at that step. Below that a standard coefficient of determination has been calculated along with an adjusted coefficient so that the results of each step have been able to have been compared. The change in adjusted coefficient has been shown in the Table, along with its significance and that has been used to identify the most parsimonious and effective model. At the bottom of the Table has been calculated the F-test statistic for the regressions and their degrees of freedom.

In Table 63, the models all have R^2 remaining below 10% until models 9 to 11 when the TRA variables have been added. Even with models 9 – 11, the adjusted R^2 has still remained below 10%.

In the Table, farming occupation, farming area, livestock class and the existing involvement in farm forestry (native or exotic), have all made a significant additional contribution to R^2. Adding personal factors including farming goals and biodiversity objectives did not significantly improve the model fit. There has been a small negative not-significant contribution from behavioural intention and a moderate but not significant increase in the coefficient of determination when behavioural control was added. That result for the TRA variables was unexpected. The intention measure in this part of the study related to landowners' actions to establish and maintain native woodlots. It may have been that the personal and psychological variables were simply not consistently specific enough to represent possible opportunistic depictions by land owners of existing native tree remnants as woodlots. Or, maybe the establishment of native woodlots has not been a behaviour sensitive to underlying personal and psychological variables that related to other environmental behaviours?

Table 63: Behavioural regression results for non-specific variables of woodlots

Variable	r	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Occupation		-7.35 .1918	-6.25 .2698	-10.53 .0753	-11.31 .0479	-11.14 .0534	-11.40 .0513	-10.63 .0581	-10.87 .0544	-11.10 .0483	-11.11 .0526	-11.18 .0519
FarmArea	0.07		0.003 .0269	0.003 .0589	0.003 .0530	0.003 .0556	0.003 .0546	0.002 .0779	0.002 .0824	0.003 .0642	0.003 .0392	0.003 .0601
Livestock				9.08 .0176	9.44 .0105	9.42 .0110	9.64 .0100	8.91 .0134	9.09 .0127	8.74 .0160	9.07 .0147	8.68 .0199
Farm Forestry					22.14 <.0001	22.17 <.0001	22.07 <.0001	20.61 <.0001	20.86 <.0001	22.39 <.0001	24.12 <.0001	22.80 <.0001
Gender						-1.28 .7972	-1.85 .7157	-1.06 .8275	-0.96 .8460	-0.94 .8477		-0.68 .8923
Age	0.04						-0.16 .3704	-0.11 .5322	-0.13 .4754	-0.10 .5593		-0.12 .5058
Goalsm	0.54							0.01 .6787	0.01 .7377	0.04 .3684		0.04 .3533
Obm	0.67								-0.005 .9936	0.80 .2888		0.74 .3391
BIm	0.005									-1.13 .0159	-0.56 .1122	-1.49 .0115
CBm	0.75											0.68 .3408
Constant		19.55 .0036	17.11 .0124	7.41 .3493	-3.72 .6358	-2.35 .8140	6.25 .6531	2.90 .8275	3.63 .8155	0.56 .9714	0.21 .9799	-1.08 .9456
R^2		0.37	1.46	2.69	9.74	9.75	9.87	9.49	9.61	10.83	10.31	11.03
R^2 adj		0.15	1.03	2.04	8.94	8.74	8.64	8.03	7.93	8.96	9.30	8.90
ΔR2 adj F-test Compare			0.88 <.05 1->2	1.01 <.05 2->3	6.90 <.01 3->4	-0.20 ns 4->5	-0.30 ns 4->6	-0.91 ns 4->7	-1.01 ns 4->8	0.0002 ns 4->9	0.36 ns 4->10	-0.04 ns 4->11
F regn		1.71 .1918	3.35 .0359	4.15 .0064	12.14 <.0001	9.66 <.0001	8.05 <.0001	6.51 <.0001	5.70 <.0001	5.78 <.0001	10.25 <.0001	5.17 <.0001
Regn df		1	2	3	4	5	6	7	8	9	5	10
Resid df		458	455	455	450	447	441	435	429	428	446	417

The model using non-specific variables with the greatest significant change in adjusted coefficient of determination (R^2) for significant predictor variables was model 4 in the table. That indicated peoples' past implementation of the behaviour related most strongly to them having been farmers, having larger sized farms, not being dairy farmers, and having experience as farm foresters.

Adding behavioural intentions to Model 4 made a nonsignificant improvement to the model (a change in adjusted R2 of +0.36 in Model 10). It was not improved any further by adding control beliefs (in Model 11). A Theory of Reasoned Action (TRA) model structure may not have provided adequate understanding of the likelihood that farmers would establish, maintain and harvest native tree woodlots. In equation 1 the best fitting and most parsimonious non-specific model (model 4) from Table 63 has been displayed.

Equation 1. Regression model for non-specific variables and land owner's native woodlot establishment behaviour

B = 22.14*farm forestry - 11.31*occupation + 9.44*livestock class + 0.003*farm area – 3.72 adjusted R2 = 9%, $F(4, 450) = 12.14$, $p<0.0001$

The regression model in equation 1 had a coefficient of determination of less than 10% with low explanatory power using the existing data set (a low but significant F-test result), and moderate generalisability (four was a low degree of freedom for the regression).

Hierarchical Regression Analysis for Intentions

To determine how much explanatory and predictive power a TRA model would have had of landowners' intentions about establishing and maintaining native woodlots in the future, a number of intention models were analysed (Table 64). The intention models began with the existing area in native woodlots already established as a representation of landowners' past behaviour. Then the TRA variables have been added, until the adjusted R^2 was no longer able to have been significantly improved.

Table 64: Behaviour regression results for TRA molar variables of woodlots

Variable	r (BIm)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Area in Woodlots	0.005	0.001 .907	-0.004 .005	-0.002 .569	-0.002 .598	-0.004 .238	-0.005 .134	-0.008 .014	-0.009 .0103	
IAm **t-test**	0.74		0.82 <.0001	0.57 <.0001	0.45 <.0001	0.32 <.0001	0.26 <.0001	0.25 <.0001	0.27 <.0001	0.26 <.0001
AAm	0.70			0.40 <.0001	0.34 <.0001	0.31 <.0001	0.19 .0005	0.17 .0017	0.18 .0010	0.20 .0002
SNm	0.64				0.29 <.0001	0.20 .0002	0.11 .027	0.09 .0735		
SEBm	0.70					0.29 <.0001	0.20 <.0001	0.15 .0013	0.16 .0003	0.16 .0003
CBm	0.75						0.50 <.0001	0.46 <.0001	0.47 <.0001	0.48 <.0001
SIm	0.64							0.16 <.0001	0.17 <.0001	0.16 <.0001
Constant		8.11 <.0001	-2.07 <.0001	-3.72 <.0001	-4.31 <.0001	-5.00 <.0001	-5.23 <.0001	-5.27 <.0001	-5.18 <.0001	-5.26 <.0001
R^2		0.00	54.62	58.77	61.43	65.29	71.99	73.16	72.96	73.06
R^2 adj		-0.002	54.42	58.49	61.08	64.90	71.61	72.73	72.59	72.76
ΔR^2 adj **F-test** **Compare**			54.63 <.01 1->2	4.07 <.01 2->3	6.19 <.01 3->4	3.82 <.01 4->5	6.71 <.01 5->6	1.12 <.01 6->7	0.14 ns 7->8	-0.17 ns 8->9
F regn		0.01 .907	273.17 <.0001	210.98 <.0001	176.38 <.0001	165.90 <.0001	188.05 <.0001	170.52 <.0001	197.41 <.0001	244.10 <.0001
Model df		1	2	3	4	5	6	7	6	5
Resid df		460	454	444	443	441	439	438	439	450

For Model 8 PRESS was 3940.29 and PRESS RMSE was 2.97 compared to SSE of 3773.94 and RMSE of 2.93, so the model has provided a good fit.

The TRA variables have been added in the following order: instrumental attitudes, affective attitudes, subjective norms, self-efficacy (beliefs), perceived behavioural control (beliefs) and self-identity. In the Table, the F-test for the changes in adjusted R^2 evaluated whether by adding variables to the previous column's model there had been a significant improvement in R^2.

As might have been expected from the previous results, in Table 64, the previous area in native woodlot has made a small and generally not-significant contribution to having been able to predict landowner's future intentions. It has been important to note though that the area in woodlots has made a larger contribution (although negative) than expected from its zero-order correlation. That has occurred especially after self-identity was added in model 7. The effect may have been due to the area in woodlots having had an overlapping influence with the TRA variables, especially with self-identity and therefore creating a suppressor effect.

As each TRA variable has been added to the regression model, the amount of variance in intentions able to have been explained has been increased. In model 7, all the TRA variables have been included but the term for subjective norms has not been significant. When that term has been removed along with previous behaviour (area in woodlots) there has been no significant decrease in predictive power. That has made model 9 the most parsimonious explanatory model to use. Model 9 has indicated that landowners' intentions have been highly influenced by their control beliefs. They have also been influenced by their instrumental attitudes and affective attitudes, as well as their self-efficacy and self-identity (equation 2).

Equation 2. Regression model for land owner's native woodlot establishment intentions including TRA molar variables

BI = 0.48*CBm + 0.26*IAm + 0.20*AAm + 0.16*SEBm + 0.16*SIm - 5.26

adjusted R^2 = 72.76%, $F(5, 450) = 244.10$, $p<0.0001$

Interactions between TRA Predictor Variables

To test for the presence of interactions in the selected regression model shown in equation 2, partial products of the TRA variables were mean centred and included in the full regression model one at a time (Table 65). All the interactions were significant, particularly between affective attitudes and self-efficacy.

The interactions of affective attitudes and self-efficacy, of control beliefs and self-efficacy, and of instrumental attitudes and self-efficacy added significantly to the variance explained by equation 2. That has suggested that the amount of confidence that people had about obtaining their desired result from establishing native tree woodlots was also associated with how they felt emotionally towards them, the likely benefits that were to be had and the amount of control they had over their actions.

Table 65: Regressions with interactions for woodlots

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
IAmc	0.26 <.0001	0.31 <.0001	0.34 <.0001	0.34 <.0001	0.32 <.0001	0.27 <.0001	0.28 <.0001	0.28 <.0001
AAmc	0.20 .0002	0.23 <.0001	0.18 .0004	0.20 <.0001	0.18 .0007	0.22 <.0001	0.28 <.0001	0.19 .0003
SEBmc	0.16 .0003	0.14 .0013	0.16 .0003	0.14 .0011	0.16 .0003	0.20 <.0001	0.15 .0006	0.17 .0002
CBmc	0.48 <.0001	0.48 <.0001	0.46 <.0001	0.45 <.0001	0.47 <.0001	0.47 <.0001	0.45 <.0001	0.48 <.0001
SImc	0.16 <.0001	0.15 <.0001	0.17 <.0001	0.16 <.0001	0.16 <.0001	0.16 <.0001	0.15 <.0001	0.16 <.0001
IAmc* AAmc		0.03 <.0001						
IAmc* SEBmc			0.04 <.0001					
IAmc* CBmc				0.01 <.0001				
IAmc* SImc					0.02 <.0001			
AAmc* SEBmc						0.04 <.0001		
AAmc* CBmc							0.05 <.0001	
AAmc * SIm								0.03 <.0001
Constant	-5.26 <.0001	-0.50 .0018	-0.6 .0002	-0.53 .0008	-0.33 .0344	-0.54 .0004	-0.50 .0014	-0.27 .0682
R^2	73.06	75.02	75.42	75.46	74.32	75.90	75.39	74.28
R^2 adj	72.76	74.69	75.10	75.13	73.98	75.59	75.06	73.94
ΔR^2 adj **F prob** **Models**		1.93 <.01 1->2	2.34 <.01 1->3	2.37 <.01 1->4	1.22 <.01 1->5	2.83 <.01 1->6	2.30 <.01 1->7	1.18 <.01 1->8
Regn F prob	244.10 <.0001	224.76 <.0001	229.66 <.0001	230.07 <.0001	216.66 <.0001	235.78 <.0001	229.25 <.0001	216.14 <.0001
Df	5	6	6	6	6	6	6	6
Resid df	450	449	449	449	449	449	449	449

Table 65 continued

Variable	Model 9	Model 10	Model 11
IAmc	0.28 <.0001	0.31 <.0001	0.29 <.0001
AAmc	0.20 <.0001	0.20 .0001	0.20 <.0001
SEBmc	0.20 <.0001	0.12 .0074	0.16 .0002
CBmc	0.46 <.0001	0.48 <.0001	0.46 <.0001
SImc	0.15 <.0001	0.16 <.0001	0.16 <.0001
SEBmc *CBmc	0.05 <.0001		
SEBmc *SImc		0.02 <.0001	
CBmc *SImc			0.04 <.0001
Constant	-0.58 .0003	-0.36 .0240	-0.41 .0068
R^2	75.68	74.26	75.03
R^2 adj	75.35	73.91	74.69
ΔR^2 adj **F prob** **Models**	2.59 <.01 1->9	1.16 <.01 1->10	1.93 <.01 1->11
Regn F prob	232.81 <.0001	215.93 <.0001	224.80 <.0001
Df	6	6	6
Resid df	449	449	449

Multicollinearity and Suppressor Check

The presence of suppressor variables was checked by comparing the multiple regression coefficients with the zero-order correlations in Table 60. As previously discussed, a suppressor effect appeared to exist between the area in woodlots and the TRA variables.

Collinearity was tested by regressing in turn each predictive variable in the TRA against all the other predictive variables and calculating the tolerance value (Hair et al., 1998, p. 191). A tolerance threshold of 0.19 can have been obtained at the point where multiple correlations between one predictive variable and all the others would have been likely to exceed 0.9. That value was consistent with the value used to assess the presence of multicollinearity in Table 59. The results of Table 66 have shown that little collinearity was likely.

Table 66: Tolerance values for predictive variables for woodlots

Variable	Tolerance
Area in Woodlots	0.93
IAm	0.29
AAm	0.38
SNm	0.47
SEBm	0.38
BCm	0.50
SIm	0.51

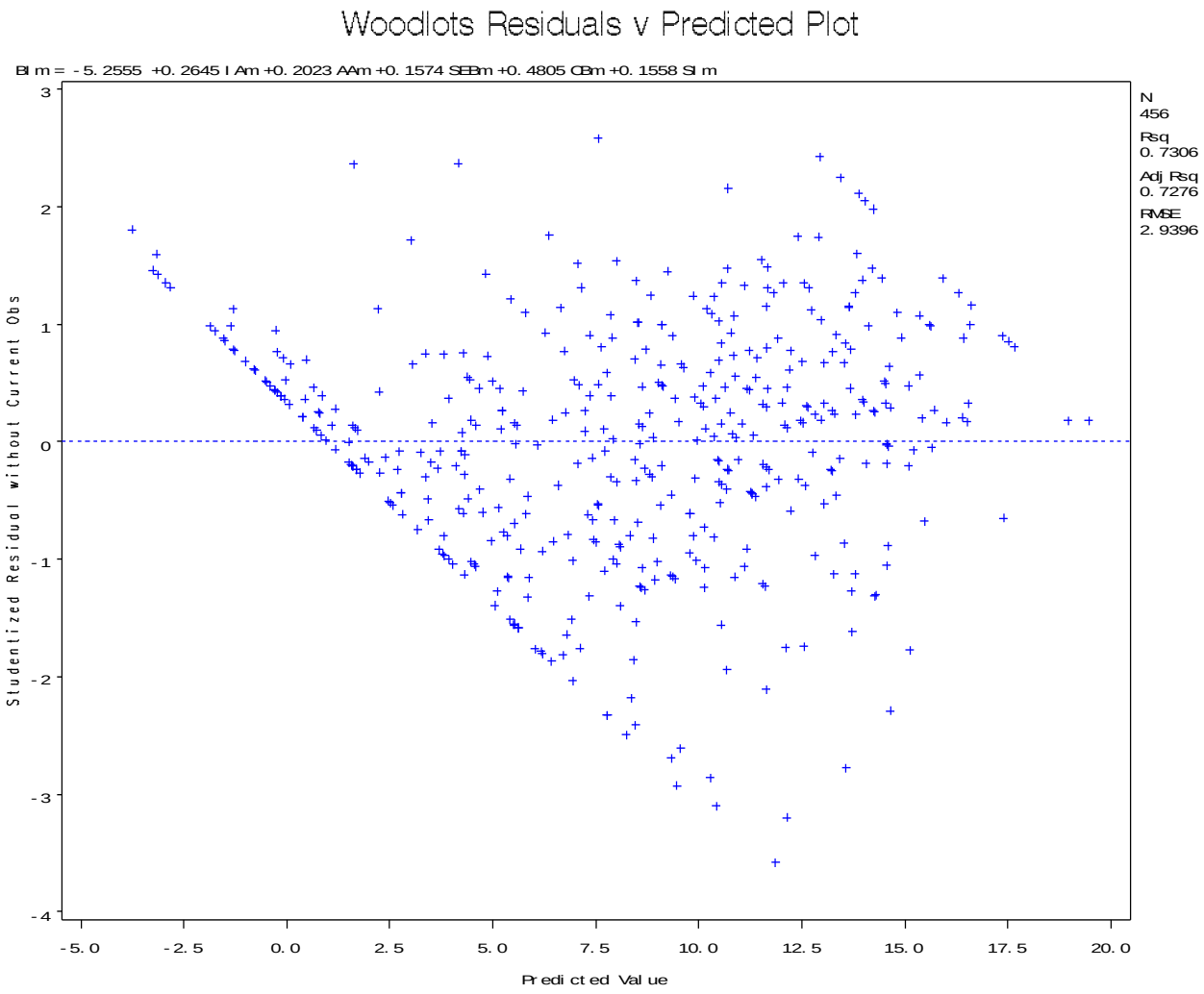
Multiple Regression Residuals

Regression residuals from equation 2 were plotted against predicted outcome results (Hair et al., 1998, p. 173). Two outliers with large standardised residuals (3.74, 4.22) were identified and excluded from the analyses. Those were IDs 6050 and 6222 respectively.

In Figure 8, the residuals from the regression model in equation 2 were not evenly spread across the range of the independent variable representative of a non-normal distribution. The diamond pattern in the graph results represented a greater variation for results in the middle range of the regression than at either end. The results were however; consistent with the non-normal data collected for each of

the regression predictive variables and described earlier (Appendix O, Table 83). The overall regression equation has been assumed to have been linear.

Figure 8: Scatter plots of residuals (studentized) against independent variables and fitted values for woodlots



Molecular Regression Analysis for Intentions

To test the TRA regression in equation 2, the molecular (indirect) measures were used in place of the molar variables. The results have been shown in Table 86 of Appendix Q. The best fitting model was model 6 (equation 3). As expected, the range of coefficients of determination remained below those for the molar model (compare equations 2 and 3).

The most obvious difference between the two models was that the influence of instrumental beliefs had become relatively insignificant ($P<0.1$) suggesting that the set of beliefs that had been used were not well specified in relation to the attitude measures.

Equation 3. Regression model for land owner's intentions for establishing and maintaining native woodlots, including TRA molecular variables

BI = 0.51*CBm + 0.34*AAm + 0.25*SEBm + 0.17SIm - 5.23

Adjusted R^2 = 71.10%, F(4, 451) = 280.84, $p<0.0001$

Comparison between Landowners Likely or Unlikely to Establish and Maintain Indigenous Woodlots

Non-specific Variables Associated with Establishing and Maintaining Indigenous Woodlots

To understand how policy interventions have affected peoples' intentions and so their behaviour, the complete sample of landowners was separated into two groups (shown in Table 67). Group 1 included those landowners likely to have considered establishing and maintaining native woodlots, with intentions above the mean for intentions (BIm = 8.2). Group 2 was those landowners unlikely to have considered establishing and maintaining native woodlots, with intentions equal to or below the mean for intentions. The landowners most likely to have considered establishing native woodlots had the smallest existing area in woodlots but the difference between the two groups was not significant. So, their future intentions have not been able to have been determined from their past behaviour.

Table 67: Numbers of respondents likely or unlikely to establish and maintain indigenous woodlots

	Group 1	**Group 2**
Selection Criteria	Above the mean for intentions	Below the mean for intentions
Number of Respondents	228	245
Mean for Intentions (20 point scale, 20 was high)	13.2	3.5
t Value for the difference in intentions between Groups 1&2	37.26***	
Area of native woodlots already established (ha)	9.8	12.4
t Value for the difference in the area between Groups 1&2	-0.69^{ns}	

Similar proportions of part-time or non-farmers existed in both groups. The two groups showed no significant differences in their farming area, and livestock enterprise, although the most likely group tended to have larger properties (497ha compared to 308 ha). The two groups also had no significant differences in gender or age. The group of landowners most likely to have considered establishing native tree woodlots tended to have already been farm foresters (58% of farm foresters were likely to have established new woodlots over the following twelve months compared to 36% of non-foresters, $p<0.0001$).

Both groups of landowners indicated that they were seeking similar levels of satisfaction from their farming goals (Table 68). Farmers most likely to have considered establishing native woodlots rated "looking after nature" more highly, and also "creating increased opportunities for future farmers". Farmers least likely to have considered establishing new native woodlots placed greater emphasis than other farmers on "producing to maximise farming profits".

Table 68: Farming goals associated with establishing and maintaining indigenous woodlots

Farming Goals	**Weights**		**Association**		**Overall Influence**	
	Intentions		Intentions		Intentions	
	High	Low	High	Low	High	Low
Build a valuable farming business	17.1	17.2 ^{ns}	4.0	-1.1	67.5	-20.3 ***
Produce to maximise farming profits	16.6	17.2 $^{\#}$	2.9	-1.6	49.3	26.6 ***
Be self-reliant in decision-making	17.2	16.9 ^{ns}	3.0	-0.5	54.2	7.8 ***
Look after nature	17.8	16.8 **	6.9	3.8	125.0	66.7 ***
Be valued in my community	15.6	14.6 $^{\#}$	4.1	1.2	70.0	20.5 ***
Create increased opportunities for future farmers	16.1	14.9 **	4.8	1.1	82.0	17.5 ***
Have variety in my work	16.7	15.9 $^{\#}$	4.9	1.9	87.1	32.6 ***
Pay off debts	16.6	16.6 ^{ns}	1.5	-1.9	28.6	-29.4 ***
Maintaining a stable farming system	17.6	17.7 ^{ns}	4.1	0.6	74.5	9.9 ***
Have time available for socialising with family and friends	17.0	17.1 ^{ns}	1.8	-0.8	32.6	-13.6 ***
Scale	*0-20*	*0-20*	*0-10*	*0-10*	*0-200*	*0-200*

*Significance of differences between groups, p=<0.0001 ***, p=<0.001 **, p=<0.01 *, p=<0.1 $^{\#}$, not significant = ^{ns}*

Farmers most likely to have considered establishing native woodlots believed that they would enhance the full range of their farming goals. However, the low intention farmers believed that native woodlots would have conflicted with goals such as "improving the farming business", "farming profitably", "being self-reliant in decision making", "paying-off debts" and "socialising" (Table 68).

The farming goals with the most influence upon landowners' intentions towards establishing native woodlots were their goals for "building a valuable farming business" and "maximising farming profits". The landowners most likely to have considered establishing native woodlots were those that had identified how they might have contributed to realising those outcomes. The landowners least likely to have considered establishing woodlots believed that they would have made their farms less profitable and reduced the value of their businesses.

Instrumental Beliefs Associated with Establishing and Maintaining Indigenous Woodlots

Table 69 has listed all the instrumental beliefs included in this study and compared their influence upon landowners with low and high intentions. The scales have been converted to bipolar scales for that comparison as has been standard TRA practice. The attitudes of landowners were (not surprisingly) significantly different between those likely to have considered establishing and maintaining native woodlots and those unlikely to. In a similar way, high-likelihood landowners had more affective attitudes (i.e. less anxious and frustrated, and more confident and contented) and feelings of self-identity consistent with the desired behaviour (i.e. being a concerned person already taking more action than most other landowners).

The list of beliefs in the Table has been presented in order of their overall influence on landowner behaviour from highest to lowest. The greyed out rows have represented beliefs about the negative consequences associated with the behaviour. Both groups of landowners placed a lot of weight in their decision making upon the expected consequences to "improve farm profitability", "increase the farm's value", and "improve landuse". Landowners likely to have considered establishing woodlots placed more decision making weight than the

others upon being able to “increase wildlife habitats” and “improve the aesthetic appearance of the farm”.

Landowners that were least likely to have considered establishing woodlots based more of their decision making upon “creating extra costs” and “creating extra work”.

Both groups of landowners believed that the characteristics most associated with establishing native woodlots were “increasing wildlife habitat” and “improving the aesthetic appearance of the farm”. Also, “creating extra costs” and making “extra work”. The difference between the two groups was that landowners most likely to establish woodlots considered them to “improve the aesthetic appearance of the farm” more than other people, and “increase the farm’s value” which other people didn't. They also considered that its negative effect upon “profitability” would have been small.

The beliefs that had the most overall influence upon landowners’ intentions were the expected ability of establishing native woodlots to have “improved the aesthetic appearance of the farm”, “created extra costs” and “increased wildlife habitat”. To have encouraged behaviour change, policy interventions would have had to have been developed that increased further decision making weight in woodlot establishment, upon all those criteria. Policy interventions would also have been needed that increased the association between establishing woodlots and improving a property’s aesthetic appearance and so have added to that belief’s influence upon landowner’s attitudes towards that behaviour.

Normative Beliefs Associated with Establishing and Maintaining Indigenous Woodlots

Landowners with high-intentions were influenced by subjective norms for establishing native woodlots more than landowners with low intentions (Table 70). Only the scales for the concept weights have been converted to bipolar scales for that comparison as has been standard TRA practice.

Landowners that intended to establish native woodlots considered that their actions would have been supported by their families but opposed by their friends and government experts. Landowners with unlikely intentions to establish native

woodlots considered that their actions would have been consistent with the expectations of family, friends and experts.

Overall, the biggest difference between the two groups was that landowners with high intentions expected positive support from their families for doing so, in much greater measure than those people with low intentions were supported by their families.

Control and Self-Efficacy Beliefs Associated with the Protection of Woodlots

Both groups of landowners had high levels of perceived behavioural control and self-efficacy (>10 in Table 71). That has meant that they considered that they generally had decision making control on the establishment of native woodlots and could have acted upon their intentions.

The key differences between the two groups was that low-intention landowners thought that they had insufficient time, ability and encouragement to do the work of establishing and maintaining native woodlots. In comparison, high-intention groups were more likely to have been already thinking about establishing native woodlots, and thinking as well that it would add to the sustainability of what they were doing.

Table 69: Instrumental beliefs associated with establishing and maintaining indigenous woodlots

Instrumental Beliefs	**Weights**		**Association**		**Overall Influence**	
	Intentions		Intentions		Intentions	
	High	Low	High	Low	High	Low
Instrumental Attitudes towards protecting bush remnants					15.8	9.6 ***
Affective Attitudes towards protecting bush remnants					14.3	9.5 ***
Self-Identity about protecting bush remnants					13.1	7.8 ***
Scale for attitudes					*0-20*	*0-20*
Improve the aesthetic appearance of the farm	6.6	4.2 ***	7.1	2.8 ***	51.2	14.8 ***
Create extra costs	3.2	6.0 ***	-5.5	-6.4 #	-18.9	-42.3 ***
Increase wildlife habitat	5.7	1.7 ***	6.7	4.5 ***	42.4	13.5 ***
Improve farm profitability	6.2	6.9 ***	-1.1	-4.9 ***	-3.4	-36.6 ***
Increase the farm's value	6.3	5.8 ns	4.3	-0.4 ***	29.7	-6.8 ***
Improve landuse	6.2	5.7 #	2.7	-2.8 ***	20.1	-14.1 ***
Risk of not being allowed to harvest	1.0	2.9 **	-2.8	-4.2 *	-10.1	-20.8 ***
Produce good quality wood	3.7	1.9 ***	2.5	1.1 *	16.2	12.4 ns
Create extra work	0.7	3.8 ***	-3.3	-4.3 #	-1.6	-19.2 ***
Not be useful to my generation	-5.4	-4.7 #	-0.3	-0.7 ns	-0.3	-0.7 ns
Scale for Beliefs	*0-10*	*0-10*	*0-10*	*0-10*	*0-100*	*0-100*

*Significance of differences between groups p=<0.0001 ***, p=<0.001 **, p=<0.01 *, p=<0.1 #, not significant = ns*

Table 70: Normative beliefs associated with intentions towards the protection of bush remnants

Subjective Norms	**Weights**		**Association**		**Overall Influence**	
	Intentions		Intentions		Intentions	
	High	Low	High	Low	High	Low
					12.3	7.7 ***
Scale for Subjective Norm					*0-20*	*0-20*
Influence of family	10.0	7.3 ***	2.1	-4.0 ***	31.4	-20.3 ***
Influence of friends	4.4	3.3 *	-0.5	-4.8 ***	0.9	-10.1 ***
Influence of government experts	7.8	6.7 ***	-1.0	-2.9 *	-2.8	-15.2 *
Scale for Beliefs	*0-20*	*0-20*	*0-10*	*0-10*	*0-200*	*0-200*

*Significance of differences between groups, p=<0.0001 ***, p=<0.001 **, p=<0.01 *, p=<0.1 #, not significant =* ns

Table 71: Control and self-efficacy beliefs associated with intentions towards woodlots

Belief Concepts	**Association**	
	Intentions	
	High	Low
Perceived Behavioural Control	16.6	16.6 ^{ns}
Enough time available	11.2	4.9 ***
Enough funds	10.5	6.1 ***
Enough abilities	12.4	6.7 ***
Enough encouragement	11.4	5.7 ***
Enough knowledge	12.1	7.6 ***
Self-Efficacy (reversed)	12.0	14.3 ***
I am confident of the result	15.3	10.0 ***
It fits with my ideas of sustainability	14.3	8.3 ***
I often think about it	14.9	7.3 ***
I am very supportive	17.1	12.3 ***
Scale for beliefs	*0-20*	*0-20*

*Significance of differences between groups, p=<0.0001 ***, p=<0.001 **, p=<0.01 *, p=<0.1 $^{\#}$, not significant =* ^{ns}

Summary of Research from Establishing and Maintaining Indigenous Woodlots on Farms

A third survey on the management by farmers of indigenous woodlots was sent in 2002 to a sample of 1600 farmers. It had a response rate of 30%, the highest for all three surveys. Respondents included a high proportion of dairy farmers and had a greater average farm area than the population statistics.

Over half the respondents stated that they had a native tree woodlot on their properties. This was a surprising result because it could take 60-100 years before newly planted indigenous trees might be ready for harvest compared with 25-30 years for exotic trees such as pines. Usually farmers have avoided such extended pay-back periods. To harvest native trees requires that a sustainable management plan be registered with MAF, something not required if exotic trees are being harvested. It could have been possible that some landowners with mature bush remnants on their properties might have wished to harvest some of the trees within them. Except for the time-scales involved, an intention to harvest existing bush remnants opportunistically in a sustainable way would have been practically the same as harvesting a woodlot also in a sustainable way. However, in this study, the focus was upon landowners deliberately introducing, establishing and maintaining woodlots 'from scratch'. It is possible that some landowners might not have distinguished between an opportunistic intention to select for harvest and a deliberate intention to establish for harvest.

An indication of how big this problem might have been for the survey has been that 21% of respondents (n=52) described one of their farming activities as "farm forestry". This group of respondents were most likely to have made deliberate decisions about their intentions towards woodlot establishment. Of these, 32 respondents stated that they had one or more indigenous woodlots, or 13% of the total number of respondents. That proportion is closer to what was expected.

A second concern with this data-set was that the correlation between the area in indigenous woodlots and peoples' future intentions towards woodlot establishment was zero ($r<0.01$). That compares with moderately strong correlations with preserving bush remnants ($r=0.4$) and riparian protection ($r=0.39$) for similar relationships. It was not surprising then when introducing

intentions to the non-specific model of human behaviour that it made a small not-significant improvement (from R2=8.9 – 9.3).

The intentions model was a lot more explanatory than the behavioural model (R2=73%). In the intentions model, using the existing areas in indigenous trees as a variable representing past behaviour made a small and insignificant contribution to each of the models in the TRA regression analysis. The existing areas in woodlots also provided a suppressor effect on some of the TRA variables in some regressions. In the intention model control beliefs, instrumental attitudes, affective attitudes, self-efficacy and self-identity were all important. Convergent validity was satisfactory for all the concepts (C.Alpha>0.7) but marginal for self-identity (C.Alpha=0.62). Discriminant validity was good for all the variables (single factor loading>0.5).

All the molar variables in the woodlot intention models displayed interactions. This suggests that peoples' underlying psychological beliefs may have been very unstable. Collinearity did not appear to be an important factor and the TRA regressions had residuals consistent with a linear relationship in the data.

The molecular TRA model supported the molar TRA model except that instrumental beliefs did not make as significant a contribution as would have been expected from the attitude results in the molar model. That may have been partly due to some of the low correlations (r=0.26 to 0.66) between some of the belief measures and attitudes.

When the beliefs of people likely to establish and maintain woodlots were compared with those unlikely to do so, there were a number of differences. The most influential beliefs upon landowner intentions were about the aesthetic appearance of their properties, extra costs, and increased wildlife habitat.

Chapter 10. Conclusions

The project was begun with five research questions. They were to: identify a suitable human behaviour model for policy makers, calculate the levels of prediction possible, determine the model fit to various stakeholder groups, evaluate the importance of attitude measures to policy making, and compare the results for different groups of stakeholders likely to be compliant and non-compliant.

Three practices involving the restoration of indigenous vegetation were examined. These were the protection and conservation of bush remnants, fencing and planting riparian areas, and establishing and maintaining woodlots. Compared to using non-specific (or external factors) alone, the TRA models of each practice were able to "*explain landowner environmental behaviour ...*" (research question one) by including measures of past behaviour, instrumental attitudes, affective attitudes, subjective norms, self-identity, self-efficacy and control beliefs.

When the results of the three practices were compared, the models based upon external (non-TRA) variables were able to explain 3 – 9% of the variation in peoples' implementation of the practices. That level was low but not an unexpected result given the complexity of these behaviours and the similarity of the results to other cross sectional studies examining other behaviours (Sheeran, 2002; Sutton 1998). The variables contained in non-TRA models were able to provide information from farmers' contexts and gave some understanding of the decision making of landowners.

For all of the models, the livestock class being farmed was consistently associated with whether or not landowners had restored indigenous vegetation on their properties. Dairy farmers, with smaller sized properties than dry-stock farmers and more intensive livestock systems in this study, were more likely to have protected any remaining bush remnants and fenced and planted riparian areas, on their properties. They were the group least likely to have established indigenous woodlots on their properties.

Respondent occupation was also found to be associated with the uptake of the practices. Part-time farmers and lifestyle landowners were more likely than commercial farmers to have planted riparian areas on their properties, but less

likely to have established woodlots. Like dairy farmers, part-time and lifestyle farmers may have considered that they had less area available to take out of productive landuse unless they had too.

The models based upon the non-specific or external variables were[12]:

1. Bush protection, %P = -11.38*livestock class + 2.87*environmental objectives + 24.59
   adjusted R^2 = 7.7%, F(7,377) = 5.58, p<0.0001

2. Riparian planting, %R = 9.23*occupation – 4.81*livestock class + 0.04*goals + 11.47
   adjusted R^2 = 2.9% F(3,582) = 6.76, p<0.0001

3. Woodlot establishment, areaW = 22.14*farm forestry – 11.31*occupation + 9.44*livestock class + 0.003*farmarea – 3.72
   adjusted R^2 = 8.9%, F(4,450) = 12.14, p<0.001

The non-specific behavioural variables used in this study were able to provide policy makers with some indication of the contextual factors influencing landowner behaviour, but their predictive ability was still limited. However, when a measure of peoples' future intentions was added to the non-specific variables, the predictive capability reached almost 10% or higher. Following the inclusion of intentions, the adjusted regression coefficients were 9%, 13% and 17% for woodlot establishment, riparian management and bush remnant protection respectively.

For two of the practices studied (bush protection and riparian planting), the relationship between intentions and behaviour was stronger than that between any of the non-specific (or external) variables and the behaviour. For the third practice of woodlot establishment, by including intentions and the TRA variables there was a non-significant improvement in the ability to explain behaviour.

[12] %P = percentage of bush already protected, %R = percentage of the riparian area already planted, areaW = the area (ha) already in indigenous woodlots

The three TRA models were[13]:

1. Bush protection, r(P & BI) = 0.4; BI = 0.02*%P + 0.55*CBm + 0.36*IAm + 0.10*SEm + 0.22SIm – 1.92
   adjusted R^2 = 56.31%, F(5,399) = 105.14 p<0.0001

2. Riparian planting, r(P & BI) = 0.37; BI = 0.03*%P + 0.28*CBm + 0.27*IAm + 0.26*SNm + 0.18*SEBm – 3.17
   adjusted R^2 = 66.54%, F(5,575) = 231.72 p<0.0001

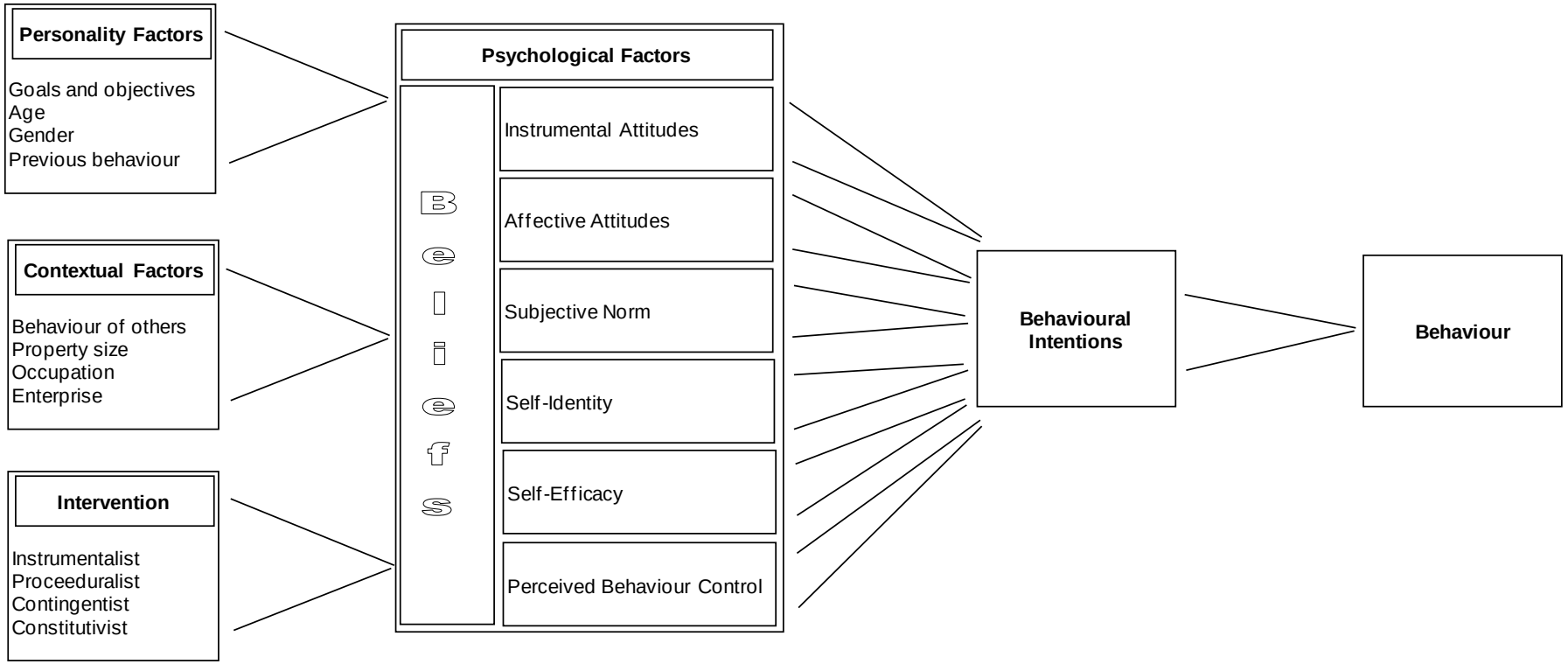
3. Woodlot establishment r(P & BI) = 0.005; BI = 0.48*CBm + 0.26*IAm + 0.20*AAm + 0.16*SEBm + 0.16*SIm -5.26
   adjusted R^2 = 72.76%, F(5,450) = 244.10, p<0.001

In this study the proposed model structure for guiding policy makers incorporating TRA variables is shown in Figure 9. That can be compared to the original TRA model described in Figure 2. The proposed model includes the external influence of non-specific variables such as personality, decision context and policy interventions upon intentions and then behaviour. In Figure 9, the influence of these variables has been mediated through the psychological factors associated in this study with the Theory of Reasoned Action. The addition of perceived behavioural control as a moderator of intentions upon behaviour (found in the Theory of Planned Behaviour) was not been required for the behaviours being considered here.

The levels of "*prediction about land owner responses to a policy programme*" (research question two) was assessed by measuring how well a TRA model could describe the factors influencing human behaviour using the results for the coefficients of determination for behavioural intention. For the examples in this study they ranged from 56 – 73%.

[13] P = practice e.g., bush protection
BI = behavioural intention
IAm = the mean of the measures for instrumental attitudes
AA = affective attitudes
CBm = the mean of the measures for control beliefs
SNm = the mean of subjective norms
SEm = the mean of the measures for self-efficacy
SEBm = the mean of the measures for self-efficacy beliefs
SIm = the mean of the measures for self-identity

Figure 9: Proposed model for describing natural resource behaviour by landowners



Those results can be favourably compared with TRA estimations in studies about condom-use which commonly have results which vary between 16 – 69% (Sheeran and Taylor, 1999).

A study of riparian practices and the TRA in the USA achieved a coefficient of determination of 21% (Corbett, 2002) and a study of riparian practices and the TRA in Queensland achieved 54% (Table 72).

The similarity of the results in this study with overseas examples suggest that the TRA can provide natural resource managers with estimations about peoples' behaviour that can be comparable between jurisdictions and at a similar level to other behavioural issues of concern to policy makers e.g., safe sex.

The TRA can "*distinguish between the policy-intervention needs of different landowner stakeholder groups*" (research question three). In the multivariate analyses of non-specific variables, landowners that were more likely to have used the practices were lifestylers (rather than farmers); dairy farmers rather than other-livestock farmers and landowners who could associate the practices with their own property management goals.

Table 72: TRA variables associated with riparian protection practices in Pacific countries

New Zealand (this study)	Australia (Queensland)[1]	United States (Utah)[2]
past behaviour	past behaviour	past behaviour (fencing)
behavioural control	benefit likelihood	past participation (in government programmes)
instrumental attitudes	willingness to comply with salient referents	information exposure (self measure of exposure)
subjective norms		social norms (water)
self-efficacy		

[1] *Fielding et al., 2005* , [2] *Corbett, 2000*

Typing landowners based upon their farming goals was well suited to distinguishing between the natural resource preferences of landowners. Landowners not able to link the natural resource practices and their business,

production or profit goals tended to have been in the group least likely to use the practices. Landowners that put a relatively high weighting upon their "looking after nature" goal or who could see a strong link between the natural resource practices and their other farming goals were more likely to use the practices.

This study was concerned with assessing the contribution of "*landowners' values, attitudes and beliefs*" to their behaviour (research question four). The research results have enabled comparisons to have been made between different natural resource practices and between; non-specific variables, molar TRA variables, and molecular TRA variables.

In all three practices the ability to understand and estimate peoples' behaviour was improved by adding TRA variables to the non-specific variables. That has supported the contention that the non-specific (and external) variables have been mediated through psychology concepts such as beliefs, attitudes and subjective norms (Eagly and Chaiken, 1993, p. 172). The regressions based upon the molar TRA variables provided good ability to estimate the likely use of the practices. In addition, regressions based upon the molecular TRA variables indicated that there was a high level of explanatory power available through carrying out univariate analyses comparing the differences between high and low intention groups.

Landowners were most influenced by the consequences of the practices upon the attractiveness of peoples' properties, their capital value, their productivity and any changes in the type of wildlife habitat available. They wanted to be confident about achieving their intended natural resource outcomes; any new practices had to fit with their ideas about farming sustainably and they responded to being able to "mull-over" the new possibilities in their mind for a while. Landowners were more likely to be favourable towards the different practices if they already thought of themselves as potential users and if they considered themselves to have made a bigger effort towards natural resource management than other people. People were less likely to have changed in favour of the desired practices if they lacked sufficient time, funds or ability for a successful change. These results have shown that the TRA could provide policy makers with very specific information for encouraging behaviour change to address practices associated with the restoration of indigenous vegetation.

Using the TRA, policy makers would have been able to describe the "*immediate antecedents to landowners' behaviour and how [they could be used to] lead to the behaviour changes desired by natural resource policy groups*" (research question five). The TRA models included key psychological variables such as instrumental attitudes and self-efficacy that could have been used to provide the focus of any policy strategy.

Taking the results to the research questions overall, this study has shown that the Theory of Reasoned Action provides a robust basis for developing psychological models that can be used for explaining and predicting human behaviour on natural resource issues. The models can be used for developing policy strategies that will encourage behaviour change to increase the areas on private land that contain planted and protected indigenous vegetation.

As well as the planned research questions, there were some additional areas of learning in this study. Examining the TRA and other cognitive psychology theories in this project provided insights into understanding the complexity of human nature, particularly the way that people make sense of their operating context and rationalise their motivations for behaving in certain ways. Although peoples' behaviour may have appeared to be highly idiosyncratic, this project has shown that when their immediate psychological antecedents have been included in a study, there can be enough similarity across groups of people to guide the design of policy interventions.

For people wishing to use the TRA (and its variants) in detailed studies of human behaviour it seems to be important to ensure that a surfeit of variables have been included so that the regression analyses can make visible those variables that may actually be needed to achieve the desired levels of explanatory power and parsimony.

Not all the questions in the surveys used in this project turned out to be measuring the expected variables, even after first subjecting them to a rigorous peer review and pilot testing. Having three different measures of each variable made the questionnaires lengthy and tedious for some respondents, but it did enable the internal consistency and external discrimination of the measures to be tested.

Including a qualitative stage in the project provided an excellent resource for developing the TRA measures. Taking a systems approach in that part of the study assisted the results by ensuring consistency across different focus groups and interviews.

Comparing the results of the woodlot survey with that for bush remnant conservation and riparian planting again highlighted the importance of ensuring that the behaviour and intention measures were specific and comparable. If they have not been aligned enough, then this study has shown that the behavioural explanatory models can be unstable.

For researchers developing new studies into the application of the TRA, if their research has been focussed upon explaining intentions then cross-sectional surveys (like these ones) may be satisfactory. However, if it was desired to link intentions to behaviour and explain that behaviour it may be that a longitudinal survey will provide them with greater explanatory power.

Those five lessons may be of value to the other researchers that follow after this study–

- Designed redundancy in the TRA variables
- Including at least three measures of each variable of importance
- Taking a comprehensive approach to systematically collecting belief information
- Ensuring that the description of behaviours and intentions are comparable
- Using longitudinal studies to examine behaviour if that is the primary focus of the research.

Chapter 11. Implications for Use of the Theory of Reasoned Action in Natural Resource Policy Design and Implementation

The Role of Regional Policy Statements

The results provided in this study (along with other similar research; Fielding et al., 2005) indicate that models of human behaviour developed using the TRA can be used to provide policy makers with information about the specific factors motivating landowners in natural resource management.

When applied in conjunction with an understanding of communication approaches (Petty and Cacioppo, 1986; Small et al., 2002) and the processes of behaviour change (Courneya et al., 2001) they have the potential to assist policy agencies at a central and regional level to develop effective policy intervention strategies. Such strategies would incorporate the needs of affected public groups, be specific about the behaviour changes desired by the policy agency and be supported by empirical evidence and associated TRA theory.

Every regional council is directed in the Resource Management Act (New Zealand Government, 1991) to produce a regional policy statement guiding its actions (and those of other local authorities) and to make the regional policy statement publicly available. The purpose of a regional policy statement is to provide "an overview of the resource management issues of the region and the policies and methods to achieve integrated management of the natural and physical resources of the whole region" (ibid, part 5, section 59). Once the overarching policy structure has been established in a regional policy statement it can be used in the development of regional and district plans and for guiding management strategies and operational work plans.

The Resource Management Act expects regional policy statements to include a description of the significant policy issues in the region, objectives that will have addressed those issues, and policies and methods to implement the objectives. The reasons for adopting the particular set of objectives, policies and methods will have been substantiated in the regional policy statement along with the expected environmental results. The procedures for monitoring the efficiency and

effectiveness of the policies or methods also needs to be included in a policy statement.

In Chapter 3 the Resource Management Act was described as a rational choice approach to natural resource policy formulation. Regional policy statements using rational choice theory develop their direction from clearly described policy goals and include a well researched portfolio of policy instruments. The review of the Resource Management Act carried out by Erickson et al. (2003, p. 119) found that most existing regional policy statements tended to be superficial and weakly supported by analysis. He hoped that future plans would be more environmentally successful because they addressed the values, beliefs and behaviour systems of society (ibid, p. xiii). Current plans, including regional policy statements, were being let down by a lack of research and analysis to balance consultation and participation (ibid, p. 34). Applying suitable TRA models as part of the planning process may provide a way for local authorities to improve the quality of regional policy statements.

Resource Management Issues and Objectives

The results from the TRA models in this study can be used by policy staff preparing a regional policy statement, for setting policy objectives that focus upon the human behaviours most linked with creating natural resource problems or enhancing their resolution. Each of the human behaviours and actions used in this study can be incorporated in high level policy objectives that address regional priorities to halt the loss of indigenous vegetation from farmland. The three required policy objectives might be:

a) The protection and conservation of indigenous ecosystems, habitats and areas with significant indigenous biodiversity values.

   Specifically, this might include protecting and conserving existing bush remnants.

b) Incorporating the restoration and enhancement of indigenous ecosystems and habitats in the maintenance of waterway health, stormwater management and erosion and sediment control.

Specifically, this might include fencing and planting riparian areas.

c) Use of indigenous flora and fauna in production systems and commercial activities.

   Specifically, this might include establishing and maintaining indigenous woodlots.

Policy Methods

Policy methods that address the policy objectives can include regulations describing the activities that are permitted, controlled or discretionary for a council, and the activities that are completely prohibited. Regulations may be particularly designed to protect and restore indigenous ecosystems and habitats that might be under threat from subdivision, use or development.

As well as regulatory methods, regional policy statements generally include non-regulatory methods for which the use of psychology models may be of assistance. From the behaviour models in this study that means including methods that address: the instrumental and affective costs and benefits of a behaviour, social norms and peer group expectations, their practicality and reliability, and the resources, skills and adaptations required to achieve the desired outcomes (Table 73). As well as the psychological conditions for change, this study and others suggest that an imperative is needed to convert peoples' intentions into actions within the timescale desired by local authorities (Sheeran and Orbell, 2000).

For each of the policy objectives included in the regional policy statement the relevant method statements need to link together similar methods from Table 73. These methods will be intended to reach landowners at all stages of behaviour change.

At the precontemplative stage they may be little interested and have little energy for public engagement over indigenous vegetation issues. The policy approach then will need to use mass communication with simple messages. By the time that landowners are at the preparation stage they will have become a lot more engaged and be seeking personalised information to guide their decision making.

Table 73: Policy methods for addressing the different psychological determinants of behaviour

Behavioural Determinants	Key Psychological Concepts	Policy Methods
Instrumental costs and benefits	instrumental attitudes, affective attitudes	1.1 information on the financial consequences to landowners of taking action (or non-action) 1.2 direct payments as financial incentives or disincentives 1.3 subjective experiences of the potential outcomes from behavioural change, e.g. spending time in an area of restored habitat
Social norms and expectations	subjective norms and self-identity	2.1 making visible the norms and expectations of others from similar social groups and situations 2.2 providing exemplars as role-models 2.3 providing opportunities for heterogeneous social groups to establish and share areas of conflict and commonality
Practicality and reliability	self-efficacy	3.1 information from research and development that establishes cause and effect relationships and makes available appropriate practices and technologies 3.2 information on the effectiveness of landowners practices as they are being implemented 3.3 training opportunities and guidelines
Resources, skills and adaptations	perceived behavioural control	4.1 provide plants and guidelines for establishing indigenous vegetation 4.2 provide training programmes for remnant and woodlot management
Implementation imperative		5.1 monitoring trends in issues of social and political concern 5.2 clarifying local and individual contributions to regional and national issues 5.3 establishing objective policy targets and enforcing rules and regulations

Each of the method descriptions below integrates similar methods from Table 73 to assist decision makers through the relevant stages and increase the area of protected indigenous vegetation in a region by a targeted amount to be achieved over the next 10 years (or so).

- The Regional Council will establish communication programmes that promote the desirability of protecting and conserving existing bush remnants, fencing and planting riparian areas with indigenous vegetation, and establishing and maintaining indigenous woodlots.

  This is particularly focussed upon awareness-raising in the precontemplative and contemplative stages by combining 1.1, and 1.3 from Table 73.

- The Regional Council will establish a contestable fund and provide indigenous plants for landowners to protect and enhance areas of indigenous vegetation in areas with high ecological priority.

  This is particularly focussed upon the contemplative and preparation stages of change and addresses 1.2 and 4.1 in Table 73.

- The Regional Council will encourage, promote and provide awards for exemplars from landowner groups in the region that model desired practices for protecting and conserving existing bush remnants, fencing and planting riparian areas with indigenous vegetation, and establishing and maintaining indigenous woodlots.

  This is particularly focussed upon the preparation stage of change and methods 2.1, 2.2, 2.3 and 5.2 in Table 73.

- The Regional Council will develop informational material and education programmes that provide landowners with advice and training on protecting and conserving existing bush remnants, fencing and planting riparian areas with indigenous vegetation, and establishing and maintaining indigenous woodlots.

  This is particularly focussed upon the preparation and action stages of change and addresses 3.1, 3.2, 3.3 and 4.2 in Table 73.

- The Regional Council will work with landowners to identify and monitor areas of indigenous vegetation in the region and identify priority areas based upon their condition and ecosystem function. This information will be updated as changes are identified and provided to landowners every three years (or so).

  Along with the overall targeted increase in protected vegetation, this is focussed upon the action stage of behaviour change and combines 5.2 and 5.3 from Table 73.

Operational Work Plans

Operational work plans for providing information to decision makers, can make use of a range of communication channels and communication content to encourage desired behaviour changes. The channels used for communication will need to be accessible and engaging to potential landowners. The content can be developed from the human behaviour models used in this study (Table 74).

To ensure that the communication programmes for all three practices are effective they will need to show that they can improve wildlife habitats and improve the aesthetical appearance of farming properties. To encourage bush preservation they will need to also show that property values can be increased. Those for riparian planting will need to show in addition, that the waterways are more attractive and bank erosion has been reduced. Those for encouraging indigenous woodlot establishment will also need to be able to show how costs can be minimised.

Contestable funding programmes based upon these results; need to address establishment and ongoing costs, particularly for indigenous woodlots.

Social award programmes need to encourage and recognise the involvement of families in farm decision making. They need to ensure that the practice becomes an accepted way of doing things amongst land owners.

Table 74: Communication Content that Addresses Behaviour Model Concepts

Behaviour	Behaviour Model Concepts	Communication Content
Preserving bush remnants	perceived behavioural control	• time available • funds available • technical ability • information available • encouragement from others
	instrumental attitudes	• increased wildlife habitats • improved property aesthetical appearance • improved property values
	self-efficacy	• greater self-confidence • fits with sustainability ideas • fits with previous thinking and values
	self-identity	• fits with existing self identity concepts
	subjective norms	• aligned with landowner's family expectations
Riparian planting	perceived behavioural control	• time available • technical ability • funds available • skills available • information available
	instrumental attitudes	• increased waterway attractiveness • improved wildlife habitat • decreased bank erosion
	self-efficacy	• fits with sustainability ideas • fits with previous thinking and values • greater self-confidence • consider it easy to do • have the capability to successfully implement
	self-identity	• fits with existing self identity concepts
	subjective norms	• aligned with landowner's family expectations
Establishing woodlots	perceived behavioural control	• time available • funds available • technical ability • encouragement from others • information available
	instrumental attitudes	• improved property aesthetical appearance

		• marginal costs minimised • increased wildlife habitats
	affective attitudes	• pleasant experience
	self-efficacy	• greater self-confidence • fits with sustainability ideas • fits with previous thinking and values
	self-identity	• fits with existing self identity concepts
	subjective norms	• aligned with landowner's family expectations

Information material needs to increase the confidence of landowners in their abilities to implement practices and achieve desired outcomes.

Monitoring results supplied to land owners need to provide them with feedback about the value of their decisions at the time that those decisions have been made.

Application Summary

In this example of a policy application using behaviour modelling, the behaviour model contributed to increasing the definition and specificity of the policy issue and its objectives. Then, behavioural theory was used to assist with determining the policies and methods before the model was again used in operational work planning.

For the applied policy example, separate behaviour models were available for each of the three practices. Policy agencies themselves may not be able to carryout such intensive research into the determinants of human behaviour and lack the capability for the analysis, interpretation and application required. However, the results in this study may be similar enough across the three practices for policy agencies to use thos results to address other natural resource issues involving indigenous vegetation e.g. erosion control.

Chapter 12. Limitations and Further Research

The three management practices all included related natural resource behaviours and had a shared outcome to integrate areas of indigenous forest into the management of private land. The decision making involved in each practice, could be described as follows:

- Protecting and conserving bush blocks involved first identifying areas of remnant vegetation on a property. Usually these blocks needed to have been fenced and weed and pest control undertaken on an on-going basis to ensure their future sustainability. Generally remaining remnant vegetation existed in discrete areas on properties and in many cases, had been isolated from more general farm management for several years or generations. That degree of isolation may have contributed to its greater consistency as a practice in the behaviour models.

- Fencing-off and planting indigenous trees in riparian areas involved identifying areas where waterways were at risk from livestock farming, then fencing them off and planting them out in native trees before establishing an on-going programme of weed and pest control. Riparian areas on many farms have been spread throughout the properties involved and have encompassed land that may have been in intensive production, as well as areas too wet to have been utilised for production. The range in potential may have contributed to the research finding that the practice had two distinct aspects. One aspect was the initial decision by landowners to protect and plant some (probably the more unproductive) riparian areas and secondly expanding the protection to all the waterways throughout their properties. Including both aspects in the same behaviour model as has been done in this study will have limited its explanatory power.

- Establishing and maintaining indigenous woodlots has required landowners to identify areas of potential landuse change on a property, prepare the area for timber management (which could involved conditional use applications to government as well as fencing and tracking), plant trees, and on-going tree husbandry, and weed and pest control. Establishing indigenous woodlots on farms has involved landowners in the greatest mix of decisions and

behaviours. The resulting lack of specificity about the practice could therefore have limited the explanatory power of this behaviour model the most out of all three practices.

All three of the indigenous plant practices have shared some component behaviours such as fencing and weed and pest control. Two of them also could have involved tree planting. In addition, all three of them involved different decision making options and they each had a different decision making context. With remnant vegetation, instead of protecting them, landowners could simply have allowed them to mature, and die out, at very little cost (financial or otherwise) for themselves. With riparian areas, landowners could have left those in production, fenced them off without planting, or planted in exotic vegetation or a mixture of exotic and indigenous. With indigenous woodlots, landowners could have allowed an area to grow into mature timber trees without having to make a harvesting decision until reaching the actual point of cutting them down.

For most respondents, establishing woodlots was quite a different decision making process to the other two practices. Protecting bush remnants and planting riparian areas both have involved a deliberate commitment and initial investment to initiate the activity. With the establishment of a woodlot, if the native trees were already in place as a result of previous land development decisions, then no initial activity or investment might have been required. Landowners could delay any decision about harvesting native trees on their property without having to manage the trees prior to that decision specifically for that purpose. Only when the trees have been harvested, might the landowner's decision to consider them as a woodlot of indigenous trees have become known to others. The indigenous woodlot practice therefore, was the least clearly specified practice in this project.

The research design used was based upon having three studies with comparable versions of the same behaviours (conservation of indigenous vegetation) so that the different behaviour models could be compared. In practice, the behaviours may not have been similar enough to have provided any opportunity for the three models to have been directly comparable.

The TRA model was originally developed to explain single, simple, observable actions but over time it was extended to address more complex behaviours (Ajzen 1988), sometimes with successful results (Sparks et al, 1997). At other times, modifications have had to be made to the model to enhance its ability to address complex behaviours. These modifications have included:

- Adding additional psychological concepts
- Developing a multiple act behavioural measure or a behavioural index
- Developing a scenario with a number of behavioural choices for respondents to select between as a measure of their behaviour
- Calibrating self-reported behaviour with observed behaviour
- Using preparatory behaviours e.g. material purchase, as an indicator of the ultimate behaviour
- Using different behaviour measures for each stage in a Stages of Change model

In this study each behaviour had a number of component actions that when combined was able to contribute towards the overall practice that could be observed by a policy agency. For the protection and conservation of bush blocks that could have been something like:

- Fencing-off all "at-risk' areas of their property from livestock over the next 12 months.
- Planting all fenced-off areas of their property with indigenous trees over the next 12 months.
- Carrying out weed control (of specific weeds) in all fenced-off areas over the next 12 months.
- Carrying out pest control (for specific pests) in all fenced-off areas over the next 12 months.

For belief-based analyses these component actions could have been combined into an index or addressed individually. More specific behaviour measures would have reduced questionnaire complexity and so respondent burden.

Focusing only on the more specific behaviours would have enabled policy makers to abstract them further from their land-management and policy context. The presence of ambiguity created by context has suggested that there may exist a tension in the way that policy organisations have addressed the behaviours associated with resource management, as some of those behaviours e.g., weed and pest control, have also been associated with resource use and exploitation as well as resource protection and enhancement. In order that policy organizations could fulfil their political mandate for developing an intervention it has been important that the behaviour has been focused upon within its political context. Although the way in which that was done in this study may have been clumsy, it has clearly indicated that further research would have been needed before we could specify the behaviours that should have been the focus of a policy intervention clearly enough to ensure that any intervention strategy would have been able to efficiently achieve the desired policy outcomes.

The lack of precision with which the behaviours were specified may have contributed to the low to moderate relationship between peoples declared intentions and their historical behaviour (correlations of 0.4, 0.005 and 0.37 for bush protection, riparian planting and woodlot establishment respectively). That compares with 0.44-0.45 for predicting safe-sex practices (Sheeran and Taylor, 1999, Albarracin et al., 2001).

Cross-sectional research would have had limitations for a study examining the relationship between intentions and beliefs. If that had been the purpose of the study then a longitudinal project should have been carried out (Armitage and Connor, 2001). For both those sets of reasons – the behaviour not having been specifically or clearly described and the project having been a cross-sectional study, it has not been surprising that the intention-behaviour correlations were as low as they were.

The survey response rates of 20 – 30% were acceptable with the large numbers in the sample but should have been over 50% to ensure that the results were representative and comparable with other types of survey (Neuman, 1999, p. 267).

The samples involved in this study were similar to estimates of the New Zealand agricultural population by the Ministry of Statistics. However the respondents in this project on average had larger farms and included a greater proportion of dairy farms. That may have been due to larger landowners having more time for surveys and dairy farmers being more sensitised to the issues around protecting indigenous vegetation on privately owned land.

In this study, each behaviour, no matter how similar, had different sets of instrumental attitude beliefs, beliefs about self-identity, and possibly also subjective norms. As noted by Blue (Blue, 1995), eliciting a suitable list of beliefs may have been problematic for people unfamiliar with the subject and the decision making process involved. Identifying belief measures to establish the relevant models in this project required a qualitative approach using focus group meetings. Despite peoples' apparent lack of interest in putting resources into belief elicitation, that step has been considered "imperative" by the Theory's promoters (Fishbein and Manfredo, 1992, p. 40).

The items on the list of beliefs generated at the meetings in this project appeared to have been very context specific. The most consistent beliefs across the three practices were associated with their costs, sources of social influence and behavioural control. The other beliefs varied in their salience with each practice. With some technical understanding however, it has been possible to have been confident about the specific beliefs driving the relationship between TRA variables and the behaviour.

A study that has employed technical concepts outside their original discipline as this one has done with the TRA concepts, risks misinterpreting their application. The factor analyses and correlations between repeated measures provided a check on that and have indicated that some questions in the survey did not fit with the expected concepts (e.g., self-identity four which in the riparian part of the study only had a factor analysis weighting of 0.04 compared to the other self-identity questions that ranged from 0.53 – 0.78).

It is of some concern that the subjective norms for each practice had so little influence in the final models when the variable had been so prominent in other TRA studies. Either subjective norms have been less important for the subjects in

this study or the method of obtaining the relevant concepts has missed the most influential target groups.

With each practice, the inclusion of behavioural intentions was able to improve the model's ability to explain behaviour. However, the adjusted regression coefficient ranged between 10 – 20% and in the case of riparian areas intentions have not made a significant difference to the use of non-specific variables. The significant contribution suggests that the TRA could provide a useful behavioural model and the lack of influence of control beliefs suggests that the TRA may be sufficient rather than the Theory of Planned Behaviour.

Instrumental attitudes made a significant contribution to each of the intention models. They were introduced early in the regression process and remained part of the final models to be chosen. Affective attitudes made separate and unique contributions to the regression analyses and did not appear to have been confounded in the analyses with instrumental attitudes. Affective attitudes only appeared in the final woodlot model.

Control beliefs and self-efficacy appeared in this study to be quite separate concepts. The measures used for behavioural control did not perform as well as control beliefs and so were replaced by the mean of the control beliefs in each model. It appears that decision makers did not respond consistently to the general control questions such as "*I have control over whether or not I protect and conserve bush remnants on my farm?*" Specific belief questions seemed to fare better, e.g. "*Over the next year, I will have the time needed so that I could protect and conserve the bush remnants on my farm?*" The questions about self-efficacy did not appear to have been so difficult although also were very general e.g. "*For me to protect and conserve bush remnants would be very complex?*"

Self-identity was not measured consistently across the three behaviours in this study and it only contributed to the behavioural model for farming indigenous woodlots. In the riparian questionnaire, which was the first one to be sent out, eight questions were used that measured the importance of riparian management issues to landowner decision making. The questions all had adequate results to their Cronbach's Alpha and factor analyses (as described above). However, they were not very well aligned with behavioural theory on self-identity, making their results more difficult to interpret.

In the bush remnant and farming woodlot surveys there were two self-identity measures. The first of these was "I think of myself as someone concerned about protecting and conserving bush remnants. This was consistent with the definition of self-identity in Table 2 and the style of questions reported in papers such as Sparks et al 1995.

The second question was "I think that I have already protected and conserved bush remnants more than most farmers". This was probably more related to an expression of group identity (or lack of it) rather than self-identity. It was a question that attempted to measure a conservation role for landowners, however perhaps the question would have been more consistent with reported practice if it had been phrased: "I think of myself as someone who takes a conservationist role to protect and conserve bush remnants".

Self-identity has been described in this report as complementing the influence of subjective norms and mediating the effect of past behaviour. The inclusion of self-identity measures with greater convergent validity would have assisted in testing its contribution further.

The research has been a study of self-reported behaviour. Self measures may differ between respondents and policy makers. A landowner that might have controlled all the gorse and ragwort in their bush-block may report that they have achieved full and complete weed control. For an ecologically minded policy maker looking at the same block of bush, any areas of old-mans-beard that could have been left would have meant that the weed control was still incomplete. In this study, for the behaviours that have been examined, the self report was the most desirable and any misalignment between self-reported behaviour and policy makers' observations would have been due to causal factors other than those determining intentions and the relationship between intentions and action. Self-reports may also have been biased towards the perceived most socially desired position. Such biases could not have been totally avoided, but were minimised in this study by involving a neutral agency to administer the surveys and having used an armslength mechanism for data analysis to demonstrate that the researchers were committed to providing a confidential analysis.

In this study three measures of subjective norms were used – family, friends, and government experts. Relative to other studies this may not have adequately

described the range of social influences upon decision makers (Fielding et al., 2005, Vries et al., 2000). Future research could examine those further, including group membership and activism, social support, perceived behaviour of others and compliance pressure.

The relationship between intentions and behaviour cannot be expected to have been automatic and while this study did not focus upon it, the use of human behaviour models could have been improved if that relationship was better understood. Acting upon intentions may have been conditional upon moderating concerns about regret, feelings of increased risk or time delays leading to instability in intentions. Those could be examined further in longitudinal studies designed to examine the intention-behaviour relationship.

The TRA has been developed to explain the immediate antecedents of behaviour. Policy makers have not had direct access to peoples' beliefs and so they must indirectly take them into account in any intervention strategy. Most voluntary policy strategies have relied upon communication approaches, to convey information or incentives to the intended audiences. Future studies using the TRA in environmental policy formulation should include careful behaviour specification, belief elicitation and concept descriptions. Further research on the relationship between communication mechanisms and behaviour change could explore those issues further and enable the TRA to have been incorporated directly into policy strategies for voluntary change interventions.

Chapter 13. References

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Appendix A. Background on the Research Company Employed for Survey Administration

TNS New Zealand began operating in 1983 as CM Research Associates. In 2002 (just before the time of this research study) they became part of the NFO group of companies. In July 2003 NFO WorldGroup became part of the TNS[14] group of companies "together forming the world's third largest market information company" and in New Zealand they describe themselves as "New Zealand's leading consultative market research company".

In this PhD study NFO were commissioned to post out survey forms to supplied names and addresses. They received the completed surveys and removed respondents names and addresses for entry into a prize draw which they administered on behalf of AgResearch. Received survey forms were forwarded to myself at AgResearch for data-entry and analysis.

[14] Taylor Nelson Sofres

Appendix B: Instructions for NFO

Email from Survey Manager NFO CM Research (NZ) Ltd to John Wilson AgResearch

14th January 2002

Re: Riparian Survey

NFO CM Research Responsibilities

1. Finalise covering letter
2. Final check of questionnaire
3. Produce 1500 covering letters on NFO CM letterhead
4. Receive from AgResearch 1500 printed and numbered survey forms on 24 January 2002
5. Put survey and covering letter into envelopes with prepaid return addresses envelopes.
6. Post out by 1 February 2002.
7. Collect returns and send courier once a week until 15th March 2002.
   Courier to Terry Parminter, AgResearch
8. Manage supervised cash incentive draw after cutoff date of 1st March.
   Draw to be made by 8th March.2002.

AgResearch

1. Provide NFO CM Research with a nationwide sample of 1500 farmer respondents in an Excel file. Note that these names are supplied solely for the purpose of this survey and cannot be used for any other purpose. We require that you delete the file after completion of the survey and keep no copy of the list. This is an essential condition of our purchase of these names
2. Provide NFO CM research with 1500 printed and numbered survey forms by 24th January 2002
3. Receive all returned survey forms weekly from NFO CM Research until 1st March 2002. If necessary, and by mutual agreement this may extend beyond 1st March.
4. AgResearch to pay marginal extra costs for returns in excess of 1000

Appendix C: Introductory Letter and Questionnaire for the Protecting Bush-block Survey

Dear Respondent,

Maintaining biodiversity, the long term survival of New Zealand's indigenous (native) plants and animals, will require assistance from many different people. We are conducting research on behalf of AgResearch, a government owned Research Company that includes the research facilities at Ruakura, Whatawhata, Grasslands, Wallaceville, Lincoln, and Invermay. AgResearch scientists would like to know more about how farmers feel about biodiversity, and their attitudes and beliefs towards biodiversity issues. We aim to obtain this information by asking farmers like you to complete and return this questionnaire.

To show our appreciation for you taking the time to participate, on return of a completed questionnaire you will be given a chance to win one of four cash draws, i.e. 2 draws of $1,000 and 2 draws of $500. Winners will be notified personally and results will be published in the Sunday Star Times. The survey is going to only 2350 people so you have a good chance of being a winner.

If you are prepared to complete the questionnaire, all you have to do is read each statement and mark on the doffed line to indicate how strongly you agree or disagree. There are also some demographic questions to complete. This questionnaire should take you about 30 minutes to complete. Please use the pre-paid self addressed envelope to return the completed questionnaire by 21st June in order to qualify for the prize draw.

All responses are completely confidential and all contact information will be held by us in accordance with the Privacy Act.

Should you have any queries whatsoever, please contact the following personnel:

Donna Willis
Survey Manager
09 5254710 ext 8705

Mele Hala
Research Executive
09 5254710 ext 8773

Good Luck in the Draw!

Donna Willis
Survey Manager

Appendix D. Bush Remnant Questionnaire

DESCRIPTION OF PROTECTING AND CONSERVING BUSH REMNANTS

Many farms have remnants of bush including larger areas of trees, small patches of vegetation, scattered native trees, and areas of scrub. Even areas of gorse can sometimes provide an excellent nursery for native species which eventually grow above the gorse and shade it out. Some farmers actively protect or even restore and protect bush remnants. Other farmers consider these areas to have only nuisance value.

You may use any of the definitions in the previous paragraph to guide you in what is a bush remnant. There are no right or wrong answers to any of these questions.

QUESTIONNAIRE DESIGN

The questions are designed to measure people's attitudes towards protecting and conserving bush remnants. Some of the questions may appear to be repetitious but they take different points of view about each of the issues involved. Don't spend too long on each question – usually your first answer is your best answer. The survey should take about 30 minutes to complete.

Any comments that you write in addition to answering the questions will be recorded.

To answer the first ten questions (Section A) please circle, tick or complete the appropriate box. For the remaining questions (Sections B, C and D) please put a cross on the line under each statement to indicate how strongly you agree or disagree with that particular statement. If you don't know enough about the question to make a response or the question does not apply to your situation, mark your answer in the neutral position.

AN EXAMPLE:

Government expenditure on environmental research should be reduced.

Strongly Agree *Neutral* *Strongly Disagree*

|__ __ __ __ __ __ __ __ __ __ __ __ __ __ _**X**_ __ __ __ __|

The person answering the question in this example has indicated that their feelings lay midway between being neutral and strongly disagreeing with the statement.

QUESTIONNAIRE

SECTION A. Background information

Please complete questions 1 - 10 by filling in the gaps provided or ticking or circling the most correct answer. Where you have more than one property, answer for the property with the most biodiversity potential.

1. Region (*please tick the appropriate box)*

□1	Northland	□2	Auckland	□3	Waikato
□4	Bay of Plenty	□5	Gisborne / East Cape	□6	Hawkes Bay
□7	Taranaki	□8	Manawatu	□9	Wairarapa
□10	Wellington	□11	Nelson	□12	West Coast
□13	Marlborough	□14	Canterbury	□15	Otago
□16	Southland				

2. Your occupation *(circle the category that best applies)*

Farmer 1 Part-time Farmer 2 Non-farmer 3

3. Your total farm property area?

_____ha OR _____acres

4. Main farming types? (c*ircle all categories that apply)*

Sheep 1 Cattle 2 Deer 3 Goats 4 Dairy Cows 5 Farm Forestry/Woodlots 6

Other: 7

_____

5. Your gender? *(please circle one)*

MALE 1 FEMALE 2

6. Your age? _____ years

7. Ethnicity (*please tick one*)

☐ 1 New Zealand European ☐ 2 Maoṛi ☐ 3 Pacific Islander

☐ 4 Asian ☐ 5 Other _____

8. How many separate areas of bush remnants do you have on your farm?

_____

9. What percentage of these remnants (if any) are you actively protecting? *(0 – 100%).*

_____%

10. Estimate the total area of these bush remnants.

_____ m^2, _____ha, or _____acres

SECTION B: Selecting Farming Goals
(Questions 11 to 20)

How much would achieving the following goals over the next 3-5 years provide you with the satisfaction you need from being a farmer?

A. Build a valuable farming business

Not important to me Neutral Very important to me
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

B. Produce to maximise farming profits

Not important to me Neutral Very important to me
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

C. Be self-reliant in decision-making

Not important to me Neutral Very important to me
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

D. Look after nature

Not important to me Neutral Very important to me
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

E. Be valued in my community

Not important to me Neutral Very important to me
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

F. Create increased opportunities for future farmers

Not important to me Neutral Very important to me
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

G. Have variety in my work

Not important to me Neutral Very important to me
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

H. Pay off debts

Not important to me Neutral Very important to me

|— —|

I. Maintain a stable farming system

Not important to me Neutral Very important to me

|— —|

J. Have time available for socialising with family and friends

Not important to me Neutral Very important to me

|— —|

If you would like to add a new goal that is not listed you can do so. Describe the new goal in the space below. Also write out the goal from the provided list (A to J), that is most similar to it in the space alongside.

21. Name of the new goal_____

22. Name the goal it is most similar to (from list above, i.e. A to J) _____

SECTION C: Contribution to Your Farming Goals of Protecting and Conserving Bush Remnants

(Questions 23 to 32)

How much does protecting and conserving bush remnants contribute to your farming goals?

A. Build a valuable farming business

My protecting and conserving bush remnants will make a very negative contribution to this goal — Neutral — My protecting and conserving bush remnants will make a very positive contribution to this goal

|— —|

B. Produce to maximise farming profits

My Protecting and conserving bush remnants will make a very negative contribution to this goal — Neutral — My Protecting and conserving bush remnants will make a very positive contribution to this goal

|— —|

C. Be self-reliant in decision-making

My Protecting and conserving bush remnants will make a very negative contribution to this goal — Neutral — My Protecting and conserving bush remnants will make a very positive contribution to this goal

|— —|

D. Look after nature

My protecting and conserving bush remnants will make a very negative contribution to this goal | Neutral | My protecting and conserving bush remnants will make a very positive contribution to this goal

|— — — — — — — — — — — — — — — — — — — —|

E. Be valued in my community

My protecting and conserving bush remnants will make a very negative contribution to this goal | Neutral | My protecting and conserving bush remnants will make a very positive contribution to this goal

|— — — — — — — — — — — — — — — — — — — —|

F. Create increased opportunities for future farmers

My protecting and conserving bush remnants will make a very negative contribution to this goal | Neutral | My protecting and conserving bush remnants will make a very positive contribution to this goal

|— — — — — — — — — — — — — — — — — — — —|

G. Have variety in my work

My protecting and conserving bush remnants will make a very negative contribution to this goal | Neutral | My protecting and conserving bush remnants will make a very positive contribution to this goal

|— — — — — — — — — — — — — — — — — — — —|

H. Pay off debts

My protecting and conserving bush remnants will make a very negative contribution to this goal | Neutral | My protecting and conserving bush remnants will make a very positive contribution to this goal

|— — — — — — — — — — — — — — — — — — — —|

I. Protect and conserve a stable farming system

My protecting and conserving bush remnants will make a very negative contribution to this goal | Neutral | My protecting and conserving bush remnants will make a very positive contribution to this goal

|— — — — — — — — — — — — — — — — — — — —|

J. Have time available for socialising with family and friends

My protecting and conserving bush remnants will make a very negative contribution to this goal | Neutral | My protecting and conserving bush remnants will make a very positive contribution to this goal

|— — — — — — — — — — — — — — — — — — — —|

SECTION D: Bush Remnants Perceptions

33. Protecting and conserving bush remnants on my farm to make use of uneconomic areas is:

Not important to me | Neutral | Very important to me

|— — — — — — — — — — — — — — — — — — — —|

34. Protecting and conserving bush remnants on my farm will solve the problem of difficult to graze areas.

Extremely unlikely | Neutral | Extremely likely

|— — — — — — — — — — — — — — — — — — — —|

35. For me, solving the problem of difficult to graze areas on my farm is:

Extremely undesirable | Neutral | Extremely desirable

|— — — — — — — — — — — — — — — — — — — —|

36. Over the next year I will have the time needed so that I could protect and conserve bush remnants on my farm.

Strongly disagree | Neutral | Strongly agree

|— — — — — — — — — — — — — — — — — — — —|

37. Protecting and conserving bush remnants on my farm to create wildlife habitat is:

Not important to me | Neutral | Very important to me

|— — — — — — — — — — — — — — — — — — — —|

38. Most people who are important to me are likely to protect and conserve bush remnants.

Definitely false | Neutral | Definitely true

|— — — — — — — — — — — — — — — — — — — —|

39. Protecting and conserving bush remnants on my farm over the next year would make me:

Frustrated Neutral Contented

|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

40. Over the next year I will have the *encouragement* that I need to protect and conserve bush remnants on my farm.

Strongly disagree Neutral Strongly agree

|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

41. Protecting and conserving bush remnants on my farm will increase weed and pest problems.

Extremely unlikely Neutral Extremely likely

|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

42. For me, an increase in weed and pest problems on my farm is:

Extremely undesirable Neutral Extremely desirable

|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

43. Protecting and conserving bush remnants on my farm will increase wildlife habitat.

Extremely unlikely Neutral Extremely likely

|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

44. For me, being able to increase wildlife habitat on my farm is:

Extremely undesirable Neutral Extremely desirable

|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

45. Over the next year I will have the *ability* needed so that I could protect and conserve bush remnants on my farm.

Strongly disagree Neutral Strongly agree

|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

46. For me to protect and conserve bush remnants on my farm would be very complex.

Definitely false Neutral Definitely true

|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

47. If it were entirely up to me I am confident that I would be able to protect and conserve bush remnants on my farm.

Definitely false Neutral Definitely true
|— — — — — — — — — — — — — — — — — — — —|

48. Over the next year I *intend* to protect and conserve bush remnants on my farm.

Definitely false Neutral Definitely true
|— — — — — — — — — — — — — — — — — — — —|

49. Protecting and conserving bush remnants on my farm creates extra costs.

Extremely unlikely Neutral Extremely likely
|— — — — — — — — — — — — — — — — — — — —|

50. For me, creating extra costs on my farm is:

Extremely undesirable Neutral Extremely desirable
|— — — — — — — — — — — — — — — — — — — —|

51. Protecting and conserving bush remnants on my farm provides erosion control.

Extremely unlikely Neutral Extremely likely
|— — — — — — — — — — — — — — — — — — — —|

52. For me, erosion control on my farm is:

Extremely undesirable Neutral Extremely desirable
|— — — — — — — — — — — — — — — — — — — —|

53. Protecting and conserving bush remnants on my farm creates extra work.

Extremely unlikely Neutral Extremely likely
|— — — — — — — — — — — — — — — — — — — —|

54. For me, creating extra work on my farm is:

Extremely undesirable Neutral Extremely desirable
|— — — — — — — — — — — — — — — — — — — —|

55. I am very supportive of protecting and conserving bush remnants.

Definitely false Neutral Definitely true

|__ __|

56. Protecting and conserving bush remnants on my farm over the next year would be:

Bad Neutral Good

|__ __|

57. The people in my life whose opinions I value would approve of me protecting and conserving bush remnants on my farm.

Definitely false Neutral Definitely true

|__ __|

58. Generally on the farm I do what my *friends* think that I should do.

Definitely false Neutral Definitely true

|__ __|

59. Protecting and conserving bush remnants will improve my farm's aesthetic appearance.

Extremely unlikely Neutral Extremely likely

|__ __|

60. For me, improving the aesthetic appearance of my farm is:

Extremely undesirable Neutral Extremely desirable

|__ __|

61. Over the next year I will have the funds so that I could protect and conserve bush remnants on my farm.

Strongly disagree Neutral Strongly agree

|__ __|

62. Protecting and conserving bush remnants on my farm to benefit future generations is:

Not important to me Neutral Very important to me

|__ __|

63. Over the next year I *plan* to protect and conserve bush remnants on my farm.

Definitely false Neutral Definitely true
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

64. Protecting and conserving bush remnants on my farm will increase the farm's value.

Extremely unlikely Neutral Extremely likely
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

65. For me, increasing my farm's value is:

Extremely undesirable Neutral Extremely desirable
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

66. I think that I have already protected and conserved bush remnants more than most farmers.

Definitely false Neutral Definitely true
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

67. Generally on the farm I do what *government experts* think that I should do.

Definitely false Neutral Definitely true
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

68. For me to protect and conserve bush remnants on my farm would require a lot of effort.

Definitely false Neutral Definitely true
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

69. My friends think that I should protect and conserve bush remnants on my farm.

Definitely false Neutral Definitely true
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

70. I often think about protecting and conserving bush remnants.

Definitely false Neutral Definitely true
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

71. Protecting and conserving bush remnants on my farm will decrease my property rights.

Extremely unlikely Neutral Extremely likely

|— — — — — — — — — — — — — — — — — — — —|

72 For me, decreasing my property rights is:

Extremely undesirable Neutral Extremely desirable

|— — — — — — — — — — — — — — — — — — — —|

73. Government experts think that I should protect and conserve bush remnants on my farm.

Definitely false Neutral Definitely true

|— — — — — — — — — — — — — — — — — — — —|

74. Protecting and conserving bush remnants on my farm will please my community.

Extremely unlikely Neutral Extremely likely

|— — — — — — — — — — — — — — — — — — — —|

75. For me, being able to please my community is:

Extremely undesirable Neutral Extremely desirable

|— — — — — — — — — — — — — — — — — — — —|

76. Protecting and conserving bush remnants on my farm over the next year would be:

Useless Neutral Useful

|— — — — — — — — — — — — — — — — — — — —|

77. To protect and conserve bush remnants fits with my idea of farming sustainably.

Definitely false Neutral Definitely true

|— — — — — — — — — — — — — — — — — — — —|

78. It is mostly up to me whether or not I protect and conserve bush remnants on my farm.

Definitely false Neutral Definitely true

|— — — — — — — — — — — — — — — — — — — —|

79. Protecting and conserving bush remnants to beautify my farm is:

Not important to me Neutral Very important to me

|__ __|

80. My family thinks that I should protect and conserve bush remnants on my farm.

Definitely false Neutral Definitely true

|__ __|

81. Over the next year I will have the information needed so that I could protect and conserve bush remnants on my farm.

Strongly disagree Neutral Strongly agree

|__ __|

82. I have control over whether or not I protect and conserve bush remnants on my farm.

Definitely false Neutral Definitely true

|__ __|

83. Most people who are important to me think that I should protect and conserve the bush remnants on my farm.

Definitely false Neutral Definitely true

|__ __|

84. Protecting and conserving bush remnants on my farm over the next year would make me:

Anxious Neutral Confident

|__ __|

85. Protecting and conserving bush remnants on my farm will decrease land utilisation.

Extremely unlikely Neutral Extremely likely

|__ __|

86. For me, decreasing land utilisation on my farm is:

Extremely undesirable Neutral Extremely desirable

|__ __|

87. Protecting and conserving bush remnants on my farm will provide animal shelter.

Extremely unlikely Neutral Extremely likely
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

88. For me, being able to provide animal shelter on my farm is:

Extremely undesirable Neutral Extremely good
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

89. Generally on the farm I do what my *family* thinks that I should do.

Definitely false Neutral Definitely true
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

90. Protecting and conserving bush remnants on my farm over the next year would be:

Foolish Neutral Wise
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

91. I think of myself as someone concerned about protecting and conserving bush remnants.

Definitely false Neutral Definitely true
|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

Any Additional
Comments:_____

_____

_____

THANK YOU FOR YOUR ASSISTANCE

Appendix E: Introductory Letter and Questionnaire for the Riparian Survey

Dear Respondent,

Stream bank or riparian management is becoming a more important issue for farmers as regional councils endeavour to improve water quality. We are conducting research on behalf of an Independent research organisation that would like to know more about how farmers feel about riparian management, and their attitudes and beliefs towards riparian issues. We aim to obtain this information by asking farmers like you to complete and return this questionnaire.

To show our appreciation for you taking your time to participate, on return of a completed questionnaire (at least 80% complete) you will be given a chance to win one of four cash draws, i.e. 2 draws of $1,000 and 2 draws of $500. Winners will be notified personally and results will be published in the Sunday Star Times.

If you are prepared to complete the questionnaire, all you have to do is read each statement and mark on the doffed line to indicate how strongly you agree or disagree. There are also nine demographic questions to complete. This questionnaire should take you 20 to 25 minutes to complete. Please use the pre-paid self addressed envelope to return the completed questionnaire by 1st March in order to qualify for the prize draw.
All responses are completely confidential and all contact information will be held by us in accordance with the Privacy Act.

Should you have any queries whatsoever, please contact the following personnel:

Donna Willis
Survey Manager
09 5254710 ext 8705

Mele Hala
Research Executive
09 5254710 ext 8773

Good Luck in the Draw!

Donna Willis
Survey Manager

Appendix F. Riparian Questionnaire

Stream Bank Management Survey

DESCRIPTION OF TWO STREAM BANK PRACTICES

In this questionnaire the terms ‘riparian’ and ‘stream bank’ are used interchangeably to mean the same thing. The riparian or stream bank area is the part of the stream bank where land management affects water-quality and where water flow affects land management. It is where land and waterway management intersect. This area can be from 5 to 50 metres wide either side of a stream.

Most farms have one or more waterways on their property. In this questionnaire waterways are the channels where water is flowing all year round, sometimes they might still be considered to be streams, sometimes they might be thought of as drains. Along the stream banks of waterways farmers may apply specialist management practices e.g. fencing it off from livestock, planting poplars, planting native trees, planting pines, excluding fertiliser, and excluding pesticides. This questionnaire considers two of these practices.

1. Fence and Plant Native Trees

Along stream banks farmers may erect a fence (to boundary fence standard) and between the fence and the water, plant or allow to grow, native (indigenous) plants.

2. Plant Exotic Trees

Along stream banks farmers may plant exotic trees such as poplars or pines and erect a single electric wire fence (or a more permanent fence) to protect both them and the waterway from cattle.

QUESTIONNAIRE DESIGN

To answer the first nine questions please circle, tick or complete the appropriate box. For the remaining questions please put a cross on the line under each statement to indicate how strongly you agree or disagree with that particular statement.

AN EXAMPLE:

Government expenditure on environmental research should be reduced.

Strongly Agree ***Neutral*** ***Strongly Disagree***

|_ _ _ _ _ _ _ _ _ _ _ _ _ _ X _ _ _ _ _|

The person answering the question in this example has indicated that their feelings lie midway between being neutral and strongly disagreeing with the statement.

SECTION A. Background information

Please complete questions 1 - 9 by filling in the gaps provided or ticking or circling the most correct answer. Where you have more than one property, answer for the property with the most waterways.

1. Region (*please tick the appropriate box)*

☐ Northland	☐ Auckland	☐ Waikato
☐ Bay of Plenty	☐ Gisborne / East Cape	☐ Hawkes Bay
☐ Taranaki	☐ Manawatu	☐ Wairarapa
☐ Wellington	☐ Nelson	☐ West Coast
☐ Marlborough	☐ Canterbury	☐ Otago
☐ Southland		

2. Your Occupation *(circle the category that best applies)*

Farmer Part-time Farmer Non-farmer

3. Your total farm property area?

_____ha OR _____acres

4. Main farming types? (c*ircle all categories that apply)*

Sheep Cattle Deer Goats Dairy Cows Farm Forestry/Woodlots
Other: _____

5. Do you have any waterways on the property, or against your boundary, with permanently running water? *(please circle)*

YES NO

6. Width of the widest waterway with permanently running water)? *(please circle)*

SMALL	MEDIUM	LARGE
Less than 2m	2 to 10m	More than 10m

5. Gender? *(please circle **one)***

MALE FEMALE

6. Age? _____ years

7. Ethnicity (*please tick one*)

☐ New Zealand European ☐ Maori ☐ Pacific Islander

☐ Asian ☐ Other _____

SECTION B: Selecting Farming Goals

(questions 10 to 19)

How much would achieving the following goals over the next 3-5 years provide you with the satisfaction you need from being a farmer?

A. build a valuable farming business

Not important to me Very important to me

|— —|

B. produce to maximise farming profits

Not important to me Very important to me

|— —|

C. be self-reliant in decision-making

Not important to me Very important to me

|— —|

D. look after nature

Not important to me Very important to me

|— —|

E. be valued in my community

Not important to me Very important to me

|— —|

F. create increased opportunities for future farmers

Not important to me Very important to me

|— —|

G. have variety in my work

Not important to me Very important to me

|— —|

H. pay off debts

Not important to me Very important to me

|— —|

I. maintain a stable farming system

Not important to me Very important to me

|— —|

J. have time available for socialising with family and friends

Not important to me Very important to me

|— —|

If you would like to add a new goal that is not listed you can do so. Describe the new goal in the space below. Also write out the goal from provided list (A to J), that is most similar to it, in the space alongside.

20. Name of the new goal_____

21. Name the goal it is most similar to (from list above, i.e. A to J) _____

SECTION C: Contribution of Stream Bank Management to Farming Goals

(questions 22 to 31)

How much does the way in which you manage your stream bank area contribute to your farming goals?

A. build a valuable farming business

Riparian management has a negative effect neutral Riparian management has a positive effect

|— —|

B. produce to maximise farming profits

Riparian management has a negative effect neutral Riparian management has a positive effect

|— —|

C. be self-reliant in decision-making

Riparian management has a negative effect neutral Riparian management has a positive effect

|— —|

D. ook after nature

Riparian management has a negative effect | neutral | Riparian management has a positive effect

|— —|

E. be valued in my community

Riparian management has a negative effect | neutral | Riparian management has a positive effect

|— —|

F. create increased opportunities for future farmers

Riparian management has a negative effect | neutral | Riparian management has a positive effect

|— —|

G. have variety in my work

Riparian management has a negative effect | neutral | Riparian management has a positive effect

|— —|

H. pay off debts

Riparian management has a negative effect | neutral | Riparian management has a positive effect

|— —|

I. maintain a stable farming system

Riparian management has a negative effect | neutral | Riparian management has a positive effect

|— —|

J. have time available for socialising with family and friends

Riparian management has a negative effect | neutral | Riparian management has a positive effect

|— —|

SECTION D: Stream Bank Practice Perceptions

32 My fencing and planting native trees along waterway banks will reduce sediment

Extremely unlikely neutral Extremely likely

|— —|

33 Over the next year I will have the knowledge that I need to fence and plant native trees along waterway banks

Strongly disagree

neutral Strongly agree

|— —|

34 For me to do the fencing of the stream banks and planting of native trees would be

Very difficult neutral Very easy

|— —|

35 My fencing and planting native trees along waterway banks will increase untidiness and weediness

Extremely unlikely neutral Extremely likely

|— —|

36 It is expected of me that I should I should fence and plant native trees along waterway banks on my farm

Definitely false neutral Definitely true

|— —|

37 My fencing and planting native trees along waterway banks will reduce nutrient contamination

Extremely unlikely neutral Extremely likely

|— —|

38 I often think about fencing and planting native trees along waterway banks

Definitely false neutral Definitely true

|— —|

39 My fencing and planting native trees along waterway banks will make stock water, animal safety, and animal management more difficult

Extremely unlikely neutral Extremely likely

|— —|

40 Most people who are important to me are likely to fence and plant native trees along waterway banks

Definitely false neutral Definitely true

|— —|

41 My fencing and planting native trees along waterway banks will improve waterway health and cleanliness

Extremely unlikely neutral Extremely likely

|— —|

42 Fencing and planting native trees along waterway banks on my farm over the next year would be

Unpleasant neutral Pleasant

|— —|

43 Over the next year I will have the skills needed to fence and plant native trees along waterway banks

Strongly disagree

neutral Strongly agree

|— —|

44 My fencing and planting native trees along waterway banks will reduce waterway temperatures

Extremely unlikely neutral Extremely likely

|— —|

45 If it were entirely up to me I am confident that I would be able to fence and plant native trees along waterway banks

Definitely false neutral Definitely true

|— —|

46 Over the next year I expect that I will have enough time to fence and plant native trees along some waterway banks

Strongly disagree neutral Strongly agree

|— —|

47 Over the next year I plan to fence off the stream banks and plant native trees

Definitely false neutral Definitely true

|— —|

48 My fencing and planting native trees along waterway banks will make more flood control difficult

Extremely unlikely neutral Extremely likely

|— —|

49 Over the next year I will have enough funds to fence and plant native trees along some waterway banks

Strongly disagree neutral Strongly agree

|— —|

50 Fencing and planting native trees along waterway banks on my farm over the next year would be

Bad neutral Good

|— —|

51 My friends think that I should fence and plant native trees along waterway banks

Definitely false neutral Definitely true

|— —|

52 My fencing and planting native trees along waterway banks will increase wildlife areas and habitat

Extremely unlikely neutral Extremely likely

|— —|

53 I am very supportive of fencing and planting native trees along waterway banks

Definitely false neutral Definitely true

|— —|

54 To fence and plant native trees along waterway banks fits with my idea of farming sustainably

Definitely false neutral Definitely true

|— —|

55 I am capable of fencing off the stream banks and planting native trees

Definitely false neutral Definitely true

|— —|

56 What proportion of the waterway banks on your property have been fenced and planted in native trees? *(circle the most appropriate percentage)*

Percentage

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

57 My fencing and planting native trees along waterway banks will reduce harmful 'bugs'

Extremely unlikely neutral Extremely likely

|— —|

58 Over the next year I intend to fence off the stream banks and plant native trees

Definitely false neutral Definitely true

|— —|

59 Over the next year I want to fence off the stream banks and plant native trees

Definitely false neutral Definitely true

|— —|

60 The people in my life whose opinions I value would approve of me fencing and planting native trees along waterway banks on my farm

Definitely false neutral Definitely true

|— —|

61 Fencing and planting native trees along waterway banks on my farm over the next year would be

Useless neutral Useful

|— —|

62 I have control over whether or not I fence off the stream banks and plant native trees

Definitely false neutral Definitely true

|— —|

63 It is mostly up to me whether or not I fence off the stream banks and plant native trees

Definitely false neutral Definitely true

|— —|

64 Most people who are important to me think that I should fence and plant native trees along waterway banks on my farm

Definitely false neutral Definitely true

|— —|

65 My fencing and planting native trees along waterway banks will increase my costs and management time

Extremely unlikely neutral Extremely likely

|— —|

66 Fencing and planting native trees along waterway banks on my farm over the next year would be

Unenjoyable neutral Enjoyable

|— —|

67 My fencing and planting native trees along waterway banks will reduce erosion and slips

Extremely unlikely neutral Extremely likely

|— —|

68 Over the next year I will have the ability that I need to fence and plant native trees along waterway banks

Strongly disagree

neutral Strongly agree

|— —|

69 My fencing and planting native trees along waterway banks will make that area more attractive

Extremely unlikely neutral Extremely likely

|— —|

70 Fencing and planting native trees along waterway banks on my farm over the next year would be

Worthless neutral Valuable

|— —|

71 Experts think that I should fence and plant native trees along waterway banks

Definitely false neutral Definitely true

|— —|

72 My family thinks that I should fence and plant native trees along waterway banks

Definitely false neutral Definitely true

|— —|

73 My fencing and planting native trees along waterway banks will reduce land available for production

Extremely unlikely neutral Extremely likely

|— —|

74 My planting and protecting exotic trees along waterway banks will increase costs and management time

Extremely unlikely neutral Extremely likely

|— —|

75 Over the next year I want to plant exotic trees along the stream banks and put up stock protection

Definitely false neutral Definitely true

|— —|

76 Most people who are important to me think that I should plant and protect exotic trees along waterway banks on my farm

Definitely false neutral Definitely true

|— —|

77 To plant and protect exotic trees along waterway banks fits with my idea of farming sustainably

Definitely false neutral Definitely true

|— —|

78 I have control over whether or not I plant exotic trees along the stream banks and put up stock protection

Definitely false neutral Definitely true

|— —|

79 Over the next year I intend to plant exotic trees along the stream banks and put up stock protection

Definitely false neutral Definitely true

|— —|

80 Experts think that I should plant and protect exotic trees along waterway banks

Definitely false neutral Definitely true

|— —|

81 I am capable of planting exotic trees along the stream banks and putting up stock protection

Definitely false neutral Definitely true

|— —|

82 What proportion of the waterway banks on your property have been planted in exotic trees? *(circle the most appropriate percentage)*

Percentage

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

83 My planting and protecting exotic trees along waterway banks will reduce nutrient contamination

Extremely unlikely neutral Extremely likely

|— —|

84 My family thinks that I should plant and protect exotic trees along waterway banks

Definitely false neutral Definitely true

|— —|

85 My planting and protecting exotic trees along waterway banks will make flood control more difficult

Extremely unlikely neutral Extremely likely

|— —|

86 My friends think that I should plant and protect exotic trees along waterway banks

Definitely false neutral Definitely true

|— —|

87 For me to do the planting of exotic trees along the stream banks and putting up stock protection would be

Very difficult neutral Very easy

|— —|

88 My planting and protecting exotic trees along waterway banks will reduce harmful ‘bugs’

Extremely unlikely neutral Extremely likely

|— —|

89 Planting and protecting exotic trees along waterway banks on my farm over the next year would be

Worthless neutral Valuable

|— —|

90 My planting and protecting exotic trees along waterway banks will reduce sediment

Extremely unlikely neutral Extremely likely

|— —|

91 My planting and protecting exotic trees along waterway banks will improve waterway health and cleanliness

Extremely unlikely neutral Extremely likely

|— —|

92 Planting and protecting exotic trees along waterway banks on my farm over the next year would be

Useless neutral Useful

|— —|

93 If it were entirely up to me I am confident that I would be able to plant and protect exotic trees along waterway banks

Definitely false neutral Definitely true

|— —|

94 Over the next year I plan to plant exotic trees along the stream banks and put up stock protection

Definitely false neutral Definitely true

|— —|

95 My planting and protecting exotic trees along waterway banks will reduce land available for production

Extremely unlikely neutral Extremely likely

|— —|

96 My planting and protecting exotic trees along waterway banks will increase wildlife areas and habitat

Extremely unlikely neutral Extremely likely

|— —|

97 My planting and protecting exotic trees along waterway banks will make stock water, animal safety, and animal management more difficult

Extremely unlikely neutral Extremely likely

|— —|

98 The people in my life whose opinions I value would approve of me planting and protecting exotic trees along waterway banks on my farm

Definitely false neutral Definitely true

|— —|

99 It is expected of me that I should I should plant and protect exotic trees along waterway banks on my farm

Definitely false neutral Definitely true

|— —|

100 Planting and protecting exotic trees along waterway banks on my farm over the next year would be

Bad neutral Good

|— —|

101 Planting and protecting exotic trees along waterway banks on my farm over the next year would be

Unpleasant neutral Pleasant

|— —|

102 I often think about planting and protecting exotic trees along waterway banks

Definitely false neutral Definitely true

|— —|

103 Most people who are important to me are likely to plant and protect exotic trees along waterway banks

Definitely false neutral Definitely true

|— —|

104 It is mostly up to me whether or not I plant exotic trees along the stream banks and put up stock protection

Definitely false neutral Definitely true

|— —|

105 My planting and protecting exotic trees along waterway banks will make that area more attractive

Extremely unlikely neutral Extremely likely

|— —|

106 Planting and protecting exotic trees along waterway banks on my farm over the next year would be

Unenjoyable neutral Enjoyable

|— —|

107 I am very supportive of planting and protecting exotic trees along waterway banks

Definitely false neutral Definitely true

|— —|

108 My planting and protecting exotic trees along waterway banks will increase untidiness and weediness

Extremely unlikely neutral Extremely likely

|— —|

109 My planting and protecting exotic trees along waterway banks will reduce waterway temperatures

Extremely unlikely neutral Extremely likely

|— —|

110 My planting and protecting exotic trees along waterway banks will reduce erosion and slips

Extremely unlikely neutral Extremely likely

|— —|

111 Managing the stream bank area for *improved waterway health* is

Not important to me neutral Very important to me

|— —|

112 For my farm, making stock water, animal safety, and animal management more difficult is:

Extremely bad neutral Extremely good

|— —|

113 For my farm, having increased untidiness and weediness is:

Extremely bad neutral Extremely good

|— —|

114 I find water quality a difficult issue to deal with on my farm

Definitely false neutral Definitely true

|— —|

115 For my farm, improving waterway health and cleanliness is:

Extremely bad neutral Extremely good

|— —|

116 For my farm, being able to reduce nutrient contamination of waterways is:

Extremely bad neutral Extremely good

|— —|

117 I think of myself as someone concerned about water quality

Definitely false neutral Definitely true

|— —|

118 What proportion of the waterways on your property have been fenced off from livestock or in other ways made inaccessible to them (including the ways described at the beginning of this survey)? *(circle the most appropriate percentage)*

Percentage

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

119 Generally on the farm, how much do you want to do what your *family* thinks that you should do?

Not at all neutral Very much

|— —|

120 For my farm, to increase costs and management time is:

Extremely bad neutral Extremely good

|— —|

121 Generally on the farm, how much do you want to do what *experts* think that you should do?

Not at all neutral Very much

|— —|

122 I think that I have already done for water quality more than most farmers

Definitely false neutral Definitely true

|— —|

123 For my farm, to increase wildlife areas and habitat is:

Extremely bad neutral Extremely good

|— —|

124 For my farm, being able to reduce sediment in waterways is:

Extremely bad neutral Extremely good

|— —|

125 For my farm, reducing erosion and slips is:

Extremely bad neutral Extremely good

|— —|

126 For my farm, making waterway banks more attractive is:

Extremely bad neutral Extremely good

|— —|

127 I think that my farm management is good for water quality

Definitely false neutral Definitely true

|— —|

128 Managing the stream bank area to *develop nature areas* is

Not important to me neutral Very important to me

|— —|

129 Managing the stream bank area for *sustainable production* is

Not important to me neutral Very important to me

|— —|

130 For my farm, being able to reduce harmful ‘bugs’ is:

Extremely bad neutral Extremely good

|— — — — — — — — — — — — — — — — — — — —|

131 For my farm, reducing the land available for production is:

Extremely bad neutral Extremely good

|— — — — — — — — — — — — — — — — — — — —|

132 For my farm, making flood control more difficult is:

Extremely bad neutral Extremely good

|— — — — — — — — — — — — — — — — — — — —|

133 For my farm, being able to reduce waterway temperatures is:

Extremely bad neutral Extremely good

|— — — — — — — — — — — — — — — — — — — —|

134 Managing the stream bank area for *erosion control* is

Not important to me neutral Very important to me

|— — — — — — — — — — — — — — — — — — — —|

135 Generally on the farm, how much do you want to do what your *friends* think that you should do?

Not at all neutral Very much

|— — — — — — — — — — — — — — — — — — — —|

THANK YOU FOR YOUR HELP

Appendix G: Introductory Letter and Questionnaire for the Woodlot Survey

Dear Respondent,

Maintaining biodiversity, the long term survival of New Zealand's indigenous (native) plants and animals, will require assistance from many different people. We are conducting research on behalf of AgResearch, a government owned Research Company that includes the research facilities at Ruakura, Whatawhata, Grasslands, Wallaceville, Lincoln, and Invermay. AgResearch scientists would like to know more about how farmers feel about biodiversity, and their attitudes and beliefs towards biodiversity issues. We aim to obtain this information by asking farmers like you to complete and return this questionnaire.

To show our appreciation for you taking the time to participate, on return of a completed questionnaire you will be given a chance to win one of four cash draws, i.e. 2 draws of $1,000 and 2 draws of $500. Winners will be notified personally and results will be published in the Sunday Star Times. The survey is going to only 1600 people so you have a good chance of being a winner.

If you are prepared to complete the questionnaire, all you have to do is read each statement and mark on the doffed line to indicate how strongly you agree or disagree. There are also some demographic questions to complete. This questionnaire should take you about 30 minutes to complete. Please use the pre-paid self-addressed envelope to return the completed questionnaire by 21st June in order to qualify for the prize draw.

All responses are completely confidential and all contact information will be held by us in accordance with the Privacy Act.

Should you have any queries whatsoever, please contact the following personnel:

Donna Willis
Survey Manager
09 5254710 ext 8705

Mele Hala
Research Executive
09 5254710 ext 8773

Good Luck in the Draw!

Donna Willis
Survey Manager

Appendix H. Woodlots Questionnaire

DESCRIPTION OF ESTABLISHING AND MAINTAINING WOODLOTS

Woodlots of native trees being grown for timber production have been established by some farmers. They can be harvested if they are maintained on a sustainable basis.

QUESTIONNAIRE DESIGN

The questions are designed to measure people's attitudes towards establishing and maintaining native tree woodlots. Some of the questions may appear to be repetitious but they take different points of view about each of the issues involved. Don't spend too long on each question – usually your first answer is your best answer. There is no right or wrong answers to these questions. The survey should take about 30 minutes to complete.

Any comments that you write in addition to answering the questions will be recorded.

To answer the first eight questions (Section A) please circle, tick or complete the appropriate box. For the remaining questions (Sections B, C and D) please put a cross on the line under each statement to indicate how strongly you agree or disagree with that particular statement. If you don't know enough about the question to make a response or the question does not apply to your situation, mark your answer in the neutral position.

AN EXAMPLE:

Government expenditure on environmental research should be reduced.

Strongly Agree *Neutral* *Strongly Disagree*

|_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ **X** _ _ _ _ _ _|

The person answering the question in this example has indicated that their feelings lay midway between being neutral and strongly disagreeing with the statement.

QUESTIONNAIRE

SECTION A. Background information

Please complete questions 1 - 8 by filling in the gaps provided or ticking or circling the most correct answer. Where you have more than one property, answer for the property with the most biodiversity potential.

1. Region (*please tick the appropriate box)*

□1	Northland	□2	Auckland	□3	Waikato
□4	Bay of Plenty	□5	Gisborne / East Cape	□6	Hawkes Bay
□7	Taranaki	□8	Manawatu	□9	Wairarapa
□10	Wellington	□11	Nelson	□12	West Coast
□13	Marlborough	□14	Canterbury	□15	Otago
□16	Southland				

2. Your occupation *(circle the category that best applies)*

Farmer 1 Part-time Farmer 2 Non-farmer 3

3. Your total farm property area?

_____ha OR _____acres

4. Main farming types? (c*ircle all categories that apply)*

Sheep 1 Cattle 2 Deer 3 Goats 4 Dairy Cows 5 Farm Forestry/Woodlots 6

Other: 7 _____

5. Your gender? *(please circle one)*

MALE 1 FEMALE 2

6. Your age? _____years

7. Ethnicity (*please tick one*)

☐ 1 New Zealand European ☐ 2 Maori ☐ 3 Pacific Islander

☐ 4 Asian ☐ Other 5 ______________________________

8. What area of native tree woodlots do you have?

________________ ha or _______________ acres

SECTION B: Selecting Farming Goals

(Questions 9 to 18)

How much would achieving the following goals over the next 3-5 years provide you with the satisfaction you need from being a farmer?

A. Build a valuable farming business

Not important to me neutral Very important to me

|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

B. Produce to maximise farming profits

Not important to me neutral Very important to me

|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

C. Be self-reliant in decision-making

Not important to me neutral Very important to me

|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

D. Look after nature

Not important to me neutral Very important to me

|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

E. Be valued in my community

Not important to me neutral Very important to me

|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

F. Create increased opportunities for future farmers

Not important to me neutral Very important to me

|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

G. Have variety in my work

Not important to me neutral Very important to me

|— —|

H. Pay off debts

Not important to me neutral Very important to me

|— —|

I. Maintain a stable farming system

Not important to me neutral Very important to me

|— —|

J. Have time available for socialising with family and friends

Not important to me neutral Very important to me

|— —|

If you would like to add a new goal that is not listed you can do so. Describe the new goal in the space below. Also write out the goal from the provided list (A to J), that is most similar to it in the space alongside.

19. Name of the new goal_____

20. Name the goal it is most similar to (from list above, i.e. A to J) _____

SECTION C: Contribution of to Your Farming Goals of Establishing and Maintaining Native Tree Woodlots

(questions 21 to 30)

How much does establishing and maintaining native tree woodlots contribute to your farming goals?

A. Build a valuable farming business

Establishing and maintaining native tree woodlots will have a negative effect on this goal	neutral	Establishing and maintaining native tree woodlots will have a positive effect on this goal

|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

B. Produce to maximise farming profits

Establishing and maintaining native tree woodlots will have a negative effect	neutral	Establishing and maintaining native tree woodlots will have a positive effect

|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

C. Be self-reliant in decision-making

Establishing and maintaining native tree woodlots will have a negative effect	neutral	Establishing and maintaining native tree woodlots will have a positive effect

|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

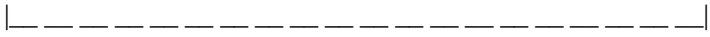
D. Look after nature

Establishing and maintaining native tree woodlots will have a negative effect	neutral	Establishing and maintaining native tree woodlots will have a positive effect

|__ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __|

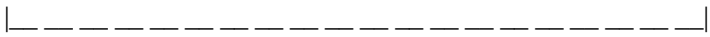
E. Be valued in my community

Establishing and maintaining native tree woodlots will have a negative effect | neutral | Establishing and maintaining native tree woodlots will have a positive effect



F. Create increased opportunities for future farmers

Establishing and maintaining native tree woodlots will have a negative effect | neutral | Establishing and maintaining native tree woodlots will have a positive effect



G. Have variety in my work

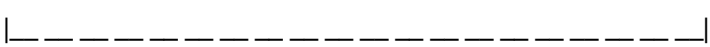
Establishing and maintaining native tree woodlots will have a negative effect | neutral | Establishing and maintaining native tree woodlots will have a positive effect

H. Pay off debts

Establishing and maintaining native tree woodlots will have a negative effect | neutral | Establishing and maintaining native tree woodlots will have a positive effect

I. Maintain a stable farming system

Establishing and maintaining native tree woodlots will have a negative effect | neutral | Establishing and maintaining native tree woodlots will have a positive effect



J. Have time available for socialising with family and friends

Establishing and maintaining native tree woodlots will have a negative effect	neutral	Establishing and maintaining native tree woodlots will have a positive effect

|— —|

SECTION D: Woodlots Perceptions

31. Establishing and maintaining native tree woodlots on my farm over the next year would be:

Useless	neutral	Useful

|— —|

32. Most people who are important to me are likely to establish and maintain native tree woodlots.

Definitely false	neutral	Definitely true

|— —|

33. Establishing and maintaining native tree woodlots on my farm will create extra work.

Extremely unlikely	neutral	Extremely likely

|— —|

34. For me, creating extra work on my farm is:

Extremely undesirable	neutral	Extremely desirable

|— —|

35. Establishing and maintaining native tree woodlots on my farm will improve land use.

Extremely unlikely	neutral	Extremely likely

|— —|

36. For me, improving land use on my farm is:

Extremely undesirable	neutral	Extremely desirable

|— —|

37. Establishing and maintaining native tree woodlots on my farm to benefit future generations is:

Not important to me neutral Very important to me

|— —|

38. For me to establish and maintain native tree woodlots on my farm would require a lot of effort.

Definitely false neutral Definitely true

|— —|

39. For me to establish and maintain native tree woodlots on my farm would be very complex.

Definitely false neutral Definitely true

|— —|

40. If it were entirely up to me I am confident that I would be able to establish and maintain native tree woodlots on my farm.

Definitely false neutral Definitely true

|— —|

41. Establishing and maintaining native tree woodlots on my farm is risky because I may not be allowed by the authorities to harvest it.

Extremely unlikely neutral Extremely likely

|— —|

42. For me, not being able to harvest trees from native tree woodlots is:

Extremely undesirable neutral Extremely desirable

|— —|

43. Over the next year I will have the knowledge needed so that I could establish and maintain native tree woodlots on my farm.

Strongly disagree neutral Strongly agree

|— —|

44. Establishing and maintaining native tree woodlots on my farm to bring more wildlife is:

Not important to me neutral Very important to me

|— —|

4

45. It is mostly up to me whether or not I establish and maintain native tree woodlots on my farm.

Definitely false neutral Definitely true

|— —|

46. Establishing and maintaining native tree woodlots on my farm over the next year would be:

Bad neutral Good

|— —|

47. I often think about establishing and maintaining native tree woodlots.

Definitely false neutral Definitely true

|— —|

48. Establishing and maintaining native tree woodlots will improve the aesthetic appearance of my farm.

Extremely unlikely neutral Extremely likely

|— —|

49. For me, improving the aesthetic appearance of my farm is:

Extremely undesirable neutral Extremely desirable

|— —|

50. Over the next year I expect that I will have the time needed so that I could establish and maintain native tree woodlots on my farm.

Strongly disagree neutral Strongly agree

|— —|

51. Establishing and maintaining native tree woodlots on my farm to increase profitability is:

Not important to me neutral Very important to me

|— —|

52. Establishing and maintaining native tree woodlots on my farm will increase wildlife habitat.

Extremely unlikely neutral Extremely likely

|— —|

53. For me, being able to increase wildlife habitat on my farm is:

Extremely undesirable neutral Extremely desirable

|— —|

54. Establishing and maintaining native tree woodlots on my farm will improve farm profitability.

Extremely unlikely neutral Extremely likely

|— —|

55. For me, improving farm profitability is:

Extremely undesirable neutral Extremely desirable

|— —|

56. Generally on the farm I do what *government experts* think that I should do.

Definitely false neutral Definitely true

|— —|

57. Over the next year I will have the ability needed so that I could establish and maintain native tree woodlots on my farm.

Strongly disagree neutral Strongly agree

|— —|

58. Over the next year I *want* to establish and maintain native tree woodlots on my farm.

Definitely false neutral Definitely true

|— —|

59. I have control over whether or not I establish and maintain native tree woodlots on my farm.

Definitely false neutral Definitely true

|— —|

60. I think of myself as someone concerned about establishing and maintaining native tree woodlots.

Definitely false neutral Definitely true

|— —|

61. Establishing and maintaining native tree woodlots on my farm creates extra costs.

Extremely unlikely neutral Extremely likely

|— —|

62. For me, creating extra costs on my farm is:

Extremely undesirable neutral Extremely desirable

|— —|

63. Government experts think that I should establish and maintain native tree woodlots on my farm.

Definitely false neutral Definitely true

|— —|

64. Most people who are important to me think that I should establish and maintain native tree woodlots on my farm.

Definitely false neutral Definitely true

|— —|

65. To establish and maintain native tree woodlots fits with my idea of farming sustainably.

Definitely false neutral Definitely true

|— —|

66. Generally on the farm I do what my *friends* think that I should do.

Definitely false neutral Definitely true

|— —|

67. Establishing and maintaining native tree woodlots on my farm over the next year would be:

Foolish neutral Wise

|— —|

68. Establishing and maintaining native tree woodlots will on my farm will not be useful to my generation.

Extremely unlikely neutral Extremely likely

|— —|

69. For me, doing things useful to my generation is:

Extremely undesirable neutral Extremely desirable

|— —|

70. Establishing and maintaining native tree woodlots on my farm will increase the farm's value.

Extremely unlikely neutral Extremely likely

|— —|

71. For me, increasing my farm's value is:

Extremely undesirable neutral Extremely desirable

|— —|

72. Establishing and maintaining native tree woodlots on my farm over the next year would make me:

Anxious neutral Confident

|— —|

73. Establishing and maintaining native tree woodlots to beautify my farm is:

Not important to me neutral Very important to me

|— —|

74. Over the next year I will have the funds needed so that I could establish and maintain native tree woodlots on my farm.

Strongly disagree neutral Strongly agree

|— —|

75. Establishing and maintaining native tree woodlots on my farm over the next year would make me:

Frustrated neutral Contented

|— —|

76. The people in my life whose opinions I value would approve of me establishing and maintaining native tree woodlots on my farm.

Definitely false neutral Definitely true

|— —|

77. My friends think that I should establish and maintain native tree woodlots on my farm.

Definitely false neutral Definitely true

|— —|

78. My family thinks that I should establish and maintain native tree woodlots on my farm.

Definitely false neutral Definitely true

|— —|

79. Over the next year I will have the *encouragement* needed so that I could establish and maintain native tree woodlots on my farm.

Strongly disagree neutral Strongly agree

|— —|

80. Establishing and maintaining native tree woodlots on my farm will produce good quality wood.

Extremely unlikely neutral Extremely likely

|— —|

81. For me, producing good quality wood on my farm is:

Extremely undesirable neutral Extremely desirable

|— —|

82. I am very supportive of establishing and maintaining native tree woodlots.

Definitely false neutral Definitely true

|— —|

83. Generally on the farm I do what my *family* thinks that I should do.

Definitely false neutral Definitely true

|— —|

84. Over the next year I *intend* to establish and maintain native tree woodlots on my farm.

Definitely false neutral Definitely true

|_ _|

85. I think that I have already established and maintained native tree woodlots more than most farmers.

Definitely false neutral Definitely true

|_ _|

Any Additional Comments:_____

_____

_____

THANK YOU FOR YOUR ASSISTANCE

Appendix I: Normality Measures for TRA Variables and Bush Remnant Protection

Table 75: Distribution of bush remnant protection variables

Question	Variable	Variable Label	Mean	St Dev	Median	Mode	Kurtosis	Skewness	Count	Shapiro-Wilk P<W
9	Behaviour	B2	53.7	41.3	60	100	-1.64	-0.18	420	<.0001
3	Farm Area	FarmArea	413	1110	160	20	98.4	8.89	625	<.0001
6	Age	Age	49.6	10.4	50	40	-0.22	0.08	630	<.0001
11	Having a Valuable Business	Bus	16.9	3.9	18	20	4.14	-2	616	<.0001
12	Maximising Profit	Prof	16.6	3.7	17	20	2.99	-1.6	616	<.0001
13	Being Self-reliant	Self	17.2	3.2	18	20	4.12	-1.8	616	<.0001
14	Looking after Nature	Nat	17.0	3.0	18	20	4.23	-1.64	616	<.0001
15	Being Valued in my Community	Val	14.4	4.48	15	11	0.88	-0.96	616	<.0001
16	Increased Future Opportunities	Fut	15.4	3.8	16	20	1.57	-1.05	616	<.0001
17	Having Varied Work	Var	16.5	3.2	17	20	1.97	-1.23	616	<.0001
18	Paying off debt	Debt	16.5	4.4	18	20	3.35	-1.87	616	<.0001
19	A Stable Farming System	Sys	17.7	2.7	18	20	5.7	-1.98	616	<.0001
20	Socialising	Soc	17.1	3.3	18	20	3.28	-1.68	616	<.0001
	Mean of ProdBus … ProdSoc	Goalsm	16.5	3.7	17	20	3.08	-1.61	616	<.0001
48	Behavioural Intentions	BI1	12.2	5.7	12	11	-0.61	-0.51	599	<.0001
63	Behavioural Intentions	BI2	11.9	5.6	12	11	-0.61	-0.47	597	<.0001
11x23	Having a Valuable Business	ProdBus	46.0	75.8	45	-10	0.71	-0.29	606	<.0001
12x24	Maximising Profit	ProdProf	14.7	73.7	8.5	-10	0.89	-0.14	603	<.0001
13x25	Being Self-reliant	ProdSelf	28.5	79.1	9.5	10	0.80	-0.21	603	<.0001
14x26	Looking after Nature	ProdNat	96.6	71.7	110	190	-0.09	-0.57	603	<.0001
15x27	Being Valued in my Community	ProdVal	43.8	64.5	22.5	5.5	0.40	0.35	603	<.0001
16x28	Increased Future Opportunities	ProdFut	33.9	75.2	10	190	0.57	-0.14	602	<.0001
17x29	Having Varied Work	ProdVar	54.1	71.6	47.5	190	0.64	-0.22	602	<.0001
18x30	Paying off debt	ProdDebt	-15.2	82.8	-7	-10	0.52	-0.02	602	<.0001
19x31	A Stable Farming System	ProdSys	50.0	83.0	37.5	190	0.15	-0.32	601	<.0001
20x32	Socialising	ProdSoc	14.7	76.6	8	10	1.10	0.13	600	<.0001
	Goals (mean)	Goalsm	36.3	54.7	34.35	24	1.68	-0.21	599	<.0001
56	Instrumental Attitudes	IA1	15.7	4.6	17	20	0.79	-1.00	599	<.0001
76	Instrumental Attitudes	IA2	13.5	5.0	14	11	0.30	-0.79	602	<.0001
90	Instrumental Attitudes	IA3	15.0	4.3	16	11	1.01	-0.95	603	<.0001
39	Affective Attitudes	AA1	14.8	4.4	16	11	1.09	-1.02	599	<.0001

Question	Variable	Variable Label	Mean	St Dev	Median	Mode	Kurtosis	Skewness	Count	Shapiro-Wilk P<W
84	Affective Attitudes	AA2	13.3	3.7	12	11	0.77	-0.24	600	<.0001
83	Subjective Norms	SN1	12.6	5.1	12	11	0.00	-0.59	605	<.0001
57	Subjective Norms	SN2	15.9	4.2	17	20	1.42	-1.21	604	<.0001
38	Subjective Norms	SN3	14.2	4.6	15	11	0.47	-0.86	606	<.0001
68	Self-Efficacy	SE1	12.8	5.2	13	10	-0.04	-0.48	600	<.0001
46	Self-Efficacy	SE2	10.6	5.7	11	11	-0.84	-0.12	600	<.0001
78	Behavioural Control	BC1	16.5	4.2	18	20	2.33	-1.60	606	<.0001
82	Behavioural Control	BC2	15.9	4.8	18	20	1.52	-1.42	601	<.0001
91	Self-Identity	SI1	16.3	3.8	17	20	2.12	-1.37	619	<.0001
66	Self-Identity	SI2	12.6	5.1	12	11	-0.08	-0.52	601	<.0001
34	Instrumental (Attitude) Belief	IAB1	13.1	5.7	14	11	-0.42	-0.75	607	<.0001
35	Instrumental Belief	IAB2	14.7	3.7	15	11	-0.30	-0.50	612	<.0001
87	Instrumental Belief	IAB3	12.9	6.1	14	20	-0.74	-0.70	607	<.0001
88	Instrumental Belief	IAB4	17.3	3.0	18	20	3.93	-1.72	624	<.0001
51	Instrumental Belief	IAB5	12.7	6.3	14	20	-0.90	-0.62	600	<.0001
52	Instrumental Belief	IAB6	14.9	5.1	16	20	0.78	-1.20	611	<.0001
59	Instrumental Belief	IAB7	15.5	4.99	17	20	1.38	-1.40	605	<.0001
60	Instrumental Belief	IAB8	16.5	3.1	17	20	2.79	-1.24	614	<.0001
43	Instrumental Belief	IAB9	15.2	5.1	17	20	1.05	-1.32	603	<.0001
44	Instrumental Belief	IAB10	14.9	4.5	16	20	0.91	-1.08	612	<.0001
41	Instrumental Belief	IAB11	11.6	6.2	12	11	-1.13	-0.37	602	<.0001
42	Instrumental Belief	IAB12	3.8	4.2	2	1	4.15	2.09	616	<.0001
49	Instrumental Belief	IAB13	15.1	5.0	17	20	0.64	-1.16	597	<.0001
50	Instrumental Belief	IAB14	5.9	4.4	5	1	-0.49	0.59	609	<.0001
53	Instrumental Belief	IAB15	14.8	4.9	16	20	0.83	-1.13	602	<.0001
54	Instrumental Belief	IAB16	6.8	4.6	6	1	-0.79	0.38	611	<.0001
85	Instrumental Belief	IAB17	10.8	6.2	11	11	-1.22	-0.17	606	<.0001
86	Instrumental Belief	IAB18	6.5	4.9	6	1	-0.22	0.69	614	<.0001
71	Instrumental Belief	IAB19	10.0	6.0	11	11	-1.06	-0.01	601	<.0001
72	Instrumental Belief	IAB20	4.7	4.5	2.1	1	0.81	1.29	612	<.0001
74	Instrumental Belief	IAB21	12.9	5.2	13	11	0.04	-0.77	601	<.0001
75	Instrumental Belief	IAB22	12.6	3.5	12	11	1.42	-0.29	609	<.0001
64	Instrumental Belief	IAB23	11.7	5.7	12	11	-0.71	-0.44	603	<.0001
65	Instrumental Belief	IAB24	16.7	3.4	18	20	3.05	-1.50	614	<.0001

Question	Variable	Variable Label	Mean	St Dev	Median	Mode	Kurtosis	Skewness	Count	Shapiro-Wilk P<W
80	Normative Belief	NB1	13.7	5.1	14	11	0.19	-0.78	602	<.0001
89	Normative Belief	NB2	10.1	5.4	11	11	-0.84	-0.32	624	<.0001
69	Normative Belief	NB3	10.6	4.9	11	11	-0.17	-0.50	601	<.0001
58	Normative Belief	NB4	5.4	4.9	3	1	-0.29	0.88	615	<.0001
73	Normative Belief	NB5	11.8	5.4	11	11	-0.32	-0.50	602	<.0001
67	Normative Belief	NB6	7.0	5.2	6	1	-0.84	0.45	614	<.0001
70	Efficacy Belief	SEB1	13.5	5.3	14	11	0.05	-0.81	603	<.0001
55	Efficacy Belief	SEB2	16.7	3.7	18	20	3.19	-1.64	613	<.0001
77	Efficacy Belief	SEB3	14.6	5.0	16	20	0.74	-1.09	610	<.0001
47	Efficacy Belief	SEB4	13.8	5.2	14	11	-0.04	-0.78	601	<.0001
36	Control Belief	CB1	10.8	5.1	11	11	-0.52	-0.22	600	<.0001
61	Control Belief	CB2	8.8	5.6	11	11	-1.05	0.03	596	<.0001
40	Control Belief	CB3	11.4	4.9	11	11	-0.09	-0.39	595	<.0001
45	Control Belief	CB4	11.4	5.1	11	11	-0.39	-0.33	593	<.0001
81	Control Belief	CB5	10.5	4.8	11	11	-0.11	-0.34	598	<.0001
34x35	A. Belief Product	IAB1prod	21.2	35.2	10.5	0.25	0.46	0.06	605	<.0001
87x88	A. Belief Product	IAB3prod	20.7	48.4	20.25	90.25	-0.37	-0.50	606	<.0001
51x52	A. Belief Product	IAB5prod	19.4	45.3	12.25	90.25	-0.14	-0.34	598	<.0001
59x60	A. Belief Product	IAB7prod	36.4	38.6	41.25	90.25	0.41	-0.55	602	<.0001
43x44	A. Belief Product	IAB9prod	31.2	38.5	29.25	90.25	0.10	-0.34	600	<.0001
41x42	A. Belief Product	IAB11prod	-5.9	51.7	-4.75	-90.25	-0.81	0.21	602	<.0001
49x50	A. Belief Product	IAB13prod	-23.9	41.0	-13.25	-90.25	-0.14	0.13	596	<.0001
53x54	A. Belief Product	IAB15prod	-17.4	39.1	-7.5	-90.25	0.19	-0.02	600	<.0001
85x86	A. Belief Product	IAB17prod	-0.3	43.5	-1.25	90.25	0.04	0.12	604	<.0001
71x72	A. Belief Product	IAB19prod	1.1	48.6	-2.25	90.25	-0.44	0.05	600	<.0001
74x75	A. Belief Product	IAB21prod	10.0	24.9	2.25	.025	3.57	0.58	599	<.0001
64x65	A. Belief Product	IAB23prod	8.8	42.7	4.75	90.25	0.21	-0.34	601	<.0001
80x89	N. Belief Product	NB1prod	41.2	61.0	21.0	5.5	0.76	0.14	601	<.0001
69x58	N. Belief Product	NB3prod	8.1	31.3	2.0	0.5	7.94	1.60	596	<.0001
73x67	N. Belief Product	NB5prod	11.4	45.9	5.5	5.5	3.65	0.03	597	<.0001
79	Objective	Ob1	15.5	4.0	16	20	2.37	-1.34	605	<.0001
33	Objective	Ob2	14.8	4.4	16	11	1.31	-1.14	608	<.0001
37	Objective	Ob3	15.2	4.6	16	20	1.69	-1.35	604	<.0001
62	Objective	Ob4	15.7	4.2	17	20	1.96	-1.31	601	<.0001

Question	Variable	Variable Label	Mean	St Dev	Median	Mode	Kurtosis	Skewness	Count	Shapiro-Wilk P<W
	Mean of Ob1 …Ob4	Obm	15.3	3.5	16	20	1.72	-1.15	599	<.0001
	Mean of IA	IAm	14.8	4.0	15.3	20	0.67	-0.86	597	<.0001
	Mean of AA	AAm	7.0	1.8	7	5.5	0.92	-0.61	595	<.0001
	Mean of SN	SNm	14.2	3.8	14.7	16.7	0.59	-0.77	598	<.0001
	Mean of SE	SEm	11.7	4.6	11.5	11	-0.30	-0.20	598	<.0001
	Mean of BC	BCm	16.2	4.0	17.5	20	2.10	-1.44	601	<.0001
	Mean of SI	SIm	15.9	3.6	16.5	20	2.09	-1.29	600	<.0001
	Mean of IAB	IABm	8.2	20.6	7.96	9.25	0.73	-0.19	592	.0005
	Mean of NB	NBm	20.2	34.9	13.1	-9.5	1.90	0.49	594	<.0001
	Mean of SEB	SEBm	14.9	3.4	15	20	-0.27	-0.49	597	<.0001
	Mean of CB	CBm	10.6	3.8	11	11	-0.03	-0.24	586	<.0001

Appendix J. Correlations between TRA Variables for Bush Remnant Protection

Table 76: Correlations between molecular TRA measures for bush remnant protection

BI2	0.75 ***	1							
IAB1prod	0.28 ***	0.28 ***	1						
IAB3prod	0.26 ***	0.31 ***	0.24 ***	1					
IAB5prod	0.28 ***	0.23 **	0.25 ***	0.20 **	1				
IAB7prod	0.39 ***	0.39 ***	0.35 ***	0.39 ***	0.29 ***	1			
IAB9prod	0.33 ***	0.29 ***	0.35 ***	0.26 ***	0.28 ***	0.45 ***	1		
IAB11prod	0.22 **	0.18 *	0.12 #	0.12 *	0.13 *	0.20 ***	0.20 ***	1	
IAB13prod	0.26 ***	0.24 ***	0.10 *	0.13 #	0.08 ns	0.02 ns	0.04 ns	0.24 ***	1
IAB15prod	0.17 ***	0.13 *	0.01 ns	0.06 ns	0.02 ns	-0.02 ns	0.06 #	0.22 ***	0.52 ***
IAB17prod	0.17 *	0.12 ns	0.08 ns	0.05 ns	0.11 #	0.13 #	0.12 #	0.21 **	0.18 *
IAB19prod	0.15 *	0.18 ***	0.06 ns	0.18 ***	0.11 #	0.10 *	0.12 *	0.22 **	0.21 ***
IAB21prod	0.22 *	0.26 ***	0.21 ***	0.20 ***	0.12 ns	0.29 ***	0.18 *	0.15 *	0.04 ns
IAB23prod	0.33 ***	0.39 ***	0.29 ***	0.36 ***	0.25 ***	0.46 ***	0.31 ***	0.19 ns	0.15 ***
NB1prod	0.41 ***	0.42 ***	0.25 ***	0.24 **	0.18 #	0.42 ***	0.27 ***	0.17 *	0.11 *
NB3prod	0.25 **	0.29 ***	0.18 *	0.04 ns	0.01 ns	0.19 *	0.14 #	0.07 ns	0.10 *
NB5prod	0.14 #	0.15 #	0.11 #	0.00 ns	0.02 ns	0.23 ***	0.19 **	0.07 ns	-0.07 ns
SEB1	0.36 ***	0.33 ***	0.27 ***	0.18 *	0.25 **	0.42 ***	0.36 ***	0.16 #	0.04 ns
SEB2	0.39 ***	0.38 ***	0.16 *	0.22 ***	0.30 ***	0.45 ***	0.37 ***	0.24 ***	0.07 ns
SEB3	0.43 ***	0.44 ***	0.27 ***	0.26 ***	0.32 ***	0.46 ***	0.36 ***	0.23 **	0.16 *
SEB4	0.46 ***	0.33 ***	0.16 *	0.17 *	0.16 *	0.09 #	0.20 **	0.14 #	0.22 ***
CB1	0.51 ***	0.54 ***	0.32 ***	0.31 ***	0.21 ***	0.31 ***	0.27 ***	0.23 ***	0.27 ***
CB2	0.38 ***	0.47 ***	0.11 #	0.21 ***	0.10 ns	0.21 ***	0.12 **	0.16 **	0.33 ***
CB3	0.49 ***	0.49 ***	0.29 ***	0.29 ***	0.15 *	0.34 ***	0.25 ***	0.16 *	0.26 ***
CB4	0.46 ***	0.47 ***	0.16 *	0.20 ***	0.18 *	0.24 ***	0.26 ***	0.22 ***	0.25 ***
CB5	0.34 ***	0.38 ***	0.17 **	0.08 ns	0.16 *	0.19 ***	0.23 ***	0.14 *	0.14 **
	BI1	BI2	IAB1 prod	IAB3 prod	IAB5 prod	IAB7 prod	IAB9 prod	IAB11 prod	IAB13 prod

Table 76 continued

BI2								
IAB15prod	1							
IAB17prod	0.22 ***	1						
IAB19prod	0.15 #	0.25 ***	1					
IAB21prod	0.03 ns	0.11 #	0.05 ns	1				
IAB23prod	0.04 ns	0.10 ns	0.13 *	0.26 ***	1			
NB1prod	0.08 #	0.10 ns	0.09 #	0.33 ***	0.31 ***	1		
NB3prod	0.05 #	0.02 ns	-0.04 ns	0.25 ***	0.21 **	0.45 ***	1	
NB5prod	-0.01 ns	-0.06 ns	-0.11 *	0.20 *	0.12 ns	0.28 ***	0.37 ***	1
SEB1	0.05 ns	0.01 ns	0.07 ns	0.26 **	0.29 ***	0.41 ***	0.25 ***	0.29 ***
SEB2	0.12 ns	0.08 #	0.18 *	0.21 **	0.35 ***	0.39 ***	0.16 *	0.14 #
SEB3	0.13 *	0.15 *	0.19 **	0.24 ***	0.46 ***	0.50 ***	0.28 ***	0.21 *
SEB4	0.11 ***	0.18 **	0.09 ns	0.14 *	0.14 *	0.11 ***	0.08 ns	-0.04 ns
CB1	0.24 ***	0.19 **	0.20 ***	0.20 **	0.32 ***	0.29 ***	0.21 **	0.07 ns
CB2	0.23 ***	0.05 ns	0.15 **	0.19 ***	0.26 ***	0.23 ***	0.20 ***	0.05 ns
CB3	0.18 *	0.15 *	0.26 ***	0.29 ***	0.35 ***	0.33 ***	0.27 ***	0.14 #
CB4	0.20 ***	0.16 *	0.15 **	0.17 **	0.26 ***	0.30 ***	0.24 ***	0.08 ns
CB5	0.08 #	0.11 *	0.06 ns	0.20 **	0.25 ***	0.38 ***	0.27 ***	0.21 *
	IAB15 prod	IAB17 prod	IAB19 prod	IAB21 prod	IAB23 prod	NB1prod	NB3prod	NB5prod

Table 76 continued

SEB1	1							
SEB2	0.46 ***	1						
SEB3	0.47 ***	0.59 ***	1					
SEB4	0.01 ns	0.15 *	0.18 **	1				
CB1	0.22 **	0.29 ***	0.33 ***	0.33 ***	1			
CB2	0.19 *	0.20 ***	0.24 ***	0.24 ***	0.48 ***	1		
CB3	0.28 ***	0.34 ***	0.39 ***	0.27 ***	0.58 ***	0.42 ***	1	
CB4	0.13 *	0.31 ***	0.30 ***	0.36 ***	0.59 ***	0.44 ***	0.51 ***	1
CB5	0.27 ***	0.28 ***	0.39 ***	0.23 ***	0.34 ***	0.35 ***	0.36 ***	0.43 ***
	SEB1	SEB2	SEB3	SEB4	CB1	CB2	CB3	CB4

Table 77: Correlations between molar and molecular measures of bush remnant protection

Intrinsic Attitudes					Subjective Norms					Behavioural Control		
	IA1	IA2	IA3			SN1	SN2	SN3			BC1	BC2
IAB1prod	0.30 ***	0.30 ***	0.30 ***		NB1prod	0.65 ***	0.44 ***	0.34 ***		CB1	0.09 #	0.13 *
IAB3prod	0.26 ***	0.32 ***	0.36 ***		NB3prod	0.42 ***	0.28 ***	0.29 ***		CB2	0.08 #	0.14 **
IAB5prod	0.29 ***	0.26 ***	0.25 ***		NB5prod	0.28 ***	0.14 **	0.11 #		CB3	0.11 #	0.13 *
IAB7prod	0.58 ***	0.51 ***	0.53 ***							CB4	0.08 #	0.08 #
IAB9prod	0.41 ***	0.47 ***	0.43 ***							CB5	0.03 ns	0.06 ns
IAB11prod	0.23 ***	0.27 ***	0.26 ***									
IAB13prod	0.07 ns	0.12 *	0.16 ***		Self-Efficacy							
IAB15prod	0.09 #	0.08 #	0.16 ***			SE1	SE2					
IAB17prod	0.18 ***	0.17 ***	0.21 ***		SEB1	0.16 ***	0.00 ns					
IAB19prod	0.14 *	0.18 ***	0.23 ***		SEB2	-0.07 #	-0.15 **					
IAB21prod	0.28 ***	0.34 ***	0.34 ***		SEB3	-0.08 #	-0.14 **					
IAB23prod	0.38 ***	0.44 ***	0.42 ***		SEB4	-0.19 ***	-0.28 ***					

Appendix K. Regression Models Using Bush Remnant Protection Molecular TRA Variables

Table 78: Regression models of bush protection using molecular TRA variables

Variable	R (BIm)	Model 1	Model 2	Model 3	Model 4	Model 5
IABm	0.53	0.13 <.0001	0.11 <.0001	0.11 <.0001	0.06 .0010	0.06 .0002
NBm	0.41		0.04 .0001	0.04 <.0001	0.02 <.0001	0.02 <.0001
SEBm1	0.10			-0.05 .3865	-0.006 .9134	
CBm	0.64				0.64 <.0001	0.064 <.0001
Constant		10.94 <.0001	10.30 <.0001	11.05 <.0001	4.41 .018	4.36 <.0001
R^2		25.51	31.72	32.54	47.48	46.73
R^2 adj		25.38	31.48	32.19	47.12	46.46
ΔR^2 adj F-test			6.10 52.08 <.01 1->2	0.71 6.10 <.025 2->3	14.93 163.19 <.01 3->4	0.66 7.23 <.025 5->4
F regn		201.0 <.0001	135.86 <.0001	93.73 <.0001	130.64 <.0001	169.60 <.0001
Regn DF		1	2	3	4	3
Resid DF		587	585	583	578	580

For Model 4 PRESS is 5561.5 and PRESS RMSE is 3.71 compared to SSE of 5415.70 and RMSE of 3.68.

Appendix L: Normality Measures for TRA Variables and Riparian Planting

Table 79: Distribution of riparian planting variables

Question	Variable	Variable Label	Mean	St Dev	Median	Mode	Kurtosis	Skewness	Count	Shapiro-Wilk P<W
8		B1								
3	Farm Area	FarmArea	502.4	2720.7	157	40	238.0	14.98	663	<.0001
6	Age	Age	48.94	12.89	49	45	2.71	-0.77	663	<.0001
9	Having a Valuable Business	Business	16.46	4.19	18	20	3.12	-1.78	663	<.0001
10	Maximising Profit	Profits	16.36	4.05	17.5	20	3.17	-1.72	663	<.0001
11	Being Self-reliant	SelfReliant	17.02	3.50	18	20	5.21	-2.00	663	<.0001
12	Looking after Nature	Future Farmers	15.11	4.36	16	20	1.51	-1.26	663	<.0001
13	Being Valued in my Community	Nature	16.80	3.19	17	20	5.24	-1.79	663	<.0001
14	Increased Future Opportunities	Valued	14.35	4.87	15.5	20	0.59	-1.02	663	<.0001
15	Having Varied Work	Variety	16.03	3.63	17	20	4.50	-1.75	663	<.0001
16	Paying off debt	PayDebts	16.14	4.87	18	20	2.37	-1.73	663	<.0001
17	A Stable Farming System	Stable System	17.32	2.89	18	20	7.99	-2.22	663	<.0001
18	Socialising	Social	16.64	3.83	18	20	4.21	-1.91	663	<.0001
58	Behavioural Intentions	BI1	7.07	5.88	5	1	-0.91	0.56	663	<.0001
47	Behavioural Intentions	BI2	7.18	6.04	5	1	-0.88	0.59	663	<.0001
59	Behavioural Intentions	BI3	8.32	6.25	10	1	-1.17	0.29	663	<.0001
	Behavioural Intentions mean	BIm	7.70	5.61	7.33	1.0	-0.96	0.43	647	<.0001
(10x22)	Goal Product	ProdBus	44.60	78.03	22.25	0	0.23	-0.14	648	<.0001
(11x23)	Goal Product	ProdProf	30.47	79.59	9.75	0	0.18	-0.12	645	<.0001
(12x24)	Goal Product	ProdSelf	29.18	83.05	8.5	0	0.15	-0.05	647	<.0001
(13x25)	Goal Product	ProdNat	92.59	71.76	99	190	0.31	-0.65	647	<.0001
(14x26)	Goal Product	ProdVal	41.77	67.76	9.5	0	0.31	0.44	645	<.0001
(15x27)	Goal Product	ProdFut	53.72	73.11	45	0	-0.01	-0.10	645	<.0001
(16x28)	Goal Product	ProdVar	42.88	69.93	10	0	0.42	0.06	645	<.0001
(17x29)	Goal Product	ProdDebt	-2.71	83.85	0	0	0.35	0.06	645	<.0001
(18x30)	Goal Product	ProdSys	62.01	82.97	66.5	0	0.16	-0.53	646	<.0001
(19x31)	Goal Product	ProdSoc	15.05	74.93	0	0	0.89	0.16	647	<.0001
50	Instrumental Attitudes	IA1	12.55	6.32	13	20	-0.86	-0.53	663	<.0001
61	Instrumental Attitudes	IA2	11.03	6.60	11	1	-1.24	-0.26	663	<.0001
70	Instrumental Attitudes	IA3	11.02	6.40	11	20	-1.18	-0.24	663	<.0001
42	Affective Attitudes	AA1	11.55	5.86	11	10	-0.82	-0.33	663	<.0001

Question	Variable	Variable Label	Mean	St Dev	Median	Mode	Kurtosis	Skewness	Count	Shapiro-Wilk P<W
66	Affective Attitudes	AA2	10.86	6.10	11	11	-1.00	-0.25	663	<.0001
64	Subjective Norms	SN1	9.13	5.88	10.5	11	-1.00	0.03	663	<.0001
36	Subjective Norms	SN2	7.34	5.46	7	1	-0.85	0.44	663	<.0001
60	Subjective Norms	SN3	11.58	6.06	11	10	-0.89	-0.37	663	<.0001
40	Subjective Norms	SN4	8.31	5.20	10	10	-0.69	0.15	663	<.0001
34	Self-Efficacy	SE1	8.31	5.20	10	10	-0.69	0.15	663	<.0001
55	Self-Efficacy	SE2	8.03	6.04	7	1	-0.97	0.45	663	<.0001
38	Self-Efficacy Belief	SE1	12.54	6.52	14	20	-0.95	-0.60	663	<.0001
53	Self-Efficacy Belief	SE2	10.49	6.61	11	1	-1.31	-0.67	663	<.0001
54	Self-Efficacy Belief	SE3	12.78	6.44	14	20	-0.78	-0.66	663	<.0001
45	Self-Efficacy Belief	SE4	11.04	6.48	11	20	-1.22	-0.24	663	<.0001
63	Behavioural Control	BC1	15.83	5.41	18	20	1.87	-1.66	663	<.0001
62	Behavioural Control	BC2	15.61	5.75	18.5	20	0.97	-1.46	663	<.0001
127	Self-Identity	SI1	14.84	4.40	16	20	1.33	-1.07	663	<.0001
117	Self-Identity	SI2	16.18	4.12	17	20	4.33	-1.83	663	<.0001
122	Self-Identity	SI3	12.27	4.56	11	10	0.25	-0.30	663	<.0001
114	Self-Identity	SI4	7.58	5.51	7.5	1	-0.63	0.50	663	<.0001
111	Self-Identity	SI5	14.53	4.65	15	20	1.69	-1.28	663	<.0001
129	Self-Identity	SI6	14.29	4.74	15	20	1.47	-1.22	663	<.0001
134	Self-Identity	SI7	15.27	4.50	16.5	20	2.60	-1.56	663	<.0001
128	Self-Identity	SI8	13.13	5.23	14	19	0.16	-0.85	663	<.0001
125	Instrumental (Attitude) Belief	IAB1	15.94	4.19	17	20	3.30	-1.62	663	<.0001
67	Instrumental Belief	IAB1n	11.90	6.96	14	20	-1.32	-0.44	663	<.0001
115	Instrumental Belief	IAB2	15.01	4.19	16	20	1.73	-1.08	663	<.0001
41	Instrumental Belief	IAB2n	12.61	6.12	14	20	-0.75	-0.65	663	<.0001
113	Instrumental Belief	IAB3	4.79	4.41	3	1	1.92	1.48	663	<.0001
35	Instrumental Belief	IAB3n	10.92	6.74	11	20	-1.39	-0.16	663	<.0001
123	Instrumental Belief	IAB4	13.94	5.22	15	20	0.46	-0.96	663	<.0001
52	Instrumental Belief	IAB4n	14.17	6.05	16	20	-0.08	-1.12	663	<.0001
120	Instrumental Belief	IAB5	5.58	4.56	4	1	0.71	1.07	663	<.0001
65	Instrumental Belief	IAB5n	15.44	6.50	18	20	1.14	-1.45	663	<.0001
131	Instrumental Belief	IAB6	6.38	4.51	6	1	-0.19	0.57	663	<.0001
73	Instrumental Belief	IAB6n	12.57	6.52	14	20	-1.02	-0.54	663	<.0001
112	Instrumental Belief	IAB7	6.40	5.46	4.8	1	-0.02	0.96	663	<.0001

Question	Variable	Variable Label	Mean	St Dev	Median	Mode	Kurtosis	Skewness	Count	Shapiro-Wilk P<W
39	Instrumental Belief	IAB7n	9.92	6.78	10	20	-1.41	0.10	663	<.0001
126	Instrumental Belief	IAB8	14.83	4.57	16	20	1.34	-1.10	663	<.0001
69	Instrumental Belief	IAB8n	13.91	6.13	16	20	-0.18	-0.99	663	<.0001
132	Instrumental Belief	IAB9	5.82	4.80	4	1	0.19	0.93	663	<.0001
48	Instrumental Belief	IAB9n	10.36	6.43	10.5	10	-1.25	-0.02	663	<.0001
124	Instrumental Belief	IAB10	15.09	4.23	15.5	20	2.07	-1.18	663	<.0001
32	Instrumental Belief	IAB10n	11.34	6.54	12.5	20	-1.27	-0.34	663	<.0001
116	Instrumental Belief	IAB11	14.97	4.23	16	19	1.81	-1.12	663	<.0001
37	Instrumental Belief	IAB11n	12.16	6.27	13	20	-0.92	-0.56	663	<.0001
133	Instrumental Belief	IAB12	12.60	4.17	11	11	0.77	-0.17	663	<.0001
44	Instrumental Belief	IAB12n	11.83	6.97	12	10	-0.83	-0.45	663	<.0001
130	Instrumental Belief	IAB13	15.18	4.15	16	20	2.57	-1.32	663	<.0001
57	Instrumental Belief	IAB13n	8.95	5.83	10	10	-0.95	0.12	663	<.0001
119	Normative Belief	NB1	11.86	4.85	11.8	10	0.30	-0.65	663	<.0001
72	Normative Belief	NB1n	8.99	6.21	10	1	-1.15	0.12	663	<.0001
135	Normative Belief	NB2	8.54	4.99	10	10	-0.79	-0.11	663	<.0001
51	Normative Belief	NB2n	8.26	5.83	10	10	-0.97	0.22	663	<.0001
121	Normative Belief	NB3	9.64	4.81	10.5	10	-0.46	-0.38	663	<.0001
71	Normative Belief	NB3n	10.55	6.21	10.5	10	-1.04	-0.18	663	<.0001
46	Control Belief	CB1	8.22	6.29	9	1	-1.17	0.33	663	<.0001
49	Control Belief	CB2	7.66	5.91	8	1	-0.97	0.40	663	<.0001
43	Control Belief	CB3	11.60	6.13	11	10	-0.93	-0.41	663	<.0001
68	Control Belief	CB4	10.14	6.14	10.5	10	-1.13	-0.12	663	<.0001
33	Control Belief	CB5	11.57	5.79	11	10	-0.75	-0.41	663	<.0001
(125x67)	A. Belief Product	IAB1prod	18.35	46.67	15.75	90.25	-0.45	-0.36	635	<.0001
(115x41)	A. Belief Product	IAB2prod	18.97	36.95	8.75	0	0.29	-0.05	638	<.0001
(113x35)	A. Belief Product	IAB3prod	-6.86	49.82	-2.125	-90.25	-0.78	0.09	636	<.0001
(123x52)	A. Belief Product	IAB4prod	27.08	40.43	20	0	0.19	-0.35	639	<.0001
(120x65)	A. Belief Product	IAB5prod	-30.75	41.52	-32.25	-90.25	-0.04	0.50	640	<.0001
(131x73)	A. Belief Product	IAB6prod	-16.03	41.16	-4.25	0	-0.03	0.01	638	<.0001
(112x39)	A. Belief Product	IAB7prod	-2.17	48.24	0	0	-0.58	-0.09	637	<.0001
(126x69)	A. Belief Product	IAB8prod	28.25	38.96	22.5	90.25	0.19	-0.29	635	<.0001
(133x44)	A. Belief Product	IAB12prod	13.10	28.47	0.75	0	1.70	0.98	636	<.0001
(130x57)	A. Belief Product	IAB13prod	-0.94	38.82	0	0	0.55	0.00	634	<.0001

Question	Variable	Variable Label	Mean	St Dev	Median	Mode	Kurtosis	Skewness	Count	Shapiro-Wilk P<W
(119x72)	N. Belief Product	NB1prod	-10.88	81.53	-5.0	0	-0.24	0.13	642	<.0001
(135x51)	N. Belief Product	NB2prod	-9.96	58.59	-5.0	0	1.14	0.33	646	<.0001
(121x71)	N. Belief Product	NB3prod	7.54	65.99	0	0	0.17	-0.01	640	<.0001
	Mean of IA	IAm	11.76	5.85	12.42	20	-1.07	-0.32	650	<.0001
	Mean of AA	AAm	11.41	5.54	11.5	20	-0.84	-0.26	651	<.0001
	Mean of SN	SNm	9.28	4.55	10	1	-0.68	-0.02	648	<.0001
	Mean of SE	SEm	11.49	4.75	11.83	9.83	-0.70	-0.32	641	<.0001
	Mean of BC	BCm	16.15	4.73	18	20	2.04	-1.62	644	<.0001
	Mean of SI	SIm	14.71	2.57	14.86	17.29	-0.24	-0.26	645	.0010
	Mean of IAB	IABm	5.59	24.18	4.21	-7.29	0.11	-0.00	619	.1170
	Mean of NB	NBm	-4.37	57.09	-2.33	-1.67	0.01	0.14	639	.0133
	Mean of CB	CBm	10.17	4.57	10.3	8.6	-0.71	-0.05	639	<.0001

Appendix M. Correlations between TRA Riparian Variables

Table 80: Correlations between molecular TRA measures for riparian planting

BI1	0.36 ***	1								
BI2	0.33 ***	0.84 ***	1							
BI3	0.31 ***	0.82 ***	0.78 ***	1						
IAB1prod	0.24 ***	0.45 ***	0.43 ***	0.51 ***	1					
IAB2prod	0.24 ***	0.45 ***	0.42 ***	0.52 ***	0.54 ***	1				
IAB3prod	0.11 *	0.32 ***	0.31 ***	0.36 ***	0.27 ***	0.25 ***	1			
IAB4prod	0.12 *	0.42 ***	0.40 ***	0.50 ***	0.40 ***	0.45 ***	0.25 ***	1		
IAB5prod	0.16 ***	0.21 ***	0.27 ***	0.24 ***	0.14 **	0.09 ***	0.25 ***	0.13 *	1	
IAB6prod	0.17 ***	0.23 ***	0.23 ***	0.24 ***	0.20 ***	0.19 ***	0.34 ***	0.12 *	0.31 ***	1
IAB7prod	0.19 ***	0.29 ***	0.30 ***	0.36 ***	0.29 ***	0.27 ***	0.36 ***	0.21 ***	0.18 ***	0.29 ***
IAB8prod	0.20 ***	0.49 ***	0.47 ***	0.57 ***	0.56 ***	0.54 ***	0.35 ***	0.63 ***	0.15 **	0.20 ***
IAB9prod	0.14 **	0.29 ***	0.30 ***	0.30 ***	0.27 ***	0.23 ***	0.33 ***	0.24 ***	0.17 ***	0.28 ***
IAB10prod	0.25 ***	0.35 ***	0.37 ***	0.43 ***	0.52 ***	0.58 ***	0.23 ***	0.44 ***	0.16 **	0.13 *
IAB11prod	0.21 ***	0.42 ***	0.37 ***	0.47 ***	0.51 ***	0.67 ***	0.14 **	0.38 ***	0.10 #	0.09 #
IAB12prod	0.13 *	0.25 ***	0.25 ***	0.31 ***	0.32 ***	0.40 ***	0.12 *	0.33 ***	0.05 ns	0.09 #
IAB13prod	0.18 ***	0.34 ***	0.29 ***	0.32 ***	0.41 ***	0.46 ***	0.24 ***	0.26 ***	0.18 ***	0.19 ***
NB1prod	0.24 ***	0.61 ***	0.59 ***	0.63 ***	0.48 ***	0.50 ***	0.34 ***	0.45 ***	0.17 ***	0.23 ***
NB2prod	0.14 **	0.46 ***	0.43 ***	0.44 ***	0.40 ***	0.37 ***	0.22 ***	0.33 ***	0.12 *	0.14 **
NB3prod	0.18 ***	0.46 ***	0.46 ***	0.52 ***	0.42 ***	0.43 ***	0.17 ***	0.36 ***	0.09 #	0.10 #
CB1	0.25 ***	0.67 ***	0.66 ***	0.64 ***	0.44 ***	0.40 ***	0.31 ***	0.38 ***	0.21 ***	0.24 ***
CB2	0.18 ***	0.46 ***	0.52 ***	0.46 ***	0.28 ***	0.22 ***	0.22 ***	0.29 ***	0.29 ***	0.17 ***
CB3	0.16 ***	0.45 ***	0.46 ***	0.49 ***	0.28 ***	0.33 ***	0.23 ***	0.35 ***	0.15 ***	0.16 **
CB4	0.21 ***	0.50 ***	0.50 ***	0.49 ***	0.33 ***	0.29 ***	0.24 ***	0.32 ***	0.22 ***	0.19 ***
CB5	0.23 ***	0.45 ***	0.47 ***	0.51 ***	0.32 ***	0.37 ***	0.29 ***	0.40 ***	0.16 ***	0.15 **
SEB1	0.27 ***	0.63 ***	0.64 ***	0.71 ***	0.41 ***	0.46 ***	0.33 ***	0.46 ***	0.20 ***	0.14 **
SEB2	0.29 ***	0.55 ***	0.55 ***	0.67 ***	0.51 ***	0.55 ***	0.41 ***	0.49 ***	0.24 ***	0.33 ***
SEB3	0.28 ***	0.56 ***	0.57 ***	0.68 ***	0.53 ***	0.56 ***	0.4 ***	0.52 ***	0.26 ***	0.28 ***
SEB4	0.25 ***	0.50 ***	0.53 ***	0.54 ***	0.41 ***	0.39 ***	0.26 ***	0.38 ***	0.18 ***	0.21 ***
	Behaviour	BI1	BI2	BI3	IAB1 prod	IAB2 prod	IAB3 prod	IAB4 prod	IAB5 prod	IAB6 prod

Table 80 continued

IAB7prod	1																	
IAB8prod	0.30 ***	1																
IAB9prod	0.23 ***	0.19 ***	1															
IAB10prod	0.26 ***	0.53 ***	0.29 ***	1														
IAB11prod	0.22 ***	0.46 ***	0.17 ***	0.55 ***	1													
IAB12prod	0.15 **	0.39 ***	0.07 ns	0.35 ***	0.41 ***	1												
IAB13prod	0.17 ***	0.38 ***	0.13 *	0.49 ***	0.49 ***	0.28 ***	1											
NB1prod	0.31 ***	0.56 ***	0.27 ***	0.44 ***	0.42 ***	0.33 ***	0.38 ***	1										
NB2prod	0.17 ***	0.36 ***	0.18 ***	0.27 ***	0.30 ***	0.24 ***	0.32 ***	0.58 ***	1									
NB3prod	0.22 ***	0.41 ***	0.21 ***	0.37 ***	0.39 ***	0.29 ***	0.35 ***	0.53 ***	0.41 ***	1								
CB1	0.31 ***	0.47 ***	0.21 ***	0.33 ***	0.38 ***	0.23 ***	0.29 ***	0.49 ***	0.36 ***	0.35 ***	1							
CB2	0.18 ***	0.34 ***	0.15 **	0.22 ***	0.24 ***	0.12 ***	0.14 **	0.37 ***	0.25 ***	0.24 ***	0.55 ***	1						
CB3	0.26 ***	0.33 ***	0.15 **	0.26 ***	0.32 ***	0.18 ***	0.24 ***	0.37 ***	0.24 ***	0.28 ***	0.46 ***	0.43 ***	1					
CB4	0.25 ***	0.34 ***	0.16 **	0.27 ***	0.30 ***	0.22 ***	0.23 ***	0.41 ***	0.27 ***	0.27 ***	0.50 ***	0.52 ***	0.67 ***	1				
CB5	0.30 ***	0.39 ***	0.22 ***	0.41 ***	0.39 ***	0.23 ***	0.25 ***	0.42 ***	0.32 ***	0.35 ***	0.47 ***	0.44 ***	0.65 ***	0.53 ***	1			
SEB1	0.33 ***	0.54 ***	0.25 ***	0.40 ***	0.45 ***	0.30 ***	0.30 ***	0.55 ***	0.42 ***	0.44 ***	0.53 ***	0.38 ***	0.42 ***	0.38 ***	0.46 ***	1		
SEB2	0.42 ***	0.62 ***	0.32 ***	0.47 ***	0.46 ***	0.28 ***	0.36 ***	0.55 ***	0.40 ***	0.42 ***	0.64 ***	0.54 ***	0.38 ***	0.42 ***	0.38 ***	0.64 ***	1	
SEB3	0.42 ***	0.60 ***	0.30 ***	0.47 ***	0.46 ***	0.32 ***	0.36 ***	0.54 ***	0.39 ***	0.41 ***	0.53 ***	0.40 ***	0.46 ***	0.45 ***	0.50 ***	0.67 ***	0.80 ***	1
SEB4	0.31 ***	0.46 ***	0.19 ***	0.32 ***	0.36 ***	0.27 ***	0.23 ***	0.47 ***	0.33 ***	0.32 ***	0.53 ***	0.49 ***	0.60 ***	0.60 ***	0.54 ***	0.53 ***	0.54 ***	0.54 ***
	IAB7 prod	IAB8 prod	IAB9 prod	IAB1 0 prod	IAB1 1 prod	IAB1 2 prod	IAB1 3 prod	NB1 prod	NB2 prod	NB3 prod	CB1	CB2	CB3	CB4	CB5	SEB1	SEB2	SEB3

*Significance of differences between groups, p=<0.0001 ***, p=<0.001 **, p=<0.01 *, p=<0.1* #

Table 81: Correlations between molar and molecular TRA measures for riparian planting

Intrinsic Attitudes					Subjective Norms					Behavioural Control		
	IA1	IA2	IA3		SN1	SN2	SN3	SN4			BC1	BC2
IAB1prod	0.57 ***	0.59 ***	0.57 ***	NB1prod	0.74 ***	0.50 ***	0.65 ***	0.57 ***		CB1	0.07 #	0.13 **
IAB2prod	0.57 ***	0.60 ***	0.52 ***	NB2prod	0.59 ***	0.42 ***	0.46 ***	0.46 ***		CB2	0.11 *	0.18 ***
IAB3prod	0.42 ***	0.40 ***	0.38 ***	NB3prod	0.49 ***	0.42 ***	0.40 ***	0.40 ***		CB3	0.12 *	0.16 ***
IAB4prod	0.50 ***	0.51 ***	0.50 ***							CB4	0.14 **	0.17 ***
IAB5prod	0.26 ***	0.27 ***	0.28 ***							CB5	0.11 *	0.17 ***
IAB6prod	0.30 ***	0.25 ***	0.27 ***									
IAB7prod	0.43 ***	0.43 ***	0.39 ***							Self-efficacy		
IAB8prod	0.64 ***	0.65 ***	0.66 ***								SE1	SE2
IAB9prod	0.35 ***	0.31 ***	0.32 ***							SEB1	0.34 ***	0.35 ***
IAB10prod	0.52 ***	0.52 ***	0.45 ***							SEB2	0.4 ***	0.4 ***
IAB11prod	0.48 ***	0.50 ***	0.46 ***							SEB3	0.39 ***	0.39 ***
IAB12prod	0.29 ***	0.30 ***	0.30 ***							SEB4	0.54 ***	0.68 ***
IAB13prod	0.38 ***	0.42 ***	0.35 ***									

*Significance of differences between groups, p=<0.0001 ***, p=<0.001 **, p=<0.01 *, p=<0.1 #*

Appendix N: Regression Models Using Molecular TRA Variables and Riparian Planting

Table 82: Regression models of riparian protection using molecular TRA variables

Variable	r (BIm)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Bn	0.37	0.08 <.0001	0.04 <.0001	0.04 <.0001	0.03 <.0001	0.03 <.0001	0.03 <.0001
IABm	0.66		0.14 <.0001	0.08 <.0001	0.03 .0039	0.02 .0060	0.02 .0096
NBm	0.68			0.04 <.0001	0.03 <.0001	0.03 <.0001	0.02 <.0001
SEBm	0.74				0.53 <.0001	0.34 <.0001	0.33 <.0001
CBm	0.70					0.26 <.0001	0.26 <.0001
SIm	0.39						0.08 .1921
Constant		6.43 <.0001	6.31 <.0001	6.82 <.0001	1.20 .0183	0.70 .1686	-0.29 .7528
R^2		13.10	46.56	58.65	66.97	68.63	68.73
R^2 adj		12.95	46.37	58.42	66.73	68.34	68.38
□ R^2 adj F prob Models			33.42 <0.01 1-2	12.05 <0.01 2-3	8.31 <0.01 3-4	1.61 <0.10 4-5	0.04 ns 5-6
Regn F prob		89.25 <.0001	243.99 <.0001	258.12 <.0001	276.31 <.0001	238.01 <.0001	198.53 <.0001
Df		1	2	3	4	5	6
Resid df		592	560	546	545	544	542

For model 5 PRESS is 5707.98 and PRESS RMSE is 3.22 compared to SSE of 5569.64 and RMSE of 3.20. It is a model that fits the data well.

Appendix O: Normality Measures for TRA Variables and Woodlot Establishment

Table 83: Distribution of woodlot establishment variables

Question	Variable	Variable Label	Mean	St Dev	Median	Mode	Kurtosis	Skewness	Count	Shapiro-Wilk P<W
8	Behaviour (area in native woodlots)	B1	11.2	41.3	0.2	0	52.25	6.77	465	<.0001
3	Farm Area	FarmArea	398.2	1308	150	40	198.2	12.6	471	<.0001
6	Age	Age	49.1	10.7	48	44	-.10	0.26	471	.0068
9	Having a Valuable Business	Business	17.2	3.5	18	20	4.35	-1.89	475	<.0001
10	Maximising Profit	Profit	17.0	3.6	18	20	3.56	-1.75	475	<.0001
11	Being Self-reliant	SelfReliant	17.1	3.3	18	20	4.13	-1.73	475	<.0001
12	Looking after Nature	Nature	17.3	3.0	18	20	5.52	-1.95	475	<.0001
13	Being Valued in my Community	Valued	15.0	4.3	16	20	1.23	-1.10	475	<.0001
14	Increased Future Opportunities	FutureFarmers	15.5	4.0	16	20	1.73	-1.18	475	<.0001
15	Having Varied Work	Variety	16.2	3.6	17	20	3.59	-1.62	475	<.0001
16	Paying off debt	PayDebts	16.6	4.4	18	20	2.99	-1.80	475	<.0001
17	A Stable Farming System	StableSystem	17.7	2.7	18	20	6.83	-2.10	475	<.0001
18	Socialising	Social	17.0	3.4	18	20	3.45	-1.67	475	<.0001
84	Behavioural Intentions	BI1	7.4	5.9	6	1	-1.05	0.45	473	<.0001
58	Behavioural Intentions	BI2	9.0	6.0	10	1	-1.15	0.12	474	<.0001
	Behavioural Intentions mean	BIm	8.2	5.6	8	1	-1.06	0.28	473	<.0001
(9x21)	Goal Product	ProdBus	202.5	97.1	200	200	-0.36	-0.14	472	<.0001
(10x22)	Goal Product	ProdProf	188.2	94.3	198	200	-0.35	0.09	472	<.0001
(11x23)	Goal Product	ProdSelf	201.9	90.4	200	220	0.04	0.10	472	<.0001
(12x24)	Goal Product	ProdNat	277.1	91.2	288	400	0.25	-0.73	471	<.0001
(13x25)	Goal Product	ProdVal	202.7	93.0	204	121	-0.30	0.09	471	<.0001
(14x26)	Goal Product	ProdFut	211.8	99.4	209	400	-0.54	-0.02	471	<.0001
(15x27)	Goal Product	ProdVar	229.8	90.3	224	220	-0.16	-0.23	471	<.0001
(16x28)	Goal Product	ProdDebt	173.1	105.1	180	220	-0.56	0.28	471	<.0001
(17x29)	Goal Product	ProdSys	227.0	91.8	220	220	-0.06	-0.23	472	<.0001
(18x30)	Goal Product	ProdSoc	187.6	90.2	198	220	0.07	0.19	471	<.0001
	Mean of ProdBus … ProdSoc	ProdGoalsm	210.1	68.5	206	400	0.39	0.03	471	0.0089
46	Instrumental Attitudes	IA1	13.8	5.3	14	11	-0.04	-0.77	469	<.0001
31	Instrumental Attitudes	IA2	12.1	6.0	13	11	-0.78	-0.53	474	<.0001

Question	Variable	Variable Label	Mean	St Dev	Median	Mode	Kurtosis	Skewness	Count	Shapiro-Wilk P<W
67	Instrumental Attitudes	IA3	11.9	5.6	12	11	-0.52	-0.48	470	<.0001
75	Affective Attitudes	AA1	12.0	5.2	12	11	-0.20	-0.54	463	<.0001
72	Affective Attitudes	AA2	11.6	4.1	11	11	1.00	-0.50	463	<.0001
64	Subjective Norms	SN1	7.4	5.4	9	11	-1.00	0.29	474	<.0001
76	Subjective Norms	SN2	13.3	5.3	14	11	0.06	-0.84	473	<.0001
32	Subjective Norms	SN3	8.9	5.4	10	11	-0.87	0.10	474	<.0001
38	Self-Efficacy	SE1	14.9	4.6	16	20	0.56	-0.98	469	<.0001
39	Self-Efficacy	SE2	11.5	5.3	11	11	-0.69	-0.27	469	<.0001
45	Behavioural Control	BC1	16.5	4.8	19	20	2.73	-1.83	469	<.0001
59	Behavioural Control	BC2	16.6	4.7	19	20	2.91	-1.89	469	<.0001
60	Self-Identity	SI1	12.1	5.8	12	11	-0.62	-0.52	470	<.0001
85	Self-Identity	SI2	8.5	6.3	9	1	-1.18	0.29	473	<.0001
80	Instrumental (Attitude) Belief	IAB1	12.3	5.6	12	11	-0.63	-0.53	474	<.0001
81	Instrumental Belief	IAB2	13.3	4.7	13	11	0.28	-0.62	474	<.0001
54	Instrumental Belief	IAB3	7.5	5.3	7	1	-1.05	0.31	469	<.0001
55	Instrumental Belief	IAB4	17.1	3.0	18	20	4.06	1.06	469	<.0001
48	Instrumental Belief	IAB5	15.4	5.1	17	19	1.37	-1.44	470	<.0001
49	Instrumental Belief	IAB6	15.8	3.6	16	20	1.45	-1.02	470	<.0001
52	Instrumental Belief	IAB7	16.1	4.2	17	20	3.17	-1.68	470	<.0001
53	Instrumental Belief	IAB8	14.1	4.6	15	20	0.62	-0.91	469	<.0001
41	Instrumental Belief	IAB9	14.0	5.2	15	20	-0.27	-0.67	469	<.0001
42	Instrumental Belief	IAB10	8.5	5.5	10	11	-0.93	0.13	469	<.0001
61	Instrumental Belief	IAB11	16.4	4.0	18	20	3.10	-1.67	469	<.0001
62	Instrumental Belief	IAB12	5.8	4.1	5	1	-0.31	0.59	469	<.0001
33	Instrumental Belief	IAB13	14.3	5.6	16	20	-0.02	-0.98	474	<.0001
34	Instrumental Belief	IAB14	8.2	4.8	9	11	-0.63	0.18	474	<.0001
68	Instrumental Belief	IAB15	11.0	6.1	11	11	-1.17	-0.17	465	<.0001
69	Instrumental Belief	IAB16	15.5	3.3	16	16	1.05	-0.81	473	<.0001
35	Instrumental Belief	IAB17	10.4	6.2	11	1	-1.22	-0.22	474	<.0001
36	Instrumental Belief	IAB18	16.4	3.4	17	20	4.03	-1.55	474	<.0001
70	Instrumental Belief	IAB19	12.4	5.8	13	15	-0.53	-0.69	474	<.0001
71	Instrumental Belief	IAB20	16.6	3.4	17	20	4.41	-1.63	474	<.0001
78	Normative Belief	NB1	9.4	5.8	11	11	-0.99	-0.05	463	<.0001
83	Normative Belief	NB2	8.6	5.3	10	11	-1.07	0.05	464	<.0001

Question	Variable	Variable Label	Mean	St Dev	Median	Mode	Kurtosis	Skewness	Count	Shapiro-Wilk P<W
77	Normative Belief	NB3	7.8	5.0	10	11	-1.08	-0.07	463	<.0001
66	Normative Belief	NB4	3.8	3.9	2	1	1.58	1.51	469	<.0001
63	Normative Belief	NB5	8.5	5.2	11	11	-0.71	0.00	469	<.0001
56	Normative Belief	NB6	7.3	5.3	7	1	-0.78	0.42	469	<.0001
47	Efficacy Belief	SEB1	11.0	6.5	11	1	-0.23	-0.23	470	<.0001
82	Efficacy Belief	SEB2	14.6	8.7	15	20	209.4	11.7	472	<.0001
65	Efficacy Belief	SEB3	11.2	6.1	11	11	-0.99	-0.29	469	<.0001
40	Efficacy Belief	SEB4	12.5	5.8	13	20	-0.69	-0.53	468	<.0001
50	Control Belief	CB1	8.0	5.5	8	1	-0.84	0.37	470	<.0001
74	Control Belief	CB2	8.2	5.6	9	1	-1.10	0.21	463	<.0001
79	Control Belief	CB3	8.4	5.1	10	11	-0.87	0.01	463	<.0001
57	Control Belief	CB4	9.4	5.4	11	11	-0.90	0.00	468	<.0001
43	Control Belief	CB5	9.8	5.2	11	11	-0.69	-0.04	468	<.0001
(80x81)	A. Belief Product	IAB1prod	14.4	34.9	3.75	0.25	1.23	0.16	474	<.0001
(54x55)	A. Belief Product	IAB3prod	-20.4	42.8	-12.25	-90.25	-0.45	0.05	469	<.0001
(48x49)	A. Belief Product	IAB5prod	32.4	39.3	30.25	90.25	0.28	-0.47	470	<.0001
(52x53)	A. Belief Product	IAB7prod	27.5	37.7	24.75	90.25	0.58	-0.34	469	<.0001
(41x42)	A. Belief Product	IAB9prod	-15.6	40.1	-1.25	0.25	0.03	-0.31	469	<.0001
(61x62)	A. Belief Product	IAB11prod	-31.0	38.7	-24.75	-90.25	-0.09	0.21	469	<.0001

Appendix P: Correlations between TRA Variables and Woodlot Establishment

Table 84: Correlations between molecular TRA measures for woodlot establishment

BI1	0.02 ns	1							
BI2	-0.01 ns	0.75 ***	1						
IAB1prod	0.09 #	0.09 #	0.07 ns	1					
IAB3prod	0.02 ns	0.35 ***	0.41 ***	0.14 *	1				
IAB5prod	-0.02 ns	0.54 ***	0.55 ***	0.14 *	0.30 ***	1			
IAB7prod	0.03 ns	0.39 ***	0.45 ***	0.14 *	0.26 ***	0.44 ***	1		
IAB9prod	-0.10 #	0.10 #	0.14 *	-0.10 #	0.18 ns	0.10 ns	0.07 ns	1	
IAB11prod	-0.01 ns	0.30 ***	0.28 ***	0.01 ns	0.32 ***	0.13 *	0.10 #	0.17 **	1
IAB13prod	0.05 ns	0.27 ***	0.20 ***	-0.02 ns	0.22 ***	0.21 ***	0.13 *	0.12 *	0.40 ***
IAB15prod	-0.01 ns	-0.03 ns	-0.05 ns	0.01 ns	-0.02 ns	0.02 ns	0.00 ns	-0.05 ns	-0.02 ns
IAB17prod	0.12 *	0.38 ***	0.39 ***	0.12 #	0.44 ***	0.35 ***	0.33 ***	0.06 ns	0.15 *
IAB19prod	0.02 ns	0.44 ***	0.49 ***	0.14 *	0.47 ***	0.47 ***	0.30 ***	0.13 *	0.14 *
NB1prod	0.06 ns	0.48 ***	0.53 ***	0.06 ns	0.27 ***	0.36 ***	0.34 ***	0.00 ns	0.10 #
NB3prod	0.07 *	0.28 ***	0.27 ***	0.01 ns	0.21 ***	0.24 ***	0.24 ***	0.01 ns	0.12 #
NB5prod	0.01 ns	0.15 *	0.12 #	-0.02 ns	0.05 ns	0.13 *	0.15 *	-0.11 #	-0.10 #
SEB1	0.05 ns	0.59 ***	0.71 ***	0.09 #	0.38 ***	0.55 ***	0.48 ***	0.11 #	0.22 ***
SEB2	0.04 ns	0.26 ***	0.29 ***	0.10 #	0.19 ***	0.27 ***	0.27 ***	0.08 #	0.05 ns
SEB3	0.12 ns	0.54 ***	0.61 ***	0.18 **	0.41 ***	0.53 ***	0.45 ***	0.09 #	0.23 ***

SEB4	0.07 ns	0.47 ***	0.48 ***	0.05 ns	0.24 ***	0.38 ***	0.35 ***	0.12 #	0.22 ***
CB1	-0.02 ns	0.61 ***	0.58 ***	0.03 ns	0.33 ***	0.40 ***	0.34 ***	0.15 *	0.33 ***
CB2	0.03 ns	0.46 ***	0.37 ***	0.12 *	0.30 ***	0.31 ***	0.20 ***	0.12 *	0.34 ***
CB3	-0.03 ns	0.62 ***	0.59 ***	0.11 #	0.40 ***	0.45 ***	0.32 ***	0.14 *	0.26 ***
CB4	0.03 ns	0.54 ***	0.58 ***	0.05 ns	0.28 ***	0.38 ***	0.35 ***	0.05 ns	0.22 ***
CB5	0.15 *	0.45 ***	0.46 ***	0.05 ns	0.24 ***	0.29 ***	0.26 ***	0.02 ns	0.13 *
	Behaviour	BI1	BI2	IAB1 prod	IAB3 prod	IAB5 prod	IAB7 prod	IAB9 prod	IAB11 prod

Table 84 continued

IAB13prod	1													
IAB15prod	-0.07 ns	1												
IAB17prod	0.16 **	-0.03 ns	1											
IAB19prod	0.11 #	0.05 ns	0.40 ***	1										
NB1prod	0.11 #	-0.03 ns	0.29 ***	0.38 ***	1									
NB3prod	0.09 #	0.09 #	0.15 *	0.16 **	0.38 ***	1								
NB5prod	-0.05 ns	0.05 ns	0.04 ns	0.02 ns	0.21 ***	0.15 *	1							
SEB1	0.16 **	-0.05 ns	0.37 ***	0.47 ***	0.48 ***	0.26 ***	0.13 *	1						
SEB2	0.06 ns	0.02 ns	0.25 ***	0.28 ***	0.28 ***	0.14 *	0.05 ns	0.30 ***	1					
SEB3	0.16 **	0.01 ns	0.50 ***	0.51 ***	0.45 ***	0.29 ***	0.21 ***	0.60 ***	0.32 ***	1				
SEB4	0.24 ***	-0.07 ns	0.20 ***	0.39 ***	0.29 ***	0.12 #	0.02 ns	0.47 ***	0.17 **	0.40 ***	1			
CB1	0.36 ***	-0.07 ns	0.29 ***	0.29 ***	0.30 ***	0.17 **	0.07 ns	0.47 ***	0.18 **	0.40 ***	0.38 ***	1		
CB2	0.24 ***	-0.03 ns	0.14 *	0.30 ***	0.22 ***	0.15 *	0.02 ns	0.27 ***	0.07 ns	0.29 ***	0.27 ***	0.47 ***	1	
CB3	0.25 ***	-0.05 ns	0.31 ***	0.45 ***	0.56 ***	0.33 ***	0.13 *	0.48 ***	0.25 ***	0.50 ***	0.41 ***	0.46 ***	0.45 ***	1
CB4	0.25 ***	0.01 ns	0.29 ***	0.32 ***	0.30 ***	0.15 *	0.10 #	0.48 ***	0.19 ***	0.47 ***	0.48 ***	0.53 ***	0.40 ***	0.51 ***
CB5	0.15 *	0.01 ns	0.27 ***	0.23 ***	0.32 ***	0.20 ***	0.14 *	0.42 ***	0.15 *	0.36 ***	0.42 ***	0.32 ***	0.34 ***	0.44 ***
	IAB13 prod	IAB15 prod	IAB17 prod	IAB19 prod	NB1prod	NB3prod	NB5prod	SEB1	SEB2	SEB3	SEB4	CB1	CB2	CB3

CB4	1
CB5	0.63 ***
	CB4

*Significance of differences between groups, p=<0.0001 ***, p=<0.001 **, p=<0.01 *, p=<0.1 #*

Table 85: Correlations between direct and indirect TRA measures for woodlot establishment

Intrinsic Attitudes					Subjective Norms					Behavioural Control		
	IA1	IA2	IA3			SN1	SN2	SN3			BC1	BC2
IAB1prod	0.11 #	0.13 *	0.08 #		NB1prod	0.52 ***	0.45 ***	0.37 ***		CB1	0.09 #	0.03 ns
IAB3prod	0.42 ***	0.42 ***	0.41 ***		NB3prod	0.35 ***	0.29 ***	0.23 ***		CB2	0.10 #	0.11 #
IAB5prod	0.58 ***	0.56 ***	0.56 ***		NB5prod	0.26 ***	0.09 #	0.08 #		CB3	0.01 ns	-0.02 ns
IAB7prod	0.54 ***	0.48 ***	0.50 ***							CB4	0.06 ns	0.06 ns
IAB9prod	0.18 ***	0.21 ***	0.14 *							CB5	0.06 ns	0.08 #
IAB11prod	0.25 ***	0.28 ***	0.31 ***									
IAB13prod	0.24 ***	0.24 ***	0.23 ***		Self-Efficacy							
IAB15prod	-0.06 ns	-0.01 ns	0.00 ns			SE1	SE2					
IAB17prod	0.46 ***	0.49 ***	0.46 ***		SEB1	-0.09 #	-0.26 ***					
IAB19prod	0.50 ***	0.50 ***	0.50 ***		SEB2	-0.01 ns	-0.10 #					
					SEB3	-0.14 *	-0.25 ***					
					SEB4	-0.24 ***	-0.39 ***					

*Significance of differences between groups, p=<0.0001 ***, p=<0.001 **, p=<0.01 *, p=<0.1 #*

Appendix Q: Regression Models Using Molecular TRA Variables and Woodlot Establishment

Table 86: Regression models of woodlot establishment using molecular TRA variables

Variable	r (BIm)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
IABm	0.005	0.17 <.0001	0.09 <.0001	0.04 .0002	0.02 .0914	0.02 .0958	
AAm	0.66		0.67 <.0001	0.51 <.0001	0.35 <.0001	0.32 <.0001	0.34 <.0001
SEBm	0.70			0.41 <.0001	0.29 <.0001	0.22 <.0001	0.25 <.0001
CBm	-0.75				0.55 <.0001	0.50 <.0001	0.51 <.0001
SIm	0.64					0.17 <.0001	0.17 <.0001
Constant		7.98 <.0001	0.23 .7323	-2.94 <.0001	-4.35 <.0001	-4.48 <.0001	-5.23 <.0001
R^2		39.38	54.55	62.20	70.14	71.42	71.35
R^2 adj		39.25	54.35	61.95	69.87	71.10	71.10
□ R^2 adj F prob Models			15.10 <.01 1-2 + AAm	7.60 <.01 2-3 + SEBm	7.92 <.01 3-4 + CBm	1.23 <.01 4-6 + SIm	0.00 ns 7-6 + IABm
Regn F prob		300.11 <.0001	270.65 <.0001	246.31 <.0001	262.44 <.0001	222.93 <.0001	280.84 <.0001
Df		1	2	3	4	5	4
Resid df		462	451	449	447	446	451

For model 6 PRESS is 4297.81 and PRESS RMSE is 3.07 compared to SSE of 4135.31 and RMSE of 3.03.